



**Recommendation WG 16.91.031**

**GUIDELINES FOR USE OF  
EARTH STATION ANTENNA PATTERN DATA**

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## **RECOMMENDATION**

**Subject:** Antenna Group

**Title:** Guidelines for use of Earth Station Antenna Pattern Data

Background:

Antenna pattern data supplied by the antenna manufacturers and the use of this data by frequency coordinators has been inconsistent and sometimes wrong.

Recommendation:

Guidelines for the use of Earth station Antenna Pattern Data

The NSMA antenna group suggests that the following guidelines be followed when using antenna pattern information.

When the Radiation Pattern Envelope is provided by the antenna manufacturer and is on file with the FCC this data should be used in the frequency coordination process.

The antenna specification sheet or the FCC reference pattern  $32-25 \log \theta$  from 1 to  $48^\circ$  and  $-10$  dB from  $48$  to  $180^\circ$  is to be used if the RPE is not on file with the FCC.

The measured antenna data supplied by the antenna manufacturers can be used when the antenna data is satisfactory to the frequency coordinator, the protection agent and the antenna manufacturer.

The computer generated pattern is not to be used in the frequency coordination process.

## MEMORANDUM

TO : NSMA working Group #16

FROM: James P. Fitzgerald

DATE: May 23, 1991

SUBJECT : Earth Station Antenna Patterns

This report briefly summarizes the discussion over the past several years concerning Earth station Antenna Patterns. The following two items were of concern:

- o Inconsistent earth station antenna pattern data supplied by the antenna manufacturers and different interpretation and use of this data by the frequency coordinators.
- o The establishment of an earth station antenna database format similar to that established for terrestrial antennas and maintained on-line by Ron Finger.

### Background

Concerning the first item the antenna pattern data presently provided by the antenna manufacturers consists of the following;

- Radiation Pattern Envelope (RPE)
- Measured Antenna Patterns
- Antenna Specification Sheets
- Computer Generated patterns

Sometimes the data supplied by the antenna manufacturer is not consistent when more than one of the above items is supplied.

A brief review of each information sheet follows:

### Radiation Pattern Envelope

The Radiation Pattern Envelope (RPE) for earth station antennae consists of the compilation of measured data from the following 6 measurements (example for 4 GHz).

Frequency MHz	Polarization
3700	Vertical
3700	Horizontal
3950	Vertical
3950	Horizontal
4200	Vertical
4200	Horizontal

The antenna manufactures interpret part 25.209 (2) of the FCC rules and present the RPE which they guarantee that their antenna meets.

(2) In all other directions:  
Outside the main beam, the gain  
of the antenna shall lie below  
the envelope defined by;

$$32-25 \log_{10}(\theta) \text{ dBi} \quad 1^\circ \leq \theta \leq 48^\circ$$

$$-10 \text{ dBi} \quad 48^\circ < \theta \leq 180^\circ$$

where  $\theta$  is the angle in degrees from the axis of the main lobe, and dBi refers to dB relative to an isotropic radiator. For the purposes of this section, the peak gain of an individual sidelobe may be reduced by averaging its peak level with the peaks of the nearest sidelobes on either side, or with the peaks of two nearest sidelobes on either side, provided that the level of no individual sidelobe exceeds the gain envelope given above by more than 6 dB.

Although there may be differences in the actual averaging by the different manufacturers since they guarantee this RFE, this appears to be the best information available to the frequency coordinators.

#### Measured Antenna Pattern Data

The measured antenna data is supplied on some antenna's. At times the measured data consists of the C radiation tests and on other occasions a manufacturer may only supply one measured pattern. How the different frequency coordinators handle this data may vary. A guideline on how to use this data needs to be established.

#### Antenna Specification Sheets

This data is supplied by the antenna manufacturer to present mechanical and electrical characteristics of the antenna system. On some occasions, this data is more conservative than either the RPE or the measurement data. If this is what the antenna manufacturer guarantees then should the frequency coordinators use this information which usually corresponds to the FCC: rules stated in Section 25.209 (2), or other data?

#### Computer generated patterns

In previous meetings with the Antenna manufacturers it was agreed that the computer generated pattern should not be used for the following reasons:

- o The computer generated pattern is overly optimistic and could be used to the earth stations advantage to clear difficult cases. Measured data has been compared to computer generated patterns where computer-generated data was as much as 20 dB lower than the actual data.
- o The use of the computer generated data severely penalizes the earth station owner in the 4 GHz frequency range when a pattern 4a coordinated with a -40 dBi gain at some discrimination angles

where ho could be protected to a -10 dBi level This also could hinder the earth station uplink it in

the Suture a terrestrial path i s engineered based on a -40 dBi gain when actually the antenna only has a -20 dBi gain in the direction of new terrestrial station. .

- o Some computer generated patterns state that the pattern is  $29-25 \log \theta$  from 1 to 92 degrees. How do the different frequency coordinators address these patterns?

It tree been clearly established that the computer generated patterns are not acceptable and it they are to be used it would be to the advantage of all manufacturers to supply a computer generated pattern to avoid the lose of business and to everyone's detriment.

#### Standard Format For Earth Station Antenna Pattern Data

Background - Discussions on this item indicated that the major antenna manufactures would supply data in the format recommended by the NSMA to resolve any problems with antenna pattern data. A earth station on antenna data format has net been established for several reasons with the major factors being:

- o A majority of the receive-only earth station antennas ore licensed to systems who use antennas that meet but do not exceed the FCC reference pattern performance and are supplied by manufacturers who did not participate in NSMA discussions.
- o The majority of earth station antenna patterns on file with the FCC were submitted in the early 1980's and putting this data i n a Standard Format would result in an unnecessary burden and cost.
- o If the recommended guidelines are approved, the need for the standard Format for Earth Antenna Pattern Data is not necessary.

Recommendation - Approve recommendations on use of antenna pattern data which removes necessity for standard format.