

PCC.III/RES. 139 (XXI-02)¹
**NEW DATA BASE FOR EARTH STATION ANTENNA PATTERNS FOR USE IN
SHARING STUDIES WITH THE FIXED-SATELLITE SERVICE**

The XXI Meeting of Permanent Consultative Committee III: Radiocommunications,

CONSIDERING:

- a) That Administrations have a need to conduct interference analysis both within the fixed satellite service and with other services;
- b) That measured earth station antenna data can improve the results of sharing studies which use standard reference radiation patterns;
- c) That this information should be made available in a common database to which all interested and involved administrations could access, and
- d) That this common database would only be feasible if some kind of standardization could be established for antenna pattern submission,

RESOLVES:

- 1. To instruct the Executive Secretary of CITEL to establish, within a one-year period, a new database for FSS earth station antenna radiation patterns to the CITEL Web site, including measured and theoretical patterns, sidelobe masks or sidelobe envelopes.
- 2. That data files submitted for inclusion in the database should comply with the format described in ANNEX 1.
- 3. To invite Member States to send to the Secretariat measured earth station antenna data in the format specified in Annex 1.

¹ Document PCC.III/doc.2298/02 rev.3.

ANNEX 1 TO RESOLUTION PCC.III/RES. 139 (XXI-02)
DRAFT DATA FORMAT FOR EARTH STATION ANTENNA PATTERN

1. GENERIC DESCRIPTION

The basic file types considered here are block structured. These data blocks are detailed in the next sections.

In all files, HEADER has to be formatted in accordance with:

Line	Description / Content
1	Title
2	Comments
3	Comments
4	File identification code

Maximum number of characters:

- Title: 52 characters
- Comments: 80 characters

1.1. File identification code

Code	File type
200	3D Fields – co-polar, cross-polar
201	3D Fields – rectangular coordinates
202	3D Fields – cylindrical coordinates
203	3D Fields – spherical coordinates

NOTE: For the purpose of this application only File Code 200 will be considered and described in details

1.2. Block structured files

For the block structured files a fifth row has to be used containing the total number of blocks.

Line	Description / Content
5	Total number of blocks

After row 5 the sequence of blocks is included with the main function data.

A single file block has a generic structure as following:

<i>Control line</i>			
n	m		
$a_{1,1}$	$a_{1,2}$...	$a_{1,m}$
$a_{2,1}$	$a_{2,2}$...	$a_{2,m}$
...
...
$a_{n,1}$	$a_{n,2}$...	$a_{n,m}$

Where:

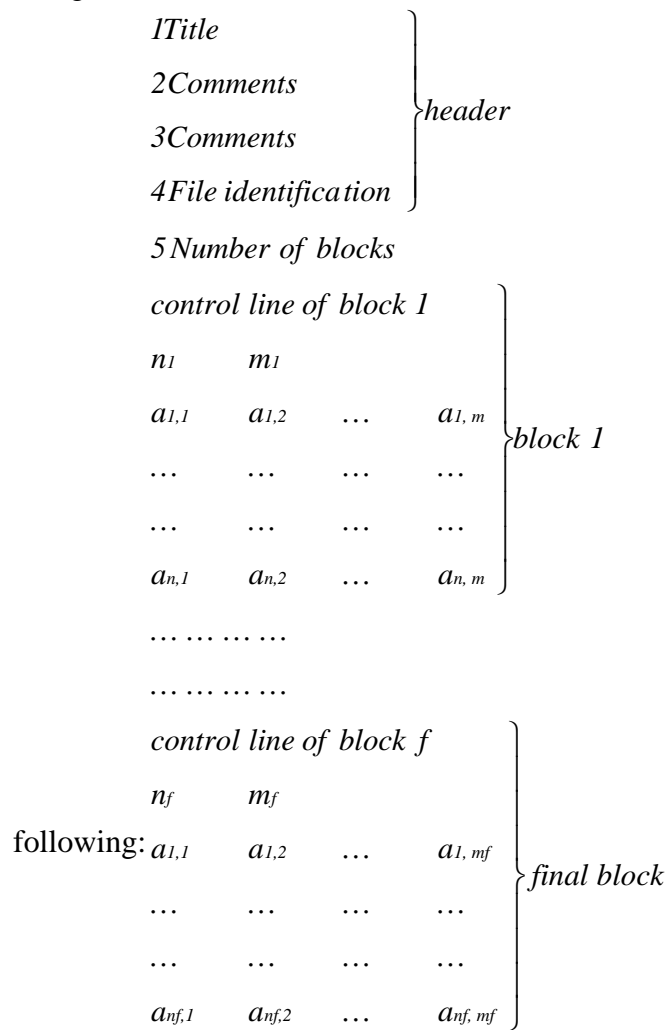
Control line = Contains relevant data concerning the specific block
(see details in the following sections);

n = number of block rows,

m = number of block columns.

1.2.1. File general structure

The general structure of a block structured file is described as



2. 3D Fields - Block Structured Files

In this section the content of field data is described only for the file type 200 (3D Fields – Co-polar and Cross-polar). See figure 1 as a reference for parameters described below.

Title

Comments

Comments

id pol orientation freq

Number of blocks

$$\begin{array}{cccccc}
 \phi_k & r_j & & & & \\
 n & m & & & & \\
 \theta_1 & |C\alpha(\theta_1, \phi_k, r_j)| & \angle C\alpha(\theta_1, \phi_k, r_j) & |X(\theta_1, \phi_k, r_j)| & \angle X(\theta_1, \phi_k, r_j) & \\
 \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\
 \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\
 \theta_n & |C\alpha(\theta_n, \phi_k, r_j)| & \angle C\alpha(\theta_n, \phi_k, r_j) & |X(\theta_n, \phi_k, r_j)| & \angle X(\theta_n, \phi_k, r_j) &
 \end{array}
 \left. \vphantom{\begin{array}{cccccc}} \right\} \text{block}$$

Where:

- *id*, file identification, is 200,
- *pol*, antenna polarization, assumes values 1 (linear); 2 (circular/elliptical) or 0 (non determined),
- *orientation*:
 - when *pol* = 1, “orientation” indicates plane ϕ which contains the main component of the electric field (preferably 90°);
 - when *pol* = 2, “orientation” is 1 (for *left-hand* circular/elliptical polarization) , or 2 (for *right-hand* circular/elliptical polarization),
 - For non-determined cases use *pol* = 0 and *orientation* = 0;

- $freq$, frequency (in GHz). Not relevant in case of general sidelobe masks or envelopes.
- ϕ_k , pattern cut half plane angle ϕ (in degrees) , related to block data, (use $\phi = 90$ for **upper elevation** cut). Varies from 0 to 360°.
- θ_i , Angular direction (in degrees) relative to the antenna boresight ($\theta_i = 0^\circ$) which shall indicate satellite pointing and maximum gain direction.
- r_j , radial distance r in meters related to specific block, (this value can be suppressed if data relates to far-field region)
- n , number of block rows, i.e., number of θ_i samples (where θ varies from 0 to 180°). Value of n shall be adequate to allow pattern resolution for data plotting or for use in coordination and interference calculations.
- m , number of block columns (for the 200 type file $m = 5$),
- $|Co(\theta_i, \phi_k, r_j)|$, co-polar field amplitude in dB or dBi, at the point (θ_i, ϕ_k, r_j) ,
- $\angle Co(\theta_i, \phi_k, r_j)$, co-polar field phase (in degrees), at the point (θ_i, ϕ_k, r_j) ,
- $|X(\theta_i, \phi_k, r_j)|$, cross-polar field amplitude in dB or dBi, at the point (θ_i, ϕ_k, r_j) ,
- $\angle X(\theta_i, \phi_k, r_j)$, cross-polar field phase (in degrees), at the point (θ_i, ϕ_k, r_j) ,

When amplitudes are indicated in dB, the antenna maximum gain (dBi) value must be supplied (use comments lines). When phase values are not available or not relevant, insert 0.0 (not blanks).

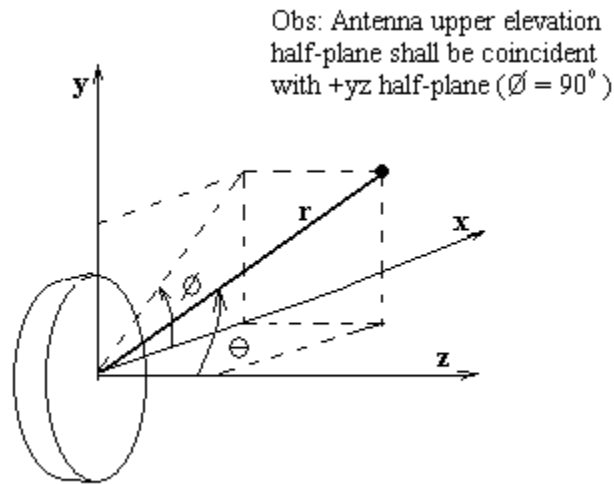


Figure 1 – Example of a reflector antenna in a spherical coordinate system as per the proposed standard file format

3. Examples

In this section a pattern data file is illustrated as an example as well as some resulting applications.

Figure 2 shows some parts of the example file containing four blocks with 360 rows (n) in each and representing the radiation pattern cut planes ϕ_k equal to 0° , 90° , 180° and 270° respectively.

Offset antenna XXX - 1,8m Ku - Measured freq 14 GHz - EL/H - Pol H									
Model BO 05355									
Original MI -2095 file:F:\XXX\HCOHELTXTXT									
200	1	90	14,000						
4									
0									
360	5								
0	46,13	132,131	-1,976	48,183					
0,5	42,503	119,138	3,083	-63,6					
1	29,327	86,983	3,126	-48,484					
1,5	20,601	9,116	-5,148	-7,781					
2	15,948	81,549	-23,206	86,305					
2,5	7,158	60,242	-17,033	89,719					
...									
177,5	-5,305	-143,914	-34,487	-175,838					
178	-5,006	-14,855	-17,404	86,68					
178,5	-5,433	130,715	-20,464	158,715					
179	-5,928	-77,425	-29,24	-9,018					
179,5	-5,846	65,336	-30,317	123,385					
90									
360	5								
0	46,13	38,426	14,575	-14,098					
0,5	43,405	40,238	22,746	165,781					
1	32,697	24,047	20,087	168,983					
1,5	22,179	-36,461	0,228	71,216					
2	2,554	17,435	4,258	99,239					
2,5	15,386	-165,509	0,391	161,129					
...									

Figure 2 – Example of a measured radiation pattern file in the proposed format

Figure 3 illustrates the graphical representation of the co-polar field pattern measured in the cut plane $\phi_k = 90^\circ$ (2nd block / 2nd row). In this case, this cut-plane corresponds to one side of the azimuth plane and the polarization is horizontal. In this same figure a reference pattern envelope is represented as per the Brazilian Regulatory Standard which is based on Recommendations ITU-R 580-5 and 465-5 for the co-polar pattern sidelobes.

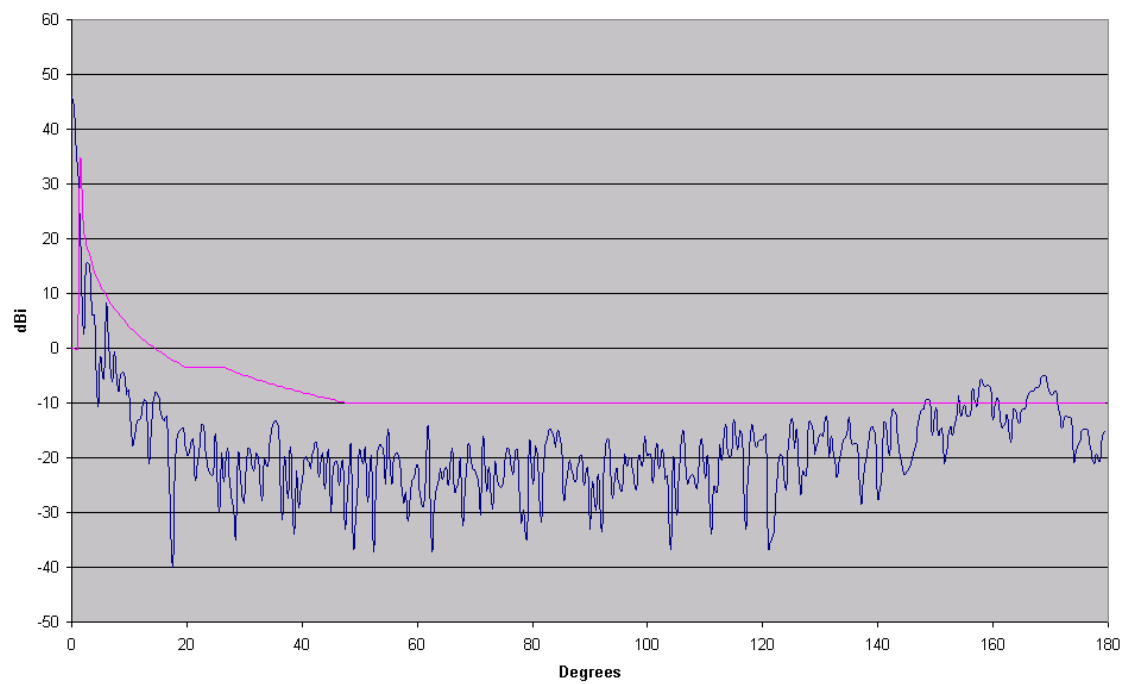


Figure 3 - Co-polar field measured pattern example in the cut plane $\phi_k = 90^\circ$ (Az /Pol H)