An online portal for broadcasting services

Executive Summary

The **eBCD2.0 platform**, in production since 2010, provides secure web-based services related to terrestrial broadcasting to TIES users.

The platform is formed by a back-end infrastructure (processes and databases) and a front-end portal. The portal offers rich and secure web-based tools including online publications (*ePub*), databases (*eQry*), calculations on-demand (*eTools*) and a portal (*myAdmin*) which allows users from administrations to check and visualize their notices and recorded assignments, thus making it easy to follow the relevant Plan modification procedures and related deadlines.

There are over 1700 users for 178 Member States registered in the portal on September 2017.

Starting October 2016 the myAdmin portal, accessible only to official focal points, includes an individual and secure mailbox per administration where BR places its output correspondence for Member States (signed letters in pdf format). Dedicated services in the back-end includes also email notifications services informing official focal points when relevant Special Sections are available on the web (at publication date) and when relevant coordination information enters the database.

eTools has been widely used for the replanning of digital television broadcasting in Africa (2012-2013) and for the Arab countries (2014-2015), allowing administrations to perform online calculations of compatibility analyses and coordination examination. It is currently used for the planning of digital broadcasting in Central America and in the Caribbean region. One feature of the tool allows the user to share their calculation results with their neighbors streamlining and facilitating the coordination process. It is also widely used by all Administrations of Region 1 concerned by the Broadcasting Plans, to perform technical examinations.

The flexibility of the platform allowed the prompt integration of legacy systems as it was the case with the RJ81 plan modification calculations, written in Perl, and available now in the portal as online calculations.

The goal of *eBCD2.0* has always been to streamline working processes, improve efficiency, be closer to administrations providing information as soon as possible and minimize the need for printed documents in line with the *green ITU* concept.

The possibility of testing the notice submission files before officially submitting it to the BR via WISFAT gives the possibility of streamlining the whole process, making easier the coordination process which implies a reduction of the workload on both the BR and administrations and a reduction of the time needed for notices to be recorded in the plan.

During the plan modification procedures, BCD needs to communicate with Member States. In many letters reference is made to information available in the portal, and we intend to move more and more towards a paperless office.

The Online Validation application allows administrations to validate their notice prior to WISFAT submission, streamlining the all process and reducing the workload on both BR and administrations, has been developed reusing many features from eTools. The eMIFR application has also been developed following

The *eBCD2.0* platform was implemented using the latest technologies (web applications, AJAX, GIS internet servers, distributed computing systems). Following the BR pilot project in Cloud Computing, cloud resources could now be seamlessly integrated with the infrastructure on-premises in case more computing power is needed.

A recent survey (see Annex 1) conducted in December 2016 shows that around 75% of the users consult the online tools at least a few times a week, consider that the online functionalities satisfy their requirements and that the lay-out and the presentation on the tools are clear and easy to use. The survey participants suggested also functionalities to be implemented in the portal and the BR would work in implementing them as soon as possible.

Following the state-of-the-art technology, we plan to redesign the web front-end using the lightweight ASP.NET MVC technology, and to integrate all the applications for terrestrial services in a single web portal.

Description of the eBCD 2.0 portal

Four main features are available from this portal, as depicted in Figure 1.

Figure 1:main features of eBCD 2.0
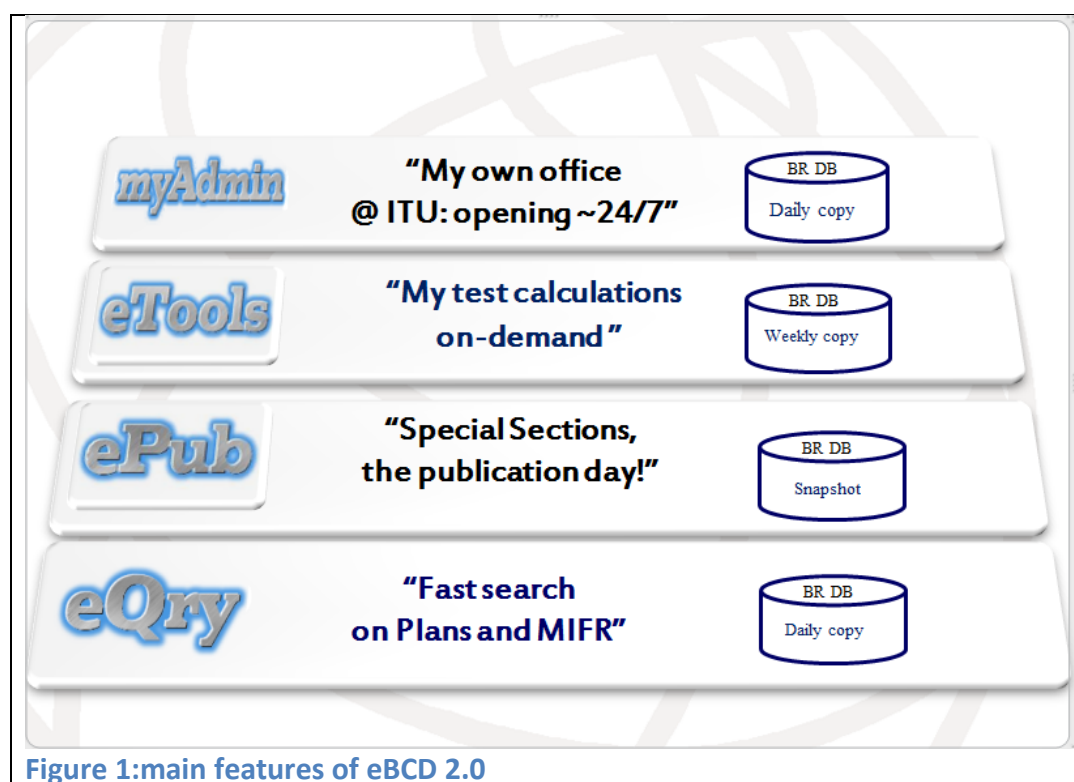
eQry

The basic feature *eQry* allows fast online searches on broadcasting Plans. It provides the possibility of performing queries on a read-only copy of the BR database, updated daily. Searches can be performed on a limited number of fields including administration, geographic area, assigned frequency, administration unique identifier, BR identification number, site or allotment name and the status (recorded/published).

The advantage to display a quasi-live database as we do in *eQry* and in *myAdmin* (a read-only copy from live database is performed each night) is to allow administrations to consult their notices and to find the latest information reflected promptly such as the Status and the coordination information. On the latter, for example, the coordination information is available as soon as it is captured, without the need for administration to wait for the delivery of the next BR IFIC.

ePub

ePub displays the broadcasting publications online. The advantage over traditional delivery via BR IFIC is the possibility for the user to consult the Special Sections at publication date. An extract is performed on the BR database in such a way to build up a static database containing

only relevant records. All broadcasting publications since 2007 are available from *ePub* and promptly consultable.

ePub allows searching by BR IFIC number and by Administration, both for its own notifications and for notifications affecting itself.

eTools

eTools offers calculation on-demand in the scope of the GE06, GE84 and RJ81 agreements for testing purposes. In addition, it offers the possibility of performing propagation prediction calculations according to the recommendations ITU-R P.1812 and P.1546. The latest addition concern the compatibility analyses calculation for region 2. Detailed descriptions of the calculations available are listed in Annex 2.

The BR is planning to add more and more calculations type, both for plan modification procedures (GE75 Art.4 calculations, GE06 Conformity Art. 5 examination) and for propagation prediction models.

The possibility of running the coordination or conformity examinations of the notice submission files before officially submitting it to the BR via WISFAT give the possibility of streamlining the whole process, reducing the workload on both the BR and administrations and reducing the time needed for notices to be recorded in the plan.

This online tool in fact offers the possibility following advantages:

1) Even if the use of BRIFIC software tools for validations is strongly encouraged, an "unofficial" online validation allows the user to verify that the notice file is correct. If this is not the case, the portal gives the reasons for the problem allowing the user to fix the problem and submit the file again, without engaging in time consuming e-mail or phone call exchange with the BR. This procedure allows also a learning process for the user.
2) The calculation of coordination contours allows the user to determine which administrations are considered to be potentially affected by the new notices.
3) The user can then engage in coordination process with those administrations, aiming to get the agreement before officially submitting the notice to the BR via WISFAT. To this purpose, eTools offers the possibility to share calculation results with users of any administrations.
4) *eTools* offers also the possibility to perform more detailed calculations with the propagation prediction modules (i.e. ITU-R P.1812), allowing to take into account also terrain data in the coordination process, or using the compatibility analysis tool.
5) When all the agreements have been obtained the users can submit the notice file with the request of publication in part B, which greatly speed up the recording process (40 days instead of at least 75 days).

The process of submission of calculation request is depicted in Figure 2.

The back-end infrastructure performing the calculations is completely decoupled from the web portal and is currently composed by more than 20 independent calculation services to manage the workload. ITU has recently performed a pilot-project to integrate cloud computing resources to the infrastructure on-premises, which would allow us to easily scale the system up when needed (see Annex 2).
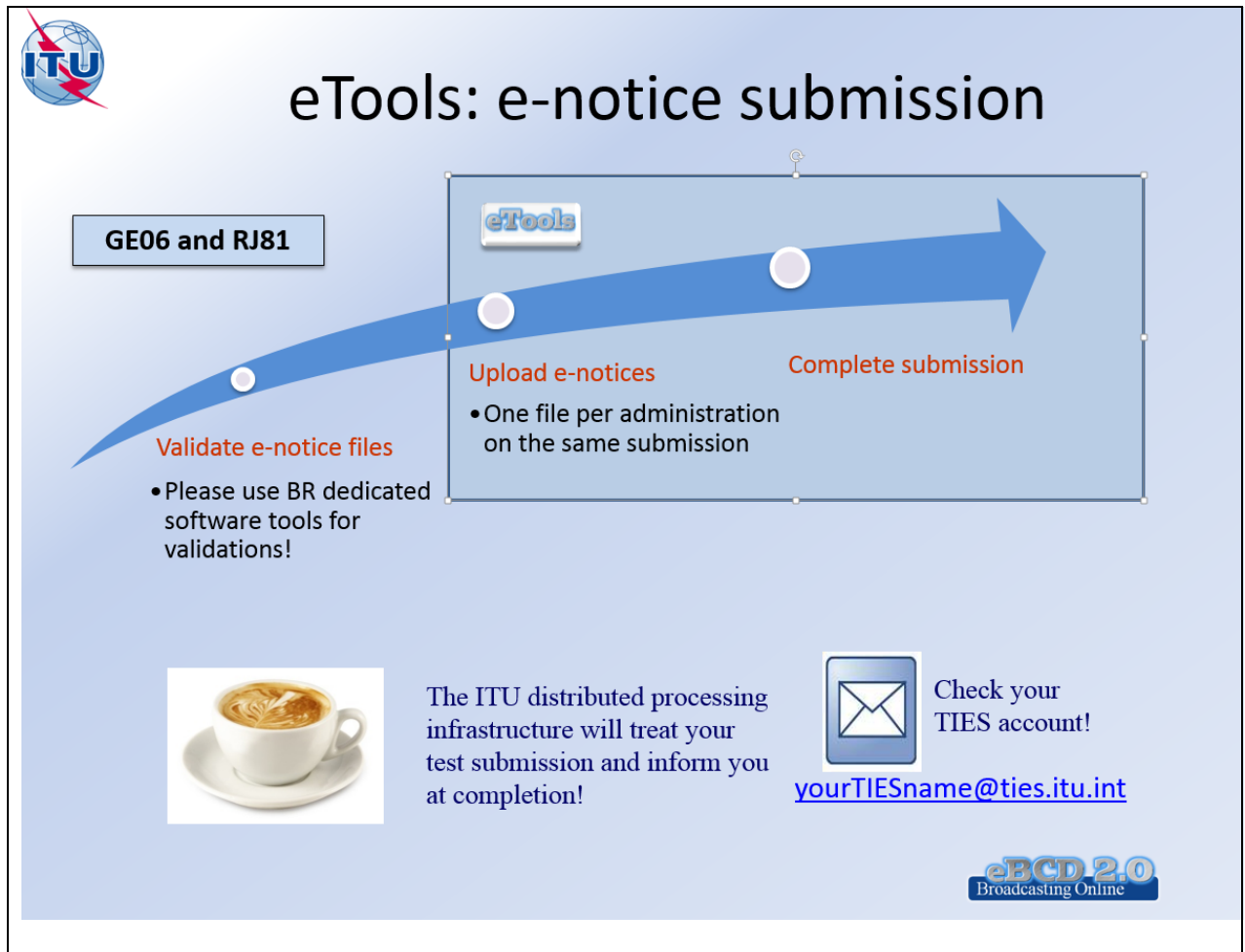

Figure 2: Process of submission of calculation request via eTools

myAdmin

myAdmin allows an administration to visualize their notices and recorded assignment and notices from other administration affecting it in a way which make it easy to follow the plan modification procedures and related deadlines.

The following components are available:

myMailBox: where the BR posts private communications for a given Member State.

1) *Outgoing BR letters sent by fax and posted simultaneously on the portal*.

2) *Other type of communications, including the following*

Plans and MIFR dashboard: where for any given plan it is displayed the statistics for the following data and the possibility to browse to the details of the notices/assignments under considerations:

Plans

MIFR

- Recorded assignments;
- Notices published in Part 1;
- Notices published in Part 2;
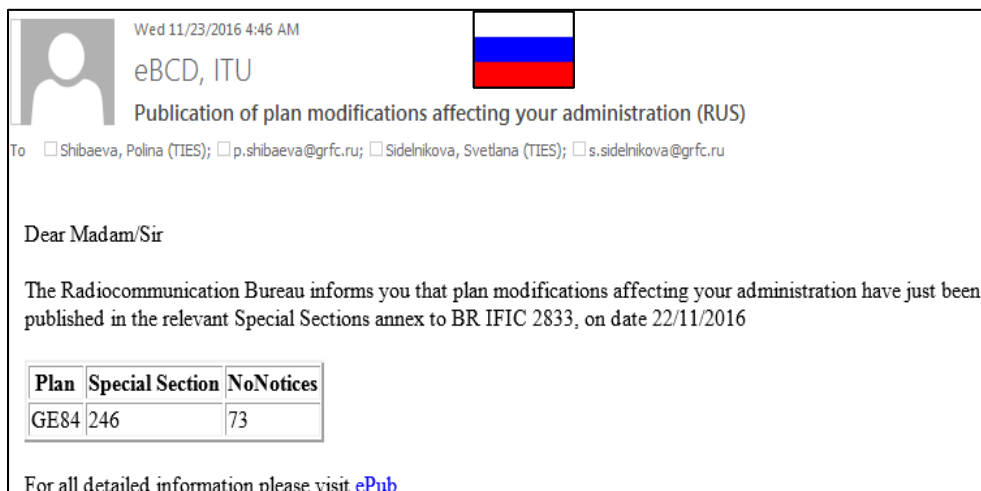- Notices published in Part 3;

Description of the eBCD 2.0 platform architecture

The front-end tools described above display data from different database, which are populated at the back-end from different processes. The layout of the architecture is depicted in the figure below.
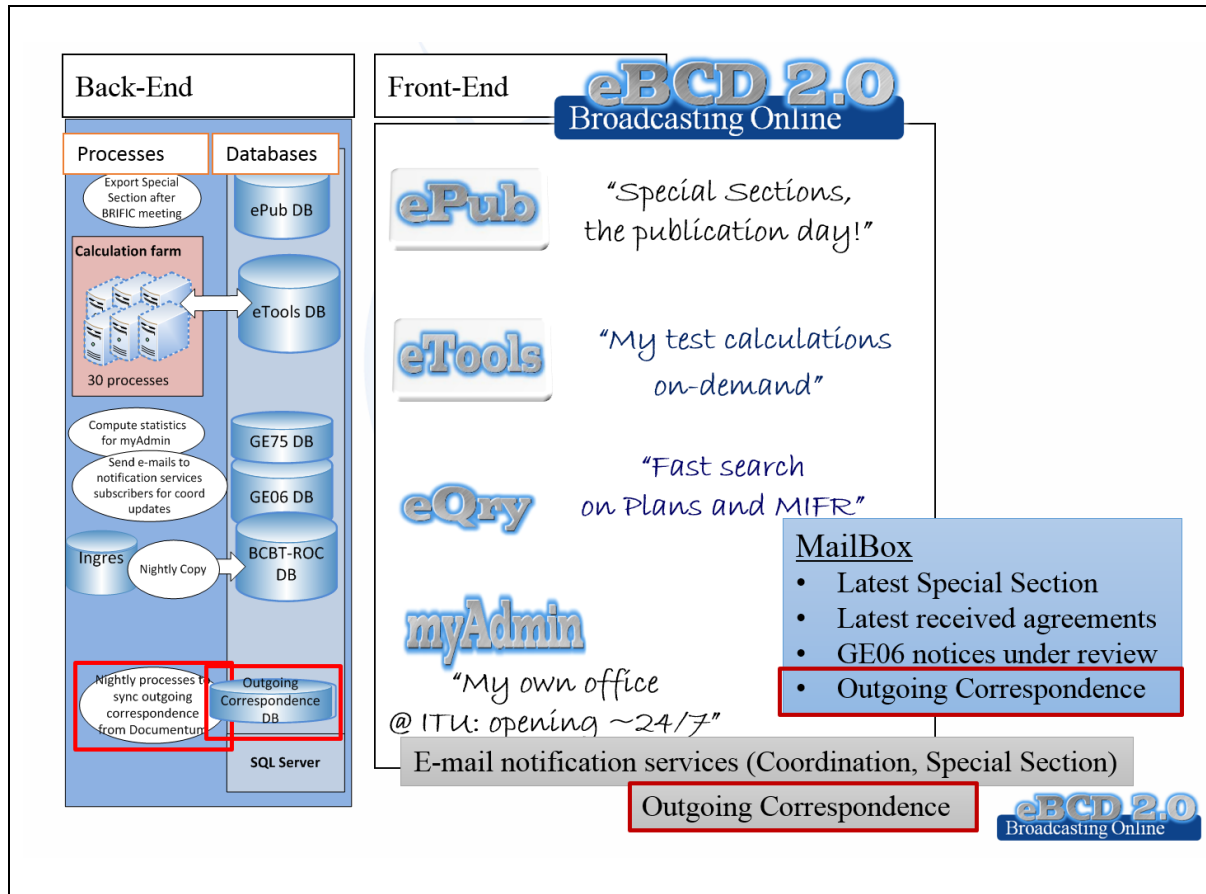
The **E-mail notification services** sends email to focal points in the following cases

- when new Special Sections containing his/her notifications/notifications affecting him/her are available on the web

- when Coordination information for his/her notices enters the database

eBCD2.0 Statistics

The number of users registered in the portal is given in Figure 3, while the statistics concerning the number of daily login and the distributions of users and Member States according to ITU regions is displayed in Figure 4.

Number of registered users per administration:

Code	N	Code	N	Code	N	Code	N	Code	N	Code	N	Code	N	Code	N	Code	N	Code	N	Code	N	Code	N
AFG	2	AFS	12	AGL	7	ALB	7	ALG	40	AND	2	ARG	10	ARM	9	ARS	10	ATG	0	AUS	6	AUT	12
AZE	12	B	23	BAH	1	BDI	10	BEL	9	BEN	16	BFA	7	BGD	4	BHR	9	BIH	4	BLR	7	BLZ	2
BOL	2	BOT	7	BRB	1	BRM	3	BRU	3	BTN	2	BUL	16	CAF	2	CAN	10	CBG	2	CHL	3	CHN	35
CLM	8	CLN	0	CME	29	COD	17	COG	6	COM	3	CPV	1	CTI	19	CTR	8	CUB	6	CVA	3	CYP	6
CZE	9	D	19	DJI	3	DMA	1	DNK	9	DOM	3	E	17	EGY	12	EQA	8	ERI	1	EST	8	ETH	4
F	59	FIN	18	FJI	1	FSM	0	G	45	GAB	13	GEO	3	GHA	17	GMB	5	GNB	4	GNE	0	GRC	26
GRD	1	GTM	1	GUI	8	GUY	2	HND	3	HNG	15	HOL	20	HRV	8	HTI	4	I	19	IND	11	INS	21
IRL	11	IRN	35	IRQ	10	ISL	0	ISR	5	J	47	JMC	3	JOR	10	KAZ	7	KEN	15	KGZ	5	KIR	1
KNA	0	KOR	13	KRE	0	KWT	8	LAO	4	LBN	13	LBR	2	LBY	15	LCA	1	LIE	3	LSO	7	LTU	4
LUX	4	LVA	9	MAU	3	MCO	3	MDA	5	MDG	4	MEX	12	MHL	0	MKD	4	MLA	18	MLD	9	MLI	9
MLT	4	MNE	10	MNG	10	MOZ	4	MRC	15	MTN	14	MWI	8	NCG	0	NGR	7	NIG	25	NMB	5	NOR	10
NPL	2	NRU	0	NZL	7	OMA	13	PAK	7	PHL	5	PNG	4	PNR	2	POL	10	POR	10	PRG	8	PRU	2
PSE	5	QAT	8	ROU	12	RRW	18	RUS	37	S	14	SDN	19	SEN	22	SEY	11	SLM	0	SLV	5	SMO	0
SMR	2	SNG	7	SOM	2	SRB	13	SRL	6	SSD	4	STP	3	SUI	11	SUR	6	SVK	9	SVN	14	SWZ	8
SYR	11	TCD	5	TGO	7	THA	15	TJK	0	TKM	3	TLS	1	TON	0	TRD	1	TUN	17	TUR	18	TUV	0
TZA	18	UAE	10	UGA	8	UKR	19	URG	2	USA	20	UZB	10	VCT	0	VEN	5	VTN	13	VUT	1	YEM	6
ZMB	9	ZWE	7																					

Number of focal points per administration:

Code	N	Code	N	Code	N	Code	N	Code	N	Code	N	Code	N	Code	N	Code	N	Code	N	Code	N	Code	N
AFG	0	AFS	0	AGL	1	ALB	0	ALG	3	AND	0	ARG	0	ARM	0	ARS	4	ATG	0	AUS	1	AUT	5
AZE	1	B	0	BAH	0	BDI	0	BEL	4	BEN	2	BFA	0	BGD	0	BHR	2	BIH	1	BLR	2	BLZ	0
BOL	2	BOT	0	BRB	0	BRM	0	BRU	0	BTN	0	BUL	3	CAF	0	CAN	0	CBG	0	CHL	0	CHN	3
CLM	0	CLN	0	CME	6	COD	0	COG	2	COM	0	CPV	0	CTI	2	CTR	0	CUB	0	CVA	1	CYP	2
CZE	0	D	2	DJI	0	DMA	1	DNK	1	DOM	0	E	0	EGY	2	EQA	0	ERI	0	EST	2	ETH	0
F	12	FIN	4	FJI	0	FSM	0	G	6	GAB	2	GEO	2	GHA	0	GMB	0	GNB	0	GNE	0	GRC	0
GRD	0	GTM	0	GUI	0	GUY	0	HND	0	HNG	7	HOL	0	HRV	0	HTI	0	I	1	IND	2	INS	0
IRL	3	IRN	3	IRQ	0	ISL	0	ISR	0	J	0	JMC	0	JOR	0	KAZ	1	KEN	0	KGZ	0	KIR	1
KNA	0	KOR	1	KRE	0	KWT	0	LAO	0	LBN	0	LBR	0	LBY	1	LCA	0	LIE	0	LSO	0	LTU	0
LUX	1	LVA	2	MAU	0	MCO	2	MDA	1	MDG	0	MEX	0	MHL	0	MKD	0	MLA	3	MLD	0	MLI	2
MLT	2	MNE	0	MNG	0	MOZ	0	MRC	4	MTN	4	MWI	0	NCG	0	NGR	0	NIG	0	NMB	0	NOR	4
NPL	0	NRU	0	NZL	2	OMA	6	PAK	1	PHL	1	PNG	0	PNR	0	POL	0	POR	3	PRG	0	PRU	0
PSE	2	QAT	2	ROU	1	RRW	0	RUS	2	S	0	SDN	3	SEN	0	SEY	7	SLM	0	SLV	0	SMO	0
SMR	0	SNG	1	SOM	0	SRB	2	SRL	0	SSD	1	STP	0	SUI	0	SUR	0	SVK	5	SVN	2	SWZ	0
SYR	2	TCD	0	TGO	5	THA	0	TJK	0	TKM	0	TLS	0	TON	0	TRD	0	TUN	5	TUR	0	TUV	0
TZA	0	UAE	0	UGA	0	UKR	2	URG	0	USA	0	UZB	1	VCT	0	VEN	0	VTN	3	VUT	0	YEM	0
ZMB	2	ZWE	0																					

Figure 3: number of registered users and focal point per administration

It can be seen as 178 Member States (over 193 BR Member States) have at least one registered user in the portal, for a total of 1726 users on 14 September 2017. Concerning the focal points, it is worth to mention that administrations have been notified in October 2016 of the restricted access to myAdmin portal. On September 2017 there are 191 registered focal points from 73 administrations.
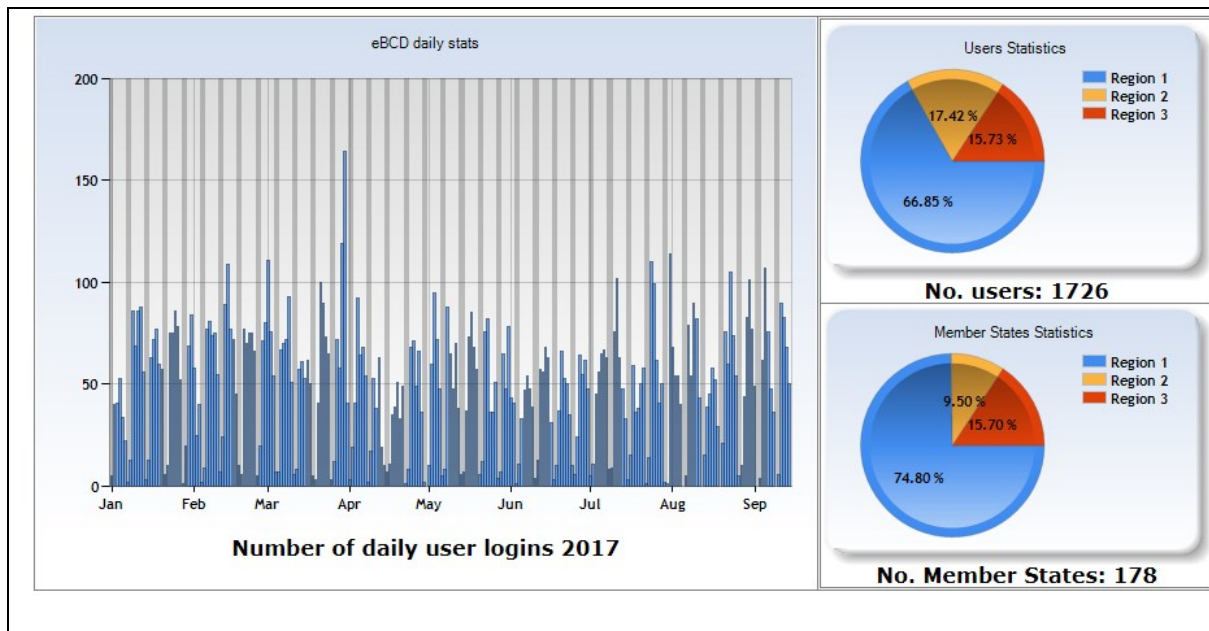
Figure 4: Number of daily logins in 2017 (left) and statistics of registered users and Member States for ITU regions (right)

Description of the usage of *eBCD2.0* for the correspondence from BCD to Member States:

<u>GE84 Plan</u>

In the BR outgoing letter to administrations concerned by modification of coordination information for the GE84 Plan the following sentences are added: *"Coordination data have been entered into BR database and can be verified by WEB application **myAdmin** on the following link (TIES login required):*

https://www.itu.int/ITU-R/eBCD/FocalPointPages/myAdministration.aspx ")

1. For WISFAT submission:

"Before submitting TB3 notices via WISFAT, you are invited to check coordination data by WEB application **myAdmin** on the following link (TIES login required):

https://www.itu.int/ITU-R/eBCD/FocalPointPages/myAdministration.aspx ")

GE06 Plan

eBCD2.0 is used and mentioned in some GE06 correspondence that concern long list of proposed modifications.

Future plans forecast the usage of *eBCD2.0* for all type of correspondence, relating to the publication and Plan procedures:

- The day of publication: inform affected administrations;
- The reminders to the administrations that did not send their decision or comments (depends on the relating Agreement);
- Inform the notifying administrations when objections are received;
- Returned request of publication in part B (missing agreements)

To streamline working processes, improve efficiency, be closer to administrations providing information as soon as possible and minimize the need for printed documents in line with the *green ITU* concept we intend to provide on the long run all correspondence via *eBCD2.0*

Description of the technology behind *eBCD2.0*

Authentication and authorization

TIES authentication is used for *eQry*, *ePub* and *eTools*. For *myAdmin*, in addition, there is an extra layer of authorization which the Broadcasting Service Division implements in order to make sure that the TIES user logged in belongs to an organization which is authorized by the Member State to act in its behalf.

The back-end distributed infrastructure

As a component of our IT system, we have developed a local distributed infrastructure which is currently used to manage the workload of calculations-on-demand submitted by our Membership. Such a workload is greatly time-dependent.

The current ITU distributed client-server system is based on the pull model, with a database acting as the master and a number of Windows services as the slaves. Users submit calculation requests via a web portal which stores the input data in the database as pending job requests. The calculation services wake up periodically to check if there are new jobs to be run, execute them, manage the jobs status and notify the user at job completion.

The system is implemented in C#. The calculation modules, called by the Windows services, can be implemented in different languages (FORTRAN, C, C++, COBOL). The database containing the tables for managing the jobs (and storing input data and output results) is SQL Server.

The web portal permits the user to control the job (submit/cancel) and also to monitor its status (pending, running, completed, failed).

The calculation modules may be CPU and data demanding. For one business case (propagation prediction calculation) for example, the input data for any given job may consist of up to one hundred files (3MB each in size), identified at run-time out of a total dataset of ~15 thousands files (total size of the dataset: ~45 GB).
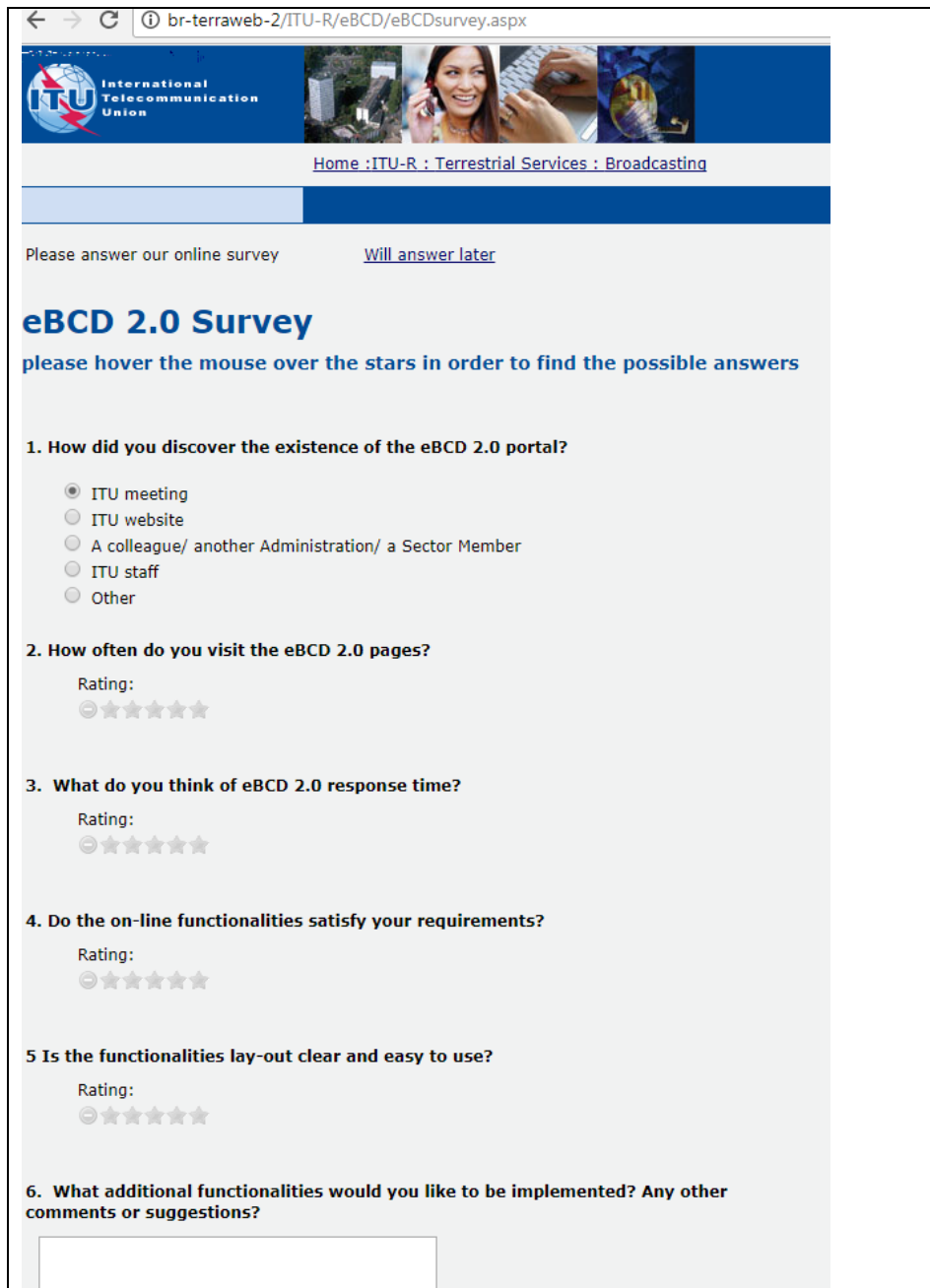
Cloud computing pilot-project

The BR has performed a pilot-project aimed to extend this distributed infrastructure to enable us to explore the potential of Cloud Computing, with the main goal to study the easiness of deploying software and data and of performing calculations on the cloud, with particular emphasis on scalability and security issues.

The BR would be in a position to seamlessly integrated cloud resources with the infrastructure on-premises in case more computing power is needed.

Annex 1: eBCD2.0 Survey

The data was collected in the period 7 December – 16 January 2017 with the questionnaire displayed in Figure 5. In this period 283 users consulted eBCD2.0 and 113 users from 73 Member States answered the survey (40% response rate).

Figure 5: Survey questions

The survey results in Figure 6 shows that around 75% of the users consult the online tools at least a few times a week, consider that the online functionalities satisfy their requirements and that the lay-out and the presentation on the tools are clear and easy to use
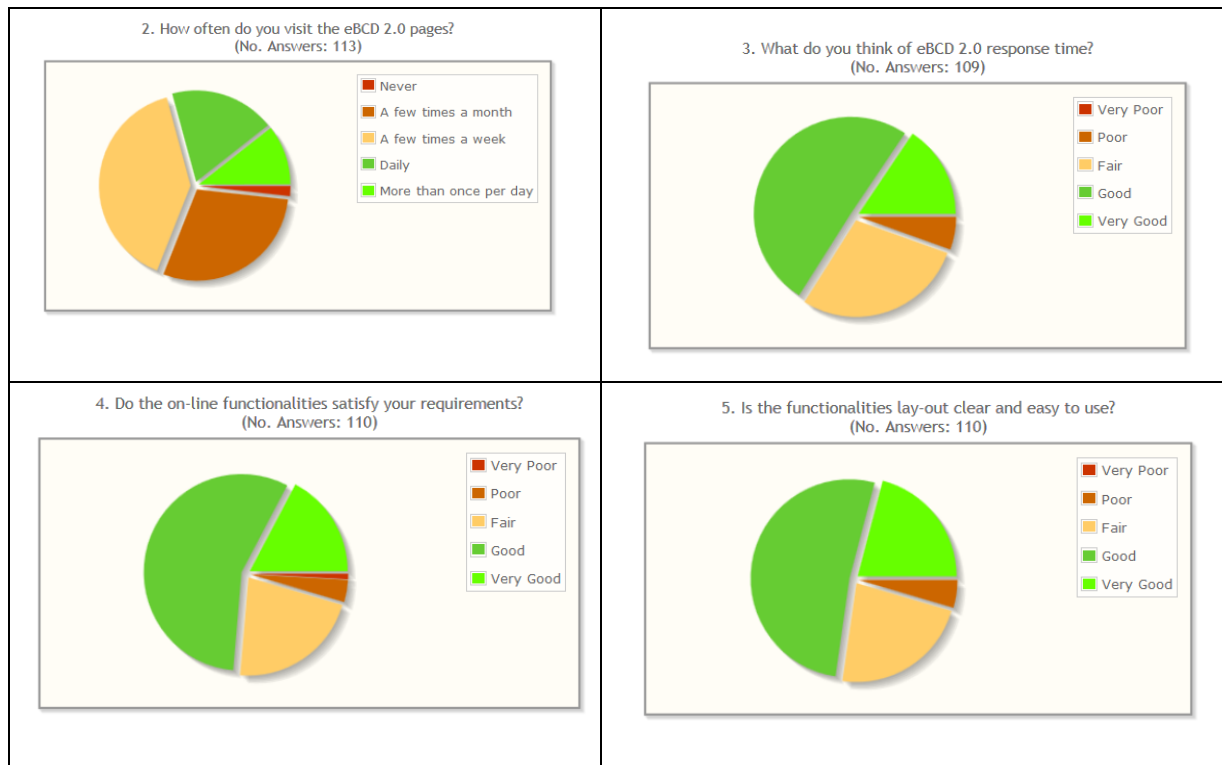

Figure 6: Survey results

Annex 2: on-demand calculations for testing and coordination purposes using eTools

GE06D Article 4 Plan modification (Coordination and Conformity Examination)

Modification of a Plan entry

The coordination examination is carried out in accordance with procedures specified in Section 1 of Annex 4 of GE06 Regional Agreement.

The result identifies the potentially affected administrations with which you need to seek agreement.

You can then start coordination activities in order to obtain all the necessary agreements before officially notifying the notices to the BR via WISFAT, streamlining the overall process and reducing the time needed for recording into the Plan.

When coordinating with affected administrations you may want to perform a more precise propagation assessment by submitting a P1812 calculation, as the coordination examination keeps into account terrain data only via the effective antenna height.

Input: e-notice file (to be previously validated using TerRaNotices)

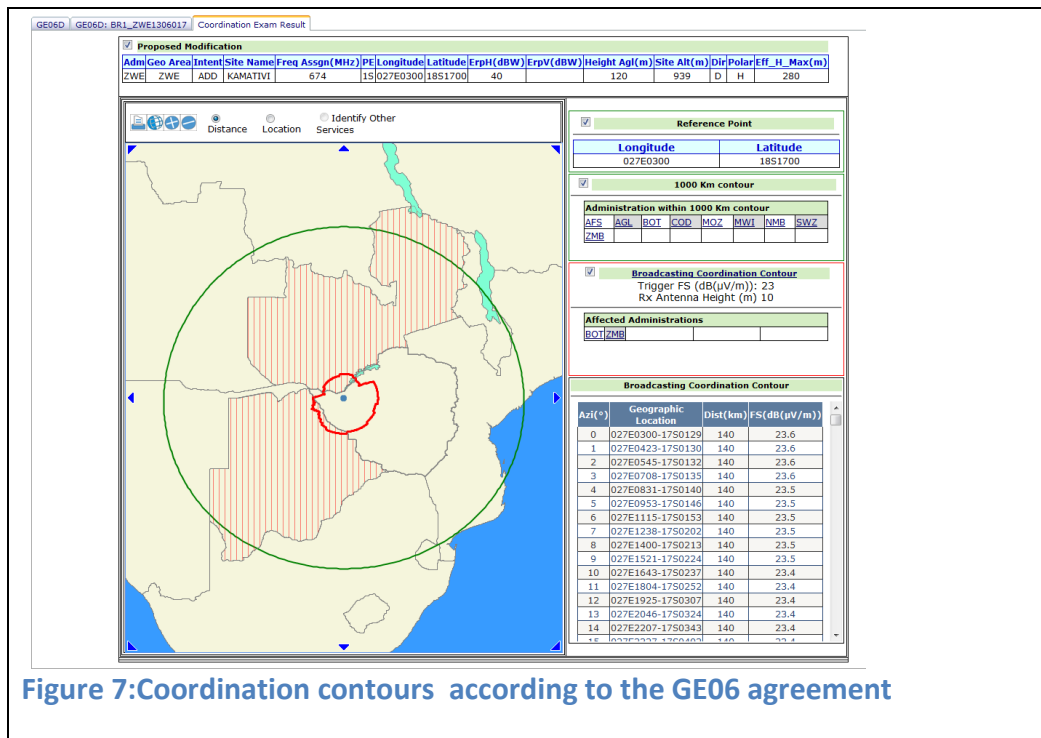Output: coordination contours displayed on a GIS map (see Figure 7)

Figure 7:Coordination contours according to the GE06 agreement

Addition of (an) assignment(s) stemming from an existing allotment entry in the Plan

The conformity examination is carried out in accordance with procedures specified in Section 2 of Annex 4 of GE06 Regional Agreement.

The result indicates whether the proposed stemming assignment(s) is (are) in conformity hence can enter the Plan without coordination or not in conformity, hence to be returned to the notifying administration.

In case for some test points the implementation field strength exceed the envelop field strength you can tune your technical parameters in order to try to reduce the field strength in the identified azimuths. You can then submit again the modified notice file for calculations and check if you succeeded in bringing the implementation field strength below the limits of the envelope.

Testing that your converted assignments are in conformity with the plan entry before officially notifying the notices to the BR via WISFAT streamlines the overall process and reduces the time needed for recording into the Plan.

Input: e-notice file (to be previously validated using TerRaNotices)

Output: Geometrical and BC cut-off field strength contours on a GIS map (see Figure 8)

Figure 8:Geometrical and BC cut-off field strength contour for the conformity examination
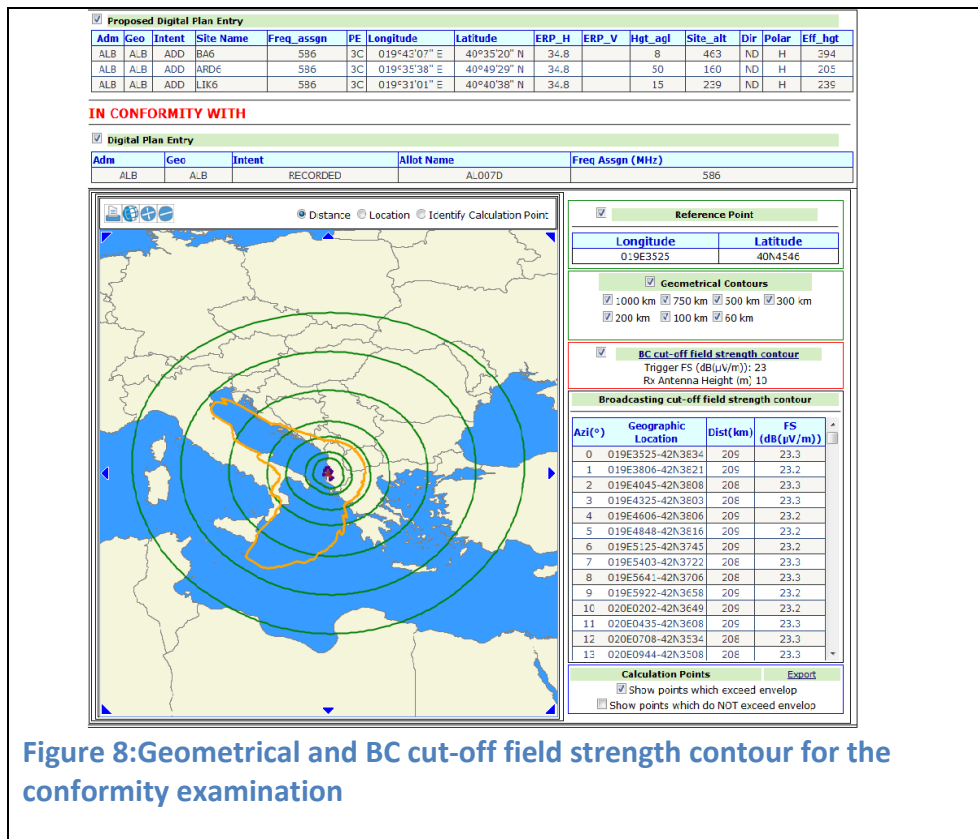
eTOOLS: on-demand calculations for testing and coordination purposes
Propagation prediction calculations using Recommendations ITU-R P.1812

This Recommendation describes a propagation prediction method suitable for terrestrial point-to-area services in the frequency range 30 MHz to 3 GHz and for distances in the range between 0.25 km and 3000 km. It predicts signal levels exceeded for a given percentage of time, $p\%$, in the range $1\% \leq p \leq 50\%$ and a given percentage of locations, p_L, in the range $1\% \leq p_L \leq 99\%$.

This method may be used to predict both the service area and availability for a desired signal level (coverage), and the reductions in this service area and availability due to undesired, co- and/or adjacent-channel signals (interference).

Input Data: The user submits a calculation request by filling a form in the web portal specifying the technical parameters needed for the propagation assessment. Both point to point (profile) and point to area (coverage) calculations can be performed. The input data required for the Point to Point calculation is shown in Figure 9, while the input data required for the Point to Point calculation is shown in Figure 10.

Figure 9: Point to Point (profile) input data

Figure 10: Point to Area (coverage) input data

The calculation currently uses the SRTM3 terrain databases (3arc-sec resolution); the possibility of using higher resolution DEM is under investigation.

Output Results

The output of the Point to Area calculation consists in a coverage contour, displaying the contour where a wanted FS (which is an input variable) is exceeded. The points of the coverage are also available in a tabular format which include the following information (Azimuth, Longitude, Latitude, Effective Radius, Terrain Height (m), Distance (km) and Fs (dB μV/m).

This calculation can be a useful tool during coordination activities, as can be seen considering the example below.

Figure 11 below shows the coordination contour for a station in Torino (Italy) using the method outlined for the plan modification procedure in the Article 4 of the GE06 agreement. This method is a conservative approach which takes into consideration the terrain information only via the effective antenna height, defined in most cases (see Annex 2.1 of Chapter 2 to Annex 2 in the GE06 agreement) as the height on the antenna over the average level of the ground between the distances of 3 and 15 km from the transmitter. This method does not clearly take into account the effect of the mountains around Torino. Figure 12 shows the coverage contour calculated with the recommendation ITU-R P.1812: the effect of the mountains is clearly visible.
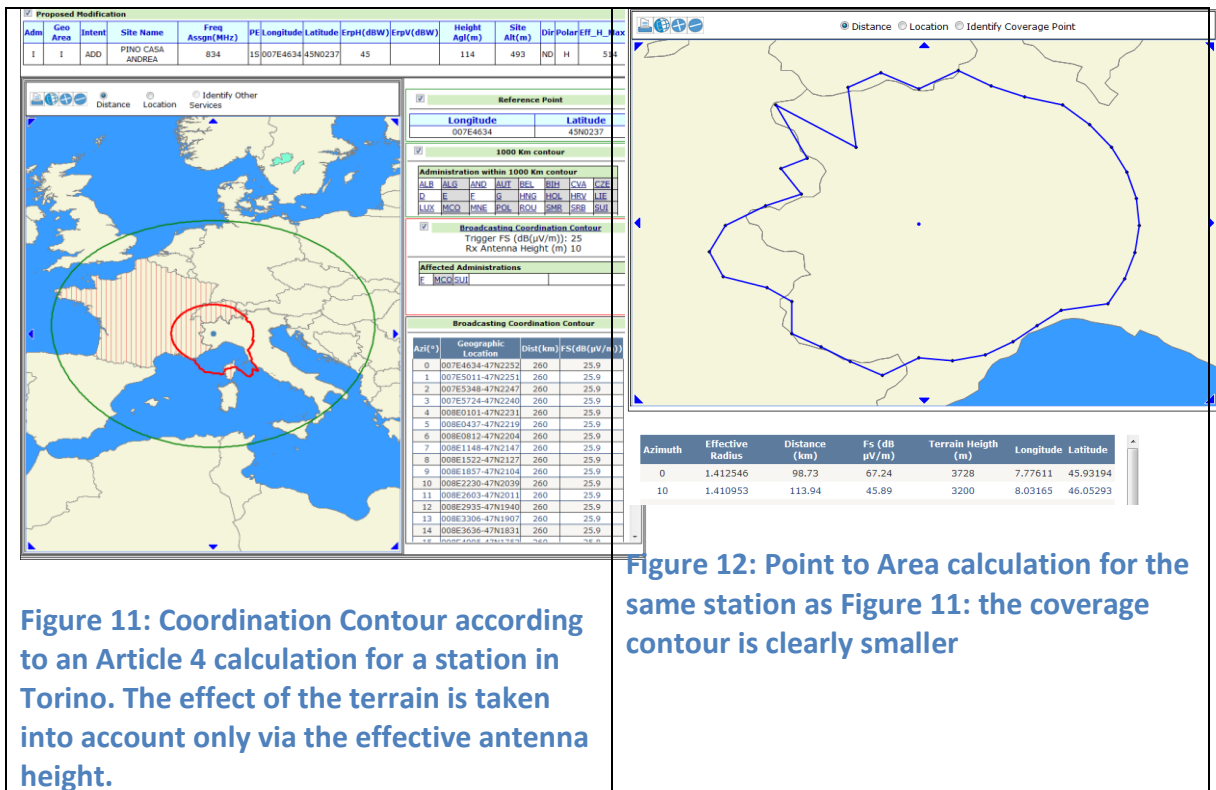
Figure 11: Coordination Contour according to an Article 4 calculation for a station in Torino. The effect of the terrain is taken into account only via the effective antenna height.

Figure 12: Point to Area calculation for the same station as Figure 11: the coverage contour is clearly smaller

A Google Earth display (see Figure 13) is also available for visualization of the terrain characteristics.
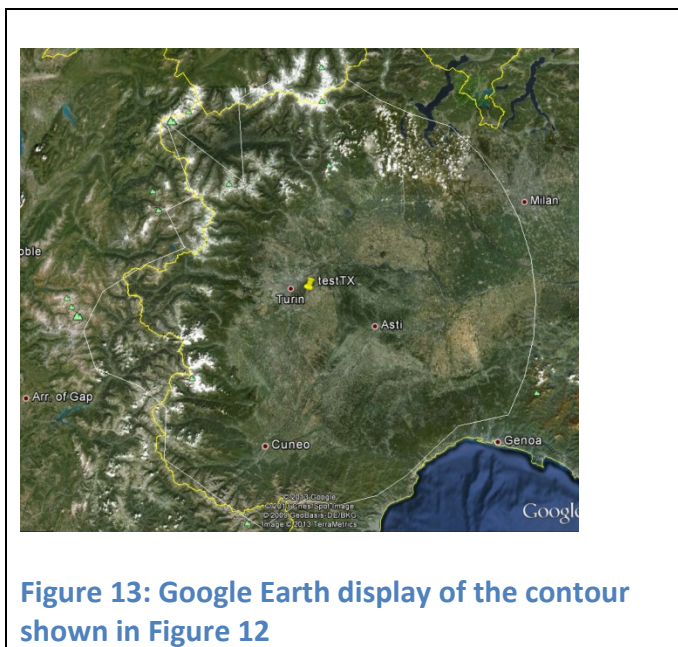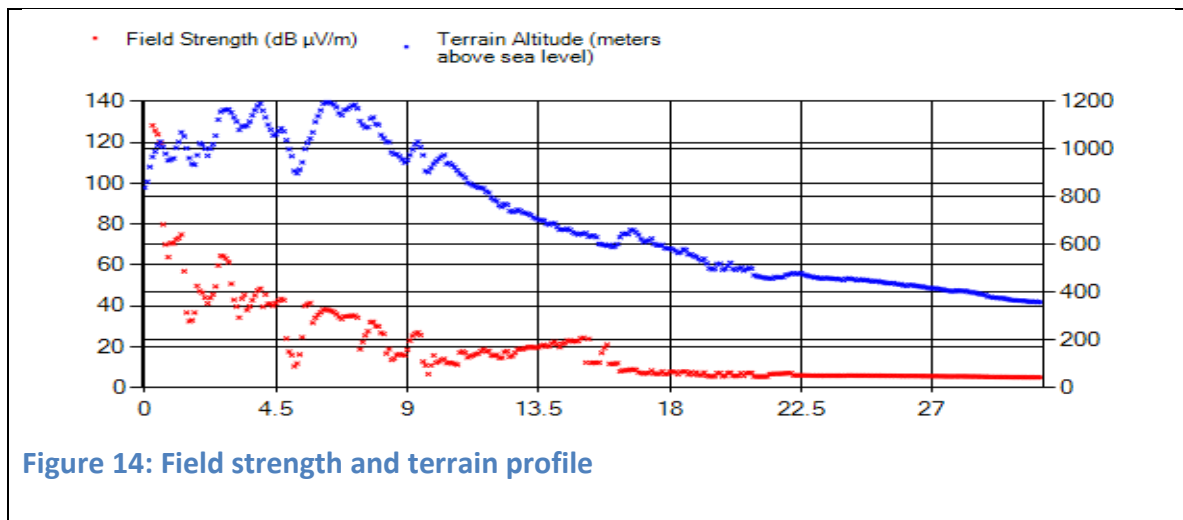

Figure 13: Google Earth display of the contour shown in Figure 12

The output of the <u>Point to Point</u> calculation (see Figure 14) consists in the field strength (dBuV/m) and the terrain altitude (meters above sea level) profile versus distance (km). The

profile is calculated from the location of the transmitter to the receiver as specified in the input data.

Figure 14: Field strength and terrain profile

List of Figures