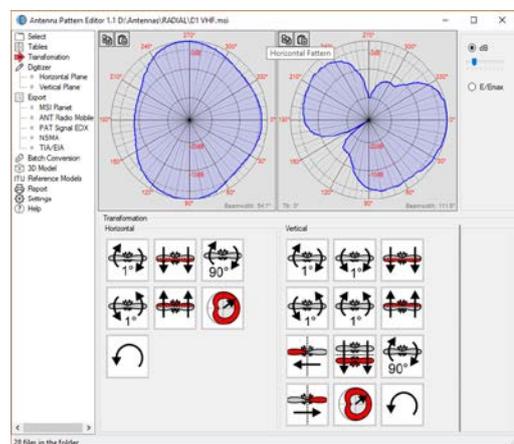
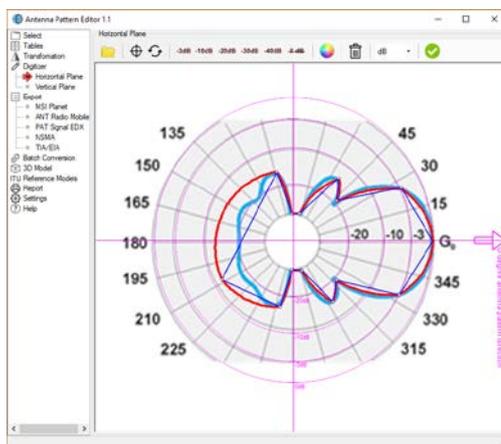
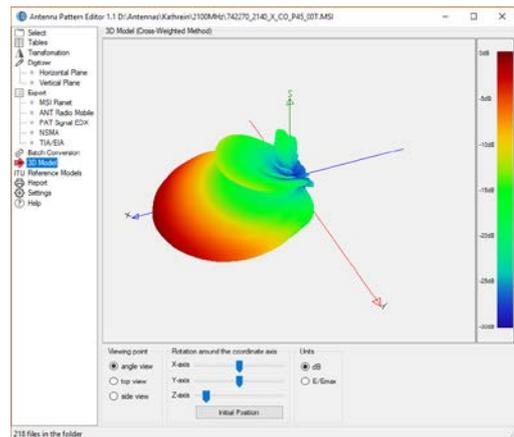
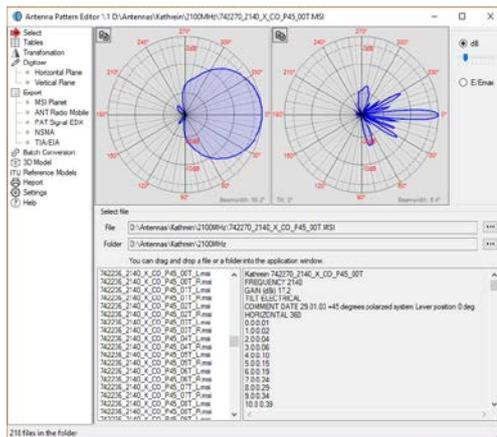


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# Antenna Pattern Editor 1.1

## User Manual



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## From the Developers

We made every effort to create a user-friendly and intuitive application. However, we recommend you spend some time reading this User Manual to get the most out of the **Antenna Pattern Editor** application.

## Features

**Antenna Pattern Editor** is a universal tool for creating, editing and converting antenna pattern file of various formats. The main idea embedded in the program is to provide the user with the opportunity to quickly create an antenna pattern file using various methods.

Antenna pattern file is a simple text or xml file that describes the main characteristics of the antennas - radiation patterns, gain, frequency range, name, manufacturer and other data. These files are used in various radio planning tools including our RadioPlanner and MLinkPlanner. (<https://www.wireless-planning.com/>)

There are a large number of antenna pattern file formats, but it often happens that there is no file in the required format. In this case, using the **Antenna Pattern Editor**, you can easily convert the file to the format you need.

Sometimes the antenna information is just a picture of the antenna pattern. In such cases, using the **Antenna Pattern Editor**, you can prepare the necessary file in just a few minutes. Thanks to the simple graphical interface, as well as the applied cubic spline interpolation algorithm, you can get the desired file by pointing only a few characteristic points on the downloaded image. You can use images of any raster format - png, jpg, bmp, tiff.

Using the Antenna Pattern Editor, you can view, edit, transform, normalize the antenna pattern, as well as a number of other functions described below.

Features:

- View 2D antenna patterns in linear and logarithmic scales
- View text information from antenna pattern file
- Generation vertical and horizontal antenna patterns
- View 3D antenna patterns in linear and logarithmic scales
- Creation an antenna pattern from the picture (digitizing)
- Perform various transformations of antenna pattern (rotation, mirroring, normalize, etc.)
- Creation of antenna patterns on various reference models
- Antenna pattern report in Word, Excel, and PDF
- Export antenna patterns to various formats
- Calculation of the width of the main lobe in the horizontal and vertical plane, as well as the electrical tilt of the antenna
- Batch convert antenna pattern files between formats

Supported antenna pattern file formats:

- MSI Planet (\*.msi, \*.pla, \*.pln, \*.ptn, \*.txt, \*.ant)
- Radio Mobile V3 (\*.ant)
- NSMA WG16.99.050 (\*.adf \*.dat \*.nsma \*.nsm \*.txt)
- TIA/EIA-804-B (\*.adf)
- EDX (\*.pat)

## Installation and Software Update

Run the installation file and follow the instructions that appear on your screen.

Periodically, we release free current updates in which we improve the functionality and stability of the software.

**Antenna Pattern Editor** supports both manual and automatic checking for updates. The software will check for available updates every time it starts. To check for updates manually, click “Help - Check for updates.” If there is an available update, a window will open with information about the current and available versions. You can download the update from the link and install it manually. Exit the RadioPlanner software before installing the update.

## Registration

**Antenna Pattern Editor** is free software. Each time you start the program, an advertisement for our commercial software products is displayed for 7 seconds. To disable the demonstration of advertising, the program must be registered, registration is paid. With the exception of showing ads, the rest of the functionality of the unregistered version is fully equal to the functionality of the registered version.

## Settings

Language	Selecting the interface language: <ul style="list-style-type: none"> <li>- English</li> <li>- Russian</li> </ul>
Units for tables	Units for entering radiation pattern values in the Tables menu: <ul style="list-style-type: none"> <li>- dB</li> <li>- E/Emax (relative)</li> </ul>

## Main Menu

As the main user menu, the software uses a Tree View interface (multi-level tree), the controls of which are in the left part of the main panel. When you select a menu item, the corresponding panel opens on the right.

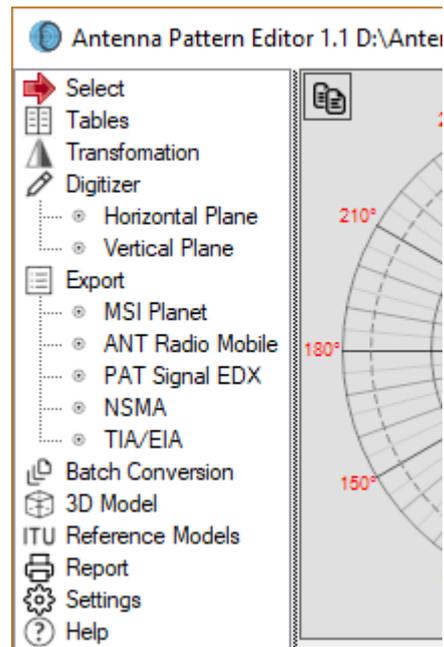


Figure 1. Tree View interface

## Select and View Antenna Pattern Files

To select an antenna pattern file and view its characteristics, go to the Select menu.

You can upload either a single file or a folder with a set of files.

**Antenna Pattern Editor** allows you to view the antenna pattern, as well as other information from the antenna pattern files. You can open the file or folder in the standard way, or simply by dragging and dropping the desired file or folder into the Antenna Pattern Editor window.

If a folder with a set of antenna files has been opened, a list will appear on the left side. You can select the desired antenna from that list. Files from folders enclosed in the current folder will not be displayed.

After selecting the file, the image of the radiation pattern in the horizontal and vertical planes appears on the top panel, in the panel on the right - all the data from the antenna description file.

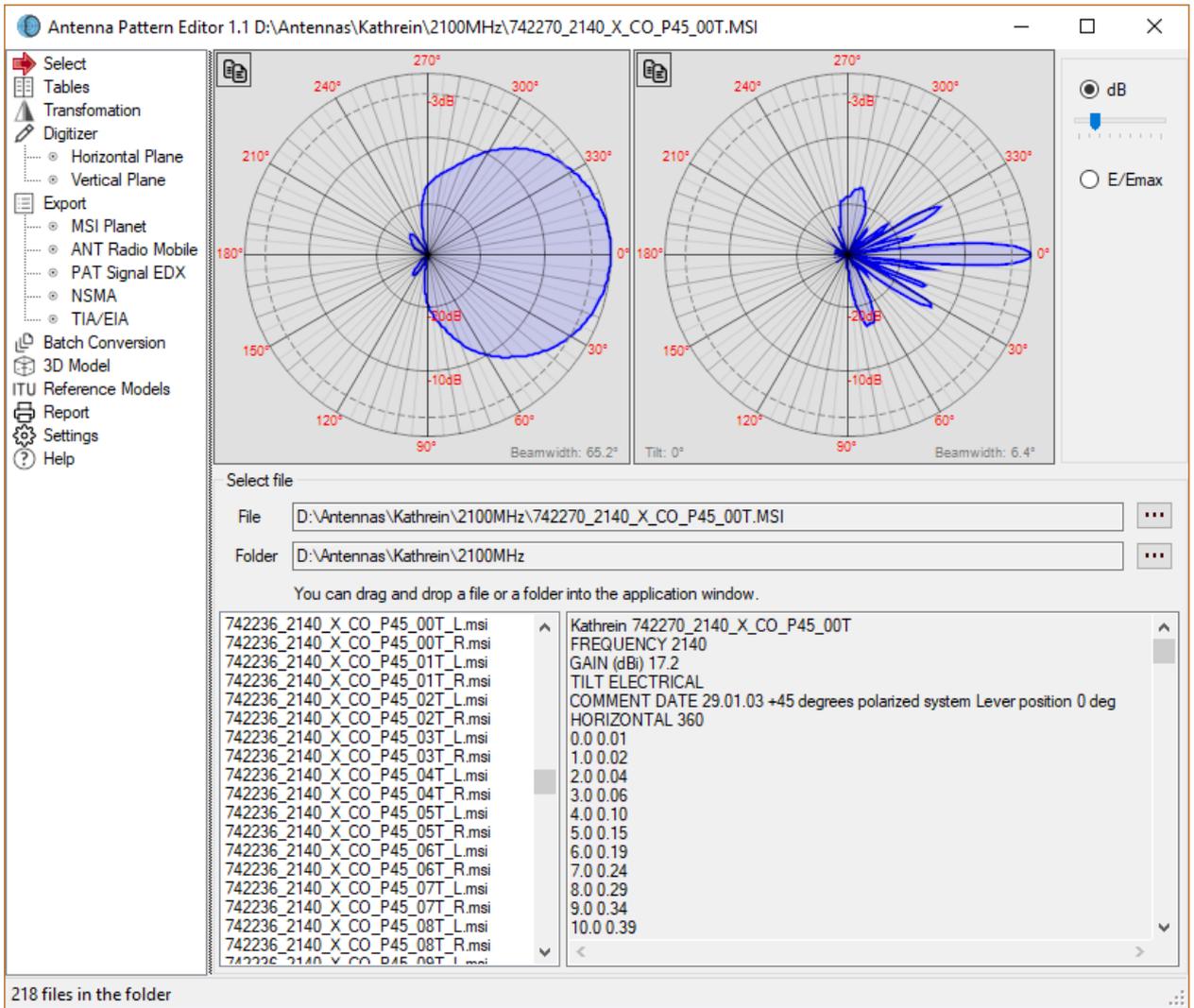


Figure 2. View antenna pattern files

Using the tools located to the right of the antenna pattern, you can change the display of the antenna pattern - in dB or relative units, as well as the decibel scale.

The width of the main lobe is displayed at a level of 3 dB (0.7) on both the horizontal and vertical antenna patterns. In addition, vertical tilt is displayed. This value is calculated by the information from the antenna pattern file.

When you exit the Select menu, the program will remember the characteristics of the selected antenna for future use.

## View 3D Antenna Models

To view the three-dimensional antenna model, go to the 3D model menu. 3D Model of the selected antenna generated by the cross-weight conversion algorithm appears on that tab.

Toolbar for viewing a 3D model:

dB or E/Emax	Units for displaying antenna pattern - decibels or
--------------	--

	relative units
Viewing point: <ul style="list-style-type: none"> <li>- Angle View</li> <li>- Top View</li> <li>- Side View</li> </ul>	Viewing point: <ul style="list-style-type: none"> <li>- Angle View</li> <li>- Top View</li> <li>- Side View</li> </ul>
Rotation around the coordinate axis	Rotate a 3D model around the X, Y, Z axes

Zero-degree antenna pattern matches the direction of the X-axis.

On the right is a scale for matching the color of the 3D model and the normalized antenna pattern

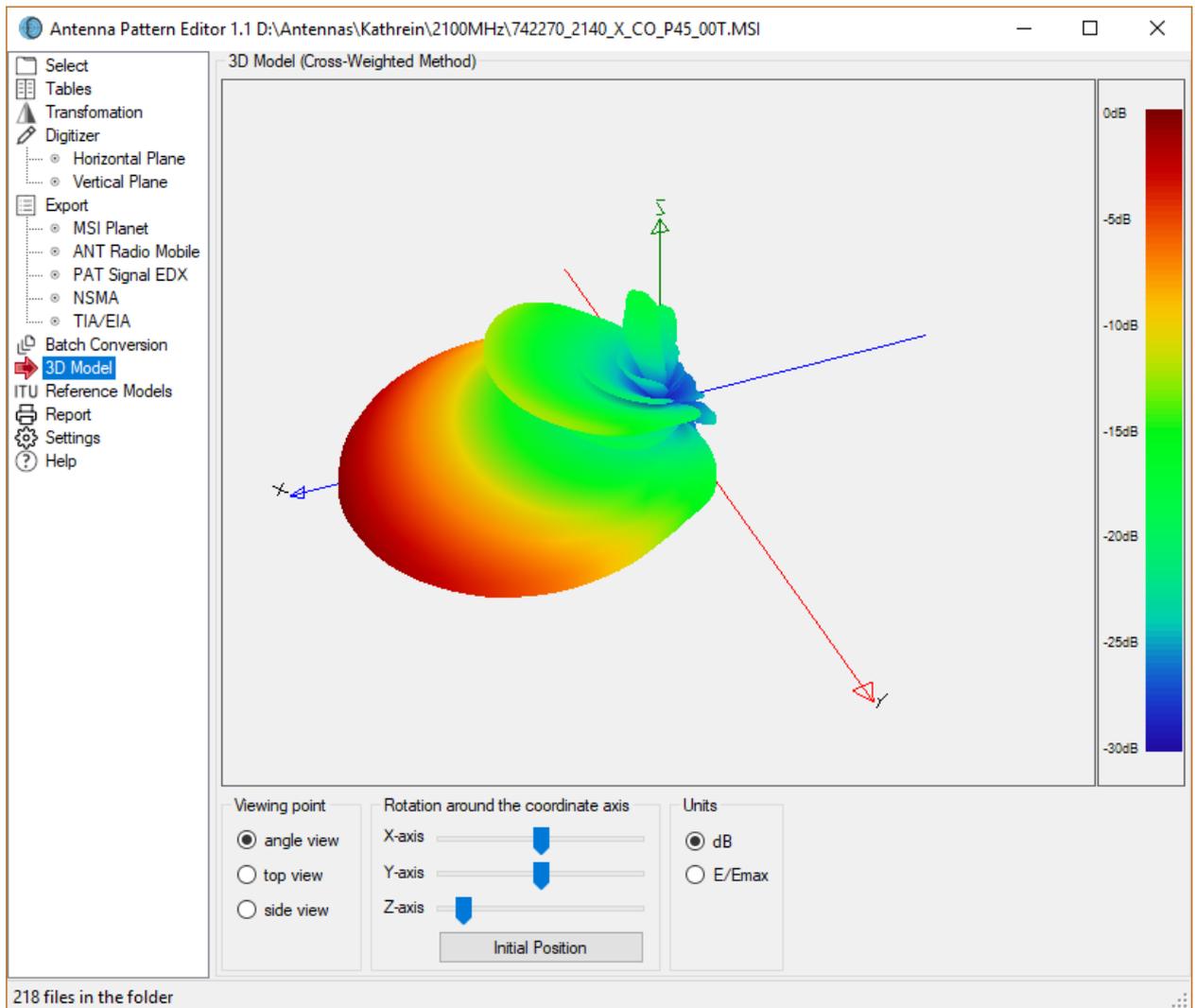


Figure 3. 3D antenna model

## Creating / Editing Antenna Pattern

### Input and Editing Antenna Pattern in Tabular Form

The program allows you to input/edit the antenna pattern in tabular form. To do this, go to the Tables menu. If the description file was previously selected in Select menu, then its antenna pattern will be displayed in the table. If the file was not selected, the table will be empty.

Tables can be filled and edited manually. Also, using the tool located at the bottom of the tables, you can select the automatic filling step. Click **Set** button to fill the table with the values of omnidirectional antenna pattern.

To delete rows in the table, select these rows in the left empty field and click on Delete. When highlighting rows in the table, the corresponding sector in the antenna pattern image is highlighted in yellow above.

The antenna pattern values in the table can be specified both in decibels and in relative units, to select units go to the **Settings** menu.

When you exit the Tables menu, the approximation of the antenna pattern values for all 360 degrees will be performed.

Using the tools  and  on top, the antenna pattern in the horizontal or vertical plane can be copied /pasted through the clipboard.

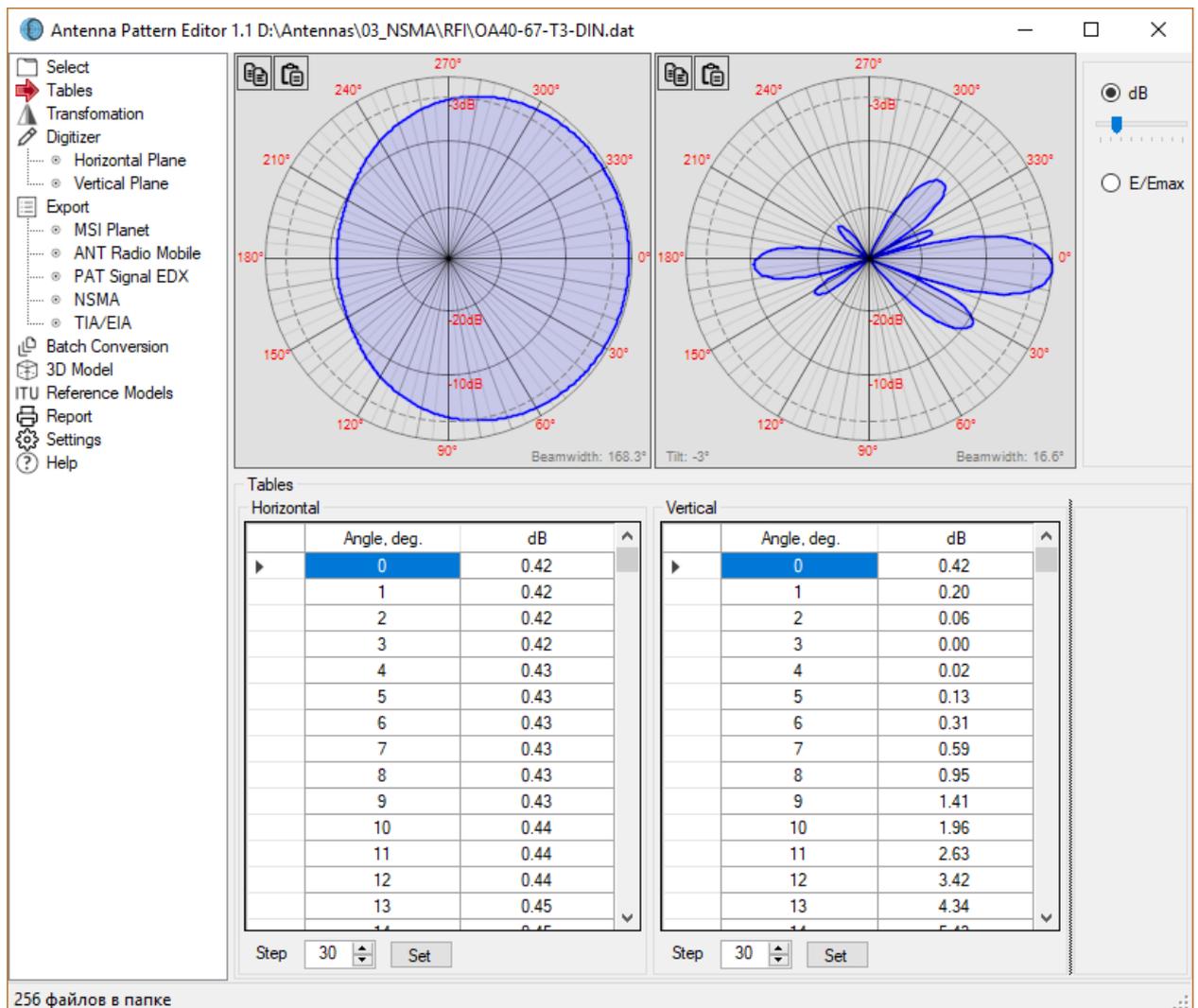


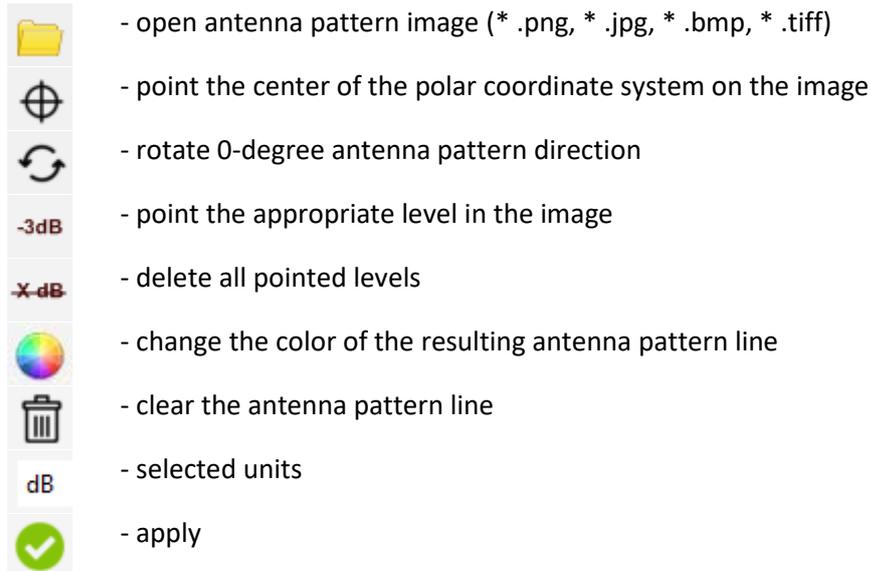
Figure 4. Antenna pattern editing

### Digitizing of the Antenna Pattern Picture

In cases where the antenna pattern is presented as an image, the antenna pattern file can be prepared by digitizing this image.

In this case, the following actions are performed - you upload a file with a picture of a horizontal antenna pattern, mark several characteristic points on it, mark the center of the polar coordinate system and one or more levels in dB of the antenna pattern. Then the same operations must be done with the vertical antenna pattern, then fill in several fields with the antenna parameters and save the antenna pattern in the desired format.

Toolbar:



Detailed step-by-step procedure for digitizing antenna pattern picture:

**Step 1.** Go to the Digitization menu antenna pattern – **Horizontal Plane**. Download the image file of the antenna pattern in the horizontal plane of any raster format. Moving the downloaded image is carried out by the mouse with the wheel pressed, scaling - by rotating the mouse wheel.

**Step 2.** Set the center of the polar coordinate system to the center of the antenna pattern. Click on the tool , and then click on the center of the downloaded image antenna pattern.

**Step 3.** Using the tool , specify the direction of the antenna pattern by 0 degrees (antenna manufacturers provide the antenna pattern, in which the direction of the antenna pattern at 0 degrees is sometimes indicated up, sometimes to the right).

**Step 4.** Using the dB - E/Emax tool, specify the units in which the antenna pattern in the image is shown - in decibels or relative units.

**Step 5.** Set the nodes of the polyline (it is marked in blue) on the characteristic points of the image of the antenna pattern (usually these are the maxima and minima of the antenna pattern, as well as the characteristic bends of the antenna pattern). Moving a polyline node is performed by clicking the left mouse button, deleting a node by clicking the right mouse button on the node, creating an additional node by clicking the right mouse button on the polyline.

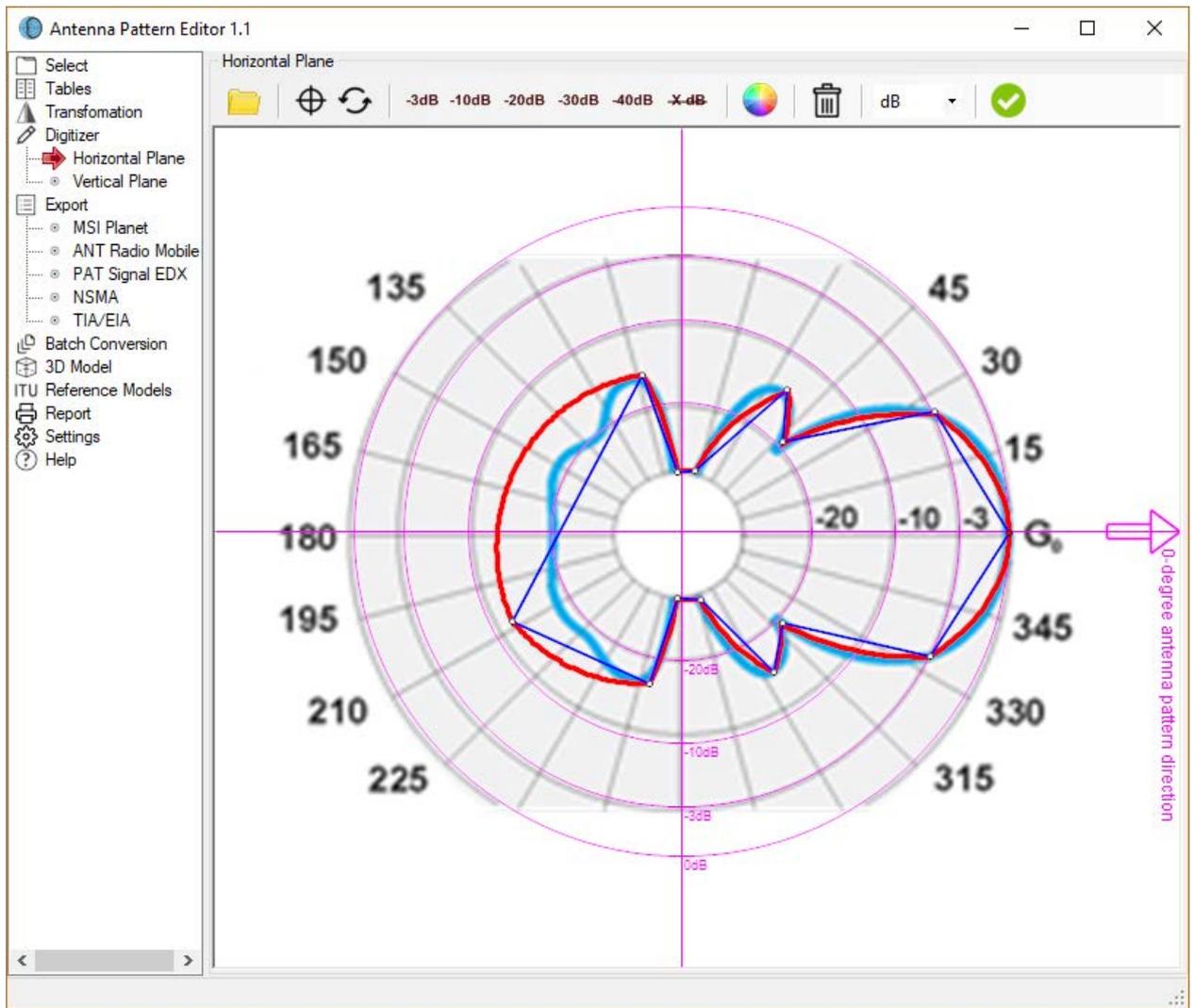


Figure 5. Digitization of the antenna pattern in the horizontal plane

**Step 6.** Evaluate the coincidence of the resulting antenna pattern, which is shown in red (the color can be changed using the tool  ) with the original image of the antenna pattern. To make the resulting radiation pattern smooth in any of the nodes, you should enable spline interpolation in it by double-clicking the left mouse button, and the node will be highlighted in red. If necessary, add additional nodes (do not forget - nodes are added on the blue polyline with the right mouse button) until a satisfactory match with the picture is obtained.

**Step 7.** If the antenna image is given in decibels in the original image, then you need to specify the levels from the range -3, -10, -20, -30 or -40 dB, which are marked on the loaded image of the antenna pattern (several are better, since the scale on image antenna pattern may be non-linear). To do this, click on the desired button, and then click on the appropriate level in the image antenna pattern. If the antenna image is shown in relative units on the image, then the -3, -10, -20, -30, and -40dB levels are not required, except for the following case. Very rarely, but it happens that some manufacturers draw the antenna pattern in relative units, in which 0 is not in the center, but at a certain radius from the center. In this case, at a radius corresponding to 0, you need to specify the level of -40dB. This level will be taken as 0.

**Step 8.** Click on  button to digitize the horizontal-plane antenna pattern. Then it will appear in the **Tables** menu.

**Step 9.** On the **Vertical Plane** tab, repeat steps 1-8 for the V-plane antenna pattern.

You can save the image of the antenna pattern along with the polyline to a file of its own \* .dgt format, which can then be opened for further editing; for these purposes, the menu commands **Digitizer – Open DGT file**, **Digitizer – Save DGT file** are provided.

### Creating an Antenna Pattern Using a Graphical Editor

Using the digitizer, you can quickly draw an antenna pattern from a blank antenna pattern in a logarithmic or linear scale. Blank templates can be opened for the horizontal and vertical antenna pattern with a tool . Next, you must specify the values of the antenna pattern on the blank template in accordance with the step-by-step instructions outlined in the section Digitizing the antenna image.

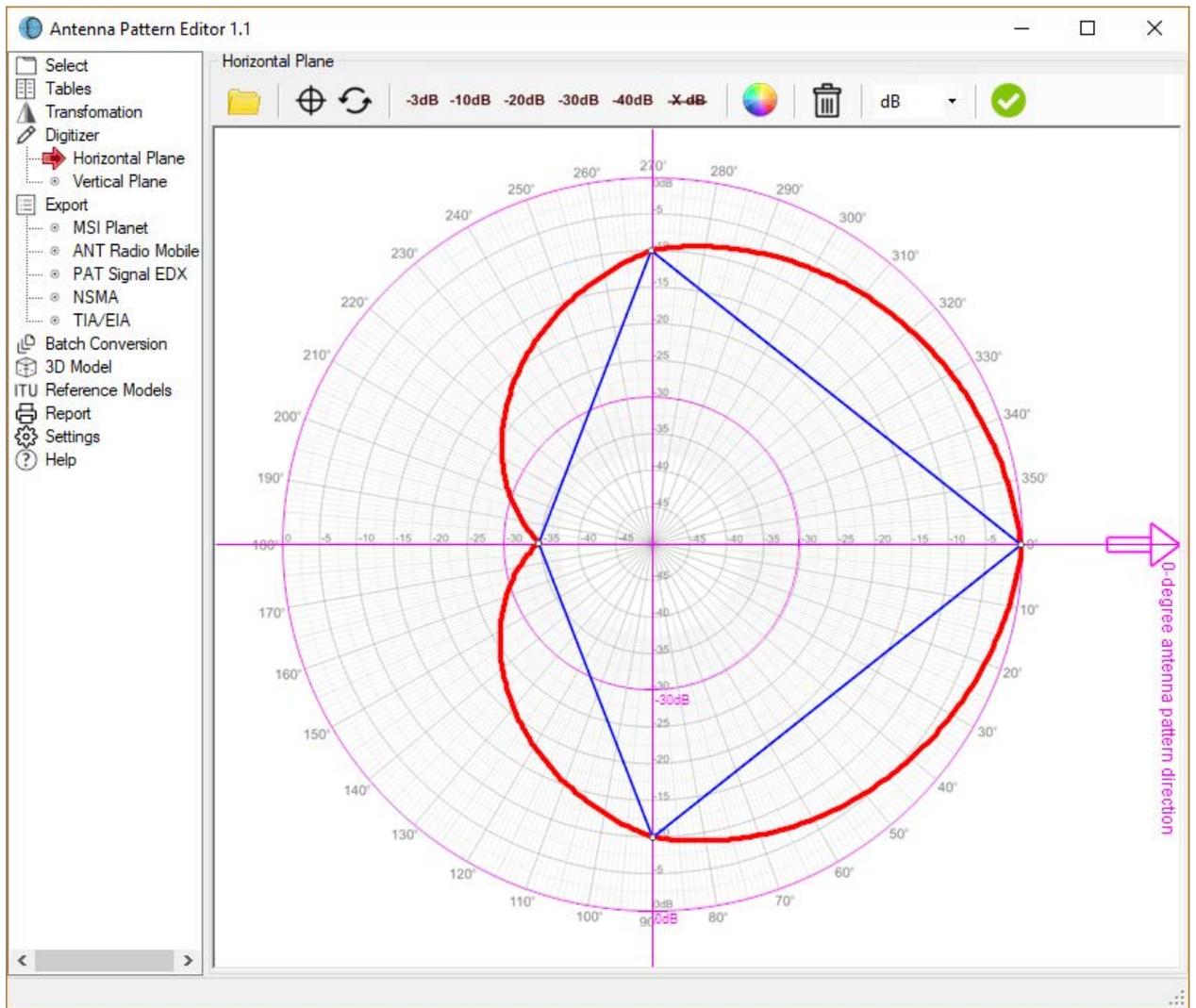


Figure 6. Drawing an antenna pattern using a blank template

### Antenna Pattern Transformation

Using the tools in the **Transformation** menu, you can perform various transformations of the antenna pattern in the horizontal and vertical planes.

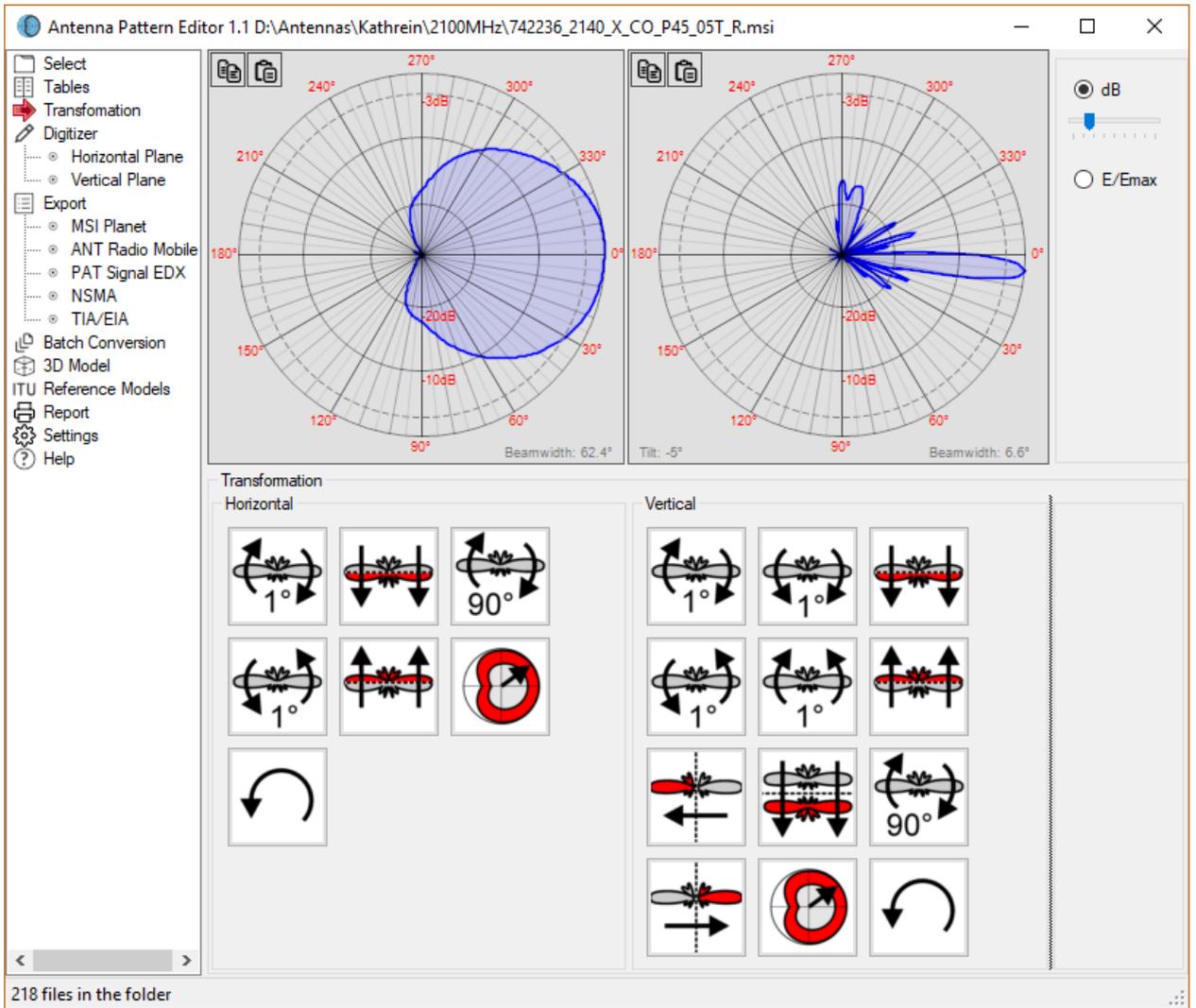
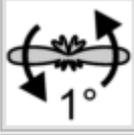
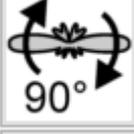
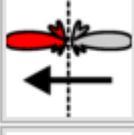
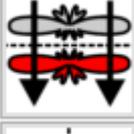
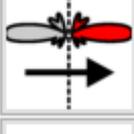


Figure 7. Antenna Pattern Transformation

-  - Rotate the antenna pattern clockwise 1 degree
-  - Rotate the antenna pattern counterclockwise 1 degree
-  - Rotate the antenna pattern clockwise 90 degree
-  - Tilt both sides of the antenna pattern 1 degree down

- 
- Rotate both sides of the antenna pattern 1 degree up
- 
- Copy the antenna pattern from top to bottom
- 
- Copy the antenna pattern from bottom to top
- 
- Copy the right side of the antenna pattern to the left
- 
-Vertical mirroring of the antenna pattern
- 
- Copy the left side of the antenna pattern to the right
- 
- Discard all changes

### Antenna Pattern Synthesis by Reference Models

Antenna Pattern Editor allows you to synthesize an antenna pattern in accordance with reference models based on information about the main characteristics of the antennas - main lobe width, side-lobe level, frequency range, etc. The antenna pattern is synthesized in the **Reference Models** menu.

For sector and omnidirectional antennas, the synthesis of radiation patterns is carried out in accordance with Rec. ITU-R F.1336-5 “Reference radiation patterns of omnidirectional, sectoral and other antennas for the fixed and mobile service for use in sharing studies in the frequency range from 400 MHz to about 70 GHz”

3 dB beamwidth in the azimuth plane (degree)	3 dB beamwidth in the azimuth plane (degree)
3 dB beamwidth in the elevation plane (degree)	3 dB beamwidth in the elevation plane (degree)
Pattern Type: <ul style="list-style-type: none"> <li>- Peak side-lobe</li> <li>- Average side-lobe</li> </ul>	Type of antenna pattern approximation: <ul style="list-style-type: none"> <li>- on the peaks (maximums) of the side lobes</li> <li>- the average level of the side lobes</li> </ul>
Antenna Type <ul style="list-style-type: none"> <li>- Typical antenna</li> <li>- Improved side-lobe performance</li> </ul>	Antenna Type <ul style="list-style-type: none"> <li>- Typical antenna</li> <li>- Improved side-lobe performance antenna</li> </ul>

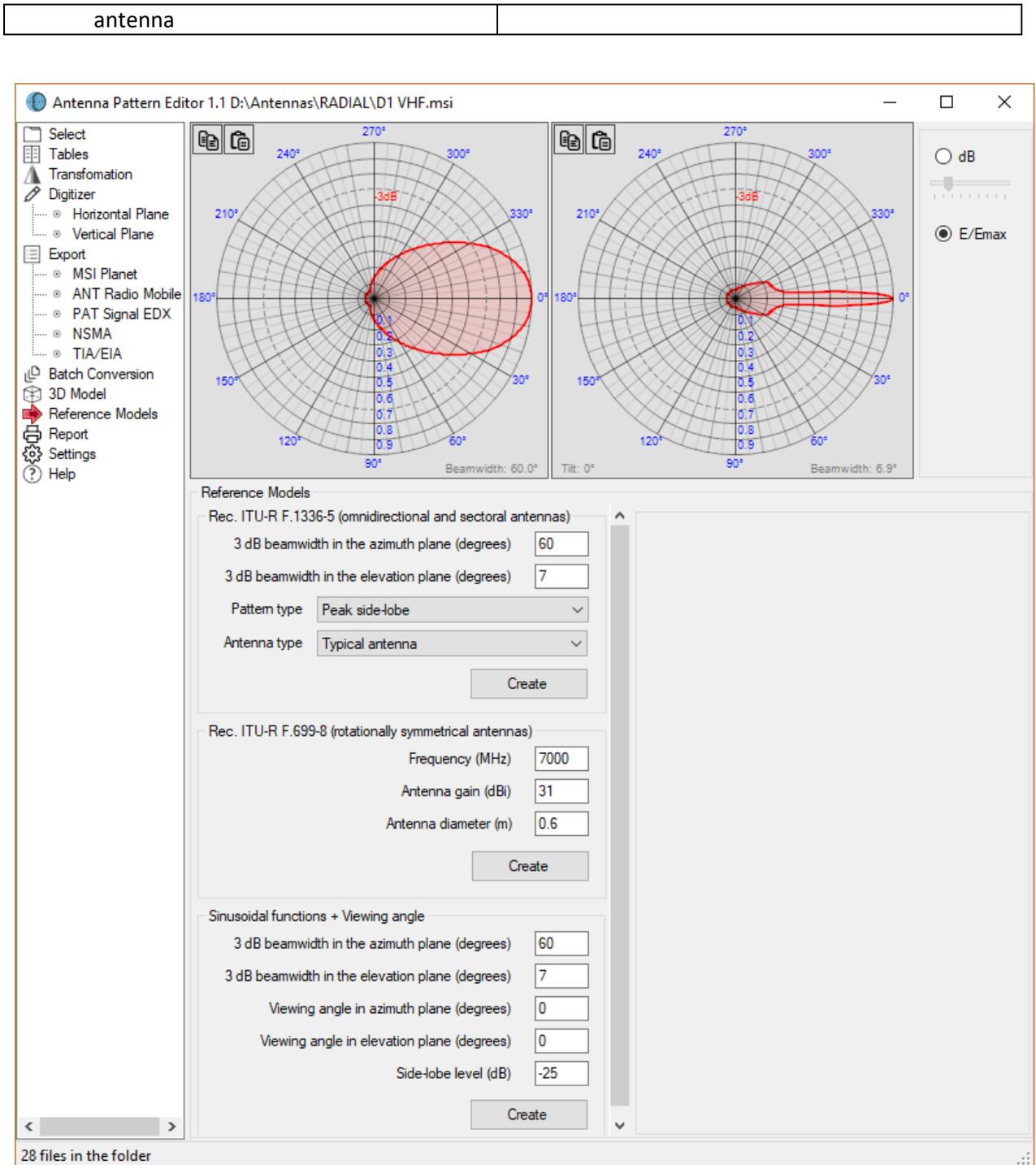


Figure 8. Antenna Pattern Synthesis by Reference Models

For rotationally symmetrical antennas (for microwave antennas and satellite earth stations antennas) the synthesis of the antenna pattern is carried out in accordance with Rec. ITU-R F.699-8 “Reference radiation patterns for fixed wireless system antennas for use in coordination studies and interference assessment in the frequency range from 100 MHz to 86 GHz”

Frequency (MHz)	Frequency, MHz
Antenna gain (dBi)	Antenna gain, dBi
Antenna diameter (m)	Antenna diameter, m

Another common antenna synthesis method that can be used in a program is synthesis using a sinusoidal function and viewing angle.

3 dB beamwidth in the azimuth plane (degree)	3 dB beamwidth in the azimuth plane, degree
3 dB beamwidth in the elevation plane (degree)	3 dB beamwidth in the elevation plane, degree
Viewing angle in the azimuth plane (degree)	Viewing angle in the azimuth plane, degree
Viewing angle in the elevation plane (degree)	Viewing angle in the elevation plane, degree
Side-lobe level (dB)	Side to main lobe level, dB

## Export antenna pattern files to various formats

Antenna pattern editor allows you to save the antenna pattern file in any of the following common formats:

- MSI Planet
- Radio Mobile V3
- NSMA WG16.99.050
- TIA/EIA-804-B
- EDX

To save the file, select the desired format in the **Export** menu, then fill in the header fields corresponding to this format. Information for each field appears when you hover over the icon next to the corresponding field. The user usually determines the completeness of the header by himself. In radio planning tools often used only the antenna pattern from the antenna pattern file. The heading is rarely used. To save the file, click the **Save** button.

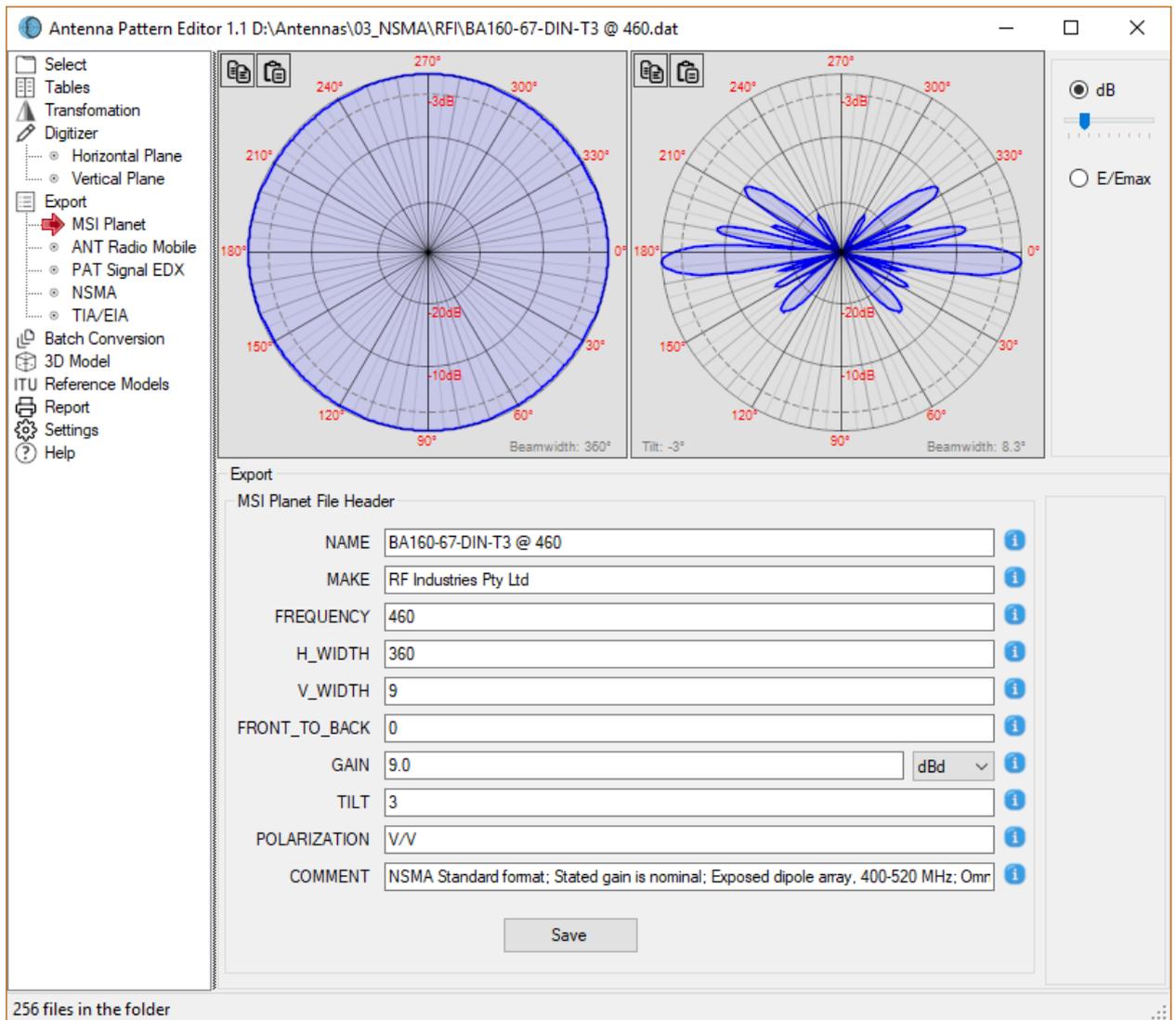


Figure 9. MSI Planet file header

## Antenna Performance Report

Antenna Pattern Editor allows you to create a report on the main characteristics of the antenna, which can then be saved in Word, Excel or PDF.

To view the report, go to the corresponding item in the main menu. A report is generated based on the antenna pattern of the current antenna and the header data of the description file.

To save the report in Word, Excel or PDF formats, use the corresponding tool from the panel at the top.

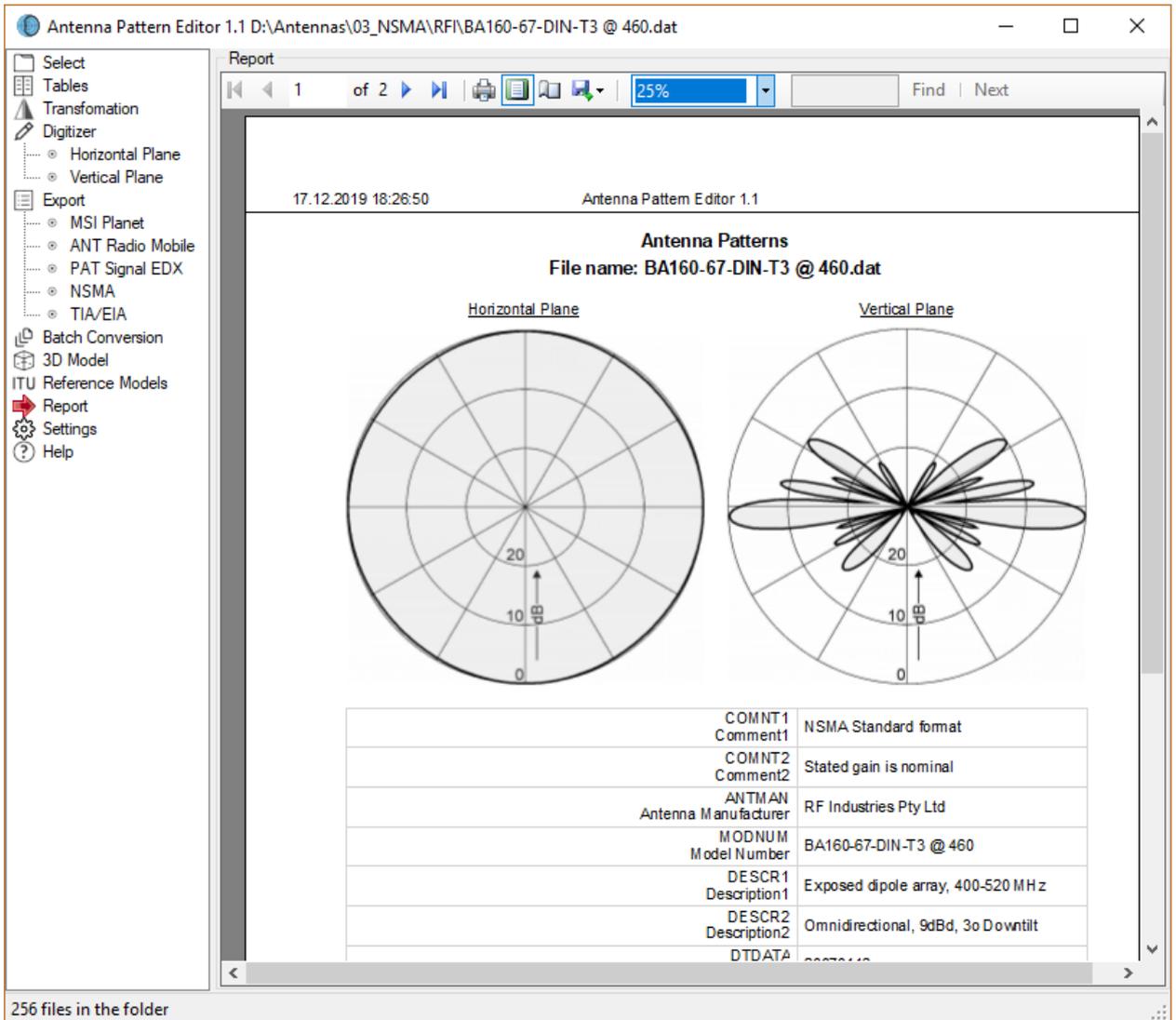


Figure 10. Antenna Performance Report

## Batch conversion antenna pattern files between different formats

In the **Batch Conversion** menu, a set of files is converted between different formats. To perform the conversion, select the source and the output folders, as well as the format in which you want to convert. To convert, click the **Run** button.

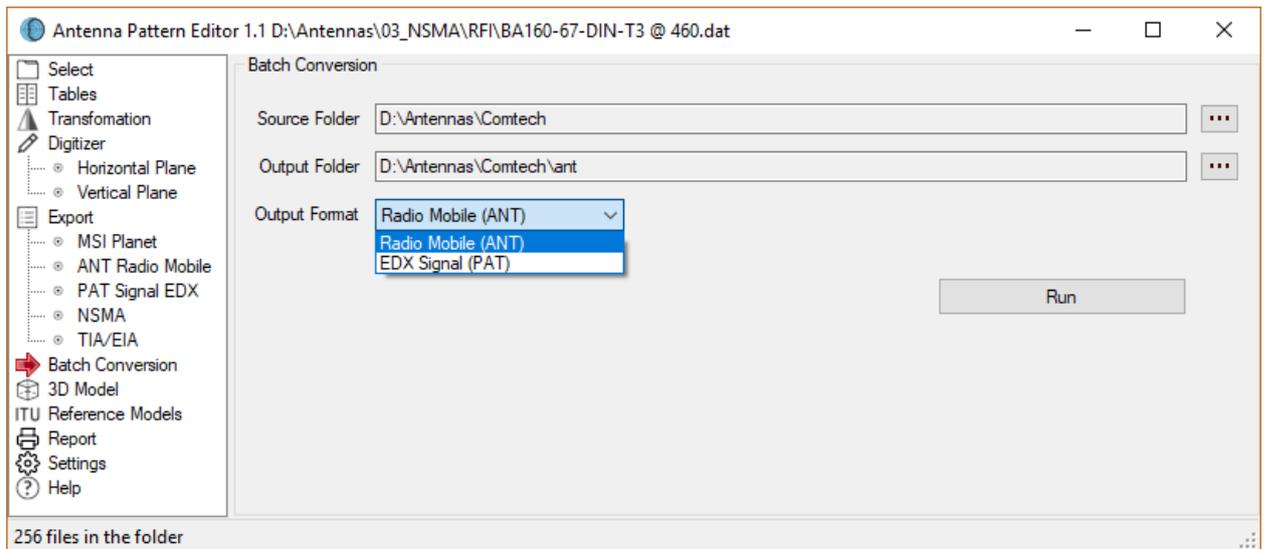


Figure 11. Batch conversion