Earth Stations Coordinations-AP7

ITU-R Space Regulatory Workshop
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Committed to connecting the world

Earth Station Coordination

- Determination of the Coordination Area Around the Earth Station based on AP7

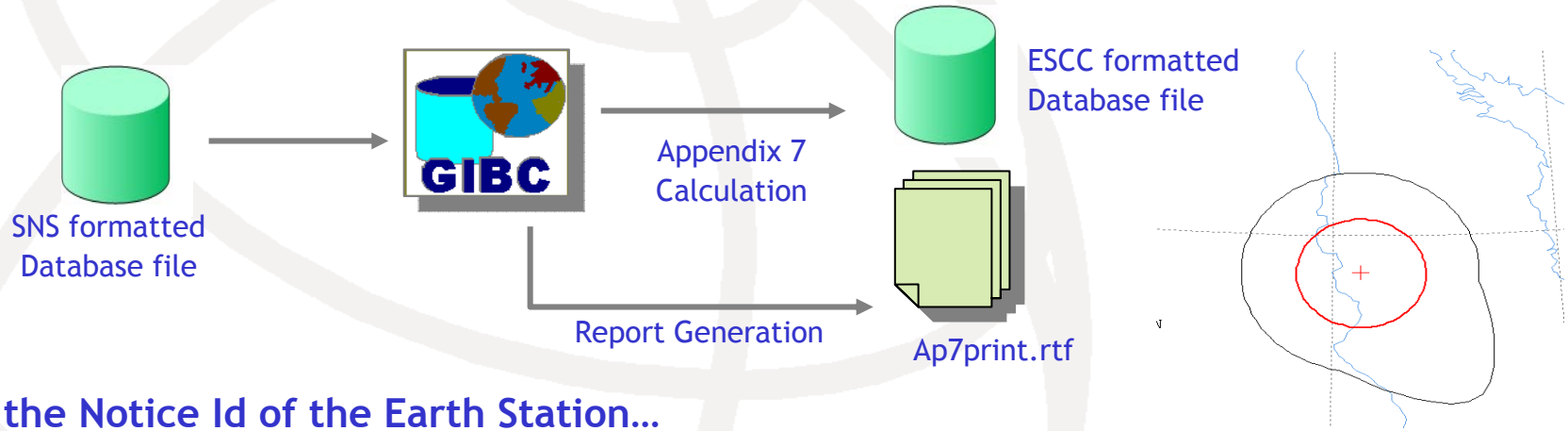
- 2 Tools :
  - GIBC Appendix 7 Calculation
  - Appendix 7 Capture

GIBC Appendix 7 calculation

GIBC can be used as the software tool allowing to perform:

Earth Stations :Coordination Contours Generation

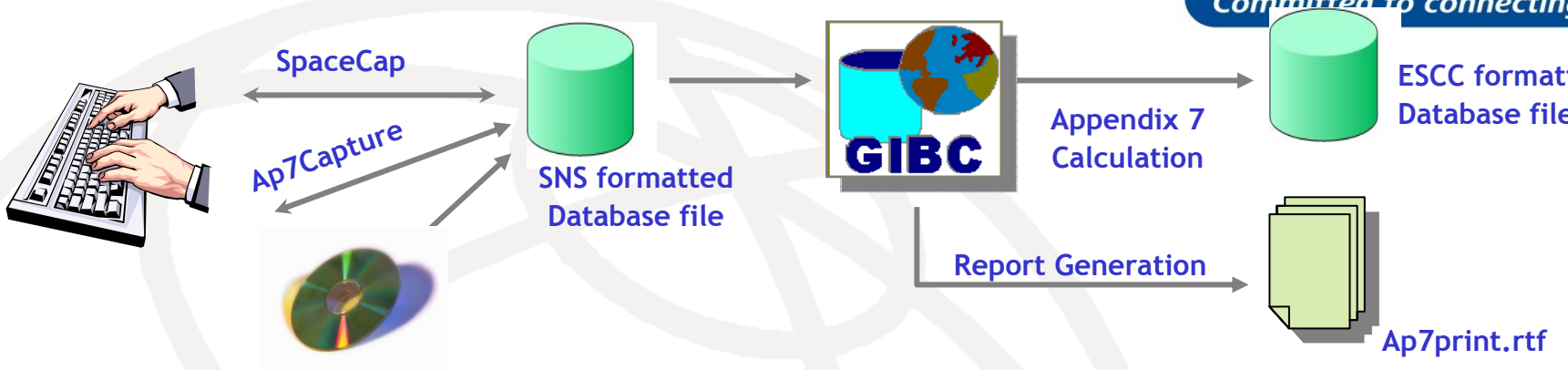
Appendix 7 of the RR-> Methods for the determination of Coordination Area around ES



Given the Notice Id of the Earth Station…

- Extract all required information from the SNS formatted database
- Perform Appendix 7 calculation
- Save the results in an ESCC formatted database file
- Produce report document in RTF format

Appendix 7 Capture tool



Simplifies the process of entering required data to Appendix 7 Calculation

- Creating a new earth station entry
- Modifying an existing earth station
- Cloning an existing one

Alternative to using SpaceCap

- Fewer forms to fill, fewer fields to enter…
- Ease, simplicity, more rapidly …

Results stored in an SNS-formatted database

- Into a new database
- Into an already existing database

In this workshop…

GIBC Appendix 7 Calculation

- **Software Installation**
- **Select input database**
- **Appendix 7 calculation**
- **Generate report document**
- **Review Report Document**
- **Include Auxiliary Contours**
- **Change Printing Options**

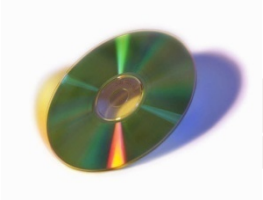
Appendix 7 Capture tool

- **Software Installation**
- **Select or create a database**
- **Browse an existing database**
- **Create a copy of an ES**
- **Modify parameters**
- **Create new ES**
- **Save into existing database**
- **Save into a new database**

Proposed Exercises:

- To Produce Coordination Contours information for two example Earth Stations
  - -One FSS Transmitting and Receiving ES in the 6/4 GHz band
  - -One FSS Transmitting ES in the 8 GHz band
- Then we will repeat the calculations to see the effect of the horizon elevation angles on the coordination contours

Installation and requirements



You can install GIBC and Ap7Capture from the SRS DVD.

Using the General Setup menu

To Install from the SRS on DVD**:**

- Run the general setup program

Program group (in Programs menu):
BR Space Applications – GIBC / Ap7Capture

Software Requirements:

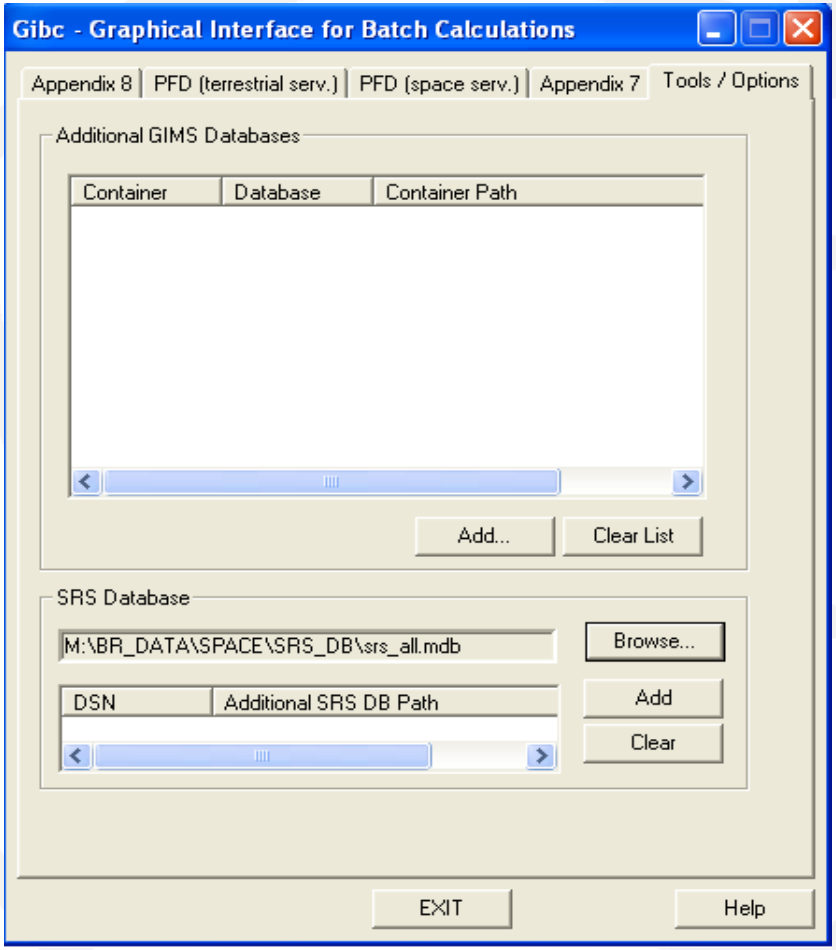
- Microsoft Data Access Components (MDAC) 2.6
- AP7Capture Installation will install the .Net Framework 2
- IDWM Geo Database (installed by default)
- SRS Database

Install GIBC & Open the application

Install Ap7Cap & Open the application

GIBC/Appendix 7- Input Database

The information required by the calculation program is extracted from the **SNS** formatted database specified in the **TOOLS & Options** page.



SRS Database **section in the** Tools & Options **Page indicates database file location.**

Default location: **SRS.MDB database file in the DVD Drive.**

Note! Keep the DVD on its drive during the calculation process

You can change the input database file location by using the browse **button. This allows you to:**

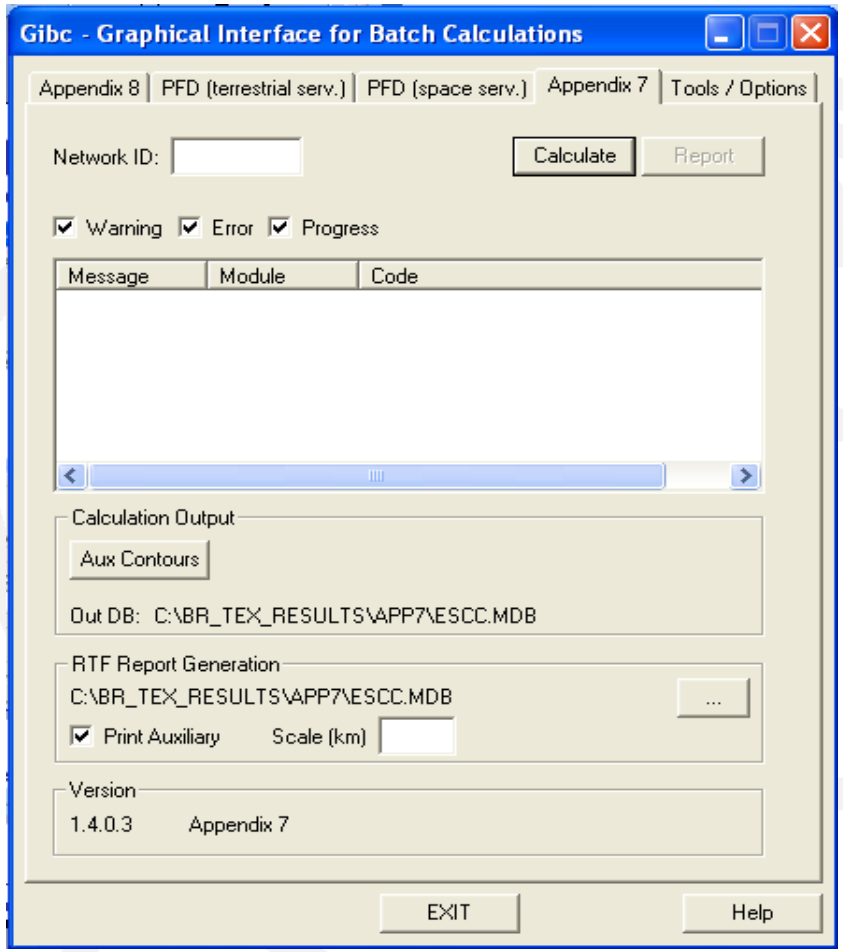
- **Change the default location of the input database**
- **Use other input database file**

Select the **Tools & Options** page

Check the SRS database file location

Select the input from the seminar CD

Appendix 7 Calculation



How to Proceed?

- **Select the Appendix 7 page**
- **Enter Earth Station Network Identification**
- **Press Calculate**

Check Progress of Calculation

Select type of messages : Warning\Error\Progress

Results in MS–Access file

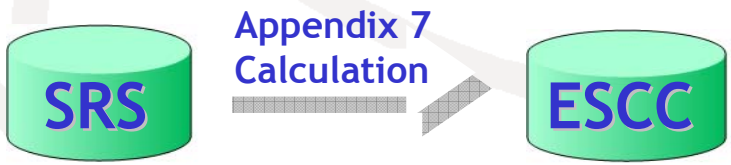
Each calculation in a separated file

Naming convention:

NetworkId_Date_Time.mdb

Results Directory:

C:\BR_TEX_RESULTS\APP7



Select the **Appendix 7** page

Enter the **Network Id** of the earth station (test case 104500375)

Press **Calculate**

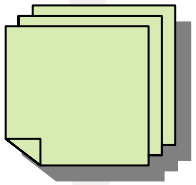
Generate Report Document

After an Appendix 7 calculation…
- **Just Press the** Report **button**
- **Last network Id field and last database file are already selected.**

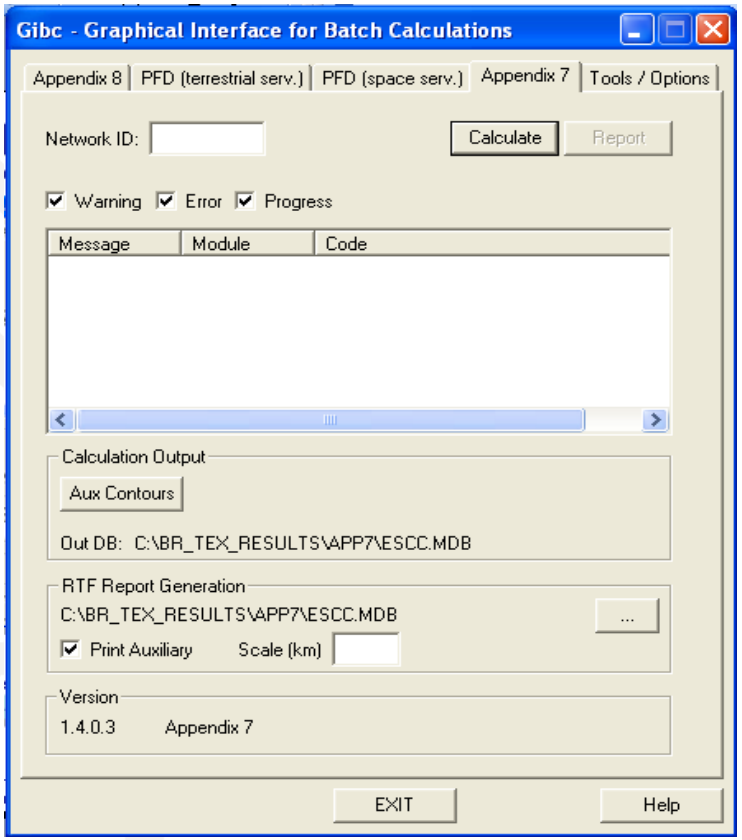
Check Progress of Calculation
- **Select type of messages :**
- **Warning\Error\Progress**

How to Proceed?
- **Enter Earth Station Network Identification**
- **Select, using the** Browse **button the ESCC database file**
- **Press the** Report **button**

Report Generation



Ap7print.rtf

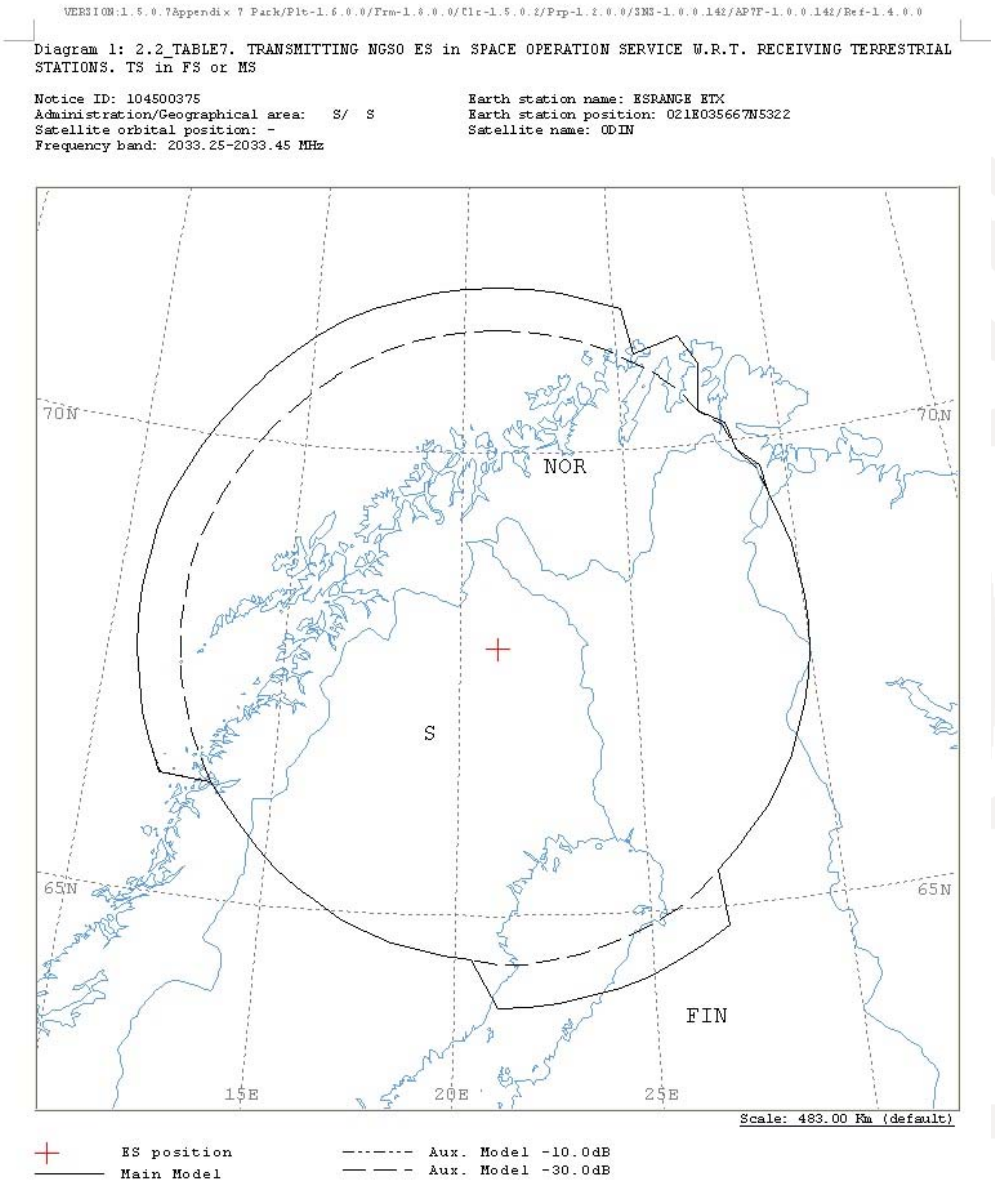


Note!

Ap7Print.RTF is rewritten each time!!!
If the file is locked you will get an error message.

To generate the report document on the test case from last calculation, press the **Report** button (with Network Id field being 104500375)

Report Document - Graphics



Ap7Print.RTF Document

Graphics:

Variable number of diagrams

Each diagram displaying:

- Title
- Details
- Coordination Contours
  - Main Mode I and II
  - Auxiliary Contours
  - Supplementary
- Country Codes
- Legend

Edit the Ap7Print.RTF file in the C:\br_tex_results\ap7 folder

Report Document Details

ANALYSIS DATE AND TIME: 2008-11-18 16:06:32
VERSION: 3.5.8.1Appendix 1 Pack/Rlt-3.6.8.8/Frm-3.8.8.8/Clc-3.5.8.2/Rep-3.2.8.8/SRS-3.8.8.142/APIF-3.8.8.142/Re

Diagram 1: 2.2_TABLE7. TRANSMITTING NGSO ES in SPACE OPERATION SERVICE W.R.T.

NOTICE ID: 104500375 EARTH STATION NAME: ESRANGE ETX EARTH STATION I
ADM/GEO_AREA: S/ S RAIN CLIMATICAL ZONE: C
SATELLITE NAME: ODIN SATELLITE ORBITAL POSITION: - DEG
ANTENNA AZIMUTH: - DEG ANTENNA ELEVATION: - DEG
FREQUENCY BAND: 2033.25-2033.45 MHZ ASSIGNED FREQUENCY: 2033.35 MHZ
MAXIMUM ANTENNA GAIN: 41.0 DBI MAXIMUM POWER DENSITY: -32.0 DBW/HZ
ANTENNA PATTERN: APEND_099V01
2.2_TABLE7 Model: PLM_DUCTING

TRANSMISSION LOSS MODE 1: 193.0 DB (DOES NOT INCLUDE HOR. CORR. AND ANT. GAIN)
TRANSMISSION LOSS MODE 2:

AZIMUTH	0	5	10	15	20	25	30	35	40	45	50	55	60	
OFF-AXIS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
HOR.ELEV.	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.1	5.1	5.1	5.1	5
HOR.CORR.	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.1	35.1	35.1	35
ANT.GAIN	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41
COORDINATION DISTANCE (KM)														
MODE 1														
0.0 DB	433	433	433	433	433	389	433	419	375	387	375	385	375	3
-10.0 DB	433	433	433	433	433	389	433	419	375	387	375	385	375	3
-20.0 DB	381	381	381	381	381	381	381	381	375	381	375	381	375	3

AZIMUTH	120	125	130	135	140	145	150	155	160	165	170	175	180	1
OFF-AXIS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
HOR.ELEV.	5.1	5.1	5.1	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5
HOR.CORR.	35.1	35.1	35.1	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35
ANT.GAIN	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41
COORDINATION DISTANCE (KM)														
MODE 1														
0.0 DB	375	375	375	375	433	433	433	433	433	433	433	433	433	3
-10.0 DB	375	375	375	375	433	433	433	433	433	433	433	433	433	3
-20.0 DB	375	375	375	375	380	380	380	380	380	380	380	380	380	3

AZIMUTH	240	245	250	255	260	265	270	275	280	285	290	295	300	3
OFF-AXIS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
HOR.ELEV.	5.4	5.3	5.3	5.3	5.3	5.3	5.2	5.2	5.2	5.2	5.1	5.2	5.3	5
HOR.CORR.	35.4	35.3	35.3	35.3	35.3	35.3	35.2	35.2	35.2	35.2	35.1	35.2	35.3	35
ANT.GAIN	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41
COORDINATION DISTANCE (KM)														
MODE 1														
0.0 DB	375	381	432	432	432	432	433	433	433	433	433	433	432	4
-10.0 DB	375	381	432	432	432	432	433	433	433	433	433	433	432	4
-20.0 DB	375	380	380	380	380	380	380	380	380	381	381	380	380	3

PROBABLY AFFECTED COUNTRIES: FIN NOR RUS

International Telecommunication Union

Committed to connecting the world

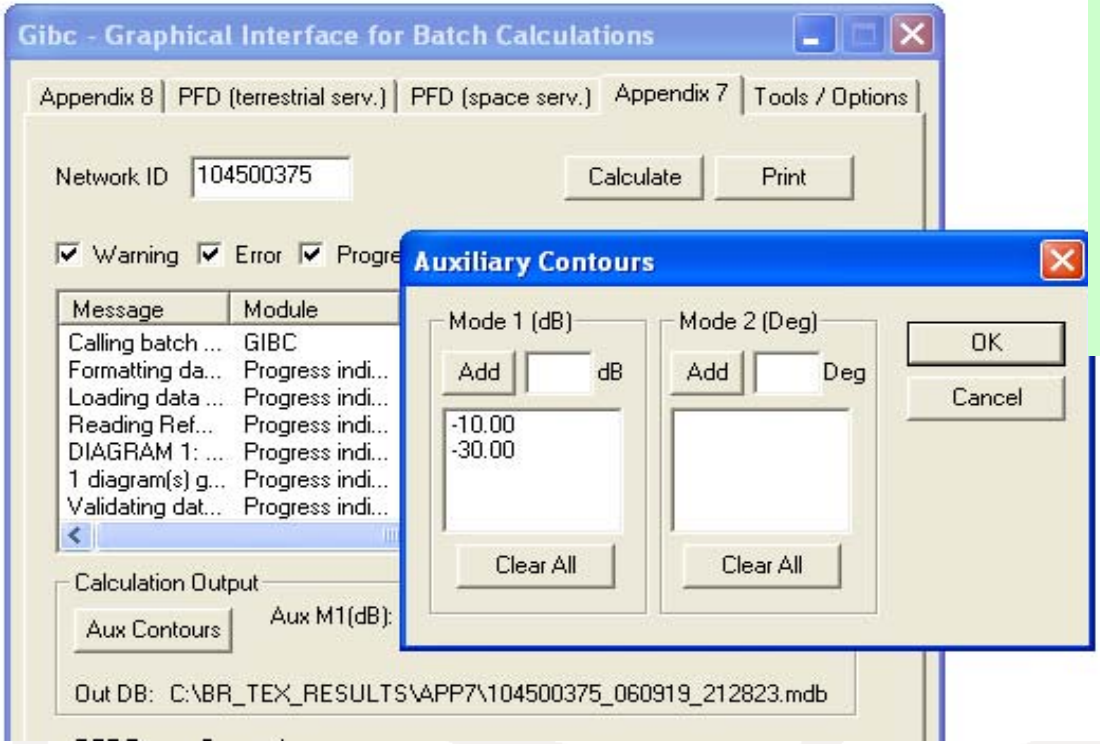
- Coordination distances at 72 azimuths (0-355degrees at 5 deg steps)
- Details of the calculation
- Intermediate data
- List of affected countries

Print the Report Document

Auxiliary Contours

Auxiliary Mode 1 **reduced required loss expressed in dB**

Auxiliary Mode 2 **Angular offset between beams expressed in degrees**



How to produce auxiliary contours?

- **Use the Aux Contours button to display the Auxiliary Contours dialog.**
- **Enter the values in the list**
  - Mode 1 (dB) (negative values)
  - Mode 2 (deg)
- **Perform the Calculation**

To add Mode 1 aux contours press the **Aux Contours** button.

Add Mode 1 Contours (-10dB, -30dB)

Perform Calculation

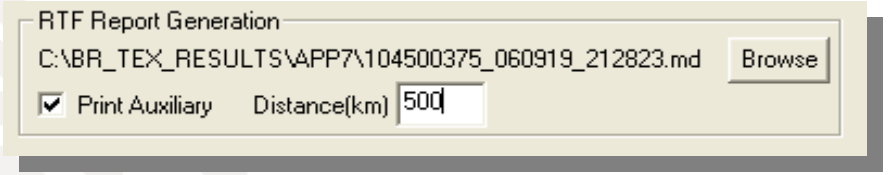
Perform Report Generation

Printing Options

Print Auxiliary

Checked-up the auxiliary contours are included in the report document (if auxiliary contours information exists).

This option is without effect if there is not any auxiliary contours information in the database.

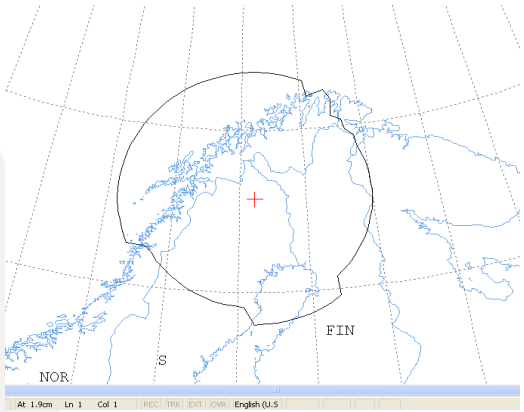


Distance\Scale

Size of the window of the map (expressed in Km).

By default (blank value) automatic value that accommodates the diagram.

Useful in comparing results from two different earth stations.



Uncheck the **Print Auxiliary** Contours option

Specify 1000Km

Perform Report Generation

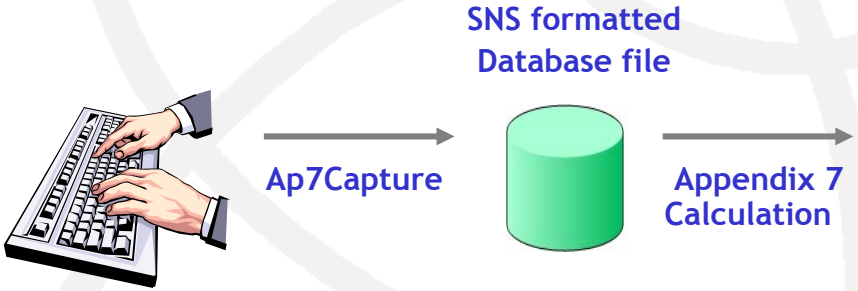
Check the report file

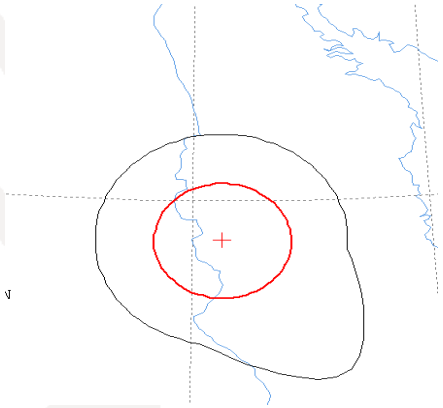
AP7Capture Tool

Modify parameters of Existing Earth Station

Create a copy of an Existing Earth Station

Create a new Earth Station





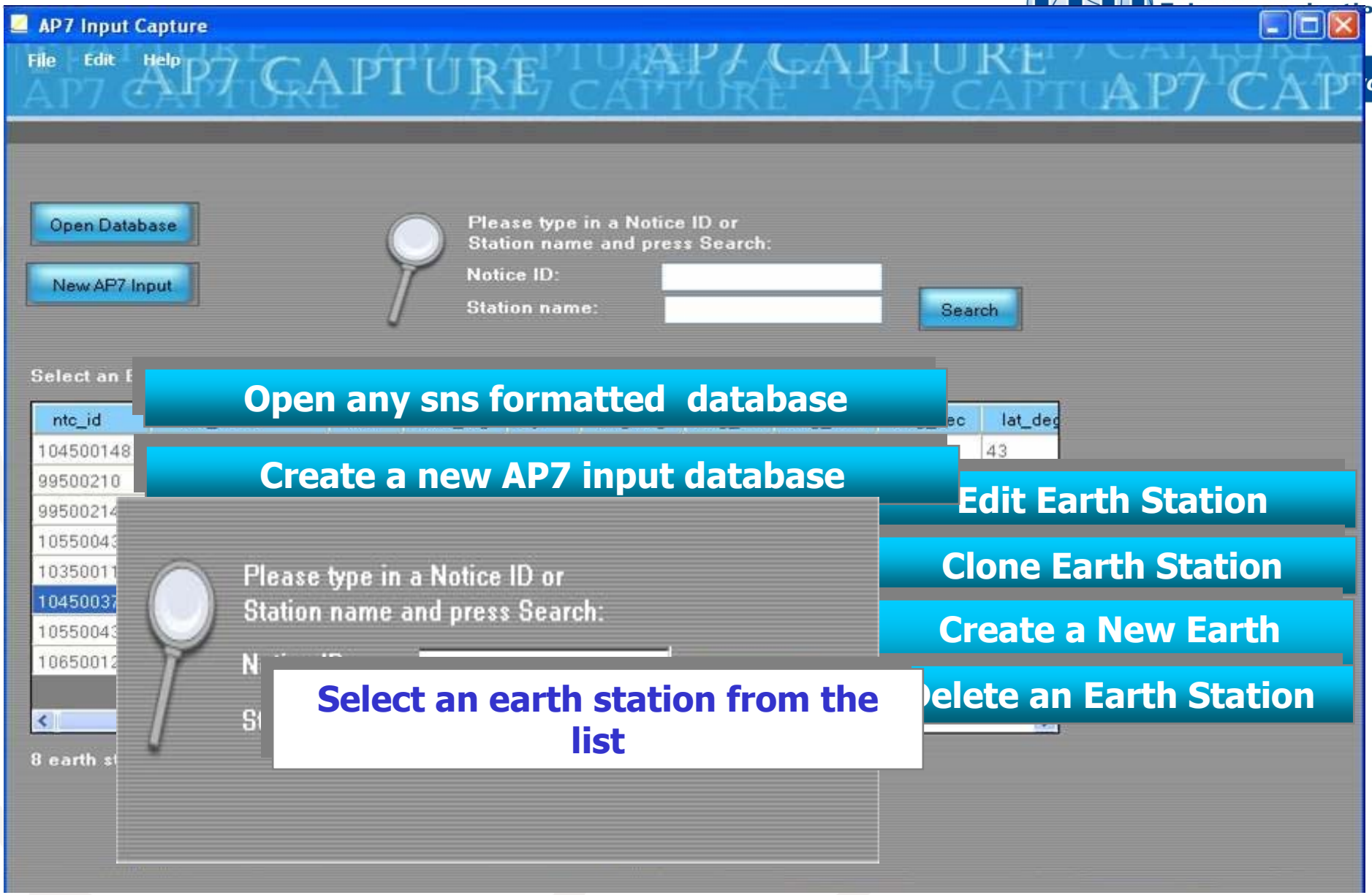
In addition, Ap7 Capture tool provides:

- Search for earth station by Notice ID
- Basic validation of AP7 input parameters
- Deletion of earth stations from AP7 input database
- User friendly interface!

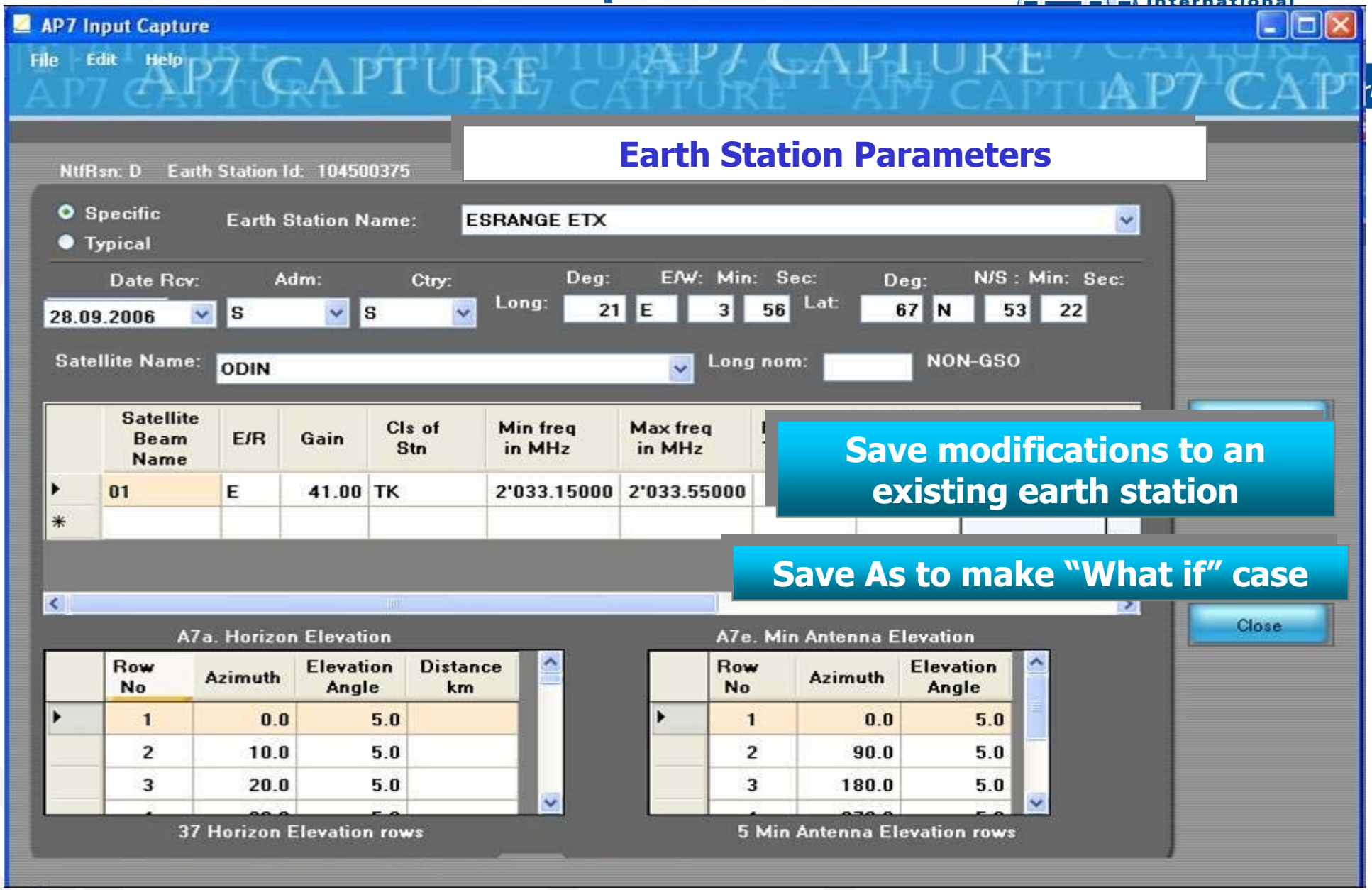
Open Ap7capture tool

Select the database on the workshop folder

AP7 Capture


AP7 Input Capture
File
Edit
Help
Open Database
New AP7 Input
Please type in a Notice ID or
Station name and press Search:
Notice ID:
Station name:
Search
Open any sns formatted database
Create a new AP7 input database
Edit Earth Station
Clone Earth Station
Create a New Earth
Delete an Earth Station
Select an earth station from the list
ntc_id
lat_deg
8 earth st

AP7 Capture


AP7 Input Capture
File Edit Help
Earth Station Parameters
NtfRsn: D Earth Station Id: 104500375
Specific
Typical
Earth Station Name: ESRANGE ETX
Date Rcv: 28.09.2006
Adm: S
Ctry: S
Long: Deg: 21 E/W: E Min: 3 Sec: 56
Lat: Deg: 67 N/S : N Min: 53 Sec: 22
Satellite Name: ODIN
Long nom:
NON-GSO
Satellite Beam Name | E/R | Gain | Cls of Stn | Min freq in MHz | Max freq in MHz
01 | E | 41.00 | TK | 2'033.15000 | 2'033.55000
Save modifications to an existing earth station
Save As to make "What if" case
Close
A7a. Horizon Elevation
Row No | Azimuth | Elevation Angle | Distance km
1 | 0.0 | 5.0
2 | 10.0 | 5.0
3 | 20.0 | 5.0
37 Horizon Elevation rows
A7e. Min Antenna Elevation
Row No | Azimuth | Elevation Angle
1 | 0.0 | 5.0
2 | 90.0 | 5.0
3 | 180.0 | 5.0
5 Min Antenna Elevation rows

Proposed Exercises

Effect of the horizon elevation angles on the Coordination Contours information for two example Earth Stations:

1st exercise: **FSS Transmitting** and **Receiving ES** in the **6/4 GHz band**

2nd exercise: **FSS Transmitting ES** in the **8 GHz band**

Input and Solution files on your seminar CD…

GIBC/App.7 - Proposed Exercises

Proposed Exercises: Effect of the horizon elevation angles

Coordination Contours information for two example Earth Stations:

- 1st exercise: **FSS Transmitting** and **Receiving ES** in the **6/4 GHz band**
  - -Input example database (SNS format): **Tx&RxEarthStation@6&4GHz.mdb**
  - -ES name: **MAGTAB**
  - -ES Notice Ids: **87500999** (with non-zero deg. horizon elevation angles)
    87501000 (with zero deg. horizon elevation angles)

- 2nd exercise: **FSS Transmitting ES** in the **8 GHz band**
  - -Input example database (SNS format): **TxEarthStation@8GHz.mdb**
  - -ES name: **MAGTAB**
  - -ES Notice Ids: **87500999** (with non-zero deg. horizon elevation angles)
    87501000 (with zero deg. horizon elevation angles)

Exercise 1

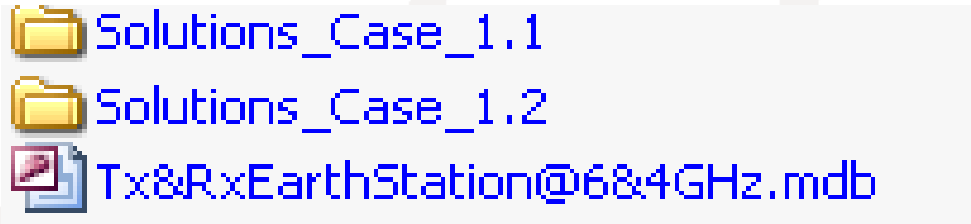
FSS Transmitting and **Receiving ES** in the **6/4 GHz band**

Input example database (SNS format):

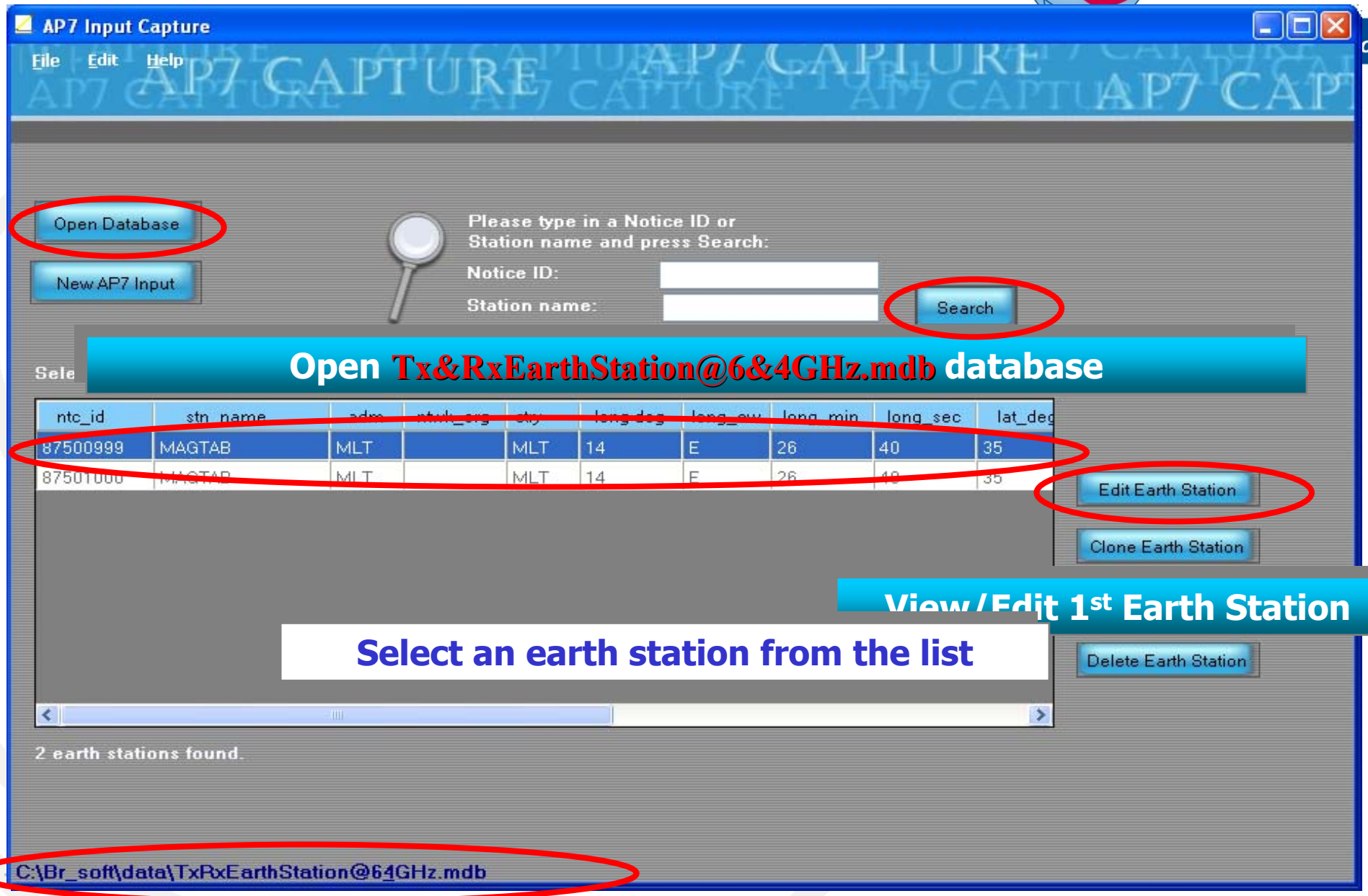
Tx&RxEarthStation@6&4GHz.mdb

ES name: **MAGTAB**

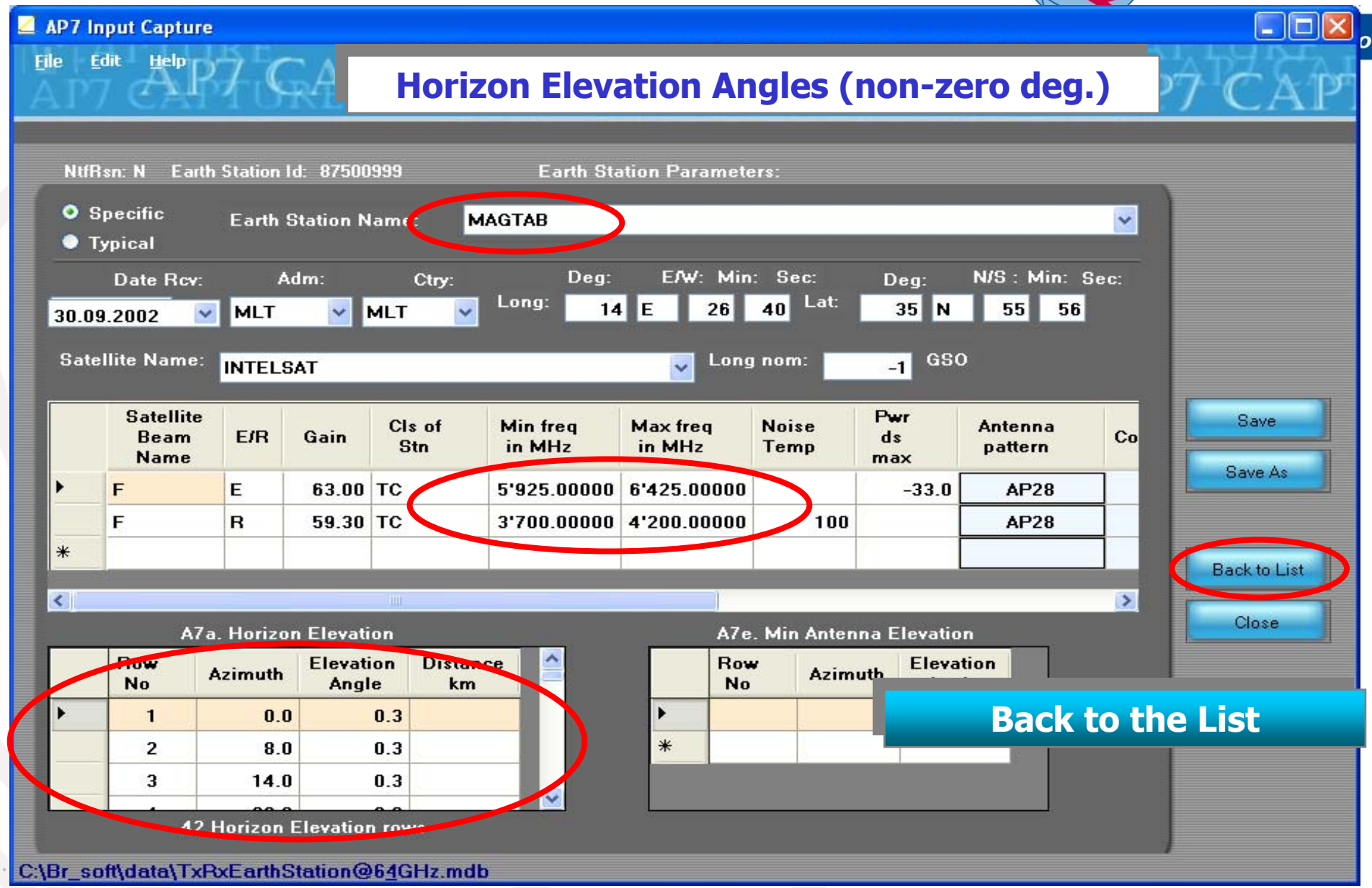
- Case 1.1 ES notice id: **87500999** (non-zero deg. horizon elevation angles)
- Case 1.2 ES notice id: **87501000** (zero deg. horizon elevation angles)



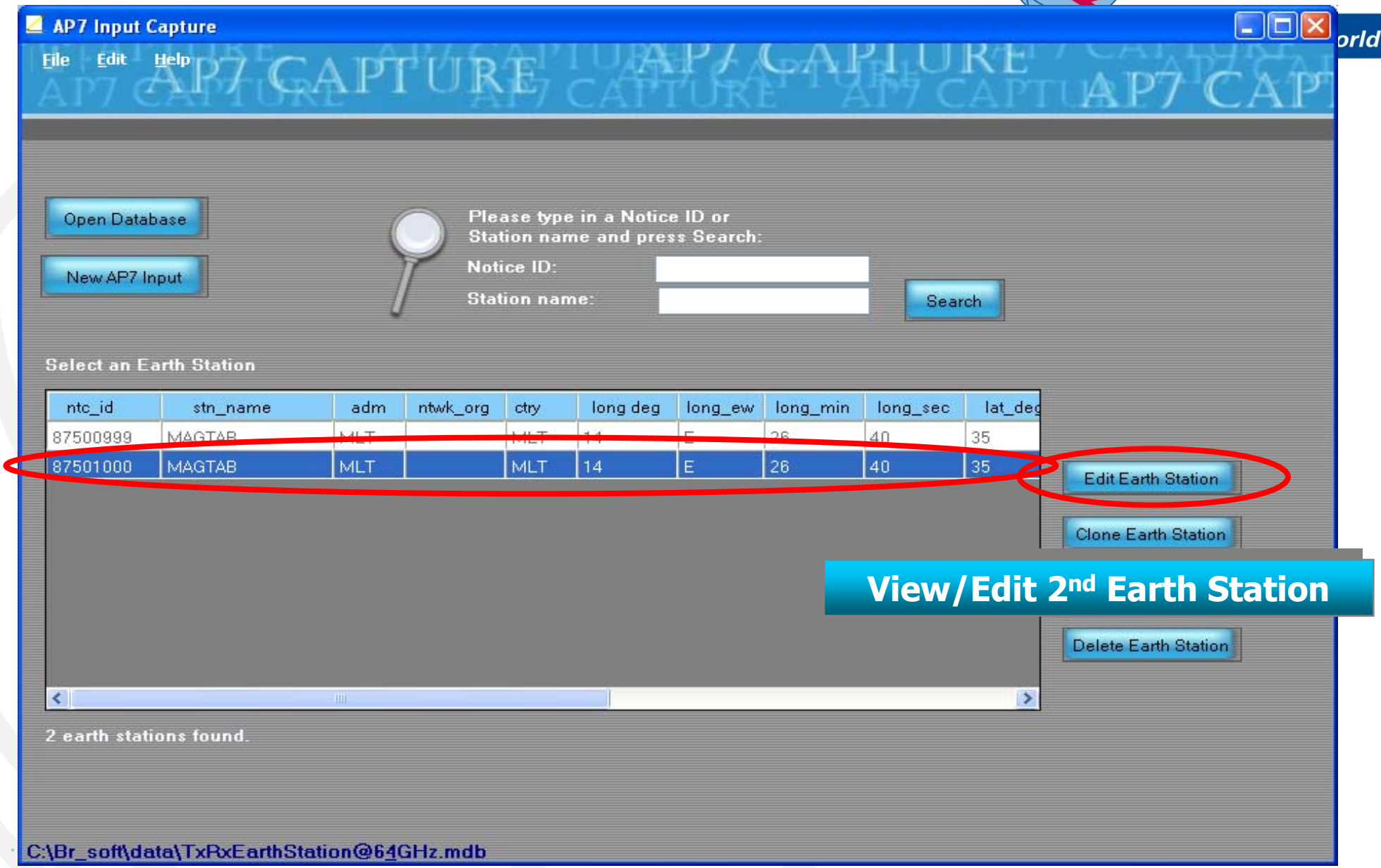
Exercise 1 - AP7 Capture/View



Exercise 1 - AP7 Capture/View

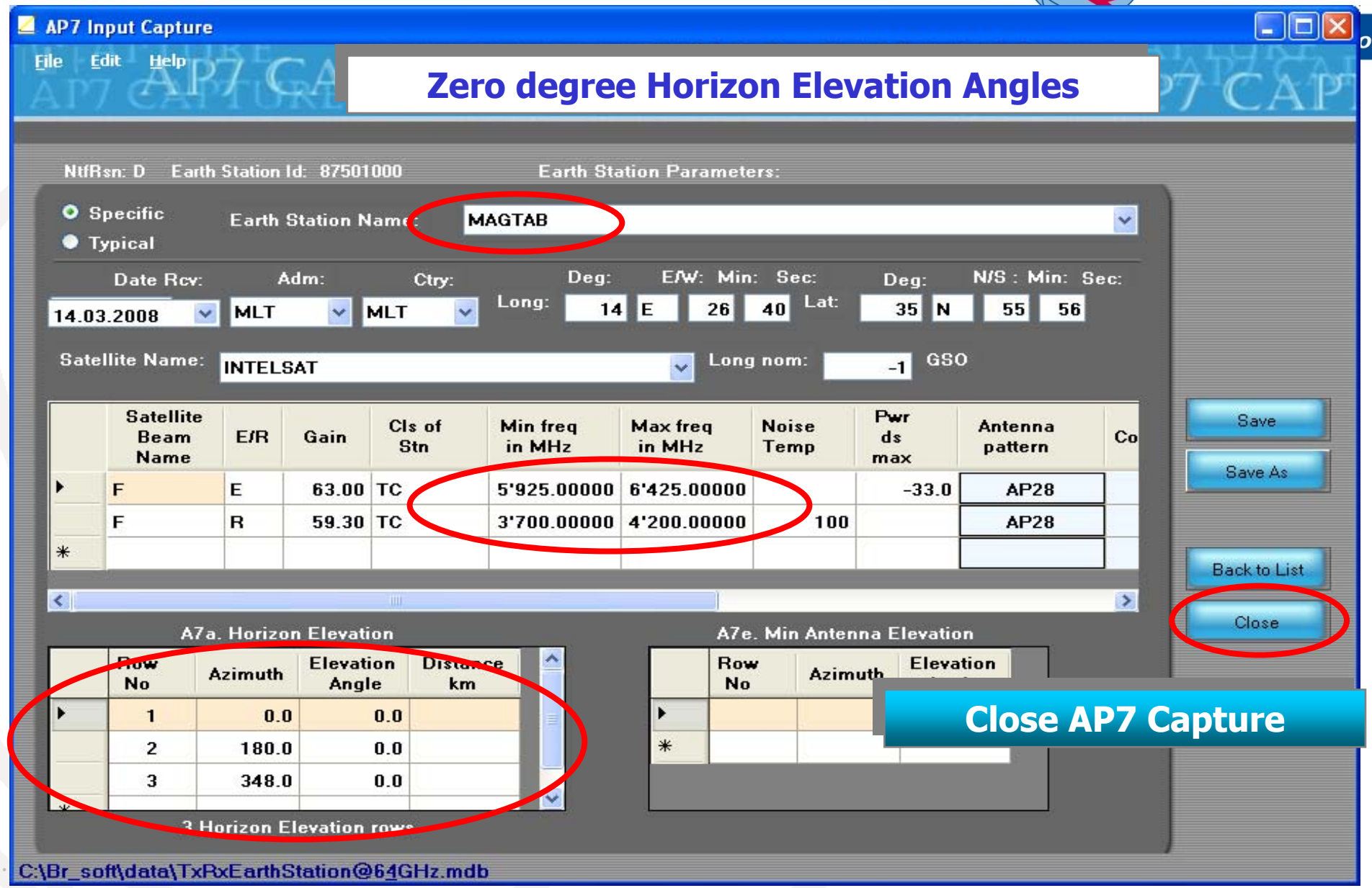


Exercise 1 - AP7 Capture/View

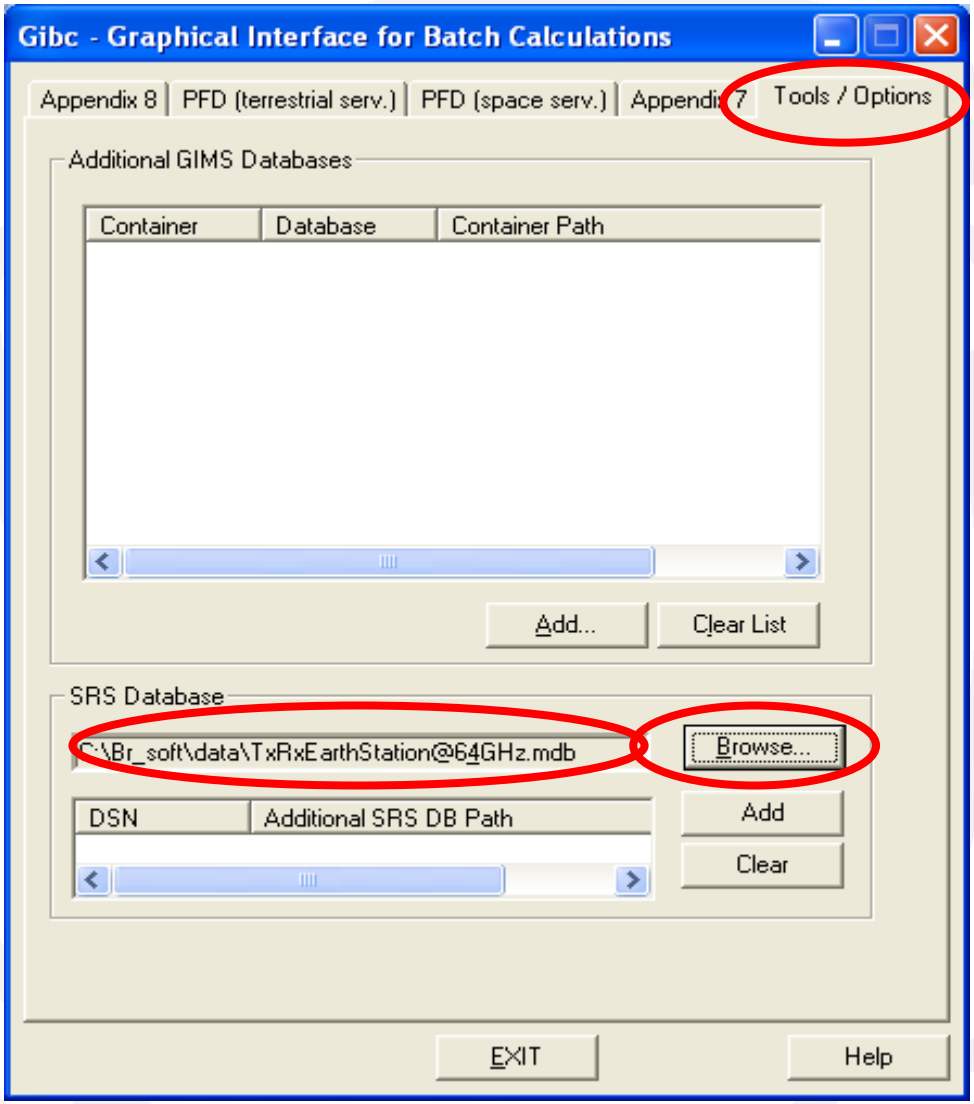


View/Edit 2nd Earth Station

Exercise 1 - AP7 Capture/View



Exercise 1
GIBC – Open input Database

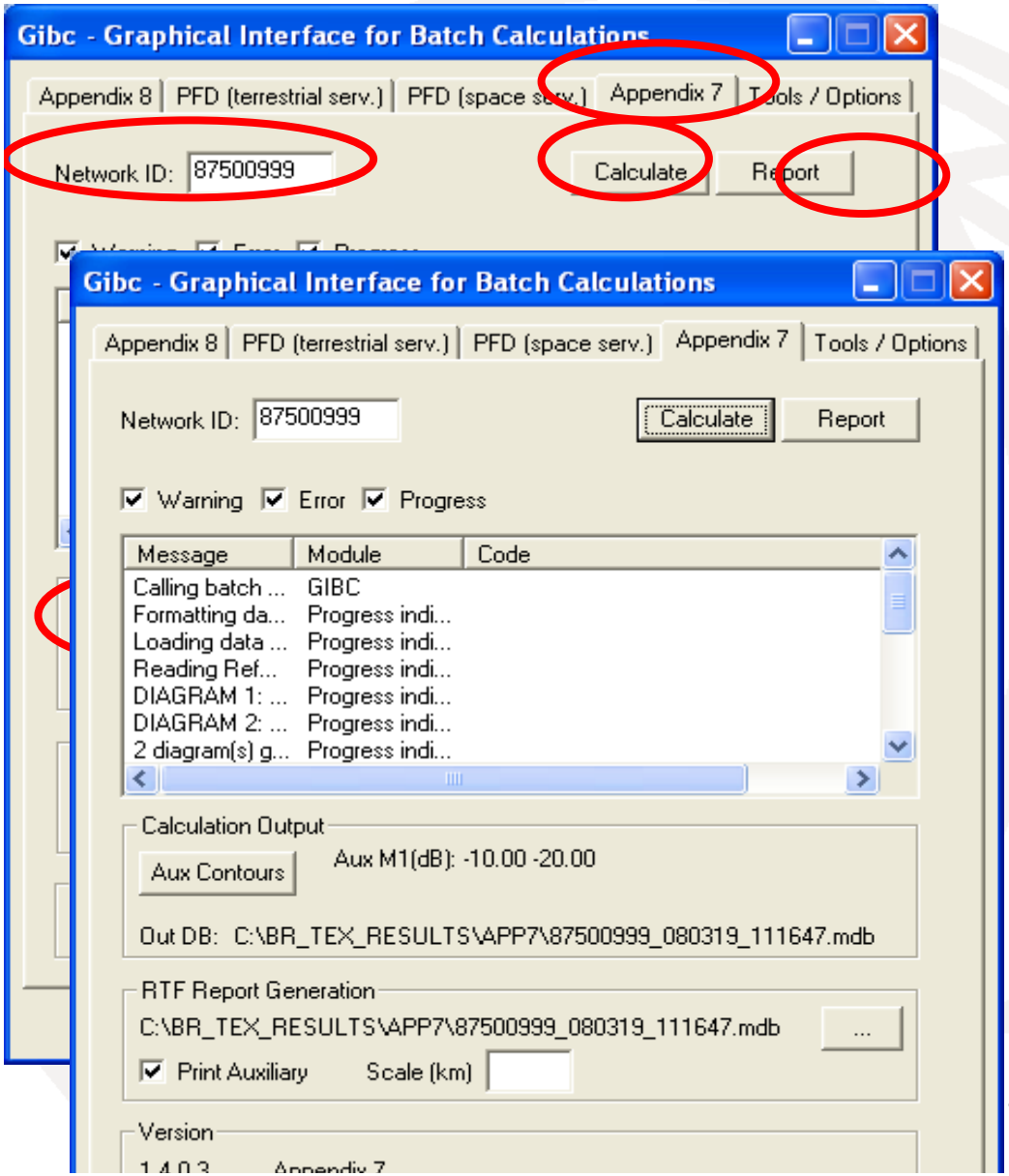


- Run GIBC
- Select the **Tools & Options** page
- Change the SRS database reference input file:

⇒ Browse and Select the following file from the workshop directory on the seminar CD

Tx&RxEarthStation@6&4GHz .mdb

Exercise 1 – GIBC – Calculate

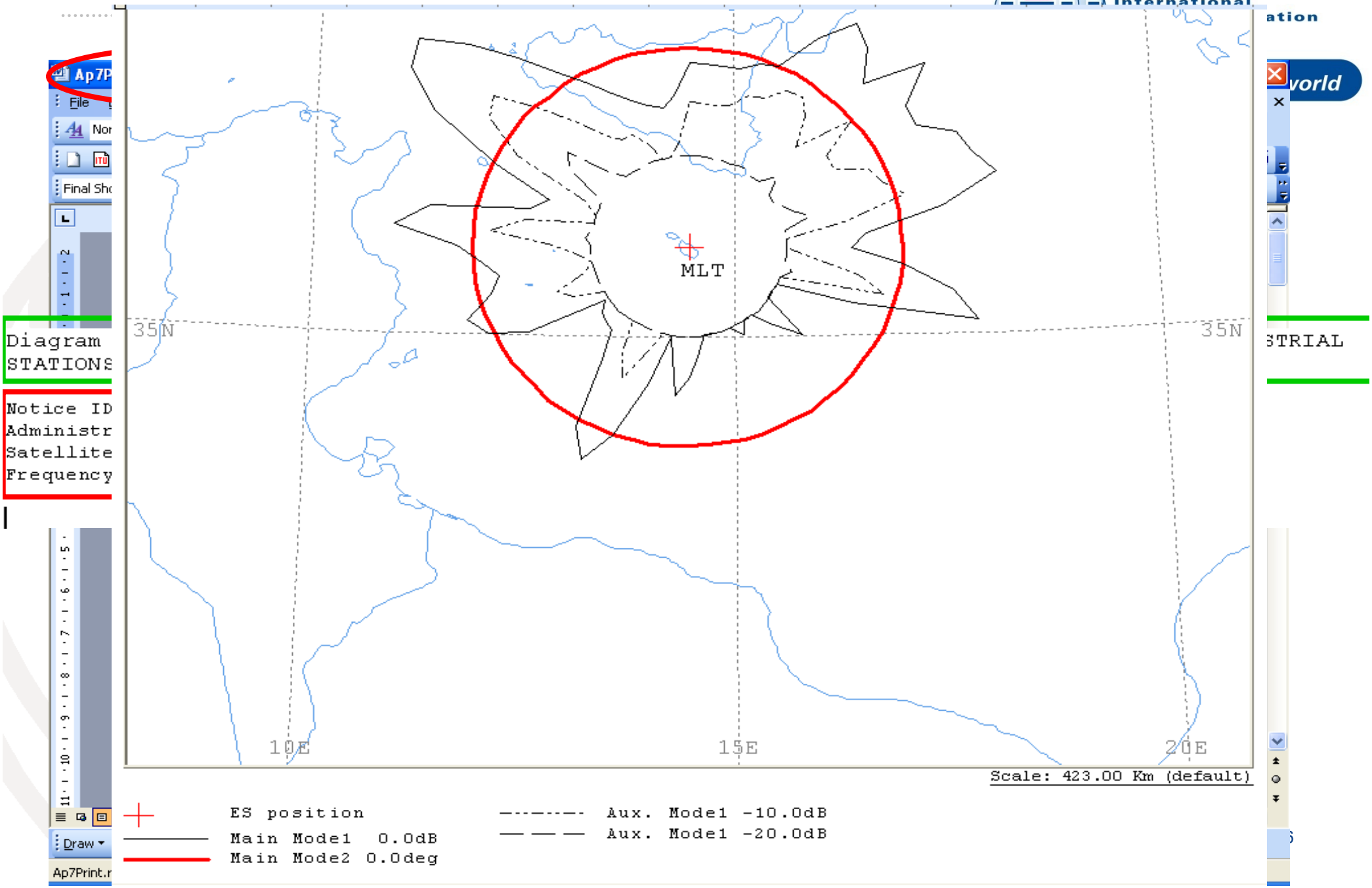


- Run GIBC
- Select the **Appendix 7** page
- Enter the 1st Earth Station notice Id.:

  87500999
- Set the Auxiliary Contours at:

  -10 dB and -20 dB for mode 1
- Calculate the coordination contours
- Create an Open the Report

Exercise 1 – GIBC – Results – Case 1.1 (Tx)



Exercise 1
GIBC – Results – Case 1.1 (Tx)

ANALYSIS DATE AND TIME: 2008-11-18 14:28:15
VERSION: 1.5.0.7Appendix 7 Pack/Plt-1.6.0.0/Frm-1.8.0.0/Clc-1.5.0.2/Prp-1.2.0.0/SNS-1.0.0.142/AP7F-1.0.0.142/Ref-1.4.0.0

Diagram 1: 2.1_TABLE7. TRANSMITTING GSO ES in FIXED-SATELLITE SERVICE W.R.T. RECEIVING

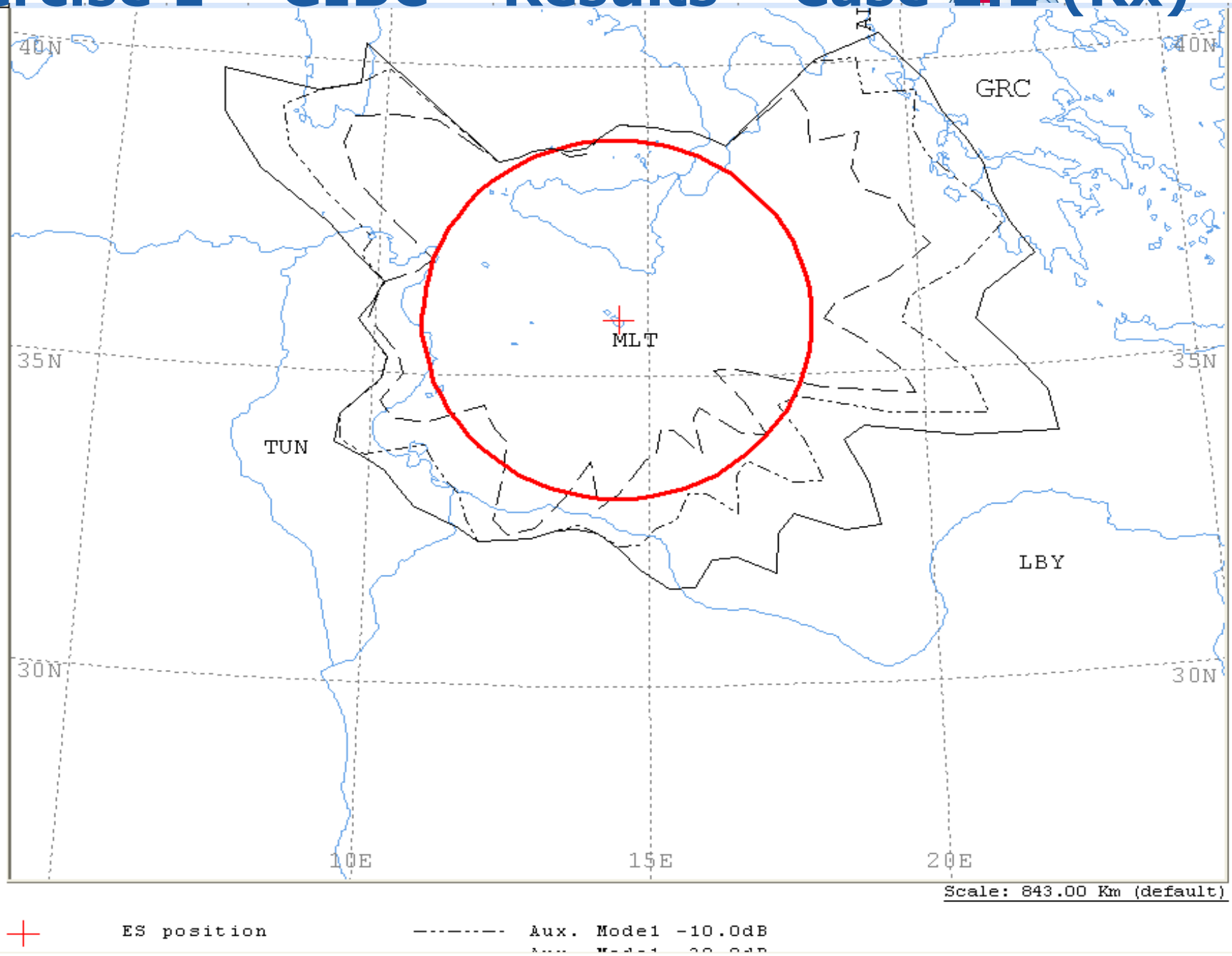
NOTICE ID: 87500999 EARTH STATION NAME: MAGTAB EARTH STATION POSITION:
ADM/GEO_AREA: MLT/MLT RAIN CLIMATICAL ZONE: K
SATELLITE NAME: INTELSAT SATELLITE ORBITAL POSITION: -1.00 DEG
ANTENNA AZIMUTH: 205.21 DEG ANTENNA ELEVATION: 45.19 DEG
FREQUENCY BAND: 5925.00-6425.00 MHZ ASSIGNED FREQUENCY: 6175.00 MHZ PE
MAXIMUM ANTENNA GAIN: 63.0 DBI MAXIMUM POWER DENSITY: -33.0 DBW/HZ NO
ANTENNA PATTERN: APERR_001V01
2.1_TABLE7 Model: PLM_DUCTING

TRANSMISSION LOSS MODE 1: 180.0 DB (DOES NOT INCLUDE HOR. CORR. AND ANT. GAIN)
TRANSMISSION LOSS MODE 2: 134.0 DB

AZIMUTH	240	245	250	255	260	265	270	275	280	285	290	295	300	305
OFF-AXIS	54.0	56.8	59.7	62.5	65.5	68.8	72.2	75.8	79.2	82.2	85.6	89.5	93.3	96.8
HOR.ELEV.	0.7	0.4	0.4	0.6	0.7	0.6	0.4	0.2	0.3	0.9	1.1	0.5	0.2	0.1
HOR.CORR.	20.2	16.4	15.1	18.5	19.7	18.2	15.5	8.8	12.3	22.6	24.3	17.8	9.2	4.6
ANT.GAIN	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
COORDINATION DISTANCE (KM)														
MODE 1														
0.0 DB	197	236	251	216	205	219	248	315	279	174	157	224	312	360
-10.0 DB	104	135	149	114	104	117	145	213	177	104	104	121	210	257
-20.0 DB	104	104	104	104	104	104	104	111	104	104	104	104	108	155
MODE 2														
0.0 DEG	230	230	230	230	230	230	230	230	229	229	229	229	229	229

PROBABLY AFFECTED COUNTRIES: I

Exercise 1 – GIBC – Results – Case 1.1 (Rx)



Exercise 1 – GIBC – Results – Case 1.1 (Rx)

ANALYSIS DATE AND TIME: 2008-11-18 14:28:15
VERSION: 1.5.0.7Appendix 7 Pack/Plt-1.6.0.0/Frm-1.8.0.0/Clc-1.5.0.2/Prp-1.2.0.0/SNS-1.0.0.142/AP7F-1.0.0.142/Ref-1.4.0.0

Diagram 2: 2.1_TABLE8. RECEIVING GSO ES in FIXED-SATELLITE SERVICE W.R.T. TRANSMITTING

NOTICE ID: 87500999 EARTH STATION NAME: MAGTAB EARTH STATION POSITION:
ADM/GEO_AREA: MLT/MLT RAIN CLIMATICAL ZONE: K
SATELLITE NAME: INTELSAT SATELLITE ORBITAL POSITION: -1.00 DEG
ANTENNA AZIMUTH: 205.21 DEG ANTENNA ELEVATION: 45.19 DEG
FREQUENCY BAND: 3700.00-4200.00 MHZ ASSIGNED FREQUENCY: 3950.00 MHZ PE
MAXIMUM ANTENNA GAIN: 59.3 DBI MAXIMUM POWER DENSITY: - DBW/HZ NC
ANTENNA PATTERN: APERR_001V01
2.1_TABLE8 Model: PLM_DUCTING

TRANSMISSION LOSS MODE 1: 204.9 DB (DOES NOT INCLUDE HOR. CORR. AND ANT. GAIN)
TRANSMISSION LOSS MODE 2: 162.9 DB

AZIMUTH	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
OFF-AXIS	129.3	131.1	132.6	133.6	134.3	134.6	134.4	133.8	132.7	131.2	129.6	127.4	125.1	122.6	119.9 1
HOR.ELEV.	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.4	0.2	0.3	0.3	0.2	0.2
HOR.CORR.	11.8	11.8	11.8	11.6	10.8	9.8	9.2	9.2	10.8	13.8	8.0	12.0	12.2	9.2	8.6
ANT.GAIN	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0 -

COORDINATION DISTANCE (KM)

MODE 1

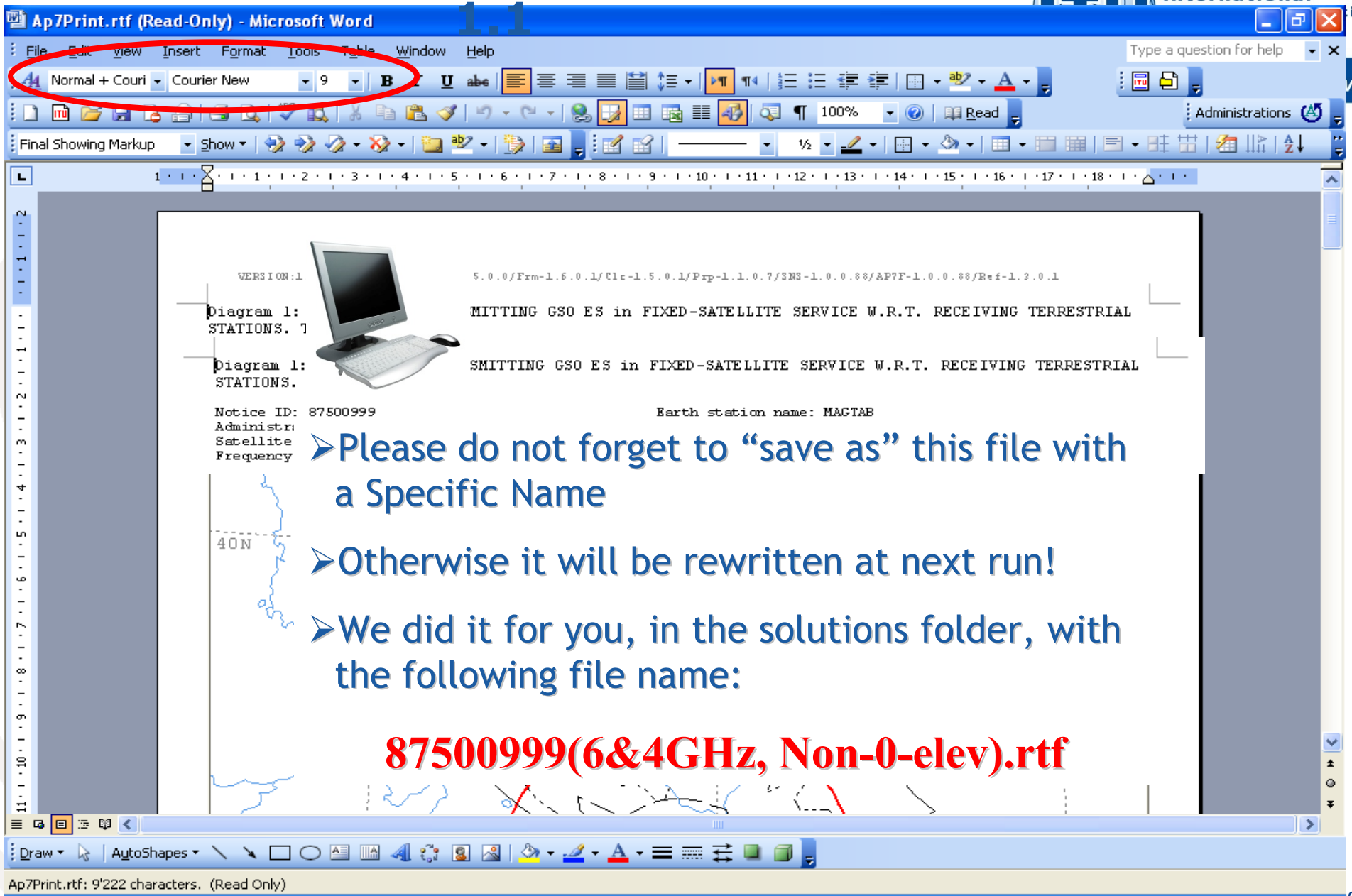
0.0 DB	490	519	491	405	386	405	427	404	392	447	507	649	749	793
-10.0 DB	483	506	490	405	386	405	427	404	392	440	433	525	625	673
-20.0 DB	370	415	420	367	367	384	413	403	389	342	323	401	502	553

MODE 2

0.0 DEG	324	324	324	324	324	324	323	323	323	323	323	323	323	323

PROBABLY AFFECTED COUNTRIES: ALB GRC I LBY TUN

Exercise 1 – GIBC – Results – Case 1.1



- Please do not forget to "save as" this file with a Specific Name
- Otherwise it will be rewritten at next run!
- We did it for you, in the solutions folder, with the following file name:

87500999(6&4GHz, Non-0-elev).rtf

Exercise 1 – GIBC – Results – Case 1.2

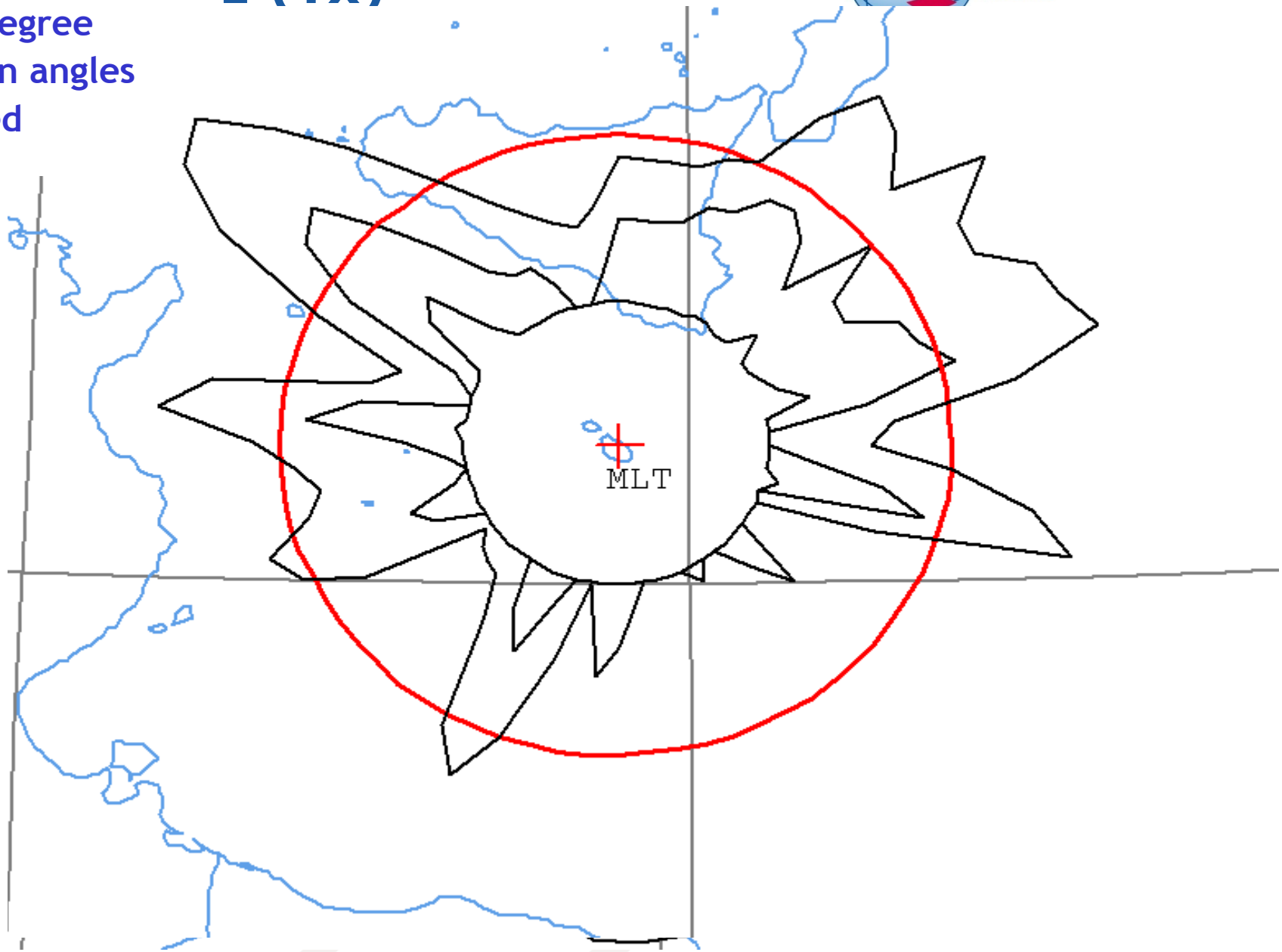
- Same Earth Station as for Case 1.1, but with zero degree horizon elevation angle
- Open the resulting file:

87501000(6&4GHz, 0-elev).rtf

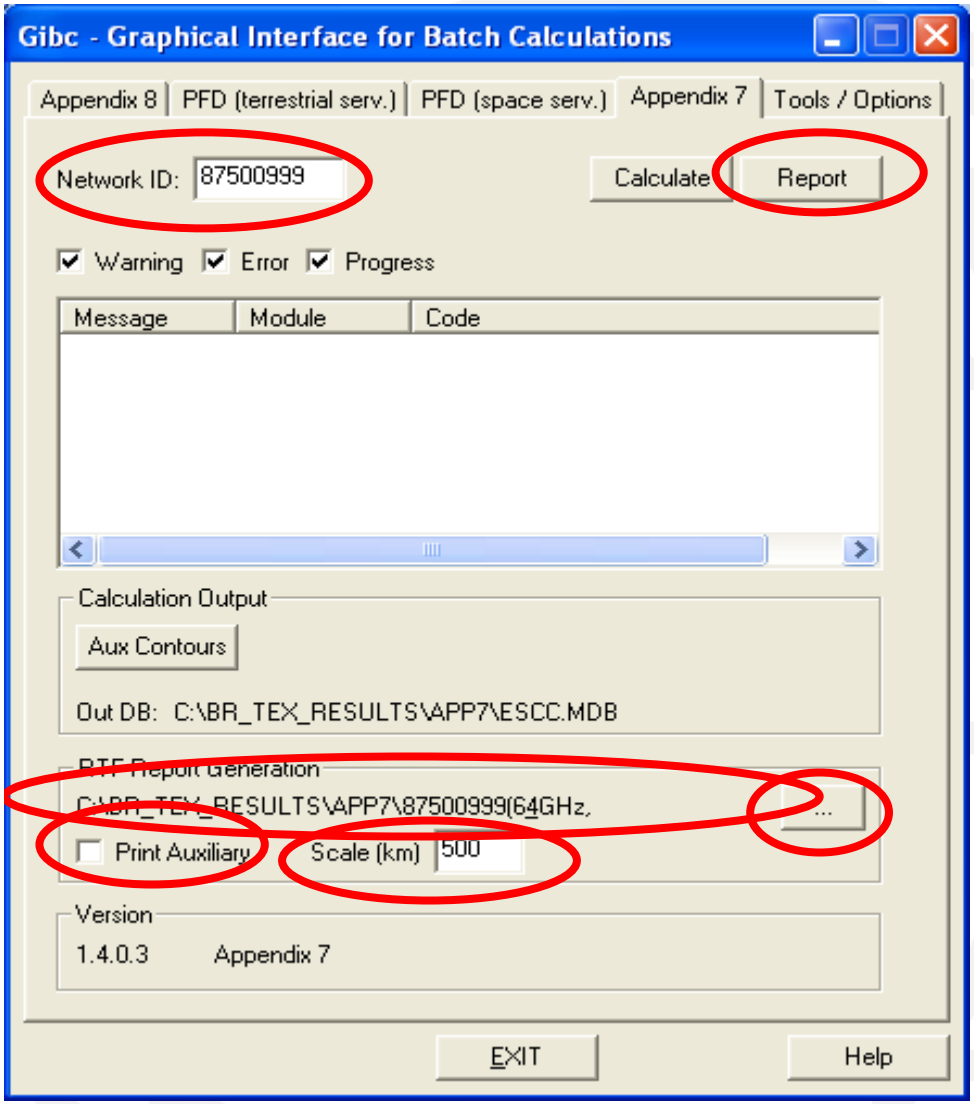
Exercises 1 – GIBC – Results – Case 1 (Tx)

With non-zero-degree horizon elevation angles

Probably affected countries: I



Exercise 1 – GIBC – Report re-generation

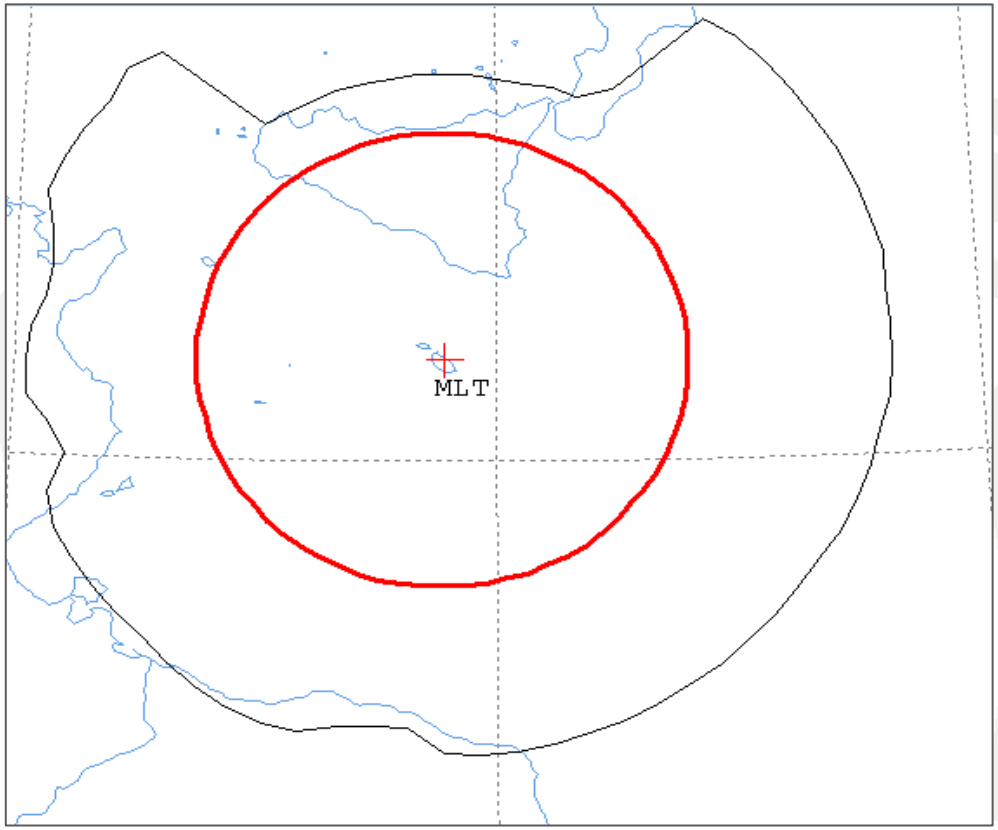


- Run GIBC
- Select the **Appendix 7** page
- Enter the 1st Earth Station notice Id.:

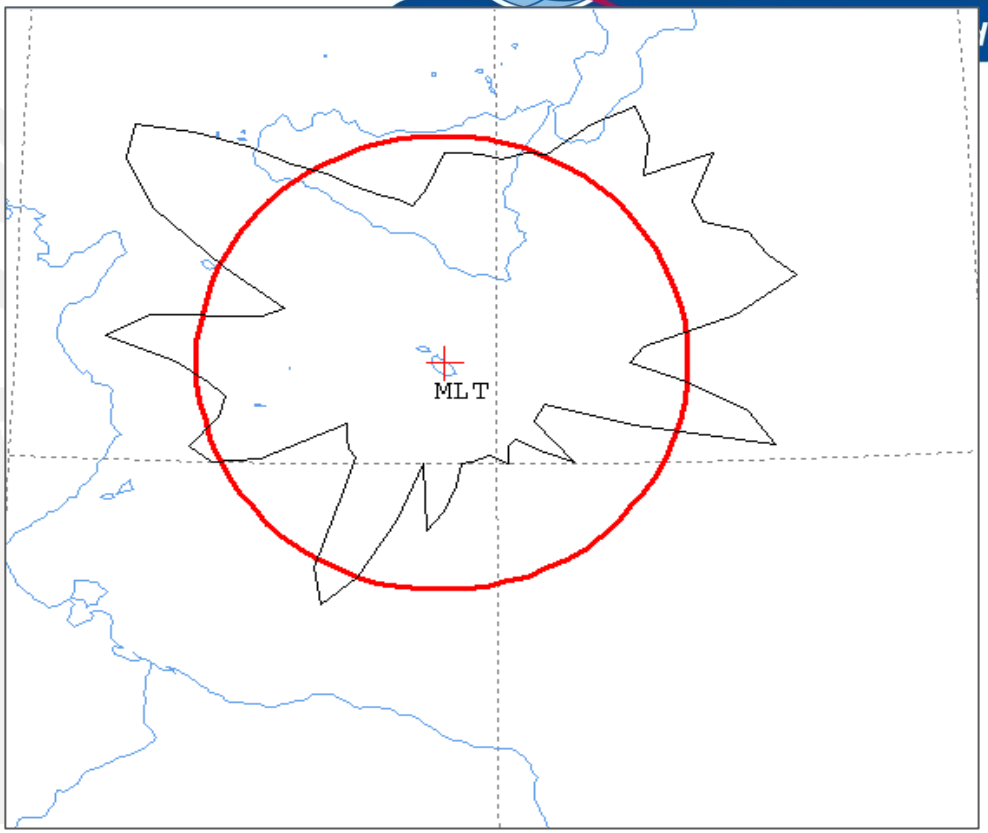
  87500999
- Select resulting database

  87500999(6&4GHz, Non-0-elev).mdb
- Disable print of auxiliary contours
- Enter the display window size
- Re-create the output Report

Exercise 1 – GIBC – Results – (Tx)

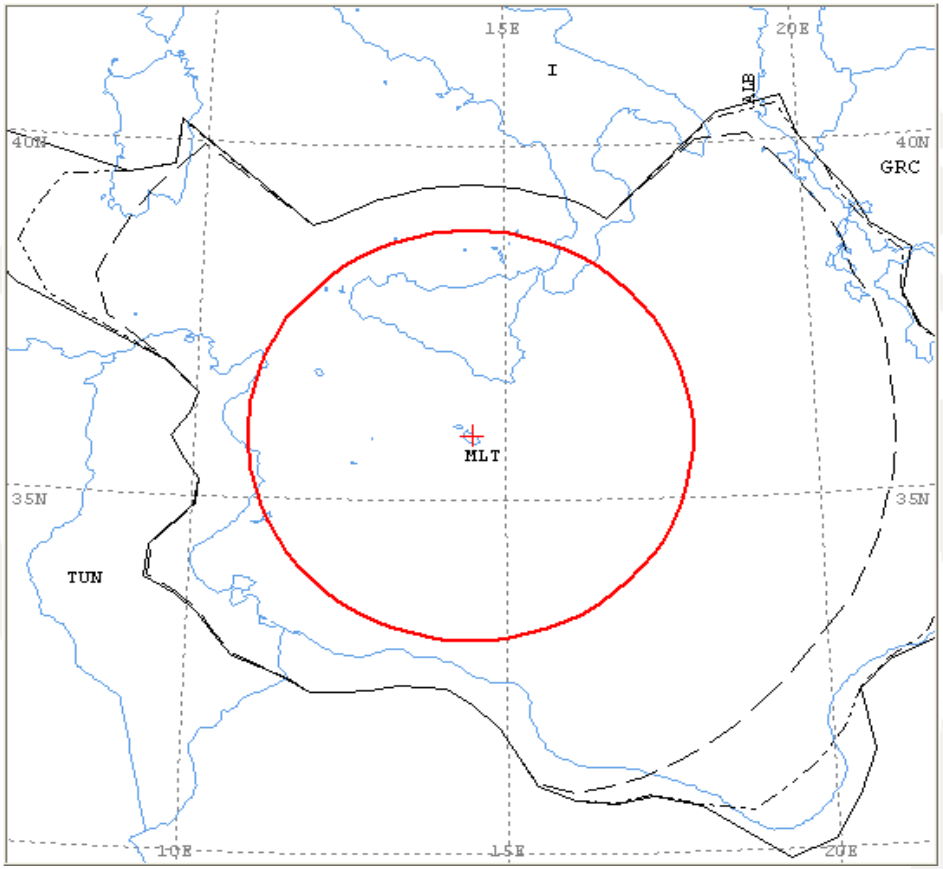


Zero-degree horizon elevation angles



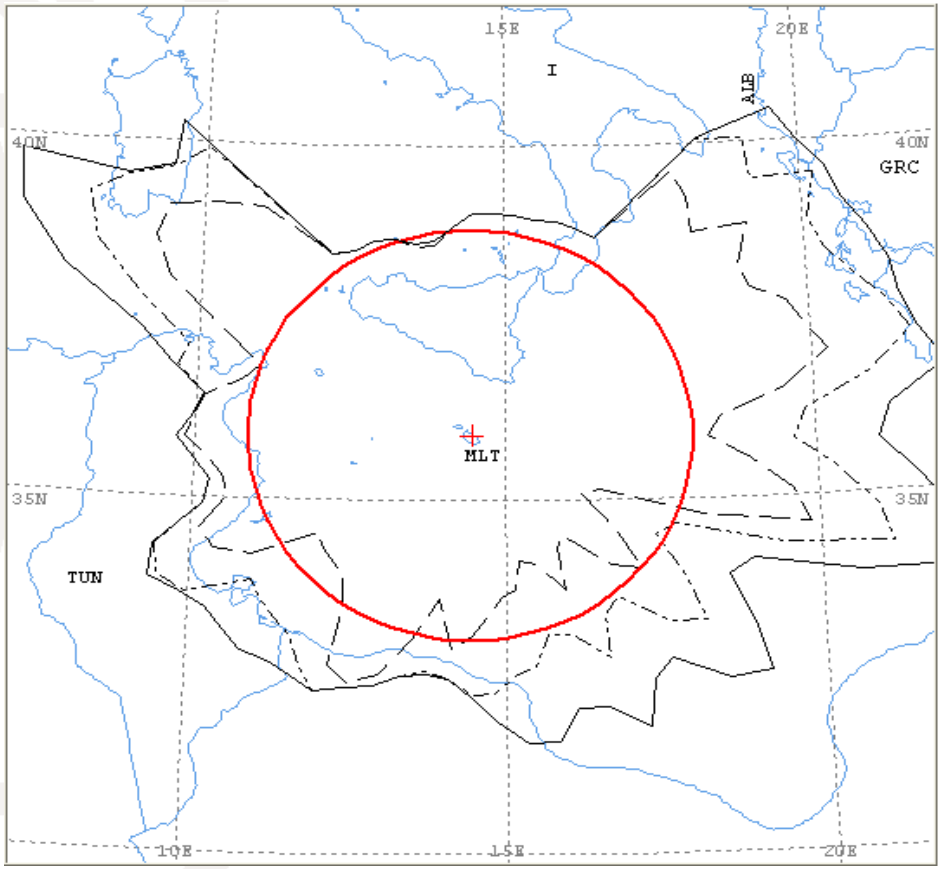
Non-zero-degree horizon elevation angles

Exercise 1 – GIBC – Results – (Rx)



With zero-degree horizon elevation angles

With non-zero-degree horizon elevation angles



Exercise 2

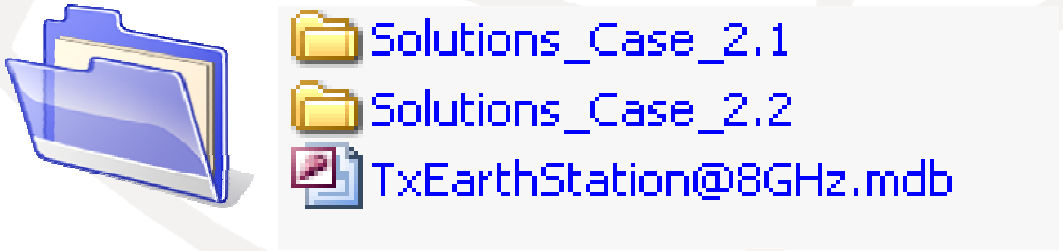
FSS Transmitting ES in the **8 GHz band**

Input example database (SNS format):

TxEarthStation@8GHz.mdb

ES name: **MAGTAB**

- Case 2.1 ES Notice Id: **87500999** (non-zero deg. horizon elevation angles)
- Case 2.2 ES Notice Id: **87501000** (zero deg. horizon elevation angles)



Exercise 2 – GIBC – Results

- FSS Transmitting Earth Station in 8 GHz band
- Input database file:

TxEarthStation@8GHz.mdb

- Results in following files:

- For case 2.1 with non-zero-degree horizon elevation angle:

87500999(Tx8GHz, Non-0-elev).rtf

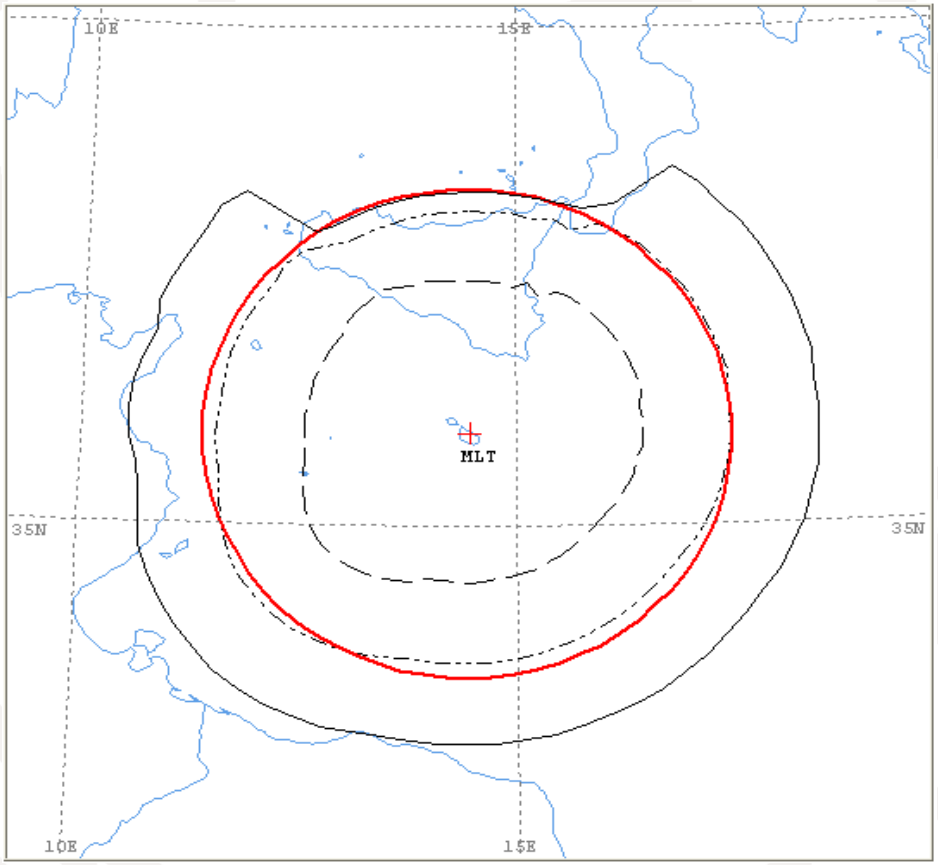
- For case 2.2 with zero-degree horizon elevation angle:

87501000(Tx8GHz, 0-elev).rtf

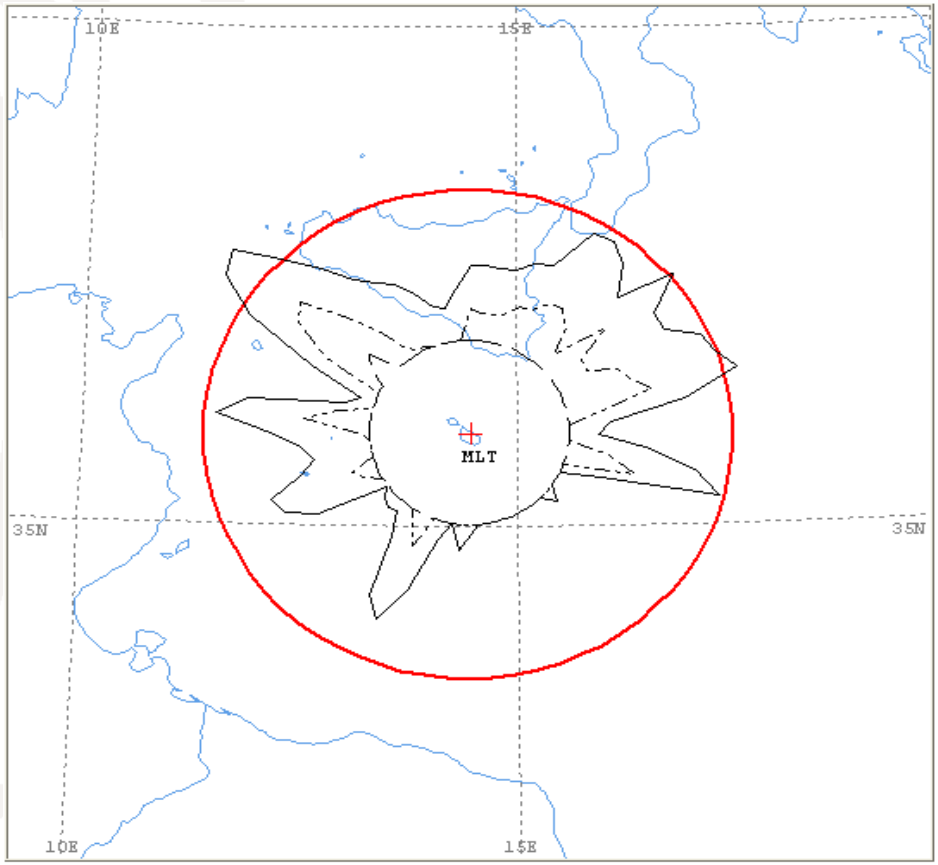
Exercise 2 – GIBC – Results

Diagram 1: 2.1_TABLE7.
TRANSMITTING GSO ES in FIXED-SATELLITE SERVICE W.R.T. RECEIVING TERRESTRIAL STATIONS. TS in FS or MS

With zero-degree horizon elevation angles



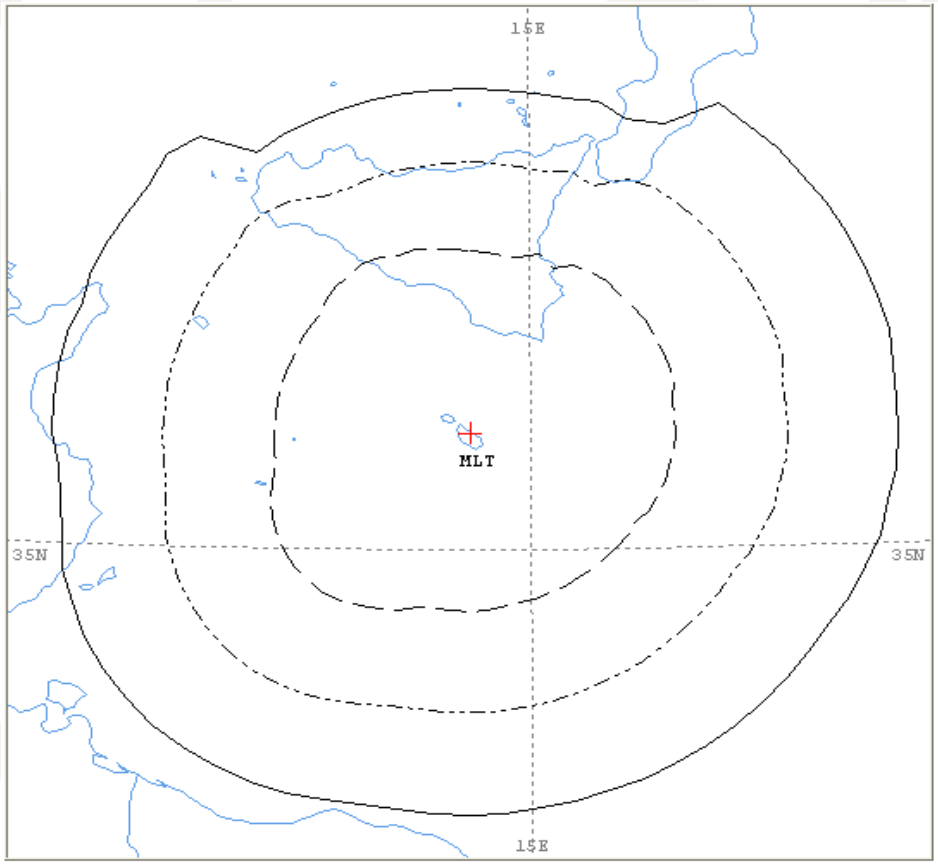
With non-zero-degree horizon elevation angles



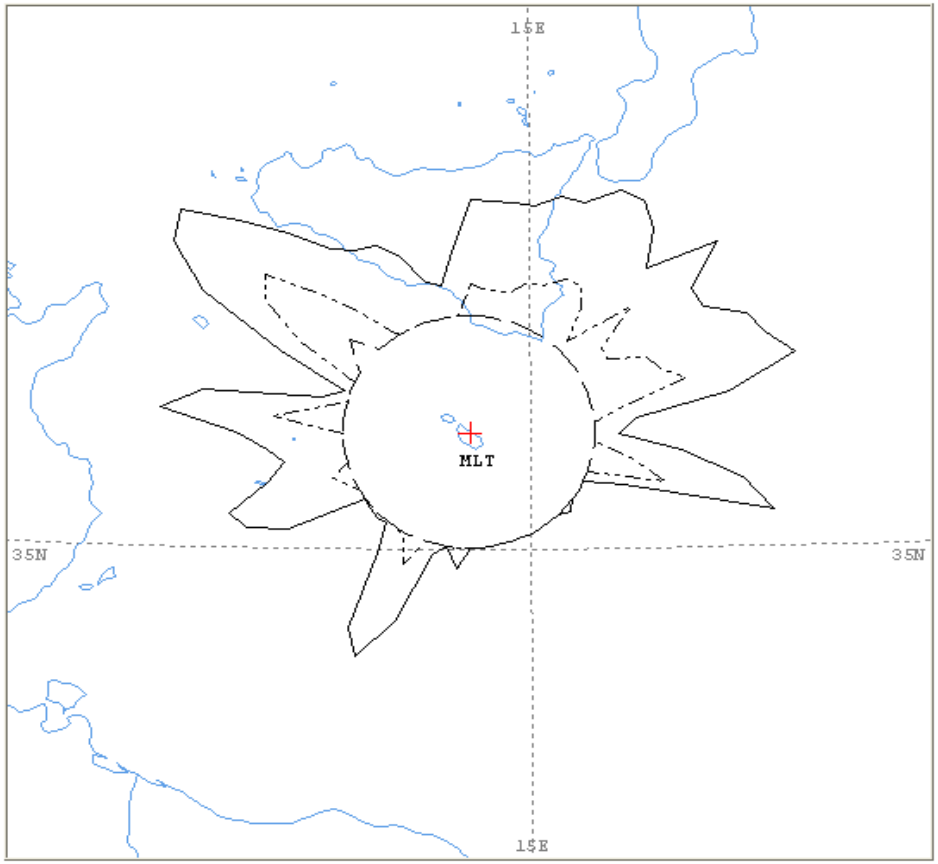
Exercise 2 – GIBC – Results

Diagram 2: 3.2.1_TABLE9.
TRANSMITTING GSO ES in FIXED-SATELLITE SERVICE W.R.T.
RECEIVING NGSO ES in EARTH EXPLORATION SATELLITE SERVICE

With zero-degree
horizon elevation angles



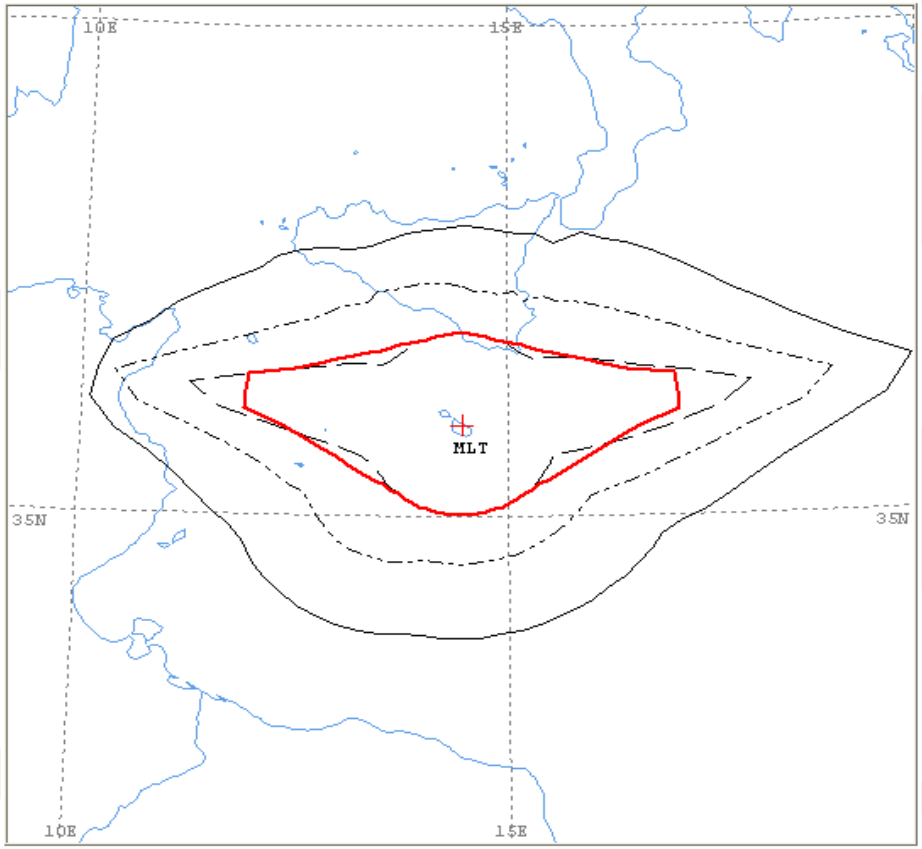
With non-zero-degree
horizon elevation angles



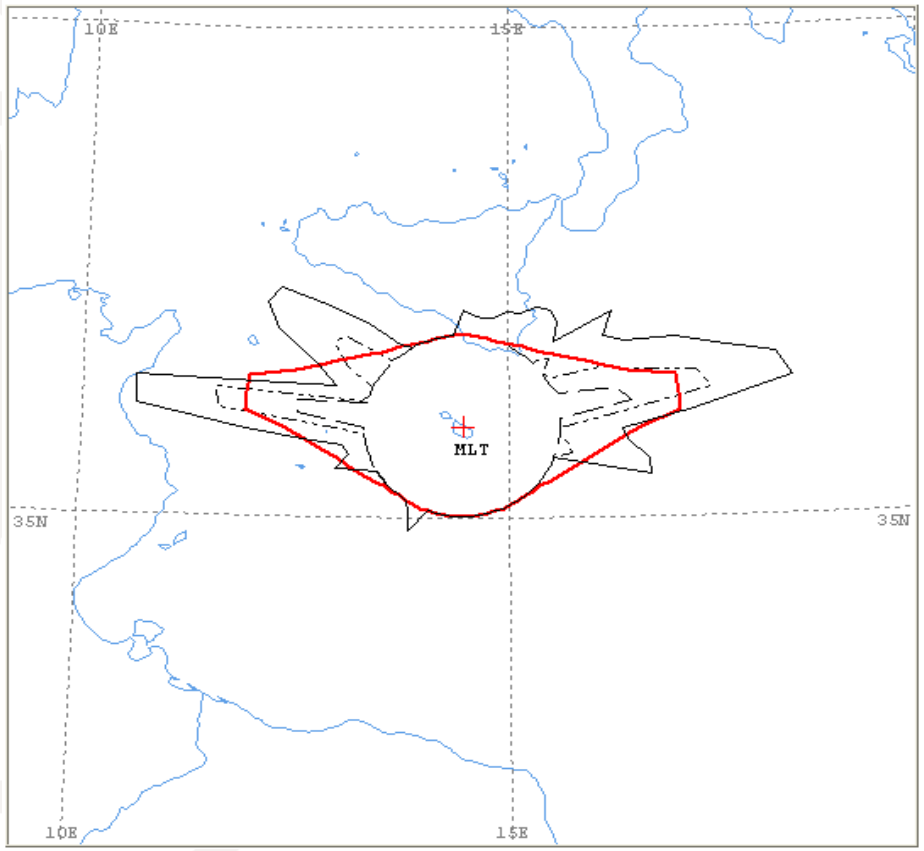
Exercise 2 – GIBC – Results

Diagram 3: 3.1_TABLE9.
TRANSMITTING GSO ES in FIXED-SATELLITE SERVICE W.R.T.
RECEIVING GSO ES in EARTH EXPLORATION SATELLITE SERVICE

With zero-degree horizon elevation angles



With non-zero-degree horizon elevation angles



Questions

Thank you

International Telecommunication Union

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