



Frequency Allocation Table (FAT)

SMS4DC training seminar
27 November – 1 December 2006

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St John's, Antigua and Barbuda, 27 November – 1 December 2006



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SMS4DC Spectrum Allocation

- Frequency allocation menu of SMS4DC provides regional and national frequency allocation tables (section 3.4.2.11 in manual)
- Frequency allocation table is used by SMS4DC for frequency assignment
- No frequency can be assigned in contradiction with frequency allocation table

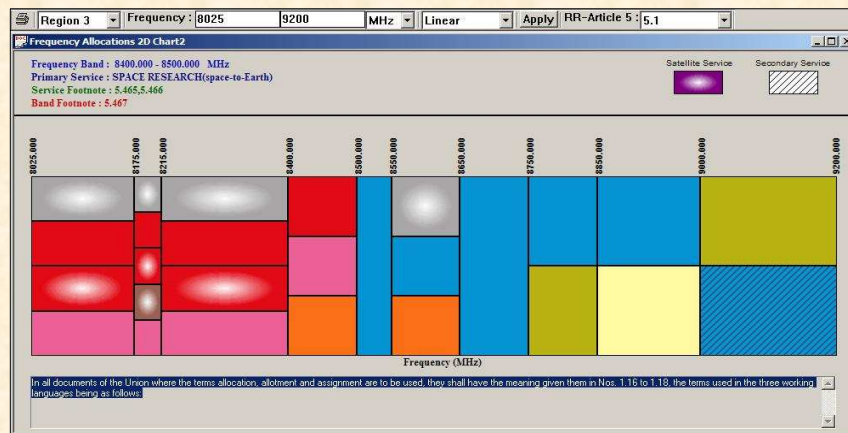
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Spectrum Allocation Chart

- “Draw Chart” item in the “Frequency Allocations” menu



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Elements of Frequency Allocation Table (FAT)

- Frequency band classification:
 - Exclusive bands,
 - Shared bands,
 - Receive-only bands (RR footnote 5.340),
 - License-free bands (not by ITU decision)
- Radiocommunication services
 - 40 radiocommunication services are defined in RR Article 1,
 - About 30 radiocommunication services appears in FAT
 - More services could be defined by regulators
- Radiocommunication service category:
 - Primary
 - Secondary

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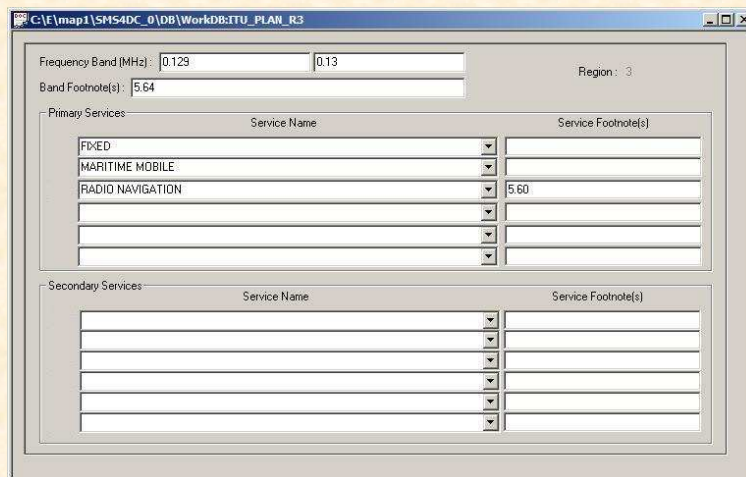


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Secondary Service

- Stations of a secondary service:
 - Shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date;
 - Cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date;
 - Can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date.

Editable Spectrum Allocation Table of SMS4DC (Edit menu)



Frequency Band (MHz)		Region
0.129	0.13	3

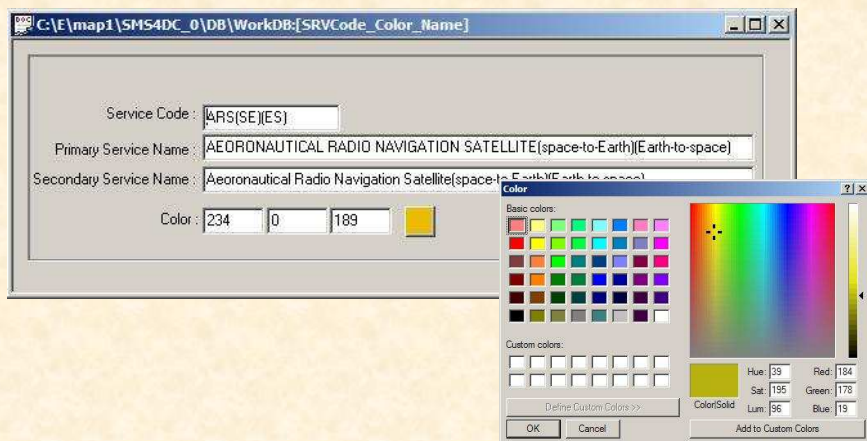
Band Footnote(s)	
5.64	

Primary Services	
Service Name	Service Footnote(s)
FIXED	
MARITIME MOBILE	
RADIO NAVIGATION	5.60

Secondary Services	
Service Name	Service Footnote(s)

Editing Legend of FAT (Edit > service Table)

- Legend text and associated color can be customized



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Method to develop national FAT (NFAT)

- Develop framework,
- Study existing situation,
- Plan bands of high density application,
- Draft NFAT,
- Verification of NFAT,
- Provide migration plan,



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Frameworks to develop national frequency allocation table

- Compatibility with national telecommunication act,
- Obeying national goals, long term and short term policies of telecommunication sector,
- Covering existing applications introduced for the radio frequency spectrum,
- Compatibility with international radio regulations and incorporated regional frequency allocation table,
- Recognizing future demands of different category of users
- Being inline with geo-climatic situation of the country,
- Consideration of spectrum utilization reference of neighbour countries,
- Compatibility with international and regional agreements,

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Frameworks: Telecommunication act of the country

- Should give explicit reference chapters and articles about spectrum utilization,
- Should establish independent responsible authority for spectrum management,
- Should recognize key functions of responsible authority for spectrum management,
- Should consolidate radio licensing regime,
- Should equip spectrum management authority with powerful regulations to supervise spectrum utilization,
- Should recognize international nature and harmonized usage of spectrum,

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Frameworks: National goals, long/short-term policies

- Consideration telecommunication market model and demand,
- Simplification and clarification of frequency assignment method,
- Promotion of operators to increase spectrum utilization efficiency,
- Separating spectrum user categories (military, security and civil applications)
- Optimizing utilization of spectrum, ground, space, orbit, time and numbers,
- Harmonization of spectrum usage,
- Facilitating common health, wealth and security,

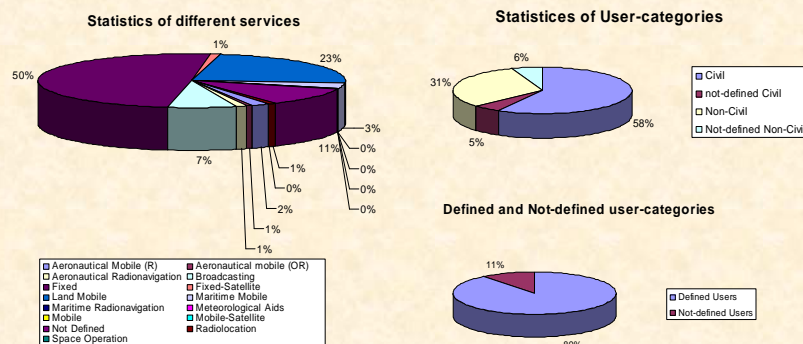
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Frameworks: Existing applications using spectrum (Example)

- Spectrum allocation table should embrace existing usages as far as possible,



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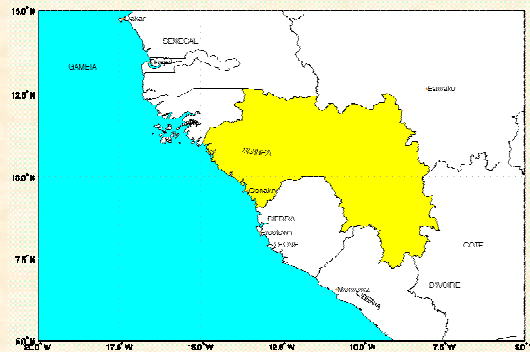
Frameworks:

Observing future demands of users

- Taking into account national plan to promote telecommunication,
- Embracing specific demands of users as far as achievable,
- Estimating and observing future demands of public correspondence,
- Policy making in utilization of spectrum efficiently
- Encouraging manufacturers as well as standardization bodies to consider local needs,
- Identifying investable areas of radiocommunication services

Frameworks: Geo-climatic situation of the country

- Guinea is in tropical zone



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Frameworks: Spectrum utilization in neighbour countries

- More harmonized spectrum allocation with neighbor countries increases spectrum utilization near the national borders,
- ITU RR Article 5 is the reference allocation table of neighbor countries,
- Guinea is a member of all regional activities and agreements regarding to spectrum allocation,

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Planning Bands of Special Application

- Public cellular mobile applications:
 - 2G and 3G cell phones
 - paging
- Professional cellular mobile applications:
 - Radio-trunks
 - WLL
- License-free bands and applications,
 - CB
 - SRD
 - ISM
 - Cordless telephones
- Exclusive broadcasting

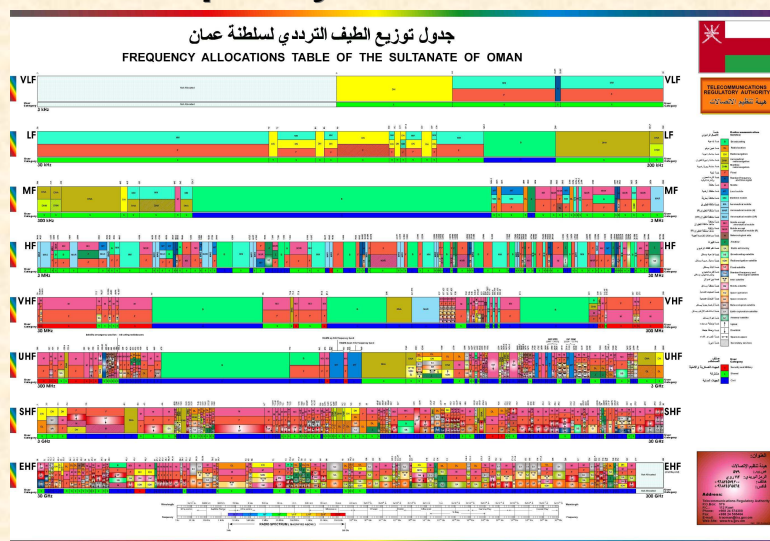
Drafting NFAT

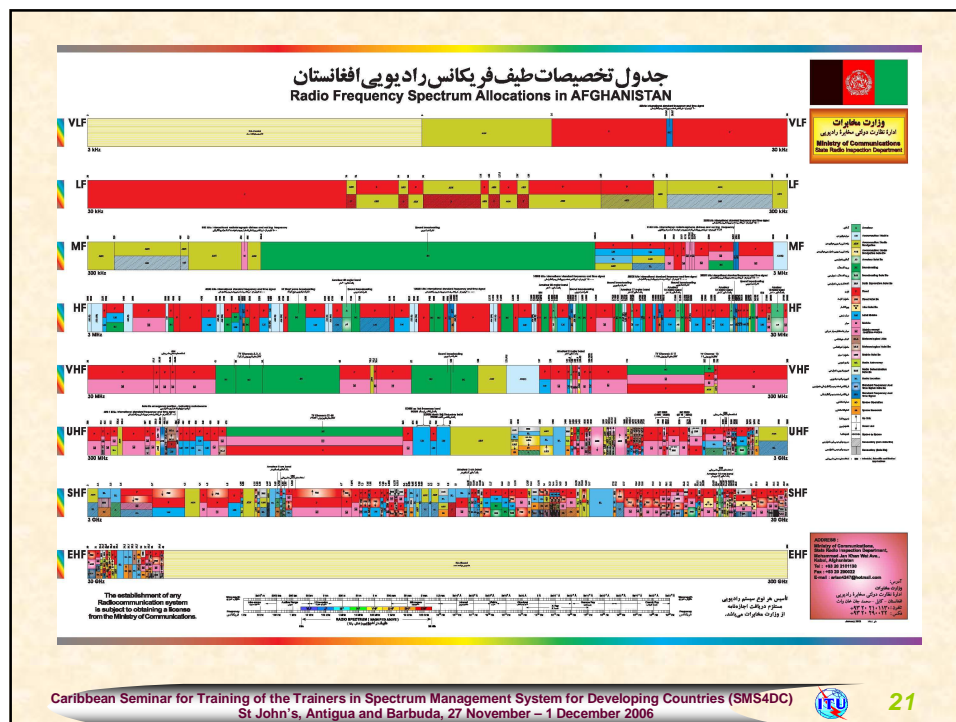
- Starting from 9 kHz,
- Stopping on the highest planned frequency,
- Determining usage of each frequency band as far as applicable consistently,
- Determination of user category as far as distinguishable,
- Drafting national footnotes under the frequency bands which are necessary,

Verification of NFAT

- Step 1: Reconsideration of all frequency bands,
- Step 2: Presentation of NFAT, totally or partially, to major spectrum users,
- Step 3: Starting migration procedure,
- Step 4: Modification of NFAT,
- Step 5: Termination of verification or return to step 2 above

Frequency Allocation Chart





Providing Migration Plan

- Comparing existing frequency assignments with NFAT,
- Determination of urgency of inconsistencies into one of:
 - Top urgent
 - Urgent
 - Less urgent
- Classification of inconsistencies into one or some of:
 - Service type inconsistency,
 - Service category inconsistency,
 - User group inconsistency
- Determining consistent frequency bands for inconsistent assignments,

Method of Migration

- Tuning transmitters from inconsistent frequency to consistent frequency bands by licensee,
- Un-renewal of radio license,
- Stopping operation of valid transmitters on inconsistent frequencies,
- Compensation of migration cost by new spectrum user,
- Compensation of migration cost by government,

Frequency Arrangement

SMS4DC Frequency Arrangement

- Frequency arrangement item in the “Frequency Allocation” menu of SMS4DC generates frequency plans (section 3.4.2.11 in manual)
- Three types of frequency arrangement is possible in SMS4DC:
 - Homogeneous,
 - Uniform, and,
 - Non-uniform
- Any frequency plan shall in conformity with Frequency allocation table
- List of all planned assignable frequencies could be browsed from item “Frequency Table” of “Frequency Allocation” menu

Types of Frequency Arrangements

- Homogeneous channel arrangement

$$f_n = f_0 + f_{offset} + n \cdot XS \quad \text{MHz}, \quad n = 0,1,2,\dots$$

$$f'_n = f_0 + f'_{offset} + n \cdot XS \quad \text{MHz}, \quad n = 0,1,2,\dots$$
- Uniform channel arrangement

$$f_n = f_0 + n \cdot XS \quad \text{MHz}, \quad n = 0,1,2,\dots$$
- Non-uniform channel arrangement
- References:
 - ITU-R Recommendations, F series,
 - CEPT Recommendations,
 - Any frequency assignment plan in RR and regional plans

SMS4DC F-plan dialog box

The image displays three screenshots of the SMS4DC Frequency Arrangement dialog box, illustrating different frequency plan configurations:


- Homogeneous plan:** Shows a dialog box with Frequency Plan ID 382480.13, Region 3, and Service Priority Primary. The Type of Frequency Plan is set to Homogeneous. The formula $F_n = F_o + F_{off} + n \times XS$ is shown. Parameters include Channel Spacing XS = 130 MHz, Reference Frequency F_o = 38248 MHz, Lower Frequency Offset F_{off} = 1300 MHz, and Upper Frequency Offset F_{off} = 0 MHz. The Number of Channels n is 40, and the Channel Set is All.
- Uniform plan:** Shows a dialog box with Frequency Plan ID 400000.12, Service Land Mobile, and Type of Frequency Plan Uniform. The formula $F_n = F_o + n \times XS$ is shown. Parameters include Channel Spacing XS = 120 MHz, Reference Frequency F_o = 40000 MHz, and Number of Channels n = 5. The Channel Set is Even.
- Non-uniform plan:** Shows a dialog box with Frequency Plan ID 500000.15, Service Fixed, and Type of Frequency Plan Non-uniform. The formula $F_n = F_o + n \times XS$ is shown. Parameters include Channel Spacing XS = 120 MHz, Reference Frequency F_o = 40000 MHz, and Number of Channels n = 8. The Channel Set is Even.

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Exercising F-plan dialog box (1)

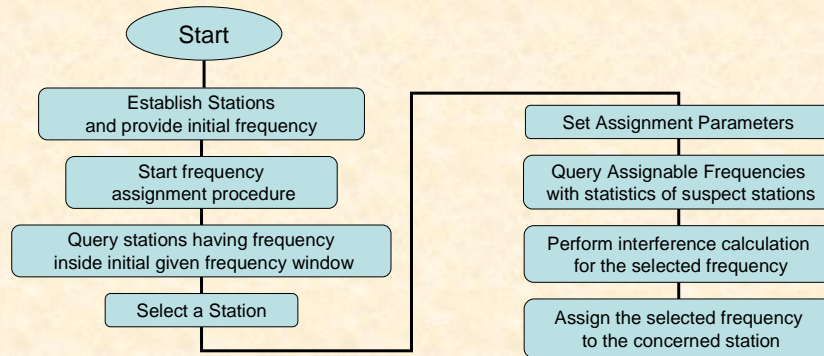
- **Step 1:** Launch the SMS4DC software
- **Step 2:** Launch the DEM view using toolbar push button
- **Step 3:** Set the Region to 1, and, Service priority to “Primary”
- **Step 4 :** Choose the item “Frequency Arrangement” in the “Frequency Allocations” menu
- **Step 5:** Choose “Fixed” service type
- **Step 6:** choose “Homogeneous” for Frequency Plan (dialog box will be changed dynamically for other types),
- **Step 7:** Put following values in relevant edit boxes (from F.386):
 $XS = 14 \text{ MHz}$, $f_o = 8387.5 \text{ MHz}$, Lower $f_{\text{offset}} = -108.5 \text{ MHz}$,
 Upper $f_{\text{offset}} = 10.5 \text{ MHz}$, Channels 1 to 6, channel set: All
- **Step 8:** Save the plan using bottom of the dialog box

Exercising F-plan dialog box ⁽²⁾

- **Step 9:** Push the button  to see the channels in text file
- **Step 10:** Choose other types of Frequency Plan and repeat exercise
- **Step 11:** Try the standard push button provided bottom the dialog box

Frequency Assignment

Frequency Assignment Procedure



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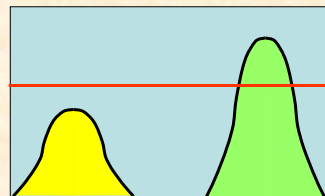


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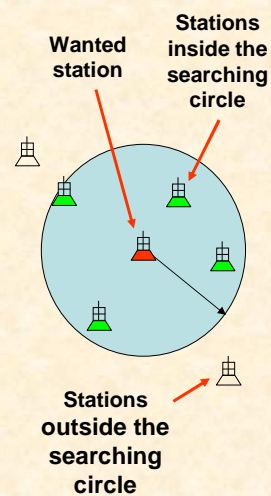
Assignable frequency Search Criteria

- A frequency window [f_{\min} to f_{\max}]
- Channel scan range,
- Radius of circular search area,
- Permissible field strength,

Permissible Field strength value in the location of victim station



Interfering signals



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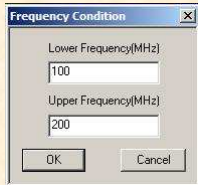
SMS4DC Frequency Assignment

- Frequency assignment procedure of SMS4DC is a very conservative tool to reuse frequencies
- Use the item “Frequency Assignment” in “Frequency Allocations” menu
- Interference calculation will be down using free space propagation model
- More realistic interference calculation could be down through the “Interference” menu for scenarios having approved procedures

Exercise (1)

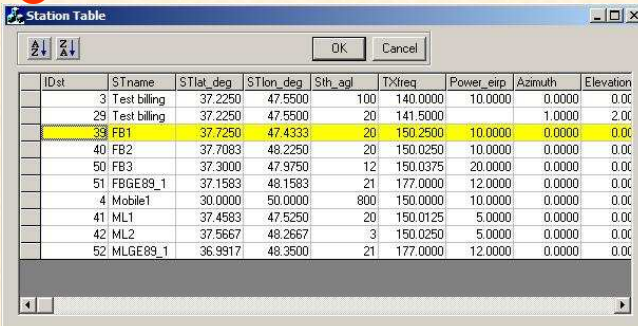
- Frequency Allocations->Frequency Assignment

1



Frequency Condition dialog box with input fields for Lower Frequency(MHz) (100) and Upper Frequency(MHz) (200).

2



Station Table window showing a table of station data. The table has columns: IDst, STname, STlat_deg, STlon_deg, Sth_agl, TXfreq, Power_eirp, Azimuth, and Elevation. The row for '39 FB1' is highlighted in yellow.

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	10.0000	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

Exercise (2)

3

Assignment Parameters

Fmin(MHz): 145 Fmax(MHz): 155
Channel scan range(kHz): 15

Search Radius(km): 50
Permissible field strength(dBuV/m): 20

OK Cancel

Frequencies may cause or receive interference

4

No	F _n	F _n	Bandwidth	Num of Stations	PlanID	Srv Priority
19	148.2375	150.2375	0.0125	0	1490.0000125	Primary
20	148.25	150.25	0.0125	0	1490.0000125	Primary
21	150.0125	148.0125	0.0125	3	1490.0000125	Primary
22	150.025	148.025	0.0125	4	1490.0000125	Primary
23	150.0375	148.0375	0.0125	3	1490.0000125	Primary
24	150.05	148.05	0.0125	1	1490.0000125	Primary
25	150.0625	148.0625	0.0125	0	1490.0000125	Primary
26	150.075	148.075	0.0125	0	1490.0000125	Primary
27	150.0875	148.0875	0.0125	0	1490.0000125	Primary
28	150.1	148.1	0.0125	0	1490.0000125	Primary

List of Stations:

No	ID	Name(2)	Service	Frequency	Coordinates	Dist. km	E1_2	E2_1	dE1_2
1	41	ML1	Land Mobile	150.012500	047E3130 37N2730	30.7	6.12	3.11	-13.88
2	42	ML2	Land Mobile	150.025000	048E1600 37N3400	75.5	47.22	44.21	27.22
3	40	FB2	Land Mobile	150.025000	048E1330 37N4230	69.7	47.91	47.91	27.91
4	50	FB3	Land Mobile	150.037500	047E5830 37N1800	67.2	-6.41	-3.40	-26.41

Selected Station:

Service: Land Mobile
Station Name(1): FB1
Location: 047E2600 37N4330
Emission: 8K50F3E--
Frequency(MHz): 150.25
Selected Channel(MHz): 150.0625

No of Channels: Total: 40 With Interference: 4

Permissible field strength: 20 (dBuV/m)

Assign Cancel

Double click to select a frequency for further analysis

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Exercise (3)

E2_1: Field strength of the victim station on the location wanted station

E1_2: Field strength of wanted station on the location of victim station

Assignment Results

List of Frequencies:

No	F _n	F _n	Bandwidth	Num of Stations	PlanID	Srv Priority
19	148.2375	150.2375	0.0125	0	1490.0000125	Primary
20	148.25	150.25	0.0125	0	1490.0000125	Primary
21	150.0125	148.0125	0.0125	3	1490.0000125	Primary
22	150.025	148.025	0.0125	4	1490.0000125	Primary
23	150.0375	148.0375	0.0125	3	1490.0000125	Primary
24	150.05	148.05	0.0125	1	1490.0000125	Primary
25	150.0625	148.0625	0.0125	0	1490.0000125	Primary
26	150.075	148.075	0.0125	0	1490.0000125	Primary
27	150.0875	148.0875	0.0125	0	1490.0000125	Primary
28	150.1	148.1	0.0125	0	1490.0000125	Primary

List of Stations:

No	ID	Name(2)	Service	Frequency	Coordinates	Dist. km	E1_2	E2_1	dE1_2
1	41	ML1	Land Mobile	150.012500	047E3130 37N2730	30.7	6.12	3.11	-13.88
2	42	ML2	Land Mobile	150.025000	048E1600 37N3400	75.5	47.22	44.21	27.22
3	40	FB2	Land Mobile	150.025000	048E1330 37N4230	69.7	47.91	47.91	27.91
4	50	FB3	Land Mobile	150.037500	047E5830 37N1800	67.2	-6.41	-3.40	-26.41

Selected Station:

Service: Land Mobile
Station Name(1): FB1
Location: 047E2600 37N4330
Emission: 8K50F3E--
Frequency(MHz): 150.25
Selected Channel(MHz): 150.025

No of Channels: Total: 40 With Interference: 4

Permissible field strength: 20 (dBuV/m)

Assign Cancel

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End