



World Radiocommunication Seminar 2016

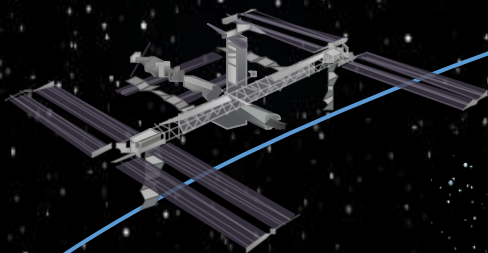
Equivalent power flux density limits (EPFD)

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Where do satellites operate ...

Low Earth Orbit
500 - 2 000 km



International Space Station

Medium Earth Orbit
8 000 - 20 000 km



GNSS

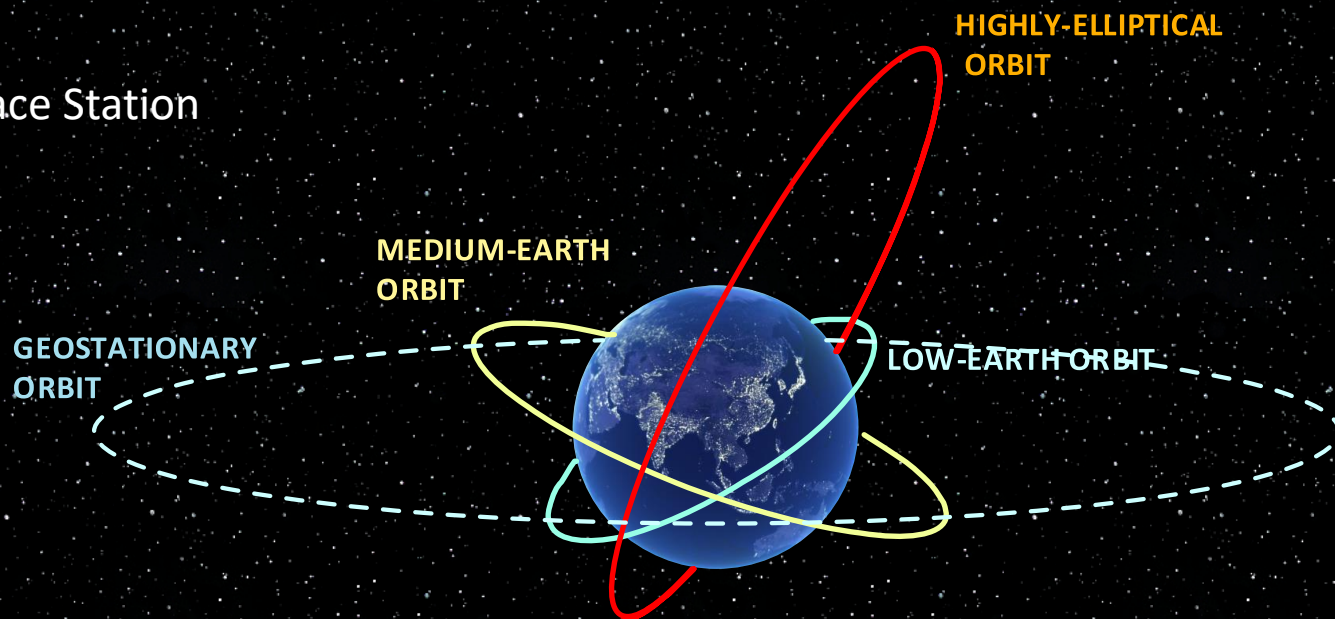
Geostationary Orbit
35,786 km above
the Earth's equator



Highly Elliptical Orbit – 40 000 km
in apogee



Sub-orbital



GEOSTATIONARY ORBIT

MEDIUM-EARTH ORBIT

LOW-EARTH ORBIT

HIGHLY-ELLIPTICAL ORBIT

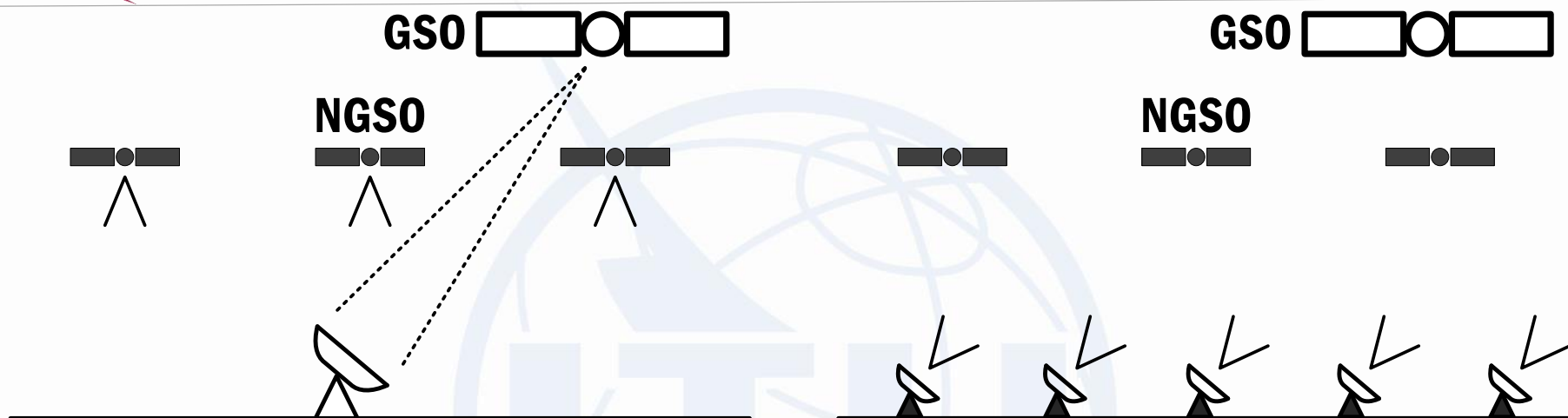


Non-GSO regulations

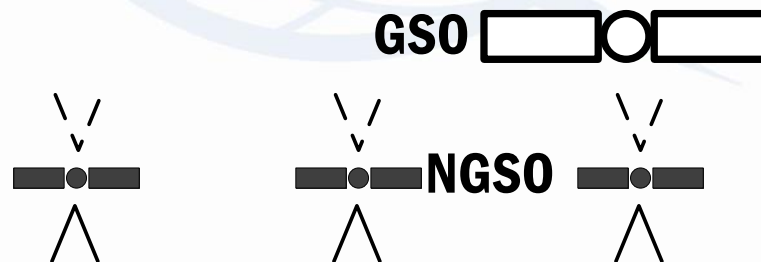


- ✓ **Evolved** in 1990 – 2003.
- ✓ **Coordination** – ensures protection of existing services on equitable access basis
 - ✓ Coordination between non-GSO and GSO in limited frequency bands
 - ✓ Coordination between non-GSO in limited frequency bands
- ✓ **Hard Limits** – Article 22 EPFD limits to protect GSO from non-GSO
- ✓ **Protection of GSO** – No. 22.2
 - ✓ Non-geostationary-satellite systems shall not cause unacceptable interference to and shall not claim protection from geostationary-satellite networks in the fixed-satellite service and the broadcasting-satellite service

- **Equivalent power-flux density** (EPFD) takes into account the aggregate of the emissions from all non-GSO satellites in the direction of any GSO earth station, taking into account the GSO antenna directivity
- EPFD considers pointing of a victim receiving antenna with respect to every source of interference
- Complex calculation methodology considers an interference varying in time and space



EPFD on inter-satellite path





What is EPFD?



- EPFD is calculated:
 - Downlink (at the input of GSO earth station receiver)
 - Uplink (at the input of GSO space station receiver)
 - Inter-satellite (at the input of GSO space station receiver)

$$epfd = 10 \log_{10} \left[\sum_{i=1}^{N_a} 10^{\frac{P_i}{10}} \cdot \frac{G_t(\theta_i)}{4 \pi d_i^2} \cdot \frac{G_r(\varphi_i)}{G_{r,max}} \right]$$



- **Article 22 – Hard Limits to protect GSO from Non-GSO**
 - Hard EPFD limits enable non-GSO FSS systems to share frequencies with and protect GSO systems without requiring individual coordinations with all the systems worldwide
 - FSS non-GSO satellite systems shall comply with the EPFD limits contained in Tables **22-1A, 22-1B, 22-1C, 22-1D, 22-1E, 22-2 and 22-3** of RR Article **22**
 - ✓ Article 22 contains reference parameters of GSO stations to be protected



- **Article 9 – coordination trigger limits**

- specific large earth station requires coordination under RR No. **9.7A** with respect to any existing non-GSO satellite systems using the coordination triggers in RR Appendix **5**; or
- FSS non-GSO satellite systems requires coordination under RR No. **9.7B** with respect to any large earth station (under certain conditions) using the coordination triggers in RR Appendix **5**.
 - ✓ Coordination trigger limits enable protection of very large specific GSO earth stations



EPFD Limits Validation Tools



- Validation Software is developed in accordance with methodology in Recommendation ITU-R S.1503-2
- Resolution 85 (WRC-03) establishes intermediate arrangements until required software is developed
- “Qualified favourable” finding is given based on the commitment by notifying administration to fulfill Article 22 limits
- Findings will be reviewed



Implementation of Resolution 85 (WRC-03)



- Circular Letter CR/414, 6 December 2016 contains details of examinations to be carried out in accordance with Resolution 85 (WRC-03).
 - The Bureau will contact individually each administration having submitted non-GSO systems in the FSS, and request the administration to submit within three months:
 - “traditional” non-GSO parameters in Appendix 4 – orbit parameters, frequency assignments etc.
 - The PFD/EIRP* masks accounting for all the features of specific non-GSO systems arrangements:
 - PFD mask produced by non-GSO satellites
 - Non-GSO satellite off-axis eirp-mask to calculate interference in inter-satellite path (non-GSO – GSO)
 - Uplink off-axis eirp mask produced by non-GSO Earth Station
 - Masks are presented in XML-format
- * See also Rec. ITU-R S. 1503-2



EPFD Validation

EXERCISES



Locate EPFD exercise files on handout USB stick:

[USB drive]:\Space_Workshops_(14-16-Dec)\09-Coordination-of-satellite-networks-technical-exercise\EPFD\

Install GIBC v7 with EPFD Modules

Warning! If you have installed GIBC v8. Please, uninstall it first.

From BR IFIC (Space Services) DVD-ROM or USB stick:

[USB drive]:\BRIFIC-2834\Space\BR_Soft\GIBC\Setup.exe

or

<http://www.itu.int/en/ITU-R/software/Pages/epfd.aspx>



Offline Exercise No. 1

Preparing data for EPFD Validation



Task:

Given an input data:

Database with non-GSO CR/C filing NSKY which was prepared using SpaceCap or extracted from SRS_ALL

[USB drive]:\Space_Workshops_(14-16-Dec)\09-Coordination-of-satellite-networks-technical-exercise\EPFD\Input Data\NSKY-CRC.MDB

XML Mask Data:

Downlink PFD Masks

[USB drive]:\Space_Workshops_(14-16-Dec)\09-Coordination-of-satellite-networks-technical-exercise\EPFD\Input Data\PFD Masks

Uplink EIRP Masks

[USB drive]:\Space_Workshops_(14-16-Dec)\09-Coordination-of-satellite-networks-technical-exercise\EPFD\Input Data\EIRP Masks

Your task is to validate the data and prepare input databases (SRS Data and Mask Data) required for EPFD Validation.

Step-by-step guide for offline exercise is given in the [annex](#).



Exercise No. 2

EPFD Validation



Task:

Given an EPFD input data:

Database with non-GSO CR/C filing NSKY which was prepared and validated using EPFDPrepare

[USB drive]:\Space_Workshops_(14-16-Dec)\09-Coordination-of-satellite-networks-technical-exercise\EPFD\EPFD Input\NSKY_SRS_data.MDB

Database with PFD/EIRP masks:

[USB drive]:\Space_Workshops_(14-16-Dec)\09-Coordination-of-satellite-networks-technical-exercise\EPFD\EPFD Input\NSKY_masks.MDB

Your task is perform EPFD validation and review the results of EPFD validation.

Results are reproduced on the USB-stick:

[USB drive]:\Space_Workshops_(14-16-Dec)\09-Coordination-of-satellite-networks-technical-exercise\EPFD\EPFD Output\



Start with GIBC



- Start GIBC
- Navigate to EPFD tab
- Start EPFDPrepare

Gibc SNS V7 - Graphical Interface for Batch Calculations

Appendix 8 | PFD (terrestrial serv.) | PFD (space serv.) | Appendix 7
Appendix 30B | Appendix 30 30A | EPFD | Power Control | Tools / Options

Step 1. Prepare and validate SRS and Masks data
Masks: C:\BR_Seminar\EPFD\NSKY\NSKY_masks.mdb
SRS: C:\BR_Seminar\EPFD\NSKY\NSKY_srs_data_for_epfd_validation_adj.r
EPFDPrepare

Step 2. Analysis
Notice Id:
Analysis: RR.22 Hard Limits
 Full WCG Down Check
 Use Dual Timestep

Message

Results

Software location and EPFD limits path
Transfinite: C:\Program Files (x86)\S1503_2Analysis\Program\S1503_2.exe
Agenium: C:\Program Files (x86)\Agenium\EPFDValidation\EPFDvalidation.exe
Limits DB: C:\br_soft\EPFD\EPFD_limits_RES85.mdb

EPFD Manual



Select EPFD Input Data



- Select mask database:
NSKY_masks.MDB
- Select SRS data:
NSKY_SRS_data.MDB
- Return to GIBC

The screenshot shows a software dialog box titled "EPFD Data Preparation". It contains instructions for selecting databases and preparing data. The "Select the databases for examination" section has two text boxes with file paths and ellipsis buttons. The "Prepare the Appendix 4 data elements required for EPFD examination" section has two numbered steps, each with a button. At the bottom, there is a "Close" button and a "Support" link.

EPFD Data Preparation

In this dialog you can either select the databases containing the data for EPFD examination or prepare the Appendix 4 data elements required for EPFD examination of the filing or create and/or validate new databases

Please select the databases required for examination

Select the databases for examination

Select the database with the masks
C:\BR_Seminar\WRS-16\EPFD\EPFD Input\NSKY_masks.mdb ...

Select SRS database with non-gso filing for examination
C:\BR_Seminar\WRS-16\EPFD\EPFD Input\NSKY_SRS_data.mdb ...

Return to GIBC

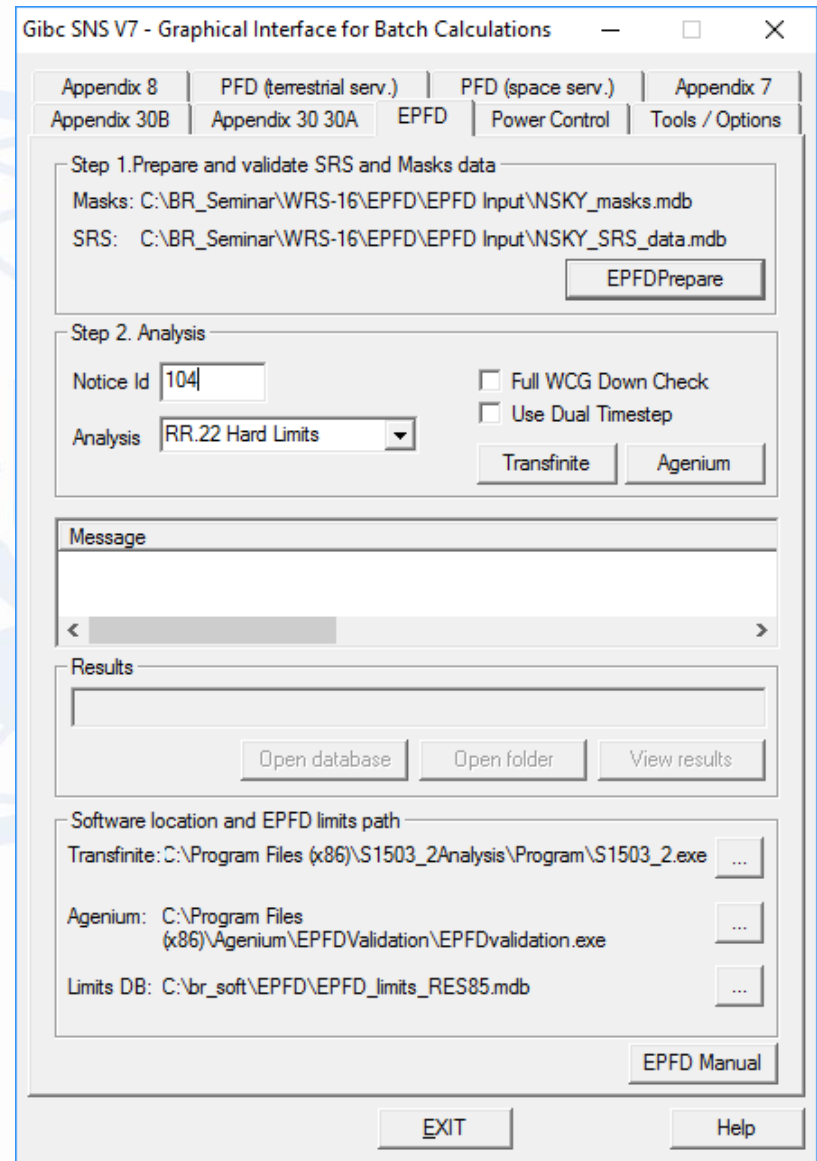
Prepare the Appendix 4 data elements required for EPFD examination

Prepare the data

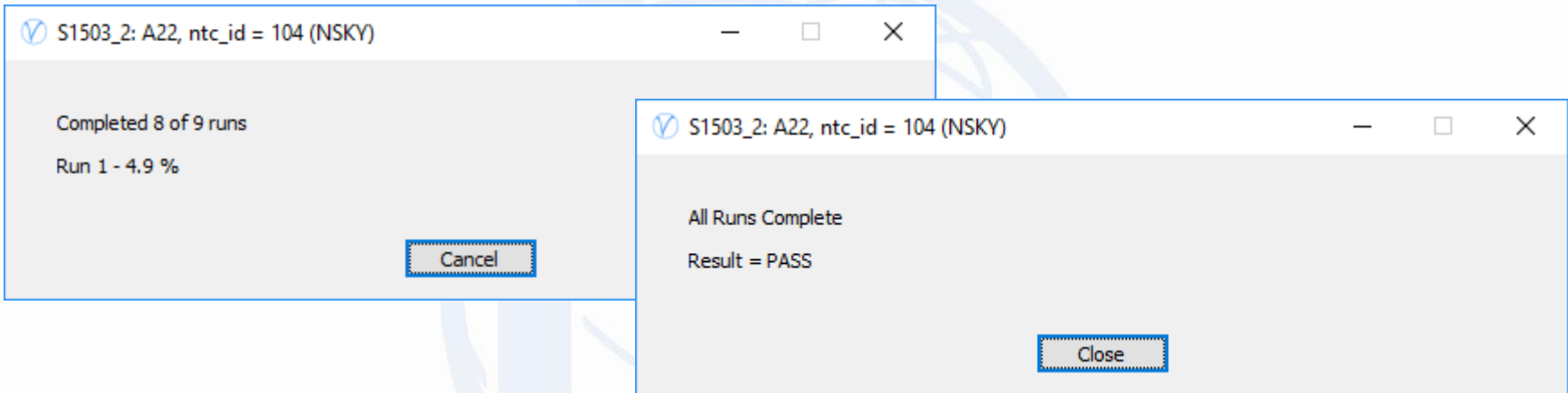
1. Create Masks Database
PFD/EIRP Mask Operations
2. Create SRS Database
Prepare SRS Data

Close [Support](#)

- Enter notice ID - **104**
- You can choose additional options:
 - Full WCG Down Check
 - Use Dual Timestep
- Check ‘Use Dual Timestep’ to speed-up calculations
- You can start calculations using Transfinite EPFD tool or Agenium EPFD Tool by clicking corresponding buttons.



- Transfinite EPFD calculation screen



S1503_2: A22, ntc_id = 104 (NSKY)

Completed 8 of 9 runs
Run 1 - 4.9 %

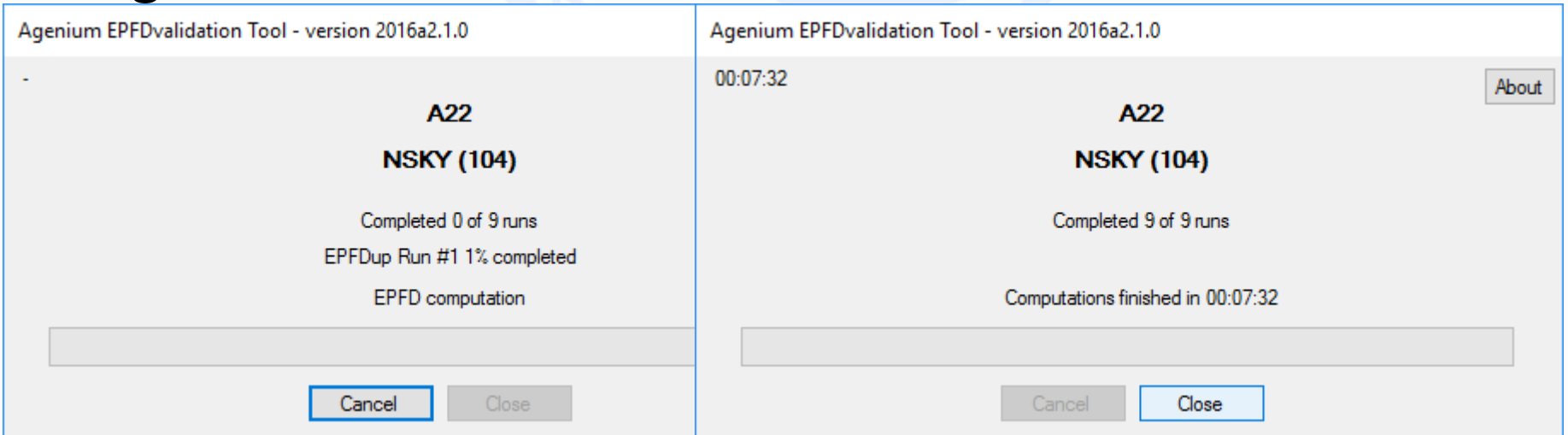
Cancel

S1503_2: A22, ntc_id = 104 (NSKY)

All Runs Complete
Result = PASS

Close

- Agenium EPFD calculation screen



Agenium EPFDvalidation Tool - version 2016a2.1.0

A22
NSKY (104)

Completed 0 of 9 runs
EPFDup Run #1 1% completed
EPFD computation

Cancel Close

Agenium EPFDvalidation Tool - version 2016a2.1.0

00:07:32

A22
NSKY (104)

Completed 9 of 9 runs

Computations finished in 00:07:32

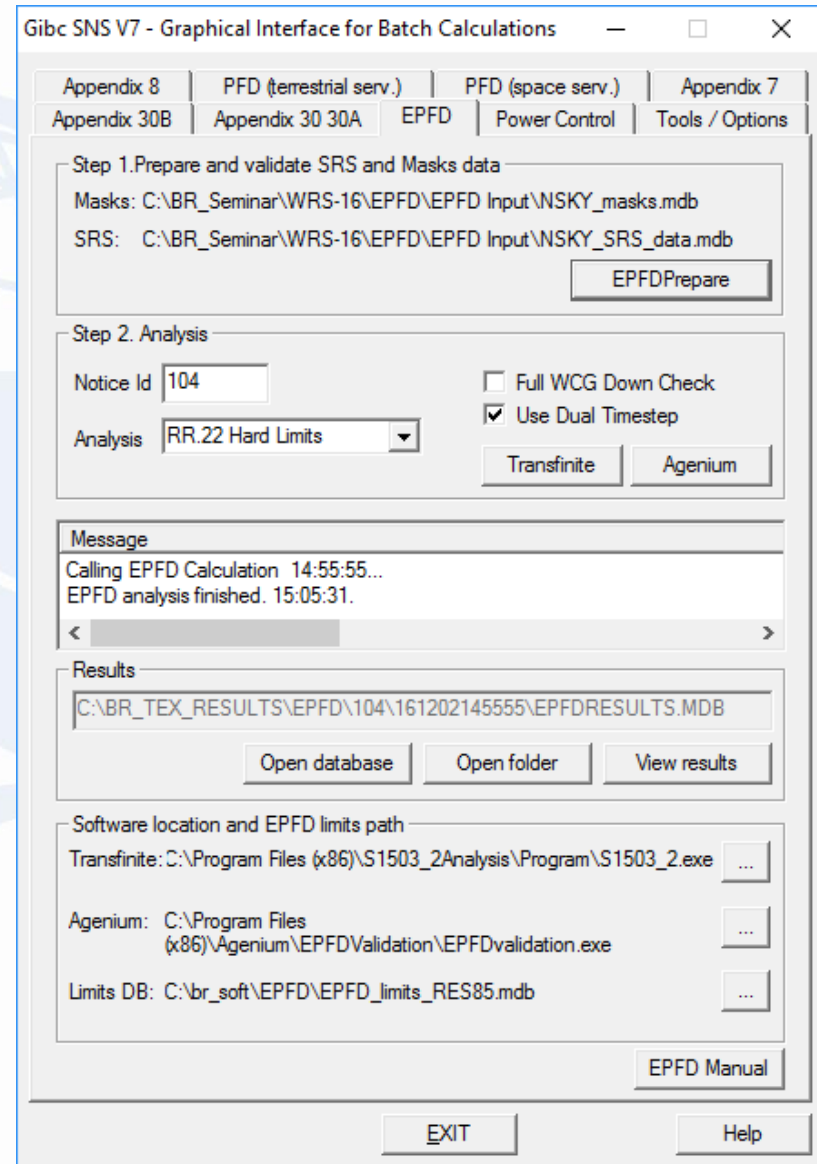
Cancel Close



EPFD results



- After the calculations are completed, you can review the results
- You can open the results database in Microsoft Access
or
- Open folder with results database
or
- You can view results in EPFDResultsView tool

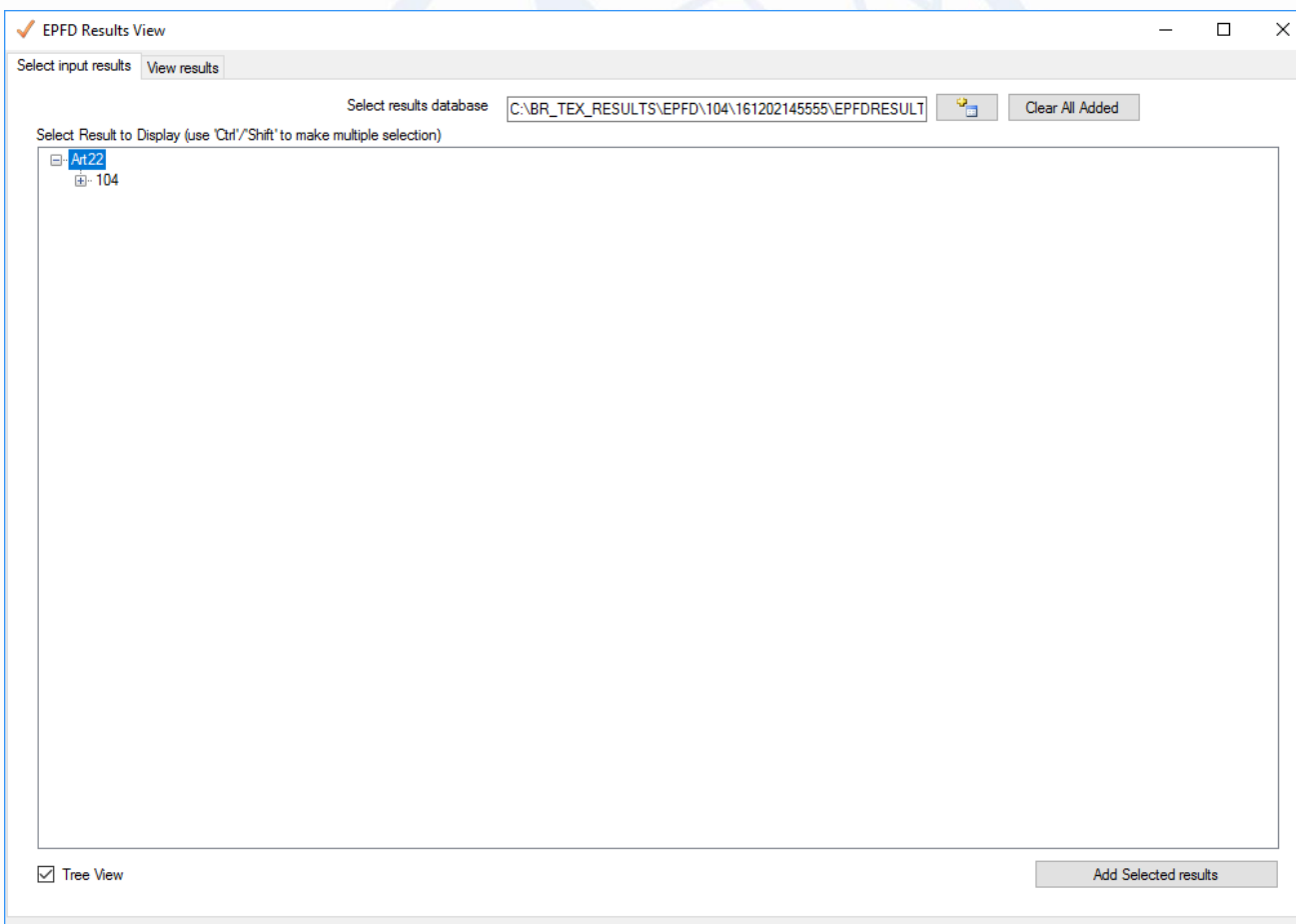




EPFD results view tool



- Open EPFDResultView tool by clicking View Results in GIBC.
- Results database is automatically opened.
- Next step is to add results for analysis.
- Select run (Art22) and click Add Selected Results.
- Instead, you can also add individual results by expanding the list.





EPFD results view tool



- Advance to View results tab.
- All results are listed in the bottom providing basic information (pass/fail, worst case location, applicable limit).
- Select any result and press 'Plot selected results' to plot Complementary cumulative distribution function.
- You can also plot a limit curve.

EPFD Results View

Select input results View results

perc	EPFD1	EPFD2	deltaEPFD
100	-1	-182.4	181.4
99.99	-1	-182.399591	181.399591
99	-1	-182.359109	181.359109
95	-1	-182.192749	181.192749
90	-1	-181.974225	180.974225
80	-1	-181.498733	180.498733
70	-1	-180.959131	179.959131
60	-1	-180.336544	179.336544
50	-1	-179.60045	178.60045
40	-1	-178.699193	177.699193
30	-1	-177.536998	176.536998
20	-1	-175.899654	174.899654
10	-235.391224	-173.100112	62.291112
5	-219.865926	-170.300562	49.565364
4	-210.176216	-169.399309	40.776908
3	-209.085606	-168.237111	40.848495

Plot also limit (extracted from results)
 Cap minimum at
 Show legend

Select Results to Display (press 'Ctrl' to make multiple selection of results produced by two software)



EPFD Type	sw_name	run_id	IncomingNtc	ExistingNtc	result_id	run_type	worst_es_lat	worst_es_long
epfd_t, FSS, F=27.5 GHz, Ant S.672, Ls -10, 1.55', per 40 kHz	Agenum	1	104		1	Art22	50.93	
epfd_l, FSS, F=19.7 GHz, Ant S.1428, d=.7 m, per 1000 kHz	Agenum	1	104		6	Art22	8.24	6.63
epfd_l, FSS, F=19.7 GHz, Ant S.1428, d=.7 m, per 40 kHz	Agenum	1	104		2	Art22	8.24	6.63
epfd_l, FSS, F=19.7 GHz, Ant S.1428, d=.9 m, per 1000 kHz	Agenum	1	104		7	Art22	8.24	6.63
epfd_l, FSS, F=19.7 GHz, Ant S.1428, d=.9 m, per 40 kHz	Agenum	1	104		3	Art22	8.24	6.63
epfd_l, FSS, F=19.7 GHz, Ant S.1428, d=2.5 m, per 1000 kHz	Agenum	1	104		8	Art22	8.24	6.63

Plot Selected Results



EPFD results view tool



- If you completed calculation using both tools – Agenium and Transfinite, you can compare results produced by these tools.
- In the main tab, click ‘Clear All Added’.
- Click button  and add results database produced by Transfinite Tool.
- Then highlight Art22 and click ‘Add selected results’.
- Then Click button  and add results database produced by Agenium Tool.
- Then highlight Art22 and click ‘Add selected results’.
- Advance to View results tab.



EPFD results view tool



- Now, you can select two results – one from Agenium and another from Transfinite for the same limit and click ‘Plot Selected Results’. (Use ‘Ctrl’ key to select multiple results).
- In the table on the right, a comparison is given for 2 results for the same percentage of time in deltaEPFD column.

EPFD Results View
– □ ×

Select input results
View results

— Run Type: Art22, SW: Transfinite, epfd,, FSS, F=19.7 GHz, Ant S.1428, d=5 m, per 40 kHz, ResultID: 5, RunID: 1
— LIMIT, Art22, SW: Transfinite, ResultID: 5, EPFD Type: epfd,, FSS, F=19.7 GHz, Ant S.1428, d=5 m, per 40 kHz
— Run Type: Art22, SW: Agenium, epfd,, FSS, F=19.7 GHz, Ant S.1428, d=5 m, per 40 kHz, ResultID: 5, RunID: 1
— LIMIT, Art22, SW: Agenium, ResultID: 5, EPFD Type: epfd,, FSS, F=19.7 GHz, Ant S.1428, d=5 m, per 40 kHz

perc	EPFD1	EPFD2	deltaEPFD
10	-223.001507	-223.001512	0.000005
5	-208.739091	-208.724636	0.014455
4	-197.641183	-197.639188	0.001995
3	-196.577263	-196.577156	0.000106
2	-195.514858	-195.511006	0.003853
1	-192.283609	-192.283497	0.000112
0.5	-190.761766	-190.761726	0.00004
0.4	-190.435273	-190.435223	0.000049
0.3	-189.752569	-189.752471	0.000098
0.2	-183.7932	-183.79244	0.00076
0.1	-176.813071	-176.812936	0.000136
0.05	-170.8805	-170.880183	0.000317
0.04	-169.0233	-169.02311	0.00019
0.03	-167.011225	-167.011083	0.000143
0.02	-164.92415	-164.924055	0.000095
0.01	-151.2483	-151.24811	0.00019
0.005	-145.312075	-145.312028	0.000047
0.004	-144.44966	-144.449622	0.000038
0.003	-143.77449	-143.774433	0.000057
0.002	-143.27483	-143.274811	0.000019
0.001	-142.92483	-142.924811	0.000019
0.0005	-142.570805	-142.570802	0.000003

Plot also limit (extracted from results)
 Cap minimum at [-270]
 Show legend

Select Results to Display (press 'Ctrl' to make multiple selection of results produced by two software)
 Copy Plot to Clipboard

	EPFD Type	sw_name	run_id	IncomingNtc	ExistingNtc	result_id	run_type	worst_es_lat	worst_es_long	worst_gso_long	pass	percentage_cc
	epfd,, FSS, F=19.7 GHz, Ant S.1428, d=2.5 m, per 40 kHz	Agenium	1	104		4	Art22	8.24	6.63	-29.19	<input checked="" type="checkbox"/>	100
	epfd,, FSS, F=19.7 GHz, Ant S.1428, d=2.5 m, per 40 kHz	Transfinite	1	104		4	Art22	8.24	6.63	-29.19	<input checked="" type="checkbox"/>	100
	epfd,, FSS, F=19.7 GHz, Ant S.1428, d=5 m, per 1000 kHz	Agenium	1	104		9	Art22	36.21	8.66	-17.01	<input checked="" type="checkbox"/>	100
	epfd,, FSS, F=19.7 GHz, Ant S.1428, d=5 m, per 1000 kHz	Transfinite	1	104		9	Art22	36.21	8.66	-17.01	<input checked="" type="checkbox"/>	100
	epfd,, FSS, F=19.7 GHz, Ant S.1428, d=5 m, per 40 kHz	Agenium	1	104		5	Art22	36.21	8.66	-17.01	<input checked="" type="checkbox"/>	100
	epfd,, FSS, F=19.7 GHz, Ant S.1428, d=5 m, per 40 kHz	Transfinite	1	104		5	Art22	36.21	8.66	-17.01	<input checked="" type="checkbox"/>	100

Plot Selected Results



End of exercise



Accompanying documents

Document WRS16/15

Limits on equivalent power flux density (EPFD)

ITU-R Recommendation S.1503-2

Functional description to be used in developing software tools for determining conformity of non-geostationary-satellite orbit fixed-satellite system networks with limits contained in Article 22 of the Radio Regulations

EPFD software web-page

<http://www.itu.int/ITU-R/go/space-epfd/en>

BRMail@itu.int

epfd-support@itu.int

Offline exercise step-by-step guide



Start with GIBC



- Start GIBC
- Navigate to EPFD tab
- Start EPFDPrepare

Gibc SNS V7 - Graphical Interface for Batch Calculations

Appendix 8 | PFD (terrestrial serv.) | PFD (space serv.) | Appendix 7
Appendix 30B | Appendix 30 30A | EPFD | Power Control | Tools / Options

Step 1. Prepare and validate SRS and Masks data
Masks: C:\BR_Seminar\EPFD\NSKY\NSKY_masks.mdb
SRS: C:\BR_Seminar\EPFD\NSKY\NSKY_srs_data_for_epfd_validation_adj.r

EPFDPrepare

Step 2. Analysis
Notice Id:
Analysis: RR.22 Hard Limits
 Full WCG Down Check
 Use Dual Timestep

Transfinite | Agenium

Message

Results

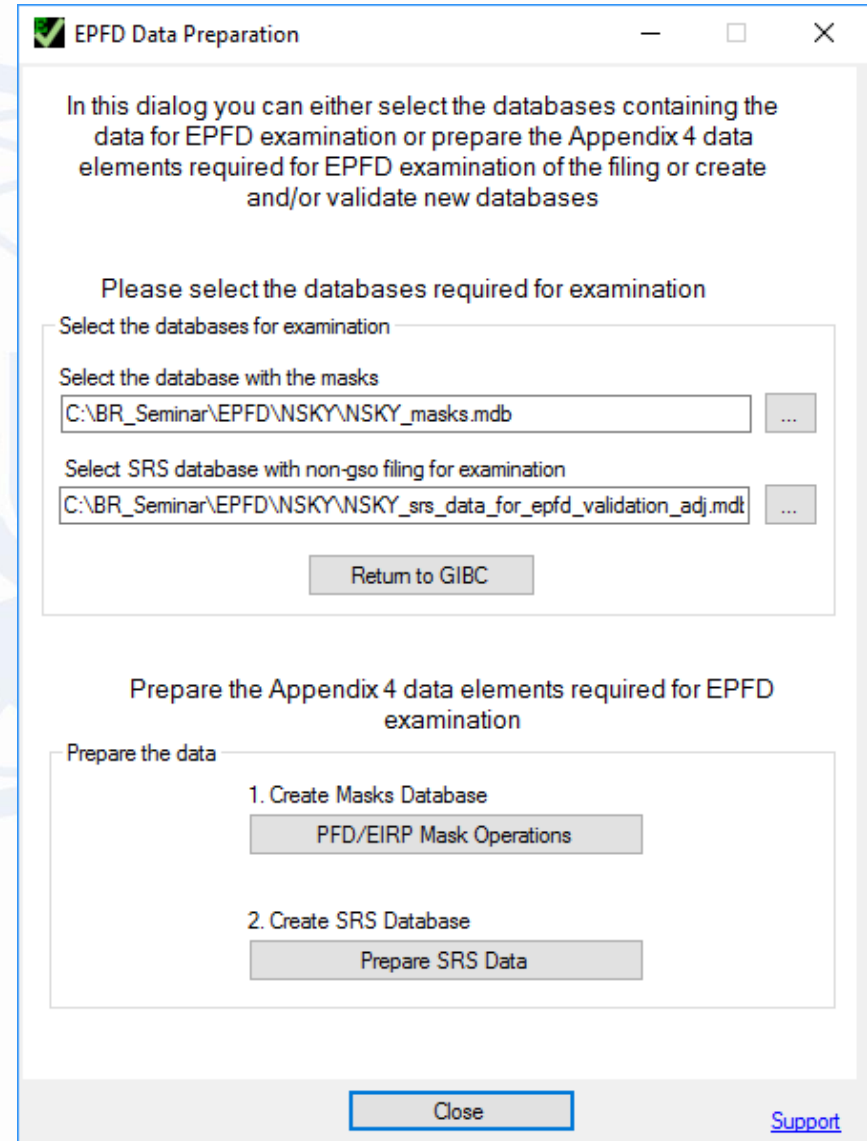
Open database | Open folder | View results

Software location and EPFD limits path
Transfinite: C:\Program Files (x86)\S1503_2Analysis\Program\S1503_2.exe
Agenium: C:\Program Files (x86)\Agenium\EPFDValidation\EPFDvalidation.exe
Limits DB: C:\br_soft\EPFD\EPFD_limits_RES85.mdb

EPFD Manual

EXIT | Help

- First step is to create mask database
- Press PFD/EIRP Mask Operations





Creating Mask Database



- Click New mask mdb file
- Click Store Mask(s) to MDB and select XML masks in EIRP Masks folder and then PFD Masks Folder.
You can select multiples files in folder.

The screenshot shows a software window titled "Mask" with a close button (X) in the top right corner. The window is divided into three main sections:

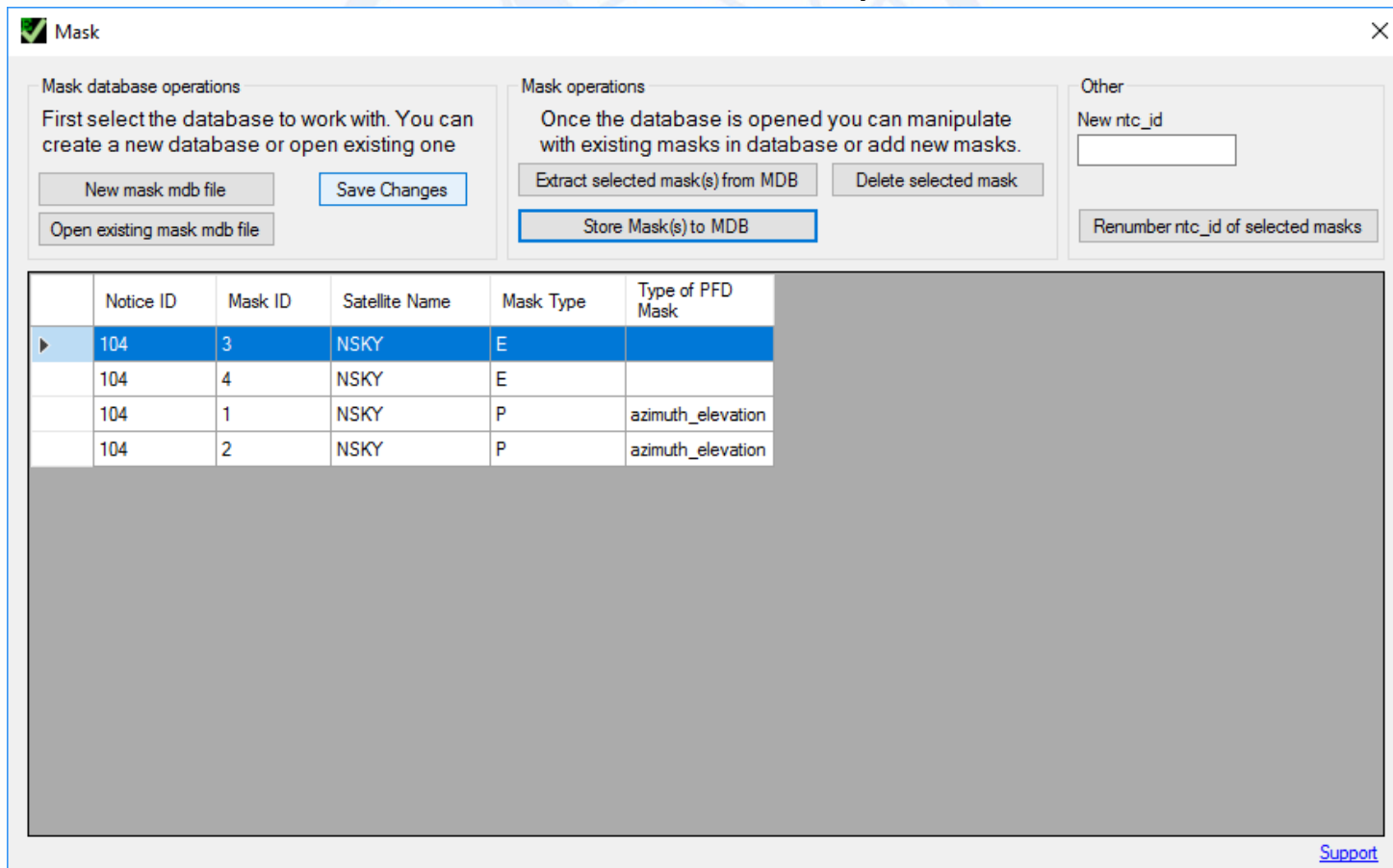
- Mask database operations:** Contains the text "First select the database to work with. You can create a new database or open existing one". Below this are three buttons: "New mask mdb file", "Open existing mask mdb file", and "Save Changes".
- Mask operations:** Contains the text "Once the database is opened you can manipulate with existing masks in database or add new masks.". Below this are three buttons: "Extract selected mask(s) from MDB", "Delete selected mask", and "Store Mask(s) to MDB".
- Other:** Contains a text input field labeled "New ntc_id" and a button labeled "Renumber ntc_id of selected masks".

Below these sections is a table with the following headers:

Notice ID	Mask ID	Satellite Name	Mask Type	Type of PFD Mask

In the bottom right corner of the window, there is a link labeled "Support".

- After finishing adding the masks, save the mask database
- Click 'Save Changes' and save database to **NSKY_masks.mdb**
- Close the window to return to EPFDPprepare main window



The screenshot shows the 'Mask' application window with the following sections:

- Mask database operations:** Includes instructions to select a database and buttons for 'New mask mdb file', 'Open existing mask mdb file', and 'Save Changes'.
- Mask operations:** Includes instructions on manipulating masks and buttons for 'Extract selected mask(s) from MDB', 'Delete selected mask', and 'Store Mask(s) to MDB'.
- Other:** Includes a 'New ntc_id' input field and a 'Renumber ntc_id of selected masks' button.

	Notice ID	Mask ID	Satellite Name	Mask Type	Type of PFD Mask
▶	104	3	NSKY	E	
	104	4	NSKY	E	
	104	1	NSKY	P	azimuth_elevation
	104	2	NSKY	P	azimuth_elevation

[Support](#)



Prepare Appendix 4 data



- Now it is time to import our CR/C filing and validate it.
- Press 'Prepare SRS Data' from EPFDPrepare main window
- You are presented with Prepare SRS Data wizard.
- Click 'Next'.



Create new database



- Select new examination database and click 'Next'

Prepare SRS Data Wizard

Welcome **Input SRS Data** Import Select NoticeID Linking to PFD/EIRP masks Validation Finish

Select a working database

First step is to create a new database or open an existing database to work with.

If you choose to create a new database you can import at the next step notice of interest from a SpaceCap produce database or SRS_ALL database.

If you are running Prepare Wizard for the first time, it is recommended to start working with a new database and to import the filing from another database. When a new database is created all very large earth stations would be contained already in this database which would facilitate No. 9.7B examination.

Alternatively, you can open an existing examination database to continue validation or to import an additional filing from SRS_ALL database or SpaceCap produced database.

New examination database
 Open existing examination database

Cancel Prev Next

[Support](#)



Import CR/C filing



- On the next screen we can start importing our CR/C filing into newly created database.
- Click 'Import from an existing database' to start import wizard.
- First click 'Select source database' and point to NSKY-CRC.mdb located in exercise folder.
- Then type Notice ID 104, click 'Open Notice' and click 'Next'

A screenshot of a software window titled "Import Wizard". The window contains the following fields and buttons:

- Select source database and notice** (Section Header)
- Press to select input database**: A button labeled "Select source database".
- Input Data Base Location**: A text box containing the path "C:\BR_Seminar\WRS-16\EPFD\01 Offline Exercise\Input Data\NSKY-CRC.mdb".
- Input notice ID**: A text box containing the number "104".
- Press to open the notice**: A button labeled "Open Notice".
- Satellite Name**: A text box containing the text "NSKY".
- At the bottom of the window, there are three buttons: "Cancel", "Prev", and "Next".
- In the bottom right corner, there is a blue link labeled "Support".



Import CR/C filing



- On the next screen select all orbits to import

Import Wizard

Check orbital planes to import

	Include	ntc_id	orb_id	nbr_sat_pl	right_asc	inclin_ang	prd_ddd	prd_hh	p
▶	<input checked="" type="checkbox"/>	104	1	5	0	81	0	1	5
	<input checked="" type="checkbox"/>	104	2	5	72	81	0	1	5
	<input checked="" type="checkbox"/>	104	3	5	144	81	0	1	5
	<input checked="" type="checkbox"/>	104	4	5	216	81	0	1	5
	<input checked="" type="checkbox"/>	104	5	5	288	81	0	1	5

Cancel Prev Next [Support](#)



Import CR/C filing



- From the left you can choose applicable EPFD limits band present in the filing.
- In our case, for single limit there are several groups subject to this limit. It is required to choose only one group per limit which is sufficient for EPFD validation.
- Check the first group both for downlink and uplink EPFD limit.
- Click 'Next'

Import Wizard

Select groups to import
No duplicated completely overlapping groups
If mask link information is present in the source database corresponding groups will be preselected automatically

Select applicable EPFD limits band

- 19700-20200 (space-Earth)
- 27500-28600 (Earth-space)**

Check groups to examine

	Import	grp_id	beam_name	emi_rcp	freq_min	freq_max
▶	<input checked="" type="checkbox"/>	104055	U2	R	27500	28600
	<input type="checkbox"/>	104056	U2	R	27500	28600
	<input type="checkbox"/>	104057	U2	R	27500	28600
	<input type="checkbox"/>	104058	U2	R	27500	28600
	<input type="checkbox"/>	104059	U2	R	27500	28600
	<input type="checkbox"/>	104060	U2	R	27500	28600
	<input type="checkbox"/>	104061	U2	R	27500	28600

Cancel Prev Next [Support](#)



Import CR/C filing



- On this screen we need to indicate which associated earth stations to import.
- The rule - one eirp mask for single earth station. It sufficient to import only one earth station in the group.
- Check the first earth station both for all the groups.
- Click 'Next'

Import Wizard

Select earth stations to import
One earth station - typical or specific, if applicable (by default, first station is selected for import)

Select group

104001
104055

Check earth station to import

Import	seq_no	stn_name	stn_type	lat_dec	gain
<input checked="" type="checkbox"/>	1	SE-A	T		29

Cancel Prev Next [Support](#)



Import CR/C filing



- Summary window shows all the objects which will be imported from an input database.
- Click 'Finish' to close the import wizard

The screenshot shows a software window titled "Import Wizard" with a green checkmark icon. The window contains a section titled "Summary of elements for import" with three input fields:

Number of orbits to import	<input type="text" value="5"/>
Number of groups to import	<input type="text" value="2"/>
Number of assoc. earth stations to import	<input type="text" value="2"/>

Below the input fields, there is a text instruction: "Press 'Finish' to proceed with the import".

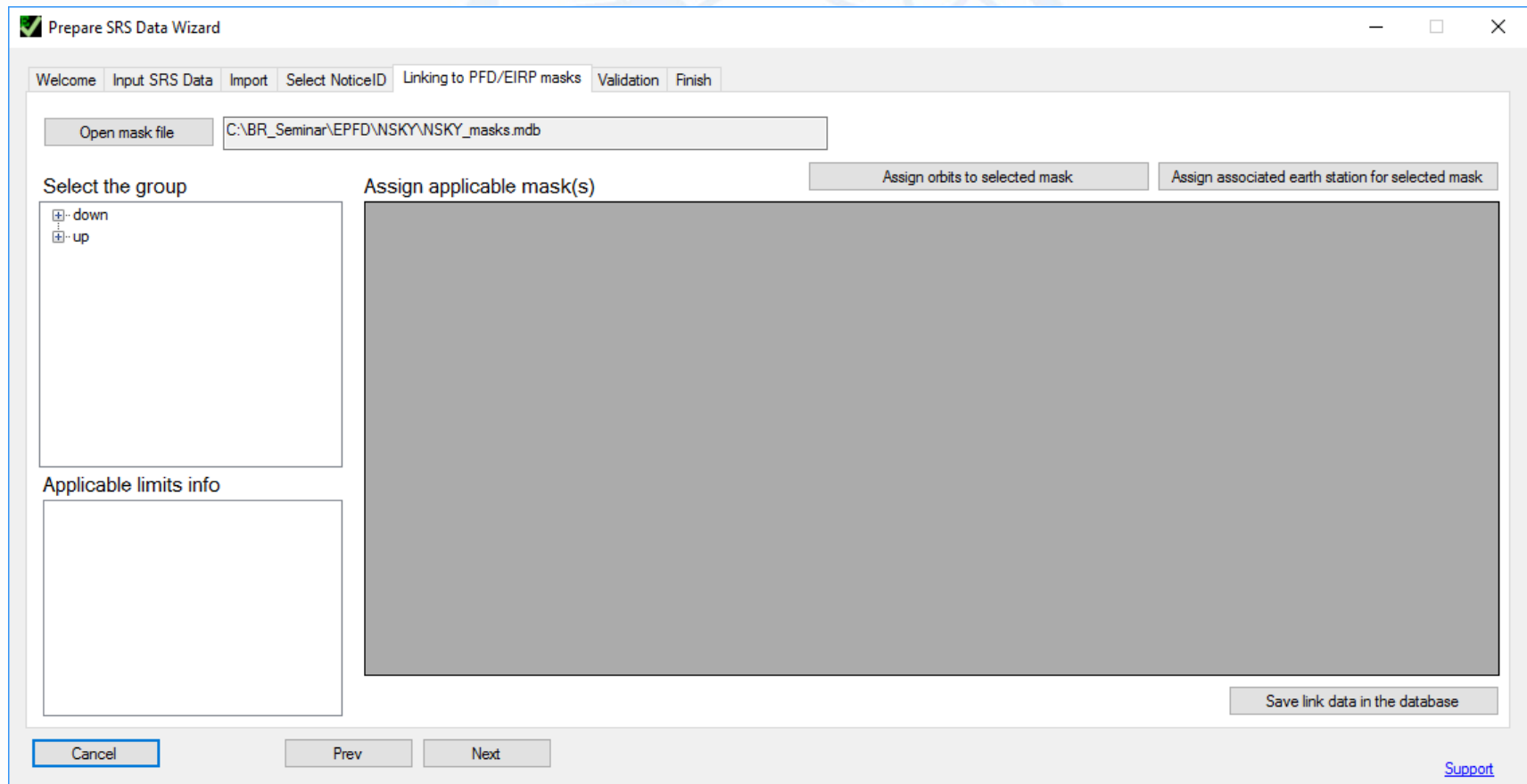
At the bottom of the window, there are three buttons: "Cancel", "Prev", and "Finish". A "Support" link is located in the bottom right corner.



Linking to Mask data



- Prepare SRS Data Wizard continues.
- Select Notice ID – 104 NSKY and advance to the next screen
- On the next screen we need to establish the link between newly imported groups and mask data.
- Open mask file created previously **NSKY_masks.mdb**





Linking to Mask data



- On the left you can select the group.
- Box below shows applicable EPFD limits.
- In the window 'Assign applicable mask(s)' check the masks which need to be assigned to selected group.
- Repeat for each group.

Prepare SRS Data Wizard

Welcome | Input SRS Data | Import | Select NoticeID | **Linking to PFD/EIRP masks** | Validation | Finish

Open mask file: C:\BR_Seminar\EPFD\NSKY\NSKY_masks.mdb

Assign orbits to selected mask | Assign associated earth station for selected mask

Select the group

- down
 - 104001 (19700-20200)
- up
 - 104055 (27500-28600)

Applicable limits info

Property	Value
Article 22, TABLE 22-1C	
Direction	down
Low frequency	19700
High frequency	20200
Reference band...	40
Appendix 5, TABLE 5-1, RR9.7A	
Direction	down

Assign applicable mask(s)

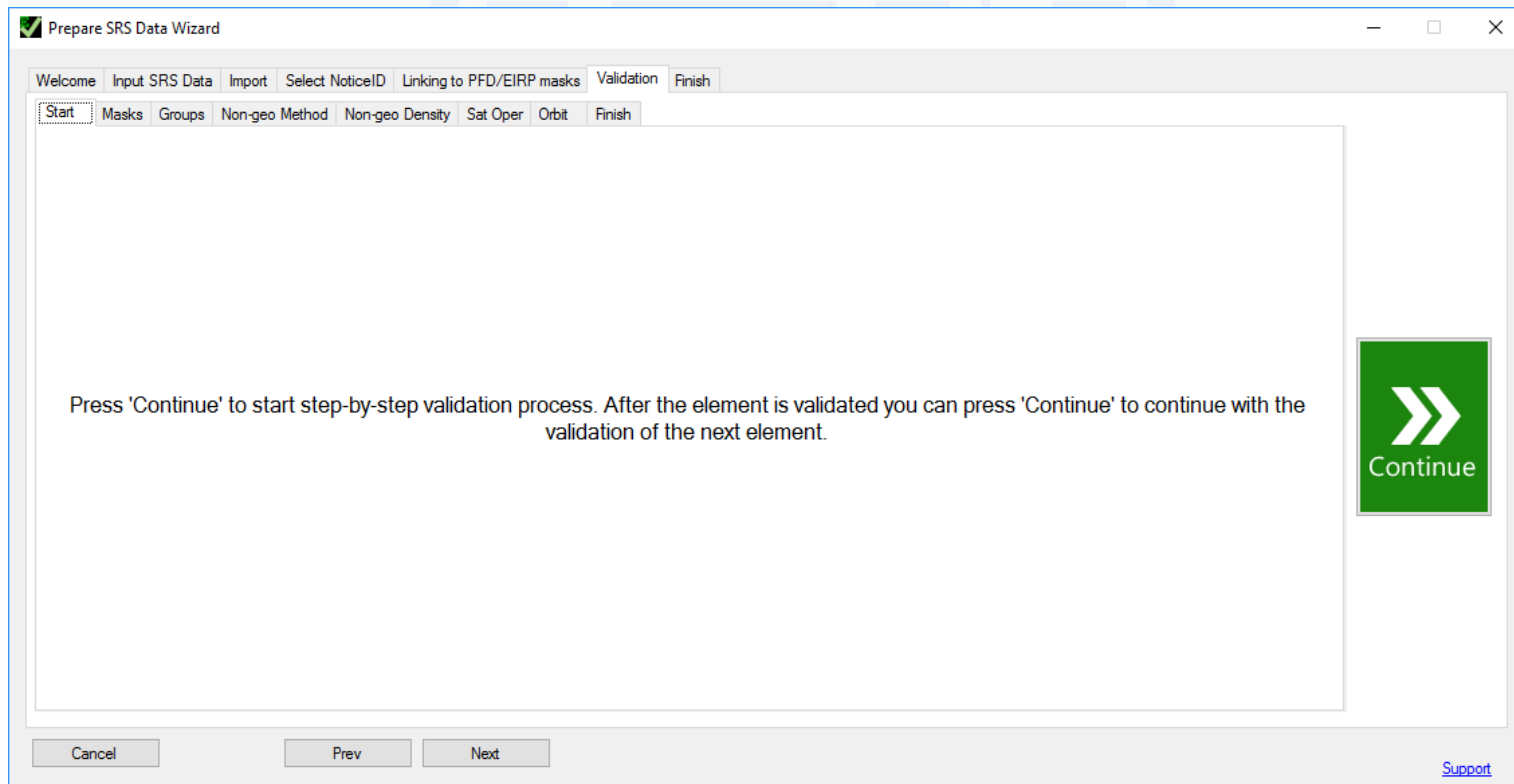
Assigned	Mask ID	Low Frequency	High Frequency	Reference Bandwidth (kHz)	Type	Data Type	Orbital Planes
<input checked="" type="checkbox"/>	1	19700	20200	40	Space station PFD	azimuth_elevation	All
<input checked="" type="checkbox"/>	2	19700	20200	1000	Space station PFD	azimuth_elevation	All

Save link data in the database

Cancel | Prev | Next

[Support](#)

- Our task is to assign two masks for downlink group, and only one for uplink.
- We cannot assign several masks to uplink group since only one could be examined at a time.
- After the examination is done for the first mask, we can change the link to assign a 2nd mask to the uplink group and repeat the examination.
- Click 'Save link data in the database' at the end.
- Next step is start validation of Appendix 4 data.
- Click green arrow 'Continue' to start Appendix 4 data validation wizard





Appendix 4 data validation



- No problems are found with respect to the link data.
- Continue next.

Prepare SRS Data Wizard

Welcome Input SRS Data Import Select NoticeID Linking to PFD/EIRP masks Validation Finish

Start Masks Groups Non-geo Method Non-geo Density Sat Oper Orbit Finish

PFD/EIRP Mask linking information (A.14)

Masks tables are Ok. Press 'Continue'

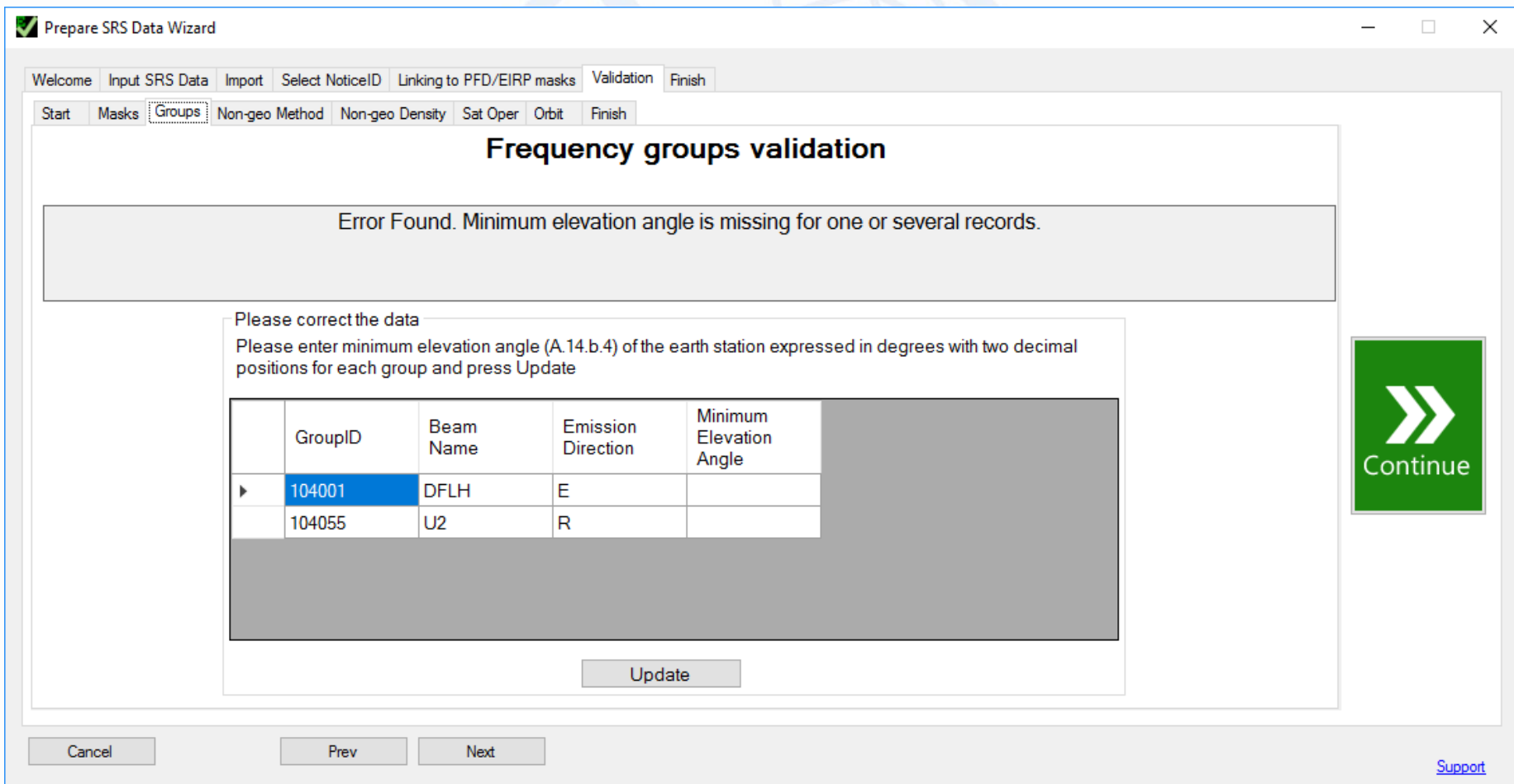
Validation Errors

Message	Description
---------	-------------

Continue

Cancel Prev Next Support

- Minimum elevation angle is missing.
- Enter 40 for each group and click 'Update'
- Continue next.



Prepare SRS Data Wizard

Welcome | Input SRS Data | Import | Select NoticeID | Linking to PFD/EIRP masks | **Validation** | Finish

Start | Masks | **Groups** | Non-geo Method | Non-geo Density | Sat Oper | Orbit | Finish

Frequency groups validation

Error Found. Minimum elevation angle is missing for one or several records.

Please correct the data
Please enter minimum elevation angle (A.14.b.4) of the earth station expressed in degrees with two decimal positions for each group and press Update

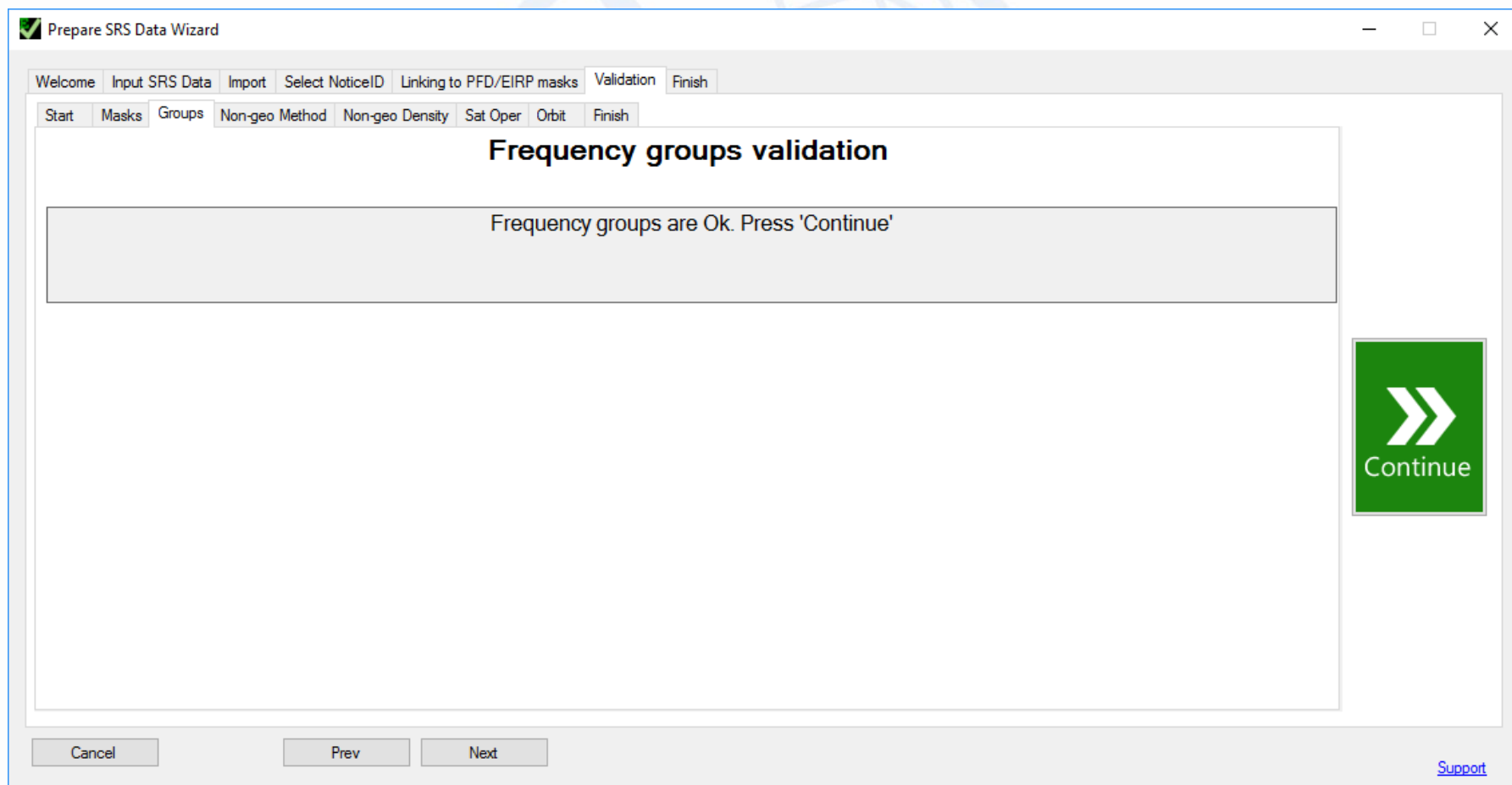
	GroupID	Beam Name	Emission Direction	Minimum Elevation Angle
▶	104001	DFLH	E	
	104055	U2	R	

Update

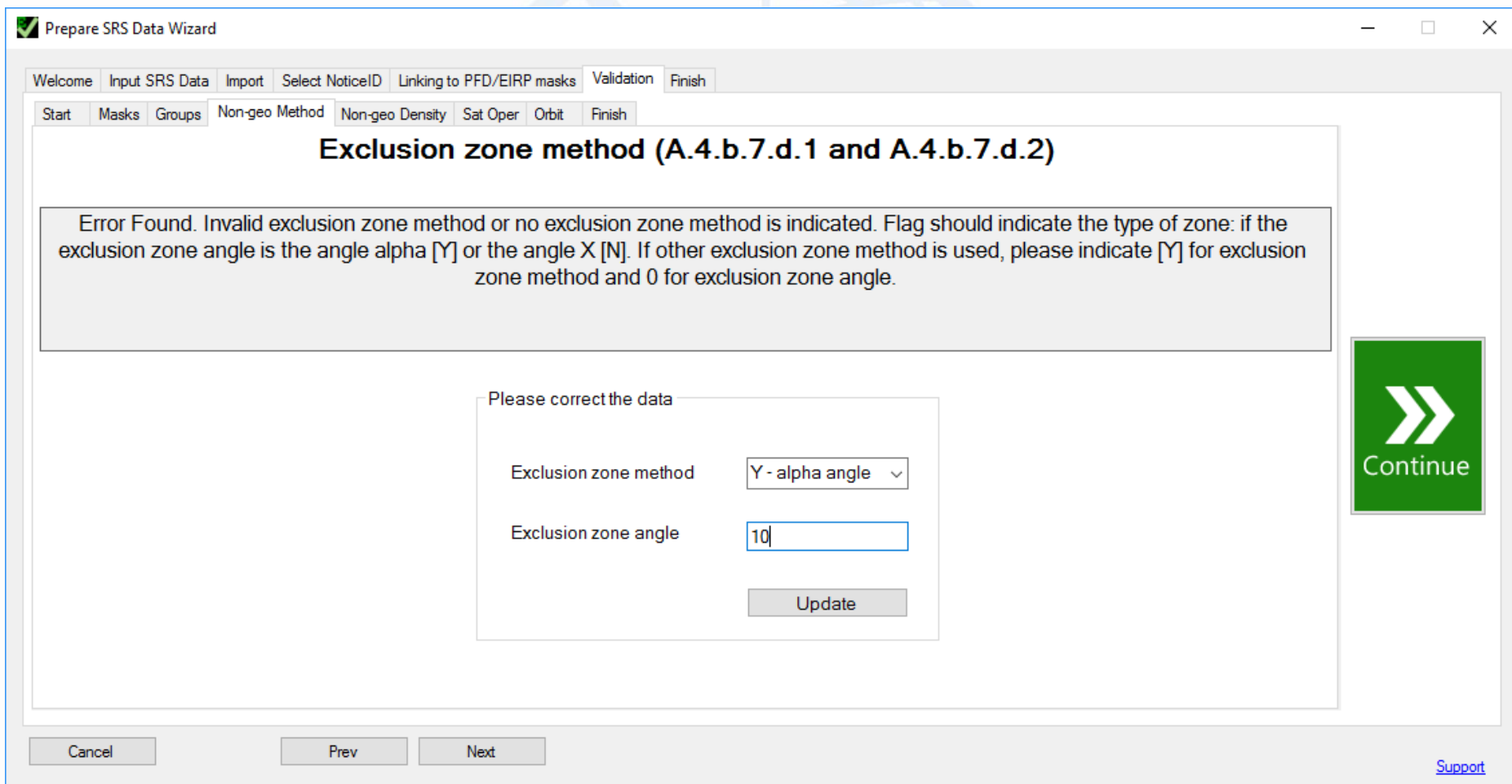
Continue

Cancel | Prev | Next | [Support](#)

- No problems are found with respect to the frequency assignment groups.
- Continue next.



- Exclusion zone method is not indicated.
- Enter 'Y' as method and 10 degrees angle. Click 'Update'.
- Continue next.



Prepare SRS Data Wizard

Welcome | Input SRS Data | Import | Select NoticeID | Linking to PFD/EIRP masks | **Validation** | Finish

Start | Masks | Groups | Non-geo Method | Non-geo Density | Sat Oper | Orbit | Finish

Exclusion zone method (A.4.b.7.d.1 and A.4.b.7.d.2)

Error Found. Invalid exclusion zone method or no exclusion zone method is indicated. Flag should indicate the type of zone: if the exclusion zone angle is the angle alpha [Y] or the angle X [N]. If other exclusion zone method is used, please indicate [Y] for exclusion zone method and 0 for exclusion zone angle.

Please correct the data

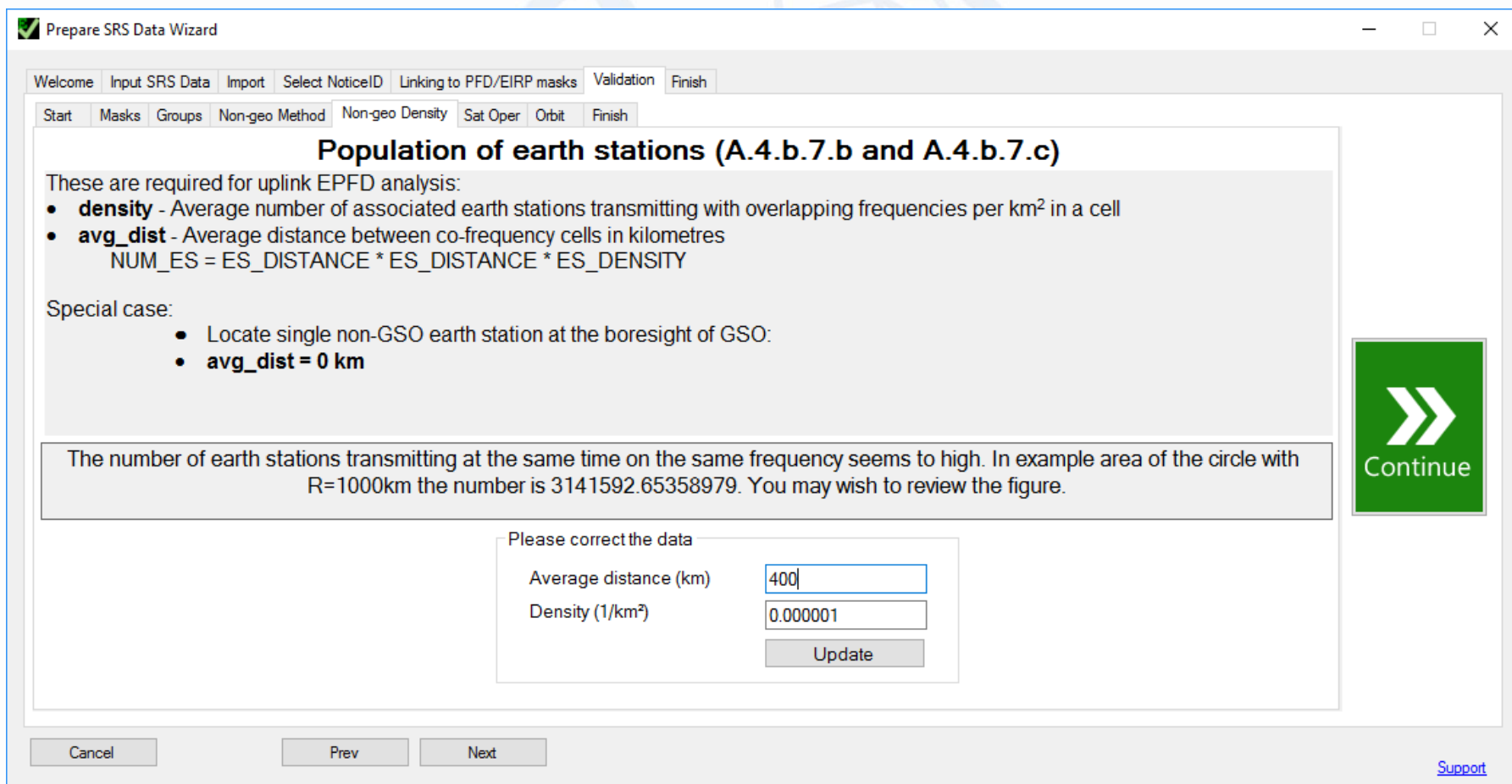
Exclusion zone method	Y - alpha angle
Exclusion zone angle	10

Update

Continue

Cancel | Prev | Next | [Support](#)

- Unrealistic earth station data is found.
- Enter 400 as average distance between representative earth stations and 0.000001 as density. Click 'Update'.



Prepare SRS Data Wizard

Welcome | Input SRS Data | Import | Select NoticeID | Linking to PFD/EIRP masks | **Validation** | Finish

Start | Masks | Groups | Non-geo Method | Non-geo Density | Sat Oper | Orbit | Finish

Population of earth stations (A.4.b.7.b and A.4.b.7.c)

These are required for uplink EPFD analysis:

- **density** - Average number of associated earth stations transmitting with overlapping frequencies per km² in a cell
- **avg_dist** - Average distance between co-frequency cells in kilometres
$$\text{NUM_ES} = \text{ES_DISTANCE} * \text{ES_DISTANCE} * \text{ES_DENSITY}$$

Special case:

- Locate single non-GSO earth station at the boresight of GSO:
- **avg_dist = 0 km**

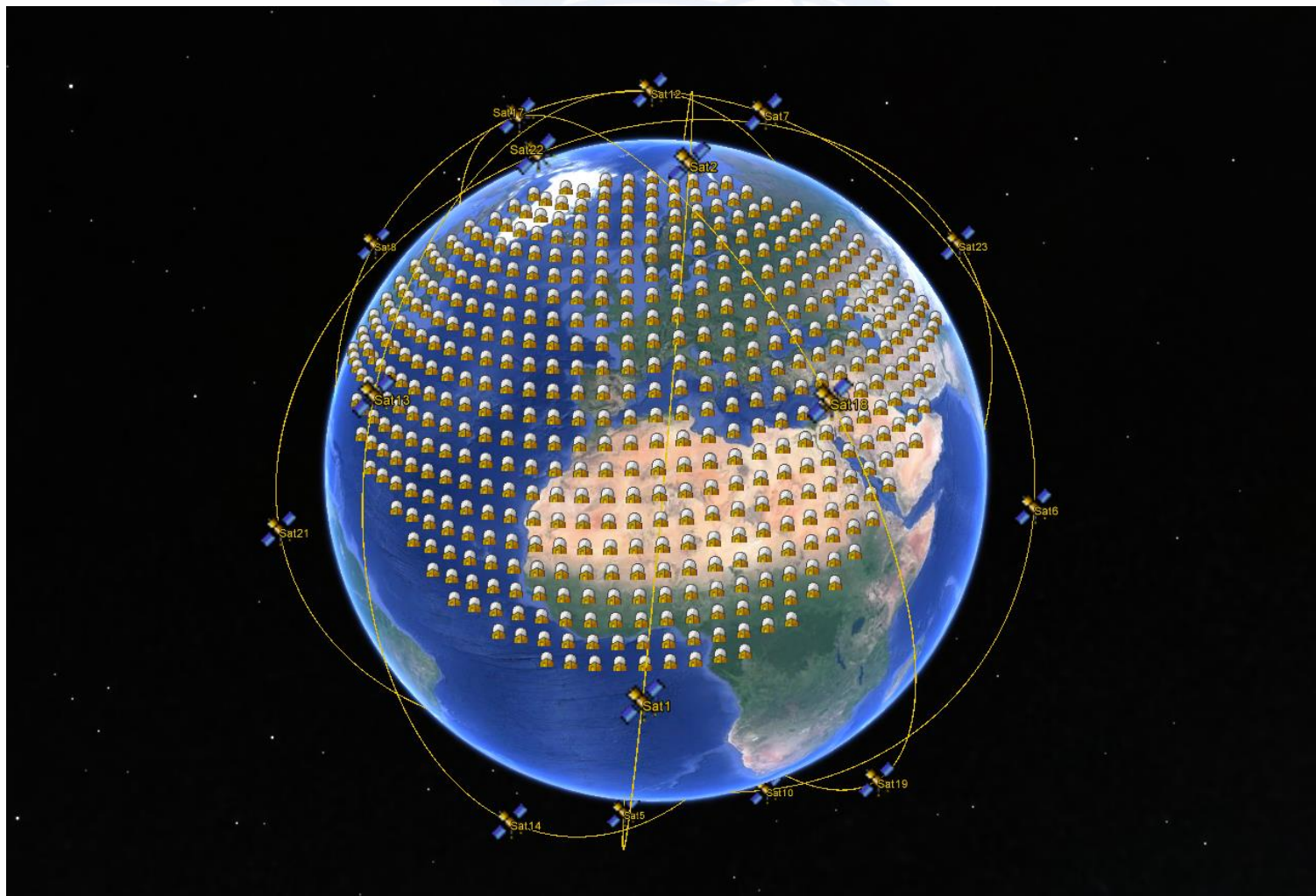
The number of earth stations transmitting at the same time on the same frequency seems to high. In example area of the circle with R=1000km the number is 3141592.65358979. You may wish to review the figure.

Please correct the data

Average distance (km)	<input type="text" value="400"/>
Density (1/km ²)	<input type="text" value="0.000001"/>
<input type="button" value="Update"/>	

Cancel | Prev | Next | [Support](#)

- Entered figures would correspond to the following Earth Stations population.



- Operational latitude ranges are missing.
- Enter data as shown on the screen and click 'Update'.
- Continue next.

Prepare SRS Data Wizard

Welcome | Input SRS Data | Import | Select NoticeID | Linking to PFD/EIRP masks | Validation | Finish

Start | Masks | Groups | Non-geo Method | Non-geo Density | Sat Oper | Orbit | Finish

Operational latitude ranges (A.4.b.6)

- **lat_fr, lat_to** - lower upper limit of the latitude range
- **nbr_op_sat** - maximum number of non-geostationary satellites transmitting with overlapping frequencies to a given location within the latitude range
- Entries should cover the whole range from -90 to 90 latitude.

Fatal Error. No record is present in sat_oper table for the selected Notice ID. Please, enter the data below.

Please correct the data

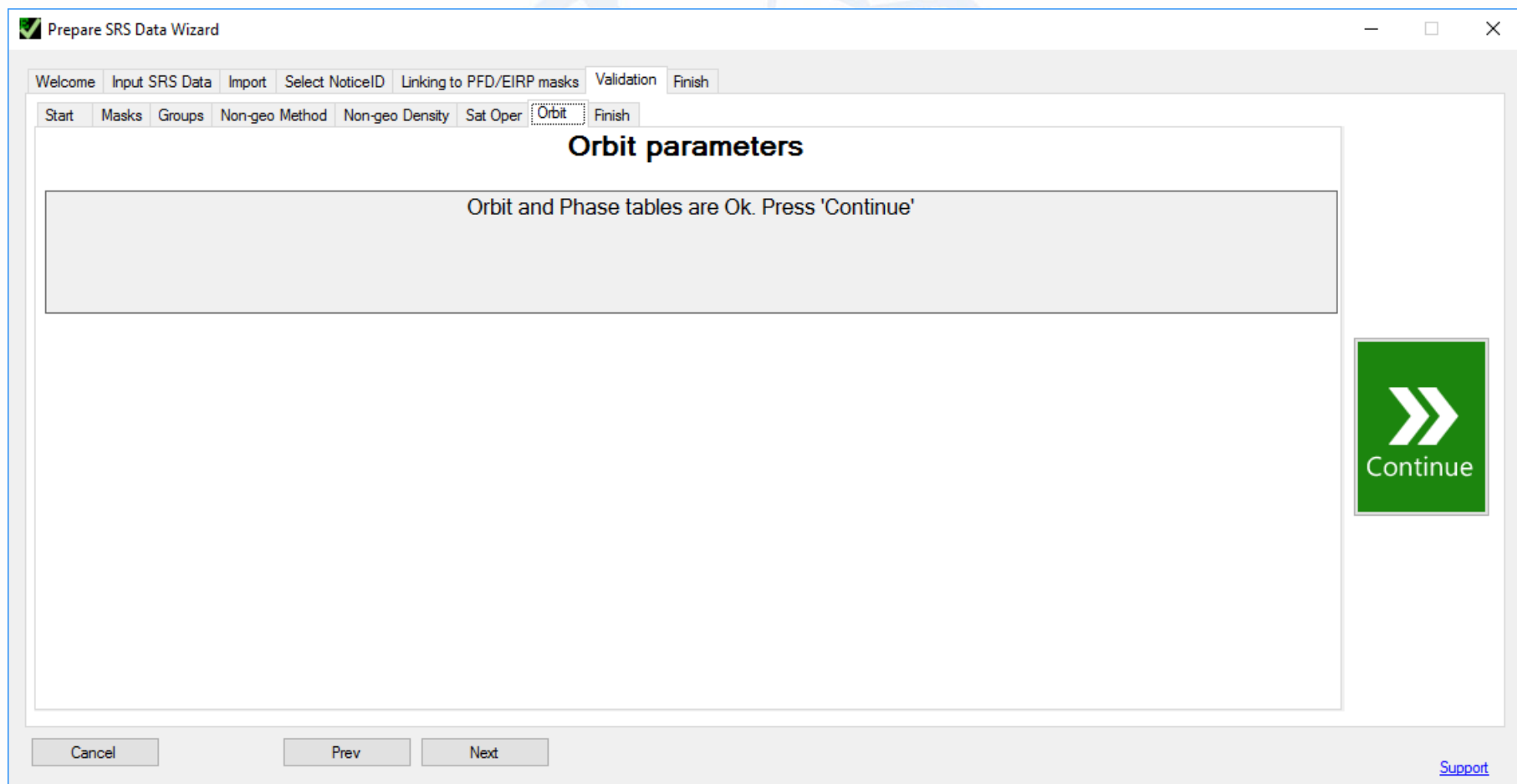
	ntc_id	lat_fr	lat_to	nbr_op_sat	change_ts
	104	-90	0	1	
▶	104	0	90	1	
*					

Update

Continue

Cancel | Prev | Next | [Support](#)

- No issues found with orbit parameters.
- Continue next.

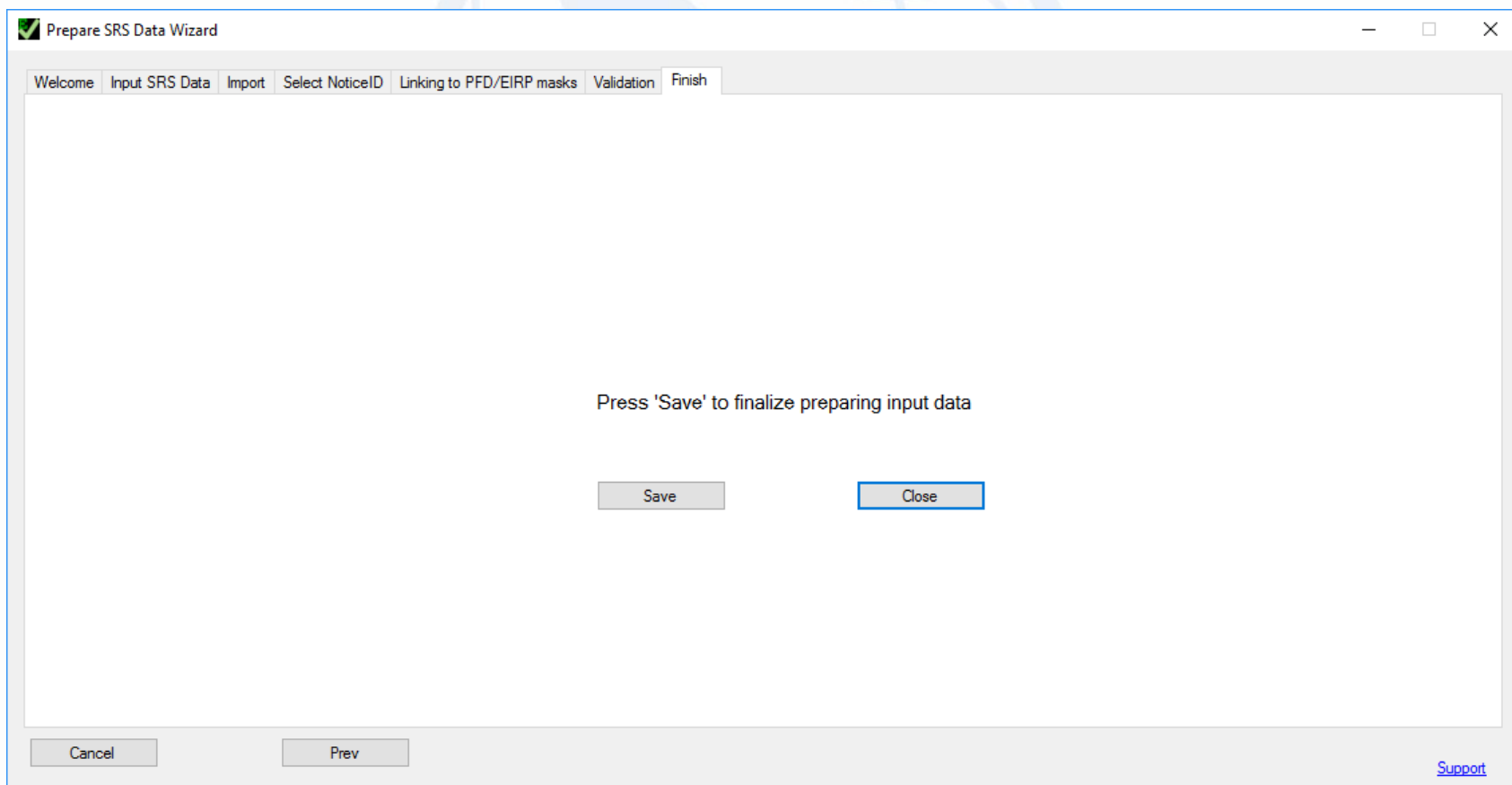




Appendix 4 data validation



- Finally, if there are no error anymore in Appendix 4 data, you can save the database to be used for EPFD validation.
- Save database to 'NSKY_SRS_data.mdb'.
- Click 'Close'.





Final notes



- For detailed explanation of EPFDPrepare tool please read the EPFD User Guide:
c:\BR_SOFT\EPFD\User Guide.pdf

