International Telecommunication Union

SMS4DC

SPECTRUM MANAGEMENT SYSTEM FOR DEVELOPING COUNTRIES

Version 5.1

International Telecommunication Union

International Telecommunication Union
Telecommunication Development Bureau
Geneva

Spectrum Management System 4 for Developing Countries

Version 5.1

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Introduction

The radio frequency spectrum is a natural resource that is available equally in every country. However, it is a resource limited by technology and management capability. In addition to radiocommunication systems that use the spectrum as a function of geographical location and time, there are also non-communication uses such as ISM (Industrial, Scientific and Medical) equipments. Electromagnetic waves provide a wireless interface to facilitate communication in variety of terrestrial and space radio services, including aeronautical, maritime, space, radio navigation, broadcasting, cellular mobile, microwave systems. As the number of implemented radiocommunication networks increases, the congestion of radio spectrum usage grows accordingly. Without some form of management, the transmission of radio signals in the same frequency bands, time and geographical locations by independent networks is certain to increase the probability of interference. Interference-free operation of multi-channel frequency-agile networks cannot be envisaged without an intelligent spectrum management system. Even diversification provided by an intelligent spectrum management system in an advanced radiocommunication network will offer only a limited capability to guarantee transmission quality. In the case of long-range communications in international airspace and waters, such as aeronautical and maritime communications, spectrum management is a much more sensitive and complicated task compared to the short-range applications. Coordination of spectrum utilization by terrestrial stations around national borders is another spectrum management task which needs special care. Harmonized decisions on usage of frequency bands with neighbouring countries are necessary to increase the efficiency of spectrum utilization and speed up the frequency coordination process. From the market perspective, economic delivery of radiocommunication services and international roaming requirements cannot be achieved except by harmonized utilization of spectrum. A massive loss of national resources and also delay in the introduction of popular telecommunication services in the national market may occur by having different national regulations or uses for internationally harmonized bands. In such cases, urgent action to harmonize national regulations and spectrum use with the global situation would encourage the growth of the telecommunication industry in the country concerned.

At the international level, the International Telecommunication Union (ITU), as a special agency of the United Nations (UN), assists global harmonization of relevant telecommunication activities, including spectrum management. At the national level, member administrations are responsible for coordinating their telecommunications activities with each other directly or through the ITU to develop international telecommunication regulations that satisfy national interests as well as meeting the requirements of international trends.

Nowadays, efficient administration of the increasing number of spectrum users is possible only by using advanced administrative-technical tools. By means of an automated spectrum management system (ASMS), the responsible authorities may perform a variety of EMC calculations, handle different scheduled administrative procedures and store the records of all national spectrum users in an electronic data base. Some of the capabilities of an ASMS include: issuing licenses, notification of frequency assignments to the Radiocommunication Bureau (BR), providing periodic reports, interference resolution, supporting coordination with other administrations, charging frequency usage, etc. Moreover, an advanced ASMS facility may be connected to remote monitoring stations to perform monitoring missions and identify unauthorized spectrum utilization as well as quickly resolving cases of harmful interference.

The ITU's Radiocommunication (ITU-R) and the Telecommunication Development (ITU-D) Sectors developed, jointly, the BASMS and WinBASMS computer software programs to support national spectrum management. These programs, released in 1995 and 1997 respectively, are in accordance with the requirements specified in an ITU-R Recommendation (ITU-R SM.1048). The Spectrum Management System for Developing Countries (SMS4DC), the next generation of WinBASMS, provides increased functionality for the spectrum management activities of developing countries. This manual is intended to describe the key characteristics and functionalities of the SMS4DC software.

Chapters 1 and 2 with Annex 1 give useful information about the overall specifications and installation and customization of the software. Chapters 3 and 4 provide detailed information about the user interface of the software and about the functions of the menu and toolbar items. Chapters 5 and 6 contain a step-by-step description of the main procedures of the SMS4DC software.

Chapter 1. SMS4DC Software Specification

1.1. Background

The purpose of the SMS4DC software is to provide Developing Countries with a tool to efficiently and effectively manage the radio spectrum, primarily for broadcasting, fixed and land mobile radio services and therefore to accelerate the development of wireless technology in these countries.

The first spectrum management software developed by ITU-R and ITU-D, the Basic Automated Spectrum Management System (BASMS), was released in 1995. It used the FoxPro language and operated on a MS-DOS platform. The later (1997) Windows version (WinBASMS) offered three languages (English, French and Spanish (Russian is also available on special request)) and was available, free of charge, to developing countries. WinBASMS was designed for ease of use and maintenance by a single user and supported most functional requirements defined in the ITU Handbook on National Spectrum Management. WinBASMS was installed and training courses given in several administrations through the ITU/BDT technical assistance missions on frequency management and radiocommunication development. Now, WinBASMS is outdated and, due to several limitations in its utilization, is no longer recommended. The limitations that have been identified include the following features or functions that are ***not*** provided:

- Simplified implementation of propagation models, particularly those given by recommendation ITU-R P.1546;
- Simplified calculation procedures within the interference calculation process and the frequency assignment process;
- Inclusion of information from monitoring or a spectrum monitoring database;
- Provision of a multiple user networking capability;
- Inclusion of a digital terrain database and associated operational programs;
- Security features;

In 2002, Radiocommunication Study Group 1 approved Recommendation ITU-R 1604 "Guidelines for an upgraded spectrum management system for developing countries" calling for improvements/upgrades to WinBASMS to meet the further needs of developing countries. Accordingly, a voluntary group of experts met on several occasions with the objective to draft specifications for this upgrade.

Documents prepared for Resolution 9 of the World Telecommunication Development Conference (WTDC), Istanbul, Turkey 18- 27 March 2002 and WTDC-98, included general objectives of an upgraded version of WinBASMS. Recommendation ITU-R 1604 contains these objectives and are reflected in this report.

The responsibility for assisting, monitoring and reporting on the progress of this aspect of the programme was given to the ITU-R and ITU-D joint group dealing with WTDC-02 Resolution 9. Within the framework of this group, a detailed technical specification was prepared which covers the objectives of an Enhanced Basic System and the essential requirements of an advanced system. The consolidated technical specification was presented to the BDT at the end of 2004 for implementation. Based on these finalized technical specifications, new software, named "Spectrum Management System for Developing Countries" (SMS4DC) was developed and released.

1.2. Objectives of SMS4DC software

The need to upgrade the existing WinBASMS was addressed in ITU-R Recommendations SM.1370-1 and SM.1604. The general objectives for the system are given in the World Telecommunication Development Conference, Istanbul, Turkey 18-27 March 2002 and WTDC-98 Resolution 9 documents and include:

1) The establishment of a computerized operational structure that enables the smooth execution of administrative tasks, frequency allocation, spectrum analysis and monitoring,
2) A single user capability,
3) Improved dynamic engineering modules,
4) Extensive training from the ITU to identify the technical requirements, operational procedures and human resource requirements,

According to the guidelines defined in the various documents mentioned above, the key features of the Upgraded WinBASMS software for spectrum management include:

- *Administrative function*. This function is implemented on a relational database management system that ensures the integrity and consistency of the administrative data. It provides user screens that perform all administrative tasks including: frequency application records, frequency assignment records, licensing records, interference records, frequency measurement records and spectrum fee records. For the time being, the program is available in the English language. In due course, it will be extended to the French, Spanish and Russian languages.
- *Engineering analysis function*. This function provides enhanced analysis tools for processing proposed frequency assignments requested by applicants. It also provides the capability to calculate interference between one or more transmitters and a victim receiver under specified conditions.

Moreover, the group of experts that developed WinBASMS and gave training in its use identified over thirty software modifications that were required in the WinBASMS program in order to improve the functioning of the software in the new upgrade. In addition to these, many other modifications came from suggestions from over fifty developing countries that attended the eight WinBASMS seminars held by the BDT. In particular, four modifications were recommended that would improve:

- Propagation loss prediction for interference problems;
- Improvement of engineering calculation capability;
- The addition of an antenna database from an antenna manufacturer.

A standard three dimensional geographical world-map (GLOBE-DEM recommended) should be integrated and used for any applicable technical calculation. The area- and line-calculation results should be displayed on a map. More features are explained in the next Section.

1.3. Features of SMS4DC software

Taking into account the detailed specification required by the ITU, the following features have been implemented in the SMS4DC software:

I. Utilities and Administrative features

a) geographical map based utilization of Administrative functions,

b) use of a relational database management system,

c) generation of the electronic notices T01, T02, TB1, TB2, TB3, TB4, TB5, T11, T12, T13, T14, G11, G12, G13, G14, GA1, GB1, GS1, GS2, GT1, GT2 and G02

d) BR IFIC database import interface,

e) security features to access the database, including auditing and six-level security which enables a system administrator to define users with different access levels and which logs actions performed in a log-file,

f) recording frequency applications, frequency plans, frequency assignments and allotments, licensing information, technical details, interference and frequency fees,

g) identifying the priority and necessity of data items required for registration of stations in an electronic data base,

h) consideration of regional and international frequency allocations tables in frequency assignment,

i) consideration of (national) frequency plans designed for each frequency band in frequency assignment,

j) multi-user capability of software utilization in a local area network,

k) user-friendly data entry masks with on-line data validation mechanisms, where applicable,

l) local and global administrative-technical data base,

m) capability to show selected stations on map, to search for a station in a map and to zoom in/out and to scroll maps,

n) inclusion of an electronic library of antenna patterns and equipment specifications necessary to perform technical calculations. Antenna patterns may be customized and two/three-dimensional demonstration of radiation diagram is provided.

o) electronic library of frequency plans,

p) electronic data base for microwave links,

q) spectrum fee data base and capability to provide customized fee calculation model,

r) capability to integrate customized formats for reports and licenses,

s) capability to switch the user language interface into the English, French and Spanish languages,

t) ability to track coordination requests or responses to received coordination requests,

u) ability to export the calculation results of SMS4DC to GoogleEarth™

v) ability to communicate bidirectionally with ARGUS monitoring software developed by R&S company

w) ability to communicate bidirectionally with ESMERALDA monitoring software developed by Thales company

x) ability to export data as Comma Separated Values files

II. Technical features:

a) implementation of ITU-R propagation models P.1546, P.1812, P.529, P.530, P.370, P.525 as well as other relevant ITU-R recommendations such as P.452, P.453, P.526, P.527, P.676, P.836, P.837, P.838 and P.841 for various types of implemented radio services,

b) implementation of GE84, GE89, GE06 and ST61 regional plans and bilateral/multilateral agreements on international frequency coordination data exchange for different services,

c) utilization of a three dimensional digital terrain map (GLOBE-DEM with 30 seconds resolution) in propagation model implementation,

d) utilization of clutter maps available in IDWM (coasts, seas, oceans, super refractivity regions, ground conductivity and etc) in the implementation of relevant propagation models,

e) capability to integrate three dimensional digital terrain maps with other, better, resolutions,

f) capability to integrate raster maps and vector maps,

g) frequency coordination calculations and integration of IDWM routines,

h) on-line display of mouse pointer geographical coordinates and active area-variable such as height, field strength value etc.

i) field-strength calculations using different propagation models within a selected area (coverage area), along a profile, along a polygon, at given points and generation of contours. The calculation results can be overlaid on a background map.

j) calculation of network coverage and the best server,

k) interference calculation around the selected terrestrial transmitters and victim receivers,

l) interference calculation between Geostationary satellite Earth stations and microwave stations,

m) interference analysis for assigning frequencies to stations in given locations using relevant ITU-R recommendations, protection ratios and PSD (Power Spectral Density) masks of emissions,

n) possibility to track and customize the issue of licenses for frequency utilization,

o) determination of affected countries for conducting international coordination,

The source code of SMS4DC software and other accompanied technical modules such as IDWM is the protected property of ITU under copyright law.

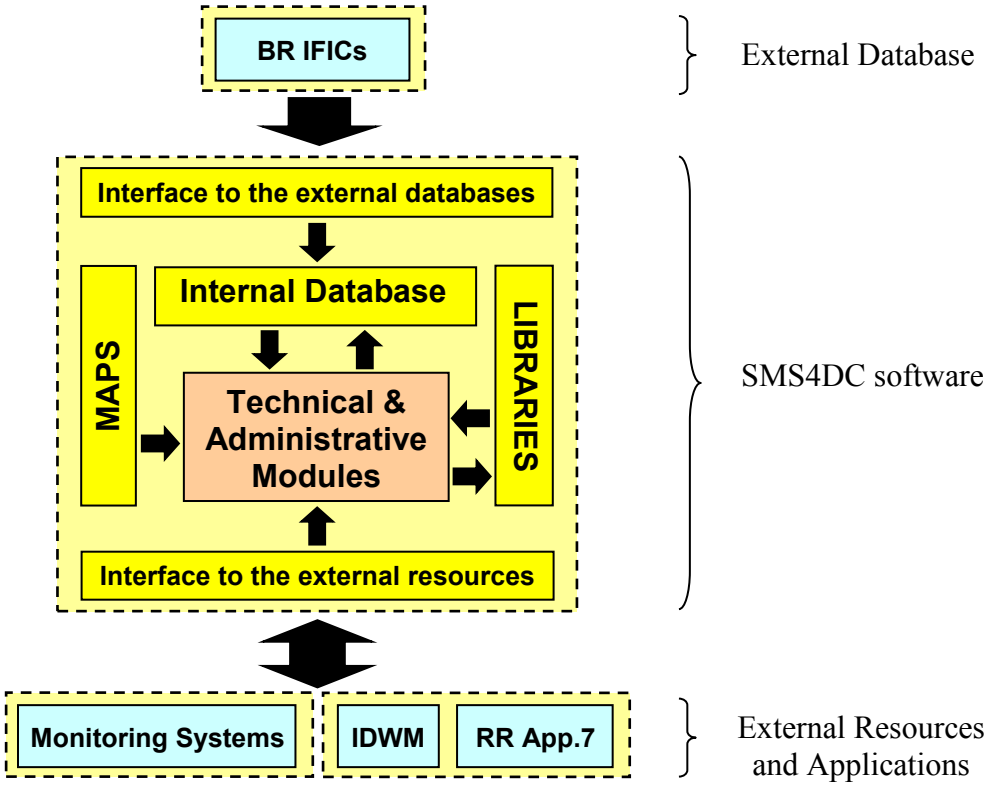
1.4. Structure of SMS4DC software

The SMS4DC software, working under the Microsoft Windows operating system, has been developed as a single package using visual C++6.0 language and, as depicted in Figure 1.1, consists of a core, shell and external parts. The following Sections give a brief explanation of each part of the structure.

1.4.1. Core of SMS4DC software

The SMS4DC core provides a user-friendly machine interface and supplies all the tools necessary to perform or administrate the required technical and administrative tasks of SMS4DC software. The administrative and technical procedures of SMS4DC software are so designed to be independent, except when sharing the same shell elements such as using the database, map or external facilities. Therefore, the core part of the software has been enabled to employ the ITU-developed and authorized modules, IDWM and RR App.7, to generate internationally reliable technical results. Moreover, importing of records from Terrestrial BR IFIC and Space BR IFIC databases is possible using the administrative module.

Figure 1.1. Structure of SMS4DC software



1.4.2. Shell and external elements of SMS4DC software

The Shell of the SMS4C software consists of: geographical raster and vector maps, an administrative/technical database of stations, various libraries and different interfaces to use external resources and databases. Several vector maps have been extracted from the latest ITU Digitized World Map (IDWM) module together with GLOBE DEM, and integrated into the software as a raster map, as required by the BDT specification for SMS4DC. Further

specifications of the integrated geographical map features are available in Section 1.5 and the IDWM reference manual.

Several libraries are integrated within the SMS4DC software and these may be expanded with additional information by users as part of their routine operational work. For example, regional and national frequency allocation tables, antenna patterns, frequency plans and spectral masks of emissions may be stored for software internal usage or as reference data for station establishment and frequency assignment.

1.5. Geographical information systems of SMS4DC software

One of the key requirements of SMS4DC software is the ability to use various types of maps for administrative tasks and technical calculations. Accordingly, SMS4DC software enables both vector and raster map facilities within the different technical and administrative modules to be available to any user, regardless of the user's access level. The following Sections describe this feature.

1.5.1. Vector maps

The SMS4DC software employs the latest ITU Digitized World Map (IDWM) for provision of following vector maps:

- political border lines,
- coastal lines as defined in ITU-R Recommendation P.452,
- ITU radiocommunication regions,
- ST61 geographical areas,
- GE84 geographical areas,
- GE89 geographical areas,
- GE06 geographical areas,

Vector maps are available for use by the relevant technical modules and can be displayed individually or all together on the world map by choosing them as menu items in the "Option" popup menu. Moreover, the results of some technical calculations, such as field strength and coordination contours, can be saved and overlaid on topographical maps. Colour and line thickness of vector poly-lines are adjustable. By moving the mouse cursor over the SMS4DC desktop, information such as country name, ITU Region, country code, geographical coordinates and administration code are displayed on the status bar. The format of vector maps is explained in Annex 2.

1.5.2. Raster maps

The SMS4DC software uses a digital elevation model (DEM), named GLOBE (Global Land One-kilometre Base Elevation). The GLOBE DEM is a global data set covering from 180 degrees west to 180 degrees east in longitude and from 90 degrees north to 90 degrees south in latitude. The resolution is 30 arc-seconds (0.008333... degrees) in latitude and longitude, resulting in dimensions of 21,600 rows and 43,200 columns. At the Equator, a degree of latitude is about 111 kilometres. GLOBE has 120 values per degree, giving GLOBE slightly better resolution than 1 km at the Equator, and progressively finer resolution toward the Poles. The supported projection systems are Lambert and UTM and the datum should be World Geodetic System 84 (WGS84). The value of each pixel represents elevation in metres above Mean Sea Level. The elevation

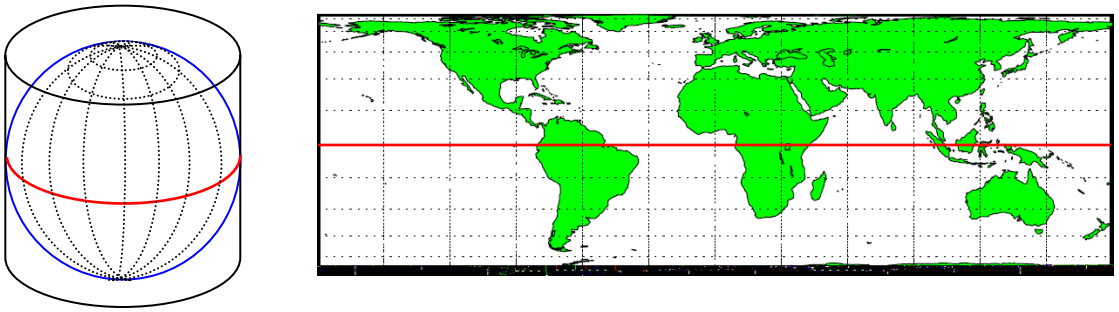
values range from -407 to 8,752 metres on land. In GLOBE Version 1.0, ocean areas have been masked as "no data" and have been assigned a value of -500.

Due to the nature of the raster structure of this DEM, small islands in the ocean smaller than approximately 1 square kilometre (specifically, those that are not characterized by at least one 30" grid cell and/or do not have coastlines digitized into IDWM) may not be represented. The projection parameters are as follows:

Projection	Geographic (latitude/longitude)
Datum	WGS84
Zunits	Metres above mean sea level
Hunits	30 arc-seconds of latitude and longitude
Spheroid	WGS84
Xshift	0.0000000000
Yshift	0.0000000000
Cell Referencing	Each cell is nominally bound by 30" intervals of latitude and longitude, beginning with any whole degree (e.g. 0.0000 degrees)
Parameters	NONE other than those above

The WGS84 cylindrical projection of Earth with constant angular accuracy provides values with varying metric accuracy with respect to latitude in such a way that the most accurate values occur in the Polar Regions. Figure 1.2 demonstrates a regular cylindrical or normal aspect orientation in which the cylinder is tangent to the Earth along the Equator and the projection is calculated horizontally from the axis.

Figure 1.2. Projection method in WGS84 mapping format

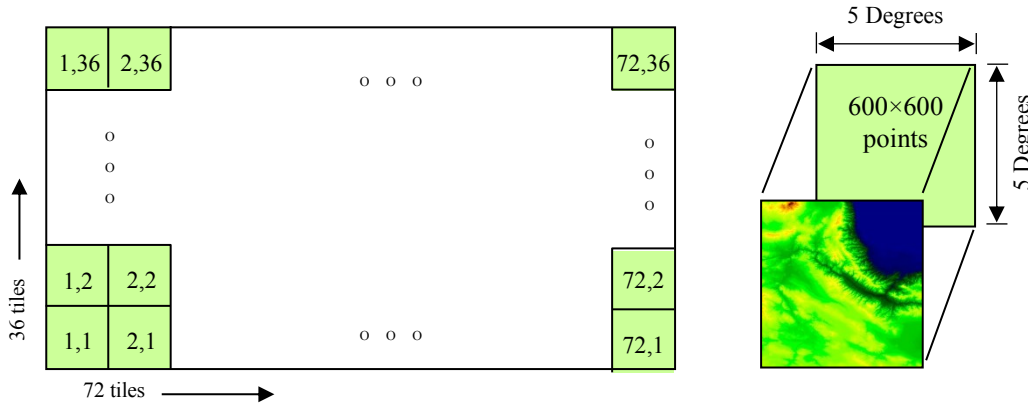


The metric accuracy of DEM along meridians (all latitudes) and Equator is 926.62 m if the earth radius is taken to be 6371 km.

Due to performance enhancement of the application, the original big tiles of GLOBE-DEM are cut into smaller tiles which are only applicable by this application and are provided in the package of the system.

For efficient manipulation of terrain digital map in SMS4DC, the big tiles of GLOBE DEM were cut into 72×36 tiles, each tile in a matrix of 600×600 points in a binary file (600×600×2 Bytes), to prevent unnecessary loading of whole map to computer memory. The numbering method of tiles is displayed in Figure 1.3.

Figure 1.3. Numbering method of GLOBE map tiles



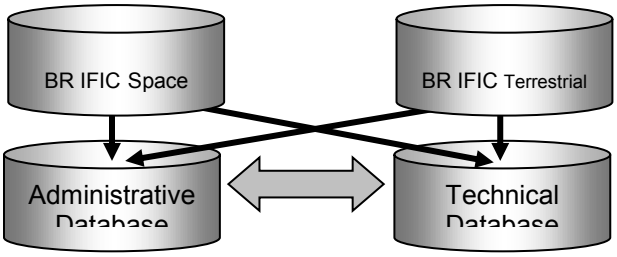
All files are stored in one directory. The reference characteristics of tile groups, such as: directory of tile files, number of tiles, coordination of lower-left corner of first tile, map resolution, machine format, are stored in a text file, named "GLOBE.TXT". This file is located in the TEXTS sub-directory of the SMS4DC working directory. Integration of other map data in the system requires assistance by developers but does not need the application to be re-compiled or re-developed. For the time being, in order to introduce other raster maps, users are able to change the content of this text file, except for the projection systems which are Lambert and UTM and the Datum, which is now WGS84.

Four adjacent 600×600 DEM tiles are loaded and displayed by selecting a rectangular area using relevant push button on the toolbar in vector-map view. Users are able to navigate along DEM in two levels. At the first level, navigation along four loaded tiles is possible by horizontal and vertical scrollbars. At the higher level, users can pan through tiles toward the North, South, West and East directions using relevant push buttons in the toolbar of the DEM view of the desktop. Geographical coordinates and interpolated height of the mouse location are displayed on the status bar. More map based features of SMS4DC software are described in Chapter 3.

1.6. Database structure of SMS4DC

The administrative and technical database of SMS4DC software is constructed under the Microsoft Access platform in a relational structure to give enhanced manipulation of administrative and technical data of stations, as well as for easy importing of data from the ITU-BR IFIC database (terrestrial and space stations). The hierarchical relationship between administrative database elements is implemented using eight administrative levels. The ITU-BR IFIC database can be imported into the administrative database. An item in "Database" menu provides an interface to set-up various options for importing data from the ITU-BR IFIC database. Figure 1.4 displays the relationships explained above.

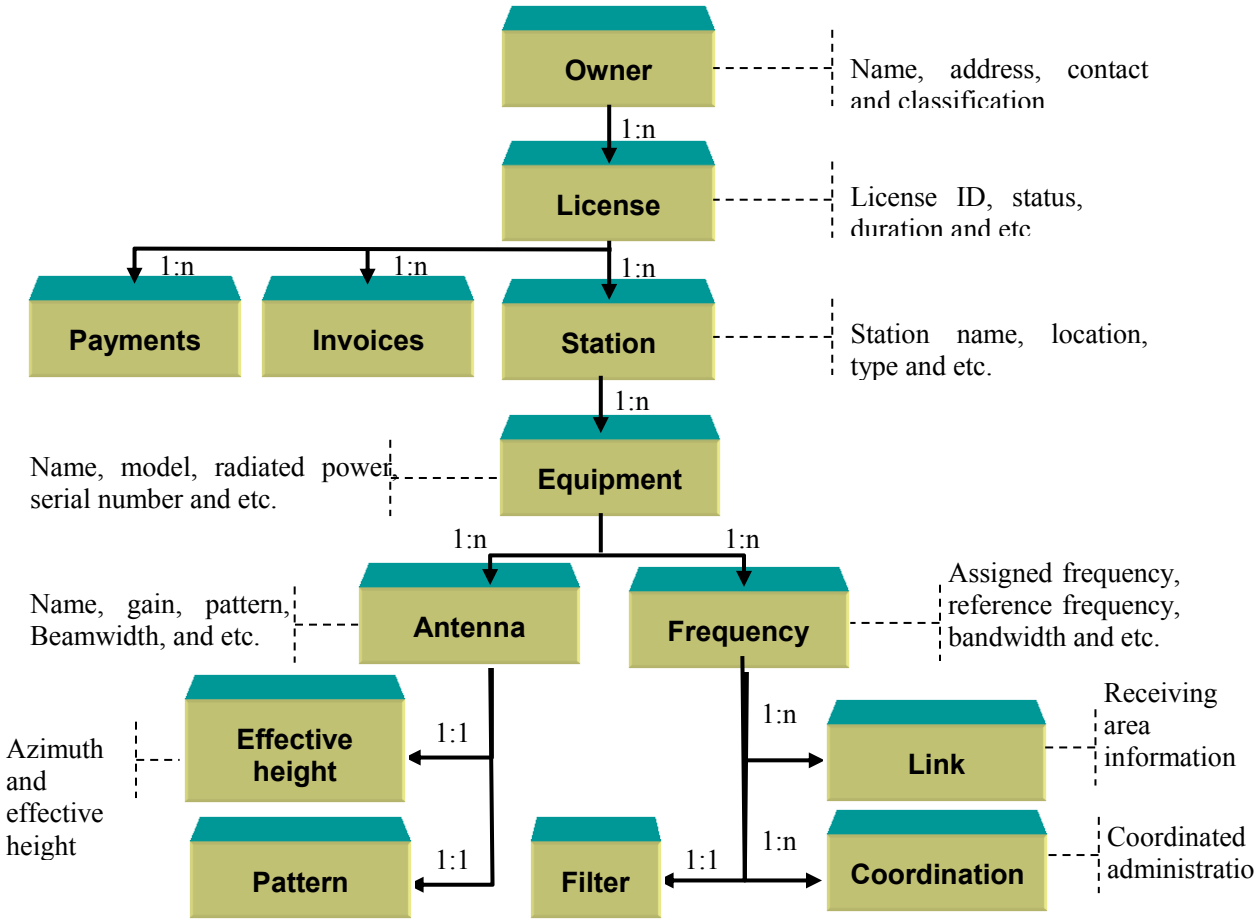
Figure 1.4. Relationship between different database of SMS4DC software and external databases

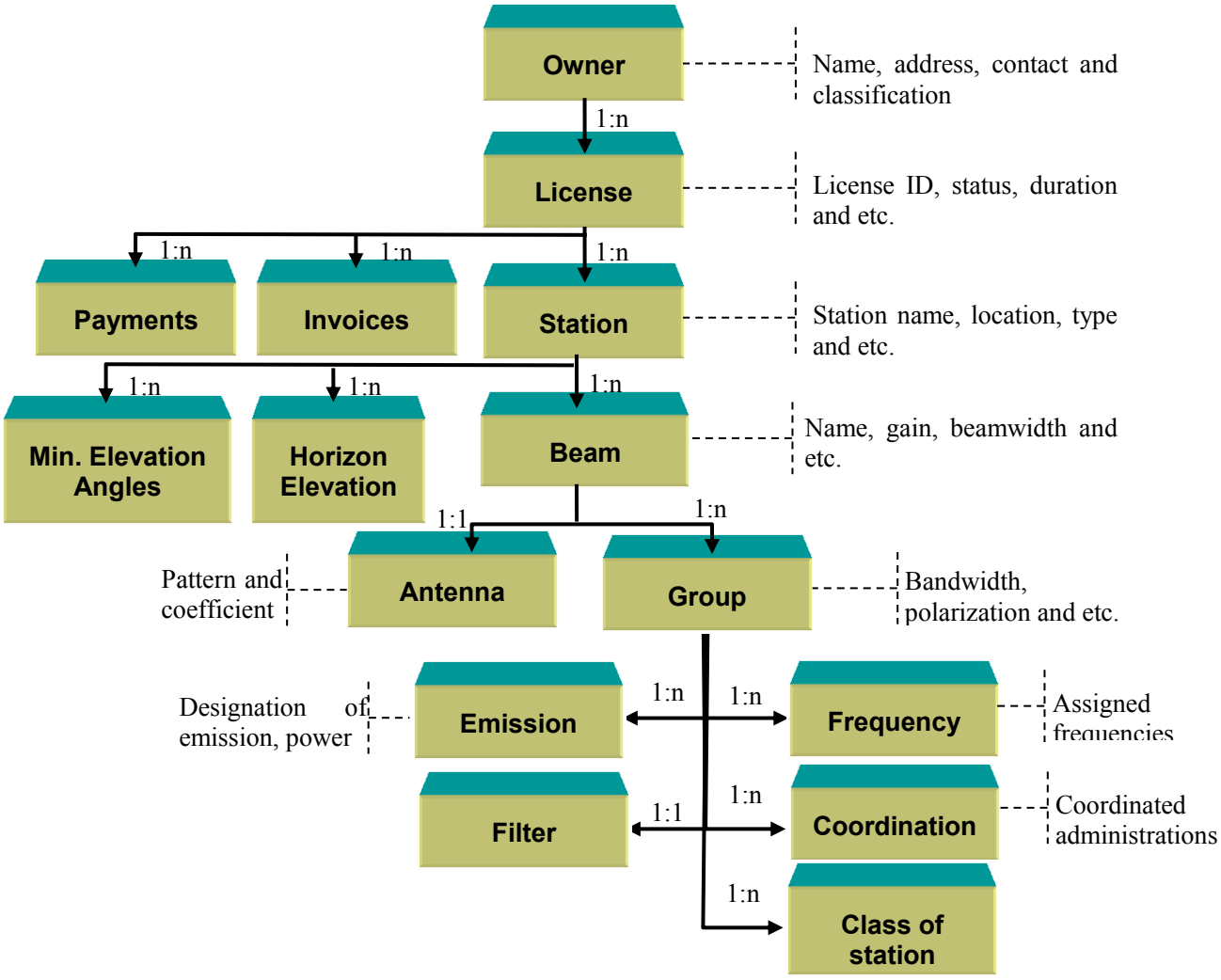


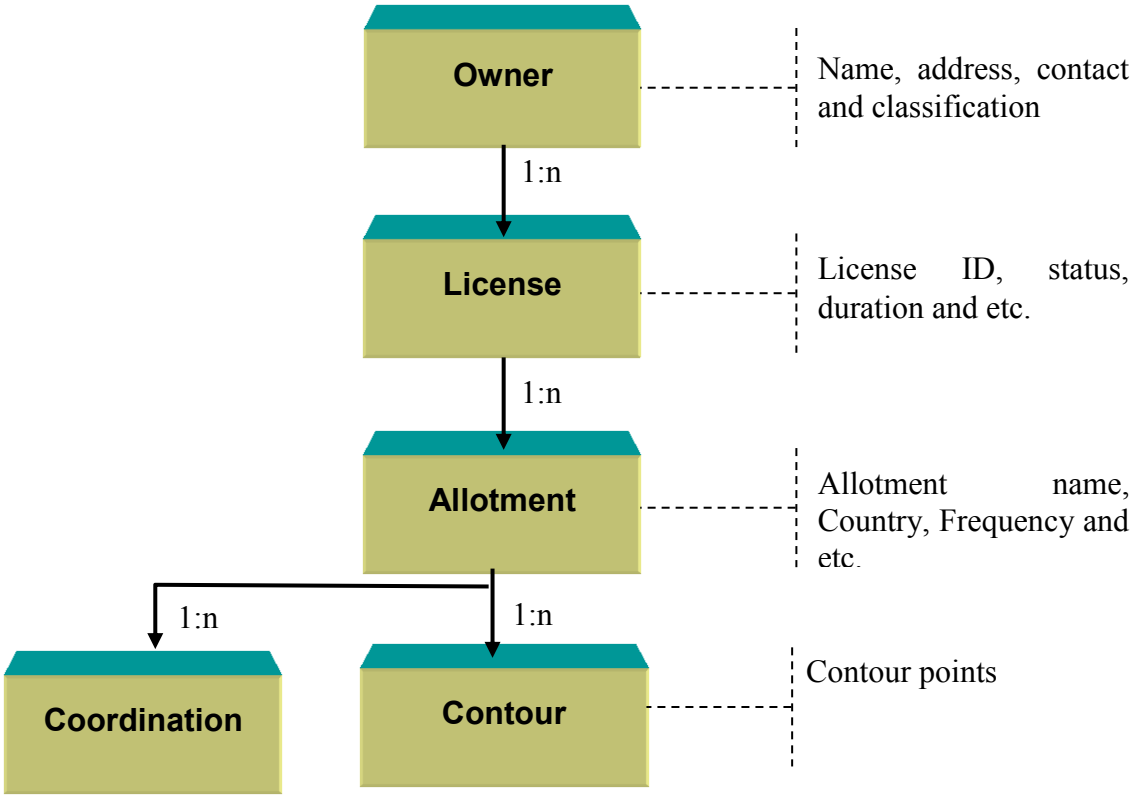
Each table of the administrative database has fields of an identical nature, i.e. tables of effective antenna heights and emission masks. The database structure of the SMS4DC software is displayed in Figure 1.5. Each box in Figure 1.5 denotes a table with several data fields.

The technical database of SMS4DC is not actually a standalone and separate hierarchal database. Technical information, together with all other information (administrative, etc), is kept in one database but separated by various logical mechanisms, which makes it possible to access technical information from the calculation modules. Also, the administrative module is able to examine details of standalone stations (that have been created in the technical module) by accessing the Anonymous Stations record category displayed in the "tree view" of the Administrative window.

Figure 1.5. Structure of administrative database for terrestrial and earth stations and also allotments




Owner
Name, address, contact and classification
1:n
License
License ID, status, duration and etc.
1:n
1:n
1:n
Payments
Invoices
Station
Station name, location, type and etc.
1:n
1:n
1:n
Min. Elevation Angles
Horizon Elevation
Beam
Name, gain, beamwidth and etc.
1:1
1:n
Pattern and coefficient
Antenna
Group
Bandwidth, polarization and etc.
Designation of emission, power
Emission
1:n
1:n
Frequency
Assigned frequencies
Filter
1:1
1:n
Coordination
Coordinated administrations
1:n
Class of station



1.7. Reference materials from ITU and used in the development of SMS4DC

The SMS4DC software incorporates: approved versions of ITU recommendations (mostly ITU-R), BR circular letters, ITU Radio Regulations, regional agreements, spectrum management handbook. These are the latest versions at the time of the SMS4DC development. Also, ITU technical modules and WinBASMS software have been studied and incorporated in accordance with the SMS4DC objectives and framework. The propagation models, administrative procedures, electronic notices, SMS4DC software structure, database structure and GUI (Graphical User Interface) of SMS4DC are consistent with this reference material. Furthermore, the results of all technical calculations have been verified individually by comparison with several sample results. A list of all references is given in Annex 2.

Chapter 2. Program installation guide

2.1. System requirement

SMS4DC requires approximately 100 Megabytes of space on the hard drive. This amount of storage is necessary for the application and the main database only and does not include map files. The space required for map files depends on the size and resolution of maps. For example, a digital terrain model (DEM) for the whole world with the resolution of 1km needs about 1.5 GB of disk space. Operation of SMS4DC requires a USB hard-lock "dongle".

In summary, SMS4DC requires a computer system with the following specifications:

Minimum	Recommended
• Pentium III processor with 1 GHz clock speed; • 256 Megabytes Random Access Memory (RAM); • Hard Disk Drive with a minimum of 2 Gigabytes free available for installation in case of single-user setup; or 200 MB in case of setup on network, • CD Drive; • SVGA Colour Monitor capable of 1024 x 768 pixel resolution; • Colour Inkjet or Laser printer; • Graphics adapter with OpenGL support;	• Pentium IV processor with 3 GHz clock speed or more; • 1 Gigabytes Random Access Memory (RAM); • Hard Disk Drive with a minimum of 10 Gigabytes free available for installation; • DVD Drive; • SVGA Colour Monitor capable of 1024 x 768 pixel resolution; • Colour Inkjet or Laser printer; • Graphics adapter with OpenGL support;

The minimum hardware requirements listed above assume operation under Windows 2000. The use of a more resource-consuming version requires a more capable hardware platform, especially with respect to the processor and the amount of RAM (e.g. suitable operation under Windows XP will be best achieved with a Pentium IV-based PC with a least 2 Gbytes of RAM). SMS4DC has been developed and tested for operation on systems with the following configurations:

- Microsoft Windows Operating system Windows 2000 (SP4), Windows XP (SP2), Windows Vista for single-user setup or for workstation in case of setup on network;
- Windows 2000 server edition or Windows XP server for operation on a network server;
- Microsoft Office 2000, 2002 and 2007
- Adobe Acrobat PDF reader version 8
- Google Earth

Note: The DPI settings for the Windows screen should be set to normal size (96 dpi).

2.2. Setup

The SMS4DC software installation is distributed on a CD. This auto-run CD contains the SMS4DC package, integrated world digital map, user manuals and ITU IDWM. ITU BR IFIC DVD must be installed in advance to enable users to import the internationally registered data of assigned frequencies, necessary for frequency coordination tasks. Two types of installation are possible:

- Setup for a multiple-client network
- Setup for a single-user

No system restart will be necessary after installation of SMS4DC package.

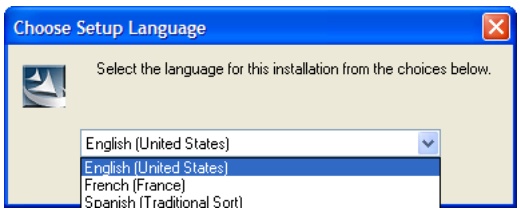
2.2.1. Setup for a multiple-client network

In the case of installing SMS4DC for a multiple-client network, the digital map tiles and database of SMS4DC can be stored on a server for common use of clients. Therefore clients connected to the server will be able to read digital maps and update the common database. Consequently, only the SMS4DC software core need be installed on the client PCs. The set-up instructions are as follows:

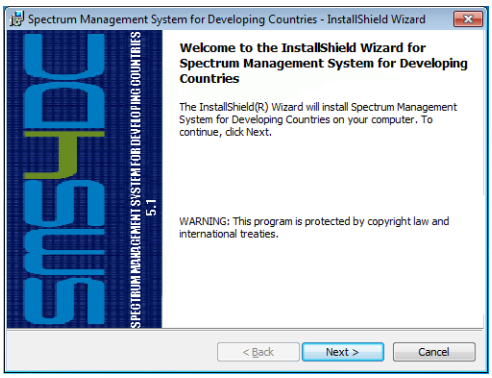
Part A: Digital map and database installation on server

I. Insert the SMS4DC CD in the CD-drive of the server PC. The SMS4DC CD is auto-run, therefore Windows installShield wizard will launch automatically. Choose the installation language from the list of available languages that are displayed (Fig. 2.1(a)). The InstallShield wizard will check the server PC's operating system (Fig. 2.1(b)).

Figure 2.1. SMS4DC software InstallShield Wizard, a) language selection, b) Check the system requirements, c) License agreement, d) User information, e) Option to choose type of installation and (f) Custom setup

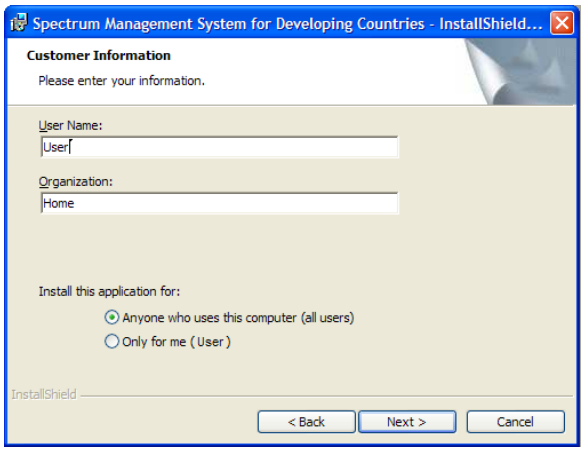


(a) Language selection

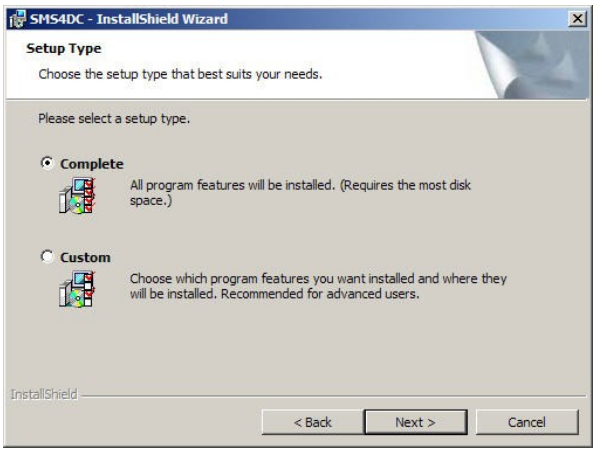


(b) Check the system requirements

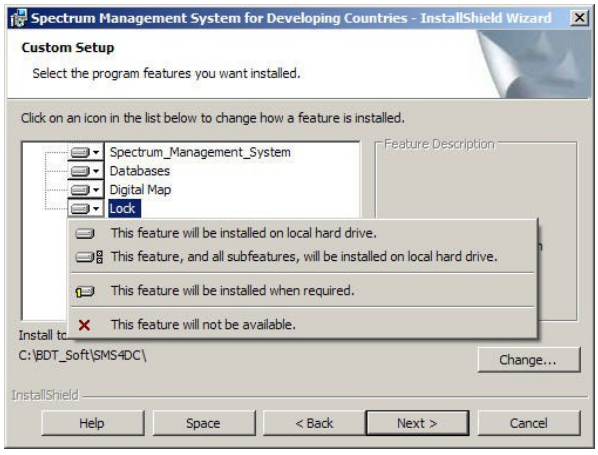
(c) License agreement



(d) User information



(e) Option to choose type of installation



(f) Custom setup

II. Accept the license agreement (Fig. 2.1(c))

III. Enter the "Customer" information (Fig. 2.1(d)).

IV. Choose the option **Custom** for the type of installation (Fig. 2.1(e)).

V. In the features list of the Custom setup menu (Figure 2.1f), uncheck the first and last features ("Spectrum_Management_System" and "Lock". "Databases" and "Digital Map" should remain checked so that the Digital Maps (2,592 files) and Databases will be transferred to the folders "…\BDT_Soft\SMS4DC\Globe" and "…\BDT_Soft\SMS4DC\DB" respectively. Click "Next" and InstallShield wizard will begin installation.

VI. When the InstallShield wizard has completed installation, use Windows Explorer to share the folders: "…\BDT_Soft\SMS4DC\Globe" as "Read Only" and "…\BDT_Soft\SMS4DC\DB" as "Full Access".

Part B: SMS4DC installation on client PCs or Laptops

I. Insert the SMS4DC CD in the CD-drive of the client PC. The SMS4DC CD is auto-run, therefore Windows installShield wizard will launch automatically. Follow steps I to III of Part A above, but on the client PC.

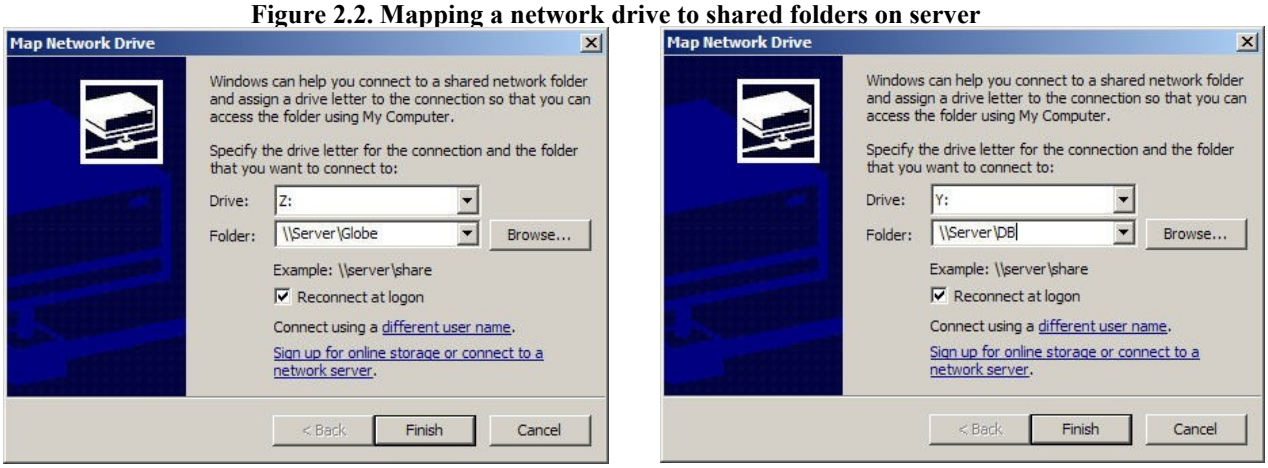
II. On the Custom setup menu (Fig. 2.1(f)) uncheck only the feature "Digital Maps" on the list of features. This will install all folders of SMS4DC package, except the Digital Maps (2,592 files). Click "Next" and InstallShield wizard will complete the installation.

III. When the InstallShield wizard has completed installation, use Windows Explorer to map a network drive to the folder containing the digital map files (on server). To do this, go to the Explorer menu item: "Tools\Map Network Drive… " and find the shared \\Server\Globe folder (Figure 2.2a)

IV. Use Windows Explorer to map a network drive to the folder containing database files (on server). For this purpose, go to the Explorer menu item: "Tools\Map Network Drive… " and find the shared \\Server\DB folder (Figure 2.2b)

V. Use Windows Notepad to open the file "…\BDT_Soft\SMS4DC\Texts\Globe.txt" and put the mapped drive name of digital maps in front of the word "FilesPath " e.g. "FilesPath Z:\" then save the file.

Figure 2.2. Mapping a network drive to shared folders on server



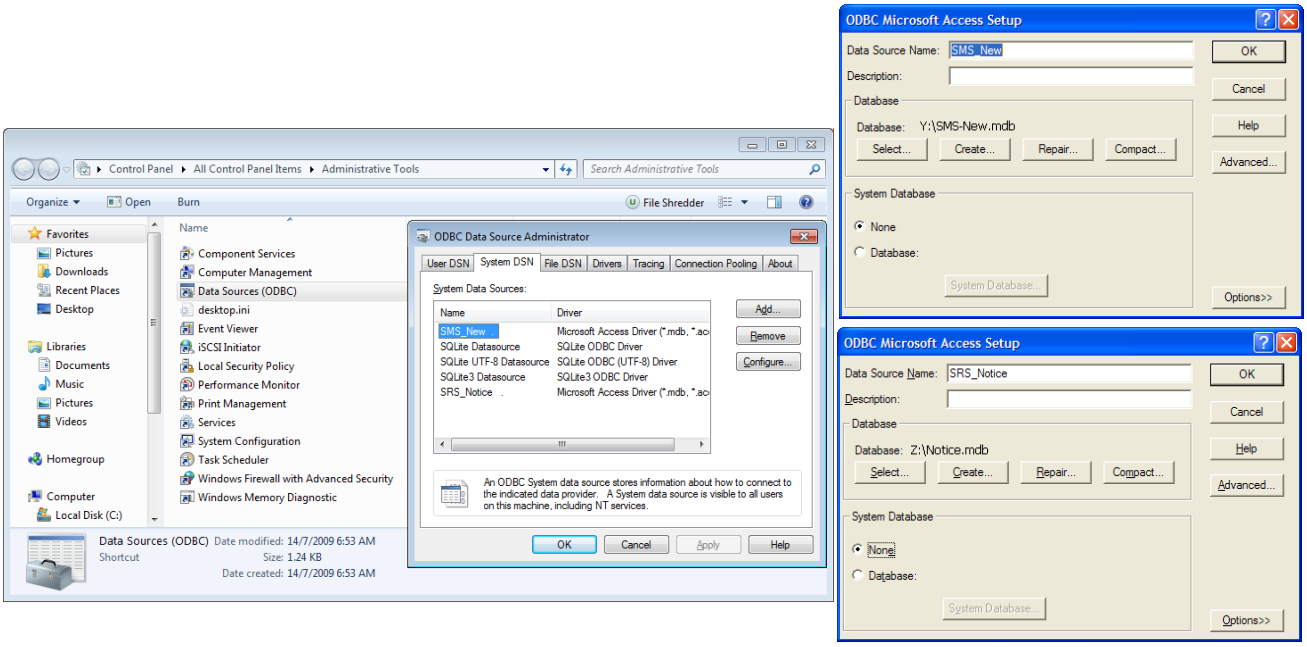
(a) Mapping network drive Z: to \\Server\Globe

(b) Mapping network drive Y: to \\Server\DB

VI. Use Windows Data Source Administrator to select and identify the SMS4DC database files. The Data Source Administrator can be found under menu "Control Panel\Administrative Tools\Data Source (ODBC)" (Figure 2.3(a)). Under the "System DSN" tab, select data source "SMS New" (name of the database file) from the list. Click the "Configure" button for the ODBC Microsoft Access Setup menu (Figure 2.3b). Click "Select" and choose from the list the network drive which has been already mapped to the shared \\Server\DB folder (i.e. Y: in example of Figure 2.3(b)). Click on OKs to finish.

VII. Repeat the procedure above but this time to select the data source "SRS-Notice".

Figure 2.3. ODBC configuration a) DNS Tab of data source administrator and b) configuration menu



(a) DSN Tab of Data Source Administrator

b) Configuration menu

2.2.2. Single – user Setup

All the elements of the SMS4DC package have to be created in the same workstation in the case of installing SMS4DC on a stand-alone PC. The instructions for the set-up procedure are:

I. Insert the SMS4DC CD in the CD-drive of the stand-alone PC. The SMS4DC CD is auto-run, therefore Windows installShield wizard will launch automatically. Choose the installation language from the list of available languages that are displayed. The InstallShield wizard will check the stand-alone PC's operating system.

II. Accept the license agreement and enter the user information. Go to the next page.

III. Choose the option **Complete** for the type of installation and allow the InstallShield wizard to complete the installation.

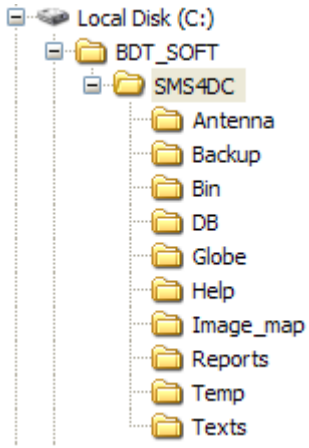
2.3. USB Hard lock setup

The USB hard lock driver program is normally installed automatically during the main SMS4DC installation. The dongle should be plugged in to an active USB port of the computer ONLY after the installation is finished. The Windows operating system will detect the USB hard lock as a new hardware, find the hard lock driver and finalize the installation.

2.4. Directory structure of SMS4DC

The directory structure of the SMS4DC software in the case of a single-user setup is illustrated in Figure 2.4.

Figure 2.4. Directory structure of SMS4DC software in case of single-user setup



As shown above, the following folders are created during software installation:

- **BDT soft**: The main folder,
- **SMS4DC**: Main folder of SMS4DC software,
- **Antenna**: Antenna definition files,
- **Backup**: The folder containing the backup of database,
- **Bin**: DLLs and executable files of SMS4DC,
- **DB**: Database files which could be copied to the server,
- **Globe**: DEM files,
- **Help**: User manual,
- **Image_map**: Background map of vector view,
- **Reports**: Output report files,
- **Temp**: A folder for temporary files,
- **Texts**: Reference text files and HTML templates

2.5. Security

The database of SMS4DC is accessible only through the software, as the database file cannot be accessed directly and only authorised users may access the database through the software. Moreover, as described in Section 3.2., hierarchical levels of access may be setup by the system supervisor for each user of the system, appropriate to their designated tasks in using the application. Within the software applications, only users who are authorized by the supervisor or senior operator can edit the database.

2.6. Local database migration

The database of the SMS4DC package operates under the Microsoft Access format, which is compatible with the database of all other ITU software applications. Importing frequency

assignment records from any existing national database (database migration) may be desirable in order to facilitate the fast and easy preparation of SMS4DC for frequency assignment work. After an evaluation of the existing situation in the field, one of the following migration methods may be considered the most convenient and time-efficient:

- Assistance of the SMS4DC development team to design an electronic data migration interface to transfer any existing electronic database to the SMS4DC database. Each case will require an individual interface to be designed to reformat and map fields of the existing electronic database to the target database while verifying logical relationships. This approach will make possible the transfer of numerous records and will require automatic generation of a log file to list all successfully transferred records together with a report of all failed transfers and their reasons for failure.
- Manual migration of existing electronic/administrative data. For those cases where an existing database contains a relatively small number of records (i.e. less than ten thousand records), it is preferable to enter all data manually over a period of time.

2.7. Customization of administrative functions

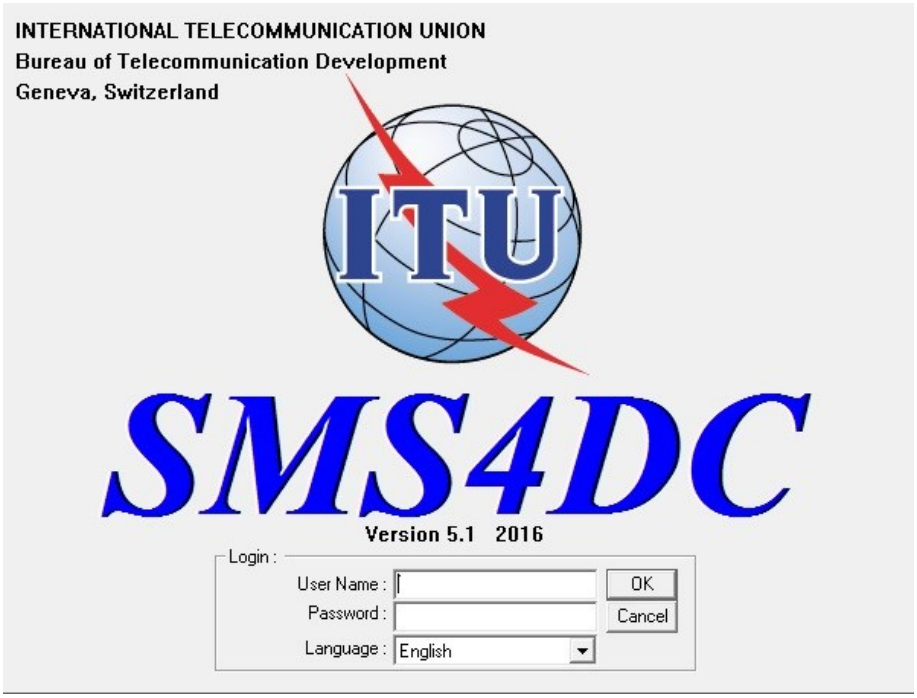
With the support of the SMS4DC experts, the licenses, invoice and receipt templates of the administrative part of package can be adapted or designed to meet local needs; although, as far as possible, this should be included as part of the advance preparation tasks.

Chapter 3. Menus and Toolbars of SMS4DC

3.1. Program start

The shortcut icon of the SMS4DC software will be displayed on the Windows Desktop and SMS4DC program entry will be available in the list of Windows Programs if the software has been installed correctly in accordance with the instructions given in Chapter 2. The program is started by clicking on the SMS4DC shortcut icon on the Windows Desktop. The title screen is then presented, if the authorized hard-lock is discovered at a USB port; otherwise, an error message will be displayed to warn that the hard-lock is missing. Figure 3.1 displays the title screen.

Figure 3.1. Title screen of SMS4DC software



In order to access the system for any task, users must enter their User Name (User-ID) and Password assigned to them by the system supervisor. These Passwords and User-ID may have a maximum of twenty alpha-numeric characters and are case-sensitive. At the first execution of the SMS4DC software, the default User-ID and Password have been set to "SMS4DC". The supervisor User-ID has been reserved for the system supervisor but the corresponding Password can be changed. The system supervisor has privileges to access the complete database and to use any features of software but the privileges of other uses will be defined by the system supervisor. The next Section explains the access levels which may be authorized by the system supervisor to other users. A valid User Name and Password will activate the OK push button. The software has

been currently developed in the English and French languages. The SMS4DC main menu is displayed by pushing the OK button.

3.2. Definition of User-ID and Password

Spectrum management involves several different tasks, requiring different types of expertise with different levels of responsibility. Therefore, each user is granted permission to access only those SMS4DC features and parts of the database relevant to his/her tasks and responsibilities. The following access levels have been implemented in the SMS4DC software:

i. *Data entry (Licensing and Billing)*: Privileged to read/write licensing and billing databases,

ii. *Engineers*: Privileged to read/write the technical database,

iii. *Senior operator*: Privileged to modify reference tables,

iv. *Supervisor:* Privileged to read/write all the database, as well as to manage User-IDs and passwords, reference tables and to configure and use any features of the software,

v. *Licensing*: Privileged to read/write the database of reference information (such as equipment specification, antenna pattern, frequency plans, etc.) and to only read other databases,

vi. *Read-only*: Privileged to use software but with no permission to edit any database,

Only the system *supervisor*, as administrator, is allowed to define and cancel User-ID and Password for other users through "Database–>Users" item. Figure 3.2 displays the menu of User-ID and Password management.

Figure 3.2. Menu of User-ID and Password management

The Supervisor has the option to create a new account or modify an existing account by selecting either the "New" or "Modify" buttons respectively according to the following:

- *Create new account*: By choosing the "New" box, the "Modify" box will turn gray. The Supervisor is able to define a new, case sensitive, User Name and Password (visible), maximum 20 characters. A blank password is not permitted. One of six access levels must then be selected for the new account from the relevant combo box. The newly created account will be enabled by default when the "Save" button is clicked; there is no need to activate "Enabled" check box. Duplicate User Names are not allowed.

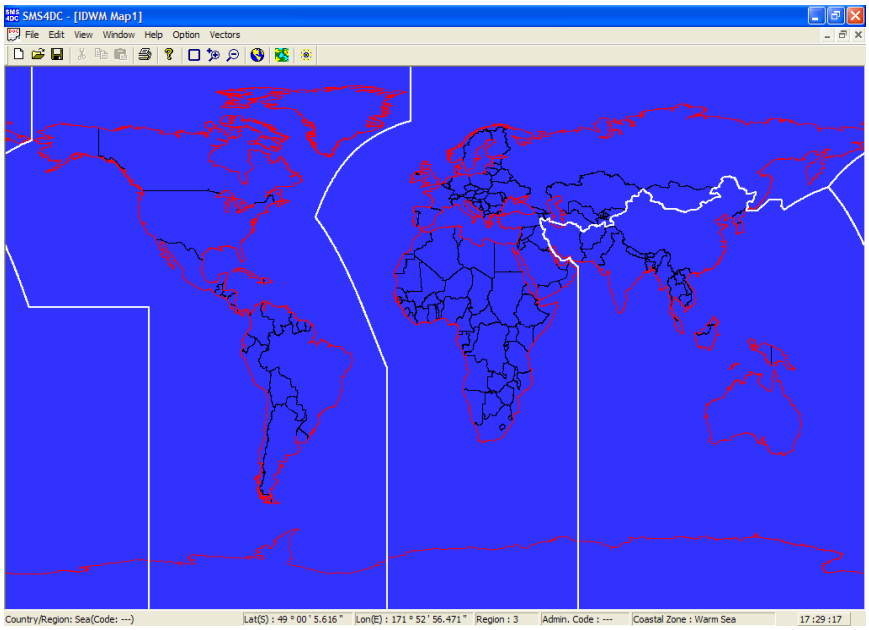
- *Modify an existing account*: By choosing the "Modify" box, the "New" box will turn gray. The Supervisor is able to browse existing User Names from the User Name combo box and to see the corresponding access level. User Names cannot be changed. No password will be displayed for the selected User Name and the relevant edit box will stay blank. The old password will be kept intact if nothing is entered in the password edit box. For the purpose of keeping an audit-trail (history) of all performed actions, the Supervisor cannot delete the full history of any user, only disable existing accounts. Disabled accounts can be recovered for the same user simply by clicking the "Enabled" check box. Pushing the "Save" button is necessary to apply any new setting.
- *Delete an account*: Users without any history of actions can be deleted by the Supervisor clicking the "Delete" push button.

To enable the SMS4DC software to be operated immediately after installation, the default setting for both User-ID and Password is: SMS4DC.

3.3. IDWM map view

The ITU Digitized World Map (IDWM) is used to draw political boundaries of countries on the desktop of SMS4DC. The coastal lines and boundaries of the three Radiocommunication Regions are overlaid on the World vector map by default to facilitate users in the selection of smaller areas for further investigation. Figure 3.3 shows the desktop of SMS4DC software displaying political border lines and the ITU Regions, similar to the picture in No.5.2 of the Radio Regulations.

Figure 3.3. Interactive desktop of SMS4DC software
(Political borderlines in black, coastlines in red and ITU-R Radio Regions in white colour)



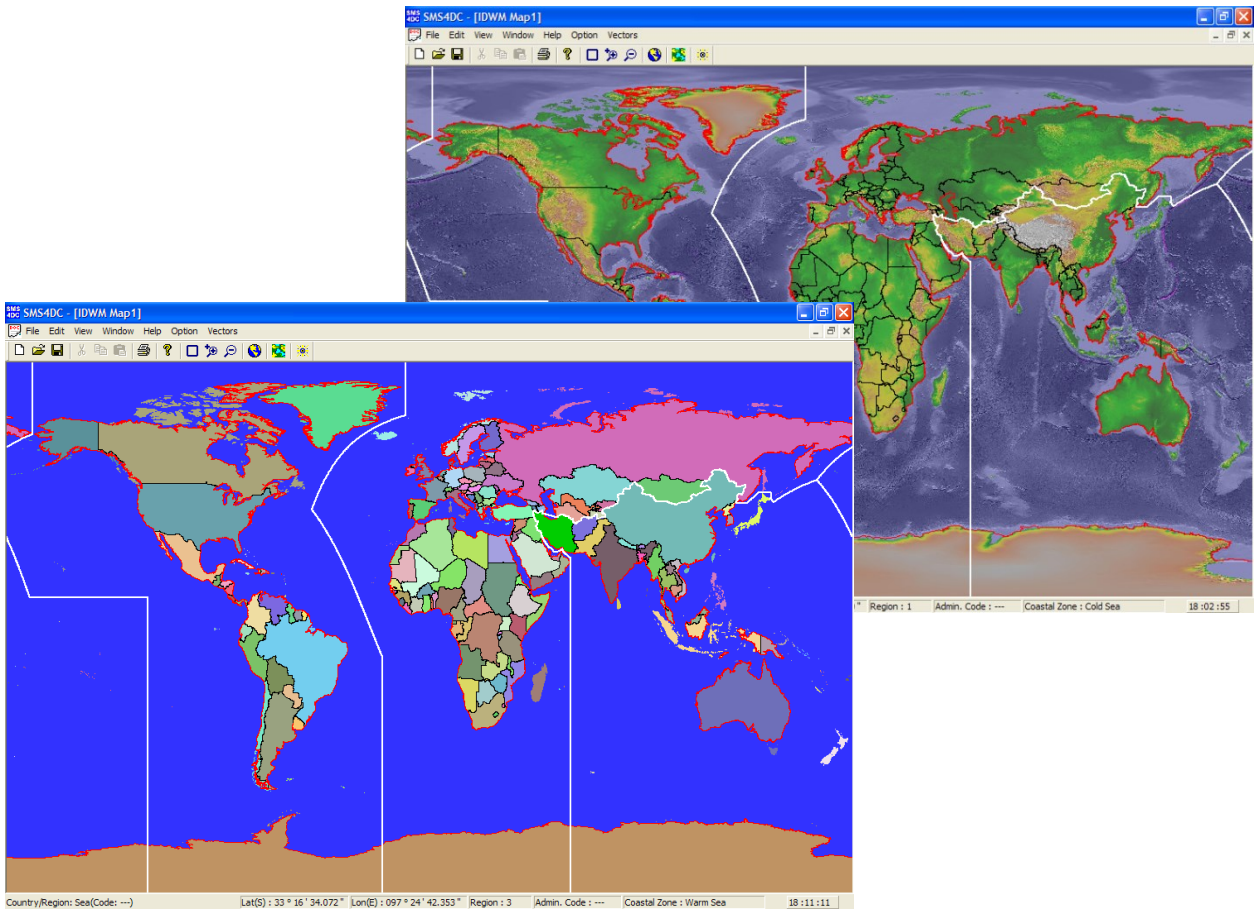
When the mouse cursor is moved across this window, the status bar will display: country names with corresponding code, region name (such as ATA for Antarctica), geographical coordinates, radiocommunication region, administration code and type of coastal area. In addition the time is shown on the right side of the status bar.

3.3.1. Option menu of IDWM map view

The following items are provided in the “Option” menu:

- Background map: Figure 3.4 shows this picture.

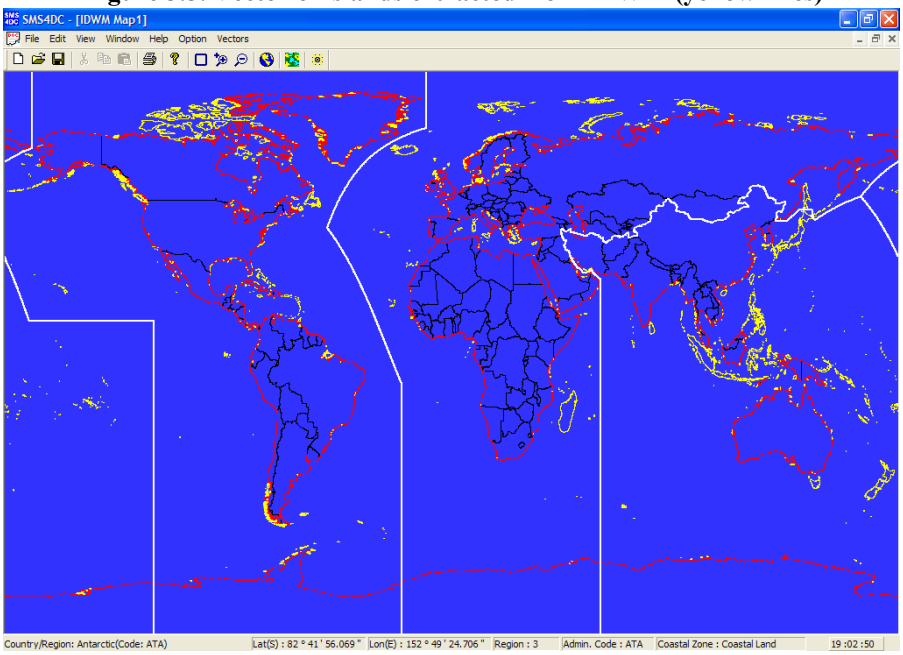
Figure 3.4. Topographical coloured picture of the World as a background to the IDWM map and also a plain coloured view



- Background Colour: This item sets the background colour of the vector map. Blue is selected as the default background colour.
- Fill Countries: This item displays each country with different or contrasting colour within its borderlines, as shown in Figure 3.4.
- Political Borderline & Line Style: These items switch on/off the vector map of countries extracted from IDWM and change the line styles. As shown in Figure 3.3, this vector map is loaded to the desktop by default. If switched on, a check mark will appear to the left of this item in the Option menu window.
- Coastlines & Line Style: This item switches on/off Polygons along coasts of open water and Caspian Sea extracted from IDWM and changes the line style as shown in Figure 3.4 in red. If switched on, a check mark will appear to the left of this item in the Option menu window.

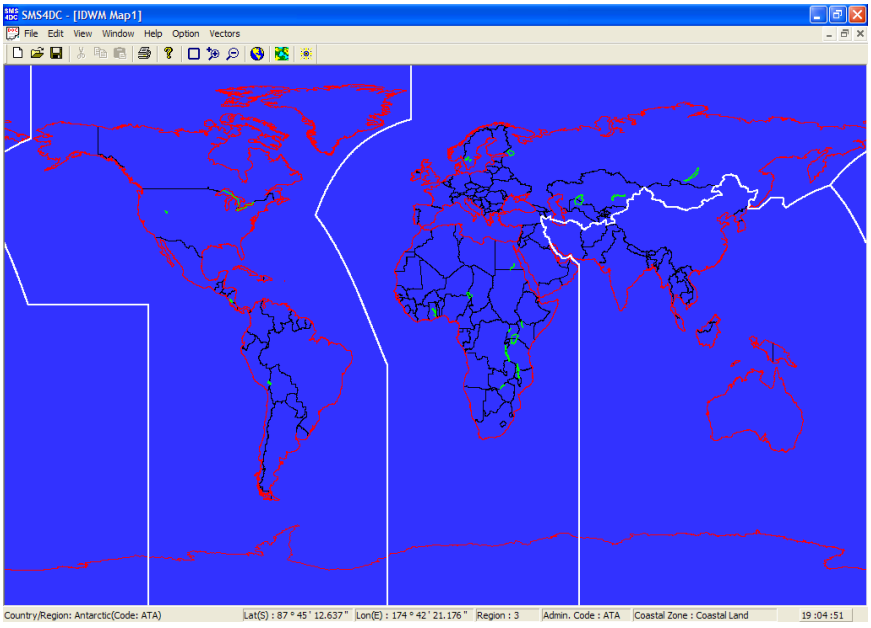
- Islands and Line Style: This item switches on/off Polygons of islands extracted from IDWM and changes the line style. Figure 3.5 shows islands displayed. If switched on, a check mark will appear to the left of this item in the Option menu window.

Figure 3.5. Vector of islands extracted from IDWM (yellow lines)



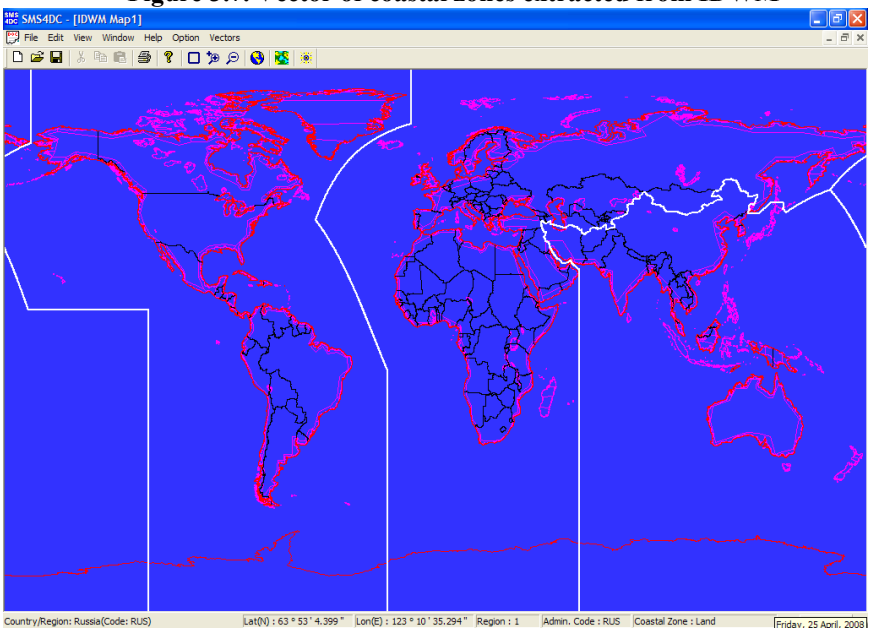
- Lakes and Line Style: This item switches on/off Polygons of lakes extracted from IDWM and changes the line style. Figure 3.6 shows lakes displayed. If switched on, a check mark will appear to the left of this item in the Option menu window.

Figure 3.6. Vector of lakes extracted from IDWM (red lines)



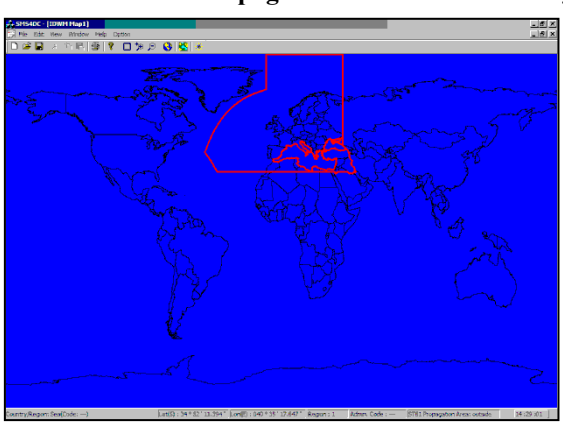
- ITU-R Regions & line Style: These items switch on/off Poly lines of ITU Radiocommunication Regions extracted from IDWM and change the line style. Figure 3.3 shows these Regions displayed in white. If switched on, a check mark will appear to the left of this item in the Option menu window. ITU-R Regions are displayed on the World vector map by default.
- Coastal Zones and line Style: This item switches on/off vectors of coastal zones (as defined in ITU-R recommendation P.452 and extracted from IDWM) and changes the line style. Figure 3.7 shows the coastal zones displayed. If switched on, a check mark will appear to the left of this item in the Option menu window. The coastal zone code of mouse location is displayed at the rightmost location of status bar.

Figure 3.7. Vector of coastal zones extracted from IDWM

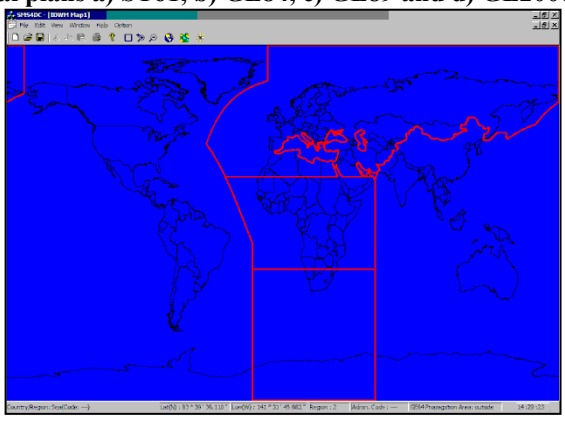


- Propagation Zones and line Style: This item provides sub-items to switch on/off vectors of different propagation zones (as defined in ST61, GE84, GE89 and GE2006 Regional Plans and extracted from the IDWM) and change the line style. Figure 3.8 shows propagation zones displayed. If switched on, a check mark will appear to the left of this item in the Option menu window. The propagation zone code at the position of the mouse cursor is displayed at the rightmost location of the status bar.

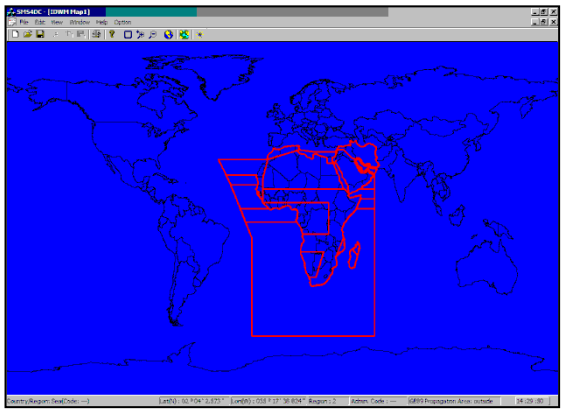
Figure 3.8. Vector of Propagation Zones defined in regional plans a) ST61, b) GE84, c) GE89 and d) GE2006



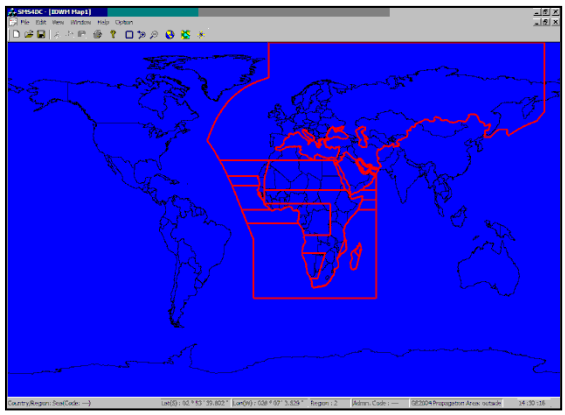
a) ST61



b) GE84



c) GE89



d) GE2006

3.3.1.1. RR Appendix 7 item in Option menu

This item calculates and draws coordination contours around a selected Earth station in accordance with the method explained in Radio Regulation Appendix 7, using the Ap.7/ITU-R SM.1448 ITU-R technical tool. The following sub-items are provided:

- Earth Station Selection: This item selects a group of frequencies for the process of coordination contour calculation. If this item is selected, the dialogue box of "Earth Station Selection" opens. As shown in Figure 3.9a, this dialogue box provides a hierarchical tree-view of beam groups, starting from the country concerned, which enables users to select a single beam as well as all beams of all Earth stations of a country by a left-click of the mouse. The relevant characteristics of the selection will be copied to the edit boxes in the dialogue box.

  As shown in Figure 3.9b, the "Option" button allows the user to customize the default values of the following parameters used for contour calculation:

  BDIRPC (%): Percentage of time to be used in the calculation of the bi-directional coordination area for a transmitting earth station (optional). The default values are taken from Table 3 of Recommendation ITU-R SM.1448 or Table 9 of Appendix 7 (WRC-2000). The value related to analogue emissions is chosen as default when both options, digital and analogue, are given in the

table. A value of BDIRPC in the input data will override the default for all bi-directional contours applicable.

TRANPC (%): Percentage of time to be used in the calculation of the coordination area for a transmitting earth station (optional).

The default values are taken from Table 1 of Recommendation ITU-R SM.1448 or Table 7 of Appendix 7 (WRC-2000). The value related to analogue emissions is chosen as default when both options, digital and analogue, are given in the table. A value of TRANPC in the input data will override the default.

RECVPC (%): Percentage of time to be used in the calculation of the coordination area for a receiving earth station (optional). The default values are taken from Table 2 of Recommendation ITU-R SM.1448 or Table 8 of Appendix 7 (WRC-2000). The value related to analogue emissions is chosen as default when both options, digital and analogue, are given in the table. A value of RECVPC in the input data will override the default.

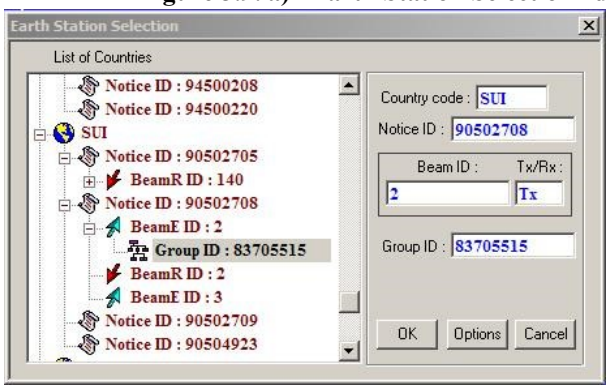
SATEAST (deg): Eastern extreme (deg) of the operational portion of the orbital arc. Only to be given when space stations on a portion of the geostationary orbital arc are to be considered.

SATWEST (deg): Western extreme (deg) of the operational portion of the orbital arc. Only to be given when space stations on a portion of the geostationary orbital arc are to be considered.

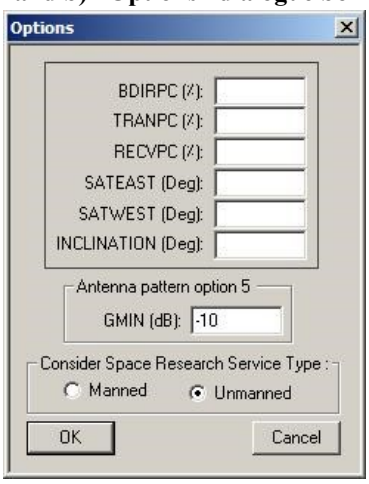
INCLINATION (deg): Maximum orbital inclination (deg) for a geostationary space station in a slightly inclined geosynchronous orbit.

GMIN: Antenna minimum gain for antenna pattern option 5.

Figure 3.9. a) "Earth Station Selection" dialogue box and b) "Options" dialogue box



(a) Earth Station Selection dialogue box



(b) Options dialogue box

After successful selection of an Earth station, SMS4DC generates and delivers an input file to the Ap.7/ITU-R SM.1448 (Ap28) ITU-R technical tool. The output of the ITU-R technical tool is saved in two output files: RESULT.LST and UPD.DAT. The generated input and two output files can be reviewed by using three relevant menu items.

- Draw Contour(s): This item draws, on a vector map, the Method 1, Method 2 and/or Auxiliary Coordination Contours for the selected groups of a selected Earth station. A dialogue box containing a spreadsheet of selected groups and calculation methods will be displayed by choosing this menu item and the user can select any group in the spreadsheet for contour drawing by using a left-click of the mouse on the record-select column. Figure 3.10 illustrates this dialogue box. A check box will be printed to the left of the item if any coordination contour is displayed on the vector map. Figure 3.11 illustrates several coordination contours around an Earth station in Geneva.

Figure 3.10. Dialogue box to select coordination contours for displaying on vector map

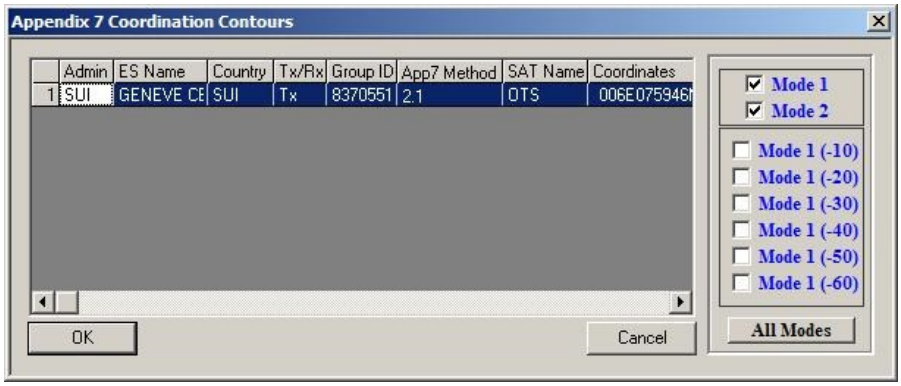
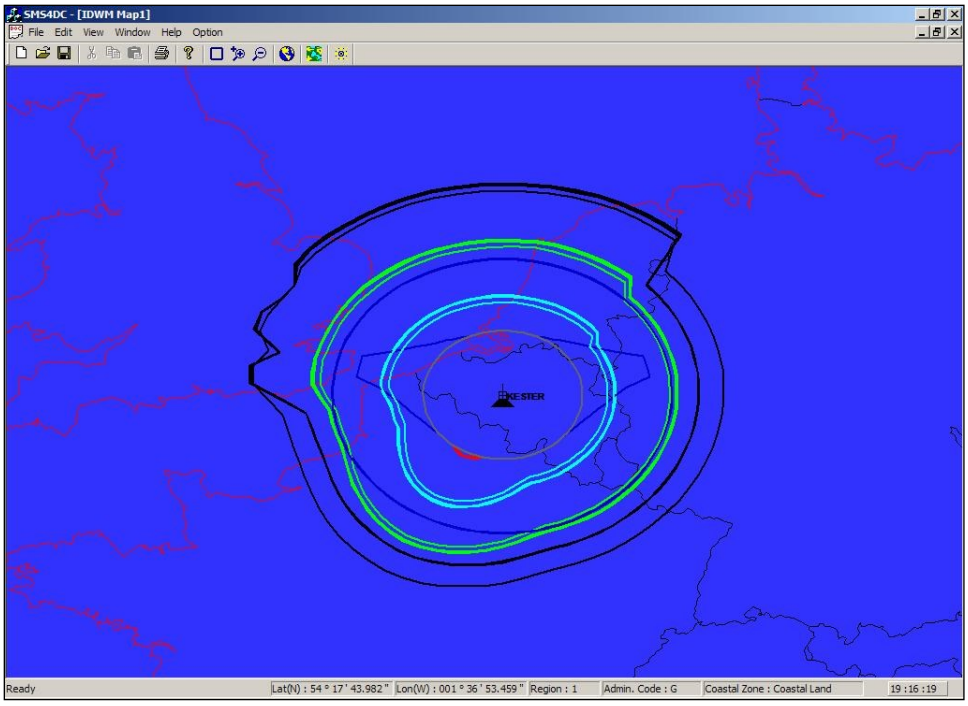
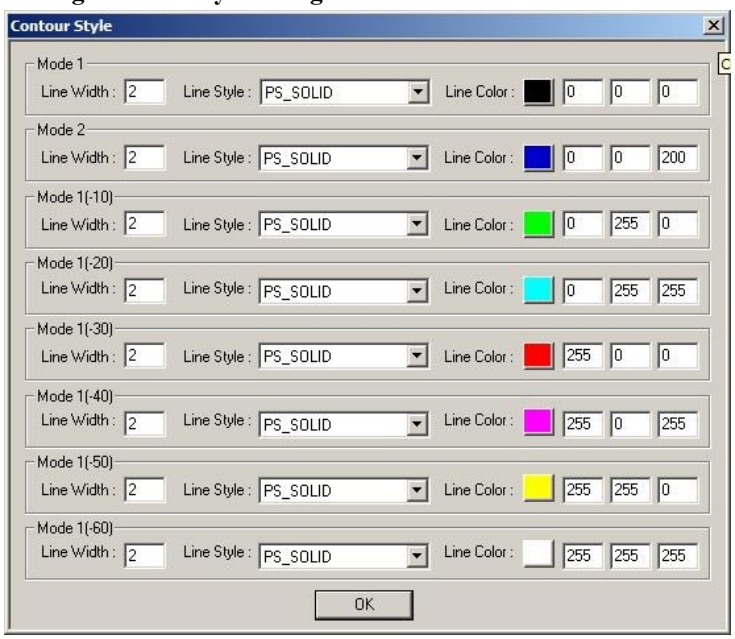


Figure 3.11. Coordination contours around an Earth station in Geneva



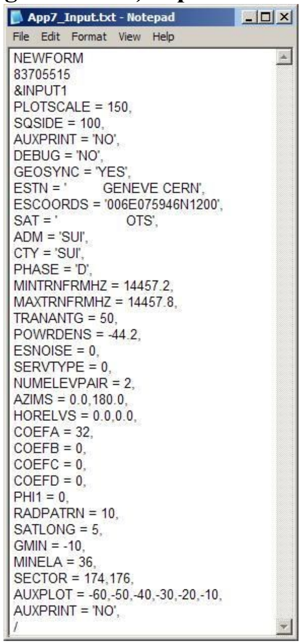
- Style: This item opens a dialogue box to customize the colour, thickness and line style of the coordination contours. Users may set an individual style for each coordination contour. Figure 3.12 shows the relevant dialogue box.

Figure 3.12. Style dialogue box of coordination contours

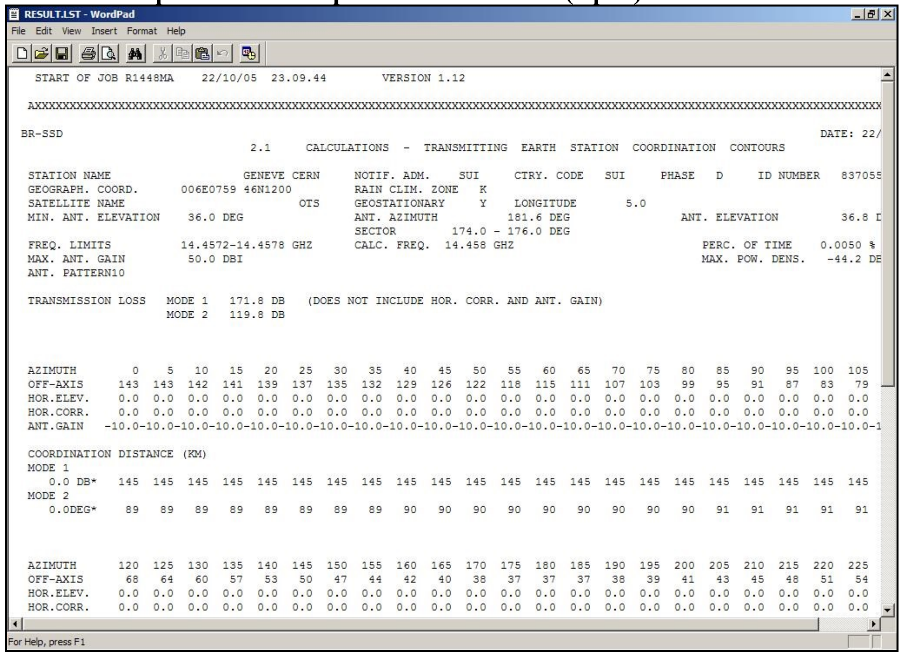


- View Input File: This item shows the generated input text file that feeds the Ap.7/ITU-R SM.1448 (Ap28) ITU-R technical tool. Figure 3.13a displays this input text file.
- View Output File (RESULT.LST): This item shows details of calculation results including probably affected countries and coordination contour data, as generated by the Ap.7/ITU-R SM.1448 (Ap28) ITU-R technical tool. Figure 3.13b displays this output text file (in WordPad format).
- View Output File (UPD.DAT): This item shows coordination information data.
- Save Vectors: This item saves a text file of vector data in a given folder. Each coordination contour will be saved in a separate file in the format "Ap7_*EarthStationName*_{I or II}_{0,10,20,…60}.txt" in the Report folder. These vectors may be drawn on DEM using "Vector->Draw" item.

Figure 3.13. a) Input file and b) Result.lst output file to the Ap.7/ITU-R SM.1448 (Ap28) ITU-R technical tool



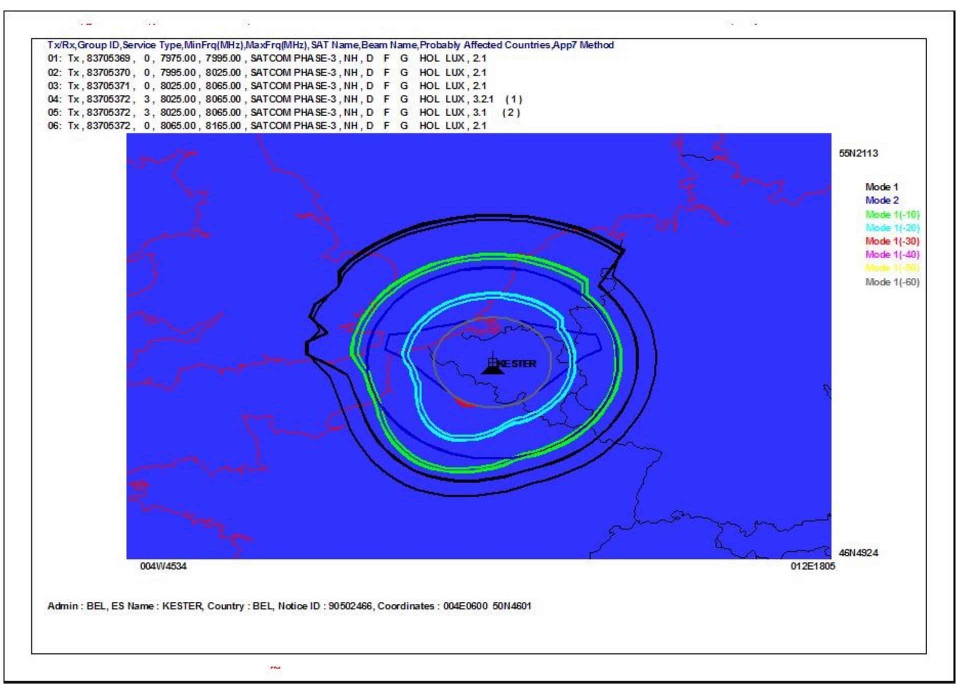
(a) Input file



(b) Result.lst output file to the Ap.7/ITU-R SM.1448 (Ap28) ITU-R technical tool

In addition to the items provided in the "Option" menu, coordination contours displayed around an Earth station may be printed using the print item of the "File" menu. The information of each contour is presented above the contour picture, as shown in Figure 3.14.

Figure 3.14. Print preview of coordination contours around and earth station



3.3.1.2. RR Appendix 7 (GIBC) item in Option menu

This item, by using the GIBC/Ap.7 ITU-R technical tool, calculates and draws coordination contours around a selected Earth station in accordance with the method explained in Appendix 7 of the Radio Regulations. The RR Appendix 7 (GIBC) Item can be chosen from the Option menu of IDWM Map screen as shown in Figure 1. By choosing this item, the main screen for Appendix 7 contour calculations will appear then a notice can be selected from the list of existing Earth stations, which have been included already in SMS4DC database, by double clicking on the desired notice ID.

Figure 3.APP7.1. RR Appendix 7 (GIBC) sub-menu

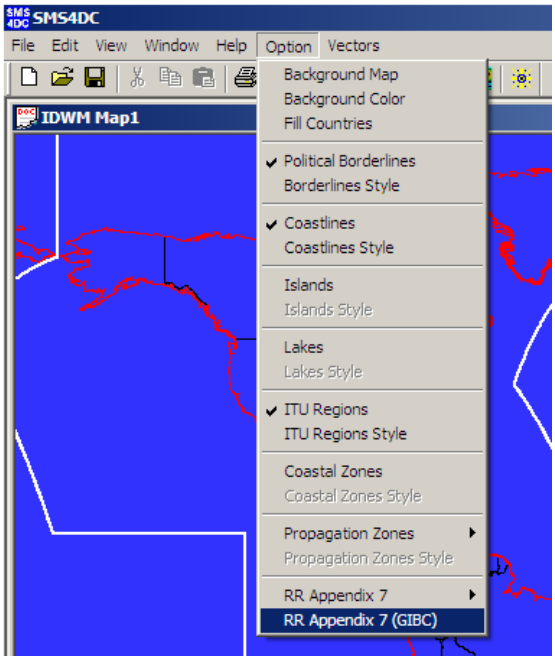
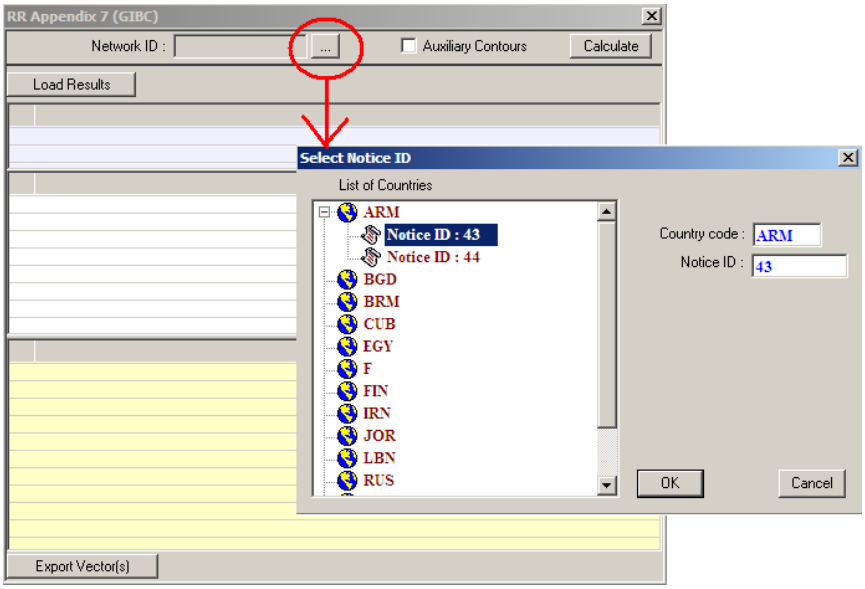


Figure 3.APP7.2 shows the main screen of Appendix 7 sub menu.

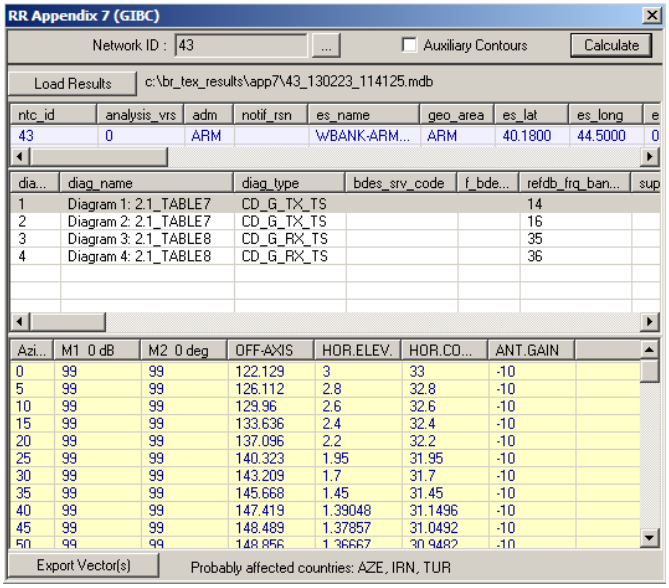
Figure 3.APP7.2. Selection of Earth station



After selection of network ID of an Earth Station, by pressing of "Calculation" button, the input data is generated automatically in SNS V7 database format, and sent to BR GIBC Appendix 7 software. The Appendix 7 contours will be calculated and results shown in three separate lists.

Figure 3.APP7.3 shows the calculations results, the first list shows the characteristics of selected Earth station in blue color. In second list the different kind of calculated diagrams will be shown and by selection of each diagram in second list, characteristics of relevant contour(s) are shown in third list.

Figure 3.APP7.3. Calculations results in three separate lists



If “Auxiliary Contours” check box is selected in the main Appendix 7 screen, after pressing of “Calculation” button, the values of auxiliary contours will be asked. For Mode 1, negative values in decibel and for Mode2 positive values in degree can be inserted as shown in Figure 3.APP7.4.

Figure 3.APP7.4. Setting Auxiliary Contours

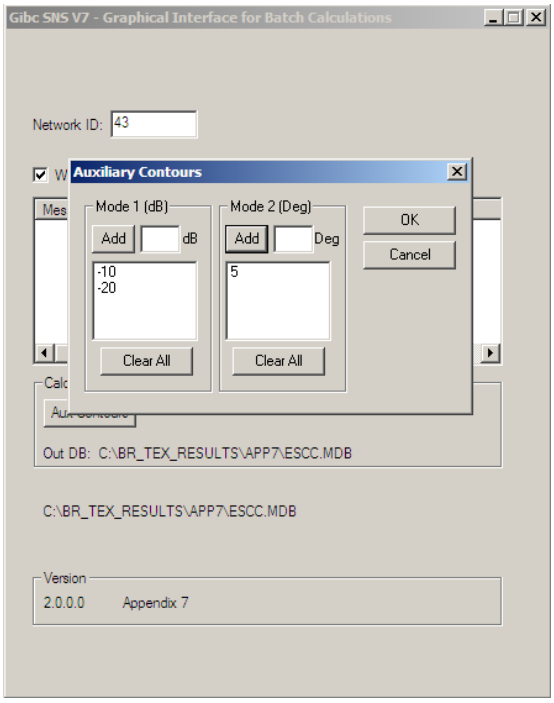
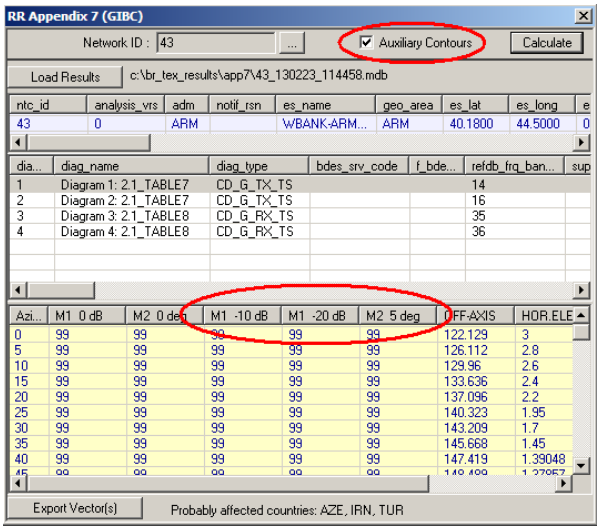


Figure 3.APP7.5 shows the results of coordination distance calculations for selected Auxiliary Contours.

Figure 3.APP7.5. Coordination distances calculated for selected Auxiliary Contours



By selecting of each diagram form the second list, the calculated coordination distances will be shown in the third list and by pressing the Export Vectors button the coordination contours will be saved in SMS4DC format and displayed on the map. Also at the bottom of the page the list of probably affected countries is shown.

It should be noted that each contour is saved in ..\SMS4DC\Texts path, with different names in SMS4DC format:

Network ID_Date _Time_DiagramNumber_M_ModeNumber_ContourValue.txt

Figure 3.APP7.6 Shows the dialog box for selection of the parameters for drawing of coordination contours on the map.

Figure 3.APP7.6. Dialog box for drawing of coordination contours

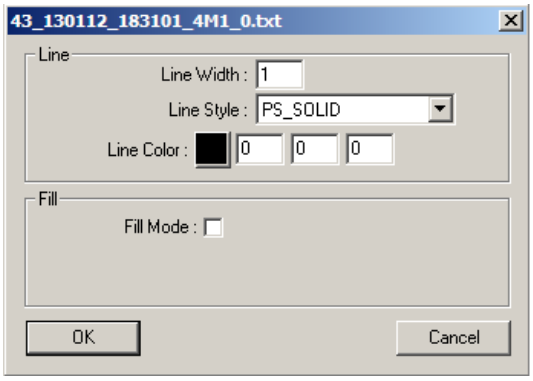
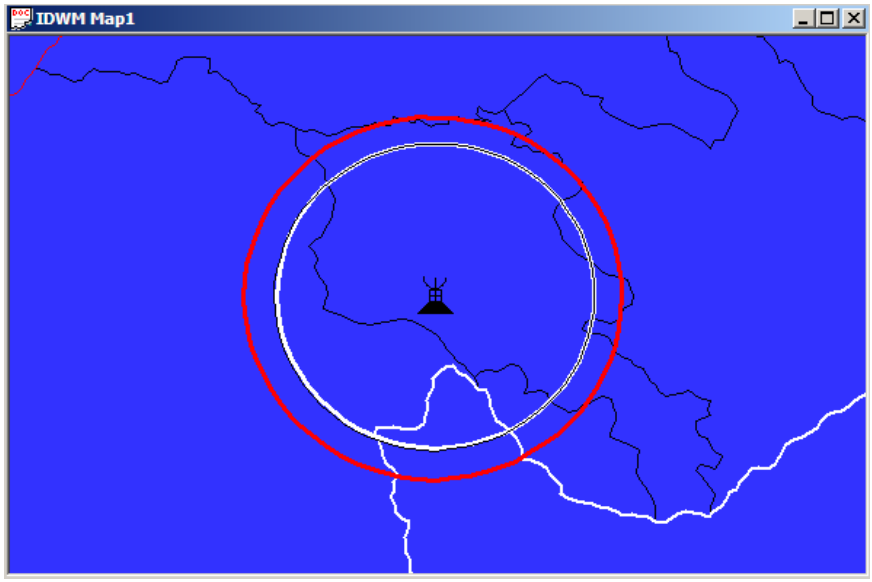


Figure 3.APP7.7 shows the drawn coordination contours on IDWM map

Figure 3.APP7.7. An example for coordination contours on IDWM map



These contours can be also displayed on DEM map by using of “Vector/Draw from file “sub menu and also could be exported to Google Earth as well.

It should be noted that GIBC software saves by default the calculation results in path “C:\BR_TEX_RESULTS\APP7” in MS Access format which this results also can be loaded by “Load Results” button from the main Appendix 7 calculation screen as shown in figures 3.APP7.8A and 3.APP7.8B.

Figure 3.APP7.8A. Loading the result files generated by GIBC

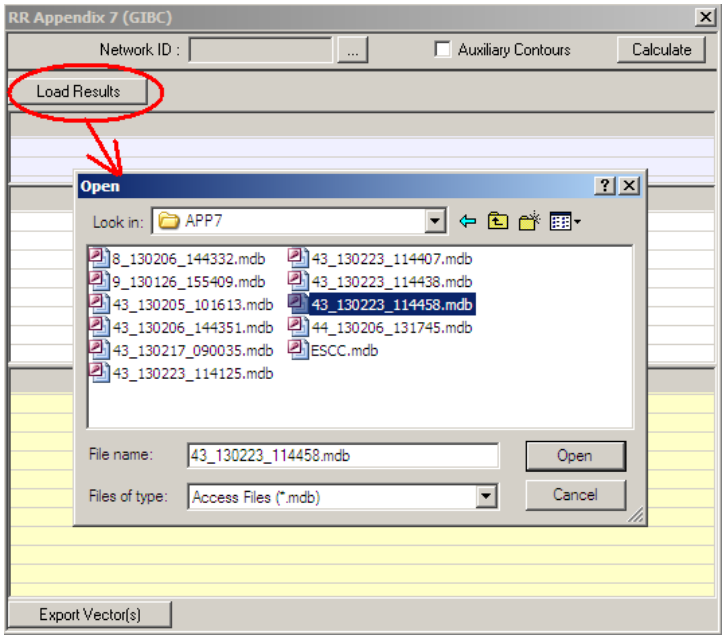
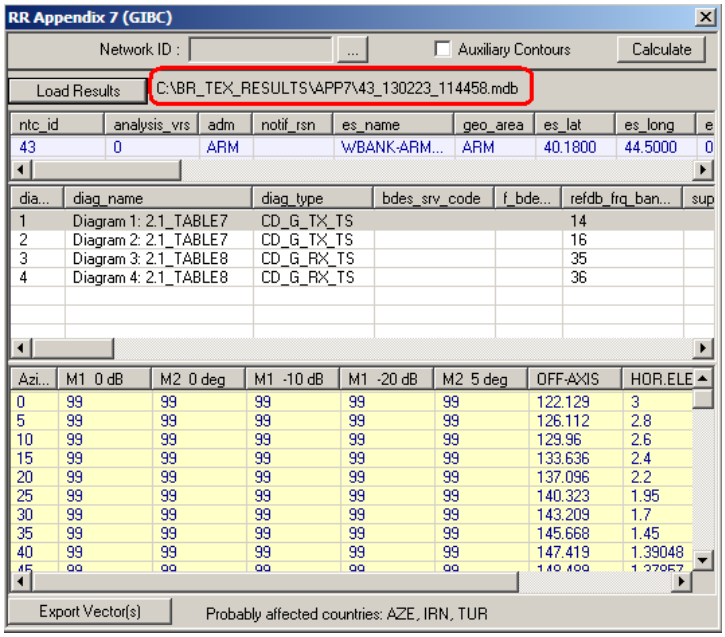


Figure 3.APP7.8B. Loading the result files generated by GIBC



3.3.2. Vectors menu of IDWM map view

The Vectors menu consists of the following items:

- Draw from File: This item loads a vector file from disk and displays it on the IDWM map. By selection of this item, SMS4DC requires the user to select a vector file from the relevant location on hard disk. Then, the vector colour and fill style must be defined using the dialogue box.
- Remove from Display: This item removes all user-defined vectors from display on the IDWM map.

3.3.3. Help menu of IDWM map view

Help menu consists of the following items:

- About SMS4DC: A message box giving brief information about the SMS4DC software version and copyright;
- Manual: This item opens the user manual for the SMS4DC software. An Acrobat reader must be installed for correct operation of this item.

3.3.4. Toolbar of IDWM map view

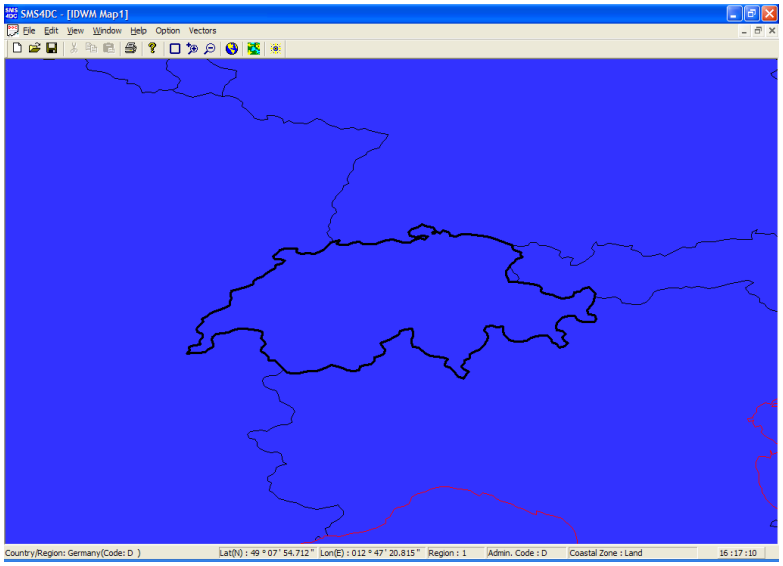
The shape of desktop menu displayed in Figure 3.3 and Figure 3.4. The following buttons are provided in the toolbar of the desktop menu to facilitate manipulation of the main functions:

Toolbar Buttons	Name	Description
	Draw Box	This button creates a variable-size rectangular box to enclose and select an area of interest on a vector map. After activating this button by a mouse left click, the mouse cursor shape is changed to  . To draw a box, the cursor is positioned at the top-left corner of an imaginary rectangle and the left button of the mouse is pressed and held while the cursor is dragged diagonally down to the right-bottom corner. When the box is drawn to the required size, the left button is released and the box remains on the map. The "Draw Box" button is deactivated by a mouse left-click and mouse cursor shape returns to normal. Only one rectangle at a time is possible on the vector map and its position is unaffected by the Zoom In and Zoom Out buttons. After a rectangle has been drawn, the DEM push button may be used to load the desk top with the four adjacent DEM tiles that include the area inside the drawn rectangle. The vector map view transfers to a secondary window.
	Zoom In	This button magnifies the view without affecting the aspect ratio. Two types of zooming method are implemented: - Zooming the complete desk-top view at a magnification of times two (x2) ; or - Creation of a variable-size box to zoom in a selected rectangular area. After activating this button, the mouse cursor shape changes to  . Each single left click pans the map at the mouse cursor location to the centre of view at a magnification of times two (x2). To zoom-in a box area, first left click on the draw box button, then on the zoom-in button. Position the cursor at the top-left corner of an imaginary rectangle then press and hold the left button of the mouse while dragging the cursor diagonally down to the right-bottom corner. On release of the button, the area in the box will be magnified two times (x2). There is no scale limitation when enlarging the vector view.

	Zoom Out	Pushing this button zooms out to return the vector maps to their original size/scale.
	Select Country	This button selects a country or geographical region from the list provided in IDWM, release 7.3. Figure 3.15a shows the relevant dialogue box. Users may browse the combo-list or type the name of the required location in the edit-box. After pushing the OK button, the desktop is panned and zoomed in, so that a vector map of the selected area appears in the middle of the desktop with the country or area borderline drawn in **bold**.
	DEM	This button displays the maps generated by the DEM (Digital Elevation Model). It will load, into the desktop, the four adjacent DEM tiles associated with either: the country specified at start-up (see country code in ctry.txt); or the rectangular area previously selected by the "Draw Box" button.
	Refresh	This button redraws the desktop content.
	Print	This button prepares a print preview to send an image of the desktop to the printing device.

Figure 3.15. a) Dialogue box of list of countries or geographical regions provided by IDWM release 7.3, b) vector map of a selected country

(a) List of countries available in IDWM

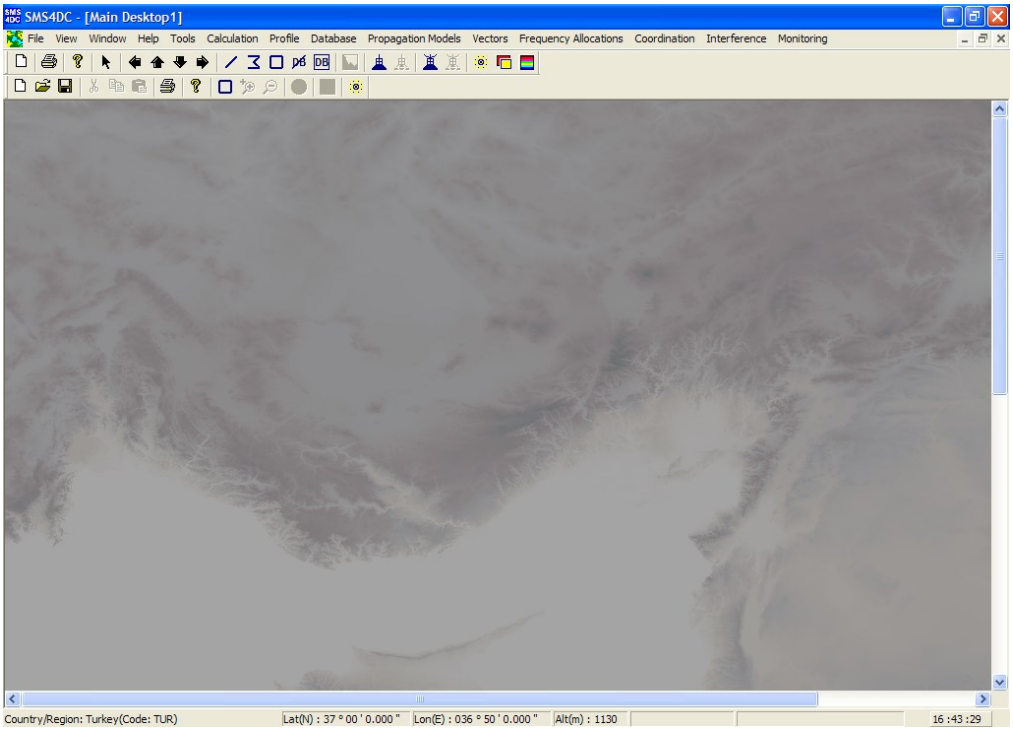


(b) Vector map of Switzerland

3.4. DEM view

The DEM view of SMS4DC desktop may be displayed by pushing the "DEM" button in the vector map view of the desktop after selection of a rectangular area, using the "Draw Box" button. Figure 3.16 shows the DEM of the area displayed in Figure 3.15b (Switzerland)

Figure 3.16. Sample DEM view in SMS4DC desktop



The Country or Region name, geographical coordinates and ground height in metres (above sea level) at the mouse cursor position are displayed on the status bar of DEM view.

3.4.1. Toolbar of DEM view

Following table explains the buttons implemented in the toolbar of the SMS4DC desktop, DEM view.

Toolbar Buttons	Name	Description
	Deactivation	This button deactivates any activated buttons. The shape of mouse cursor returns to normal by using this button.
	Go to Geo-directions	One press of these arrow buttons navigates DEM one tile toward one of the directions: West (left arrow), North up arrow), South (down arrow) and East (right arrow).
	Draw Line	This button draws a line between two points and activates functions based on a predefined line. Clicking this button changes the mouse cursor shape to a cross (+). The cross is positioned at the start point of the line and the left mouse button pushed and held while dragging the cross to the required end point of the line. When the left button is released, the line is drawn and stays on the map. The Great-Circle distance between two points is displayed on the status bar in km. The line may stay drawn on the DEM for further usage.
	Draw Polyline	This button draws polylines and activates relevant functions based on a predefined polyline. Clicking this button changes the mouse cursor shape to a cross (+). The cross is positioned at the first point of the polyline and the left mouse button is clicked. The cross is moved to the next point and the left mouse button is clicked. Each single click on mouse left button generates a vertex. A

		double left-click terminates poly line. The polyline may stay drawn on the DEM for further usage.
	Draw Box	This button creates a variable-size rectangular box to enclose and select an area of interest on the DEM and activates area dependent functions. After activating this button by a mouse left click, the mouse cursor shape changes to ⇘. To draw a box, the cursor is positioned at the top-left corner of an imaginary rectangle and the left button of the mouse is pressed and held while the cursor is dragged diagonally down to the right-bottom corner. When the box is drawn to the required size, the left button is released and the box remains on the map. The mouse will be ready to create another drawing and the last depicted box will stay on DEM for further usage.
	Draw Line from Database	This button draws a line between two stations in the database and activates functions based on predefined lines. Pushing this button opens a spreadsheet of stations from which users may select two stations by mouse left click. The background DEM will be panned to the location of the selected stations and a line will be drawn connecting them. Selection of one, or more than two, stations has no effect. Users may sort the list of stations displayed in the spreadsheet. An example is shown in Figure 3.17.
	Draw Box from Database	This button draws a square box containing, at its centre, a station from the database and activates functions based on predefined area. Pushing this button opens a spreadsheet of stations from which users may select one station by mouse left click. The length of the box sides will be requested (in km) and consequently drawn after confirmation. Selection of more than one station has no effect. Users may sort the list of stations displayed in the spreadsheet. An example is shown in Figure 3.17.
	Draw Profile	This button draws a path profile along a previously drawn line. Figure 3.18 displays a profile along the line connecting two stations. This button will be active only after a line has been drawn. A Polyline drawing does not activate this button.

Figure 3.17. An example of drawing line from database

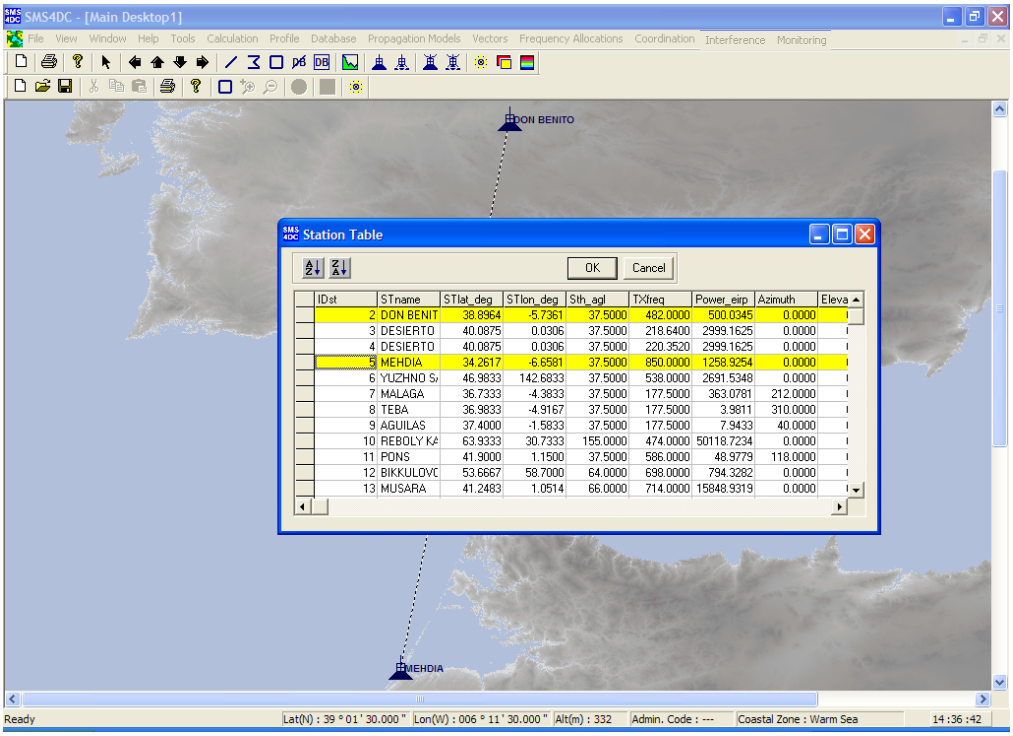
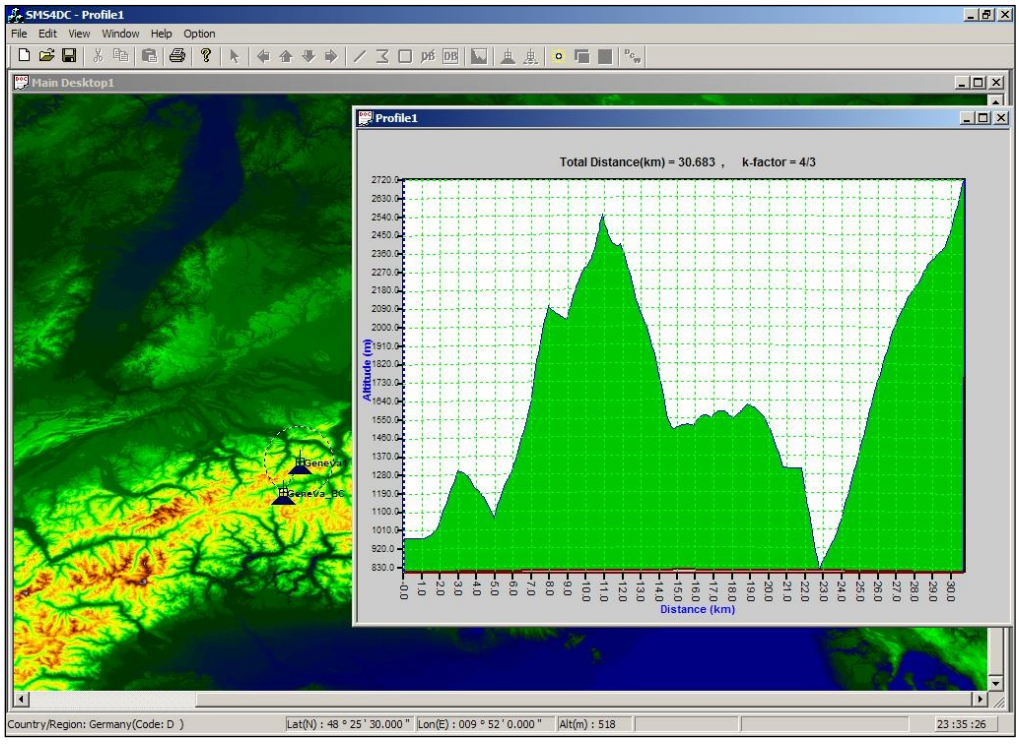
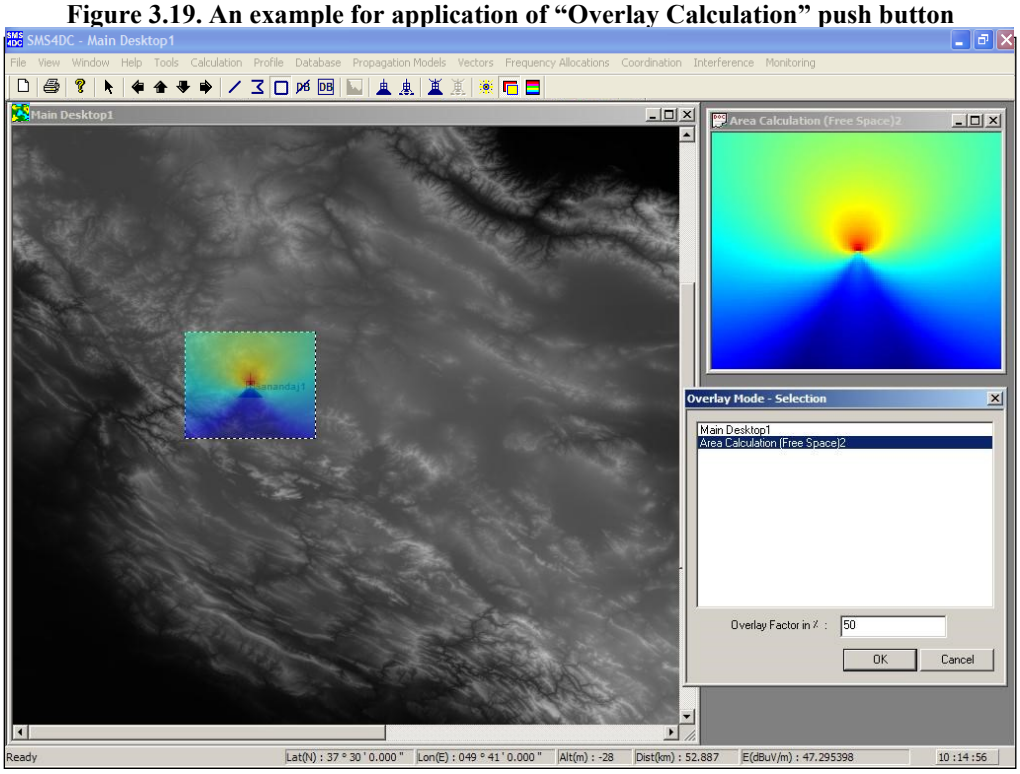


Figure 3.18. A profile drawn along a line connecting two stations



	Add Station	This button adds an anonymous station from any one of the radiocommunication services supported by SMS4DC. A left click on this button changes the mouse cursor shape to a cross (+). The cross is then positioned on the map at the proposed location of the station. A further left click displays the station data entry mask. The geographical coordinates of the selected location will be loaded into the entry mask. If required, different coordinates can be entered by keyboard. After validation and confirmation of entry mask information, the details of the newly created station will be entered into the database. This entry may be reviewed in the Database/Licensing menu under the folder: Administrative Data\Anonymous Stations. Also, a station symbol will be displayed on the map at the given location and a tooltip (a text box summarizing general information about the station) will pop-up if the mouse cursor is positioned inside the station symbol.
	Move Station	This button moves a station to a new location using the mouse. A left click on this button activates (turns grey). Then click and hold the mouse right button on the station to drag its symbol to the proposed new location. When the mouse right button is released, a message box asks the user to confirm saving the new location and losing the old location. If the user confirms the relocation, the database will be updated with the new details. Also, the effective heights of the antenna in different azimuths for the new location must be recalculated as the old values are no longer valid. At least one station must be on the map to activate this button.
	Add Earth Station	This button adds an anonymous Earth station. A left click on this button changes the mouse cursor shape to a cross (+). The cross is then positioned on the map at the proposed location of the Earth station. A further left click displays the Earth station data entry mask. The geographical coordinates of the selected location will be loaded into the entry mask. If required, different coordinates can be entered by keyboard. After validation and confirmation of entry mask information, the details of the newly created Earth station will be entered into the database. Also, an Earth station symbol will be displayed on the map at the given location and a tooltip (a text box summarizing general information about the station) will pop-up if the mouse cursor is positioned inside the station symbol.
	Move Earth Station	This button moves an Earth station to a new location using the mouse. A left click on this button activates (turns grey). Then click and hold the mouse right button on the station to drag its symbol to the proposed new location. When the mouse right button is released, a message box asks the user to confirm saving the new location and losing the old location. If the user confirms the relocation, the database will be updated with the new details. At least one Earth station on map is necessary to activate this button.
	Refresh	This button refreshes the screen display removes any overlaid area-calculation results from the background DEM.
	Calculation Overlay	This button overlays area-calculation results on the DEM. This button will be activated once the box drawing toolbar button has been used to select an area on the map. The “Overlay Calculation” toolbar button is pushed to display a dialogue box containing the available area-calculation results. Users may select from the list, one result at a time, to overlay on the background DEM. The size and location of area, in which calculations have been made, must be identical to the selected area. Otherwise, the overlaid results will not fit the selected area correctly. The refresh button can be used to remove overlaid results from the DEM. Figure 3.19 shows a sample application of this button.
	Show Legend	This button shows or removes legends for activated display. An appropriate legend is displayed depending on the type of activated display, i.e. DEM colour legend for DEM view; field strength colour legend for area calculation result window etc.

Figure 3.19. An example for application of "Overlay Calculation" push button



3.4.2. Menus of DEM view

Under the DEM view of SMS4DC software, various technical procedures and GIS utilities are implemented. The following menus are designed for DEM view:

- File
- View
- Window
- Help
- Tools
- Calculation
- Profile
- Database
- Propagation Models
- Vectors
- Frequency Allocations
- Coordination
- Interference
- Monitoring

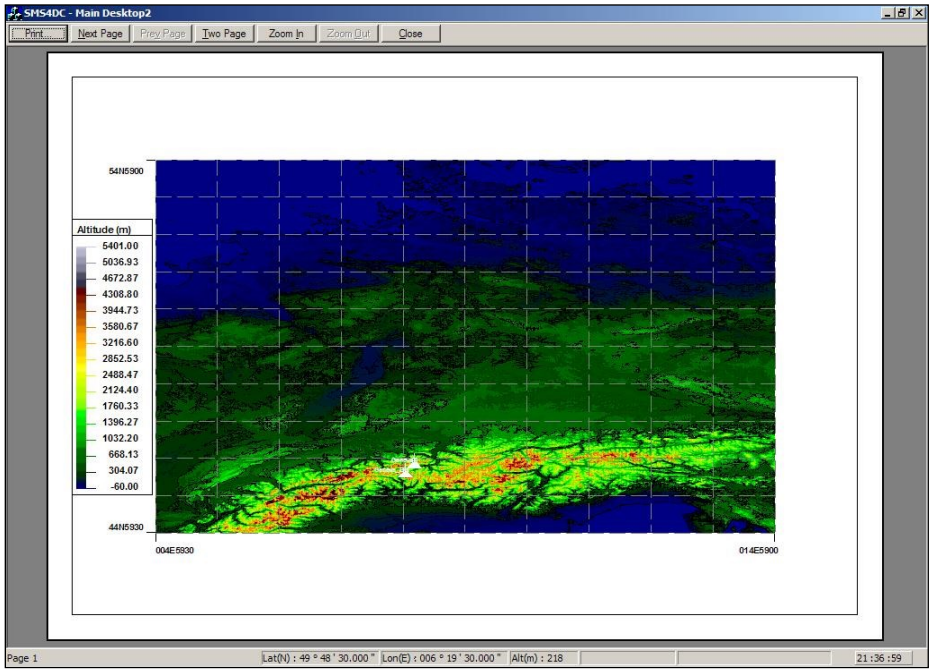
Each menu provides several items and some of these items contain various sub-items. Menus implemented in the menu bar depend on the type of active window. The following Sections describe these menus, items, sub-items and corresponding features.

3.4.2.1. File menu of DEM view

The File menu consists of the Following items:

- New: Opens a new DEM view. Each DEM view behaves independently.
- Close: Closes the active DEM view
- Print, Print Preview and Print Setup items: Printing item-groups to setup printer, print preview of active view and sending print to printing device. Print preview provides a snapshot of what is going to be sent for printing. Figure 3.20 shows an example of print preview.

Figure 3.20. An example of print preview in DEM view of SMS4DC desktop



Several simple functions of the print preview window, enable the user to browse and print displayed pages.

- Exit: This item saves the last setting and quits the SMS4DC software.

Moreover, a list of the four most recently opened, loaded or saved files will be available in the "File" menu above the item "Exit".

3.4.2.2. View menu of DEM view

The Edit menu consists of the following items:

- Toolbar: This item switches on or off the toolbar. A check mark to the left of this item will appear if the toolbar is switched on.
- Status Bar: This item switches on or off the status bar. A check mark to the left of this item will appear if the toolbar is switched on.

3.4.2.3. Window menu of DEM view

The Window menu consists of the following items:

- New Window: Opening a new DEM view. Each window behaves independently.
- Cascade and Tile items: Visual arrangement of open widows on the screen
- List of open windows: Enumerated list of open widows. The active window is identified by a check mark to the left.

3.4.2.4. Help menu of DEM view

Help menu consists of the following items:

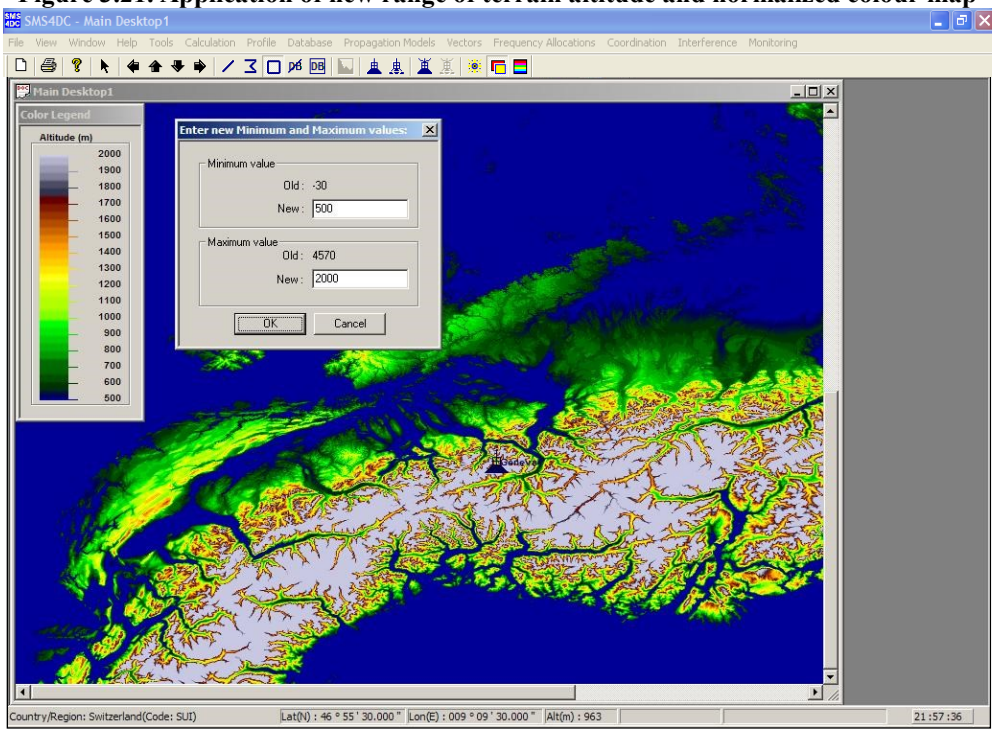
- About SMS4DC: A message box giving brief information about SMS4DC software version number and copyright
- Manual: Item to open the user manual of SMS4DC software. Acrobat (pdf) reader has to be installed for proper operation of this item.

3.4.2.5. Tools menu of DEM view

The tools menu consists of the following items:

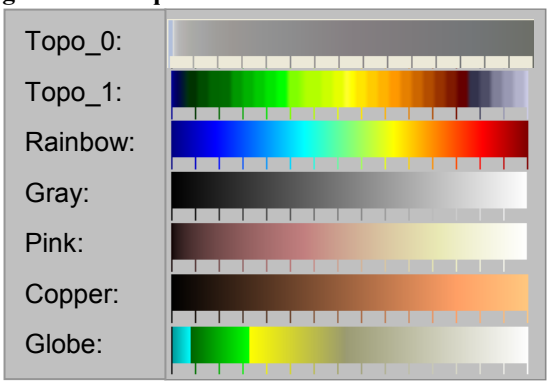
- Normalize: Changes the display range of terrain altitude in DEM view, users may modify the minimum and maximum threshold of terrain altitude. Points higher and lower than the defined altitude range will be displayed by two colours at the bottom and top of the legend. Figure 3.21 shows a sample application of this altitude range. The old values are those values which are suggested by SMS4DC, based on minimum and maximum altitude of points loaded into the memory from four adjacent DEM tiles. The short-key Ctrl+N is defined to activate this item.

Figure 3.21. Application of new range of terrain altitude and normalized colour map



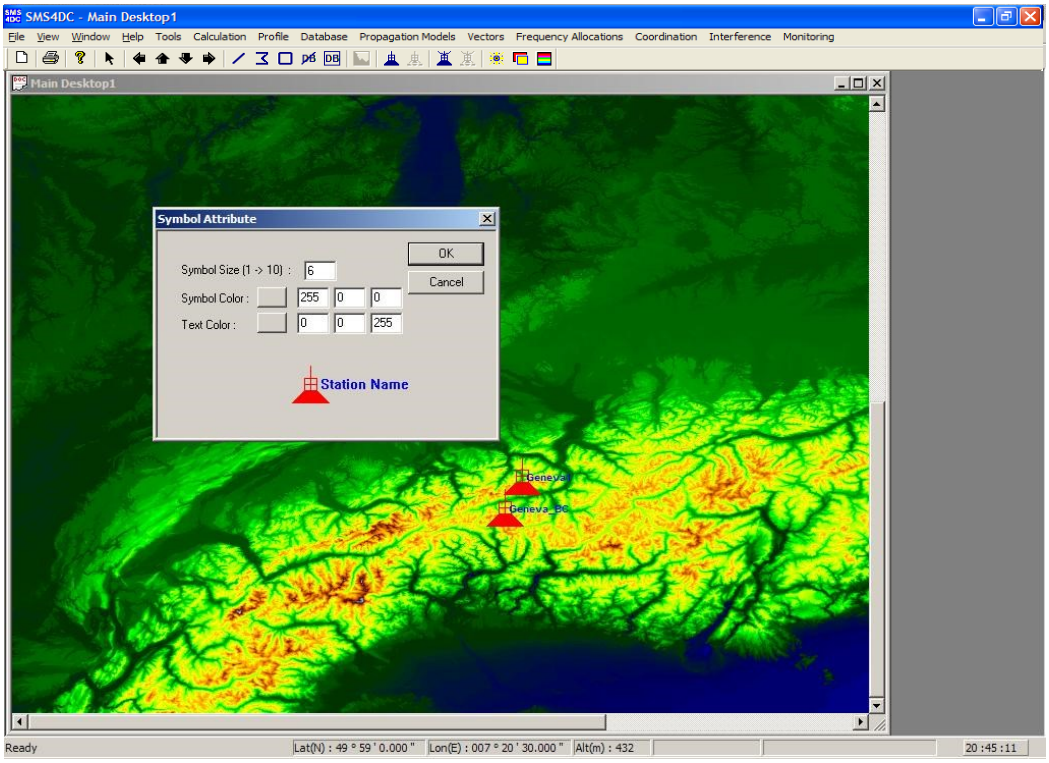
- Colour map: This item changes the colour map used in the display of terrain altitude in DEM view. Figure 3.22 displays the implemented colour maps.

Figure 3.22. Implemented various colour maps



- Lighten: This item increases brightness of displayed DEM. RGB value of all points is increased by 20 each time this item is used.
- Darken: This item decreases brightness of displayed DEM. RGB value of all points is decreased by 20 each time this item is used.
- Grid: May be used for switching on or off of the geo-grid in degrees. A check mark will appear to the left of the item if switched on. Moreover, the short-key Ctrl+G is defined for this item.
- Grid step: Users may adjust geo-grid steps within the range of 0.01 to 10 inclusive. The default grid step is one degree.
- Legend: This item switches on or off the map-colour legend. A check mark will appear to the left of the item and a “Show Legend” toolbar push button will be activated automatically by SMS4DC if the item is switched on. Reselection of item removes the check mark and releases the “Show Legend” toolbar push button.
- Symbol Attribute: May be used for changing the colour and size of the station symbol together with the colour of the station name. Figure 3.23 shows the implementation of this item.

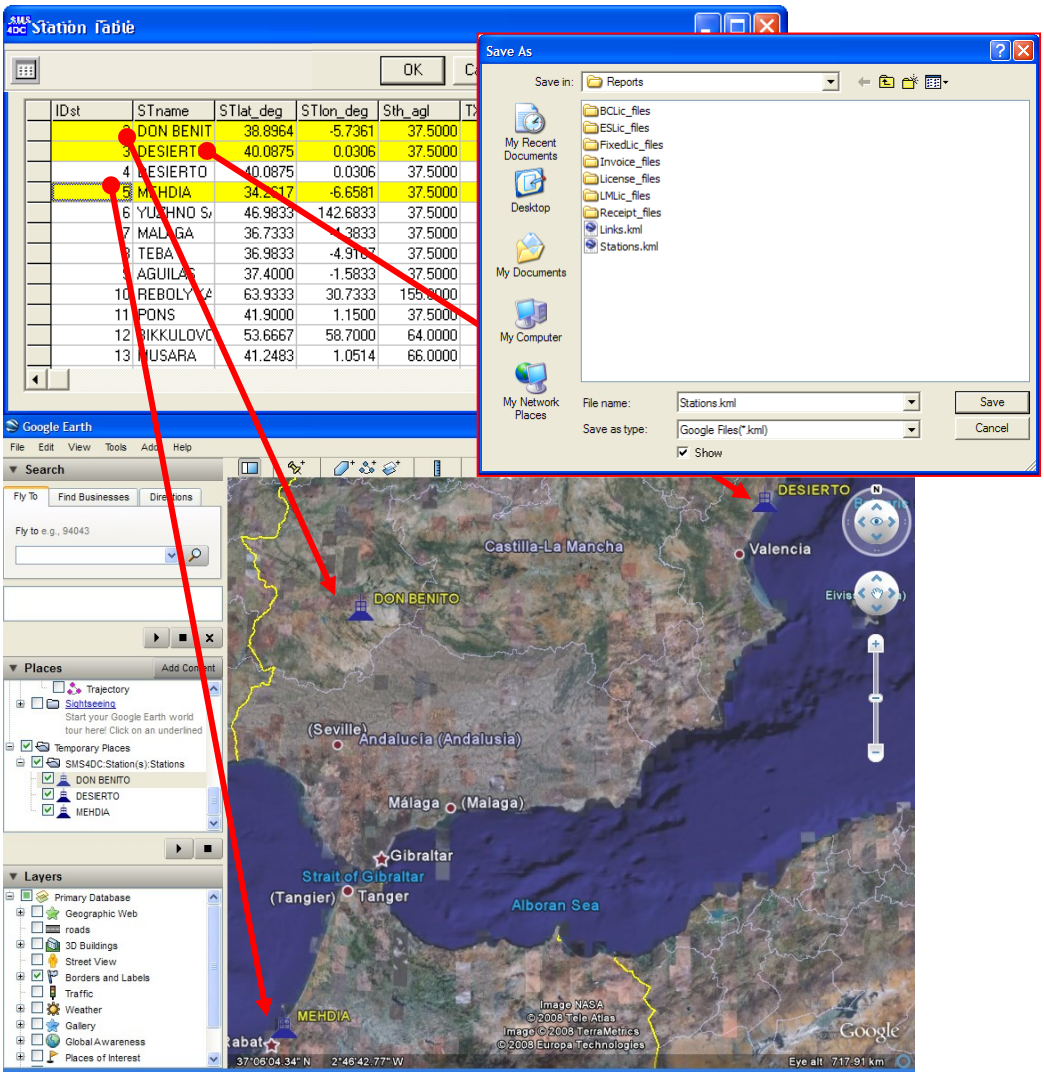
Figure 3.23. Station symbol attribute modification



- Antenna Editor: Initiates a dialogue box to load, modify, visualize (2D and 3D), define and print antenna radiation patterns. The Antenna Editor is explained fully in Section 3.4.2.5.1.
- 2D View / Contour: Item to perform specific functions on the DEM for a selected area. To activate this item, an area must be selected, in advance, using either the "Draw Box" or "Draw Box from Database" toolbar buttons. If this item is selected, a 2D view of the selected area will be copied to a new window and users will be able to perform several GIS functions such as dynamic zooming in/out, topographical contour generation, normalizing, colour map changing and printing. The 2D View / Contour item and its menus are explained fully in Section 3.4.2.5.2 .
- 3D View: Displays a 3D view of a selected area. To activate this item, an area must be selected using either the "Draw Box" or "Draw Box from Database" toolbar buttons. When this item is selected, a 3D view of the selected area will be created in a new window and users will be able to perform some helpful functions such as dynamic zooming in/out, topographical contour generation, normalizing, colour map changing, rotation, light source modification and colour management. The 3D View is explained fully in Section 3.4.2.5.3.
- Map Layers: Provides three sub-items to select background DEM: "Tools->Map Layers->GlobeDEM", "Tools->Map Layers->UserMap1" and "Tools->Map Layers->UserMap2". The selected DEM (i.e. UserMap1 or UserMap2) may be identified by a checkmark to the left of the item. SMS4DC employs the map "GlobeDEM" by default and, as an option, two additional maps may be managed by users.

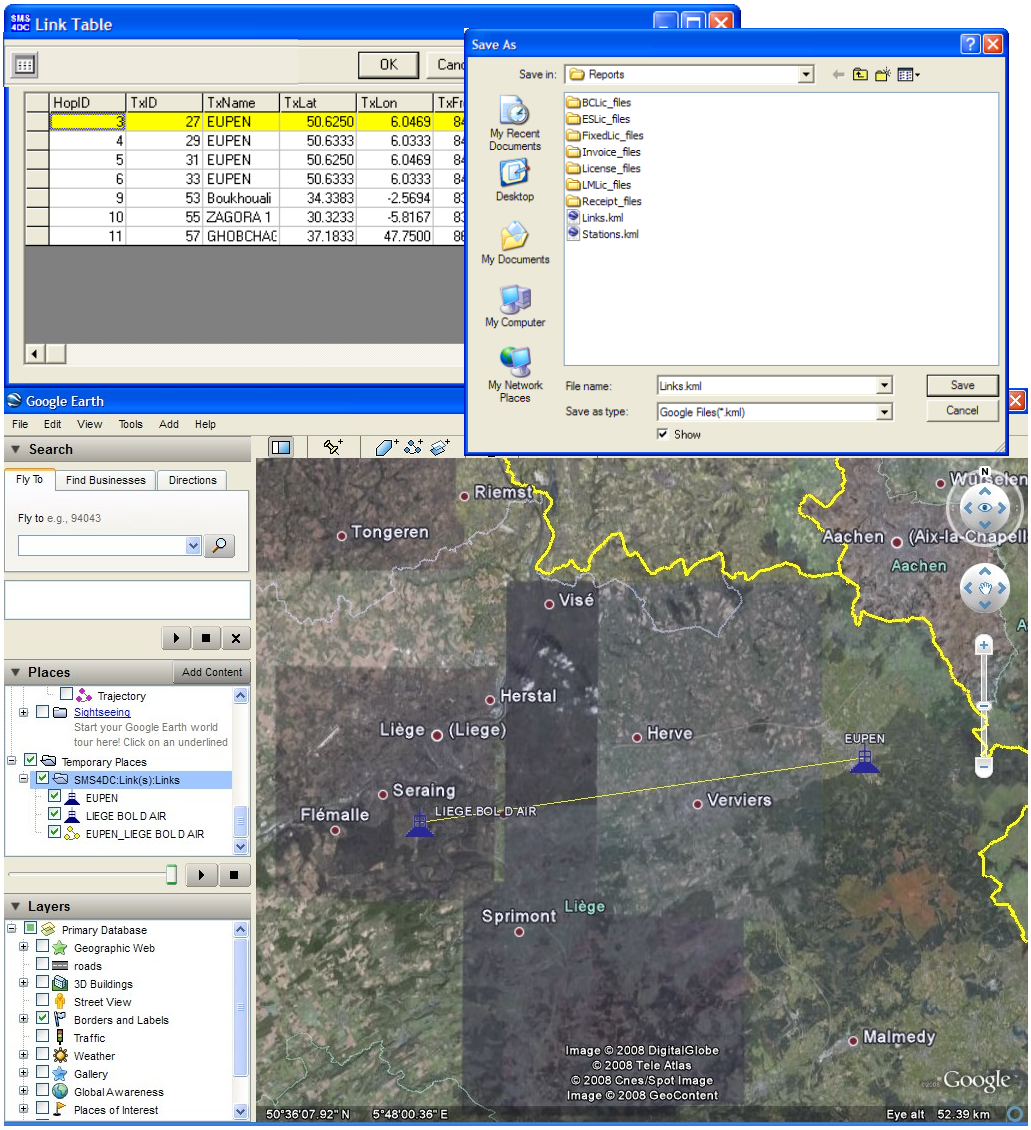
Each map has a "description text file" which describes the map layer. These files: Globe.txt, UserMap1.txt and UserMap2.txt, are contain the layer descriptions of maps of the three sub-items and are stored in the folder "…\SMS4DC\Texts". The format of these files is explained in Annex 2.

- Google Earth Export/Display: This menu is for exporting various types of data to the GoogleEarth™ application. Under this menu, there are the following sub-menus:
    - Selected Station(s): Selecting this menu shows a list of all existing terrestrial stations on the database. After selecting the stations from the list and pressing OK, the output file for GoogleEarth will be generated and a screen will be shown (see the example below) requesting that the user specifies the path and file name for the KML (extension of GoogleEarth file) file and whether or not to transfer immediately the results for display in a GoogleEarth window.



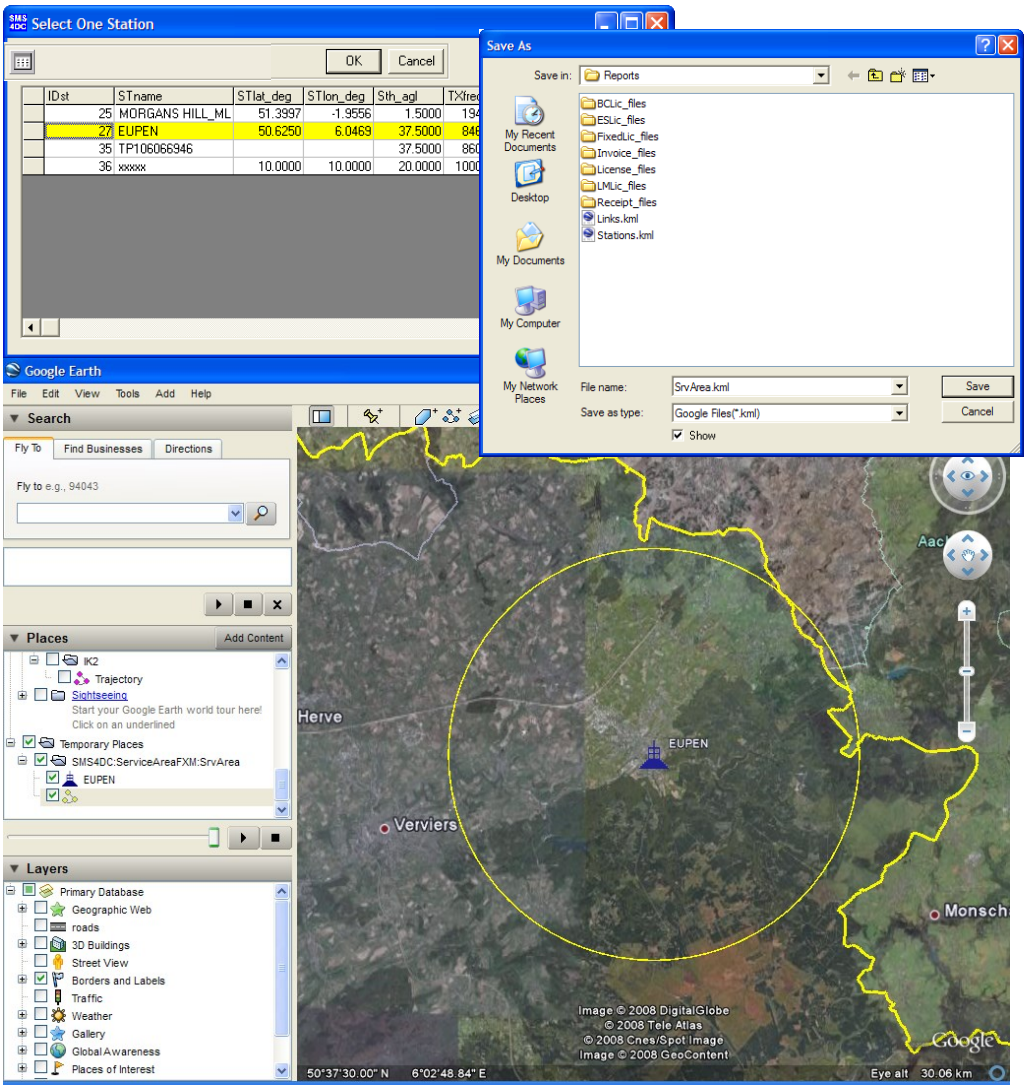
    - Links: Selecting this menu item shows a list of all existing point-to-point links. After selecting the desired link(s) from the list and pressing OK, the output file for GoogleEarth will be generated and then a screen will be shown requesting the user to specify the path and name of the KML (extension of GoogleEarth file) file and

also whether or not to transfer immediately the results for display in a GoogleEarth window.

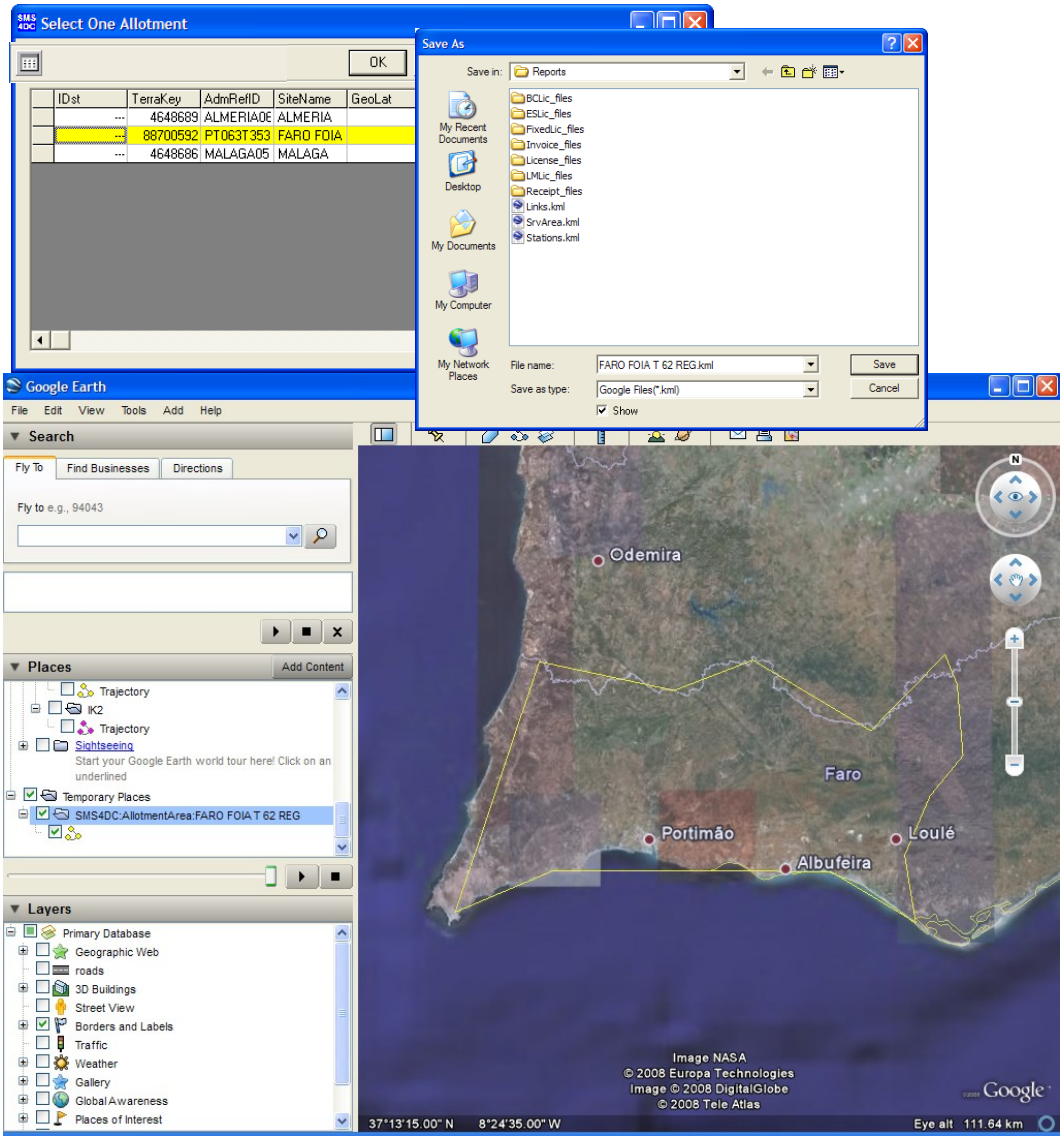


- Selected Earth Station(s): Selection of this menu item shows a list of all existing Earth stations. After selecting stations from this list and pressing OK, the output file for GoogleEarth is generated and a screen requesting the user to specify the path and name of the KML (extension of GoogleEarth file) file and also whether or not to transfer the results immediately for display in a GoogleEarth window.
- Receiving Area: Selection of this menu item shows a list of all existing terrestrial stations with a defined receiving area. After selecting stations from this list and pressing OK, the output file for GoogleEarth is generated and a screen requesting the user to specify the path and name of the KML (extension of GoogleEarth file) file and also whether or not to transfer the results immediately for display in a GoogleEarth window.
- Service Area (FXM): Selection of this menu item shows a list of all existing FXM stations with a defined service area. After selecting stations from this list and pressing OK, an output file for GoogleEarth is generated and a screen requesting

the user to specify the path and name of the KML (extension of GoogleEarth file) file and also whether or not to transfer the results immediately for display in a GoogleEarth window.



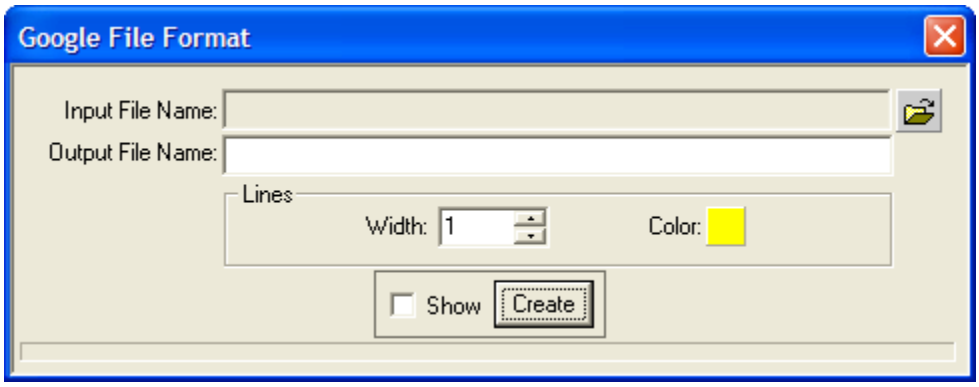
- Service Area (GE06 BC,BT): Selection of this menu item shows a list of all existing BC and BT stations in the GE06 Plan with a defined service area. After selecting stations from the list and pressing OK, the output file for GoogleEarth will be generated and a screen is shown requesting the user to specify the path and name of the KML (extension of GoogleEarth file) file and also whether or not to transfer the results immediately for display in a GoogleEarth window.
- Allotment Area: Selection of this menu item shows a list of all existing GE06 allotments in the database. After selecting an allotment from the list and pressing OK, the output file for GoogleEarth will be generated and then a screen is shown requesting the user to specify the path and name of the KML (extension of GoogleEarth file) file and also whether or to transfer the results immediately for display in a GoogleEarth window.



- GE06 Plan Entry: This menu item creates a KML file (for GoogleEarth) displaying Plan Entry Code and linked assignments and/ or associated allotment with the selected assignment/allotment in the GE06 Plan. All allotments/assignments (in conformity with GE06 Plan) in the database will be shown in a spreadsheet and users can select the wanted allotment/assignment, by using a mouse left click on the record-select column of the spreadsheet. Finally, the wanted assignment/allotment and its linked assignments and/or associated allotment with their general information are listed in a spreadsheet. Users may select some or all of them by a mouse left click on the record select column.
- Converted Assignment(s): This menu item creates a KML file (for GoogleEarth) to display converted assignments stemmed from a selected allotment, or to display the source allotment of a selected converted assignment in the GE06 Plan. All allotments and converted assignments (in conformity with GE06 Plan) in the database will be shown in a spreadsheet and users may select the wanted allotment/assignment, using a mouse left click on the record-select column of the spreadsheet. Finally, the source allotment and all related converted assignments,

with their general information are listed in a spreadsheet. Users may select some or all of them by a mouse left click on the record select column.

- Vectors: This menu item enables the conversion of all other vectors created by SMS4DC, to KML files which are readable by Google Earth.

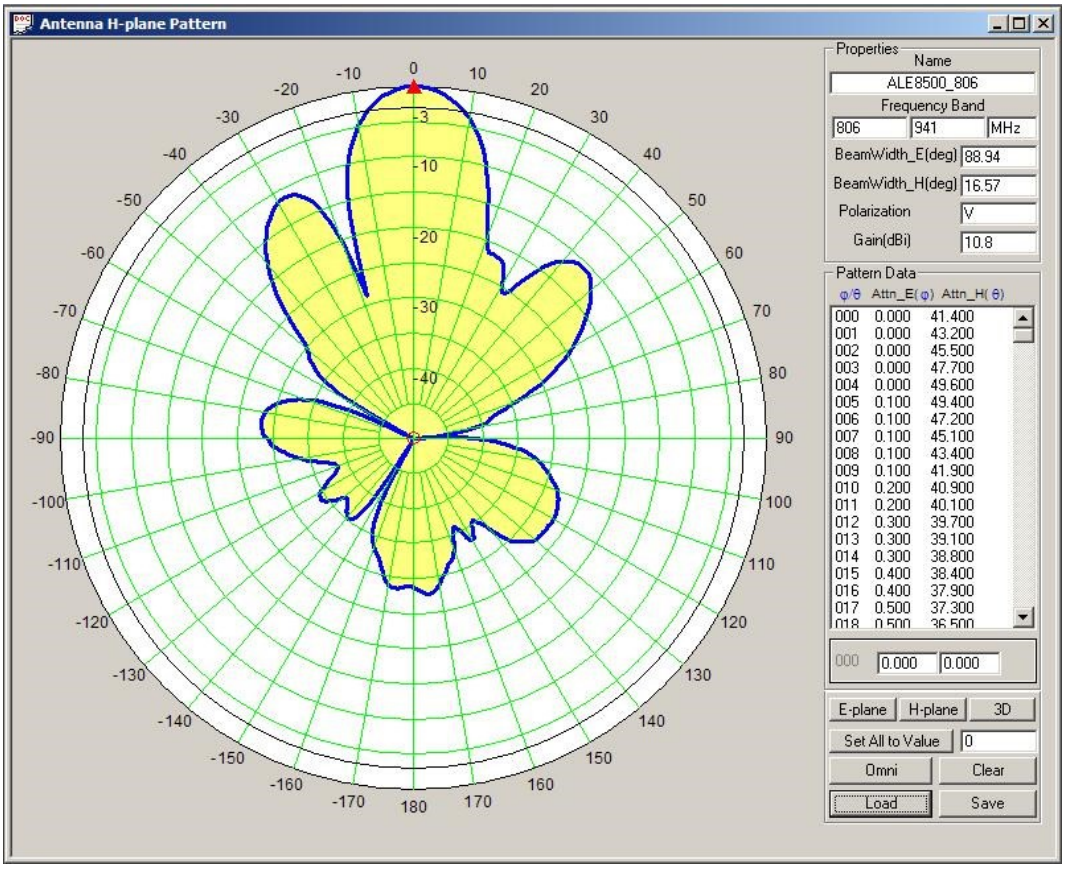


3.4.2.5.1. Antenna Editor in Tools menu of DEM view

As introduced in Section 3.4.2.5, the "Tools->Antenna Editor" menu item opens a dialogue box to load, modify, visualize (2D and 3D), define and print antenna radiation pattern. An isotropic pattern will be loaded to the dialogue box by default.

Figure 3.24 shows a sample antenna radiation pattern. The 3dB circle is also shown which may be used to read the +/-3dB beam width. The following information and buttons appear on the dialogue box:

Figure 3.24. Antenna Editor dialogue box



- Antenna Name: Antenna commercial name. Any space character in the name will be automatically replaced by a hyphen when the pattern is saved.
- Frequency band: Antenna working frequency band
- Beamwidth: Antenna 3dB beamwidth in E- and H-planes
- Polarization: The orientation of antenna's electrical field with respect to the horizontal plane. Therefore, the polarization used by the antenna depends on the physical installation of antenna. Two types H and V are possible here which represent horizontal and vertical polarization respectively.
- Gain: Antenna gain along main beam (boresight). The 2D radiation pattern in dBi (with respect to the isotropic antenna). Isotropic gain has been normalized to zero dB.
- Pattern Data: Attenuation values in dBi in any angle of 2D radiation pattern in both E- and H- planes. The angles provided in the table, under the heading "φ/θ", are for information only and do not coincide with the displayed angles around the H-plan pattern. In the case of the H-plan pattern, the angles around the pattern are the elevation angles if main beam is horizontal.

  A marker is displayed at the point of the radiation pattern where its value is selected by a mouse left-click in the data table. Also, arrow keys may be used to browse the data table. Attenuation levels in the selected row are copied to the two edit boxes below the table and

can be edited. Attenuation values must be in the range zero to fifty dB. The radiation pattern will be modified simultaneously by editing the attenuation values.

- E- and H-plane push buttons: Push buttons to show 2D E- and H-plane radiation patterns in dialogue box.
- 3D: Push button to draw 3D radiation pattern in a new window. Several features are provided for this view which has additional explanation in the item "3D" of the "Option" menu.
- "Set All to Value" push button: Sets all attenuation levels for all angles of the active 2D radiation pattern to a given value between zero and fifty. The radiation pattern and data table are modified simultaneously by entering a value in this edit box.
- "Omni" push button: To provide an omni radiation pattern to the current radiation plane with zero dB attenuation level. The data table is also modified simultaneously.
- "Clear" push button: This push button sets attenuation values for all angles of radiation pattern in the current radiation plane (H or E) to 50 dB.
- "Load" push button: To load a file, with the file name in the format "ant_*.ant", containing E- and H-plan radiation patterns as well as other characteristics of antenna.
- "Save" push button: Generates a file name in the format "ant_*.ant" and saves the modified or new pattern. A warning message will be displayed if the file name is already in use.

Additionally, antenna patterns may be modified graphically using a mouse left click on the pattern shape. The corresponding attenuation value for the relevant angle is modified simultaneously.

Under "Antenna Editor" dialogue box, an "Option" menu is implemented which enables users to change 2D plot style and draw 3D radiation pattern. The following items are available in the "Option" menu:

- Fill Diagram: To fill inside the curve of radiation pattern with a colour which may be selected from standard colour palette. If active, a check mark will be shown to the left side of item.
- Thick Lines: To increase the line thickness of radiation pattern curve. If active, a check mark will be shown to the left side of item.
- 5 Degrees Grid: Increases the angular grid of 2D radiation pattern plot from 10 degrees to 5 degrees. If active, a check mark will be shown to the left side of item.
- 1 Degrees Grid: Increases the angular grid of 2D radiation pattern plot from 10 degrees to 1 degree. If active, a check mark will be shown to the left side of item.
- 1 dB Grid: Increases the radial grid of 2D radiation pattern plot from 10 dB to 1 dB. If active, a check mark will be shown to the left side of item. Figure 3.25 shows the highest resolution of grid setting for the "Antenna Editor" dialogue box.
- 3D: Draws the 3D radiation pattern of antenna in a new window. This item is identical to the 3D push button on the antenna dialogue box. Figure 3.26 displays the 3D view of an antenna radiation pattern.

Figure 3.25. The highest resolution grid in "Antenna Editor" dialogue box

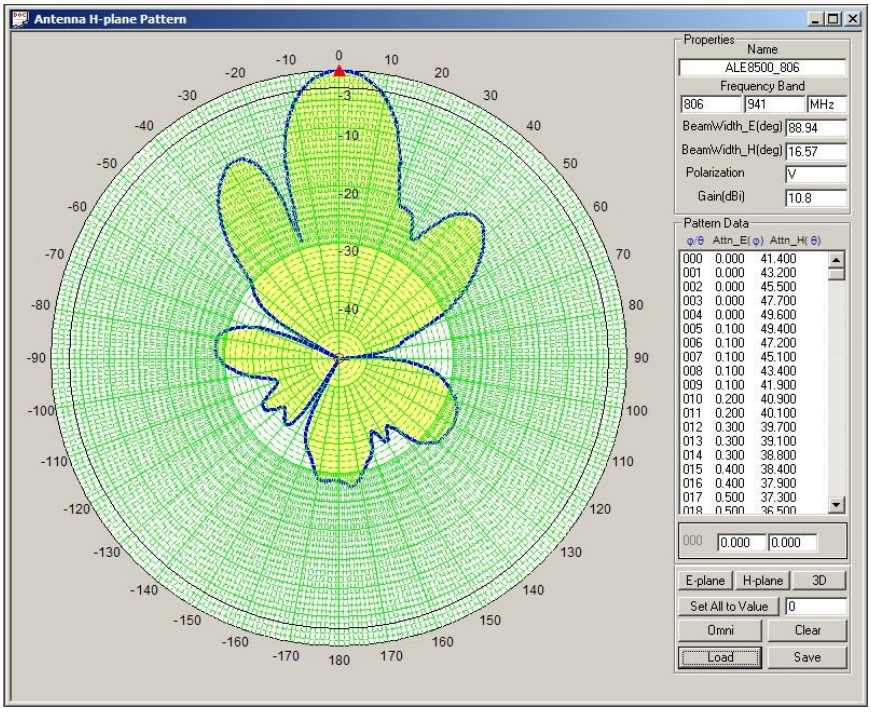
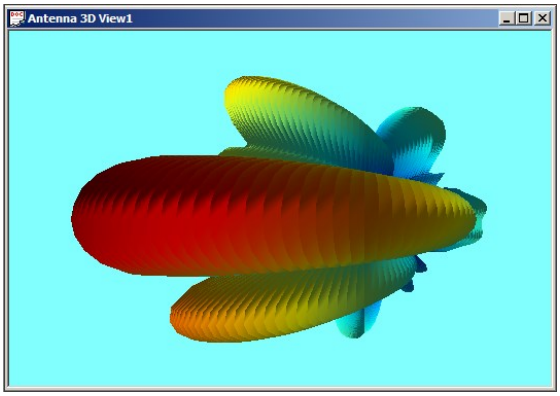
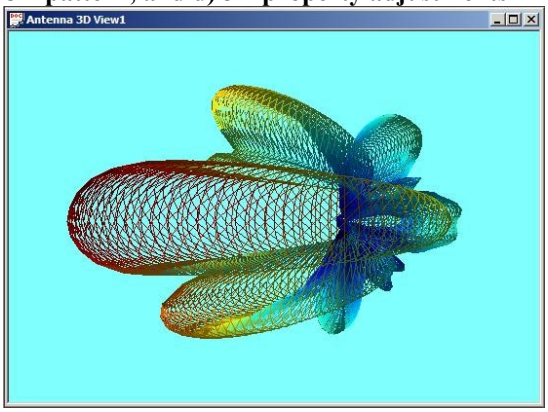


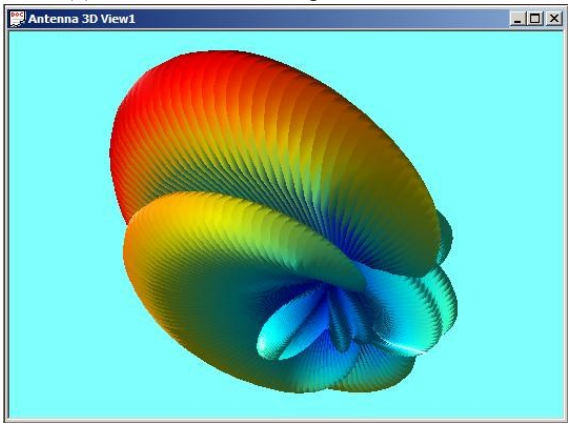
Figure 3.26. 3D view of an antenna radiation pattern.
a) filled 3D pattern, b) empty 3D pattern, c) Rotated 3D pattern, and d) 3D property adjustments



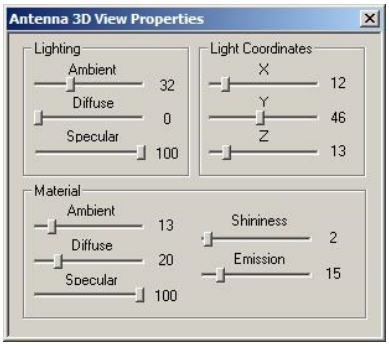
(a) Filled 3D radiation pattern



(b) Empty 3D radiation pattern



(c) 3D rotated radiation pattern



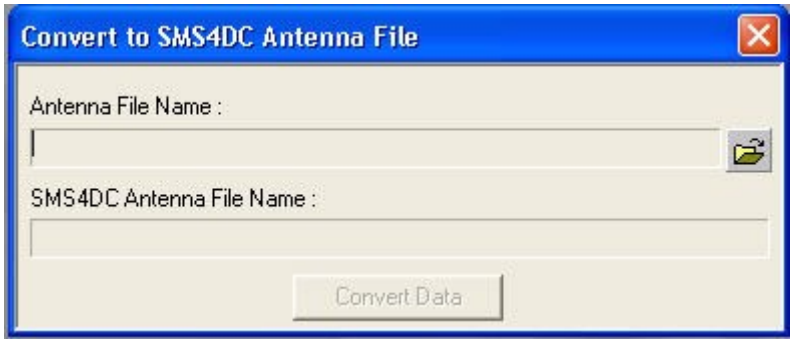
(d) Dialogue box to adjust visual effects of 3D view

Several actions are defined for the mouse in the 3D pattern view. The pattern shape may be rotated briefly or continuously by horizontal or vertical mouse move, slow or fast respectively, while holding the left mouse button. An additional mouse left button click stops the rotation. The size of pattern shape can be enlarged or reduced by horizontal or vertical mouse movement while holding the right mouse button. Horizontal or vertical mouse movement while holding right mouse button plus CTRL key, pans the 3D radiation pattern.

The "Option" menu under the 3D pattern view provides the following items to adjust the display properties:

- Fill diagram: To paint radiation pattern mesh with a rainbow colour map.
- Quad mode: To change colour distribution mode on the face of 3D pattern to quad mode.
- Properties: To adjust the visual setting of the 3D pattern. The relevant dialogue box is shown in Figure 3.26d.
- Background Colour: To change background colour of the 3D pattern view.

3.4.2.5.2. Convert Antenna File



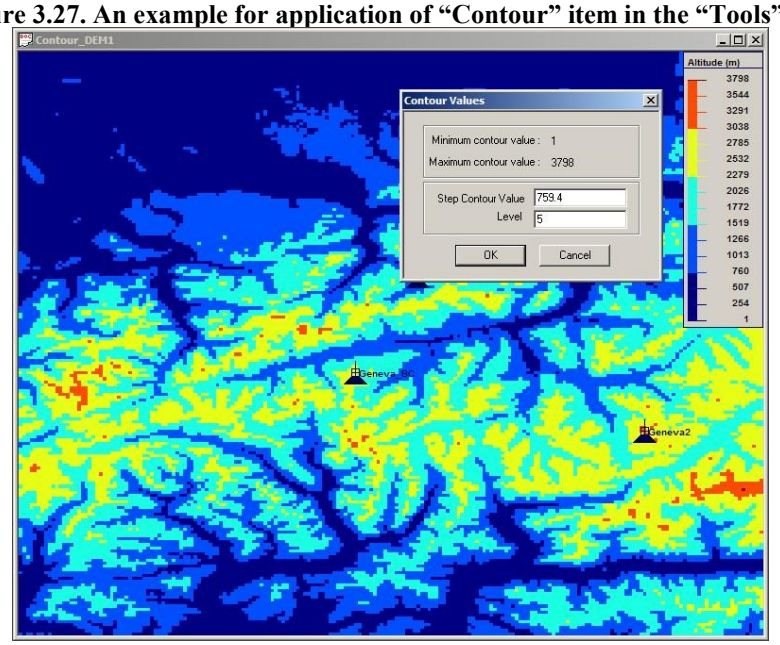
By selection of this menu item the above sscreen will be displayed. This functionality will be used to convert the antenna files provided by some antenna manufacturers to the *.ant file format supported by SMS4DC.

3.4.2.5.3. 2D View/Contour item in Tools menu of DEM view

As introduced in Section 3.4.2.5, once an area has been selected in the DEM using either the "Draw Box" or "Draw Box from Database" toolbar push buttons, the "2D View/Contour" item will be activated. After choosing this item, the selected area is copied to a resizable new window. The DEM view may be zoomed in or out by changing the window size using the mouse. "Show Legend" toolbar push button may be used for switching on/off the legend and printing facilities available from the "File" menu. "Tools" and "Database" menus are available in this view. "Normalize", "Colourmap", "Legend" and "Symbol Attribute" items in the "Tools" menu, and "Display Selected Station(s)" and "Remove Stations from Display" items in the "Database" menu have the same functions as described in 3.4.2.5 and 3.4.2.8 respectively. There is also a "Contour" item under the "Tools" menu which can be used for decreasing the number of colours by increasing simultaneously the level-step in "Legend". Figure 3.27 display an example of the

application of this feature. This item functions in the same way as the "Contour Levels" item under Tools menu of the area calculation widow.

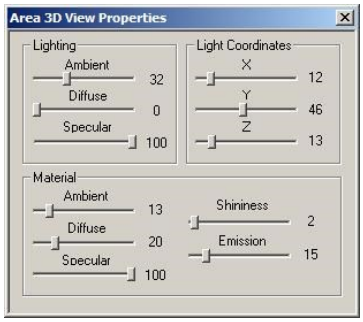
Figure 3.27. An example for application of "Contour" item in the "Tools" menu



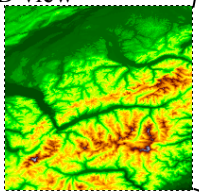
3.4.2.5.4. 3D View item in Tools menu of DEM view

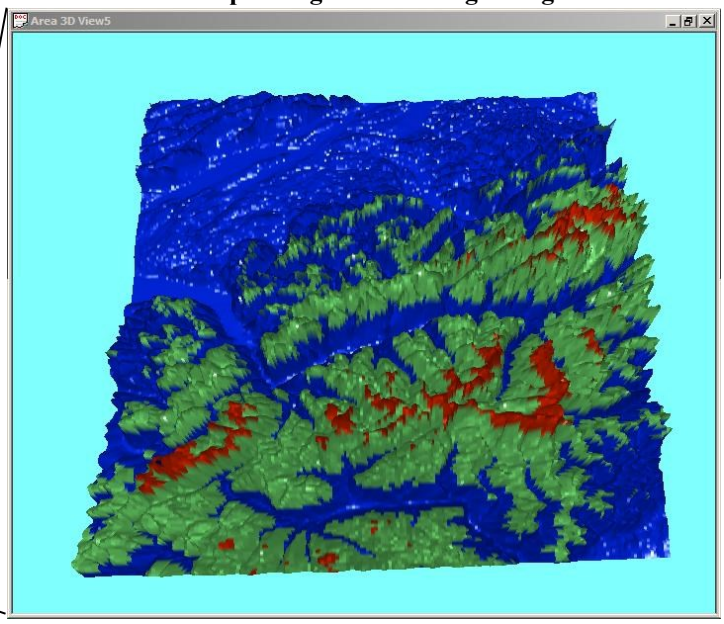
As introduced in Section 3.4.2.5, when an area has been selected using "Draw Box" or "Draw Box from Database" toolbar buttons, this item becomes active. By choosing this item, a 3D view of the selected area will be created in a new window. The "Option" menu is available and the mouse can be used to adjust some visual effects. Figure 3.28 shows a 3D view of a selected area.

Figure 3.28. 3D view of a selected area and corresponding visual setting dialogue box



(a) Dialogue box to adjust visual effects of 3D view





"Option" menu under 3D view provides the following items to adjust display properties:

- Fill diagram: To paint DEM mesh with a given colour map.
- Quad mode: To change colour distribution mode on the surface of a 3D DEM to quad mode.
- Background Colour: To change background colour of 3D view.
- Properties: To adjust visual settings of a 3D display. The relevant dialogue box is shown in Figure 3.28a.
- Contour: To decrease the number of displayed colours by increasing the level-step in "Legend". The 3D shape in Figure 3.28 shows an example for a three colour display.

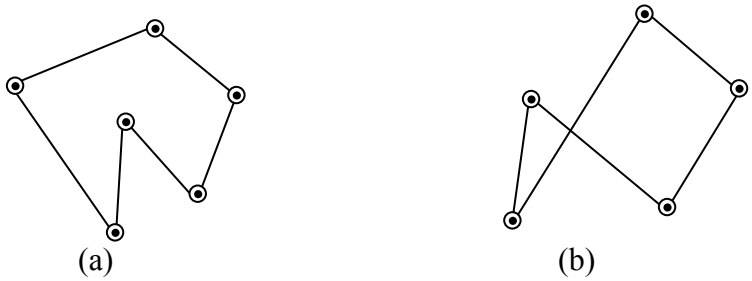
Several actions are defined for the mouse in the 3D view. A 3D figure can be rotated briefly or continuously by horizontal or vertical mouse movement, slow or fast respectively, while holding the mouse left button. An additional mouse left button click stops the rotation. The size of the 3D shape can be enlarged or reduced by horizontal or vertical mouse movement while holding the right button. Horizontal or vertical mouse movement while holding the right mouse button plus CTRL key, pans the 3D figure.

3.4.2.6. Calculations menu of DEM view

The calculations menu consists of the following items:

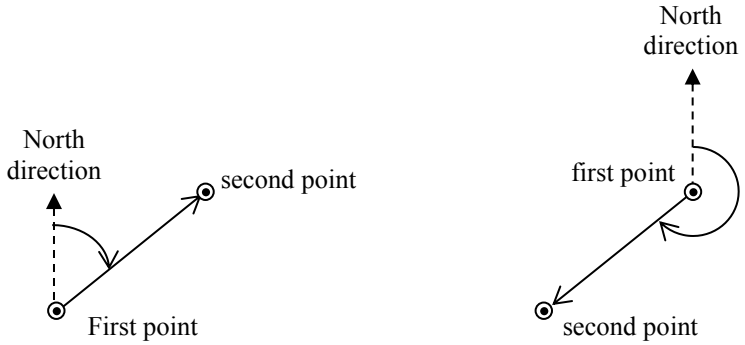
- Distance (km): Calculation of great circle distance of a path along a line (profile) or poly-line in km. This item is activated if a line or polyline has been created previously using "Draw Line" or "Draw Line from Database" or "Poly Line" toolbar buttons (see Section 3.4.1). The value of distance in km is presented on the status bar in the format of "Dist(km): *value*".
- Area (km^2): Calculation of an area bounded by a simple polygon (non-intersecting boundary), constructed by connecting two end points of a polyline drawn by using the "Poly Line" toolbar button (Section 3.4.1). The area value in km^2 is presented on the status bar. Figure 3.29 explains the concept of a simple polygon.

Figure 3.29. Types of polygon. a) simple polygon, and b) complex polygon



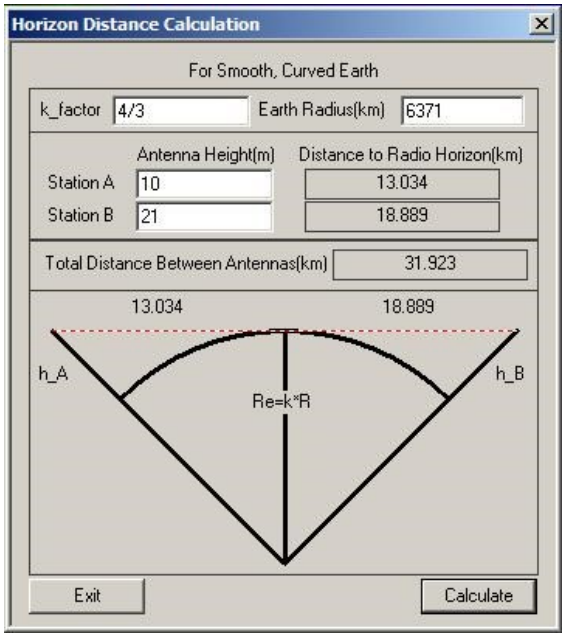
- Azimuth (Deg.): Calculation of the azimuth angle of a first point in respect to a second point in degrees. This item is activated if a line has been drawn using the "Draw Line" or "Draw Line from Database" toolbar buttons (Section 3.4.1). The value of the azimuth angle is presented on the status bar. Figure 3.30 shows two different examples.

Figure 3.30. Azimuth calculation



- Elevation (Deg.): Calculation of elevation angle of path from first point to the second point in degrees with respect to the horizon. This item is activated if a line has been drawn previously using "Draw Line" or "Draw Line from Database" toolbar buttons (see Section 3.4.1). By selecting this item a dialogue box is shown giving users the possibility to change k-factor in the range – 20 to – 0.01 and +0.01 to +20 (default value is +1.33). Terrain height is used for propagation calculations. The value of calculated elevation angle is presented at the status bar. A negative value of elevation angle indicates that the second point is below the (radio) horizon with respect to the first point.
- Horizon Distance: This item provides a multi-entry calculator to calculate point to point distance between antennas over a smooth Earth path and the individual distance from each antenna to the horizon. Figure 3.31 displays the provided dialogue box.

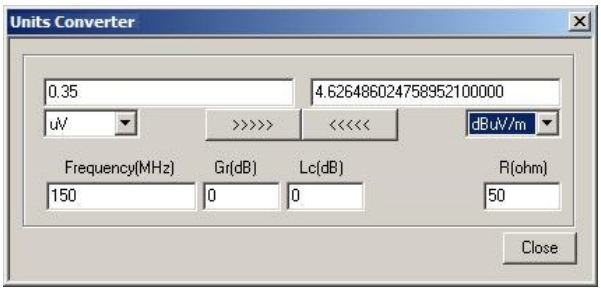
Figure 3.31. Dialogue box of horizon distance calculation



The value of k-factor should be in the range – 20 to – 0.01 and +0.01 to +20 (default value is +1.33)

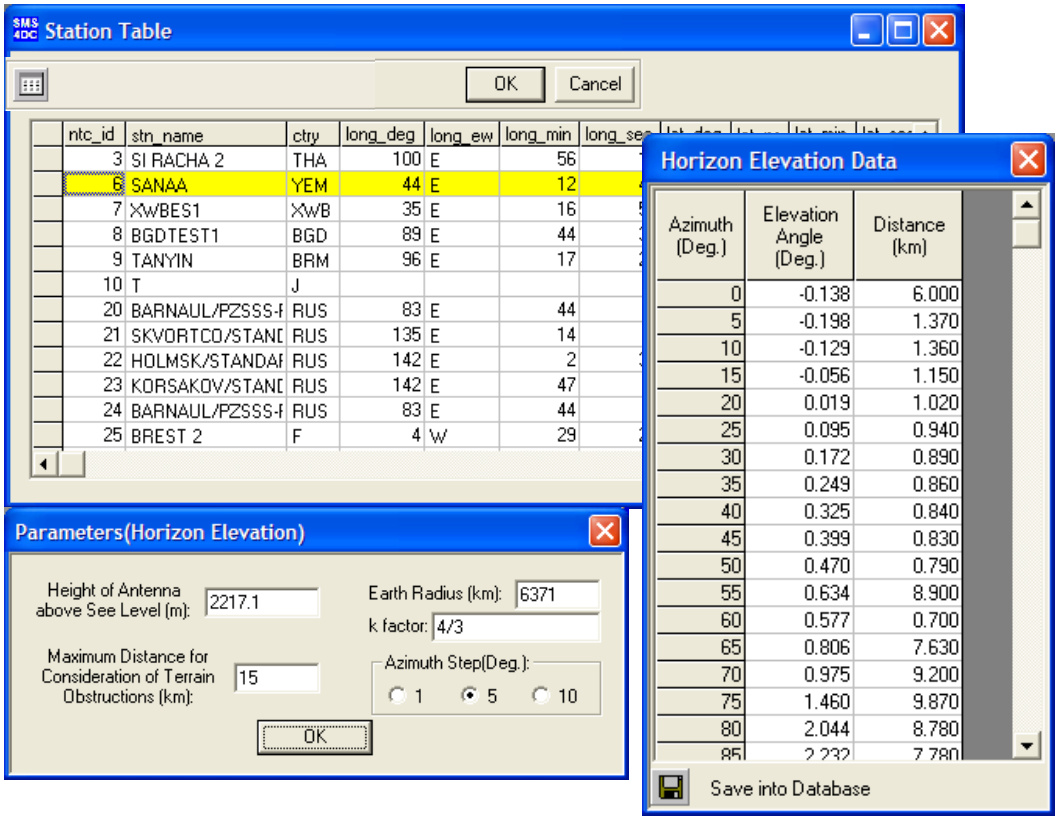
- Effective Height: Calculation of the effective height of an antenna for a station in the database. A full description of this item is given in Section 3.4.2.6.1.
- Units Converter: A calculator to convert various technical units from one type to another. Supported units are µV, µW, mW, W, kW, dBW, dBm and dBµV/m. The values for frequency, receiving antenna gain, cable loss of receiver and reference impedance must be given by the user for some conversions. Figure 3.32 displays the unit calculator dialogue box.

Figure 3.32. Unit calculator dialogue box



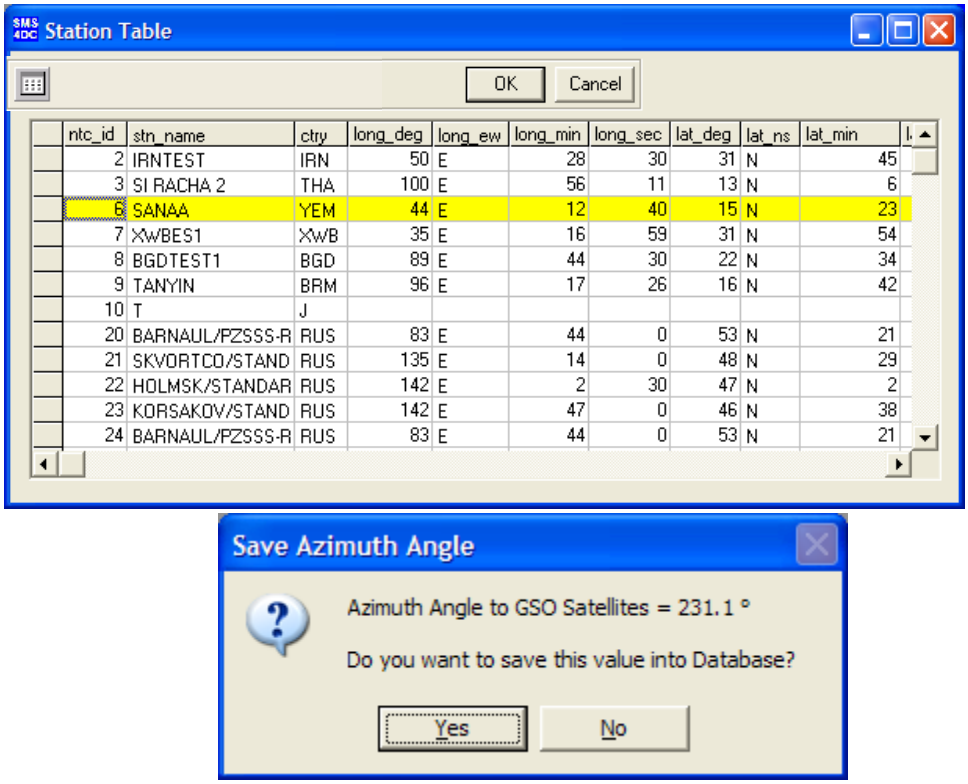
- Intermodulation: This item calculates intermodulation products from up to three independent signals which are suspected to be received as interference by a victim receiver. Selection of this item initiates an intermodulation calculator which is explained in Section 3.4.2.6.2.
- Earth Station:
  - Horizon Elevation:

    This menu item calculates the Horizon Elevation Angles for a selected Earth station and stores the values in the database.



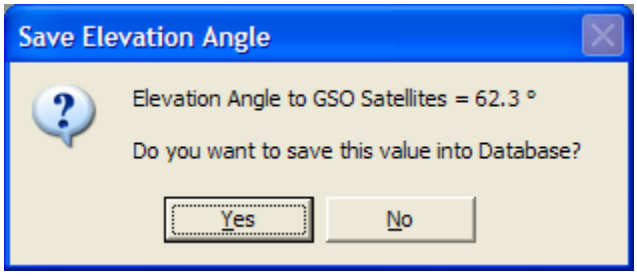
- Azimuth to GSO Satellites

  This menu item is used to calculate the Azimuth from the Earth station to its associated Space station (satellite) and store in the database.



- Elevation to GSO Satellites

  This menu item is used to calculate the Elevation from the Earth station to its associated Space station (satellite) and store in the database.

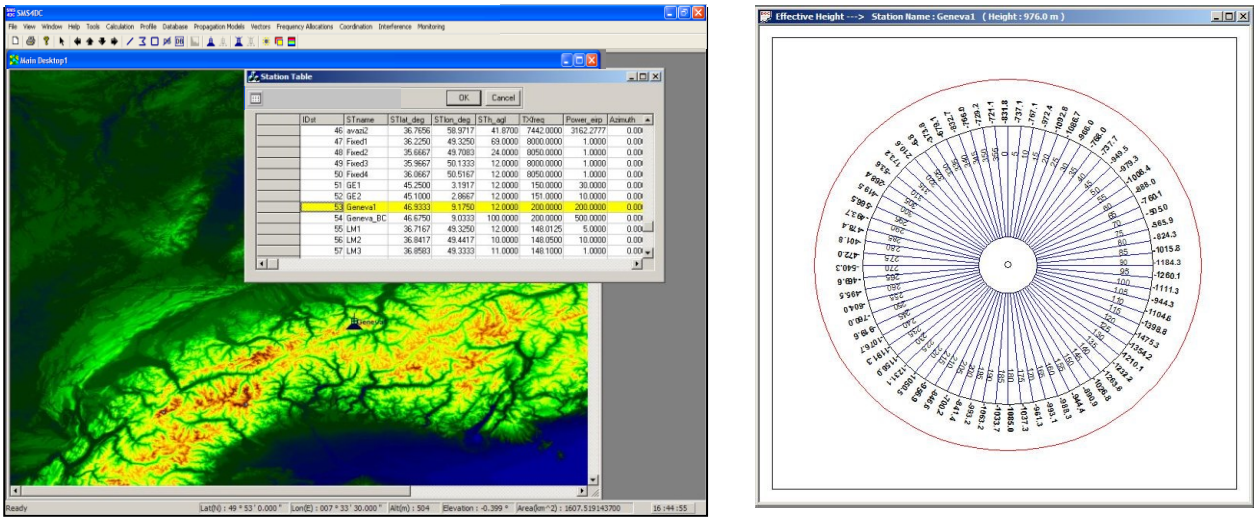


3.4.2.6.1. Effective height calculation in the Calculations menu

The calculation of effective height of an antenna is possible through the item “Effective Height” provided in the “Calculations” menu of the SMS4DC desktop (DEM view). As explained in ITU-R P.1546, the effective height of an antenna is a function of surrounding terrain height, from 3 km to 15 km, as well as antenna height. Effective antenna height is used by field-strength prediction models included in GE84, GE89, GE06, ST61, P.370, P.1812 and P.1546.

After selection of the item “Calculations -> Effective Height”, the database of stations is displayed. Once a station is selected from the spreadsheet, the background DEM will be panned to the location of selected station and a diagram representing effective height around the antenna will be displayed as shown in Figure 3.33.

Figure 3.33. Spreadsheet of stations and picture of effective height of an antenna



As displayed in Figure 3.33, the diagram of antenna effective height consists of two concentric circles of values. The inner circle is azimuth angle and outer circle gives the antenna effective height along the corresponding azimuth. The "Tools" menu, in this case, provides the following items:

- Text Colour: To customize the colour of texts using the standard "Colour Dialogue" box;
- Line Colour: To customize the colour of lines using the standard "Colour Dialogue" box;
- Background: To insert the DEM centred on the station location as a background of effective height values. Activation of this item is indicated by a check-mark to the left;
- Colour Map: Colour maps which may be selected for the background DEM, if the background DEM has been shown already. List of colour maps shown in Figure 3.22.
- Save Effective Height (Database): Saves the effective height values, in metres, together with the corresponding azimuths (with 5 degrees resolution) into the database.
- Save Effective Height (text): Saves the effective height values, in metres, together with the corresponding azimuths (with 5 degrees resolution), the station name, the map property file name and the location into a text file. Figure 3.34 provides an example of the application of some of the above items.
- Background DEM: On the window that shows an Effective Height diagram over a Background DEM, a mouse right click will display a table of values of effective height of the antenna at different azimuths. The items save Effective Height (Database) and Save Effective Height (text) (also seen in the menu "Calculations -> Effective Height->Tools") will appear at the bottom of this table. Additionally, printing features are available through the "File" menu
- Edit Database: This item enables the editing of values (previously saved in the database) of effective height of antenna at different azimuths, including a value for the maximum effective height (Max Heff) (see Figure 3.35). A "Save" push button is available above the table to save the modifications.

Figure 3.34 Background map, saved text file and context menu

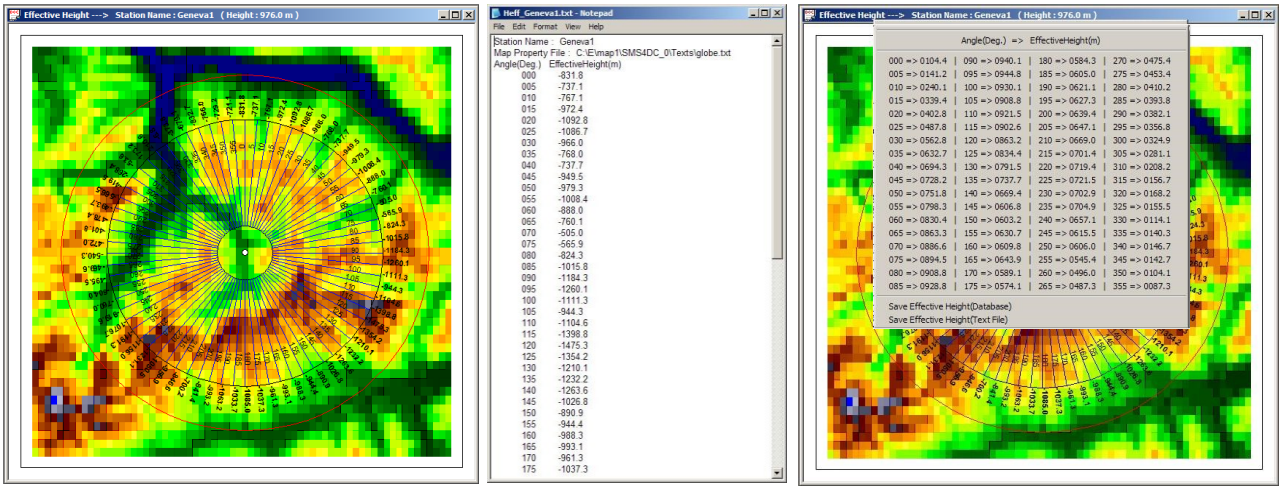
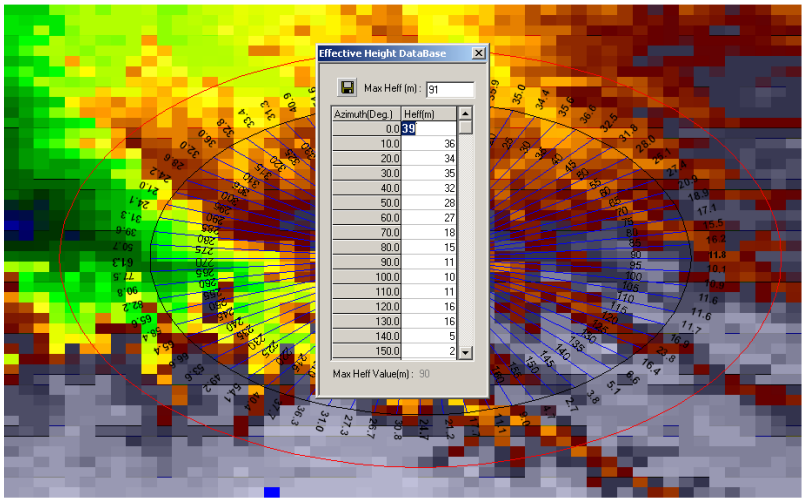


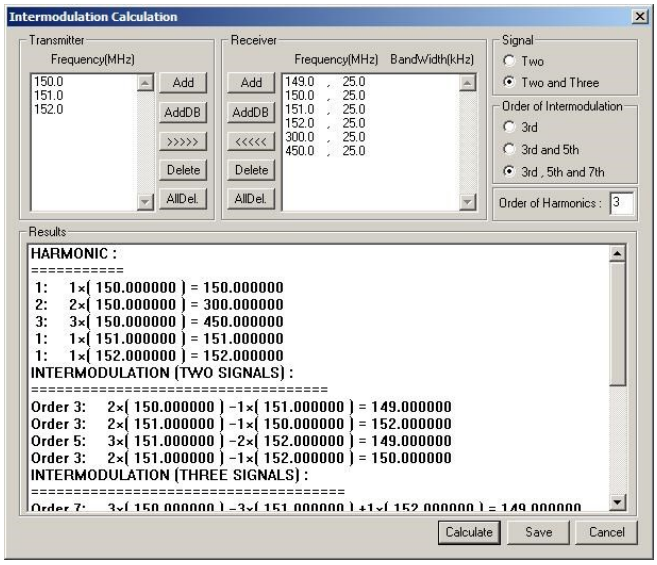
Figure 3.35 Sample for editing saved effective heights values



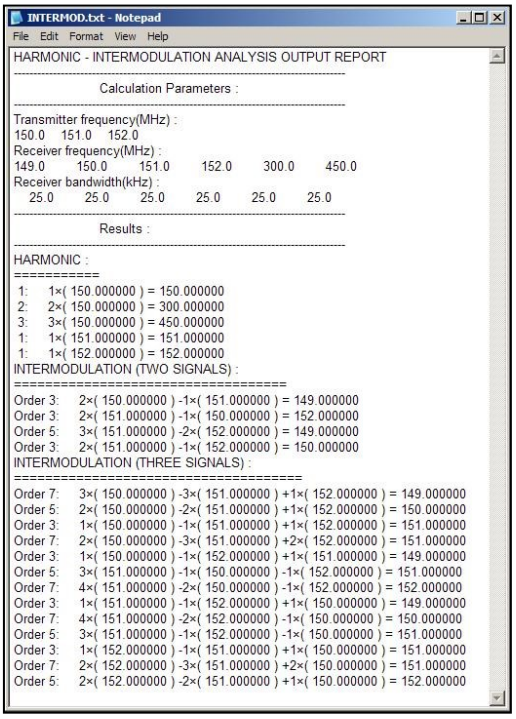
3.4.2.6.2. Intermodulation calculation in the Calculation menu

The “Calculation-> intermodulation” item enables users to calculate intermodulation products of up to three independent transmitting frequencies, up to 7th order, which might cause interference to victim receivers. Figure 3.36 shows the Intermodulation calculator on screen with a sample calculation and a saved text report of the results.

Figure 3.36. a) Intermodulation calculator and b) saved report (text file)



(a) Intermodulation calculator



(b) Saved report (text file)

The Calculator displayed in Figure 3.36a consists of following Sections:

- Transmitter: This section of the screen lists the main transmitting frequencies that are producing the intermodulation products. “Add” or “AddDB” push button can be used to add a transmitting frequency manually or from the database of stations, respectively. “Delete” and “AllDel” push buttons are for deleting one or all frequencies from the list, respectively. The “Move” Push button copies all the transmitting frequencies into the frequency list of Receiver Section by considering 25 kHz as the default bandwidth.
- Receiver: This section of the screen lists the victim receiver centre frequencies with a corresponding equivalent-bandwidth. “Add” or “AddDB” push button can be used to add a transmitting frequency and corresponding bandwidth manually, or from the database of stations. “Delete” and “AllDel” push buttons delete one or all frequencies from the list respectively. The “Move” Push button copies all receiving frequencies into the frequency list of the Transmitter Section.
- Signal: The number of transmitting signals which have to be combined to produce intermodulation products. Two or up to three signals can be selected.
- Order of intermodulation: The order of intermodulation products which have to be investigated to determine if they might cause interference to the receivers or not. The order of intermodulation is the sum of absolute value of multiplicands of the main harmonics contributing to the intermodulation product.
- Order of Harmonics: The maximum order of main harmonics which have to be investigated to determine if they might cause interference to the receivers or not..
- Results: List of suspect intermodulation products with their detailed calculations for:
    - main harmonics,

- two transmitting signals contributing, and
- three transmitting signals contributing.

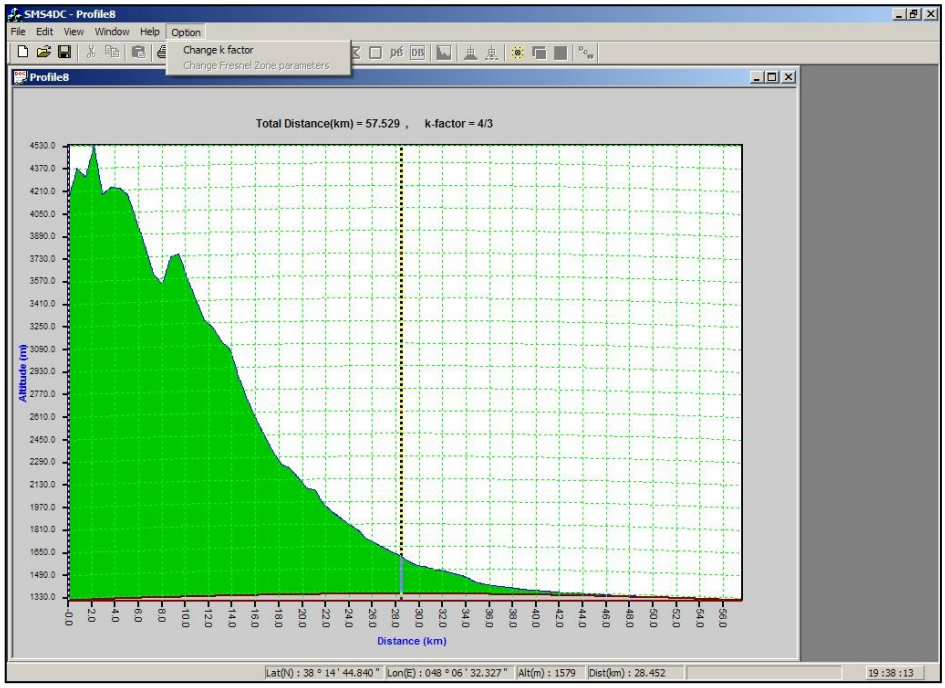
- Calculate push button: Push button to calculate suspect combinations using the latest settings and frequencies input to the calculator. In order to view the latest results, it is necessary to run the calculator after changing values or radio buttons of calculator.
- Save push button: This button saves the results of intermodulation calculations and calculator settings in a text file in a user-specified folder location. The content of a sample file is shown in Figure 3.36b.

3.4.2.7. Profile menu of DEM view

The Profile menu consists of the following items:

- Line: Plots a path profile along a path established on the DEM using the "Draw Line" or "Draw Line from Database" toolbar push buttons (Section 3.4.1). Figure 3.37 displays a path profile plotted by this item.

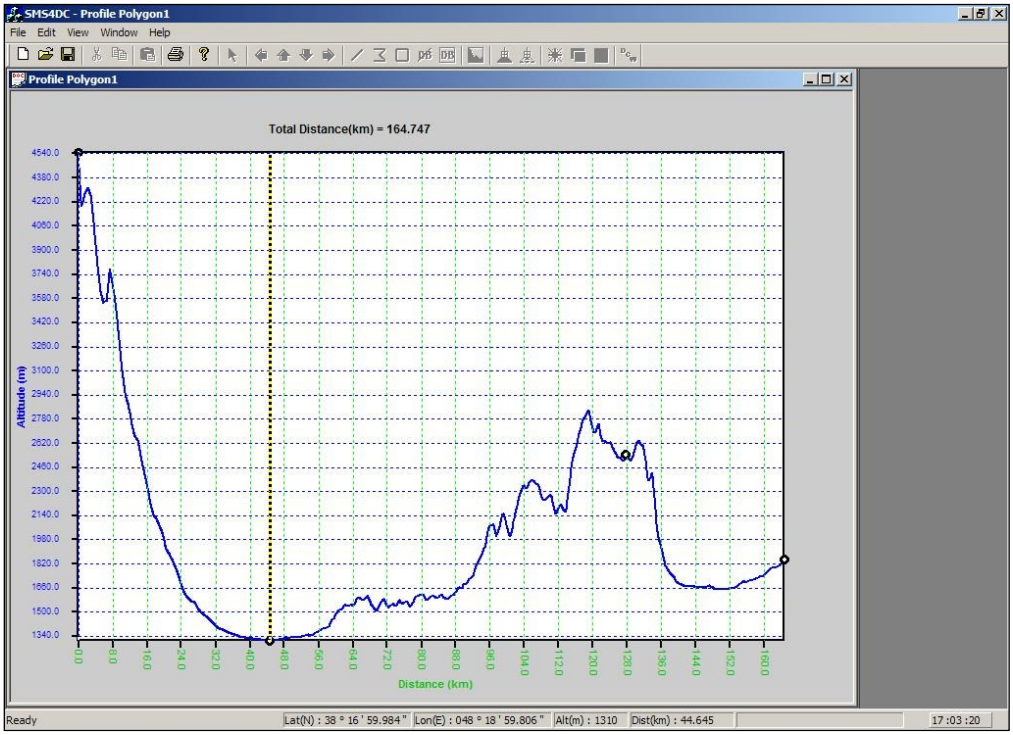
Figure 3.37. Path profile plotted along a line depicted using "Draw Line" or "Draw Line from Database" toolbar push buttons



The graph of the path profile is equipped with a vertical marker which is movable horizontally by mouse movement while holding left mouse button. Values for the geographical coordinates, terrain height and ground-distance from left point (beginning point of this line), at the current vertical marker location, are displayed on the status bar. Additionally, users may change the value of k-factor through the "Option" menu in the range –20 to –0.01 and +0.01 to +20. The default value of k-factor is 1.33.

- Polyline: Plotting path profile along a polyline established on DEM using "Polyline" toolbar push button (Section 3.4.1). Figure 3.38 displays a path profile depicted by this item.

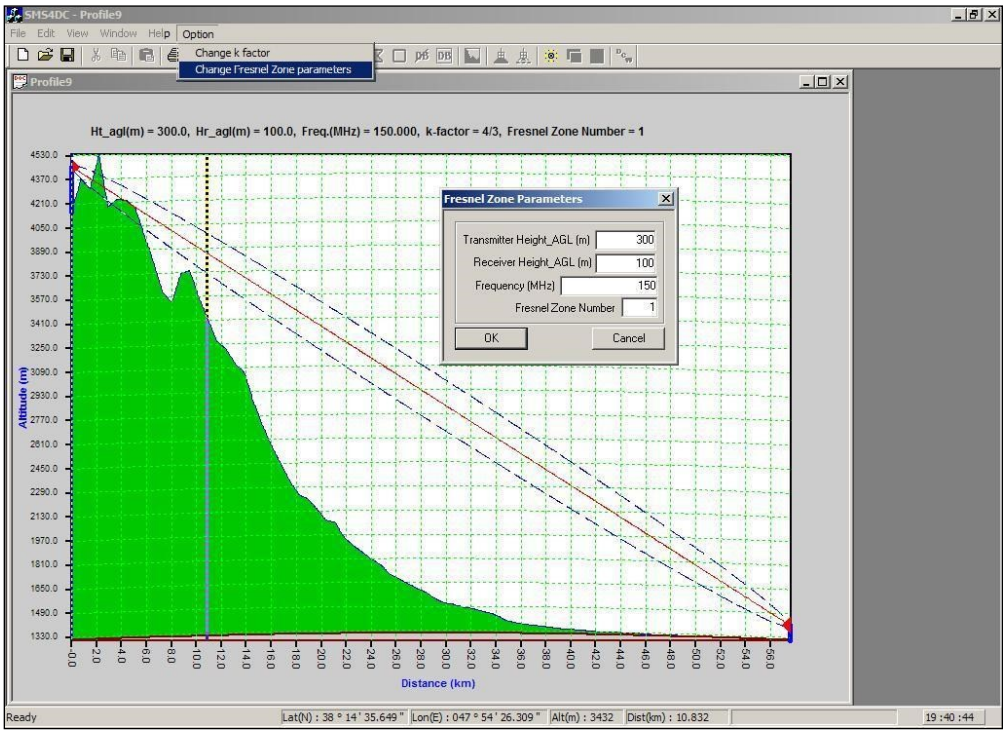
Figure 3.38. Path profile plotted along a poly line depicted using "Polyline" toolbar push button



The graph of path profile is equipped with a vertical marker which is movable horizontally by mouse movement while holding left mouse button. Values for: geographical coordinates, terrain height and ground-distance from left point (beginning point of this polyline), at the current vertical marker position, are displayed on the status bar. The k-factor is not considered in this plot.

- Fresnel Zone: This plots a path profile and the corresponding n^{th} Fresnel Zone along a path established on DEM using the "Draw Line" or "Draw Line from Database" toolbar push buttons (Section 3.4.1). The default values for left site antenna, right site antenna, frequency, k-factor and Fresnel Zone number are displayed at the top of plot. These values may be changed through the menu item: "Option->Change Fresnel Zone Parameters". Figure 3.39 shows a path profile and corresponding Fresnel Zone plotted by this item.

Figure 3.39. Path profile with Fresnel Zone along a line depicted using "Draw Line" or "Draw Line from Database" push buttons



The graph of the path profile and corresponding Fresnel Zone is equipped with a vertical marker which is movable horizontally by mouse movement while holding left mouse button. The values for: geographical coordinates, terrain height and ground-distance from left point (beginning point of this line), at the current position of the vertical marker, are displayed on the status bar. Additionally, users may change the value of k-factor through the "Option" menu in the range –20 to –0.01 and +0.01 to +20. The default value of k-factor is 1.33.

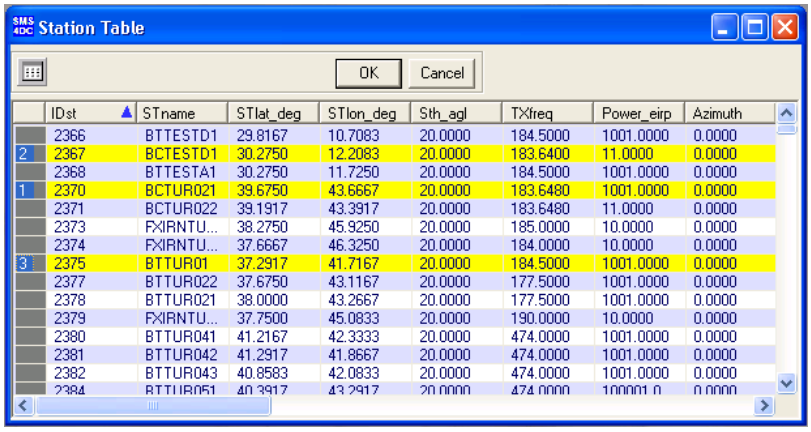
3.4.2.8. Database menu of DEM view

The Database menu consists of the following items:

- Display Selected Station(s): This item is designed to display stations which are selected from the database of stations. Therefore, by choosing this item, the spreadsheet of stations is displayed to enable selection of one or more stations using a mouse left click on the cells on the first column of each row. When the OK button is pushed, the selected stations will be displayed on the DEM, but the DEM will not pan to the location of the selected stations,

  Some helpful functions are implemented in the spreadsheet of stations. Users may select rows by mouse left-click on corresponding rows of the record-select column (first column from left). The colour of selected rows will be yellow. A mouse left click on each column name will sort the records in ascending or descending order based on the contents of that column. Additionally, a push-button is provided to export the selected rows in CSV (Comma Separated Values) format. Figure 3.40 shows the spreadsheet of stations.

Figure 3.40. Spreadsheet of stations with some selections

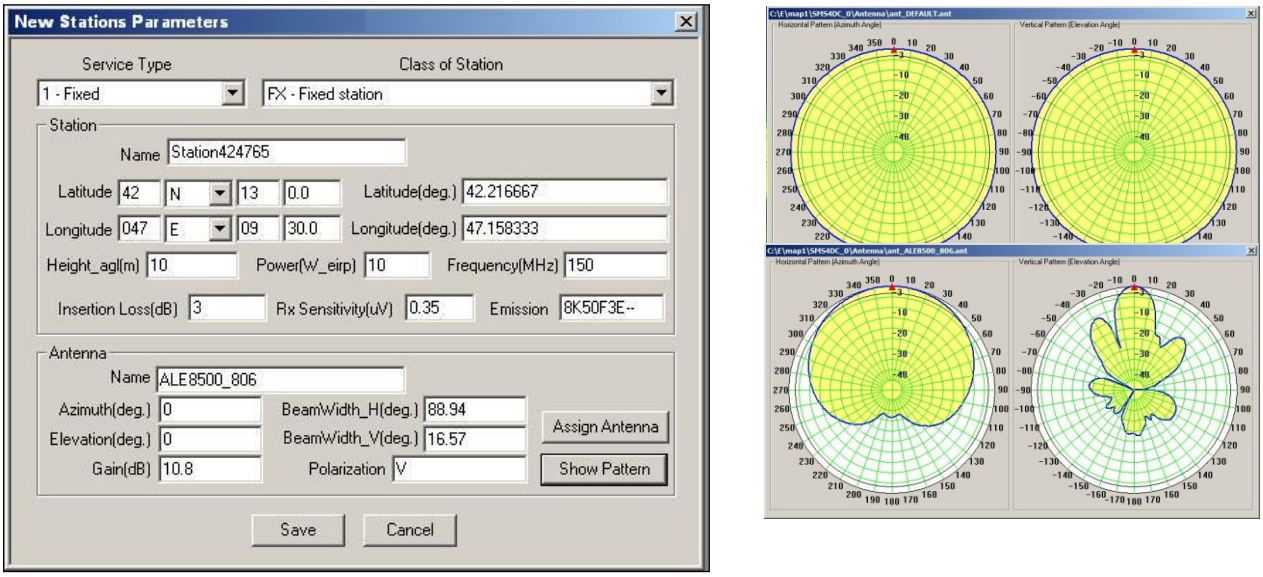


	IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth
	2366	BTTESTD1	29.8167	10.7083	20.0000	184.5000	1001.0000	0.0000
2	2367	BCTESTD1	30.2750	12.2083	20.0000	183.6400	11.0000	0.0000
	2368	BTTESTA1	30.2750	11.7250	20.0000	184.5000	1001.0000	0.0000
1	2370	BCTUR021	39.6750	43.6667	20.0000	183.6480	1001.0000	0.0000
	2371	BCTUR022	39.1917	43.3917	20.0000	183.6480	11.0000	0.0000
	2373	FXIRNTU...	38.2750	45.9250	20.0000	185.0000	10.0000	0.0000
	2374	FXIRNTU...	37.6667	46.3250	20.0000	184.0000	10.0000	0.0000
3	2375	BTTUR01	37.2917	41.7167	20.0000	184.5000	1001.0000	0.0000
	2377	BTTUR022	37.6750	43.1167	20.0000	177.5000	1001.0000	0.0000
	2378	BTTUR021	38.0000	43.2667	20.0000	177.5000	1001.0000	0.0000
	2379	FXIRNTU...	37.7500	45.0833	20.0000	190.0000	10.0000	0.0000
	2380	BTTUR041	41.2167	42.3333	20.0000	474.0000	1001.0000	0.0000
	2381	BTTUR042	41.2917	41.8667	20.0000	474.0000	1001.0000	0.0000
	2382	BTTUR043	40.8583	42.0833	20.0000	474.0000	1001.0000	0.0000
	2384	BTTUR051	40.3917	43.2917	20.0000	474.0000	100001.0	0.0000

- Station(s) in Desktop: This item performs a similar function to the item “Display Selected Station(s)” (explained in the previous bullet) except that the DEM is panned to the location of the selected stations if they are located in the four adjacent DEM tiles. Otherwise, if the selected stations are not in four adjacent DEM tiles, the intermediate four adjacent tiles will be loaded to the desktop. For more information on map manipulation in SMS4DC software refer to Chapter 1.
- Move Station: This item enables the user to move a station to a new location using the mouse. This item will be “grayed out” and inaccessible if no station is displayed on the DEM. Therefore, at least one station should be displayed on DEM for activation of “Move Station” item, by using either of the first two items of the “Database” menu (explained in the two previous bullets). It should be noted that the effective heights of antenna in different azimuths have to be recalculated for the new location as the old values are no longer valid.

  Selecting this item causes a check mark to appear to the left of the item and the “Move Station” toolbar button will be activated (see Section 3.4.1). To move a station, the user positions the mouse cursor inside the station symbol then clicks and holds the mouse right button. The station symbol may then be dragged across the DEM to the proposed new location where the mouse right button is released. A message box requests the user to confirm the new location, with a warning that, in the database record, the new coordinates will replace and delete the coordinates of the original location. Re-selecting this item removes the check mark next to the item and deactivates the “Move Station” toolbar button.
- Add Station: This enables users to add a station at the mouse cursor position on the DEM and save the corresponding technical data in the working database. The mouse cursor shape changes to the “+” shape and the “+” is positioned at the proposed location of the new station. A left click of the mouse button displays a data entry mask to input the technical data of the station. The geographical coordinates of the location at the mouse position on the DEM are loaded into the corresponding data fields in the mask. These coordinates may be modified by keyboard entry. Figure 3.41 shows an example of the data entry mask. The newly created station will be inserted in the folder for Anonymous Stations in the Administrative Window.

Figure 3.41. Data entry mask to enter parameters of new station, isotropic and a sample of directional antenna patterns

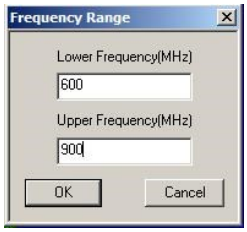


The range of radiocommunication services that may be dealt with by SMS4DC is limited, by the ITU-D specification, to the: Fixed, Land Mobile and Broadcasting (Sound and TV) services. Therefore the range of the Class of Stations is limited to only those classes that correspond to these three specified services. The "Assign Antenna" push button enables antenna selection from a folder of antenna specification data files. An isotropic antenna will be assigned by default if no specific antenna is selected. The vertical and horizontal polarization directivity pattern of an antenna can be displayed using the "Show Pattern" push button. A new antenna may be defined by using the item "Tools->Edit Antenna".

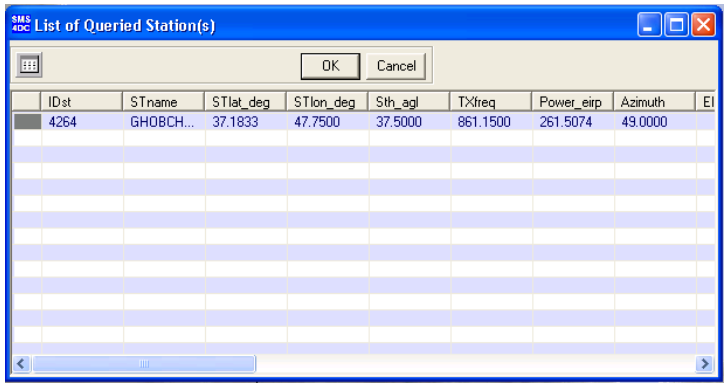
- Search Station: There are three sub-items: "Search Station->By Location", "Search Station->By Location and Frequency" and "Search Station->List of Queried Station(s)". In order to activate these sub-items, an area must be selected in advance by the "Draw Box" or "Draw Box from Database" toolbar buttons. The third sub-item, "List of Queried Station(s)", additionally requires at least one station to be located in the selected area. The first sub-item displays a station symbol at the locations of all stations located in a selected area. The second sub-item produces a similar display but only for those stations between the lower and upper frequency limits specified by the user in a pop-up dialogue box (Figure 3.42a). The third sub-item produces a spreadsheet (Figure 3.42b) which lists the details of all stations within the selected area. This spreadsheet is equipped with two buttons to enable users to sort the stations in ascending or descending order, with respect to column "IDst" (by default), or any other column selected by a mouse left click on that column's field name. The third button can be used to export the selected rows in CSV (Comma Separated Values) format.
- Remove Stations from Display: This item removes all displayed terrestrial stations from the DEM.
- Display Links: This item displays selected point – to – point radio links on the background DEM. Selection of this item opens a spreadsheet of all point – to – point links

in the database, from which users may select one or more links for display on the background DEM. Figure 3.43 shows an example. Arrows are used to indicate transmission direction for bi-directional or unidirectional links and will remain attached to connected stations even when they are moved to a new location on the map. "Remove Station(s) from Display" item can be used for removing links from map.

Figure 3.42. a)Dialogue box to define frequency band criteria to search stations in a given area, and b) list of queried stations found in the given area

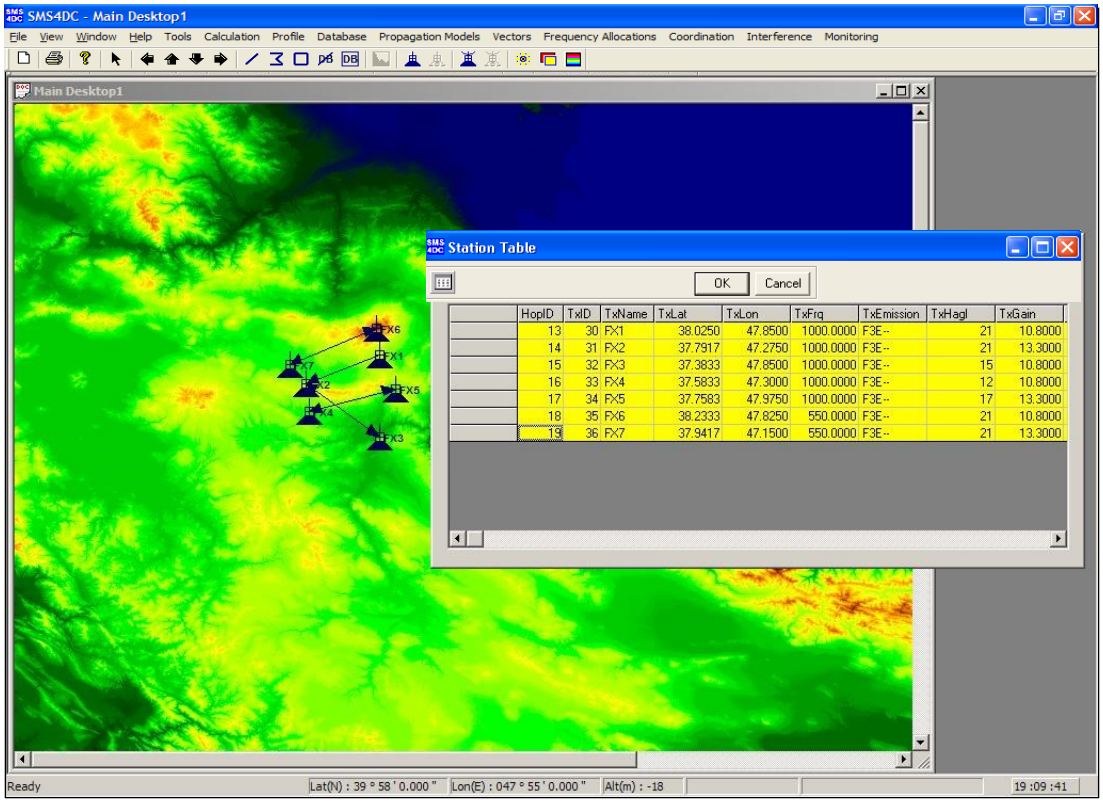


(a) Frequency criteria



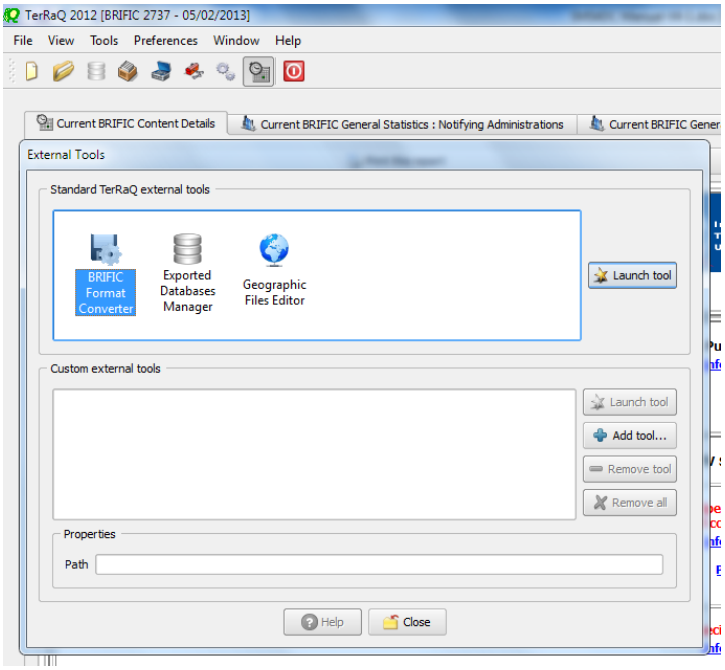
(b) List of queried stations found in the given area

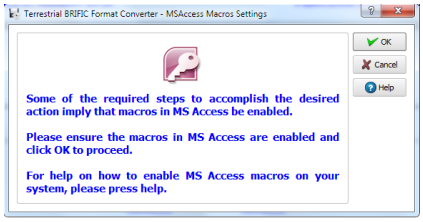
Figure 3.43. A sample display of point – to – point links on the map

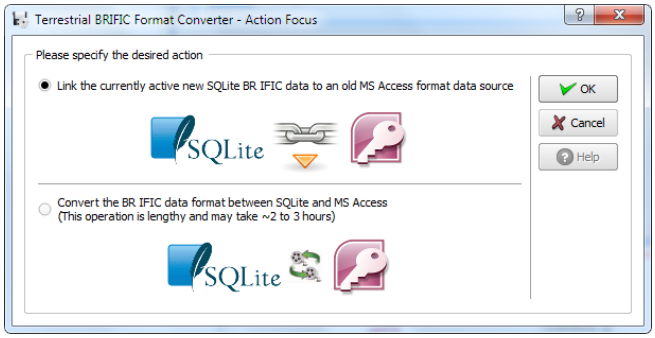


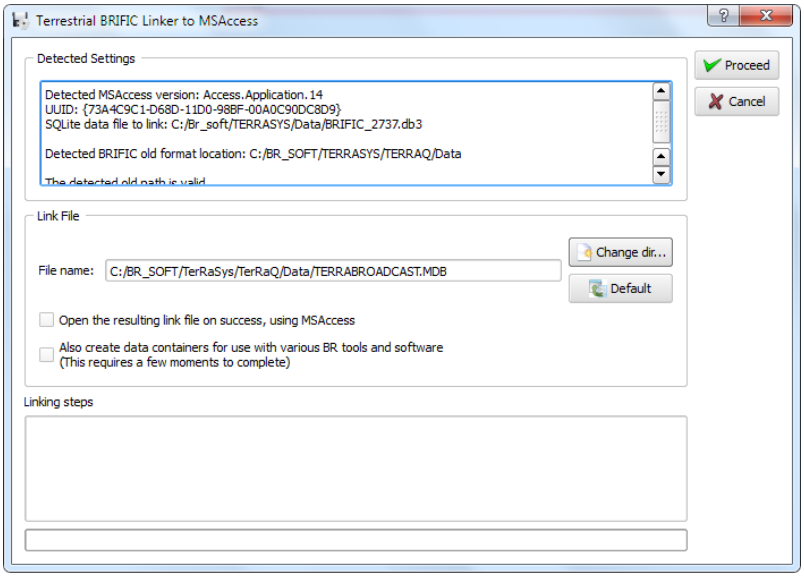
- Import from IFIC (Terrestrial Services): This item enables the import of selected data from the BR IFIC database into the SMS4DC database. This function requires the (latest) BR IFIC database to be installed in accordance with the installation instructions. As from terrestrial BR IFIC No. 2739, the BR IFIC database is not in Microsoft Access format but

in SQLite format. Before being able to perform the data import, it is essential to create a data bridge after each installation of the BR IFIC. The bridge can be built through the usage of the "BR IFIC Format Converter" which is available in the TerRaQ-Plus (see the following picture).







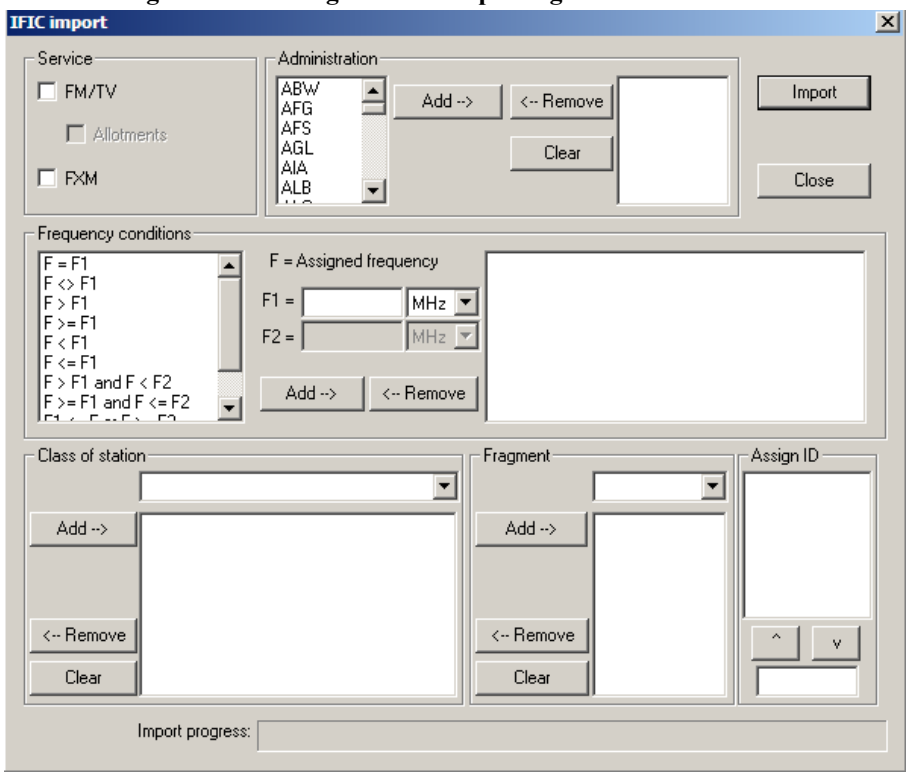


As shown in Figure 3.44, choosing this item launches the "IFIC import" dialogue box and provides a data filter to specify the type of data required for import. The content of this dialogue box is similar to the BR TerRaQ software. The following filter conditions can be set using the dialogue box:

- Radiocommunication service type: use the check boxes to select either FM/TV (for Broadcasting assignments or allotments) or FXM (for Fixed or Land Mobile assignments). If FM/TV is selected, the Allotments check box is activated. This enables the user additionally to request the import of information for broadcasting allotments.
- Administration: The user may select administrations from this window list and add them to (or remove them from) the selection window list.
- Frequency condition: To specify a frequency range filter for the imported records.
- Class of Station: A Combo box to select class of station for which data is to be imported.
- Fragment: A Combo box enables the selection of the fragments corresponding to the service type selected.
- Assign ID(s) of the specific notice(s) to import.

Leaving conditions blank means no preference with respect to that item and SMS4DC will ignore the relevant condition. However, a warning message will be displayed if no conditions are defined.

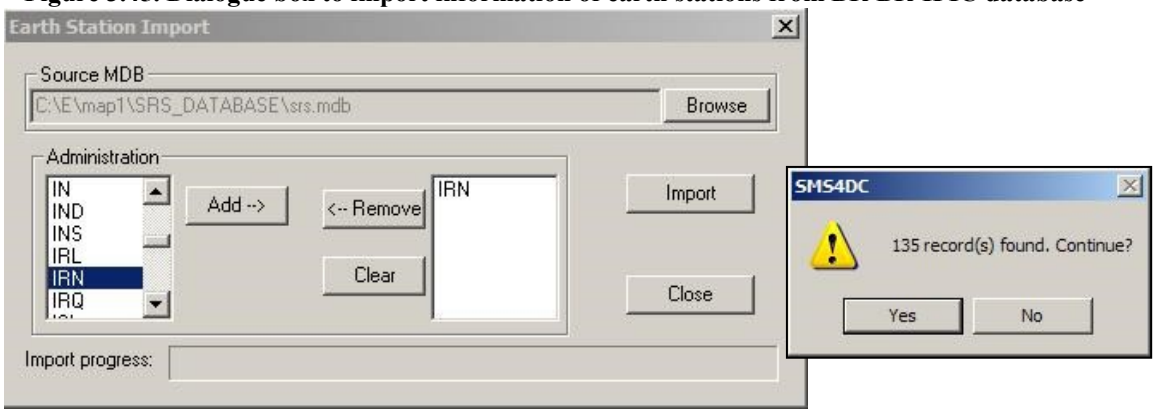
Figure 3.44. Dialogue box of importing data from BRIFIC



- Import from BR IFIC (Space Services): This item imports information of Earth stations which belong to one or more administrations, into the SMS4DC database. The information source must be an "mdb" file having a data format identical with the BR IFIC (Space Services) database format (including space BR IFIC and electronic notices).

  As displayed in Figure 3.45, choosing this item opens the "BR-IFIC import" dialogue box and provides a mask to specify the source database (with mdb extension) and one or more administrations whose Earth station information is to be imported. The browse button enables the user to find the correct "mdb" file location. After choosing the administration(s) of interest and pushing the "Import" button, SMS4DC displays a Yes/No dialogue screen and the number Earth station records available for import (according to the administrations selected). This screen enables the user to continue or abandon the data import. A progress bar is included at the bottom of the main import screen.

Figure 3.45. Dialogue box to import information of earth stations from BR BR-IFIC database

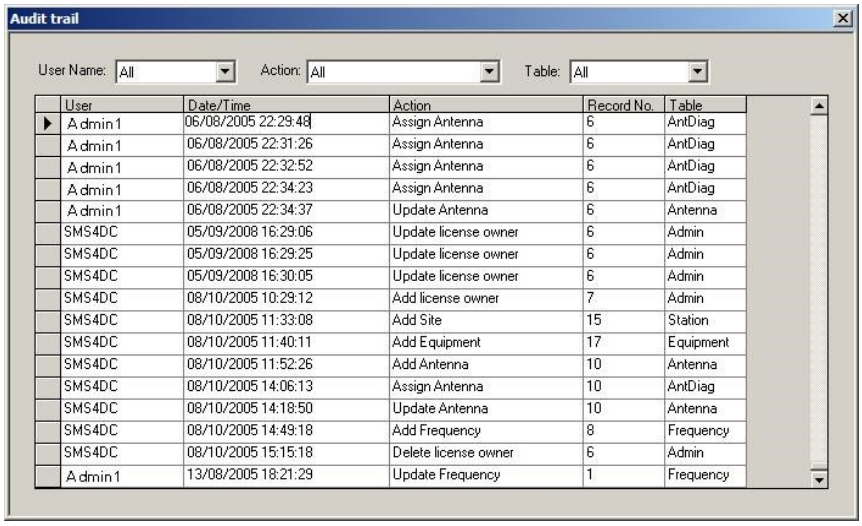


- Licensing: This item provides access to the Administrative module of SMS4DC. The details of all the Administrative functions of SMS4DC are described in chapter 4.
- Audit Trail: This item shows the action log for audit purposes. The log is in spreadsheet format, listing: action date and time; users who performed the actions; effected record and the table in which the effected records are registered. Three combo boxes are provided which allow the list to be filtered to a specific user, action or modified database table.

  Figure 3.46 shows an example of the audit trail spreadsheet.

  Table 3.1 shows the list of logged actions: Owners, Licenses, Stations, Equipments, Antennas, Frequencies, Links, Payments and Invoice tables.

Figure 3.46. Log of actions performed by each users on relevant record of database table with time and date tag



User	Date/Time	Action	Record No.	Table
Admin1	06/08/2005 22:29:48	Assign Antenna	6	AntDiag
Admin1	06/08/2005 22:31:26	Assign Antenna	6	AntDiag
Admin1	06/08/2005 22:32:52	Assign Antenna	6	AntDiag
Admin1	06/08/2005 22:34:23	Assign Antenna	6	AntDiag
Admin1	06/08/2005 22:34:37	Update Antenna	6	Antenna
SMS4DC	05/09/2008 16:29:06	Update license owner	6	Admin
SMS4DC	05/09/2008 16:29:25	Update license owner	6	Admin
SMS4DC	05/09/2008 16:30:05	Update license owner	6	Admin
SMS4DC	08/10/2005 10:29:12	Add license owner	7	Admin
SMS4DC	08/10/2005 11:33:08	Add Site	15	Station
SMS4DC	08/10/2005 11:40:11	Add Equipment	17	Equipment
SMS4DC	08/10/2005 11:52:26	Add Antenna	10	Antenna
SMS4DC	08/10/2005 14:06:13	Assign Antenna	10	AntDiag
SMS4DC	08/10/2005 14:18:50	Update Antenna	10	Antenna
SMS4DC	08/10/2005 14:49:18	Add Frequency	8	Frequency
SMS4DC	08/10/2005 15:15:18	Delete license owner	6	Admin
Admin1	13/08/2005 18:21:29	Update Frequency	1	Frequency

Table 3.1. Actions and tables for which SMS4DC keeps a log for audit purposes

Actions logged	Description
Add …	Adds a new record to the corresponding table. The Audit Trail spreadsheet lists: the user taking the action, date and time of action, record number, name of relevant table.
Delete …	Deletes an existing record from the corresponding table. The delete command may cascade several deleting actions. For example: deleting an Owner record will delete all associated licenses, stations, equipment etc. which are attached to the owner. Therefore, a delete action will be logged in the "Audit trail" spreadsheet for each associated deleted record. The Audit Trail spreadsheet lists: the user taking the action, date and time of actions, name of relevant tables. Prior to performing a delete action, a warning message is generated by SMS4DC. No "undo" is possible after deleting a record.
Update …	Updates an existing record in the corresponding table. The Audit Trail spreadsheet lists: the user taking the action, date and time of action, name of the relevant table. No "undo" is possible after deleting a record.
{Fixed, Land Mobile or Broadcasting} License Generated	Issues and prints a license for Fixed, Mobile or Broadcasting stations. A record is generated in the "Audit trial" spreadsheet for each print of a multiple print out.
Invoice creation	Issues an invoice and prints a billing letter for Fixed, Mobile or Broadcasting stations in a license.
Assign antenna	Adds an antenna to the Antenna Library.
BR notification generated	Generates an ITU BR notification XML file.

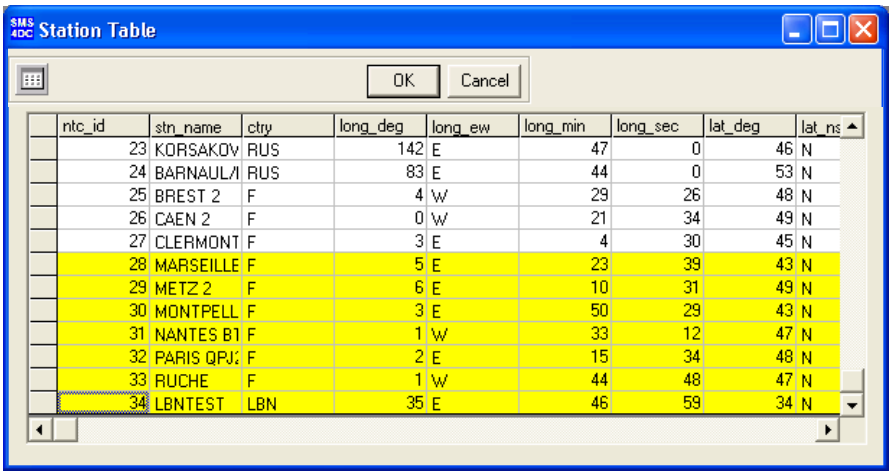
- Users: This item allows the "*Supervisor*" to create a new user account or modify an existing account. Application of this item explained fully in Section 3.2.
- Backup: This item builds and saves a backup file of the SMS4DC database into the default path "…\SMS4DC\BackUp" or a user-defined location. After selecting this item the user is requested to specify a directory where backup files will be created. The date of the backup file creation will be included in the name of backup mdb file, i.e. SMS-New*yyymmdd*.mdb. It is recommended strongly that a backup, using this command, is made on a regular and systematic basis. The following instruction will restore the database from the backup database file:
    1. Deleting "*yyymmdd*" part of backup filename;
    2. Copying mdb file into the folder "…\SMS4DC\DB"

- Display Selected Earth Station(s): This item is designed to display Earth stations which have been selected from the database. Choosing this item displays a spreadsheet of Earth stations so that one or more Earth stations may be selected using a mouse left click. After pushing the "OK" button, the selected earth stations will be displayed on the DEM without panning the DEM to the location of these stations.

  Helpful functions are implemented in the spreadsheet of Earth stations. Users may select rows and columns by mouse left-click on the corresponding rows of the record-select column (first column from left) and field name respectively. The colour of the selected rows changes to yellow while the colour of the selected column is dark-blue. A mouse left click on the top of the record-select column selects all records. Moreover, two push

buttons are provided to sort the list of stations, in ascending or descending alpha-numeric order, with respect to the "IDst" column (by default) or any other selected column. The third button can be used to export the selected rows in CSV (Comma Separated Values) format. Figure 3.47 displays the spreadsheet of earth stations.

Figure 3.47. Spreadsheet of stations with some selections

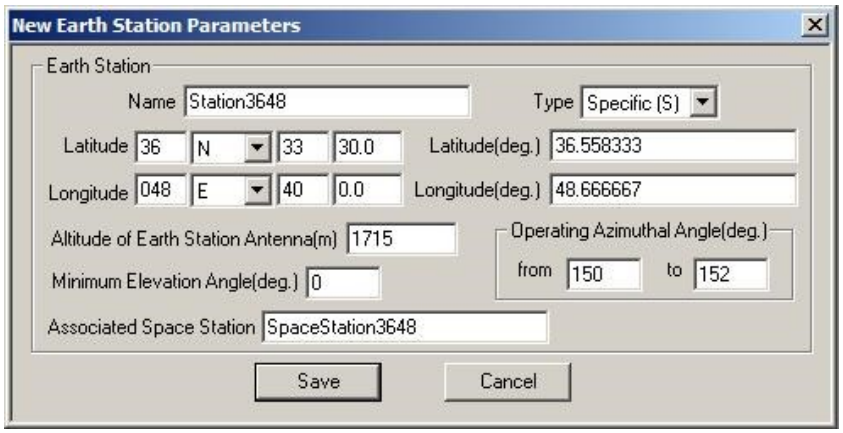


ntc_id	stn_name	ctry	long_deg	long_ew	long_min	long_sec	lat_deg	lat_ns
23	KORSAKOV	RUS	142	E	47	0	46	N
24	BARNAUL/I	RUS	83	E	44	0	53	N
25	BREST 2	F	4	W	29	26	48	N
26	CAEN 2	F	0	W	21	34	49	N
27	CLERMONT	F	3	E	4	30	45	N
28	MARSEILLE	F	5	E	23	39	43	N
29	METZ 2	F	6	E	10	31	49	N
30	MONTPELL	F	3	E	50	29	43	N
31	NANTES B1	F	1	W	33	12	47	N
32	PARIS QPJ	F	2	E	15	34	48	N
33	RUCHE	F	1	W	44	48	47	N
34	LBNTEST	LBN	35	E	46	59	34	N

- Earth Station(s) in Desktop: This item provides a similar function to the item "Display Selected Earth Station(s)" (explained in the previous bullet) except the DEM is panned to the location of selected stations if the selected stations are located on the four adjacent DEM tiles. If selected stations are not in four adjacent DEM tiles, the intermediate four adjacent tiles will be loaded to the desktop. For more information on map manipulation in SMS4DC software refer to Chapter 1.
- Move Earth Station: This item enables the user to move an earth station to a new location using the mouse. At least one earth station must be displayed on the DEM to activate the "Move Earth Station" item, otherwise the item will be "grayed out" on the menu.

  Selection of this item will cause a check mark to appear on the left of the item and the "Move Earth Station" toolbar button will be activated (see Section 3.4.1). To move an Earth station, the user clicks and holds the right mouse button on the symbol of the required Earth station, then drags it to the proposed new location. When the mouse right button is released a message box pops-up to request the user to confirm/approve saving the new location. Reselecting (mouse right click on) this item removes the check mark from the item and deactivates the "Move Earth Station" toolbar button.
- Add Earth Station: This enables users to add an Earth station at the mouse position and save the corresponding information in the working database. Selecting the item changes the mouse cursor to the "+" shape, this is moved to the proposed location of the new Earth station. A left mouse click displays a data entry mask to input information about the new station. The geographical coordinates and terrain height of mouse location are loaded automatically into the corresponding entries in the mask. Figure3.48 shows the data entry mask. The newly created record for the Earth station will be saved in the folder for Anonymous Stations in the Administrative Window.

Figure 3.48. Data entry mask to enter information for a new Earth station



- Search Earth Station: This item displays an Earth station symbol at the locations of all stations located in a user selected area. To activate this item, an area must be selected in advance by "Draw Box" or "Draw Box from Database" toolbar buttons.
- Remove Earth Stations from Display: This item removes the symbols of all Earth stations displayed on the DEM.
- Display Receiving Area: This item displays a predefined receiving area of a station. The receiving area (which may be: circle, zone or multipoint) must be defined previously by means of the "Add Receiver" push button function on the frequency level of the concerned station in the Administrative window. All stations with predefined receiving area will be listed in a spreadsheet and the concerned station may be selected using a mouse left click on the record-select column of the spreadsheet. After selecting the wanted station, a vector-style dialogue box appears which enables the user to adjust line colour and style, as well as the fill style inside the area (see Figure3.49). Once the parameters have been determined, the receiving area of the wanted station will be displayed on the DEM map as shown in Figure3.50.

Figure 3.49. Spreadsheet of stations with predefined receiving area

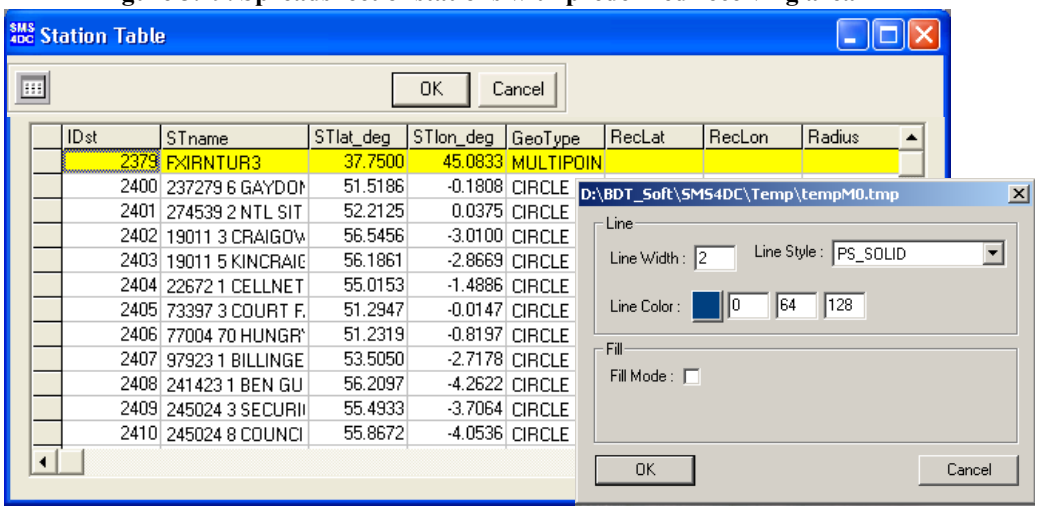


Figure 3.50. Sample output of Display Receiving Area function

- Display Service Area (FXM): This item displays a predefined service area of a station in the fixed or land mobile service. A service area of a station is defined at the station level in the Licensing/Administrative window and may be: a circle (by entering Latitude, Longitude and Radius of Service and selecting the Station Type field as Fixed) or zone (by entering Area of Transmission and selecting the Station Type field as Typical). All stations with a predefined service area will be listed in a spreadsheet and users may select the concerned station, using a mouse left click on the record-select column of the spreadsheet. When the wanted station is selected, a vector-style dialogue box appears which enables the user to adjust line colour and style, as well as the fill style inside the area (as shown in Figure 3.51). Once the parameters have been determined, the service area will be displayed on the DEM map as shown in Figure3.52.

Figure 3.51. Spreadsheet of stations with predefined service area

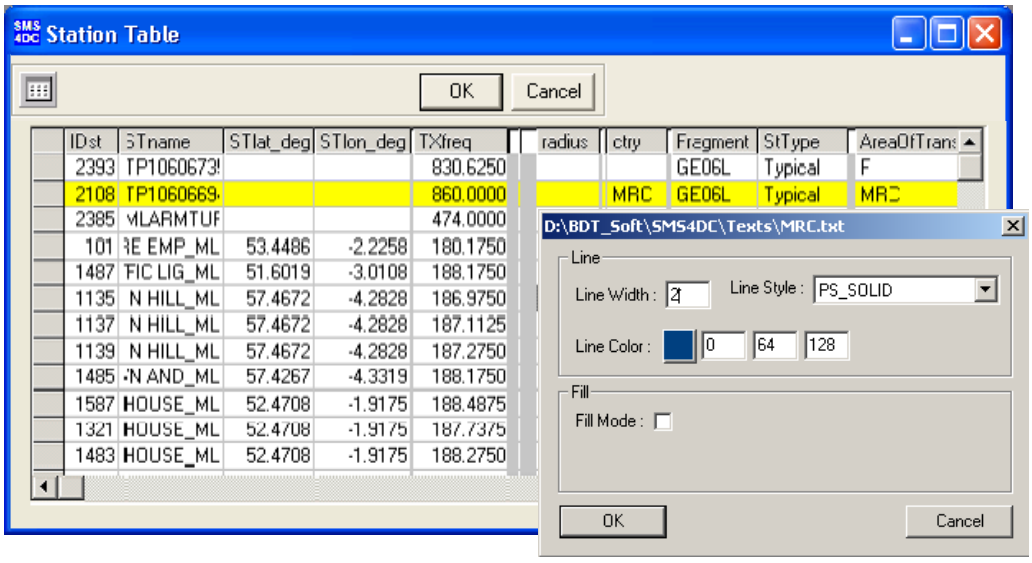
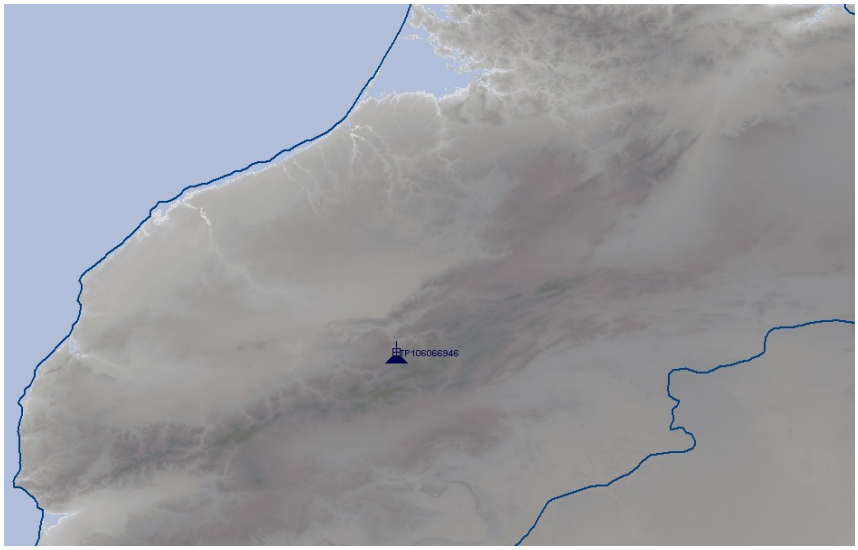


Figure 3.52. Sample output of Display Service Area (FXM) function



- Display Service Area (GE06 BC, BT): This item displays the service area test points of a broadcasting assignment in the GE06 Plan. The service area test points are added to this assignment by the service area function under the GE06 sub-menu**.** All assignments (in conformity with GE06 Plan) within the predefined service area will be listed in a spreadsheet and users may select the concerned assignment, using a mouse left click on the record-select column of spreadsheet. When the wanted assignment is selected, a vector-style dialogue box appears which enables the user to adjust the line colour and style, as well as the fill style inside the area (see Figure 3.53 Once the parameters have been determined, the service area of the wanted assignment will be displayed on the DEM map, as shown in Figure 3.53.

Figure 3.53. Spreadsheet of broadcasting assignments in GE06 Plan with predefined service area

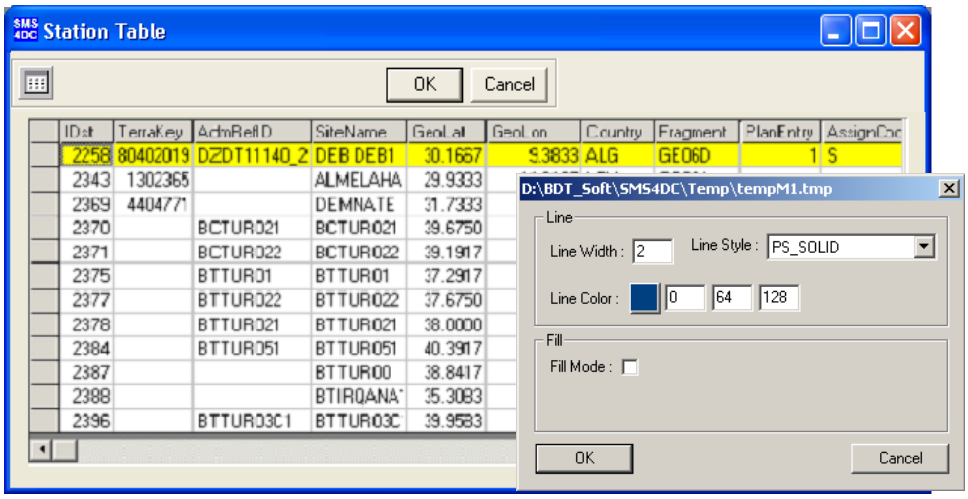


Figure 3.54. Sample output of Display Service Area (GE06 BC, BT) function

- Display Allotment Area: this item displays the predefined allotment area test points of a broadcasting allotment in the GE06 Plan. Allotment area tests points are added to an allotment by the "Define Allotment Area" function under the Database menu, or in the Licensing/Administrative data window in the Allotments folder by using a mouse right click on a required Allotment Name to display the sub-menu items: "Adding a new contour" or "Attach contour". All allotments (in conformity with GE06 Plan) with predefined allotment areas will be listed in a spreadsheet and users may select the concerned allotment, using a mouse left click on the record-select column of the spreadsheet. After selecting the wanted allotment, a vector-style dialogue box appears which enables the user to adjust line colour and style, as well as fill style inside the area, as illustrated in Figure 3.55. Once the parameters have been determined, the allotment area of the wanted allotment will be displayed on DEM map, as shown in Figure3.56.

Figure 3.55. Spreadsheet of broadcasting allotments in GE06 Plan with predefined allotment area

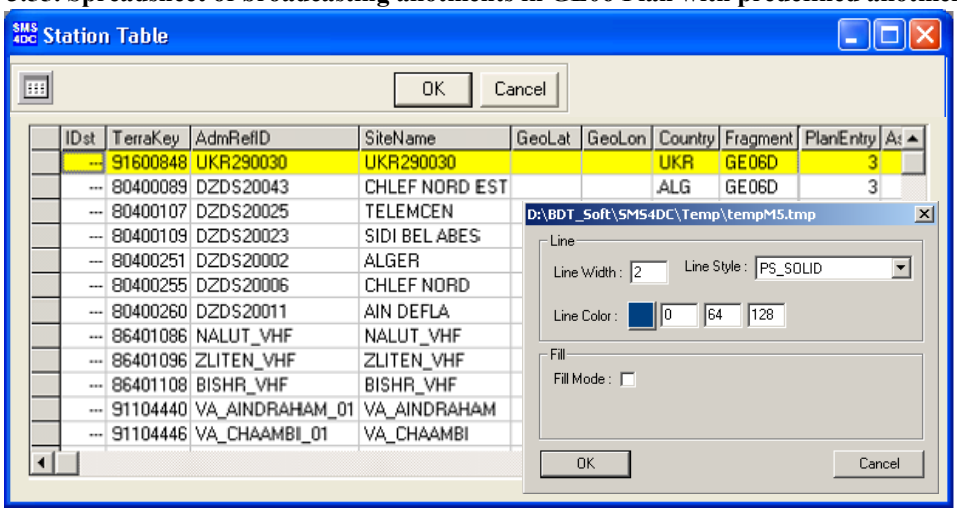


Figure 3.56. Sample output of Display Allotment Area function

- Define Allotment Area: This item defines an allotment area for a broadcasting allotment in the GE06 Plan. As the first step, the user should draw a polyline around the edge of the desired allotment area on DEM map (see the example in Figure3.57). Then this function will be activated and can be selected by the user. All allotments (in conformity with GE06 Plan) will be listed in a spreadsheet and users may select the concerned allotment, as shown in Figure3.58. When the wanted allotment is selected, the allotment area will be added.

Figure 3.57. Desired allotment area on DEM map

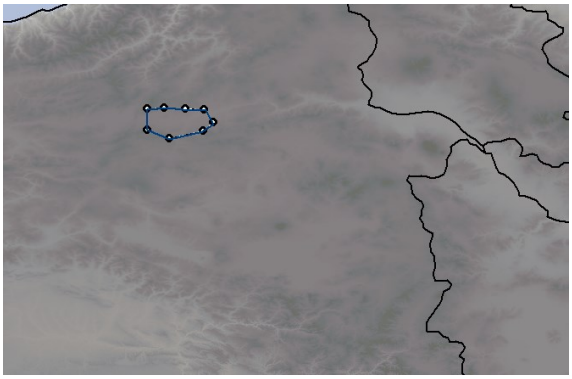
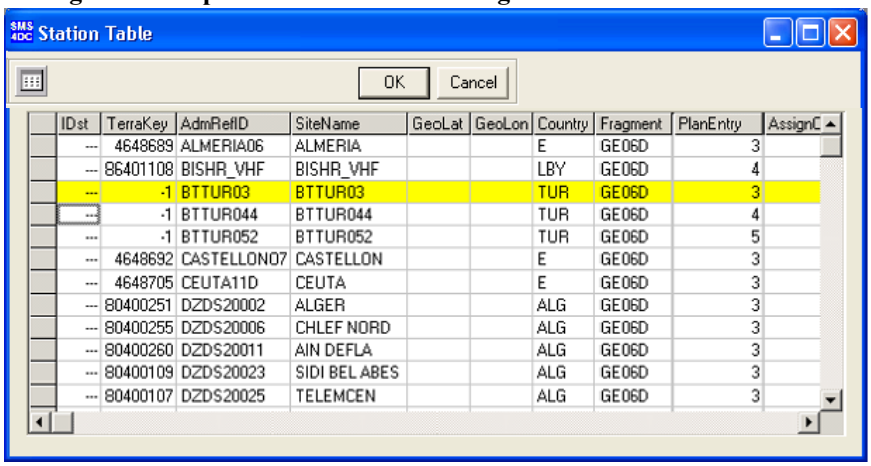


Figure 3.58. Spreadsheet of broadcasting allotments in GE06



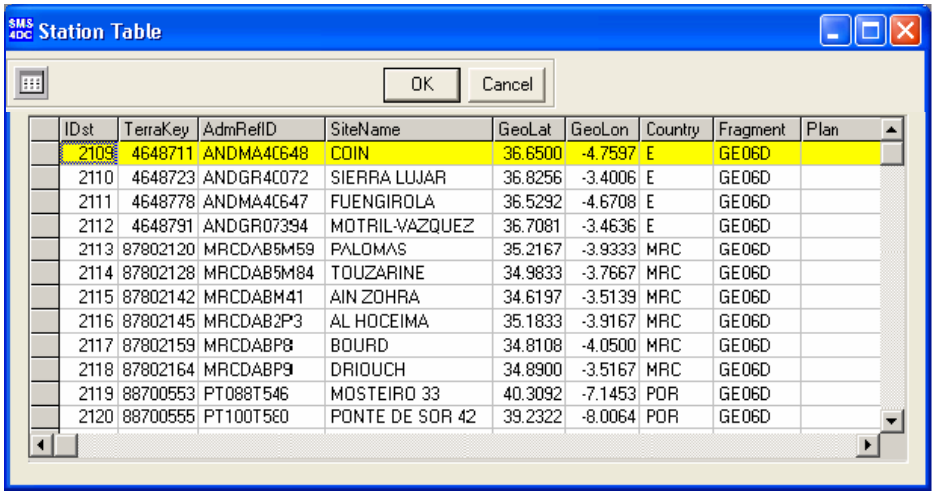
Station Table

OK Cancel

IDst	TerraKey	AdmRefID	SiteName	GeoLat	GeoLon	Country	Fragment	PlanEntry	AssignC
---	4648689	ALMERIA06	ALMERIA			E	GE06D	3	
---	86401108	BISHR_VHF	BISHR_VHF			LBY	GE06D	4	
---	-1	BTTUR03	BTTUR03			TUR	GE06D	3	
---	-1	BTTUR044	BTTUR044			TUR	GE06D	4	
---	-1	BTTUR052	BTTUR052			TUR	GE06D	5	
---	4648692	CASTELLON07	CASTELLON			E	GE06D	3	
---	4648705	CEUTA11D	CEUTA			E	GE06D	3	
---	80400251	DZDS20002	ALGER			ALG	GE06D	3	
---	80400255	DZDS20006	CHLEF NORD			ALG	GE06D	3	
---	80400260	DZDS20011	AIN DEFLA			ALG	GE06D	3	
---	80400109	DZDS20023	SIDI BEL ABES			ALG	GE06D	3	
---	80400107	DZDS20025	TELEMCEN			ALG	GE06D	3	

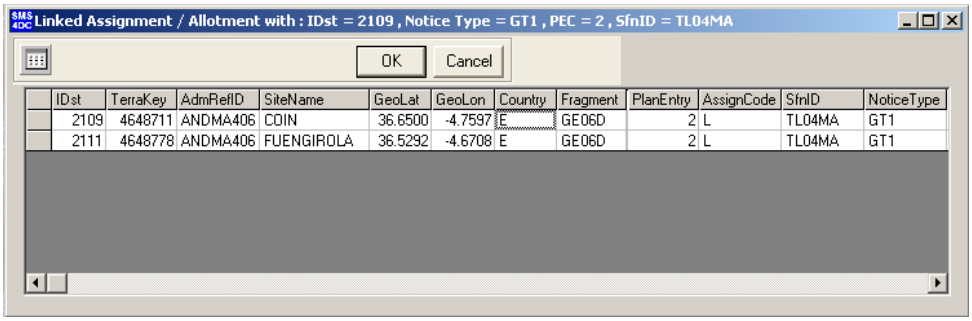
- Display GE06 Plan Entry: This item displays the Plan Entry Code and linked assignments and/ or associated allotment with selected assignment/allotment in GE06 Plan. All allotments/assignments (in conformity with GE06 Plan) will be listed in a spreadsheet and users may select an allotment/assignment, using a mouse left click on the record-select column of the spreadsheet (see Figure3.59). After selection, another spreadsheet appears, listing the wanted assignment/allotment and its linked assignments and/or associated allotment with their general information (see Figure3.60Figure 3.60), from which users can select some or all of them by a mouse left click on the record select column. By pushing the OK button after selection, they are displayed on the DEM map (see Figure3.61).

Figure 3.59. Spreadsheet of broadcasting assignments/allotments in GE06 Plan



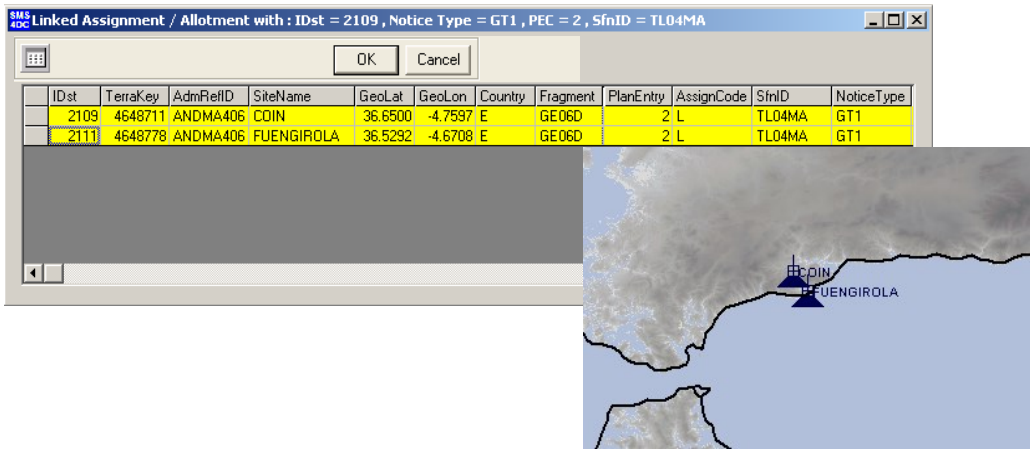
IDst	TerraKey	AdmRefID	SiteName	GeoLat	GeoLon	Country	Fragment	Plan
2109	4648711	ANDMA4C648	COIN	36.6500	-4.7597	E	GE06D	
2110	4648723	ANDGR4C072	SIERRA LUJAR	36.8256	-3.4006	E	GE06D	
2111	4648778	ANDMA4C647	FUENGIROLA	36.5292	-4.6708	E	GE06D	
2112	4648791	ANDGR07394	MOTRIL-VAZQUEZ	36.7081	-3.4636	E	GE06D	
2113	87802120	MRCDAB5M59	PALOMAS	35.2167	-3.9333	MRC	GE06D	
2114	87802128	MRCDAB5M84	TOUZARINE	34.9833	-3.7667	MRC	GE06D	
2115	87802142	MRCDABM41	AIN ZOHRA	34.6197	-3.5139	MRC	GE06D	
2116	87802145	MRCDAB2P3	AL HOCEIMA	35.1833	-3.9167	MRC	GE06D	
2117	87802159	MRCDABP8	BOURD	34.8108	-4.0500	MRC	GE06D	
2118	87802164	MRCDABP9	DRIOUCH	34.8900	-3.5167	MRC	GE06D	
2119	88700553	PT088T546	MOSTEIRO 33	40.3092	-7.1453	POR	GE06D	
2120	88700555	PT100T560	PONTE DE SOR 42	39.2322	-8.0064	POR	GE06D	

Figure 3.60. Sample output of Display GE06 Plan Entry



IDst	TerraKey	AdmRefID	SiteName	GeoLat	GeoLon	Country	Fragment	PlanEntry	AssignCode	SfnID	NoticeType
2109	4648711	ANDMA406	COIN	36.6500	-4.7597	E	GE06D	2	L	TL04MA	GT1
2111	4648778	ANDMA406	FUENGIROLA	36.5292	-4.6708	E	GE06D	2	L	TL04MA	GT1

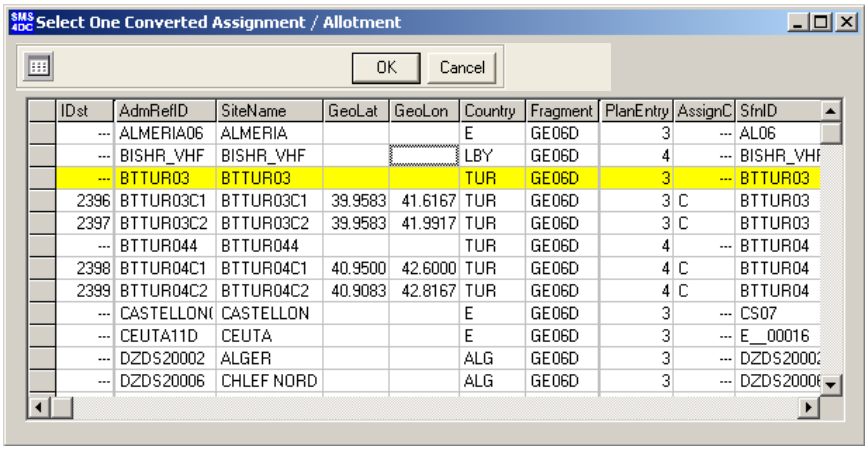
Figure 3.61. Sample output of Display GE06 Plan Entry



IDst	TerraKey	AdmRefID	SiteName	GeoLat	GeoLon	Country	Fragment	PlanEntry	AssignCode	SfnID	NoticeType
2109	4648711	ANDMA406	COIN	36.6500	-4.7597	E	GE06D	2	L	TL04MA	GT1
2111	4648778	ANDMA406	FUENGIROLA	36.5292	-4.6708	E	GE06D	2	L	TL04MA	GT1

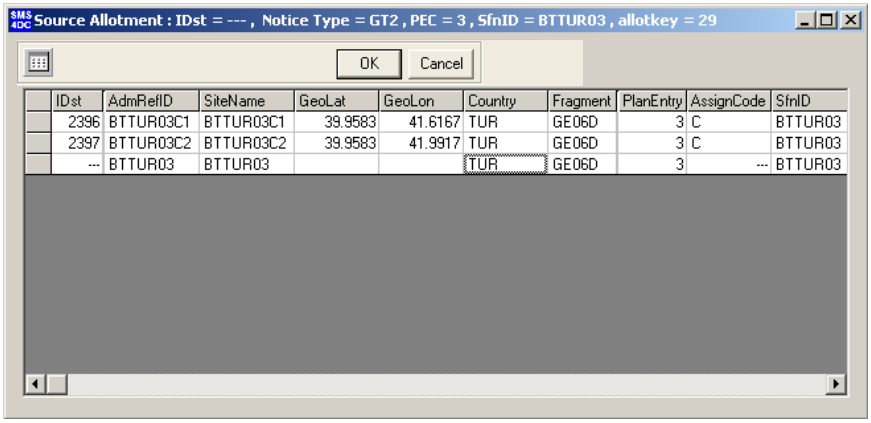
- Display Converted Assignments: This item displays converted assignments stemmed from a selected allotment, or displays the source allotment of a selected converted assignment in the GE06 Plan. All allotments and converted assignments (in conformity with GE06 Plan) will be listed in a spreadsheet and users may select the wanted allotment/assignment, using a mouse left click on the record-select column of spreadsheet (see Figure3.62). After selection, another spreadsheet appears listing the source allotment and all related converted assignments, with their general information (see Figure3.63), from which users can select some or all of them by mouse left click on record select column. After pushing the OK button they are displayed on the DEM map (see Figure 3.64).

Figure 3.62. Spreadsheet of broadcasting allotments or converted assignments in GE06 Plan



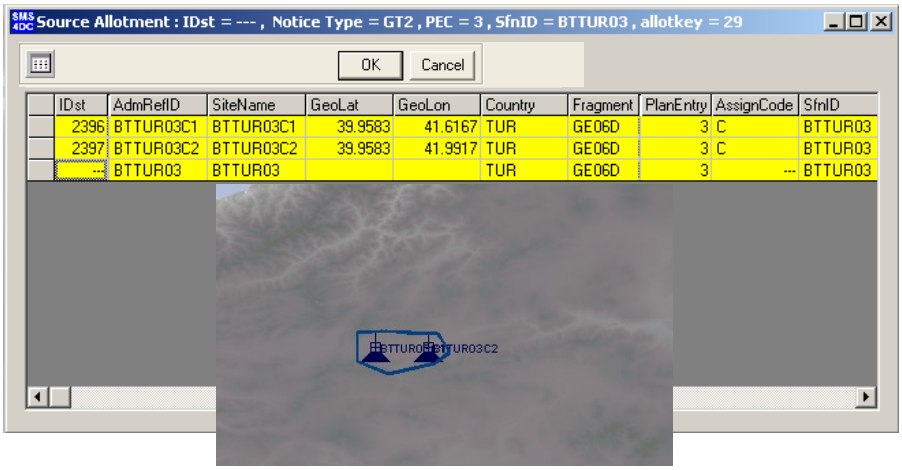
IDst	AdmRefID	SiteName	GeoLat	GeoLon	Country	Fragment	PlanEntry	AssignC	SfnID
---	ALMERIA06	ALMERIA			E	GE06D	3	---	AL06
---	BISHR_VHF	BISHR_VHF			LBY	GE06D	4	---	BISHR_VHF
---	BTTUR03	BTTUR03			TUR	GE06D	3	---	BTTUR03
2396	BTTUR03C1	BTTUR03C1	39.9583	41.6167	TUR	GE06D	3	C	BTTUR03
2397	BTTUR03C2	BTTUR03C2	39.9583	41.9917	TUR	GE06D	3	C	BTTUR03
---	BTTUR044	BTTUR044			TUR	GE06D	4	---	BTTUR04
2398	BTTUR04C1	BTTUR04C1	40.9500	42.6000	TUR	GE06D	4	C	BTTUR04
2399	BTTUR04C2	BTTUR04C2	40.9083	42.8167	TUR	GE06D	4	C	BTTUR04
---	CASTELLON(	CASTELLON			E	GE06D	3	---	CS07
---	CEUTA11D	CEUTA			E	GE06D	3	---	E__00016
---	DZDS20002	ALGER			ALG	GE06D	3	---	DZDS20002
---	DZDS20006	CHLEF NORD			ALG	GE06D	3	---	DZDS20006

Figure 3.63. Sample output of Display Converted Assignments



IDst	AdmRefID	SiteName	GeoLat	GeoLon	Country	Fragment	PlanEntry	AssignCode	SfnID
2396	BTTUR03C1	BTTUR03C1	39.9583	41.6167	TUR	GE06D	3	C	BTTUR03
2397	BTTUR03C2	BTTUR03C2	39.9583	41.9917	TUR	GE06D	3	C	BTTUR03
---	BTTUR03	BTTUR03			TUR	GE06D	3	---	BTTUR03

Figure 3.64. Sample output of Display Converted Assignments on DEM



3.4.2.9. Propagation Models menu of DEM view

This menu provides access to a range of field-strength calculations along a line, poly-line, inside a selected rectangular area and at end-points of a link. A variety of propagation models is available: free-space, LOS (line of sight), ITU-R recommendation P.1546, ITU-R recommendation P.1812, ITU-R recommendation P.370, Okumura-Hata, ITU-R recommendation P.526 (considering both diffraction and smooth earth models separately), ITU-R recommendation P.452 and ITU-R recommendation P.530. Two types of network processing are available using the following propagation models: free-space, ITU-R recommendation P.370, ITU-R recommendation P.1546, ITU-R recommendation P.1812 and Okumura-Hata. Moreover, an item for the calculation of Earth-space path loss, using ITU-R recommendation P.618 propagation model, is available in this menu. For each propagation model, Table 3.2 shows a summary of the functions available in the sub-item menu of the propagation menu.

Table 3.2. Propagation Models (1) and the sub-item menu of functions available for each propagation model

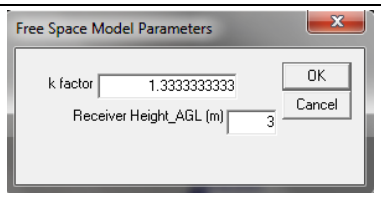
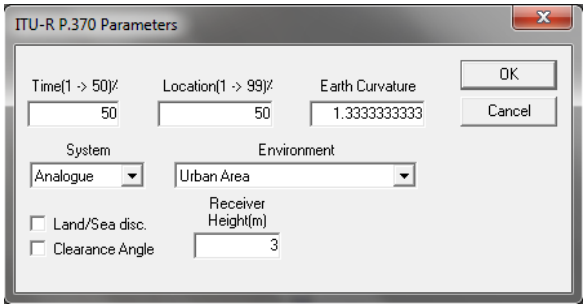
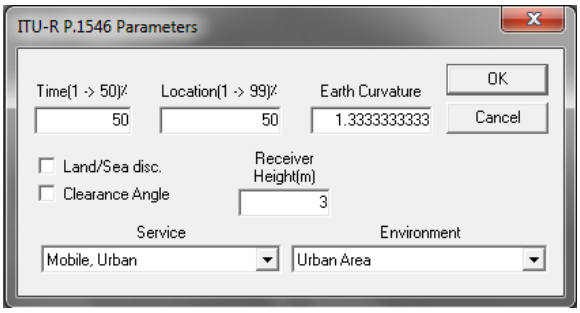
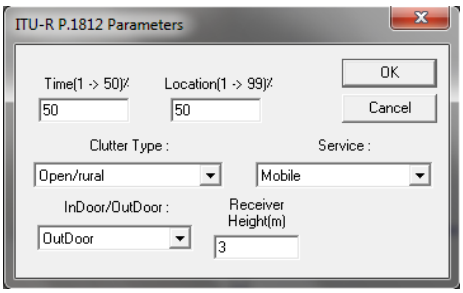
Propagation Models \ Sub-items	Line	Polyline	Area	Link	Contour	Network processor		Earth-space
						Max. Field Strength	Best Server	
Free Space	Y	Y	Y	N	N	Y	Y	N
Line of Sight	Y	Y	Y	N	N	N	N	N
ITU-R P.370	Y	Y	Y	Y	Y	Y	Y	N
ITU-R P.1546	Y	Y	Y	Y	Y	Y	Y	N
ITU-R P.1812	Y	Y	Y	Y	Y	Y	Y	N
Okumura-Hata	N	N	Y	N	N	Y	Y	N
ITU-R P.526 (by diffraction)	N	N	N	Y	N	N	N	N
ITU-R P.526 (Smooth Earth)	N	N	N	Y	N	N	N	N
ITU-R P.452	N	N	N	Y	N	N	N	N
ITU-R P.530	N	N	N	Y	N	N	N	N
ITU-R P.618	N	N	N	N	N	N	N	Y

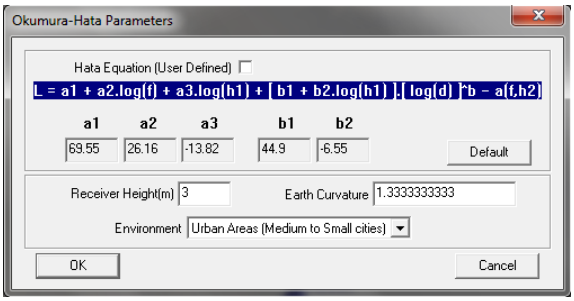
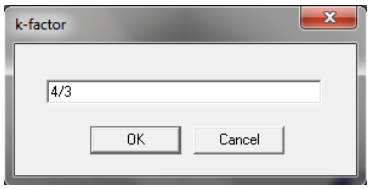
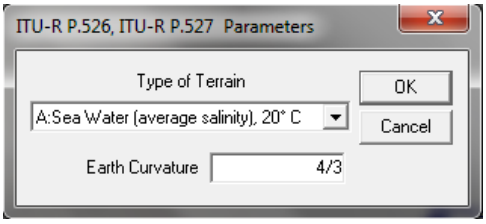
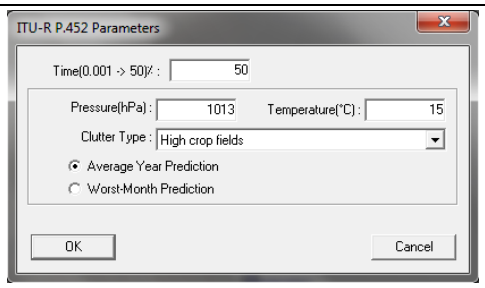
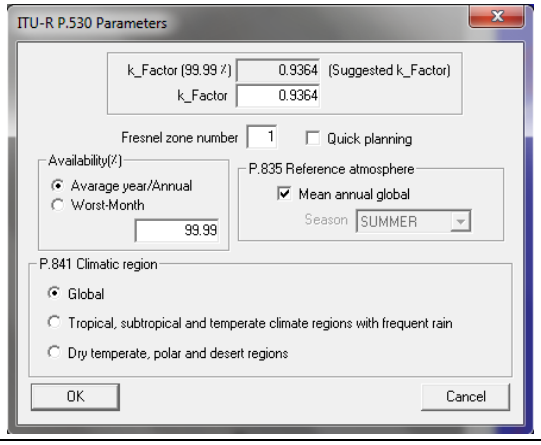
(1): 'Y' and 'N' stand for "Yes" and "No" respectively.

The last item in the "Propagation Models" menu enables users to overlay calculation results inside a rectangular area on background DEM.

With reference to the latest ITU-R recommendation, each propagation model in Table 3.2 has its own parameter-set and can be customized by users by using the relevant dialogue box. Table 3.3 shows the dialogue box of parameters for each model.

Table 3.3. Parameters of different propagation models

Propagation Model	Parameters	Dialogue Box of Parameters
Free Space & Line of Sight	• k-factor in the range –20 to –0.01 and 0.01 to 20 • Receiver height	
ITU-R P.370	• Time percentage (1 to 50%) • Location percentage (1 to 99%) • Earth Curvature (k-factor) in the range –20 to –0.01 and 0.01 to 20 • System type (Analogue and digital) • Environment (Urban Area, Rural Area, Suburban Area) • Land/Sea Discrimination key, • Clearance Angle key, • Receiver height	
ITU-R P.1546	• Time percentage (1 to 50%) • Location percentage (1 to 99%) • Earth Curvature (k-factor) in the range –20 to –0.01 and 0.01 to 20 • Land/Sea Discrimination key, • Clearance Angle key, • Service (Urban Mobile, Suburban or Rolling hills Mobile, Analogue Broadcasting, Digital broadcasting) • Receiver height • Environment (Open Area, Rural Area, Urban Area, Dense Urban Area, Suburban Area)	
ITU-R P.1812	• Time percentage (1 to 50%) • Location percentage (1 to 99%) • Clutter Type (Water/Sea, Open/rural,Suburban, Urban/ trees/forest, Dense urban •) Service (Mobile, Analogue Broadcasting, Digital broadcasting) • InDoor/OutDoor • Receiver height	

Okumura-Hata	• Hata Equation (User Defined): enables user to customize equation coefficients • Receiver height • Earth Curvature (k-factor) in the range –20 to –0.01 and 0.01 to 20 • Environment (Open Area, Rural Area, Urban Area, Dense Urban Area, Suburban Area)	
ITU-R P.526 (by diffraction)	• k-factor in the range –20 to –0.01 and 0.01 to 20	
ITU-R P.526 (Smooth earth from P.527)	• Type of terrain (A: Sea Water, B: Wet Ground, C: Fresh Water, D: Medium Dry Ground, E: Very Dry Ground, F: Pure Water, G: -1ºC Ice, G: -10ºC Ice) • k-factor in the range –20 to –0.01 and 0.01 to 20	
ITU-R P.452	• Time percentage (0.001 to 50%) • Pressure (hPa) • Tempreture (C) • Clutter Type • Average Year / Worst-Month Prediction	
ITU-R P.530	• Predicted k-factor for 99.99% • k-factor in the range –20 to –0.01 and 0.01 to 20 • Fresnel Zone number • Annual/ Worst-Month Availability • Quick Plannin Option • Reference atmosphere based on ITU-R Rec. P.835 • Climatic region based on ITU-R Rec. P.841	
ITU-R P.618	Explained in Section 3.4.2.9.1	

The following paragraphs describe the different calculation functions that are available in sub-menus for the propagation models. Table 3.2 summarises the functions available for each model. The Earth-space propagation model, ITU-R P.618, is explained separately in Section 3.4.2.9.1.

- Calculation along a line: This function calculates field strength values produced by a station along a path profile at a given receiving height above ground level. However, in the case of the line-of-sight (LOS) model, the "Line" calculation sub-item provides only a visibility analysis along the line from the wanted station. To activate the "Line" sub-items, a line must be drawn in advance on the DEM using "Draw Line" or "Draw Line from Database" toolbar buttons (see Section 3.4.1). By choosing the "Line" sub-item, a spreadsheet of stations in the database is opened and users may select a station (preferably near to the depicted line) by a mouse left click on the corresponding row of the record-select column. After pushing the OK button, a dialogue box is presented that contains several parameters, the values of which may be customized for use in the model. Each model has its own parameter dialogue box which is explained in the Table 3.3.

  Once the user approves the values in the parameter dialogue box, a 2D plot appears, displaying two curves: path profile and field strength value. In the case of the LOS model, only a path profile is displayed, in which portions of the profile are filled with red, if a line-of-sight to the selected station exists, or blue if there is no LOS. The graph is equipped with a vertical marker which is movable horizontally by the mouse while holding the left click. The geographical coordinates, terrain height, ground-distance from the left point (beginning point of the line) and field strength value (dBμV/m), or visibility status in the case of the LOS model, at the position of the vertical marker are displayed on the status bar. Figure3.65 shows a visibility analysis plot using the LOS model and Figure3.66 shows a sample plot of field-strength values along a profile using ITU-R P.370 propagation models.

Figure 3.65. "Line" calculation sub-item using "Line of Sight" model (visibility check). Blue : No LOS, and red: LOS to the concerned station

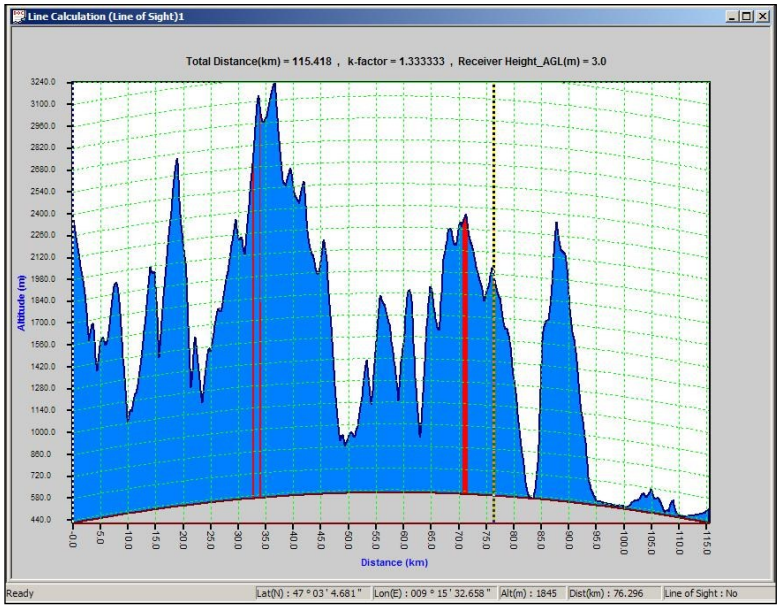
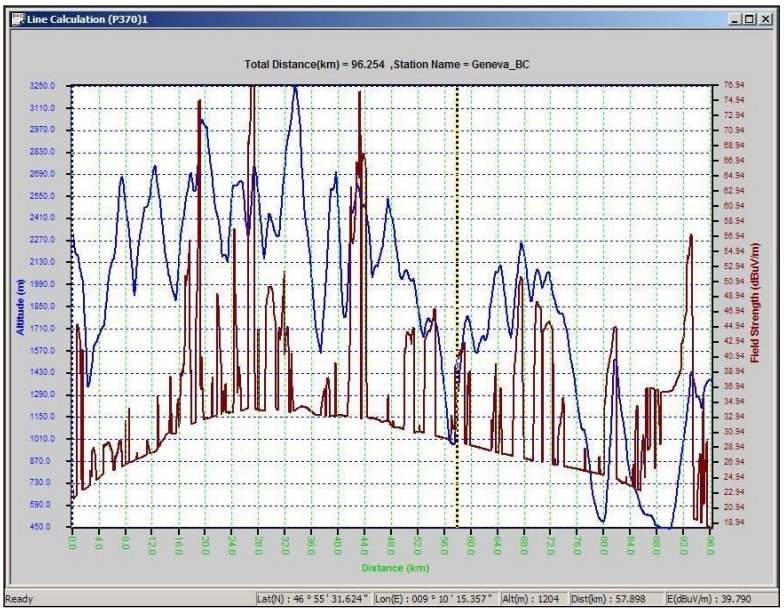


Figure 3.66. A sample plot of field-strength values along a profile using ITU-R P.370 propagation model (path profile in blue and field strength in brown)



Displayed 2D plots can be printed through Windows standard printing function from "File" menu.

Calculation along poly line: This calculates field strength values produced by a selected station along a polyline at a given receiving height above ground level. However, performing a "Polyline" calculation using the "Line of Sight" model provides only a visibility analysis from the polyline to the selected station. To activate "Polyline" sub-items, a polyline must be drawn on the DEM using the "Draw Polyline" toolbar button (Section 3.4.1). After choosing the "Polyline" sub-item, a spreadsheet of stations in database is opened and users may select a station (preferably near to the poly line drawn on the DEM) by a mouse left click on the corresponding row of the record-select column. After pushing the OK button, a dialogue box is presented that contains several parameters, the values of which may be customized for use in the model. Each model has its own parameter dialogue box, previously explained in Table 3.3. Once the user approves the values in the parameter dialogue box, a 2D plot appears, displaying two curves: path profile and field strength value. In the case of the LOS model, only a path profile is displayed, in which portions of the profile are filled with red, if a line-of-sight to the selected station exists, or blue if there is no LOS. The graph is equipped with a vertical marker which is movable horizontally by the mouse while holding the left click. The geographical coordinates, terrain height, ground-distance from the left point (beginning point of the line) and field strength value (dBµV/m), or visibility status in the case of the LOS model, at the position of the vertical marker are displayed on the status bar. Figure 3.67 displays a visibility analysis (LOS model) along a poly line and Figure 3.68 illustrates a sample plot of field-strength values along a poly line calculated using the ITU-R P.370 propagation model.

Figure 3.67. "Polyline" calculation sub-item using "Line of Sight" model (visibility check). Blue : No LOS, and red: LOS to the concerned station

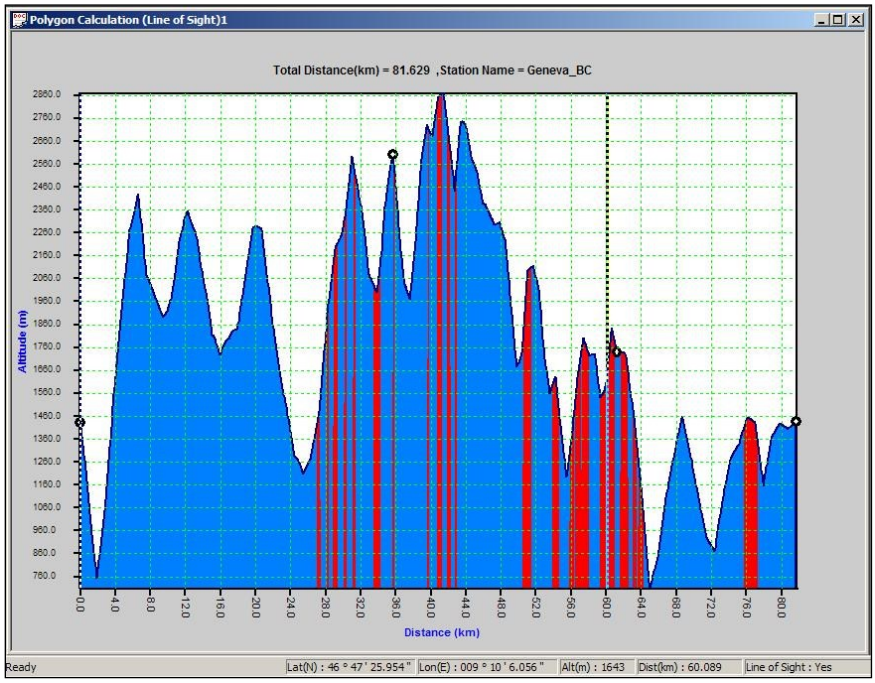
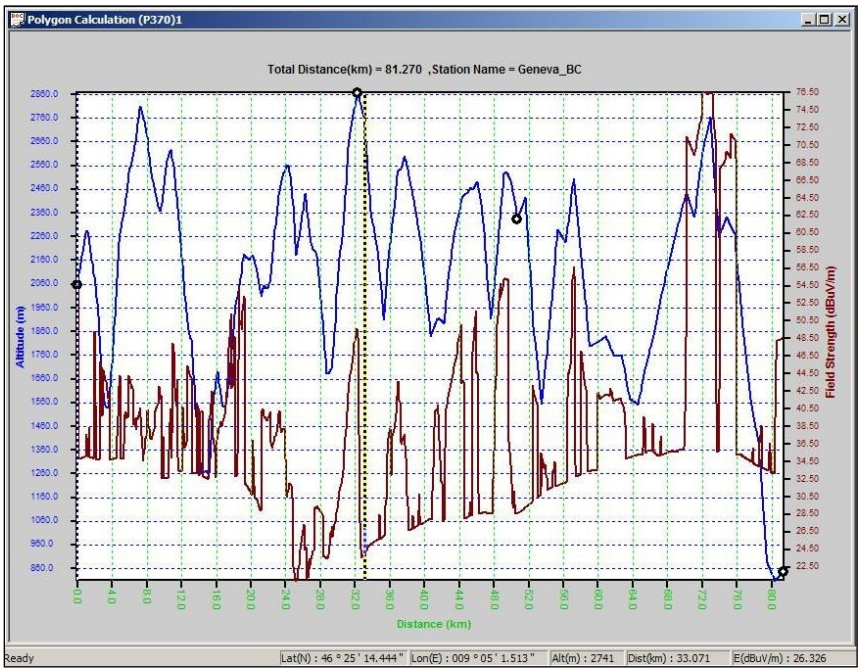


Figure 3.68. A sample plot of field-strength values along a poly line using ITU-R P.370 propagation model (path profile in blue and field strength in brown)



Poly line points along path can be distinguished by 'o' symbol. Displayed 2D plots can be printed through Windows standard printing function from "File" menu.

- Area calculation: This calculates of field strength values produced by a selected station inside a rectangular area at a given receiving height above ground level. However, performing an "Area" calculation sub-item using the "Line of Sight" model provides only visibility analysis from the selected station to the area. To activate the "Area" sub-items a rectangular area must be drawn in advance on the DEM using the "Draw Box" or "Draw Box from Database" toolbar buttons (see Section 3.4.1). By choosing "Area" sub-item, a spreadsheet of stations in the database is opened and users may select a station inside the area by a mouse left click on the corresponding row of the record-select column. Selection of stations outside of the rectangle will cause a warning message and there will be no further action. After pushing the OK button, a dialogue box is presented that contains several parameters, the values of which may be customized for use in the model. Each model has its own parameter dialogue box, previously explained in Table 3.3.

  When the user approves the values in the dialogue box of parameters, a new window appears and the area-calculation progress bar is displayed simultaneously in the status bar. Once the calculation process has finished, the area-calculation result will appear in the new window. The geographical coordinates, terrain height, distance to the reference station and field strength value (dBμV/m), at the current mouse cursor position, are displayed on the status bar. In the case of the LOS model, only a visibility analysis will be displayed, showing those parts of the selected area with line of sight (LOS) to the selected station in red and those parts without LOS in blue. Figure3.69 displays an example of a visibility analysis of a selected area with respect to a given station. Figure3.70 displays sample results using ITU-R P.370, Okumura-Hata and free-space propagation models.

Figure 3.69. "Area" calculation sub-item using "Line of Sight" model (visibility check). Blue : No LOS, and red: LOS to the concerned station

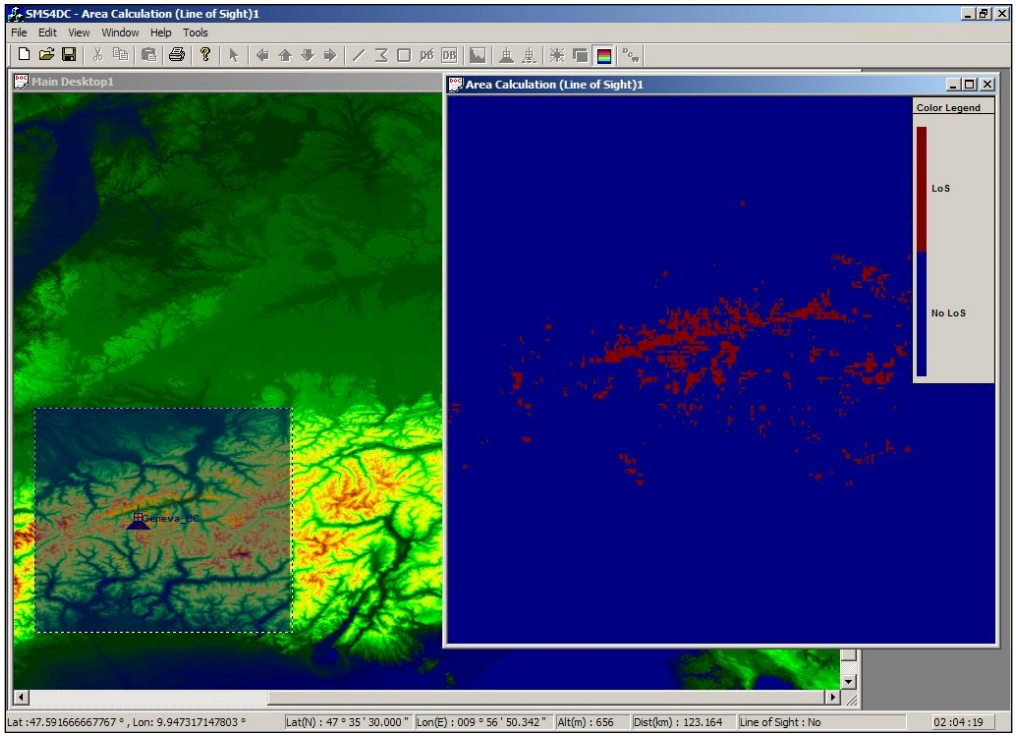
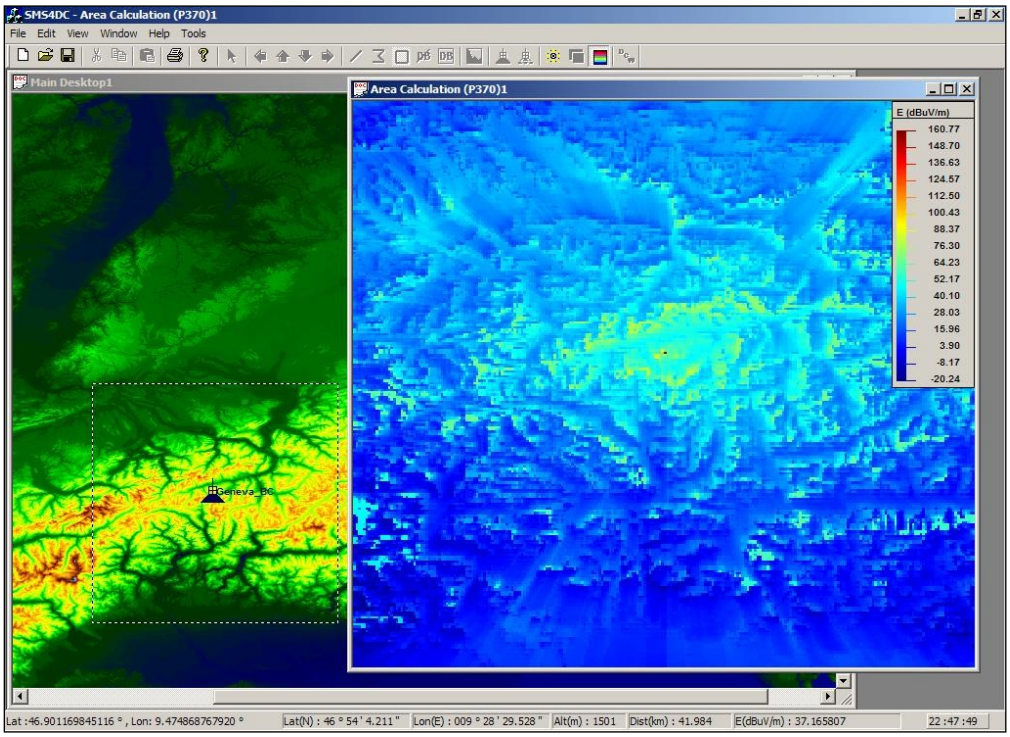
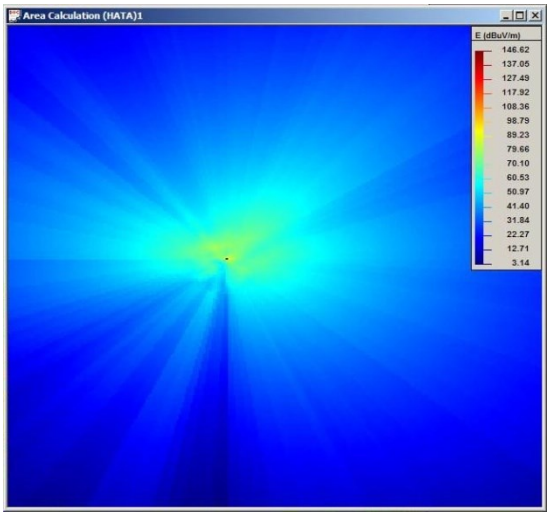


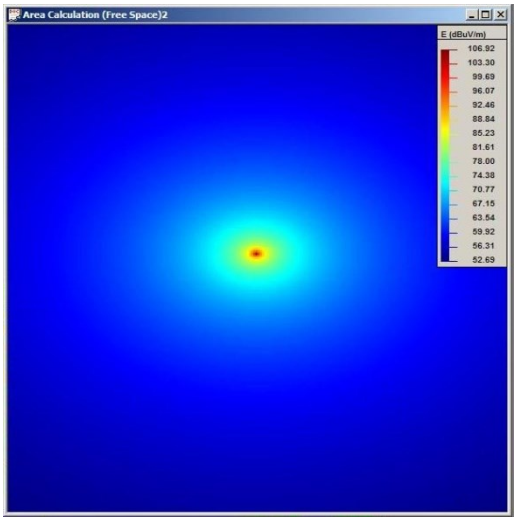
Figure 3.70. Area calculation using a) ITU-R P.370 propagation model, b) Okumura-Hata, and c) Free Space propagation models



(a) Area calculation using ITU-R P.370 propagation model



(b) Area calculation using Okumura-Hata model

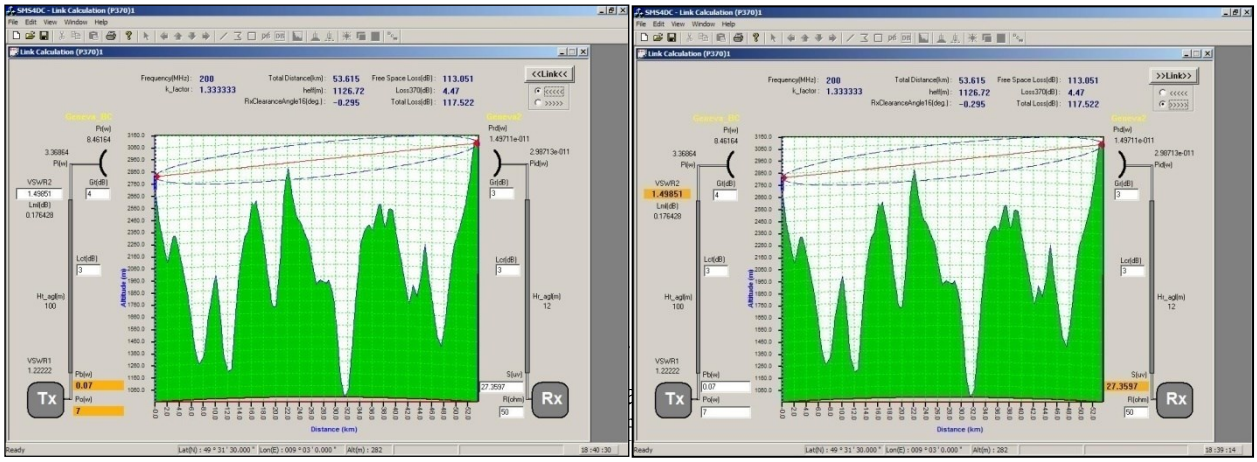


(c) Area calculation using Free-Space model

Two toolbar buttons: “Refresh” and “Show Legend” are active in the area calculation result window, which is explained in Section 3.4.1. Moreover, several helpful items are implemented under the “Tools” menu that provides functions for the 2D field-strength values. This menu is explained in Section 3.4.2.9.2.

- Link calculation: This item applies specific propagation models for the calculation of a link budget. Table 3.2 shows the propagation models that may be used for link budget calculations. Selecting this menu item opens a spreadsheet of stations in the database from which two stations may be selected to form a link. Stations are selected by a mouse left click on the relevant row of the record-select column. After selection of the stations, a dialogue box of propagation model parameters will appear. By confirming the values for these parameters, a link calculation dialogue box is presented, displaying the calculation results as well as providing a visual user-interface to optimize the link characteristics. The link calculation dialogue box contains: a path profile diagram, the first Fresnel zone, Earth curvature and those technical characteristics of a link that are relevant to the propagation model in use. Figure3.71 displays the link calculation dialogue box using the ITU-R P.370 propagation model.

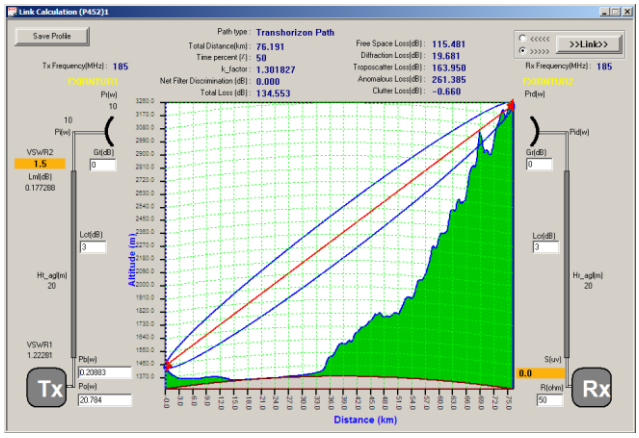
Figure 3.71. Link calculation dialogue box using the ITU-R P.370 propagation model, calculation direction a) from left to right and b) from right to left



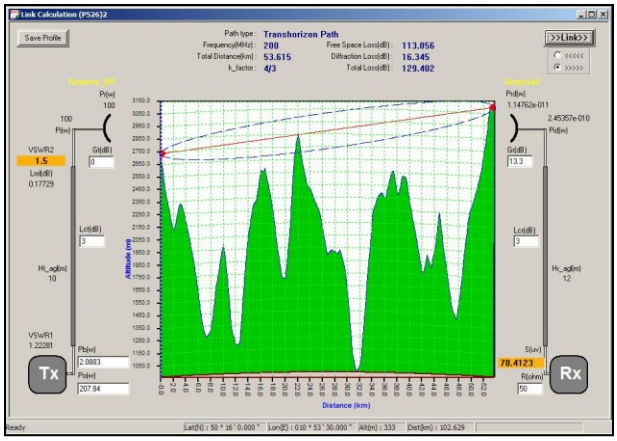
two radio buttons on the top-right of the dialogue box, the direction of the link can be reversed and the link budget re-calculated for the opposite direction of transmission. Some of the values in the dialogue box are presented in edit-boxes so they may be changed by the user to optimise the link. These edit boxes change mode automatically, depending on the direction of the link, so they will accept data entry if the link is in one direction but when the link direction is reversed, they display a result of the calculation in a coloured, non-editable box. As shown in Table 3.3, link calculation using different propagation models also requires different technical parameters. Accordingly, calculation results are different for different propagation models. The most comprehensive result is obtained using the ITU-R P.530 model. Figure3.72 shows the link calculation dialogue box using different propagation models.

A vertical marker is also provided along displayed 2D plots. This can be moved horizontally by holding a mouse right button. The geographical coordinates, profile height and distance from the left side for the marker current position are displayed on status bar.

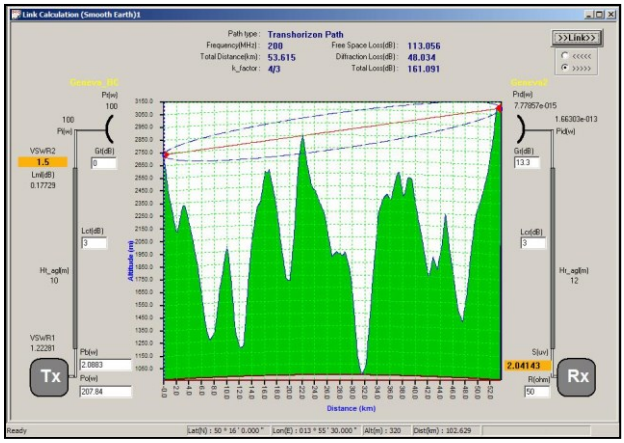
Figure 3.72. Link calculation dialogue box using different propagation models



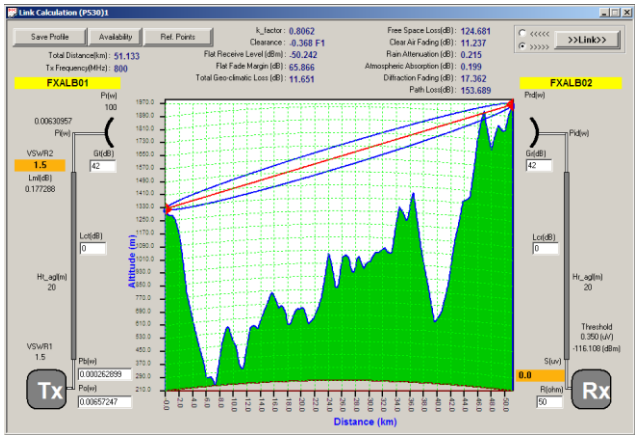
(a) Using P.452



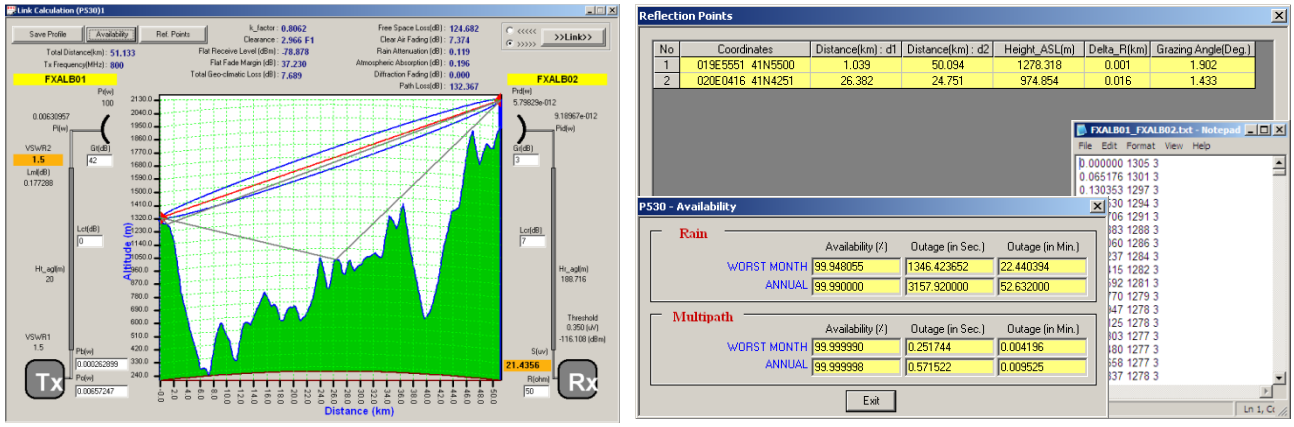
(b) Using ITU-R P.526 with diffraction



(c) Using ITU-R P526 with smooth earth



(d) Using ITU-R P.530



(e) Using ITU-R P.530, reflection points, availability calculation and text file profile data

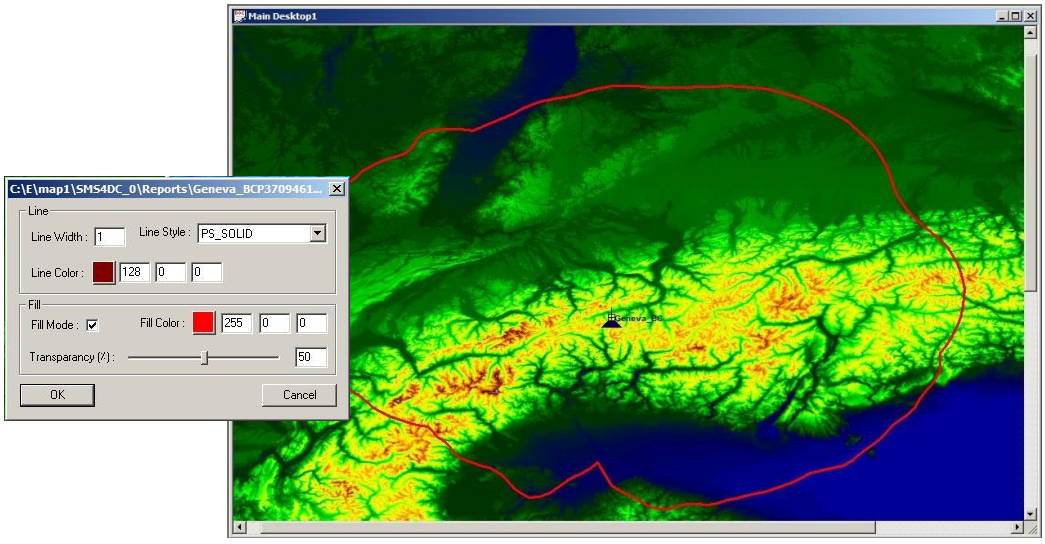
The ITU-R P.530 link calculation dialogue box allows the height of the antennas to be optimized visually by dragging them to a new height using a mouse right click and hold. Releasing the mouse button after changing the antenna height causes the reflection paths, as well as the link characteristics, to be re-calculated automatically.

- Field Strength Contour: This item saves and displays field strength contours around a selected station where the field strength values inside the contour are higher than a given threshold. A dialogue box of the propagation model requests the user to enter a threshold value for this parameter.

  When this item is selected, a spreadsheet of stations in the database opens so that a station may be selected by a mouse left click on the relevant row of the record-select column. After selection of a station, a propagation model parameter-entry dialogue box will appear. In case of model P.370, an additional parameter, Δh, is required. This parameter defines the degree of terrain irregularity; for broadcasting services it is applied in the range 10 km to 50 km from the transmitter.

  After confirming the values for the model to use, the user is asked to specify the folder in which the vector text file is to be saved and then the calculation progress bar is displayed. When the calculation has finished, a vector-style dialogue box appears which enables the user to adjust line colour and style as well as fill style inside the contour. Finally, the resulting contour will be drawn on the background DEM. Figure3.73 shows a sample field strength contour and vector-style dialogue box.

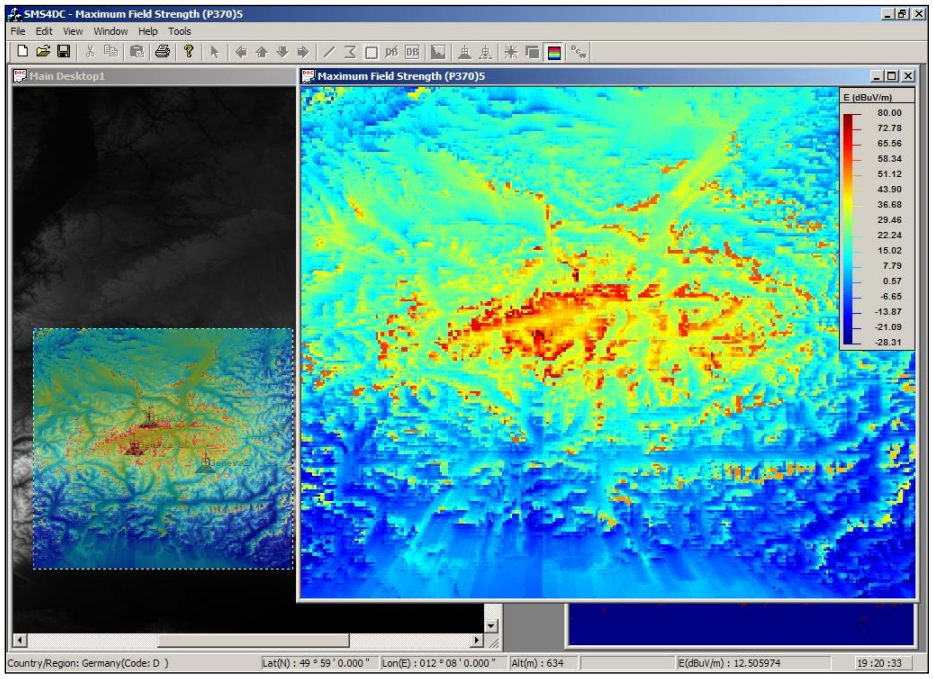
Figure 3.73. A sample field strength contour and vector style dialogue box



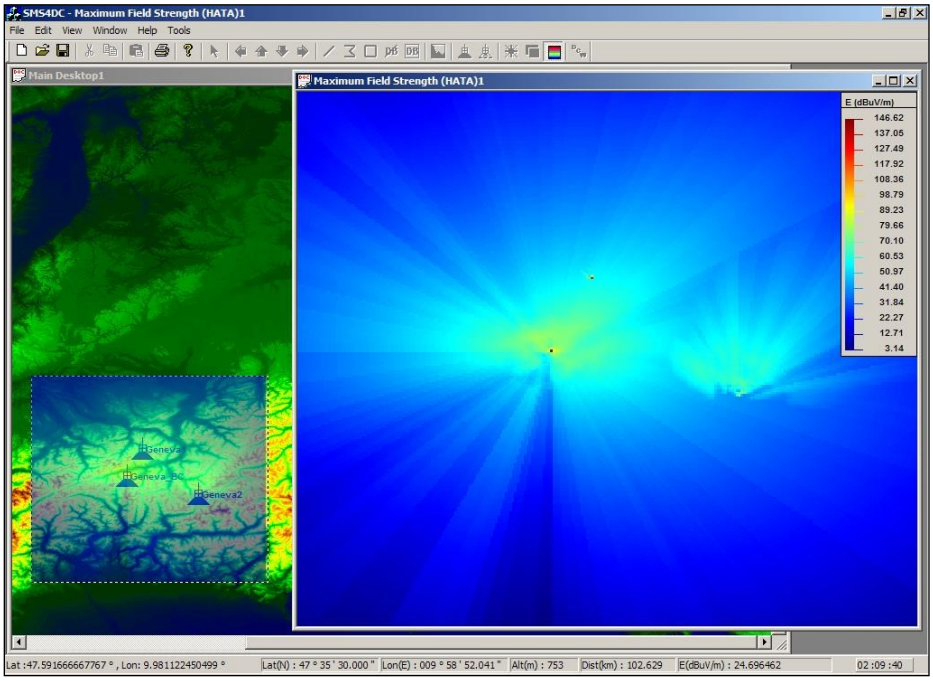
- Maximum Field Strength: This item calculates and displays the maximum value of field strength values produced by more than one transmitting stations at any point inside a predefined rectangular area. Prior to the selection of this sub-item, a rectangular area must be selected using the “Draw Box” or “Draw Box from Database” toolbar buttons (se Section 3.4.1). Then, the stations inside the selected area will be listed to enable the user to select several stations. Stations are selected by a mouse left click on the corresponding rows of the record-select column. A dialogue box of propagation model parameters opens after the station selection is completed. The area calculation progress bar will be

displayed and the maximum field strength values at each pixel will be displayed after the calculation has finished. The calculation time depends on the number of stations selected and the size of the calculation area. Figure 3.74 demonstrates an application of the maximum field strength function using different propagation models in an analysis of a three-station network.

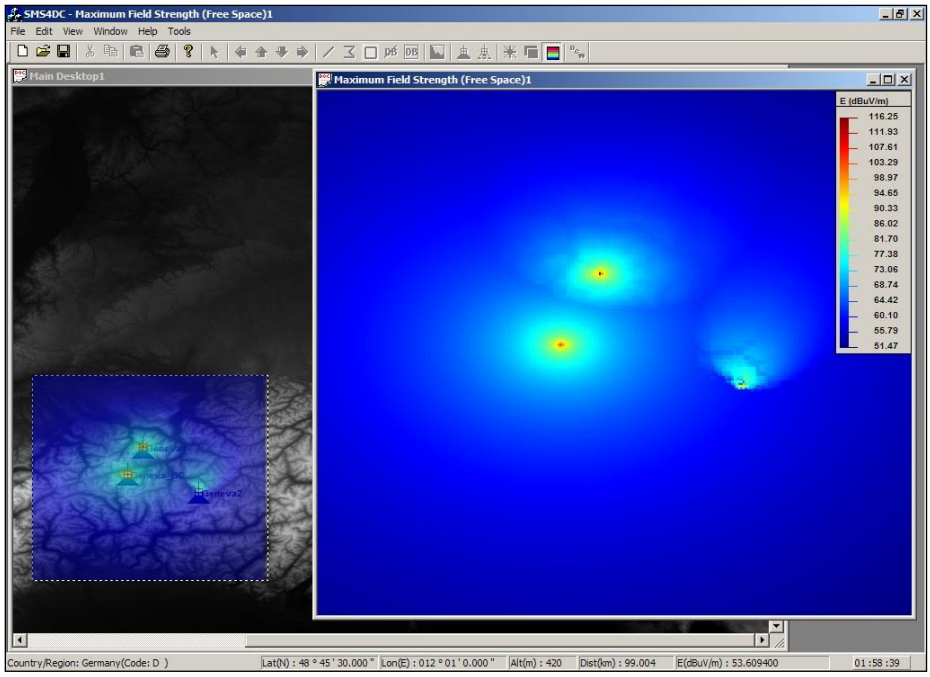
Figure 3.74. Application of maximum field strength method in analysis of a three-station network using a) ITU-R P.370, b) Okumura-Hata and c) Free-Space propagation models



(a) Using ITU-R P.370 propagation model



(b) Using Okumura-Hata propagation model

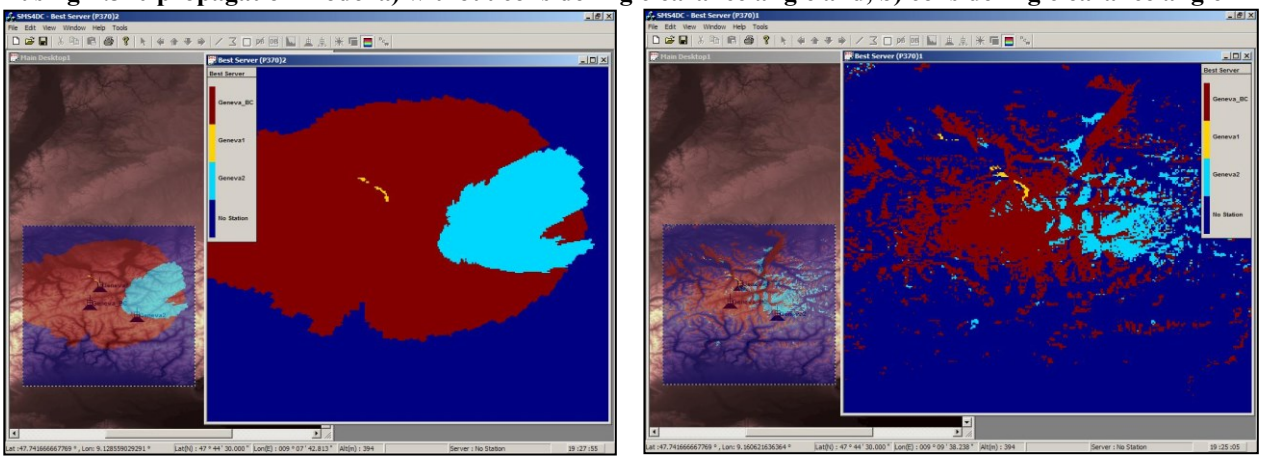


(c) Using Free-Space model

The status bar, in this application, shows country name, administration code, geographical coordinates, altitude (in metres), and maximum field strength value at the position of the mouse cursor.

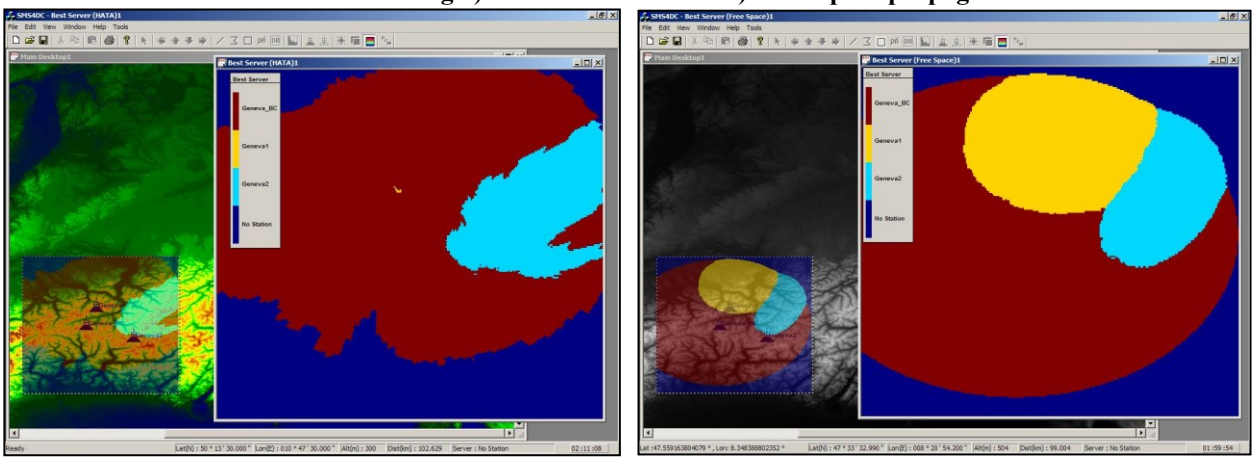
- Best Server: This item calculates and displays the best serving station, among various stations, at each point inside a predefined rectangular area. Prior to the selection of this sub-item, a rectangular area must be selected using the “Draw Box” or “Draw Box from Database” toolbar buttons (see Section 3.4.1). Then, the stations inside the selected area will be listed to enable the user to select several stations. Stations are selected by a mouse left click on the corresponding rows of the record-select column. A dialogue box of propagation model parameters opens after the station selection is completed. The area calculation progress bar will be displayed and the areas covered by different stations distinguished by different colours. The calculation time depends on the number of stations selected and the size of the calculation area. Figure 3.75 and Figure 3.76 demonstrate an application of the best server function using different propagation models in an analysis of a three-station network.

Figure 3.75. Three-station network processing using best server function using P.370 propagation model a) without considering clearance angle and, b) considering clearance angle



(a) Best server result without considering clearance angle (b) Best server result considering clearance angle

Figure 3.76. Application of best server function in an analysis of a three-station network using a) Okumura-Hata and b) Free-Space propagation models



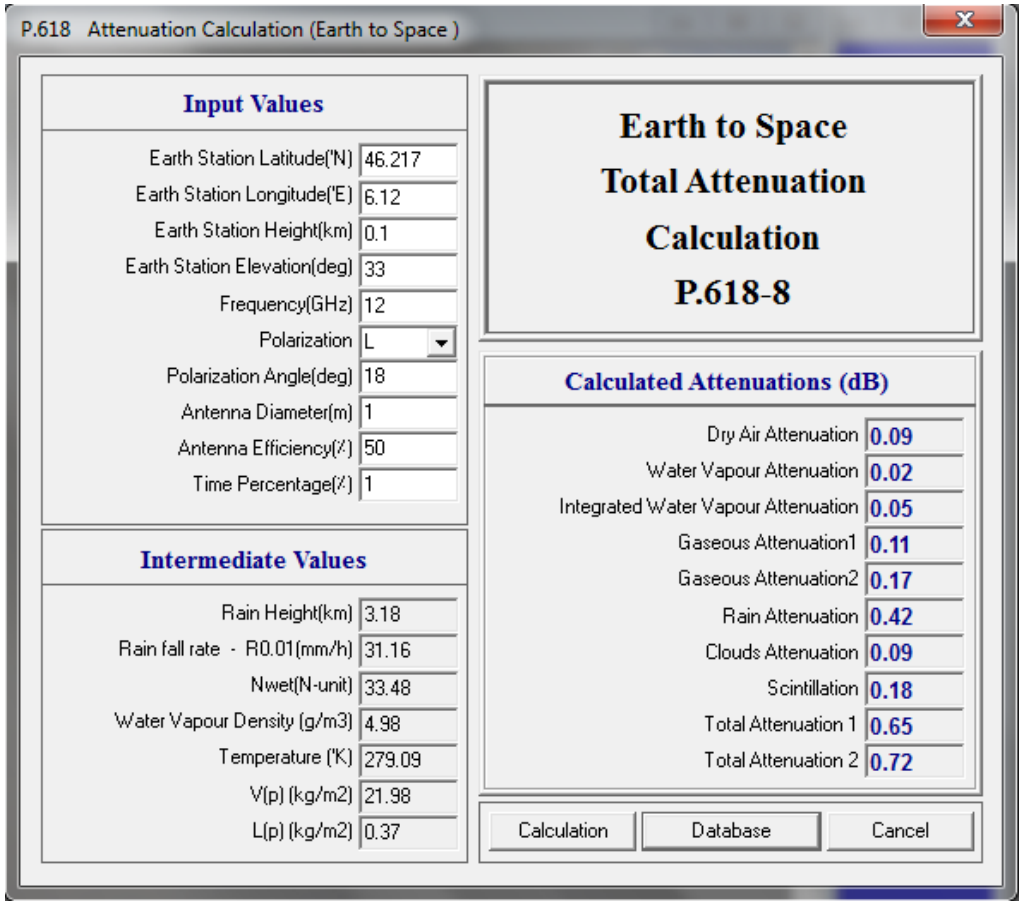
(a) Using Okumura-Hata propagation model (b) Using Free-Space propagation model

In this application, the legend colour distinguishes the best served areas of each station. The country name, administration code, geographical coordinates, altitude(in metres) and the best serving station name at the mouse cursors current position are presented on the status bar.

3.4.2.9.1. Menu of propagation models, P.618 propagation model

The ITU-R P.618 propagation model is used to calculate the Earth-space radiocommunication path loss due to the water vapour, rain, cloud, scintillation and atmospheric gaseous. Selection of this item from the "Propagation Models" menu of SMS4DC desktop (DEM view) causes the following dialogue box to appear:

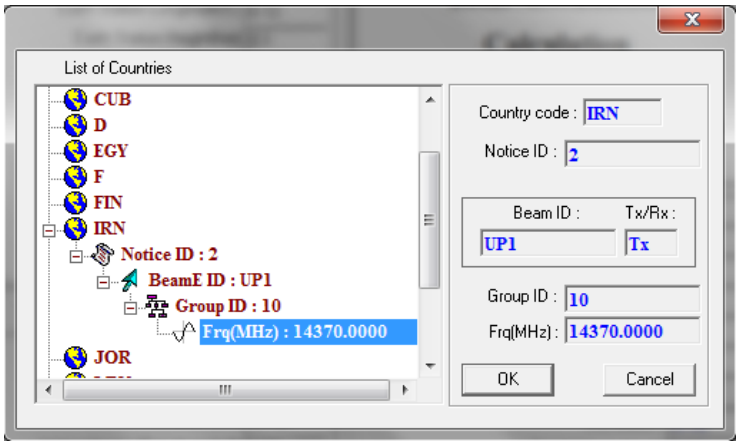
Figure 3.77. ITU-R P.618 propagation model dialogue box for Erath-space radiocommunication



Users may enter the input parameters in the relevant edit boxes directly, or use the information about a transmitting earth station stored in the local database. Pushing the "Database" button opens a dialogue box which enables the user to choose an uplink frequency for an Earth station. A mouse left click or arrow keys can be used for navigation in the tree-view of Earth station information. In order to perform an uplink calculation, a transmitting frequency must be selected by a double left-click on the frequency. Figure 3.78 shows the uplink frequency selection dialogue box. Data base information for the selected earth station and uplink frequency are available in the right side of dialogue box.

By finalizing the selection of the uplink frequency, the relevant emission information will be uploaded to the edit box of the propagation model dialogue box.

Figure 3.78. Uplink frequency selection dialogue box



Once the input values have been provided, the values of different attenuations may be calculated by pushing the "Calculation" button at the bottom of the propagation model dialogue box. Depending to the various methods described in the ITU-R recommendations P.676 and P.836 for estimation of gaseous attenuation, two asymptotic values are calculated for total attenuation.

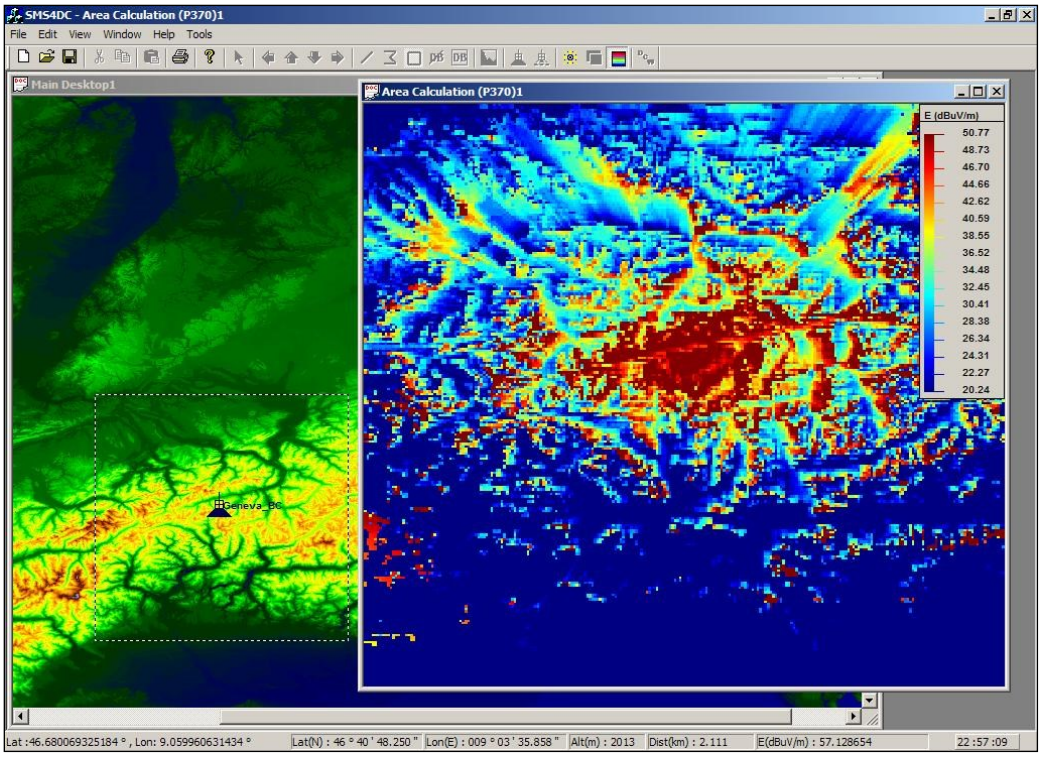
3.4.2.9.2. Tools menu of area calculation window

Several helpful items that function on the 2D field-strength values are implemented under the "Tools" menu of the area calculation window. The Area calculation window, itself, displays the 2D field strength values produced by a station inside a rectangular area. This type of calculation can be launched through the "Area" sub-items of propagation models provided in the "Propagation Models" menu of SMS4DC desktop, DEM view.

The following items are provided under this "Tools" menu:

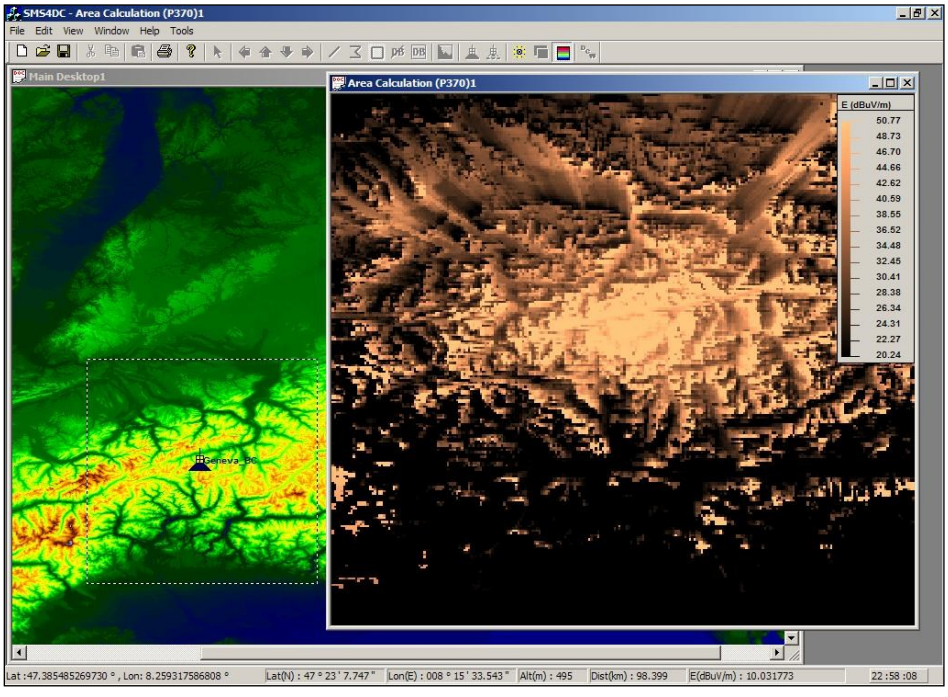
- Normalize: Changes the colour display range of field-strength values by changing the minimum and maximum thresholds of field strength value (also see Tools->Legend for the colour scale). Points with field strength values higher and lower than the defined value range will be displayed by two colours shown at the bottom and top of the Legend colour scale; values between the maximum and minimum will be represented by the range of colours shown in the Legend colour scale. Figure 3.79 displays a sample of applied value range. The old values are those values which are suggested by SMS4DC based on minimum and maximum field strength value of points loaded into the memory from 2D area calculation result. Moreover, the short-key Ctrl+N is assigned to this item.

Figure 3.79. Normalized area calculation result



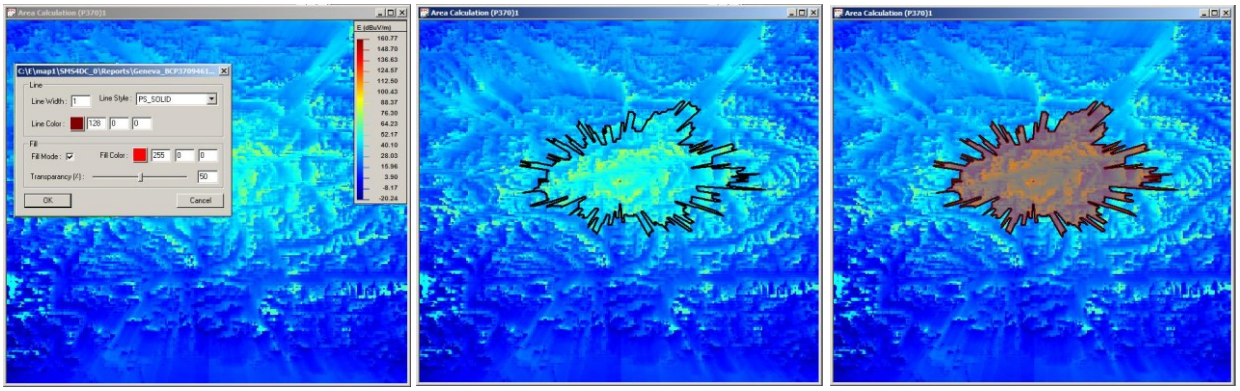
- Colour map: Changes the colour map used in the display of field strength values in the area calculation window. Figure 3.22 shows the available colour maps. Figure 3.80 shows an example of selecting the copper colour map on a 2D field strength view.

Figure 3.80. An example of employing of copper colour map on 2D field strength view



- Legend: This item switches on or off the field strength colour scale legend bar. If this item is selected, a check mark appears to the left and, automatically, the "Show Legend" toolbar button will appear as "pushed". Reselection of the item removes the check mark and releases the "Show Legend" toolbar button.
- Contour Value: This item displays a continuous line (or contour) around a selected station by constructing and joining together a set of vector points having a calculated field strength value equal to a threshold value set by the user. Inside the contour, the field strength will be statistically higher than the threshold value, while outside the contour, the field strength will be lower. After selection this item, users may define a threshold value. The user is requested to specify the folder and file name in which the vector field strength values are to be saved in a text file. Once the location and file name have been entered, SMS4DC starts to generate the vector file and displays a calculation progress bar in status bar. Finally, a vector-style dialogue box appears which enables user to adjust line colour and style as well as the fill style inside the contour. Figure 3.81 displays some examples of contours for an area calculation.

Figure 3.81. Example of depicted contours on an area calculation result
a) vector style dialogue box, b) unfilled vector, and c) filled vector

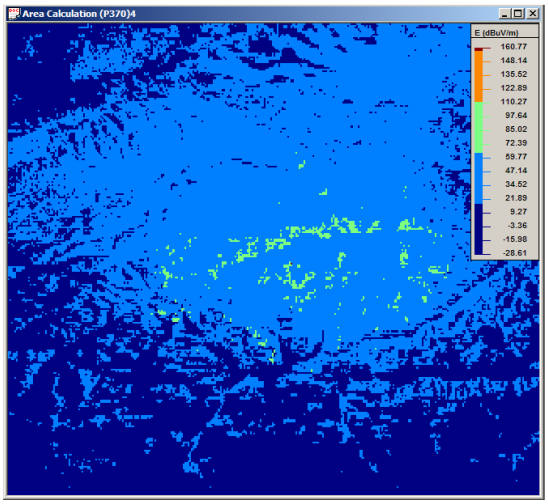


(a) (b) (c)

Overlaying of multiple vectors is possible on the same area calculation result and the Windows printing function is available through the "File" menu. The saved vector can be re-loaded into an area calculation window.

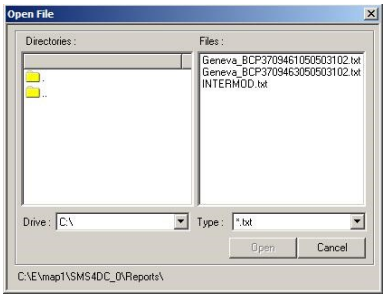
- Contour Levels: This item is useful for decreasing the number of colours by simultaneously increasing the level-step in "Legend". Figure 3.82 display an example of the application of this feature.

Figure 3.82. An example for application of "Contour Levels" in the "Tool" menu

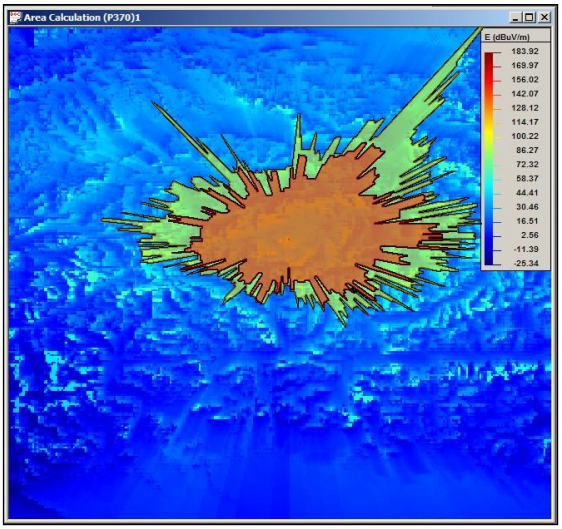


- Draw Contour from File: This item loads and displays saved vectors into the active area calculation result window. Choosing this item opens a dialogue box enabling the user to select for display a vector file from the hard disk. After selection of the vector file, the vector-style dialogue box appears and users may adjust vector colour and style as well as fill style inside the contour. Multiple vectors with various styles may be displayed. Figure 3.83 shows an example of the application this feature.

Figure 3.83. a) Dialogue box for loading a vector file and,
b) Contours loaded and displayed in an area calculation result window



(a)

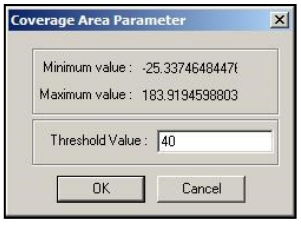


(b)

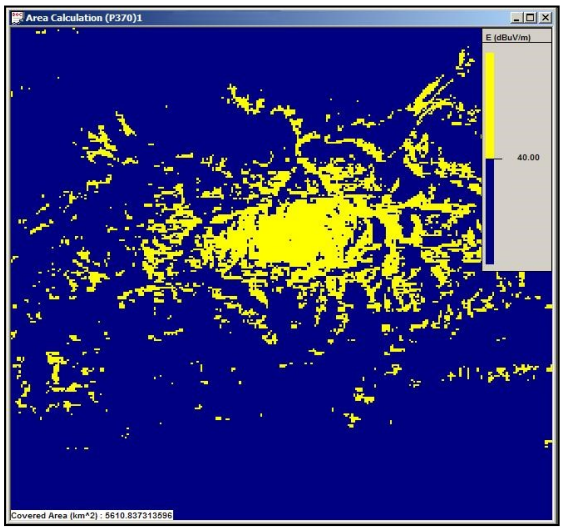
- Remove Contour from Display: This item removes all vectors from the active display.
- Coverage Area: This item calculates the area in km^2, inside which the field strength value is higher than a specified threshold value and displays the result. Selection of this item opens a dialogue box to request specification of a value for the field strength threshold.

Once the threshold value has been specified, SMS4DC draws a two-colour map in the result window: those areas with field strength value higher than the threshold are painted with the first colour and those lower than the threshold value have the second colour. The value of the total area is presented at the bottom of the area calculation result widow and a check mark appears to the item left side. Figure 3.84 displays effect of this item in the result window.

Figure 3.84. a) Dialogue box to define threshold value and,
b) Application of "Coverage Area" item for a sample area calculation result



(a)



(b)

Reselection of "Coverage Area" item undoes colour map of area calculation result window and removes check mark from item left side.

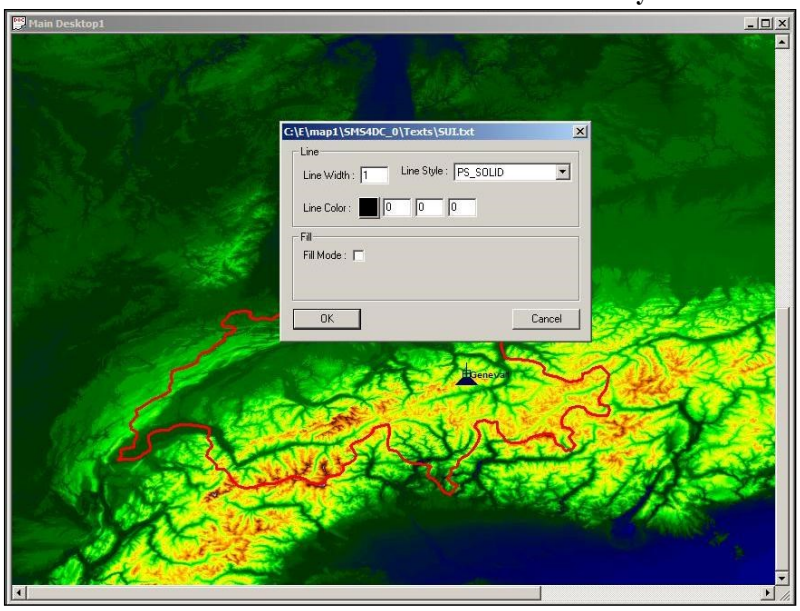
- Google Earth Export/Display: Selection of this menu item brings up a "Save as" screen (as displayed in 3.4.2.5) asking for the path and name of the result file in Google Earth format and also whether to execute the Google Earth application to display this file.

3.4.2.10. Vectors menu of DEM view

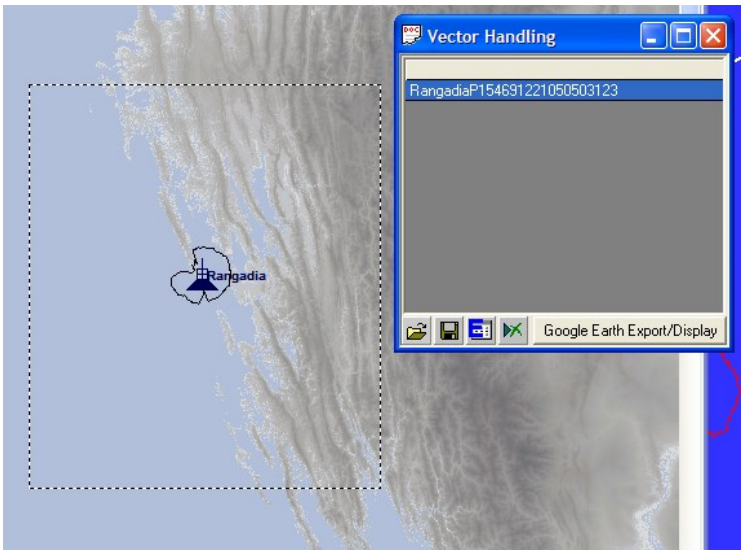
The "Vector" menu provides the following items to display or remove different vectors from the DEM:

- Draw Circle: This item draws a circle around a station with a given radius. Performing this item opens the spreadsheet of stations which enables users to select a station by left click on relevant row of record-select column. After selection of a station, a small dialogue box will appear to define the radius of the circle. This circle is a helpful tool to identify the boundaries of circular areas around a station.
- Draw from File: This item loads a vector file from the hard disk and displays it on the DEM. Selection of this item requires the user to select a vector file from the relevant folder on the hard disk. Then, the vector colour and fill style must be defined using a dialogue box. Figure 3.85 illustrates a vector of the Swiss border which has been loaded from a file. The location of the vector file is also printed on title bar of the vector-style dialogue box.

Figure 3.85. The "Draw from File" item of "Vector" menu and vector style definition dialogue box



- Draw Country Border: This item draws the border of a selected country on the DEM. After selection of this item, a list is displayed (see Figure 3.15a) of all countries for which boundary vectors are available in the IDWM (the latest version is installed with SMS4DC). Users may browse the combo-list or type the location name into the edit-box. Once a country has been selected, a vector-style dialogue box will appear to enable customisation of the line and fill style of selected country's border. The path and folder name for the vector file is displayed on the title bar of the vector-style dialogue box.
- Remove from Display: This item removes all displayed vectors from the background DEM.
- Vector Handling: This menu shows the vector handling screen which enables the user to see the list of all the vectors loaded on the DEM and change their display characteristics and remove or save them. Also it is possible to directly export and show the vectors in Google Earth.

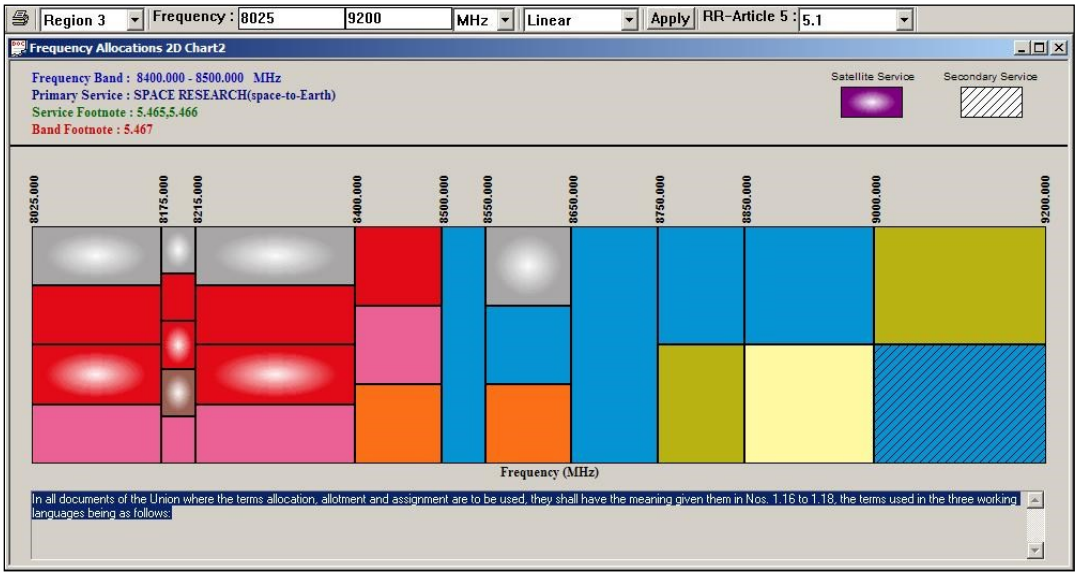


3.4.2.11. Frequency Allocations menu of DEM view

The Frequency Allocations menu provides the user with the Regional and national frequency allocations table (FAT), frequency allocations chart, national frequency assignment plans and frequency assignment utility. The following items are implemented in this menu:

- Draw Chart: This item shows a Section of a Regional or national FAT in the well-known strip format. Each segment in the frequency allocations strip denotes a frequency allocation to a radiocommunication service with its service priority. This view has an integrated toolbar, that may be used for selection of ITU Regions or national frequency allocations table, frequency range, type of drawing (linear or logarithmic) and RR Article 5 footnotes. Selecting "National" in Region combo box (at left of view) enables the user to browse national footnotes in the footnote combo box (at right of view). The "Apply" push button in the toolbar updates the view in accordance with any new toolbar settings. Figure 3.86 displays a sample picture of FAT chart.

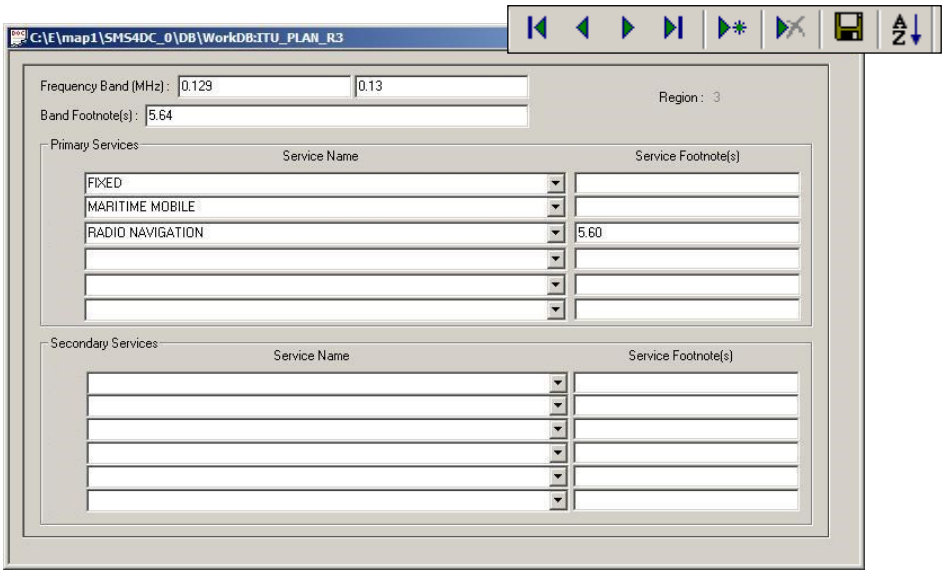
Figure 3.86. A Section of frequency allocations chart in Region 3



The mouse cursor shape on the strip is changed to a cross (+) and a left-click on a coloured patch shows its characteristics, including: frequency band, service name, service priority, service footnotes and frequency band footnotes at the top-left corner of chart. The text of the selected footnote in the relevant combo-box of the toolbar appears below the chart. The chart can be printed through the print item of the "File" menu.

The "Edit" menu under the frequency allocations chart provides three powerful items: "Plan", "Service Table" and "Footnotes" to edit the content of the frequency allocations table and chart colour. Users may browse and edit the content of integrated FATs, inserting up to six primary services and up to six secondary services, using the "Plan" item. Figure 3.87 shows the relevant dialogue box and browsing toolbar.

Figure 3.87. FAT browsing toolbar and dialogue box for editing the integrated FAT



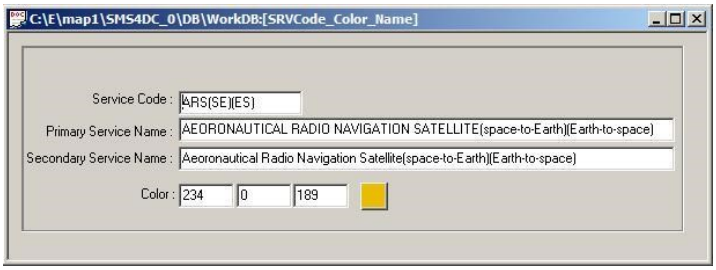
As illustrated in Figure 3.88, each row of service tables in the FAT editing dialogue box consists of a service combo-box (to select one of the standard radiocommunication services) and an edit box for its relevant service footnotes. Band footnote(s) are those relevant to all radiocommunication services for that frequency band. The push buttons in the FAT browsing toolbar are explained in Table 3.4, below.

Table 3.4. Push buttons in FAT browsing toolbar in the item "Frequency Allocations->Edit->Plan"

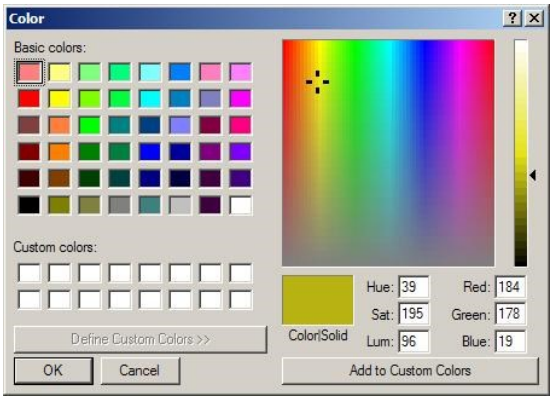
Toolbar Buttons	Name	Description
	Move to the first record	Push button to load the allocation that has been made in the first (lowest) frequency band of the active FAT.
	Go to the previous record	Push button to load the allocation that has been made in the previous (lower) frequency band of the active FAT with respect to the displayed frequency allocation on the dialogue box. Also, pressing Page Up key while the cursor is in the Frequency Band text boxes, does the same task.
	Go to the next record	Push button to load the allocation that has been made in the next (higher) frequency band of the active FAT with respect to the displayed frequency allocation on dialogue box. Also, pressing Page Down key while the cursor is in the Frequency Band text boxes, does the same task.
	Move to the last record	Push buttons to load the allocation that has been made in the last (highest) frequency band of active FAT.
	Add record	Push buttons to add, to the active FAT, a new frequency band and relevant frequency allocations.
	Delete current record	Push buttons to delete, from the active FAT, the current record (a frequency band and all relevant frequency allocations).
	Save current record	Push buttons to save a modified allocation in the active FAT.
	Sort	To sort the contents of a frequency allocations table (FAT) with respect to the frequency band (i.e. lowest frequency to highest frequency or *vice versa*). Normally, after the addition of a new frequency band to the FAT it will be appended to the database of FAT. By using this toolbar push button the new frequency band will take its correct position in a sorted FAT.

"Service table" item in the "Frequency Allocations->Draw Chart->Edit" menu enables user to browse and modify radiocommunication service name and colour used in the frequency allocations chart. Figure 3.88 displays the relevant dialogue box.

Figure 3.88. a) Dialogue box for modification of legend of frequency allocations chart and b) integrated standard colour palette



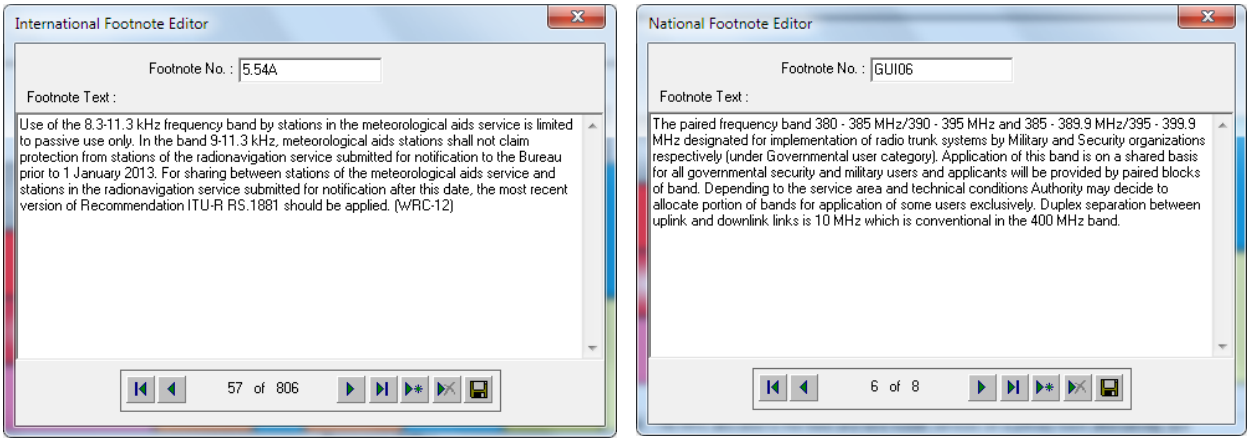
(a) Dialogue box for modification of legend of frequency allocations chart



(b) Standard colour palette

The same toolbar (previously explained for "Frequency Allocations->Draw Chart->Edit->Plan" item) is also available in this item to browse and save modifications. Table 3.4 explains the functions of the toolbar push buttons. The last item "Frequency Allocations->Draw Chart->Edit->Footnote" provides the user with a facility for footnote modification or definition. Figure 3.89 displays the dialogue box for the footnote editor associated with this item.

Figure 3.89. International or national footnote editor a) International, b) National



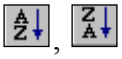
a) Editing a Regional footnote

b) Editing a National footnote

Users have the freedom to type any footnote text in the one of the Windows-supported languages. The default language of the footnote editor is the SMS4DC preferred language which is selected during logon. CTRL+Enter is necessary to start a new line. Depending on the type of uploaded background FAT, a table of Regional or National footnotes will be available for modification. Moreover, users are able to add more footnotes to the footnote list of an active FAT. Table 3.4 contains a description of the browsing toolbar integrated with the footnote editor dialogue box. The new footnotes may be assigned to the sub-bands of the FAT using "Frequency Allocations->Edit->Plan" item (Figure 3.87).

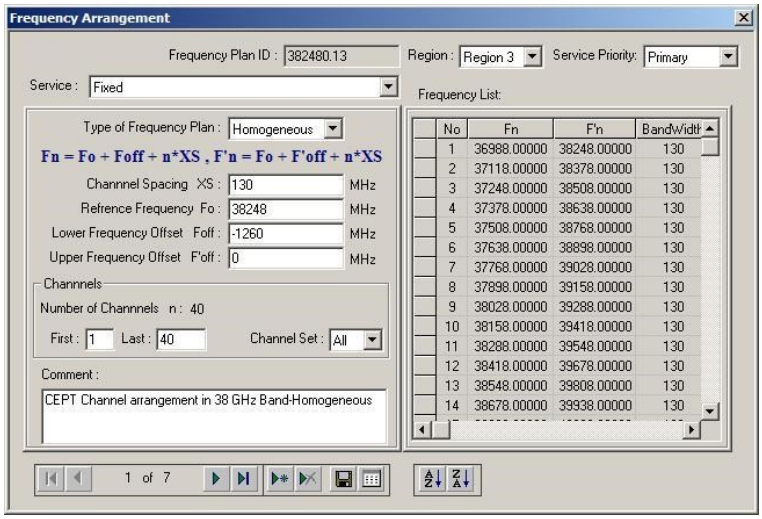
- Frequency Arrangement: Item to browse, define and report national frequency arrangement plans in one of the three possible formats: homogeneous, uniform and non-uniform. As shown in Figure 3.90, for each type of arrangement, which may be selected from the combo box "Type of Frequency Plan", a different set of parameters is required. The content of the dialogue box format changes in accordance with the different types of frequency arrangement. A spreadsheet is added to the dialogue box to display the centre frequency of the active frequency plan. This spreadsheet can be edited directly in the case of non-uniform channelling plan. Frequency plans created by means of the frequency arrangement dialogue box are used for national frequency assignment (i.e. for the user country specified during first execution of the SMS4DC software). Table 3.5 explains the dialogue box content.

Table 3.5. Description of Frequency Arrangement dialogue box [1]

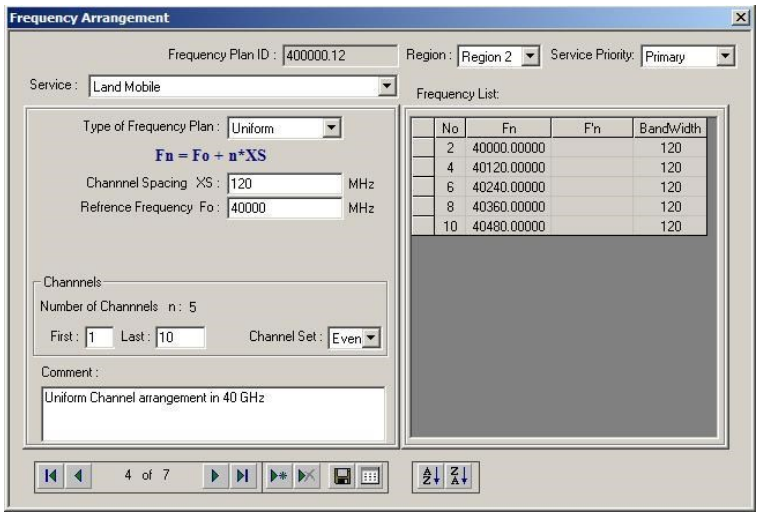
Item	Description	H	U	N
Frequency Plan ID	An ID which is generated by SMS4DC, automatically in case of homogeneous and uniform channel arrangements, by a combination of reference frequency and channel spacing. In the case of non-uniform arrangement, the ID must be specified by the user.	X	X	X
Region	The ITU Region of the frequency allocation table in which frequency arrangement plan is defined.	X	X	X
Service Priority	Priority of service in which frequency assignment plan is defined.	X	X	X
Type of Frequency Plan	A combo box to select one of three available frequency arrangement formats. The dialogue box reconfigures according to the plan type.	X	X	X
Channel Spacing	Frequency distance XS between centre frequencies of two adjacent channels.	X	X	
Reference Frequency	Frequency used as a reference to calculate centre frequencies in homogeneous and uniform frequency arrangement plans.	X	X	
Lower and Upper Frequency Offsets	Frequency offsets to calculate "go" and "return" centre frequencies tabulated in "Frequency List" spreadsheet.	X		
Number of Channels	Number of duplex paired or simplex channels defined in plan.	X	X	X
First:… Last: …	The first and the last channel numbers in a plan.	X	X	
Channel Set	One of "All", "Odd" or "Even" channel set which have their centre frequencies in the plan (spreadsheet of frequency list).	X	X	
Comment	Any comment relevant to the current frequency arrangement.	X	X	X
	Push buttons to load the first (lowest) frequency arrangement.	X	X	X
	Push button to load the previous (lower) frequency arrangement.	X	X	X
	Push button to load the next (higher) frequency arrangement.	X	X	X
	Push buttons to load the last (highest) frequency arrangement.	X	X	X
	Push buttons to reset the dialogue box for addition of a new frequency arrangement.	X	X	X
	Push buttons to delete current frequency arrangement.	X	X	X
	Push buttons to save modified or new frequency arrangement. Pushing this button is necessary after any modification to the frequency list in case of non-uniform frequency arrangements.	X	X	X
	Push button to display and provide a report of a current frequency arrangement Figure 3.91). This report can be saved in a text file.	X	X	X
	Push button to sort spreadsheet of frequency list, ascending or descending, with respect to a selected or "No" (i.e. channel number) column. Selection of a column can be made by mouse left-click on field name.	X	X	X
"Add channel" push button	Push button to add a new row in the frequency list for addition of a new frequency pair with the relevant bandwidth in a non-uniform frequency plan.			X
"Delete channel" push button	Push button to delete a selected row from the frequency list and to remove a frequency pair in a non-uniform frequency plan.			X
Frequency List	List of centre frequencies which have been calculated or entered directly.	X	X	X

[1]: H, U and N stand for Homogeneous, Uniform and Non-uniform channel arrangement plans

Figure 3.90. Frequency arrangement definition dialogue box for the three frequency plan types



(a) Homogeneous channel arrangement



(b) Uniform channel arrangement

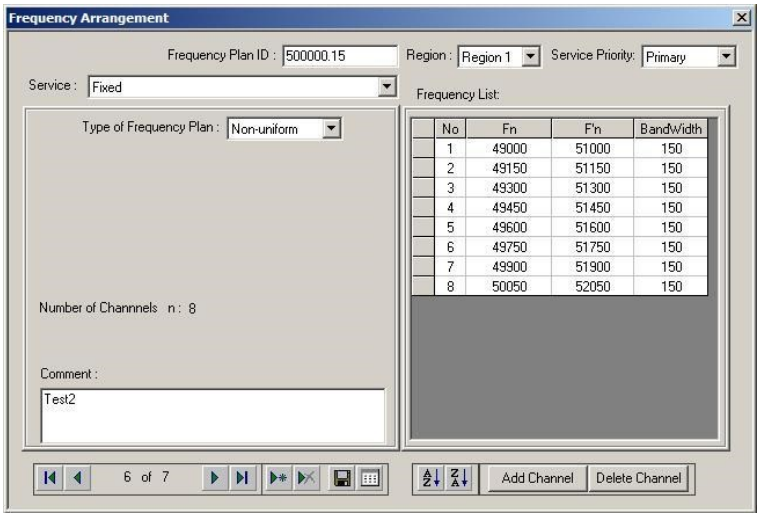
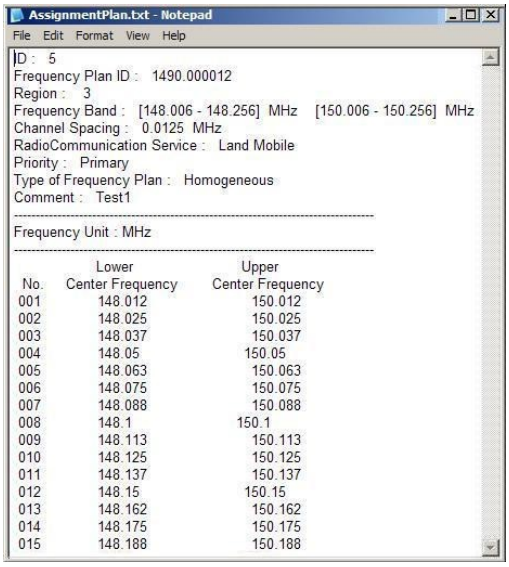


Figure 3.91. Report of frequency arrangement plan



AssignmentPlan.txt - Notepad

File Edit Format View Help

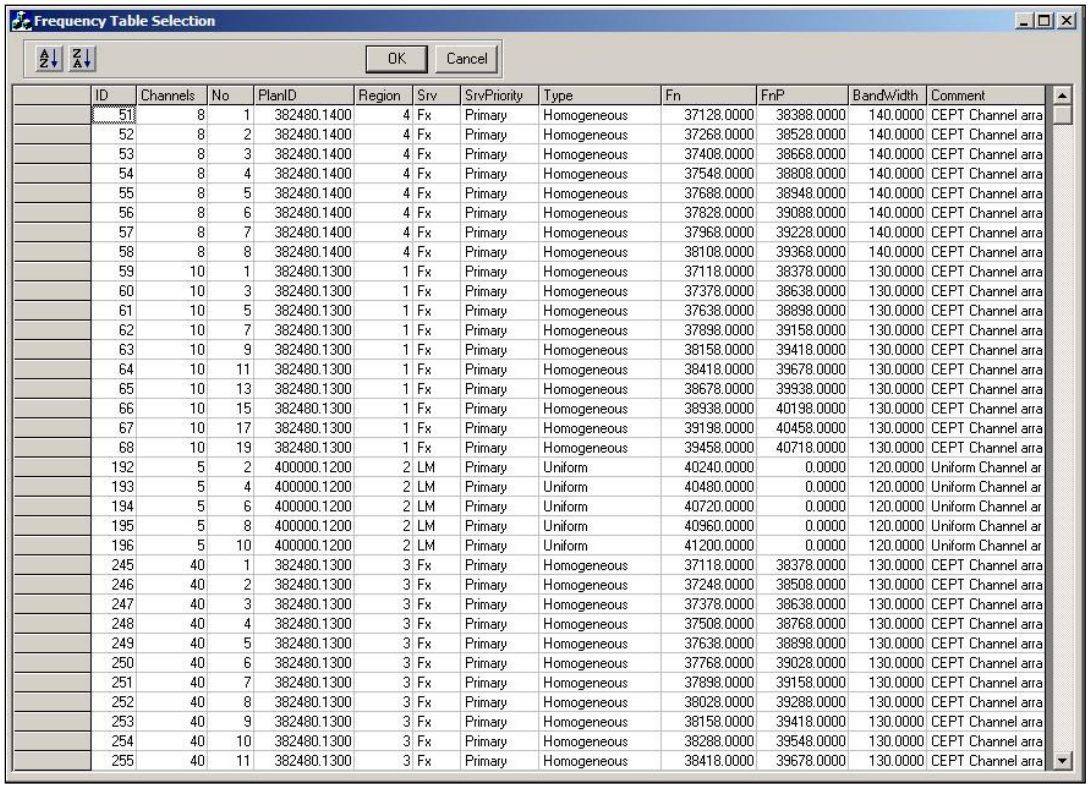
ID : 5
Frequency Plan ID : 1490.000012
Region : 3
Frequency Band : [148.006 - 148.256] MHz [150.006 - 150.256] MHz
Channel Spacing : 0.0125 MHz
RadioCommunication Service : Land Mobile
Priority : Primary
Type of Frequency Plan : Homogeneous
Comment : Test1

Frequency Unit : MHz

No.	Lower Center Frequency	Upper Center Frequency
001	148.012	150.012
002	148.025	150.025
003	148.037	150.037
004	148.05	150.05
005	148.063	150.063
006	148.075	150.075
007	148.088	150.088
008	148.1	150.1
009	148.113	150.113
010	148.125	150.125
011	148.137	150.137
012	148.15	150.15
013	148.162	150.162
014	148.175	150.175
015	148.188	150.188

- Frequency Table: This item displays all assignable frequencies of all frequency arrangement plans. Two push buttons are provided to sort the list, ascending or descending, with respect to the ID (by default) or any other selected column. Selection of a column can be made by a mouse left-click on field name. Currently, the "OK" push button has no function.

Figure 3.92. Spreadsheet of frequencies assignable through approved frequency plans



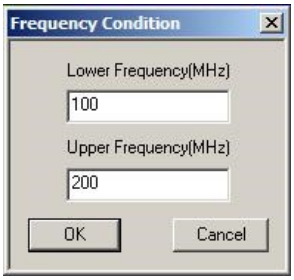
Frequency Table Selection

OK Cancel

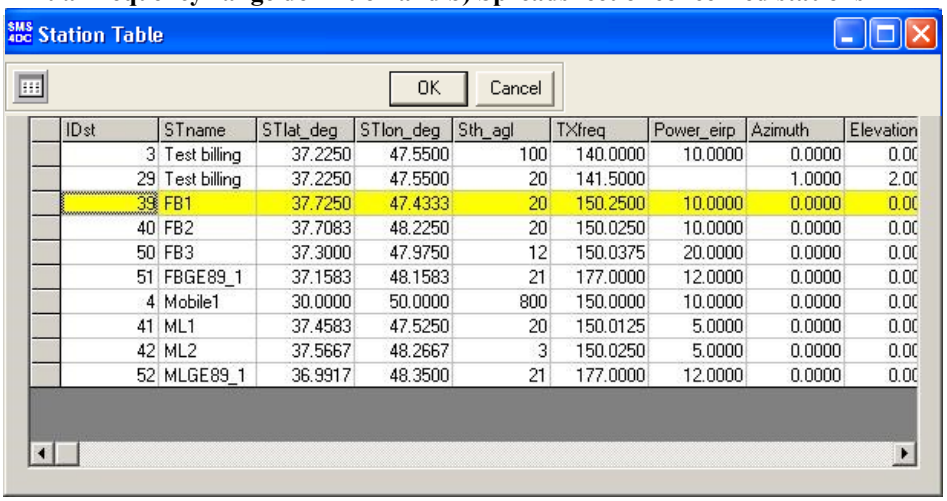
ID	Channels	No	PlanID	Region	Srv	SrvPriority	Type	Fn	FnP	BandWidth	Comment
51	8	1	382480.1400	4	Fx	Primary	Homogeneous	37128.0000	38388.0000	140.0000	CEPT Channel arra
52	8	2	382480.1400	4	Fx	Primary	Homogeneous	37268.0000	38528.0000	140.0000	CEPT Channel arra
53	8	3	382480.1400	4	Fx	Primary	Homogeneous	37408.0000	38668.0000	140.0000	CEPT Channel arra
54	8	4	382480.1400	4	Fx	Primary	Homogeneous	37548.0000	38808.0000	140.0000	CEPT Channel arra
55	8	5	382480.1400	4	Fx	Primary	Homogeneous	37688.0000	38948.0000	140.0000	CEPT Channel arra
56	8	6	382480.1400	4	Fx	Primary	Homogeneous	37828.0000	39088.0000	140.0000	CEPT Channel arra
57	8	7	382480.1400	4	Fx	Primary	Homogeneous	37968.0000	39228.0000	140.0000	CEPT Channel arra
58	8	8	382480.1400	4	Fx	Primary	Homogeneous	38108.0000	39368.0000	140.0000	CEPT Channel arra
59	10	1	382480.1300	1	Fx	Primary	Homogeneous	37118.0000	38378.0000	130.0000	CEPT Channel arra
60	10	3	382480.1300	1	Fx	Primary	Homogeneous	37378.0000	38638.0000	130.0000	CEPT Channel arra
61	10	5	382480.1300	1	Fx	Primary	Homogeneous	37638.0000	38898.0000	130.0000	CEPT Channel arra
62	10	7	382480.1300	1	Fx	Primary	Homogeneous	37898.0000	39158.0000	130.0000	CEPT Channel arra
63	10	9	382480.1300	1	Fx	Primary	Homogeneous	38158.0000	39418.0000	130.0000	CEPT Channel arra
64	10	11	382480.1300	1	Fx	Primary	Homogeneous	38418.0000	39678.0000	130.0000	CEPT Channel arra
65	10	13	382480.1300	1	Fx	Primary	Homogeneous	38678.0000	39938.0000	130.0000	CEPT Channel arra
66	10	15	382480.1300	1	Fx	Primary	Homogeneous	38938.0000	40198.0000	130.0000	CEPT Channel arra
67	10	17	382480.1300	1	Fx	Primary	Homogeneous	39198.0000	40458.0000	130.0000	CEPT Channel arra
68	10	19	382480.1300	1	Fx	Primary	Homogeneous	39458.0000	40718.0000	130.0000	CEPT Channel arra
192	5	2	400000.1200	2	LM	Primary	Uniform	40240.0000	0.0000	120.0000	Uniform Channel ar
193	5	4	400000.1200	2	LM	Primary	Uniform	40480.0000	0.0000	120.0000	Uniform Channel ar
194	5	6	400000.1200	2	LM	Primary	Uniform	40720.0000	0.0000	120.0000	Uniform Channel ar
195	5	8	400000.1200	2	LM	Primary	Uniform	40960.0000	0.0000	120.0000	Uniform Channel ar
196	5	10	400000.1200	2	LM	Primary	Uniform	41200.0000	0.0000	120.0000	Uniform Channel ar
245	40	1	382480.1300	3	Fx	Primary	Homogeneous	37118.0000	38378.0000	130.0000	CEPT Channel arra
246	40	2	382480.1300	3	Fx	Primary	Homogeneous	37248.0000	38508.0000	130.0000	CEPT Channel arra
247	40	3	382480.1300	3	Fx	Primary	Homogeneous	37378.0000	38638.0000	130.0000	CEPT Channel arra
248	40	4	382480.1300	3	Fx	Primary	Homogeneous	37508.0000	38768.0000	130.0000	CEPT Channel arra
249	40	5	382480.1300	3	Fx	Primary	Homogeneous	37638.0000	38898.0000	130.0000	CEPT Channel arra
250	40	6	382480.1300	3	Fx	Primary	Homogeneous	37768.0000	39028.0000	130.0000	CEPT Channel arra
251	40	7	382480.1300	3	Fx	Primary	Homogeneous	37898.0000	39158.0000	130.0000	CEPT Channel arra
252	40	8	382480.1300	3	Fx	Primary	Homogeneous	38028.0000	39288.0000	130.0000	CEPT Channel arra
253	40	9	382480.1300	3	Fx	Primary	Homogeneous	38158.0000	39418.0000	130.0000	CEPT Channel arra
254	40	10	382480.1300	3	Fx	Primary	Homogeneous	38288.0000	39548.0000	130.0000	CEPT Channel arra
255	40	11	382480.1300	3	Fx	Primary	Homogeneous	38418.0000	39678.0000	130.0000	CEPT Channel arra

- Frequency Assignment: This item assigns a frequency to a selected station after calculation of potential interference caused to or received from any other stations of all (mobile, fixed, broadcast) radiocommunication services in a given frequency band inside a circular search area. The procedure starts by selecting from a list of stations the national station for which a transmitting frequency assignment has been requested (a national station is a station which is located inside the default country of SMS4DC). Since the number of national stations stored in the local database may become thousands, SMS4DC makes it easier to find the concerned station by applying a frequency condition (filter). This filter shortens the list to show only those stations within a limited frequency range specified to include the concerned station. Therefore, whenever this item is selected, a dialogue box is opened for the user to define the frequency range in which an assignment is required and thereby limit the number of stations listed in the station selection spreadsheet. When the spreadsheet of national stations is displayed, the concerned station may be easily identified and selected for a frequency assignment. Figure 3.93 displays the dialogue box to narrow frequency range and list of stations with frequencies in range.

Figure 3.93. a) Dialogue box of initial frequency range definition and b) Spreadsheet of concerned stations



(a) Frequency range

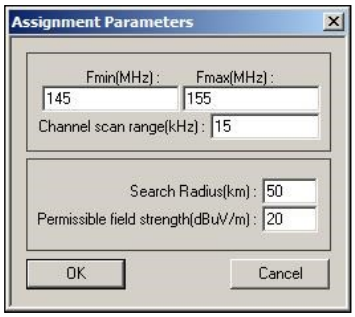


IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth	Elevation
3	Test billing	37.2250	47.5500	100	140.0000	10.0000	0.0000	0.00
29	Test billing	37.2250	47.5500	20	141.5000		1.0000	2.00
39	FB1	37.7250	47.4333	20	150.2500	10.0000	0.0000	0.00
40	FB2	37.7083	48.2250	20	150.0250	10.0000	0.0000	0.00
50	FB3	37.3000	47.9750	12	150.0375	20.0000	0.0000	0.00
51	FBGE89_1	37.1583	48.1583	21	177.0000	12.0000	0.0000	0.00
4	Mobile1	30.0000	50.0000	800	150.0000	10.0000	0.0000	0.00
41	ML1	37.4583	47.5250	20	150.0125	5.0000	0.0000	0.00
42	ML2	37.5667	48.2667	3	150.0250	5.0000	0.0000	0.00
52	MLGE89_1	36.9917	48.3500	21	177.0000	12.0000	0.0000	0.00

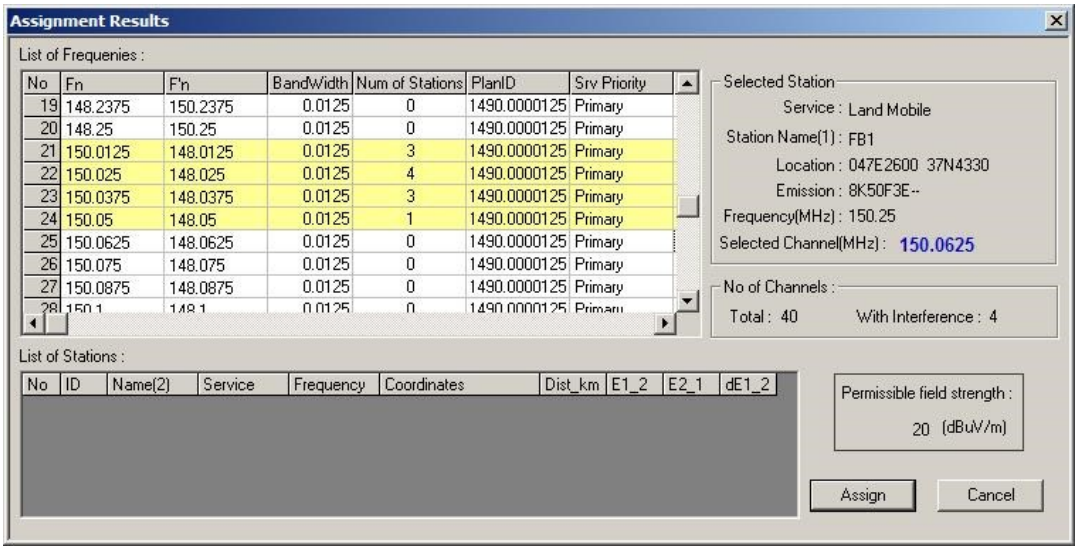
(b) List of stations which contains the concerned station

Selection of a station can be made by a left click on the record-select column of the concerned row. Assignment parameters must be set after station selection. Figure 3.94a shows the assignment parameters dialogue box. The assignment algorithm searches for suitable channels to assign within any channel plan arrangement in the range between Fmin and Fmax. Then, all existing stations within the "Channel Scan Range" of each channel in that plan and within the search radius specified are examined for potential interference. Therefore, to ensure adjacent channels are examined for interference, the "Channel Scan Range" must be greater than zero and may usually be set to the channel spacing for the applicable channel arrangement. Once the assignment parameters have been set, all frequencies available within those parameters are examined for potential interference and the results are displayed in the result dialogue box. Figure 3.94b displays the result of investigation for assignable frequencies.

Figure 3.94. a) Frequency assignment parameters and b) Result of investigation for assignable frequencies



(a) Frequency assignment parameters



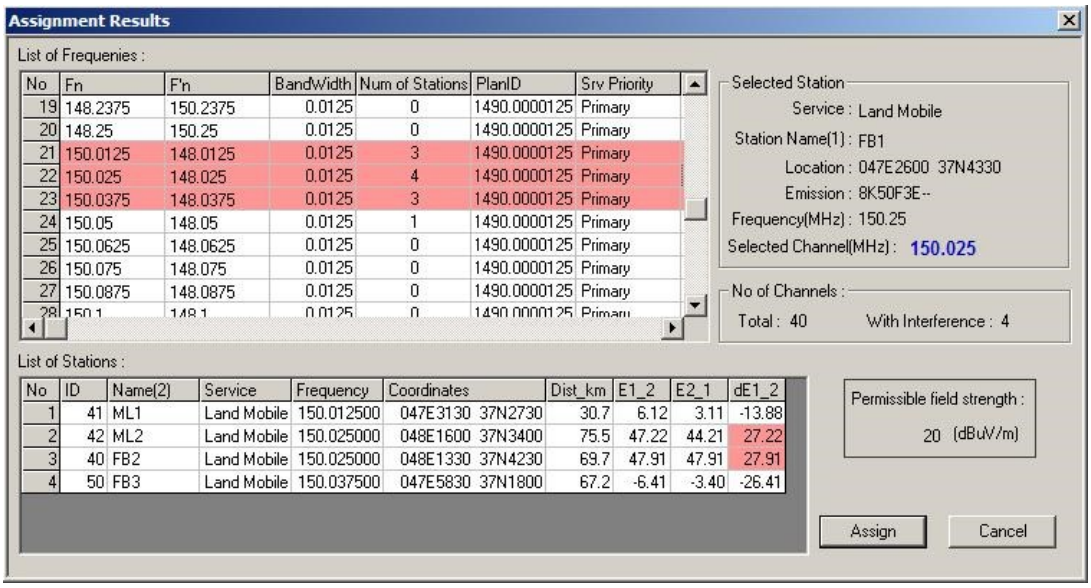
(b) Result of investigation for assignable frequencies (prior to interference calculation for a selected frequency)

SMS4DC looks for all available frequencies in the table of assignable frequencies (Figure 3.92) between frequencies Fmin and Fmax, as entered in the "Assignment Parameters" dialogue box. The frequencies of channels identified by this search procedure are listed in the first and second columns of a spreadsheet frequency list. For two-frequency (duplex) channels, the second column contains the corresponding paired frequency. Then, inside the circular area with the radius as specified in the "Assignment Parameters" dialogue box, a search is made in the database to identify any existing stations using the listed frequencies, plus/minus the Channel Scan Range. For each frequency (pair), the number of stations found is displayed in the column "Num of stations". A yellow background colour highlights the row of any frequencies with nonzero in the column "Num of Stations" as having potential interference. The procedure will identify all stations within the range of the "Assignment Parameters" dialogue box, regardless of radiocommunication service.

Choosing any row with yellow highlight from the list of frequencies by a mouse double left-click, initiates detailed interference calculations, both to and from the station under assignment, using the Free Space propagation model. The emission masks of the interferer and victim stations are considered for interference calculations, if these have been recorded in the database. The Net Filter Discrimination (NFD) value is set to zero in the absence of emission mask records. The result of calculations for each yellow highlight

frequency in the list will be displayed in the spreadsheet of "List of Stations". Where no potential interference problem is found for a frequency, the second spreadsheet will remain blank. The fields "E1_2" and "E2_1" stand for produced field strength value, in dBμV/m, by concerned station on stations in the "List of Stations" and vice versa. The last field, with the name "dE1_2" is equal to "E1_2" minus the "Permissible Field Strength" value (specified in the "Assignment Parameters" dialogue box. A red background in the field dE1_2 indicates an interference situation. In the List of Frequencies spreadsheet, the colour of rows for frequencies containing with an interference situation is changed to red after detailed interference calculation. Figure 3.95 displays results of detailed interference calculation for a suspect assignable frequency.

Figure 3.95. Result of detailed interference calculation for a suspect assignable frequency



After considering the results, a suitable frequency for assignment may be selected by a double right mouse click on the "No." (channel number) column and the row for the frequency to be selected. Once the "Assign" push button is used, the selected transmitting frequency in the list and its corresponding receiving frequency will be assigned to the concerned station. If additional frequencies are to be assigned to this (or any other multiple frequency station), the Database -> Licensing menu should be used to add a "nominal" new frequency to the station in the Administrative part. However, the nominal frequency should then be changed to an assigned (and interference checked) frequency by using the Frequency Allocation -> Frequency Assignment menu procedures described above.

3.4.2.12. Coordination menu of DEM view

This menu has sub-menu items designed to deal with different scenarios of frequency coordination by procedures and calculation in accordance with either:

The latest versions of the following Regional Plans:

- GE84: Regional Agreement relating to the Use of the Band 87.5 – 108 MHz for FM Sound Broadcasting (Region 1 and Part of Region 3)
- ST61: Regional Administrative Conference of the Members of the Union in the European Broadcasting Area, Geneva, (revised in 2006)
- GE89: Regional Administrative Conference for the Planning of VHF/UHF Television Broadcasting in the African Broadcasting Area and Neighbouring Countries, Geneva, (revised in 2006)
- GE06: Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of region 1 and 3, in the frequency bands 174-230 MHz and 470-862 MHz.

Or country-specific, bilateral or multilateral border coordination agreements as described in the following sub-menus:

- Agreement: The entry of user-defined agreements which would be utilized for border coordination item.
- Border: Implementation of border coordination for concerned TX or RX stations in Fixed and Land Mobile service in accordance with a regional agreement.
- HCM Agreement

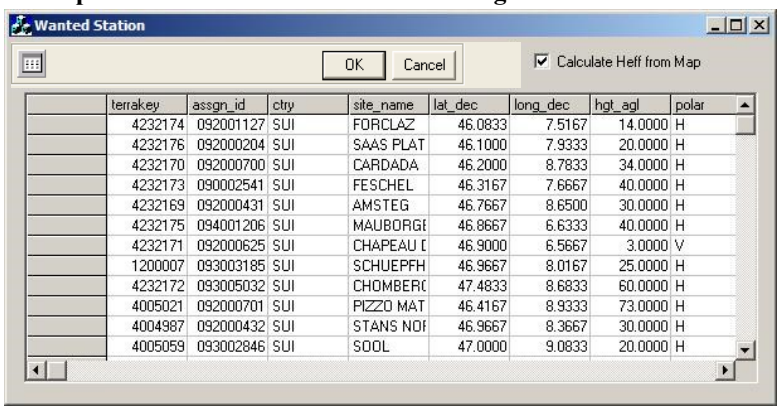
Following Sections explain sub-items under mentioned regional plans.

3.4.2.12.1. GE84 sub-menu of DEM view

The coordination of FM sound broadcasting station with stations in broadcasting, fixed and land mobile radiocommunication services, in accordance with the GE84 plan (Figure 3.8b), can be processed through this sub-menu. The following items are implemented:

- BC2BC (Cord. Distance): This item enables users to identify countries in the GE84 plan, whose FM sound broadcasting stations are likely to be affected by the emissions from an FM sound broadcasting station located in another country in the GE84 plan. After selecting this item, a list of countries is presented in a dialogue box (Figure 3.15a). The country where the (potentially interfering) FM sound broadcasting station is located can be selected from this list. Then, all the FM sound broadcasting stations (in conformity with GE84) located inside the selected country will be listed in a spreadsheet. The user may select the concerned station, using a mouse left click on the record-select column of the spreadsheet and proceed to the coordination calculation. As shown in Figure 3.96 a check box is available on the list allowing the user to calculate the effective height of antenna directly from the DEM map instead of loading the existing record from the database. Also, if this check box is used, the background DEM will be panned to the location of the selected station.

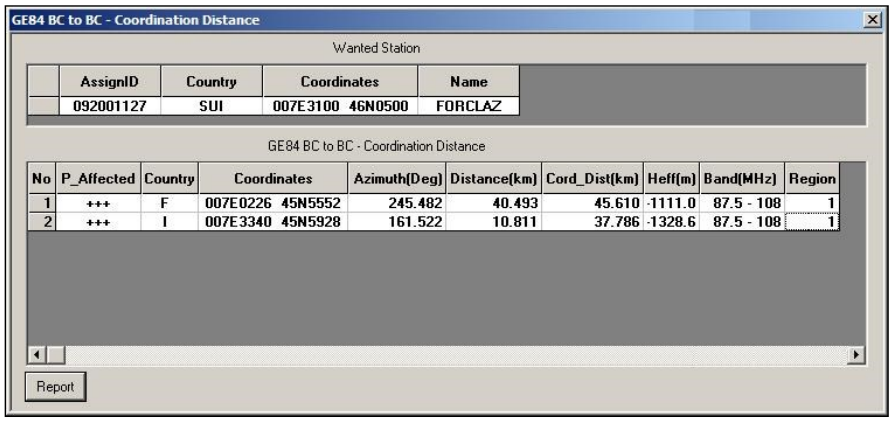
Figure 3.96. Spreadsheet of FM sound broadcasting stations in the selected country



terrakey	assgn_id	ctry	site_name	lat_dec	long_dec	hgt_agl	polar
4232174	092001127	SUI	FORCLAZ	46.0833	7.5167	14.0000	H
4232176	092000204	SUI	SAAS PLAT	46.1000	7.9333	20.0000	H
4232170	092000700	SUI	CARDADA	46.2000	8.7833	34.0000	H
4232173	090002541	SUI	FESCHEL	46.3167	7.6667	40.0000	H
4232169	092000431	SUI	AMSTEG	46.7667	8.6500	30.0000	H
4232175	094001206	SUI	MAUBORGE	46.8667	6.6333	40.0000	H
4232171	092000625	SUI	CHAPEAU D	46.9000	6.5667	3.0000	V
1200007	093003185	SUI	SCHUEPFH	46.9667	8.0167	25.0000	H
4232172	093005032	SUI	CHOMBERC	47.4833	8.6833	60.0000	H
4005021	092000701	SUI	PIZZO MAT	46.4167	8.9333	73.0000	H
4004987	092000432	SUI	STANS NOF	46.9667	8.3667	30.0000	H
4005059	093002846	SUI	SOOL	47.0000	9.0833	20.0000	H

Finally, the list of countries (Administrations) likely to be affected and their azimuth and distance from their nearest border point to the wanted station are listed in a spreadsheet underneath the first row, which provides general information about the wanted FM sound broadcasting station. Figure 3.97 displays a sample output of BC2BC coordination calculation.

Figure 3.97. Result of coordination distance calculation for GE84 FM sound station in respect to the other GE84 FM sound stations



AssignID	Country	Coordinates	Name
092001127	SUI	007E3100 46N0500	FORCLAZ

No	P_Affected	Country	Coordinates	Azimuth(Deg)	Distance(km)	Cord_Dist(km)	Heff(m)	Band(MHz)	Region
1	+++	F	007E0226 45N5552	245.482	40.493	45.610	-1111.0	87.5 - 108	1
2	+++	I	007E3340 45N5928	161.522	10.811	37.786	-1328.6	87.5 - 108	1

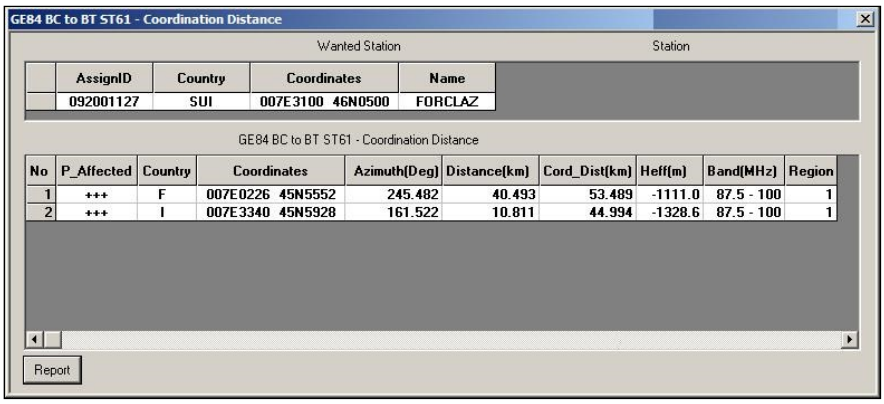
The information displayed in the result spreadsheets can be saved as a report in a file presented in a report-style with the HTML format by using the "Report" push button.

- BC2BT ST61 (Cord. Distance): This item enables users to identify countries in the ST61 plan, whose TV broadcasting stations are likely to be affected by emissions from an FM sound broadcasting station located in another country in the GE84 plan. After selecting this item, a list of countries is presented in a dialogue box (Figure 3.15a). The country where the (potentially interfering) FM sound broadcasting station is located, can be selected from this list. Then, all the FM sound broadcasting stations (in conformity with GE84) located inside the selected country will be listed in a spreadsheet and users may select the concerned station, using a mouse left click on the record-select column of a spreadsheet and proceed to the coordination calculation. As shown in Figure 3.96, a check box is available on the list allowing the user to calculate effective height of antenna directly from the DEM map instead of loading the existing record from the database.

Also, if this check box used, the background DEM will be panned to the location of selected station.

Finally, the list of countries (Administrations) likely to be affected and their azimuth and distance from their nearest border point to the wanted station are listed in a spreadsheet underneath the first row, which gives the general information of the wanted FM sound broadcasting station. Figure 3.98 displays a sample output of BC2BT coordination calculation.

Figure 3.98. Result of coordination distance calculation for GE84 FM sound station in respect to ST61 TV broadcasting stations

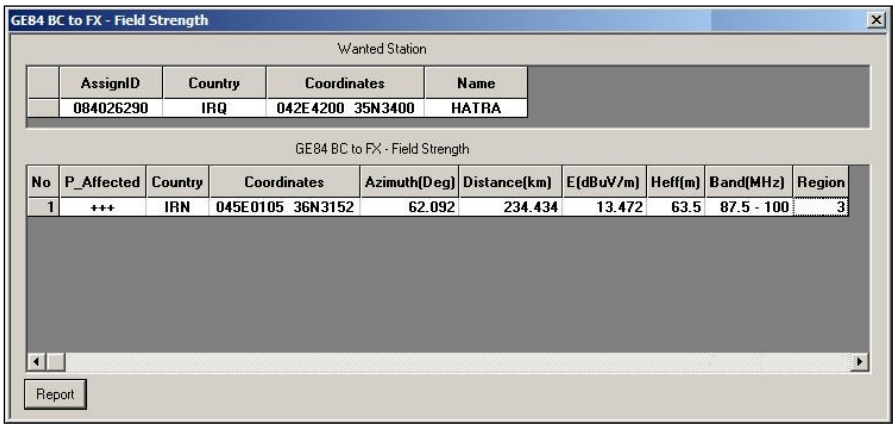


The information displayed in the result spreadsheets can be saved in a file presented in a report-style with the HTML format by using “Report” push button.

- BC2FX (Fst): Item enabling users to identify countries in the GE84 plan, whose fixed stations are likely to be affected by the emissions from an FM sound broadcasting station located in another country of the GE84 plan. The technical criteria have been fully defined in the GE84 plan. After selecting this item, a list of countries is presented in a dialogue box (Figure 3.15a). The country where the (potentially interfering) FM sound broadcasting station is located can be selected from this list. Then, all the FM sound broadcasting stations (in conformity with GE84) located inside the selected country will be listed in a spreadsheet and users may select the concerned station, using a mouse left click on the record-select column of the spreadsheet and proceed to the coordination calculation. As shown in Figure 3.96, a check box is available on the list allowing the user to calculate effective height of antenna directly from the DEM map, instead of loading the existing record from the database. Also, if this check box used, the background DEM will be panned to the location of the selected station.

  Finally, the list of countries (Administrations) likely to be affected and their azimuth and distance from the nearest border point to the wanted station are listed in a spreadsheet below the first row, which provides general information about the wanted FM sound broadcasting station. Figure 3.99 displays a sample output of BC2FX coordination calculation.

Figure 3.99. Result of coordination field strength calculation for GE84 FM sound station in respect to the fixed stations

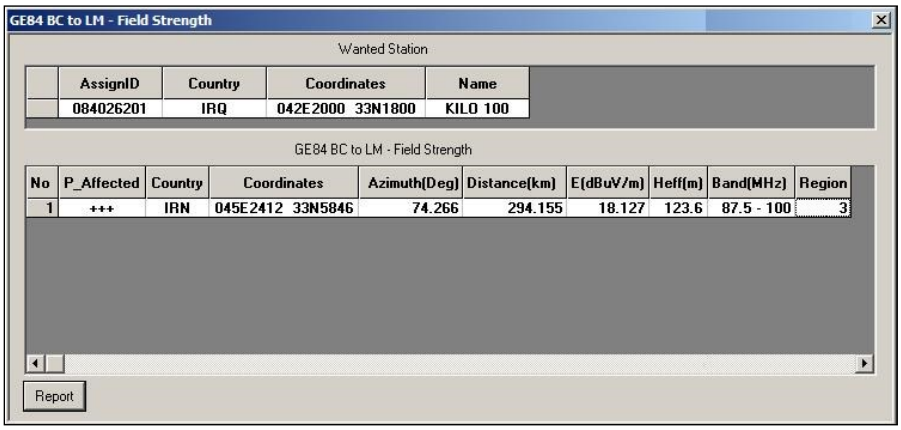


The information displayed in the result spreadsheets can be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

- BC2LM (Fst.): This item enables users to identify countries in the GE84 plan, whose land mobile stations are likely to be affected by emissions from an FM sound broadcasting station located in another country in the GE84 plan. The technical criteria have been fully defined in GE84 plan. After selecting this item, a list of countries is presented in a dialogue box (Figure 3.15a). The country where the (potentially interfering) FM sound broadcasting station is located can be selected from this list. Then, all the FM sound broadcasting stations (in conformity with GE84) located inside the selected country will be listed in a spreadsheet. The user may select the concerned station, using a mouse left click on the record-select column of the spreadsheet and proceed to the coordination calculation. As shown in Figure 3.96, a check box is available on the list allowing the user to calculate the effective height of the antenna directly from the DEM map instead of loading the existing record from the database. Also, if this check box used, the background DEM will be panned to the location of the selected station.

  Finally, the list of countries (Administrations) likely to be affected and their azimuth and distance from the nearest point on the border to the wanted station are listed in a spreadsheet underneath the first row that provides the general information about the wanted FM sound broadcasting station. Figure 3.100 displays a sample output of BC2LM coordination calculation.

Figure 3.100. Result of coordination field strength calculation for GE84 FM sound station in respect to the land mobile stations

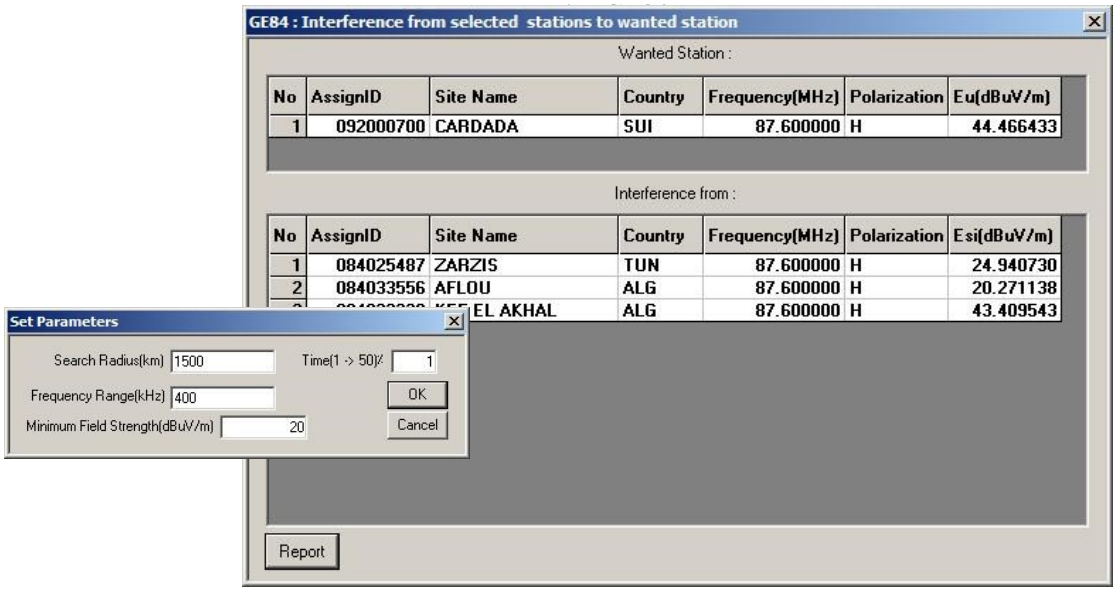


The information displayed in the result spreadsheets can be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

- Interference from (Usable Fst.): This item calculates the aggregate and nuisance field strength from selected FM sound broadcasting stations inside a circular area within a given frequency range, to a GE84 FM sound broadcasting station. After selecting this item, a list of countries is presented in a dialogue box (Figure 3.15a). The country where the (wanted) FM sound broadcasting station is located can be selected from this list. Then, all the FM sound broadcasting stations (in conformity with GE84) located inside the selected country will be listed in a spreadsheet. The user may select the concerned station, using a mouse left click on the record-select column of the spreadsheet. When the wanted FM sound broadcasting station has been selected, a dialogue box appears that allows the user to specify: the radius of circular area, frequency search range, time percentage and minimum acceptable field strength. Once the calculation parameters have been specified, a list of all FM sound broadcasting stations that meet the specified search parameters is shown in a spreadsheet, from which users can select some or all of them for the next calculation step by a mouse left click on record select column. As shown in Figure 3.96, a check box is available on the list to allow the user to calculate effective height of the antenna directly from the DEM map instead of loading an existing record from the database. If the OK button is pushed, calculation starts and the relevant progress bar is displayed.

  Finally, a result spreadsheet is displayed showing a list of stations exceeding the minimum field strength value, together with their country code and field strength value. The aggregate field strength value at the location of the wanted FM sound broadcasting station is calculated. Figure 3.101 displays a sample output of the interference calculation.

Figure 3.101. Result of calculation of interference from FM sound broadcasting stations inside a specified area within a specified frequency range to a wanted FM sound broadcasting station

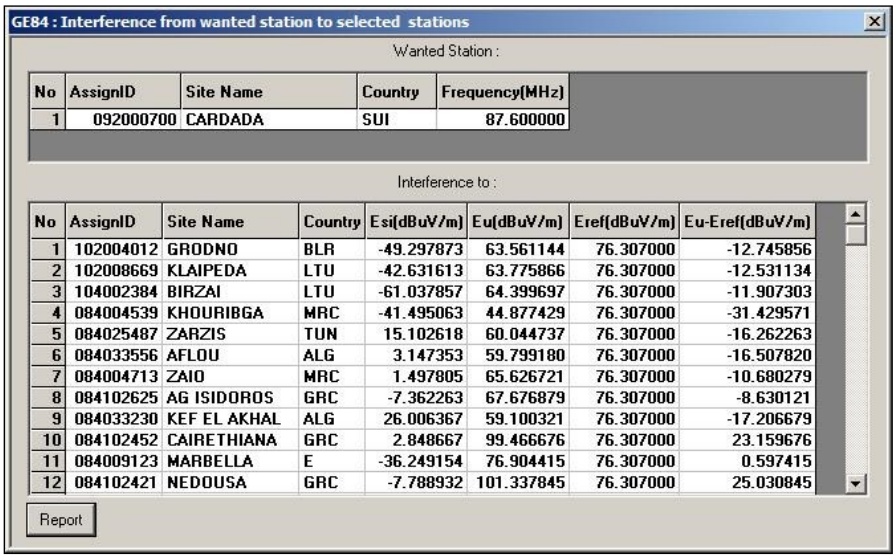


The information displayed in the result spreadsheet can be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

- Interference to (Usable Fst): This item calculates the nuisance field strength to the locations of GE84 FM sound broadcasting stations, situated inside a specified circular area and within a given frequency range, from a selected FM sound broadcasting station. After selecting this item, a list of countries is presented in a dialogue box to allow selection of the country where the (interfering) FM sound broadcasting station is located (Figure 3.15a). Then, a spreadsheet is displayed listing all FM sound broadcasting stations (in conformity with GE84) located inside the selected country. The user may select the concerned (interfering) station by using a mouse left click on the record-select column of this spreadsheet. A dialogue box will be displayed for the user to specify the calculation parameters: the radius of circular area, search frequency range, time percentage and minimum acceptable field strength value. Once these have been determined, all FM sound broadcasting stations that meet the search criteria are listed in a spreadsheet from which users can select, by mouse left click on record select column, some, or all of them, for the next calculation step. As displayed in Figure 3.96, a check box is available on the list allowing the user to calculate effective height of antenna directly from the DEM map instead of loading an existing record from the database. When the OK button is pushed, calculation starts and the relevant progress bar is displayed.

  Finally, a result spreadsheet is displayed listing the stations identified as being interfered with by the wanted FM sound broadcasting station and showing: their country code, the field strength produced by wanted station (Esi), the aggregate field strength value (Eu) of all stations (including wanted station), reference usable field strength value (Eref) and value by which the reference usable field strength value is exceeded. Figure 3.102 displays a sample output of this interference calculation.

Figure 3.102. Field strength value produced by a wanted FM BC station to selected FM BC stations and aggregate field strength value at any selected FM BC station



No	AssignID	Site Name	Country	Frequency(MHz)
1	092000700	CARDADA	SUI	87.600000

No	AssignID	Site Name	Country	Esi(dBuV/m)	Eu(dBuV/m)	Eref(dBuV/m)	Eu-Eref(dBuV/m)
1	102004012	GRODNO	BLR	-49.297873	63.561144	76.307000	-12.745856
2	102008669	KLAIPEDA	LTU	-42.631613	63.775866	76.307000	-12.531134
3	104002384	BIRZAI	LTU	-61.037857	64.399697	76.307000	-11.907303
4	084004539	KHOURIBGA	MRC	-41.495063	44.877429	76.307000	-31.429571
5	084025487	ZARZIS	TUN	15.102618	60.044737	76.307000	-16.262263
6	084033556	AFLOU	ALG	3.147353	59.799180	76.307000	-16.507820
7	084004713	ZAIO	MRC	1.497805	65.626721	76.307000	-10.680279
8	084102625	AG ISIDOROS	GRC	-7.362263	67.676879	76.307000	-8.630121
9	084033230	KEF EL AKHAL	ALG	26.006367	59.100321	76.307000	-17.206679
10	084102452	CAIRETHIANA	GRC	2.848667	99.466676	76.307000	23.159676
11	084009123	MARBELLA	E	-36.249154	76.904415	76.307000	0.597415
12	084102421	NEDOUSA	GRC	-7.788932	101.337845	76.307000	25.030845

The information displayed in the result spreadsheets can be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

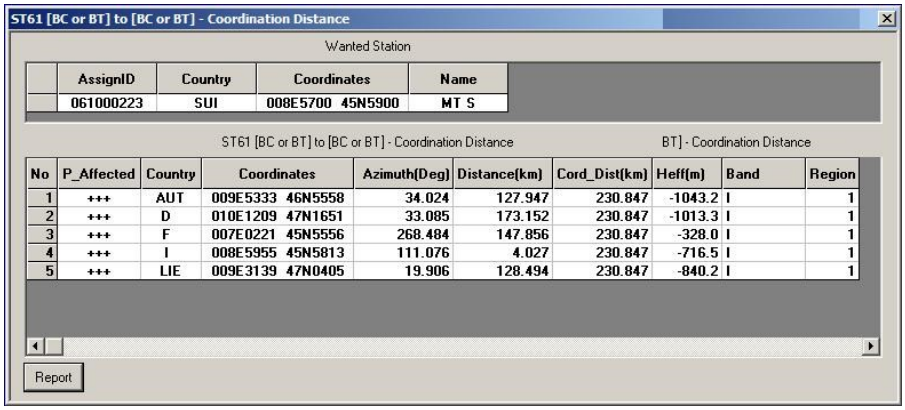
3.4.2.12.2. ST61 sub-menu of DEM view

This item can be used for the calculation of coordination distances from a wanted VHF sound or TV broadcasting station to the nearest point of the neighbouring countries which are in ST61 Plan, Rev. 2006 (Figure 3.8a). This item contains only one item with the following description:

- [BC, BT] 2 [BC, BT] (Cord. Distance): This item enables users to identify countries in the ST61 Plan (see ST61 area: Figure 3.8a), whose sound or TV broadcasting stations are likely to be affected by emissions from a sound or TV broadcasting station situated in another country of the ST61 plan. After selecting this item, a dialogue box (Figure 3.15a) is presented containing a list of countries that enables the user to select the country where the (interfering) broadcasting station is situated. Then, a spreadsheet is displayed listing all sound and TV broadcasting stations (in conformity with ST61) located inside the selected country. The user may select the concerned station, using a mouse left click on the record-select column of the spreadsheet, and proceed to the coordination distance calculation. As shown in Figure 3.96, a check box is available on the spreadsheet allowing the user to calculate the effective height of the antenna directly from the DEM map instead of loading the existing record from the database. If this check box used, the background DEM will be panned to the location of the selected station.

  Finally, a spreadsheet is displayed that contains a list of countries (Administrations), identified as likely to be affected, together with the azimuth and distance from their nearest border point to the wanted (interfering) station. The first row of this spreadsheet contains general information about the wanted broadcasting station. Figure 3.103 displays a sample output of the [BC, BT] 2 [BC, BT] coordination distance calculation. If no affected country is found, a message box will be displayed instead of the result dialogue box.

Figure 3.103. Result of coordination distance calculation for ST61 BC and ST61 BT station in respect to the ST61 BC and ST61 BT stations of other ST61 countries



The information displayed in the result spreadsheet may be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

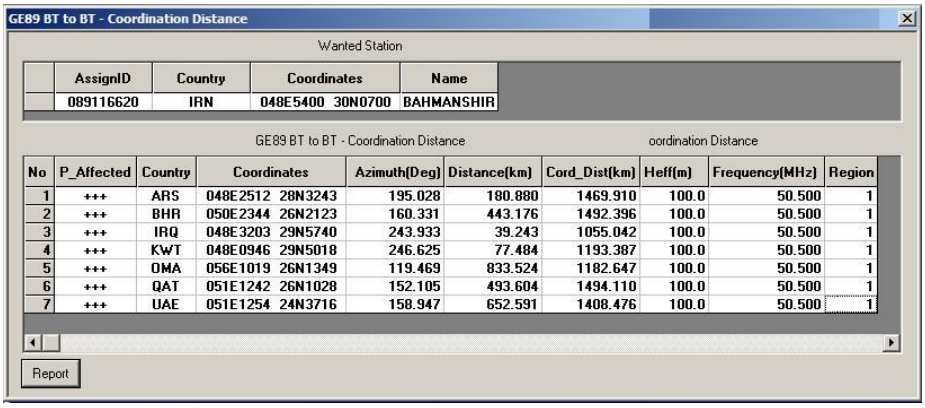
3.4.2.12.3. GE89 sub-menu of DEM view

This item has been developed to analyze different scenarios for coordination calculations, for TV broadcasting stations, in accordance with the GE89 plan, Rev 2006 (Figure 3.8c). The following sub-items are described under this item:

- BT2BT (Cord. Distance): This item identifies those countries in GE89 plan whose TV broadcasting stations are likely to be affected by emissions from a wanted TV broadcasting station situated inside another country. After selecting this item, a dialogue box (Figure 3.15a) presents a list of countries from which the user can select the country where the (interfering) TV broadcasting station is situated. Then, a spreadsheet displays a list of all TV broadcasting stations (in conformity with GE89 plan) situated inside the selected country. The (interfering) station may be selected from this list, using a mouse left click on the record-select column of the spreadsheet, and proceed to the coordination distance calculation. As displayed in Figure 3.96, a check box is available on the list enabling the user to calculate effective height of the antenna directly from the DEM map instead of loading the existing record from database. If this check box used, the background DEM will be panned to the location of selected station.

  Finally, a spreadsheet is displayed, containing a list of countries (Administrations), identified as likely to be affected, together with the azimuth and distance from their nearest border point to the wanted (interfering) station. The first row of this spreadsheet contains the general information about the wanted (interfering) TV broadcasting station. Figure 3.104 displays a sample output of the BT2BT coordination distance calculation.

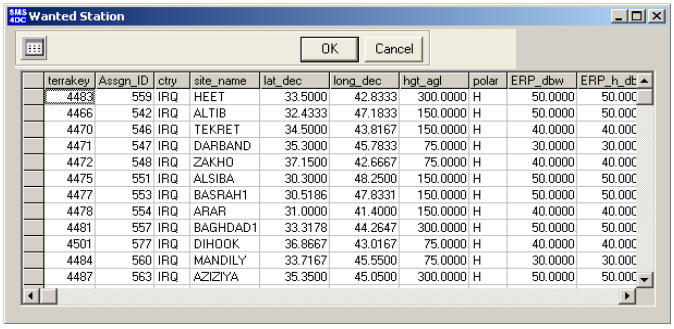
Figure 3.104. Result of coordination distance calculation for a wanted GE89 TV station in respect to the TV broadcasting stations of other countries



The information displayed in the result spreadsheets may be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

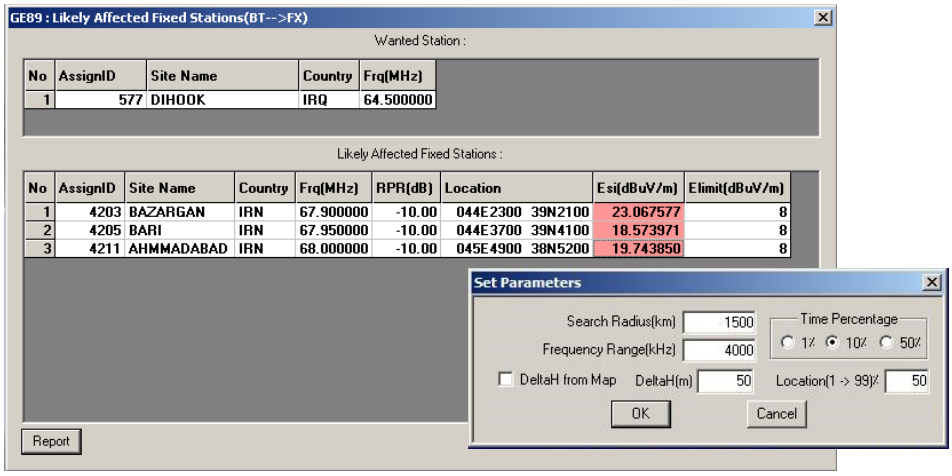
- BT2FX (Fst.): This item enables users to identify, in accordance with the GE89 plan, fixed stations that are likely to be affected by the TV broadcasting station of another country. The calculation requires values to be specified for the following parameters: the radius of the circular search area around the wanted (interfering) BT station, the frequency range and the percentage of time and locations. The technical criteria have been fully defined in GE89 plan. After choosing this item a dialogue box (Figure 3.15a) presents a list of countries from which the user can select the country where the (interfering) TV broadcasting station is situated. Then, a spreadsheet displays a list of all TV broadcasting stations (in conformity with GE89 plan) situated inside the selected country. The concerned station may be selected using a mouse left click on the record-select column of the spreadsheet. After this selection, a dialogue box will appear that enables entry of values for: the radius of the circular search area, search frequency range, time percentage, location percentage and terrain roughness (DeltaH). Once these values have been specified, a list of all fixed stations which meet these conditions is presented in a spreadsheet and users can select some or all of them for the next calculation step by a mouse left click on the record select column. As shown in Figure 3.96, a check box is available on the spreadsheet allowing the user to calculate effective height of the antenna directly from the DEM map instead of loading an existing record from the database. If this check box is used, the background DEM will be panned to the location of last selected station. Pressing the OK button starts the calculation and a progress bar is displayed.

Figure 3.105. Spreadsheet of broadcasting stations inside the selected country



Finally, the results are shown in a spreadsheet, which lists: the fixed stations identified, the field strength produced by wanted TV station (Esi), the relative protection ratio (RPR) and acceptable field strength value of interfering signal (Elimit). The top row of the result spreadsheet displays the general information about the wanted TV station. Figure 3.106 shows a sample output of this item after completion of the calculation. It should be noted that if the field strength produced by wanted TV station exceeds the acceptable field strength value of the interfering signal, it will be shown in red.

Figure 3.106. List of affected fixed stations around the wanted TV station in accordance with the GE89 plan

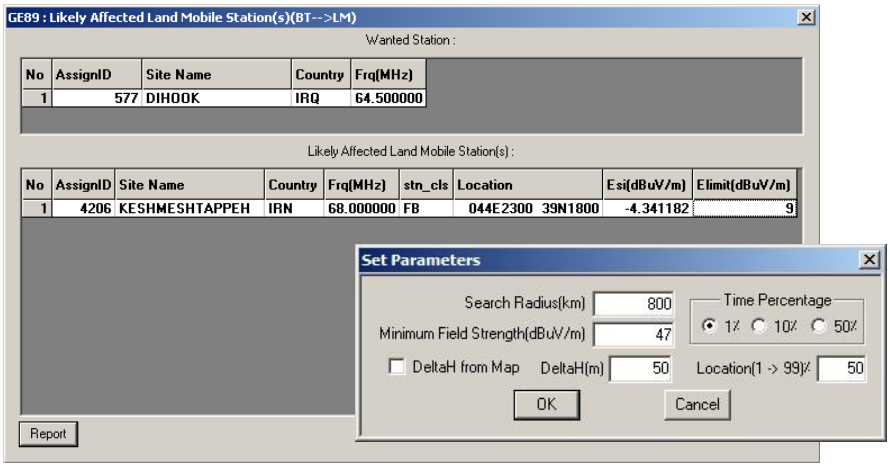


The information displayed in the result spreadsheets can be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

- BT2LM (Fst.): This item enables users to identify, in accordance with the GE89 plan, base stations and mobile stations in the land mobile service likely to be affected by a TV broadcasting station situated in another country. The calculation requires values to be specified for the following parameters: the radius of the circular search area around the wanted (interfering) BT station, the frequency range and the percentage of time and locations. The technical criteria have been fully defined in GE89 plan. After choosing this item a dialogue box (Figure 3.15a) presents a list of countries from which the user can select the country where the (interfering) TV broadcasting station is situated. Then, a spreadsheet displays a list of all TV broadcasting stations (in conformity with GE89 plan) situated inside the selected country. The concerned station may be selected using a mouse left click on the record-select column of the spreadsheet. After this selection, a dialogue box will appear that enables entry of values for: the radius of the circular search area, search frequency range, time percentage, location percentage and terrain roughness (DeltaH). Once these values have been specified, a list of all stations which meet these conditions is presented in a spreadsheet and users can select some or all of them for the next calculation step by a mouse left click on the record select column. As shown similar to in Figure 3.96, a check box is available on the spreadsheet allowing the user to calculate effective height of the antenna directly from the DEM map instead of loading an existing record from the database. If this check box is used, the background DEM will be panned to the location of last selected station. Pressing the OK button starts the calculation and a progress bar is displayed. Finally, the results are shown in a spreadsheet, which lists: the stations in land mobile service identified, the field strength produced by

wanted TV station (Esi), the relative protection ratio (RPR) and acceptable field strength value of interfering signal (Elimit). The top row of the result spreadsheet displays the general information about the wanted TV station. Figure 3.107 shows a sample output of this item after completion of the calculation. It should be noted that if the field strength produced by wanted TV station exceeds the acceptable field strength value of the interfering signal, it will be shown in red.

Figure 3.107. List of affected stations in land mobile service around the wanted TV station in accordance with the GE89 plan (No affected station detected in Figure)

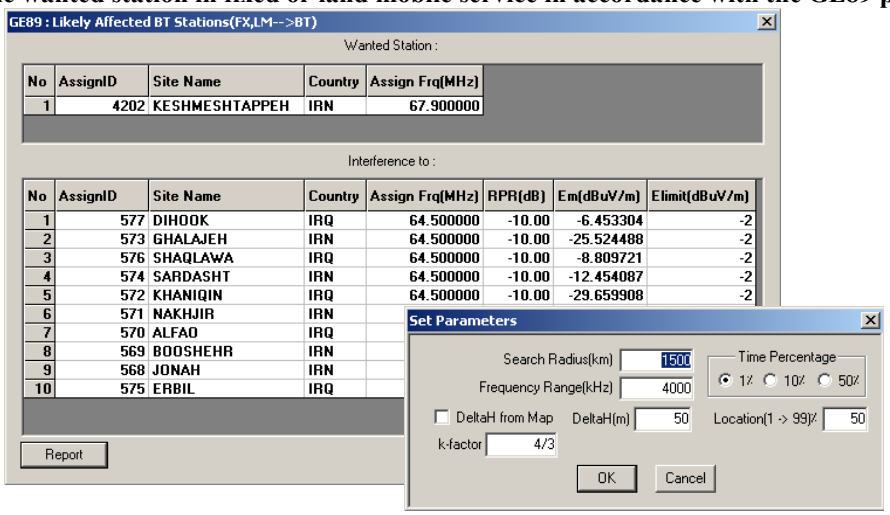


The information displayed in the result spreadsheets may be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

- [FX, LM]2BT (Fst.): This item enables users to identify, in accordance with the GE89 Plan, those TV broadcasting stations likely to be affected by stations in the land mobile or fixed services situated in another country. The calculation requires values to be specified for the following parameters: the radius of the circular search area around the wanted BT station, the frequency range and the percentage of time and locations. The technical criteria have been fully defined in GE89 plan. After choosing this item a dialogue box (Figure 3.15a) presents a list of countries from which the user can select the country where the fixed or land mobile station is situated. Then, a spreadsheet displays a list of all stations in Fixed or Land Mobile service situated inside the selected country. The concerned station may be selected using a mouse left click on the record-select column of the spreadsheet. After this selection, a dialogue box will appear that enables entry of values for: the radius of the circular search area, search frequency range, time percentage, location percentage and terrain roughness (DeltaH), k-factor and protection ratio. Once these values have been specified, a list of all TV broadcasting stations which meet these conditions is presented in a spreadsheet and users can select some or all of them for the next calculation step by a mouse left click on the record select column. Pressing the OK button starts the calculation and a progress bar is displayed. Finally, the results are shown in a spreadsheet, which lists: for each TV broadcasting station identified, country name, country code, protection ratio, the field strength produced by interferer station (Em) and tolerable field strength value of interfering signal (Elimit). The top row of the result spreadsheet displays the general information about the interferer station. Figure 3.108 shows a sample output of this item after completion of the calculation. It should be noted

that if the field strength produced by the interfering station exceeds the acceptable field strength value specified for the interfering signal, it will be shown in red.

Figure 3.108. List of affected TV stations in broadcasting service around the wanted station in fixed or land mobile service in accordance with the GE89 plan



The information displayed in the result spreadsheets may be saved in a file presented in a report-style with the HTML format by using “Report” push button.

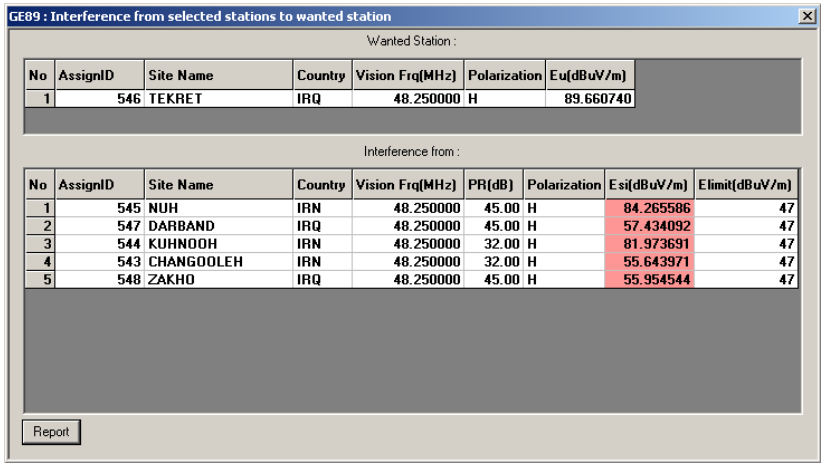
3.4.2.12.3.1. GE89 Interference sub-menu of DEM view

Under this sub-menu, different scenarios for interference calculations have been implemented for the broadcasting stations in the GE89 plan (Rev 2006). The items for this sub-menu are described below:

- Interference from (BT2BT) (Usable Fst.): This item calculates aggregate and nuisance field strength from selected TV broadcasting stations to a wanted GE89 TV broadcasting station. The procedure to identify the (interfering) BT stations for examination requires a search around the wanted BT station within a specified circular area and a given frequency range. After selecting this item, a dialogue box (Figure 3.15a) is presented containing a list of countries from which the user may select the country where the wanted BT station is situated. Then, a spreadsheet is displayed listing all TV broadcasting stations (in conformity with GE89 plan) situated inside the selected country will be listed in a spreadsheet. The wanted TV broadcasting station may be selected using a mouse left click on the record-select column of this spreadsheet and a dialogue box will appear enabling the user to specify values for: the radius of circular search area, the search frequency range, percentage of time and location, terrain roughness and minimum acceptable field strength. Once these values have been specified, a spreadsheet is displayed listing all TV broadcasting stations meeting the specified conditions. Users can select some or all of them for the next calculation step by a mouse left click on record select column. Similar to Figure 3.96, a check box is available on the list, allowing the user to calculate effective height of the antenna directly from the DEM map instead of loading an existing record from the database. If this check box is used, the background DEM will be panned to the location of the last selected station. When OK button is pushed, the calculation starts and a progress bar is displayed.

Finally, in a result spreadsheet, a list is displayed showing those TV stations exceeding the tolerable interference level, together with their country code, the field strength produced by each TV station on the wanted TV station (Esi), the protection ratio (PR) and acceptable field strength value of interfering signal (Elimit). The top row of the spreadsheet contains summary information about the wanted TV station. The aggregate field strength value (Eu) of all TV stations at the location of the wanted TV station is displayed. Figure 3.109 shows a sample output from this calculation item.

Figure 3.109. Interference of TV broadcasting stations, inside a given area within a frequency range, on a wanted TV broadcasting station in accordance with GE89



No	AssignID	Site Name	Country	Vision Frq(MHz)	Polarization	Eu(dBuV/m)
1	546	TEKRET	IRQ	48.250000	H	89.660740

No	AssignID	Site Name	Country	Vision Frq(MHz)	PR(dB)	Polarization	Esi(dBuV/m)	Elimit(dBuV/m)
1	545	NUH	IRN	48.250000	45.00	H	84.265586	47
2	547	DARBAND	IRQ	48.250000	45.00	H	57.434092	47
3	544	KUHNOOH	IRN	48.250000	32.00	H	81.973691	47
4	543	CHANGOOLEH	IRN	48.250000	32.00	H	55.643971	47
5	548	ZAKHO	IRQ	48.250000	45.00	H	55.954544	47

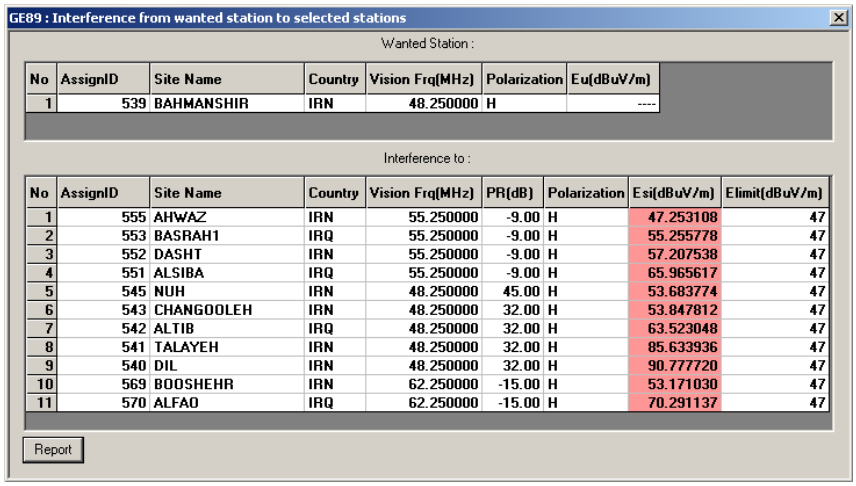
The information displayed in the result spreadsheets may be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

- Interference to (BT2BT) (Fst): This item calculates the nuisance field strength of a selected GE89 TV broadcasting station at the location of other GE89 TV broadcasting stations situated inside a circular area and within a given frequency range. After selecting this item, a dialogue box (Figure 3.15a), containing a list of countries, is presented to enable selection of the country where the concerned TV broadcasting station is situated. Then, a spreadsheet is presented listing all TV broadcasting stations (in conformity with GE89) situated inside the selected country and users may select the concerned station, using a mouse left click on the record-select column of this spreadsheet. When the wanted TV broadcasting station has been selected, a dialogue box will appear requesting the user to specify: the radius of the circular area, the search frequency range, time percentage and minimum acceptable field strength value. Once these values have been specified, a spreadsheet is presented listing all TV broadcasting stations meeting the search conditions. The user may select some or all of them for the next calculation step by a mouse left click on the record select column. As displayed in Figure 3.96, a check box is available on the spreadsheet allowing the user to calculate effective height of the antenna directly from the DEM map instead of loading an existing record from the database. When the OK button is pushed, the calculation starts and a progress bar is displayed.

  Finally, the result spreadsheet displays a list of those stations which have interference from the wanted TV broadcasting station; together with their country code, the field strength produced by the wanted station (Esi), the protection ratio (PR) and the acceptable

field strength value (Elimit). Figure 3.110 shows a sample output of this interference calculation. The field "Eu" is not in use.

Figure 3.110. Interference from wanted TV broadcasting station on other TV broadcasting stations inside a given area and within a given frequency range



GE89 : Interference from wanted station to selected stations

Wanted Station :

No	AssignID	Site Name	Country	Vision Frq(MHz)	Polarization	Eu(dBuV/m)
1	539	BAHMANSHIR	IRN	48.250000	H	----

Interference to :

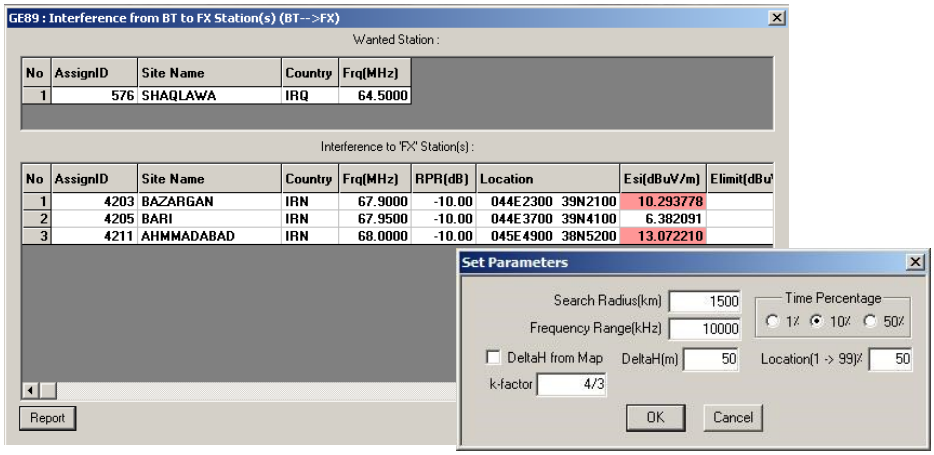
No	AssignID	Site Name	Country	Vision Frq(MHz)	PR(dB)	Polarization	Esi(dBuV/m)	Elimit(dBuV/m)
1	555	AHWAZ	IRN	55.250000	-9.00	H	47.253108	47
2	553	BASRAH1	IRQ	55.250000	-9.00	H	55.255778	47
3	552	DASHT	IRN	55.250000	-9.00	H	57.207538	47
4	551	ALSIBA	IRQ	55.250000	-9.00	H	65.965617	47
5	545	NUH	IRN	48.250000	45.00	H	53.683774	47
6	543	CHANGOOLEH	IRN	48.250000	32.00	H	53.847812	47
7	542	ALTIB	IRQ	48.250000	32.00	H	63.523048	47
8	541	TALAYEH	IRN	48.250000	32.00	H	85.633936	47
9	540	DIL	IRN	48.250000	32.00	H	90.777720	47
10	569	BOOSHEHR	IRN	62.250000	-15.00	H	53.171030	47
11	570	ALFAO	IRQ	62.250000	-15.00	H	70.291137	47

Report

The information displayed in the result spreadsheets may be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

- BT2FX (Fst.): This item enables users to calculate interference, in accordance with the GE89 Plan, from a wanted TV broadcasting station to those point-to-point links situated inside a circular area around the concerned TV station, within a given frequency range, in a given percentage of time and location, taking into consideration antenna radiation patterns of receivers and transmitter. The technical criteria have been fully defined in GE89 plan. After choosing this item, a list of countries is presented in a dialogue box (Figure 3.15a), enabling selection of the country where the concerned TV broadcasting station is situated. Then, a spreadsheet will be displayed listing all TV broadcasting stations (in conformity with GE89 plan) situated inside the selected country and the user may select the concerned station, using a mouse left click on the record-select column of spreadsheet. When the wanted TV broadcasting stations has been selected, a dialogue box will appear enabling the user to specify values for: the radius of the circular search area, the search frequency range, time percentage, location percentage, terrain roughness (DeltaH) and k-factor. Once these values have been specified, a list of all point-to-point links which meet the conditions is presented in a spreadsheet and the user may select some or all of them for next calculation step by a mouse left click on the record select column. When the OK button is pushed, the calculation starts and a progress bar is displayed.Finally, the result spreadsheet is displayed, listing the calculation results for all selected point-to-point links; together with their country code, relative protection ratio (RPR), the field strength produced by wanted TV station (Esi) and tolerable field strength value of interfering signal (Elimit). The first row of the spreadsheet contains a summary of information about the wanted TV station. Figure 3.111 displays a sample output of this calculation item

Figure 3.111. Interference from wanted TV broadcasting station on point-to-point links and dialogue box of calculation parameter

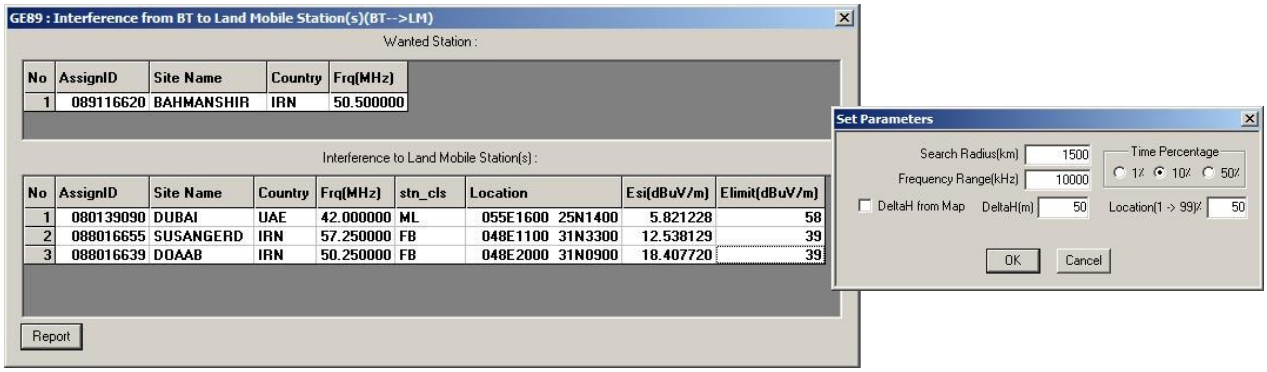


The information displayed in the result spreadsheets may be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

- BT2LM (Fst.): This item enables the user to calculate interference, in accordance with the GE89 Plan, from a wanted TV broadcasting station to those stations in the land mobile service situated inside a circular area around the interferer station, within a given frequency range, in a given percentage of time and location and taking into consideration the BT station's antenna radiation pattern. The technical criteria have been fully defined in GE89 plan. After choosing this item, a list of countries is presented in a dialogue box (Figure 3.15a) enabling the user to select the country where the concerned TV broadcasting station is situated. Then, all TV broadcasting stations (in conformity with GE89 plan) located inside the selected country will be listed in a spreadsheet and the user may select the concerned station, using a mouse left click on the record-select column. After selecting the wanted TV broadcasting station, a dialogue box will appear for the user to enter values for: the radius of circular search area, search frequency range, time percentage, location percentage and terrain roughness (DeltaH). Once these values have been specified, a list of all stations which meet the conditions is listed in a spreadsheet and the user may select some or all of them for next calculation step by a mouse left click on the record select column. When the OK button is pushed, the calculation starts and a progress bar is displayed

  Finally, a result spreadsheet displays the calculation results for all selected stations in the land mobile service, together with their country code, the field strength produced by wanted TV station (Esi) and tolerable field strength value of interfering signal (Elimit). The top row of the spreadsheet contains a summary of information about the wanted TV station. Figure 3.112 displays a sample output of this calculation item.

Figure 3.112. Interference from wanted TV broadcasting station on stations in land mobile service and dialogue box of calculation parameter

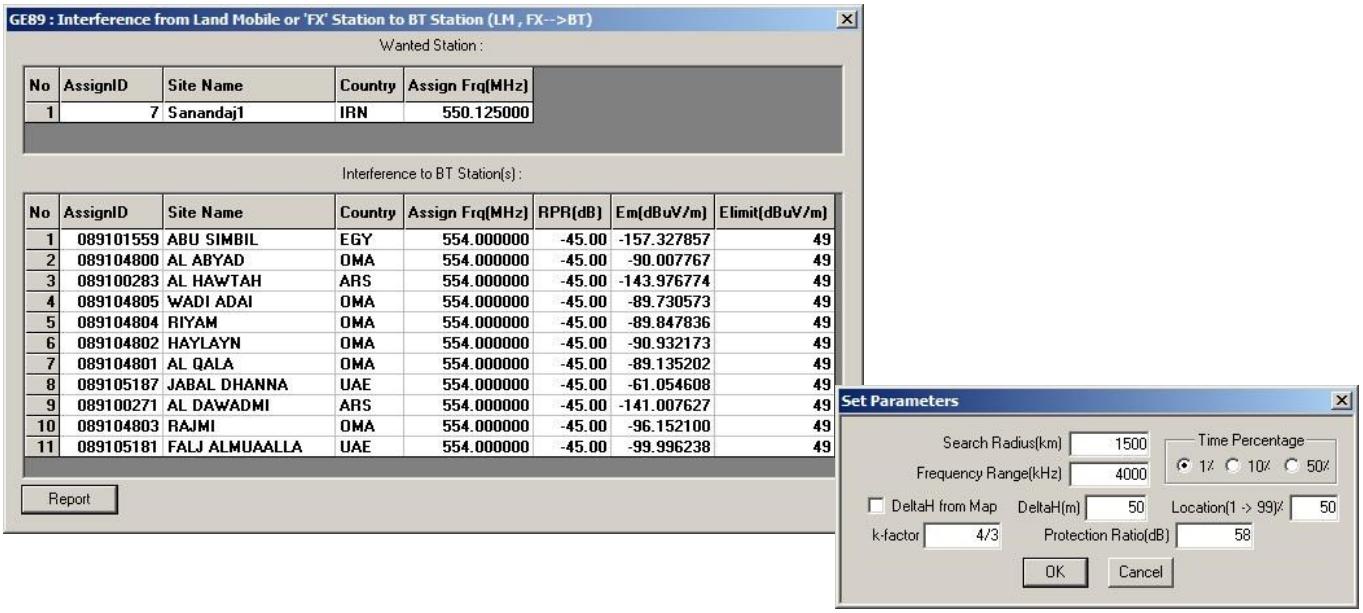


The information displayed in the result spreadsheets can be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

- [FX, LM]2BT (Fst.): This item enables users to calculate, in accordance with the GE89 Plan, the interference from a wanted station in the Fixed or Land Mobile service to those TV broadcasting stations inside a circular area around the interferer station, within a given frequency range, at a given percentage of time and locations. The technical criteria have been fully defined in GE89 plan. After choosing this item, all stations in the Fixed or Land Mobile service are listed in a spreadsheet and the user is able to select the concerned station, using a mouse left click on the record-select column. When the wanted station in Fixed or Land Mobile service has been selected, a dialogue box will appear, enabling the user to enter values for: the radius of circular search area, search frequency range, time percentage, location percentage, terrain roughness (DeltaH), k-factor and protection ratio. Once these values have been specified, all TV broadcasting stations which meet the conditions are listed in a spreadsheet and the user may select some or all of them for the next calculation step by a mouse left click on the record select column. When the OK button is pushed, the calculation starts and a progress bar is displayed.

  Finally, the result spreadsheet displays a list of stations in the Fixed or Land Mobile service with an analysis of their interference to selected TV broadcasting stations. For each TV broadcasting station the following information is displayed in a spreadsheet: Country name, country code, protection ratio, the field strength produced by interferer station (Em) and tolerable field strength value of interfering signal (Elimit). The first row of this spreadsheet contains summary information about the interferer station. Figure 3.113 displays a sample output of this calculation item.

Figure 3.113. Interference caused by interferer station in the Fixed or Land Mobile service to stations in the TV Broadcasting service and the dialogue box of calculation parameters



GE89 : Interference from Land Mobile or 'FX' Station to BT Station (LM , FX-->BT)

Wanted Station :

No	AssignID	Site Name	Country	Assign Frq(MHz)
1	7	Sanandaj1	IRN	550.125000

Interference to BT Station(s) :

No	AssignID	Site Name	Country	Assign Frq(MHz)	RPR(dB)	Em(dBuV/m)	Elimit(dBuV/m)
1	089101559	ABU SIMBIL	EGY	554.000000	-45.00	-157.327857	49
2	089104800	AL ABYAD	OMA	554.000000	-45.00	-90.007767	49
3	089100283	AL HAWTAH	ARS	554.000000	-45.00	-143.976774	49
4	089104805	WADI ADAI	OMA	554.000000	-45.00	-89.730573	49
5	089104804	RIYAM	OMA	554.000000	-45.00	-89.847836	49
6	089104802	HAYLAYN	OMA	554.000000	-45.00	-90.932173	49
7	089104801	AL QALA	OMA	554.000000	-45.00	-89.135202	49
8	089105187	JABAL DHANNA	UAE	554.000000	-45.00	-61.054608	49
9	089100271	AL DAWADMI	ARS	554.000000	-45.00	-141.007627	49
10	089104803	RAJMI	OMA	554.000000	-45.00	-96.152100	49
11	089105181	FALJ ALMUAALLA	UAE	554.000000	-45.00	-99.996238	49

Report

Set Parameters

Search Radius(km) 1500

Frequency Range(kHz) 4000

Time Percentage: 1% 10% 50%

DeltaH from Map

DeltaH(m) 50

Location(1 -> 99)% 50

k-factor 4/3

Protection Ratio(dB) 58

OK Cancel

The information displayed in the result spreadsheets may be saved in a file presented in a report-style with the HTML format by using the “Report” push button.

3.4.2.12.4. GE06 sub-menu of DEM view

This item has been developed to analyse different scenarios of coordination and interference and perform calculations according to the GE06 Plan (Figure 3.8d) with respect to the broadcasting assignments (digital/analogue) or allotments as well as stations in the fixed and land mobile services. The sub-item functions under this menu are described below:

- BCBT2BCBT (Affected Admin): this item identifies those countries in GE06 Plan whose broadcasting services are likely to be affected by emissions from a wanted broadcasting assignment (digital/analogue) or allotment situated in another country. After choosing this item, all broadcasting assignments and allotments (in conformity with GE06 Plan) will be listed in a spreadsheet and the user may select, using a mouse left click on the record-select column of the spreadsheet, the assignment/allotment required for the coordination contour calculation. As displayed in Figure 3.114, a check box is available on the spreadsheet allowing the user, in appropriate cases, to calculate effective height of the antenna directly from the DEM map instead of loading an existing record from the database.

  All linked assignments and/or associated allotment for the wanted digital broadcasting assignment/allotment, based on its plan entry code, are considered by the software for calculation of the coordination contour. The technical criteria have been fully defined in the GE06 Plan.

  When the wanted broadcasting assignment/allotment selected, a dialogue box will appear to determine the k factor, search radius and azimuth step. The coordination contour is developed using equally spaced radials equal to azimuth step (1°/10°) apart, over 360° around the allotment/assignment, centred on a single reference point. The coordination contour is calculated for each radial by starting at a distance equal to search radius from the reference point. Calculation starts and relevant progress bar is displayed if OK button pushed.

  Finally, the list of countries (Administrations) likely to be affected which their national boundaries intersected with or enclosed by calculated coordination contour and the trigger field strength value are listed in a spreadsheet below the general information of wanted broadcasting assignment/allotment and its linked assignments and/or associated allotment. Figure 3.115 displays a sample output of BCBT2BCBT coordination contour calculation for identification of likely to be affected countries in respect to their broadcasting service.

Figure 3.114. Spreadsheet of broadcasting assignments or allotments

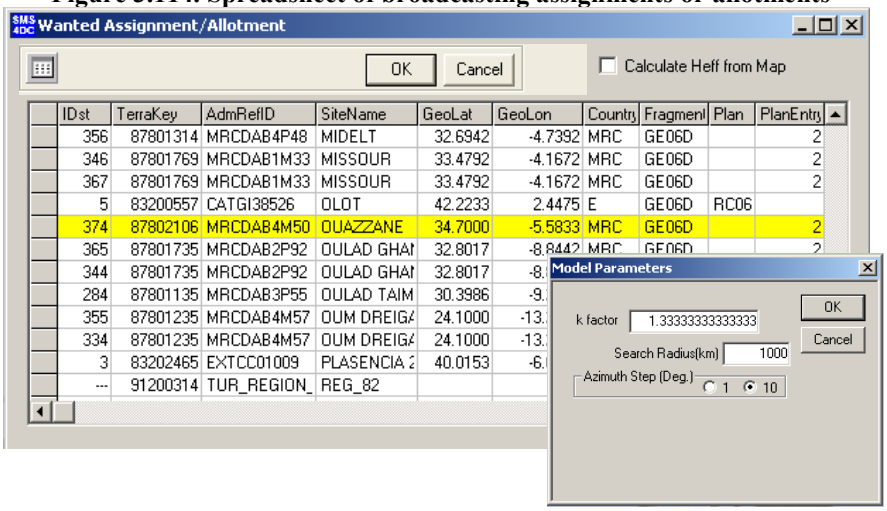
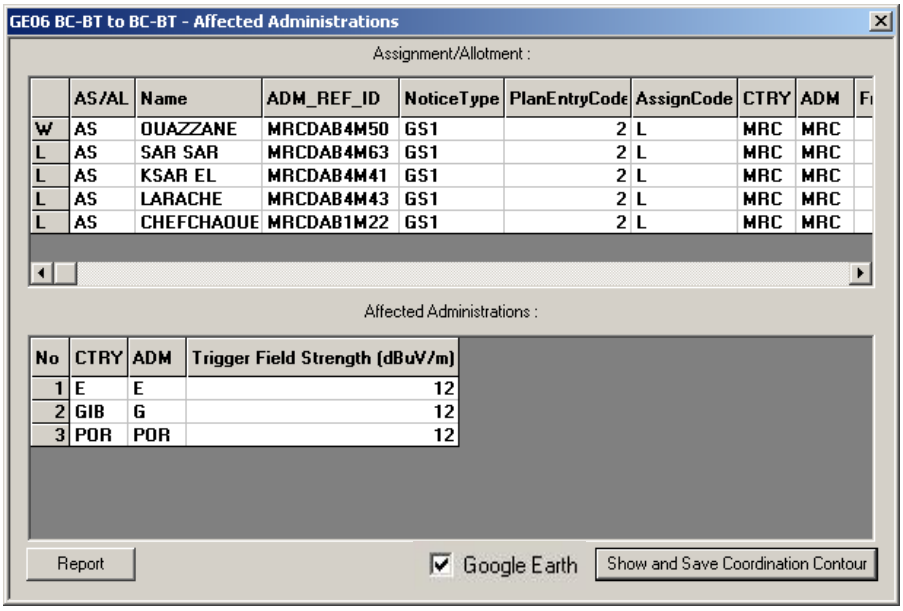


Figure 3.115. Result of identification of likely affected Administrations for a wanted GE06 assignment / allotment in respect to their broadcasting service



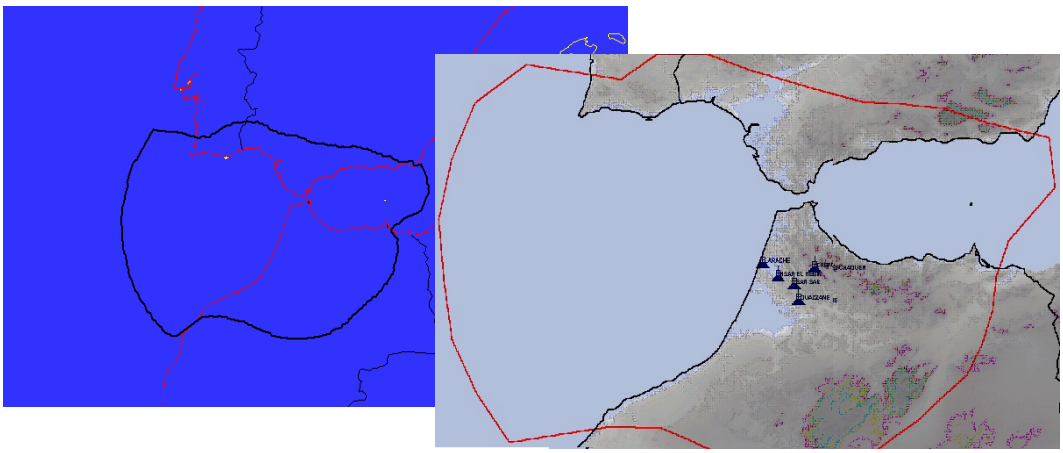
	AS/AL	Name	ADM_REF_ID	NoticeType	PlanEntryCode	AssignCode	CTRY	ADM
W	AS	OUAZZANE	MRCDAB4M50	GS1	2	L	MRC	MRC
L	AS	SAR SAR	MRCDAB4M63	GS1	2	L	MRC	MRC
L	AS	KSAR EL	MRCDAB4M41	GS1	2	L	MRC	MRC
L	AS	LARACHE	MRCDAB4M43	GS1	2	L	MRC	MRC
L	AS	CHEFCHAOUE	MRCDAB1M22	GS1	2	L	MRC	MRC

No	CTRY	ADM	Trigger Field Strength (dBuV/m)
1	E	E	12
2	GIB	G	12
3	POR	POR	12

The calculated coordination contour could be saved and drawn on DEM map by using "Show and Save Coordination Contour" push button as shown in Figure 3.116. In this case, software save the coordination contour in BDT_Soft\SMS4DC\Reports path with the file name of ADM-ADMREFID-BCBT2BCBT.txt which refers to administration and adm-ref-Id of wanted assignment/allotment. This vector can be redrawn from "Draw from File" function under the "Vector" menu on DEM or IDWM map. Also there is a check box named "Google Earth" which if is checked while clicking on "Show and Save Coordination Contour" button, displays the corresponding dialog box for creation and display the result contour file in Google Earth.

The information displayed in result spreadsheets can be reported in a file presented in a report-style with the HTML format by using "Report" push button.

Figure 3.116. Result of coordination contour calculation for a wanted GE06 assignment / allotment



- BCBT2FXLM (Affected Admin): Item enabling users to find likely to be affected Administrations which their stations in fixed and land mobile services are inside a coordination contour around a wanted broadcasting assignment/allotment within a frequency range or those that have frequency overlap with relevant broadcasting assignment/allotment. All broadcasting assignments and allotments (in conformity with GE06 Plan) will be listed in a spreadsheet and users could select the concerned assignment (digital/analogue) or allotment, using a mouse left click on the record-select column of spreadsheet, for proceeding of coordination contour calculation. As displayed in Figure 3.117, a check box is available on this spreadsheet to allow the user to calculate effective height of the antenna directly from the DEM map instead of loading the existing record from the database where appropriate.

  All linked assignments and/or associated allotment with wanted digital broadcasting assignment or allotment, based on its plan entry code, are considered by software for calculation of coordination contour. The technical criteria have been fully defined in GE06 Plan.

  When the wanted broadcasting assignment/allotment has been selected, a dialogue box will appear, for the user to specify: the k factor, search radius, azimuth step and frequency range or overlapping frequency option. The coordination contour is developed using equally spaced radials, equal to the azimuth step (1°/10°) apart, over 360° around the allotment/assignment, centred on a single reference point. The coordination contour is calculated for each radial by starting at a distance equal to the search radius from the reference point. The software considers all receiving stations/areas which have their frequencies in the identified frequency range, or if the frequency overlapping option is selected, it will take into account only those receiving stations/areas that have a frequency overlap with the relevant broadcasting assignment/allotment.

  Once values for the parameters have been entered into the dialogue box and "OK" is pressed, a spreadsheet list of unique trigger field strength values and their relevant receiving antenna heights are displayed (see Figure 3.118). These values have been extracted from the tables of trigger values in GE06 Plan and correspond with the receiving stations/areas located within the specified search radius. Users can select some or all of them for the next calculation step by a mouse left click on the record select column. When the OK button is pressed, the calculation starts and a progress bar is displayed.

Figure 3.117. Spreadsheet of broadcasting assignments/allotments

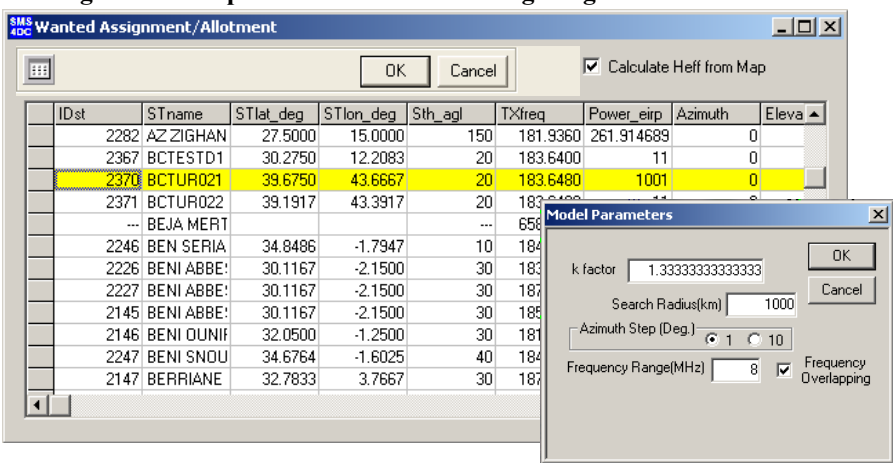
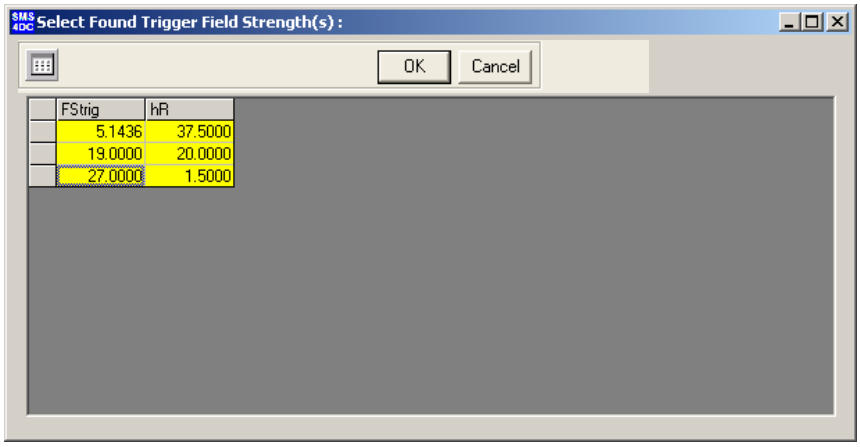
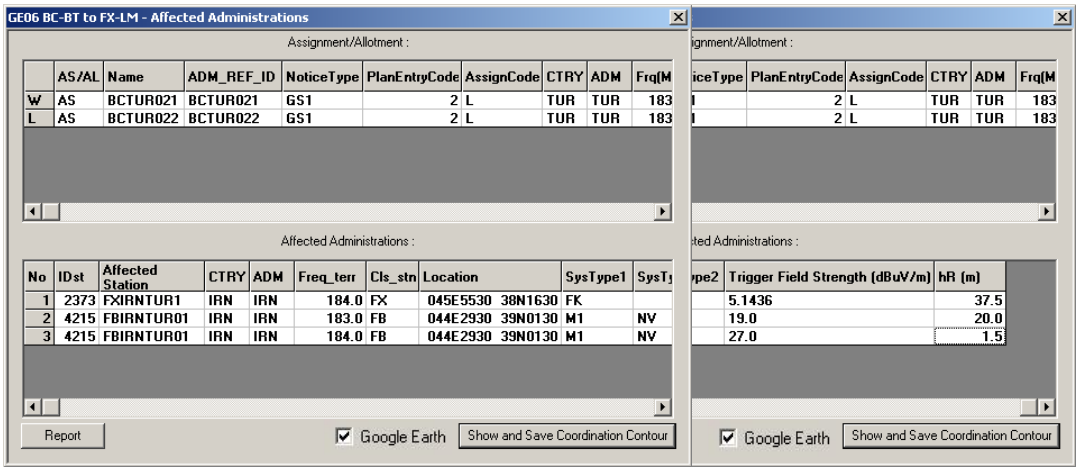


Figure 3.118. Spreadsheet of unique triggers values and their relevant receiving antenna heights



Finally, a spreadsheet ("Affected Administrations") lists the stations in the fixed and land mobile services that are likely to be affected because their location/receiving area intersects with, or is enclosed by, the calculated coordination contours. For each affected station, additional information is displayed, including: Country code, Administration code, the relevant trigger field strength value and receiving antenna height. The first row of this spreadsheet contains a summary of information about the wanted broadcasting assignment/allotment and its linked assignments and/or associated allotment. Figure 3.119 displays a sample output of the BCBT2FXLM coordination contours calculation for identification of countries whose stations in the fixed and land mobile services are likely to be affected.

Figure 3.119. Result of identification of likely affected Administrations for a wanted GE06 assignment/allotment in respect to their fixed and land mobile services

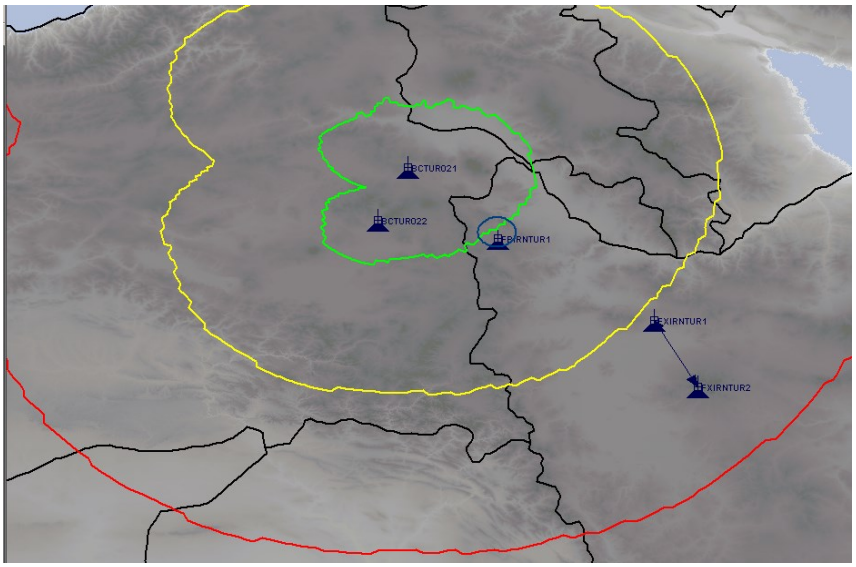


The calculated coordination contours may be saved and drawn on the DEM map by using the "Show and Save Coordination Contour" push button (see Figure 3.120). In this case, the coordination contours are saved in the BDT_Soft\SMS4DC\Reports path. The file name is in the format: [*ADM*]-[*ADMREFID*]-BCBT2FXLMX.txt to provide a unique reference to the administration and adm-ref-Id of the wanted assignment/allotment. This vector can be redrawn from "Draw from File" function under the "Vector" menu on DEM or IDWM map. Also there is a check box named "Google Earth" which if is checked

while clicking on "Show and Save Coordination Contour" button, displays the corresponding dialog box for creation and display the result contour file in Google Earth.

The information displayed in the result spreadsheets can be saved in a file presented in a report-style with the HTML format by using the “Report” push button.

Figure 3.120. Result of coordination contours calculation for a wanted GE06 assignment / allotment in respect to fixed and mobile stations



- FXLM2BCBT (Affected Admin): This item identifies Administrations whose broadcasting service is likely to be affected by a wanted station in the fixed or land mobile service situated inside another country. This item has two sub-items as follows:
- FXLM2BCBT (Affected Admin)/TX FXLM: This item enable users to identify those Administrations whose broadcasting service is likely to be affected by a wanted station in the fixed or land mobile service situated inside another country. The administrations with which coordination is required are identified by the coordination contour for the broadcasting service that intersects with, or encloses, the national boundaries of other administrations. In the case of typical or mobile stations each boundary test point of the service area boundary will be considered as a source of potential interference. The largest field strength obtained, at each calculation point under consideration, among all boundary test points, is taken as the value of field strength to be used. The technical criteria have been fully defined in GE06 Plan. All stations in the fixed and land mobile services (in conformity with GE06 Plan) will be listed in a spreadsheet and the user may select the concerned station, using a mouse left click on the record-select column of this spreadsheet. A check box added to the spreadsheet allows the user to calculate effective height of the antenna directly from the DEM map instead of loading an existing record from the database (see Figure 3.121). When the wanted station has been selected, a dialogue box will appear for the user to specify values for: the k factor, search radius and azimuth step. The coordination contour is developed using equally spaced radials, equal to azimuth step (1°/10°) apart, over 360° around the wanted station, centred on a single reference point. The coordination contour is calculated for each radial by starting at a distance equal to the search radius from the reference point. Once values for the

parameters have been specified and the OK button pushed, the calculation starts and a progress bar is displayed.

Finally, a result spreadsheet displays the list of affected Administrations, as well as the relevant trigger field strength and receiving antenna height. The first row of the spreadsheet displays a summary of information about the wanted station. Figure 3.122 shows a sample output of this calculation item.

Figure 3.121. Spreadsheet of stations in fixed and land mobile services

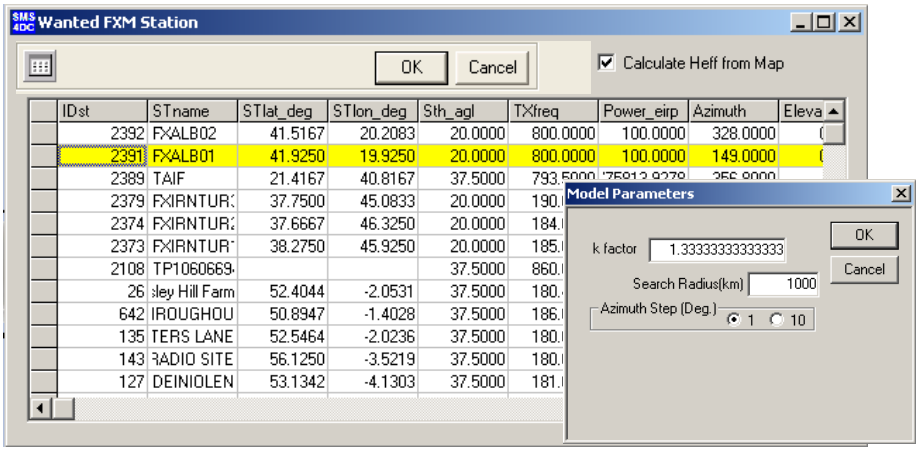
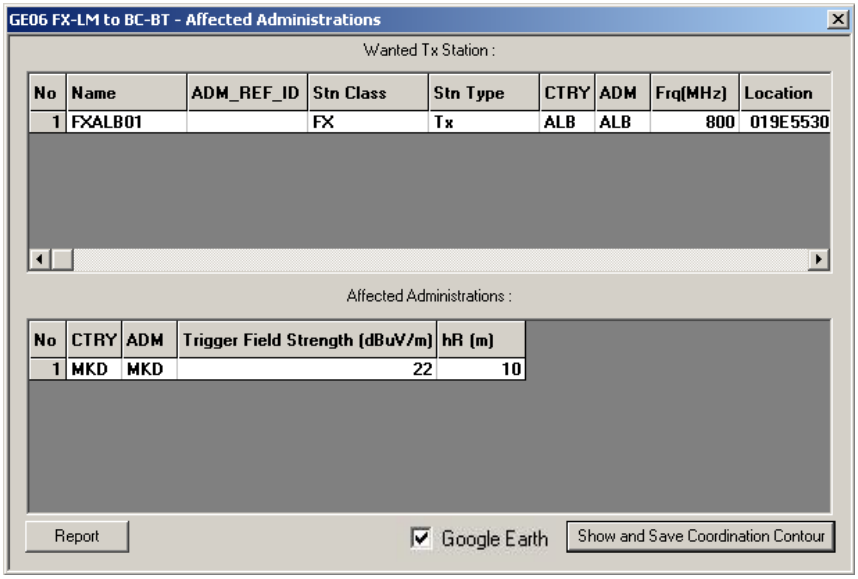


Figure 3.122. Result of identification of Administrations whose broadcasting service is likely to be affected by a wanted transmitting station in the fixed or land mobile service

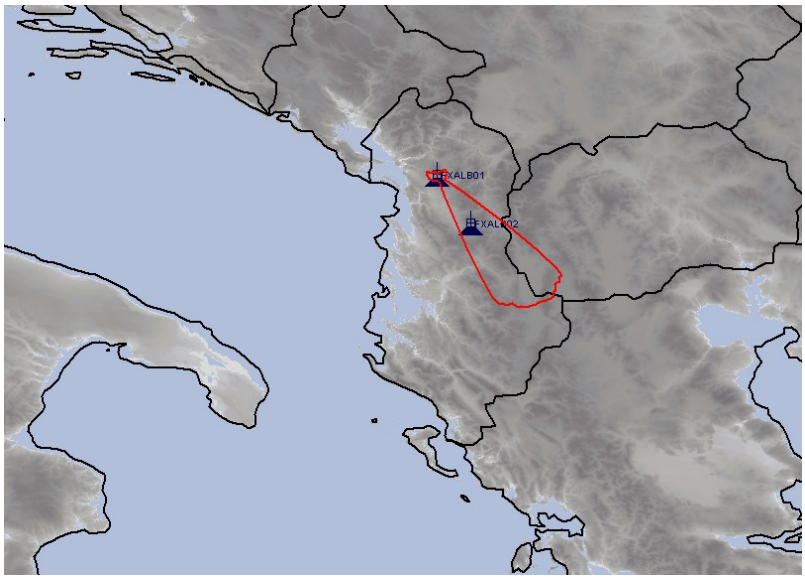


The calculated coordination contours may be saved and drawn on the DEM map by using "Show and Save Coordination Contour" push button as shown in Figure 3.123. In this case, the coordination contours are saved in the BDT_Soft\SMS4DC\Reports path. The file name is in the format: [*ADM*]-[*ADMREFID*]- FXLM2BCBT.txt to provide a unique reference to the administration and adm-ref-Id of the wanted assignment/allotment. This vector can be redrawn from "Draw from File" function under the "Vector" menu on DEM or IDWM map. Also there is a check box named "Google Earth" which if is checked

while clicking on "Show and Save Coordination Contour" button, displays the corresponding dialog box for creation and display the result contour file in Google Earth.

The information displayed in the result spreadsheets can be saved in a file presented in a report-style with the HTML format by using the “Report” push button.

Figure 3.123. Result of coordination contour calculation for a wanted transmitting station in fixed or land mobile service



The information displayed in the result spreadsheets may be saved in a file presented in a report-style with the HTML format by using the “Report” push button.

- FXLM2BCBT (Affected Admin)/RX FXLM: This item enables users to identify administrations whose receiving stations in the fixed or land mobile service are likely to be affected in respect to the broadcasting service. The administrations with which coordination is required are identified where their national boundaries are intersected or encloses by the coordination contour for the broadcasting service. The technical criteria have been fully defined in GE06 Plan. All stations in fixed and land mobile services (in conformity with GE06 Plan) will be listed in a spreadsheet and users may select the concerned station, using a mouse left click on the record-select column of the spreadsheet (see Figure 3.124). When the wanted station has been selected, a dialogue box will appear for the user to specify values for: the k factor, search radius and azimuth step. Also, there are some options for selection of the assumed transmitter BC/BT station and also consideration of the antenna discrimination of the fixed or land mobile receiving station. The coordination contour is developed using equally spaced radials equal to the azimuth step (1°/10°) apart, over 360° around the wanted station, centred on a single reference point. The coordination contour is calculated by placing the assumed broadcasting station, referred to above, at a distance equal to the search radius from the reference point and determining the field strength at the reference point. In the case of selection of an assumed analogue TV stations, the RPR value is considered in the calculation of the trigger values. Once values for the parameters have been specified, a list of unique trigger values and their relevant receiving antenna heights are displayed (see Figure 3.125). These values have been extracted from the tables of trigger values in GE06 Plan and correspond with the wanted receiving station/area. Users may select some or all of them

for the next calculation step by a mouse left click on record select column. When the OK button is pushed, the calculation starts and a progress bar is displayed.
Finally, a result spreadsheet displays the list of affected Administrations as well as relevant trigger field strength and receiving antenna height. The first row of this spreadsheet displays a summary of information about the wanted station. Figure 3.126 shows a sample output of this calculation item.

Figure 3.124. Spreadsheet of stations in fixed and land mobile services

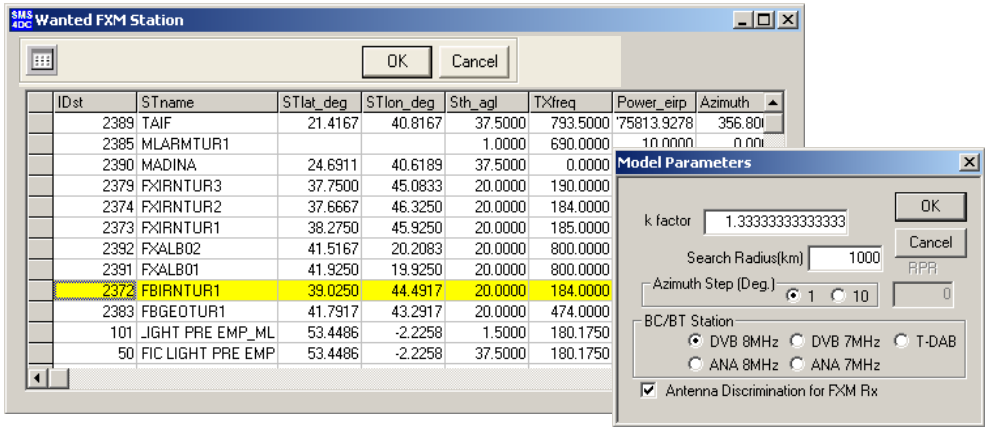


Figure 3.125. Spreadsheet of unique trigger values and their relevant receiving antenna heights

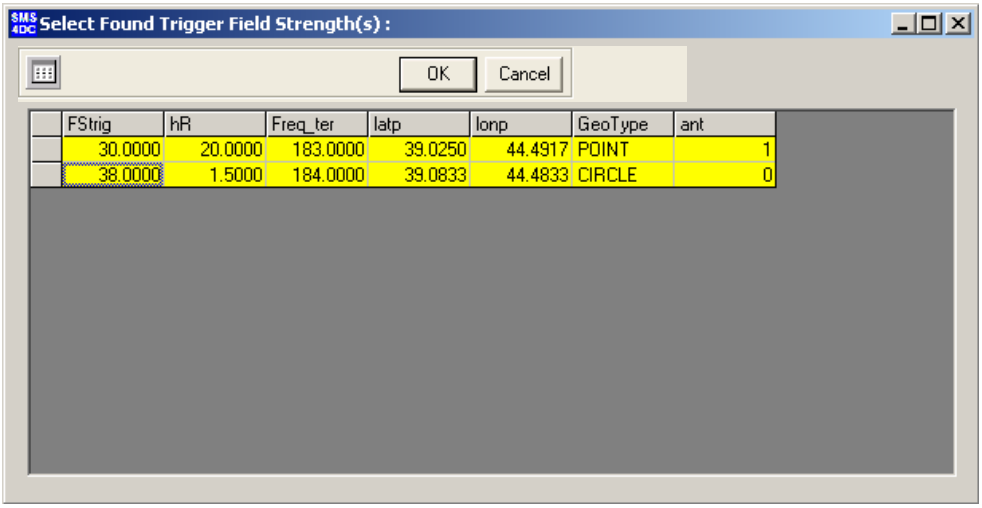
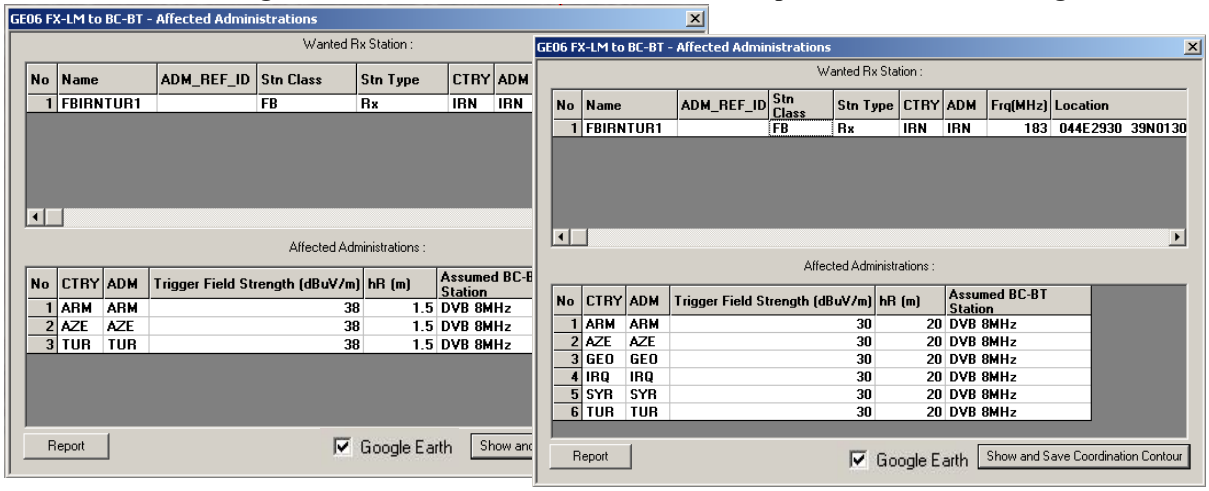


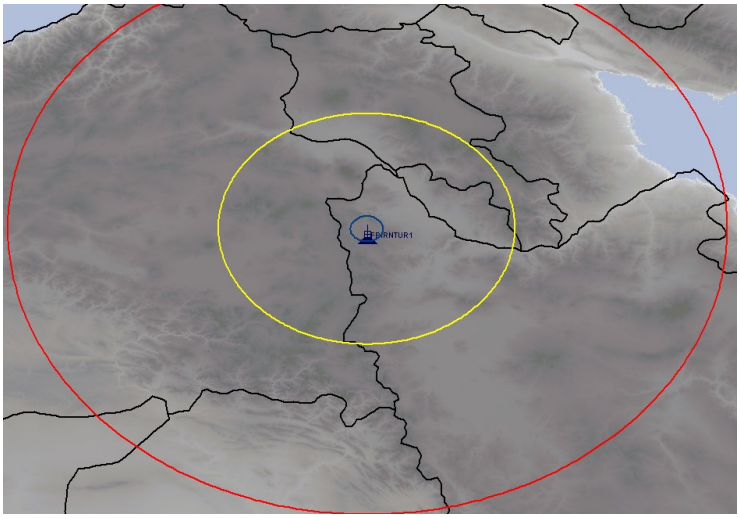
Figure 3.126. Result of identification of likely affected Administrations for a wanted receiving station in fixed or land mobile service in respect to their broadcasting service



The calculated coordination contours may be saved and drawn on DEM map by using "Show and Save Coordination Contour" push button (see Figure 3.127). In this case, the coordination contours are saved in the BDT_Soft\SMS4DC\Reports path. The file name is in the format: [*ADM*]-[*ADMREFID*]- FXLM2BCBT.txt to provide a unique reference to the administration and adm-ref-Id for the wanted assignment/allotment. This vector can be redrawn from "Draw from File" function under the "Vector" menu on DEM or IDWM map. Also there is a check box named "Google Earth" which if is checked while clicking on "Show and Save Coordination Contour" button, displays the corresponding dialog box for creation and display the result contour file in Google Earth.

The information displayed in the result spreadsheets can be saved in a file presented in a report-style with the HTML format by using the "Report" push button.

Figure 3.127. Result of coordination contour calculation for a wanted receiving station in fixed or land mobile service



- Coverage Area: This item calculates noise-limited and interference-limited coverage areas for a wanted broadcasting assignment. All assignments (digital/analogue) in the broadcasting service (in conformity with GE06 Plan) will be listed in a spreadsheet and the user may select the concerned assignment, using a mouse left click on the record-select column of spreadsheet (see Figure 3.128), a check box is available on this spreadsheet to allow the user to calculate effective height of the antenna directly from the DEM map instead of loading the existing record from the database. When the wanted assignment has been selected, a dialogue box will appear for the user to specify values for the location probability and the minimum median field strength. The default values have been extracted from the tables of the GE06 Plan, based on: Notice Type and Reference Plan Configuration/ Rx mode and system variant of the wanted assignment. There are also some options for selection of: search radius, frequency range, interference time percentage, environment and consideration of analogue plan, digital plan, stations in fixed and land mobile service and the antenna discrimination for calculation of interference-limited coverage area. Once the user has specified values for these parameters, or accepted the default values, the locations of the noise-limited coverage area are found, which represent the area that could be served if there was no interference. This area will be approximated on the basis of 36 radials. A vector-style dialogue box appears which enables the user to adjust line colour and style as well as fill style of the noise-limited contour. Similar to Figure 3.129, a spreadsheet lists all interferer stations/assignments/allotments that meet the conditions, and the user may select some or all of them for calculation of their interference-limited coverage area by a mouse left click on the record select column. When the OK button is pushed the calculation starts and a progress bar is displayed. Nuisance field strengths caused by the interfering stations/ assignments/ allotments are calculated at each of the noise-limited test points. All linked assignments and/or associated allotment with interfering digital broadcasting assignment/allotment, based on its plan entry code, are considered by the software for calculation of nuisance field strengths. The technical criteria have been fully defined in the GE06 Plan. Usable field strength is calculated for each of these test points and then the new coverage radius will be found on the bearing at which the field strength from the wanted station equals (or exceeds) the usable field strength. A vector-style dialogue box appears which enables the user to adjust line colour and style as well as fill style of the interference-limited contour. Finally, the noise-limited coverage area, as well as the interference-limited coverage area will be displayed on the DEM map (see Figure 3.130).

Figure 3.128. Spreadsheet of assignments in broadcasting service

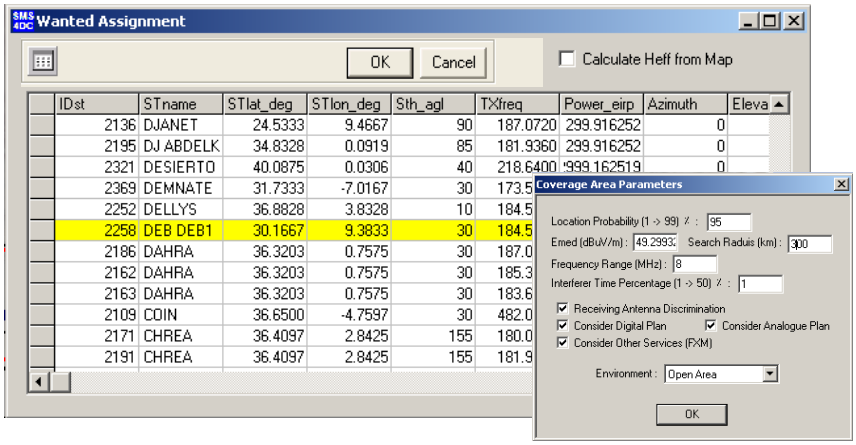
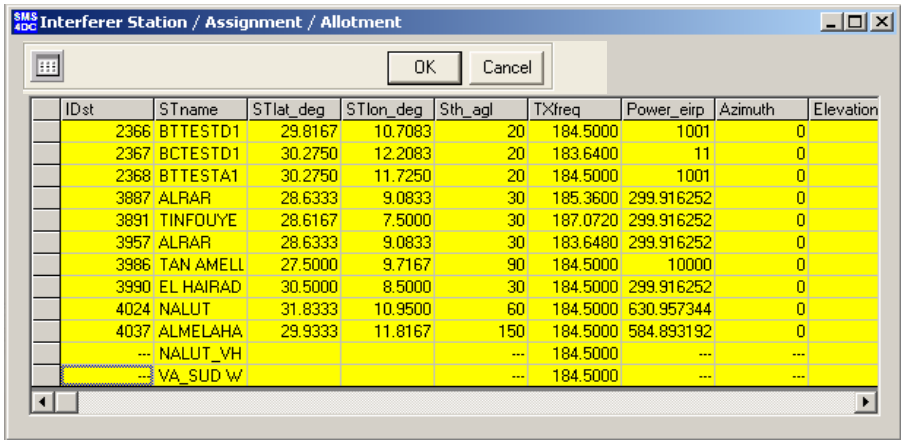
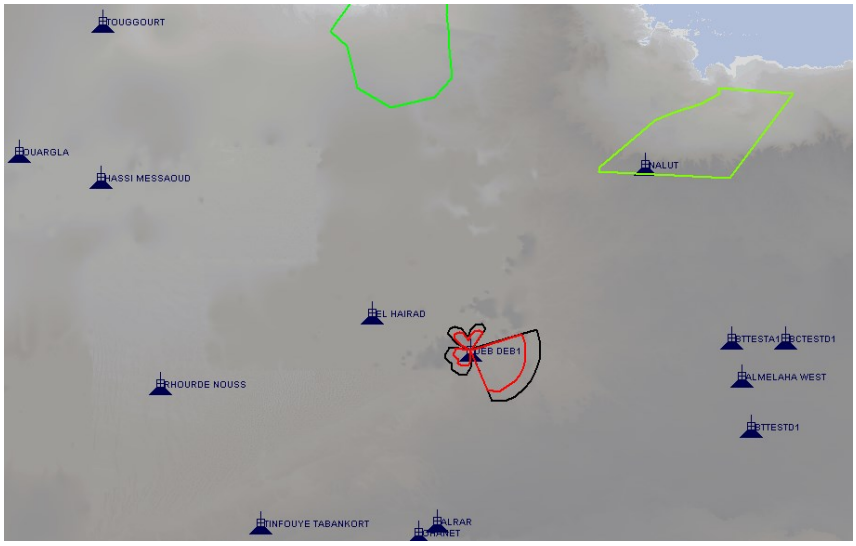


Figure 3.129. Spreadsheet of found interferer stations/assignments/allotments

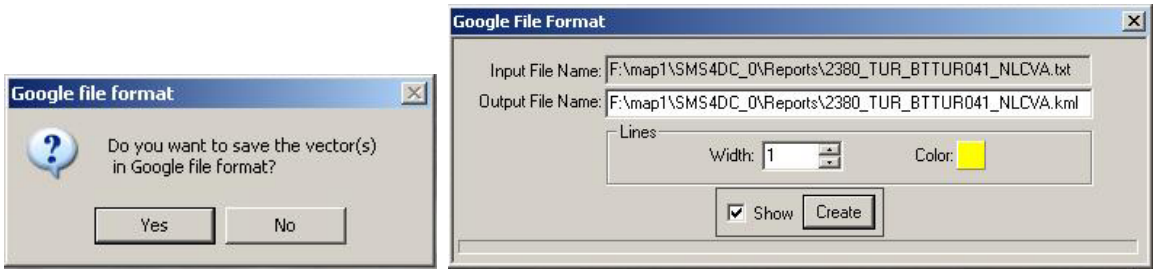


IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth	Elevation
2366	BTTESTD1	29.8167	10.7083	20	184.5000	1001	0	
2367	BCTESTD1	30.2750	12.2083	20	183.6400	11	0	
2368	BTTESTA1	30.2750	11.7250	20	184.5000	1001	0	
3887	ALRAR	28.6333	9.0833	30	185.3600	299.916252	0	
3891	TINFOUYE	28.6167	7.5000	30	187.0720	299.916252	0	
3957	ALRAR	28.6333	9.0833	30	183.6480	299.916252	0	
3986	TAN AMELL	27.5000	9.7167	90	184.5000	10000	0	
3990	EL HAIRAD	30.5000	8.5000	30	184.5000	299.916252	0	
4024	NALUT	31.8333	10.9500	60	184.5000	630.957344	0	
4037	ALMELAHA	29.9333	11.8167	150	184.5000	584.893192	0	
---	NALUT_VH			---	184.5000	---	---	
---	VA_SUD W			---	184.5000	---	---	

Figure 3.130. Result of calculation of noise-limited and interference-limited coverage area for a broadcasting assignment



The calculated noise-limited and interference-limited coverage areas will be saved in the BDT_Soft\SMS4DC\Reports path. The file names are in the format: IDst-ADM-ADMREFID-NLCVA.txt and IDst-ADM-ADMREFID-ILCVA.txt, respectively, to provide unique references for: station ID, Administration and adm-ref-Id of the wanted assignment. These vectors may be redrawn from "Draw from File" function under the "Vector" menu on the DEM or IDWM map. Also it is possible to create and display the result contour file(s) in Google Earth.



- Service Area: This item calculates service area test points for a wanted broadcasting assignment. A dialogue box will appear for the user to determine the assignment type as: New or Existing assignment, number of test points and possibility to limit service area to national boundary of wanted assignment. In the latter case, if the coverage radius crosses the national boundary, the test point in this area is located at the crossing point between a radial and the boundary. The user may also attach a user defined service area to the wanted assignment.

  In the case of a New Assignment (see Figure 3.131), the service area is calculated as noise-limited coverage area, but taking into account a required minimum median field strength which is augmented by a margin of 3 dB. All broadcasting assignments (in conformity with GE06 Plan) will be listed in a spreadsheet and users may select the concerned assignment (digital/analogue), using a mouse left click on the record-select column of the spreadsheet, and proceed to the service area test point calculation. When the wanted assignment has been selected, another dialogue box will appear for the user to determine the location probability and the minimum median field strength. The default values have been extracted from the tables of GE06 Plan based on: Notice Type and Reference Plan Configuration/Rx mode and system variant of the wanted assignment, as well as environment (similar to Figure 3.132). If the wanted assignment is an analogue station, the usable field strength (UFS) is also calculated and can be saved at each test point which may be required for calculation of interference. Finally, the service area test points will be displayed on DEM map (see Figure 3.133).

  Also it is possible to create and display the result contour file(s) in Google Earth.

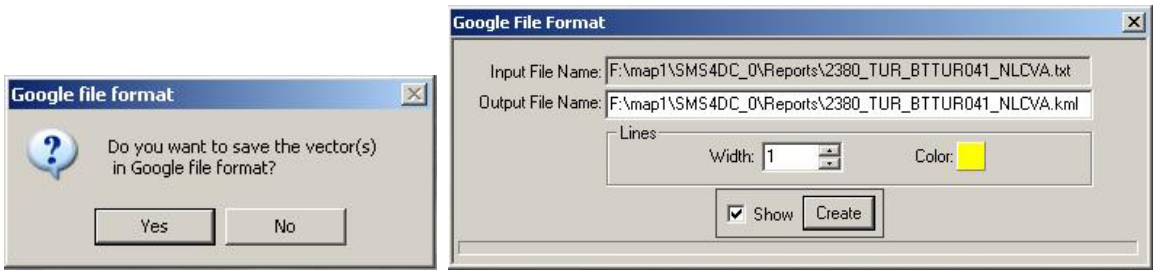


Figure 3.131. Dialogue box for determination of service area parameters

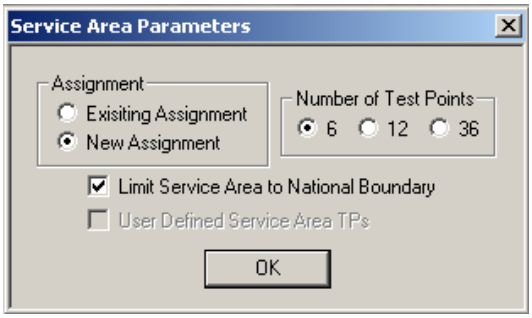


Figure 3.132. Spreadsheet of broadcasting assignments

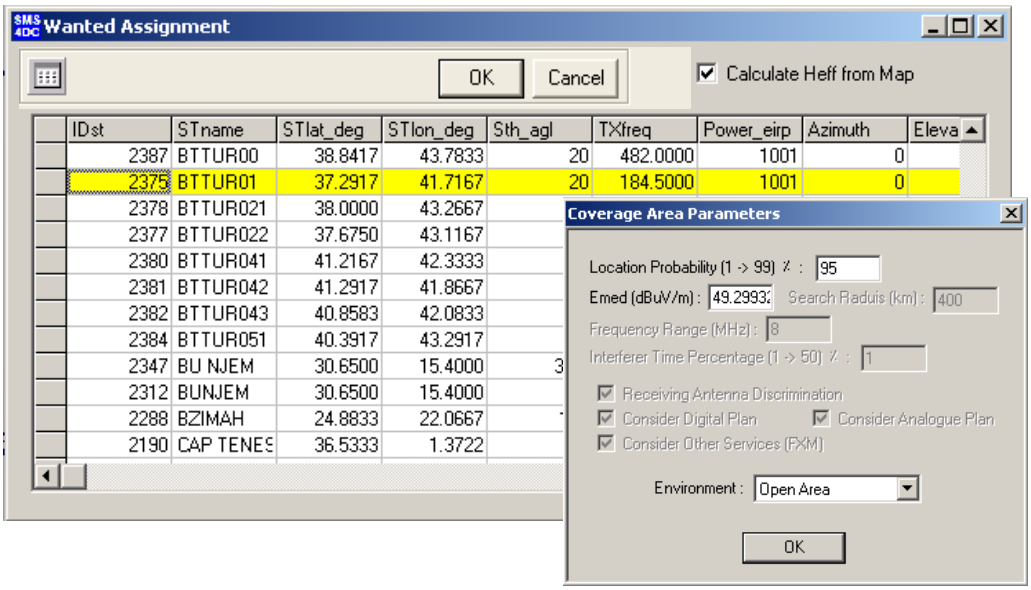
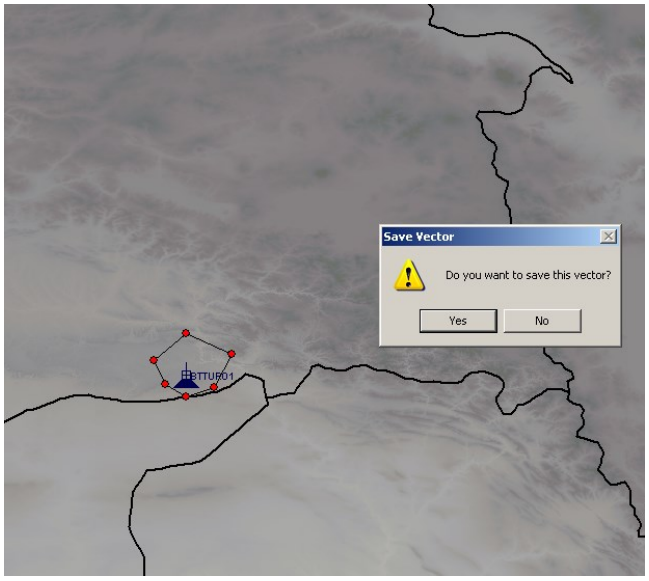


Figure 3.133. Result of calculation of service area test points for a broadcasting assignment



The calculated service area test points as well as the median field strength/usable field strength (in the case of analogue assignments) and wanted field strength value on each test point may be displayed by a mouse right click on the frequency level of a wanted assignment in the Administrative window (see Figure 3.142). In the case of an Existing Assignment (see Figure 3.134), the service area is calculated as an interference-limited coverage area. All broadcasting assignments (in conformity with GE06 Plan) will be listed in a spreadsheet and users may select the concerned assignment (digital/analogue), using a mouse left click on the record-select column of spreadsheet and proceed to the calculation of service area test points. When the wanted assignment has been selected, another dialogue box will appear for the user to specify: the location probability and the minimum median field strength. The default values have been extracted from the tables of the GE06 Plan, based on: Notice Type and Reference Plan Configuration/Rx mode and

system variant of the wanted assignment (similar to Figure 3.135). There are also some user options for selection of: search radius, frequency range, interference time percentage, environment and consideration of analogue plan, digital plan, stations in fixed and land mobile service and the antenna discrimination for calculation of the interference-limited coverage area. Similar to the Figure 3.136, the list of all interferer stations/assignments/allotments, meeting conditions, is listed in a spreadsheet from which users can select, by mouse left click on the record select column, some or all of them for calculation of the interference-limited coverage area. When the OK button is pushed the calculation starts and a progress bar is displayed. Nuisance field strengths caused by the interfering stations/assignments/allotments are calculated at each of the noise-limited test points. All linked assignments and/or associated allotment with interfering digital broadcasting assignment/allotment, based on its plan entry code, are considered by software for calculation of nuisance field strengths. The technical criteria have been fully defined in GE06 Plan. Usable field strength is calculated for each of these test points and then the new coverage radius will be found on the bearing at which the field strength from the wanted station equals (or exceed) the usable field strength. Finally, the service area test points will be displayed on the DEM map (see Figure 3.137).

Figure 3.134. Dialogue box for determination of service area parameters

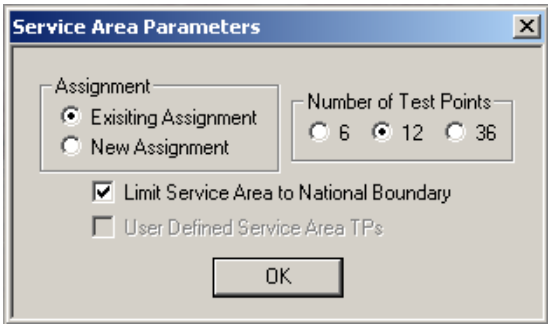


Figure 3.135. Spreadsheet of broadcasting assignments

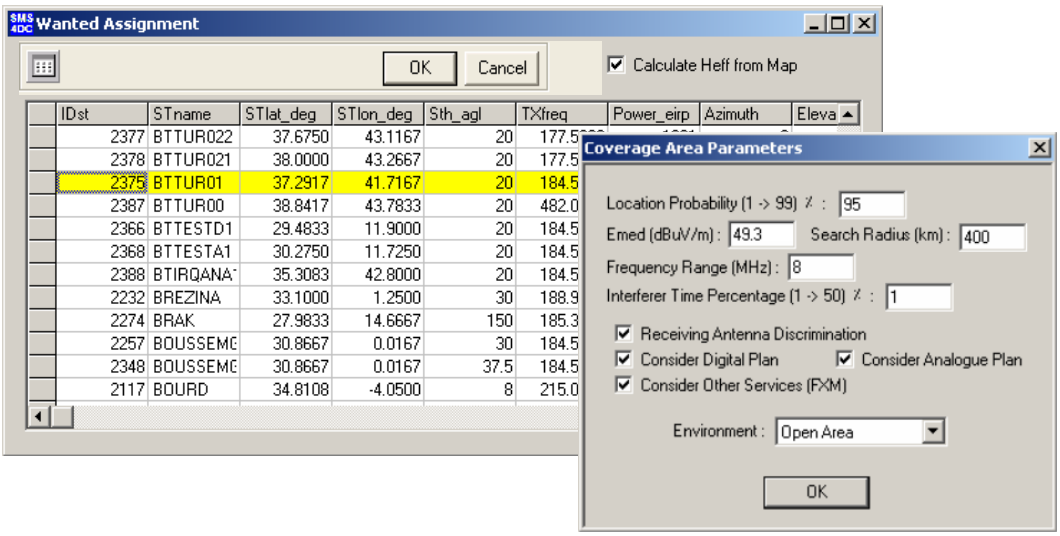


Figure 3.136. Spreadsheet of found interferer stations/assignments/allotments

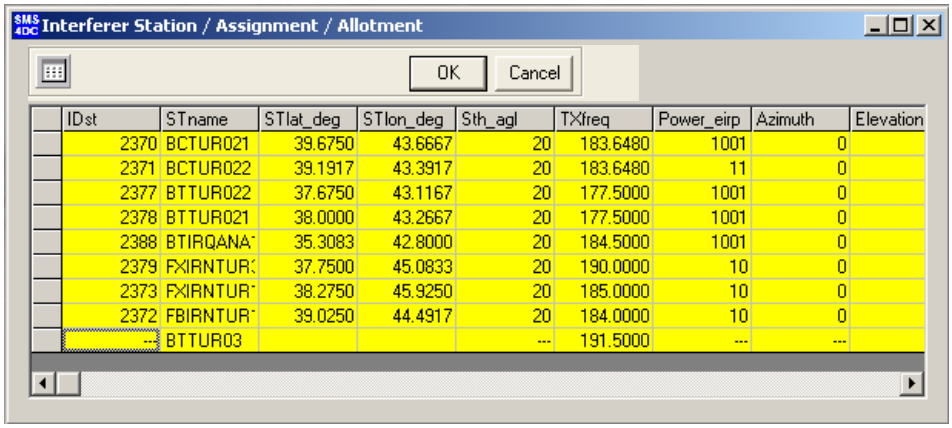
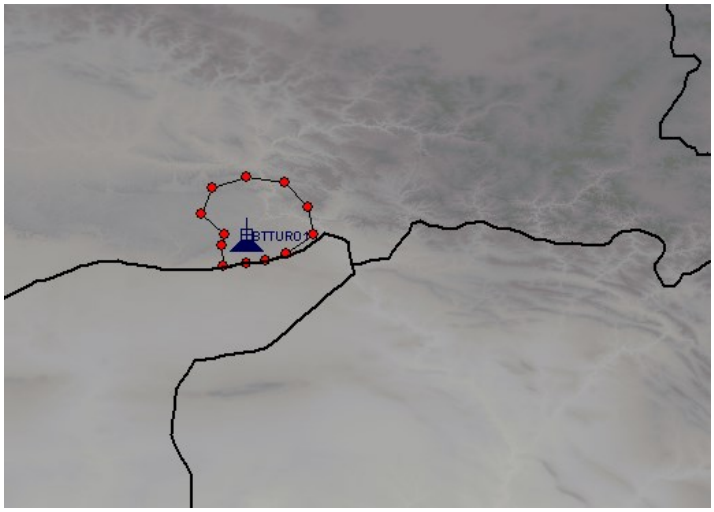


Figure 3.137. Result of calculation of service area test points for a broadcasting assignment



The calculated service area test points as well as the usable field strength and wanted field strength value on each test point may be displayed by a mouse right click on the frequency level of a wanted assignment in the Administrative window (see Figure 3.142).

In the case of User Defined Service Area, the user can attach a desired service area to the wanted assignment. As the first step, desired service area must be drawn on the map as a polyline (similar to Figure 3.138). After that, the option for selecting the "User Defined Service Area" in service area parameters will be active and user may select it (see Figure 3.139). All broadcasting assignments (in conformity with GE06 Plan) will be listed in a spreadsheet and users may select the concerned assignment (digital/analogue), using a mouse left click on the record-select column of this spreadsheet. When the wanted assignment has been selected, another dialogue box will appear for the user to determine environment (see Figure 3.140). If the wanted assignment is an analogue station, the usable field strength (UFS) is also calculated at each test point which may be required for calculation of interference by other functions. Finally, the service area test points will be displayed on the DEM map (see Figure 3.141).

Also it is possible to create and display the result contour file(s) in Google Earth.

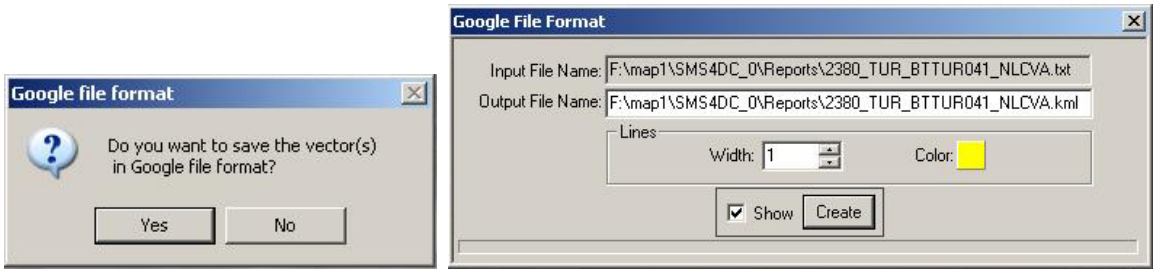


Figure 3.138. Desired service area should be drawn on map as a poly line

Figure 3.139. Dialogue box for determination of service area parameters

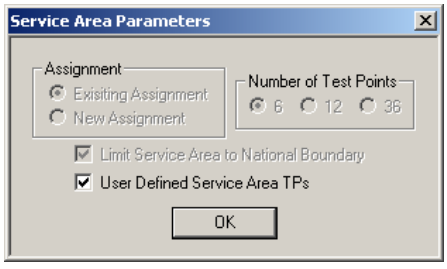


Figure 3.140. Spreadsheet of broadcasting assignments

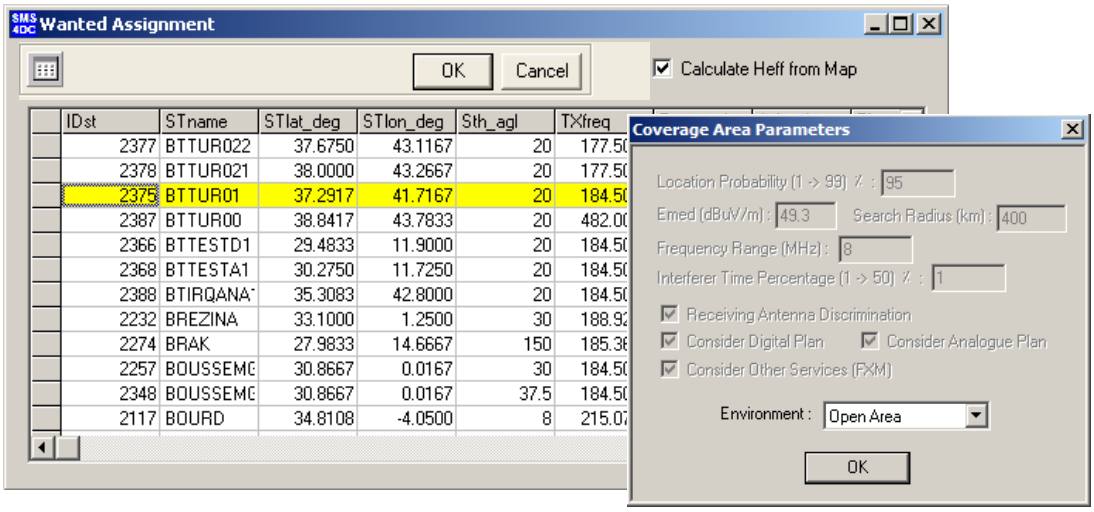
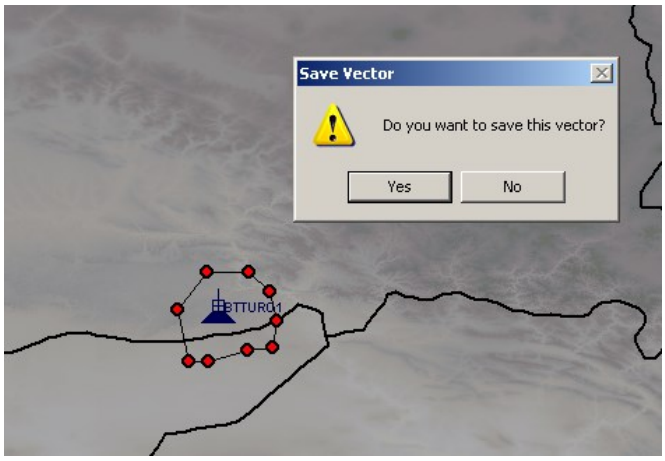
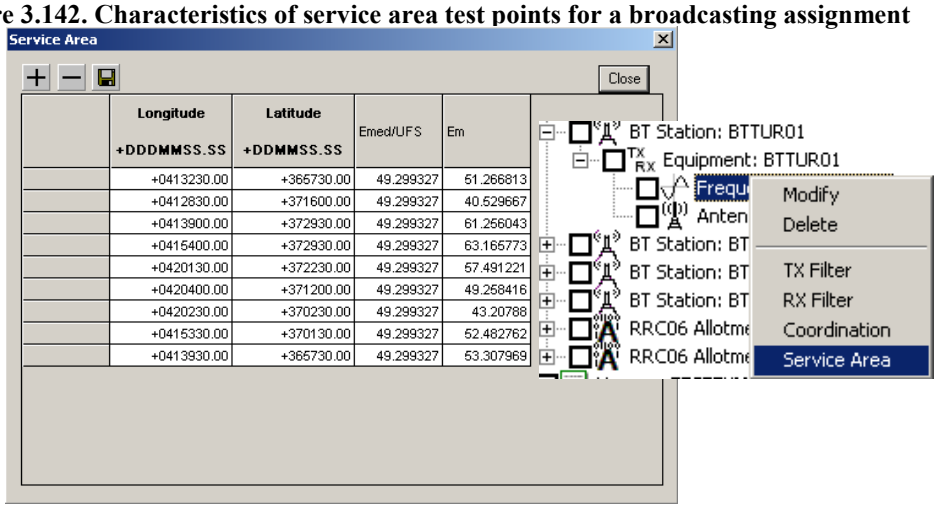


Figure 3.141. User defined service area test points for a broadcasting assignment



The calculated service area test points as well as the median field strength/usable field strength (in the case of analogue assignments) and wanted field strength value on each test point may be displayed by a mouse right click on the frequency level of a wanted assignment in the Administrative window (see Figure 3.142).

Figure 3.142. Characteristics of service area test points for a broadcasting assignment



3.4.2.12.4.1. GE06 Interference To sub-menu of DEM view

Under this sub-menu, different scenarios of interference calculations have been implemented for the broadcasting assignments/allotments and stations in the fixed and land mobile services in the GE06 Plan. The following items have been designed for this sub-menu:

- BCBT2DBCBT: This item calculates interference from an analogue TV assignment or a digital BCBT Plan Entry to digital BCBT assignments/allotments. All broadcasting assignments/allotments (in conformity with GE06 Plan) will be listed in a spreadsheet and the user may select the concerned assignments/allotments, using a mouse left click on the record-select column of spreadsheet. When the wanted broadcasting assignment /allotment has been selected, a dialogue box will appear for the user to determine: the search radius, search frequency range, percentage of time, protection margin limit, environment and implementation of receiving antenna discrimination (see Figure 3.143). All linked assignments and/or associated allotment with wanted digital broadcasting assignment/allotment, based on its plan entry code, are considered by the software for calculation of nuisance field strengths. Once the calculation parameters have been determined, a list of all victim digital broadcasting assignments/allotments that meet the conditions, is listed in a spreadsheet from which users may select some or all of them for the next calculation step by a mouse left click on the record select column (similar to Figure 3.144). When the OK button is pushed, the calculation starts and a progress bar is displayed. Interference is calculated at each service area test point of the victim assignments or at each test point of the victim allotments and the maximum value of interference among all test points of a victim assignment/allotment is considered. For this purpose, the combined nuisance field strength value is subtracted from the minimum median field strength at each test point to give the protection margin. The minimum value of protection margin is considered and compared with the protection margin limit.

  Finally, a spreadsheet lists the victim assignments/allotments with their country and administration code, minimum protection margin and relevant test point, combined nuisance field strength value and minimum median field strength value. The first row of this spreadsheet displays a summary of information about the wanted broadcasting assignment/allotment and its linked assignments and/or associated allotment. Figure 3.145 displays a sample output from the BCBT2DBCBT interference calculation.

Figure 3.143. Spreadsheet of interferer digital/analogue broadcasting assignments/allotments

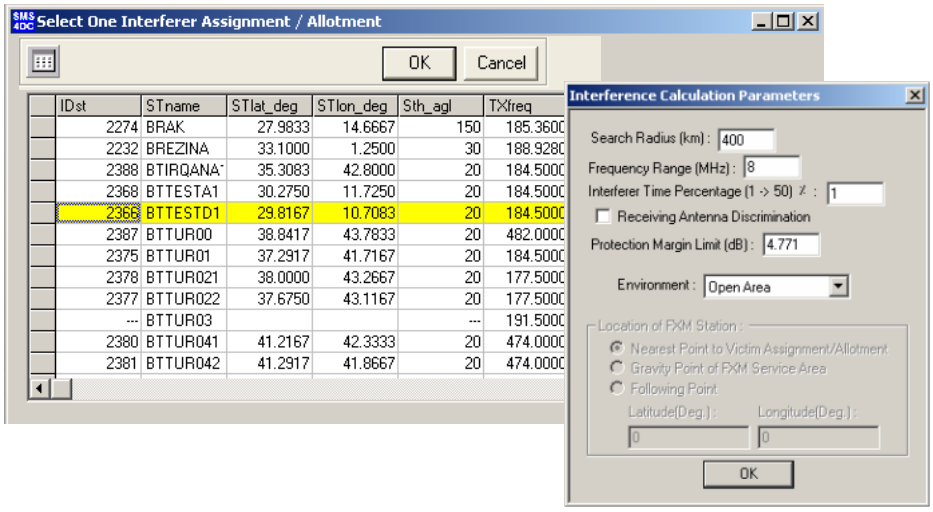
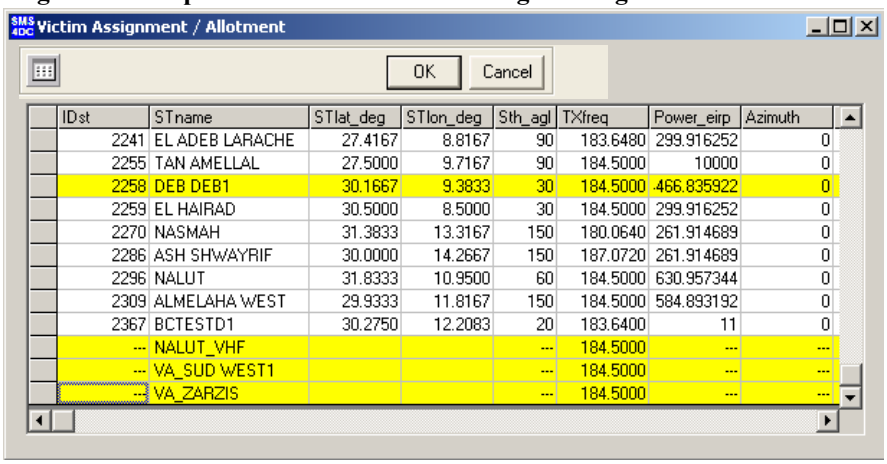
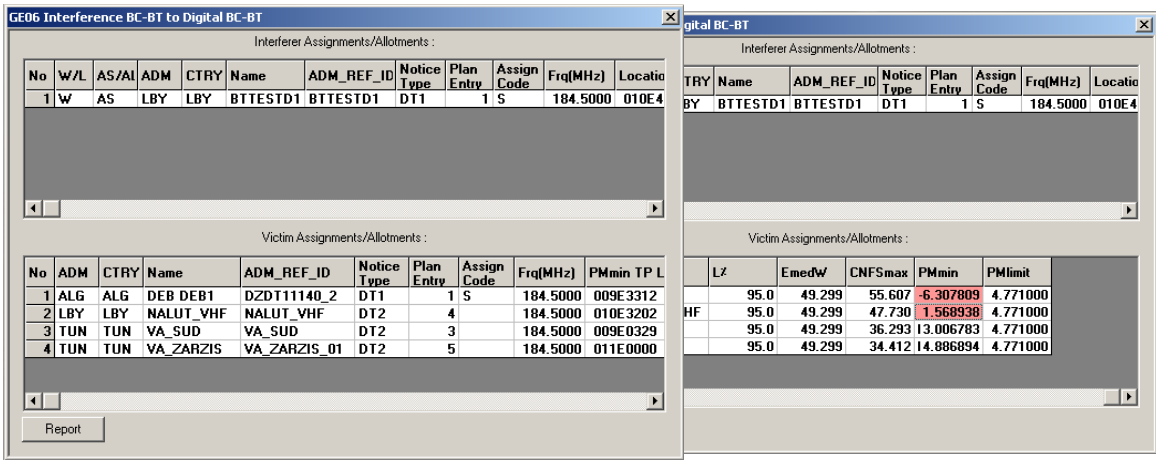


Figure 3.144. Spreadsheet of found victim digital assignments/allotments



IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth
2241	EL ADEB LARACHE	27.4167	8.8167	90	183.6480	299.916252	0
2255	TAN AMELLAL	27.5000	9.7167	90	184.5000	10000	0
2258	DEB DEB1	30.1667	9.3833	30	184.5000	466.835922	0
2259	EL HAIRAD	30.5000	8.5000	30	184.5000	299.916252	0
2270	NASMAH	31.3833	13.3167	150	180.0640	261.914689	0
2286	ASH SHWAYRIF	30.0000	14.2667	150	187.0720	261.914689	0
2296	NALUT	31.8333	10.9500	60	184.5000	630.957344	0
2309	ALMELAHA WEST	29.9333	11.8167	150	184.5000	584.893192	0
2367	BCTESTD1	30.2750	12.2083	20	183.6400	11	0
---	NALUT_VHF			---	184.5000	---	---
---	VA_SUD WEST1			---	184.5000	---	---
---	VA_ZARZIS			---	184.5000	---	---

Figure 3.145. Sample output from BCBT2DBCBT interference calculation



No	W/L	AS/Al	ADM	CTRY	Name	ADM_REF_ID	Notice Type	Plan Entry	Assign Code	Frq(MHz)	Locatio
1	W	AS	LBY	LBY	BTTESTD1	BTTESTD1	DT1	1	S	184.5000	010E4

No	ADM	CTRY	Name	ADM_REF_ID	Notice Type	Plan Entry	Assign Code	Frq(MHz)	PMmin TP L
1	ALG	ALG	DEB DEB1	DZDT11140_2	DT1	1	S	184.5000	009E3312
2	LBY	LBY	NALUT_VHF	NALUT_VHF	DT2	4		184.5000	010E3202
3	TUN	TUN	VA_SUD	VA_SUD	DT2	3		184.5000	009E0329
4	TUN	TUN	VA_ZARZIS	VA_ZARZIS_01	DT2	5		184.5000	011E0000

TRY	Name	ADM_REF_ID	Notice Type	Plan Entry	Assign Code	Frq(MHz)	Locatio
BY	BTTESTD1	BTTESTD1	DT1	1	S	184.5000	010E4

	L²	EmedW	CNFSmax	PMmin	PMlimit
	95.0	49.299	55.607	-6.307809	4.771000
HF	95.0	49.299	47.730	1.568938	4.771000
	95.0	49.299	36.293	13.006783	4.771000
	95.0	49.299	34.412	14.886894	4.771000

The column "PM min" reports an interference case and can be identified visually by a red background among the other values in this column.

The information displayed in the result spreadsheets can be presented (and saved) in the form of a report with the HTML format by using "Report" push button.

- BCBT2ABT: Item to calculate interference caused by an analogue TV assignment or a digital BCBT Plan Entry to analogue TV assignments. All broadcasting assignments/allotments (in conformity with GE06 Plan) will be listed in a spreadsheet and users may select the concerned assignments/allotments using a mouse left click on the record-select column of this spreadsheet. When the wanted broadcasting assignment /allotment has been selected, a dialogue box will appear for the user to specify values for: the search radius, searching frequency range, percentage of time, limiting margin, environment and implementation of receiving antenna discrimination (see Figure 3.146). All linked assignments and/or associated allotment belonging to the wanted digital broadcasting assignment/allotment, based on its plan entry code, are considered by software for calculation of nuisance field strengths. Once the calculation parameters have been specified, a spreadsheet is displayed, listing all victim analogue broadcasting assignments, meeting conditions. The user may select some or all of them for the next

calculation step by a mouse left click on the record select column (similar to Figure 3.147). When the OK button is pushed, the calculation starts and a progress bar is displayed. Interference is calculated at each service area test point of victim assignments and the maximum value of interference among all test points of a victim assignment is considered. For this purpose, at each test point of the victim assignment, the power sum value of UFS (Usable Field Strength value calculated by service area function) and nuisance field strength value is calculated. The nuisance field strength is subtracted from the value of UFS to give Margin. The maximum value of Margin among the test points is considered to compare with limiting margin.

Finally, a spreadsheet is displayed listing the victim assignments with their country and administration code, maximum value of margin and relevant test point, nuisance field strength value and wanted field strength. The top row of this spreadsheet contains a summary of information about the wanted broadcasting assignment/allotment and its linked assignments and/or associated allotment. Figure 3.148 shows a sample output of the BCBT2ATV interference calculation.

Figure 3.146. Spreadsheet of interferer digital/analogue broadcasting assignments/allotments

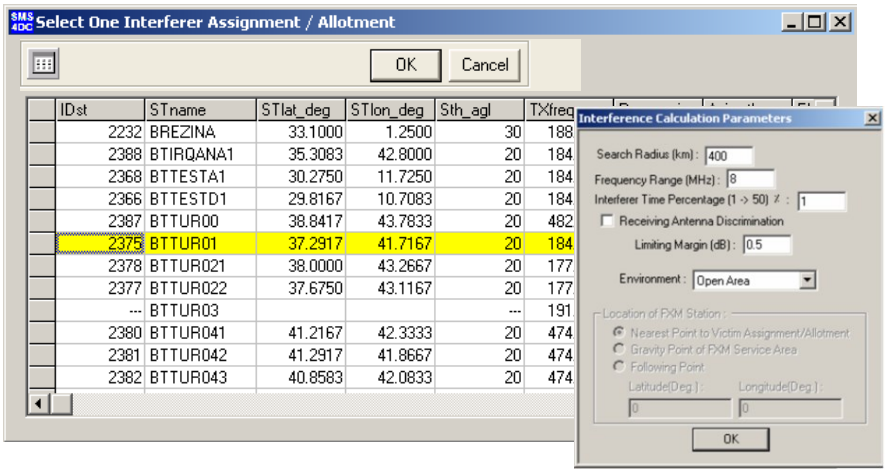


Figure 3.147. Spreadsheet of found victim analogue assignments

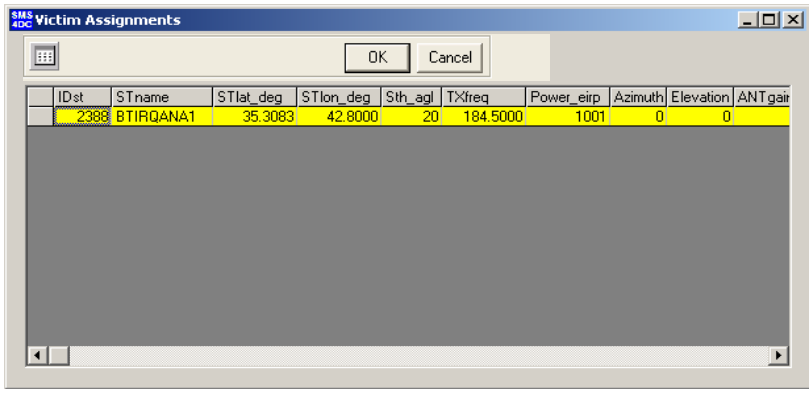
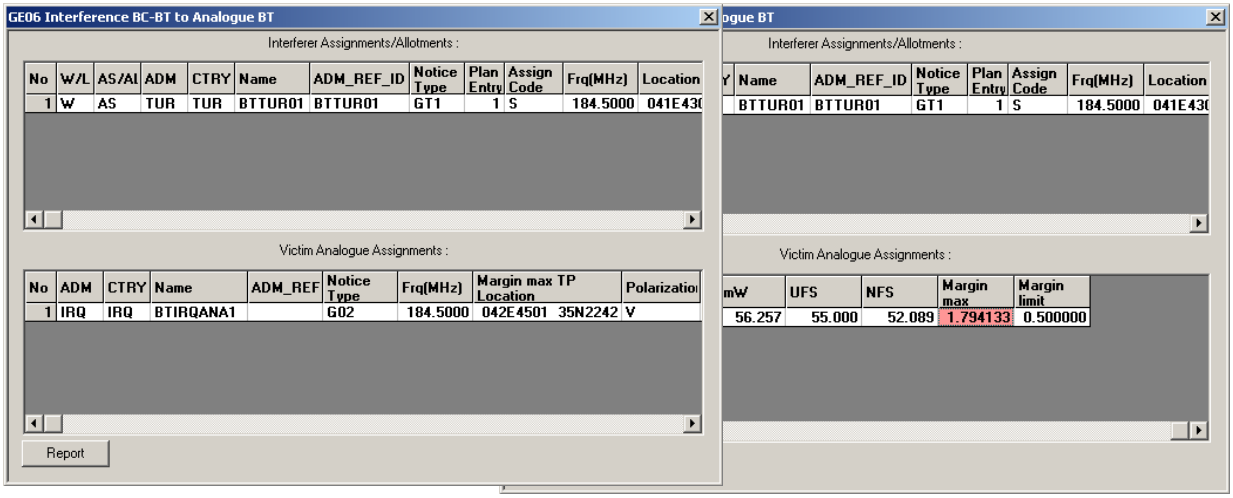


Figure 3.148.Sample output of BCBT2ATV interference calculation



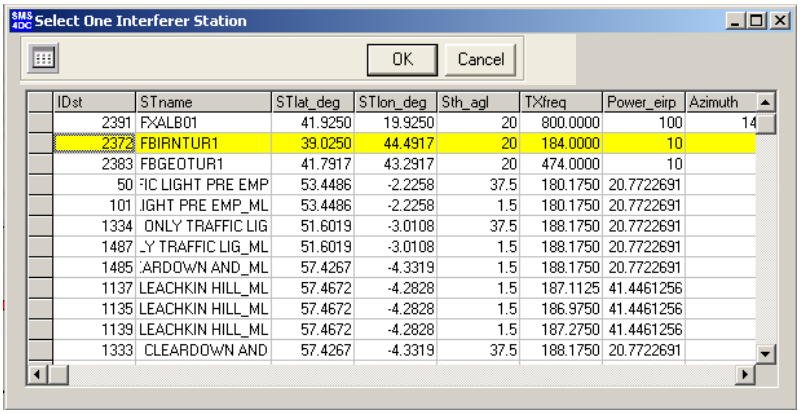
The column "Margin max" reports an interference case that can be identified visually by a red background among the other values in this column,

The information displayed in the result spreadsheets may be presented as a report (and saved in a file) with the HTML format by using the "Report" push button.

- FXM2DBCBT: This item calculates interference caused by a station in the fixed or land mobile services to digital BCBT assignments/allotments. All stations in the fixed or land mobile services (in conformity with GE06 Plan) will be listed in a spreadsheet and the user may select the concerned station, using a mouse left click on the record-select column of this spreadsheet (see Figure 3.149). When the wanted station has been selected, a dialogue box will appear for the user to specify values for: the search radius, search frequency range, percentage of time, protection margin limit, environment and implementation of receiving antenna discrimination. In the case of the interfering mobile station or typical station, the software asks for the location of the station. There are three possibilities: as nearest point to victim assignment/ allotment, gravity point of service area and user defined location (see Figure 3.150). Once the calculation parameters have been specified, a spreadsheet displays a list of all victim digital broadcasting assignments/allotments that meet the conditions and the user may select some or all of them for the next calculation step by a mouse left click on the record select column (similar to Figure 3.151). When the OK button is pushed, the calculation starts and a progress bar is displayed. Interference is calculated at each service area test point of victim assignments, or at each test point of victim allotments, and the maximum value of interference among all test points is considered. For this purpose, the combined nuisance field strength value is subtracted from the minimum median field strength at each test point to give the protection margin. The minimum value of protection margin is considered and compared with protection margin limit.

  Finally, a spreadsheet displays a list of the victim assignments/allotments with their country and administration code, minimum protection margin and relevant test point, combined nuisance field strength value and minimum median field strength. The top row of this spreadsheet contains a summary of information about the wanted station. Figure 3.152 displays a sample output of the FXM2DBCBT interference calculation.

Figure 3.149. Spreadsheet of interferer stations in fixed and land mobile services



IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth
2391	FXALB01	41.9250	19.9250	20	800.0000	100	14
2372	FBIRNTUR1	39.0250	44.4917	20	184.0000	10	
2383	FBGEOTUR1	41.7917	43.2917	20	474.0000	10	
50	IC LIGHT PRE EMP	53.4486	-2.2258	37.5	180.1750	20.7722691	
101	IGHT PRE EMP_ML	53.4486	-2.2258	1.5	180.1750	20.7722691	
1334	ONLY TRAFFIC LIG	51.6019	-3.0108	37.5	188.1750	20.7722691	
1487	Y TRAFFIC LIG_ML	51.6019	-3.0108	1.5	188.1750	20.7722691	
1485	ARDOWN AND_ML	57.4267	-4.3319	1.5	188.1750	20.7722691	
1137	LEACHKIN HILL_ML	57.4672	-4.2828	1.5	187.1125	41.4461256	
1135	LEACHKIN HILL_ML	57.4672	-4.2828	1.5	186.9750	41.4461256	
1139	LEACHKIN HILL_ML	57.4672	-4.2828	1.5	187.2750	41.4461256	
1333	CLEARDOWN AND	57.4267	-4.3319	37.5	188.1750	20.7722691	

Figure 3.150. Sample of interference calculation parameters for fixed/base stations and mobile/typical stations

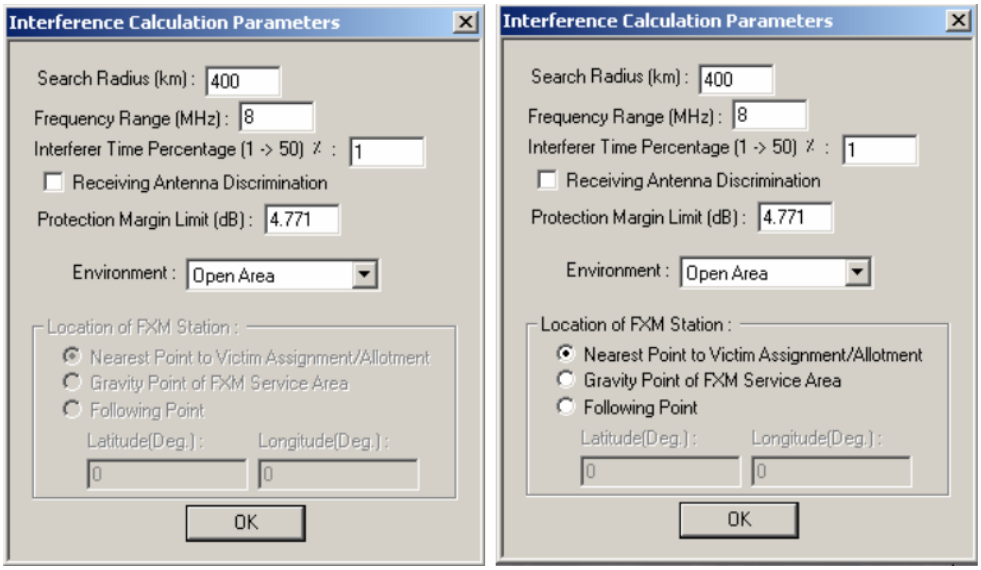
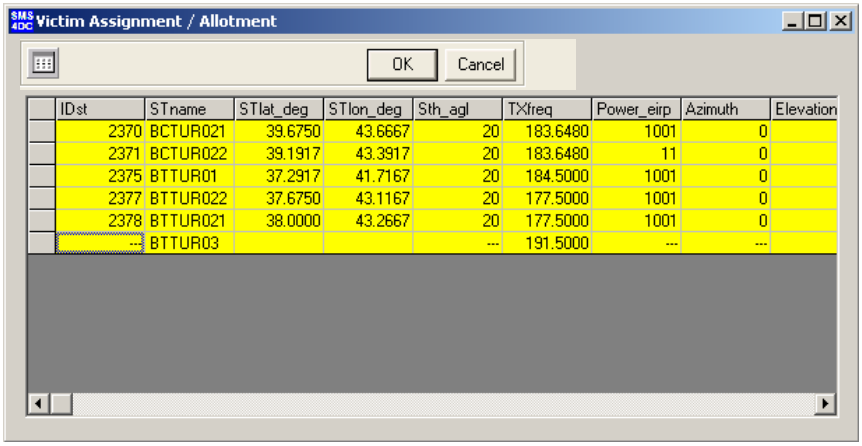
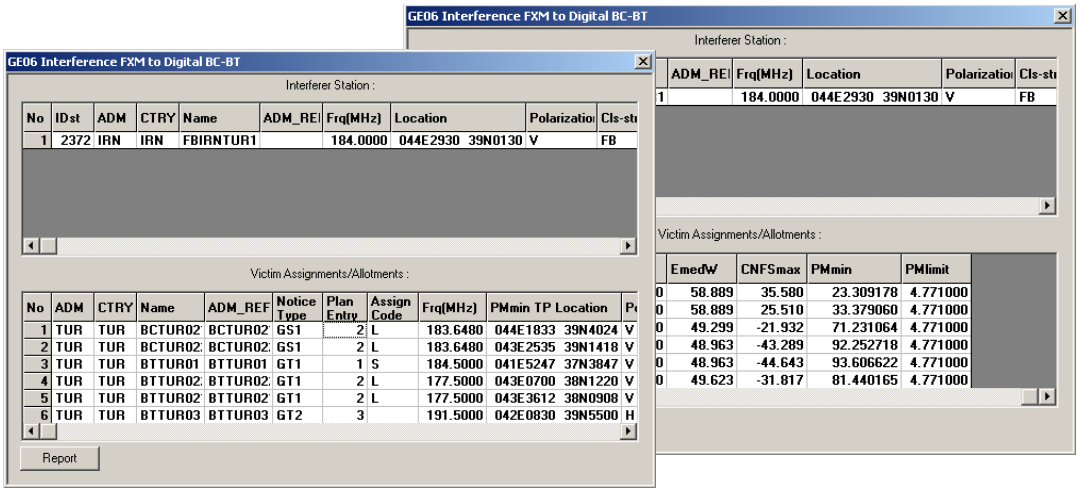


Figure 3.151. Spreadsheet of found victim digital assignments/allotments



IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth	Elevation
2370	BCTUR021	39.6750	43.6667	20	183.6480	1001	0	
2371	BCTUR022	39.1917	43.3917	20	183.6480	11	0	
2375	BTTUR01	37.2917	41.7167	20	184.5000	1001	0	
2377	BTTUR022	37.6750	43.1167	20	177.5000	1001	0	
2378	BTTUR021	38.0000	43.2667	20	177.5000	1001	0	
---	BTTUR03			---	191.5000	---	---	

Figure 3.152. Sample output of FXM2DBCBT interference calculation



The column "PM min" reports an interference case and can be identified visually by a red background among the other values in this column.

The information displayed in the result spreadsheets can be presented as a reported (and saved in a file) with the HTML format by using the "Report" push button.

- FXM2ABT: This item calculates interference caused by a station in fixed or land mobile service to analogue TV assignments. All stations (in conformity with GE06 Plan) will be listed in a spreadsheet and users may select the concerned station, using a mouse left click on the record-select column of this spreadsheet. When the wanted station has been selected, a dialogue box will appear for the user to specify values for: the search radius, searching frequency range, percentage of time, limiting margin, environment and implementation of receiving antenna discrimination (see Figure 3.153). Once values for the calculation parameters have been specified, a spreadsheet displays a list of all victim analogue broadcasting assignments that meet the conditions and users may select some or all of them for the next calculation step by a mouse left click on the record select column (similar to Figure 3.154). When the OK button is pushed, calculation starts and a progress bar is displayed. Interference is calculated at each service area test point of victim assignments and the maximum value of interference is considered among all test points. For this purpose, at each test point of the victim assignment, the power sum value of UFS (Usable Field Strength value calculated by service area function) and nuisance field strength value is calculated. The nuisance field strength value is subtracted from the value of UFS to give the Margin. The maximum value of Margin among test points is considered and compared with the limiting Margin.

  Finally, a spreadsheet lists the victim assignments with their country and administration code, maximum value of margin and relevant test point, nuisance field strength value and wanted field strength. The first row of this spreadsheet contains summary information about the wanted station. Figure 3.155 displays a sample output of the FXM2ABT interference calculation.

Figure 3.153. Spreadsheet of interferer stations in fixed and land mobile services

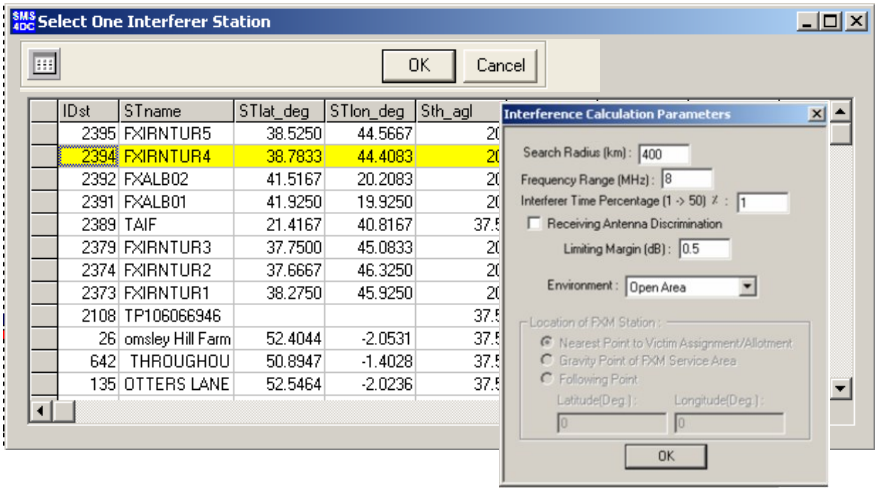


Figure 3.154. Spreadsheet of found victim analogue assignments

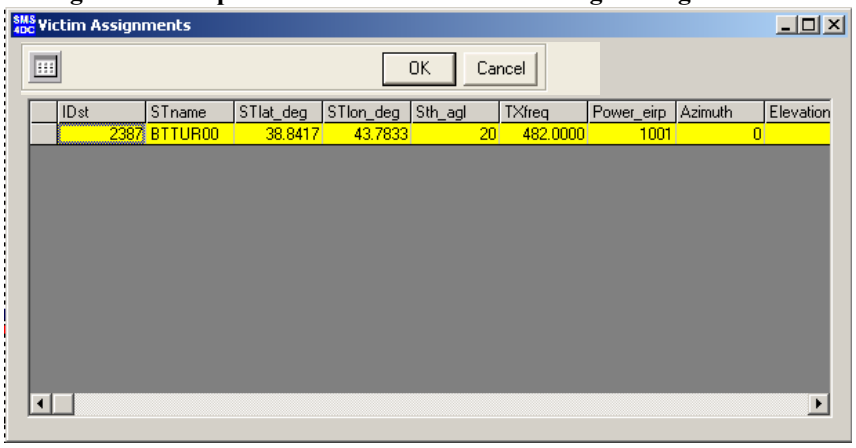
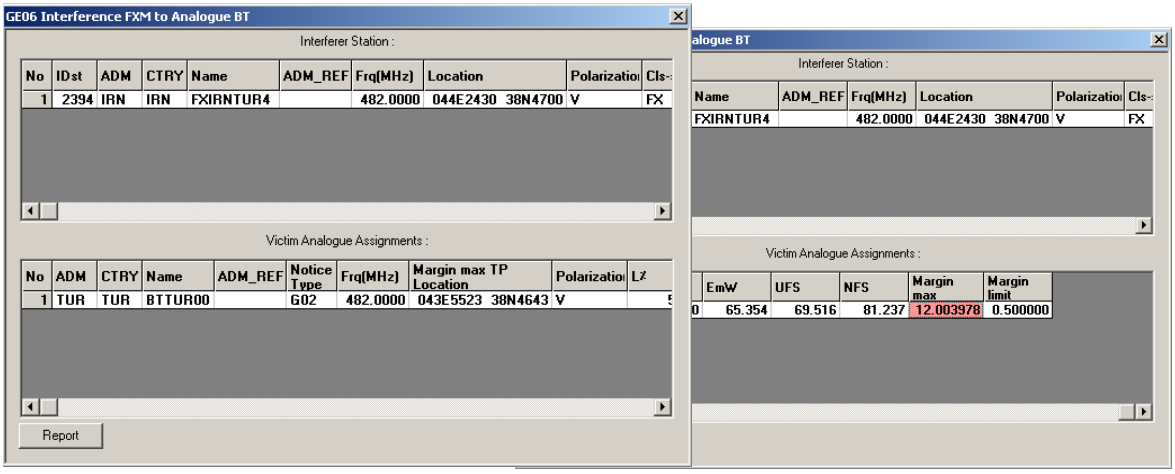


Figure 3.155. Sample output of FXM2ABT interference calculation



The column “Margin max” reports an interference case and the red background identifies it visually from the other values in this column.

The information displayed in the result spreadsheets can be presented as a report and saved in the HTML format by using "Report" the push button.

- BCBT2FXM: this item calculates interference caused by an analogue TV assignment or a digital BCBT Plan Entry to stations in the fixed or land mobile services. All broadcasting assignments/allotments (in conformity with GE06 Plan) will be listed in a spreadsheet and the user may select the concerned assignments/allotments, using a mouse left click on the record-select column of this spreadsheet. When the wanted broadcasting assignment /allotment has been selected, a dialogue box will appear for the user to specify values for: the search radius, search frequency range, percentage of time, protection margin limit, environment and implementation of receiving antenna discrimination (see Figure 3.156). All linked assignments and/or associated allotment belonging to the wanted digital broadcasting assignment/allotment, based on its plan entry code, are considered by the software for the calculation of nuisance field strengths. Once the calculation parameter values have been specified, a spreadsheet lists all victim stations in the fixed or land mobile services that meet the conditions, from which users may select some or all of them for the next calculation step by a mouse left click on the record select column (similar to the Figure 3.157). When the OK button is pushed, the calculation starts and a progress bar is displayed. Interference is calculated at receiving stations, or at each service area test point of victim stations, and the maximum value of interference is determined by comparing the values from all test points. For this purpose, the nuisance field strength value is subtracted from the minimum median field strength at each test point to give the protection margin. The minimum value of protection margin is considered and compared with the protection margin limit. In the generic case for FXM stations, the interference field strength generated by TV assignment\allotment is compared with the maximum allowed interference level, which is calculated based on the GE06 Agreement (GE06, Appendix to Annex 4.2).

  Finally, a spreadsheet lists: the victim stations with their country and administration code, minimum protection margin/ the interference field strength generated by TV assignment or allotment (INTFS) subtracted from the maximum allowed interference level (E) and relevant test point, nuisance field strength value and minimum median field strength. The first row of this spreadsheet contains a summary of information about the wanted broadcasting assignment/allotment and its linked assignments and/or associated allotment. Figure 3.158 displays a sample output of the BCBT2FXM interference calculation.

Figure 3.156. Spreadsheet of interferer digital/analogue broadcasting assignments/allotments

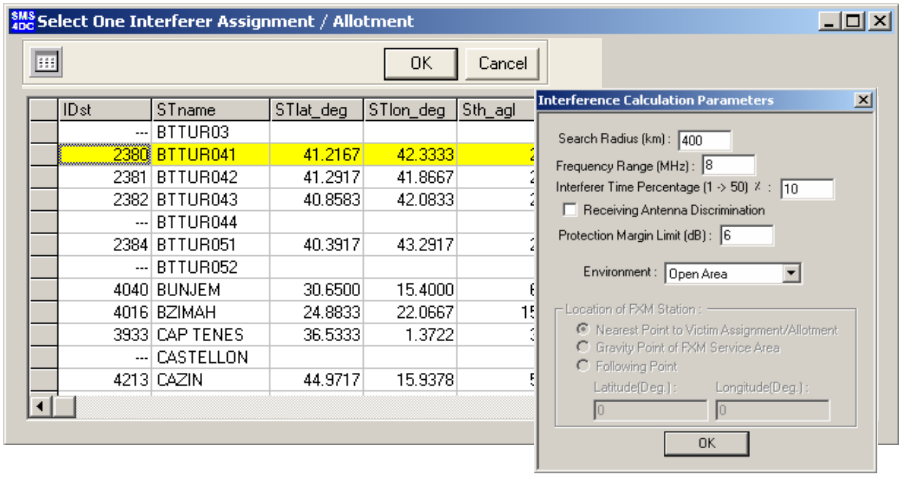


Figure 3.157. Spreadsheet of found victim stations in fixed or land mobile service

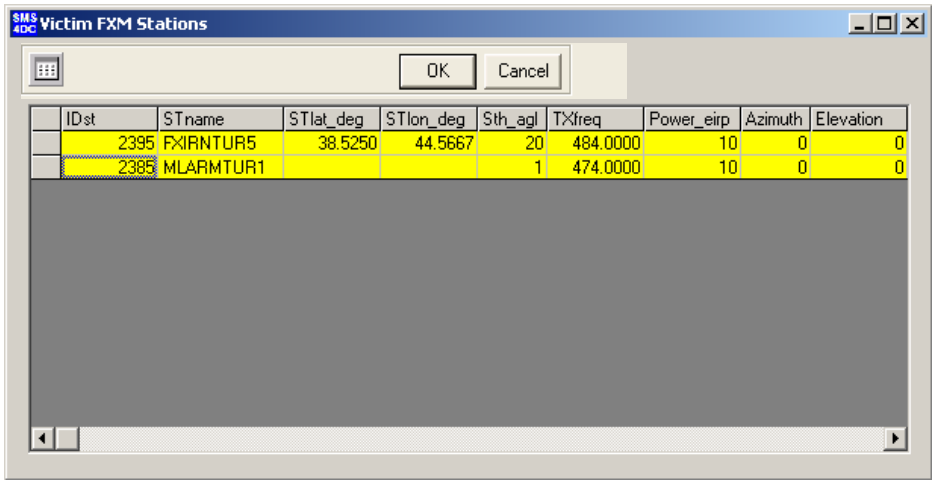
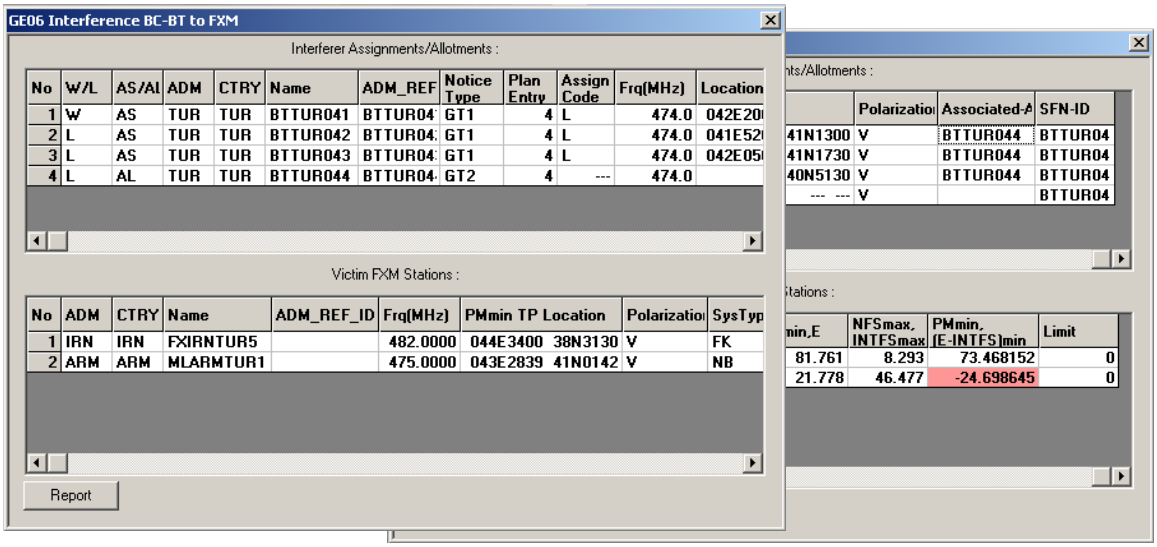


Figure 3.158. Sample output of BCBT2FXM interference calculation



The column “PM min” reports an interference case and the red background identifies it visually from the other values in this column.

The information displayed in the result spreadsheets may be presented as a report and saved in the HTML format by using the “Report” push button.

3.4.2.12.4.2. GE06 Interference From sub-menu of DEM view

Under this sub-menu different scenarios of interference calculations have been implemented for the broadcasting assignments/allotments and stations in the fixed and land mobile services in GE06 Plan. The following items have been designed for this sub-menu:

- BCBT2DBCBT: This item calculates interference to a digital BCBT assignment/allotment caused by analogue TV assignments or digital BCBT Plan Entries. All digital broadcasting assignments/allotments (in conformity with GE06 Plan) will be listed in a spreadsheet and the user may select the victim assignment/allotment, using a mouse left click on the record-select column of this spreadsheet. When the victim digital broadcasting assignment/allotment has been selected, a dialogue box will appear for the user to specify values for the search radius, search frequency range, percentage of time, protection margin limit, environment and implementation of receiving antenna discrimination (see Figure 3.159). Once the values for the calculation parameters have been specified, a spreadsheet lists all interferer broadcasting assignments/allotments, meeting conditions, from which the user may select some or all of them for the next calculation step by a mouse left click on the record select column (similar to Figure 3.160). When the OK button is pushed, the calculation starts and a progress bar is displayed. Interference is calculated at each service area test point of victim assignment, or at each test point of victim allotment, and the maximum value of interference is determined by comparing values at all test points. For this purpose, the combined nuisance field strength value is subtracted from minimum median field strength at each test point to give the protection margin. The minimum value of protection margin is considered and compared with the protection margin limit. All linked assignments and/or associated allotment belonging to the interfering digital broadcasting assignment/allotment, based on its plan entry code, are considered by the software for the calculation of nuisance field strengths.

  Finally, a spreadsheet lists: the interferer assignments/allotments and their linked assignments and/or associated allotment with their country and administration code, minimum protection margin and relevant test point, combined nuisance field strength value and minimum median field strength. The first row of the spreadsheet contains summary information about the victim broadcasting assignment/allotment. Figure 3.161 displays a sample output of the BCBT2DBCBT interference calculation.

Figure 3.159. Spreadsheet of victim digital broadcasting assignments/allotments

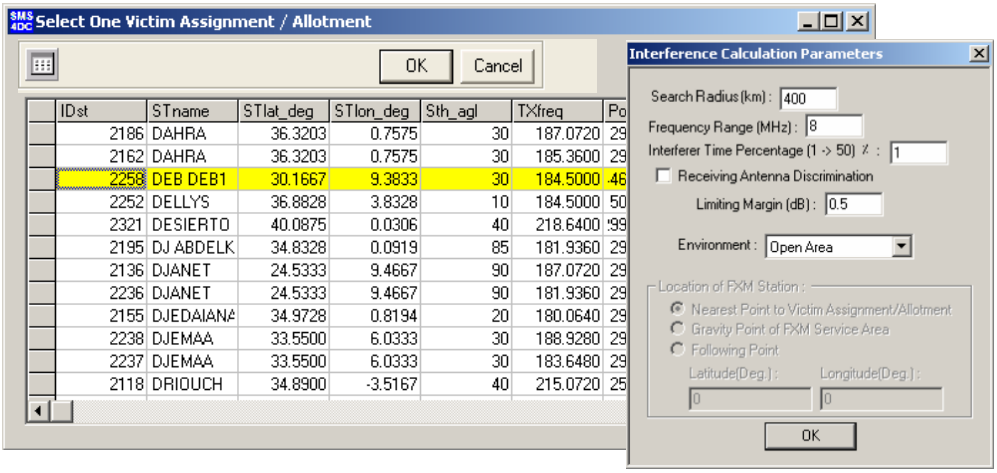
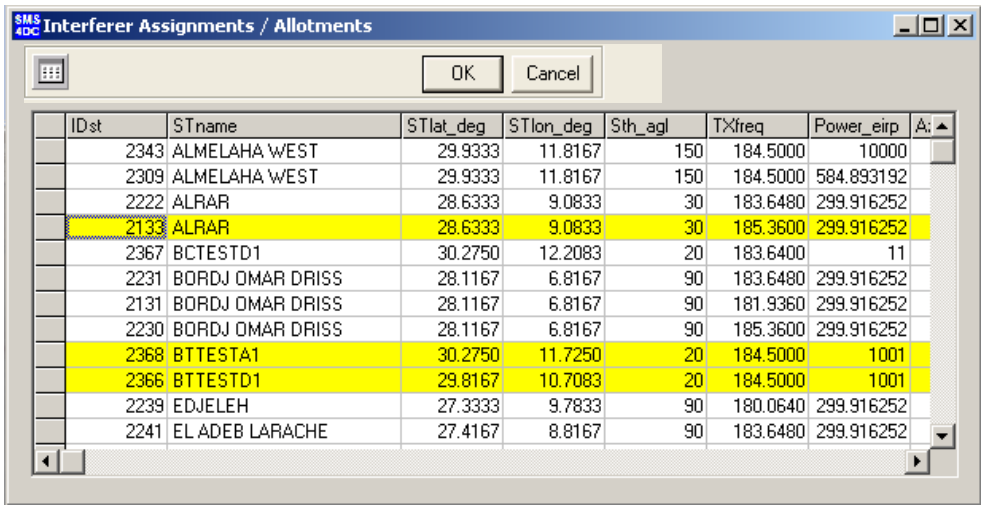
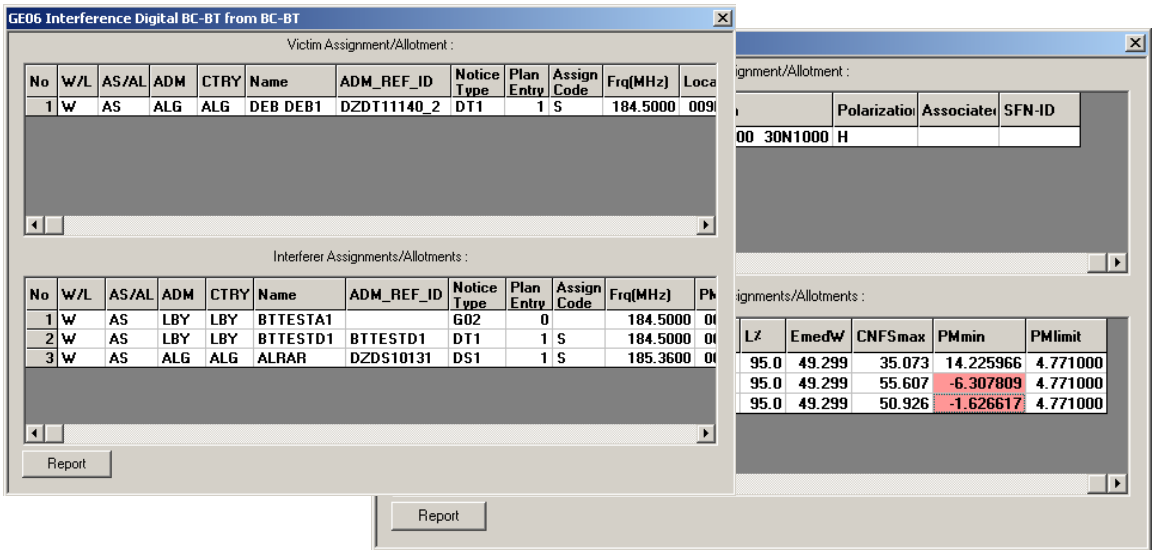


Figure 3.160. Spreadsheet of interferer digital/analogue broadcasting assignments/allotments



IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	A:
2343	ALMELAHA WEST	29.9333	11.8167	150	184.5000	10000	
2309	ALMELAHA WEST	29.9333	11.8167	150	184.5000	584.893192	
2222	ALRAR	28.6333	9.0833	30	183.6480	299.916252	
2133	ALRAR	28.6333	9.0833	30	185.3600	299.916252	
2367	BCTESTD1	30.2750	12.2083	20	183.6400	11	
2231	BORDJ OMAR DRISS	28.1167	6.8167	90	183.6480	299.916252	
2131	BORDJ OMAR DRISS	28.1167	6.8167	90	181.9360	299.916252	
2230	BORDJ OMAR DRISS	28.1167	6.8167	90	185.3600	299.916252	
2368	BTTESTA1	30.2750	11.7250	20	184.5000	1001	
2366	BTTESTD1	29.8167	10.7083	20	184.5000	1001	
2239	EDJELEH	27.3333	9.7833	90	180.0640	299.916252	
2241	EL ADEB LARACHE	27.4167	8.8167	90	183.6480	299.916252	

Figure 3.161. Sample output of BCBT2DBCBT interference calculation



No	W/L	AS/AL	ADM	CTRY	Name	ADM_REF_ID	Notice Type	Plan Entry	Assign Code	Frq(MHz)	Loca
1	W	AS	ALG	ALG	DEB DEB1	DZDT11140_2	DT1	1	S	184.5000	009

No	W/L	AS/AL	ADM	CTRY	Name	ADM_REF_ID	Notice Type	Plan Entry	Assign Code	Frq(MHz)	PM
1	W	AS	LBY	LBY	BTTESTA1		G02	0		184.5000	0(
2	W	AS	LBY	LBY	BTTESTD1	BTTESTD1	DT1	1	S	184.5000	0(
3	W	AS	ALG	ALG	ALRAR	DZDS10131	DS1	1	S	185.3600	0(

	Polarizatio	Associate	SFN-ID
00 30N1000	H		

L	EmedW	CNFSmax	PMmin	PMlimit
95.0	49.299	35.073	14.225966	4.771000
95.0	49.299	55.607	-6.307809	4.771000
95.0	49.299	50.926	-1.626617	4.771000

The column "PM min" reports an interference case and the red background identifies it visually from the other values in this column.

The information displayed in the result spreadsheets may be displayed as a report and saved in the HTML format by using the "Report" push button.

- BCBT2ABT: This item calculates interference to an analogue TV assignment caused by analogue TV assignments or digital BCBT Plan Entries. All analogue TV assignments (in conformity with GE06 Plan) will be listed in a spreadsheet and the user may select the victim assignment, using a mouse left click on the record-select column of this spreadsheet. When the victim broadcasting assignment has been selected, a dialogue box will appear for the user to specify values for: the search radius, search frequency range, percentage of time, limiting margin, environment and implementation of receiving antenna discrimination (see Figure 3.162). Once the calculation parameters have been

determined, a spreadsheet lists all interferer analogue TV assignments or digital BCBT assignments/allotments, that meet the conditions, from which users may select some or all of them for the next calculation step by a mouse left click on the record select column, (similar to Figure 3.163). When the OK button is pushed, the calculation starts and a progress bar is displayed. Interference is calculated at each service area test point of victim assignment and the maximum value of interference is determined by comparing the values from all test points. For this purpose, at each test point of the victim assignment, the power sum value of UFS (Usable Field Strength value calculated by service area function) and nuisance field strength value is calculated. The nuisance field strength value is subtracted from the value of UFS to give the Margin. The maximum value of Margin among test points is considered and compared with the limiting margin. All linked assignments and/or associated allotment belonging to the interfering digital broadcasting assignment/allotment, based on its plan entry code, are considered by the software for calculation of nuisance field strengths.

Finally, a spreadsheet lists: the interfering assignments/allotments and their linked assignments and/or associated allotment with their country and administration code, maximum value of margin and relevant test point, nuisance field strength value and wanted field strength. The first row of this spreadsheet contains a summary of information about the victim TV analogue assignment. Figure 3.164 displays a sample output of the BCBT2ATV interference calculation.

Figure 3.162. Spreadsheet of victim analogue broadcasting assignments

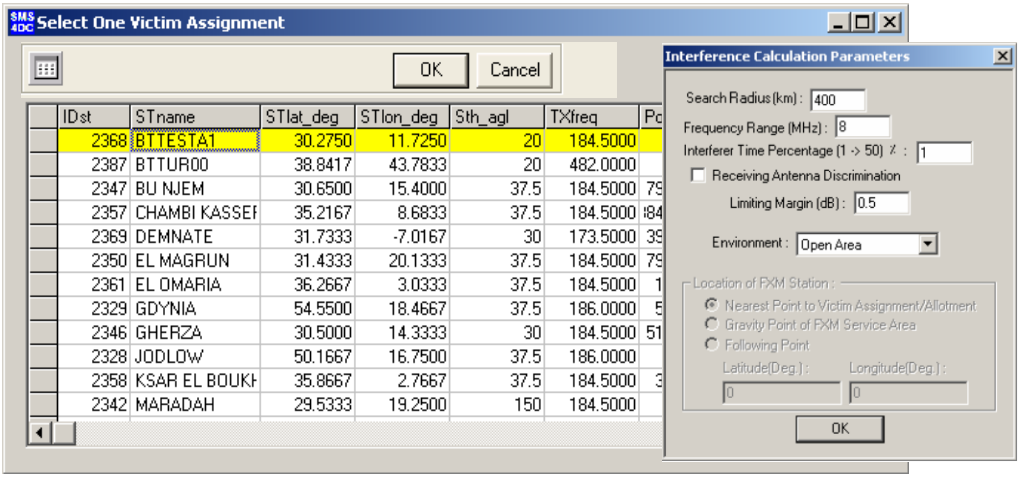


Figure 3.163. Spreadsheet of interferer digital/analogue broadcasting assignments/allotments

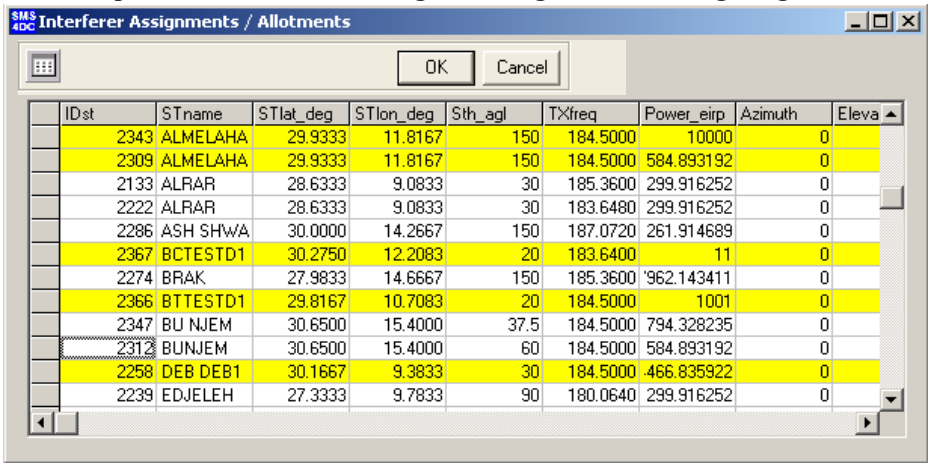
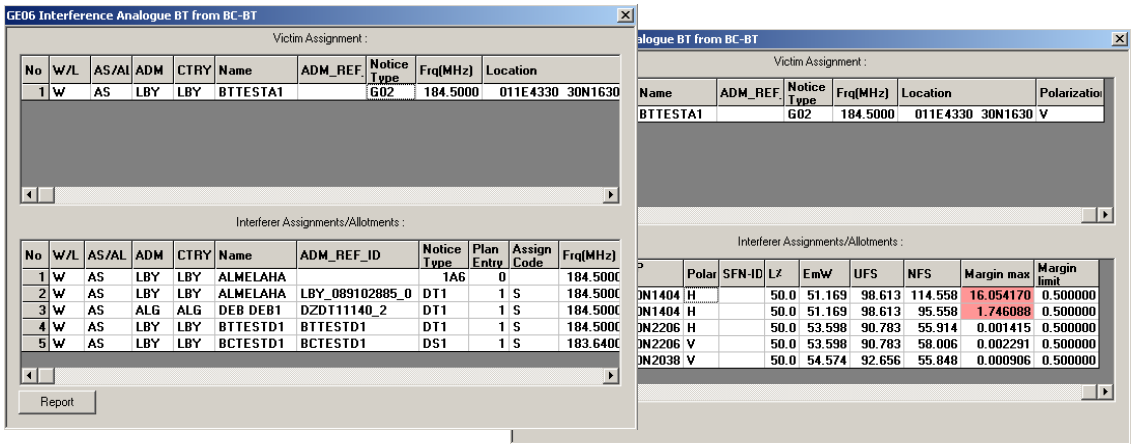


Figure 3.164. Sample output of BCBT2ABT interference calculation



The column "Margin max" reports an interference case and can be identified by red background among other values in this column, visually.

The information displayed in result spreadsheets can be reported in a file presented in a report-style with the HTML format by using "Report" push button.

- FXM2DBCBT: Item to calculate interference to a digital BCBT assignment/allotment caused by stations in fixed or land mobile service. All digital BCBT assignments/allotments (in conformity with GE06 Plan) will be listed in a spreadsheet and users could select the victim assignment/allotment, using a mouse left click on the record-select column of spreadsheet. When the victim assignment/allotment selected, a dialogue box will appear to determine the search radius, searching frequency range, percentage of time, protection margin limit, environment and implementation of receiving antenna discrimination. In the case of interferer mobile station or typical station, there are three possibilities as nearest point to victim assignment/allotment, gravity point of service area and user defined location as displayed in Figure 3.165. Once the calculation parameters determined, list of all interferer stations in fixed and mobile services, meeting conditions, is listed in a spreadsheet which users can select some or all of them for next calculation step by mouse left click on record select column, Similar to the Figure 3.166. Calculation starts and relevant progress bar is displayed if OK button pushed. Interference is calculated at each service area test point of victim assignment or at each test point of victim allotment and the maximum value of interference is considered among all test points. For this purpose combined nuisance field strength value is subtracted from minimum median field strength at each test point to give protection margin. The minimum value of protection margin is considered and compared with protection margin limit. Finally, the interferer stations in fixed and mobile services with their country and administration code, caused minimum protection margin and relevant test point, caused combined nuisance field strength value and the minimum median field strength are listed in a spreadsheet below the general information of victim digital assignment/allotment. Figure 3.167 displays a sample output of FXM2DBCBT interference calculation.

Figure 3.165. Spreadsheet of victim digital assignment/allotment

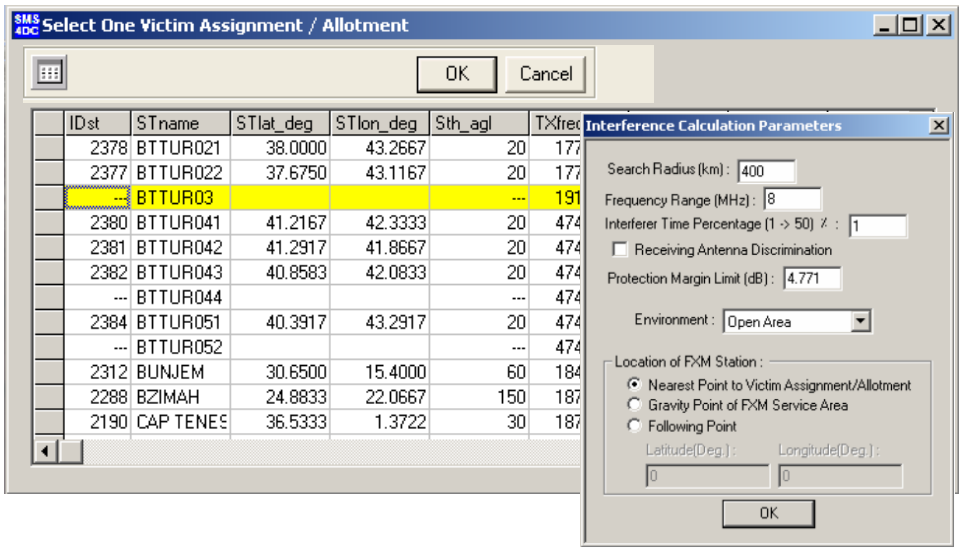


Figure 3.166. Spreadsheet of found interferer stations in fixed and land mobile services

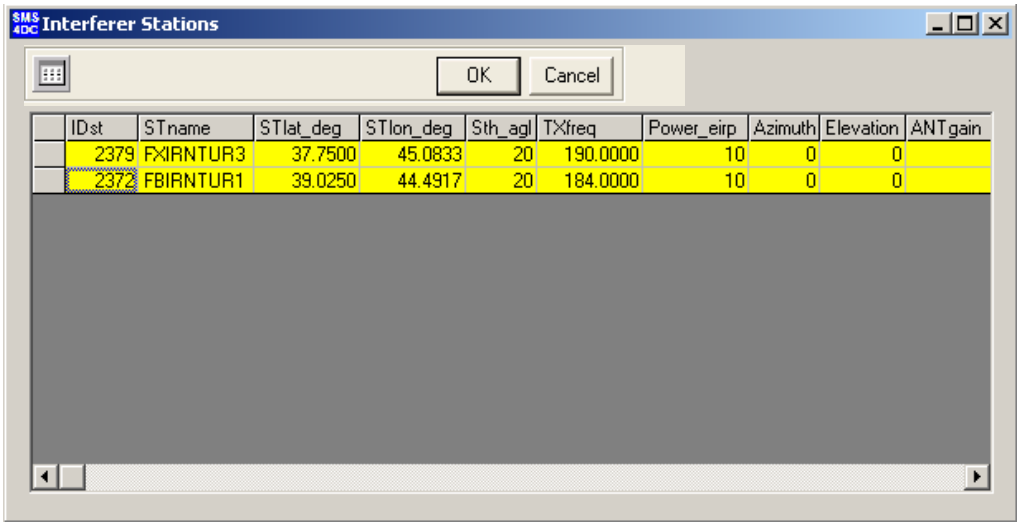
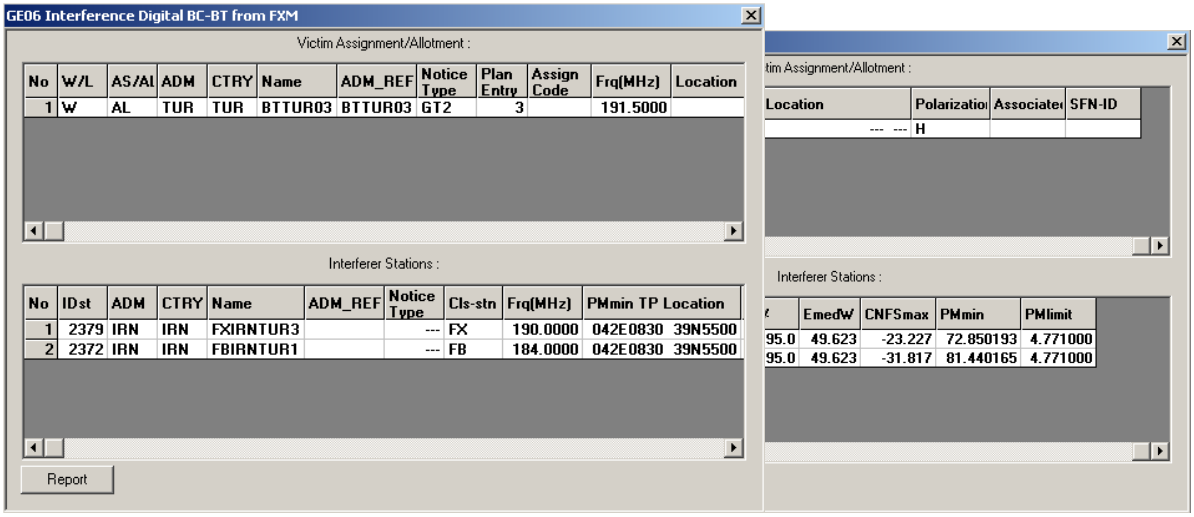


Figure 3.167. Sample output of FXM2DBCBT interference calculation



The column “PM min” reports an interference case and the red background identifies it visually from the other values in this column.

The information displayed in the result spreadsheets may be presented as a report and saved in the HTML format by using the “Report” push button.

- FXM2ABT: This item calculates interference to an analogue TV assignment caused by stations in the fixed or land mobile services. All analogue TV assignments (in conformity with GE06 Plan) will be listed in a spreadsheet and the user may select the victim analogue TV assignment, using a mouse left click on the record-select column of this spreadsheet. When the victim analogue TV assignment has been selected, a dialogue box will appear for the user to specify values for: the search radius, search frequency range, percentage of time, limiting margin, environment and implementation of receiving antenna discrimination (see Figure 3.168). Once values for the calculation parameters have been specified, a spreadsheet lists: all interfering stations in the fixed and land mobile services that meet the conditions, from which users may select some or all of them for the next calculation step by a mouse left click on the record select column (similar to the Figure 3.169). When the OK button is pushed, the calculation starts and a progress bar is displayed. Interference is calculated at each service area test point of victim assignment and the maximum value of interference is determined by comparing the values at all test points. For this purpose, at each test point of the victim assignment, the power sum value of UFS (Usable Field Strength value calculated by service area function) and nuisance field strength value is calculated. The nuisance field strength value is subtracted from the value of UFS to give the Margin. The maximum value of Margin among test points is considered and compared with the limiting margin.

  Finally, a spreadsheet lists: the interfering stations in the fixed or land mobile services with their country and administration code, maximum value of margin and relevant test point, nuisance field strength value and wanted field strength. The first row of this spreadsheet contains a summary of information about the victim analogue TV assignment. Figure 3.170 displays a sample output of the FXM2ATV interference calculation.

Figure 3.168. Spreadsheet of victim analogue assignment

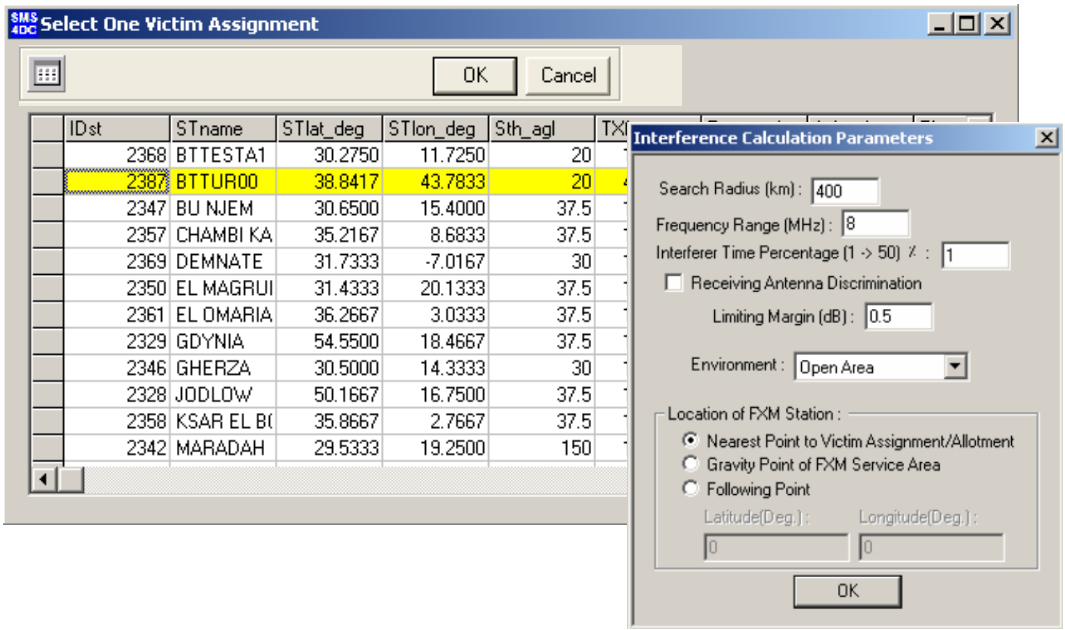


Figure 3.169. Spreadsheet of interferer stations in fixed and land mobile services

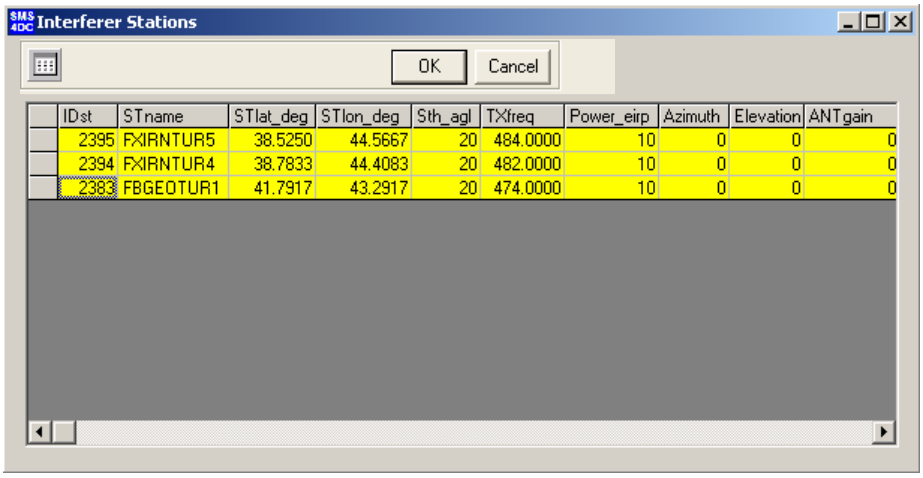
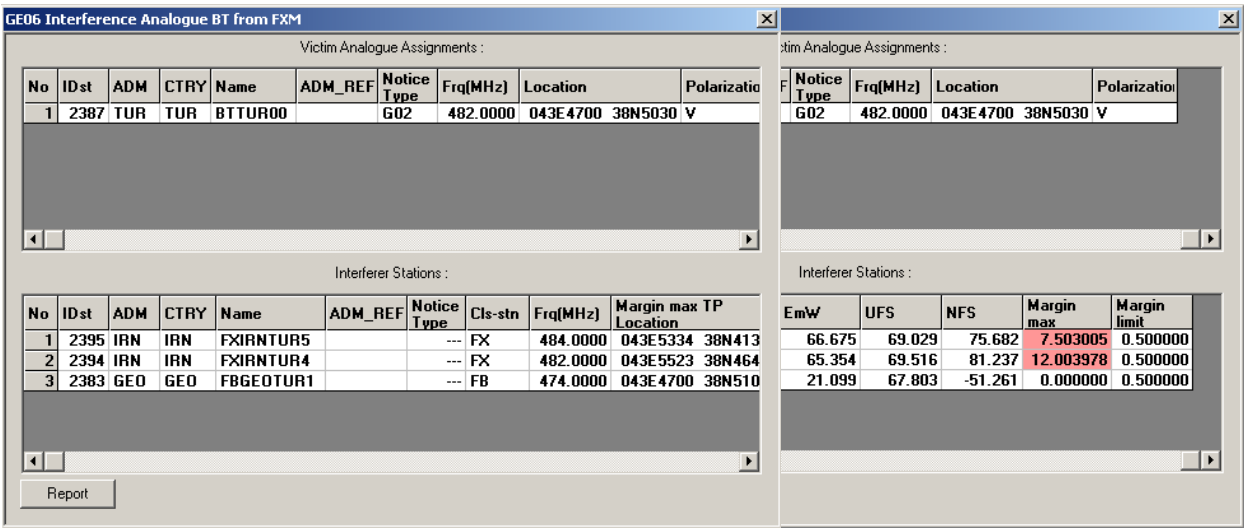


Figure 3.170. Sample output of FXM2ABT interference calculation



The column "Margin max" reports an interference case and the red background identifies it visually from the other values in this column.

The information displayed in the result spreadsheets can be presented as a report and saved in the HTML format by using the "Report" push button.

- BCBT2FXM: This item calculates interference to a station in the fixed or land mobile services caused by analogue TV assignments or digital BCBT Plan Entries. All stations in fixed or land mobile service (in conformity with GE06 Plan) will be listed in a spreadsheet and the user may select the victim station, using a mouse left click on the record-select column of this spreadsheet. When the victim station has been selected, a dialogue box will appear for the user to specify values for: the search radius, search frequency range, percentage of time, protection margin limit, environment and implementation of receiving antenna discrimination (see Figure 3.171). Once the values for the calculation parameters have been specified, a spreadsheet lists all the interfering broadcasting assignments/allotments that meet the conditions, from which users may select some or all of them for the next calculation step by a mouse left click on the record

select column (similar to Figure 3.172). When the OK button is pushed, the calculation starts and a progress bar is displayed. Interference is calculated at receiving stations or at each service area test point of victim stations and the maximum value of interference is determined by comparison of the values of all test points. For this purpose, the nuisance field strength value is subtracted from minimum median field strength at each test point to give the protection margin. The minimum value of protection margin is considered and compared with the protection margin limit. In the generic case for FXM stations, the interference field strength generated by TV assignment\allotment is compared with the maximum allowed interference level which calculated based on GE06 Agreement (Appendix to Annex 4.2). All linked assignments and/or associated allotment belonging to the interfering digital broadcasting assignment/allotment, based on its plan entry code, are considered by the software for the calculation of nuisance field strengths.

Finally, a spreadsheet lists: the interferer assignments/allotments and their linked assignments and/or associated allotment, their country and administration codes, minimum protection margin/ the interference field strength generated by TV assignment\allotment (INTFS) subtracted from the maximum allowed interference level (E) and relevant test point, nuisance field strength value and minimum median field strength. The first row of this spreadsheet contains a summary of information about the victim station. Figure 3.173 displays a sample output of the BCBT2FXM interference calculation.

Figure 3.171. Spreadsheet of victim station in fixed or land mobile service

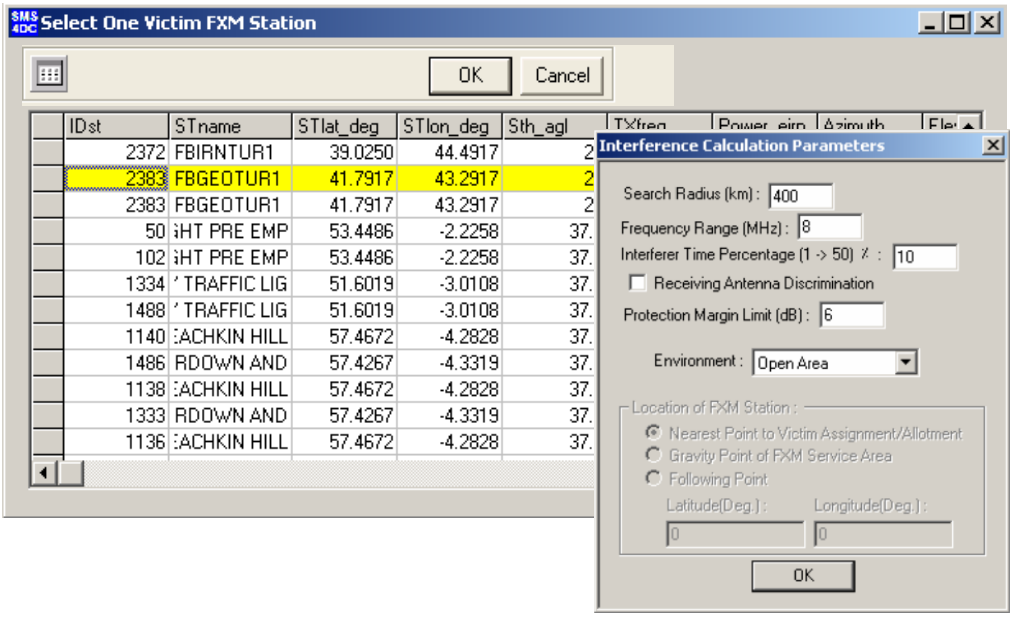
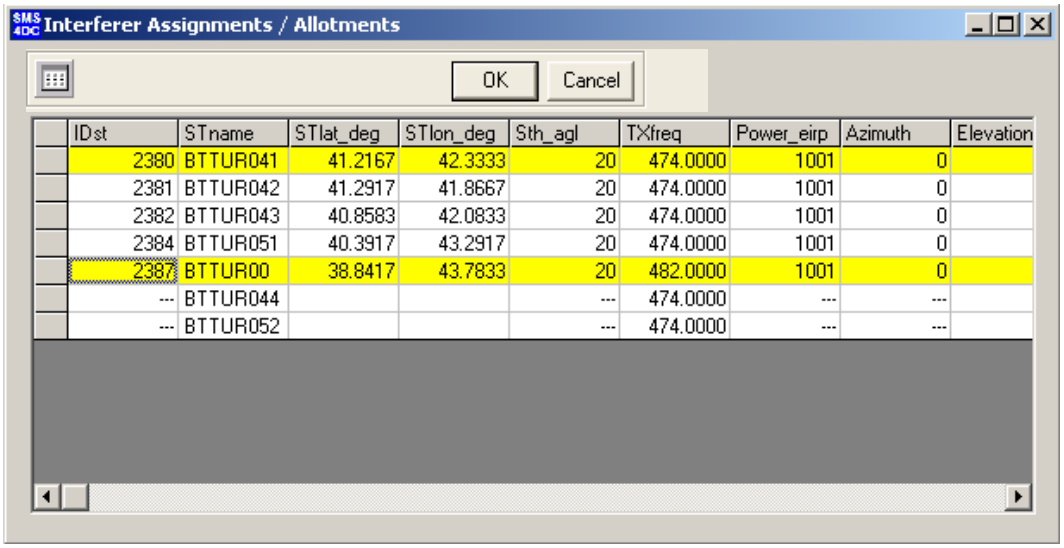
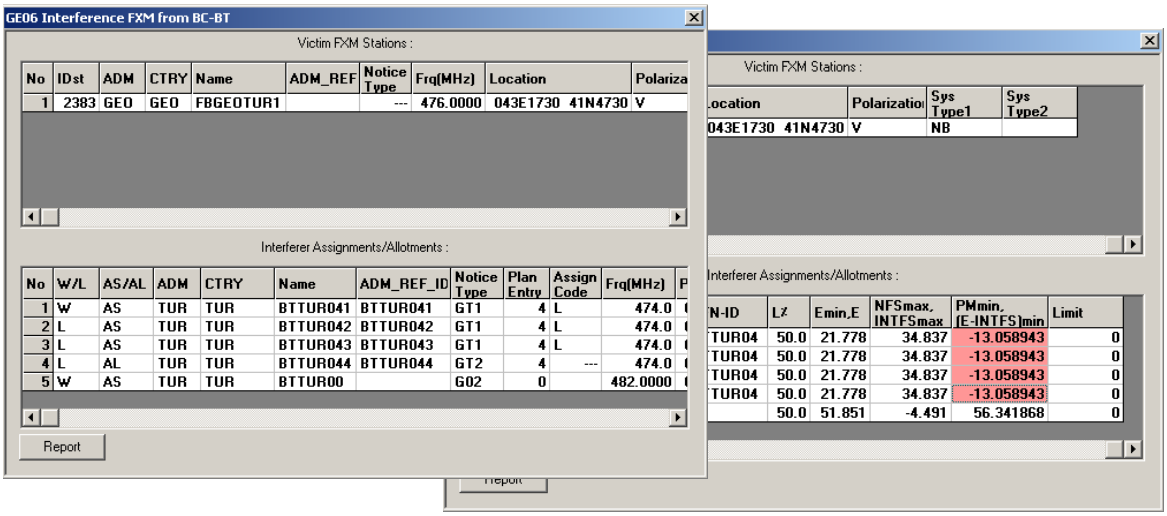


Figure 3.172. Spreadsheet of found interferer digital/analogue broadcasting assignments/allotments



IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth	Elevation
2380	BTTUR041	41.2167	42.3333	20	474.0000	1001	0	
2381	BTTUR042	41.2917	41.8667	20	474.0000	1001	0	
2382	BTTUR043	40.8583	42.0833	20	474.0000	1001	0	
2384	BTTUR051	40.3917	43.2917	20	474.0000	1001	0	
2387	BTTUR00	38.8417	43.7833	20	482.0000	1001	0	
---	BTTUR044			---	474.0000	---	---	
---	BTTUR052			---	474.0000	---	---	

Figure 3.173. Sample output of BCBT2FXM interference calculation



No	IDst	ADM	CTRY	Name	ADM_REF	Notice Type	Frq(MHz)	Location	Polariza
1	2383	GEO	GEO	FBGEOTUR1		---	476.0000	043E1730 41N4730	V

No	W/L	AS/AL	ADM	CTRY	Name	ADM_REF_ID	Notice Type	Plan Entry	Assign Code	Frq(MHz)	P
1	W	AS	TUR	TUR	BTTUR041	BTTUR041	GT1	4	L	474.0	
2	L	AS	TUR	TUR	BTTUR042	BTTUR042	GT1	4	L	474.0	
3	L	AS	TUR	TUR	BTTUR043	BTTUR043	GT1	4	L	474.0	
4	L	AL	TUR	TUR	BTTUR044	BTTUR044	GT2	4	---	474.0	
5	W	AS	TUR	TUR	BTTUR00		G02	0		482.0000	

Victim FXM Stations :

ocation	Polarizatio	Sys Type1	Sys Type2
043E1730 41N4730	V	NB	

Interferer Assignments/Allotments :

N-ID	LZ	Emin,E	NFSmax, INTFSmax	PMmin, (E-INTFS)min	Limit
TUR04	50.0	21.778	34.837	-13.058943	0
TUR04	50.0	21.778	34.837	-13.058943	0
TUR04	50.0	21.778	34.837	-13.058943	0
TUR04	50.0	21.778	34.837	-13.058943	0
	50.0	51.851	-4.491	56.341868	0

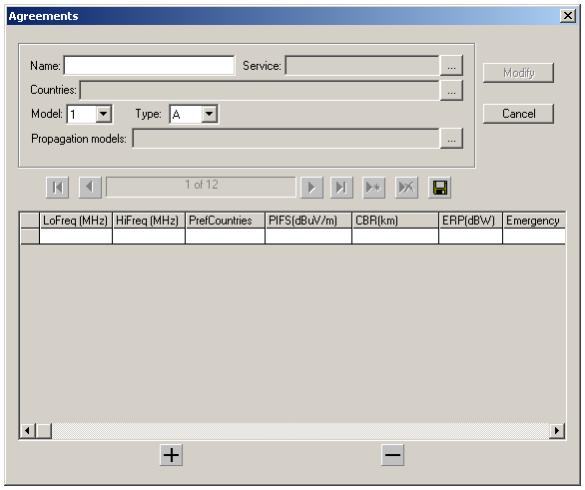
The column “PM min” reports an interference case and the red background identifies it visually from the other values in this column.

The information displayed in the result spreadsheets may be presented as a report and saved in the HTML format by using the “Report” push button.

3.4.2.12.5. Agreement item in Coordination menu of DEM view

The item "Agreement" in Coordination menu enables the entry of user-defined agreements which may be used for border coordination through the **"**Border**"** item in Section 3.4.2.12.6. Each agreement consists of two parts; header and technical characteristics. Figure 3.174 displays the entry mask for user-defined agreements.

Figure 3.174.a) User-defined agreement entry mask and b) List of countries which could be selected



(a) User-defined agreement entry mask

(b) List of selectable countries

The header part of entry mask defines: the agreement name, incorporated countries, included radiocommunication service(s), propagation models and category of agreement. Currently, SMS4DC employs P.1546 and Free Space propagation models for border calculation based on user-defined agreements. Only one propagation model per agreement can be selected using the button, on the right panel of the entry field. Multiple countries can be selected to be added to the list of member countries by pushing the button on the right side of the entry field. The following categories can be set using two combo boxes; Mode and Type. Table 3.6 presents the available categories for definition of agreements. The software is installed without any border agreements, therefore the agreement table will be blank (see Figure 3.174) until the user defines an agreement.

Table 3.6. Available categories for user-defined agreements

Mode	Mode 1					Mode 2			
Service	Land Mobile		Fixed			Land Mobile		Fixed	
Frequency(1)	All Frequencies		Below 1GHz		Above 1GHz	All Frequencies		Below 1GHz	
Type	A	A	A	A	B	No type is applicable			
Model	P.1546	Free Space	P.1546	Free Space	-	P.1546	Free Space	P.1546	Free Space
Contour type	CBR	CBR	CBR	CBR	Coordination Distance	X-km	X-km	X-km	X-km

(1): The actual frequency range of agreement is the combination with the propagation model frequency range

The contour type, used in Table 3.6, will be explained in Section 3.4.2.12.6. The content of the spreadsheet, in the lower part of agreement entry mask, varies for different categories of agreement. All fields in the spreadsheet are editable, except AgID. Editing of the field "PrefCountries" is managed by the push button "Preferential Countries" at the bottom of the entry mask. Table 3.7 describes the spreadsheet data (entry) fields and shows what type of agreement configuration causes them to be presented to the user.

Table 3.7. Description of fields used in the spreadsheet

Field name	Description	Category	
		Mode	Type
AgID	The ID number of an agreement in the database.	All	All
LoFreq,HiFreq	The lower and upper edge of the applicable frequency range (MHz).	All	All
PrefCountries	The list of preferential countries. If this cell in relevant row or the row is selected, the "Preferential Countries" push button can be used for choosing and inserting data in this cell.	2	---
PIFS	Permissible Interference Field Strength. This value (in dBμV/m) is compared with the calculated field strength value to determine whether or not coordination is necessary.	All	A
CBR	The CBR (Cross Border Range), in km, is the distance beyond the national border used to establish a contour of points. The distance of any point on this contour to the border, along the line connecting to the concerned station, will be identical and equal to CBR (see Figure 3.175).	1	A
X-km	The X-km, in km, is the distance beyond national border used to establish a contour of points. The nearest distance of any point on this contour to the border will be identical and equal to X-km (see Figure 3.175).	2	
CoordDist1	The coordination distance used where the summation of station height, above sea level, and antenna height, above ground level, is less than 300 metres.	1	B
CoordDist2	The coordination distance used where the summation of station height, above sea level, and antenna height, above ground level, is over 300 metres.	1	B
ERP	The Effective Radiated Power (ERP), in dBW, of reference transmitter, used for field strength calculations (except in type B, mode 1).	All	A
Emergency	The code indicating the operation type for the frequency band, 1 for emergency and 0 for normal operation modes. This field is available for all categories of agreement.	All	All

A set of standard toolbar buttons is provided for browsing the content of user-defined agreements. These buttons are explained in Table 3.8. The modify push button may be used to modify the displayed agreement. The values entered in the spreadsheet will be saved in the agreement directly, without need to push the save button.

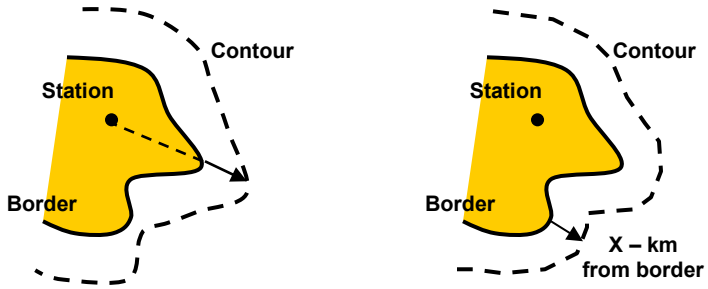
Table 3.8. Toolbar push buttons provided for browsing of user-defined agreements

Item	Description
	Push buttons to load entry mask with the first agreement.
	Push button to load entry mask with the previous agreement.
	Push button to load entry mask with the next agreement.
	Push buttons to load entry mask with the last agreement.
	Push buttons to reset the dialogue box for addition of a new agreement.
	Push buttons to delete the current agreement.
	Push buttons to save a modified or new agreement. Pushing this button is necessary after any modification to the header part.

3.4.2.12.6. Border coordination item in Coordination menu of DEM view

The item "Border" in the menu of Coordination performs the border coordination calculations for concerned stations in the fixed or land mobile radiocommunication services, in accordance with a known bilateral/multilateral agreement. The term "border coordination" refers to procedures involving various types of field strength calculation beyond a distance from the country border. This field strength has to be calculated when the CBR (Cross Border Range) and X-km categories are used to construct the contour. The CBR contour is the locus of points where their distances to the border, along the line connecting points to the concerned station, are identical. The x-km contour is the locus of points where their nearest distance to the border is set at an agreed value of *x* km. Figure 3.175 compares these categories.

Figure 3.175. Categories of contour definition for field strength calculation in border coordination



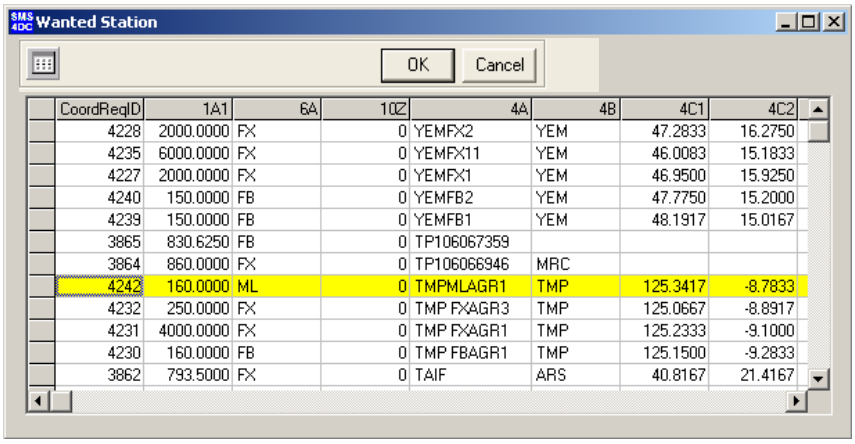
(a) Method of CBR (b) Method of X-km

Information concerning reference bilateral/multilateral agreements may be entered into the SMS4DC database from the item: "Coordination->Agreement" in Database menu.

After selecting this item, a spreadsheet is opened of the fixed and land mobile stations in the database. The user is able to select one station by a mouse left click on the relevant row of the record select column. By pushing the OK button below the spreadsheet, SMS4DC searches the database for applicable border agreements (with their reference calculations) to be used for the

selected station. Figure 3.176 displays a sample spreadsheet of stations in the fixed and land mobile services.

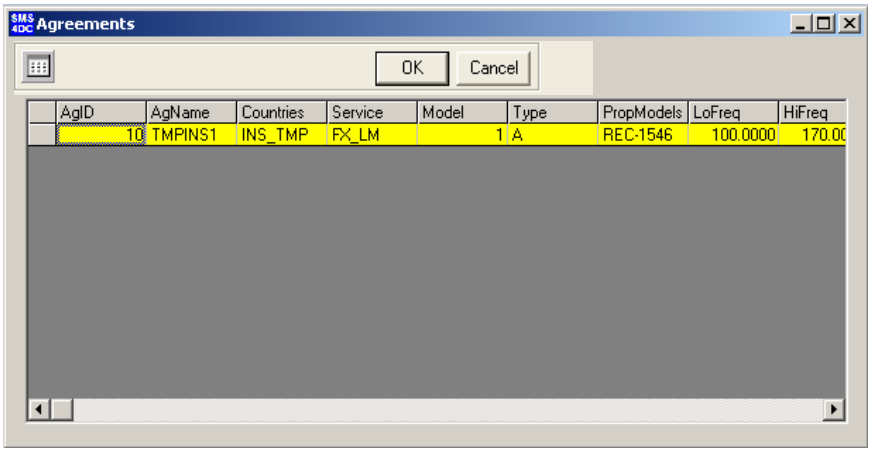
Figure 3.176. Spreadsheet of stations in fixed and land mobile service



CoordReqID	1A1	6A	10Z	4A	4B	4C1	4C2
4228	2000.0000	FX	0	YEMFX2	YEM	47.2833	16.2750
4235	6000.0000	FX	0	YEMFX11	YEM	46.0083	15.1833
4227	2000.0000	FX	0	YEMFX1	YEM	46.9500	15.9250
4240	150.0000	FB	0	YEMFB2	YEM	47.7750	15.2000
4239	150.0000	FB	0	YEMFB1	YEM	48.1917	15.0167
3865	830.6250	FB	0	TP106067359			
3864	860.0000	FX	0	TP106066946	MRC		
4242	160.0000	ML	0	TMPMLAGR1	TMP	125.3417	-8.7833
4232	250.0000	FX	0	TMP FXAGR3	TMP	125.0667	-8.8917
4231	4000.0000	FX	0	TMP FXAGR1	TMP	125.2333	-9.1000
4230	160.0000	FB	0	TMP FBAGR1	TMP	125.1500	-9.2833
3862	793.5000	FX	0	TAIF	ARS	40.8167	21.4167

If an applicable agreement (or agreements) is found, they will be displayed in a subsequent spreadsheet. The applicability of agreements will depend on the frequency, country and service type of the selected station. Several informative fields, such as: code of participating countries, services included and contour definition category, are presented for each agreement displayed. A blank spreadsheet means that no applicable agreement exists.

Figure 3.177. An example of applicable agreement to the selected station

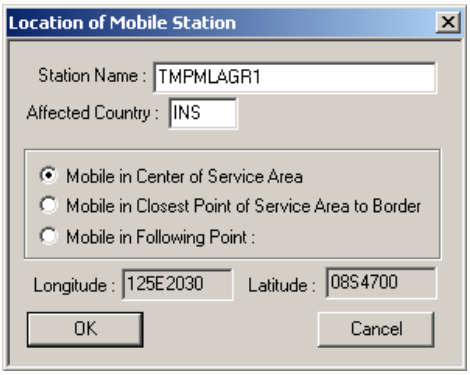


AgID	AgName	Countries	Service	Model	Type	PropModels	LoFreq	HiFreq
10	TMPINS1	INS_TMP	FX_LM	1	A	REC-1546	100.0000	170.0

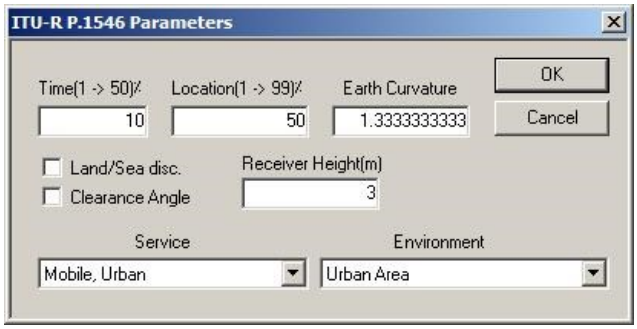
After choosing one of the presented applicable agreements, the search radius will be requested as additional criteria. Once the search radius has been specified, a dialogue boxes will be opened. There are different types of dialogue box depending on the type of accepted propagation model in the agreement and class of selected station. In the case of a selected station in the land mobile service, a dialogue box will be opened to determine the location of the mobile station in order to conduct the field strength calculation (see Figure 3.178a). In addition to the mobile station name, the user has to decide the location of mobile station in one of the following situations: the centre

of circular service area, the closest distance to the concerned country or a specific point inside the service area.

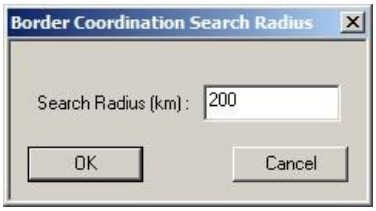
Figure 3.178. a) Dialogue box of mobile station location and b) ITU-R P.1546 propagation model parameters c) Search area determination



(a) Dialogue of mobile station location



(b) Propagation model parameters



(c) Search area determination

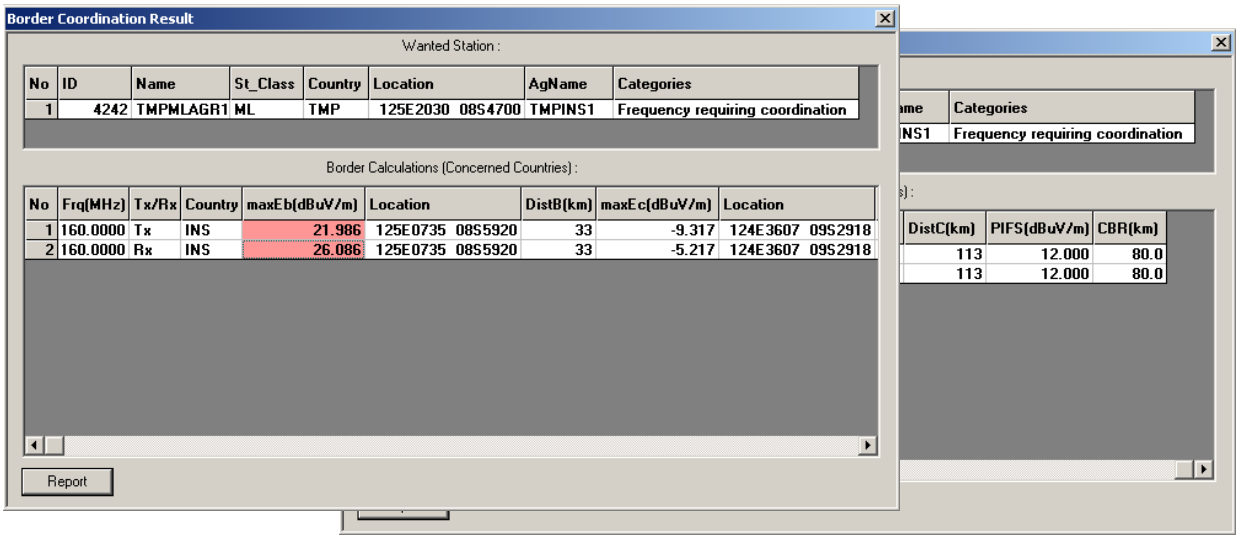
This dialogue box will be repeated for any neighbouring country inside the circular search area around the selected station. In the case of using the ITU-R P.1546 propagation model, another dialogue box will be opened to set values for the model's parameters such as: time percentage, search frequency range, k-factor and type of environment and receiver height (see Figure 3.178b).

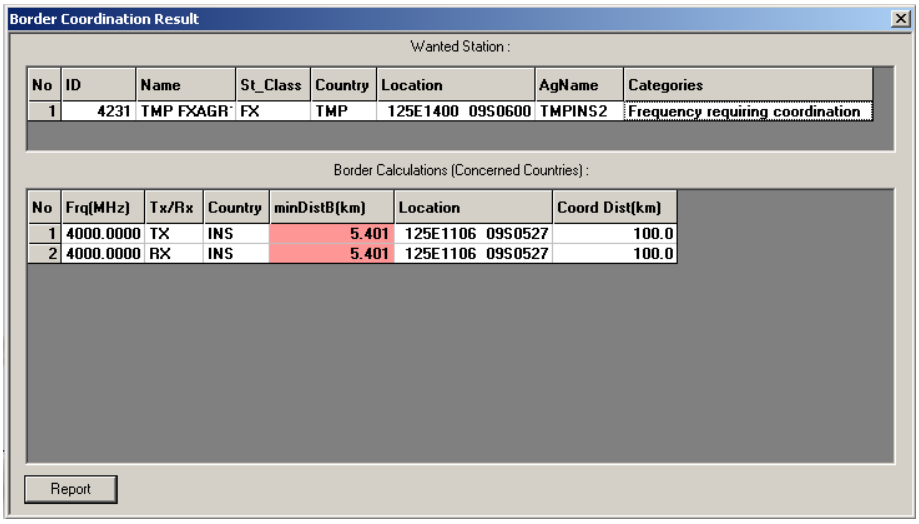
After finishing the calculations and closing the progress bar, the result dialogue box will be displayed. The wanted station information is displayed above the result dialogue box while the calculation results are listed in the lower table. The fields representing the calculation results are different for the different categories of calculation contour (CBR or X-km) and selected station. Figure 3.179 displays these different result dialogue boxes, created for different scenarios of border calculation. Table 3.6 describes the fields used in the different result dialogue boxes displayed in Figure 3.179.

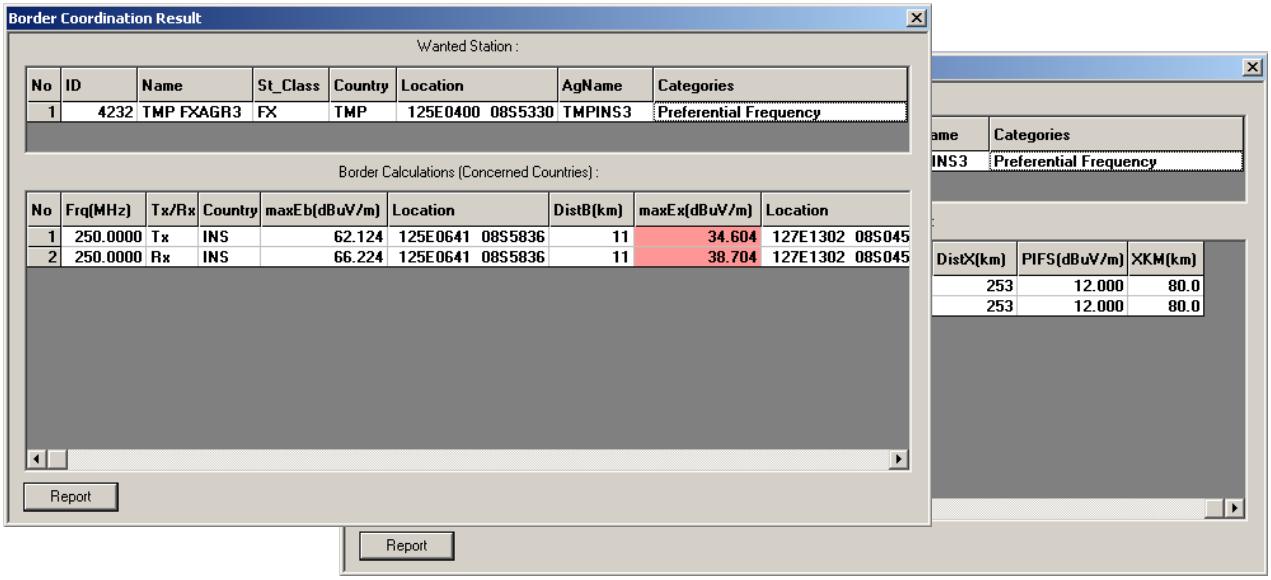
Table 3.9. Description of fields used to represent results of border calculation

Field	Description	Type of Agreement		
		Frequency Requiring coordination		Preferential Frequency
		Type A: LM in all frequency and FX below 1GHz	**Type B:** FX above 1GHz	LM in all frequency and FX below 1GHz
Frequency	Frequency under investigation	X	X	X
TX or RX	Mode of frequency under investigation	X	X	X
Concerned countries	Countries likely to be affected by a station in another country	X	X	X
Max. Eb	Maximum field strength on border line	X		X
Max. Eb location	The location of maximum Eb	X		X
DistB	Distance of wanted station to the maximum Eb location	X		X
Max Ec	Maximum field strength on CBR (Figure 3.175)	X		
Max. Ec location	The location of maximum Ec	X		
DistC	Distance of wanted station to the maximum Ec location	X		
Max Ex	Maximum field strength on X-km contour (Figure 3.175)			X
Max. Ex location	The location of maximum Ex			X
DistX	Distance of wanted station to the maximum Ex location			X
PIFS	Permissible Interference Field Strength in accordance with agreement	X		X
CBR	Cross Border Range in accordance with agreement	X		
X-km	Contour of X km beyond wanted country border line			X
Min. DistB	Minimum distance of wanted station to the border line		X	
Min DistB location	The location of maximum Eb		X	
Coord. Dist.	Minimum permitted distance to the border (from agreement) for comparison with MinDistB		X	

Figure 3.179. Border coordination result windows for different type of wanted-victim stations configuration





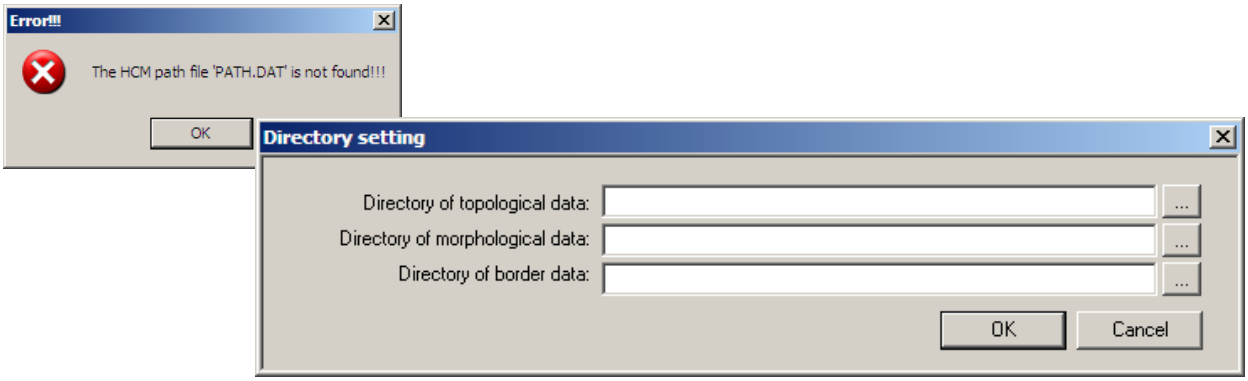


Users are able to generate and store an HTML report of any type of results by pushing the “Report” button in the bottom of the result dialogue box.

3.4.2.12.7. HCM Agreement item in Coordination menu of DEM view

The item “HCM Agreement” in the menu of Coordination, performs the coordination calculations for concerned stations in the fixed or land mobile radiocommunication services, in accordance with Harmonized Calculation Method (HCM) agreement. This function needs the path of relevant maps (TOPO, MORPHO, BORDER) in appropriate format. The path should be specified in a file which is named PATH.DAT in SMS4DC/bin folder. If the software cannot find the PATH.DAT, it warns and then asks the path of relevant maps, as shown on Figure 3.HCM.1.

Figure 3.HCM.1. The path of relevant maps to be used by HCM Agreement function

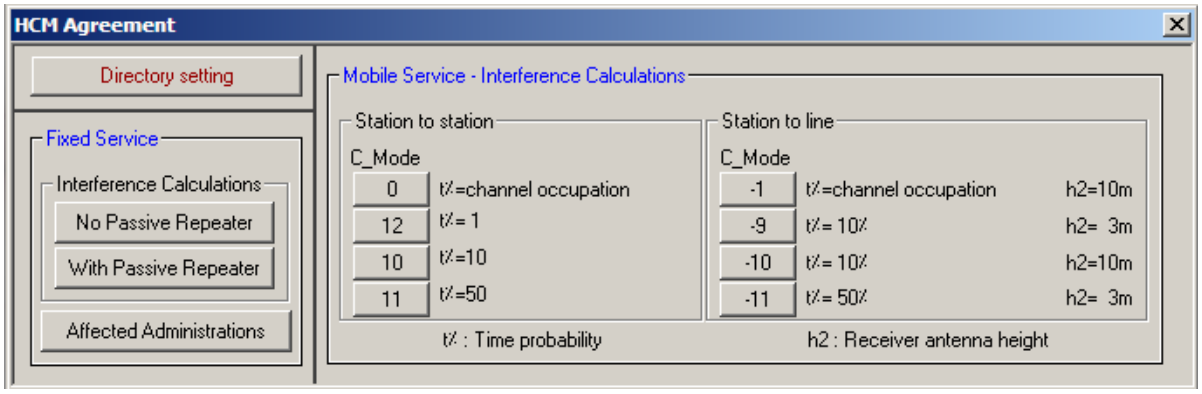


After successful creation of the PATH.DAT, a dialogue box including the functions of HCM Agreement will be appeared for fixed and mobile services as displayed on Figure 3.HCM.2. The "Directory setting" button of the dialogue box can be used to modify the path of relevant maps.

- **Fixed service**

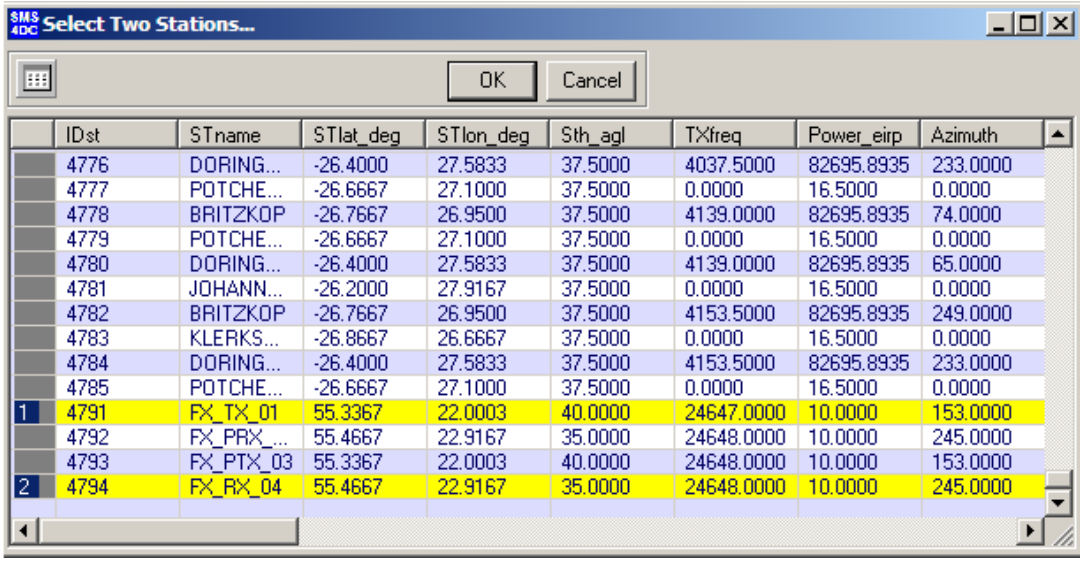
The "No Passive Repeater" and "With passive repeater", buttons are for performing the interference calculation between two stations or between two stations trough passive repeaters. Also there is "Affected Administration" button for fixed service for identification of affected administrations based on HCM Agreement.

Figure 3.HCM.2. HCM Agreement functions for Fixed and Mobile services



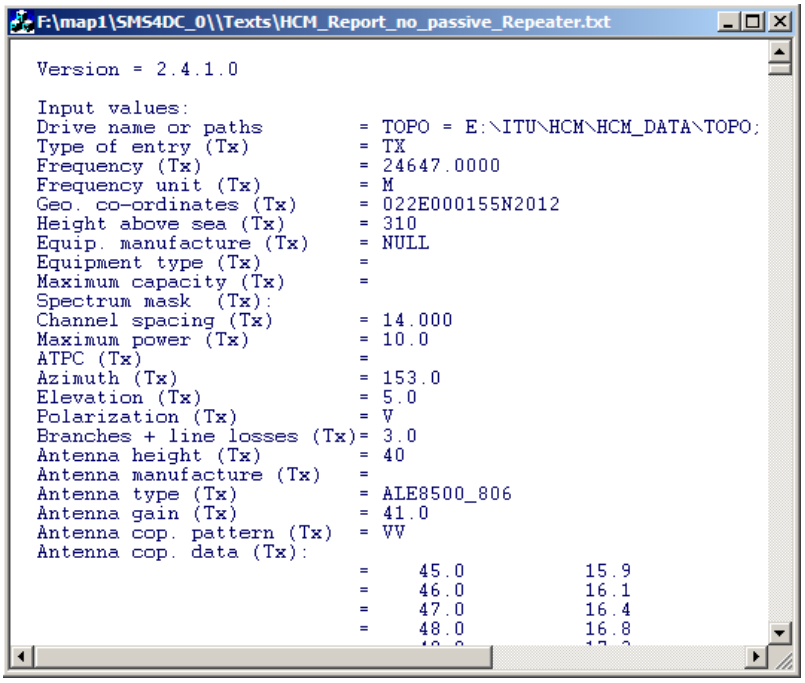
With selecting the "Interference Calculations / No Passive Repeater " button, a spreadsheet is displayed listing the existing stations. After selecting of two stations (transmitter and receiver stations) the results of interference calculation will be displayed as shown in Figures 3.HCM.3 and 3.HCM.4.

Figure 3.HCM.3. Spreadsheet of Fixed stations in HCM Agreement Function for Fixed service without Repeater



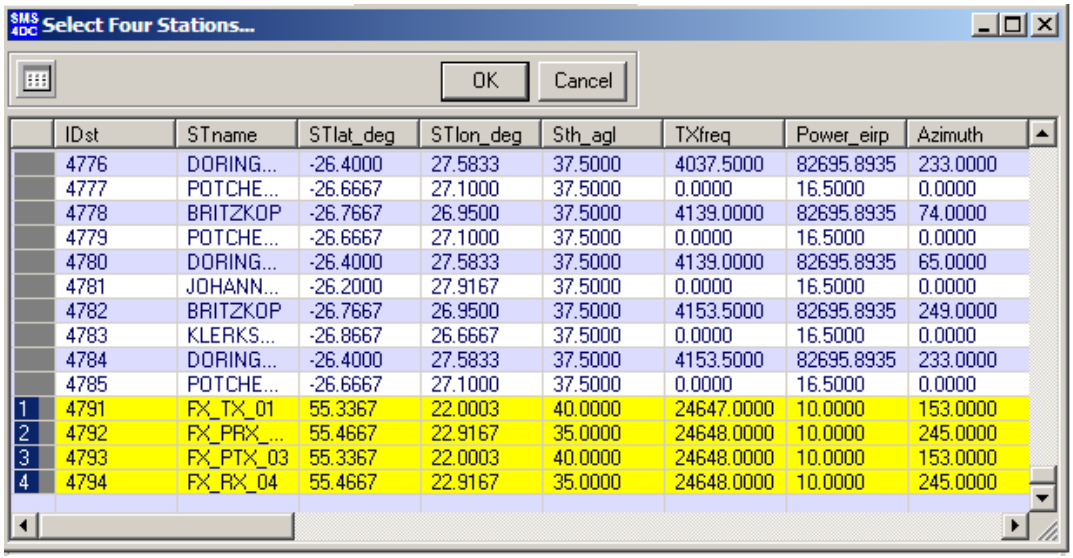
	IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth
	4776	DORING...	-26.4000	27.5833	37.5000	4037.5000	82695.8935	233.0000
	4777	POTCHE...	-26.6667	27.1000	37.5000	0.0000	16.5000	0.0000
	4778	BRITZKOP	-26.7667	26.9500	37.5000	4139.0000	82695.8935	74.0000
	4779	POTCHE...	-26.6667	27.1000	37.5000	0.0000	16.5000	0.0000
	4780	DORING...	-26.4000	27.5833	37.5000	4139.0000	82695.8935	65.0000
	4781	JOHANN...	-26.2000	27.9167	37.5000	0.0000	16.5000	0.0000
	4782	BRITZKOP	-26.7667	26.9500	37.5000	4153.5000	82695.8935	249.0000
	4783	KLERKS...	-26.8667	26.6667	37.5000	0.0000	16.5000	0.0000
	4784	DORING...	-26.4000	27.5833	37.5000	4153.5000	82695.8935	233.0000
	4785	POTCHE...	-26.6667	27.1000	37.5000	0.0000	16.5000	0.0000
1	4791	FX_TX_01	55.3367	22.0003	40.0000	24647.0000	10.0000	153.0000
	4792	FX_PRX_...	55.4667	22.9167	35.0000	24648.0000	10.0000	245.0000
	4793	FX_PTX_03	55.3367	22.0003	40.0000	24648.0000	10.0000	153.0000
2	4794	FX_RX_04	55.4667	22.9167	35.0000	24648.0000	10.0000	245.0000

Figure 3.HCM.4. Sample output of HCM Agreement for Fixed service without Repeater



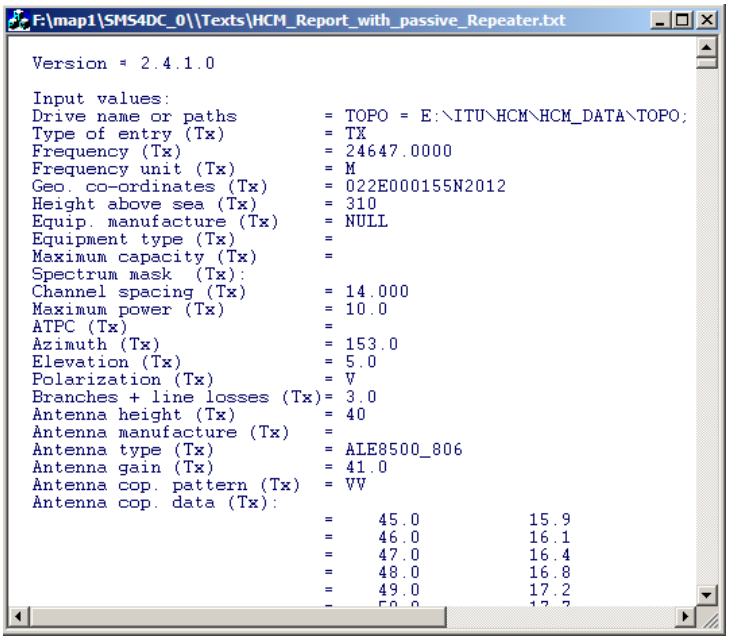
With selecting the "Interference Calculations / With Passive Repeater " button, a spreadsheet is displayed listing the existing stations. After selecting of four stations (Transmitter, repeaters and receiver stations) the results of interference calculation will be displayed as shown in Figures 3.HCM.4 and 3.HCM.6.

Figure 3.HCM.5. Spreadsheet of Fixed stations in HCM Agreement Function for Fixed service with Repeater



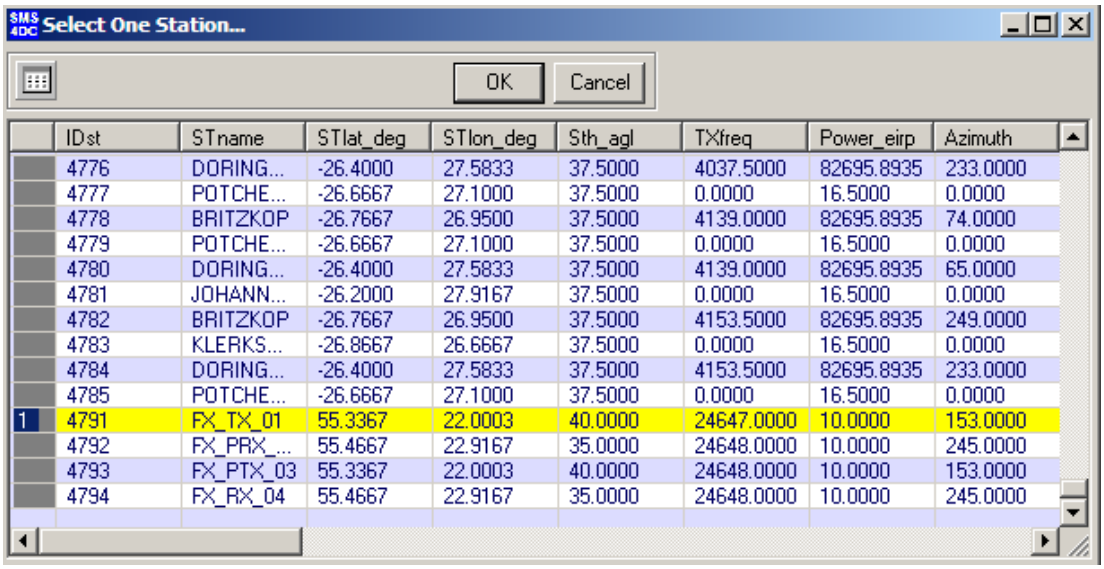
	IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth
	4776	DORING...	-26.4000	27.5833	37.5000	4037.5000	82695.8935	233.0000
	4777	POTCHE...	-26.6667	27.1000	37.5000	0.0000	16.5000	0.0000
	4778	BRITZKOP	-26.7667	26.9500	37.5000	4139.0000	82695.8935	74.0000
	4779	POTCHE...	-26.6667	27.1000	37.5000	0.0000	16.5000	0.0000
	4780	DORING...	-26.4000	27.5833	37.5000	4139.0000	82695.8935	65.0000
	4781	JOHANN...	-26.2000	27.9167	37.5000	0.0000	16.5000	0.0000
	4782	BRITZKOP	-26.7667	26.9500	37.5000	4153.5000	82695.8935	249.0000
	4783	KLERKS...	-26.8667	26.6667	37.5000	0.0000	16.5000	0.0000
	4784	DORING...	-26.4000	27.5833	37.5000	4153.5000	82695.8935	233.0000
	4785	POTCHE...	-26.6667	27.1000	37.5000	0.0000	16.5000	0.0000
1	4791	FX_TX_01	55.3367	22.0003	40.0000	24647.0000	10.0000	153.0000
2	4792	FX_PRX_...	55.4667	22.9167	35.0000	24648.0000	10.0000	245.0000
3	4793	FX_PTX_03	55.3367	22.0003	40.0000	24648.0000	10.0000	153.0000
4	4794	FX_RX_04	55.4667	22.9167	35.0000	24648.0000	10.0000	245.0000

Figure 3.HCM.6. Sample output of HCM Agreement for Fixed service with Repeater



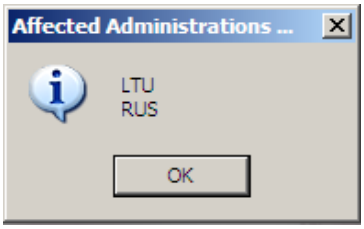
By selecting the "Affected Administrations" a list of existing fixed stations will be appeared as shown on Figure 3.HCM.7, and by selecting of the wanted station the list of affected administrations, based on HCM Agreement, will be displayed as shown in Figure 3.HCM.8.

Figure 3.HCM.7. Spreadsheet of Fixed stations in HCM Agreement Function for determination of affected Administrations



	IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth
	4776	DORING...	-26.4000	27.5833	37.5000	4037.5000	82695.8935	233.0000
	4777	POTCHE...	-26.6667	27.1000	37.5000	0.0000	16.5000	0.0000
	4778	BRITZKOP	-26.7667	26.9500	37.5000	4139.0000	82695.8935	74.0000
	4779	POTCHE...	-26.6667	27.1000	37.5000	0.0000	16.5000	0.0000
	4780	DORING...	-26.4000	27.5833	37.5000	4139.0000	82695.8935	65.0000
	4781	JOHANN...	-26.2000	27.9167	37.5000	0.0000	16.5000	0.0000
	4782	BRITZKOP	-26.7667	26.9500	37.5000	4153.5000	82695.8935	249.0000
	4783	KLERKS...	-26.8667	26.6667	37.5000	0.0000	16.5000	0.0000
	4784	DORING...	-26.4000	27.5833	37.5000	4153.5000	82695.8935	233.0000
	4785	POTCHE...	-26.6667	27.1000	37.5000	0.0000	16.5000	0.0000
1	4791	FX_TX_01	55.3367	22.0003	40.0000	24647.0000	10.0000	153.0000
	4792	FX_PRX_...	55.4667	22.9167	35.0000	24648.0000	10.0000	245.0000
	4793	FX_PTX_03	55.3367	22.0003	40.0000	24648.0000	10.0000	153.0000
	4794	FX_RX_04	55.4667	22.9167	35.0000	24648.0000	10.0000	245.0000

Figure 3.HCM.8. Sample output of HCM Agreement for determination of affected Administrations in Fixed service

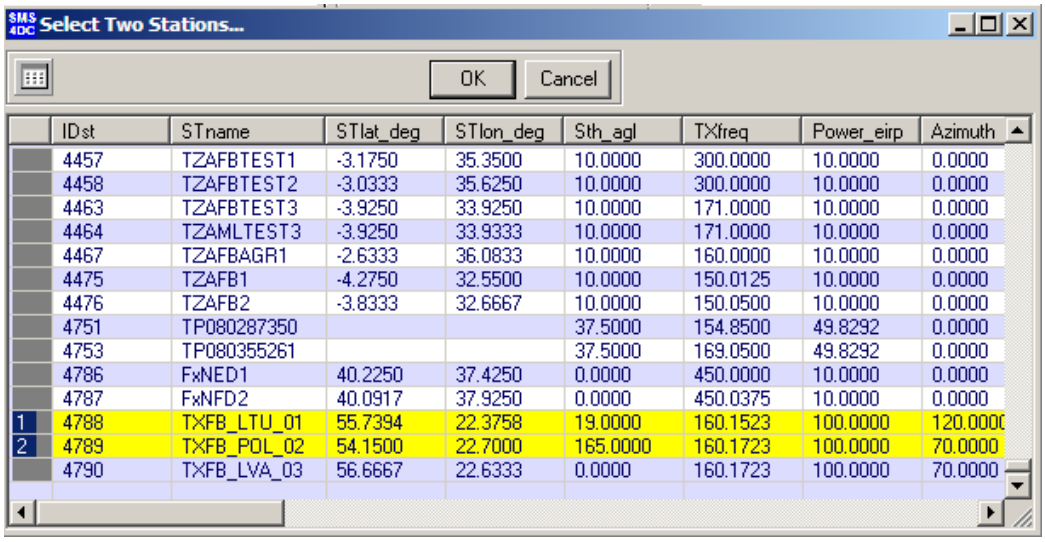


- **Mobile service**

Figure 3.HCM.2 shows the list of functions for mobile service. The HCM program including the choice of different calculation-modes, these choices are called CMODE. Negative CMODE - codes are for (border-) line-calculations. Transmitter-data has to be supplied and appropriate (border-) line should be selected. Zero and all positive CMODE-codes are for station to station calculations.

Station to station, Zero and all positive CMODE-codes, these items calculate the interference between two stations. After choosing one of these items, all mobile stations will be listed in a spreadsheet and the user may select, using a mouse left click on the record-two stations as transmitter and receiver as shown in Figure 3.HCM.9.

Figure 3.HCM.9. Spreadsheet of Mobile stations in HCM Agreement Functions for interference calculations between two stations



	IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth
	4457	TZAFBTEST1	-3.1750	35.3500	10.0000	300.0000	10.0000	0.0000
	4458	TZAFBTEST2	-3.0333	35.6250	10.0000	300.0000	10.0000	0.0000
	4463	TZAFBTEST3	-3.9250	33.9250	10.0000	171.0000	10.0000	0.0000
	4464	TZAMLTEST3	-3.9250	33.9333	10.0000	171.0000	10.0000	0.0000
	4467	TZAFBAGR1	-2.6333	36.0833	10.0000	160.0000	10.0000	0.0000
	4475	TZAFB1	-4.2750	32.5500	10.0000	150.0125	10.0000	0.0000
	4476	TZAFB2	-3.8333	32.6667	10.0000	150.0500	10.0000	0.0000
	4751	TP080287350			37.5000	154.8500	49.8292	0.0000
	4753	TP080355261			37.5000	169.0500	49.8292	0.0000
	4786	FxNED1	40.2250	37.4250	0.0000	450.0000	10.0000	0.0000
	4787	FxNFD2	40.0917	37.9250	0.0000	450.0375	10.0000	0.0000
1	4788	TXFB_LTU_01	55.7394	22.3758	19.0000	160.1523	100.0000	120.0000
2	4789	TXFB_POL_02	54.1500	22.7000	165.0000	160.1723	100.0000	70.0000
	4790	TXFB_LVA_03	56.6667	22.6333	0.0000	160.1723	100.0000	70.0000

When the two stations have been selected, a dialogue box will appear for the user to specify required values such as Antenna type, height above sea level, channel occupation, depolarization loss and permissible filed strength. The “Set Parameter” dialogue box is shown in Figure 3.HCM.10.

Once the user has specified values for these parameters, or accepted the default values, the calculation starts and the results file will be displayed.

Figure 3.HCM.11 shows the results of interference calculations for the case of "station to station".

Figure 3.HCM.10. Dialogue box of interference calculation parameters for Mobile stations in HCM Agreement

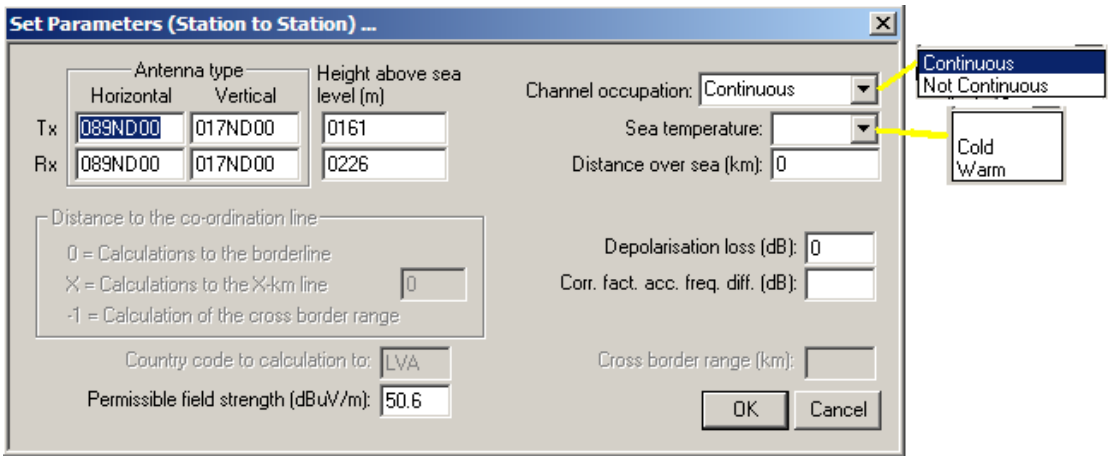
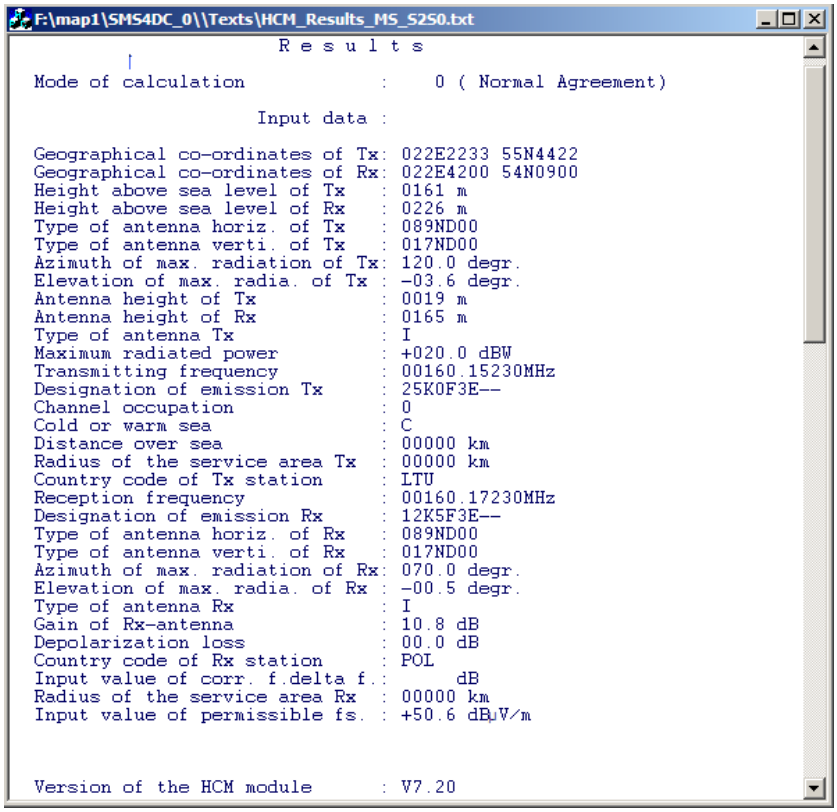
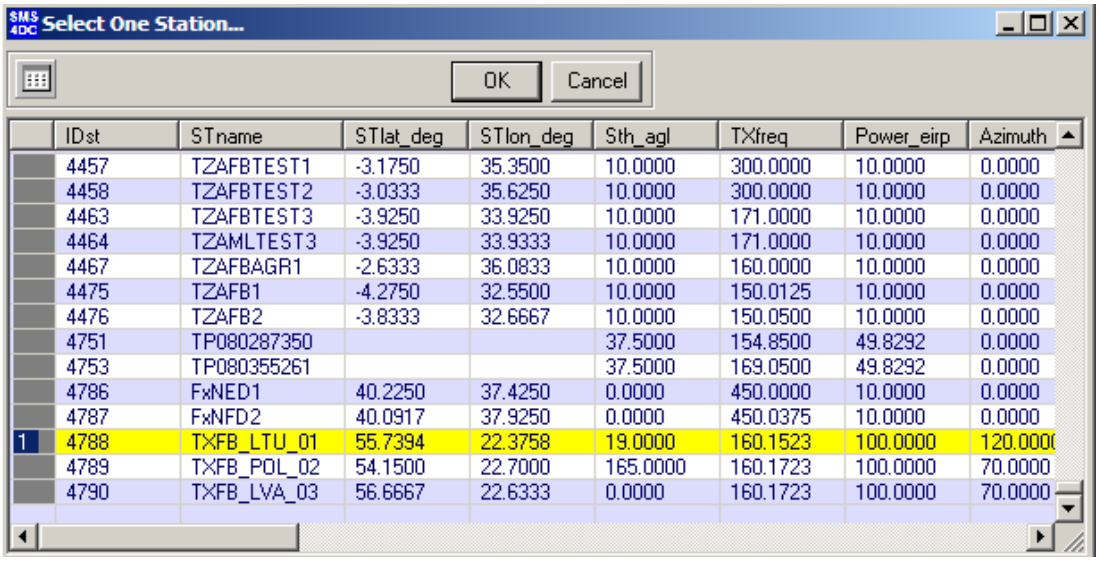


Figure 3.HCM.11. Sample output of HCM Agreement for Mobile service-Station to Station interference calculation



Station to line, all negative CMODE-codes, these items performs line calculations.. After choosing one of these items, all mobile stations will be listed in a spreadsheet and the user may select, using a mouse left click on the record-one station as transmitter as shown in Figure 3.HCM.12.

Figure 3.HCM.12. Spreadsheet of Mobile stations in HCM Agreement Functions for line calculations



	IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth
	4457	TZAFBTEST1	-3.1750	35.3500	10.0000	300.0000	10.0000	0.0000
	4458	TZAFBTEST2	-3.0333	35.6250	10.0000	300.0000	10.0000	0.0000
	4463	TZAFBTEST3	-3.9250	33.9250	10.0000	171.0000	10.0000	0.0000
	4464	TZAMLTEST3	-3.9250	33.9333	10.0000	171.0000	10.0000	0.0000
	4467	TZAFBAGR1	-2.6333	36.0833	10.0000	160.0000	10.0000	0.0000
	4475	TZAFB1	-4.2750	32.5500	10.0000	150.0125	10.0000	0.0000
	4476	TZAFB2	-3.8333	32.6667	10.0000	150.0500	10.0000	0.0000
	4751	TP080287350			37.5000	154.8500	49.8292	0.0000
	4753	TP080355261			37.5000	169.0500	49.8292	0.0000
	4786	FxNED1	40.2250	37.4250	0.0000	450.0000	10.0000	0.0000
	4787	FxNFD2	40.0917	37.9250	0.0000	450.0375	10.0000	0.0000
1	4788	TXFB_LTU_01	55.7394	22.3758	19.0000	160.1523	100.0000	120.0000
	4789	TXFB_POL_02	54.1500	22.7000	165.0000	160.1723	100.0000	70.0000
	4790	TXFB_LVA_03	56.6667	22.6333	0.0000	160.1723	100.0000	70.0000

When the transmitter station has been selected, a dialogue box will appear for the user to specify required values such as Antenna type, height above sea level, channel occupation, cross border range, country code to calculate to, distance to the coordination line and permissible filed strength. The "Set Parameter" dialogue box is shown in Figure 3.HCM.13.

Once the user has specified the values for these parameters, or accepted the default values, the calculation starts and the results file will be displayed.

Figure 3.HCM.13. Dialogue box of line calculation parameters for Mobile stations in HCM Agreement

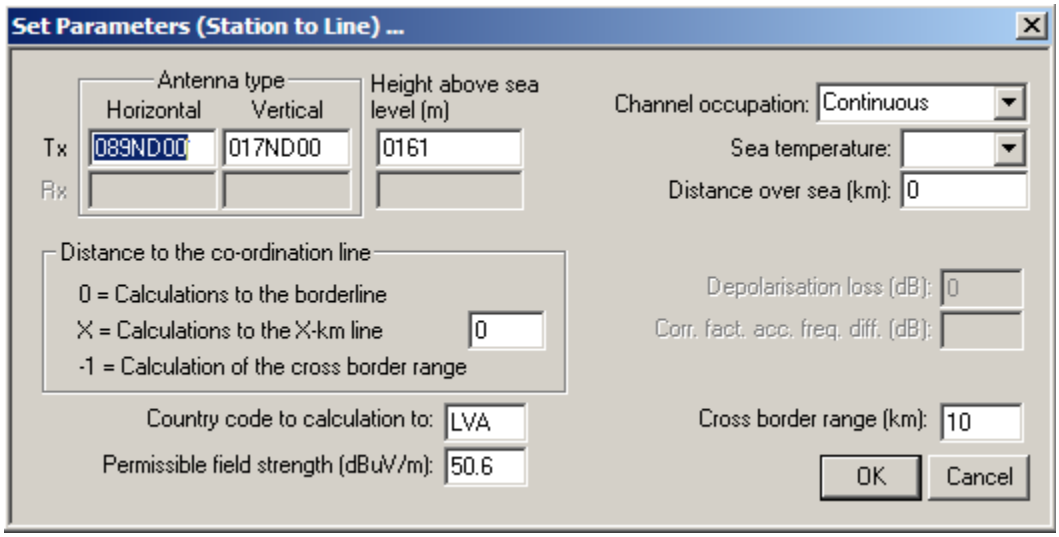
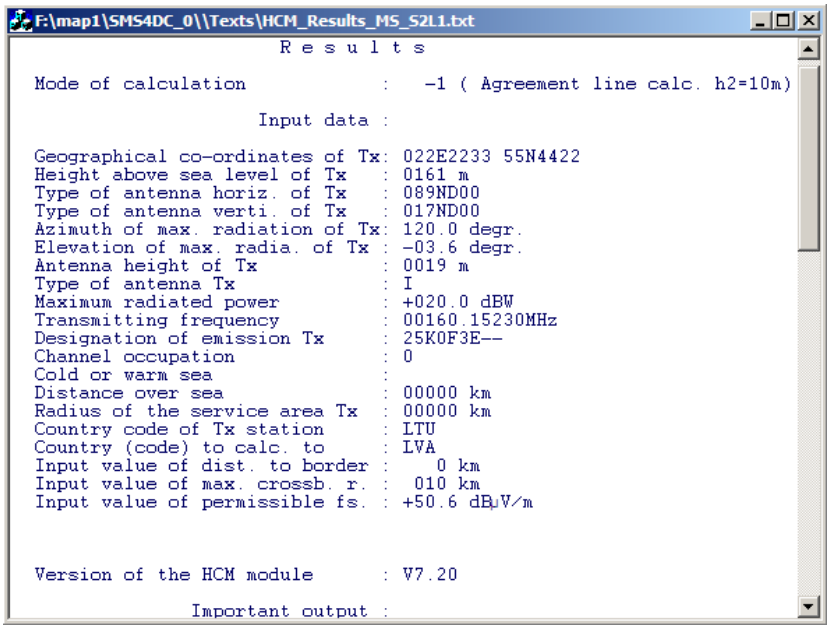


Figure 3.HCM.14 shows the results of line calculations for the case of "station to line".

Figure 3.HCM.14. Sample output of HCM Agreement for Mobile service-Station to line calculation

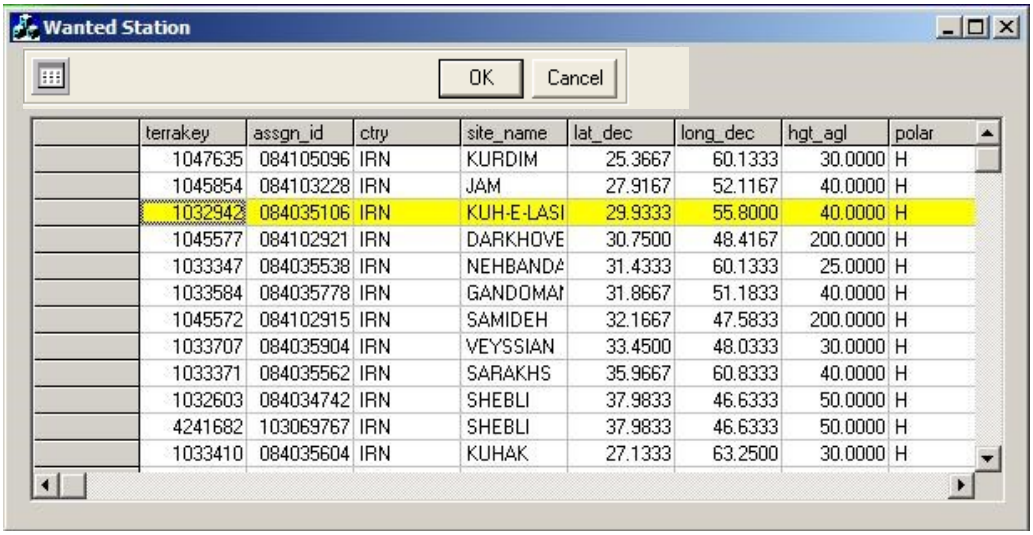


3.4.2.13. Interference menu of DEM view

Interference calculations have been implemented in this menu to analyse several configurations of wanted and victim stations: BC - BC (FM sound broadcasting stations), BT - BT (Analogue TV broadcasting stations), FX – FX (point to point hops and individual fixed stations), ES - ES (earth stations), ES – FX and cross service interference calculation procedures. The technical reference of the procedures implemented is explained in Chapter 5. These features are described below:

- BC2BC: This item calculates the aggregate interference level of interfering BC stations on a directional receiver of a wanted BC station. The interference free area around the wanted FM sound broadcasting station is calculated in this item. By selection of this item, a list of all FM sound broadcasting station is presented. Users are able to select a wanted BC station using a mouse left click on the record select column of the concerned row. Figure 3.180 displays the spreadsheet of all available FM sound broadcasting stations in the database.

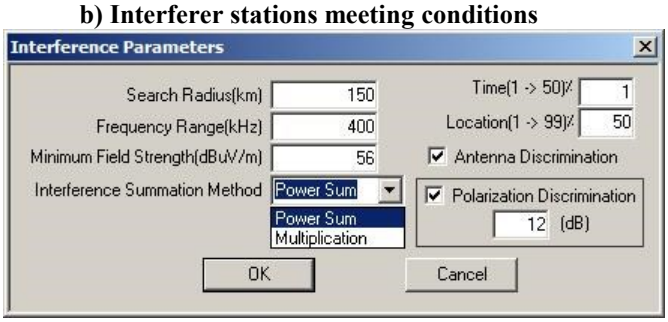
Figure 3.180. Spreadsheet of all available FM sound broadcasting stations



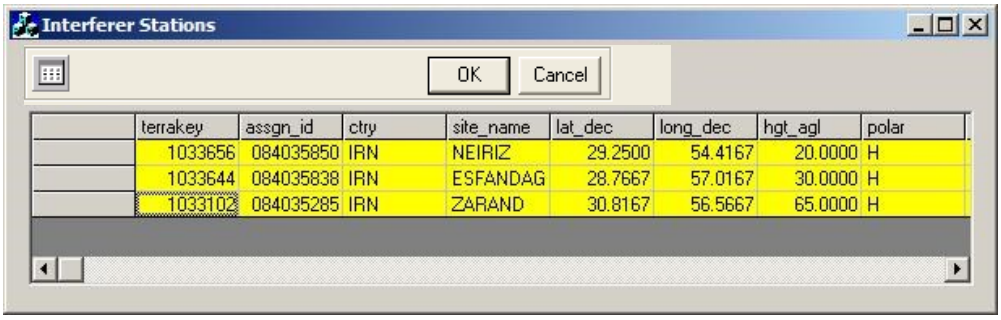
terrakey	assgn_id	ctry	site_name	lat_dec	long_dec	hgt_agl	polar
1047635	084105096	IRN	KURDIM	25.3667	60.1333	30.0000	H
1045854	084103228	IRN	JAM	27.9167	52.1167	40.0000	H
1032942	084035106	IRN	KUH-E-LASI	29.9333	55.8000	40.0000	H
1045577	084102921	IRN	DARKHOVE	30.7500	48.4167	200.0000	H
1033347	084035538	IRN	NEHBANDA	31.4333	60.1333	25.0000	H
1033584	084035778	IRN	GANDOMAI	31.8667	51.1833	40.0000	H
1045572	084102915	IRN	SAMIDEH	32.1667	47.5833	200.0000	H
1033707	084035904	IRN	VEYSSIAN	33.4500	48.0333	30.0000	H
1033371	084035562	IRN	SARAKHS	35.9667	60.8333	40.0000	H
1032603	084034742	IRN	SHEBLI	37.9833	46.6333	50.0000	H
4241682	103069767	IRN	SHEBLI	37.9833	46.6333	50.0000	H
1033410	084035604	IRN	KUHAK	27.1333	63.2500	30.0000	H

When the OK button is pushed, a dialogue box of Interference Parameters is opened to set the search conditions for the victim BC stations. This dialogue box contains the parameters: search radius (in km), frequency range (respect to the centre frequency of current signal), minimum field strength (the minimum value of useable field strength), interference summation (aggregation) method, time and location percentage, antenna discrimination (receiving directional antenna discrimination in accordance with ITU-R BS.599 toward to the corresponding BC transmitter) and polarization discrimination. A spreadsheet presents a list of all BC stations found in the database that meet the set conditions. Figure 3.181 demonstrates the dialogue box of interference calculation parameters and found BC stations.

Figure 3.181. a) Dialogue box of interference calculation parameters and b) Interferer stations meeting conditions



(a) Dialogue box of interference calculation parameters



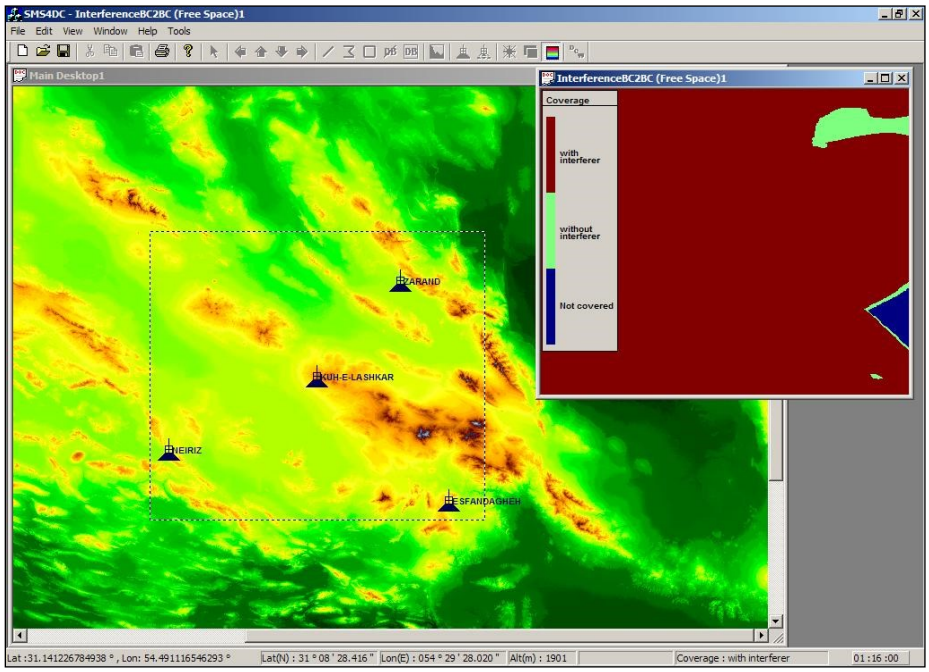
(b) Spreadsheet of found BC stations

Some or all of listed BC stations can be selected for detailed area calculations. The area calculation results, using the free space propagation model, will be displayed in a new window and a different menu bar is presented. The circular search area, specified in Figure 3.181, is fitted inside the result window. The position of the mouse cursor on the area result window shows, on the status bar, the existence of interference for receivers of the concerned BC station. The "Tools" menu of the new menu bar provides the following helpful items:

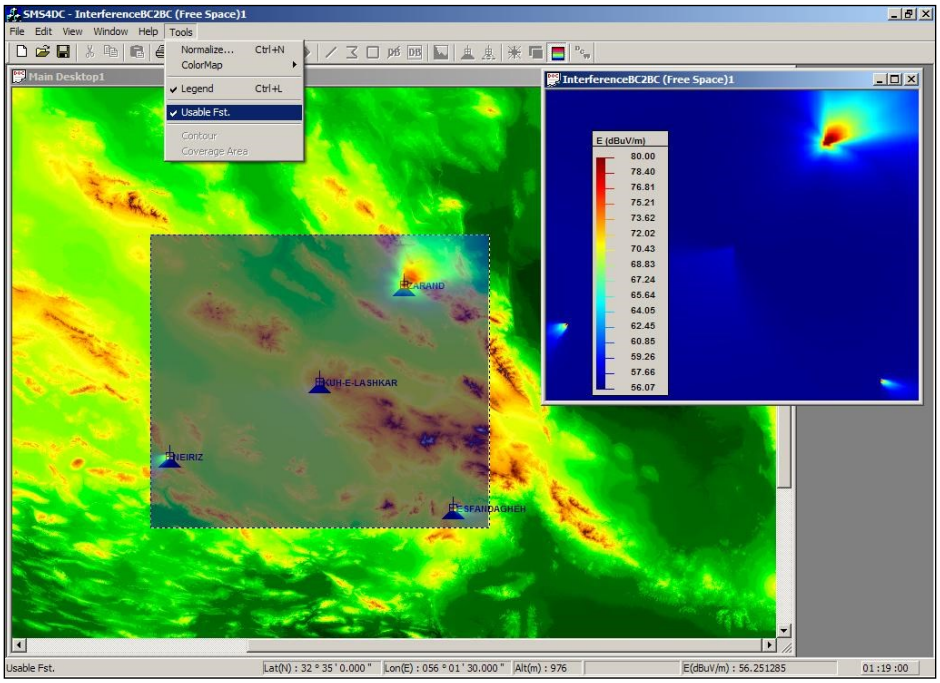
- Normalize: Changes the display range of field-strength values. The user can modify the minimum and maximum threshold of field strength value. Points with field strength values higher and lower than the defined value range will be displayed by the two colours at the bottom and top of the legend;
- Colour Map: Changes the colour map used in the demonstration of terrain height in the DEM view. Figure 3.22 displays the implemented colour maps;
- Legend: To switch on / off the legend of 2D plot. A check mark will appear in item left side if switched on. A corresponding toolbar button is also available (see Section 3.4.1).
- Usable Fst.: Changes the type of demonstrated area calculation result from contour into the 2D field strength value and vice versa. The relevant value at the position of the mouse cursor is displayed on the status bar.

Figure 3.182 displays the 2D plots and "Tools" menu described above. ITU-R BS.412 is used to define the protection ratio.

Figure 3.182. a) Coverage area of a concerned BC station in presence of /without interferer stations b) Usable field strength on receivers of wanted broadcasting station inside a selected area



(a)

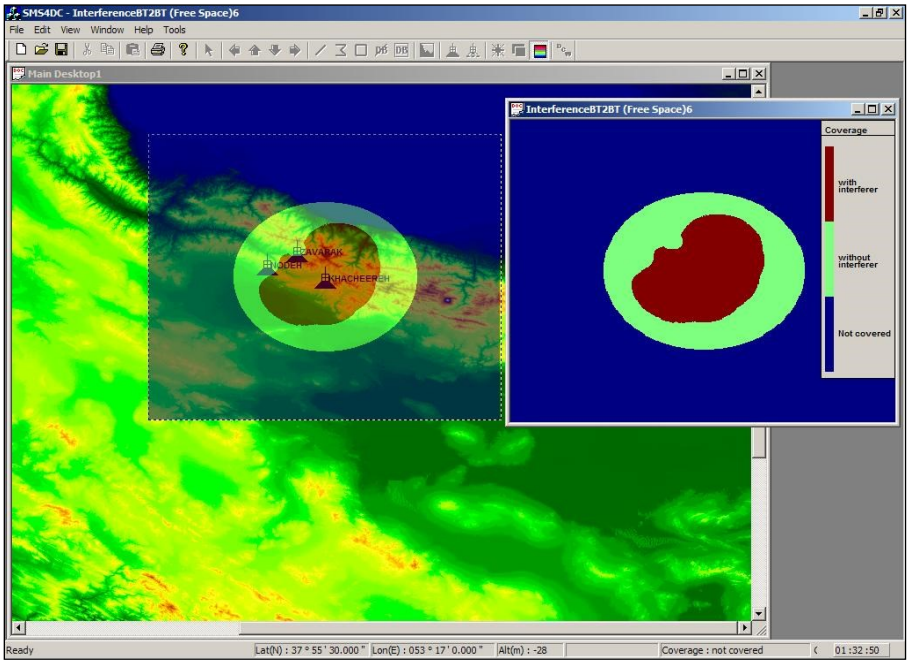


(b)

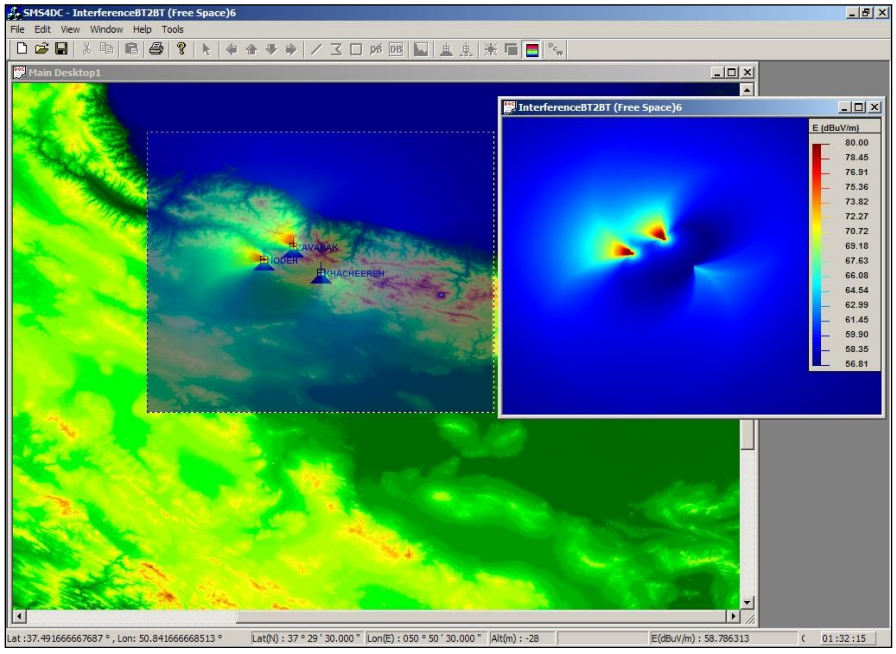
- BT2BT: This item calculates the aggregate interference level of interfering BT stations on a receiver of a wanted BT station. The interference free area around the wanted TV broadcasting station is calculated in this item. The procedure of BT to BT interference calculation is same as BC to BC which is explained in the previous bullet, except ITU-R

BT.655 is used to define the protection ratio and ITU-R BT.419-3 for the directional antenna radiation pattern employed. Figure 3.183 displays 2D results obtained from the interference calculation for several interferer BT stations on a directional receiver of a wanted BT station. In the member countries of the GE06 agreement and in relevant frequency bands, it is preferable to use the calculation functions under the GE06 submenu.

Figure 3.183. a) Coverage area of a concerned TV station in presence of /without interferer stations b) usable field strength on receivers of wanted TV broadcasting station inside a selected area



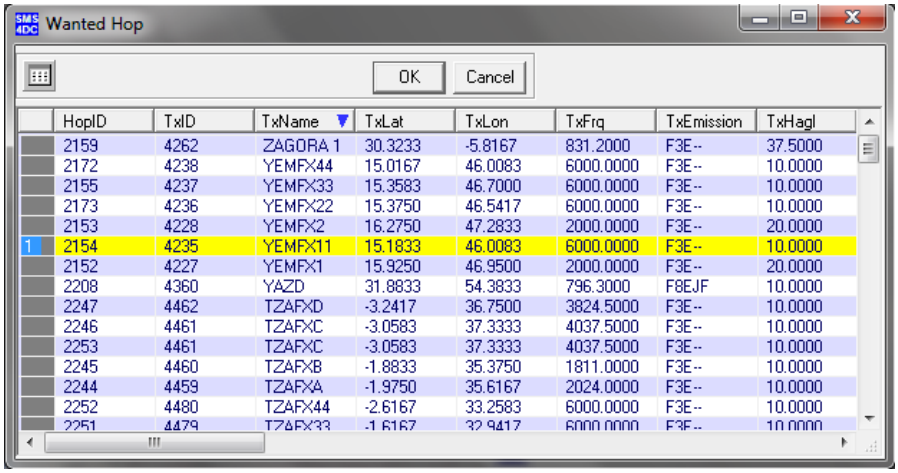
(a)



(b)

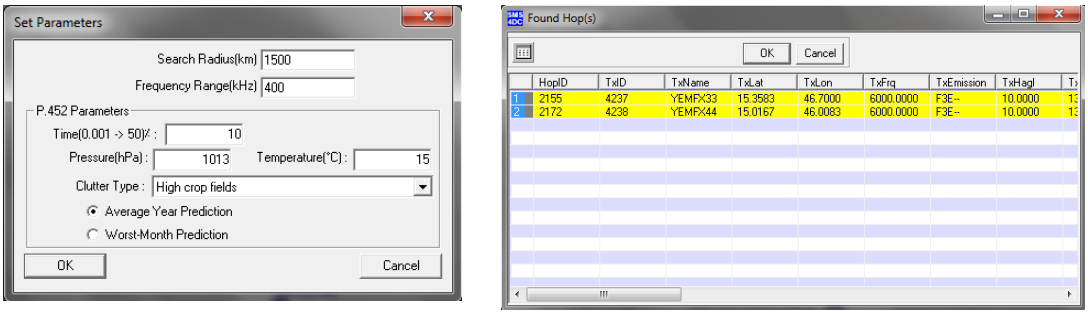
- FX2FX (link): This item calculates interference from stations of different point – to – point hops on each other by consideration of antenna radiation patterns and XPD, in accordance with recommendation ITU-R P.452. This item contains two sub-items: "Interference to" and "Interference from", enabling the user to calculate the interference caused by the wanted hop transmitter on receivers of other hops or the interference caused by other hop transmitters on the wanted hop receiver, respectively. Choosing one of the sub items under this item opens a spreadsheet of available links from which the user may select a wanted hop, using a mouse left click on the record select column of the concerned record. Figure 3.184 displays this spreadsheet.

Figure 3.184. List of point–to–point hops



After selecting a hop, a dialogue box of "Set Parameters" is presented to set the search conditions and values for the parameters of the ITU-R P.452 propagation model. Once these values have been selected, the list of hops that meet the conditions will be listed in a spreadsheet and users are able to select some or all of them for conducting detailed calculations. The "Set Parameter" dialogue box and an example list of found hops is shown in Figure 3.185.

Figure 3.185. "Set Parameter" dialogue box and hops meeting relevant conditions

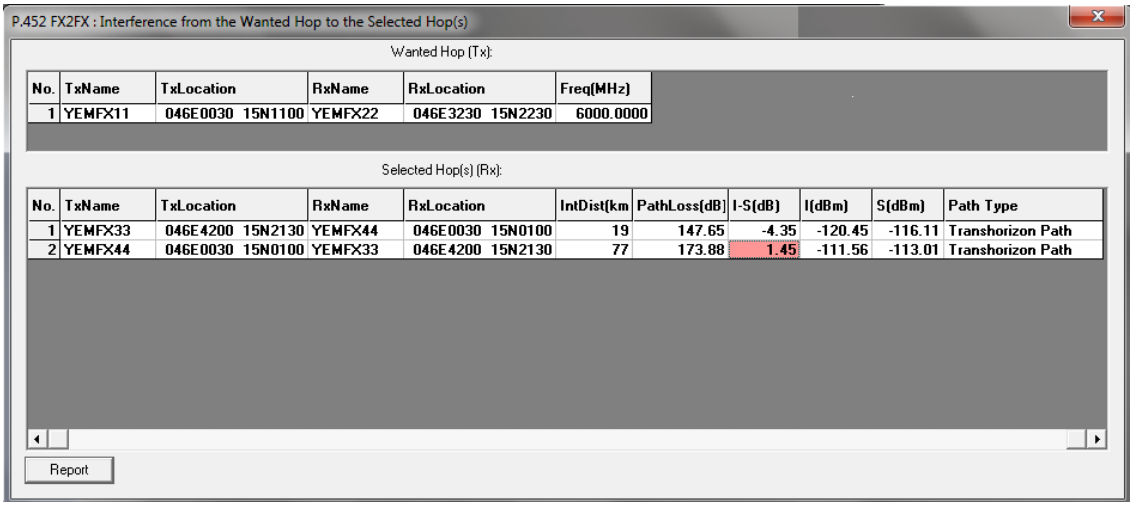


(a) Set Parameter dialogue box

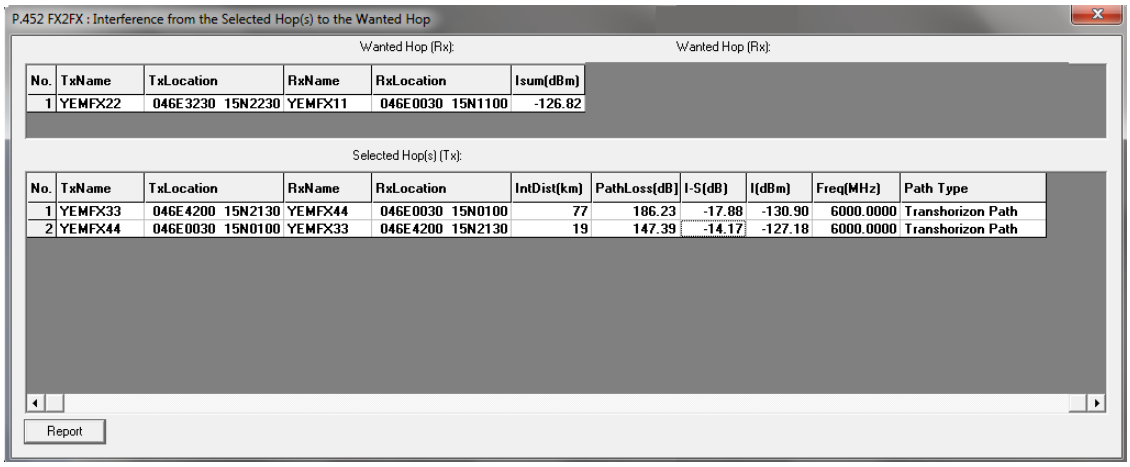
(b) Hops meeting relevant conditions

After selecting the interfering (or victim) hop, the calculation starts and a progress bar is displayed. The calculation result is shown in the Result dialogue box after the progress bar closes. The wanted hop information and interference calculation results are displayed in the result dialogue box. Figure 3.186 shows the result dialogue box for the two sub-items "Interference to" and "Interference from", respectively.

Figure 3.186. a) Dialogue box of interference of wanted hop TX on receiver of victim hops, and, b) dialogue box of interference from TX of other hops on wanted hop RX



(a) Dialogue box of interference of wanted hop TX on receiver of victim hops

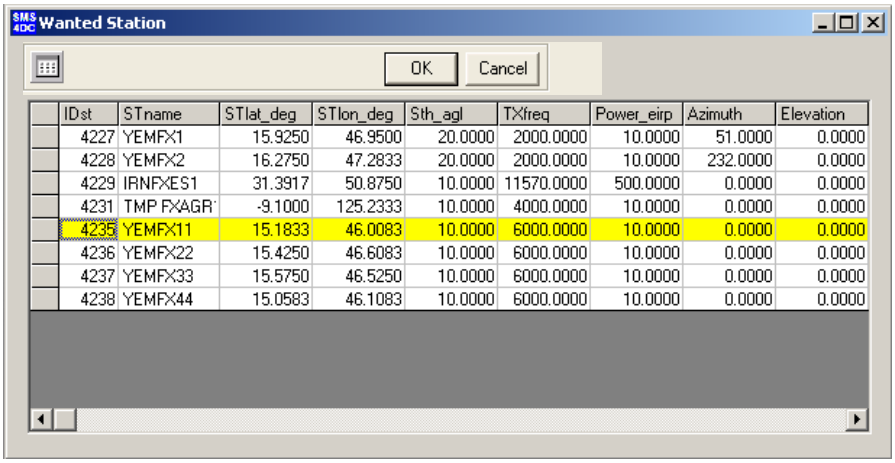


(b) Dialogue box of interference from TX of other hops on wanted hop RX

In the table of result "IntDist", "S", "I" and "Path Type" refer to: distance of the interference path between transmitter and receiver, sensitivity of victim receiver, received interference level and type of propagation path in accordance with the recommendation ITU-R P.452, respectively. As shown in Figure 3.186a, a red text background highlights the occurrence of interference. The "Report" push button on the bottom of the result dialogue box can be used to generate, store and display an HTML report of the interference calculation results.

- FX2FX (station): This item calculates interference from fixed stations to each other in accordance with recommendation ITU-R P.452, by consideration of antenna patterns and NFD (Net Filter Discrimination). This item contains two sub-items: “Interference to” and “Interference from”, enabling the user to calculate the interference caused by a wanted transmitting station on victim fixed receivers or the interference caused by other fixed transmitters on the wanted fixed receiver, respectively. Choosing one of the sub items under this item opens a spreadsheet of available fixed stations, from which users may select one of them, using a mouse left click on the record select column of the concerned record. Figure 3.187 displays this spreadsheet.

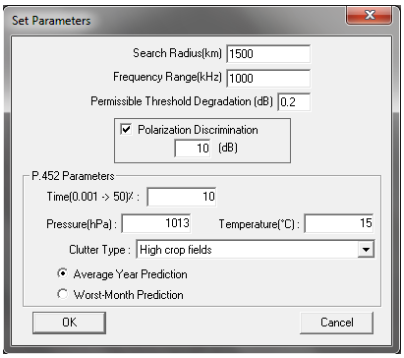
Figure 3.187. List of fixed stations



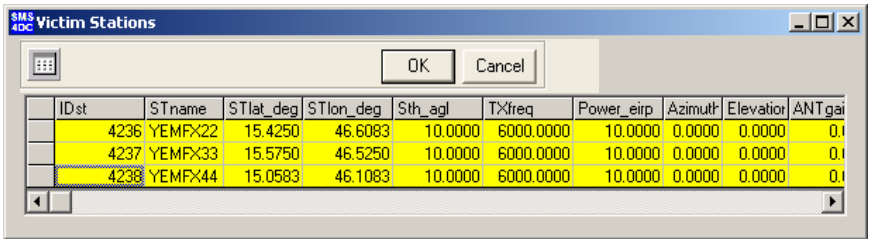
IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth	Elevation
4227	YEMFX1	15.9250	46.9500	20.0000	2000.0000	10.0000	51.0000	0.0000
4228	YEMFX2	16.2750	47.2833	20.0000	2000.0000	10.0000	232.0000	0.0000
4229	IRNFXES1	31.3917	50.8750	10.0000	11570.0000	500.0000	0.0000	0.0000
4231	TMP FXAGR	-9.1000	125.2333	10.0000	4000.0000	10.0000	0.0000	0.0000
4235	YEMFX11	15.1833	46.0083	10.0000	6000.0000	10.0000	0.0000	0.0000
4236	YEMFX22	15.4250	46.6083	10.0000	6000.0000	10.0000	0.0000	0.0000
4237	YEMFX33	15.5750	46.5250	10.0000	6000.0000	10.0000	0.0000	0.0000
4238	YEMFX44	15.0583	46.1083	10.0000	6000.0000	10.0000	0.0000	0.0000

After selecting a station, the dialogue box of “Set Parameters” is presented to set the search conditions and values for the parameters of the ITU-R P.452 propagation model. Once these values have been set, a spreadsheet lists the RX or TX stations (for sub-items “Interference to” or “Interference from”) that meet these conditions and the user may select some or all of them for the detailed calculations. The “Set Parameter” dialogue box and an example spreadsheet list of stations found is displayed in Figure 3.188.

Figure 3.188. “Set Parameter” dialogue box and fixed stations meeting relevant conditions



(a) Set Parameter dialogue box

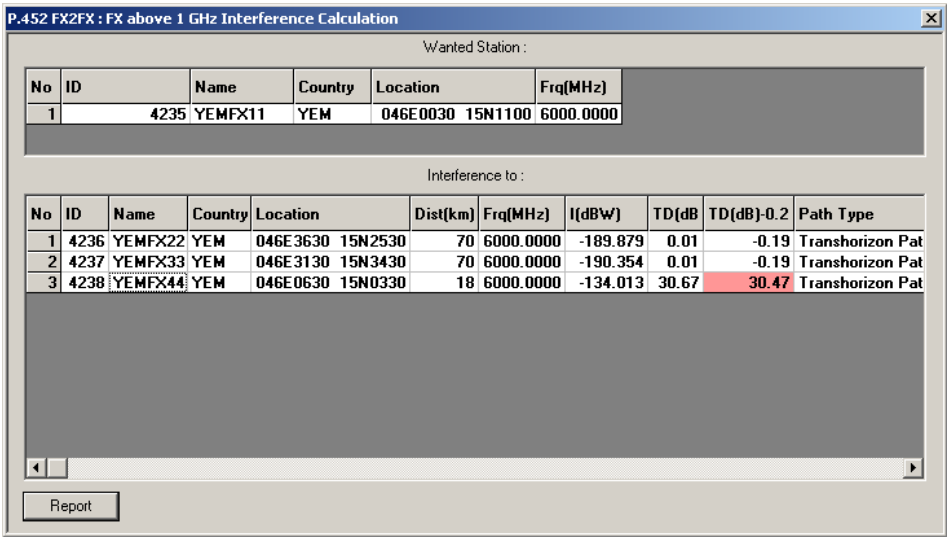


IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth	Elevation	ANTgai
4236	YEMFX22	15.4250	46.6083	10.0000	6000.0000	10.0000	0.0000	0.0000	0.(
4237	YEMFX33	15.5750	46.5250	10.0000	6000.0000	10.0000	0.0000	0.0000	0.(
4238	YEMFX44	15.0583	46.1083	10.0000	6000.0000	10.0000	0.0000	0.0000	0.(

(b) Fixed stations meeting relevant conditions

After selection of interfering (or victim) station, the calculation starts and a progress bar is displayed. When the progress bar closes, the wanted station information and interference calculation results are displayed in the result dialogue box. Figure 3.189 displays the result dialogue box for the two sub-items "Interference to" and "Interference from" respectively.

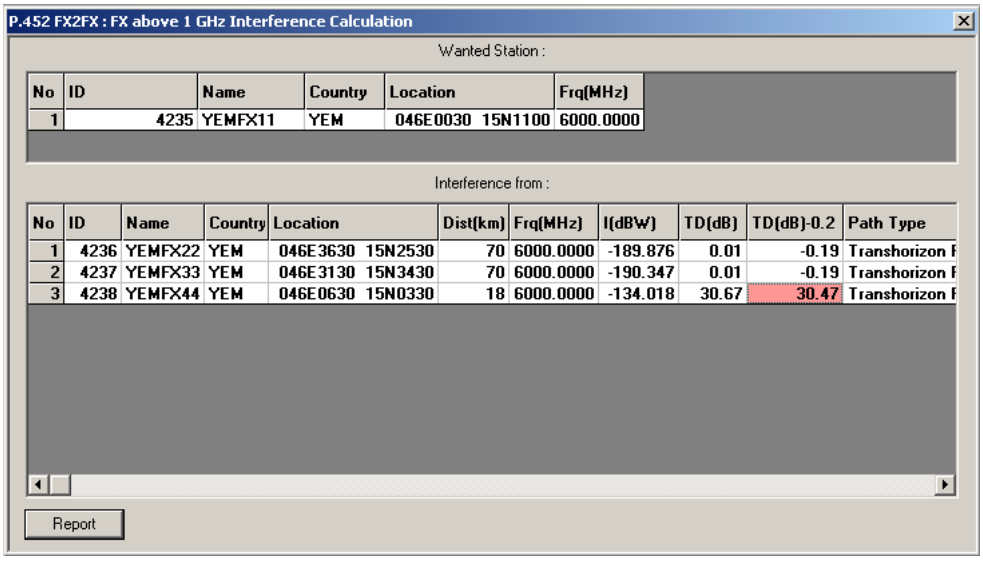
Figure 3.189. a) Dialogue box of interference of wanted fixed TX on victim fixed receiver, and, b) dialogue box of interference from unwanted fixed TX on wanted fixed RX



No	ID	Name	Country	Location	Frq(MHz)
1	4235	YEMFX11	YEM	046E0030 15N1100	6000.0000

No	ID	Name	Country	Location	Dist(km)	Frq(MHz)	I(dBW)	TD(dB	TD(dB)-0.2	Path Type
1	4236	YEMFX22	YEM	046E3630 15N2530	70	6000.0000	-189.879	0.01	-0.19	Transhorizon Pat
2	4237	YEMFX33	YEM	046E3130 15N3430	70	6000.0000	-190.354	0.01	-0.19	Transhorizon Pat
3	4238	YEMFX44	YEM	046E0630 15N0330	18	6000.0000	-134.013	30.67	30.47	Transhorizon Pat

(a) Dialogue box of interference of wanted fixed TX on victim fixed receiver



No	ID	Name	Country	Location	Frq(MHz)
1	4235	YEMFX11	YEM	046E0030 15N1100	6000.0000

No	ID	Name	Country	Location	Dist(km)	Frq(MHz)	I(dBW)	TD(dB)	TD(dB)-0.2	Path Type
1	4236	YEMFX22	YEM	046E3630 15N2530	70	6000.0000	-189.876	0.01	-0.19	Transhorizon F
2	4237	YEMFX33	YEM	046E3130 15N3430	70	6000.0000	-190.347	0.01	-0.19	Transhorizon F
3	4238	YEMFX44	YEM	046E0630 15N0330	18	6000.0000	-134.018	30.67	30.47	Transhorizon F

(b) Dialogue box of interference from unwanted fixed TX on wanted fixed RX

In the table of results, "TD", "Dist" and "Path Type" refer to: Threshold Degradation, distance of the interference path between transmitter and receiver and type of propagation path in accordance with the recommendation ITU-R P.452, respectively. Positive values for TD – Permissible TD value, in the relevant column, indicate an

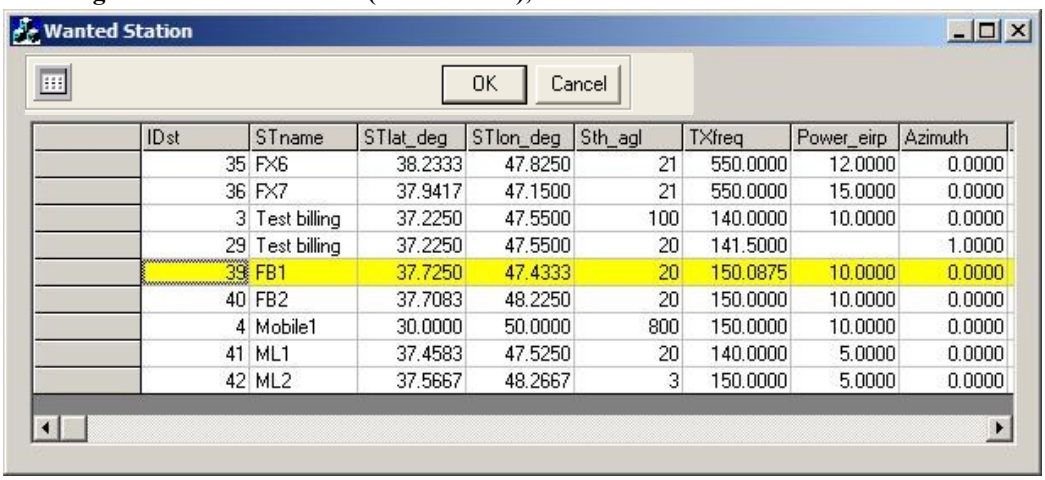
interference case and a red background identifies them visually from other values in this column,

The “Report” button on the bottom of the result dialogue box can be used to generate, store and display an HTML report of the interference calculation results.

- FXM sub-menu of Interference: The item “FXM” in the “Interference” menu has been implemented for the calculation of interference produced/experienced between stations in the land mobile service (any frequency) and between stations in the fixed service (below 1GHz) and between each other, taking into account the receiving antenna radiation pattern. Four sub-items are implemented, as the two calculation procedures: “Interference to” and “Interference from”, can use either the Free Space or the P.1546 propagation models. The two calculation procedures are explained separately below but both models are included in these explanations:

  - Interference to (Free Space and P.1546): This item calculates interference to fixed or land mobile receiving stations from a wanted transmitting station in the fixed or land mobile services, under given conditions. Choosing this item opens the spreadsheet of all fixed, base and mobile transmitting stations in the database, from which the user may select a wanted station using a mouse left click on the relevant record select column. Figure 3.190 shows a spreadsheet of fixed (below 1GHz), base and mobile stations.

Figure 3.190. List of fixed (below 1GHz), base and land mobile stations

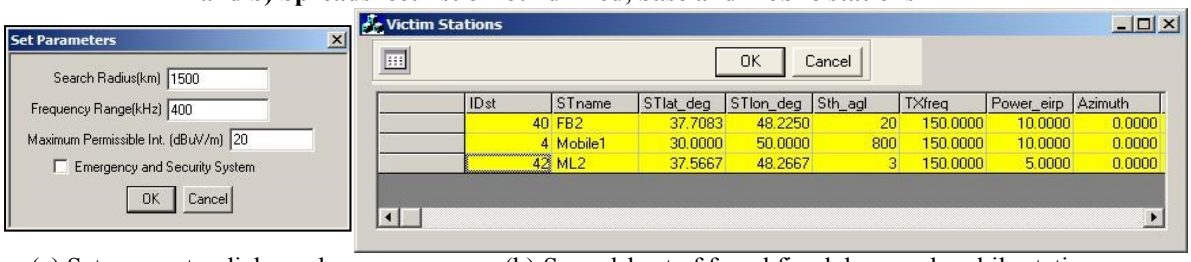


	IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth
	35	FX6	38.2333	47.8250	21	550.0000	12.0000	0.0000
	36	FX7	37.9417	47.1500	21	550.0000	15.0000	0.0000
	3	Test billing	37.2250	47.5500	100	140.0000	10.0000	0.0000
	29	Test billing	37.2250	47.5500	20	141.5000		1.0000
	39	FB1	37.7250	47.4333	20	150.0875	10.0000	0.0000
	40	FB2	37.7083	48.2250	20	150.0000	10.0000	0.0000
	4	Mobile1	30.0000	50.0000	800	150.0000	10.0000	0.0000
	41	ML1	37.4583	47.5250	20	140.0000	5.0000	0.0000
	42	ML2	37.5667	48.2667	3	150.0000	5.0000	0.0000

Then, the search parameters may be selected from the “Set Parameters” dialogue box. The user may set: Search radius, frequency range, minimum field strength value and a check box to identify Emergency & Security Systems. The maximum permissible interference field strength value is used to extract the reference field strength value for the interference calculation by considering correction factors given in the Berlin Agreement, Annex 3A (as a good example of a coordination agreement, in use by several countries and referenced in ITU-R Rec. SM.1049-1). After definition of the search criteria, SMS4DC lists all fixed, base and mobile stations that meet the defined conditions, from which the user is able to select some or all of them. Figure 3.195

shows the "Set Parameters" dialogue box for setting the search conditions and the list of fixed, base and mobile stations that are found by the subsequent search.

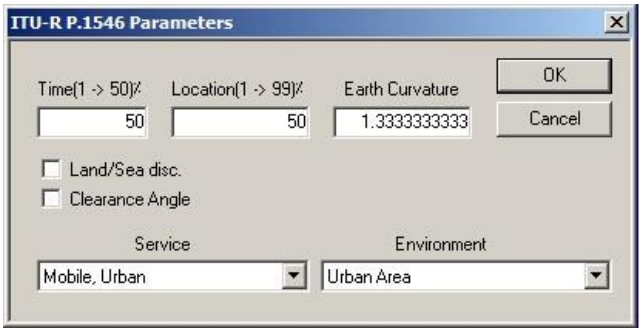
Figure 3.191. a) Set Parameter dialogue box for setting search condition and b) Spreadsheet list of found fixed, base and mobile stations



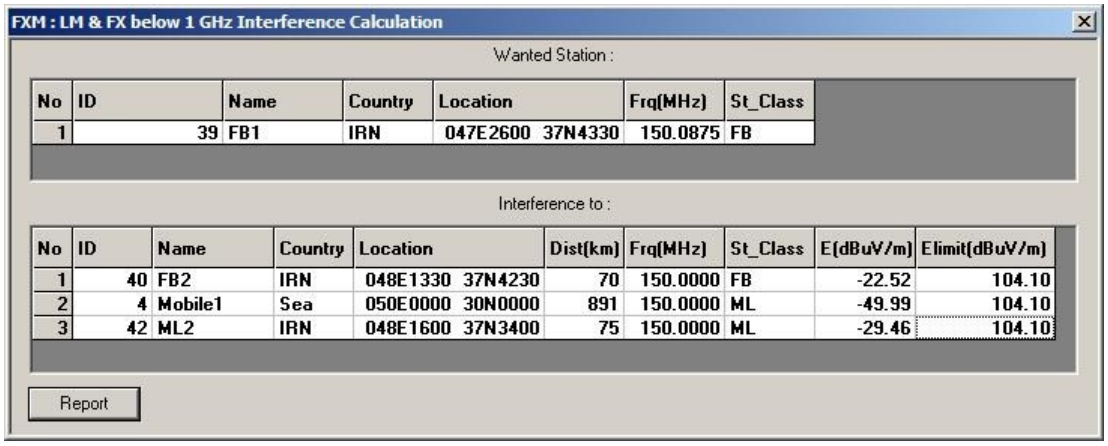
(a) Set parameter dialogue box (b) Spreadsheet of found fixed, base and mobile stations

Once the victim station has been selected, a dialogue box allows the user to specify values for the P.1546 or free space propagation model parameters. Then the Result dialogue box presents the calculation result, containing the wanted TX station characteristics together with the calculated interference level on victim receivers. The height of the receiver is extracted from the victim station's information. Figure 3.192 **Error! Reference source not found.**shows the dialogue box for P.1546 propagation model parameters and interference calculation result dialogue box. For the free space model, only the k-factor is a necessary model parameter.

Figure 3.192. a) P1546 propagation model parameters and b) Result of interference calculation of wanted TX on victim RXs (below 1GHz)



(a) P1546 propagation model parameters



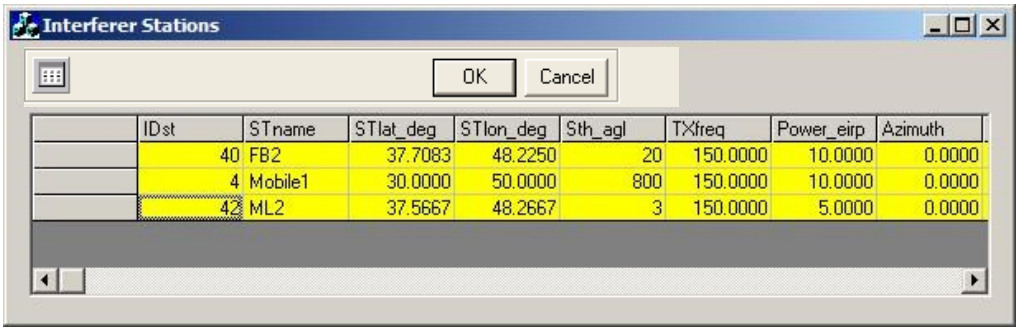
(b) Result of interference calculation of wanted TX on victim RXs

The “Report” button at the bottom of the result dialogue box may be used to generate, store and display an HTML report of interference calculation results.

- Interference from (Free Space and P.1546): This item calculates interference from fixed or land mobile transmitting stations to a wanted receiving station in the fixed or land mobile services, under given conditions. Choosing this item opens a spreadsheet listing all fixed, base and mobile receiving stations in the database from which users may select a wanted receiving station using a mouse left click on the relevant record select column. Figure 3.193 shows a spreadsheet of fixed (below 1GHz), base and mobile stations.

Then the search parameters may be selected from the “Set Parameters” dialogue box. The user may set: search radius, frequency range, minimum field strength value and a check box to identify Emergency & Security Systems. The minimum field strength value is used to define the reference field strength value for interference calculation by considering correction factors given in the Berlin Agreement, Annex 3A (as a good example of a coordination agreement used by several countries and referenced in recommendation ITU-R SM.1049-1). After definition of the search criteria, SMS4DC lists all fixed, base and mobile transmitting stations that meet the defined conditions, from which users are able to select some or all of them. Figure 3.193 shows a spreadsheet of search results listing the fixed, base and mobile transmitting stations that met the conditions set in this case.

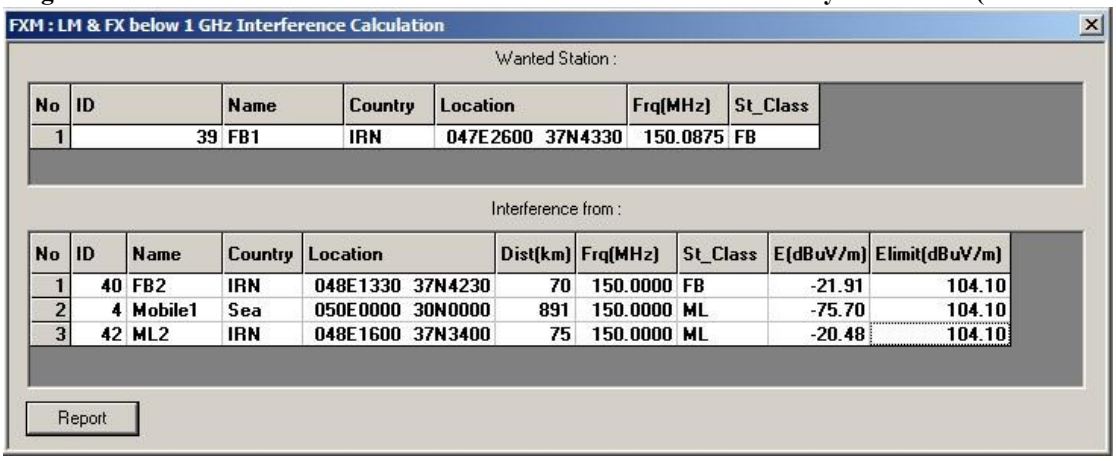
Figure 3.193. Spreadsheet list of found fixed, base and mobile transmitting stations



	IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth
	40	FB2	37.7083	48.2250	20	150.0000	10.0000	0.0000
	4	Mobile1	30.0000	50.0000	800	150.0000	10.0000	0.0000
	42	ML2	37.5667	48.2667	3	150.0000	5.0000	0.0000

after the victim station has been selected, the consequent dialogue box enables values to be specified for the P.1546 or free space propagation models parameters. Then the Result dialogue box presents the calculation result, containing the wanted TX station characteristics together with the calculated interference level at the wanted victim receiver. The height of the receiver is extracted from the victim station’s information on the database. Figure 3.194 shows the interference calculation result dialogue box. For the free space model only the k-factor is a necessary model parameter.

Figure 3.194. Result of interference calculation on wanted RX caused by victim TXs (below 1GHz)



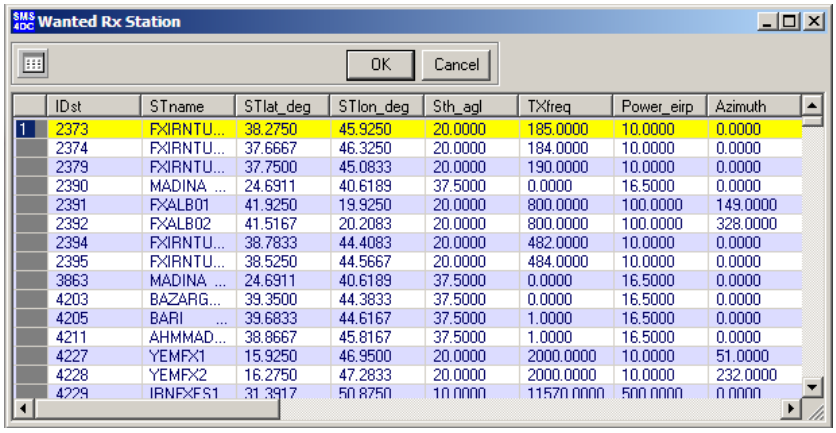
No	ID	Name	Country	Location	Frq(MHz)	St_Class
1	39	FB1	IRN	047E2600 37N4330	150.0875	FB

No	ID	Name	Country	Location	Dist(km)	Frq(MHz)	St_Class	E(dBuV/m)	Elimit(dBuV/m)
1	40	FB2	IRN	048E1330 37N4230	70	150.0000	FB	-21.91	104.10
2	4	Mobile1	Sea	050E0000 30N0000	891	150.0000	ML	-75.70	104.10
3	42	ML2	IRN	048E1600 37N3400	75	150.0000	ML	-20.48	104.10

The "Report" button at the bottom of the result dialogue box may be used to generate, store and display an HTML report of the interference calculation results.

- Intermodulation (SM1134): This item calculate intermodulation interference that are created at the output of a receiver under influence of intensive unwanted signals at the receiver input due to non-linearity of an amplitude response of the receiver based on ITU-R Recommendation SM.1134. Choosing this item opens the spreadsheet of all terrestrial stations in the database, from which the user may select a wanted receiving station using a mouse left click on the relevant record select column. Figure 3.195 shows a spreadsheet of wanted stations.

Figure 3.195. List of wanted stations

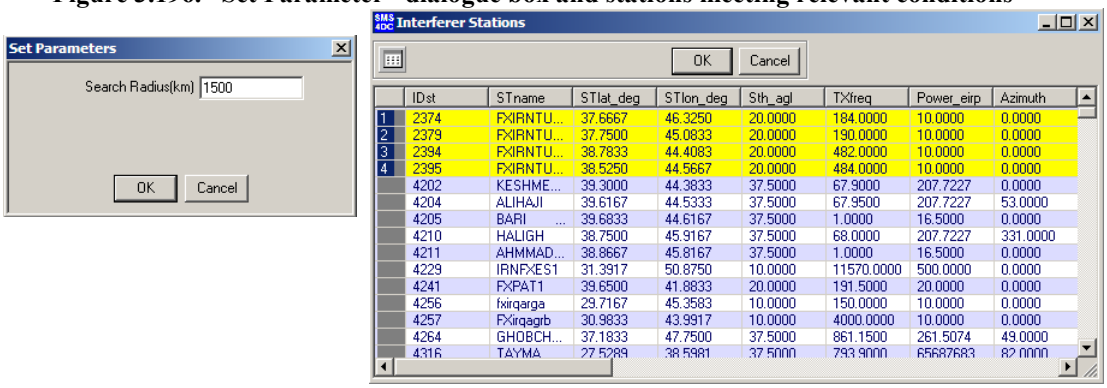


	IDst	STname	STlat_deg	STlon_deg	Sth_agl	TXfreq	Power_eirp	Azimuth
1	2373	FXIRNTU...	38.2750	45.9250	20.0000	185.0000	10.0000	0.0000
	2374	FXIRNTU...	37.6667	46.3250	20.0000	184.0000	10.0000	0.0000
	2379	FXIRNTU...	37.7500	45.0833	20.0000	190.0000	10.0000	0.0000
	2390	MADINA ...	24.6911	40.6189	37.5000	0.0000	16.5000	0.0000
	2391	FXALB01	41.9250	19.9250	20.0000	800.0000	100.0000	149.0000
	2392	FXALB02	41.5167	20.2083	20.0000	800.0000	100.0000	328.0000
	2394	FXIRNTU...	38.7833	44.4083	20.0000	482.0000	10.0000	0.0000
	2395	FXIRNTU...	38.5250	44.5667	20.0000	484.0000	10.0000	0.0000
	3863	MADINA ...	24.6911	40.6189	37.5000	0.0000	16.5000	0.0000
	4203	BAZARG...	39.3500	44.3833	37.5000	0.0000	16.5000	0.0000
	4205	BARI ...	39.6833	44.6167	37.5000	1.0000	16.5000	0.0000
	4211	AHMMAD...	38.8667	45.8167	37.5000	1.0000	16.5000	0.0000
	4227	YEMFX1	15.9250	46.9500	20.0000	2000.0000	10.0000	51.0000
	4228	YEMFX2	16.2750	47.2833	20.0000	2000.0000	10.0000	232.0000
	4229	IRNFXFS1	31.3917	50.8750	10.0000	11570.0000	500.0000	0.0000

Then, the search parameters may be selected from the "Set Parameters" dialogue box and the user may set Search radius. After definition of the search criteria, SMS4DC lists all stations that meet the defined conditions, from which the user is able to select some or all

of them as interferer stations. Figure 3.196 shows the "Set Parameters" dialogue box for setting the search conditions and the list of stations that are found by the subsequent search.

Figure 3.196. "Set Parameter" dialogue box and stations meeting relevant conditions



after the victim station has been selected, the consequent dialogue box enables values to be specified for the P.1546. Then the Result dialogue box presents the calculation result, containing the wanted RX station characteristics together with the calculated interference level at the wanted victim receiver. Figure 3.197 shows the P.1546 propagation model parameters dialogue box and Figure 3.198 shows the intermodulation interference calculation result.

Figure 3.197. P1546 propagation model parameters and

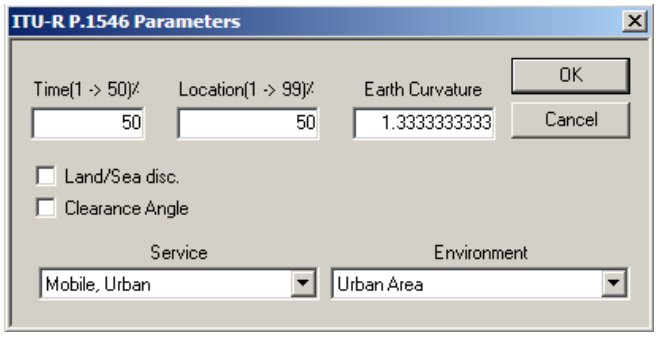
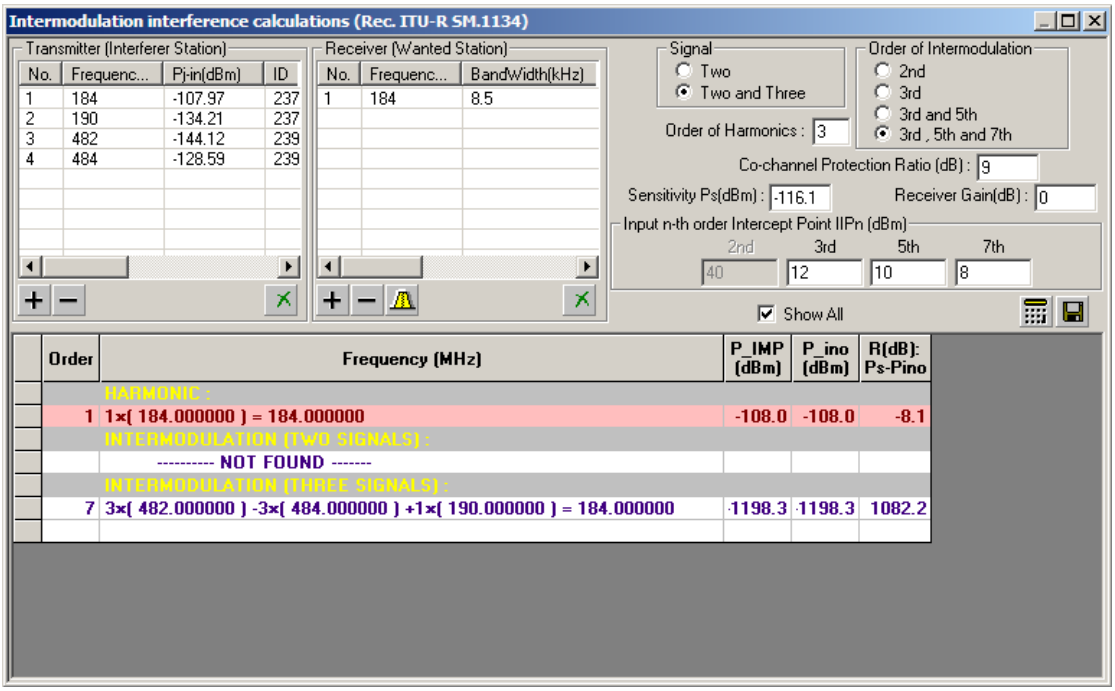
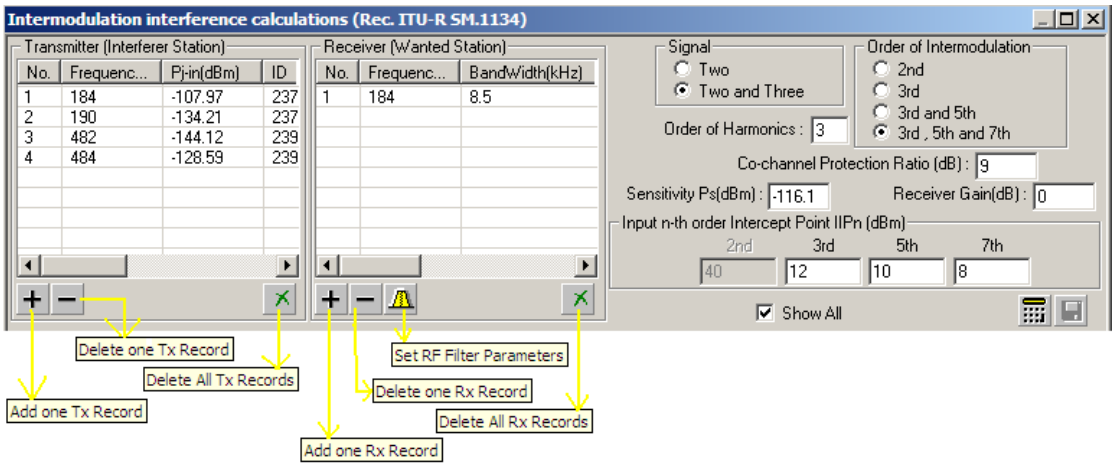


Figure 3.198. intermodulation interference calculation result



It is posiible to set the parameters such as order of intermodulation, order of harmonics, co-channel protection ratio, RF filter of receiver as well as to add or delete new transmitters or recievers as shown in Figure 3.199.

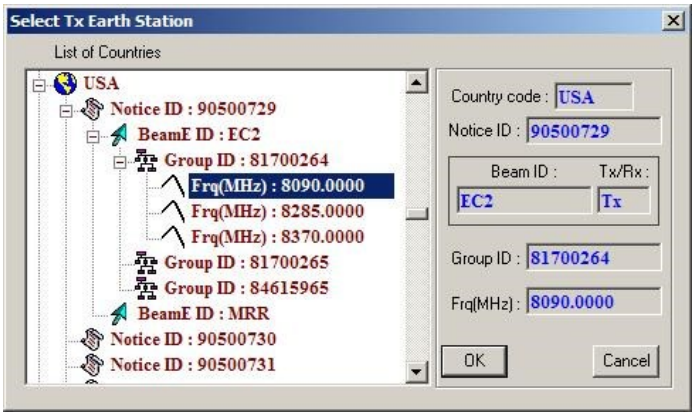
Figure 3.199. Seting parameters, Adding Transmitter/Reciever stations in the page of intermodulation interference calculation result



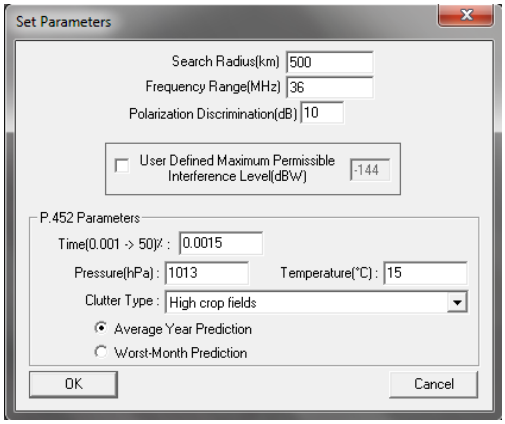
The “Save” in the result dialogue box may be used to generate, store and display a report of the interference calculation results.

- ES2ES (station): This item calculates interference caused or received by a selected Earth station, operating with geostationary satellites, on or from other Earth stations located inside a circular area around the selected earth station using recommendation ITU-R P.452 by consideration of antennas pattern and NFD (Net Filter Discrimination). This item contains two sub-items: “Interference to” and “Interference from”, enabling the user to calculate the interference caused by a wanted transmitting Earth station to victim receiving Earth stations or the interference caused by other Earth stations to a wanted receiving Earth station, respectively. Choosing one of the sub items under this item opens a dialogue box enabling the user to choose a transmitting or receiving Earth station. The tree view structure of the Earth stations database allows selection of an Earth station through the relevant: notice ID, Beam ID, Group ID or Frequency, directly by double click on the concerned level. Selection of a notice ID means selection of all relevant beams, selection of a beam means selection of all groups under the selected beam and so on. These data have to be imported from the space IFIC database, or have to be entered into the SMS4DC database directly. Figure 3.200a shows the dialogue box for selecting an Earth station.

Figure 3.200. Dialogue boxes for a) selecting earth station and b) defining calculation parameters



a) Dialogue box for selecting earth station



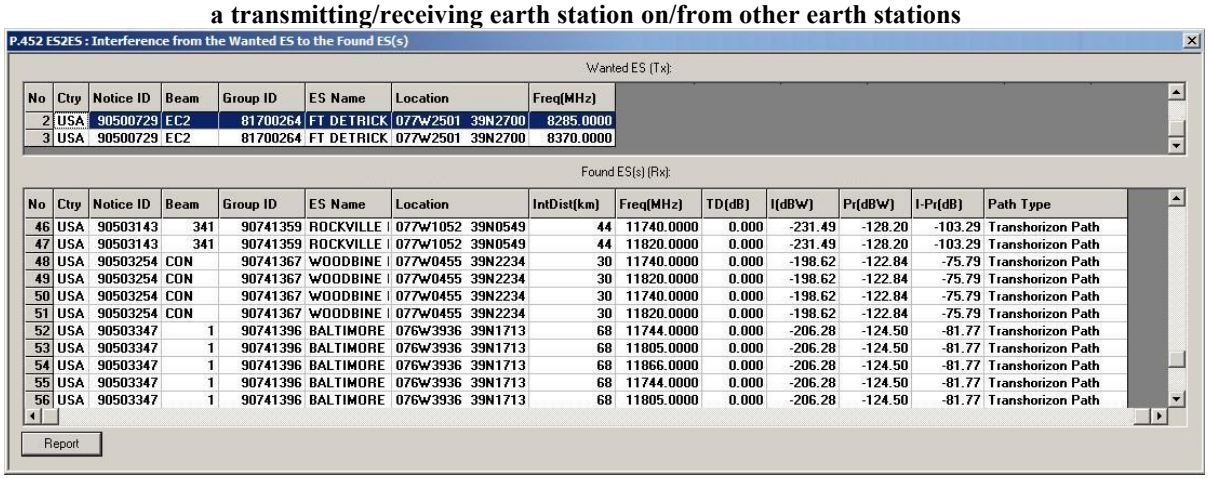
b) Dialogue box for defining calculation

Once the earth station has been selected, values for the calculation parameters have to be set in the next dialogue box. The calculation parameters dialogue box includes: radius of circular searching area, frequency range above and below the selected frequency in which the frequency of victim earth stations located, polarization discrimination, user-defined maximum permissible interference level (dBW) and the ITU-R P.452 parameter set. The parameters related to the recommendation ITU-R P.452 are explained in Table 3.3 and polarization discrimination will be considered by the calculation if the polarization of transmitting and victim Earth stations’ antennas are orthogonal. Figure 3.200b shows the dialogue box for entering values for the parameters described above.

Users have the option to set the parameter “User-Defined Maximum Permissible Interference Level” or to let the software decide. SMS4DC extracts these parameters from the Tables 16a and 16b of recommendation ITU-R SM.1448. Pushing the OK button on the parameters dialogue box starts the calculation. When the progress bar closes, the

calculation results will be displayed in a dialogue box containing two separate spreadsheets. Figure 3.201a displays the interference calculation result window.

Figure 3.201a. Calculation result of caused/received interference by/from a transmitting/receiving earth station on/from other earth stations



No	Ctry	Notice ID	Beam	Group ID	ES Name	Location	Freq(MHz)
2	USA	90500729	EC2	81700264	FT DETRICK	077W2501 39N2700	8285.0000
3	USA	90500729	EC2	81700264	FT DETRICK	077W2501 39N2700	8370.0000

No	Ctry	Notice ID	Beam	Group ID	ES Name	Location	IntDist(km)	Freq(MHz)	TD(dB)	I(dBW)	Pr(dBW)	I-Pr(dB)	Path Type
46	USA	90503143	341	90741359	ROCKVILLE I	077W1052 39N0549	44	11740.0000	0.000	-231.49	-128.20	-103.29	Transhorizon Path
47	USA	90503143	341	90741359	ROCKVILLE I	077W1052 39N0549	44	11820.0000	0.000	-231.49	-128.20	-103.29	Transhorizon Path
48	USA	90503254	CON	90741367	WOODBINE I	077W0455 39N2234	30	11740.0000	0.000	-198.62	-122.84	-75.79	Transhorizon Path
49	USA	90503254	CON	90741367	WOODBINE I	077W0455 39N2234	30	11820.0000	0.000	-198.62	-122.84	-75.79	Transhorizon Path
50	USA	90503254	CON	90741367	WOODBINE I	077W0455 39N2234	30	11740.0000	0.000	-198.62	-122.84	-75.79	Transhorizon Path
51	USA	90503254	CON	90741367	WOODBINE I	077W0455 39N2234	30	11820.0000	0.000	-198.62	-122.84	-75.79	Transhorizon Path
52	USA	90503347	1	90741396	BALTIMORE	076W3936 39N1713	68	11744.0000	0.000	-206.28	-124.50	-81.77	Transhorizon Path
53	USA	90503347	1	90741396	BALTIMORE	076W3936 39N1713	68	11805.0000	0.000	-206.28	-124.50	-81.77	Transhorizon Path
54	USA	90503347	1	90741396	BALTIMORE	076W3936 39N1713	68	11866.0000	0.000	-206.28	-124.50	-81.77	Transhorizon Path
55	USA	90503347	1	90741396	BALTIMORE	076W3936 39N1713	68	11744.0000	0.000	-206.28	-124.50	-81.77	Transhorizon Path
56	USA	90503347	1	90741396	BALTIMORE	076W3936 39N1713	68	11805.0000	0.000	-206.28	-124.50	-81.77	Transhorizon Path

The upper part of the spreadsheet result window lists all selected interfering or interfered frequencies where, for each frequency, the individual interference calculation is shown in the lower spreadsheet. A blank result spreadsheet means no interference case for the selected frequency in the upper spreadsheet. For each case, values are given for: TD (reference threshold degradation in dB), I (interference value at the location of victim receiver in dBW), Pr (maximum permissible interference level in dBW) and type of interfering emission path. Positive values for I – Pr in the column "I – Pr" indicate an interference case and a red background identifies them visually from other values in this column.

The "Report" button, at the bottom of the result dialogue box, can be used to generate, store and display an HTML report of the interference calculation results.

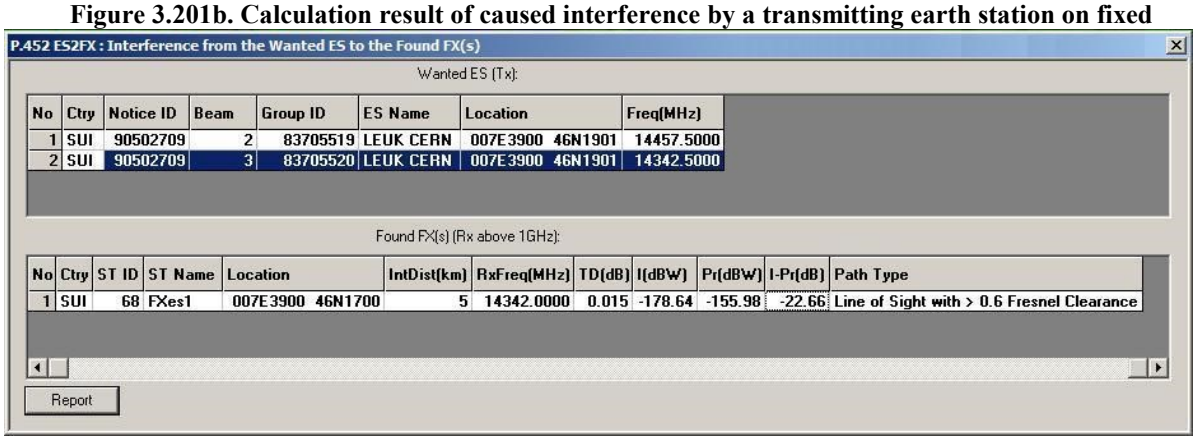
- ES2FX: This item calculates interference caused by a selected earth station, operating with geostationary satellites, on terrestrial stations in the fixed service, above 1GHz, located inside a circular area around the selected earth station using recommendation ITU-R P.452 by consideration of antennas pattern and NFD (Net Filter Discrimination). Choosing this item opens a dialogue box enabling user to choose the transmitting earth station. The tree view structure of the Earth stations database allows selection of an Earth station through relevant: notice ID, Beam ID, Group ID or, directly, Frequency by a double click on the concerned level. Selection of a notice ID means selection of all relevant beams, selection of a beam means selection of all groups under the selected beam and so on. These data have to be imported from the space IFIC database or have to be entered into the SMS4DC package directly. Figure 3.200a displays the dialogue box for selecting an Earth station.

  Once the Earth station has been selected, values for the calculation parameters have to be set in the next dialogue box. The calculation parameters dialogue box includes: radius of circular searching area, frequency range above and below the selected frequency in which the frequency of victim fixed stations located, polarization discrimination, user-defined maximum permissible interference level (dBW) and the ITU-R P.452 parameter set. The

parameters related to recommendation ITU-R P.452 are explained in Table 3.3 and polarization discrimination will be considered by SMS4DC if the polarization of transmitting earth station and victim fixed station antennas are orthogonal. The dialogue box for data entry of these parameters is shown in Figure 3.200b.

The user has the option to set the parameter "User-Defined Maximum Permissible Interference Level" or to leave it as a software decision. SMS4DC extracts this parameter from recommendation ITU-R SF.1006. The calculation will be started by pushing the OK button of the parameters dialogue box. When the progress bar closes, the calculation results will be displayed in a dialogue box containing two separate spreadsheets. Figure 3.201b shows this interference calculation result window.

Figure 3.201b. Calculation result of caused interference by a transmitting earth station on fixed



The upper spreadsheet of the result window lists all the selected interfering frequencies; while for each of these frequencies, an individual interference calculation is shown in the lower spreadsheet. A blank result spreadsheet means no interference case for the selected frequency in upper spreadsheet. For each case studied, information is shown for: TD (reference threshold degradation in dB), I (interference value at the location of victim receiver in dBW), Pr (maximum permissible interference level in dBW) and type of interfering emission path. Positive values for I – Pr in the column "I – Pr" indicate an interference case and a red background identifies them visually from other values in this column.

The "Report" push button at the bottom of the result dialogue box can be used to generate, store and display an HTML report of the interference calculation results.

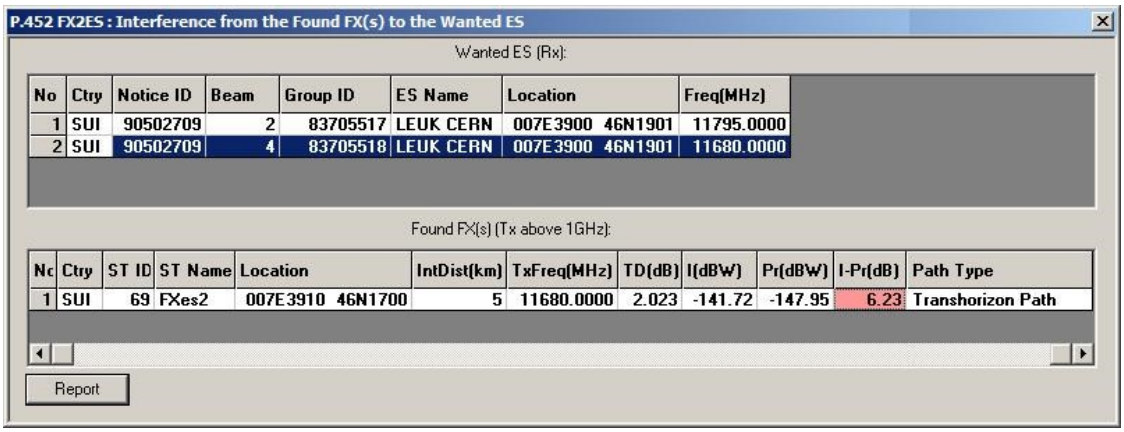
- FX2ES: This item calculates interference received by a receiver of a selected Earth station, operating with geostationary satellites, caused by transmitting terrestrial stations in the fixed service, above 1GHz, located inside a circular area around the selected Earth station using recommendation ITU-R P.452, by consideration of antennas pattern and NFD (Net Filter Discrimination). Choosing this item opens a dialogue box enabling the user to choose the receiving earth station. The tree view structure of the Earth stations database allows selection of an Earth station through the relevant: notice ID, Beam ID, Group ID or, directly, Frequency by a double click on the concerned level. Selection of a notice ID means selection of all relevant beams; selection of a beam means selection of all

groups under the selected beam and so on. These data have to be imported from the BR IFIC (Space Services) database or have to be entered into the SMS4DC package directly. Figure 3.200a displays the dialogue box for selecting an Earth station.

Once the Earth station has been selected, values for the calculation parameters have to be set in the next dialogue box. The calculation parameters dialogue box includes: radius of circular searching area, frequency range above and below the selected frequency in which the frequency of transmitting fixed stations is located, polarization discrimination, user-defined maximum permissible interference level (dBW) and the ITU-R P.452 parameter set. The parameters related to the ITU-R P.452 recommendation are explained in Table 3.3 and polarization discrimination will be considered by SMS4DC if the polarization of victim earth station and interferer fixed station antennas are orthogonal. The dialogue box for data entry of these parameters is shown in Figure 3.200b.

The User has the option to set the parameter "User-Defined Maximum Permissible Interference Level" or to leave it for the software to decide. SMS4DC extracts this parameter from recommendation ITU-R SF.1006. The calculation will be started by pushing the OK button in the parameters dialogue box. After the progress bar closes, the calculation results will be displayed in a dialogue box containing two separate spreadsheets. Figure 3.202 displays this interference calculation result window.

Figure 3.202. Calculation result of caused interference by a transmitting terrestrial fixed station on receiving earth station



The upper spreadsheet of the result window lists all selected victim frequencies; while, for each frequency, the individual interference calculation is shown in the lower spreadsheet. A blank result spreadsheet means no interference case for the selected frequency in the upper spreadsheet. For each case studied, the following information is given: TD (reference threshold degradation in dB), I (interference value at the location of victim receiver in dBW), Pr (maximum permissible interference level in dBW) and type of interfering emission path. The positive values for I – Pr in the column "I – Pr" indicate an interference case and a red background identifies them visually from other values in this column.

The "Report" button at the bottom of the result dialogue box can be used to generate, store and display an HTML report of the interference calculation results.

3.4.2.14. Monitoring menu of DEM view

One of the important parts of a Spectrum Management System is the monitoring sub-system which acts as the eyes of the total system. With the cooperation of Rohde and Schwarz and THALES Companies, it is now possible for SMS4DC to interact with ARGUS (R&S monitoring software) and ESMERALDA (THALES monitoring software) and communicate bidirectionally. Also a general interface between SMS4DC and monitoring softwares is available under "Others" submenue.

The first essential step in connecting SMS4DC with ARGUS ,ESMERALDA and other monitoring softwares is the correct setup of the ARGUS.TXT ,THALES.TXT and OTHERS.TXT files respectively which are located in the TEXTS folder of SMS4DC installation. The lines of the text file correspond to the path of INBOX and OUTBOX folders of monitoring systems respectively. The monitoring software might be installed on the same PC having SMS4DC. In this case the path to local INBOX and OUTBOX of monitoring system should be placed in the *.TXT files. If monitoring software is located on another PC, then the SMS4DC PC and monitoring PC should be connected to eachother through a network (LAN or WAN).

3.4.2.14.1. ARGUS menu

This menu item groups all the functionalities needed for communication with ARGUS software. The data exchange between SMS4DC and ARGUS is done through two kinds of orders:

- SMDI - Spectrum Management Data Interface: ARGUS requests data from SMS4DC.
- ORM - Order Report Module: SMS4DC requests measurements from ARGUS.

3.4.2.14.1.1. Respond to Order sub-menu of ARGUS menu

Activation of this menu (Figure 3.203), makes SMS4DC ready to listen to the SMDI orders issued by ARGUS system and as soon as it receives an order, prepares the requested information and sends for the ARGUS system. The orders are created in ARGUS by "File/Import/Data from Database" menu (Figure 3.204). Currently it is possible to request "Transmitter List", "Frequency List of Occupied Frequencies" and "Frequency List of Unassigned Frequencies" (Figure 3.205). Removing the check mark of this item disables this link from ARGUS to SMS4DC.

For more information about creating orders in ARGUS, consult the user's manual of ARGUS system.

Figure 3.203. "Respond to Order" menu item

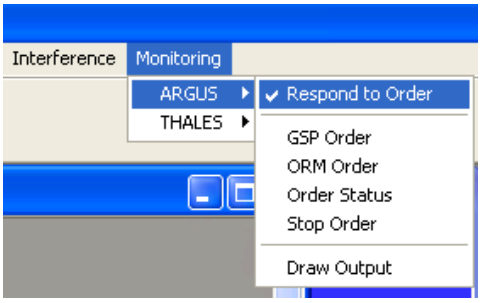


Figure 3.204. Menu item in ARGUS for requesting information from SMS4DC

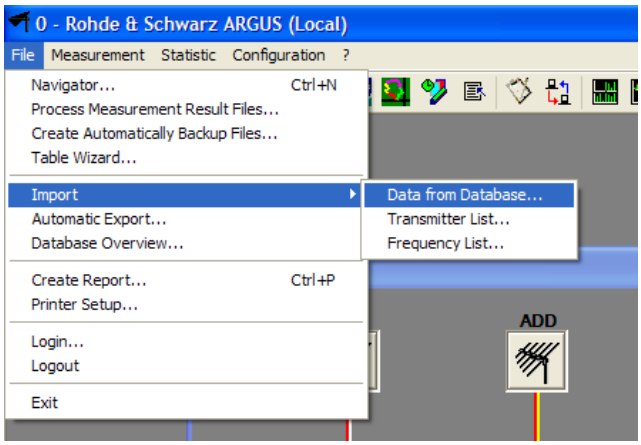
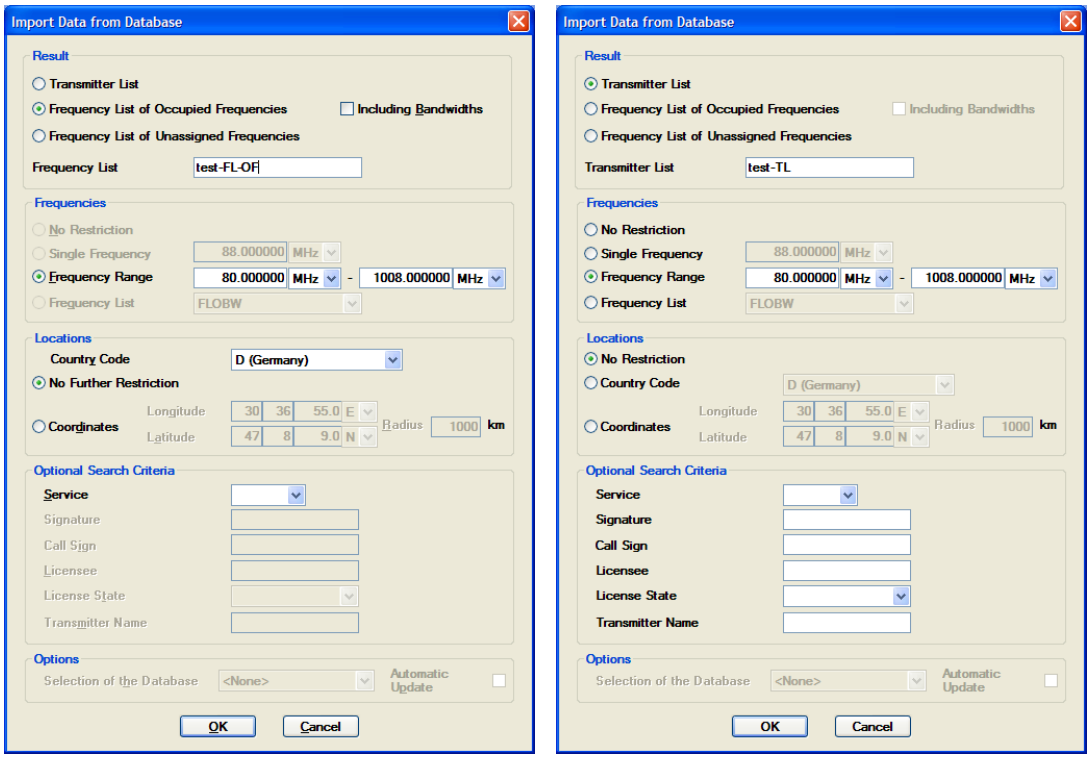


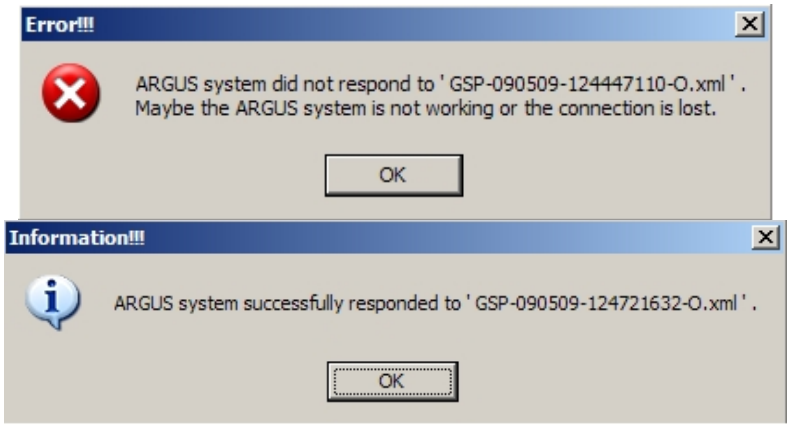
Figure 3.205 Two sample screen shots for requesting Transmitter and Frequency Lists



3.4.2.14.1.2. GSP Order sub-menu of ARGUS menu

SMS4DC should know the system configuration of the measurement devices connected to ARGUS system. Otherwise it is not possible to issue a precise measurement order. In order to know this configuration, the SMS4DC requests those specifications from ARGUS by a Get System Parameters (GSP) order. By selection of this menu item, a GSP order will be sent to ARGUS and normally after a few seconds, the specifications will be sent back to SMS4DC. If any problem happens in sending the order or receiving the results, an error message will appear as shown in Figure 3.206.

Figure 3.206. Messages regarding different statuses of the responds to a GSP order



3.4.2.14.1.3. ORM Order sub-menu of ARGUS menu

After successful execution of the "GSP Order" sub-menu, it is now possible to create an ORM measurement order by selection of "ORM Order" menu. By selection of this menu, SMS4DC looks for the latest result of the GSP orders which shows the latest known configuration of the measurement system. If a result is found then it is loaded and the date of it will be displayed on the screen. In the displayed screen, there are 3 tab dialogs called "General Setting", "Date and Time Setting" and "Result Setting" which are shown in Figure 3.208, Figure 3.209 and Figure 3.210 respectively.

In these screens there are some items which are inactive by default. Each of these items may get active based on the values of other items. For example the "Frequency List" combo box on the lower right corner of "General Setting" screen may be active only for "Frequency List Scan" measurement. The first essential step in creation of a measurement order is the selection of the measurement device. This can be done by double clicking on a listed device in the small window on the top-right side of the screen. By this selecition, the related parameter limitations and settings will be applied to the combo boxes of the screen. In the General Setting of the measurement order (Figure 3.208), there are so many technical parameters which some of them are described here and more detailed technical information may be found in the users manual of ARGUS.

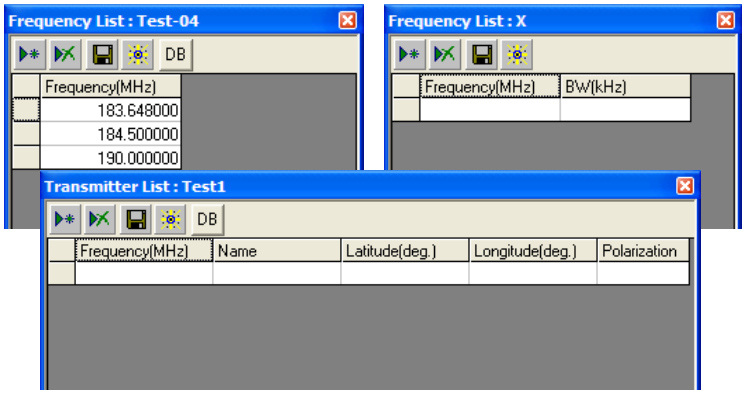
- Execution Type:
    - Automatic: This type of order will be processed by ARGUS automatically and the results will be prepared and sent back to SMS4DC.
    - Manual: This order needs to be processed by the ARGUS operator and the measurement results should be attached together manually to form the result.
- Order Task: Currently the following types of measurements are available
    - Frequency List Scan
    - Transmitter List Scan
    - Scan
    - DScan
    - FFM (Fixed Frequency Measurement)
    - Sweep
- Measurement Parameter: At most four of these parameters can be measured simultaneously with the exception of "Location" which should be measured alone.
    - Level
    - Offset
    - Frequency
    - IF
    - Audio
    - AM

- FM
- PM
- BandWidth
- Bearing
- Sub Audio Tone
- Program
- PI Code
- Sound ID
- Location

- Frequency, Transmitter and Suppress List Drop Down lists

The first two are only active for "Frequency List Scan" and "Transmitter List Scan" respectively and the third one is active for "Scan", "DScan" and "Sweep" measurements. It is possible to create user defined lists and store them in the system. First of all a unique name should be written in the Drop-Down Box. Then the corresponding button above that box should be pressed and one of the screens shown in Figure 3.207 will be displayed.

Figure 3.207. Screens for definition of Frequency, Suppress, and Transmitter Lists



A special DB button is visible in these screens. This button enables the user to create the list based on the existing information in the SMS4DC database.

Figure 3.208. General Setting of a measurement order

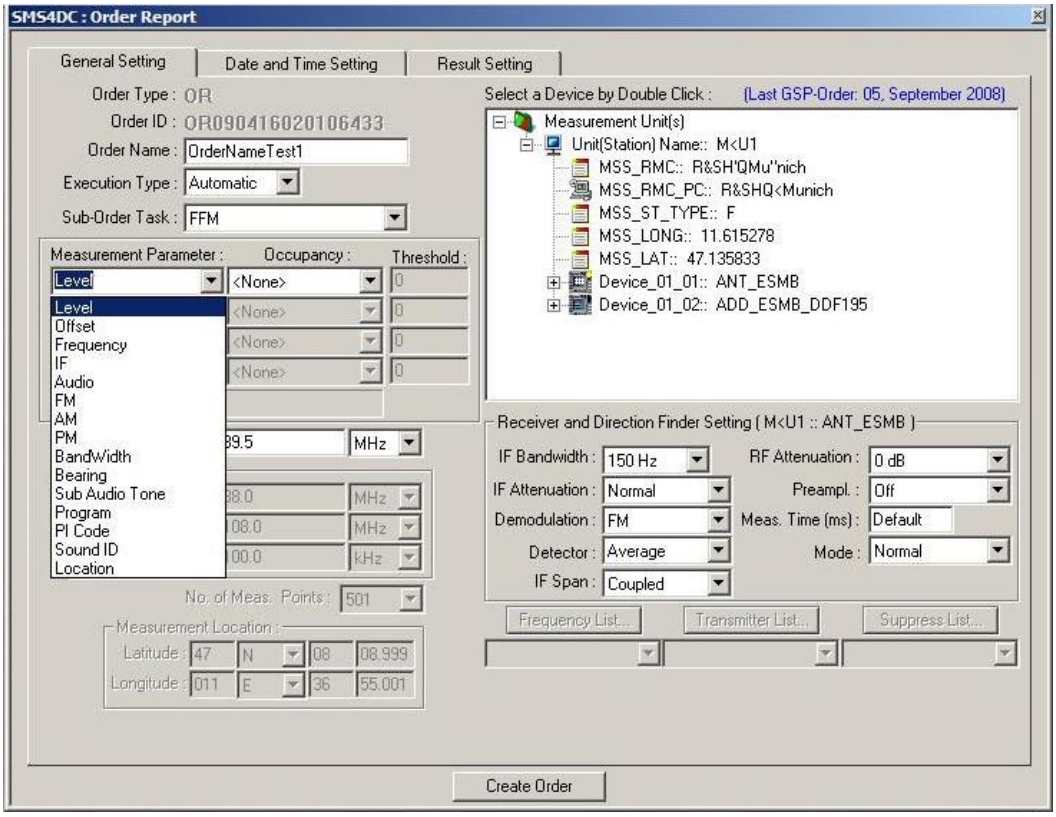
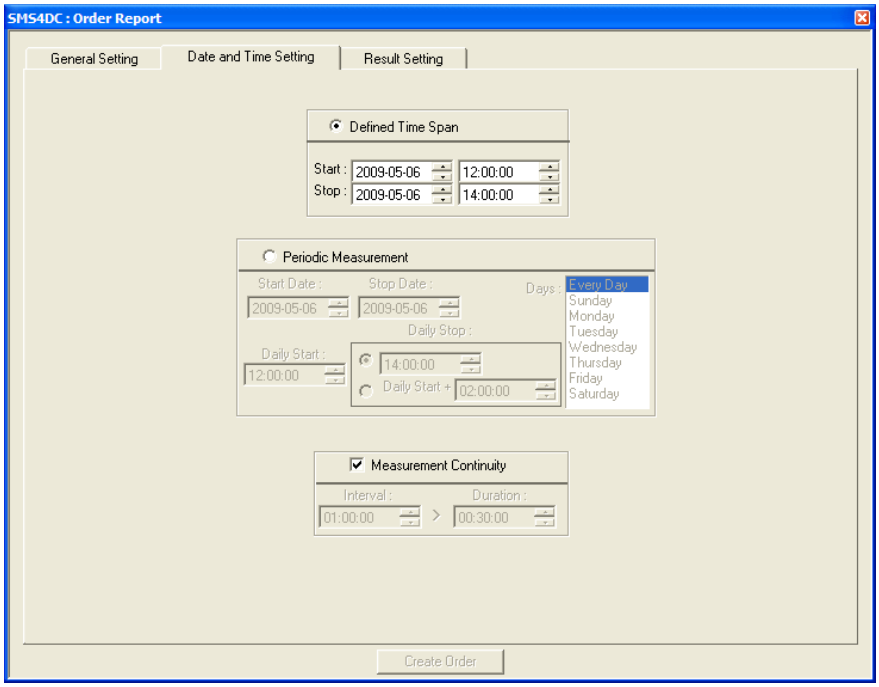


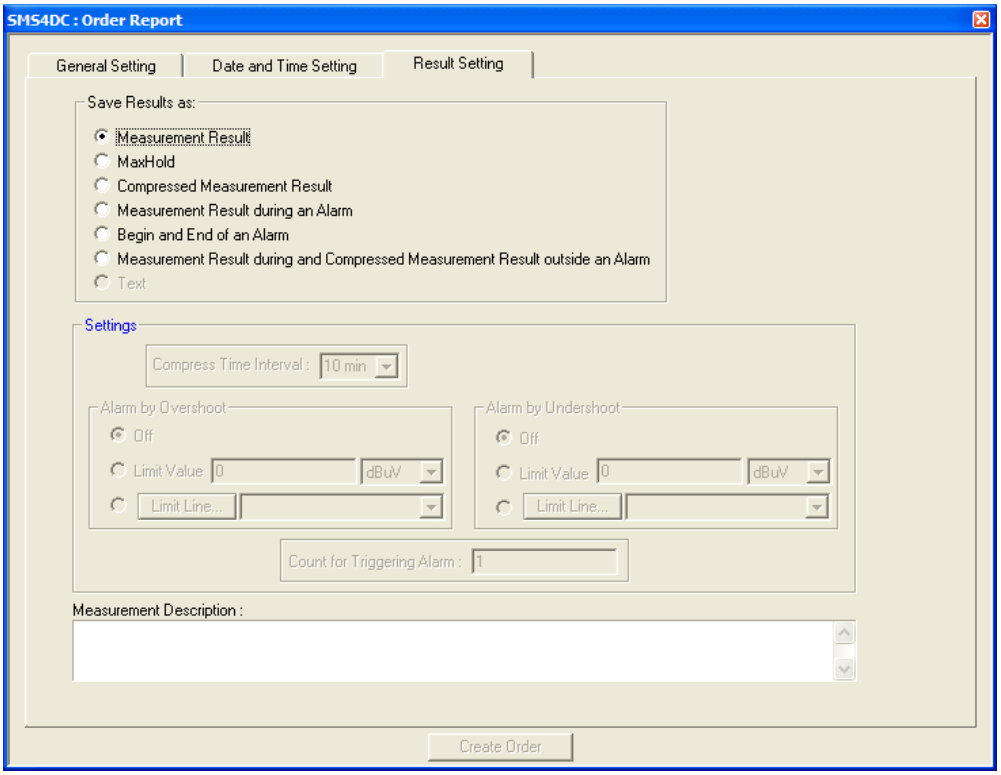
Figure 3.209. Date and Time Setting of a measurement order



In the "Date and Time Setting" screen it is possible to create a one-time measurement which is defined using the items on the top of the screen or a periodic measurement using the items in the

centre of the screen. And also using the items at the bottom of the page, the continuity of the measurement in the defined time span or period, can be defined.

Figure 3.210. Result Setting of a measurement order



In the final screen for (Figure 3.210) creation of an ORM, the following selections are available:

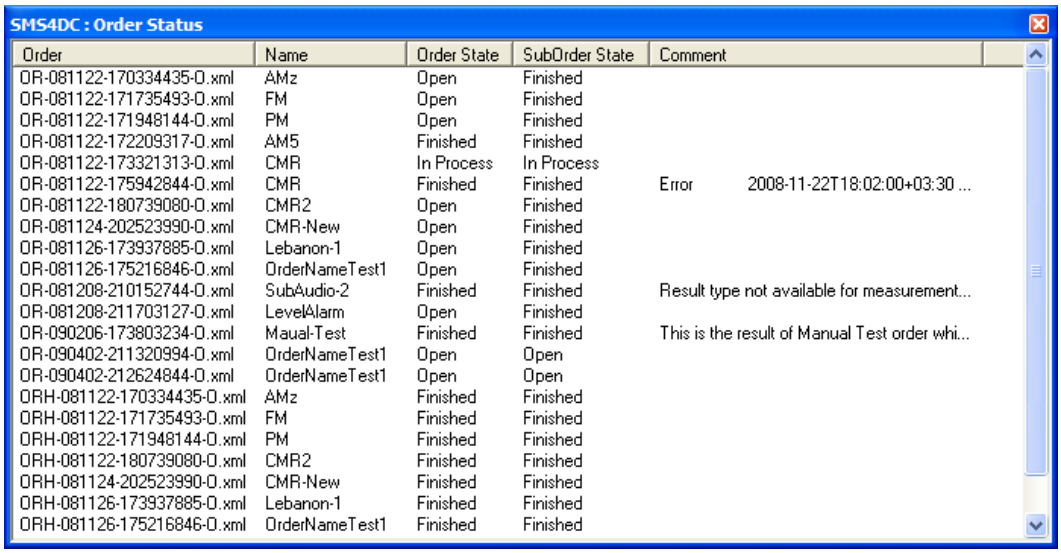
- Measurement Result: All Measurement results are stored.
- MaxHold: For each frequency only the maximum measured value is stored.
- Compressed Measurement Result: Compression interval per adjusted becomes for each measuring parameter (so far as possible) a result of measurement (Average, Standard deviation, Minimum, Maximum) stored. Storage always takes place to the full minute.
- Measurement Result during an Alarm: All measured values are stored during an alarm. Measured values outside of the alarm are not stored.
- Begin and End of an Alarm: The time at the beginning and time at the end of the alarm arisen last are only stored. The result of measurement contains the additional column status with the values start and stop. Measured values are not stored.
- Measurement Result during and Compressed Measurement Result outside and Alarm: All measured values are stored during an alarm. Measured values outside the alarm are stored compressed (see Compressed Measurement Result).

3.4.2.14.1.4. Order Status sub-menu of ARGUS menu

By this facility, it is possible to see the status of all existing orders in the INBOX folder of ARGUS system. The states might be one of the following:

- Open: When SMS4DC places a new order in the INBOX of the ARGUS system, which shall execute the order, the state of the order is „Open“. The state of the sub-orders is also „Open“.
- In Process: ARGUS sets the state of the sub-order to „In Process“ and executes the automatic measurement. The state of the order is also set to „In Process“ by ARGUS.
- Finished: After measurement, ARGUS creates the report with the measurement results and additional information and sets the state of the sub order to „Finished“.
- Forwarded: In case another control unit shall execute the sub-order of the order, ARGUS passes on a copy of the order. The state of the order changes to „Forwarded“.

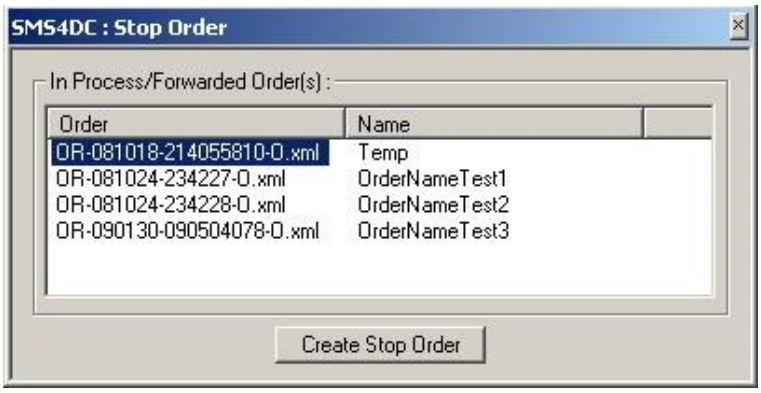
Figure 3.211. The screen showing the status of all existing orders in the INBOX folder of ARGUS



3.4.2.14.1.5. Stop Order sub-menu of ARGUS menu

By selection of this menu, a list of all running or pending ORM orders will be displayed (Figure 3.212) and one of them can be selected and stopped by pressing the "Create Stop Order" button.

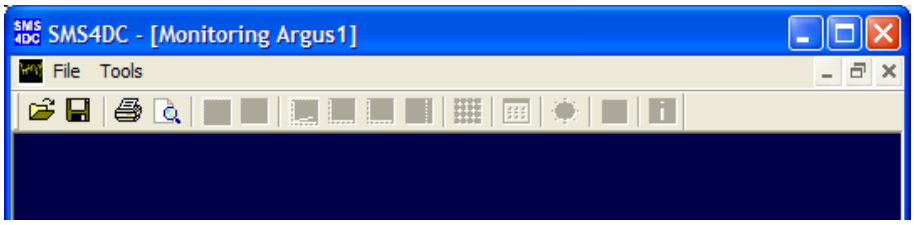
Figure 3.212. The screen showing all running or pending orders ready to be stopped



3.4.2.14.1.6. Draw Output sub-menu of ARGUS menu

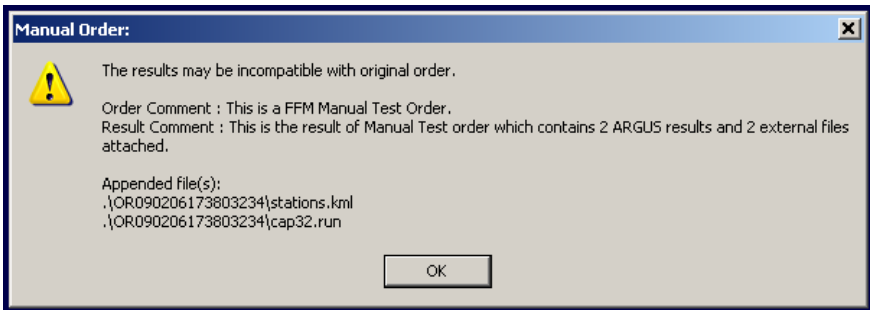
After successful completion of measurement of an ORM order, it is possible to visualise the results in either ARGUS or SMS4DC. By selection of "Draw Output" menu, the screen shown in Figure 3.213 is displayed and by selection of File->Open, the result XML file should be selected from the OUTBOX folder of ARGUS system.

Figure 3.213. The toolbar of the screen showing the results of a measurement



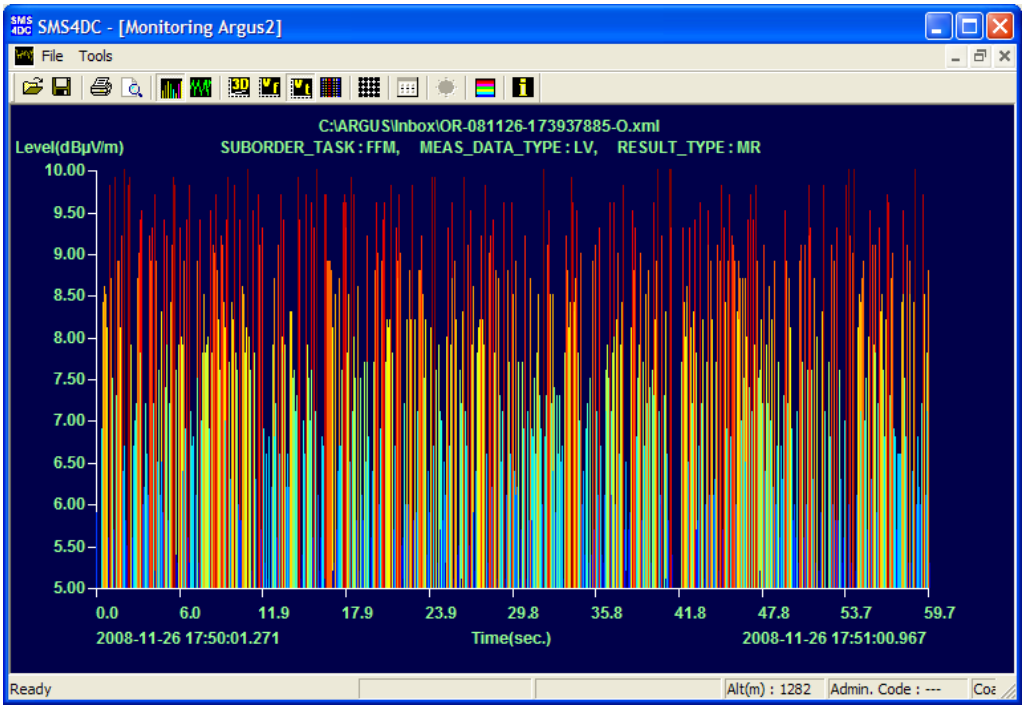
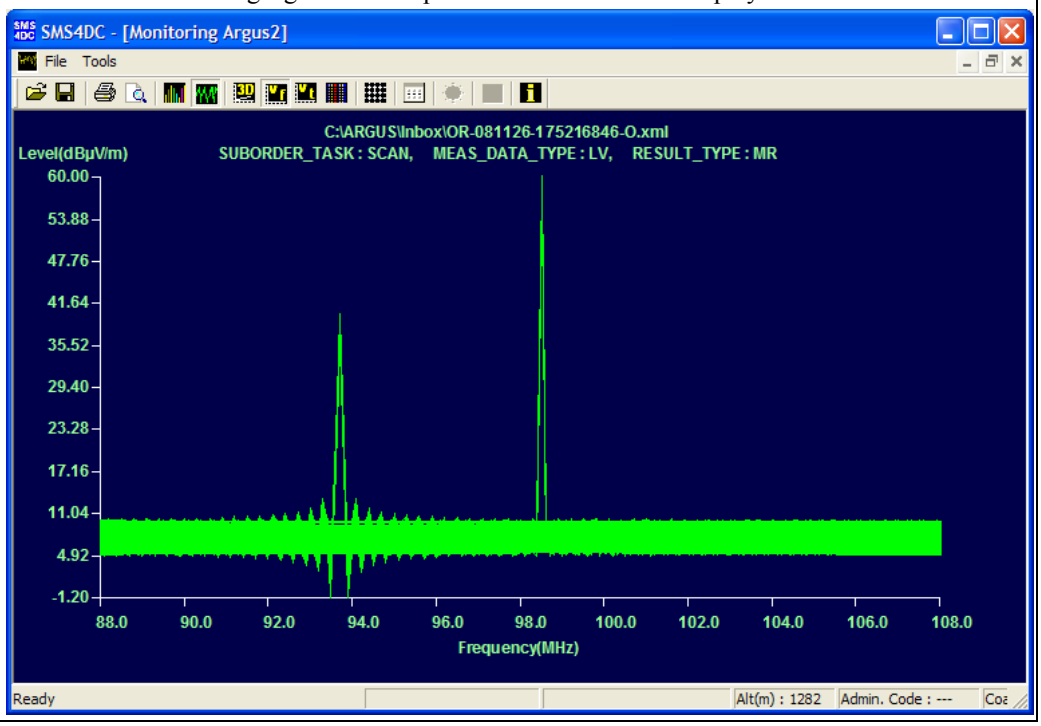
If a result file for a manual order is opened then before displaying the containing result, the system shows the following dialog box which displays a warning message about the possible incompatibility of the order and the results, the comments of order and the result file and also a list of attached files, if any (Figure 3.214).

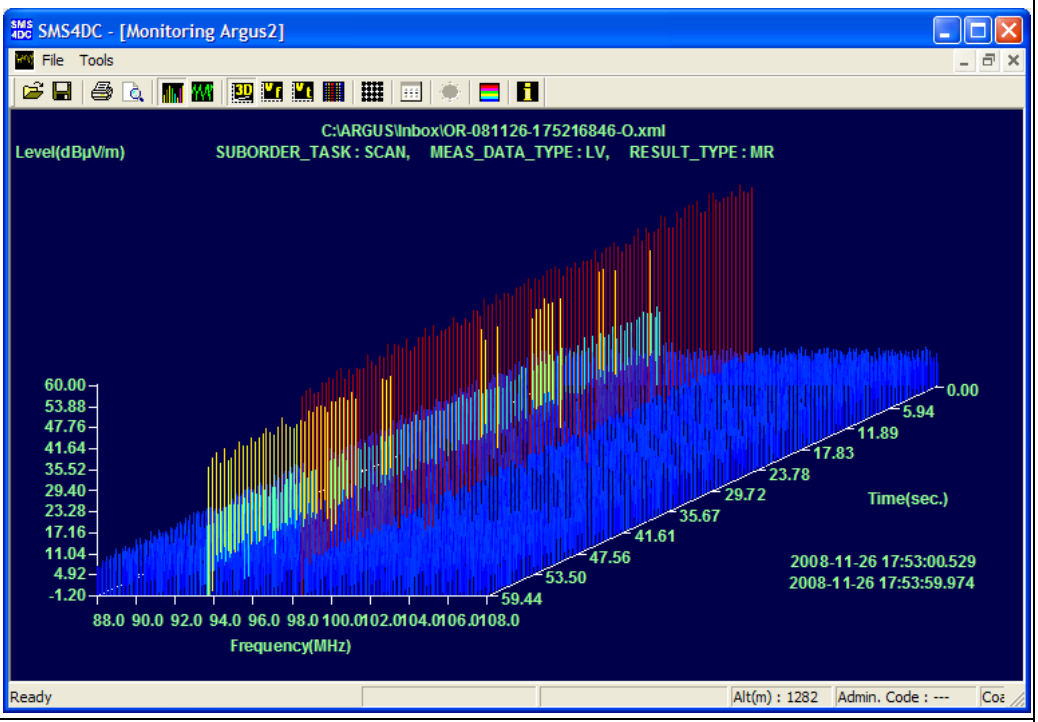
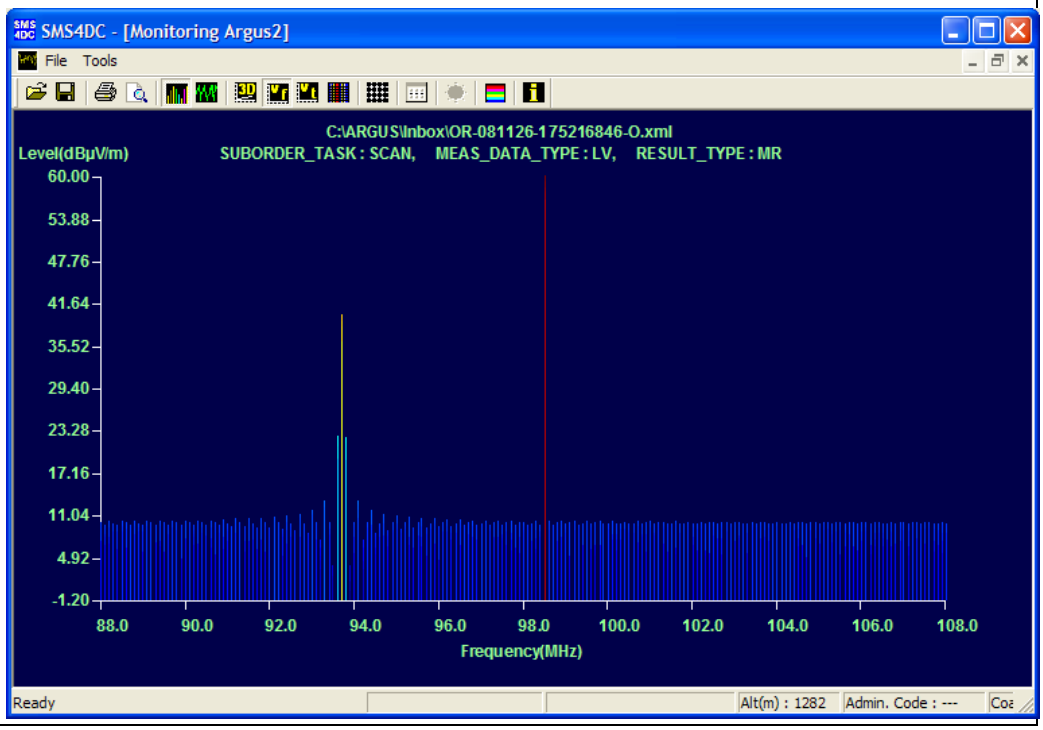
Figure 3.214. The screen showing the warning message before displaying the results of a manual measurement

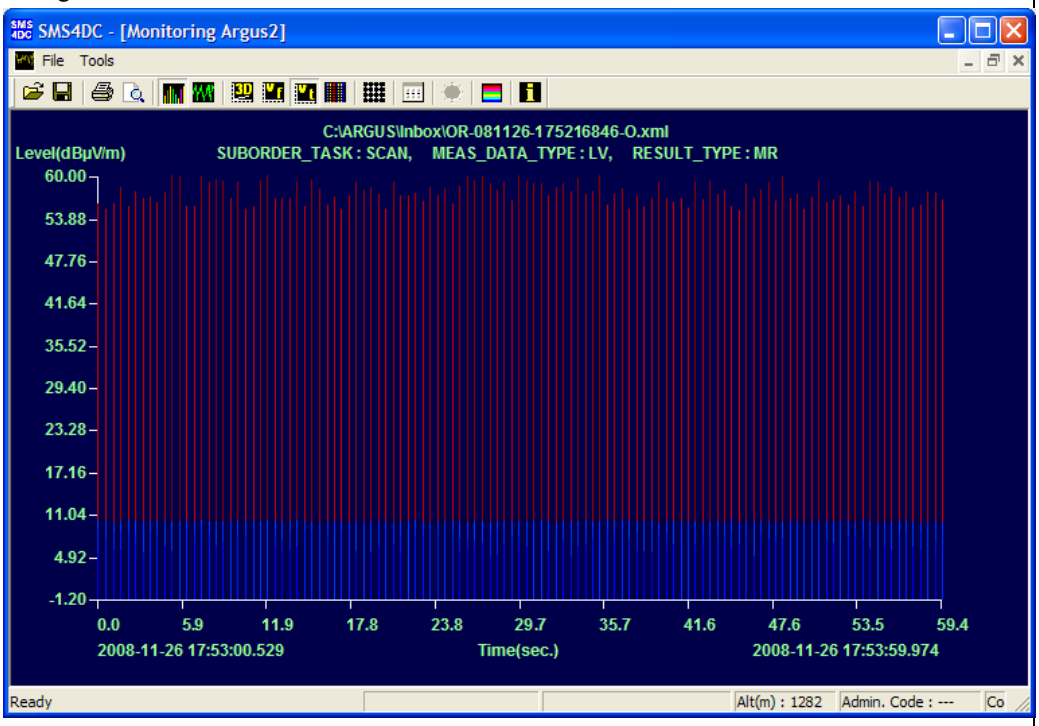
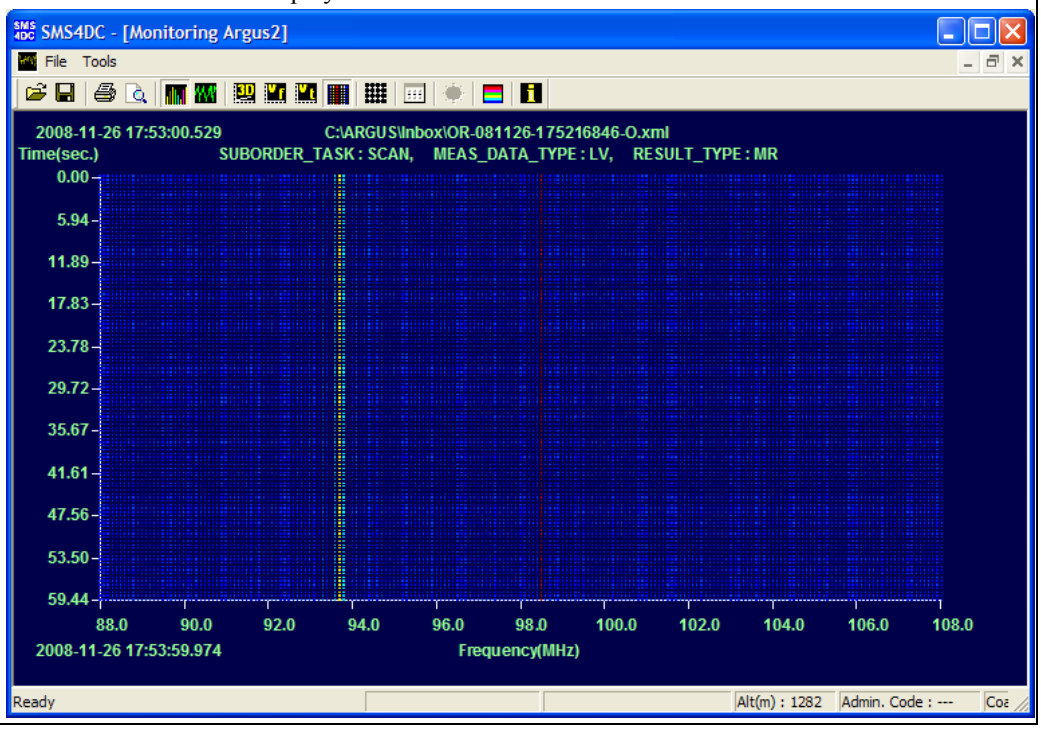


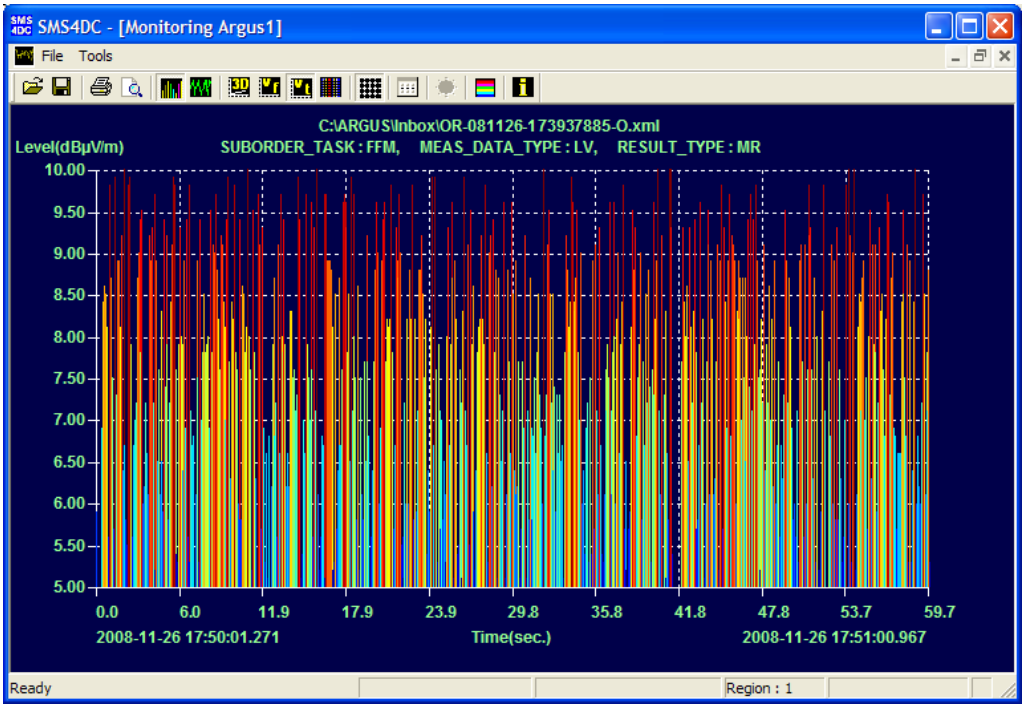
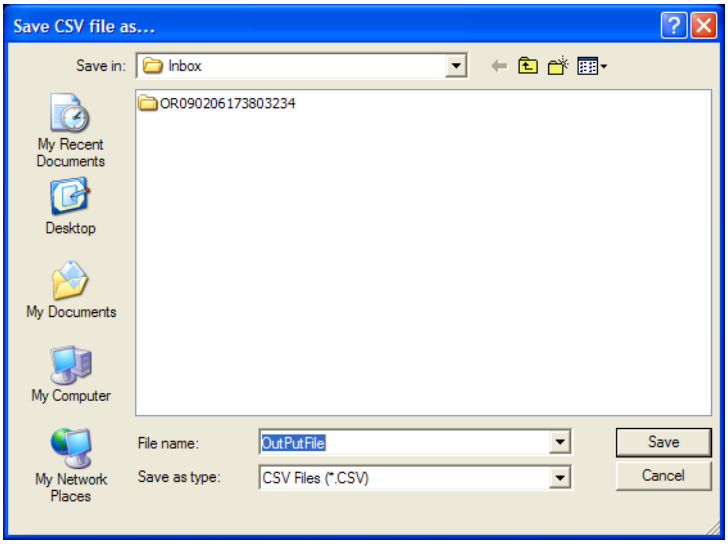
3.4.2.14.1.7. Toolbar of ARGUS Monitoring Results view

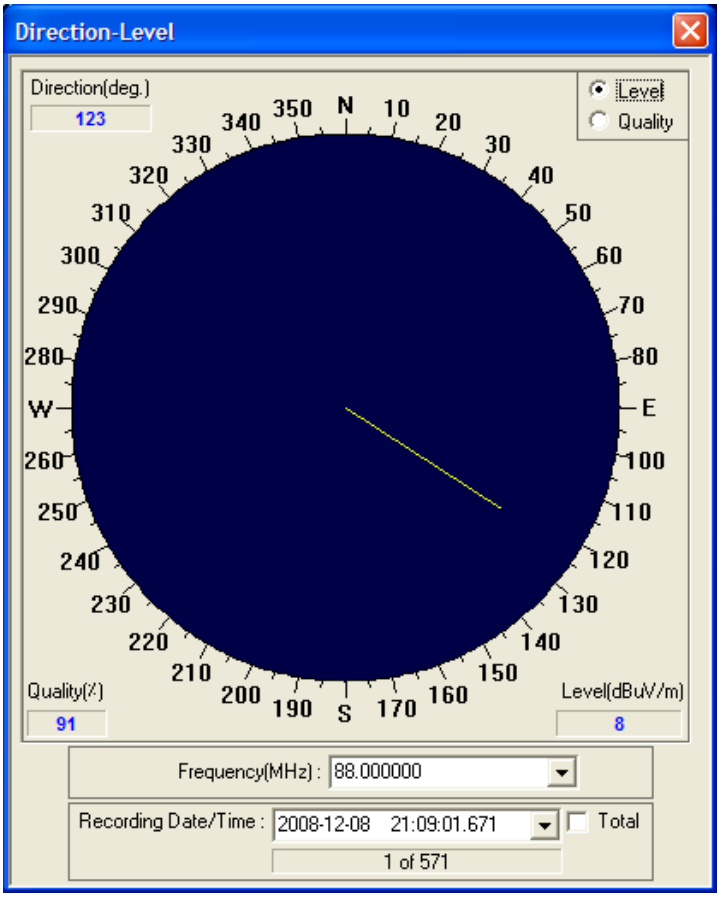
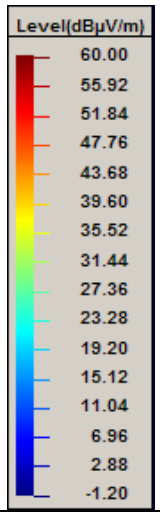
The following buttons are provided in the toolbar of the draw output screen to facilitate manipulation of the main functions:

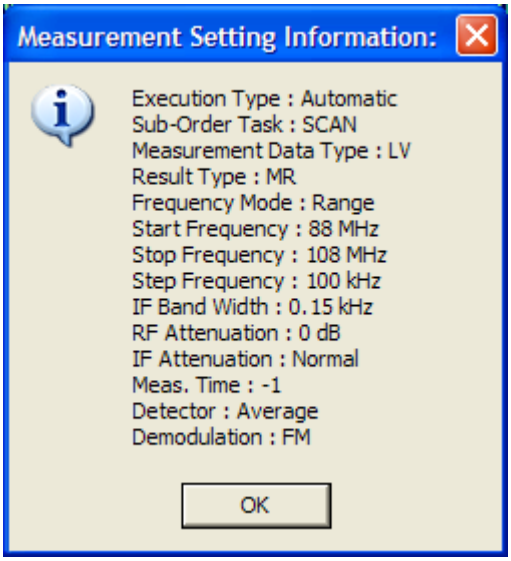
Toolbar Buttons	Name	Description
	Bar Chart	This button acts the same as Tools->Mode->Bar Chart menu and displays the resulted values as a bar chart. The following figure is a sample screen shot of a bar chart display of measurement results. 
	Line	This button acts the same as Tools->Mode->Line menu and displays the resulted values as a bar chart. The following figure is a sample screen shot of a line display of measurement results. 

	3D View	This button acts the same as Tools->3D (Frequency, Time, Value) and displays the resulted values as a 3D chart. The following figure is a sample screen shot of a 3D display of measurement results. 
	2D (Freq., Value)	This button acts the same as Tools->2D (Frequency, Value) and displays the resulted values as a 2D chart. The following figure is a sample screen shot of a 2D display of measurement results, having Frequency as X-axis and Level as Y-axis. 

	2D (Time, Value)	This button acts the same as Tools->2D (Time, Value) and displays the resulted values as a 2D chart. The following figure is a sample screen shot of a 2D display of measurement results, having Time as X-axis and Level as Y-axis. 
	Water fall	This button acts the same as Tools->2D (Water Fall) and displays the resulted values as a 2D chart having Frequency as X-axis and Time as Y-axis. The following figure is a sample screen shot of a 2D Water Fall display of measurement results. 

	Grid	This button acts the same as Tools->Grid or Ctrl+G keyboard shortcut and displays a 10 by 10 grid over X-Y plane of the existing chart. The following figure is a sample screen shot of a 2D chart display of measurement results with the grid. 
	Data Export	This button acts the same as File->Export Data As… and exports the measurement data as a Comma Separated Values (CSV) file. The following figure is a sample screen shot of the export screen. 

	Direction - Quality	This button is active only when a bearing measurement result is loaded. This result may contain different Level and Quality values for each direction, each frequency (if measured for a frequency range or list) and at different sampling times. In the screen it is possible to select between Level and Quality values, view each measured data alone or a group of measured data for each frequency. 
	Legend	This button acts the same as Ctrl+L keyboard shortcut or Tools->Legend menu item and displays the legend of colors used to depict values in the chart for measurement data. 

	Measurement Setting Information	This button acts the same as Ctrl+M keyboard shortcut or Tools->Measurement Setting Information menu item and displays the parameters of the order corresponding to the displayed result. 

As described in section 3.4.2.14.1.3, the result may contain the measurement results for up to four parameters. In this case it is possible to choose the desired parameter to show its measurement results. All possible submenu items of the Tools->Value menu is shown in the following table. Based on the type of measurement and availability of the results, only some of them might be active. Selection of statistical (e.g. Mean Value) values for some of the parameters might be possible only for Compressed Measurement Result (CMR) files which are described in section 3.4.2.14.1.3.

Measured Parameter	Value
Level	Value Mean Value Standard Deviation Maximum Value Minimum Value
Frequency Offset	Value Mean Value Standard Deviation Maximum Value Minimum Value
Modulation	Value Mean Value Standard Deviation Maximum Value Minimum Value

Band Width	Value Mean Value Standard Deviation Maximum Value Minimum Value
Bearing->Quality	Value Mean Value Standard Deviation Maximum Value Minimum Value
Bearing->Direction	Value Mean Value Standard Deviation Maximum Value Minimum Value
Sub Audio Tone	Value Mean Value Standard Deviation Maximum Value Minimum Value
Program	
PI Code	
Sound ID	
Occupancy	
Number	

3.4.2.14.2. ESMERALDA menu

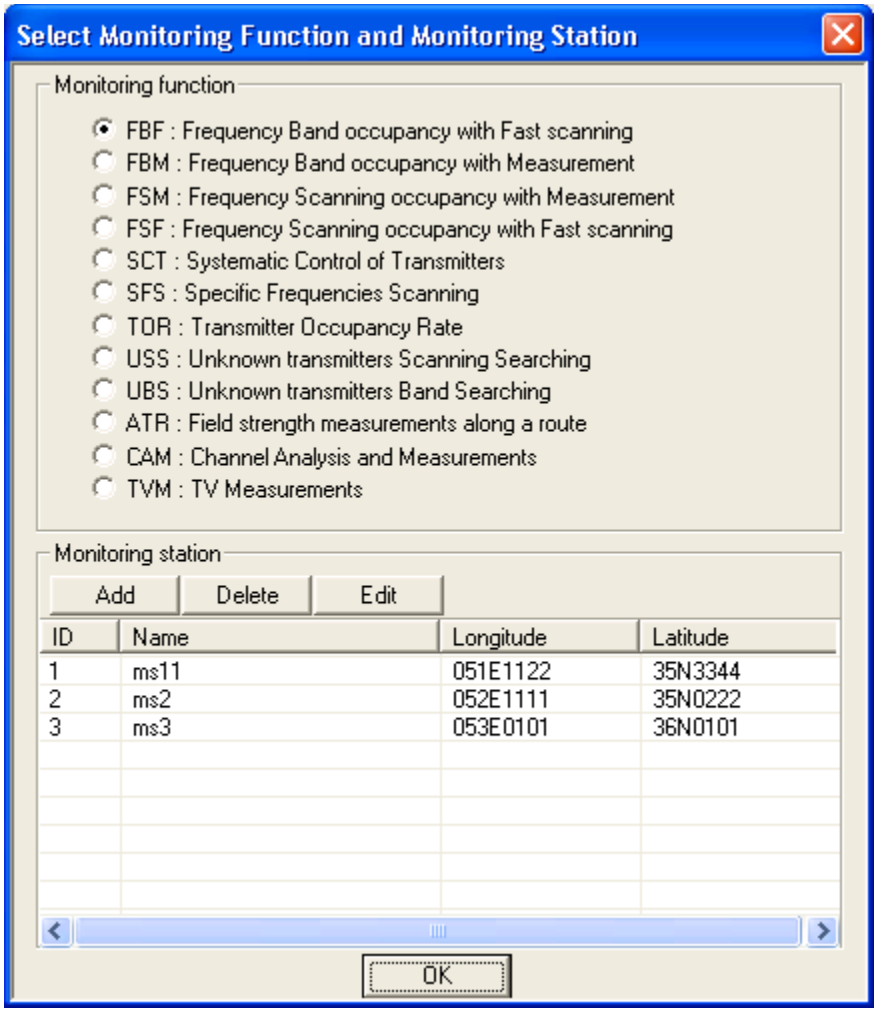
This menu item groups all the functionalities needed for communication with ESMERALDA monitoring software. The data exchange between SMS4DC and ESMERALDA is done through creation of different special files which are listed below:

- *.REQ: Request files. Created by the monitoring system and submitted to the SMS4DC to create a check file based on that.
- *.CHK: Check files. Measurement orders created by SMS4DC to be submitted to the monitoring system.
- *.RES: Result files
- *.ATR: Results of ATR measurement

3.4.2.14.2.1. Check-list Generation/Mission Creation sub-menu of ESMERALDA menu

By selection of this menu item, it is possible to create measurement missions (orders) to be submitted to the ESMERALDA monitoring software. Figure 3.215 shows the first screen.

Figure 3.215 The screen for measurement mission creation



The monitoring functions are listed below:

-**FBF**: Frequency Band occupancy with Fast scanning

-**FBM**: Frequency Band occupancy with Measurement

-**FSM**: Frequency Scanning occupancy with Measurement

-**FSF**: Frequency Scanning occupancy with Fast scanning

These missions are used to determine:

1. with a one-minute minimum resolution, the occupancy rate for a list of discrete frequencies over one or several days.

2. the occupancy rate of a band with the scanning pitch resolution on a sub-band, over one or several days.

A. Frequency Occupancy Rate with Frequency band Scanning

·FBM: determination of the continuous frequency sub-band occupancy rate (maximum 20 sub bands)associated with measurement of transmitter parameters.

·FBF: determination of the continuous frequency sub-band occupancy rate without measurement of transmitter parameters.

B. Frequency Occupancy Rate with Frequency Scanning

·FSM: determination of the discrete frequency list occupancy rate with measurement of transmitter parameters.

·FSF: determination of the discrete frequency list occupancy rate without measurement of transmitter parameters.

-**SCT**: Systematic Control of Transmitters. This mission is used to verify the compliance of known transmitters to the expected values and to obtain information items about the unknown transmitters encountered.

-**SFS**: Specific Frequencies Scanning. This type is used to monitor the activity on selected frequencies.

-**TOR**: Transmitter Occupancy Rate. This mission is used to determine, with a one-minute minimum resolution, the occupancy rate of a transmitter over one or several days.

-**USS**: Unknown transmitters Scanning Searching

-**UBS**: Unknown transmitters Band Searching

These missions intend to detect the presence of signals the source transmitter of which is not referenced in the management data base.

These missions are carried out

·either in frequency band scanning mode: (UBS)

·or in frequency scanning mode: (USS).

-**ATR**: Field strength measurements along a route. An “Along the Route” mission is used to determine the coverage area of one or more transmitters along a route. It enables, in a mobile measurement station, to associate a level of energy with a GPS position.

-**CAM**: Channel Analysis and Measurements. A "channel analysis" mission allows to analyze, display and store the transmitter characteristics on a given channel (fixed frequency). It tries to split the activity of a frequency into several communications (a succession of measurements above the detection threshold is identified as a communication).

-**TVM**: TV Measurements

The purpose of a “TV Measurements ” mission is to:

·check the characteristics of a transmitter by measuring the various frequencies: image, sound, chrominance, attenuated band sub-carriers,

·perform a protection measurement between a given transmitter (1st transmitter of mission file) and possible spurious transmitter (2nd transmitter of the mission file).

After selection of the desired mission type then there will be four more screens for further parameters as shown in Figure 3.216 to Figure 3.219.

Figure 3.216. Step 1 of the parameter definition for the missions

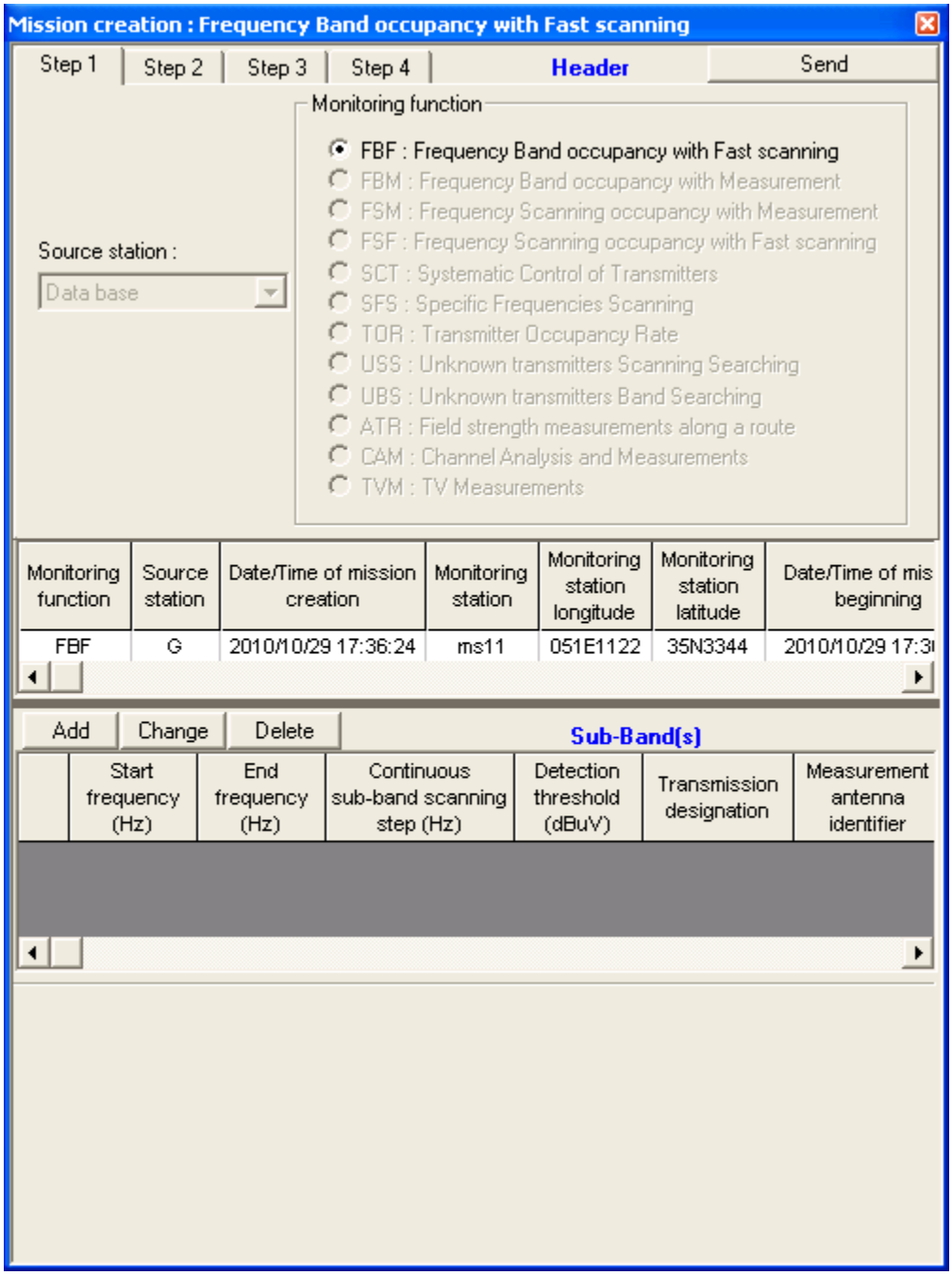


Figure 3.217. Step 2 of the parameter definition for the missions. Date and Time settings

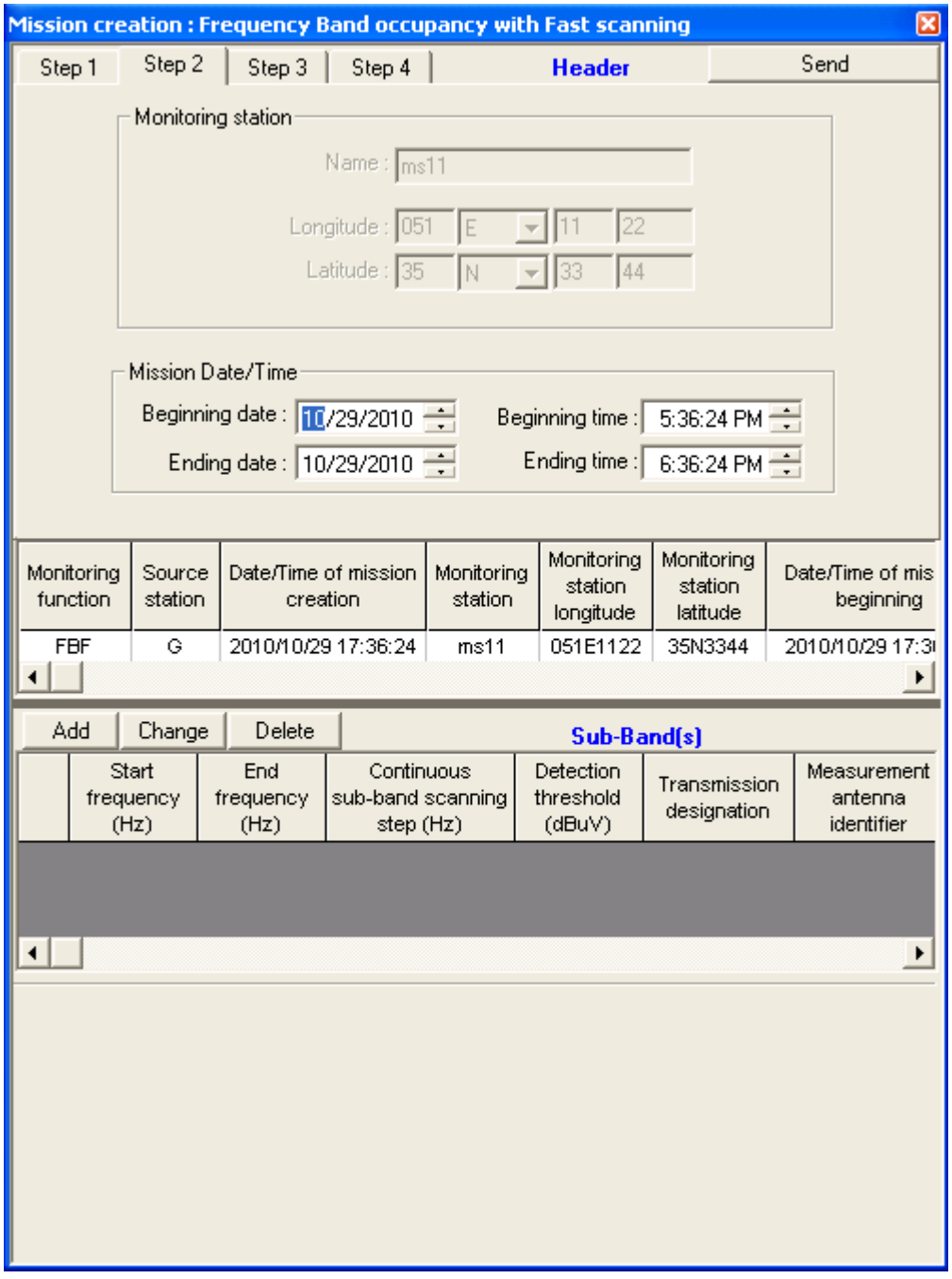


Figure 3.218. Step 3 of the parameter definition for the missions

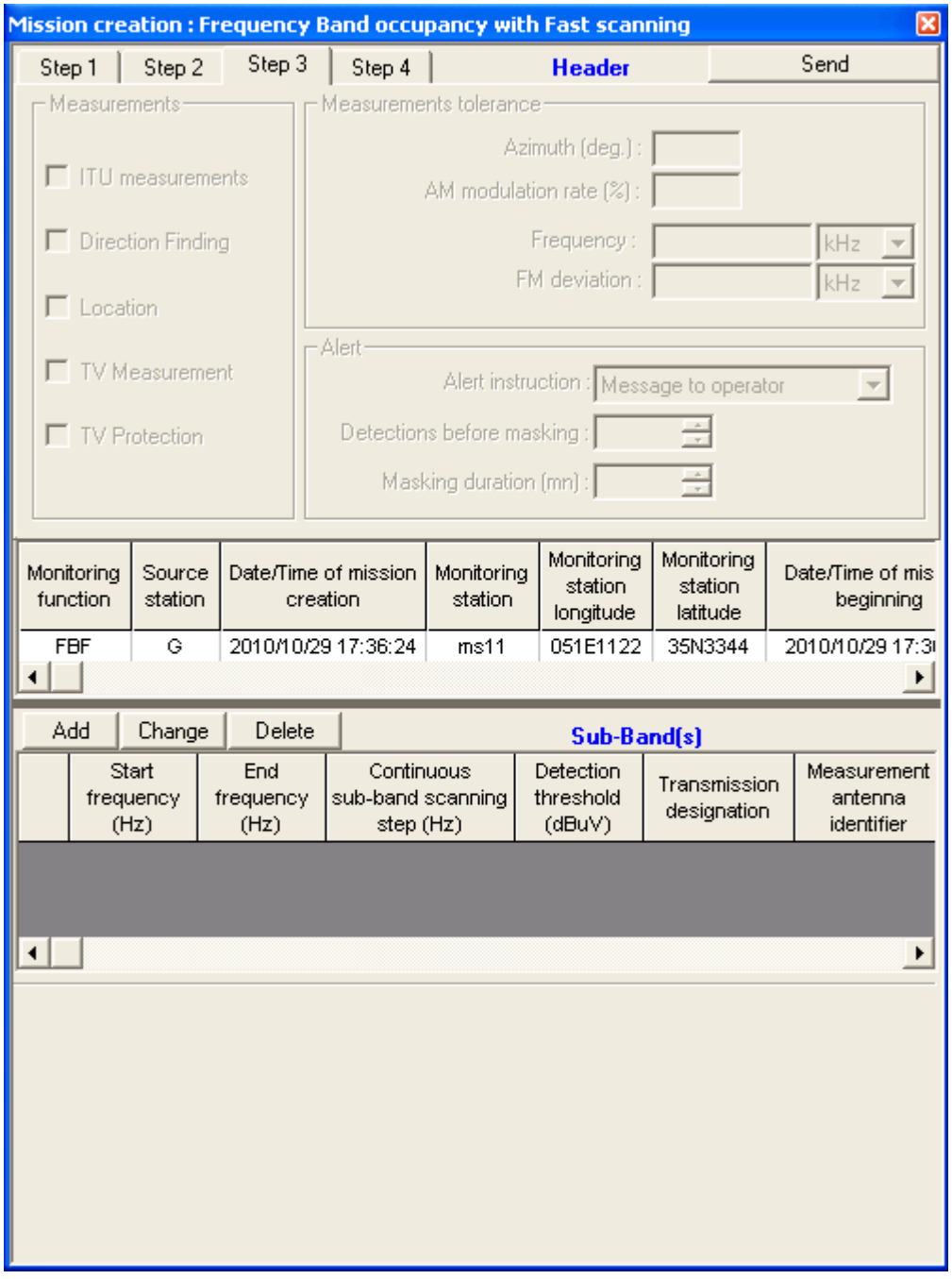
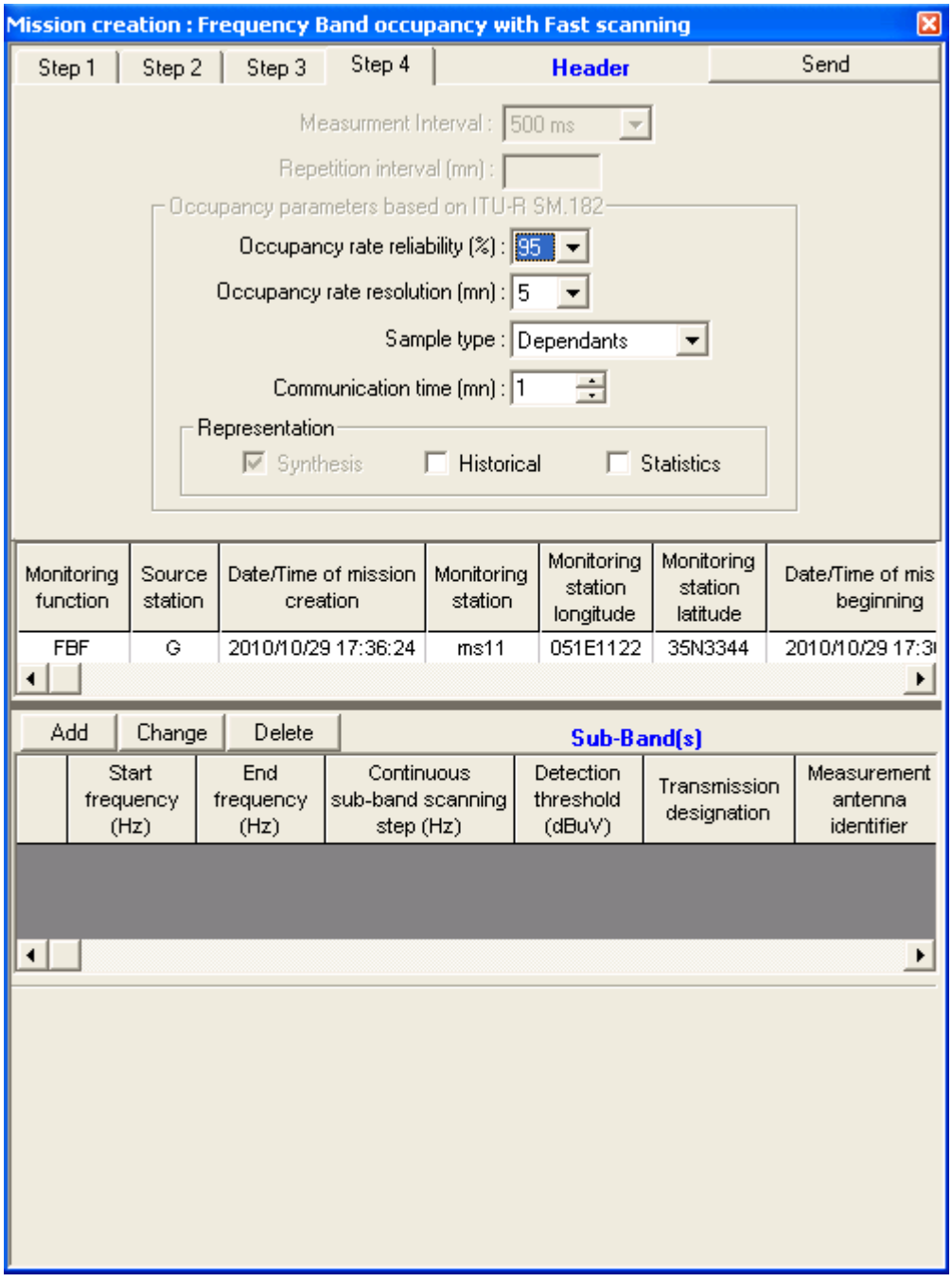


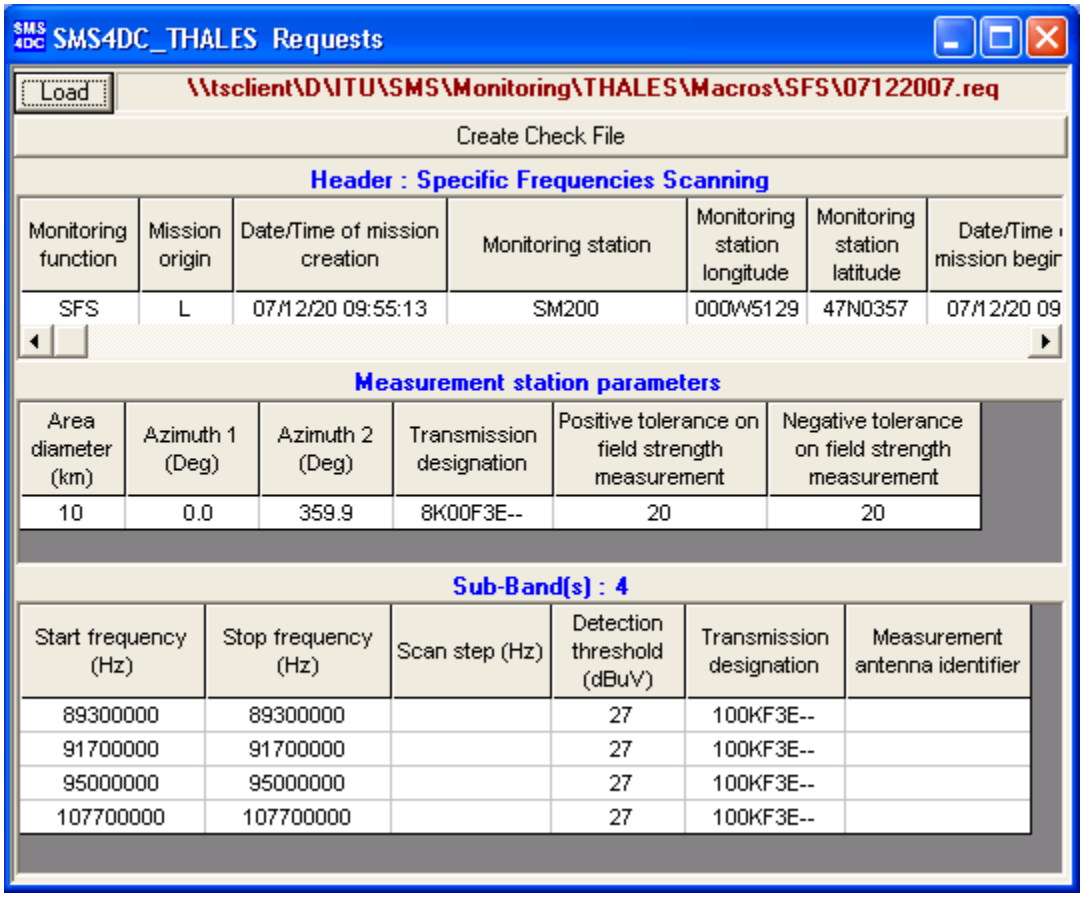
Figure 3.219. Step 4 of the parameter definition for the missions



3.4.2.14.2.2. Check-list Generation/Requests sub-menu of ESMERALDA menu

This functionality is used when there are request files coming from the monitoring system. On the screen (Figure 3.220) the desired *.REQ file should be selected by pressing Load button and by pressing Create Check File button the corresponding check file will be created and submitted to the monitoring system.

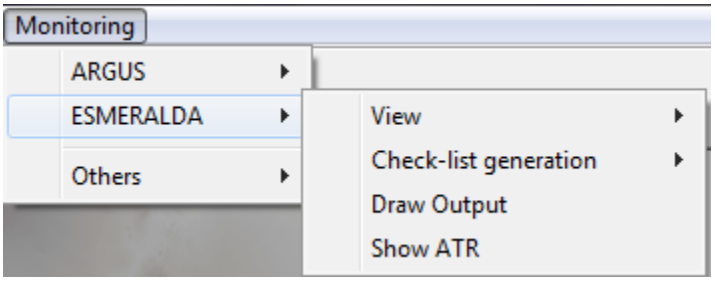
Figure 3.220. Screen for creation of a Check file based on a Request file



3.4.2.14.2.3. Check-list Generation/Requests (Automatic) sub-menu of ESMERALDA menu

Activation of this menu (Figure 3.221), makes SMS4DC ready to listen to the requests issued by ESMERALDA monitoring system and as soon as it receives a request, processes the information and creates a check file and sends back to ESMERALDA monitoring software.

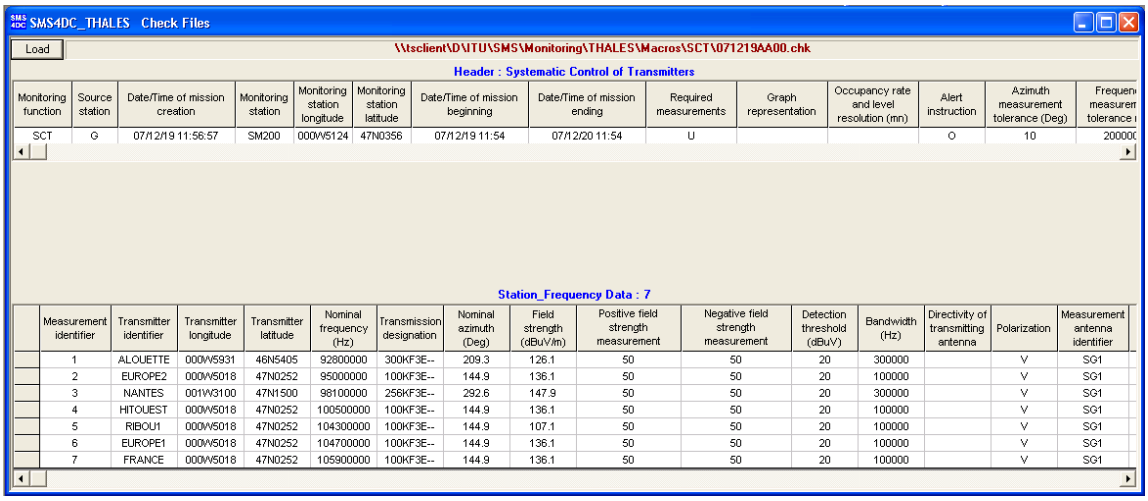
Figure 3.221. Menu for activation of automatic processing of incoming requests



3.4.2.14.2.4. View/Check-list sub-menu of ESMERALDA menu

This menu item is used for displaying the content of check files. (Figure 3.222) shows an example of a check file for SCT mission. It is possible to display contents of check files, result files and occupancy files simultanously.

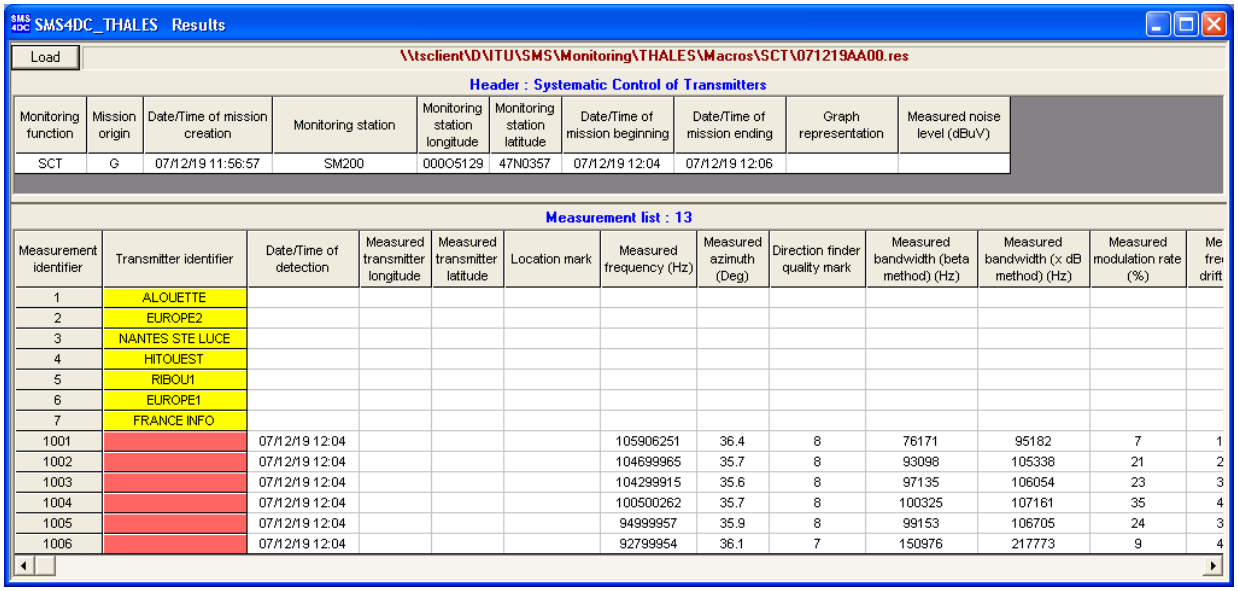
Figure 3.222. Contents of a sample SCT Check file



3.4.2.14.2.5. View/Results sub-menu of ESMERALDA menu

This menu item is used for displaying the content of result files. (Figure 3.223) shows an example of a result file for SCT mission. It is possible to display contents of check files, result files and occupancy files simultanously.

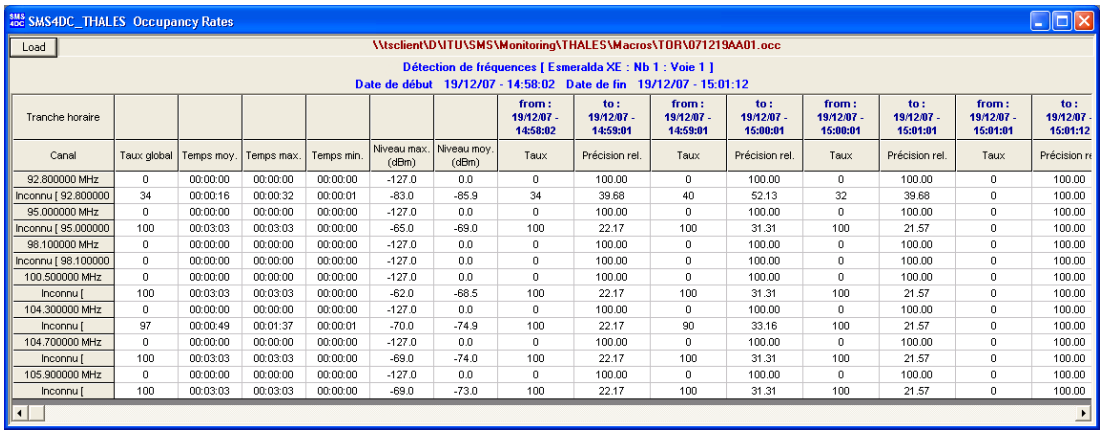
Figure 3.223 Contents of a sample Result file of a SCT mission



3.4.2.14.2.6. View/Occupancy Rate sub-menu of ESMERALDA menu

This menu item is used for displaying the content of occupancy files. Figure 3.224 shows an example of an occupancy file for TOR mission. It is possible to display contents of check files, result files and occupancy files simultanously.

Figure 3.224. Contents of a sample Occupancy Rate result for a TOR mission

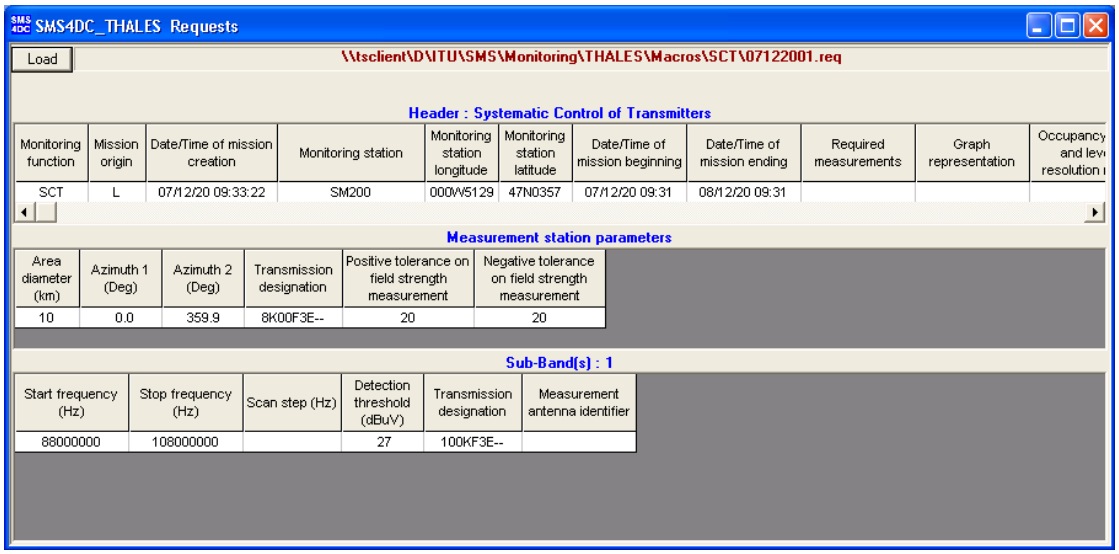


Tranche horaire							from : 19/12/07 - 14:58:02	to : 19/12/07 - 14:59:01	from : 19/12/07 - 14:59:01	to : 19/12/07 - 15:00:01	from : 19/12/07 - 15:00:01	to : 19/12/07 - 15:01:01	from : 19/12/07 - 15:01:01	to : 19/12/07 - 15:01:12
Canal	Taux global	Temps moy.	Temps max.	Temps min.	Niveau max. (dBm)	Niveau moy. (dBm)	Taux	Précision rel.	Taux	Précision rel.	Taux	Précision rel.	Taux	Précision re
92.800000 MHz	0	00:00:00	00:00:00	00:00:00	-127.0	0.0	0	100.00	0	100.00	0	100.00	0	100.00
Inconnu [92.800000	34	00:00:16	00:00:32	00:00:01	-83.0	-85.9	34	39.68	40	52.13	32	39.68	0	100.00
95.000000 MHz	0	00:00:00	00:00:00	00:00:00	-127.0	0.0	0	100.00	0	100.00	0	100.00	0	100.00
Inconnu [95.000000	100	00:03:03	00:03:03	00:00:00	-65.0	-69.0	100	22.17	100	31.31	100	21.57	0	100.00
98.100000 MHz	0	00:00:00	00:00:00	00:00:00	-127.0	0.0	0	100.00	0	100.00	0	100.00	0	100.00
Inconnu [98.100000	0	00:00:00	00:00:00	00:00:00	-127.0	0.0	0	100.00	0	100.00	0	100.00	0	100.00
100.500000 MHz	0	00:00:00	00:00:00	00:00:00	-127.0	0.0	0	100.00	0	100.00	0	100.00	0	100.00
Inconnu [	100	00:03:03	00:03:03	00:00:00	-62.0	-68.5	100	22.17	100	31.31	100	21.57	0	100.00
104.300000 MHz	0	00:00:00	00:00:00	00:00:00	-127.0	0.0	0	100.00	0	100.00	0	100.00	0	100.00
Inconnu [	97	00:00:49	00:01:37	00:00:01	-70.0	-74.9	100	22.17	90	33.16	100	21.57	0	100.00
104.700000 MHz	0	00:00:00	00:00:00	00:00:00	-127.0	0.0	0	100.00	0	100.00	0	100.00	0	100.00
Inconnu [	100	00:03:03	00:03:03	00:00:00	-69.0	-74.0	100	22.17	100	31.31	100	21.57	0	100.00
105.900000 MHz	0	00:00:00	00:00:00	00:00:00	-127.0	0.0	0	100.00	0	100.00	0	100.00	0	100.00
Inconnu [	100	00:03:03	00:03:03	00:00:00	-69.0	-73.0	100	22.17	100	31.31	100	21.57	0	100.00

3.4.2.14.2.7. View/Requests sub-menu of ESMERALDA menu

This menu item is used for displaying the content of request files. (Figure 3.225) shows an example of a request file for SCT mission. It is possible to display contents of check files, result files and occupancy files simultanously.

Figure 3.225. Contents of a sample Request file for a SCT mission



Monitoring function	Mission origin	Date/Time of mission creation	Monitoring station	Monitoring station longitude	Monitoring station latitude	Date/Time of mission beginning	Date/Time of mission ending	Required measurements	Graph representation	Occupancy and lev resolution
SCT	L	07/12/20 09:33:22	SM200	000W5129	47N0357	07/12/20 09:31	08/12/20 09:31			

Measurement station parameters

Area diameter (km)	Azimuth 1 (Deg)	Azimuth 2 (Deg)	Transmission designation	Positive tolerance on field strength measurement	Negative tolerance on field strength measurement
10	0.0	359.9	8K00F3E--	20	20

Sub-Band(s) : 1

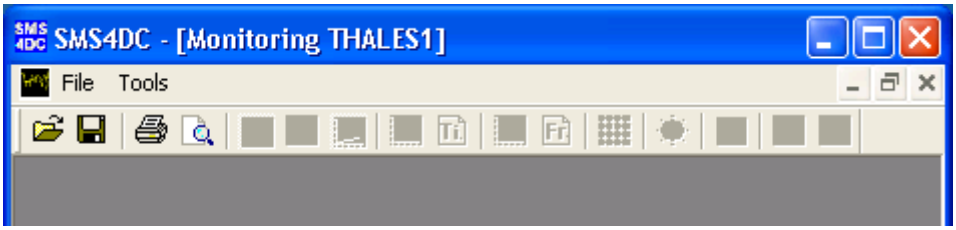
Start frequency (Hz)	Stop frequency (Hz)	Scan step (Hz)	Detection threshold (dBuV)	Transmission designation	Measurement antenna identifier
88000000	108000000		27	100KF3E--	

3.4.2.14.2.8. Draw Output sub-menu of ESMERALDA menu

After successful completion of a measurement, it is possible to visualize some the results in SMS4DC. It should be noted that only some of the results of ESMERALDA monitoring software are graphically visible but it is possible to view all the text results by the functionality which is described in section 3.4.2.14.2.5. By selection of the "Draw

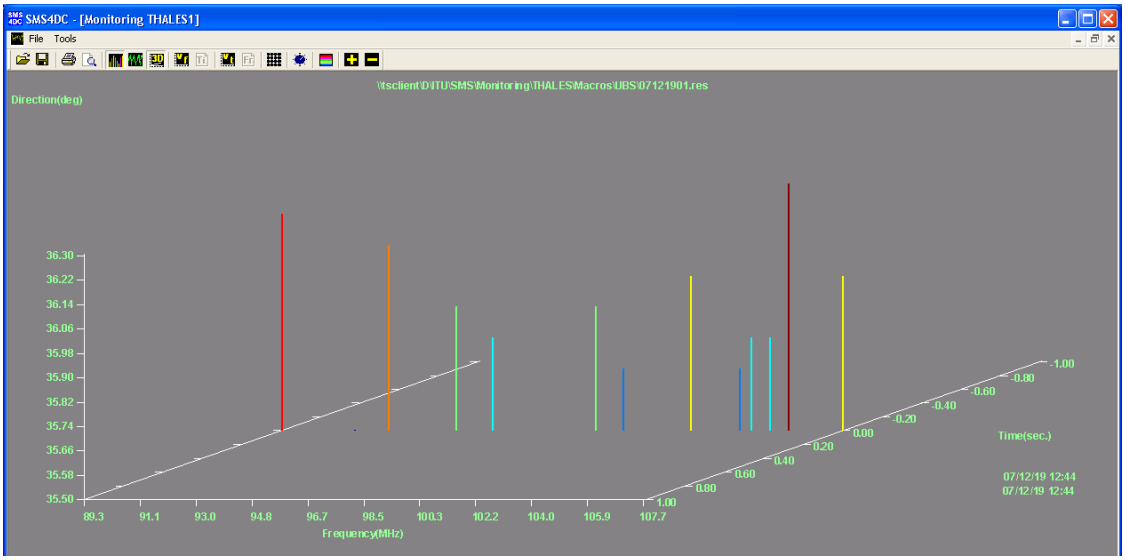
Output" under ESMERALDA menu, the screen shown in (Figure 3.226) is displayed and by selection of File->Open, the result file should be selected from the OUTBOX folder of ESMERALDA system.

Figure 3.226. The screen for graphically displaying the measurement results of ESMERALDA monitoring system



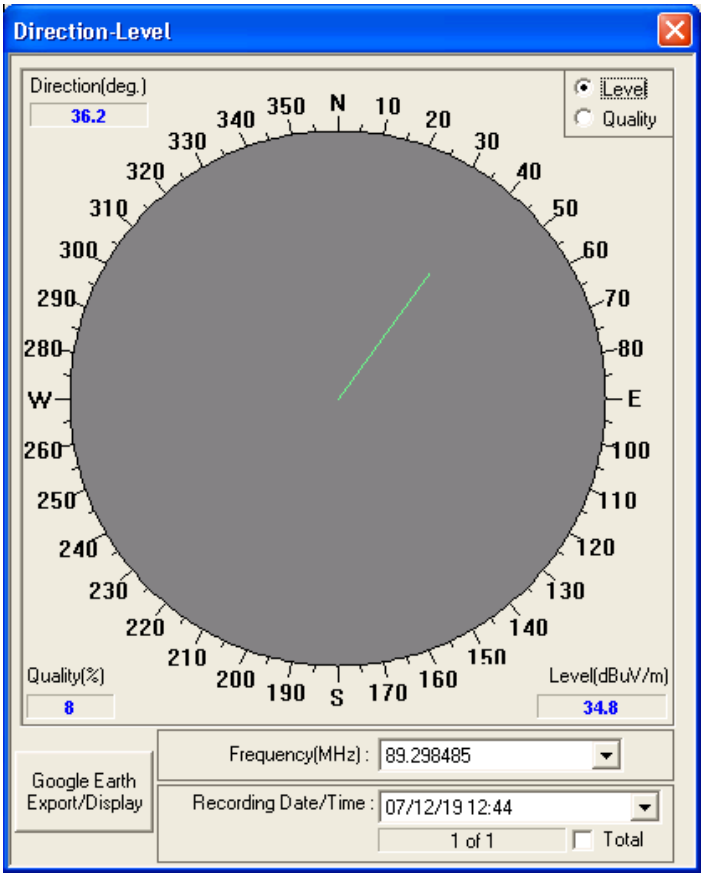
The toolbar buttons are already described in section 3.4.2.14.1.7. The following picture shows an example of the results for a UBS measurement.

Figure 3.227. Graphical display of the measurement results of a UBS mission



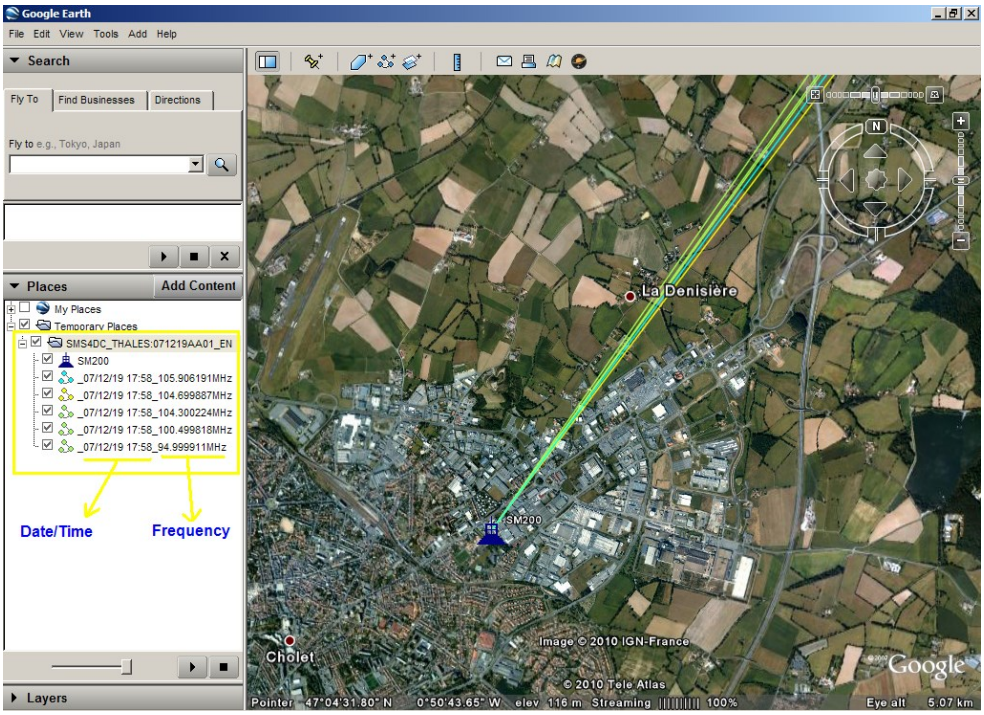
While displaying the results of Direction-Level measurement (), it is possible to export the results to be viewed in Google Earth.

Figure 3. 228. Screen for displaying and/or exporting the results of a direction measurement



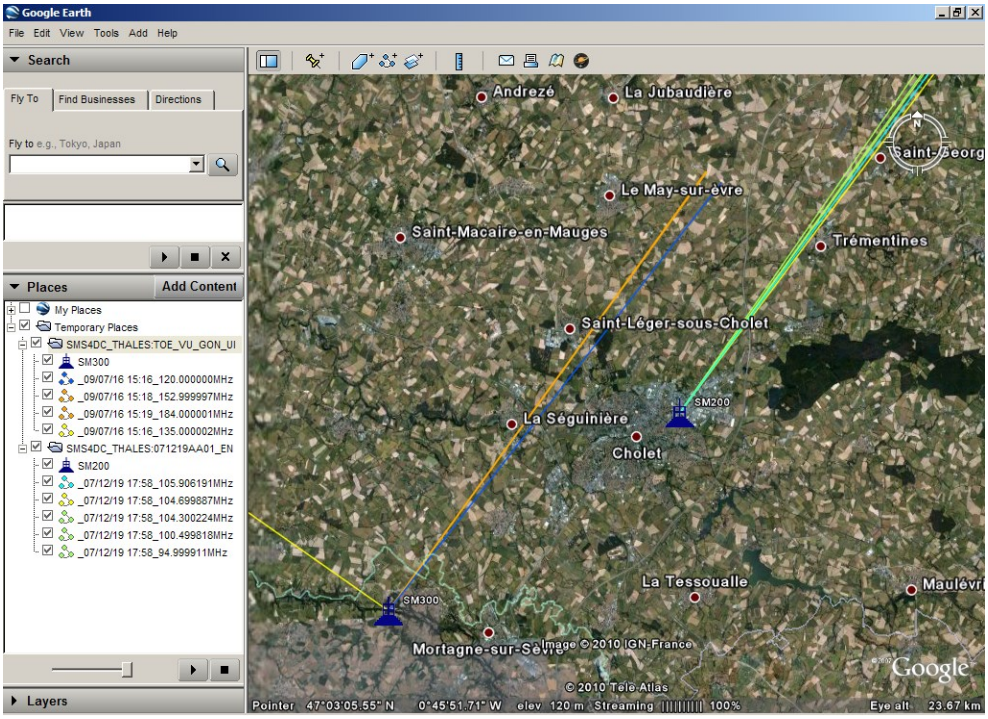
By pressing "Google Earth Export/Display" button, the signal direction is displayed on the Google Earth screen (for this capability, the Google Earth application must be installed).

Figure 3.229. Screen for displaying the results of a direction measurement on Google Earth



It is also possible to load and display different measurement files. This might be useful for finding the location of a transmitter by having at least three direction-finding results of three different monitoring stations.

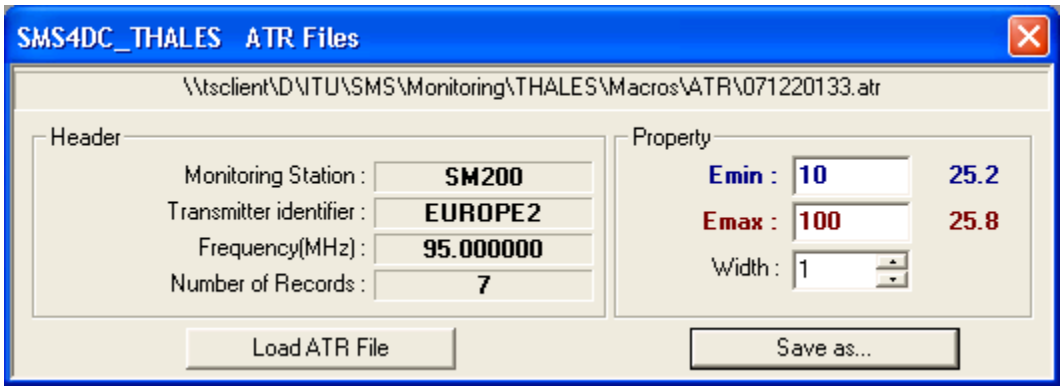
Figure 3.230. Screen for displaying the results of two direction measurements on Google Earth



3.4.2.14.2.9. Show ATR sub-menu of ESMERALDA menu

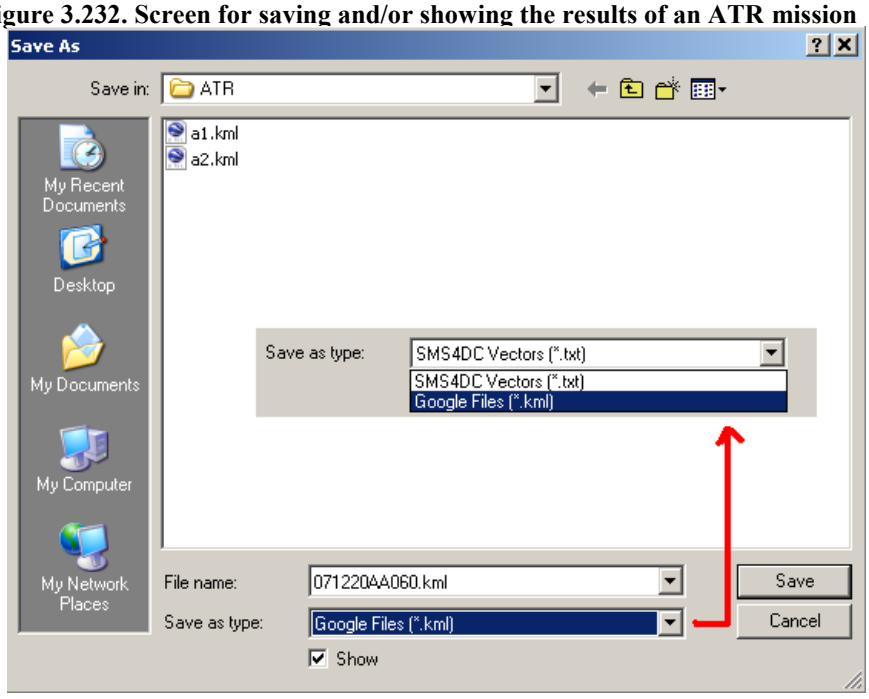
This menu item is used for displaying the content of result files. (Figure 3.231) shows an example of a result file for ATR mission. It is possible to display contents of check files, result files and occupancy files simultanously.

Figure 3.231. Screen for displaying and/or converting the results of an ATR mission



By pressing "Save as" button the results could be saved in SMS4DC Vectors (*.txt) or Google Files (*.kml) formats.

Figure 3.232. Screen for saving and/or showing the results of an ATR mission



By putting check mark in "Show" check box and then pushing "Save" button the results will be shown in Google Earth.

Figure 3.233. Example for showing an ATR mission on Google Earth

3.4.2.14.3. Others menu

Document 1C/120-E dated 17 September 2010 from Director of the BDT provides the necessary information required for General Interface Between SMS4DC and Monitoring Systems.

This menu item groups all the functionalities needed for communication with other monitoring software. The data exchange between SMS4DC and monitoring software is done through two kinds of orders:

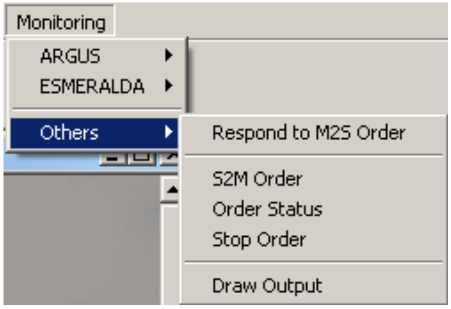
- M2S - Interface for sending requests from monitoring system to the SMS4DC.
- S2M - Interface for sending requests from the SMS4DC to monitoring systems.

3.4.2.14.3.1. Respond to M2S Order sub-menu of Others menu

Activation of this menu (Figure 3.234), makes SMS4DC ready to listen to the M2S orders issued by monitoring system and as soon as it receives an order, prepares the requested information and sends to the monitoring system. Removing the check mark of this item disables this link from monitoring system to SMS4DC.

For more information about creating orders in the monitoring system, consult the user's manual of relevant monitoring system.

Figure 3.234. "Respond to M2S Order" menu item



3.4.2.14.3.2. S2M Order sub-menu of Others menu

By this function it is possible to create an S2M measurement order by selection of "S2M Order" menu. By selection of this menu, Order Report screen will appear. In the displayed screen, there

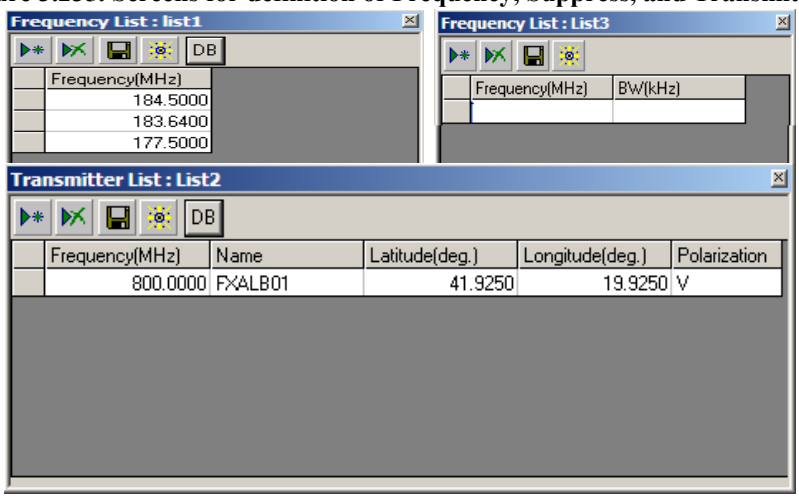
are 3 tab dialogs called "General Setting", "Date and Time Setting" and "Result Setting" which are shown in Figure 3.236, Figure 3.237 and Figure 3.238 respectively.

In these screens there are some items which are inactive by default. Each of these items may get active based on the values of other items. For example the "Frequency List" combo box of "General Setting" screen may be active only for "Frequency List Scan" measurement. In the General Setting of the measurement order (Figure 3.236), there are so many technical parameters which some of them are described here and more detailed technical information may be found in the user's manual of monitoring software.

- Order Task: Currently the following types of measurements are available
    - Frequency List Scan
    - Transmitter List Scan
    - Scan
    - DScan
    - FFM (Fixed Frequency Measurement)
    - Sweep
- Measurement Parameter: At most four of these parameters can be measured simultaneously with the exception of "Location" which should be measured alone.
    - Level
    - Offset
    - Frequency
    - IF
    - Audio
    - AM
    - FM
    - PM
    - BandWidth
    - Bearing
    - Sub Audio Tone
    - Program
    - PI Code
    - Sound ID
    - Location
- Frequency, Transmitter and Suppress List Drop Down lists

The first two are only active for "Frequency List Scan" and "Transmitter List Scan" respectively and the third one is active for "Scan", "DScan" and "Sweep" measurements. It is possible to create user defined lists and store them in the system. First of all a unique name should be written in the Drop-Down Box. Then the corresponding button in front of that box should be pressed and one of the screens shown in Figure 3.235 will be displayed.

Figure 3.235. Screens for definition of Frequency, Suppress, and Transmitter Lists



A special DB button is visible in these screens. This button enables the user to create the list based on the existing information in the SMS4DC database.

Figure 3.236. General Setting of a measurement order

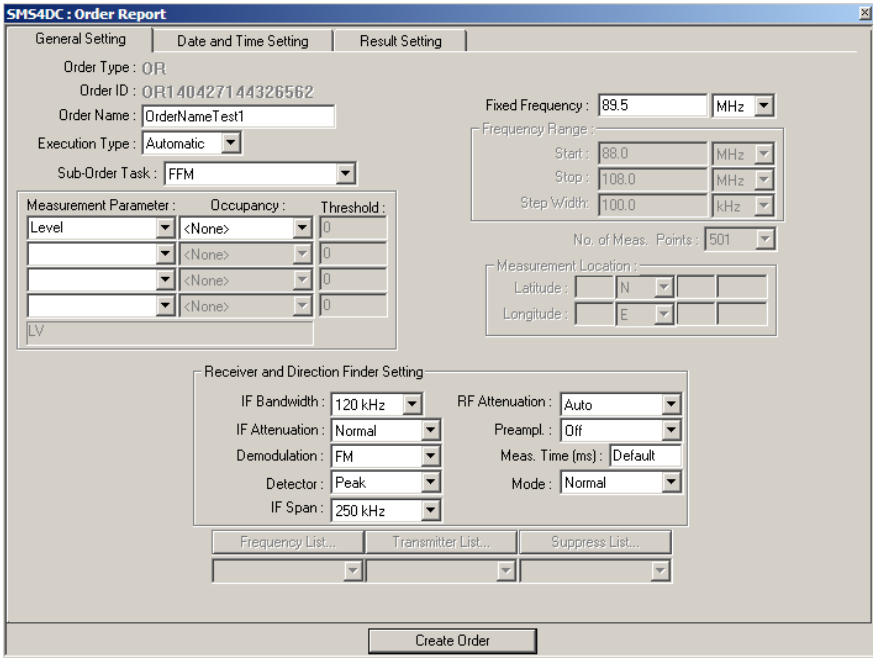
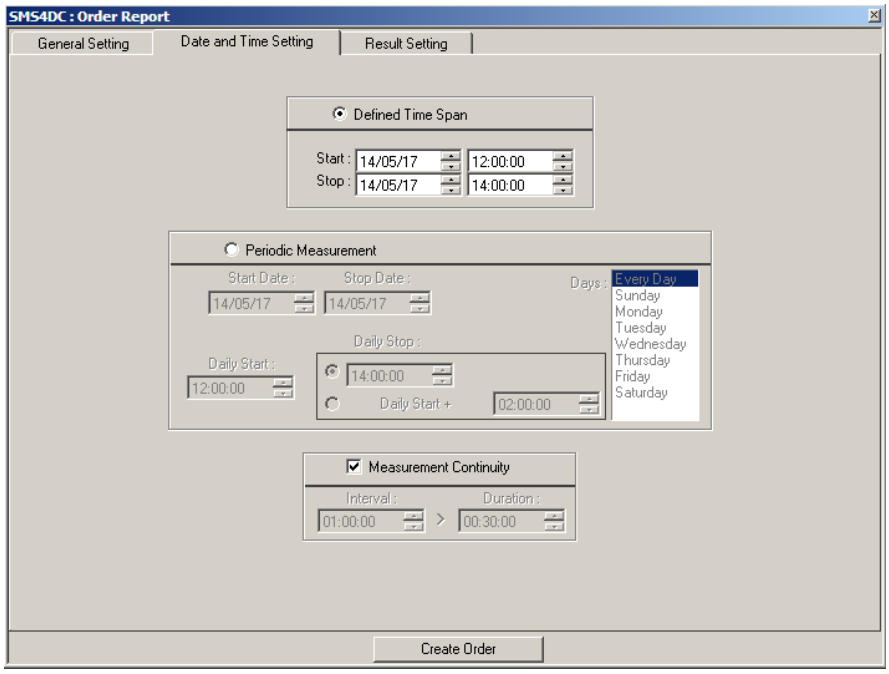
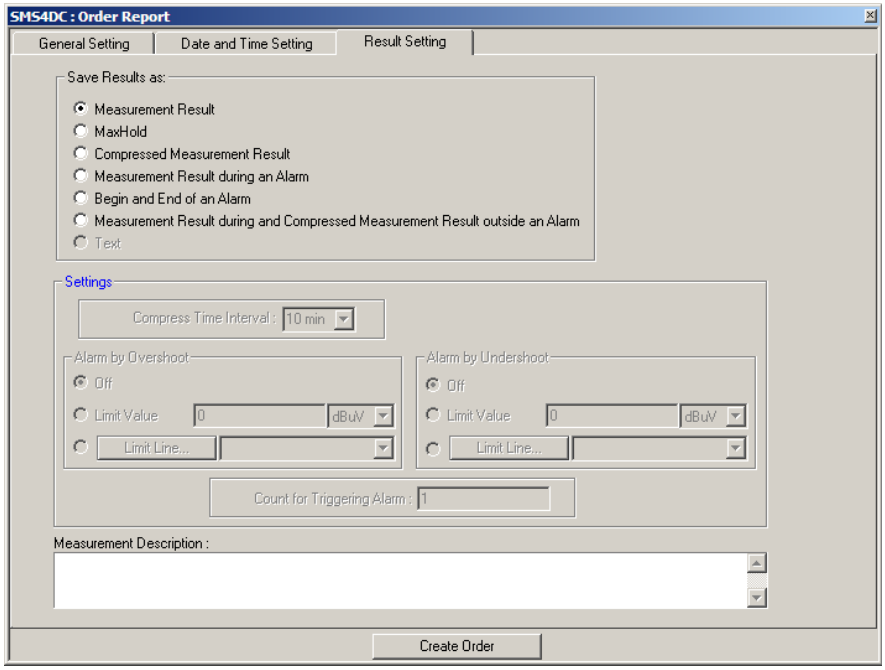


Figure 3.237. Date and Time Setting of a measurement order



In the "Date and Time Setting" screen it is possible to create a one-time measurement which is defined using the items on the top of the screen or a periodic measurement using the items in the centre of the screen. And also using the items at the bottom of the page, the continuity of the measurement in the defined time span or period, can be defined.

Figure 3.238. Result Setting of a measurement order



In the final screen for (Figure 3.238) creation of an S2M, the following selections are available:

- Measurement Result: All Measurement results are stored.
- MaxHold: For each frequency only the maximum measured value is stored.
- Compressed Measurement Result: Compression interval per adjusted becomes for each measuring parameter (so far as possible) a result of measurement (Average, Standard deviation, Minimum, Maximum) stored. Storage always takes place to the full minute.
- Measurement Result during an Alarm: All measured values are stored during an alarm. Measured values outside of the alarm are not stored.
- Begin and End of an Alarm: The time at the beginning and time at the end of the alarm arisen last are only stored. The result of measurement contains the additional column status with the values start and stop. Measured values are not stored.
- Measurement Result during and Compressed Measurement Result outside and Alarm: All measured values are stored during an alarm. Measured values outside the alarm are stored compressed (see Compressed Measurement Result).

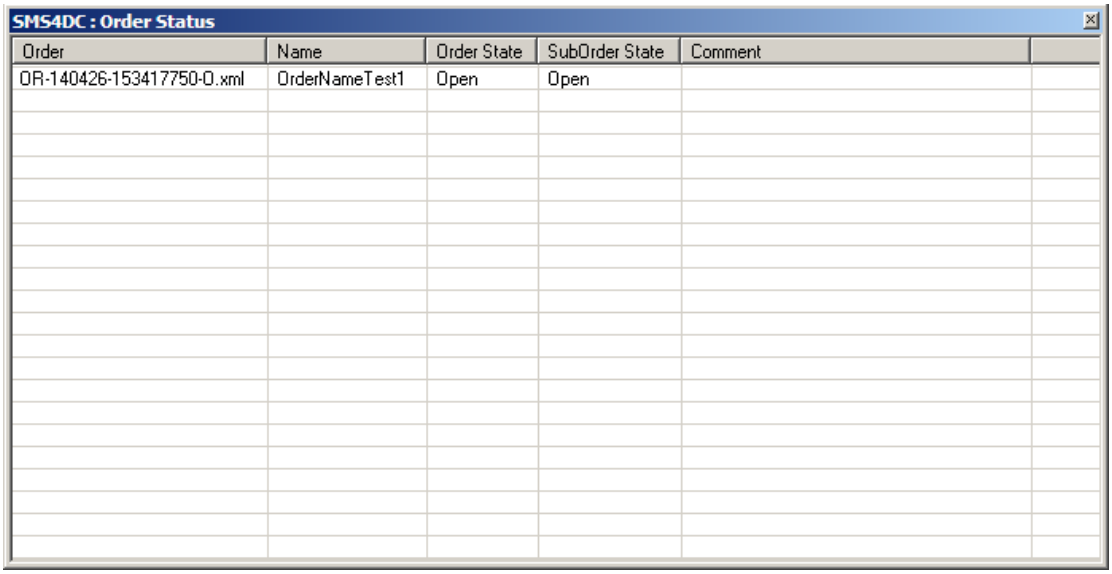
3.4.2.14.3.3. Order Status sub-menu of Others menu

By this facility, it is possible to see the status of all existing orders in the INBOX folder of monitoring system. The states might be one of the following:

- Open: When SMS4DC places a new order in the INBOX of the monitoring system, which shall execute the order, the state of the order is „Open“. The state of the sub-orders is also „Open“.

- In Process: monitoring system sets the state of the sub-order to „In Process“ and executes the automatic measurement. The state of the order is also set to „In Process“ by monitoring system.
- Finished: After measurement, monitoring system creates the report with the measurement results and additional information and sets the state of the sub order to „Finished“.

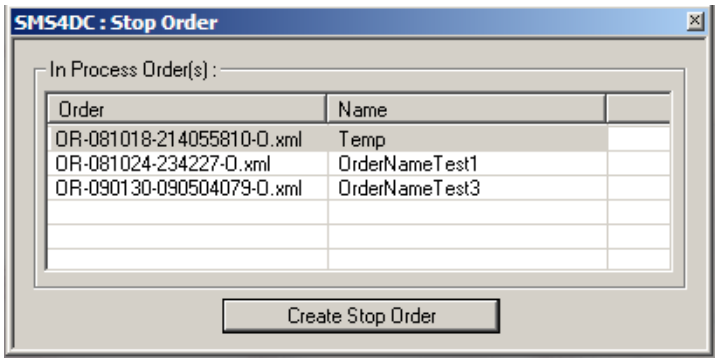
Figure 3.239. The screen showing the status of all existing orders in the INBOX folder of monitoring system



3.4.2.14.3.4. Stop Order sub-menu of Others menu

By selection of this menu, a list of all running or pending S2M orders will be displayed (Figure 3.240) and one of them can be selected and stopped by pressing the "Create Stop Order" button.

Figure 3.240. The screen showing all running or pending orders ready to be stopped



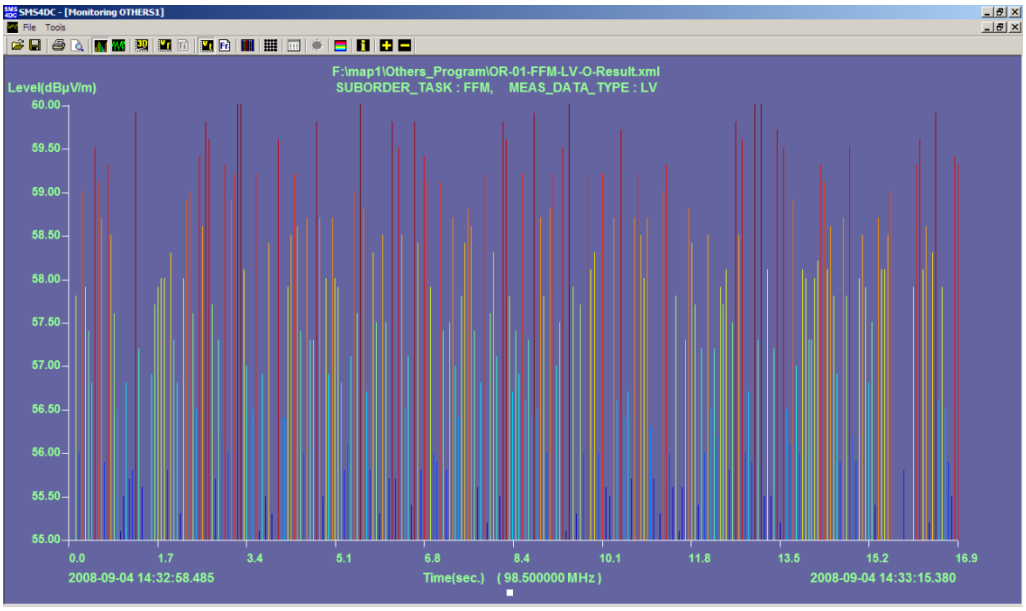
3.4.2.14.3.5. Draw Output sub-menu of Others menu

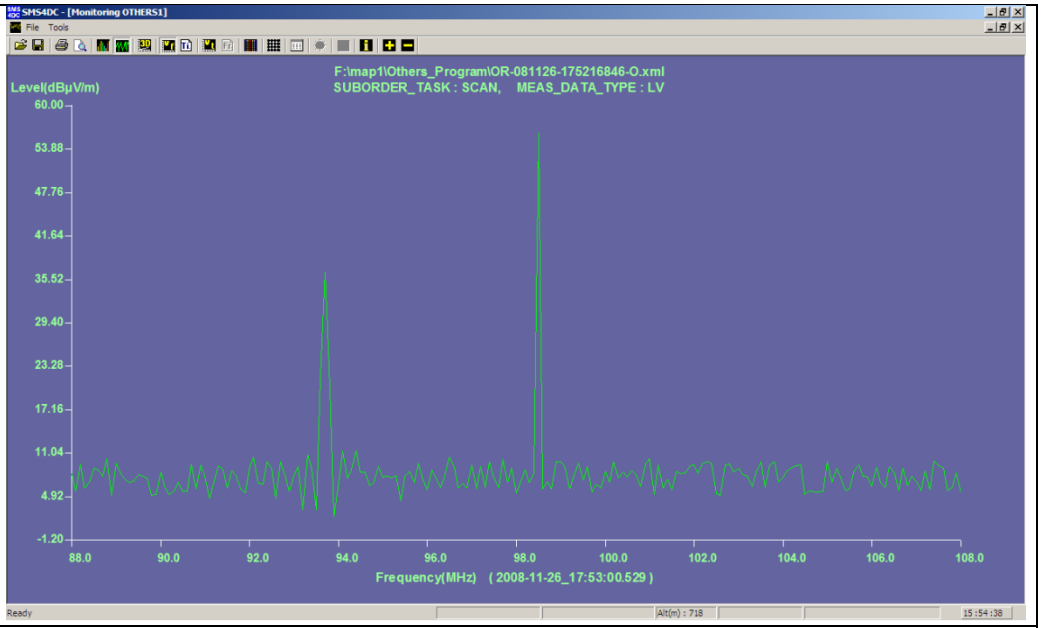
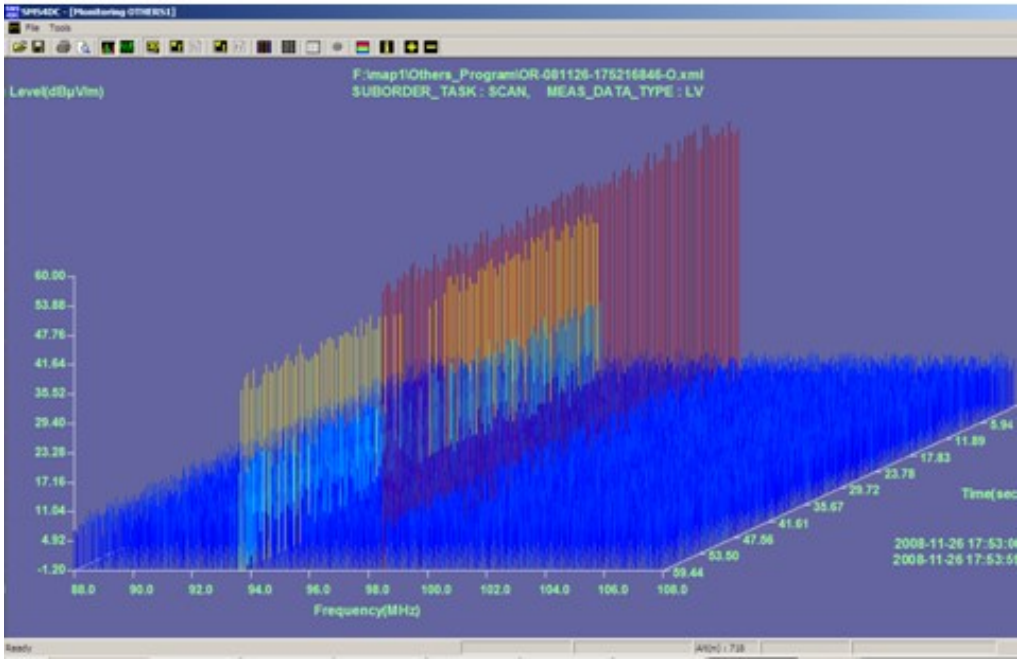
After successful completion of measurement of a S2M order, it is possible to visualise the results in either monitoring system or SMS4DC. By selection of "Draw Output" menu, the screen shown in Figure 3.241 is displayed and by selection of File->Open, the result XML file should be selected from the OUTBOX folder of monitoring system.

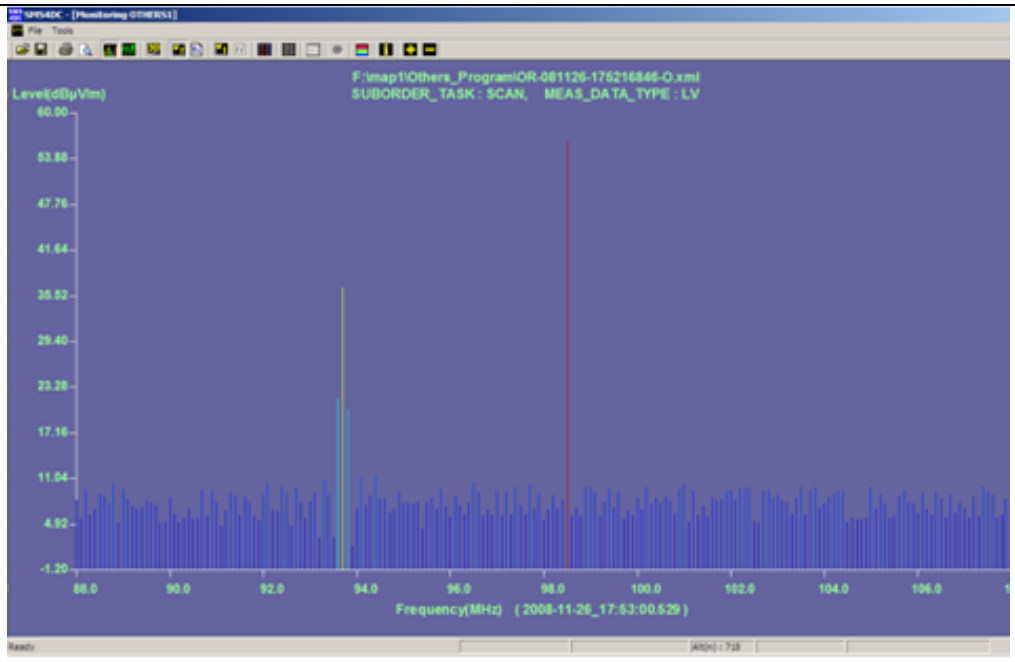
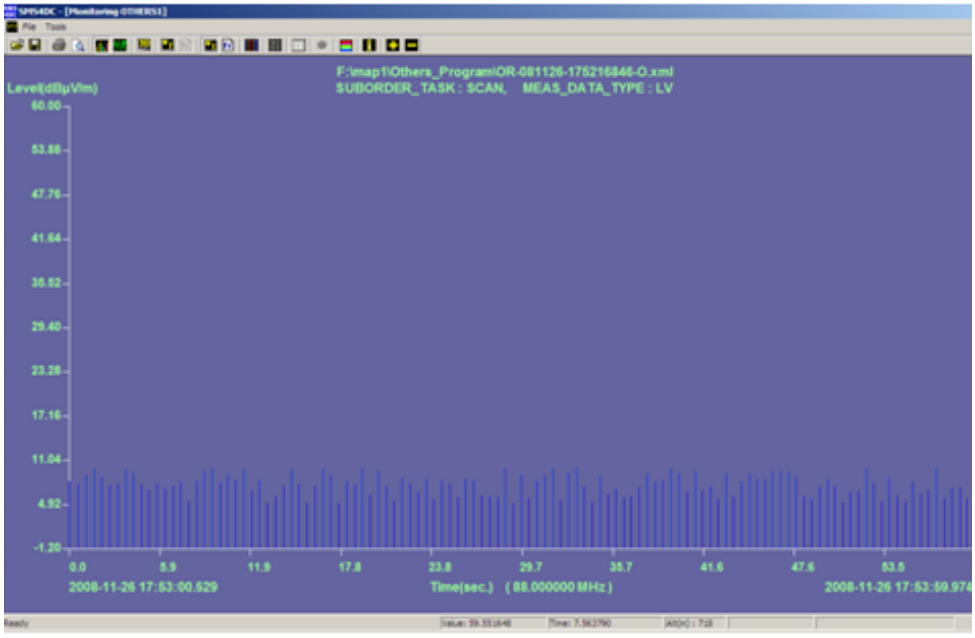
Figure 3.241. The toolbar of the screen showing the results of a measurement

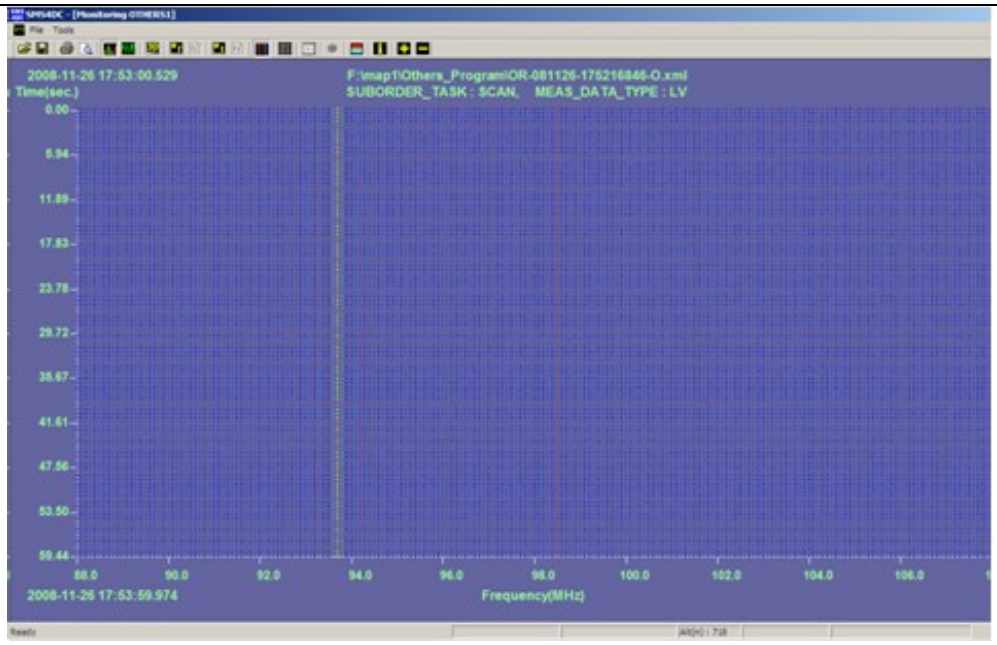
3.4.2.14.3.6. Toolbar of Others Monitoring Results view

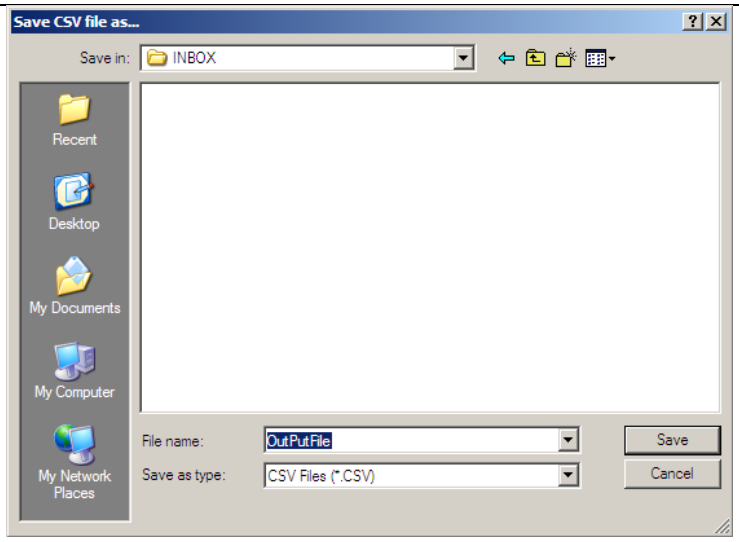
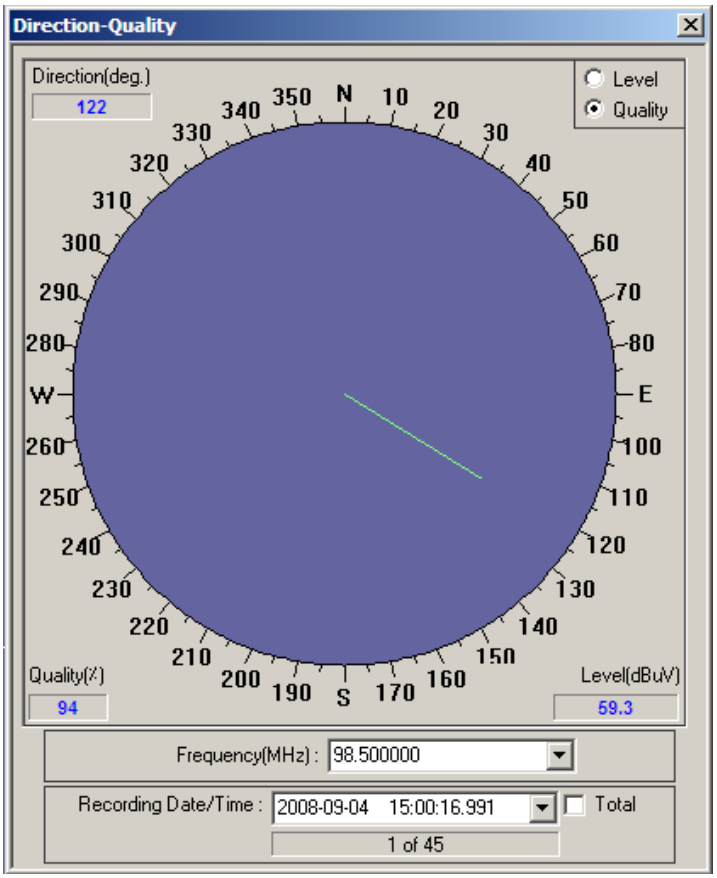
The following buttons are provided in the toolbar of the draw output screen to facilitate manipulation of the main functions:

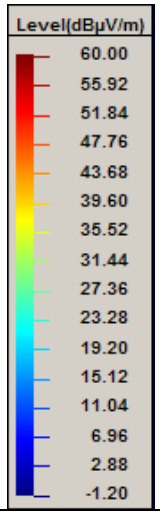
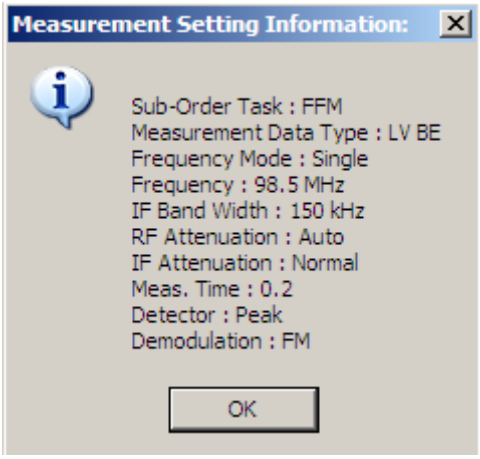
Toolbar Buttons	Name	Description
	Bar Chart	This button acts the same as Tools->Mode->Bar Chart menu and displays the resulted values as a bar chart. The following figure is a sample screen shot of a bar chart display of measurement results. 
	Line	This button acts the same as Tools->Mode->Line menu and displays the resulted values as a bar chart. The following figure is a sample screen shot of a line display of measurement results.

		
	3D View	This button acts the same as Tools->3D (Frequency, Time, Value) and displays the resulted values as a 3D chart. The following figure is a sample screen shot of a 3D display of measurement results. 
	2D (Freq., Value)	This button acts the same as Tools->2D (Frequency, Value) and displays the resulted values as a 2D chart. The following figure is a sample screen shot of a 2D display of measurement results, having Frequency as X-axis and Level as Y-axis.

		
	2D (Time, Value)	This button acts the same as Tools->2D (Time, Value) and displays the resulted values as a 2D chart. The following figure is a sample screen shot of a 2D display of measurement results, having Time as X-axis and Level as Y-axis. 
	Water fall	This button acts the same as Tools->2D (Water Fall) and displays the resulted values as a 2D chart having Frequency as X-axis and Time as Y-axis. The following figure is a sample screen shot of a 2D Water Fall display of measurement results.

		
	Grid	This button acts the same as Tools->Grid or Ctrl+G keyboard shortcut and displays a 10 by 10 grid over X-Y plane of the existing chart. The following figure is a sample screen shot of a 2D chart display of measurement results with the grid. 
	Data Export	This button acts the same as File->Export Data As… and exports the measurement data as a Comma Separated Values (CSV) file. The following figure is a sample screen shot of the export screen.

		
	Direction - Quality	This button is active only when a bearing measurement result is loaded. This result may contain different Level and Quality values for each direction, each frequency (if measured for a frequency range or list) and at different sampling times. In the screen it is possible to select between Level and Quality values, view each measured data alone or a group of measured data for each frequency. 

	Legend	This button acts the same as Ctrl+L keyboard shortcut or Tools->Legend menu item and displays the legend of colours used to depict values in the chart for measurement data. 
	Measurement Setting Information	This button acts the same as Ctrl+M keyboard shortcut or Tools->Measurement Setting Information menu item and displays the parameters of the order corresponding to the displayed result. 

As described in section 3.4.2.14.3.2, the result may contain the measurement results for up to four parameters. In this case it is possible to choose the desired parameter to show its measurement results. All possible submenu items of the Tools->Value menu is shown in the following table. Based on the type of measurement and availability of the results, only some of them might be active. Selection of statistical (e.g. Mean Value) values for some of the parameters might be possible only for Compressed Measurement Result (CMR) files which are described in section 3.4.2.14.3.2.

Measured Parameter	Value
Level	Value Mean Value Standard Deviation Maximum Value Minimum Value

Frequency Offset	Value Mean Value Standard Deviation Maximum Value Minimum Value
Modulation	Value Mean Value Standard Deviation Maximum Value Minimum Value
Band Width	Value Mean Value Standard Deviation Maximum Value Minimum Value
Bearing->Quality	Value Mean Value Standard Deviation Maximum Value Minimum Value
Bearing->Direction	Value Mean Value Standard Deviation Maximum Value Minimum Value
Sub Audio Tone	Value Mean Value Standard Deviation Maximum Value Minimum Value
Program	
PI Code	
Sound ID	
Occupancy	
Number	

Chapter 4. Administrative functions of SMS4DC

General

SMS4DC is powered by a database with a relational structure that starts from the license-ownership and proceeds to the detailed specification of radiocommunication stations in the Fixed, Land Mobile and Broadcasting (sound and TV) services and also for Earth stations in the space services. A tree-view representation method is used that provides the user with tools for the:

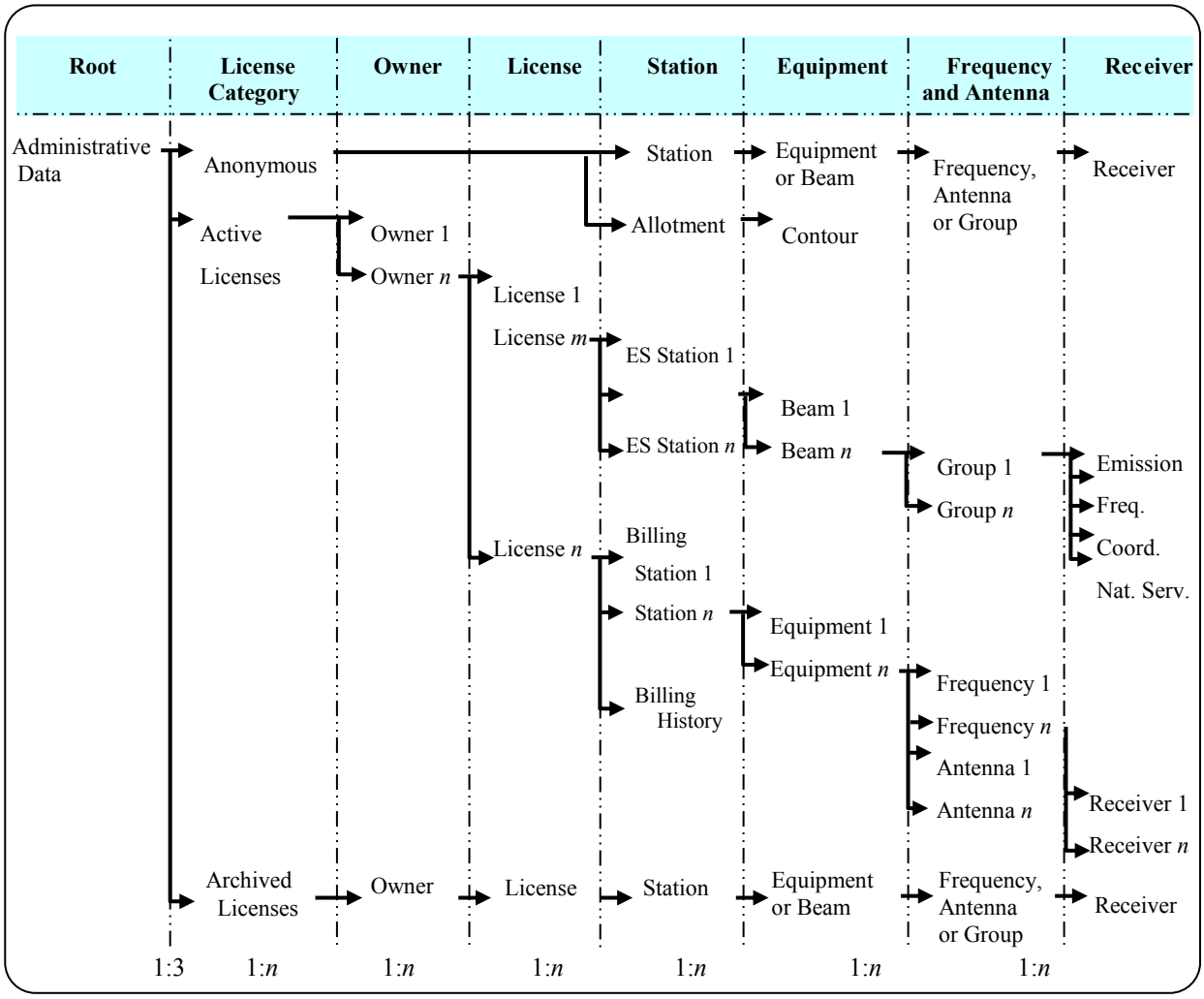
- Administration of licensees' information,
- Establishment, modification and expansion of radiocommunication networks,
- Issuing and modification of radio licenses,
- Invoicing of spectrum fees and recording the payment history of users,
- ITU BR procedures for notification of frequency assignments and allotments,
- Tracking of licensing work flow,
- Archiving of licenses, and,
- Navigation registered frequency assignments to radiocommunication stations and reporting

Modification and addition of any information in the licensing part is conditional on having a User ID and Password in the categories of "Supervisor", "Licensing" or "Data entry". A mouse click or arrow keys may be used for the selection of table fields. The Enter key must be pushed *before* accessing the edit mode of the parameter fields and, again, *after* the edit mode to save the data or the parameter selected. Modification or deleting of the information of a granted radio license is not permitted.

4.1. Hierarchical administrative levels

Choosing the "Licensing" item in the "Database" menu of the DEM View opens the "Administrative" window. The "Administrative" window consists of two Sections; a tree view of administrative data in the left panel and content of selected item in the right panel. Navigating through different levels of administrative data is similar to navigating through folders in "Windows Explorer" and the same navigational keys and shortcut keys have the same function: (i.e. arrow keys, PgUp, PgDn, Home, End, +, -, keypad * and letters). Figure 4.1 displays the levels of Administrative Data. Each level is explained briefly here and completely in later Sections:

Figure 4.1. Levels of Administrative Data



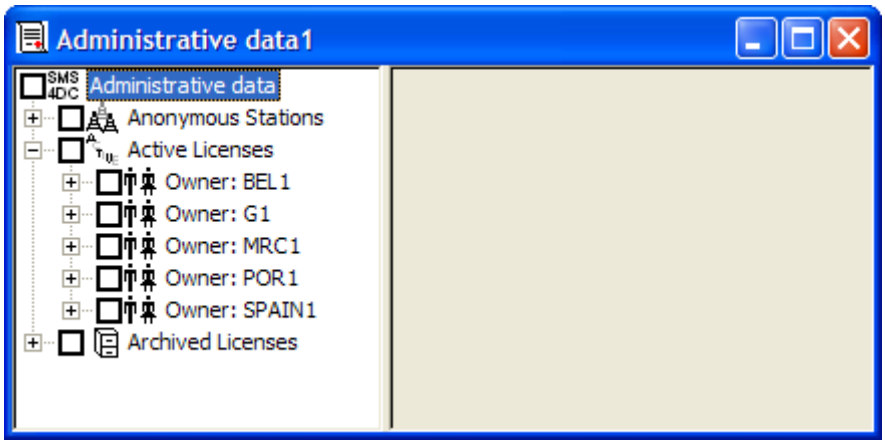
- Root: The expandable/collapsible highest level in the tree view of “Administrative Data”. By expanding root, three types of permanent folders “Anonymous Stations”, “Active Licenses” and “Archived Licenses” will be displayed as sub-levels.
- Anonymous Stations: A folder containing all anonymous stations which have been created previously outside the Administrative window of SMS4DC and can be moved to a License folder of an Owner in the folder of Active Licenses.
- Active Licenses: A folder holding all active and granted licenses. This folder contains all active Owners with their information in lower hierarchical levels. Creation of new administrative information is done inside this folder.
- Owner: A spectrum user who may have several radio Licenses. Each radio License, in turn, could embrace several Stations, where each Station, in lower hierarchical levels, could have several Equipments, Frequencies, Receivers or microwave Links.
- Archived Licenses: A folder which holds all cancelled granted licenses. The structure of information under this Archive is identical to the structure of valid information under the “Owner” folders (introduced in the previous item).
- License: The level immediately after Owner, containing general information about a radio license in a given radiocommunication service. Each radio license could hold several radio communication stations in a service type identical to the permitted type in radio license.
- ES Station: A radiocommunication transmitting or receiving Earth station at a predetermined location and an inherent radiocommunication service under a radio license, capable of containing several beams.
- Station: A radiocommunication transmitting or receiving station at a predetermined location and an inherent radiocommunication service under a radio license capable of containing several equipments.
- Billing History: The list of all invoices and payments for the corresponding license.
- Beam: A space radiocommunication uplink or downlink radiation beam of a given Earth station which could consist of a group of emissions.
- Equipment: Radiocommunication equipment installed in a station and capable of transmitting or receiving radiocommunication signals. Any equipment could use several frequencies and antennas.
- Group: A group of emissions, which have different frequencies and probably different classes of emission. Each group has been assigned to an uplink or downlink radiation beam.
- Frequency & Antenna: Frequency(s) and antenna(s) registered for the corresponding radiocommunication equipment.
- Receiver: Corresponding receiving information for a transmitting frequency in one of the Point, Polygon, Circle or Zone types.

Logically, at the time of SMS4DC installation, no predefined owners, license or stations exist.

4.2. The level of Administrative Data

As shown in Figure 4.2, by double clicking on the level of Administrative Data (root) in the tree view, three types of sub-folders “Anonymous Stations”, “Active Licenses” and “Archived Licenses” are displayed.

Figure 4.2. The highest level of tree view in Administrative window



4.2.1. Context menu in the level of Administrative Data

A right click on the level name opens a context menu containing the items below:

- New Owner: This item enables the user to enter the owners personal and contact information in the table of Owner Information. The Table of Owner Information is created in right panel and the tree view in the left panel will be grayed by choosing this item. Three push buttons “Modify”, “Cancel” and “Save” are available above the table. A mouse click or arrow keys can be used for the selection of table fields. Pushing the Enter key is necessary to enter the edit mode of each field. The Enter key must be pushed again to save the entered value in the field; otherwise the information entered in the fields will be lost. Mandatory fields in the table are distinguished by bold fieldnames and the New Owner information will be saved and inserted into the tree view if these bold fields have valid data entered and the “Save” button is pressed, otherwise a warning message requests the user to complete all mandatory fields. Figure 4.3 illustrates the entry table for Owner Information. Table 4.2 describes the fields of the Owner Information grid.
- New Allotment: This item enables user to enter digital broadcasting frequency allotment information. A Table of Allotment Information is created in the right panel and the tree view in the left panel will be grayed by choosing this item. Three push buttons “Modify”, “Cancel” and “Save” are available above the table. Figure 4.4 illustrates the entry table for the Allotment Information. Table 4.2 describes the fields of the Allotment Information grid.
- Delete Selection: In the tree view, there is a check box beside each tree item. These boxes allow the user to select those stations/allotments that are no longer needed and delete them in one operation. This feature is normally required after data import from BR-IFIC.
- Refresh: In some cases, the contents of the data tree may be changed when the tree view is open (e.g. in network operation of the system when the data is changed from another workstation, on the same workstation but from the technical part). In this case, this menu item is selected to have the latest changes applied.

Figure 4.3. Owner information entry table

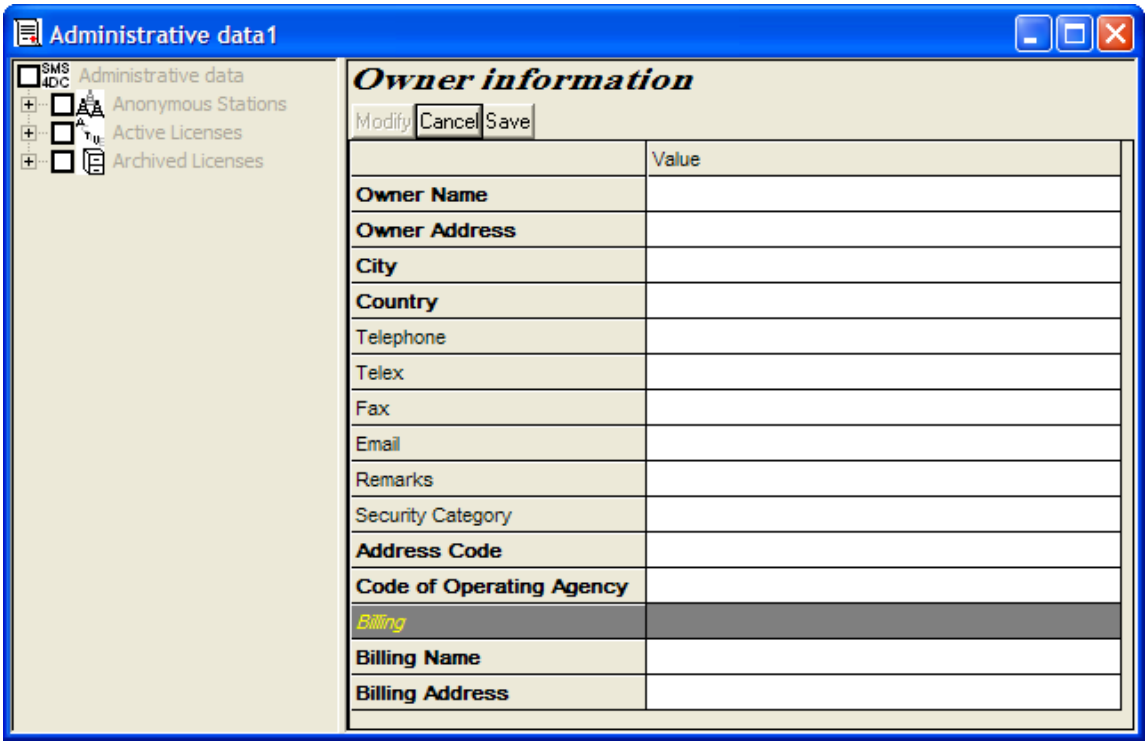
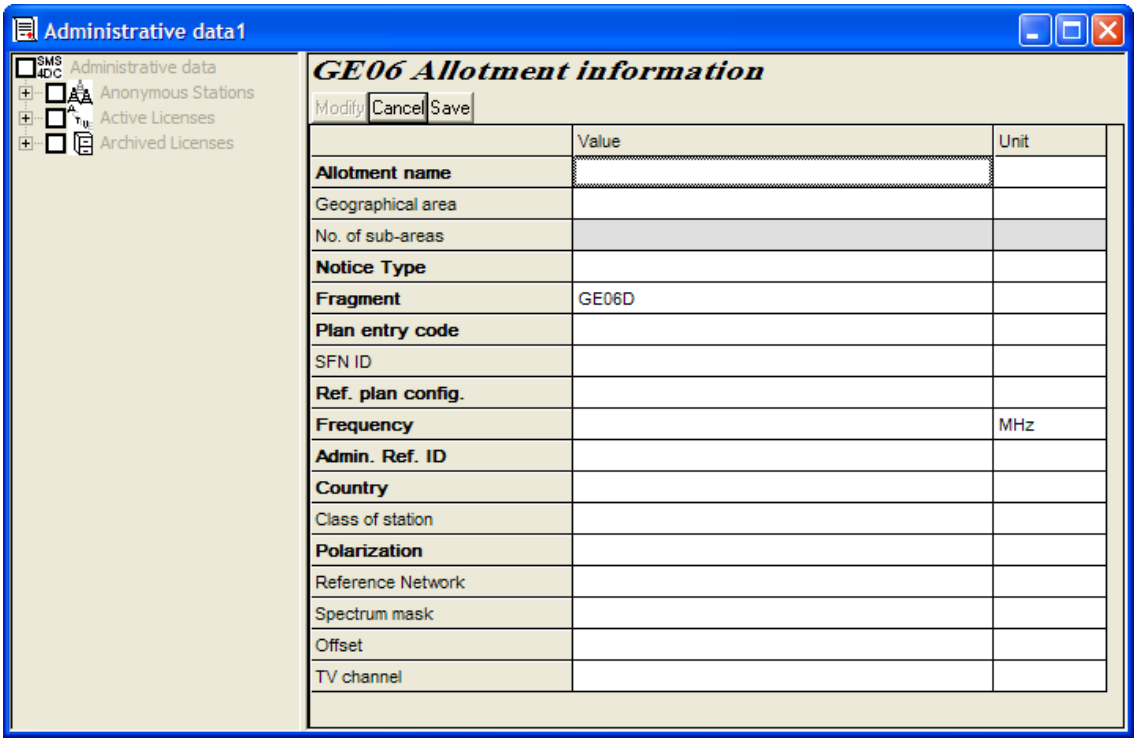


Figure 4.4. Allotment information entry table



SMS4DC leaves the session without further action by pushing “Cancel” button.

Table 4.1. Description of fields in the table of Owner Information [(1)]

Field name	Type	Description
Owner name	M	Name of spectrum user, unique. This name is displayed in front of the word Owner in tree view
Owner Address	M	Avenue, Street and No. of user address
City	M	City of owner
Country	M	Combo box to select the country of owner address
Telephone, Telex, Fax, Email	O	Quick contact information of owner
Remark	O	Any informative text for the administrator
Security category	O	A user defined security classification of owner information
Address code	M	A code allocated by the BR to uniquely identify a correspondence address of an Administration (field 12b in BR database).
Code of Operating Agency	M	The code used to identify an Operator. The Code is assigned to the Operator by the BR (field 12a in BR database).
Billing Name	M	The name which the owner prefers to be used for billing purpose.
Billing Address	M	The address where the billing letters have to be sent by Administration.

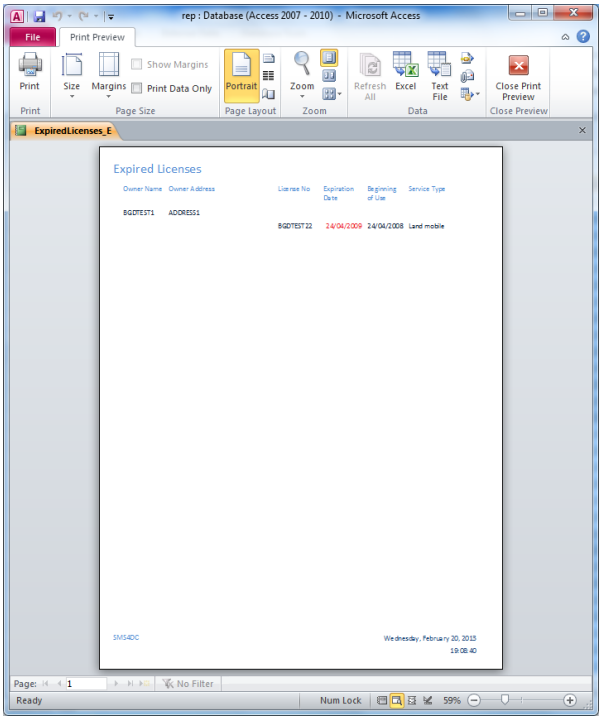
[(1)] : M: Mandatory, O: Optional

Table 4.2. Description of fields in the table of Allotment Information [(1)]

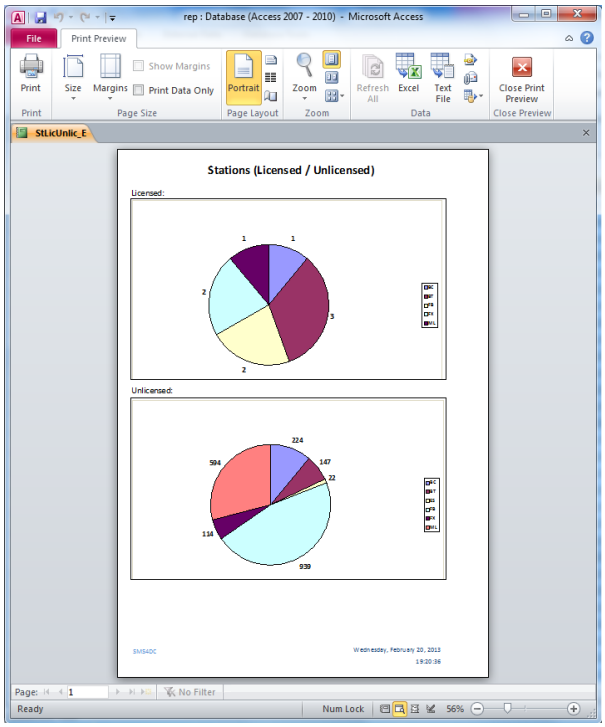
Field name	Type	Description
Allotment name	M	Name of Allotment, which should be unique. This name is displayed in front of the word Allotment in tree view
Geographical area	O	Geographical area code
No. of sub-areas	O	Number of sub-areas (contours) of this allotment (read only)
Notice Type	M	Notice type (GS2 or GT2)
Fragment	M	Fragment (GE06D)
Plan entry code	M	Plan Entry Code (1, 2, 3, 4 or 5)
SFN ID	O	Single Frequency Network ID
Ref. Plan Config.	M	Reference Plan Configuration (1, 2, 3, 4 or 5)
Frequency	M	Frequency (MHz)
Admin. Ref. ID	M	Administration Reference ID
Country	M	Country Code.
Class of station	O	Class of station (BC or BT)
Polarization	M	Polarization type (H, V, M or U)
Reference Network	O	Reference Network (1, 2, 3 or 4)
Spectrum mask	O	1, 2, 3, N or S
Offset	O	
TV channel	O	

[(1)] : M: Mandatory, O: Optional

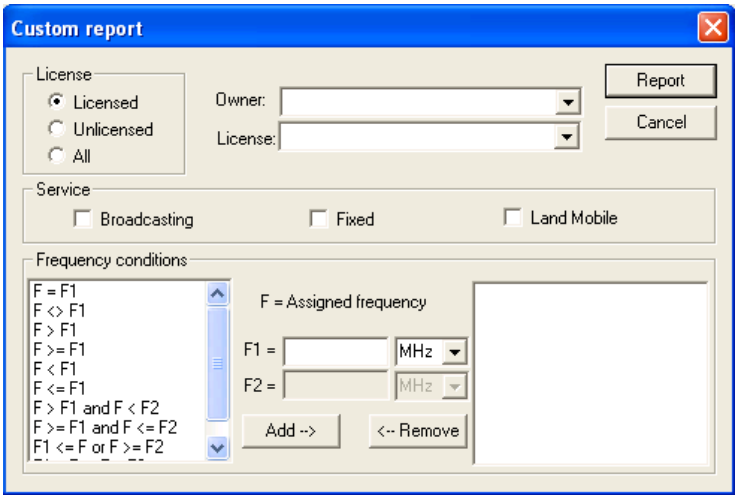
- Reports->Expired Licenses: This menu item displays a report listing the expired licenses.

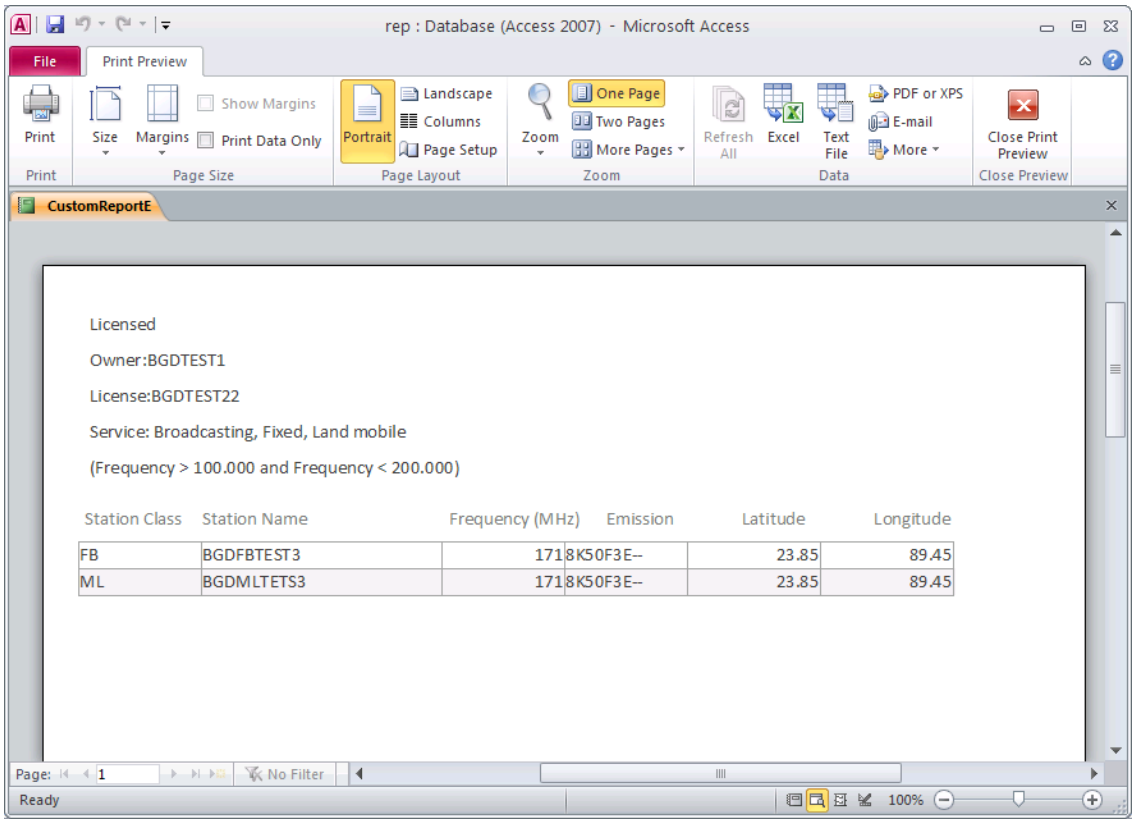


- Reports->Total Stations: This menu item displays two graphs concerning licensed and unlicensed stations grouped by their class of station.



- Reports->Custom Report: This menu item displays a dialog box in which some criteria can be defined. Based on these defined criteria a report in MS Access format created and shown.





4.3. The level of Owner

The Level of Owner is placed under either the Administrative Data or Archive levels. Selection of an existing Owner in the tree view by a mouse click or other action, displays a table of corresponding Owner Information in the right panel of the Administrative window. The content of the Information table can be modified, saved or any action cancelled using the "Modify", "Save" or "Cancel" push buttons above the table. For a "Modify" action, the tree view in the left panel of the Administrative window will be locked (grayed). For a successful "Save" action, mandatory fields (field name in bold) must not be left blank. The content of Owner Information table is described in Table 4.3. Each Owner has a unique name and could have unlimited number of radio licenses.

4.3.1. Context menu in the level of Owner

A right click on the level name opens a context menu containing the items "Modify Owner", "Delete Owner" and "New License". These items are explained below:

- Modify Owner: This item modifies the content of the Owner Information table if it has no license granted. In this case, the tree view in the left panel of Administrative window will be locked and to save any modifications successfully, mandatory fields (bold field names) in the information table must not be left blank. Content of Owner Information table is described in Table 4.3.
- Delete Owner: This item deletes the Owner information and all other attached information in the lower levels of tree view if has no license granted. The owners who have been granted licenses cannot be deleted.
- New License: This item creates a new license platform and attaches it to the corresponding owner. Choosing this item creates the table of license information in the right panel of the Administrative window and locks the tree view. Three push buttons "Modify", "Cancel" and "Save" are available above the table. At the time of creation of a license, the "Modify" push button is disabled. To save a new license successfully, mandatory fields (field names in bold), must not be left blank. The saved License, with its license number, is inserted under the corresponding license in the tree view. Figure 4.5 illustrates the entry table for License Information. Table 4.3 describes the fields in License Information entry table.

Figure 4.5. License information entry table

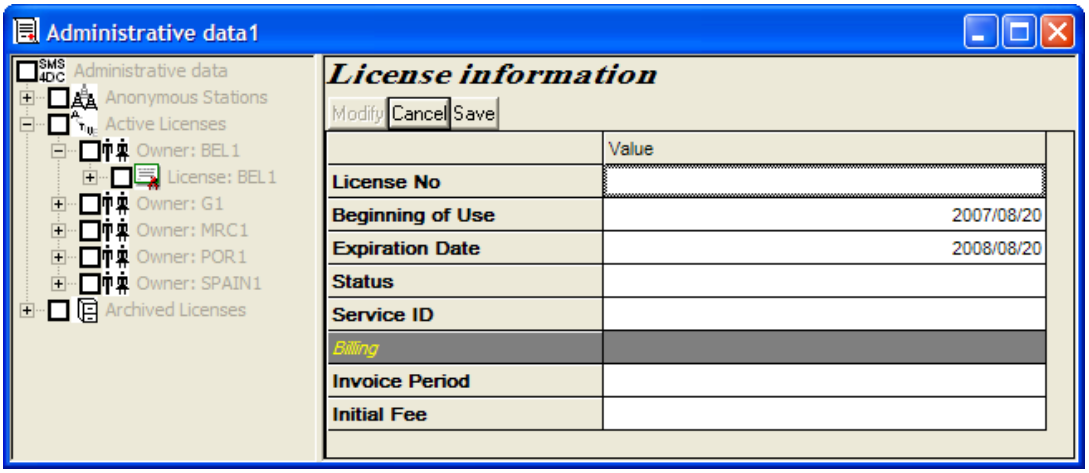


Table 4.3. Description of fields in the entry table of License Information [(1)]

Field name	Type	Description
License No	M	Number of license, unique among licenses of an Owner.
Beginning of Use	M	License beginning date which is license creation date by default. A date picker is attached to this field to enable the user to select another date.
Expiration Date	M	License expiration date, which is, by default, one year after the license creation date. A date picker is attached to this field to enable the user to select another date.
Status	M	A combo box to select one of following status values: • Data entry. The default status of license. • Data entry complete. Manually selectable status if all data entered • Technical investigation. Manually selectable status when a license is at the technical investigation level. • Assignment complete. Manually selectable status when relevant frequencies are assigned • Coordination complete. Manually selectable status when the coordination is completed • Technically OK. Manually selectable status when the technical investigation is completed • First invoice unpaid. This status will be selected by SMS4DC automatically after the first invoice is issued. • Financially OK. Manually selectable status if the owner has no debit in its billing history. Otherwise it will stay in the "First invoice unpaid" status. • Granted. Manually selectable status on condition of being in the status "Financially OK" • Rejected. Manually selectable status which means rejection of a license.
Service ID	M	One of the codes describing type of terrestrial or space services. For the terrestrial stations the codes F, B or MT are used for Fixed, Broadcasting (sound and TV) and Land Mobile services respectively. For the Earth stations, thirteen different codes used, starting with the letter "S". The relevant table is available in Annex 1. This code must be selected at the time of license creation and cannot be modified if any station attached to the license, even if no license is granted.
Invoice Period	M	Period of invoice generation. One of the selections "Monthly", "Bi-monthly", "Quarterly" and "Annually". When the selected period has ended, an invoice will be added to the Billing History of relevant granted License.
Initial Fee	M	The initial fee to be paid for obtaining a radio license.

(1) : M: Mandatory, O: Optional

4.4. The level of License

The level of license comes between the owner level and the station level. Each license may consist of several stations in same radiocommunication service. The station service type has to be determined at the license level. Selection of a license in tree view by a mouse click or other action, displays an entry table of corresponding License Information in the right panel of the Administrative window. The content of the License Information entry table can be modified, saved or cancelled using the "Modify" and "Save" or "Cancel" buttons above the table. A "Modify" action locks the tree view in the left panel of the Administrative window. For a

successful “Modify” action, mandatory fields (bold field names) must not be left blank. Modification of service type is not permitted if there are stations attached to the license. Content of License Information entry table is described in Table 4.3. Each License under the specific Owner has a unique name and could have an unlimited number of stations. Moreover, the billing history of each license is connected permanently to the level of the corresponding License.

4.4.1. Context menu in the level of License

A right click on the level name opens a context menu that always contains the following items: “Modify”, “Delete”, “Copy to Archive”, “Cancel License”, “Move Anonymous Station”, “Print License” and “Print Summary”. Other items may appear which are dependent on the type of the selected radiocommunication service. The permanent and type-dependent items are described below:

- Modify: This item modifies the content of the License Information table if has not been granted already. The service ID in the entry table of License Information is locked if any station is attached to the license. At the time of modification, the tree view in the left panel of the Administrative window will be locked and for modifications to be saved successfully, mandatory fields (field names in bold) in the information entry table must not be left blank. The content of License Information entry table is described in Table 4.3.
- Delete: This item deletes the License information and all other attached information in the lower levels of tree view, if has not been granted already. Granted licenses cannot be deleted.
- Copy to Archive: This item saves a duplicate copy of the selected License in the archive. After performing this item, the tree view will be refreshed and archive level will show the new license inserted into the tree view under the corresponding Owner level. This item not only duplicates the selected license but also regenerates all attached information in the lower levels, except attached receivers. The content of License Information entry table is described in Table 4.3.
- Cancel License: This item cancels a granted license from the Owner information. The cancelled License Information, together with all corresponding information in the higher and lower levels, will be moved to the “Archived Stations”.
- Add Fixed Station: This item adds a station in the Fixed radiocommunication service to the selected License. This item is included in context menu if the parent license was created in the Fixed service (F for service ID). Selecting this item opens a blank “Fixed/Base Station Information” entry table in the right panel of the Administrative window and locks the tree view. Three push buttons “Modify”, “Cancel” and “Save” are available above the table. To save successfully, mandatory fields (field names in bold) must not be left blank. The saved station, with its name, is inserted under the corresponding license in tree view. Figure 4.6 displays this entry table and its content is described in Table 4.4.

Figure 4.6. Fixed/Base Station Information entry table

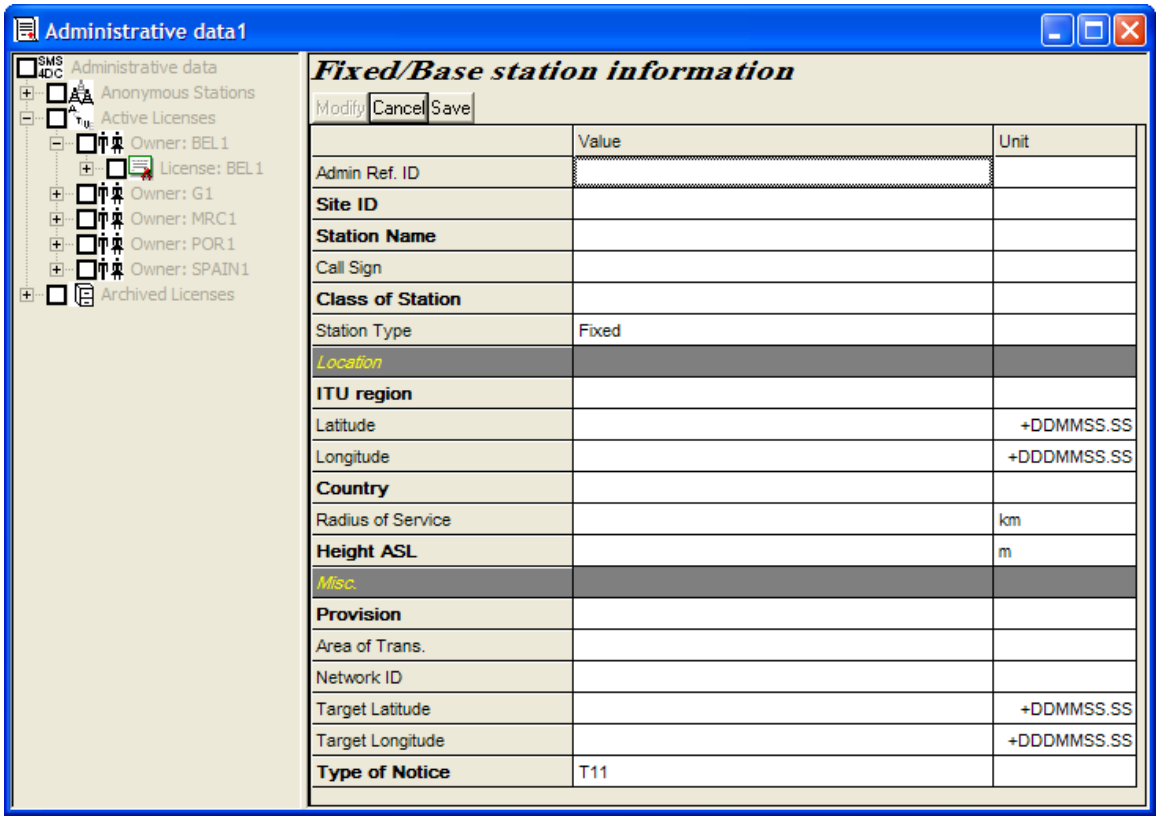


Table 4.4. Description of fields in the entry table of Fixed/Base Station Information (1)

Field name	Type	Description
Admin Ref. ID	O	A unique identification number assigned by Administration and is used in BR Notices.
Site ID	M	An alphanumeric unique ID, specific for station identification in corresponding license.
Station Name	M	Name of station
Call Sign	O	Assigned call sign, in accordance with the RR Article 19 (BR Notice item 3a)
Class of Station	M	A combo box for determination of class of station, as classified in Preface to BR IFIC. For Fixed stations, only FX is available.
Station Type	O	A combo box to select either Fixed, Base, Mounted or Handheld. In the example, this field entry is Fixed.
ITU Region	M	A combo box to select the ITU Region where station is located.
Latitude	M	Latitude of station in the format ±DDMMSS.SS, in the range -90 to +90. Optional for Typical stations.
Longitude	M	Longitude of station in the format ±DDDMMSS.SS, in the range -180 to +180. Optional for Typical stations.
Country	M	A combo box to select the country code.
Radius of Service	O	The maximum range of radio communication.
Height ASL	M	Station height above sea level, (measured at the base of the antenna).

Provision	M	Related provision in ITU RR under which the notification should be made.
Area of Trans.	O	Area wherein transmission is going to be made (Preface to BR IFIC, Chapter IV)
Network ID	O	A common ID for all stations in same network under the parent license.
Target Latitude	O	Target Latitude when notifying a Modification of the placement of the station
Target Longitude	O	Target Longitude when notifying a Modification of the placement of the station
Type of Notice	M	T11, T14, G11 or G14 for FX station and T12, T14, G12 or G14 for FB station

(1) : M: Mandatory, O: Optional

- Add Base Station: This item adds a base station in Land Mobile radiocommunication service to the selected License. This item is included in context menu if the parent license was created in the Land Mobile service (MT for service ID). Selecting this item opens a blank "Fixed/Base Station Information" entry table in the right panel of the Administrative window and locks the tree view. Three push buttons "Modify", "Cancel" and "Save" are available above the table. At the time of creation of a Base station, the "Modify" push button is disabled. For a successful save, mandatory fields (bold field names) must not be left blank. The saved station, with its name, is inserted under the corresponding license in tree view. Figure 4.6 displays this entry table and its content is described in Table 4.4.
- Add Mobile Station: This item adds a mobile station in the Land Mobile radiocommunication service to the selected License. This item is included in the context menu if the parent license was created in the Land Mobile service (MT for service ID). Selecting this item opens a blank "Mobile Station Information" entry table in the right panel of the Administrative window and locks the tree view. Three push buttons "Modify", "Cancel" and "Save" are available above the entry table. At the time of creation of a mobile station, the "Modify" push button is disabled. For a successful save, mandatory fields (field names in bold) must not be left blank. The saved mobile station, with its name, is inserted under the corresponding license in tree view. Figure 4.7 displays this entry table and its content is described in Table 4.5.

Figure 4.7. Mobile Station Information entry table

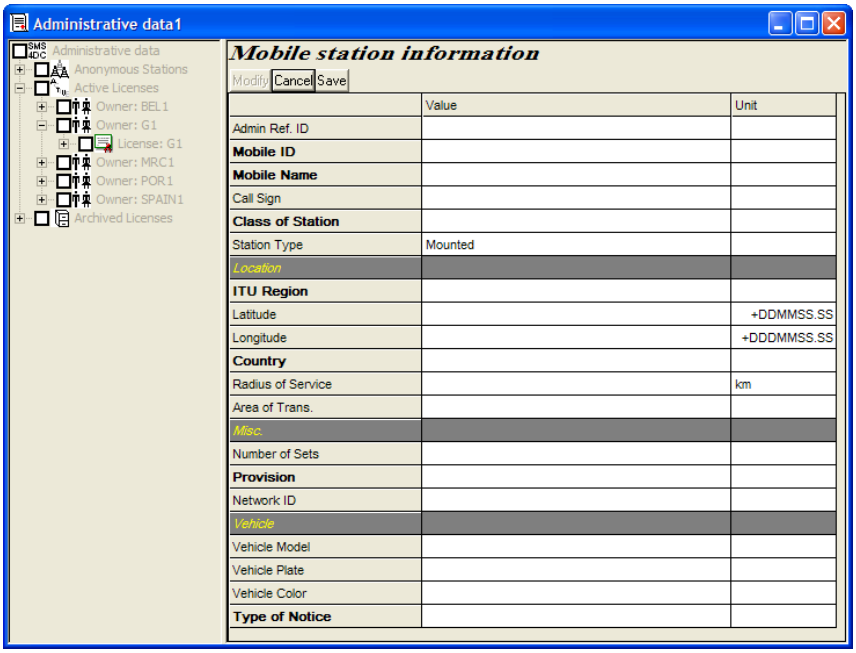


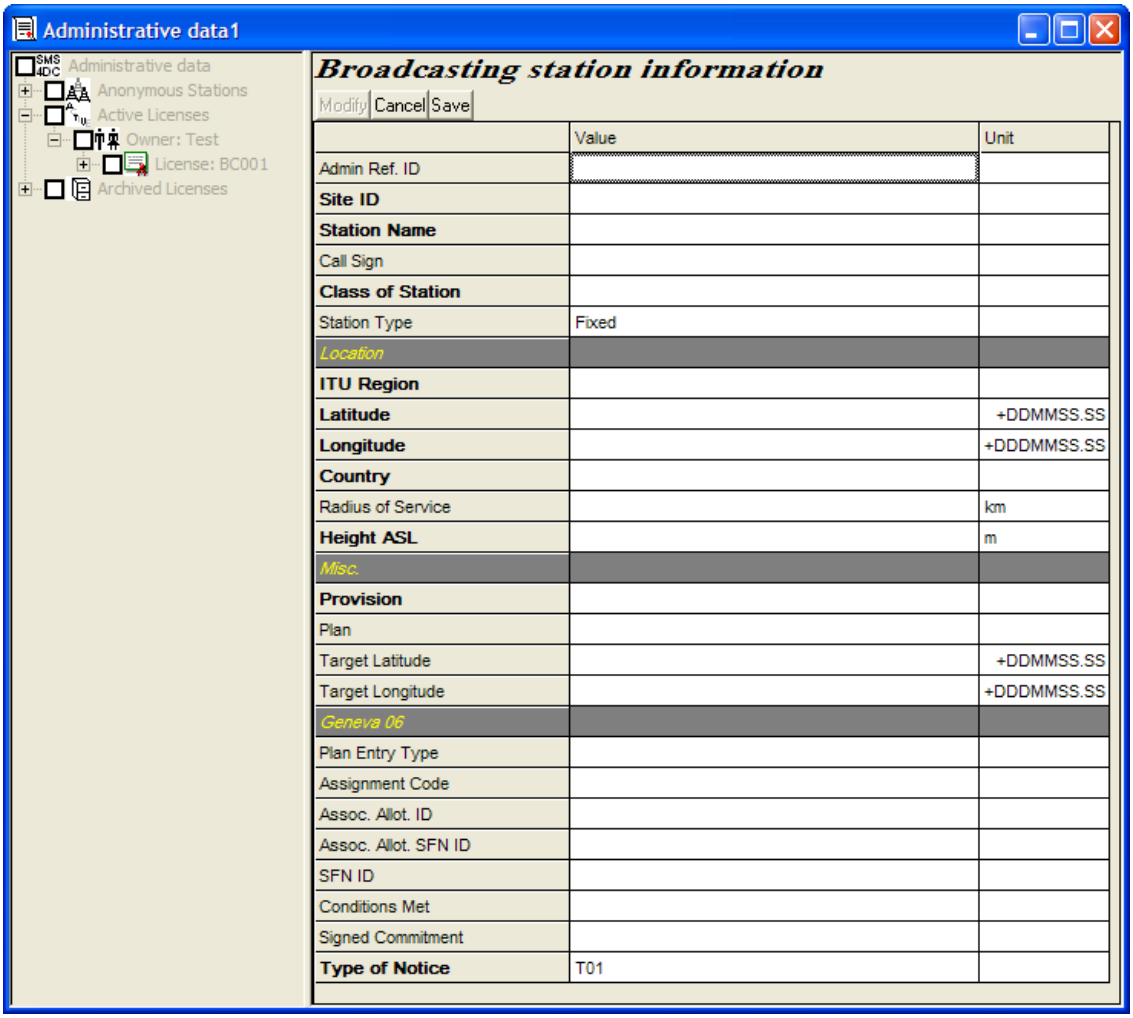
Table 4.5. Description of fields in the entry table of Mobile Station Information [(1)]

Field name	Type	Description
Admin Ref. ID	O	A unique identification number assigned by Administration and is used in BR Notices.
Mobile ID	M	An alphanumeric unique ID, specific for station identification in corresponding license.
Mobile Name	M	Name of mobile station
Call Sign	O	Assigned call sign, in accordance with the RR Article 19 (BR Notice item 3a)
Class of Station	M	A combo box for determination of class of station, as classified in Preface to BR IFIC. For a mobile station, only ML is available.
Station Type	O	A combo box to select either Mounted or Handheld.
ITU Region	M	A combo box to select the ITU Region where the station is located.
Latitude	M	Latitude of corresponding base station in the format ±DDMMSS.SS, in the range -90 to +90. Optional for Typical station.
Longitude	M	Longitude of corresponding base station in the format ±DDDMMSS.SS, in the range -180 to +180. Optional for Typical station.
Country	M	A combo box to select the country code.
Radius of Service	O	The maximum range of radio communication.
Area of Trans.	O	Area wherein transmission is going to be made (Preface to BR IFIC, Chapter IV)
Number of Sets	O	Number of mobile sets
Provision	M	Related provision in ITU RR under which the notification should be made.
Network ID	O	A common ID for all stations in same network under the parent license.
Vehicle Model	O	Model of vehicle
Vehicle Plate	O	Plate number of vehicle
Vehicle Colour	O	Colour of vehicle
Type of Notice	M	T13 or G13

[(1)] : M: Mandatory, O: Optional

- Add Broadcasting Station: This item adds a sound or TV broadcasting station in Broadcasting radiocommunication service to the selected License. This item is included in the context menu if the parent license was created in the broadcasting service (B for service ID). Selecting this item opens a blank "Broadcasting Station Information" entry table in right panel of Administrative window and locks the tree view. Three push buttons "Modify", "Cancel" and "Save" are available above the table. At the time of creation of a broadcasting station, the "Modify" push button is disabled. For a successful save, mandatory fields (bold field names) must not be left blank. The saved broadcasting station, with its name, is inserted under the corresponding license in tree view. Figure 4.8 displays this entry table and its contents are described in Table 4.6.

Figure 4.8. Broadcasting Station Information entry table



	Value	Unit
Admin Ref. ID		
Site ID		
Station Name		
Call Sign		
Class of Station		
Station Type	Fixed	
Location		
ITU Region		
Latitude		+DDMMSS.SS
Longitude		+DDDMMSS.SS
Country		
Radius of Service		km
Height ASL		m
Misc.		
Provision		
Plan		
Target Latitude		+DDMMSS.SS
Target Longitude		+DDDMMSS.SS
Geneva 06		
Plan Entry Type		
Assignment Code		
Assoc. Allot. ID		
Assoc. Allot. SFN ID		
SFN ID		
Conditions Met		
Signed Commitment		
Type of Notice	T01	

Table 4.6. Description of fields in the entry table of Broadcasting Station Information [(1)]

Field name	Type	Description
Admin Ref. ID	O	A unique identification number assigned by the Administration and is used in BR Notices.
Site ID	M	An alphanumeric unique ID, specific for station identification in corresponding license.
Station Name	M	Name of broadcast station
Call Sign	O	Assigned call sign, in accordance with the RR Article 19 (BR Notice item 3a)
Class of Station	M	A combo box for determination of class of station, as classified in Preface to BR IFIC. For broadcasting, only, BC and BT are available.
Station Type	O	"Fixed"
ITU Region	M	A combo box to select the ITU Region where station is located.
Latitude	M	Latitude of station in the format ±DDMMSS.SS, in the range -90 to +90
Longitude	M	Longitude of station in the format ±DDDMMSS.SS, in the range -180 to +180
Country	M	A combo box to select the country code.
Radius of Service	O	The maximum range of radio communication.
Height ASL	M	Station height above sea level (measured at the base of the antenna).
Provision	M	Related provision in ITU RR under which the notification should be made.
Plan	O	A combo box to select one of GE84, GE89, GE06 or ST61 reference plan in which frequency assignment is to be made.
Target Latitude	O	Target Latitude when notifying a Modification of the placement of the station
Target Longitude	O	Target Longitude when notifying a Modification of the placement of the station
Plan Entry Code	O	
Assignment Code	O	
Assoc. Allot. ID	O	Associated Allotment ID
Assoc Allot SFN ID	O	Associated Allotment SFN ID
SFN ID	O	Single Frequency Network ID
Conditions Met	O	Are conditions met?
Signed Commitment	O	Has signed commitment?
Type of Notice	M	T01, T02, GS1, GT1, G02 and GB1

[(1)] : M: Mandatory, O: Optional

- Add Earth Station: This item adds an Earth station in a space radiocommunication service to the selected License. This item is included in context menu if the parent license was created in the space services (with service IDs started with the letter “S” such as SA, SB, SF, etc). Selecting this item opens a blank “Earth Station Information” entry table in the right panel of the Administrative window and locks the tree view. Three push buttons “Modify”, “Cancel” and “Save” are available above the table. At the time of creation of an Earth station, the “Modify” push button is disabled. For a successful save, mandatory fields (field names in bold) must not be left blank. The saved station with its name, is

inserted under the corresponding license in the tree view. Figure 4.9 displays this entry table and its content is described in Table 4.7.

Figure 4.9. Earth Station Information entry table

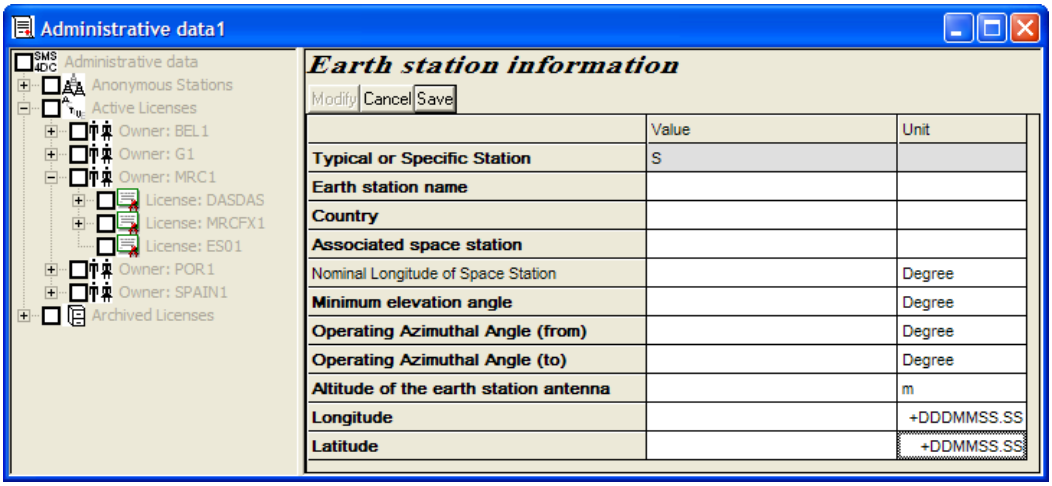


Table 4.7. Description of fields in the entry table of Earth Station Information [(1)]

Field name	Type	Description
Typical or Specific Station	M	A code specifying the type of Earth station, “S” for specific or “T” for Typical
Earth Station Name	M	Name of Earth station operating with geo-stationary satellites
Country	M	A code specifying administration code
Associated space station	M	The name of the geo-stationary space station communicating with Earth station
Nominal longitude of space station	O	Orbital position of associated geo-stationary space station in degrees
Minimum elevation angle	M	The minimum elevation angle of Earth station, in degrees, to reach space and overcome surrounding terrain
Operating Azimuthal Angle (from)	M	Starting azimuthal angle of earth station antenna beam in degrees
Operating Azimuthal Angle (to)	M	The highest azimuthal angle of earth station antenna beam in degrees. This value will be identical with the value of “Operating Azimuthal Angle (from)”, in case fixed beam.
Altitude of the earth station antenna	M	The height of Earth station antenna centre with respect to the ground level in metres
Latitude	M	Latitude of station in the format ±DDMMSS.SS, in the range -90 to +90
Longitude	M	Longitude of station in the format ±DDDMMSS.SS, in the range -180 to +180

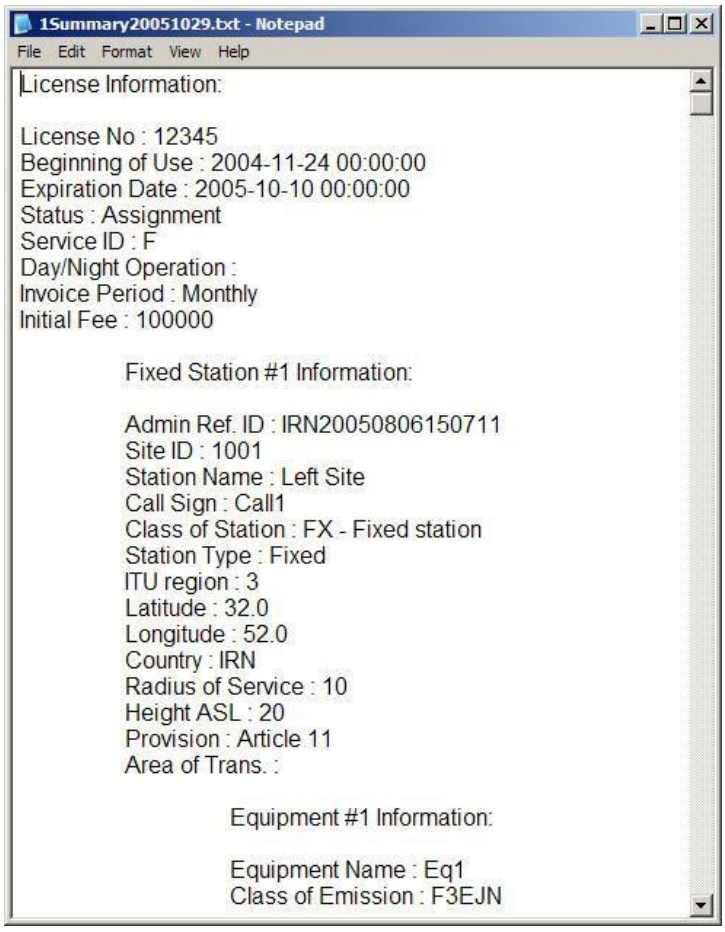
[(1)] : M: Mandatory, O: Optional

- Add Allotment: This item adds a GE06 allotment in the broadcasting service to the selected License. This item is included in the context menu if the parent license was created in the broadcasting service (with service ID equal to “B”). Selecting this item opens a blank “GE06 Allotment Information” entry table in the right panel of the Administrative window and locks the tree view. Three push buttons “Modify”, “Cancel” and “Save” are available above the table. At the time of creation of an Allotment, the “Modify” push button is disabled. For a successful save, mandatory fields (field names in bold) must not be left blank. The saved allotment, with its name, is inserted under the corresponding license in tree view. Figure 4.9 displays this entry table and its contents are described in Table 4.2.
- Move Anonymous Station: This item moves a station from the folder of “Anonymous Stations” to the active license. By choosing this item, all stations inside the folder “Anonymous Stations”, with consistent service type of license, are tabulated in a spreadsheet for user selection. A mouse left click can be used for the selection of stations from the spreadsheet. The service type of the listed anonymous stations is determined in the service ID of the parent license information table. Pushing OK button under the spreadsheet inserts a selected station under the corresponding license in tree view.
- Move Anonymous Allotment: This item moves an allotment from the folder of “Anonymous Stations” to the active license. By choosing this item, all allotments inside the folder “Anonymous Stations", are tabulated in a spreadsheet for user selection. A mouse left click can be used for the selection of allotments from the spreadsheet. Pushing

the OK button under the spreadsheet inserts a selected allotment under the corresponding license in tree view.

- Print License: This item generates and displays a printable radio license in HTML format, using a customizable template. SMS4DC asks the user to specify the folder where the generated HTML file, with the name "LIC*license_no*.HTM", is to be saved. The appearance and content of the printable file can be easily customized by modifying the relevant template file with a suitable editor, i.e. "Front Page". Template files are stored in the folder "Reports".
- Print Summary: This item generates and displays an indented text file containing all the information under the corresponding license. SMS4DC asks user for the folder where the generated text file, with the name "*license_no*SUMMARY.TXT", is to be saved. Then the text file will be opened by Notepad. Figure 4.10 displays a license summary file.

Figure 4.10. A license summary file



4.5. The level of Earth Station

The level of Earth station is placed between the license level and the beam level. Each Earth station may consist of several beams in the same space radiocommunication service. The content of the Beam Information table depends on the type of beam. Selection of an Earth station in tree view by a mouse click or other action, displays a table of corresponding Earth Station Information in the right panel of Administrative window (see Figure 4.9). The content of

Information table can be modified, saved or any action cancelled using “Modify” and “Save” or “Cancel” push buttons above the table, if relevant license has not been granted. In case of modification, the tree view in the left panel of the Administrative window will be locked and, to save modifications successfully, mandatory fields (field names in bold) must not be left blank. The content of the Earth Station Information table is described in Table 4.7. Each Earth Station under a specific License has a unique name and could have an unlimited number of beams.

4.5.1. Context menu in the level of Earth Station

A right click on the level name opens a context menu containing “Modify”, “Delete”, “Add Beam (Up)”, “Add Beam (Down)”, “Horizontal Elev. Angles”, “Minimum Elev. Angles” and “Notice” items. These items are described below:

- Modify: This item modifies the content of the Earth Station Information table. At the time of modification, the tree view in the left panel of the Administrative window will be locked and, to save a modification successfully, mandatory fields (field names in bold) in the information entry table must not be left blank. The content of the Earth Station Information table is described in Table 4.7.
- Delete: This item deletes the Earth Station and all other attached information in the lower levels of tree view if it has not been included in any granted license.
- Add Beam (up): This item defines an uplink beam and chooses or creates its pattern from the antenna beam library for the current Earth station. Selecting this item creates a blank “Earth station antenna information” entry table in the right panel of the Administrative window and locks the tree view. Five push buttons “Modify”, “Cancel”, “Save”, “Library” and “Patt. Values” are available above the table. At the time of creation of a beam, the “Modify” push button is disabled. For a successful save, mandatory fields (field names in bold) must not be left blank. The saved station, with its name, is inserted under the corresponding Earth station in tree view. Figure 4.11 displays this entry table and its content is described in Table 4.8.
- The push buttons “Library” and “Patt. Values” are designed to enter the characteristics of Earth station antenna. The user is able to choose a ready-to-use antenna from the library (Figure 4.12) or to define an antenna pattern directly by entering its gain values at different offset angles (Figure 4.13).

Figure 4.11. Earth Station Antenna Information entry table

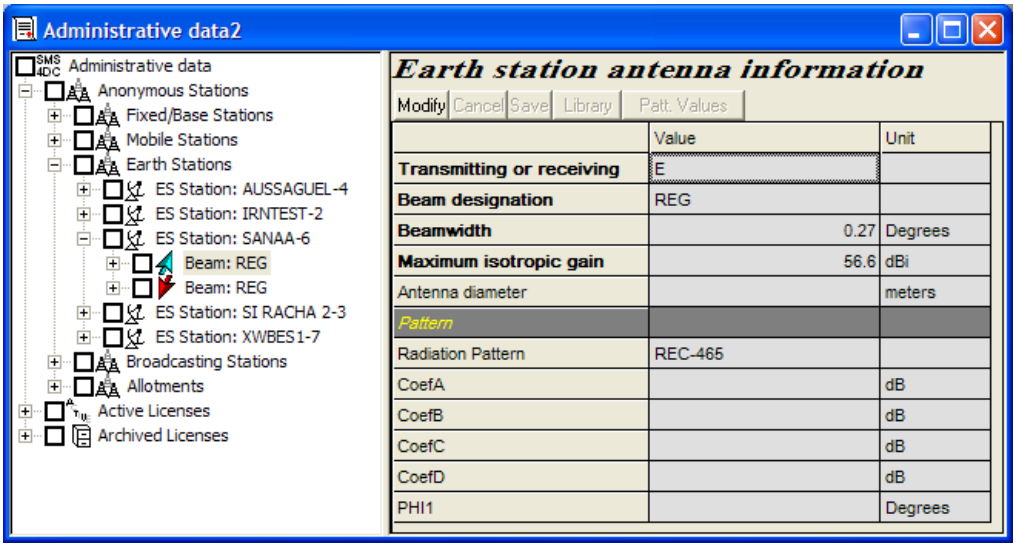


Table 4.8. Description of fields in the entry table of Earth Station Antenna Information [(1)]

Field name	Type	Description
Transmitting or receiving	M	A letter specifying type of beam, "E" for uplink and "R" for downlink. SMS4DC sets this flag automatically, depending on the chosen item of context menu it cannot be modified directly. Read-only.
Beam designation	M	A textual information for designation of beam
Beamwidth	M	Beamwidth of Earth station antenna beam in degrees
Maximum isotropic gain	M	The maximum isotropic gain of Earth station antenna along the beam in dBi
Antenna diameter	O	Diameter of parabolic antenna in metres, if specified
Reference pattern	O	Textual information about the reference antenna pattern used. This information will be imported from the earth station antenna library and cannot be modified directly from here.
CoefA to CoefD	O	Numerical coefficients of antenna pattern in dB. This information will be imported from the earth station antenna library and cannot be modified directly from here.
PHI1	O	A numerical coefficient of antenna pattern in degree. This information will be imported from the earth station antenna library and cannot be modified directly from here.

[(1)] : M: Mandatory, O: Optional

By using the "Library" push button, a library of Earth station antenna patterns is opened and the user may select an existing antenna or define a new pattern, using the push button "New Pattern". A new antenna pattern will be characterized by a set of new coefficients and, after definition, will be added to the library for selection. Figure 4.12 and Figure 4.13 show the library of Earth station antennas and the entry mask for coefficients for new antenna patterns.

Figure 4.12. Library of antenna patterns of earth station

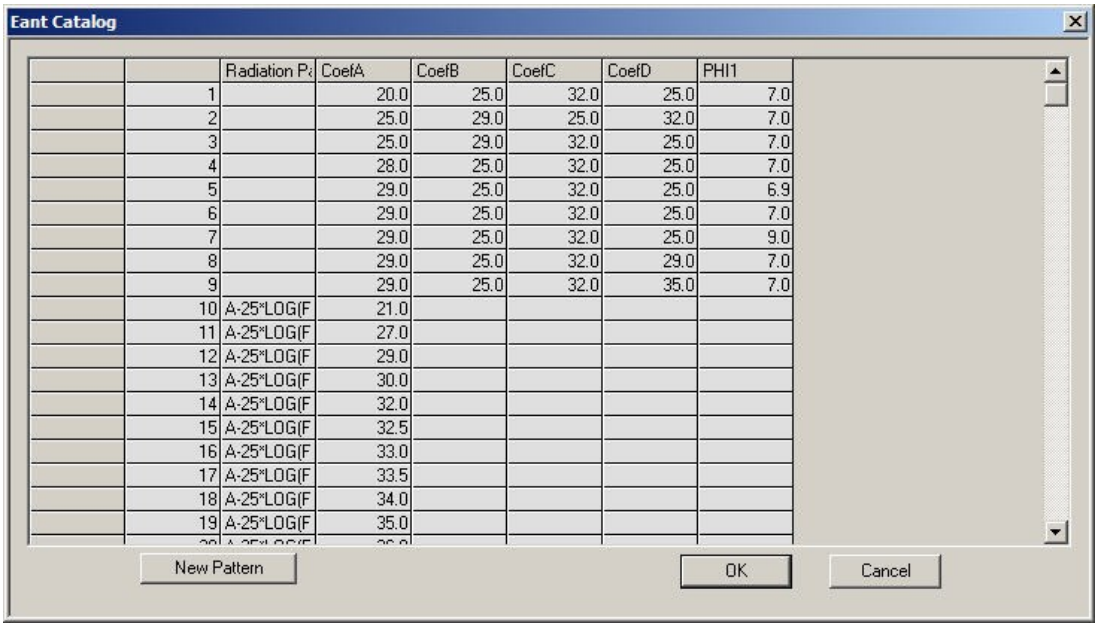
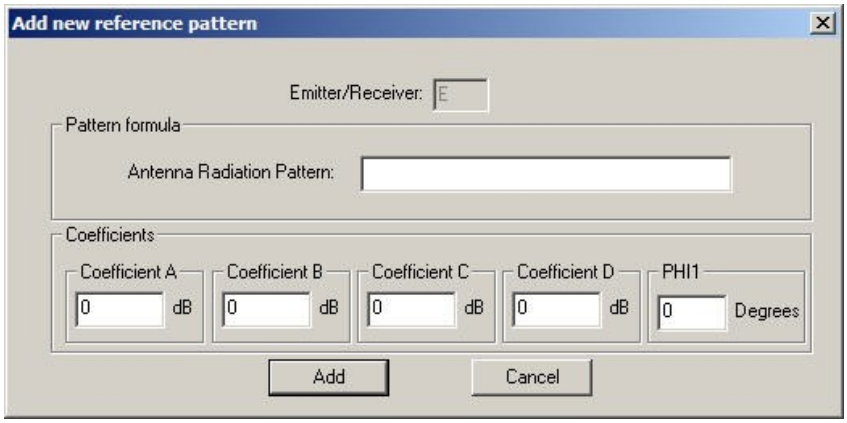
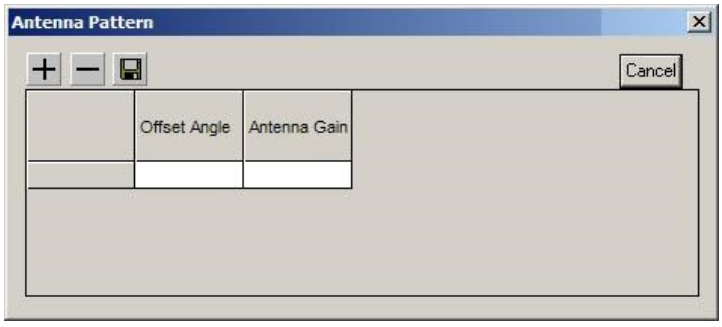


Figure 4.13. Entry mask of coefficients for a new antenna pattern



In case of having no reference coefficients for earth station antenna pattern, the antenna gain values for different offset angles with respect to the antenna main beam direction may be entered directly into the SMS4DC database. Figure 4.14 displays the Earth station antenna pattern definition entry table which will opened if the “Patt. Values” button is pressed.

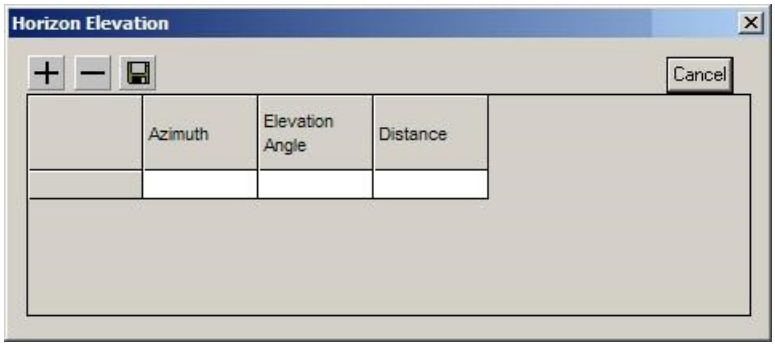
Figure 4.14. The earth station antenna pattern definition entry table



Four push buttons are provided at the top of the "Antenna Pattern" table: for addition of new record, for deleting the existing record, to save the table and to exit from mask, respectively. Blank rows are deemed as zero.

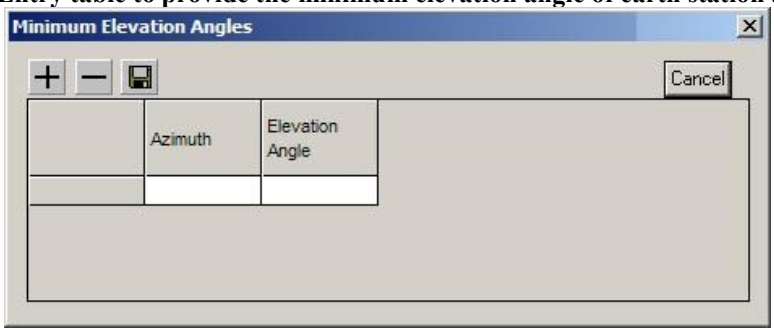
- Horizon Elevation: This item enters the azimuth and elevation angle to the horizon and its distance to the earth station around the earth station in different azimuths. As displayed in Figure 4.15, choosing this item opens an entry table consisting of three columns: "Azimuth", "Elevation Angle" and "Distance" (in km) to save this information.

Figure 4.15. Entry table to provide an earth station the horizon elevation angles in different azimuths



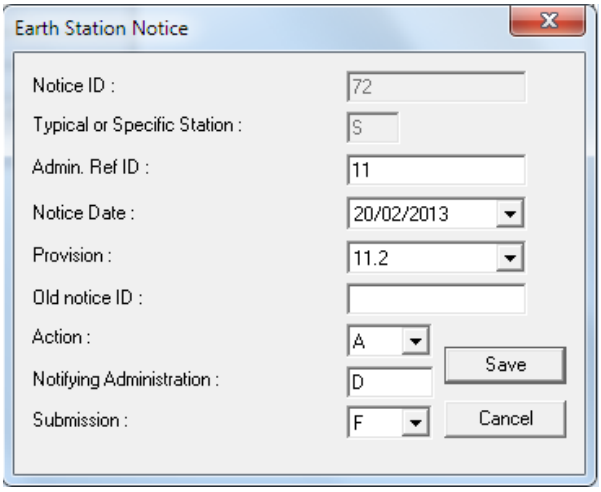
- Minimum Elev. angles: This item enters the minimum elevation angle of earth station antenna at different azimuths. As displayed in Figure 4.16, choosing this item opens an entry table consisting of two columns to save this information.

Figure 4.16. Entry table to provide the minimum elevation angle of earth station antenna



Notice: This item generates a BR electronic notice, ready for submission to ITU BR. By selection of this item, a dialogue box is opened for the user to complete the remaining general information of earth station. Figure 4.17 displays the BR Notice dialogue box.

Figure 4.17. Notice dialogue box



Data items of Notice dialogue box explained in Table 4.9.

Table 4.9. Data items of Notice dialogue box

Item name	Description
Admin Ref. ID	Reference ID of administration
Notice Date	The date of Notice generation or other date which the user selects from the associated calendar
Provision	Combo box to select one of the applicable provisions of the RR
Old Notice ID	The notice ID of the old Notice, in case of resubmission
Action	Combo box to select one of A, M or S which are for Add, Modification and Suppress
Notifying Administration	The ITU code of the Administration notifying this notice. This code is automatically detected by the software but the user is able to change it.
Submission	A combo box to select either F or R, standing for First and Re-submission of Notice

The extracted BR electronic notice can be saved as an “mdb” database file using the “Save” push button, once this dialogue box entry is and no mandatory fields of Earth station remain blank, as in other information tables. The saved “mdb” file may be imported into the BR “Space Capture” tool for a double check.

4.6. The level of Beam

The level of beam is placed between the Earth station level and the group level. Each beam may consist of several groups under the same radiation beam. The content of a Group Information

table depends on the type of beam defined in Earth station level. Selecting a beam in tree view by a mouse click or any other action, displays a table of the corresponding Earth Station's Antenna Information table in the right panel of the Administrative window. The content of the Information table can be modified and then saved or cancelled using the "Modify" and "Save" or "Cancel" push buttons above the table, if relevant license has not been granted. In the case of modification, the tree view in the left panel of the Administrative window will be locked and, for the modifications to be saved successfully, the mandatory fields (field names in bold) must not be left blank. Modification of the type of beam is not permitted if groups were attached to the beam. The content of the Earth Station Antenna Information table for different types of beams is described in Table 4.7. Any beam under a specific Earth station has a unique name and may have unlimited number of groups.

4.6.1. Context menu in the level of Beam

A right click on the level name opens a context menu containing "Delete", "Add Group" and "Show Pattern" items. Two, slightly different, tables of group information have been developed for different types of beam. These items are described below:

- Delete: This item delete the Earth Station Antenna Information and all other attached information in the lower levels of tree view, if it has not been included in any granted license. Granted licenses cannot be deleted.
- Add Group: This item adds to the selected License a group of emissions under a beam to an earth station, operating with geo-stationary satellites, in a space radiocommunication service. Selecting this item opens a blank "Group Information" entry table in the right panel of the Administrative window and locks the tree view. The priority of the field in this information table is partially dependent on the type of selected beam. Three push buttons "Modify", "Cancel" and "Save" are available above the table. At the time of creation of a group, the "Modify" push button is disabled. To save a table, mandatory fields (field name in bold) must not be left blank. The saved group, with its name, is inserted under the corresponding beam in tree view. Figure 4.18 shows this entry table and its content is described in Table 4.10.

Figure 4.18. Group Information entry table

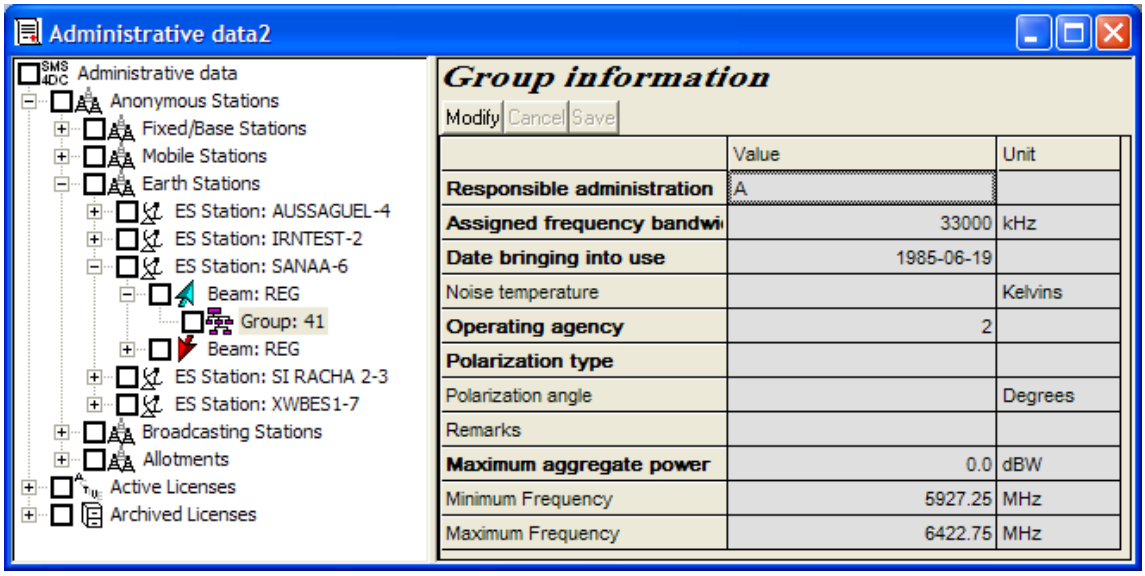


Table 4.10. Description of fields in the entry table of Group Information (1)

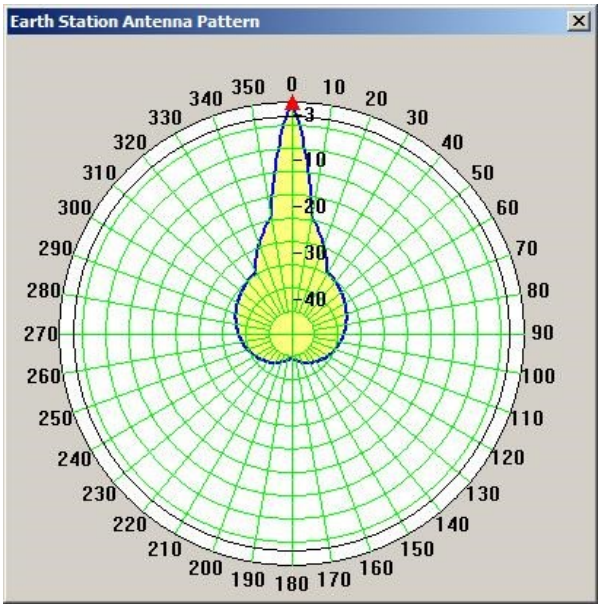
Field name	Type	Description
Responsible administration	M	A combo box to select the organization responsible for the emission previously registered with the ITU (Listed in Preface to BR IFIC (Space Services). The word "Other" could be selected in the case of an unregistered organization name
Assigned frequency bandwidth	M	The bandwidth of the assigned frequency in kHz
Data of bringing into use	M	The date on which the emission will begin operation
Noise temperature	O/M	Receiving system noise temperature. This item is mandatory for downlink.
Operating agency	M	A combo box to select the operating organization previously registered with the ITU (Listed in Preface to BR IFIC (Space Services). The word "Other" could be selected in case of an unregistered organization name
Polarization type	M	A combo box to select the polarization of emission.
Polarization angle	O	The angle of slant polarization if the type L999 selected for polarization type
Remarks	O	Any remark
Maximum aggregate power	M/O	The maximum value of the peak envelope power supplied to the input of the Earth Station Antenna in the Assignment Coordination Group's Bandwidth. Mandatory in case of uplink.
Minimum frequency	M	Minimum frequency of a group. Automatically calculated when the assigned frequencies are entered.
Maximum frequency	M	Maximum frequency of a group Automatically calculated when the assigned frequencies are entered.

(1) : M: Mandatory, O: Optional

- Show Pattern: This item displays the radiation pattern of the antenna (symmetrical with respect to the bore sight) assigned to the relevant Earth station in the direction of uplink or

downlink, depending on the type of beam. The default antenna pattern will be displayed if no antenna assigned or a non-standard antenna assigned to the earth station. The default antenna pattern is extracted from Recommendation ITU-R S.465.

Figure 4.19. An example of earth station antenna pattern



4.7. The level of Group

The level of group is placed under the beam level. However, each group could consist of several emissions and frequencies. The content of the emission entry table depends partially on the type of beam defined in earth station level. Selecting a group in tree view by a mouse click or other action, displays a table of corresponding Group Information table in the right panel of the Administrative window. The content of the Information table can be modified, saved or the action cancelled using the "Modify" and "Save" or "Cancel" push buttons above the table, if relevant license has not been granted. In case of a modification, the tree view in the left panel of the Administrative window will be locked and a warning message displayed if the user tries to save the table with mandatory fields that are left blank. The content of the Group Information table for different types of beams is described in Table 4.10. Any group under the specific beam of earth station has a unique name and could have several emissions and frequencies.

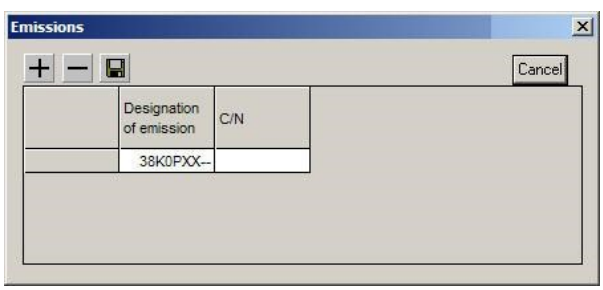
4.7.1. Context menu in the level of Group

A right click on the level name opens a context menu containing "Emissions", "Frequency Assignments", "Special Section", "Coordination", "Class of Station", "Filter" and "Delete" items. The following is a description of these items:

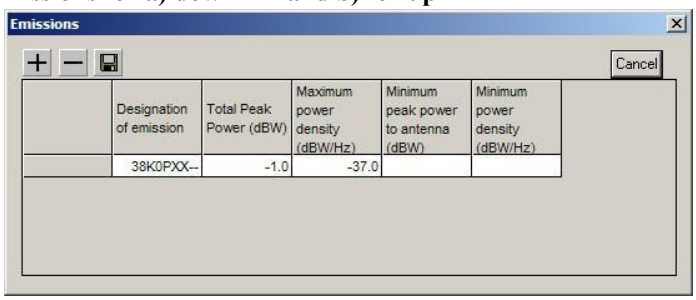
- Emissions: This item provides a list of emissions in the downlink and uplink directions. Selecting this item opens an entry table to define a multiple emission specification. At the top of table there are three push buttons to add new emissions, to delete registered emissions in the table and to save entered emissions into the database. The content of the

table is different for uplink and downlink directions. Figure 4.20 shows the entry tables and Table 4.11 explains the table fields.

Figure 4.20. Entry tables to provide list of emissions for a) downlink and b) for up link



(a) for downlink



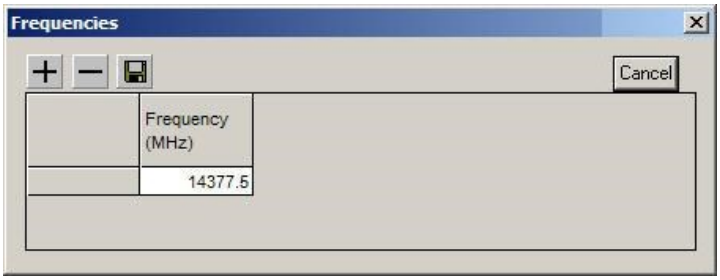
(b) for uplink

Table 4.11. Description of fields in the entry table of Emission Information

Field name	Description	Up	Down
Designation of emission	Combination of class of station and necessary bandwidth, as explained in ITU RR App.1	X	X
C/N	The quality threshold level for the Carrier-to-Noise ratio, set in the appropriate ITU-R Recommendations, for the full Earth Station Antenna/Space Station/Earth Station Antenna path under clear sky propagation conditions (-10 to 25).		X
Total peak power (dBW)	The total peak envelope power supplied to the input of the antenna in the Assignment Coordination Group's Bandwidth (-10 to 40). In case of an individual carrier, this field will receive the maximum peak power.	X	
Maximum power density (dBW/Hz)	The maximum power density in the worst 4 kHz (below 15 GHz) or 1 MHz (above 15 GHz) in the Assignment Coordination Group's Bandwidth supplied to the input of the antenna averaged over 4 kHz (below 15 GHz) or 1 MHz (above 15 GHz) (-120 to 00)	X	
Minimum peak power to antenna (dBW)	The minimum value of the peak envelope power supplied to the input of the antenna for an individual ACG Frequency	X	
Minimum power density (dBW/Hz)	The minimum power density in the worst 4 kHz (below 15 GHz) or 1 MHz (above 15 GHz) supplied to the input of the antenna of an individual ACG Frequency averaged over 4 kHz (below 15 GHz) or 1 MHz (above 15 GHz) (-120 to 00)	X	

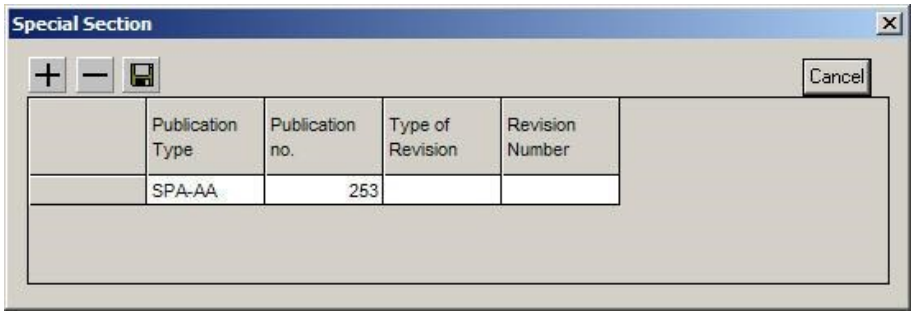
- Frequency Assignments: This item assigns a frequency to a group of emissions. Selecting this item opens an entry table to register multiple frequencies in MHz. At the top of table there are three push buttons to add new frequencies, to delete registered frequencies in the table and to save entered frequencies into the database. Figure 4.21 shows this entry table.

Figure 4.21. Entry table of assigned frequencies to a group of emissions



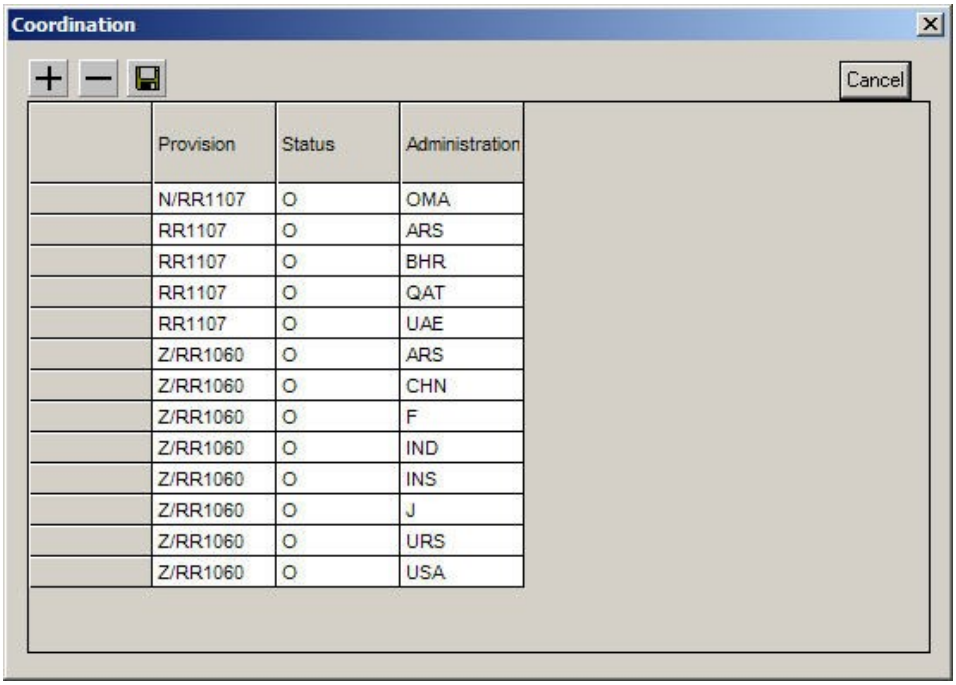
- Special Section: This item sets the BR publication reference for a given group of emissions. Selecting this item opens an entry table to set multiple references. At the top of table there are three push buttons to add a new reference, to delete an existing reference in table and to save entered information into the database. Figure 4.22 displays this entry table.

Figure 4.22. Entry mask to store ITU BR publication reference



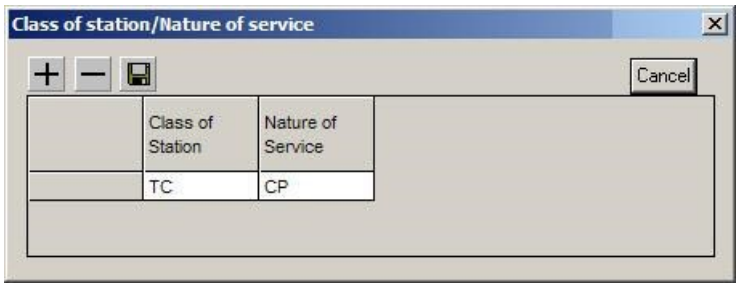
- Coordination: This item stores a list of administrations for which coordination has to be initiated under the specified provisions. Selecting this item opens an entry table to provide a list of administrations with the related coordination provision. At the top of the table there are three push buttons to add a new case, to delete an existing case in the table and to save entered information into the database. Figure 4.23 displays this entry table.

Figure 4.23. Entry table of list of administration to which coordination has to be initiated



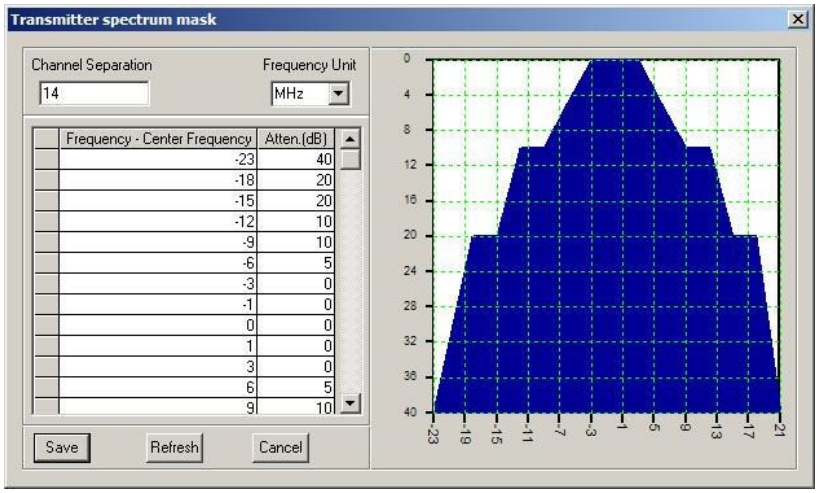
- Class of Station: This item sets class of stations and nature of services applicable to the group of beams. Selecting this item opens an entry table to define class of stations and nature of services using the relevant combo box. At the top of table there are three push buttons to add a new case, to delete an existing case in the table and to save entered information into the database. Figure 4.24 displays this entry table.

Figure 4.24. Entry table to set class of stations and nature of services



- Filter: This item defines the emission mask of the uplink or downlink signals of a given group. Selecting this item opens a dialogue box (Figure 4.25) to enter emission mask attenuation data in up to 20 off-centre frequencies. Prior to the display of this dialogue box, a warning message will be generated to remind the user that the emission mask is lacking and no emission mask has been defined previously. Attenuation values in the table must be positive and the refresh button is necessary to reflect any value change to the picture of the mask in the right panel. Using the Save button assigns the defined emission mask to the concerned emission.

Figure 4.25. Dialogue box for definition of transmitting frequency emission mask



- Delete: This item deletes the Group Information and all other attached information if it has not been included in any granted license. Granted licenses cannot be deleted.

4.8. The level of Station

The level of station is placed between the License level and the Equipment level. Each station may consist of several equipments in the same radiocommunication service. The content of the equipment information table depends on the class of station defined in the station level. Selection of a station in tree view by a mouse click or other action, displays a table of the corresponding Station Information in the right panel of the Administrative window. The content of the Information table can be modified, saved or any action cancelled using "Modify", "Save" or "Cancel" buttons above the table, if the relevant license has not been granted. For modification, the tree view in the left panel of the Administrative window will be locked and a warning will be displayed if the user tries to save a modified table with mandatory fields (bold field names) containing invalid data or left blank. Modification of class of station is not permitted if there is some equipment attached to the station. The contents of the Station Information table for different classes of station are described in Table 4.4 to Table 4.6.

Each Station under the specific License has a unique name and could have an unlimited number of equipments.

4.8.1. Context menu in the level of Station

A right click on the Level name opens a context menu containing "Modify", "Delete", "New Equipment" and "Electronic Notice" items. Different tables of equipments have been developed for different classes of stations. The following is a description of these items:

- Modify: This item modifies the content of the Station Information table if has not been included previously in any granted license. Modification of the class of station is not permitted if there has been equipment(s) attached to the station. At the time of modification, the tree view in the left panel of the Administrative window will be locked and a warning will be displayed if the user tries to save a modified table with mandatory

fields (bold field names) that contain invalid data or are left blank. The contents of a Station Information table for different classes of stations are described in Table 4.4 to Table 4.6.

- Delete: this item deletes the station information and all other attached information in the lower levels of tree view, if has not been included in any granted license. Granted licenses cannot be deleted.
- New Equipment: This item defines new equipment or loads it from the equipment catalogue library to the current station. Selecting this item creates a blank "Equipment Information" entry table in the right panel of the Administrative window and locks the tree view. Content of Equipment Information table depends on the class of station defined in the higher (station) level.

Table 4.12 describes the fields used in the entry table of Equipment Information for different classes of stations.

Table 4.12. Description of fields in the table of equipment information for different class of stations (1)

Field name	Type	Field Description	Class of Station				
			FX	FB	ML	BC	BT
Equipment Name	M	Name of equipment given by manufacturer.	X	X	X	X	X
Power to Antenna	M	Transmitter power, in W, provided at transmitting antenna port.	X	X	X	X	X
Power Type	M	A combo box to select one of the letters X, Y or Z in accordance with the Preface to BR IFIC, Chapter IV, Section 7	X	X	X	X	X
Radiated Power	M	Transmitter radiated power in W in the direction of antenna maximum gain.	X	X	X		
Type of Rad. Power	M	One of the type of radiation power E, I or M for e.r.p., e.i.r.p. or e.m.r.p. (RR No.s 1.161 to 1.163)	X	X	X		
Manufacturer	O	Manufacturer of equipment	X	X	X	X	X
Model	O	A code to identify the model of manufactured equipment	X	X	X	X	X
Serial no.	O	Serial number of equipment	X	X	X	X	X
Vision Carr. Freq. Offset (/12 line)	O	Displacement of the vision carrier nominal frequency, expressed as multiples of 1/12 of the line frequency. Allowed values for offset expressed as a fraction of the Line Frequency of the television system are 0 or integer in the range from -399 to +399. Following table explains the allowed codes (Item 1e in BR database): **Code Meaning Code Meaning** 0 0 +1 + 1/12 –1 – 1/12 +2 + 2/12 –2 – 2/12 +3 + 3/12 –3 – 3/12 ~ ~ ~ ~ +399 + 399/12 –399 – 399/12 NOTE - The Regional Agreements ST61 and GE89 and the original notice forms only allowed the use of offset expressed in 1/12th of line frequency. However, it is noted that whole ITU Regions outside the ST61 and GE89 planning areas usually express these offsets in kHz, and that for digital					X

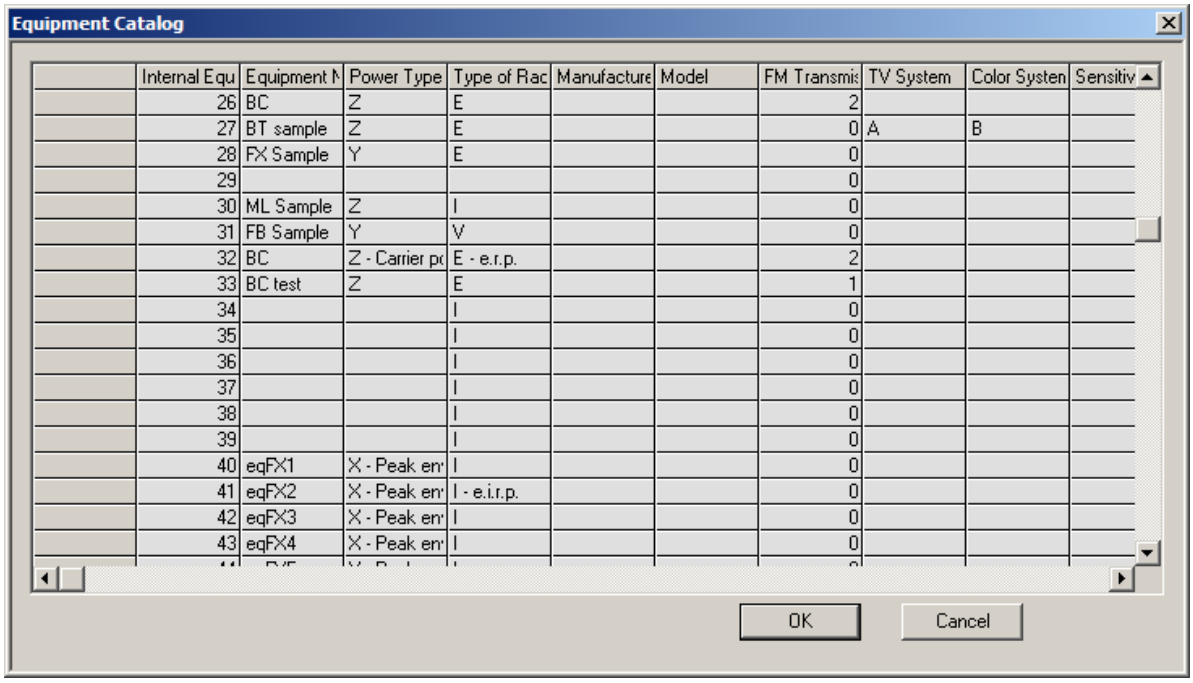
		television, offsets in kHz will be the only possibility. Therefore, form T02 allows a choice between these two expressions of the same physical information.					
Vision Carr. Freq. Offset (kHz)	O	Same as previous item, except presented in kHz Values are between -500 and +500 and may contain decimals. Item 1e in BR database					X
Sound Carr. Freq. Offset (/12 line)	O	Displacement of sound carrier nominal frequency, expressed as multiples of 1/12 of line frequency. If the Frequency offset stability indicator is "Normal" or "Precision", the value of the sound carrier frequency offset code is equal to the value of the vision carrier frequency offset Code. This item is optional if frequency stability is “Normal” or “Precision” for actions ADD and MODIFY and these fields must not be notified in other cases. They will be ignored if the frequency stability is “Relaxed”. By default, if the frequency stability is “Normal” or “Precision” the value is equal to the vision frequency offset. The same rule as for vision frequency offset apply.					X
Sound Carr. Freq. Offset (kHz)	O	Same as previous item, except presented as a frequency in the range of –500.000 to 500.000 kHz.					X
TV System	M	TV system as defined in the Preface to BR IFIC, Chapter 8, Section IV					X
Colour System	M	One of the TV colour systems: NTSC, PAL or SECAM. Item 7c2 in BR database. Item 7c1 in BR database					X
FM Transmission code	M	The code to identify the type of the FM radio transmission and the maximum frequency deviation used. Used for FM sound broadcasting only (Item 7d in BR database). **Code Meaning** 1 Monophonic (maximum frequency deviation ± 75 kHz). 2 Monophonic (maximum frequency deviation ± 50 kHz). 3 Stereophonic, polar modulation system (maximum frequency deviation ± 50 kHz). 4 Stereophonic, pilot-tone system (maximum frequency deviation ± 75 kHz). 5 Stereophonic, pilot-tone system (maximum frequency deviation ± 50 kHz).				X	
Max. erp of the horz. Polarized comp.	M	The product of the power supplied to the Antenna and the Transmitting Antenna's Maximum Gain for the horizontally polarized component. Item 8bh in BR database				X	X
Max. erp of the vert. Polarized comp.	M	The product of the power supplied to the Antenna and the Transmitting Antenna's Maximum Gain for the vertically polarized component. Item 8bv in BR database				X	X
Power Ratio	O	The power ratio (dB) between the effective radiated power of the vision carrier and the effective radiated power of the primary sound carrier. This information is mandatory for analogue television notices for actions ADD and MODIFY and must not be notified in the other cases. Recommendation ITU-R BT.470 gives acceptable values of vision to sound power ratio for different television systems. Item 8d in BR database					X
Field Strength Ref.	O	Reference usable field strength, obtained from plan				X	X

Sensitivity	M	Receiver sensitivity in dBμV/m	X		X		
Energy Dispersal	O	A textual description of the energy dispersal systems characteristics. Typically this would include the frequency deviation, the sweep frequency and the shape of the waveform added to the baseband signal prior to the FM modulator to prevent high levels of energy concentration on the Reference (Carrier) Frequency during periods of no, or small levels of modulation signal (Item 7f in BR database).	X				
Frequency Stability	M	Acceptable values are RELAXED, NORMAL and PRECISION on electronic notices, abbreviated as R, N or P for paper notices. Relaxed corresponds to the minimum frequency stability in Appendix 2 of the Radio Regulations. If the frequency stability is NORMAL, non-precision offset is possible, and if the frequency stability is PRECISION, precision offset is possible. See Recommendation ITU-R BT.655. Under GE89 Agreement, the frequency stability must be Normal or Precision; Under ST61 Agreement, the frequency stability must be Normal or Precision if the effective radiated power is equal to or more than 30dBW for bands below 470 MHz, or if the effective radiated power is equal to or more than 40dBW for bands above 470 MHz. BR Notice item 7a1					X
Noise Factor	O		X				
System Type 1 And System Type 2	M	(GE06)	X	X	X		
Ref. Plan. Config.	M	Reference Planning Configuration (GE06)				X	X
System Variant	M	(GE06)					X
RX Mode	M	(GE06)					X
Maximum Power Density	O	The maximum power density at the output of the transmitter for each carrier type and averaged over the worst 4 kHz for carriers below 15 GHz and for each carrier type averaged over the worst 1 MHz for carriers above 15 GHz, supplied to the antenna transmission line. Item 8ab in BR database	X	X	X	X	X

(1): M: Mandatory, O: Optional

Four buttons “Modify”, “Cancel”, “Save” and “Library” are available above the table. At the time of entering new equipment or selecting from library, the “Modify” push button is disabled. Mandatory fields in the entry table of Equipment Information (field names in bold) must not be left blank, otherwise a warning message is displayed. Figure 4.26 shows the table of Equipment catalogue. After pushing the save button, a message box gives the user the option to overwrite the corresponding equipment information in the equipment catalogue or to create a new equipment type. The new equipment created in the equipment catalogue will be available for all stations in the same class of station.

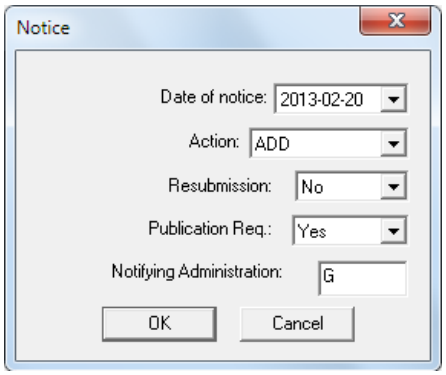
Figure 4.26. Spreadsheet of Equipment catalogue



The saved equipment, with its name, is inserted under the corresponding station in tree view.

- Electronic Notice: This item generates, stores and displays an electronic notice to notify the ITU BR of the assigned frequency(s) or administrative modification(s). As required in the specification, SMS4DC is able to generate T01, T02, T11, T12, T13, T14, TB1, TB2, TB3, TB4, TB5, G11, G12, G13, G14, GS1, GT1, G02 and GB1 electronic notices. Depending on the notice type, SMS4DC determines the type of electronic notice applicable to the case and provides options in the relevant dialogue box (Figure 4.27a and Figure 4.27b). No notice form will be generated if the mandatory fields in the consequent levels of the tree view are incomplete and an error message will be displayed. Therefore, users must complete all mandatory information, including: frequency(s), receiver information and antenna characteristics; to generate a complete notice form. Figure 4.27c shows an example of a generated G11 notice. The default date of the notice will be the date of notice generation. However, this may be customized by using the integrated date picker

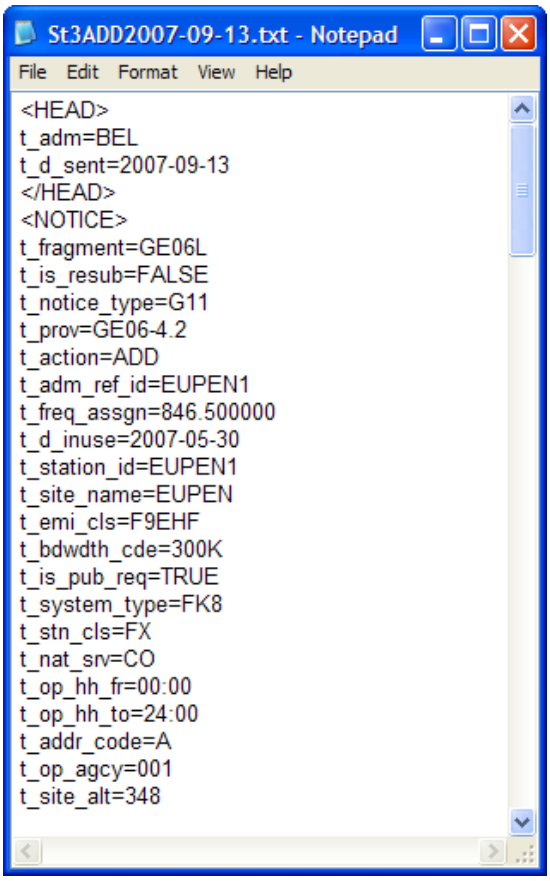
Figure 4.27. a) Notice option dialogue box,
b) applicable actions for each service type, and c) a sample G11 BR Notice



(a) Notice option dialogue box

Action	Service Type		
	Fixed	Mobile	Broadcasting
ADD	X	X	X
ADMINID			X
CONFORM			X
COORDINATION			X
MODIFY	X	X	X
PARTB			X
SUPPRESS	X	X	X
WITHDRAW	X	X	X

(b) Envisaged actions for each service type



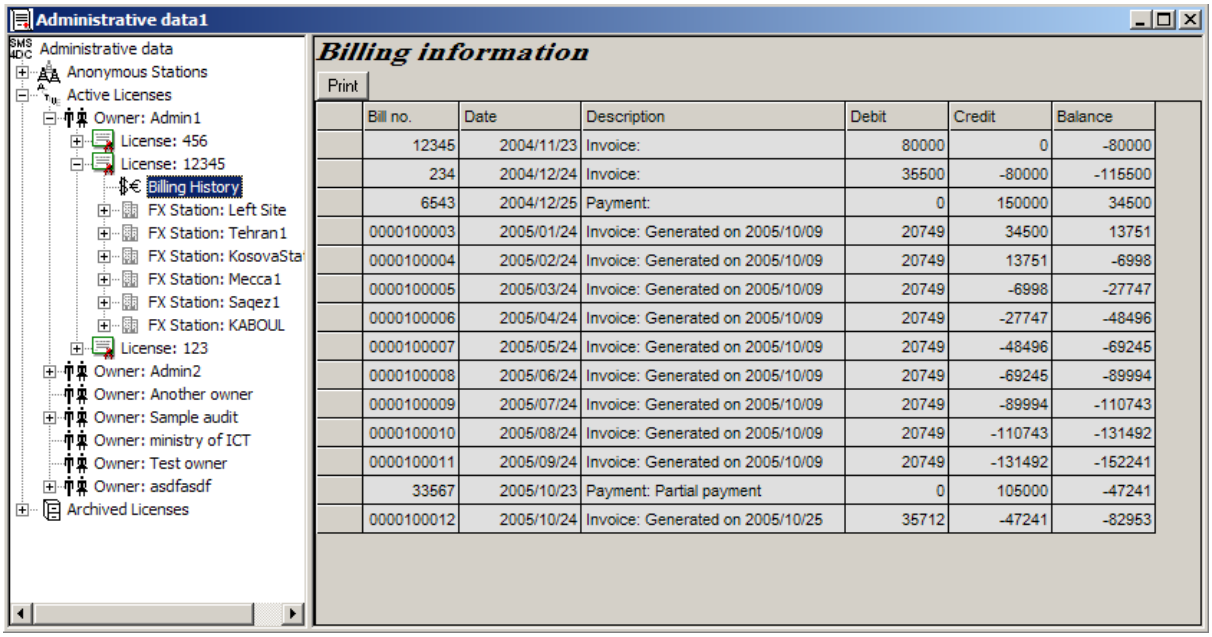
(c) A sample G11 BR Notice

4.9. The level of Billing History

SMS4DC provides the user with a procedure for regular frequency-fee payment management. Once the data entry of a license is finished, the Administrator may issue the first invoice letter and require the license owner to pay for being granted the corresponding radio license. When the first payment is settled, the license may be granted and regular invoices will be issued automatically by the software; one invoice record for each time period (determined in the combo box “Invoice Period” in License Information entry table).

The level of billing history is placed below the level of license (with no lower levels). As displayed in Figure 4.28, each license has an individual billing history which is created by SMS4DC at the same time that the relevant license was created. Selection of a Billing History in tree view, by a mouse click or other action, displays a list of issued invoices and registered payments for the corresponding license in the right panel of Administrative window. A print button at the top of the table has been implemented to print the selected invoice or receipt of payment. By pushing “print” button, the location to save the generated html invoice file is requested, and then the generated file is opened. Figure 4.28 displays the Billing Information table and its content is explained in Table 4.13.

Figure 4.28. Billing Information table



Bill no.	Date	Description	Debit	Credit	Balance
12345	2004/11/23	Invoice:	80000	0	-80000
234	2004/12/24	Invoice:	35500	-80000	-115500
6543	2004/12/25	Payment:	0	150000	34500
0000100003	2005/01/24	Invoice: Generated on 2005/10/09	20749	34500	13751
0000100004	2005/02/24	Invoice: Generated on 2005/10/09	20749	13751	-6998
0000100005	2005/03/24	Invoice: Generated on 2005/10/09	20749	-6998	-27747
0000100006	2005/04/24	Invoice: Generated on 2005/10/09	20749	-27747	-48496
0000100007	2005/05/24	Invoice: Generated on 2005/10/09	20749	-48496	-69245
0000100008	2005/06/24	Invoice: Generated on 2005/10/09	20749	-69245	-89994
0000100009	2005/07/24	Invoice: Generated on 2005/10/09	20749	-89994	-110743
0000100010	2005/08/24	Invoice: Generated on 2005/10/09	20749	-110743	-131492
0000100011	2005/09/24	Invoice: Generated on 2005/10/09	20749	-131492	-152241
33567	2005/10/23	Payment: Partial payment	0	105000	-47241
0000100012	2005/10/24	Invoice: Generated on 2005/10/25	35712	-47241	-82953

Table 4.13. Description of Billing Information table items

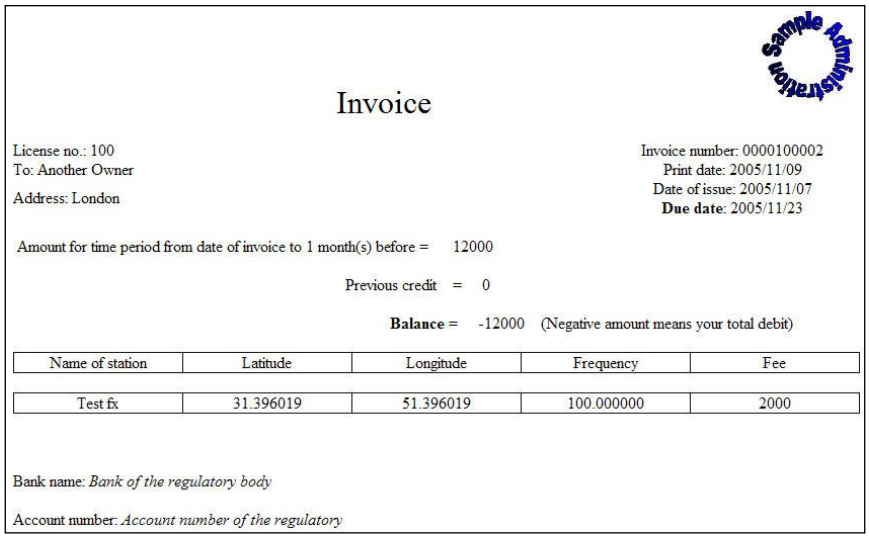
Column name	Description
Bill no.	Record ID. For payments it is entered manually while for invoices it is generated automatically.
Date	The date of creation of record or defined date
Description	Type of transaction, invoice or payment
Debit	Amount payable for the time period starting from last invoice to the date of current invoice if description presents an invoice or zero if description presents a payment.
Credit	Amount in owners account prior to paying the current payment, if an invoice is presented.
Balance	The balance in the account. A negative sign means payment is necessary, while positive means the owner still has credit.

4.9.1. Context menu in the level of Billing History

A right click on the level name opens a context menu containing: “First Invoice” and “New Payment” items. The following is a description of these items:

- First Invoice: This item issues the first invoice which owner has to pay including the initial fee (determined in the entry table of License Information) for obtaining a radio license. Selecting this item adds the first invoice record to the Billing History Information table of active license. The consequent invoices will be issued automatically for any previous time period (selected in the combo box Invoice Period of entry table of License Information). The Print button for a selected invoice record, generates, saves and displays an HTML invoice letter file. Figure 4.29 displays an invoice.

Figure 4.29. An example of issued invoice



Invoice

Sample Administration

License no.: 100
To: Another Owner
Address: London

Invoice number: 0000100002
Print date: 2005/11/09
Date of issue: 2005/11/07
Due date: 2005/11/23

Amount for time period from date of invoice to 1 month(s) before = 12000

Previous credit = 0

Balance = -12000 (Negative amount means your total debit)

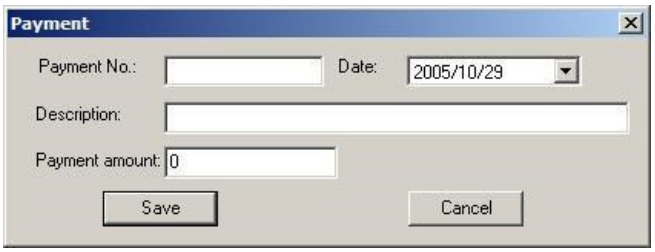
Name of station	Latitude	Longitude	Frequency	Fee
Test fx	31.396019	51.396019	100.000000	2000

Bank name: *Bank of the regulatory body*

Account number: *Account number of the regulatory*

- New Payment: This item registers the payment and considers it in the Billing History of owner of the active license. Selecting this item opens a dialogue box to enter payment details. Figure 4.30 shows this dialogue box. The Print button, for a selected payment record, generates, saves and displays an HTML receipt letter file.

Figure 4.30. Dialogue box of payment registration in Billing History Information table of a License



4.10. The level of Equipment

The level of equipment is placed between the terrestrial station level and the Frequency and Antenna level. Each equipment may have several frequencies and antennas. Selection of an equipment in tree view by a mouse click or other action, displays the corresponding Equipment Information table in the right panel of the Administrative window. The content of the Information table can be modified, saved or any action cancelled using “Modify”, “Library” and “Save” or “Cancel” push buttons above the table, if the relevant license has not been granted. In case of modification, the tree view in the left panel of the Administrative window will be locked and mandatory fields (field name in bold) must be not left blank, otherwise a warning is displayed. The content of the equipment table is different for different classes of station and is described in Table 4.12. Each equipment under the specific station has a unique name and may have an unlimited number of frequencies and antennas.

New equipment can be defined using the “New Equipment” item of context menu in station level.

4.10.1. Context menu in the level of Equipment

A right click on the level name opens a context menu containing the items: “Modify”, “Delete”, “New Antenna” and “New Frequency”. The following is a description of these items:

- Modify: This item modifies the content of the Equipment Information table if it has not been already included in any granted license. At the time of modification, the tree view in the left panel of the Administrative window will be locked and mandatory fields (field names in bold) must not be left blank, otherwise a warning is displayed. The content of the Equipment Information table for different classes of stations is described in Table 4.12.
- Delete: This item deletes the equipment information and all other attached information in the lower levels of tree view, if has not been included in any granted license. Granted licenses cannot be deleted.
- New Antenna: This item defines a new antenna or loads it from the antenna catalogue library to the current equipment. Selecting this item creates a blank “Antenna Information” entry table in the right panel of the Administrative window and locks the tree view. The content of Antenna Information entry table has slight variations for different classes of stations. Figure 4.31 illustrates entry table for Antenna Information for the fixed service and Table 4.14 describes the fields used in the Antenna Information entry table.

Figure 4.31. Table of Antenna Information

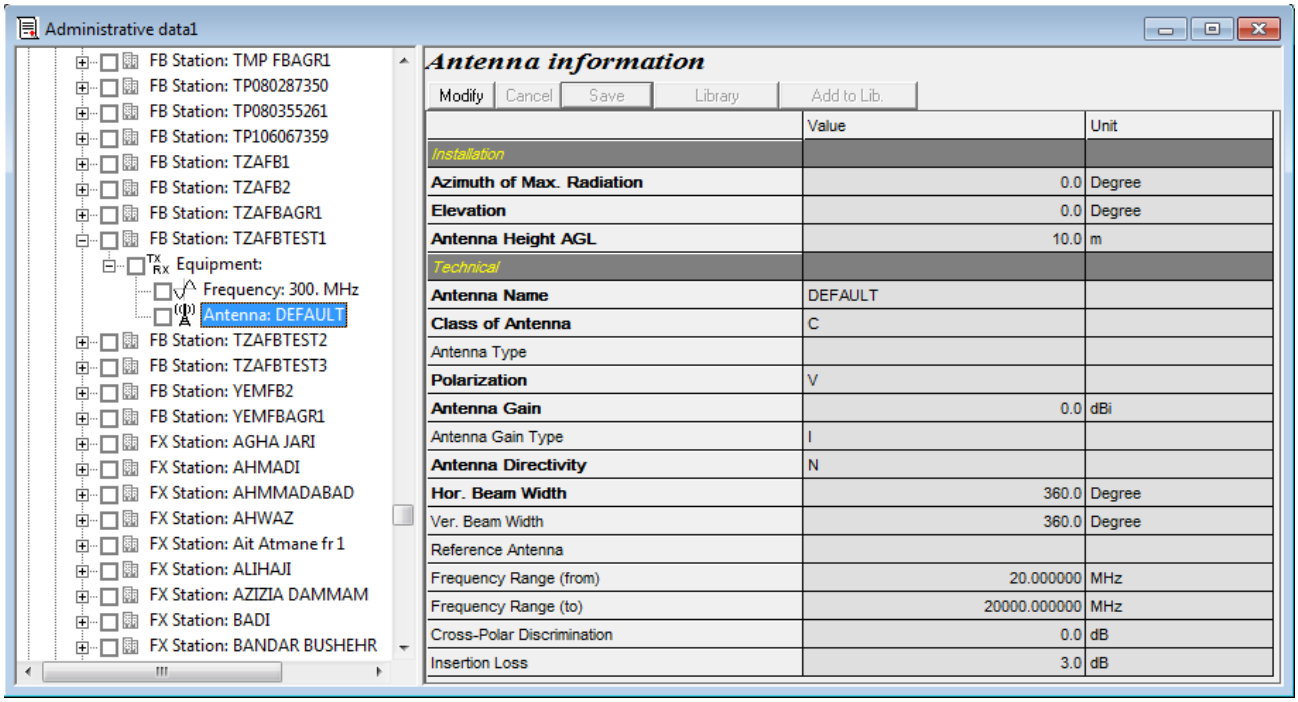


Table 4.14. Description the fields of Antenna information entry table

Field name	Type	Description	Station Type	
			FX	others
Azimuth of Max. Radiation	M	The angle of the direction of the Antenna's Maximum Gain, measured in the horizontal plane from True North in a clockwise direction. In case of rotational antenna the angle of the direction of the Antenna's Maximum Gain at the left hand edge of the Operational Sector swept by the rotational antenna beam.	X	X
Rot. Azimuth (to)	O	The angle of the direction of the Antenna's Maximum Gain at the right hand edge of the Operational Sector swept by the rotational antenna beam, measured in the horizontal plane from True North in a clockwise direction.	X	
Elevation	M	The angle measured in the vertical plane between the direction of the Antenna Maximum Gain and the horizontal plane. For orientation below horizon the angle will be negative.	X	X
Antenna Height AGL	M	Height of antenna centre above ground level. Summation of this value and site height (ASL) must reach to the antenna	X	X
Antenna Name	M	Name of antenna	X	X
Class of Antenna	M	A combo box for selecting one of the T, R or C for TX, RX or TX/RX Antenna respectively	X	X
Antenna Type	O	Type of antenna	X	X
Polarization	M	The code for representing the polarization of antenna. Select from the following table: CL Left hand circular or indirect: the electric field vector rotates anti-clockwise. CR Right hand circular or direct: the electric field vector rotates clockwise. D Dual: when substantially equal-amplitude vertically and horizontally polarized components are radiated without particular control of the phase relation between them. Typically, the vertically and horizontally polarized sources may be displaced one from the other so that the resultant polarization varies between circular and slant, according to azimuth angle. H Horizontal linear: the electric field vector is in the horizontal plane. M Mixed: the collective term applied when both vertical and horizontal components are radiated, embracing slant, circular and dual polarization. SL Left hand slant: the electric field vector is in the plane rotated 45 degrees anti-clockwise from the vertical plane. SR Right hand slant: the electric field vector is in the plane rotated 45 degrees clockwise from the vertical plane. V Vertical linear: the electric field vector is in the vertical plane. L999 The electric field vector, observed in any fixed plane, normal to the beam axis, whilst looking in direction of propagation, remains in the direction specified by the angle measured anti-clockwise from a line parallel to the equatorial plane; the value of this angle follows the symbol L and is expressed in degrees from 0 to 359. X Other than above	X	X
Antenna Gain	M	The ratio of the power required at the input of a loss-free reference antenna (gain reference antenna) to the power supplied to the input of the Antenna to produce, in the direction of maximum radiation, the same field strength, or the same power flux-density at the same distance. The gain may be considered for a specified polarization.	X	X
Antenna Gain Type	O	Whether the Maximum Gain is relative to a dipole, an isotropic or a short vertical Antenna is determined by the	X	X

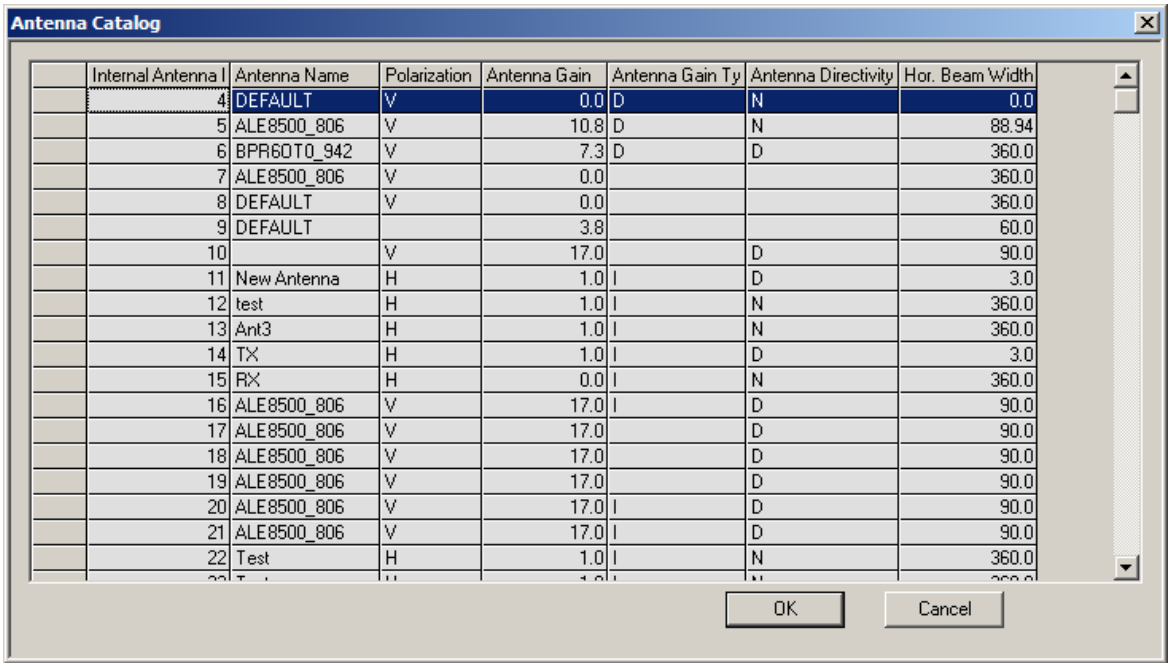
		type of reference Antenna (e.g., dipole) used to determine the relative value of Antenna gain. A combo box to select one of following codes: I In case of dBi, respect to the isotropic antenna D In case dBd, gain respect to dipole antenna V In case of gain relative to the short dipole		
Antenna Directivity	M	A combo box to select one of the D, N or X representing directional, non-directional or revolving directional antenna respectively.	X	X
Hor. Beam Width	M	The angular width of the main lobe of radiation in degrees, measured in the horizontal plane containing the direction of the Antenna's Maximum Gain, within which the off-axis gain in any direction does not fall more than 3 dB below the value of the Antenna's Maximum Gain.	X	X
Ver. Beam Width	O	The angular width of the main lobe of radiation in degrees, measured in the vertical plane containing the direction of the Antenna's Maximum Gain, within which the off-axis gain in any direction does not fall more than 3 dB below the value of the Antenna's Maximum Gain.	X	X
Reference Antenna	O	The Code identifying a standard description of Antenna off-axis radiation characteristics. This information is optional and furnished when used as a basis to effect coordination with another administration. The information to be given in item should be the exact reference of the antenna appearing in the CCIR Book "Antenna Diagrams" (CCIR/78 or CCIR/84). For example one of the following: • **Antenna Gain Equation (ref: 0642a)**: one or more mathematical expression(s) that define the gain characteristics of the antenna e.g., Radio Relay systems 1-40 GHz in Recommendation ITU-R F.699-2; Equation; • **Antenna Gain Polar Diagram (ref: 0642b)**: the graphical representation in polar form of an Antenna's gain against off-axis angle; Diagram; • **ITU-R Antenna Characteristic Code (ref: 0642c)**: a code identifying a standard description of antenna characteristics, e.g., in Recommendations ITU-R BS.705-1 and ITU-R BS.1195; Up to 10 characters; • **Gain Value (ref: 0642d)**: the value of gain at the specified Off-axis Angle; Decimal (in the range −5.0 to 50.0) to 1 decimal place in dB; and • **Off-axis Angle (ref: 0642e)**: angle of the direction of the Gain Value, measured in the specified plane, from the direction of maximum gain in a clockwise direction; Integer (in the range 0 to 350 in multiples of 10) in degrees.	X	X
Frequency range (from)	O	Antenna working frequency band lower edge	X	X
Frequency range (to)	O	Antenna working frequency band upper edge	X	X
Cross-polar discrimination	O	XPD value of antenna as defined in ITU-R P.310	X	X
Insertion Loss	O	Summation of cable loss, branching loss and any other loss between the RF Sections and antenna.	X	X

As shown on Figure 4.31, some of the fields (e.g. Antenna Name, Polarization) are gray which means they are read only. This is done intentionally to prevent the data for antennas to be changed by mistake, because this information is very critical for all of the calculations in the system.

As displayed in Figure 4.31, five push buttons "Modify", "Cancel", "Save", "Library" and "Add to lib." are available above the table. At the time of entering a new antenna or selecting from the library, the "Modify" push button is disabled. Mandatory fields (field names in bold) in the table of Antenna Information, must not be left blank otherwise an error message is displayed. Figure 4.32 shows the table of the Antenna catalogue (library).

The "Add to lib." button adds new antennas from "*.ant" files that are created by the technical module. After an antenna has been added to the library, it becomes available for selection in other data entry screens (e.g. new station).

Figure 4.32. Spreadsheet of Antenna catalogue



	Internal Antenna I	Antenna Name	Polarization	Antenna Gain	Antenna Gain Ty	Antenna Directivity	Hor. Beam Width
	4	DEFAULT	V	0.0	D	N	0.0
	5	ALE8500_806	V	10.8	D	N	88.94
	6	BPR6OT0_942	V	7.3	D	D	360.0
	7	ALE8500_806	V	0.0			360.0
	8	DEFAULT	V	0.0			360.0
	9	DEFAULT		3.8			60.0
	10		V	17.0		D	90.0
	11	New Antenna	H	1.0	I	D	3.0
	12	test	H	1.0	I	N	360.0
	13	Ant3	H	1.0	I	N	360.0
	14	TX	H	1.0	I	D	3.0
	15	RX	H	0.0	I	N	360.0
	16	ALE8500_806	V	17.0	I	D	90.0
	17	ALE8500_806	V	17.0		D	90.0
	18	ALE8500_806	V	17.0		D	90.0
	19	ALE8500_806	V	17.0		D	90.0
	20	ALE8500_806	V	17.0	I	D	90.0
	21	ALE8500_806	V	17.0	I	D	90.0
	22	Test	H	1.0	I	N	360.0

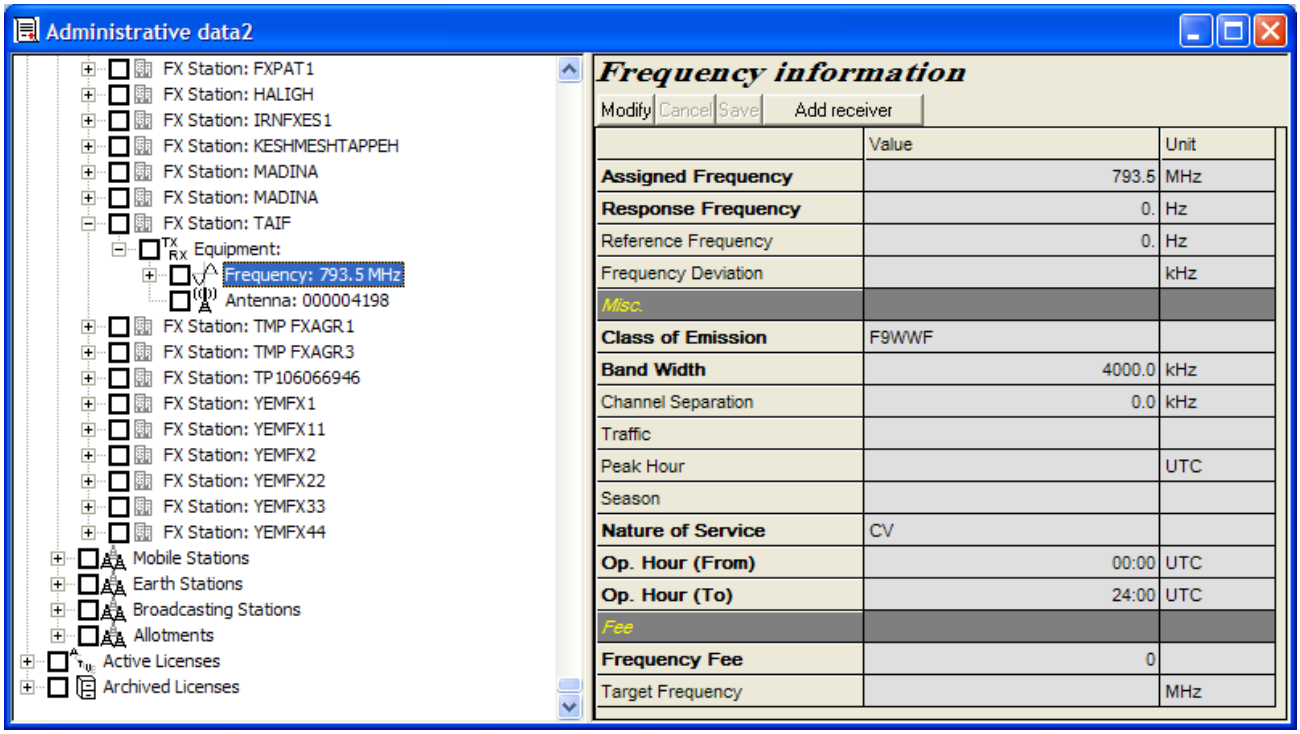
- New Frequency: This item defines a new frequency. Selecting this item creates a blank "Frequency Information" entry table in the right panel of the Administrative window and locks the tree view. The content of the Frequency Information entry table depends on the class of station defined in the higher (station) level. Table 4.15 displays the fields used in the entry table of Frequency Information for different classes of stations. Figure 4.33 illustrates the entry table for Frequency Information.

Table 4.15. Description the fields of Frequency Information entry table

Field name	Type	Description	Class of station				
			FX	BT	FB	BC	ML
Assigned Frequency	M	As defined in RR no. 1.148, the centre of the frequency band assigned to a station.	X	X	X	X	X
Vision Carr. Frequency	M	Vision carrier frequency of a TV signal in accordance with the plan		X			
Sound Carr. Frequency	M	Sound carrier frequency of a TV signal in accordance with the plan		X			
Response Frequency	M	The frequency paired with assigned frequency. Different frequencies mean duplex transmission while identical frequencies represent single-frequency radiocommunication.	X				X
Reference Frequency	O	As defined in RR no. 1.150, a frequency having a fixed and specified position with respect to the assigned frequency.	X		X		X
Frequency Range	O	The frequency range of radiocommunication equipment operation.			X		X
Frequency Deviation	O	For any type of modulation, as applicable: the peak-to-peak frequency deviation (MHz). (See Recommendations ITU-R F.276-2 and ITU-R F.405-1, ITU-R F.275-3, ITU-R F.404-2 and ITU-R S.464-2).	X				
Class of Emission	M	The set of characteristics of an *emission*, designated by standard symbols, as defined in RR no. 1.139 and explained in RR Ap.1	X	X	X	X	X
Band Width	M	The necessary bandwidth of signal as defined in RR no. 1.152	X	X	X	X	X
Channel Separation	O	Frequency distance between adjacent frequency channels	X	X	X	X	X
Channel no.	O	Channel number in frequency plan, if applicable	X	X	X	X	X
Traffic	O	Estimated minutes of channel use in day, if applicable	X	X	X	X	X
Peak Hour	O	The hour, or a time period within the operational period, having peak traffic	X	X	X	X	X
Season	O	A combo box to identify calendar time period of operation	X	X	X	X	X
Nature of Service	M	A combo box to select the code indicating the purpose of the Radiocommunication Service as identified in Class Of Station and defined in the Radio Regulations in accordance with Preface to BR IFIC chapter IV, Section 6	X	X	X	X	X
Op. Hour (From) & Op. Hour (to)	M	The time of day measured in UTC at which the transmission of the Signal usually commences and ends. Where a Start Time (Stop Time) is the same time (or later (earlier) time of day) as the Stop Time (Start Time), then the Stop Time is considered to be on the next calendar day, immediately following the Start Time. For the 24 hour operation use: 00:00 23:59	X	X	X	X	X
Frequency Fee	M	The fee that must be paid for use of the assigned frequency (usually for a given period of time)	X	X	X	X	X
Target Frequency	O	Required if the assigned frequency is to be modified and will be notified.	X	X	X	X	X
Type of Spectrum Mask	O			X		X	
Frequency Offset	O			X		X	

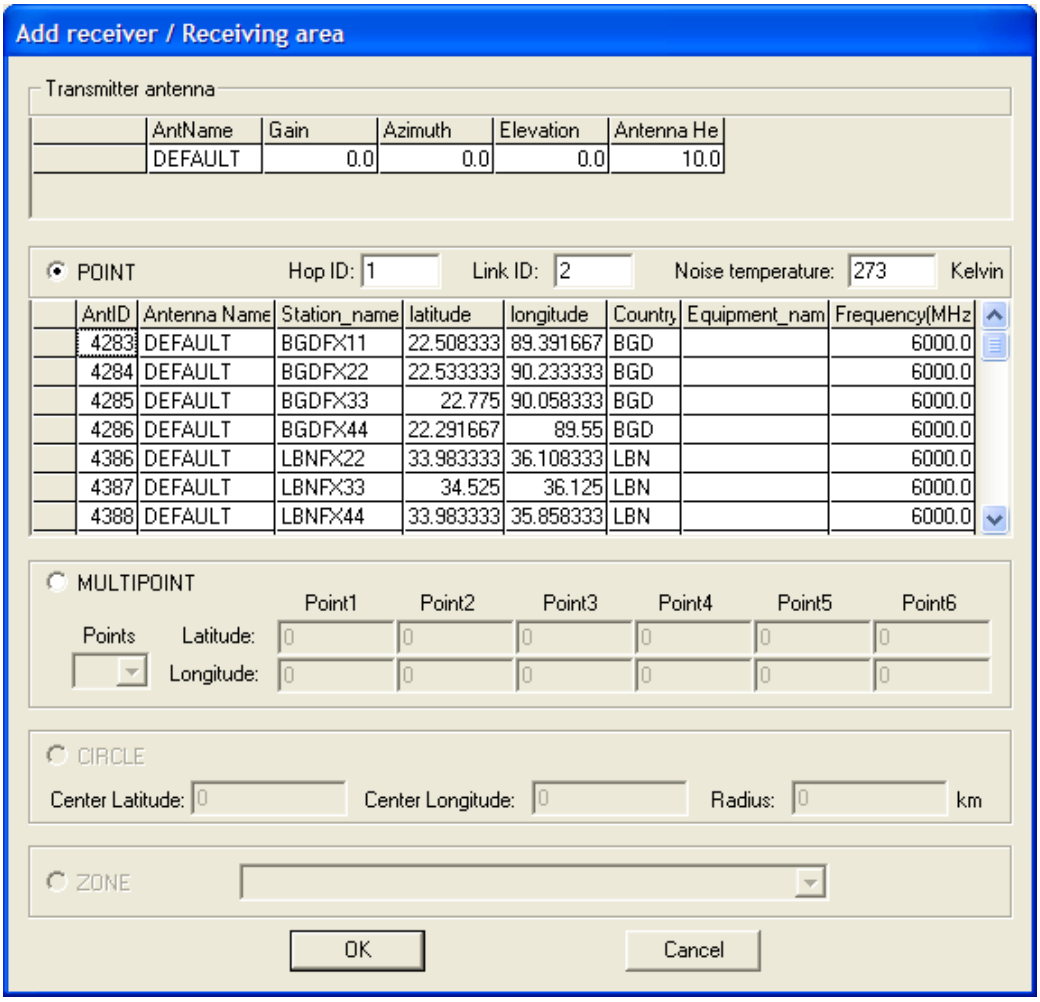
As displayed in Figure 4.34, four buttons “Modify”, “Cancel”, “Save” and “Add Receiver” are available above the table. At the time of entering a new frequency, the “Modify” and “Add Receiver” push buttons are disabled. Mandatory fields (field names in bold) in the entry table of Frequency Information, must not be left blank, otherwise an error message will be displayed.

Figure 4.33. Frequency Information entry table in case station in Fixed service



Once the new frequency has been saved, the “Modify” and “Add Receiver” push buttons become active. However, for the “Add Receiver” push button to function, at least a transmitting antenna (the code “T” for Class of Antenna combo box in the relevant antenna information entry table) must have been created previously under the same Equipment. Then, by pushing “Add Receiver” button the “Add Receiver/Receiving area” dialogue box appears, which enables the user to choose the method of receiving and a transmitting antenna if more than one transmitting antenna exists for the corresponding Equipment. Figure 4.34 shows this dialogue box.

Figure 4.34. Add Receiver/Receiving Area dialogue box to define method of receiving



As illustrated in Figure 4.34, after selection of a transmitter antenna from the "Transmitting Antenna" table, one of the three receiving methods: POINT, MULTIPOINT or CIRCLE must be selected according to the following description:

- **POINT:** A method to define a point–to–point radiocommunication link from the transmitter of the selected frequency to one of the available receiving stations listed in the table POINT. The listed stations are those receiving stations (stations with the code "R" or "C" for their Class of Antenna combo box in Antenna Information entry table) created under the active license;
- **MULTIPOINT:** A method to define the shape of receiving area using a polygon with up to six vertexes. The coordinates of the polygon vertexes can be entered into the corresponding table of MULTIPOINT Section;
- **CIRCLE:** A method to define a circular receiving area with a given radius. The coordinates of the centre of the circular receiving area are relaxed to permit the user to define an off-station coverage area.
- **ZONE:** A method to define a zone as receiving area.

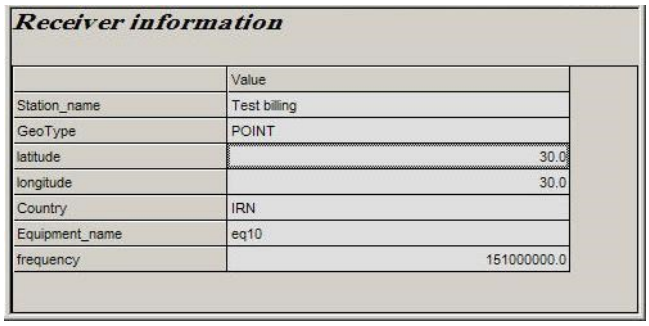
Upon pressing OK button of this dialogue box, SMS4DC creates a "Receiver Information" table in the right panel of the Administrative window which is not editable.

The content of the Receiver Information table depends on the receiving method selected in the "Add Receiver/Receiving area" dialogue box. Table 4.16 describes the fields displayed in the table of Receiving Information. Figure 4.34 shows these tables.

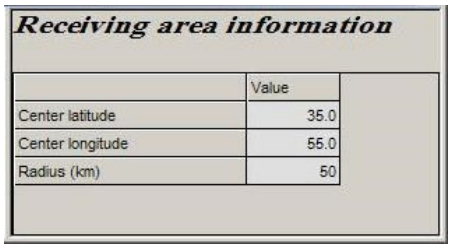
Table 4.16. Description the fields of Receiver Information entry table [(1), (2)]

Field name	Type	Description	Method			
			P	M	C	Z
Station Name	M	Name of receiving station	X			
GeoType	O	POINT, MULTIPOINT, CIRCLE, ZONE	X			
Latitude	M	Latitude of receiving station	X			
Longitude	M	Longitude of receiving station	X			
Country	O	Country where the station is situated	X			
Equipment Name	O	Name of receiving equipment	X			
Frequency	M	Receiving frequency	X			
Long. And Lat. Of up to 6 points	M	Longitude and latitude for a maximum of six points to construct a polygon		X		
Centre Latitude	M	Latitude of centre of circular receiving area			X	
Centre Longitude	M	Longitude of centre of circular receiving area			X	
Radius	M	Radius of circular receiving area in km			X	
Zone	M	Code of Zone				X
[(1)]: M: Mandatory, O: Optional, P: Point – to – point, M: Multipoint, C: Circle, Z: Zone						

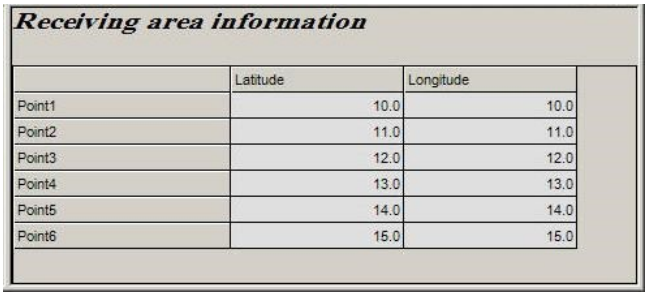
Figure 4.35. Receiver Information table in three different kinds



(a) Table of point receiver information



(b) Circular receiving area



(c) Multipoint receiving area

For definition of point–to–multipoint radiocommunication systems, a multiple receiver can be added to a transmitting frequency, using POINT receiver option in “A Receiver/Receiving Area” dialogue box.

4.11. The level of Frequency

The level of Frequency is placed between the equipment level and the Receiver level. Each frequency may be used by several receivers. Selection of a frequency in tree view, by a mouse click or other action, displays the corresponding Frequency Information table in the right panel of the Administrative window. The content of the Information table can be modified, saved or and action cancelled using the “Modify”, “Save” or “Cancel” push buttons above the table, if the relevant license has not been granted. During a modification, the tree view in the left panel of the Administrative window will be locked and, when saving a modified table, mandatory fields (field names in bold) must not be left blank, otherwise an error message is displayed. The content of the frequency table is different for different classes of station and is described in Table 4.15. Each frequency under a specific equipment has a unique value and could have an unlimited number of receivers.

The “Add Receiver” button above the Frequency Information entry table enables the user to attach additional receivers to the concerned transmitting frequency. The use of this button is explained in Section 4.6.1. A new frequency for the concerned equipment can be defined through the “New Frequency” item of the context menu in Equipment level (Section 4.6.1).

4.11.1. Context menu in the level of Frequency

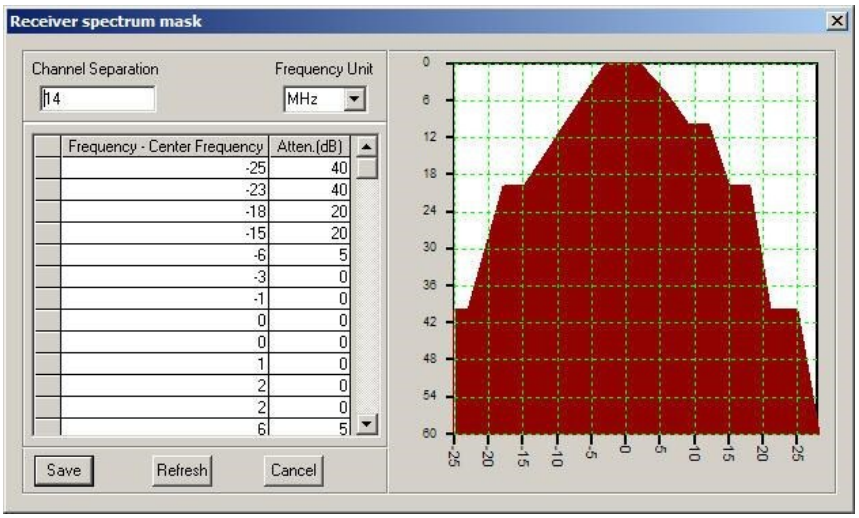
A right click on the level name opens a context menu containing: “Modify”, “Delete”, “TX Filter”, “RX Filter” and "Coordination" items. The following is a description of these items:

- Modify: This item modifies the content of the Frequency Information table, if has not been included previously in any granted license. During a modification, the tree view in the left panel of the Administrative window will be locked and, when saving a modified table, mandatory fields (field names in bold) must not be left blank, otherwise an error message will be displayed. The content of the Frequency Information table for different classes of stations is described in Table 4.15.
- Delete: This item deletes the frequency information and all other attached information in the lower level of the tree view, if has not been included in any granted license. Granted licenses cannot be deleted.
- TX Filter: This item displays or defines a transmitting emission mask for the concerned transmitting frequency. Selecting this item opens a dialogue box for entering emission mask attenuation data in up to 20 off-centre frequencies. Prior to displaying the dialogue box, a warning message will be generated to remind the user that an emission mask is lacking and an emission mask has not been defined previously. The shape dialogue box is identical to Figure 4.36 except blue is used as the fill-colour inside the emission mask. Attenuation values in the table must be positive and the refresh button is necessary to reflect any change of values to the mask picture in the right panel. Using the Save button assigns the defined emission mask to the concerned transmitting frequency.
- RX Filter: This item displays or defines a receiving emission mask for the concerned receiving frequency. Selecting this item opens a dialogue box to enter emission mask attenuation data in up to 20 off-centre frequencies. Prior to displaying the dialogue box, a

warning message will be generated to remind the user that an emission mask is lacking and an emission mask has not been defined previously. Figure 4.36 displays the relevant dialogue box. Attenuation values in the table must be positive and the refresh button is necessary to reflect any change of values to the mask picture in the right panel. Using the Save button assigns the defined emission mask to the concerned receiving frequency.

- Coordination: This item displays or defines the list of country/administration codes which are under process of coordination, together with the results of the coordination.

Figure 4.36. Dialogue box for definition of transmitting frequency emission mask



4.12. The level of Antenna

The level of Antenna is placed below the level of equipment and there are no lower levels. Each antenna can be chosen for the transmitting or receiving of frequencies assigned to the same equipment by using "Add Receiver/Receiving Area" dialogue box, as explained in Section 4.6.1. Selection of an antenna in the tree view, by a mouse click or other action, displays the corresponding Antenna Information entry table in the right panel of the Administrative window. The content of the Information table can be modified, saved or any action cancelled using the "Modify" and "Save" or "Cancel" buttons above the table, if the relevant license has not been granted. In the case of modification, the tree view in the left panel of the Administrative window will be locked and mandatory fields (field names in bold) must not be left blank, otherwise a warning message will be displayed. The content of the antenna table is described in Table 4.14.

The "Library" push button above the Antenna Information entry table enables user to use the library to attach an antenna to the corresponding equipment. Using of this button is explained in Section 4.6.1. The New antenna for the concerned equipment can be defined through the "New Antenna" item of the context menu in Equipment level (Section 4.6.1).

4.12.1. Context menu in the level of Antenna

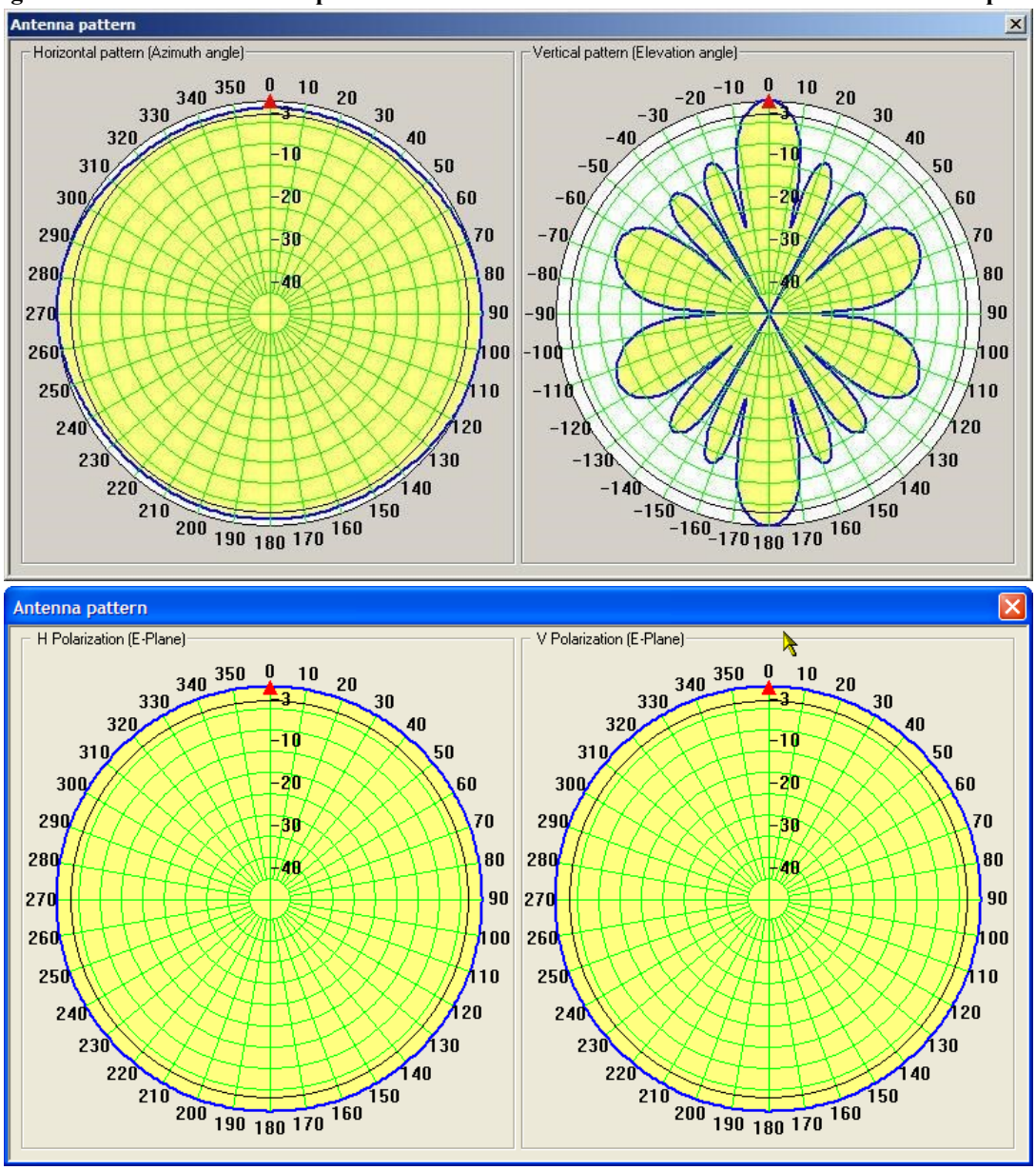
A right click on the level name opens a context menu containing the "Modify", "Delete" and "Antenna Pattern" items. The following is a description of these items:

- Modify: This item modifies the content of the Antenna Information table if has not been included previously in any granted license. During a modification, the tree view in the left

panel of the Administrative window will be locked and, when saving a modified table, mandatory fields (field names in bold) must not be left blank, otherwise an error message will be displayed. The content of the Antenna Information entry table for different classes of stations is described in Table 4.14.

- Delete: This item deletes the antenna information, if has not been included in any granted license. Granted licenses cannot be deleted.
- Antenna Pattern: This item displays antenna 2D radiation patterns in vertical and horizontal planes for horizontally or vertically polarized antennas and two horizontal planes for mixed-polarized antennas. Figure 4.37 illustrates the 2D radiation pattern of a directional antenna.

Figure 4.37. The 2D radiation pattern of a directional antenna in the vertical and horizontal plans



4.13. The level of Receiver

The level of Receiver is placed below the frequency level and is the lowest level. The method of receiving can be determined for a given transmitting frequency in same License by using the “Add Receiver/Receiving Area” dialogue box, as explained in Section 4.6.1. Modification of the Receiver Information table is not possible directly from the Receiver level and the user has to redefine the method of receiving in frequency level using the “Add Receiver” button for the corresponding Frequency Information table. The relevant procedure is explained in Section 4.6.1.

4.13.1. Context menu in the level of Receiver

A right click on the level name opens a context menu containing only the item “Delete”. This item deletes the receiving method information. The content of the Receiver Information table for different classes of stations is described in Table 4.16.

4.14. The level of Allotment

The level of allotment is placed between the license level and the contour level. Each allotment may consist of several contours as sub-areas. Selection of an allotment in the tree view by a mouse click or other action, displays a table of the corresponding Allotment Information in the right panel of the Administrative window. The content of the Information table can be modified, saved or any action cancelled using the “Modify” and “Save” or “Cancel” buttons above the table. During a modification, the tree view in the left panel of the Administrative window will be locked and, when saving a modified table, mandatory fields (field names in bold) must not be left blank, otherwise an error message is displayed. The contents of the allotment Information table are described in Table 4.2. Each allotment has a unique name and could have an unlimited number of contours.

4.14.1. Context menu in the level of Allotment

A right click on the level name opens a context menu containing the items: “Modify”, “Delete”, “New Contour”, "Attach Contour" and “Electronic Notice”. The following is a description of these items:

- Modify: This item modifies the content of an Allotment Information table. During a modification, the tree view in the left panel of the Administrative window will be locked and, when saving a modified table, mandatory fields (field names in bold) must not be left blank, otherwise an error message is displayed. The content of the Allotment Information table is described in Table 4.2.
- Delete: This item deletes the allotment and all other attached information in the lower levels of the tree view.
- New Contour: This item defines a new sub-area and attaches it to the current allotment. Selection of this item creates a blank “GE06 contour information” entry table in the right panel of the Administrative window and locks the tree view. Figure 4.38 illustrates the entry table of contour information and Table 4.17 shows the fields used in the table.

Figure 4.38. GE06 contour information entry table

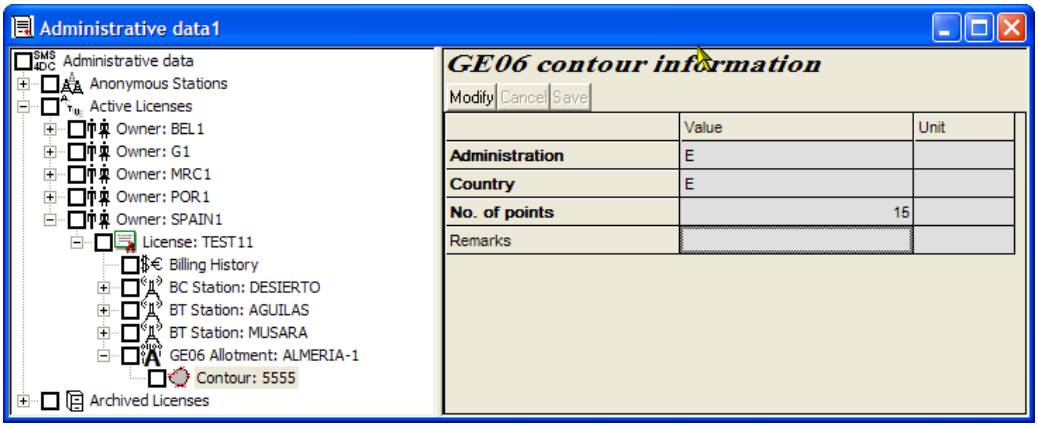


Table 4.17. Description of fields in the table of Contour Information

Field name	Type	Description
Administration	M	Administration Code
Country	M	Country Code
No. of points	M	Number of points in the contour
Remarks	O	

(1) : M: Mandatory, O: Optional

- Attach Contour: This item selects a contour from the list of existing contours in the system and attaches it to the selected allotment. By performing this item all contours are tabulated in a spreadsheet for user selection. A mouse left click can be used for selection of contours from the spreadsheet. Pressing the OK button under the spreadsheet inserts the selected contour under the corresponding allotment in tree view.
- Electronic Notice: This item generates, saves and displays the appropriate electronic notice to notify the allotments to ITU BR. As required by the specification, SMS4DC is able to generate GS2 and GT2 electronic notices for allotments. Depending on the notice type, SMS4DC displays the appropriate type electronic notice and provides options in the relevant dialogue box. The user must complete all the mandatory fields in the consequent levels of the tree view otherwise, the notice form will not be generated and an error message will be displayed.

4.15. The level of Contour

The level of contour is placed below the level of allotment. Each contour may consist of several points as a sub-area. Selection of a contour in the tree view by a mouse click or other action, displays a table of the corresponding contour information in the right panel of the Administrative window. The content of the Information table can be modified, saved or cancelled using the "Modify" and "Save" or "Cancel" buttons above the table. During a modification, the tree view in the left panel of the Administrative window will be locked and, when saving a modified table, mandatory fields (field names in bold) must not be left blank, otherwise an error message is displayed. The contents of the contour information table are described in Table 4.17. Each allotment has a unique ID and could have an unlimited number of points.

4.15.1. Context menu in the level of Contour

A right click on the level name opens a context menu containing the items: “Modify”, “Delete”, “New Contour”, "Attach Contour" and “Electronic Notice”. The following is a description these items:

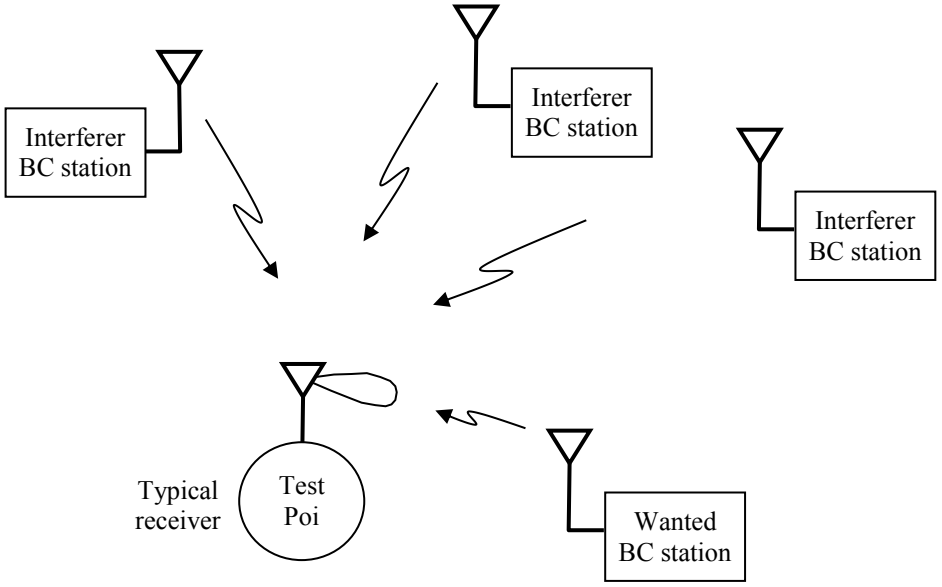
- Modify: This item modifies the content of the contour information table. During a modification, the tree view in the left panel of the Administrative window will be locked and, when saving a modified table, mandatory fields (field names in bold) must not be left blank, otherwise an error message is displayed. The content of the contour information table is described in Table 4.17.
- Delete: This item detaches the contour from this allotment. This item does not delete the contour from database so it remains accessible for attachment to other allotments.
- Contour Points: This item views or defines all of the points for this new sub-area.
- Electronic Notice: This item generates, saves and displays an appropriate electronic notice to notify the sub-areas to the ITU BR. As required by the specification, SMS4DC is able to generate GA1 electronic notice for contours. The user must complete all the mandatory fields in the consequent levels of tree view, otherwise the notice form will not be generated and an error message will be displayed.

Chapter 5. Technical Reference of SMS4DC

5.1. BC to BC interference calculation procedure

Figure 5.1. displays the configuration used in the item "Interference->BC2BC" (Section 3.4.2.13) for calculation of interference from an unwanted sound broadcasting stations to a typical receiver of a wanted sound broadcasting station.

Figure 5.1. Configuration used for calculation of interference from an unwanted BC stations to a typical receiver of a wanted BC station



The nuisance field strength of the i[th] interfering broadcasting station, E_{Si}, is calculated taking into account several factors using the formula:

$$E_{Si} = P + E_{ti} + A_i + A_r - D_P \qquad \text{dB}$$

Where:

- E_{ti} The field strength value i[th] interfering broadcasting station in dB(V/m), based on recommendation ITU-R P.1546 and normalized to the e.r.p. of 1 kW, exceeded during T percent of time
- P e.r.p. (in dB(1 kW)) of the i[th] interfering broadcasting station in the direction of test point receiver
- A_i Radio frequency protection ratio (in dB) given in recommendation ITU-R BS.412-9
- A_r Discrimination factor of the receiving antenna given in recommendation ITU-R BS.599

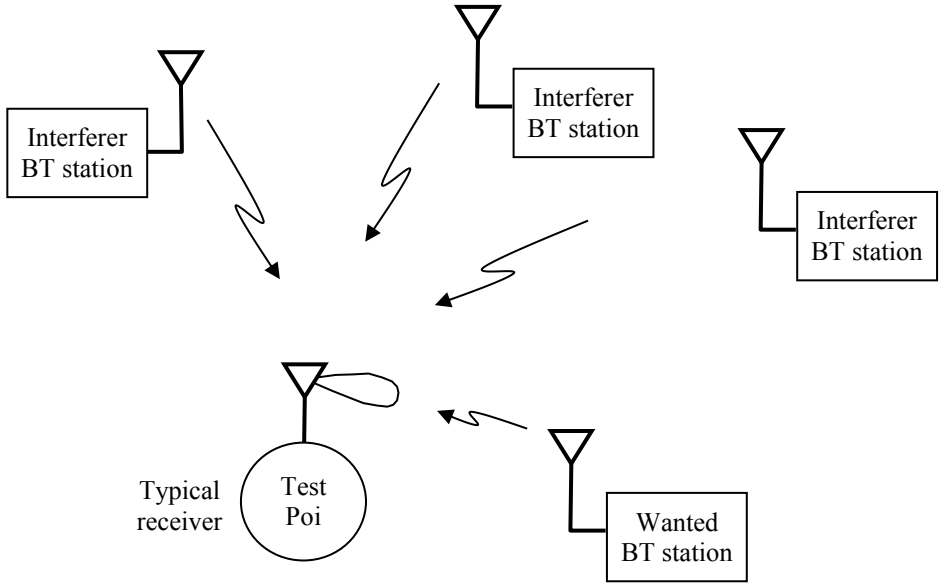
D_P Polarization discrimination which will be taken into account if polarization of the wanted station and interferer station antennas are orthogonal

Appropriate account can be taken of the effect of multiple interferers by the use of the simplified multiplication method, as a statistical computation method, or the power sum method as a non-statistical computation method. For more information see Report 945-2.

5.2. BT to BT interference calculation procedure

The item "Interference->BT2BT" (Section 3.4.2.13) is designed for the calculation of the aggregate interference level of interfering BT stations on a directional receiver of a wanted BT station. Figure 5.2 displays the configuration used for the calculation of interference from an unwanted sound broadcasting stations to a typical receiver of a wanted sound broadcasting station.

Figure 5.2. Configuration used for calculation of interference from unwanted BT stations to a typical receiver of a wanted BT station



The nuisance field strength of the i[th] interfering broadcasting station, E_{Si} is calculated, taking into account several factors, using the formula:

$$E_{Si} = P + E_{ti} + A_i + A_r - D_P \qquad \text{dB}$$

Where:

E_{ti} The field strength value of the i[th] interfering broadcasting station in dB(V/m), based on ITU-R P.1546 recommendation and normalized to the e.r.p. of 1 kW, exceeded during T percent of time

P e.r.p. (in dB(1 kW)) of the i[th] interfering broadcasting station in the direction of test point receiver

A_i Radio frequency protection ratio (in dB) given in recommendation ITU-R BT.655-7 for the case of co-channel and upper/lower adjacent channels

A_r Discrimination factor of the receiving antenna given in ITU-R BT.419-3 recommendation

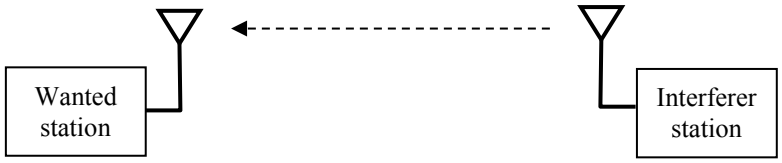
D_P Polarization discrimination which will be taken into account if polarization of wanted station and interferer station antennas are orthogonal

Appropriate account can be taken of the effect of multiple interferers by the use of the simplified multiplication method as a statistical computation method, or the power sum method as a non-statistical computation method. For more information see Report 945-2.

5.3. Interference between stations in the Fixed and Land mobile services

The sub item "FXM->Interference to (Free Space and P.1546)" in the "Interference" menu (Section 3.4.2.13.1) has been implemented for the calculation of interference produced/experienced by stations in the land mobile service (any frequency) and the fixed service (below 1GHz) on each other by consideration of receiving antenna radiation pattern. For all cases, the configuration displayed in Figure 5.3 is used for the interference calculation.

Figure 5.3. Configuration used for the calculation of interference between a wanted and an interferer station in the fixed and mobile services



The field strength level E of an interferer station on a wanted receiving station, is calculated by either the Free Space (ITU-R P.525) or ITU-R P.1546 propagation models. A station may be considered as having interference if E is greater than the reference field strength value E_{limit} where E_{limit} is:

$$E_{\text{limit}} = E_{\max} - G_r + C + A_r + k\Delta f \qquad \text{dB}$$

Where:

$E_{\max}$ Maximum permissible interference field strength

G_r Receiver antenna gain

A_r Discrimination factor of the receiving antenna (positive value)

C 2.1 for e.i.r.p power type otherwise is zero

$k\Delta f$ The correction factor for the permissible interference field strength at different nominal frequencies based on the Berlin Agreement, Annex 3A

5.4. Interference between stations in the Fixed service above 1 GHz

The item "Interference->FX2FX" (Section 3.4.2.13) has been implemented to calculate interference between fixed above 1GHz in accordance with recommendation ITU-R P.452 by consideration of the antenna patterns and the Net Filter Discrimination (NFD). The configuration used for the

interference calculation is displayed in Figure 5.3 above. The interference level I caused by an interfering fixed station is calculated using:

$$I = P_{TX} + G_{TX} - A_P + G_{RX} - NFD - D_P \qquad \text{dB}$$

where:

- A_P Propagation loss calculated based on Rec. P. 452 in dB
- G_{TX} Transmitter antenna gain in direction of receiver in dB
- G_{RX} Receiver antenna gain in direction of transmitter in dB
- NFD Net Filter Discrimination in dB, calculated using TX and RX emission masks
- P_{TX} Transmitter power
- N Noise power ($K \cdot T \cdot B \cdot F$)
- D_P Polarization Discrimination in dB which will be taken into account when polarization of wanted and interferer station antennas are orthogonal

In addition to the interference level I , caused by an interfering fixed station, which may be compared with a reference acceptable interference level; the permissible Threshold Degradation of a receiver could be used to identify an occurrence of interference. The Threshold Degradation of the victim receiver can be calculated as follow:

$$TD = 10\log\left(1 + 10^{0.1(I-N)}\right) \qquad \text{dB}$$

Where symbols I and N are defined above.

A station may be considered as having interference if the Threshold Degradation is greater than Permissible Threshold Degradation.

Chapter 6. Functional Reference of SMS4DC

6.1. Establishing a station

As explained in Section 3.5, in terms of SMS4DC notation and irrespective of the kind of radiocommunication service, a radiocommunication station may be classified into one of the types: anonymous, active or archived. Anonymous stations are those created visually, on a map display, by using a mouse and the toolbar buttons, as explained in Section 3.4.1. Stations created in this way may be transferred to active licenses, as explained in Section 4.4.1. Figure 3.41 and Figure 3.48 provide the relevant entry masks. Furthermore, if a license has been created, the user may also employ the Administrative Section of SMS4DC to establish a station. Establishing radiocommunication stations under active licenses is explained in Section 3.4.1.

Stations of cancelled licenses are those stations covered by archived licenses. Information about archived stations may be reviewed but without any functionality (read only).

6.2. Finding a station

The capabilities provided by the items of the "Database" menu enable the user to find anonymous and active stations in the following cases:

- Finding stations by name: the user may use items "Display Selected Station(s)" and "Station(s) in Desktop" to find and display station(s) by name. Further explanation is given in Section 3.4.2.8.
- Finding stations by location and/or frequency condition: the sub-items "Search Station->By Location", "Search Station->By Location and Frequency" and "Search Station->List of Listed Station(s)" of "Database" menu provide a range of facilities to search for a station or group of specific stations.

6.3. Changing the DEM map

In addition to the integrated vector maps and Globe DEM installed with SMS4DC, users are able to define two additional user-defined DEMs through the sub-items "Tools->Map Layers->UserMap1" and "Tools->Map Layers->UserMap2". Each DEM consists of a "layer description text file" and a folder containing the files of the digital map tiles. These explanatory text files have the reserved names: Globe.txt, UserMap1.txt and UserMap2.txt. They are responsible for the layer description of maps used in the three sub-items and are stored in the folder "…\SMS4DC\Texts". The format of these files is explained in Annex 1.

An example for the numbering of map-tile files is shown in Figure 1.3.

6.4. Restoring the database from a backup

- On a regular basis, the local database of SMS4DC should be saved in the folder "…\SMS4DC\DB". The command "Database->Backup" generates a single backup mdb file with the name SMS-New*yyymmdd*.mdb. This file is saved in a user-defined location, or, into the path "…\SMS4DC\BackUp" by default. The following instructions explain the procedure for restoring backup database file:
    1. Delete "*yyymmdd*" part of the backup filename;

2. Copy mdb file into the folder "…\SMS4DC\DB"

6.5. Path profile extraction

SMS4DS can display path profiles along straight lines or polylines following a direct command or indirectly, in the context of other functions, such as field strength calculations:

a) Draw a line or polyline using one of the toolbar buttons "Draw Line", "Draw Polyline" or "Draw Line from Database" as explained in Section 3.4.1.

b) Use the "Draw Profile" button (Section 3.4.1) or one of the items provided in the "Profile" menu, as explained in Section 3.4.2.7.

6.6. New antenna definition

The item "Tools->Antenna Editor", described in Section 3.4.2.5.1, provides an interface to define the radiation pattern and characteristics of a new antenna. Also, changing an existing antenna name to a new name and saving it, will create a new antenna. Therefore, users may create a new antenna by modification of characteristics of an existing antenna with similar characteristics. Information about each antenna is stored in a file in the folder "…\SMS4DC\Antenna" and the format of file is explained in the Annex 2.

6.7. User account management

The nature of spectrum management implies that different users will need to be given different levels of access permission to the SMS4DC features and database. Therefore, six different access levels are provided for the SMS4DC software and these are explained in Section 3.2. Among these six different access levels, only the system *supervisor*, as administrator, is allowed to define and cancel User-ID and Passwords for other users through the "Database–>Users" item. Figure 3.2 displays the menu of User-ID and Password management. Full description of user accounts is explained in Section 3.2. Moreover, the history of the actions taken by different users is logged by an audit-trail system which can be reviewed through the item: "Database->Audit Trail" (Section 3.4.2.8).

6.8. Importing information published by the ITU-BR

Information of two types of periodic BR-Publications can be imported into the local database of SMS4DC. The items: "Database->Import from BR IFIC (Terrestrial Services)" and "Database->Import from BR IFIC (Space Services)" (Section 3.4.2.8) are able to query the information on the BR-IFIC terrestrial database and space BR-IFIC database, respectively. The BR-IFIC Terrestrial database contains a list of notified terrestrial stations and the BR-IFIC /space BR-IFIC contains a list of notified earth stations. If either of these databases is to be available for SMS4DC use, they must be installed prior to the installation of SMS4DC.

6.9. Field strength calculation

This item in the menu "Propagation Models" (Section 3.4.2.9) enables the user to calculate field-strength along a line, poly-line, inside a selected rectangular area and at end-points of a link. The field strength calculation may use free-space, LOS (line of sight), ITU-R recommendation P.1546, ITU-R recommendation P.370, Okumura-Hata, ITU-R recommendation P.526 (considering both diffraction and smooth earth models separately), ITU-R recommendation P.452 and ITU-R

recommendation P.530 propagation models. Two types of network processing sub-items have developed under the free-space, ITU-R recommendation P.370, ITU-R recommendation P.1546 and Okumura-Hata propagation models. Moreover, in this menu, an item is available for calculation of the Earth-space path loss, using the ITU-R recommendation P.618 propagation model. The sub-items implemented for these propagation models are summarized in Table 3.2.

6.10. Modification of a frequency allocation

The Frequency Allocations menu (Section 3.4.2.11) provides the user with the regional and national frequency allocations table (FAT), frequency allocations chart, national frequency assignment plans and frequency assignment utility.

The "Frequency Allocations->Draw Chart" "Edit" menu provides three powerful items: "Plan", "Service Table" and "Footnotes" to edit the content of the frequency allocations table and change chart colours. Using the "Plan" item, the user is able to browse and edit the content of integrated FATs, with up to six primary services and up to six secondary services. Figure 3.87 shows the relevant dialogue box and browsing toolbar. A full description of the implemented features is available in Section 3.4.2.11.

6.11. Addition of footnotes

All footnotes to the tables of frequency allocations are accessible through the item "Frequency Allocations->Draw Chart->Edit->Footnote". This item provides the user with a facility for footnote modification or definition. Figure 3.89 displays the footnote editor dialogue box. The user may type free-form footnote text in any one of the Windows supported languages.

Furthermore, users are able to add more footnotes to the footnote list of the active FAT. A description of the browsing toolbar, integrated with the footnote editor dialogue box, is given in Table 3.4. The new footnotes can be assigned to the sub-bands of FAT using the item "Frequency Allocations->Edit->Plan" (see Figure 3.87). A full description of the implemented features is available in Section 3.4.2.11.

6.12. Definition and modification of frequency arrangements

SMS4DC is able to accept all types of frequency arrangements. The item "Frequency Allocations->Frequency Arrangement" enables users to browse, define and print a report of national frequency arrangement plans. These plans may have one of three formats; homogeneous, uniform and non-uniform. A full description of the implemented features is available in Section 3.4.2.11.

Moreover, a complete list of all assignable frequencies, from all the frequency arrangement plans, can be viewed using the item "Frequency Allocations->Frequency Table".

6.13. Frequency assignment

SMS4DC is powered by an advanced method of frequency assignment to a concerned station (in the Fixed, Land Mobile or Broadcasting services), based on interference calculations to/from any other stations (in these services) in a given frequency band inside a circular search area. This procedure is implemented in the item "Frequency Allocations->Frequency Assignment" and is started by choosing a national station to which a frequency is to be assigned and terminates by selecting one of the frequencies that, after comprehensive interference analysis, has been suggested as suitable for assignment. These frequencies are listed in a table of assignable frequencies (Figure 3.92) that meet

the overall user–defined assignment conditions. Multiple frequency assignment is supported for a single station. A full description of procedures implemented is available in Section 3.4.2.11.

In addition to the feature described above, there are other parts of SMS4DC software which, indirectly, assist in the task of frequency assignment. For example, items provided in the "Coordination" menu permit the user to assess the availability of a frequency with respect to the other stations in neighbouring counties, in accordance with the procedures of a regional plan. Section 3.4.2.12 describes the implementation of procedures for regional plans in the "Coordination" menu.

The Interference menu is also another powerful tool provided by SMS4DC for the calculation of interference between terrestrial (Fixed, Land Mobile or Broadcasting) services and between terrestrial services and Earth stations in the space radiocommunication service. Section 3.4.2.13 explains the relevant items.

6.14. Interference calculation

Interference calculations of SMS4DC are implemented in the "Interference" menu for several types of wanted-victim stations configuration (Section 3.4.2.13). Interference calculation procedures are provided in this menu for the following situations: BC - BC (FM sound broadcasting stations), BT - BT (TV broadcasting stations), FX – FX (point to point hops), FX – FX (fixed stations on each other), ES - ES (earth stations), ES - FX and FX – ES.

6.15. Billing in SMS4DC

Since no harmonized procedure for frequency fee calculation has been adopted yet by the ITU member administrations, SMS4DC provides the user with a procedure for the management of regular payments of frequency-fees. As shown in Figure 4.28, for each radiocommunication license, the "Billing History" level in the administrative hierarchy deals with frequency fees. Section 4.9 explains the method for keeping a billing history of licenses.

6.16. Importing a vector file and depicting on map

The item "Vectors->Draw from File" is designed to load a vector file from memory and display it on the DEM. The format of vectors in SMS4DC is explained in Annex 2. By selection of this item SMS4DC requests the user to select a vector file from the relevant folder on the hard disk. Then, vector colour and fill style must be defined using the displayed dialogue box. Further description of this item is presented in Section 3.4.2.10. Additional vector functions are available in "Vectors" menu.

6.17. Production of BR electronic notices

The item "Notice" in the context menu of level of Earth Station and the item "Electronic Notice" in the context menu of level of Station are designed to generate ITU-BR electronic notice forms. If the user has completed all the mandatory fields of these notices, they will be ready for submission to the ITU. Section 4.5.1 and Section 4.8.1 explains the procedures for producing electronic notices for Earth stations and terrestrial stations respectively. For terrestrial stations, the following notice forms may be generated: T01, T02, TB1, TB2, TB3, TB4, TB5, T11, T12, T13, T14, G11, G12, G13, G14, GA1, GB1, GS1, GS2, GT1, GT2 and G02.

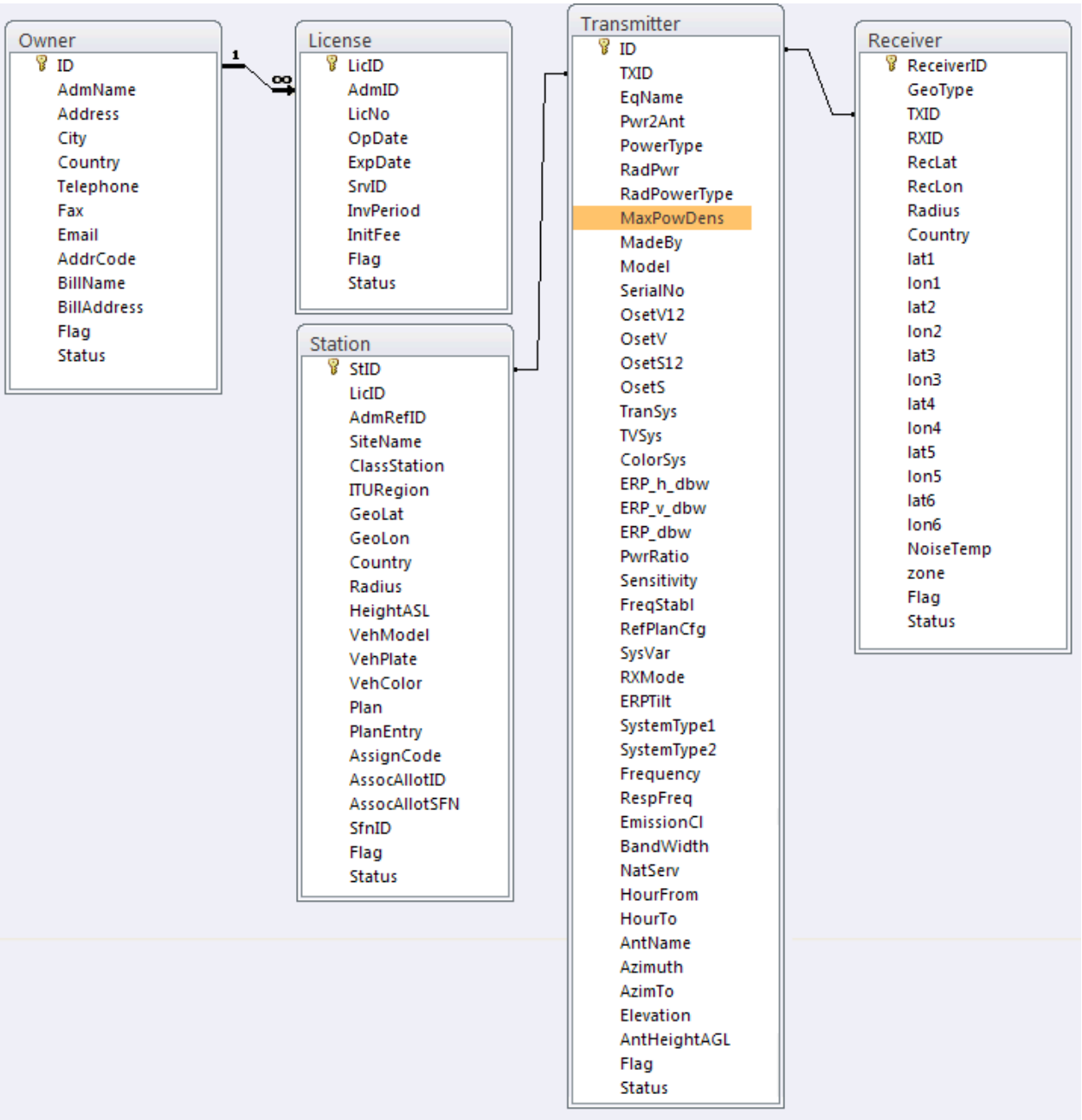
6.18. Customization of SMS4DC

In line with the ITU recommendations, publication circulars, SMS4DC requirements and experience gained globally; SMS4DC software has been developed to fulfil the daily needs of administrations in performing the technical and administrative tasks of spectrum management. Therefore, it is deemed to comply with the professional objectives of a Spectrum Management System for developing countries. However, technical staff of the ITU may provide the following customization services at the request of administrations:

- Migration of an existing national electronic database of frequency assignment into the local database of SMS4DC;
- Developing national reports and radio frequency license printouts;
- Integration of the national frequency allocations table (N-FAT);
- Development of more administrative / technical features by individual request;
- Personal training of local experts in the application and administration of SMS4DC.

Annex 1 - Database Manager

Entering the existing data to SMS4DC is usually a time consuming and error prone job. In order to facilitate this process, a tool is provided separately to the SMS4DC package to the users requiring it. As each user has its own unique data structure and format, a database container in Microsoft Access format is defined and in which the user should put his data in the defined format. This container database is called ImportTemplate.mdb and can be found in the DB folder of the SMS4DC installation. It contains five tables which are linked together with some key data items (Following Figure).



As shown in the structure of the container, there are so many data items in those five tables. There are two fields named “Flag” and “Status” which are common in all tables. These two fields should be left empty by the user as the import tool uses these fields to communicate the import result and problems with the user. All other fields should be filled according to the requirements in the following table:

Table	Field	Type	Description
Owner	ID	Long integer	Unique ID of each Owner
	AdmName	Text	Name of the Owner authority
	Address	Text	Address of the Owner authority
	City	Text	City of the Owner authority
	Country	Text	Country code of the Owner authority (Annex 1)
	Telephone	Text	Telephone of the Owner authority
	Fax	Text	Fax of the Owner authority
	Email	Text	Email of the Owner authority
	AddrCode	Text	
	BillName	Text	Name of the Owner billing authority
	BillAddress	Text	Address of the Owner billing authority
License	LicID	Long integer	Unique ID of each License
	AdmID	Long integer	The ID of its corresponding owner in the Owner table
	LicNo	Text	Number of license given by the Administration
	OpDate	Date	Date of beginning of operation of this license
	ExpDate	Date	Expiring date of this license
	SrvID	Text	Code of the radiocommunication service of this license (one of these values): - B: broadcasting - F: fixed - MT: land mobile
	InvPeriod	Text	Invoicing period (one of these values):

			- Monthly - Bi-monthly - Quarterly - Annually
	InitFee	Long integer	Licensing fee
Station	StID	Long integer	Unique ID of the station
	LicID	Long integer	ID of its corresponding license in the License table
	AdmRefID	Text	ID given to this assignment by the Administration
	SiteName	Text	Station name
	ClassStation	Text	Class of station (one of these values): - BC: sound broadcasting station (broadcasting service) - BT: television broadcasting station (broadcasting station) - FB: fixed base station (land mobile service) - FX: fixed station (fixed service) - ML: mobile station (land mobile service)
	ITURegion	Integer	ITU-R region code (one of these values): 1 2 3
	GeoLat	Double	Latitude of the geographical coordinates
	GeoLon	Double	Longitude of the geographical coordinates
	Country	Text	Administration code (Annex 1)
	Radius	Long integer	Radius of the service area (in kilometers)
	HeightASL	Long integer	Height of the station above sea level (in meters)
	VehModel	Text	Model of the vehicle having mobile station
	VehPlate	Text	Plate number of the vehicle having mobile station
	VehColor	Text	Color of the vehicle having mobile station
	Plan	Text	Fragment or Plan of the frequency assignment

			- Article 11 - Geneva 1984 - Geneva 1989 - Geneva 2006A - Geneva 2006D - Geneva 2006L
	PlanEntry	Integer	Plan Entry Code (refer to Geneva 2006 Plan)
	AssignCode	Text	Assignment Code (refer to Geneva 2006 Plan)
	AssocAllotID	Text	Associated Allotment ID (refer to Geneva 2006 Plan)
	AssocAllotSFN	Text	Associated Allotment SFN (refer to Geneva 2006 Plan)
	SFNID	Text	SFN ID (refer to Geneva 2006 Plan)
Transmitter	ID	Long integer	Unique ID of the record
	TXID	Long integer	ID of the related station in the Station table
	EqName	Text	Equipment Name
	Pwr2Ant	Double	Power to Antenna
	PowerType	Text	Power Type
	RadPwr	Double	Radiated Power
	RadPowerType	Text	Type of Rad. Power
	MaxPowDens	Double	Maximum Power Density
	MadeBy	Text	Manufacturer
	Model	Text	Model
	SerialNo	Text	Serial no.
	OsetV12	Long integer	Vision Carr. Freq. Offset
	OsetV	Long integer	Vision Carr. Freq. Offset (kHz)
	OsetS12	Long integer	Sound Carr. Freq. Offset
	OsetS	Long integer	Sound Carr. Freq. Offset (kHz)

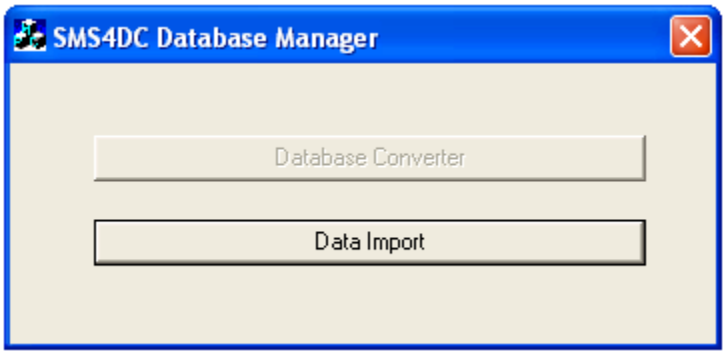
	TranSys	Integer	FM transmission system
	TVSys	Text	TV System
	ColorSys	Text	Color System
	ERP_h_dbw	Double	Max. erp of the horiz. polarized component
	ERP_v_dbw	Double	Max. erp of the vert. polarized component
	ERP_dbw	Double	Max. Overall erp in horiz. plane
	PwrRatio	Double	Power Ratio
	Sensitivity	Double	Sensitivity
	FreqStabl	Text	Frequency stability
	RefPlanCfg	Text	
	SysVar	Text	
	RXMode	Text	
	ERPTilt	Double	ERP Beam Tilt dbw
	SystemType1	Text	
	SystemType2	Text	
	Frequency	Double	Assigned Frequency
	RespFreq	Double	Response Frequency
	EmissionCl	Text	Class of Emission
	BandWidth	Double	Band Width kHz
	NatServ	Text	Nature of Service
	HourFrom	Text	Op. Hour (From)
	HourTo	Text	Op. Hour (To)
	AntName	Text	Antenna Name
	Azimuth	Double	Azimuth of Maximum Radiation

	AzimTo	Double	Rot. Azimuth (to)
	Elevation	Double	Elevation
	AntHeightAGL	Double	Antenna Height AGL
Receiver	ReceiverID	Long integer	Unique ID of the receiver
	GeoType		Type of geographic area (POINT, CIRCLE, MULTIPOINT or ZONE)
	TXID		ID of the related transmitter in the Transmitter table
	RXID		Reserved for future use
	RecLat		Latitude of the receiver (decimal)
	RecLon		Longitude of the receiver (decimal)
	Radius		Radius of the receiving area (km)
	Country		Country code of the receiver
	Lat1		Latitude of the first vertex of the receiving polygon
	Lon1		Longitude of the first vertex of the receiving polygon
	Lat2		Latitude of the second vertex of the receiving polygon
	Lon2		Longitude of the second vertex of the receiving polygon
	Lat3		Latitude of the third vertex of the receiving polygon
	Lon3		Longitude of the third vertex of the receiving polygon
	Lat4		Latitude of the fourth vertex of the receiving polygon
	Lon4		Longitude of the fourth vertex of the receiving polygon
	Lat5		Latitude of the fifth vertex of the receiving polygon
	Lon5		Longitude of the fifth vertex of the receiving polygon

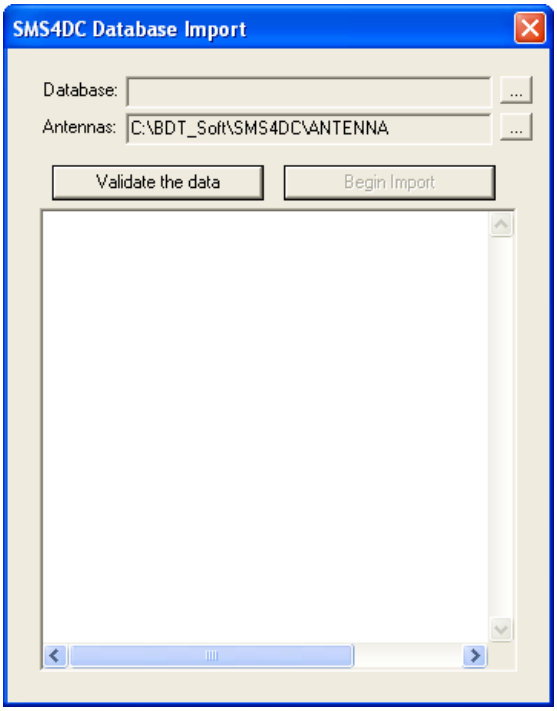
	Lat6		Latitude of the sixth vertex of the receiving polygon
	Lon6		Longitude of the sixth vertex of the receiving polygon
	NoiseTemp		Noise temperature (degree Kelvin)
	Zone		3 letter code of the receiving zone

In order to begin the import process, it is recommended to copy the ImportTemplate.mdb to another folder and fill this copied database file (e.g. Import.mdb) with the data that you wish to import. By doing this you will keep the original ImportTemplate.mdb untouched and you can use it again for your future import tasks. It is very important to create the antenna file for each antenna used in the Transmitter table. These antenna files should be created by SMS4DC and be copied in the Antenna folder of the SMS4DC installation.

When the data is completely and correctly placed in the Import.mdb then you need to execute the DBManager.exe which can be found in the BIN folder of the SMS4DC installation. The following screen may appear after the execution of this tool.

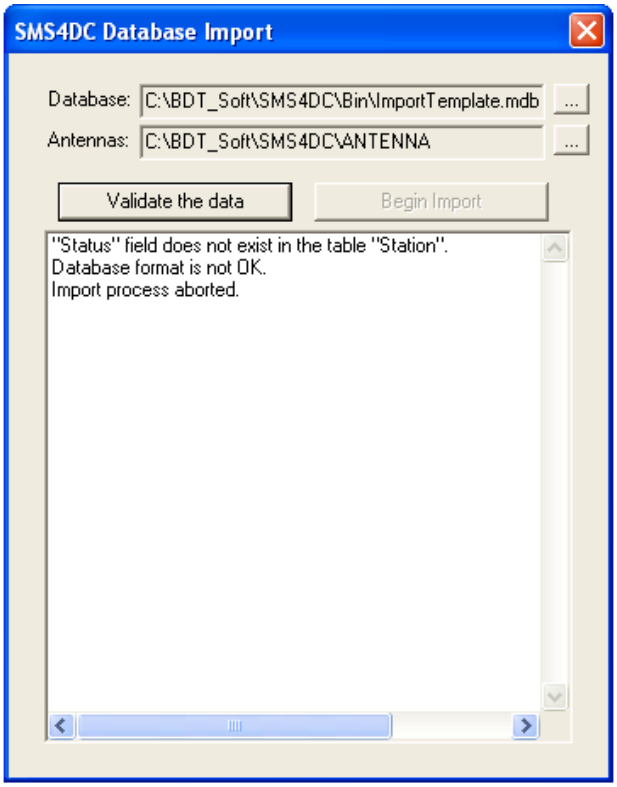


You may press the “Data Import” button and the following screen will appear.

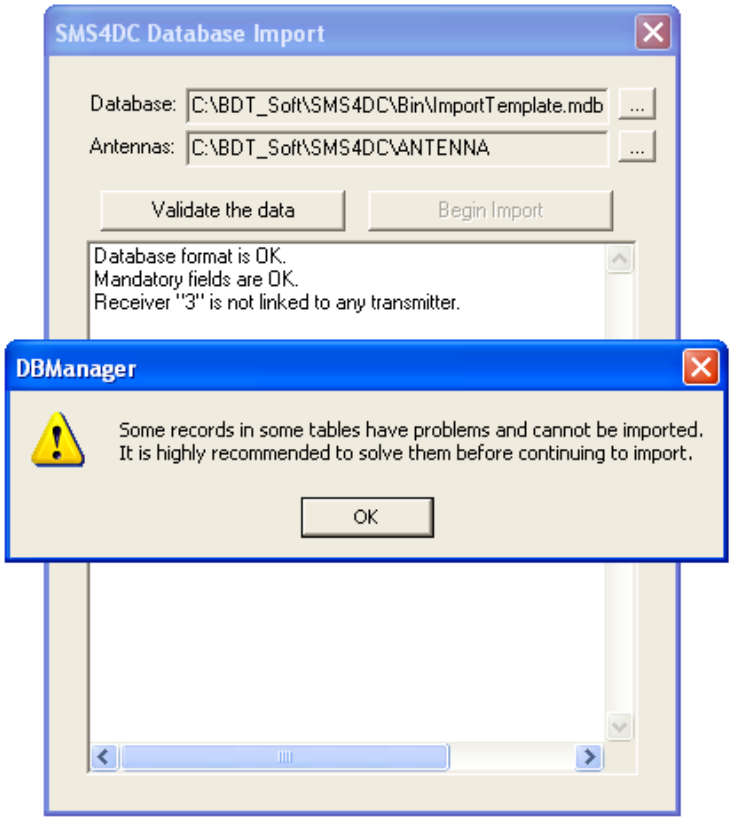


Now the database containing the import data should be selected (Import.mdb in our example). By pressing the “Validate the data” button the validity of the database and the data entered in each table and each record is checked and a report will be shown on the screen. Of course the Flag and Status fields in each table will show the reason for possible validation errors.

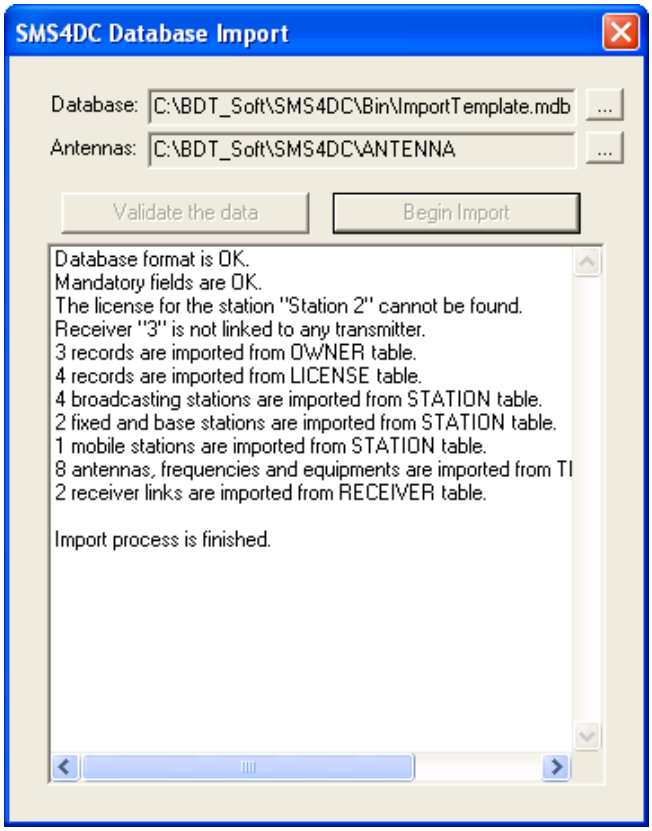
There might be major or minor errors in the data. In case of major errors, the validation check will be aborted and it is not possible to import the data. The problems should be solved externally and the validation check should be performed again. The following screen shows an example of such situation.



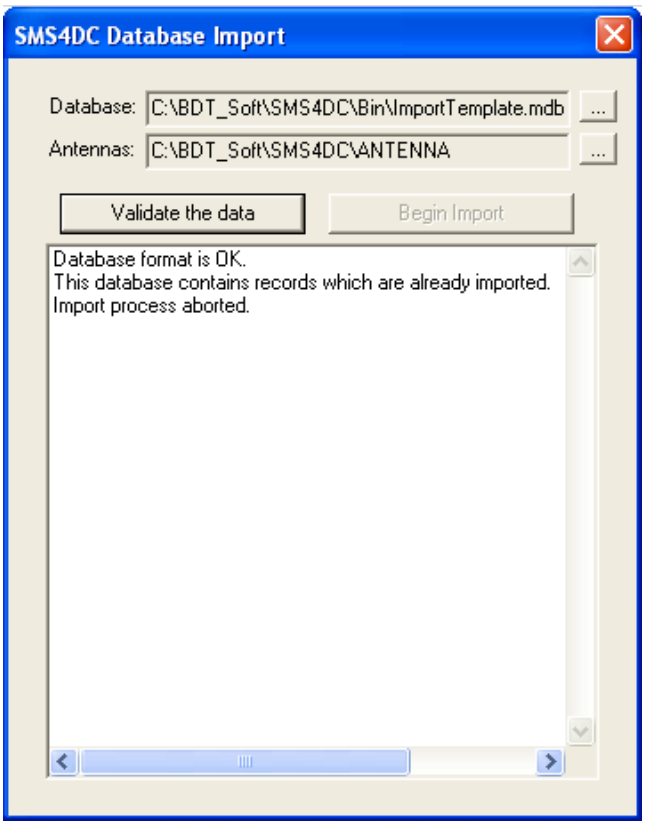
In case of minor errors, a warning message will be shown but it is possible to continue importing the validated information. The following shows an example of this situation.



After successful validation of the data, by pressing “Begin Import” the import process will begin. Related to the number of records in the import database, this process may be lengthy and needs several minutes to finish. When finished, an activity report will be shown on the screen as shown below.



The import tool will not let importing the data twice. The following message will be shown if an already imported database is chosen.



This tool makes a backup copy of the main database of SMS4DC in the BACKUP folder of the SMS4DC installation directory, before each import. In case you need to revert the import changes back, please refer to the BACKUP folder and check the time and date stamp of the database files for the desired backup version. Then you simply need to copy the backed up file to the DB folder and rename it to SMS-NEW.mdb.

Annex 2 - Formats

Map formats

The key information of 3D digital raster map tiles, integrated into the SMS4DC software by default, is stored in the file Globe.txt. The content of this information file is as following:

Item in file	Description	Example in Globe.txt
FilesPath	Location of tiles file	C:\bdt_soft\SMS4DC\globe\
FilesPerfix	Prefix used to save tiles, i.e. globe_01_01.dat	globe
Lower_left_x	Longitude of lower left of whole map (tile 01_01) in degrees	-179.995833333333334
Lower_left_y	Latitude of lower left of whole map (tile 01_01) in degrees	-89.995833333333334
Resolution_x	Resolution along equator in degrees	0.00833333333334
Resolution_y	Resolution along meridians in degrees	0.00833333333334
Number_pixel_x	Number of pixels along x of each tile	600
Number_pixel_y	Number of pixels along y of each tile	600
AreaExtendX	Not used	0
AreaExtendY	Not used	0
Nxmax	Number of tiles along x (parallel to the equator)	72
Nymax	Number of tiles along y (parallel to the meridians)	36
NoDara	Void pixels	-500
Precision	Number of bits used for saving each value in files	int16
MachineFormat	The format applied to the precision for saving values	L
MapType	Type of map	Topo

Vector file formats

The format of vectors in SMS4DC is a simple two column table, saved in ASCII format in the txt files. Each row of the table, represents the longitude and latitude of each vertex of vector and the consequent vertexes appear in consequent rows of the table. The end point of vectors is distinguished by the row “NaN NaN”, otherwise consequent rows will be connected together.

Antenna file formats

Antenna radiation patterns are held in text files (ASCII files with *.ant file name) containing following information:

Item	Description	Example
Name	Antenna name	V886_dat
Gain_dBi	Antenna gain in dBi	15.000000
BeamWidth_H	Horizontal 3dB beamwidth of antenna	36.000000
BeamWidth_V	Vertical 3dB beamwidth of antenna	39.000000
Frq_Lo	Lower edge of antenna working frequency band	886.000000
Frq_Hi	Upper edge of antenna working frequency band	896.000000
Frq_unit	A code presenting frequency unit	MHz
Polarization	A code to indicate the polarization of antenna.	V
Pattern	A 360x3 matrix containing attenuation values (in dB) of 2D patterns in horizontal and vertical planes. First column is the angle for which the attenuation values are given in the second/third columns for the horizontal and vertical planes.	0 0.0162 20.424 1 0.0813 20.719 : : : 359 0.0166 20.542

Annex 3 - References

ITU–R Recommendations

BS.412-9: Planning standards for terrestrial FM sound broadcasting at VHF

BS.599: Directivity of antennas for the reception of sound broadcasting in band 8 (VHF)

BS.1195: Transmitting antenna characteristics at VHF and UHF

BT.419-3: Directivity and polarization discrimination of antennas in the reception of television broadcasting

BT.470: Conventional analogue television systems

BT.655: Radio-frequency protection ratios for AM vestigial sideband terrestrial television systems interfered with by unwanted analogue vision signals and their associated sound signals

F.699: Reference radiation patterns for fixed wireless system antennas for use in coordination studies and interference assessment in the frequency range from 100 MHz to about 70 GHz

P.310: Definitions of terms relating to propagation in non-ionized media

P.370-7: VHF and UHF propagation curves for the frequency range from 30 MHz to 1 000 MHz

P.452-15: Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz

P.453-9: The radio refractive index: its formula and refractivity data

P.525-2: Calculation of free-space attenuation

P.526-8: Propagation by diffraction

P.527-3: Electrical characteristics of the surface of the Earth

P.529-3: Prediction methods for the terrestrials land mobile service in the VHF and UHF bands

P.530-15: Propagation data and prediction methods required for the design of terrestrial line-of-sight systems

P.618: Propagation data and prediction methods required for the design of Earth-space telecommunication systems

P.676-5: Attenuation by atmospheric gases

P.836-3: Water vapour: surface density and total columnar content

P.837-4: Characteristics of precipitation for propagation modelling

P.838-2: Specific attenuation model for rain for use in prediction methods

P.841-4: Conversion of annual statistics to worst-month statistics

P.1546-5: Method for point-to-area predictions for terrestrial services in the frequency range 30 MHz to 3 000 MHz

P.1812-3 A path-specific propagation prediction method for point-to-area terrestrial services in the VHF and UHF bands

S.456: Reference Earth-Station Radiation Pattern for use in Coordination and Interference Assessment in the Frequency Range from 2 to about 30 GHz

SF.1006: Determination of the Interference Potential between Earth Stations of the Fixed-Satellite Service and Stations in the Fixed Service

SM.1048: Design guidelines for a basic automated spectrum management system (BASMS)

SM.1049-1: A Method of Spectrum Management to be used for Aiding Frequency Assignment for Terrestrial Services in Border Areas

SM.1370-1: Design guidelines for developing advanced automated spectrum management systems

SM.1413-1: Radiocommunication Data Dictionary for notification and coordination purposes (2003 & Oct. 2004)

SM.1448: Determination of the Coordination Area around an Earth Station in the Frequency Bands Between 100 MHz and 105 GHz

SM.1604: Guidelines for an upgraded spectrum management system for developing countries (2003)

BR Circular Letters

CR/120: Forms of notice and formats for electronic notification of VHF/UHF television and VHF sound broadcasting assignments

CR/118: Forms of notice and file formats for electronic notification of frequency assignments to stations in the fixed, mobile and other terrestrial services (excepting the broadcasting service in the LF/MF and VHF/UHF bands)

CR/261: File formats for submission of electronic notices related to assignments of terrestrial services other than broadcasting in the planning area and bands governed by the Regional Agreement relating to the planning of the digital terrestrial broadcasting service in Region 1 (parts of Region 1 situated to the west of meridian 170E and to the north of parallel 40S, except the territory of Mongolia) and in the Islamic Republic of Iran, in the frequency bands 174 230 MHz and 470-862 MHz

CR/262: File formats for submission of electronic notices related to analogue and digital broadcasting assignments/allotments for the application of Articles 4 and 5 of the Regional Agreement GE06

CR/264: Updates regarding the contents of the BR International Frequency Information Circular (BR IFIC) for Terrestrial Services

CR/270: Guidelines for submission of electronic notices related to assignments of terrestrial services other than broadcasting in the planning area and bands governed by the Regional Agreement Geneva 2006

Regional agreements

Berlin Agreement: Agreement between the Administrations of Austria, Belgium, the Czech Republic, Germany, France, Hungary, the Netherlands, Croatia, Italy, Liechtenstein, Lithuania, Luxembourg, Poland, Romania, the Slovak Republic, Slovenia and Switzerland on the co-ordination of frequencies between 29.7 MHz and 39.5 GHz for the fixed service and the land mobile service. Berlin, 28 November 2003

ST61: Regional agreement for the European broadcasting area

GE84: Regional Agreement relating to the Use of the Band 87.5 – 108 MHz for FM Sound Broadcasting (Region 1 and part of Region 3) (revised 2006)

GE89: Regional Agreement (Geneva, 1989) Relating to the Planning of VHF/UHF Television Broadcasting in the African Broadcasting Area and Neighbouring Countries (revised 2006)

GE06: Regional Radiocommunication Agreement (Geneva, 2006) for planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3, in the frequency bands 174-230 MHz and 470-862 MHz

Other documents

Preface to the BR International Frequency Information Circular (Terrestrial Services), English Edition BR IFIC 2609

Description of the ORM-Interface, Monitoring Software R&S ARGUS, Version 5.3 3030.6512.42

Description of the SMDI-Interface, Monitoring Software R&S ARGUS, Version 5.2 3030.6529.42

Spectrum Monitoring Interface Specifications, ESMERALDA, Version 46 250 391 10 - 506

After Sale Service

In order to facilitate the SMS4DC operations, ITU provides backstopping to the SMS4DC licensees. This support service includes:

- Answers/solutions to questions/problems with respect to installation, operation and maintenance of the SMS4DC.
- Provision of SMS4DC's new versions/patches (free of charge)
- Assistance for integration of high resolution maps provided by concerned users, to the SMS4DC.

In this connection ITU has established an expert group team which can be reached through phone call/e-mail and if needed by undertaking ITU missions to the requested countries.

For further questions and inquiries please contact:

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