RADIOCOMMUNICATION BUREAU	Antenna Pattern Library	Ref : APL-UM-001
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Antenna Patterns Reference Manual

Abstract

- The document contains the description of antennas from the standard antenna pattern library (APL_Std).

Participants

- STS division

Point of contact

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Related document

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DOCUMENT CHANGE RECORD

Issue	Date	Change Description
V1 Draft 1	2003-07-08	Initial Draft
V2 1.0.0	2004-06-14	Pattern APEUSA211V01 is added.
V3 1.0.0	2004-10-05	Patterns mapping (old names -> APL names) is changed.
1.0.1	2005-03-22	Misprint in APERR_002V01 formula is corrected.
1.1.0	2005-06-09	Patterns APERR_017V01 and APERR_018V01 are added.
1.1.1	2005-08-02	References and description of patterns APERR_002V01 and APEREC015V01 are updated.
1.1.2	2005-10-14	Typo in APENST803V01 : for D/λ<100, changed –10 – 10 log (D/λ) into 10 – 10 log (D/λ)
1.1.3	2006-07-11	Typo in APERR_008V01: "-1" in the range from 1.28 .. 3.22 has been removed. MODRES reference has been added for APERR_007V01.
1.1.4	2006-10-20	Pattern APENST807V01 is added. AP8 reference has been added for APERR_001V01. REC-465-5 reference has been added for APEREC013V01. REC-580-6 reference has been added for APEREC015V01. ABCDphi1 reference has been added for APENST807V01. ND-EARTH reference has been added for APEND_099V01. ND-SPACE reference has been added for APSND_499V01.
1.1.5	2007-01-19	Patterns APERR_019V01, APEREC020V01, APSREC407V01 and APSREC408V01 are added.
1.1.6	2007-01-30	G1 for pattern APERR_019V01 is changed.
1.1.7	2007-05-28	REC-465-3 reference has been added for APEREC003V01. REC-580-2 reference has been added for APEREC004V01.

1.INTRODUCTION

1.1 Definitions

Antenna patterns are mathematical functions calculating antenna gain for off-axis angle in the direction of interest.

An antenna can be an Earth station antenna (in his document can be referred as “Earth antenna”) or Space station antenna (in his document can be referred as “Space antenna”).

Some antenna pattern definitions come from ITU publications: Radio Regulations, Recommendations, Rules of Procedures. Other antenna patterns are supplied by Administrations. This division by the source is reflected in the name of a pattern and maintained in the structure of the document.

1.2 Purpose

The purpose of this document is to provide complete information about antenna patterns from the standard APL_Std.dll library and to describe each antenna pattern according to a common application interface, defined in *Application Interface Programming Manual*, APL-UM-002v1, Draft 1, 2003-07-08.

This document corresponds to version 1.4.0.0 of APL_Std.dll.

1.3 Abbreviations

AP	Antenna Pattern
APL	Antenna Pattern Library
BR	Radiocommunication Bureau
DLL	Dynamically Linked Library
ITU	International Telecommunication Union
REC	Recommendation
RR	Radio Regulations

1.4 Referenced documents

Reference	Year	Version	Description
RR-2003	2003		ITU Radio Regulations, Volumes 1 & 2, Articles & Appendices, Geneva.
RR-2001	2001		ITU Radio Regulations, Volumes 1 & 2, Articles & Appendices, Geneva.
RR-1998	1998		ITU Radio Regulations, Volumes 1 & 2, Articles & Appendices, Geneva.
ROP-2002	2002		ITU Rules of Procedure.
REC-847	1993	1	Recommendation ITU-R IS.847-1.
REC-694	1990	0	Recommendation ITU-R M.694-0.
REC-672	1997	4	Recommendation ITU-R S.672-4.
REC-580-6	2003	6	Recommendation ITU-R S.580-6.
REC-580-5	1994	5	Recommendation ITU-R S.580-5.
REC-580-2	1990	2	Recommendation ITU-R S.580-2.
REC-465-5	1993	5	Recommendation ITU-R S.465-5.
REC-465-3	1990	3	Recommendation ITU-R S.465-3.

Reference	Year	Version	Description
REC-1448	2000	0	Recommendation ITU-R SM.1448-0.
REC-1445	2000	0	Recommendation ITU-R BO.1445-0.
REC-1428	2001	1	Recommendation ITU-R S.1428-1.
REC-1296	1997	0	Recommendation ITU-R BO.1296-0.
REC-1295	1997	0	Recommendation ITU-R BO.1295-0.
REC-1213	1995	0	Recommendation ITU-R BO.1213-0.

1.5 Constants

The exact value for the speed of light used for calculation of wavelength from frequency and vice versa is the following: 2.99792458×10^8 m/s.

1.6 Overview of the document

This document is organised as follows:

Section 1 (this section) contains the introduction, with a brief description of the purpose of the project and provides the reader with the “reading tools” (list of acronyms, references and so on).

Section 2 gives a brief definition of antenna patterns.

Section 3 contains some preliminary remarks, which help to understand antenna pattern descriptions.

Section 4 provides a detailed description of Standard (STD) antenna patterns (Earth and Space).

Section 5 provides a detailed description of Non Standard (NST) antenna patterns (Earth and Space).

Section 6 provides a detailed description of antenna patterns supplied by Administrations (ADM) (Earth and Space).

2.ANTENNA PATTERNS SUMMARY

	Name	Earth/ Space	Receiving/ Transmitting	STD/ NST/ ADM	Mspace Pattern	Gims Pattern	Page in this Manual
1	APERR_001V01	Earth	Receiving and Transmitting	STD	AP28, AP29	AP28, AP29, APPDX29, AP8	12
2	APERR_002V01	Earth	Receiving and Transmitting	STD	AP30B	-	14
3	APEREC003V01	Earth	Receiving and Transmitting	STD	REC-465, REC-465-3	REC-465, REC-465-3	16
4	APEREC004V01	Earth	Receiving and Transmitting	STD	REC-580, REC-580-2	REC-580, REC-580-2	18
5	APEREC005V01	Earth	Receiving and Transmitting	STD	-	REC-694	20
6	APERR_006V01	Earth	Receiving	STD	R13RES	-	22
7	APERR_007V01	Earth	Receiving	STD	MODRES	REC-1213	24
8	APERR_008V01	Earth	Receiving	STD	R2RES	R2RES	26
9	APERR_009V01	Earth	Transmitting	STD	R13TES	R13TES	28
10	APERR_010V01	Earth	Transmitting	STD	MODTES	REC-1295, MODTES	30
11	APERR_011V01	Earth	Transmitting	STD	R2TES	R2TES	32
12	APERR_012V01	Earth	Receiving and Transmitting	STD	AP7	AP7	34
13	APEREC013V01	Earth	Receiving and Transmitting	STD	REC-465-5	REC-465-5	36
14	APEREC014V01	Earth	Receiving and Transmitting	STD	-	-	38
15	APEREC015V01	Earth	Receiving and Transmitting	STD	REC-580-6	REC-580-6	40
17	APERR_017V01	Earth	Receiving	STD	-	-	42
18	APERR_018V01	Earth	Receiving	STD	-	-	44
19	APERR_019V01	Earth	Receiving	STD	-	-	46
20	APERR_020V01	Earth	Receiving	STD	-	-	48
99	APEND_099V01	Earth	Receiving and Transmitting	STD	ND-EARTH	ND-EARTH	50
401	APSRR_401V01	Space	Receiving and Transmitting	STD	R123SS	AP30BF1, AP30F10X	52
402	APSRR_402V01	Space	Receiving and Transmitting	STD	R123FR	AP30BF2, AP30F11X, AP30AFCX	54
403	APSRR_403V01	Space	Receiving	STD	R13RSS	AP30AFB, AP30AFBX	57
404	APSRR_404V01	Space	Receiving	STD	MODRSS	AP30AFBP	59
405	APSRR_405V01	Space	Transmitting	STD	R13TSS	AP30F9, AP30F9X	61
406	APSRR_406V01	Space	Transmitting	STD	MOD13FRTSS	MOD13FR, MOD13FRX	63
407	APSREC407V01	Space	Receiving and Transmitting	STD	-	-	65

	Name	Earth/ Space	Receiving/ Transmitting	STD/ NST/ ADM	Mspace Pattern	Gims Pattern	Page in this Manual
408	APSREC408V01	Space	Receiving and Transmitting	STD	-	-	67
499	APSND_499V01	Space	Receiving and Transmitting	STD	ND-SPACE	ND-SPACE	69
801	APENST801V01	Earth	Receiving and Transmitting	NST	-	-	71
802	APENST802V01	Earth	Receiving and Transmitting	NST	-	-	73
803	APENST803V01	Earth	Receiving and Transmitting	NST	AP30B	-	75
804	APENST804V01	Earth	Receiving and Transmitting	NST	-	A-B*LOG(FI)	77
805	APENST805V01	Earth	Receiving and Transmitting	NST	-	-	79
806	APENST806V01	Earth	Receiving and Transmitting	NST	-	NN-25LOG(FI), A-25*LOG(FI)	81
807	APENST807V01	Earth	Receiving and Transmitting	NST	-	ABCDphi1	83
899	APENST899V01	Earth	Receiving and Transmitting	NST	-	-	85
201	APELUX201V01	Earth	Transmitting	ADM	DBL-TYP1, DBL-TYP2	-	87
202	APELUX202V01	Earth	Receiving	ADM	DBLTVROC0001	-	89
203	APELUX203V01	Earth	Receiving	ADM	DBLTVROI0001	-	91
204	APELUX204V01	Earth	Receiving and Transmitting	ADM	MIX1	-	93
205	APELUX205V01	Earth	Receiving and Transmitting	ADM	MIX2	-	95
207	APENOR207V01	Earth	Transmitting	ADM	BIFROST-TES1	-	97
208	APENOR208V01	Earth	Transmitting	ADM	BIFROST-TES2	-	99
209	APENOR209V01	Earth	Transmitting	ADM	BIFROST-TES3	-	101
210	APENOR210V01	Earth	Receiving	ADM	BIFROST-RES	-	103
211	APEUSA211V01	Earth	Transmitting	ADM	-	-	105
601	APSF__601V01	Space	Transmitting	ADM	RADTSS	RADSAT3, RADSAT3X	107
605	APSNOR605V01	Space	Receiving and Transmitting	ADM	BIFROST-SS1	-	109
606	APSNOR606V01	Space	Receiving and Transmitting	ADM	BIFROST-SS2	-	111

3.GENERAL REMARKS

3.1 Pattern naming conventions

Pattern names are composed of 12 characters: letters and digits. All letters are capital. Pattern names have the following convention:

AP<type><origin><pattern-number>V<version-number>, where

- <type> is E for earth antennas or S for space antennas. (1 letter)
- <origin> is the origin of the pattern definition. (3 letters. Underscores are added where necessary.) Has the following convention:

RR_	Standard Pattern from Radio Regulations
REC	Standard Pattern from Recommendation
NST	Non Standard Pattern
ND_	Non-directional Pattern
Or Administration code:	
F__	
LUX	
NOR	

- <pattern-number> is a unique number identifying the pattern. (3 digits)
- <version-number> is a version of the pattern definition. (2 digits)

3.2 Structure

Each antenna pattern description has the following structure:

ID: Pattern unique number (also presented in the pattern name).

Name: Name of the pattern according to pattern naming convention in 3.1.

Type: Type of antenna, including: Earth or Space antenna, Receiving and/or Transmitting antenna, Fast Roll-Off antenna.

Description: Brief description of the pattern as provided in the pattern properties in APL_Std.dll.

Start Date: Start validity date for this pattern.

End Date: End validity date for this pattern.

Region 1, Region 2, Region 3: Radiocommunications Regions (as defined in RR-2001, article 5), where this pattern is used.

Cross Polar Gain: Indicates if the pattern specification contains cross-polar component definition.

Relative Gain: Indicates if the pattern specification allows to calculate relative antenna gain (apart from absolute gain).

Obsolete Pattern Names/Options: List of obsolete names and options for this pattern as used by different BR software components.

Version: Last version of the pattern including: major version number, minor version number and revision number.

Revision date: Last revision date for this pattern.

References: All referenced documents containing the pattern specification.

Co-polar component: Mathematical description of the co-polar pattern component as defined in the referenced documents and implemented in the APL Standard Library. The following notations are used:

G	is the co-polar gain at the off-axis angle φ, dB.
G_x, Gx	is the cross-polar gain at the off-axis angle φ, dB.
G_{max}, Gmax	is the maximum co-polar gain, dB.
φ, Phi	is the off-axis angle referred to the main lobe, degrees.
φ_o, Phi0	is the half-power beamwidth, degrees.
D	is the antenna diameter, meters.
λ, lambda	is the wavelength, meters.
η	is the antenna efficiency.
B_{min}, Bmin	is the beamlet, degrees.
φ_m, Phi m	is the start angle of the first side lobe (plateau constant part), degrees.
φ_r, Phi r	is the start angle of the near side lobe (logarithmic part), degrees.
φ_b, Phi b	is the start angle of the back lobe (back constant part), degrees.
G_1, G1	is the gain of the first side lobe (plateau constant part), dB.
CoefA, CoefB	are parameters describing the near side lobe (logarithmic part), both in dB.
G_{min}, Gmin	is the gain of the back lobe (back constant part), dB.

log is a base 10 logarithmic function.

Cross-polar component: Mathematical description of the cross-polar pattern component if defined for this pattern.

Pattern Information: Information about pattern extracted from the referenced documents including conditions for which this pattern is defined and when it is used.

Example: Example of the pattern corresponding to some value(s) of input parameter(s).

Pattern Input Parameters: Specification of the pattern input parameters as defined in the APL Standard library:

`REQUIRED`: parameter is required. If it is not provided an error is generated.
`OPTIONAL`: parameter value can be provided or `NOVALUE` can be input. See Note below.
`NOVALUE`: parameter is not required. If it is provided, it is not validated, not used and a warning is generated.

Note: There are 2 particular cases when a parameter is optional: for earth patterns `Specific` and for space patterns `GainMax`.
If `Specific` is optional and it is provided, it allows to get intermediate gain calculation results as output.
`GainMax` is optional for space patterns, a space pattern calculates the relative gain for `GainMax = NOVALUE` and the absolute gain for any other `GainMax`. See 3.5.

Low Level Validation Rules: Validation rules (restrictions on input parameters) specific for this pattern that shall be checked before antenna pattern gain calculations.

Specific Parameters Structure Size: Size of the structure containing specific pattern parameters.

Required Specific Parameters: List of specific parameters from the specific parameter structure, required for this pattern. (Other parameters from the specific parameter structure are ignored and can serve as output pattern information.)

3.3 Input of antenna patterns

Name	Meaning	Units	Parameter type	Pattern type
GainMax	Maximum antenna gain	dB	double precision	Earth/Space
Beamlet	Beamlet for fast roll-off space antennas	Degrees	double precision	Space
Diameter	Diameter of an earth antenna	Meters	double precision	Earth
Frequency	Frequency for which a gain is calculated	MHz	double precision	Earth
Efficiency	Efficiency of an earth antenna	0.0 - 1.0	double precision	Earth
Specific	List of additional pattern specific parameters		specific structure	Earth/Space
Phi	Angle for which a gain is calculated	Degrees	double precision	Earth/Space
Phi0	Cross-sectional half-power beamwidth	Degrees	double precision	Earth/Space

Earth station antenna patterns:

The following input parameters are defined as standard for the APL calling interface for Earth station antenna patterns: `GainMax, Diameter, Frequency, Efficiency, Phi, Phi0`.

`CoefA, CoefB, CoefC, CoefD, Phi1` are not standard parameters and can be passed to routines as fields of `Specific` parameters structure.

A particular Earth station antenna is described by the following parameters: `GainMax, Diameter, Frequency, Efficiency` and `Specific`. The antenna gain is calculated for `Phi, Phi0`.

Space station antenna patterns:

The following input parameters are defined as standard for the APL calling interface for Space station antenna patterns: `GainMax, Beamlet, Phi, Phi0`.

A particular Space station antenna is described by the following parameters: `GainMax, Beamlet` and `Specific`. The antenna gain is calculated for `Phi, Phi0`.

NOTE for space station antenna patterns:

Although Phi0 (φ_0) and GainMax are independent input arguments, the relationship between the maximum gain of an antenna and the half-power beamwidth can be derived from the expression:

$$G_{max}\ (dB) = 44.44 - 10 \log a - 10 \log b$$

where a and b are the angles (in degrees) subtended at the satellite by the major and minor axes of the elliptical cross-section of the beam. Phi0 must fulfil the condition: $a \leq \varphi_0 \leq b$.

3.3.1 Input parameters top level validation

The validation of antenna pattern parameters will be implemented at two different levels:

1. Top level of the interface: common to all the antenna patterns
2. Low level: specific to each antenna pattern

The top level validation shall perform a generic verification of the parameters common for all patterns. It includes check on presence of required parameters and check of top level validation limits for each provided parameter.

Name	Error Low Limit	Error Upper Limit	Warning Low Limit	Warning Upper Limit
GainMax	0.00E+00	7.00E+02	0.00E+00	1.00E+02
Beamlet	1.00E-05	1.80E+02	1.00E-03	1.80E+01
Diameter	1.00E-05	1.00E+05	1.00E-02	1.00E+02
Frequency	1.00E-03	1.00E+10	1.00E+00	1.00E+06
Efficiency	1.00E-05	1.00E+00	1.00E-01	1.00E+00
Specific				
Phi	0.00E+00	1.80E+02	0.00E+00	1.80E+02
Phi0	1.00E-05	1.80E+02	1.00E-03	1.80E+01

Top level validation checks the limits inclusively like in the example: If $0 \leq \text{GainMax} \leq 7\text{x}10^2$, validation is successful. If not, an error is generated.

After the top level validation the low level validation will be performed if the corresponding low level validation rules are provided. It will be able to perform more specific verification (for example, correlation of different parameters) that depends on the type of the pattern. The low level validation rules are specified in the section dedicated to each particular pattern. If a pattern has no its particular limits specified, only top level validation shall be performed.

Top level validation errors and warnings are the following:

Event Code	Symbol	Event Message
-5100	APC_ERR_NO_GAINMAX	TL Valid. Required GainMax is not provided.
-5101	APC_ERR_NO_BEAMLET	TL Valid. Required Beamlet is not provided.
-5102	APC_ERR_NO_DIAMETER	TL Valid. Required Diameter is not provided.
-5103	APC_ERR_NO_FREQUENCY	TL Valid. Required Frequency is not provided.
-5104	APC_ERR_NO_EFFICIENCY	TL Valid. Required Efficiency is not provided.
-5105	APC_ERR_NO_SPECIFIC	TL Valid. Required Specific is not provided.
-5106	APC_ERR_NO_PHI	TL Valid. Required Phi is not provided.
-5107	APC_ERR_NO_PHI0	TL Valid. Required Phi0 is not provided.
5100	APC_WAR_IGN_GAINMAX	TL Valid. Not required GainMax is provided. It is ignored.
5101	APC_WAR_IGN_BEAMLET	TL Valid. Not required Beamlet is provided. It is ignored.
5102	APC_WAR_IGN_DIAMETER	TL Valid. Not required Diameter is provided. It is ignored.
5103	APC_WAR_IGN_FREQUENCY	TL Valid. Not required Frequency is provided. It is ignored.
5104	APC_WAR_IGN_EFFICIENCY	TL Valid. Not required Efficiency is provided. It is ignored.
5105	APC_WAR_IGN_SPECIFIC	TL Valid. Not required Specific is provided. It is ignored.
5106	APC_WAR_IGN_PHI	TL Valid. Not required Phi is provided. It is ignored.
5107	APC_WAR_IGN_PHI0	TL Valid. Not required Phi0 is provided. It is ignored.
-5200	APC_ERR_VAL_GAINMAX	TL Valid. GainMax () is out of limits [:].
-5201	APC_ERR_VAL_BEAMLET	TL Valid. Beamlet () is out of limits [:].
-5202	APC_ERR_VAL_DIAMETER	TL Valid. Diameter () is out of limits [:].
-5203	APC_ERR_VAL_FREQUENCY	TL Valid. Frequency () is out of limits [:].
-5204	APC_ERR_VAL_EFFICIENCY	TL Valid. Efficiency () is out of limits [:].
-5205	APC_ERR_VAL_SPECIFIC	TL Valid. Specific () is out of limits [:].
-5206	APC_ERR_VAL_PHI	TL Valid. Phi () is out of limits [:].
-5207	APC_ERR_VAL_PHI0	TL Valid. Phi0 () is out of limits [:].
5200	APC_WAR_VAL_GAINMAX	TL Valid. GainMax () is out of limits [:].
5201	APC_WAR_VAL_BEAMLET	TL Valid. Beamlet () is out of limits [:].
5202	APC_WAR_VAL_DIAMETER	TL Valid. Diameter () is out of limits [:].

Event Code	Symbol	Event Message
5203	APC_WAR_VAL_FREQUENCY	TL Valid. Frequency () is out of limits [:].
5204	APC_WAR_VAL_EFFICIENCY	TL Valid. Efficiency () is out of limits [:].
5205	APC_WAR_VAL_SPECIFIC	TL Valid. Specific () is out of limits [:].
5206	APC_WAR_VAL_PHI	TL Valid. Phi () is out of limits [:].
5207	APC_WAR_VAL_PHI0	TL Valid. Phi0 () is out of limits [:].

3.4 Output of antenna patterns

All antenna pattern functions return both co-polar (G) and cross-polar (Gx) gains. If a pattern is specified only to calculate the co-polar gain, the cross-polar gain is set equal to the co-polar gain (G = Gx).

Name	Meaning	Units	Parameter type	Pattern type
G	Co-polar gain	dB	double precision	Earth/Space
Gx	Cross-polar gain	dB	double precision	Earth/Space

3.4.1 Output gain validation

Validation of the output parameters shall be done in the following order:

- Check that $G \leq G_{max}$
- Check that $G_x \leq G_{max}$
- Check that $G_x \leq G$

Output gain validation errors and warnings are the following:

Event Code	Symbol	Condition	Event Message
-5501	APC_ERR_G_GT_GMAX	G <= Gmax	G () is greater than Gmax ().
-5502	APC_ERR_GX_GT_GMAX	Gx <= Gmax	Gx () is greater than Gmax ().
5503	APC_WAR_GX_GT_G	Gx <= G	Gx () is greater than G ().
5504	APC_WAR_GX_ABSENT		Cross-polar gain is not calculated. Value is set to co-polar gain.

3.5 Relative and absolute gain

For Space station antenna patterns usually 2 possibilities are provided: to calculate relative antenna pattern gains or absolute antenna pattern gains.

The principal difference between relative and absolute gain calculations is the following. For absolute gain calculations a flooring of 0 dB is applied. This ensures positive values for both co-polar and cross-polar gains. For relative gain calculations this flooring is not applied. Relative gains always have decreasing negative values.

Normally for space station antennas GainMax is an optional parameter. When it is not given on input (N0VALUE is input), the APL shall calculate the relative gain in dB, when it is given on input, the APL shall calculate the absolute gain in dB.

4. STANDARD ANTENNA PATTERNS

4.1 Earth station antenna patterns

ID	1
Name	APERR_001V01
Type	Earth
	Receiving and Transmitting

Description Appendix 8 (RR-2001) Earth station antenna pattern. (Former Appendix 28 and Appendix 29 antenna pattern.)

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: AP28, AP29
GIMS: AP28, AP29, APPDX29, AP8
R1448: 1

Version 0 0 1
Revision Date 2003-05-23

References

Reference	Append/Art	Annex	Section	Page	
RR-2001	AP8-10	III		186	Formula a), b), .
RR-1998	APS7	II		107	Formula 39-40, .
RR-1998	APS8	III		124	.

Co-Polar Component

If $D/\lambda \geq 100$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \leq \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \leq \varphi < \varphi_r$

$G = 32 - 25 \log \varphi$ for $\varphi_r \leq \varphi < \varphi_b$

$G = -10$ for $\varphi_b \leq \varphi \leq 180°$

If $D/\lambda < 100$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \leq \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \leq \varphi < \varphi_r$

$G = 52 - 10 \log (D/\lambda) - 25 \log \varphi$ for $\varphi_r \leq \varphi < \varphi_b$

$G = 10 - 10 \log (D/\lambda)$ for $\varphi_b \leq \varphi \leq 180°$

where:

$D/\lambda = 10^{\left(\frac{G_{max} - 7.7}{20}\right)}$. $\varphi_m = 20\ \lambda/D \sqrt{G_{max} - G_1}$.

$G_1 = 2 + 15 \log (D/\lambda)$. $\varphi_b = 48°$.

$\varphi_r = 15.85 (D/\lambda)^{-0.6}$ for $D/\lambda \geq 100$,

$= 100\ \lambda/D$ for $D/\lambda < 100$.

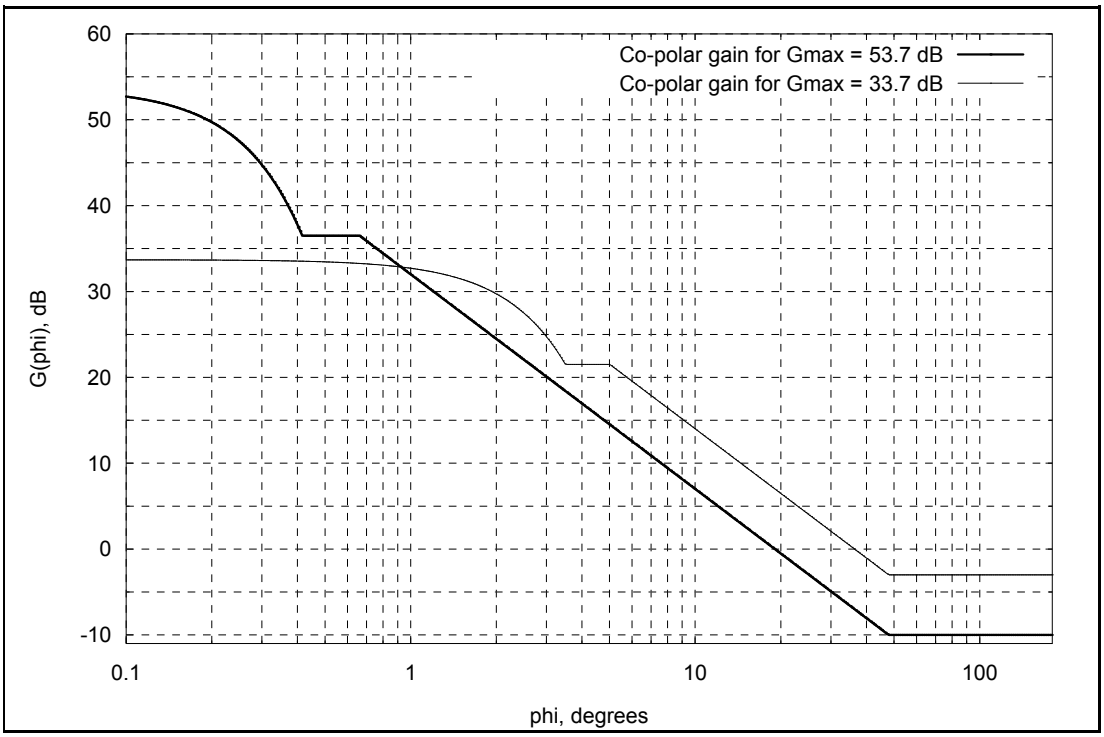
Pattern Information

Appendix 8 (RR-2001) Earth station antenna pattern. (Former Appendix 28 and Appendix 29 antenna pattern.)

Used for the determination of coordination requirements between GSO networks sharing the same frequency band for "non-planed" services.

Antenna efficiency is implicitly set to 0.6.

Example



Gmax = 53.7
Phi m, out = 0.42
Phi r, out = 0.66
Phi b, out = 48.
D/lambda, out = 199.53
G1, out = 36.5

Gmax = 33.7
Phi m, out = 3.5
Phi r, out = 5.01
Phi b, out = 48.
D/lambda, out = 19.95
G1, out = 21.5

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6010	STDC_WAR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().

ID	**2**
Name	**APERR_002V01**
Type	Earth
	Receiving and Transmitting

Description Appendix 30B (RR-2003) reference Earth station pattern with the improved side-lobe. Appendix 30B (RR-2001) reference Earth station antenna pattern.

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: AP30B
GIMS: -
R1448: -

Version	0	0	1
Revision Date	2003-05-23		

References

Reference	Append/Art	Annex	Section	Page	
RR-2003	AP30B-33	1	A-1.6.5	811	Table 2, For coefficient A = 29 only.
RR-2001	AP30B-29	1	A-1.6.4,1.	721	Table 1, .

Co-Polar Component

If $D/\lambda \geq 100$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda \ \varphi)^2$ for $0° \leq \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \leq \varphi < \varphi_r$

$G = CoefA - 25 \log \varphi$ for $\varphi_r \leq \varphi < \varphi_b$

$G = -10$ for $\varphi_b \leq \varphi \leq 180°$

If $D/\lambda < 100$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda \ \varphi)^2$ for $0° \leq \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \leq \varphi < \varphi_r$

$G = CoefA + 20 - 10 \log (D/\lambda) - 25 \log \varphi$ for $\varphi_r \leq \varphi < \varphi_b$

$G = 10 - 10 \log (D/\lambda)$ for $\varphi_b \leq \varphi \leq 180°$

where:

CoefA = 29 or 32.

$$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta \pi^2}} . \qquad \varphi_b = 10^{\left(\frac{CoefA+10}{25}\right)} .$$

$G_1 = 15 \log (D/\lambda) - 30 + CoefA$. $\varphi_m = 20 \lambda/D \sqrt{G_{max} - G_1}$.

$\varphi_r = 15.85 (D/\lambda)^{-0.6}$ for $D/\lambda \geq 100$,

$= 100 \lambda/D$ for $D/\lambda < 100$.

Pattern Information

Appendix 30B (RR-2001) Earth station antenna reference pattern applicable for D/lambda > 100.

Used for the determination of coordination requirements and interference assessment in FSS Plan.

Pattern contains an optional improved near side-lobe (coefA=29) which may be used if so desired by administrations, particularly in the cases where an aggregate C/I ratio of 26 dB cannot be obtained.

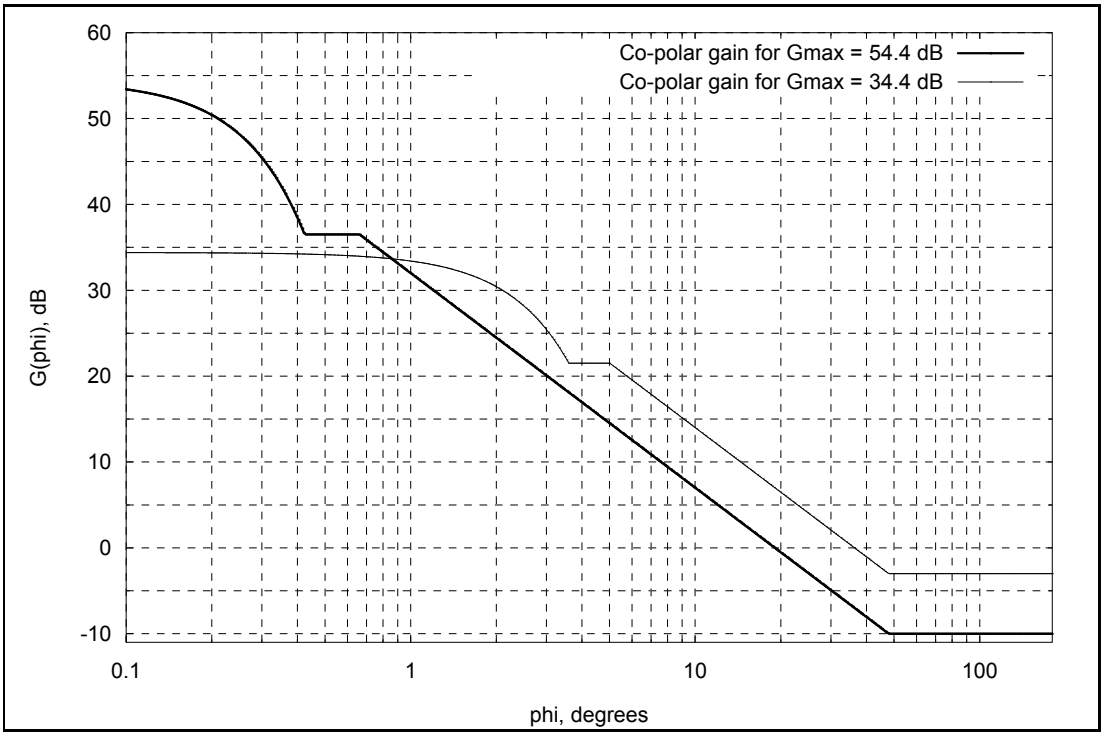
Pattern is extended for D/lambda < 100 as in Appendix 8 of RR-2001.

If efficiency is not specified, a value of 0.7 is to be used.

Plan is based on the antennas having diameter 7 m for the 6/4 GHz band and 3 m for the 13/10-11 GHz band and the antenna efficiency of 0.7.

WRC-03 replaced this Appendix 30B reference antenna pattern for coefA=32 by pattern APEREC015V01 (RR-2003). This pattern (APERR_002V01) is still used as improved side-lobe Appendix 30B reference antenna pattern with coefA=29 (RR-2003) for D/lambda > 100.

Example



Gmax = 54.4
Efficiency = 0.7
CoefA, inout = 32.
Phi m, out = 0.42
Phi r, out = 0.66
Phi b, out = 47.86
D/lambda, out = 199.66
G1, out = 36.5

Gmax = 34.4
Efficiency = 0.7
CoefA, inout = 32.
Phi m, out = 3.6
Phi r, out = 5.01
Phi b, out = 47.86
D/lambda, out = 19.97
G1, out = 21.5

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	REQUIRED
Specific	REQUIRED
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

coefA

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6019	STDC_ERR_COEFA_VAL	Both	CoefA () wrong value. Must be 29 or 32.
-6010	STDC_ERR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().
-6001	STDC_ERR_GMAX_LT_G1	Both	Gmax () is less than G1 (). Square root of negative value.

ID	**3**
Name	**APEREC003V01**
Type	Earth
	Receiving and Transmitting

Description Recommendation ITU-R S.465-3 OBSOLETE reference Earth station antenna pattern.

Start Date | **End Date** 1992-12-31

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: REC-465, REC-465-3
GIMS: REC-465, REC-465-3
R1448: 7

Version	0	0	1
Revision Date	2003-05-23		

References

Reference	Append/Art	Annex	Section	Page	
REC-465-5					Note 4, .
REC-465-3			2		.

Co-Polar Component

If $D/\lambda \geq 100$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \leq \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \leq \varphi < \varphi_r$

$G = 32 - 25 \log \varphi$ for $\varphi_r \leq \varphi < \varphi_b$

$G = -10$ for $\varphi_b \leq \varphi \leq 180°$

If $D/\lambda < 100$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \leq \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \leq \varphi < \varphi_r$

$G = 52 - 10 \log (D/\lambda) - 25 \log \varphi$ for $\varphi_r \leq \varphi < \varphi_b$

$G = 10 - 10 \log (D/\lambda)$ for $\varphi_b \leq \varphi \leq 180°$

where:

$$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta\pi^2}} . \qquad \varphi_m = 20\ \lambda/D\ \sqrt{G_{max} - G_1} .$$

$G_1 = 32$ for $D/\lambda \geq 100$,

$= 2 + 15 \log (D/\lambda)$ for $D/\lambda < 100$.

$\varphi_r = 1°$ for $D/\lambda \geq 100$,

$= 100\ \lambda/D$ for $D/\lambda < 100$.

$\varphi_b = 48°$.

Pattern Information

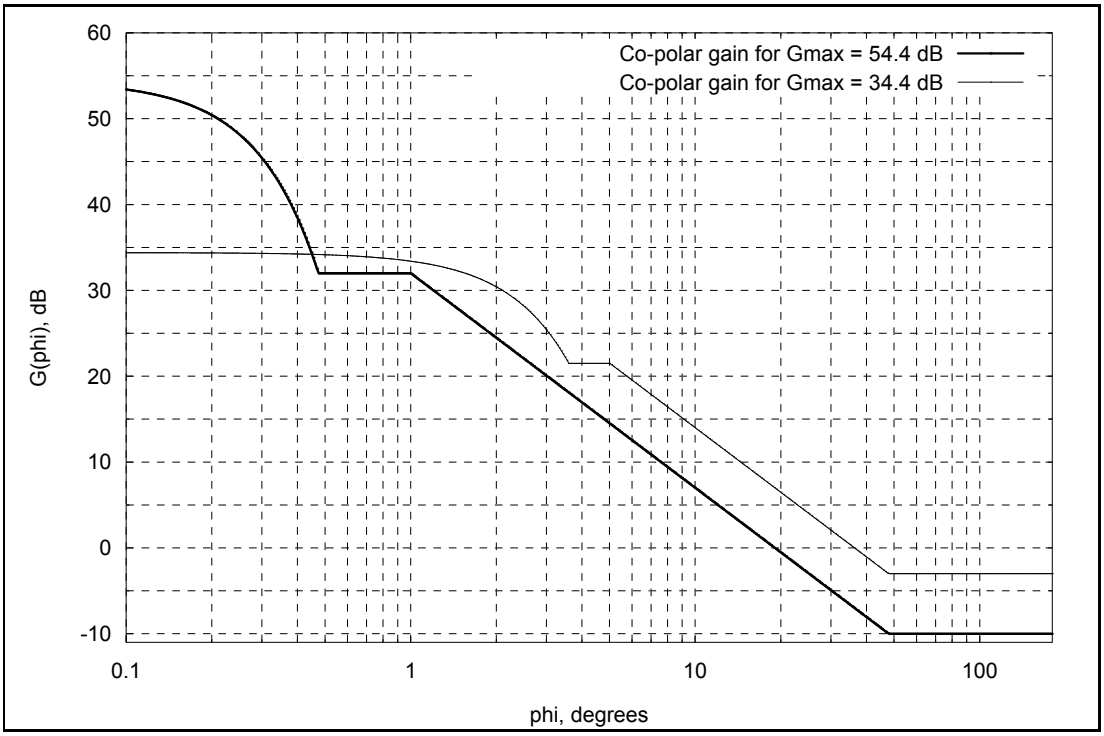
Recommendation ITU-R S.465-3 OBSOLETE reference Earth station antenna pattern for use in coordination and interference assessment in the frequency range from 2 to about 30 GHz for earth stations coordinated before 1993.

Use, when possible, current version of the Recommendation ITU-R: S.465-5 (APEREC013V01).

Pattern is extended in the main-lobe range similar to Appendix 8 of RR-2001 to produce continuous curves.

If efficiency is not specified, a value of 0.7 is to be applied for FSS Plan and a value of 0.6 is to be applied for "non-planned" services.

Example



Gmax = 54.4
Efficiency = 0.7
Phi m, out = 0.47
Phi r, out = 1.
Phi b, out = 48.
D/lambda, out = 199.66
G1, out = 32.

Gmax = 34.4
Efficiency = 0.7
Phi m, out = 3.6
Phi r, out = 5.01
Phi b, out = 48.
D/lambda, out = 19.97
G1, out = 21.5

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	REQUIRED
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6010	STDC_ERR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().
-6001	STDC_ERR_GMAX_LT_G1	Both	Gmax () is less than G1 (). Square root of negative value.

ID	**4**
Name	**APEREC004V01**
Type	Earth
	Receiving and Transmitting

Description Recommendation ITU-R S.580-2 OBSOLETE reference Earth station antenna pattern for antennas installed before 1995.

Start Date | **End Date** 1992-12-31

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: REC-580, REC-580-2
GIMS: REC-580, REC-580-2
R1448: 10

Version 0 0 1
Revision Date 2003-05-23

References

Reference	Append/Art	Annex	Section	Page	
REC-580-2			1,2,3,4		Note 6, .

Co-Polar Component

If $D/\lambda > 150$:
- $G = G_{max} - 2.5\times10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$
- $G = G_1$ for $\varphi_m \le \varphi < \varphi_r$
- $G = 29 - 25 \log \varphi$ for $\varphi_r \le \varphi \le 20°$
- $G = \text{Min}\ (-3.5, 32 - 25 \log \varphi)$ for $20° < \varphi < \varphi_b$
- $G = -10$ for $\varphi_b \le \varphi \le 180°$

If $100 \le D/\lambda \le 150$:
- $G = G_{max} - 2.5\times10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$
- $G = G_1$ for $\varphi_m \le \varphi < \varphi_r$
- $G = 32 - 25 \log \varphi$ for $\varphi_r \le \varphi < \varphi_b$
- $G = -10$ for $\varphi_b \le \varphi \le 180°$

If $50 \le D/\lambda < 100$:
- $G = G_{max} - 2.5\times10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$
- $G = G_1$ for $\varphi_m \le \varphi < \varphi_r$
- $G = 32 - 25 \log \varphi$ for $\varphi_r \le \varphi < 20°$
- $G = 52 - 10 \log (D/\lambda) - 25 \log \varphi$ for $20° \le \varphi < \varphi_b$
- $G = 10 - 10 \log (D/\lambda)$ for $\varphi_b \le \varphi \le 180°$

If $D/\lambda < 50$:
- $G = G_{max} - 2.5\times10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$
- $G = G_1$ for $\varphi_m \le \varphi < \varphi_r$
- $G = 52 - 10 \log (D/\lambda) - 25 \log \varphi$ for $\varphi_r \le \varphi < \varphi_b$
- $G = 10 - 10 \log (D/\lambda)$ for $\varphi_b \le \varphi \le 180°$

where:

$$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta\pi^2}}\ .$$

$$\varphi_m = 20\ \lambda/D\ \sqrt{G_{max} - G_1}\ .$$

G_1 = $2 + 15 \log (D/\lambda)$ for $D/\lambda \le 150$,
= $-1 + 15 \log (D/\lambda)$ for $D/\lambda > 150$.

φ_r = $15.85\ (D/\lambda)^{-0.6}$ for $D/\lambda \ge 100$,
= $100\ \lambda/D$ for $D/\lambda < 100$.

φ_b = 48°.

Pattern Information

Recommendation ITU-R S.580-2 OBSOLETE reference Earth station antenna pattern for use as design objectives for antennas operating with GSO satellites and installed before 1995.

Use, when possible, current version of the Recommendation ITU-R: S.580-6 (APEREC015V01).

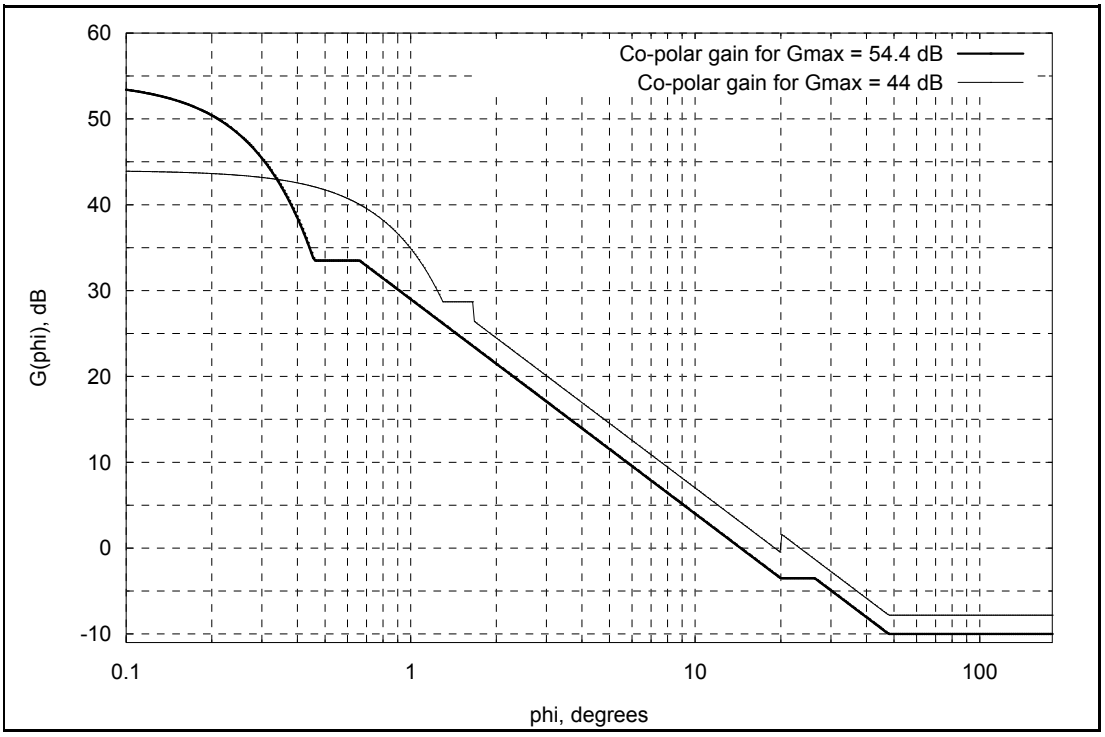
Pattern is extended for angles greater than 20 degrees as in Recommendation ITU-R S.465-3.

Pattern is extended in the main-lobe range similar to Appendix 7 and Appendix 8 of RR-2001 to produce continuous curves.

Pattern is extended for D/lambda < 35 as in Appendix 8 of RR-2001.

If the efficiency is not specified, a value of 0.7 is to be applied for FSS Plan and a value of 0.6 is to be applied for "non-planned" services.

Example



Gmax = 54.4
Efficiency = 0.7
Phi m, out = 0.46
Phi r, out = 0.66
Phi1, out = 0.
Phi b, out = 48.
D/lambda, out = 199.66
G1, out = 33.5

Gmax = 44
Efficiency = 0.7
Phi m, out = 1.3
Phi r, out = 1.66
Phi1, out = 0.
Phi b, out = 48.
D/lambda, out = 60.3
G1, out = 28.7

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	REQUIRED
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6010	STDC_ERR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().
-6001	STDC_ERR_GMAX_LT_G1	Both	Gmax () is less than G1 (). Square root of negative value.

ID	**5**
Name	**APEREC005V01**
Type	Earth
	Receiving and Transmitting

Description Recommendation ITU-R M.694-0 reference Earth station antenna pattern.

Start Date 1990-01-01 **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: REC-694
R1448: -

Version 0 0 1
Revision Date 2003-05-23

References

Reference	Append/Art	Annex	Section	Page	
REC-694		I			.

Co-Polar Component

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 52 - 10 \log (D/\lambda) - 25 \log \varphi$ for $\varphi_r \le \varphi < \varphi_b$

$G = 0$ for $\varphi_b \le \varphi \le 180°$

where:

$D/\lambda = 10^{\left(\frac{G_{max} - 7.7}{20}\right)}$.

$G_1 = 2 + 15 \log (D/\lambda)$.

$\varphi_m = 20\ \lambda/D \sqrt{G_{max} - G_1}$.

$\varphi_r = 100\ \lambda/D$.

$\varphi_b = \varphi_1 = 120\ (\lambda/D)^{0.4}$.

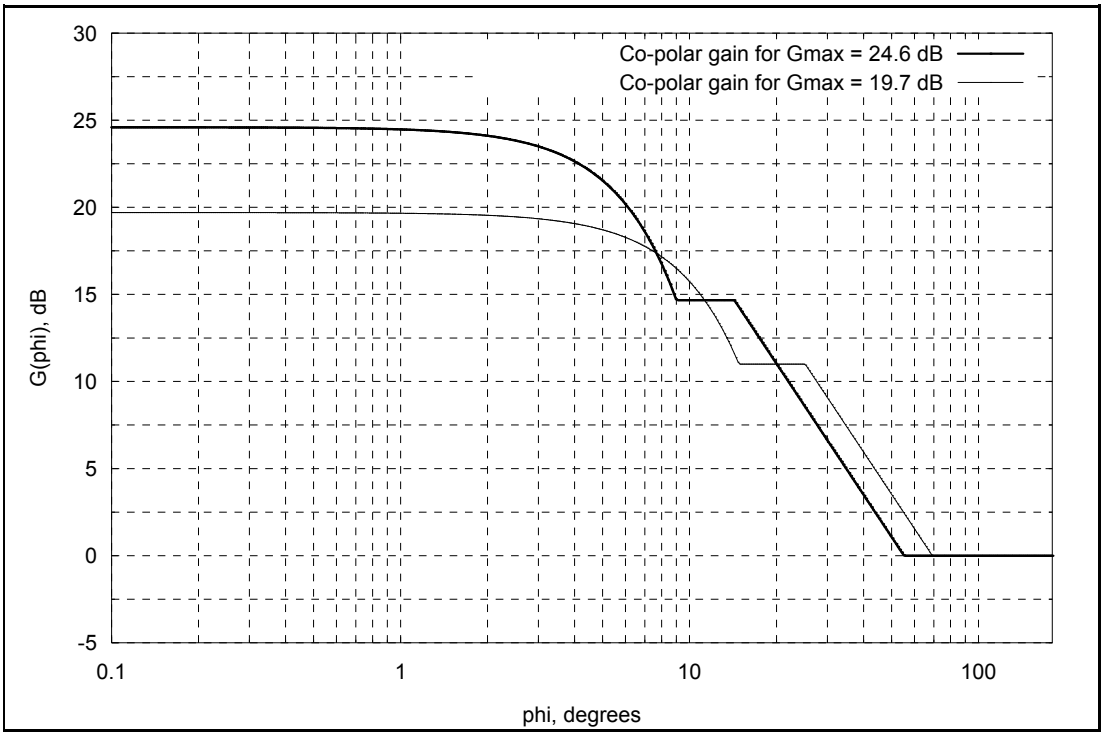
Pattern Information

Recommendation ITU-R M.694-0 reference radiation pattern for ship earth station antennas having circular paraboloidal reflectors with diameters between 0.8 m and 1.3 m and with an operating frequency range of about 1500 to 1650 MHz.

Used for coordination studies and the assessment of interference between ship earth stations and terrestrial stations, and between ship earth stations and the space stations of different satellite systems sharing the same frequency bands.

Antenna efficiency is implicitly set to 0.6 (as in Appendix 8 of RR-2001).

Example



Gmax = 24.6
Phi m, out = 9.
Phi r, out = 14.29
Phi b, out = 55.1
D/lambda, out = 7.
G1, out = 14.68

Gmax = 19.7
Phi m, out = 14.82
Phi r, out = 25.12
Phi b, out = 69.05
D/lambda, out = 3.98
G1, out = 11.

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6003	STDC_WAR_GMAX	Both	Gmax () is out of limits [19.7:24.8]. See ranges for Diameter and Frequency in RE
6009	STDC_WAR_PHIR_LT_PHIM	Both	Phi r () is less than Phi m ().
6010	STDC_WAR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().

ID	**6**
Name	**APERR_006V01**
Type	Earth
	Receiving

Description Appendix 30 (RR-2001) reference receiving earth station antenna pattern for Regions 1 and 3 for individual reception (1977 BSS Plan).

Start Date | **End Date** 1997-10-26

Region 1 ☑ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☑
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: R13RES
GIMS: -
R1448: -

Version 0 0 1
Revision Date 2003-05-23

References

Reference	Append/Art	Annex	Section	Page	
RR-2001	AP30-115	5	3.7.2 a)	543	Figure 7, Curve A and B, individual reception.

Co-Polar Component

$G = G_{max}$ for $0 \le (\varphi/\varphi_0) \le 0.25$

$G = G_{max} - 12\,(\varphi/\varphi_0)^2$ for $0.25 < (\varphi/\varphi_0) \le 0.707$

$G = G_{max} - 9 - 20 \log (\varphi/\varphi_0)$ for $0.707 < (\varphi/\varphi_0) \le 1.26$

$G = G_{max} - 8.5 - 25 \log (\varphi/\varphi_0)$ for $1.26 < (\varphi/\varphi_0) \le 9.55$

$G = G_{max} - 33$ for $9.55 < (\varphi/\varphi_0)$

Cross-Polar Component

$G_x = G_{max} - 25$ for $0 \le (\varphi/\varphi_0) \le 0.25$

$G_x = G_{max} - 30 - 40 \log \left| \frac{\varphi}{\varphi_o} - 1 \right|$ for $0.25 < (\varphi/\varphi_0) \le 0.44$

$G_x = G_{max} - 20$ for $0.44 < (\varphi/\varphi_0) \le 1.4$

$G_x = G_{max} - 30 - 25 \log \left| \frac{\varphi}{\varphi_o} - 1 \right|$ for $1.4 < (\varphi/\varphi_0) \le 2$

$G_x = G_{max} - 30$ for $2 < (\varphi/\varphi_0)$

If $G_x > G$: $G_x = G$

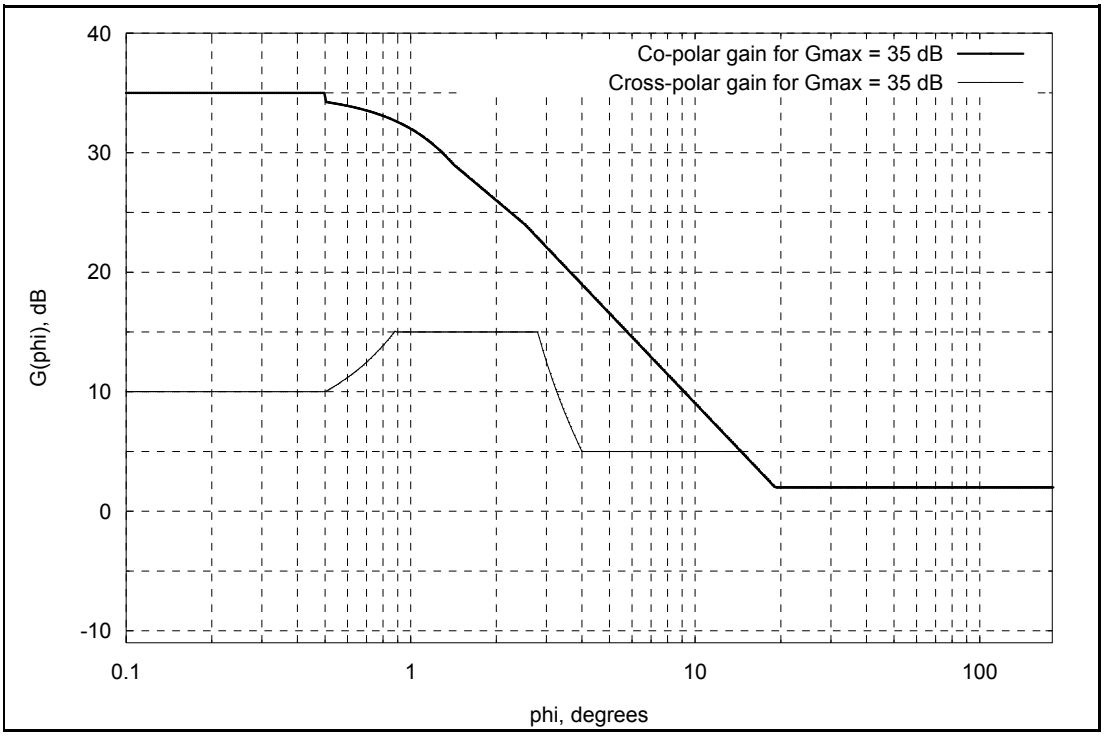
Pattern Information

Appendix 30 (RR-2001) reference receiving earth station antenna pattern for Regions 1 and 3 for individual reception.

Used in the original 1977 Conference BSS Plan and for the assignments notified and brought into use before 27 October 1997.

In the original 1977 BSS Plan the minimum antenna diameter was such that the half-power beamwidth was 2 degrees for individual reception.

Example



Gmax = 35
Phi0 = 2

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Specific Parameters Structure Size

0

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6006	STDC_WAR_PHI0	Both	Phi0 () is out of limits [0.1:5.0].

ID	**7**
Name	**APERR_007V01**
Type	Earth
	Receiving

Description Appendix 30 (RR-2003) reference receiving earth station antenna pattern for Regions 1 and 3 (WRC-97).

Start Date 1995-01-01 **End Date**

Region 1 ☑ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: MODRES
GIMS: REC-1213
R1448: -

Version 0 0 1
Revision Date 2003-11-12

References

Reference	Append/Art	Annex	Section	Page	
RR-2003	AP30-116	5	3.7.2 a)	544	Figure 7bis, .

Co-Polar Component

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 29 - 25 \log \varphi$ for $\varphi_r \le \varphi < \varphi_b$

$G = -5$ for $\varphi_b \le \varphi < 70°$

$G = 0$ for $70° \le \varphi < 180°$

where:

λ is the wavelength corresponding to fixed reference frequency of 12.1 GHz.

$\varphi_m = 20\ \lambda/D \sqrt{G_{max} - G_1}$.

$\varphi_r = 95\ \lambda/D$.

$G_1 = 29 - 25 \log \varphi_r$.

$\varphi_b = 10^{\left(\frac{34}{25}\right)}$.

Cross-Polar Component

$G_x = G_{max} - 25$ for $0° \le \varphi < 0.25\ \varphi_0$

$G_x = G_{max} - 25 + 8 \left(\frac{\varphi - 0.25\varphi_0}{0.19\varphi_0} \right)$ for $0.25\ \varphi_0 \le \varphi < 0.44\ \varphi_0$

$G_x = G_{max} - 17$ for $0.44\ \varphi_0 \le \varphi < \varphi_0$

$G_x = G_{max} - 17 + S \left| \frac{\varphi - \varphi_0}{\varphi_1 - \varphi_0} \right|$ for $\varphi_0 \le \varphi < \varphi_1$

$G_x = 21 - 25 \log \varphi$ for $\varphi_1 \le \varphi < \varphi_2$

$G_x = -5$ for $\varphi_2 \le \varphi < 70°$

$G_x = 0$ for $70° \le \varphi \le 180°$

where:

$S = 21 - 25 \log \varphi_1 - (G_{max} - 17)$

$\varphi_0 = 2\ \lambda/D \sqrt{\frac{3}{0.0025}}$.

$\varphi_1 = \frac{\varphi_0}{2} \sqrt{10.1875}$.

$\varphi_2 = 10^{\left(\frac{26}{25}\right)}$.

Pattern Information

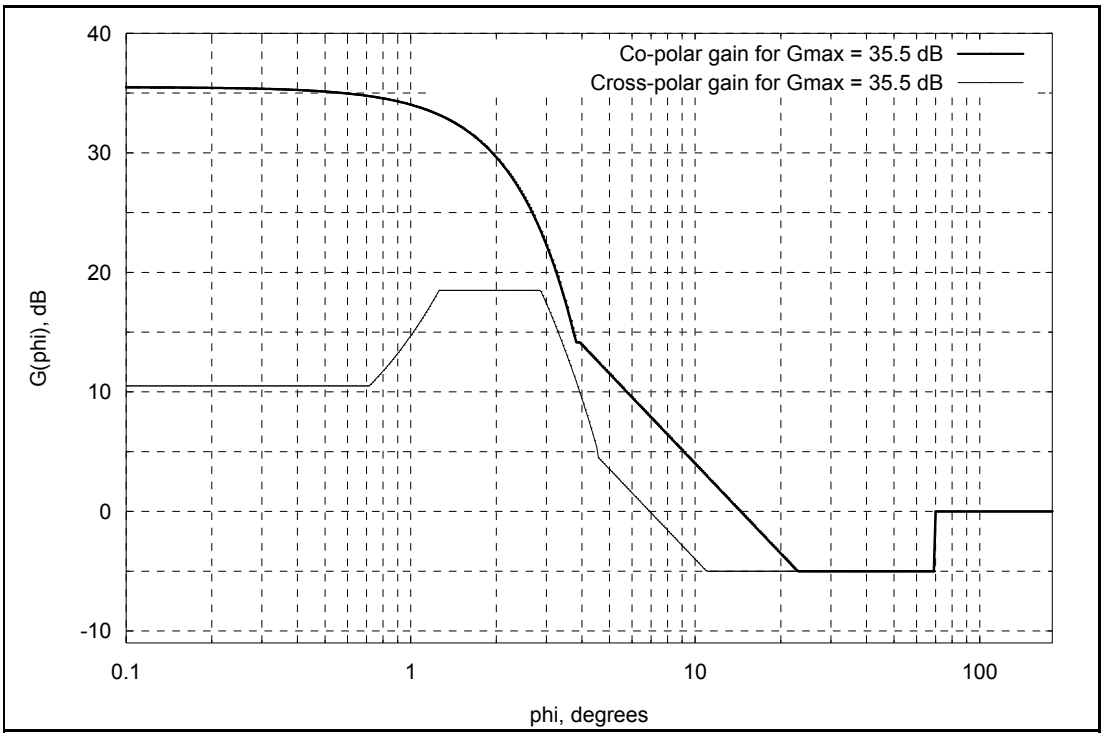
Appendix 30 (RR-2003) reference receiving earth station antenna pattern for Regions 1 and 3.

Used at WRC-97 for revising the Regions 1 and 3 BSS Plan.

The Plan is based on a 60 cm antenna given in Recommendation ITU-R BO.1213. Antenna maximum gain is 35.5 dBi and the reference frequency is 12.1 GHz.

The minimum antenna diameter was such that the half-power beamwidth was 2.96 degrees.

Example



Gmax = 35.5
Diameter = 0.6
Phi m, out = 3.82
Phi r, out = 3.92
Phi b, out = 22.91
D/lambda, out = 24.22
G1, out = 14.16

Pattern Input Parameters

GainMax	REQUIRED
Diameter	REQUIRED
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6031	STDC_ERR_0_LT_S	Cross-polar	0 () is less than S ().
-6009	STDC_ERR_PHIR_LT_PHIM	Co-polar	Phi r () is less than Phi m ().
-6008	STDC_ERR_ANG2_LT_ANG1	Cross-polar	Phi1 () is less than Phi2 ().
-6001	STDC_ERR_GMAX_LT_G1	Co-polar	Gmax () is less than G1 (). Square root of negative value.
6009	STDC_WAR_PHIR_LT_PHIM	Co-polar	Phi r () is less than Phi m ().

ID	**8**
Name	**APERR_008V01**
Type	Earth
	Receiving

Description Appendix 30 (RR-2001) reference receiving earth station antenna pattern for Region 2 for individual reception.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☑
Region 2 ☑ Relative Gain ☑
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: R2RES
GIMS: R2RES
R1448: -

Version 0 0 1
Revision Date 2003-05-23

References

Reference	Append/Art	Annex	Section	Page	
RR-2001	AP30-118	5	3.7.2 b)	546	Figure 8, Curve A and B, .

Co-Polar Component

$G = G_{max}$	for $0 \le (\varphi/\varphi_0) \le 0.25$
$G = G_{max} - 12\ (\varphi/\varphi_0)^2$	for $0.25 < (\varphi/\varphi_0) \le 1.13$
$G = G_{max} - 14 - 25 \log (\varphi/\varphi_0)$	for $1.13 < (\varphi/\varphi_0) \le 14.7$
$G = G_{max} - 43.2$	for $14.7 < (\varphi/\varphi_0) \le 35$
$G = G_{max} - 85.2 + 27.2 \log (\varphi/\varphi_0)$	for $35 < (\varphi/\varphi_0) \le 45.1$
$G = G_{max} - 40.2$	for $45.1 < (\varphi/\varphi_0) \le 70$
$G = G_{max} + 55.2 - 51.7 \log (\varphi/\varphi_0)$	for $70 < (\varphi/\varphi_0) \le 80$
$G = G_{max} - 43.2$	for $80 < (\varphi/\varphi_0)$

Cross-Polar Component

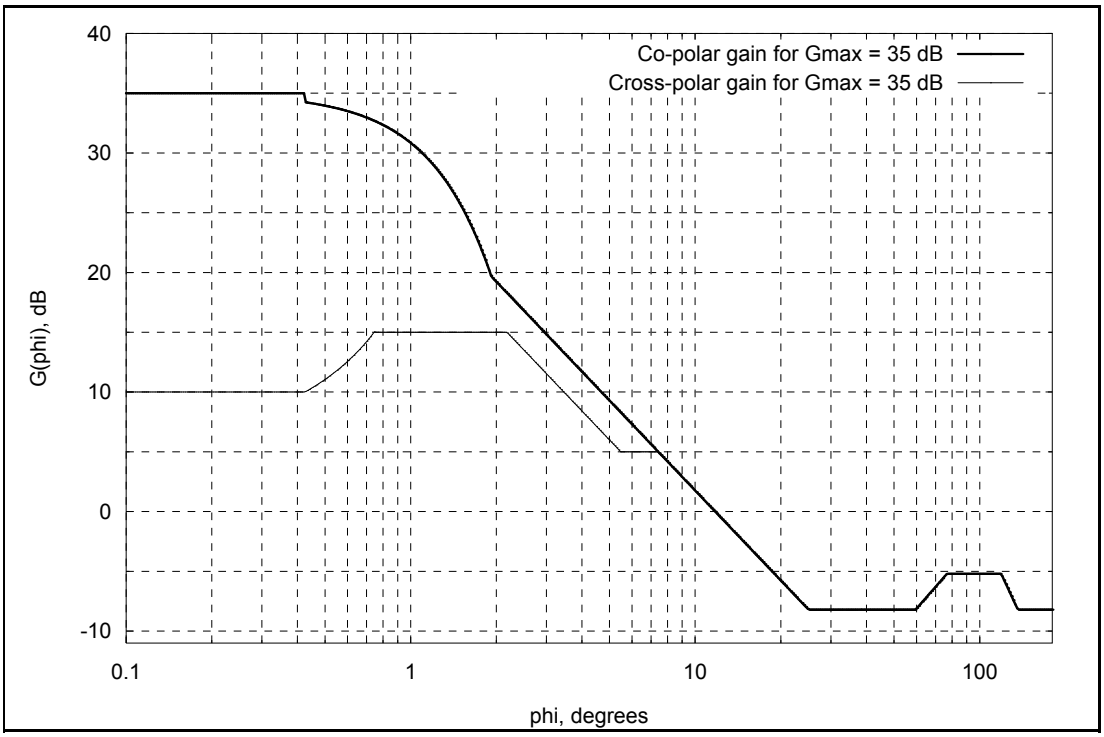
$G_x = G_{max} - 25$	for $0 \le (\varphi/\varphi_0) \le 0.25$
$G_x = G_{max} - 30 - 40 \log \left\lvert \frac{\varphi}{\varphi_o} - 1 \right\rvert$	for $0.25 < (\varphi/\varphi_0) \le 0.44$
$G_x = G_{max} - 20$	for $0.44 < (\varphi/\varphi_0) \le 1.28$
$G_x = G_{max} - 17.3 - 25 \log \left\lvert \frac{\varphi}{\varphi_o} \right\rvert$	for $1.28 < (\varphi/\varphi_0) \le 3.22$
$G_x = G_{max} - 30$	for $3.22 < (\varphi/\varphi_0)$
If $G_x > G$: $G_x = G$	

Pattern Information

Appendix 30 (RR-2001) reference receiving earth station antenna pattern for Region 2 for individual reception used for planning the BSS in Region 2.

The minimum antenna diameter is such that the half-power beamwidth is 1.7 degrees.

Example



Gmax = 35
Phi0 = 1.7

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Specific Parameters Structure Size

0

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6006	STDC_WAR_PHI0	Both	Phi0 () is out of limits [0.1:5.0].

ID	**9**
Name	**APERR_009V01**
Type	Earth Transmitting

Description Appendix 30A (RR-2001) reference transmitting earth station antenna pattern for Regions 1 and 3 (WARC Orb-88).

Start Date | **End Date** 1997-10-26

Region 1 ☑ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☑
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: R13TES
GIMS: R13TES
R1448: 8

Version 0 0 1
Revision Date 2003-05-23

References

Reference	Append/Art	Annex	Section	Page	
RR-2001	AP30A-110	3	3.5.3	674	Figure A, Curve A and B, WARC Orb-88.

Co-Polar Component

$G = G_{max}$	for $0° \le \varphi \le 0.1°$
$G = G_{max} - 21 - 20 \log \varphi$	for $0.1° < \varphi \le 0.32°$
$G = G_{max} - 5.7 - 53.2 \varphi^2$	for $0.32° < \varphi \le 0.44°$
$G = G_{max} - 25 - 25 \log \varphi$	for $0.44° < \varphi \le 48°$
$G = G_{max} - 67$	for $48° < \varphi \le 180°$

Cross-Polar Component

$G_x = G_{max} - 30$

If $G_x > G$: $G_x = G$

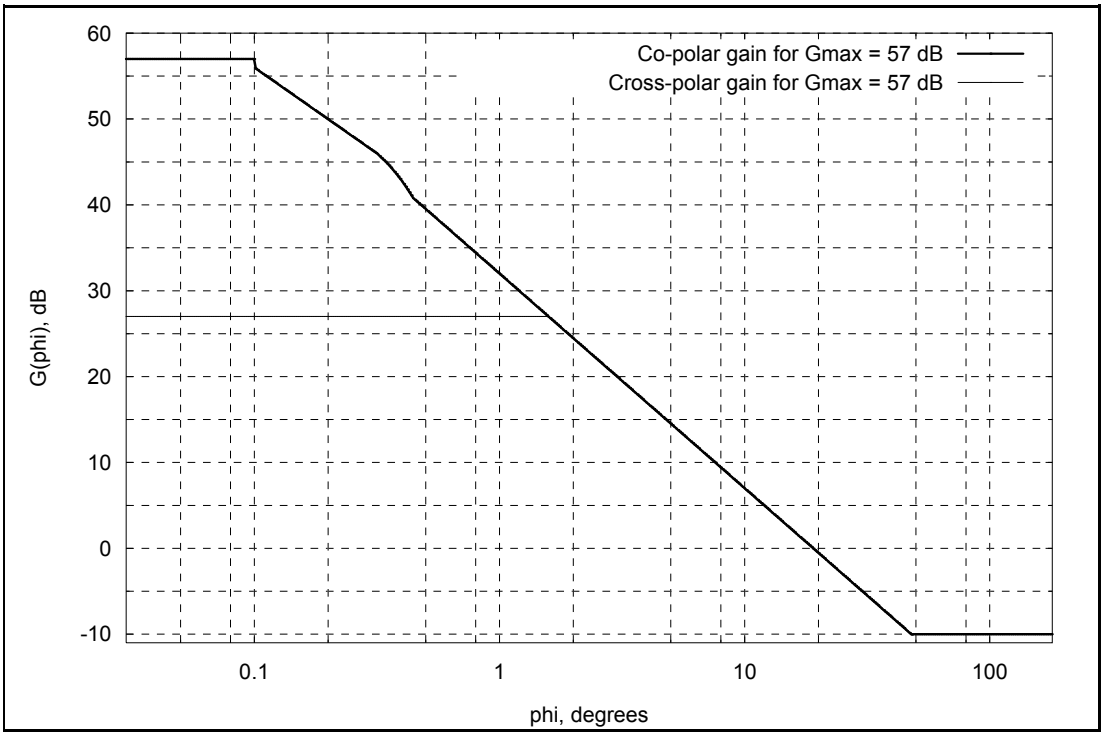
Pattern Information

Appendix 30A (RR-2001) reference transmitting earth station antenna pattern for Regions 1 and 3.

Used in the original 1988 feeder-link Plan (WARC Orb-88) and for the assignments notified and brought into use before 27 October 1997.

The feeder-link Plan is based on an antenna diameter of 5 m for the band 17.3-18.1 GHz and 6 m for the band 14.5-14.8 GHz. The on-axis gain was taken as 57 dBi.

Example



Gmax = 57

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	NOVALUE
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Low Level Validation Rules

ID	**10**
Name	**APERR_010V01**
Type	Earth Transmitting

Description Appendix 30A (RR-2001) reference transmitting earth station antenna pattern for Regions 1 and 3 (WRC-97).

Start Date 1997-01-01 **End Date**

Region 1 ☑ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☑
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: MODTES
GIMS: REC-1295, MODTES
R1448: 9

Version 0 0 1
Revision Date 2003-05-23

References

Reference	Append/Art	Annex	Section	Page	
RR-2001	AP30A-110	3	3.5.3	674	Figure A, Curve A' and B', WRC-97.
REC-1295		1			Figure 1, Curve A' and B', .

Co-Polar Component

$G = G_{max}$	for $0° \le \varphi \le 0.1°$
$G = G_{max} - 21 - 20 \log \varphi$	for $0.1° < \varphi \le 0.32°$
$G = G_{max} - 5.7 - 53.2\ \varphi^2$	for $0.32° < \varphi \le 0.54°$
$G = G_{max} - 28 - 25 \log \varphi$	for $0.54° < \varphi \le 36.31°$
$G = G_{max} - 67$	for $36.31° < \varphi \le 180°$

Cross-Polar Component

$G_x = G_{max} - 35$

If $G_x > G$: $G_x = G$

Pattern Information

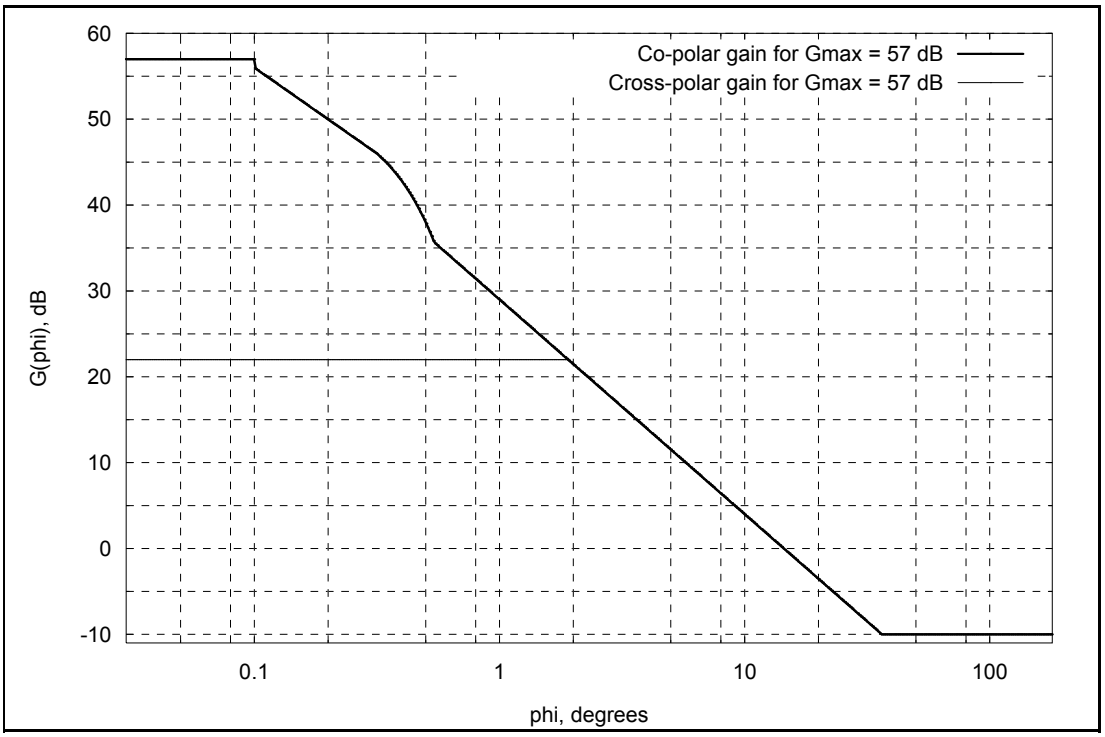
Appendix 30A (RR-2001) reference transmitting earth station antenna pattern for Regions 1 and 3.

Used for planning purposes at WRC-97 in the revision of the Appendix 30A Plan of the Radio Regulations at 14 GHz and 17 GHz in Regions 1 and 3 and specified in Recommendation ITU-R BO.1295-0.

The feeder-link Plan is based on an antenna diameter of 5 m for the band 17.3-18.1 GHz and 6 m for the band 14.5-14.8 GHz.

The on-axis gain was taken as 57 dBi.

Example



Gmax = 57

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	NOVALUE
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Low Level Validation Rules

ID	**11**
Name	**APERR_011V01**
Type	Earth Transmitting

Description Appendix 30A (RR-2003) reference transmitting earth station antenna pattern for Region 2.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☑
Region 2 ☑ Relative Gain ☐
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: R2TES
GIMS: R2TES
R1448: -

Version 0 0 1
Revision Date 2003-11-12

References

Reference	Append/Art	Annex	Section	Page	
RR-2003	AP30A-121	3	4.4.2	685	Figure 6, Curve A and B, .

Co-Polar Component

$G = G_{max}$ for $0° \le \varphi < 0.1°$

$G = 36 - 20 \log \varphi$ for $0.1° \le \varphi < 0.32°$

$G = 51.3 - 53.2\ \varphi^2$ for $0.32° \le \varphi < 0.54°$

$G = \max(29 - 25 \log \varphi, -10)$ for $0.54° \le \varphi \le 180°$

If $G > G_{max}$: $G = G_{max}$

Cross-Polar Component

$G_x = G_{max} - 30$ for $0° \le \varphi < 0.6/D$

$G_x = \max(9 - 20 \log \varphi, -10)$ for $0.6/D \le \varphi \le 180°$

If $G_x > G_{max} - 30$: $G_x = G_{max} - 30$

Pattern Information

Appendix 30A (RR-2003) reference transmitting earth station antenna pattern for Region 2.

Used for planning purposes of the feeder-link frequency band 17.3-17.8 GHz in the Appendix 30A Plan of the Radio Regulations.

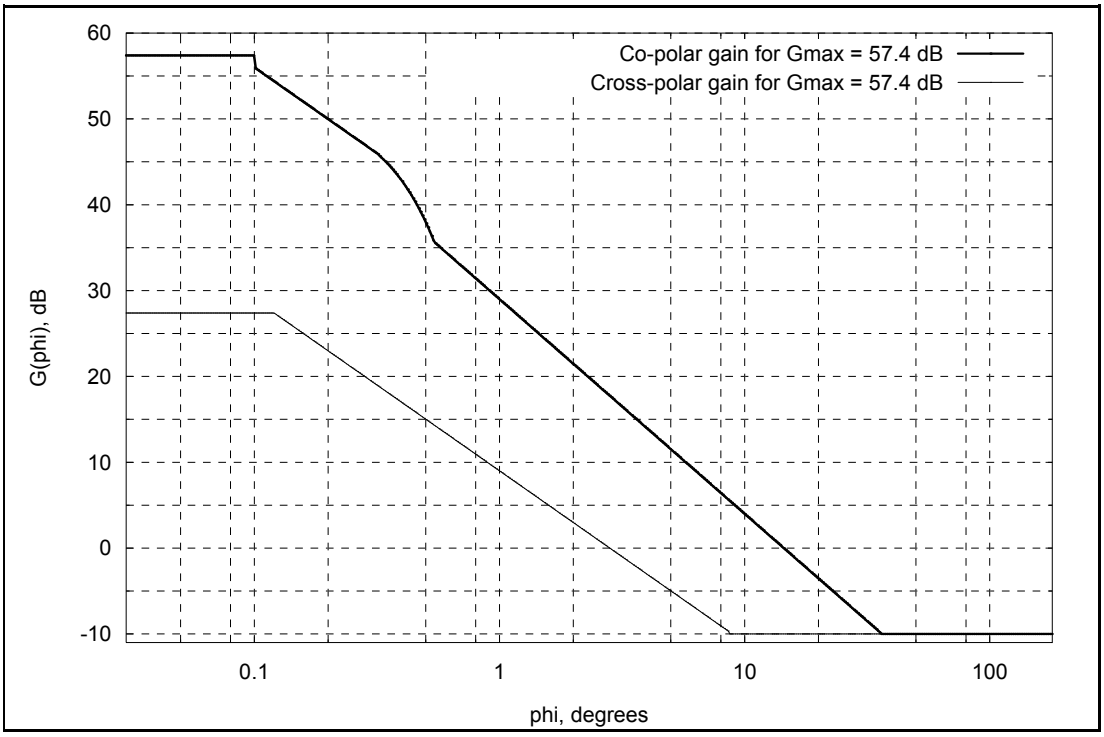
The feeder-link Plan is based on an antenna diameter of 5 m. The minimum antenna diameter permitted in the Plan is 2.5 m. The Plan is based on antenna efficiency of 0.65. The corresponding on-axis gain for an antenna having a 5 m diameter is 57.4

dBi at 17.55 GHz.

The co-polar pattern is extended for angles less than 0.1 degrees as equal to on-axis gain.

A ceiling of maximum antenna gain is applied for the co-polar pattern.
A ceiling of maximum antenna gain reduced by 30 dB is applied for the cross-polar pattern.

Example



Gmax = 57.4
Diameter = 5

Pattern Input Parameters

GainMax	REQUIRED
Diameter	REQUIRED
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	NOVALUE
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6013	STDC_ERR_C0_LT_CX	Cross-polar	Co-polar curve () is less than cross-polar curve (). (at plateau level) Gmax is too b
-6007	STDC_ERR_DIAMETER	Both	Diameter () is less than 2.5 (). Limit for Diameter in RR: D > 2.5 m.

ID	**12**
Name	**APERR_012V01**
Type	Earth
	Receiving and Transmitting

Description Appendix 7 (RR-2001) Earth station antenna pattern.

Start Date 2000-01-01 **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: AP7
GIMS: AP7
R1448: 6

Version 0 0 1
Revision Date 2003-05-23

References

Reference	Append/Art	Annex	Section	Page	
RR-2001	AP7-55	3	3	135	Formula 97, .
REC-1448	3	1	3	50	Formula 99, .
REC-847	1	1	3	22	Formula 33, no low limit on D/lambda (35) is mentioned.

Co-Polar Component

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 29 - 25 \log \varphi$ for $\varphi_r \le \varphi < \varphi_b$

$G = -10$ for $\varphi_b \le \varphi \le 180°$

where:

$D/\lambda = 10^{\left(\frac{G_{max} - 7.7}{20}\right)}$.

$G_1 = -1 + 15 \log (D/\lambda)$, for $D/\lambda \ge 100$,

$= -21 + 25 \log (D/\lambda)$, for $35 \le D/\lambda < 100$.

$\varphi_m = 20\ \lambda/D \sqrt{G_{max} - G_1}$.

$\varphi_r = 15.85 (D/\lambda)^{-0.6}$, for $D/\lambda \ge 100$,

$= 100\ \lambda/D$, for $35 \le D/\lambda < 100$.

$\varphi_b = 36°$.

Pattern Information

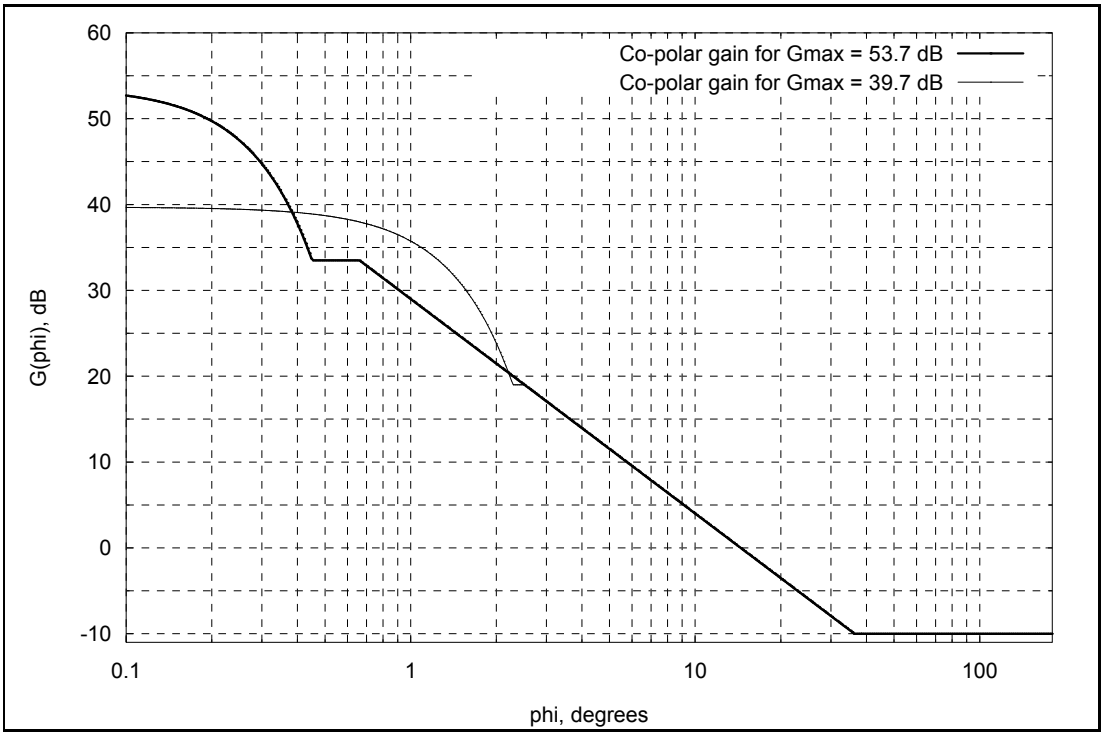
Appendix 7 (RR-2001) Earth station antenna pattern. Specified in Recommendation ITU-R SM.1448-0. Also specified in Recommendation ITU-R IS.847-1 (but without low limit on D/lambda).

Used for the determination of the coordination area around an earth station in frequency bands between 100 MHz and 105

GHz.

Antenna efficiency is implicitly set to 0.6. Pattern is applicable only for D/lambda > 35.

Example



Gmax = 53.7
Phi m, out = 0.45
Phi r, out = 0.66
Phi b, out = 36.
D/lambda, out = 199.53
G1, out = 33.5

Gmax = 39.7
Phi m, out = 2.29
Phi r, out = 2.51
Phi b, out = 36.
D/lambda, out = 39.81
G1, out = 19.

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6002	STDC_ERR_DLAMBDA	Both	D/lambda () is less than 35 ().

ID	**13**
Name	**APEREC013V01**
Type	Earth
	Receiving and Transmitting

Description Recommendation ITU-R S.465-5 reference Earth station antenna pattern for earth stations coordinated after 1993.

Start Date 1993-01-01 **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: REC-465-5
GIMS: REC-465-5
R1448: -

Version 0 0 1
Revision Date 2003-05-23

References

Reference	Append/Art	Annex	Section	Page	
REC-465-5			2	2	.

Co-Polar Component

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 32 - 25 \log \varphi$ for $\varphi_r \le \varphi < \varphi_b$

$G = -10$ for $\varphi_b \le \varphi \le 180°$

where:

$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta\pi^2}}$. $\varphi_m = 20\ \lambda/D\ \sqrt{G_{max} - G_1}$.

$G_1 = 32$ for $D/\lambda > 100$,

$= -18 + 25 \log (D/\lambda)$ for $D/\lambda \le 100$.

$\varphi_r = 1°$ for $D/\lambda > 100$,

$= 100\ \lambda/D$ for $D/\lambda \le 100$.

$\varphi_b = 10^{\left(\frac{42}{25}\right)}$.

Pattern Information

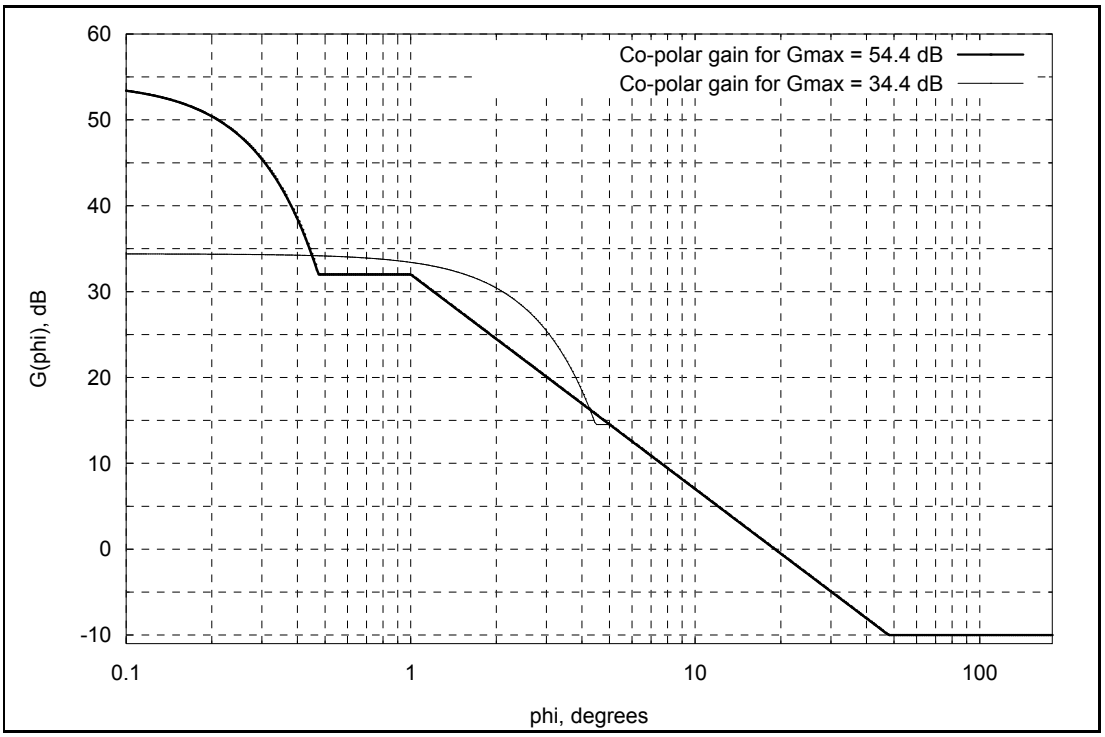
Recommendation ITU-R S.465-5 reference Earth station antenna pattern for use in coordination and interference assessment in the frequency range from 2 to about 30 GHz for earth stations coordinated after 1993.

For earth stations coordinated before 1993 use pattern APEREC003V01 (Recommendation ITU-R S.465-3).

Pattern is extended in the main-lobe range similar to Appendix 8 and Appendix 7 of RR-2001 to produce continuous curves.

If efficiency is not specified, a value of 0.7 is to be applied for FSS Plan and a value of 0.6 is to be applied for "non-planned" services.

Example



Gmax = 54.4
Efficiency = 0.7
Phi m, out = 0.47
Phi r, out = 1.
Phi b, out = 47.86
D/lambda, out = 199.66
G1, out = 32.

Gmax = 34.4
Efficiency = 0.7
Phi m, out = 4.47
Phi r, out = 5.01
Phi b, out = 47.86
D/lambda, out = 19.97
G1, out = 14.51

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	REQUIRED
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6010	STDC_ERR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().
-6001	STDC_ERR_GMAX_LT_G1	Both	Gmax () is less than G1 (). Square root of negative value.

ID	**14**
Name	**APEREC014V01**
Type	Earth
	Receiving and Transmitting

Description Recommendation ITU-R S.580-5 reference Earth station antenna pattern for antennas installed BEFORE 1995.

Start Date | **End Date** 1994-12-31

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: -
R1448: -

Version	0	0	1
Revision Date	2003-05-23		

References

Reference	Append/Art	Annex	Section	Page	
REC-580-5			1,2,3		near side lobe is 32 - 25 log (phi).

Co-Polar Component

If $D/\lambda > 150$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 29 - 25 \log \varphi$ for $\varphi_r \le \varphi \le 19.95°$

$G = \text{Min}(-3.5, 32 - 25 \log \varphi)$ for $19.95° < \varphi < \varphi_b$

$G = -10$ for $\varphi_b \le \varphi \le 180°$

If $50 \le D/\lambda \le 150$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 32 - 25 \log \varphi$ for $\varphi_r \le \varphi < \varphi_b$

$G = -10$ for $\varphi_b \le \varphi \le 180°$

If $D/\lambda < 50$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 52 - 10 \log (D/\lambda) - 25 \log \varphi$ for $\varphi_r \le \varphi < \varphi_b$

$G = 10 - 10 \log (D/\lambda)$ for $\varphi_b \le \varphi \le 180°$

where:

$$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta\pi^2}}. \qquad \varphi_m = 20\ \lambda/D\ \sqrt{G_{max} - G_1}.$$

$G_1 = 2 + 15 \log (D/\lambda)$ for $D/\lambda < 50$,

$= -18 + 25 \log (D/\lambda)$ for $50 \le D/\lambda < 100$,

$= 2 + 15 \log (D/\lambda)$ for $100 \le D/\lambda \le 150$,

$= -1 + 15 \log (D/\lambda)$ for $150 < D/\lambda$.

$\varphi_r = 15.85 (D/\lambda)^{-0.6}$ for $D/\lambda \ge 100$,

$= 100\ \lambda/D$ for $D/\lambda < 100$.

$$\varphi_b = 10^{\left(\frac{42}{25}\right)}.$$

Pattern Information

Recommendation ITU-R S.580-5 reference Earth station antenna pattern for use as design objectives for antennas operating with GSO satellites and installed BEFORE 1995.

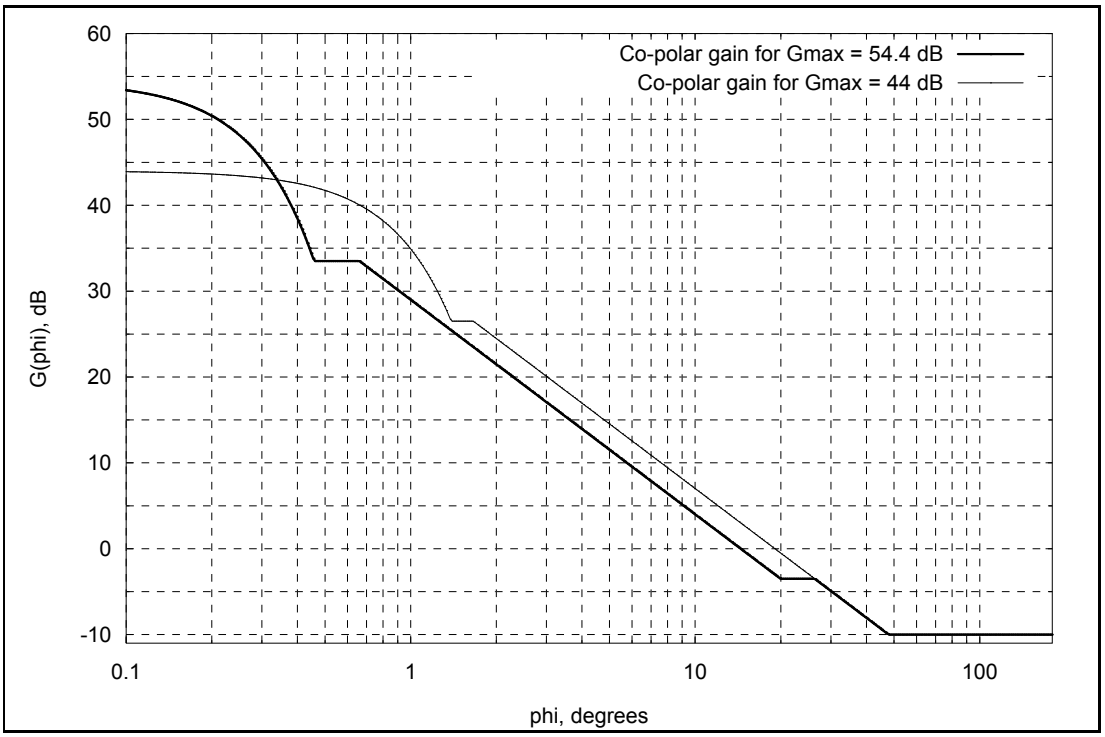
Pattern is extended for angles greater than 20 degrees as in Recommendation ITU-R S.465-5.

Pattern is extended in the main-lobe range similar to Appendix 7 and Appendix 8 of RR-2001 to produce continuous curves.

Pattern is extended for D/lambda < 50 as in Appendix 8 of RR-2001.

If the efficiency is not specified, a value of 0.7 is to be applied for FSS Plan and a value of 0.6 is to be applied for "non-planned" services.

Example



Gmax = 54.4
Efficiency = 0.7
Phi m, out = 0.46
Phi r, out = 0.66
Phi b, out = 47.86
D/lambda, out = 199.66
G1, out = 33.

Gmax = 44
Efficiency = 0.7
Phi m, out = 1.39
Phi r, out = 1.66
Phi b, out = 47.86
D/lambda, out = 60.3
G1, out = 26.51

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	REQUIRED
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6010	STDC_ERR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().
-6001	STDC_ERR_GMAX_LT_G1	Both	Gmax () is less than G1 (). Square root of negative value.

ID 15
Name APEREC015V01
Type Earth
Receiving and Transmitting

Description Appendix 30B (RR-2003) reference Earth station antenna pattern. Recommendation ITU-R S.580-6 reference Earth station antenna pattern.

Start Date 1995-01-01 **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: REC-580-6
GIMS: REC-580-6
R1448: -

Version 0 0 1
Revision Date 2003-05-23

References

Reference	Append/Art	Annex	Section	Page	
RR-2003	AP30B-32	1	A-1.6.4	810	Table 1, .
REC-580-6			1,2,3		Note 3,5,6, .
REC-580-5			1,2,3		Note 7, near side lobe is 29 - 25 log (phi).

Co-Polar Component

If $D/\lambda \geq 50$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \leq \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \leq \varphi < \varphi_r$

$G = 29 - 25 \log \varphi$ for $\varphi_r \leq \varphi \leq 19.95°$

$G = \text{Min}\ (-3.5,\ 32 - 25 \log \varphi)$ for $19.95° < \varphi < \varphi_b$

$G = -10$ for $\varphi_b \leq \varphi \leq 180°$

If $D/\lambda < 50$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \leq \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \leq \varphi < \varphi_r$

$G = 52 - 10 \log (D/\lambda) - 25 \log \varphi$ for $\varphi_r \leq \varphi < \varphi_b$

$G = 10 - 10 \log (D/\lambda)$ for $\varphi_b \leq \varphi \leq 180°$

where:

$$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta \pi^2}}\ .$$

$\varphi_m = 20\ \lambda/D\ \sqrt{G_{max} - G_1}\ .$

$G_1 = 2 + 15 \log (D/\lambda)$ for $D/\lambda < 50$,

$= -21 + 25 \log (D/\lambda)$ for $50 \leq D/\lambda < 100$,

$= -1 + 15 \log (D/\lambda)$ for $100 \leq D/\lambda$.

$\varphi_r = 15.85\ (D/\lambda)^{-0.6}$ for $D/\lambda \geq 100$,

$= 100\ \lambda/D$ for $D/\lambda < 100$.

$$\varphi_b = 10^{\left(\frac{42}{25}\right)}.$$

Pattern Information

Appendix 30B (RR-2003) Earth station antenna reference pattern since WRC-03 applicable for D/lambda > 50.

Recommendation ITU-R S.580-6 reference Earth station antenna pattern.

Pattern is extended for angles greater than 20 degrees as in Recommendation ITU-R S.465-5.

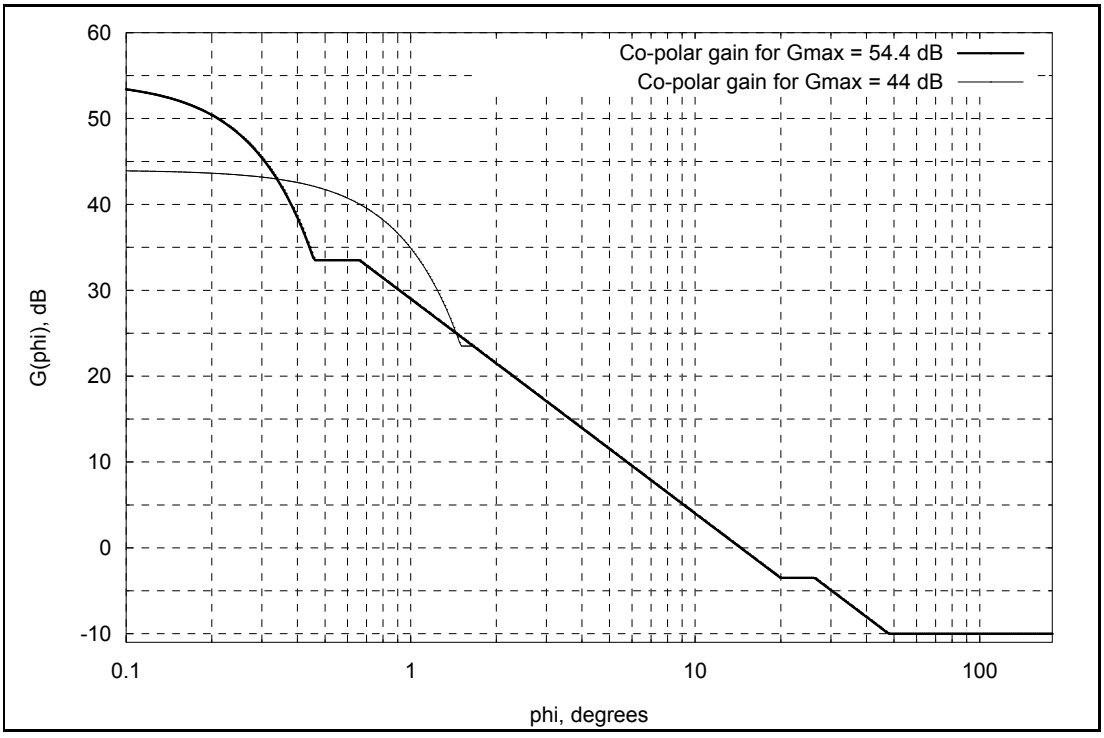
Pattern is extended in the main-lobe range as in Appendix 7 of RR-2001 to produce continuous curves.

Pattern is extended for D/lambda < 50 as in Appendix 8 of RR-2001.

If the efficiency is not specified, a value of 0.7 is to be applied for FSS Plan and a value of 0.6 is to be applied for "non-planned" services.

This pattern corresponds also to obsolete Recommendation ITU-R S.580-5 reference Earth station antenna pattern for use as design objectives for antennas operating with GSO satellites and installed AFTER 1995.

Example



Gmax = 54.4
Efficiency = 0.7
Phi m, out = 0.46
Phi r, out = 0.66
Phi b, out = 47.86
D/lambda, out = 199.66
G1, out = 33.

Gmax = 44
Efficiency = 0.7
Phi m, out = 1.5
Phi r, out = 1.66
Phi b, out = 47.86
D/lambda, out = 60.3
G1, out = 23.5

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	REQUIRED
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6010	STDC_ERR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().
-6001	STDC_ERR_GMAX_LT_G1	Both	Gmax () is less than G1 (). Square root of negative value.

ID	**17**
Name	**APERR_017V01**
Type	Earth
	Receiving

Description Appendix 30 (RR-2003) reference receiving earth station antenna pattern for Regions 1, 2 and 3 for digital BSS assignments.

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: -
R1448: -

Version	0	0	1
Revision Date	2005-06-08		

References

Reference	Append/Art	Annex	Section	Page	
RR-2003	AP30-127	5	2.4.1	587	Formula 2, Figure 2, .

Co-Polar Component

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = \max(29 - 25 \log \varphi, 0)$ for $\varphi_r \le \varphi < 180°$

where:

λ is the wavelength corresponding to input frequency.

$\varphi_m = 20\ \lambda/D \sqrt{G_{max} - G_1}$.

$\varphi_r = 95\ \lambda/D$.

$G_1 = 29 - 25 \log \varphi_r$.

Pattern Information

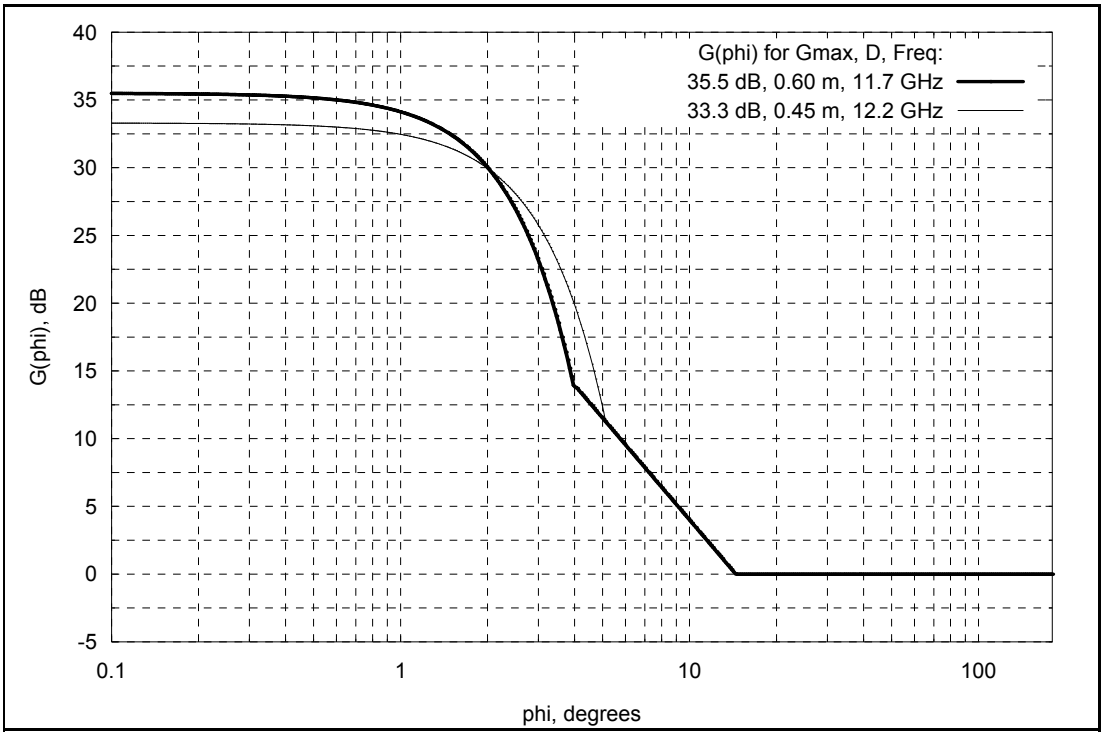
Appendix 30 (RR-2003) reference receiving earth station antenna pattern for Regions 1, 2 and 3 for digital BSS assignments to be used for determining interference by a terrestrial station at the edge of a BSS service area.

The pattern is based on Recommendation ITU-R BO.1213. The pattern is similar to APERR_007V01 pattern with the following differences: frequency is an input parameter; a flooring of 0 dB is applied in back lobe; cross-polar part of the pattern is absent.

For Regions 1 and 3 the pattern is foreseen to be applied with the maximum gain of 35.5 dBi corresponding to antenna diameter of 0.6 m and frequency 11.7 GHz.

For Region 2 the pattern is foreseen to be applied with the maximum gain of 33.3 dBi corresponding to antenna diameter of 0.45 m and frequency 12.2 GHz.

Example



Gmax = 35.5
Diameter = 0.6
Frequency = 11700.
Phi m, out = 3.98
Phi r, out = 4.06
D/lambda, out = 23.42
G1, out = 13.79

Gmax = 33.3
Diameter = 0.45
Frequency = 12200.
Phi m, out = 5.14
Phi r, out = 5.19
D/lambda, out = 18.31
G1, out = 11.13

Pattern Input Parameters

GainMax	REQUIRED
Diameter	REQUIRED
Frequency	REQUIRED
Efficiency	NOVALUE
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6009	STDC_ERR_PHIR_LT_PHIM	Both	Phi r () is less than Phi m ().
-6001	STDC_ERR_GMAX_LT_G1	Both	Gmax () is less than G1 (). Square root of negative value.

ID	**18**
Name	**APERR_018V01**
Type	Earth
	Receiving

Description Appendix 30 (RR-2003) reference receiving earth station antenna pattern for Region 2 for analogue BSS assignments.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☑
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: -
GIMS: -
R1448: -

Version 0 0 1
Revision Date 2005-06-09

References

Reference	Append/Art	Annex	Section	Page	
RR-2003	AP30-128	5	2.4.2	588	Formula 3, Figure 3, .

Co-Polar Component

$G = G_{max}$ for $0 \le (\varphi/\varphi_0) \le 0.25$

$G = G_{max} - 12\,(\varphi/\varphi_0)^2$ for $0.25 < (\varphi/\varphi_0) \le 1.13$

$G = G_{max} - 14 - 25 \log (\varphi/\varphi_0)$ for $1.13 < (\varphi/\varphi_0) \le 14.7$

$G = G_{max} - 43.2$ for $14.7 < (\varphi/\varphi_0)$

where:

φ_0 = 1.7 degrees.

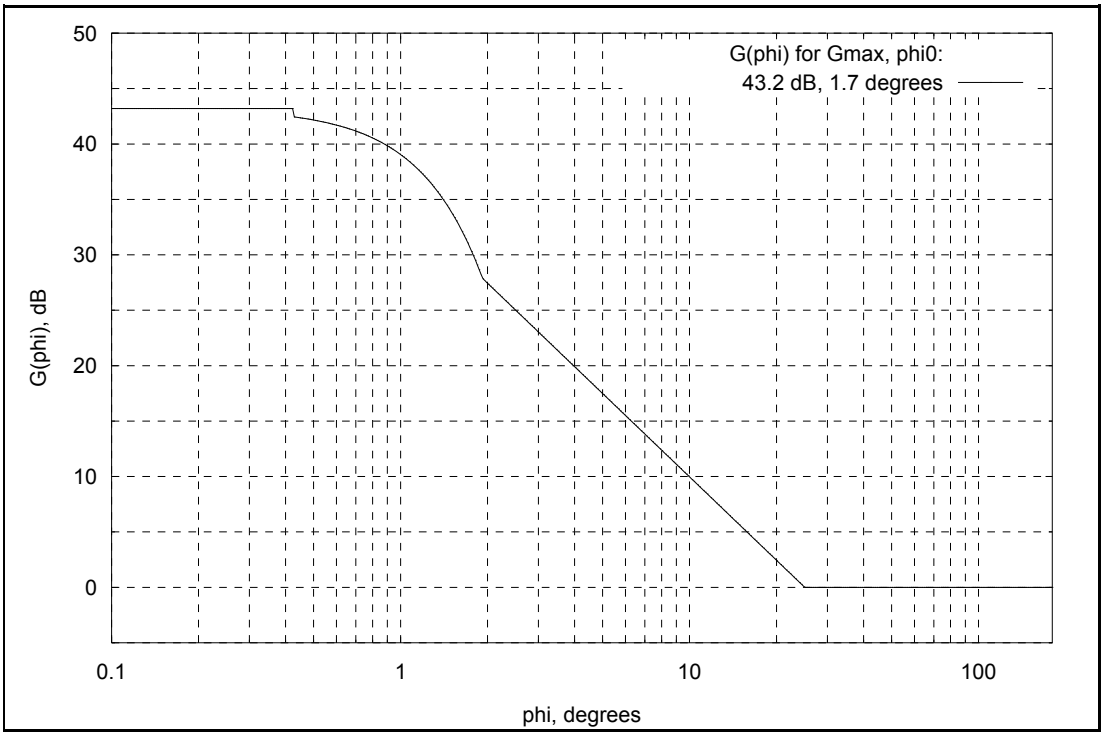
Pattern Information

Appendix 30 (RR-2003) reference receiving earth station antenna pattern for Region 2 for analogue BSS assignments to be used for determining interference by a terrestrial station at the edge of a BSS service area.

The pattern is similar to APERR_008V01 pattern with the following differences: beamwidth is internally set to 1.7 degrees and cannot be changed; a ceiling of (Gmax - 43.2) dB is applied in back lobe; cross-polar part of the pattern is absent.

The pattern is foreseen to be applied with maximum antenna gain of 43.2 dBi.

Example



Gmax = 43.2

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	NOVALUE
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Low Level Validation Rules

ID	**19**
Name	**APERR_019V01**
Type	Earth
	Receiving

Description Article 22 (RR-2003) reference receiving earth station antenna pattern.

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: -
R1448: -

Version	0	0	1
Revision Date	2007-01-30		

References

Reference	Append/Art	Annex	Section	Page	
RR-2003	Ar22-8		II	270	Table 22-1E, Note 22.5C.12, .

Co-Polar Component

If $D/\lambda \geq 42$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \leq \varphi < \varphi_m$
$G = G_1$ for $\varphi_m \leq \varphi < \varphi_r$
$G = 29 - 25 \log \varphi$ for $\varphi_r \leq \varphi \leq 19.95°$
$G = \text{Min}\ (-3.5, 32 - 25 \log \varphi)$ for $19.95° < \varphi < \varphi_b$
$G = -10$ for $\varphi_b \leq \varphi \leq 180°$

If $D/\lambda < 42$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \leq \varphi < \varphi_m$
$G = G_1$ for $\varphi_m \leq \varphi < \varphi_r$
$G = 32 - 25 \log \varphi$ for $\varphi_r \leq \varphi < \varphi_b$
$G = -10$ for $\varphi_b \leq \varphi \leq 180°$

where:

$G_{max} = 7.7 + 20 \log (D/\lambda)$.

$\varphi_m = 20\ \lambda/D \sqrt{G_{max} - G_1}$.

$G_1 = 2 + 15 \log (D/\lambda)$.

$\varphi_r = 15.85\ (D/\lambda)^{-0.6}$ for $D/\lambda \geq 100$,

$= 100\ \lambda/D$ for $D/\lambda < 100$.

$\varphi_b = 48°$.

Pattern Information

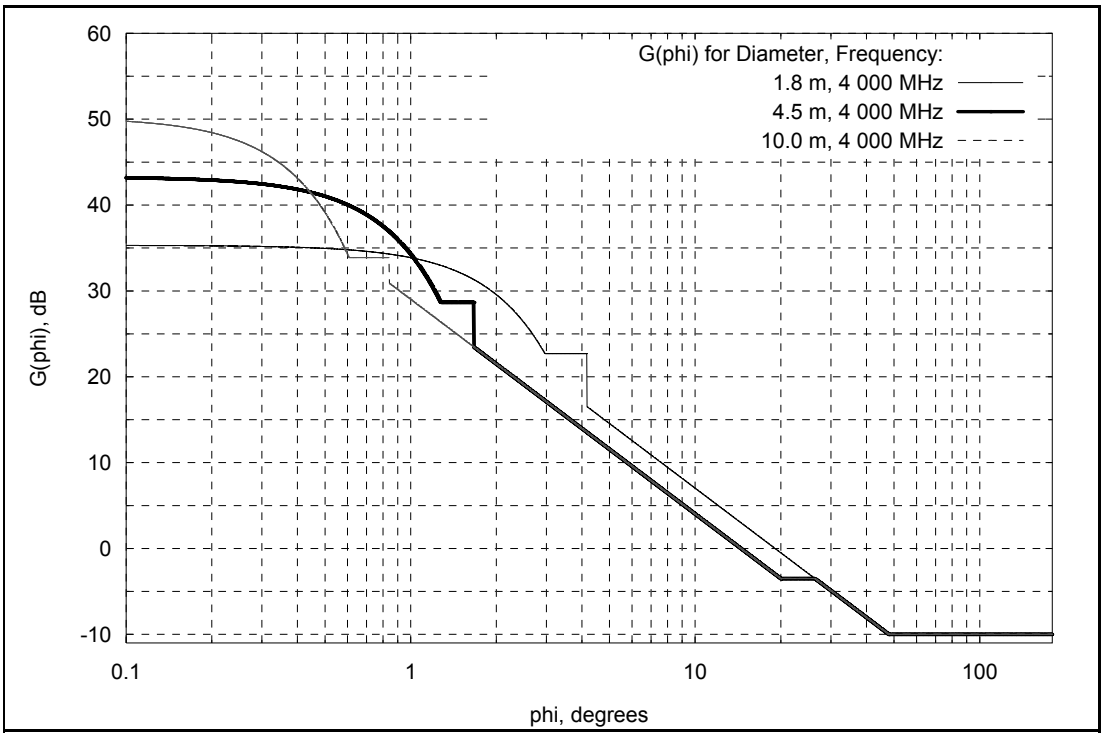
Article 22 (RR-2003) reference receiving earth station antenna pattern for calculation of the epfd radiated by non-geostationary satellite systems in the fixed-satellite service in 3 700-4 200 MHz frequency band.

Antenna efficiency is implicitly set to 0.6.

Maximum antenna gain is not required on input and is calculated from the antenna diameter and frequency.

Note that this pattern has a discontinuity (positive step) at phi_r.

Example



Diameter = 1.8
Frequency = 4000.
Gmax, out = 35.31
D/lambda, out = 24.016
Phi m, out = 2.956
Phi r, out = 4.163
G1, out = 22.707

Diameter = 4.5
Frequency = 4000.
Gmax, out = 43.269
D/lambda, out = 60.041
Phi m, out = 1.272
Phi r, out = 1.665
G1, out = 28.676

Diameter = 10.
Frequency = 4000.
Gmax, out = 50.204
D/lambda, out = 133.425
Phi m, out = 0.605
Phi r, out = 0.841
G1, out = 33.878

Pattern Input Parameters

GainMax	NOVALUE
Diameter	REQUIRED
Frequency	REQUIRED
Efficiency	NOVALUE
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6010	STDC_ERR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().

ID	**20**
Name	**APERR_020V01**
Type	Earth
	Receiving

Description Recommendation ITU-R S.1428-1 reference receiving earth station antenna pattern.

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: -
R1448: -

Version 0 0 1
Revision Date 2007-01-15

References

Reference	Append/Art	Annex	Section	Page	
REC-1428			1	2	.

Co-Polar Component

If $D/\lambda > 100$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$	for	$0° \le \varphi < \varphi_m$
$G = G_1$	for	$\varphi_m \le \varphi < \varphi_r$
$G = 29 - 25 \log \varphi$	for	$\varphi_r \le \varphi < 10°$
$G = 34 - 30 \log \varphi$	for	$10° < \varphi < \varphi_b$
$G = -12$	for	$\varphi_b \le \varphi < 80°$
$G = -7$	for	$80° \le \varphi < 120°$
$G = -12$	for	$120° \le \varphi \le 180°$

If $25 < D/\lambda \le 100$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$	for	$0° \le \varphi < \varphi_m$
$G = G_1$	for	$\varphi_m \le \varphi < \varphi_r$
$G = 29 - 25 \log \varphi$	for	$\varphi_r \le \varphi \le \varphi_b$
$G = -9$	for	$\varphi_b < \varphi \le 80°$
$G = -4$	for	$80° < \varphi \le 120°$
$G = -9$	for	$120° < \varphi \le 180°$

If $20 \le D/\lambda \le 25$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$	for	$0° \le \varphi < \varphi_m$
$G = G_1$	for	$\varphi_m \le \varphi < \varphi_r$
$G = 29 - 25 \log \varphi$	for	$\varphi_r \le \varphi < \varphi_b$
$G = -9$	for	$\varphi_b < \varphi \le 80°$
$G = -5$	for	$80° < \varphi \le 180°$

where: $G_{max} = 7.7 + 20 \log (D/\lambda)$. $\varphi_m = 20\ \lambda/D \sqrt{G_{max} - G_1}$.

$G_1 = 29 - 25 \log \varphi_r$.

$\varphi_b = 34.1°$ for $D/\lambda \ge 100$,
$= 33.1°$ for $D/\lambda < 100$.

$\varphi_r = 15.85 (D/\lambda)^{-0.6}$ for $D/\lambda \ge 100$,
$= 95\ \lambda/D$ for $D/\lambda < 100$.

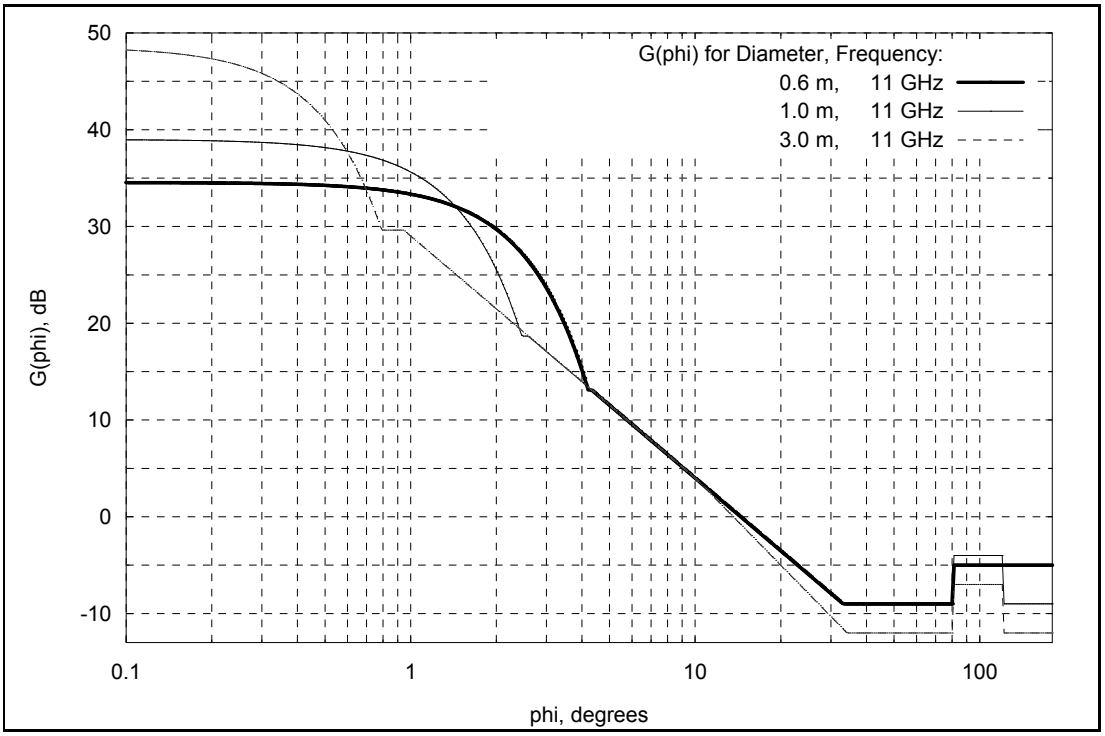
Pattern Information

Recommendation ITU-R S.1428-1 reference FSS earth station radiation pattern for use in interference assessment involving non-GSO satellites in frequency bands between 10.7 GHz and 30 GHz.

Antenna efficiency is implicitly set to 0.6.

Maximum antenna gain is not required on input and is calculated from the antenna diameter and frequency.

Example



Diameter = 0.6
Frequency = 11000.
Gmax, out = 34.554
D/lambda, out = 22.015
Phi m, out = 4.205
Phi r, out = 4.315
G1, out = 13.124

Diameter = 1.
Frequency = 11000.
Gmax, out = 38.991
D/lambda, out = 36.692
Phi m, out = 2.457
Phi r, out = 2.589
G1, out = 18.671

Diameter = 3.
Frequency = 11000.
Gmax, out = 48.53
D/lambda, out = 110.076
Phi m, out = 0.79
Phi r, out = 0.944
G1, out = 29.624

Pattern Input Parameters

GainMax	NOVALUE
Diameter	REQUIRED
Frequency	REQUIRED
Efficiency	NOVALUE
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6002	STDC_ERR_DLAMBDA	Both	D/lambda () is less than 20 ().

ID	**99**
Name	**APEND_099V01**
Type	Earth
	Receiving and Transmitting

Description Non-directional earth station antenna pattern.

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: ND-EARTH
GIMS: ND-EARTH
R1448: -

Version	0	0	1
Revision Date	2003-05-23		

References

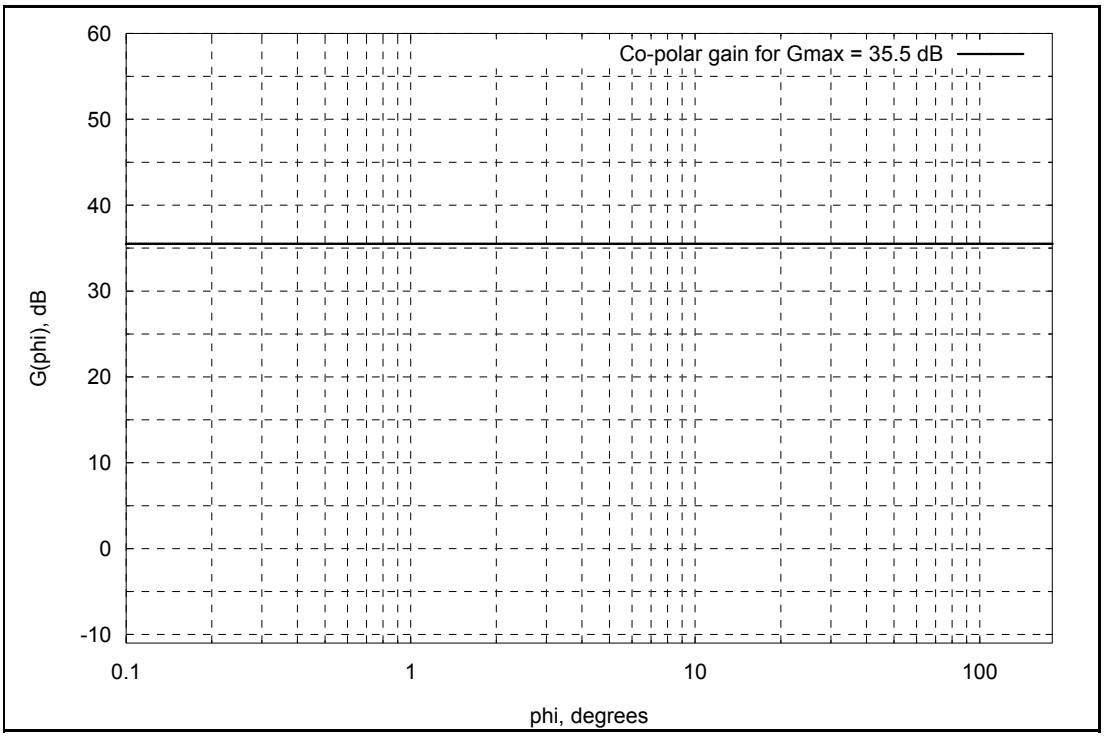
Co-Polar Component

$G = G_{max}$ for all angles

Pattern Information

Non-directional earth station antenna pattern (also known as quasi-omnidirectional) with the maximum isotropic gain.

Example



Gmax = 35.5

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	NOVALUE
Phi	NOVALUE
Phi0	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Low Level Validation Rules

4.2 Space station antenna patterns

ID	**401**
Name	**APSRR_401V01**
Type	Space
	Receiving and Transmitting

Description Appendix 30 and Appendix 30A (RR-2001) reference space station antenna pattern for Region 2. Appendix 30B (RR-2001) space station antenna co-polar pattern for all Regions.

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☑
Region 2 ☑ Relative Gain ☑
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: R123SS
GIMS: AP30BF1, AP30F10X
R1448: -

Version	0	0	2
Revision Date	2003-06-11		

References

Reference	Append/Art	Annex	Section	Page	
RR-2001	AP30-123	5	3.13.3	551	Figure 10, Curve A+C and B, .
RR-2001	AP30A-123	3	4.6.3	687	Figure 7, Curve A+C and B, .
RR-2001	AP30B-30	1	A-1.7.2	722	Figure 1, Curve A+B, .

Co-Polar Component

$G = G_{max} - 12\ (\varphi/\varphi_0)^2$ for $0 \le (\varphi/\varphi_0) \le 1.45$

$G = G_{max} - 22 - 20 \log (\varphi/\varphi_0)$ for $1.45 < (\varphi/\varphi_0)$

Cross-Polar Component

$G_x = G_{max} - 30$

If $G_x > G$: $G_x = G$

Pattern Information

1) Appendix 30 (RR-2001) reference transmitting space station antenna pattern of elliptical cross-section for Region 2 used

for BSS planning.

A minimum value of 0.8 degrees for the half-power beamwidth has been adopted for planning for Region 2. An antenna efficiency of 0.55 was assumed.

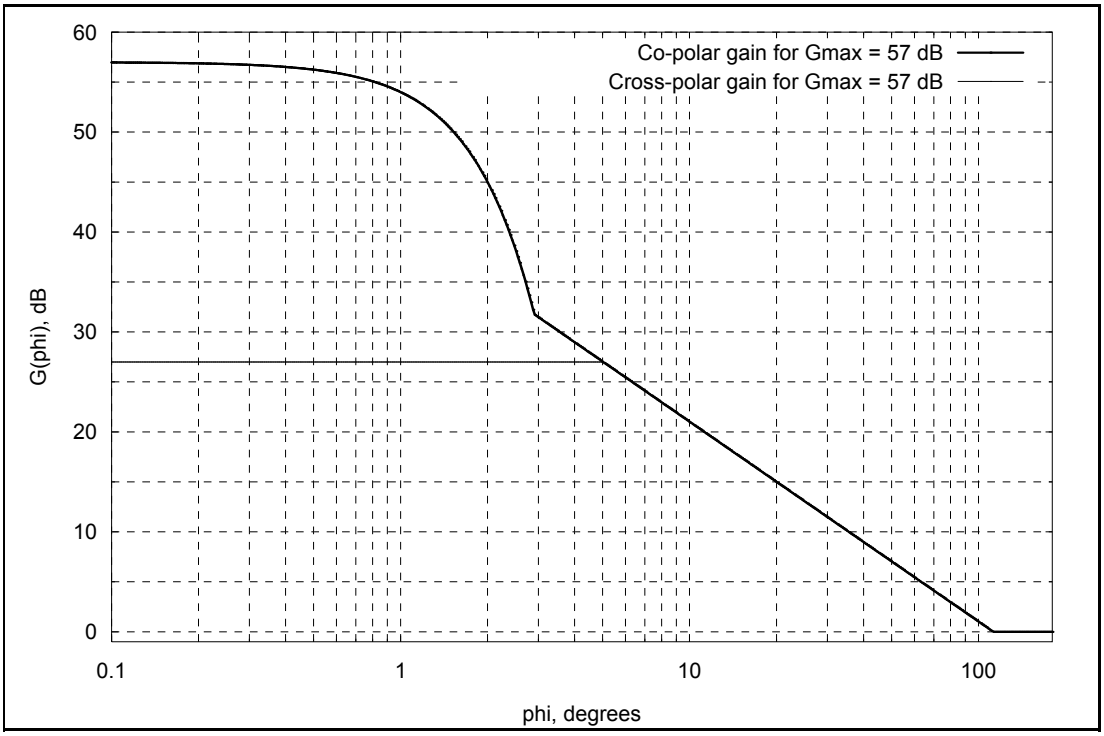
2) Appendix 30A (RR-2001) reference receiving space station antenna pattern for Region 2 used for BSS planning in Region 2.

A minimum value of 0.6 degrees for the half-power beamwidth has been agreed on for planning for Region 2. An antenna efficiency of 0.55 was assumed.

3) Appendix 30B (RR-2001) space station antenna co-polar pattern for receiving and transmitting antennas for all Regions. Used for the determination of coordination requirements and interference assessment in FSS Plan. The Allotment Plan is based on the use of space station antennas with beams of elliptical or circular cross-section.

Antenna efficiency is assumed to be 0.55. The minimum half-power beamwidth is 1.6 degrees for the 6/4 GHz band and 0.8 degrees for the 13/10-11 GHz band.

Example



Gmax = 57
Phi0 = 2

Pattern Input Parameters

GainMax	OPTIONAL
Beamlet	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6032	STDC_WAR_CX_IS_0	Cross-polar	Gmax () is less than 30 (). Cx pattern is zero. Gmax is too low.

ID	**402**
Name	**APSRR_402V01**
Type	Space
	Receiving and Transmitting
	Fast Roll-Off

Description Appendix 30, Appendix 30A and Appendix 30B (RR-2001) fast roll-off reference space station antenna pattern for all Regions.

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☑
Region 2 ☑ Relative Gain ☑
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: R123FR
GIMS: AP30BF2, AP30F11X, AP30AFCX
R1448: -

Version 0 0 2
Revision Date 2003-06-11

References

Reference	Append/Art	Annex	Section	Page	
RR-2001	AP30-124	5	3.13.3	552	Figure 11A and 11B, Curve A+C and B, .
RR-2001	AP30A-114	3	3.7.3	678	Figure C, Curve A+C and B, .
RR-2001	AP30A-123	3	4.6.3	687	Figure 8, Curve A+C and B, .
ROP-2002	AP30A		Part A1	21	attachment 1 to Rules concerning Appendix 30A.
RR-2001	AP30B-31	1	A-1.7.2	723	Figure 2, Curve A+B, .
ROP-2002	AP30B		Part A1	20	attachment 1 to Rules concerning Appendix 30B.

Co-Polar Component

$G = G_{max} - 12\,(\varphi/\varphi_0)^2$ for $0 \le (\varphi/\varphi_0) \le 0.5$

$$G = G_{max} - 12 \left(\frac{\frac{\varphi}{\varphi_0} - x}{\frac{B_{min}}{\varphi_0}} \right)^2 \quad \text{for } 0.5 < (\varphi/\varphi_0) \le \left(\frac{1.45}{\varphi_0} B_{min} + x \right)$$

$G = G_{max} - 25.23$ for $\left(\frac{1.45}{\varphi_0} B_{min} + x \right) < (\varphi/\varphi_0) \le 1.45$

$G = G_{max} - 22 - 20 \log (\varphi/\varphi_0)$ for $1.45 < (\varphi/\varphi_0)$

where:

$x = 0.5\,(1 - B_{min} / \varphi_0)$

Cross-Polar Component

$G_x = G_{max} - 30$

If $G_x > G$: $G_x = G$

Pattern Information

1) Appendix 30 (RR-2001) fast roll-off reference transmitting space station antenna pattern for Regions 1, 2 and 3 used for

BSS planning when it was necessary to reduce interference.

A minimum value of 0.6 degrees for the half-power beamwidth has been adopted for planning for Regions 1 and 3, and 0.8 degrees for Region 2. An antenna efficiency of 0.55 was assumed. This pattern is derived from an antenna producing an elliptical beam with fast roll-off in the main lobe assuming a "beamlet" of 0.6 degrees for Regions 1 and 3 and 0.8 degrees for Region 2.

2) Appendix 30A (RR-2001) fast roll-off reference receiving space station antenna pattern for Regions 1 and 3 used for BSS planning when it was necessary to reduce co-polar interference.

A minimum value of 0.6 degrees for the half-power beamwidth has been adopted for planning for Regions 1 and 3. An antenna efficiency of 0.55 was assumed. This pattern is derived from an antenna producing an elliptical beam with fast roll-off in the main lobe assuming a "beamlet" of 0.6 degrees for Regions 1 and 3. For planning purposes at WRC-97 an antenna diameter of 5 m for the band 17.3-18.1 GHz and 6 m for the band 14.5-14.8 GHz were assumed. The on-axis gain was taken as 57 dBi.

3) Appendix 30A (RR-2001) fast roll-off reference receiving space station antenna pattern for Region 2 used for BSS planning where it was necessary to reduce interference.

A minimum value of 0.6 degrees for the half-power beamwidth has been agreed on for planning. An antenna efficiency of 0.55 was assumed. This pattern is derived from an antenna producing an elliptical beam with fast roll-off in the main lobe assuming a "beamlet" of 0.6 degrees for Region 2.

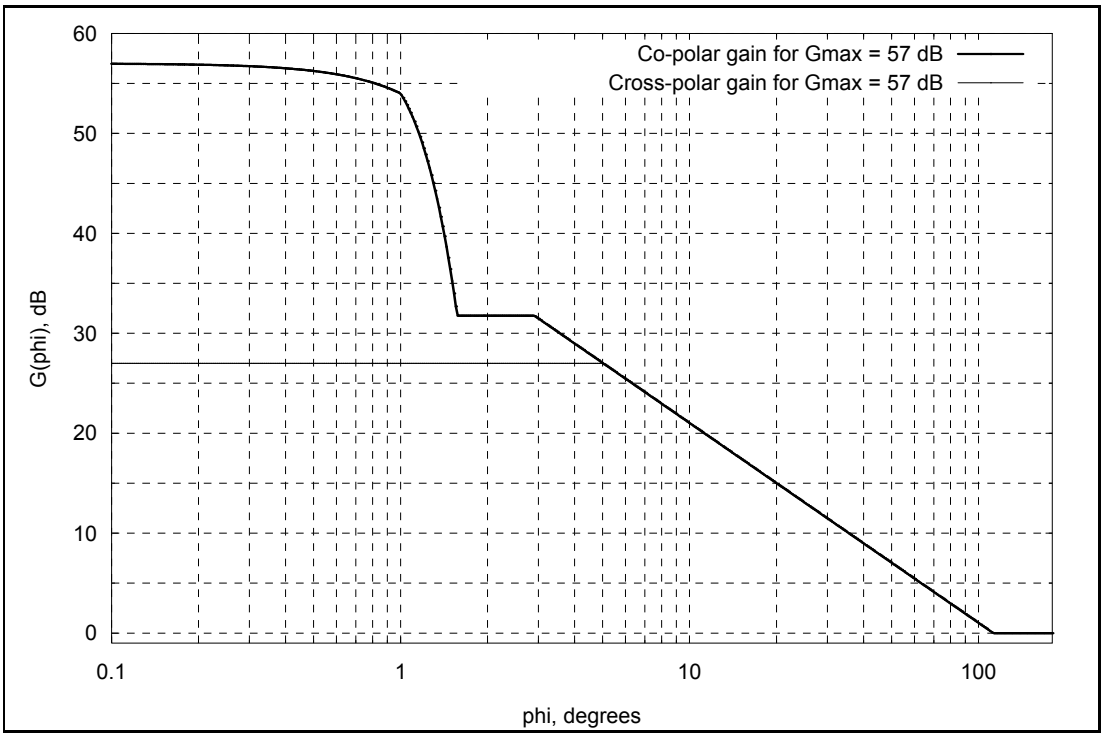
The pattern was corrected as in ITU Rules of Procedure, 2002, Rules concerning Appendix 30A.

4) Appendix 30B (RR-2001) space station antenna co-polar pattern for receiving and transmitting fast roll-off antennas for all Regions. Used for the determination of coordination requirements and interference assessment in FSS Plan when so specified by administrations. The Allotment Plan is based on the use of space station antennas with beams of elliptical or circular cross-section.

Antenna efficiency is assumed 0.55. The minimum half-power beamwidth is 1.6 degrees for the 6/4 GHz band and 0.8 degrees for the 13/10-11 GHz band. The "beamlet" value of 0.6 degrees for the 6/4 GHz band and 0.8 degrees for the 13/10-11 GHz bands are assumed.

The pattern was corrected as in ITU Rules of Procedure, 2002, Rules concerning Appendix 30B.

Example



Gmax = 57
Bmin = 0.6
Phi0 = 2

Pattern Input Parameters

GainMax	OPTIONAL
Beamlet	REQUIRED

Specific Parameters Structure Size

0

Required Specific Parameters

-

Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6011	STDC_WAR_PHI0_LT_BMIN	Co-polar	Phi0 () is less than Bmin ().
6032	STDC_WAR_CX_IS_0	Cross-polar	Gmax () is less than 30 (). Cx pattern is zero. Gmax is too low.

ID	**403**
Name	**APSRR_403V01**
Type	Space
	Receiving

Description Appendix 30A (RR-2001) reference receiving space station antenna pattern for Regions 1 and 3 (WARC Orb-88).

Start Date | **End Date** 1997-10-26

Region 1 ☑ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☑
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: R13RSS
GIMS: AP30AFB, AP30AFBX
R1448: -

Version 0 0 2
Revision Date 2003-06-11

References

Reference	Append/Art	Annex	Section	Page	
RR-2001	AP30A-113	3	3.7.3	677	Figure B, Curve A+C and B, WARC Orb-88.

Co-Polar Component

$G = G_{max} - 12\ (\varphi/\varphi_0)^2$ for $0 \le (\varphi/\varphi_0) < 1.3$

$G = G_{max} - 17.5 - 25 \log (\varphi/\varphi_0)$ for $1.3 \le (\varphi/\varphi_0)$

Cross-Polar Component

$G_x = G_{max} - 30 - 12\ (\varphi/\varphi_0)^2$ for $0 \le (\varphi/\varphi_0) \le 0.5$

$G_x = G_{max} - 33$ for $0.5 < (\varphi/\varphi_0) \le 1.67$

$G_x = G_{max} - 40 - 40 \log (\varphi/\varphi_0 - 1)$ for $1.67 < (\varphi/\varphi_0)$

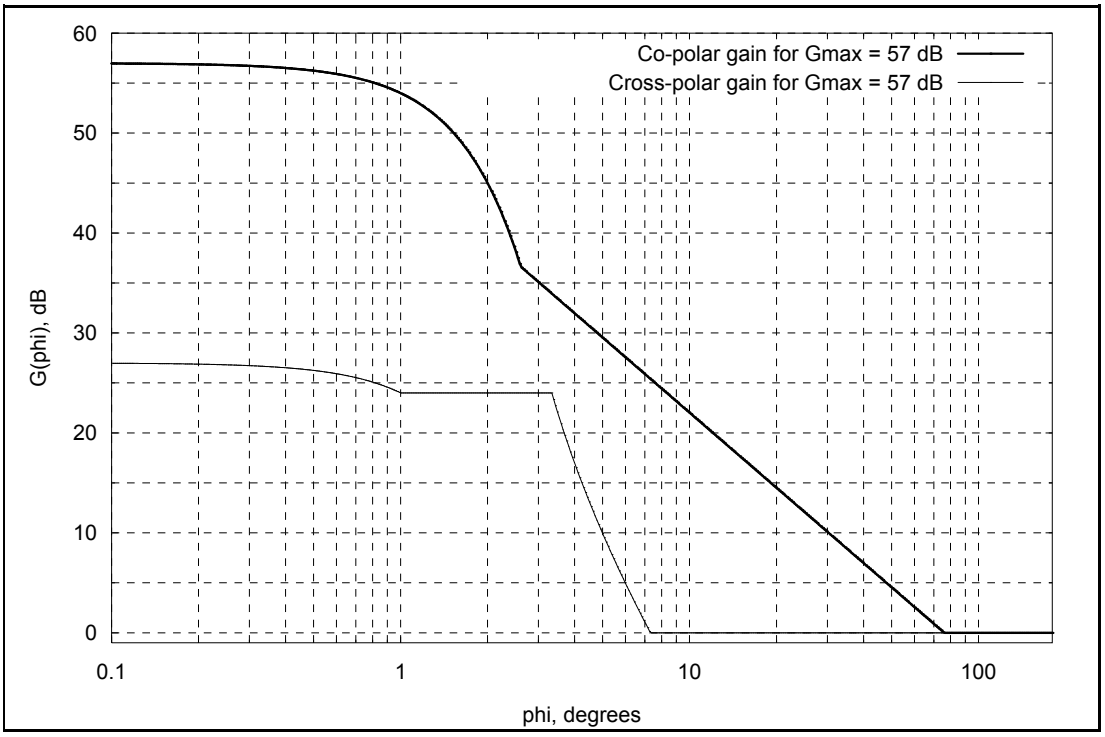
Pattern Information

Appendix 30A (RR-2001) reference receiving satellite antenna pattern for Regions 1 and 3.

Used in the original 1988 feeder-link Plan (WARC Orb-88) and for the assignments notified and brought into use before 27 October 1997.

A minimum value of 0.6 degrees for the half-power beamwidth has been used for planning for Regions 1 and 3. An antenna efficiency of 0.55 was assumed.

Example



Gmax = 57
Phi0 = 2

Pattern Input Parameters

GainMax	OPTIONAL
Beamlet	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6032	STDC_WAR_CX_IS_0	Cross-polar	Gmax () is less than 30 (). Cx pattern is zero. Gmax is too low.

ID 404
Name APSRR_404V01
Type Space / Receiving

Description Appendix 30A (RR-2001) reference receiving space station antenna pattern for Regions 1 and 3 (WRC-97).

Start Date 1997-01-01 **End Date**

Region 1 ☑ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☑
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: MODRSS
GIMS: AP30AFBP
R1448: -

Version 0 0 2
Revision Date 2003-06-11

References

Reference	Append/Art	Annex	Section	Page	
RR-2001	AP30A-113	3	3.7.3	677	Figure B, Curve A'+C and B', WRC-97.
REC-1296				2	Figure 1, Curve A'+C and B', .

Co-Polar Component

$G = G_{max} - 12\ (\varphi/\varphi_0)^2$ for $0 \le (\varphi/\varphi_0) < 1.3$

$G = G_{max} - 17.5 - 25 \log (\varphi/\varphi_0)$ for $1.3 \le (\varphi/\varphi_0)$

Cross-Polar Component

$G_x = G_{max} - 35$ for $0 \le (\varphi/\varphi_0) < 1.75$

$G_x = G_{max} - 40 - 40 \log (\varphi/\varphi_0 - 1)$ for $1.75 \le (\varphi/\varphi_0)$

Pattern Information

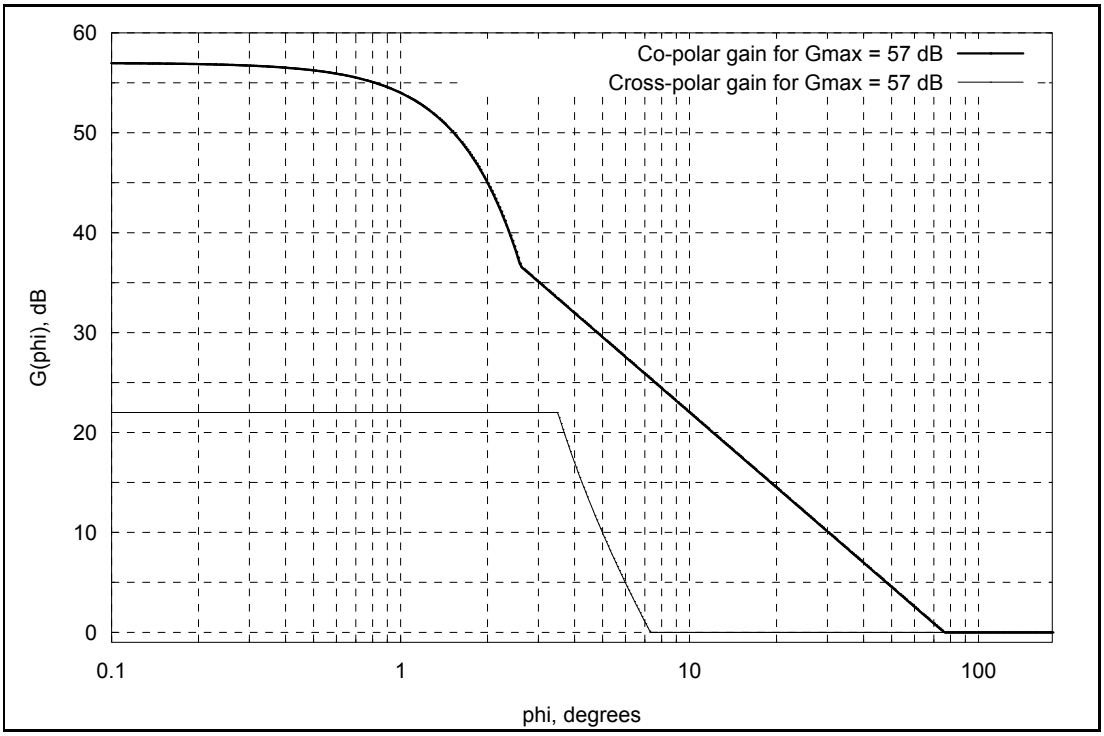
Appendix 30A (RR-2001) reference receiving satellite antenna pattern for Regions 1 and 3.

Used for replanning at WRC-97 and specified in Recommendation ITU-R BO.1296.

A minimum value of 0.6 degrees for the half-power beamwidth has been used for planning for Regions 1 and 3. An antenna efficiency of 0.55 was assumed.

For planning purposes at WRC-97 antenna diameters of 5 m for the band 17.3-18.1 GHz and 6 m for the band 14.5-14.8 GHz were assumed. The on-axis gain was taken as 57 dBi.

Example



Gmax = 57
Phi0 = 2

Pattern Input Parameters

GainMax	OPTIONAL
Beamlet	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6032	STDC_WAR_CX_IS_0	Cross-polar	Gmax () is less than 35 (). Cx pattern is zero. Gmax is too low.

ID 405
Name APSRR_405V01
Type Space Transmitting

Description Appendix 30 (RR-2001) reference transmitting space station antenna pattern for Regions 1 and 3.

Start Date

End Date

Region 1 ☑ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☑
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: R13TSS
GIMS: AP30F9, AP30F9X
R1448: -

Version 0 0 2
Revision Date 2003-06-11

References

Reference	Append/Art	Annex	Section	Page	
RR-2001	AP30-122	5	3.13.3	550	Figure 9, Curve A+C and B, .

Co-Polar Component

$G = G_{max} - 12\,(\varphi/\varphi_0)^2$ for $0 \le (\varphi/\varphi_0) \le 1.58$

$G = G_{max} - 30$ for $1.58 < (\varphi/\varphi_0) \le 3.16$

$G = G_{max} - 17.5 - 25 \log (\varphi/\varphi_0)$ for $3.16 < (\varphi/\varphi_0)$

Cross-Polar Component

$G_x = G_{max} - 40 - 40 \log \left| \frac{\varphi}{\varphi_0} - 1 \right|$ for $0 \le (\varphi/\varphi_0) \le 0.33$

$G_x = G_{max} - 33$ for $0.33 < (\varphi/\varphi_0) \le 1.67$

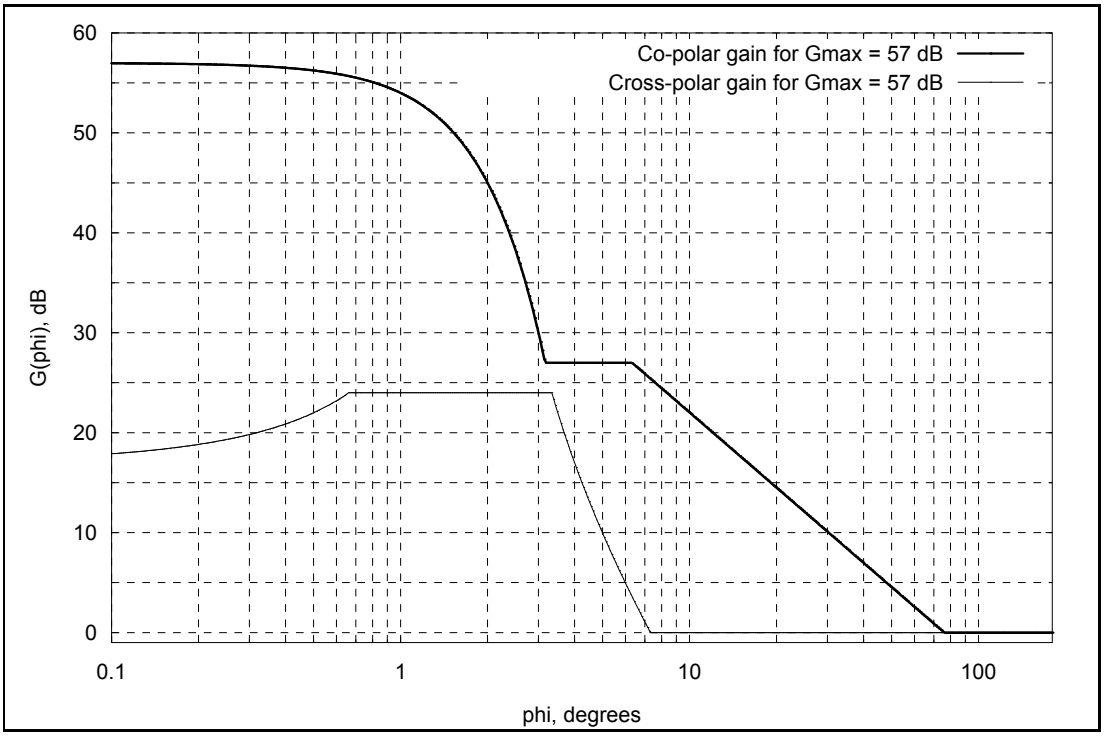
$G_x = G_{max} - 40 - 40 \log \left| \frac{\varphi}{\varphi_0} - 1 \right|$ for $1.67 < (\varphi/\varphi_0)$

Pattern Information

Appendix 30 (RR-2001) reference transmitting space station antenna pattern of elliptical cross-section for Regions 1 and 3 used for BSS planning.

A minimum value of 0.6 degrees for the half-power beamwidth has been adopted for planning for Regions 1 and 3. An antenna efficiency of 0.55 was assumed.

Example



Gmax = 57
Phi0 = 2

Pattern Input Parameters

GainMax	OPTIONAL
Beamlet	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6032	STDC_WAR_CX_IS_0	Cross-polar	Gmax () is less than 33 (). Cx pattern is zero. Gmax is too low.

ID	**406**
Name	**APSRR_406V01**
Type	Space
	Transmitting
	Fast Roll-Off

Description Appendix 30 (RR-2001) improved fast roll-off transmitting space station antenna pattern for Regions 1 and 3 (WRC-2000).

Start Date 2000-01-01 **End Date**

Region 1 ☑ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☑
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: MOD13FRTSS
GIMS: MOD13FR, MOD13FRX
R1448: -

Version 0 0 2
Revision Date 2003-06-11

References

Reference	Append/Art	Annex	Section	Page	
RR-2001	AP30-127	5	3.13.3	555	Figure 13, Curve A+C and B, WRC-2000.
REC-1445		1		2	Figure 1, Curve A+C and B, .

Co-Polar Component

$G = G_{max} + \Delta G$

$\Delta G = \text{Min}(\Delta G_1, \Delta G_2)$

$\Delta G_1 = -12\,(\varphi/\varphi_0)^2$ for $0 \le (\varphi/\varphi_0) \le 0.5$

$\Delta G_1 = -12 \left(\dfrac{\dfrac{\varphi}{\varphi_0} - x}{\dfrac{B_{min}}{\varphi_0}} \right)^2$ for $0.5 < (\varphi/\varphi_0) \le \left(\dfrac{1.45}{\varphi_0} B_{min} + x \right)$

$\Delta G_1 = -25.3$ for $\left(\dfrac{1.45}{\varphi_0} B_{min} + x \right) < (\varphi/\varphi_0) \le 1.45$

$\Delta G_1 = -22 - 20 \log (\varphi/\varphi_0)$ for $1.45 < (\varphi/\varphi_0)$

$\Delta G_2 = -12\,(\varphi/\varphi_0)^2$ for $0 \le (\varphi/\varphi_0) \le 1.58$

$\Delta G_2 = -30$ for $1.58 < (\varphi/\varphi_0) \le 3.16$

$\Delta G_2 = -17.5 - 25 \log (\varphi/\varphi_0)$ for $3.16 < (\varphi/\varphi_0)$

where:

$B_{min} = 0.6°$ for Regions 1 and 3.

$x = 0.5\,(1 - B_{min} / \varphi_0)$.

Cross-Polar Component

$G_x = G_{max} - 40 - 40 \log \left| \dfrac{\varphi}{\varphi_0} - 1 \right|$ for $0 \le (\varphi/\varphi_0) \le 0.33$

$G_x = G_{max} - 33$ for $0.33 < (\varphi/\varphi_0) \le 1.67$

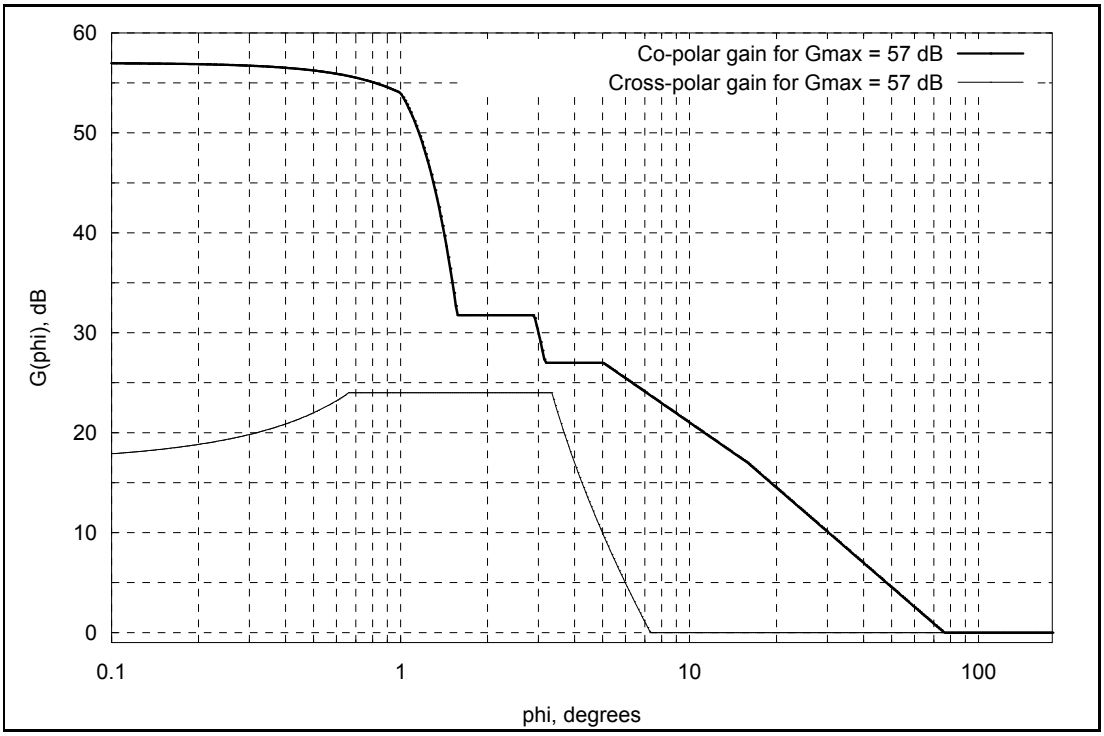
$G_x = G_{max} - 40 - 40 \log \left| \dfrac{\varphi}{\varphi_0} - 1 \right|$ for $1.67 < (\varphi/\varphi_0)$

Pattern Information

Appendix 30 (RR-2001) improved fast roll-off transmitting space station antenna pattern for Regions 1 and 3. Has been used in the replanning at WRC-2000.

A "beamlet" is 0.6 degrees for Regions 1 and 3. A minimum value of 0.6 degrees for the half-power beamwidth has been adopted for planning for Regions 1 and 3. An antenna efficiency of 0.55 was assumed.

Example



Gmax = 57
Bmin = 0.6
Phi0 = 2

Pattern Input Parameters

GainMax	OPTIONAL
Beamlet	REQUIRED

Specific Parameters Structure Size

0

Required Specific Parameters

-

Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6011	STDC_WAR_PHI0_LT_BMIN	Co-polar	Phi0 () is less than Bmin ().
6032	STDC_WAR_CX_IS_0	Cross-polar	Gmax () is less than 33 (). Cx pattern is zero. Gmax is too low.

ID 407
Name APSREC407V01
Type Space
Receiving and Transmitting

Description Recommendation ITU-R S.672-4 space station antenna pattern in FSS for Ls = -10 dB.

Start Date

End Date

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☑
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: -
R1448: -

Version 0 0 1
Revision Date 2007-01-15

References

Reference	Append/Art	Annex	Section	Page	
REC-672		1	1.1	6	Formula I-IV, Figure 1, Ls = -10 dB.

Co-Polar Component

$G = G_{max} - 12\,(\varphi/\varphi_0)^2$ for $0 \le (\varphi/\varphi_0) \le a/2$

$G = G_{max} + L_s$ for $a/2 < (\varphi/\varphi_0) \le b/2$

$G = G_{max} + L_s + 20 - 25 \log (2\varphi/\varphi_0)$ for $b/2 < (\varphi/\varphi_0)$

where:

$L_s = -10$ dB

$a = 1.83$

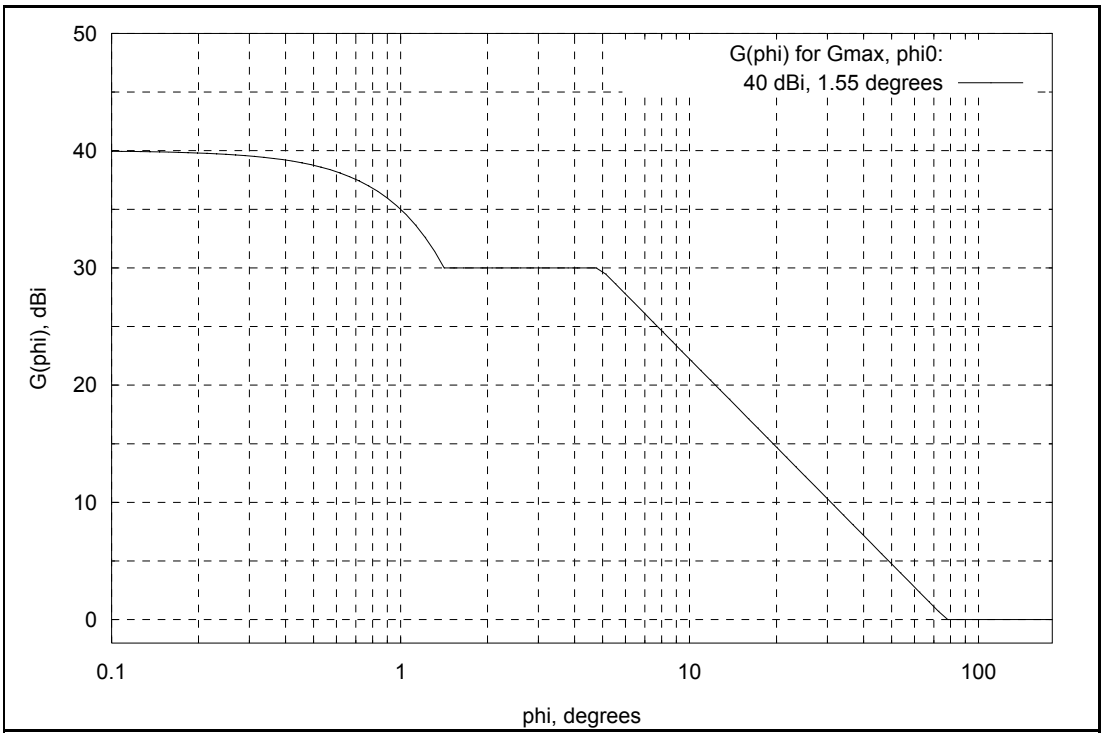
$b = 6.32$

Pattern Information

Recommendation ITU-R S.672-4 space station antenna pattern for use as a designe objective in the FSS employing geostationary satellites. Single feed circular beams.

Ls = -10 dB for use in article 22, table 22-2.

Example



Gmax = 40
Phi0 = 1.55

Pattern Input Parameters

GainMax	OPTIONAL
Beamlet	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Low Level Validation Rules

ID 408
Name APSREC408V01
Type Space
Receiving and Transmitting

Description Recommendation ITU-R S.672-4 space station antenna pattern in FSS for Ls = -20 dB.

Start Date

End Date

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☑
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: -
R1448: -

Version 0 0 1
Revision Date 2007-01-15

References

Reference	Append/Art	Annex	Section	Page	
REC-672		1	1.1	6	Formula I-IV, Figure 1, Ls = -20 dB.

Co-Polar Component

$G = G_{max} - 12\,(\varphi/\varphi_0)^2$ for $0 \le (\varphi/\varphi_0) \le a/2$

$G = G_{max} + L_s$ for $a/2 < (\varphi/\varphi_0) \le b/2$

$G = G_{max} + L_s + 20 - 25 \log (2\varphi/\varphi_0)$ for $b/2 < (\varphi/\varphi_0)$

where:

$L_s = -20$ dB

$a = 2.58$

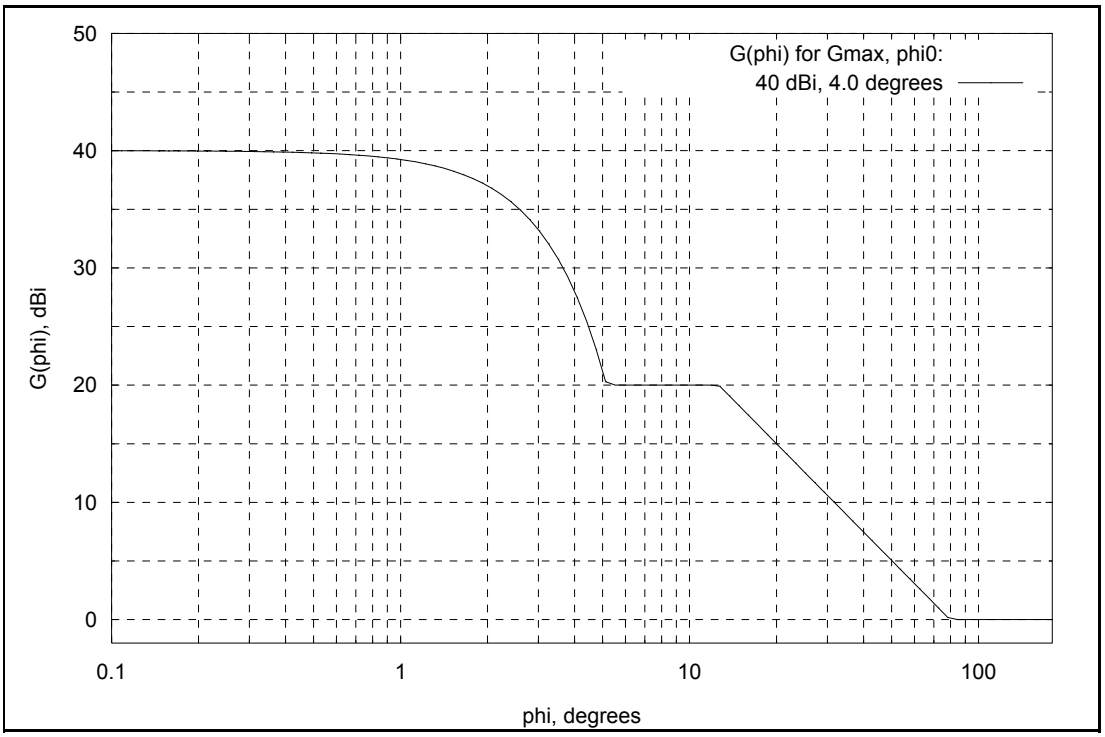
$b = 6.32$

Pattern Information

Recommendation ITU-R S.672-4 space station antenna pattern for use as a designe objective in the FSS employing geostationary satellites. Single feed circular beams.

Ls = -20 dB for use in article 22, tables 22-2 and 22-3.

Example



Gmax = 40
Phi0 = 4.0

Pattern Input Parameters

GainMax	OPTIONAL
Beamlet	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Low Level Validation Rules

ID 499
Name APSND_499V01
Type Space
Receiving and Transmitting

Description Non-directional space station antenna pattern.

Start Date

End Date

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☑
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: ND-SPACE
GIMS: ND-SPACE
R1448: -

Version 0 0 1
Revision Date 2003-05-23

References

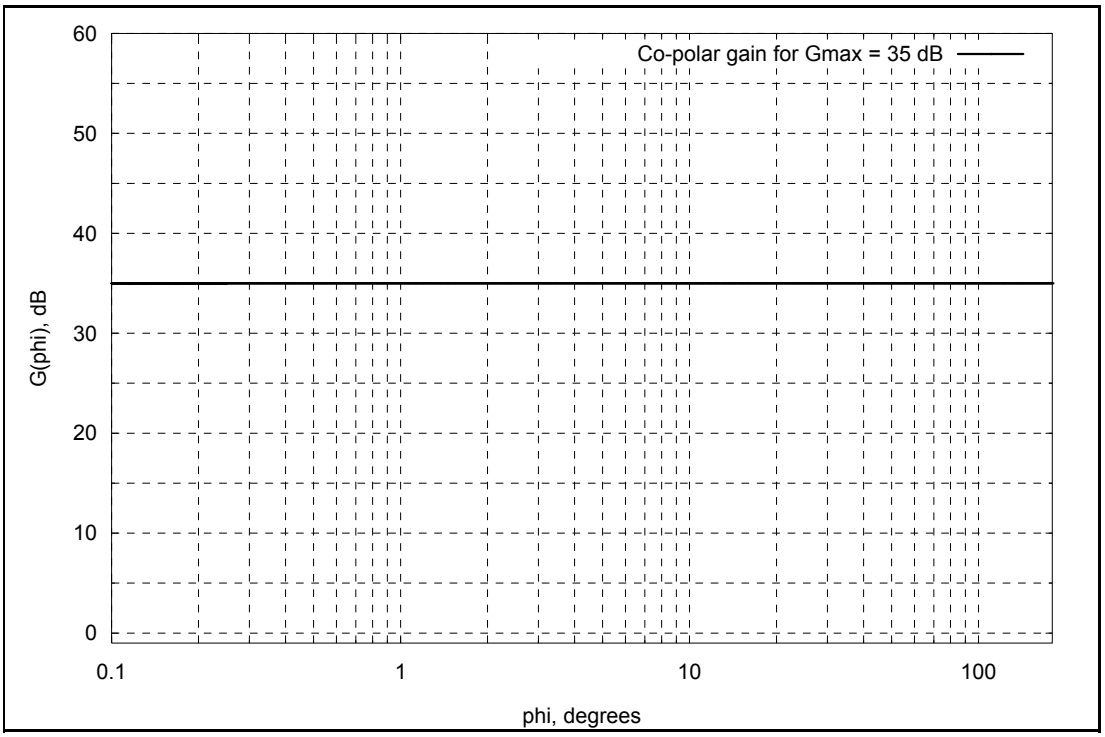
Co-Polar Component

$G = G_{max}$ for all angles

Pattern Information

Non-directional space station antenna pattern (also known as quasi-omnidirectional) with the maximum isotropic gain.

Example



Gmax = 35

Pattern Input Parameters

GainMax	OPTIONAL
Beamlet	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Specific	NOVALUE
Phi	NOVALUE
Phi0	NOVALUE

Low Level Validation Rules

5. NON STANDARD ANTENNA PATTERNS

5.1 Earth station antenna patterns

ID	**801**
Name	**APENST801V01**
Type	Earth
	Receiving and Transmitting

Description Non-standard OBSOLETE earth station antenna pattern similar to that in Recommendation ITU-R S.465-3, where the side-lobe radiation is represented by the expression CoefA - 25 log(phi).

Start Date | **End Date** 1992-12-31

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: -
R1448: 7

Version 0 0 1
Revision Date 2003-05-23

References

Co-Polar Component

If $D/\lambda > 100$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = \text{Max}(\text{CoefA} - 25 \log \varphi, -10)$ for $\varphi_r \le \varphi \le 180°$

If $D/\lambda \le 100$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 52 - 10 \log (D/\lambda) - 25 \log \varphi$ for $\varphi_r \le \varphi < \varphi_b$

$G = 10 - 10 \log (D/\lambda)$ for $\varphi_b \le \varphi \le 180°$

where:

$$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta\pi^2}}. \qquad \varphi_m = 20\ \lambda/D\ \sqrt{G_{max} - G_1}\ .$$

G_1 = CoefA for $D/\lambda > 100$,
= $2 + 15 \log (D/\lambda)$ for $D/\lambda \le 100$.

φ_r = 1° for $D/\lambda > 100$,
= $100\ \lambda/D$ for $D/\lambda \le 100$.

$\varphi_b = 10^{\left(\frac{\text{CoefA}+10}{25}\right)}$ for $D/\lambda > 100$,

$= 10^{\left(\frac{42}{25}\right)}$ for $D/\lambda \le 100$.

Pattern Information

Non-standard OBSOLETE earth station antenna pattern similar to that in Recommendation ITU-R S.465-3, where the side-lobe radiation is represented by the expression CoefA - 25 log(phi).

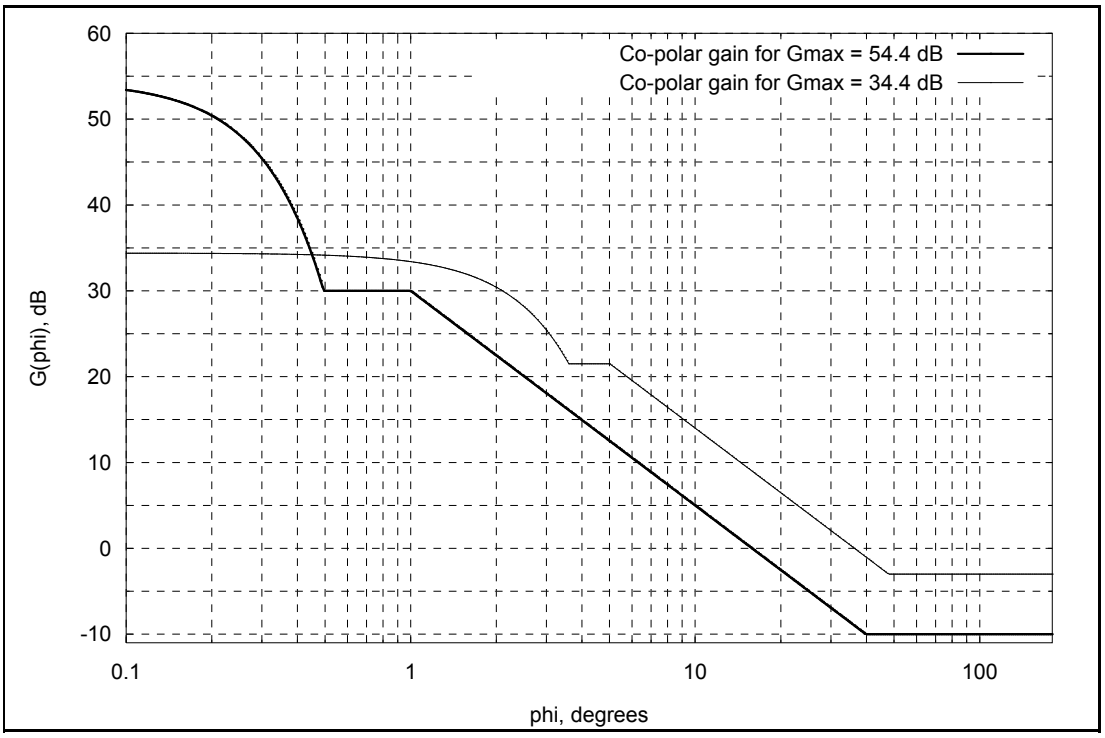
Use, when possible, current version of the Recommendation ITU-R: S.465-5 (APENST806V01).

Pattern is extended in the main-lobe range similar to Appendix 8 of RR-2001.

If efficiency is not specified, a value of 0.7 is to be applied for FSS Plan and a value of 0.6 is to be applied for "non-planned" services.

For D/lambda < 100 provided CoefA is ignored and a standard value of CoefA=32 is applied.

Example



Gmax = 54.4
Efficiency = 0.7
CoefA, inout = 30.
Phi m, out = 0.49
Phi r, out = 1.
Phi b, out = 39.81
D/lambda, out = 199.66
G1, out = 30.

Gmax = 34.4
Efficiency = 0.7
CoefA, inout = 30.
Phi m, out = 3.6
Phi r, out = 5.01
Phi b, out = 47.86
D/lambda, out = 19.97
G1, out = 21.5

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	REQUIRED
Specific	REQUIRED
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

coefA

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6014	STDC_ERR_COEFA_LIM	Both	CoefA () is out of limits [18:47].
-6010	STDC_ERR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().
-6001	STDC_ERR_GMAX_LT_G1	Both	Gmax () is less than G1 (). Square root of negative value.
6002	STDC_WAR_DLAMBDA	Both	D/lambda () is less than 100 (). CoefA is ignored.
6009	STDC_WAR_PHIR_LT_PHIM	Both	Phi r () is less than Phi m ().

ID	**802**
Name	**APENST802V01**
Type	Earth
	Receiving and Transmitting

Description Non-standard generic earth station antenna pattern described by 4 main coefficients: A, B, C, D and angle phi1. Minimum antenna gain (Gmin) must be provided.

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: -
R1448: 5

Version	0	0	1
Revision Date	2003-05-23		

References

Co-Polar Component

$G = G_{max}$ for $0° \le \varphi < 1°$

$G = CoefA - CoefB * \log \varphi$ for $1° \le \varphi \le Phi1$

$G = Max(Min(G(Phi1), CoefC - CoefD * \log \varphi), G_{min})$ for $Phi1 < \varphi \le 180°$

If $G > G_{max}$: $G = G_{max}$

If $G < G_{min}$: $G = G_{min}$

Pattern Information

Non-standard generic earth station antenna pattern described by 4 main coefficients: A, B, C, D and angle phi1. Minimum antenna gain (Gmin) must be provided.

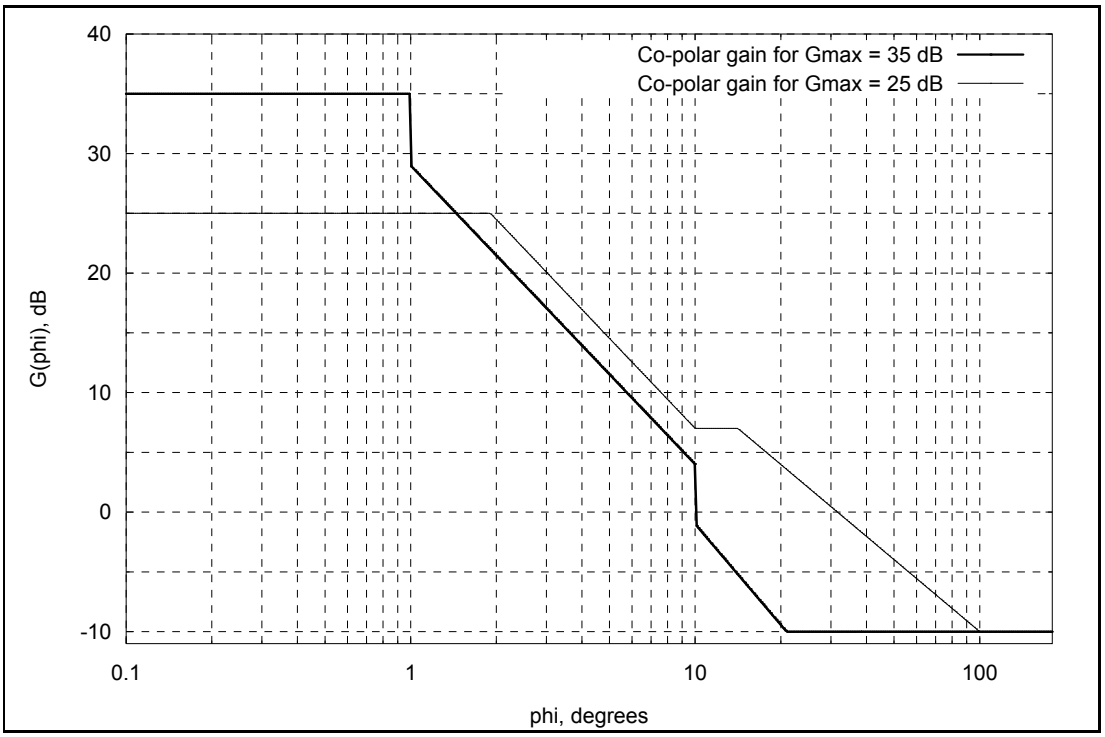
Pattern is equal to maximum antenna gain in the main-lobe range (for off-axis angles less than 1 degree).

A ceiling of maximum antenna gain is applied for the pattern.
A flooring of minimum antenna gain is applied for the pattern.

If the minimum antenna gain (Gmin) is unknown, a value of -10 dB must be set.

The pattern is similar to APENST807V01 but Gmin is taken from STDT_EarthSpecificStruct.

Example



Gmax = 35
CoefA, inout = 29.
CoefB, inout = 25.
CoefC, inout = 27.
CoefD, inout = 28.
Gmin, out = -10.
Phi r, out = 1.
Phi1, out = 10.
Phi b, out = 20.96

Gmax = 25
CoefA, inout = 32.
CoefB, inout = 25.
CoefC, inout = 30.
CoefD, inout = 20.
Gmin, out = -10.
Phi r, out = 1.
Phi1, out = 10.
Phi b, out = 100.

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	REQUIRED
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

coefA, coefB, coefC, coefD, phi1, gmin

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6020	STDC_ERR_GMIN	Both	Gmin () is out of limits [-100:Gmax].
-6018	STDC_ERR_NSTD_PHI1	Both	Phi1 () is out of limits [1.0:99.9].
-6017	STDC_ERR_COEFD	Both	CoefD () is out of limits [10:50].
-6016	STDC_ERR_COEFC	Both	CoefC () is out of limits [18:47].
-6015	STDC_ERR_COEFB	Both	CoefB () is out of limits [10:50].
-6014	STDC_ERR_COEFA_LIM	Both	CoefA () is out of limits [18:47].

ID	**803**
Name	**APENST803V01**
Type	Earth
	Receiving and Transmitting

Description Non-standard generic earth station antenna pattern similar to that in Appendix 30B (RR-2001), where the side-lobe radiation is represented by the expression CoefA - 25 log(phi).

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: AP30B
GIMS: -
R1448: -

Version	0	0	1
Revision Date	2003-05-23		

References

Co-Polar Component

If $D/\lambda \geq 100$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \leq \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \leq \varphi < \varphi_r$

$G = CoefA - 25 \log \varphi$ for $\varphi_r \leq \varphi < \varphi_b$

$G = -10$ for $\varphi_b \leq \varphi \leq 180°$

If $D/\lambda < 100$:

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \leq \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \leq \varphi < \varphi_r$

$G = CoefA + 20 - 10 \log (D/\lambda) - 25 \log \varphi$ for $\varphi_r \leq \varphi < \varphi_b$

$G = 10 - 10 \log (D/\lambda)$ for $\varphi_b \leq \varphi \leq 180°$

where:

$$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta\pi^2}}. \qquad \varphi_b = 10^{\left(\frac{CoefA+10}{25}\right)}.$$

$G_1 = 15 \log (D/\lambda) - 30 + CoefA$. $\varphi_m = 20\ \lambda/D\ \sqrt{G_{max} - G_1}$.

$\varphi_r = 15.85\ (D/\lambda)^{-0.6}$ for $D/\lambda \geq 100$,

$= 100\ \lambda/D$ for $D/\lambda < 100$.

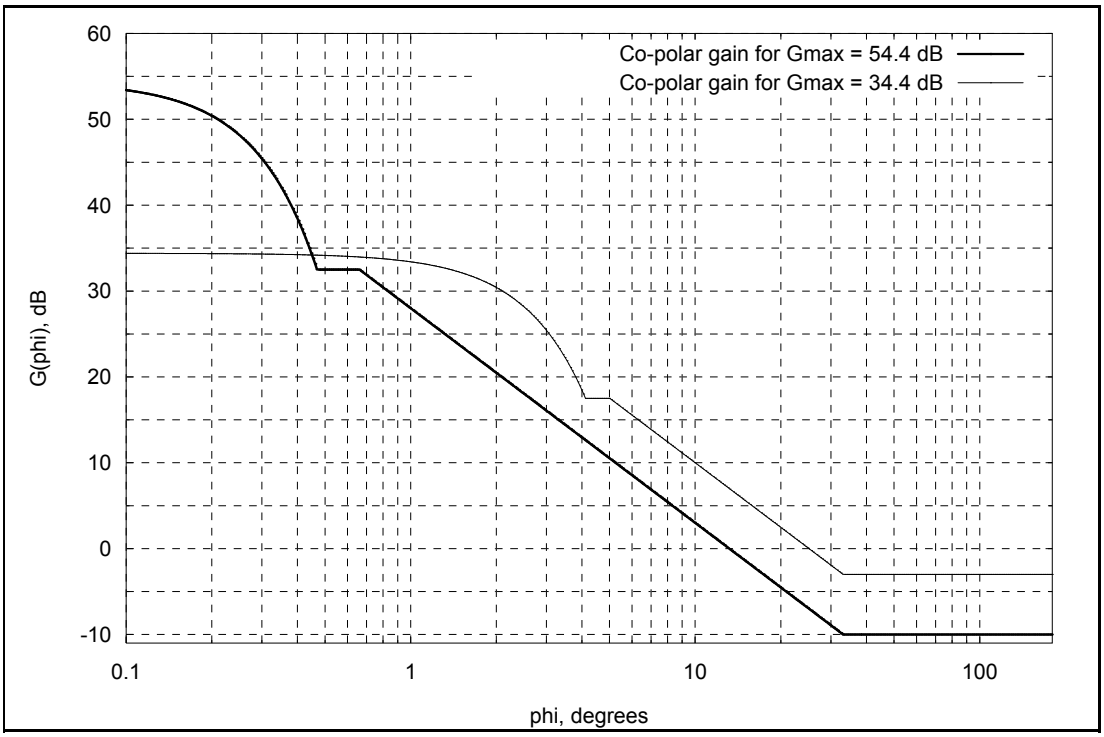
Pattern Information

Non-standard generic earth station antenna pattern similar to that in Appendix 30B (RR-2001), where the side-lobe radiation is represented by the expression CoefA - 25 log(phi).

Used by some administrations in submissions under Appendix 30B.

If efficiency is not specified, a value of 0.7 is to be applied for FSS Plan.

Example



Gmax = 54.4
Efficiency = 0.7
CoefA, inout = 28.
Phi m, out = 0.47
Phi r, out = 0.66
Phi b, out = 33.11
D/lambda, out = 199.66
G1, out = 32.5

Gmax = 34.4
Efficiency = 0.7
CoefA, inout = 28.
Phi m, out = 4.12
Phi r, out = 5.01
Phi b, out = 33.11
D/lambda, out = 19.97
G1, out = 17.5

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	REQUIRED
Specific	REQUIRED
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

coefA

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6014	STDC_ERR_COEFA_LIM	Both	CoefA () is out of limits [18:47].
-6010	STDC_ERR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().
-6001	STDC_ERR_GMAX_LT_G1	Both	Gmax () is less than G1 (). Square root of negative value.

ID	**804**
Name	**APENST804V01**
Type	Earth
	Receiving and Transmitting

Description Non-standard generic earth station antenna pattern described by 2 main coefficients: A and B.

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: A-B*LOG(FI)
R1448: 2

Version	0	0	1
Revision Date	2003-05-23		

References

Co-Polar Component

$G = G_{max}$ for $0° \le \varphi \le 1°$

$G = \text{Max}(\text{CoefA} - \text{CoefB} * \log \varphi, -10)$ for $1° < \varphi \le 180°$

If $G > G_{max}$: $G = G_{max}$

Pattern Information

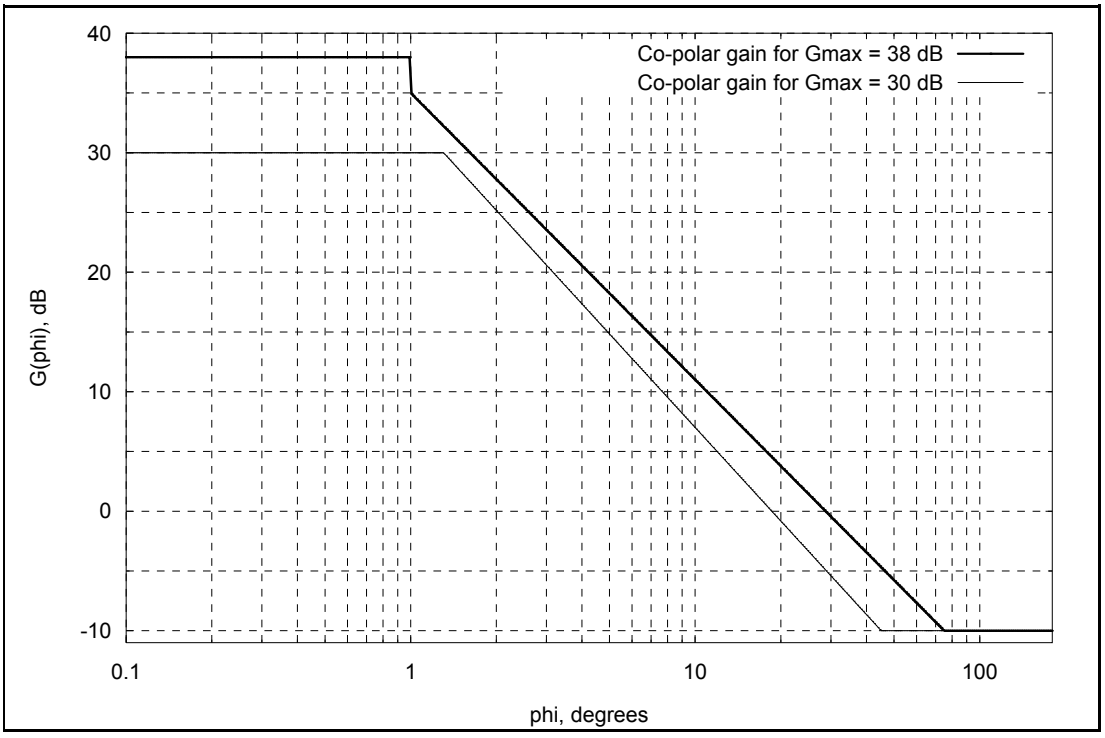
Non-standard generic earth station antenna pattern described by 2 main coefficients: A and B.

Pattern is equal to the maximum antenna gain in the main-lobe range (angles less than 1 degrees).

A ceiling of the maximum antenna gain is applied for the pattern.

A flooring of -10 dB is applied for the pattern.

Example



Gmax = 38
CoefA, inout = 35.
CoefB, inout = 24.
Phi r, out = 1.
Phi b, out = 74.99

Gmax = 30
CoefA, inout = 33.
CoefB, inout = 26.
Phi r, out = 1.
Phi b, out = 45.07

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	REQUIRED
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

coefA, coefB

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6015	STDC_ERR_COEFB	Both	CoefB () is out of limits [10:50].
-6014	STDC_ERR_COEFA_LIM	Both	CoefA () is out of limits [18:47].

ID 805
Name APENST805V01
Type Earth
Receiving and Transmitting

Description Non-standard generic earth station antenna pattern that is a combination of a non-standard pattern described by 2 main coefficients: A and B, within a certain range and the Appendix 8 (RR-2001) earth station antenna pattern onwards.

Start Date

End Date

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: -
R1448: 3

Version 0 0 1
Revision Date 2003-05-23

References

Co-Polar Component

$G = G_{max}$ for $0° \le \varphi < 1°$

$G = \text{Max}(\text{CoefA} - \text{CoefB} * \log \varphi, -10)$ for $1° \le \varphi \le \text{Phi1}$

$G = G_2(\varphi)$ for $\text{Phi1} < \varphi \le 180°$

If $G > G_{max}$, $G = G_{max}$

If $G < -10$, $G = -10$

where:

$G_{AB}(\text{Phi1}) = \text{CoefA} - \text{CoefB} * \log(\text{Phi1})$

$G_{AP8}(\text{Phi1}) = \text{APERR\_001V01}(\text{Phi1})$

$G_{AP8}(\varphi) = \text{APERR\_001V01}(\varphi)$

$G_2(\varphi) = \text{Min}(G_{AB}(\text{Phi1}), G_{AP8}(\varphi))$ if $G_{AP8}(\text{Phi1}) > G_{AB}(\text{Phi1})$

$= G_{AP8}(\varphi)$ if $G_{AP8}(\text{Phi1}) \le G_{AB}(\text{Phi1})$

Pattern Information

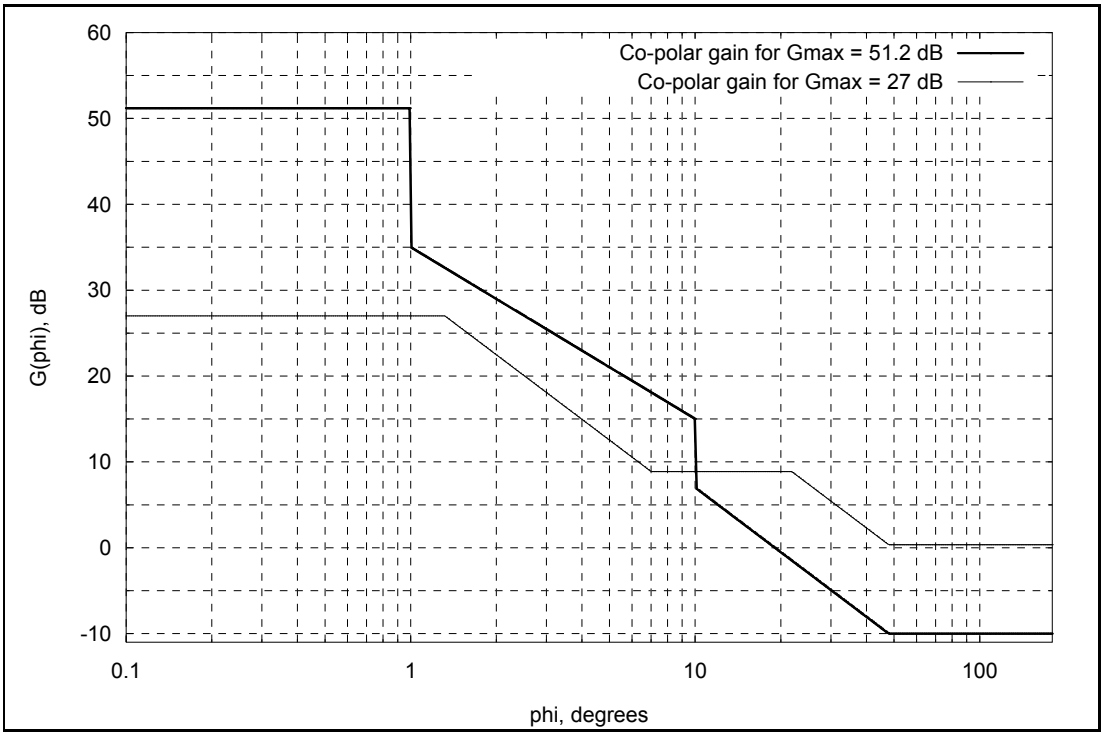
Non-standard generic earth station antenna pattern that is a combination of a non-standard pattern described by 2 main coefficients: A and B, within a certain range and the Appendix 8 (RR-2001) earth station antenna pattern onwards.

Pattern is equal to the maximum antenna gain in the main-lobe range (angles less than 1 degrees).

A ceiling of the maximum antenna gain is applied for the pattern.
A flooring of -10 dB is applied for the pattern.

Antenna efficiency is implicitly set to 0.6 as for Appendix 8 (RR-2001) calculations.

Example



Gmax = 51.2
CoefA, inout = 35.
CoefB, inout = 20.
Phi m, out = 0.54
Phi r, out = 0.79
Phi1, out = 10.
Phi b, out = 48.
D/lambda, out = 149.62
G1, out = 34.63

Gmax = 27
CoefA, inout = 30.
CoefB, inout = 25.
Phi m, out = 7.03
Phi r, out = 10.84
Phi1, out = 7.
Phi b, out = 48.
D/lambda, out = 9.23
G1, out = 16.48

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	REQUIRED
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

coefA, coefB, phi1

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6018	STDC_ERR_NSTD_PHI1	Both	Phi1 () is out of limits [1.0:99.9].
-6015	STDC_ERR_COEFB	Both	CoefB () is out of limits [10:50].
-6014	STDC_ERR_COEFA_LIM	Both	CoefA () is out of limits [18:47].
6010	STDC_WAR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().

ID	**806**
Name	**APENST806V01**
Type	Earth
	Receiving and Transmitting

Description Non-standard generic earth station antenna pattern similar to that in Recommendation ITU-R S.465-5, where the side-lobe radiation is represented by the expression CoefA - 25 log(phi).

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: NN-25LOG(FI), A-25*LOG(FI)
R1448: -

Version	0	0	1
Revision Date	2003-05-23		

References

Co-Polar Component

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = \text{Max}(\text{CoefA} - 25 \log \varphi, -10)$ for $\varphi_r \le \varphi \le 180°$

where:

$$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta\pi^2}}$$

$G_1 = \text{CoefA}$ for $D/\lambda > 100$,

$= \text{CoefA} - 50 + 25 \log D/\lambda$ for $D/\lambda \le 100$.

$\varphi_m = 20\ \lambda/D \sqrt{G_{max} - G_1}$.

$\varphi_r = 1°$ for $D/\lambda > 100$,

$= 100\ \lambda/D$ for $D/\lambda \le 100$.

$\varphi_b = 10^{\left(\frac{\text{CoefA}+10}{25}\right)}$.

Pattern Information

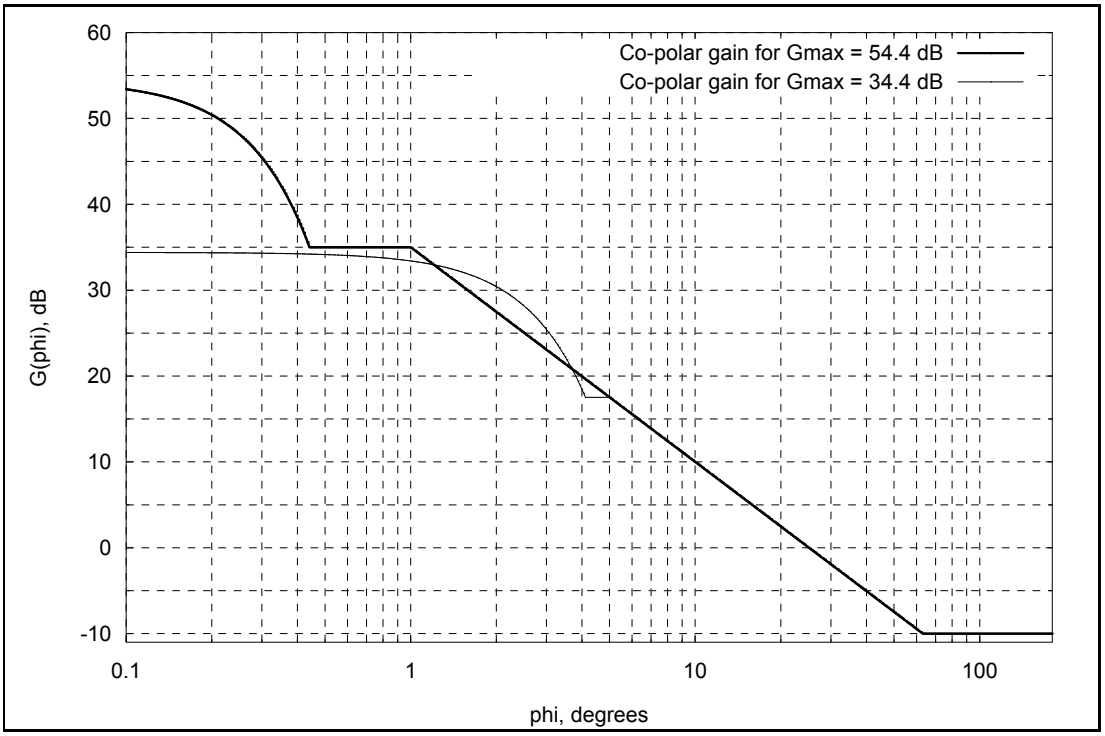
Non-standard generic earth station antenna pattern similar to that in Recommendation ITU-R S.465-5, where the side-lobe radiation is represented by the expression CoefA - 25 log(phi).

Pattern is extended in the main-lobe range similar to Appendix 8 of RR-2001.

CoefA is taken into account for both D/lambda >= 100 and for D/lambda < 100.

If efficiency is not specified, a value of 0.7 is to be applied for FSS Plan and a value of 0.6 is to be applied for "non-planned" services.

Example



Gmax = 54.4
Efficiency = 0.7
CoefA, inout = 35.
Phi m, out = 0.44
Phi r, out = 1.
Phi b, out = 63.1
D/lambda, out = 199.66
G1, out = 35.

Gmax = 34.4
Efficiency = 0.7
CoefA, inout = 35.
Phi m, out = 4.12
Phi r, out = 5.01
Phi b, out = 63.1
D/lambda, out = 19.97
G1, out = 17.51

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	REQUIRED
Specific	REQUIRED
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

coefA

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6014	STDC_ERR_COEFA_LIM	Both	CoefA () is out of limits [18:47].
-6010	STDC_ERR_PHIB_LT_PHIR	Both	Phi b () is less than Phi r ().
-6001	STDC_ERR_GMAX_LT_G1	Both	Gmax () is less than G1 (). Square root of negative value.
6009	STDC_WAR_PHIR_LT_PHIM	Both	Phi r () is less than Phi m ().

ID 807
Name APENST807V01
Type Earth
Receiving and Transmitting

Description Non-standard generic earth station antenna pattern described by 4 main coefficients: A, B, C, D and angle phi1. Minimum antenna gain (Gmin) is -10 dB.

Start Date

End Date

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: ABCDphi1
R1448: 5

Version 0 0 1
Revision Date 2006-10-20

References

Co-Polar Component

$G = G_{max}$ for $0° \le \varphi < 1°$

$G = CoefA - CoefB * \log \varphi$ for $1° \le \varphi \le Phi1$

$G = Max(Min(G(Phi1), CoefC - CoefD * \log \varphi), -10)$ for $Phi1 < \varphi \le 180°$

If $G > G_{max}$: $G = G_{max}$

If $G < -10$: $G = -10$

Pattern Information

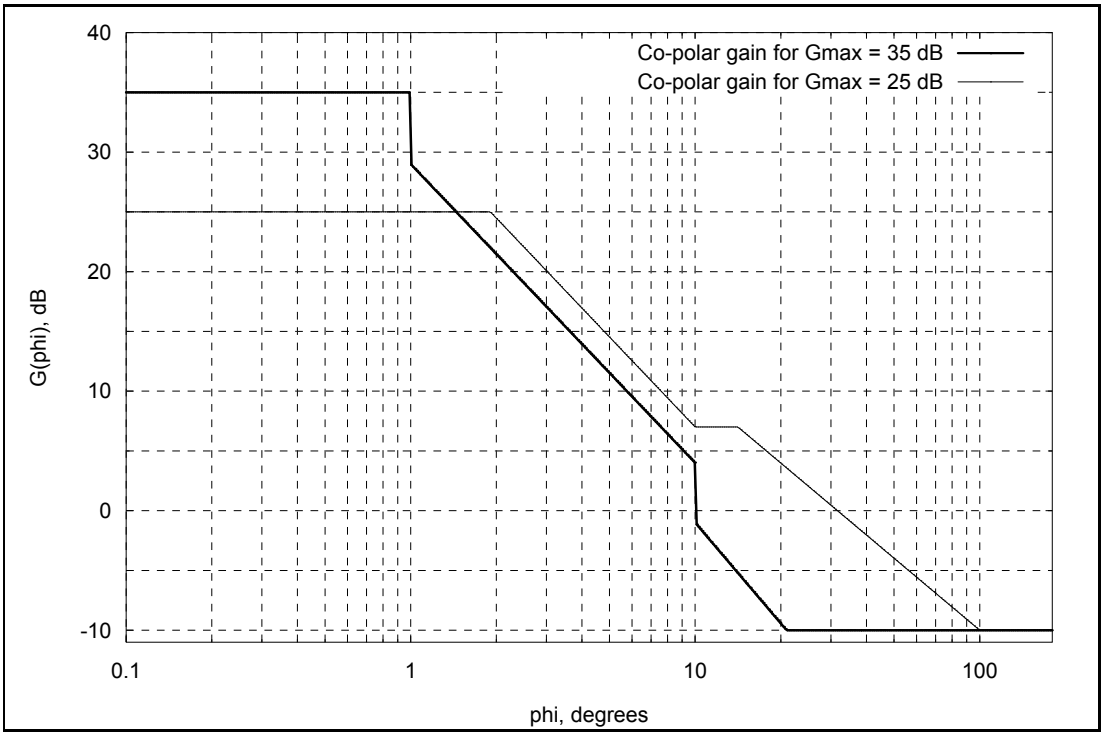
Non-standard generic earth station antenna pattern described by 4 main coefficients: A, B, C, D and angle phi1. Minimum antenna gain (Gmin) is -10 dB.

Pattern is equal to maximum antenna gain in the main-lobe range (for off-axis angles less than 1 degree).

A ceiling of maximum antenna gain is applied for the pattern.
A flooring of minimum antenna gain is applied for the pattern.

The pattern is similar to APENST802V01 but Gmin is set to -10 dB regardless of the value in STDT_EarthSpecificStruct.

Example



Gmax = 35
CoefA, inout = 29.
CoefB, inout = 25.
CoefC, inout = 27.
CoefD, inout = 28.
Gmin, out = -10.
Phi r, out = 1.
Phi1, out = 10.
Phi b, out = 20.96

Gmax = 25
CoefA, inout = 32.
CoefB, inout = 25.
CoefC, inout = 30.
CoefD, inout = 20.
Gmin, out = -10.
Phi r, out = 1.
Phi1, out = 10.
Phi b, out = 100.

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	REQUIRED
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

coefA, coefB, coefC, coefD, phi1

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6020	STDC_ERR_GMIN	Both	Gmin () is out of limits [-100:Gmax].
-6018	STDC_ERR_NSTD_PHI1	Both	Phi1 () is out of limits [1.0:99.9].
-6017	STDC_ERR_COEFD	Both	CoefD () is out of limits [10:50].
-6016	STDC_ERR_COEFC	Both	CoefC () is out of limits [18:47].
-6015	STDC_ERR_COEFB	Both	CoefB () is out of limits [10:50].
-6014	STDC_ERR_COEFA_LIM	Both	CoefA () is out of limits [18:47].

ID	**899**
Name	**APENST899V01**
Type	Earth
	Receiving and Transmitting

Description Earth station antenna pattern which is given by a table.

Start Date **End Date**

Region 1 ☑ Cross Polar Gain ☐
Region 2 ☑ Relative Gain ☐
Region 3 ☑

Obsolete Pattern Names/Options

MSPACE: -
GIMS: -
R1448: 4

Version	0	0	1
Revision Date	2003-05-23		

References

Co-Polar Component

$$G = G_j + \frac{(\varphi - \varphi_j)(G_{j-1} - G_j)}{\varphi_{j-1} - \varphi_j}$$

where:

φ_j is the smallest angle in the table which is greater than φ.

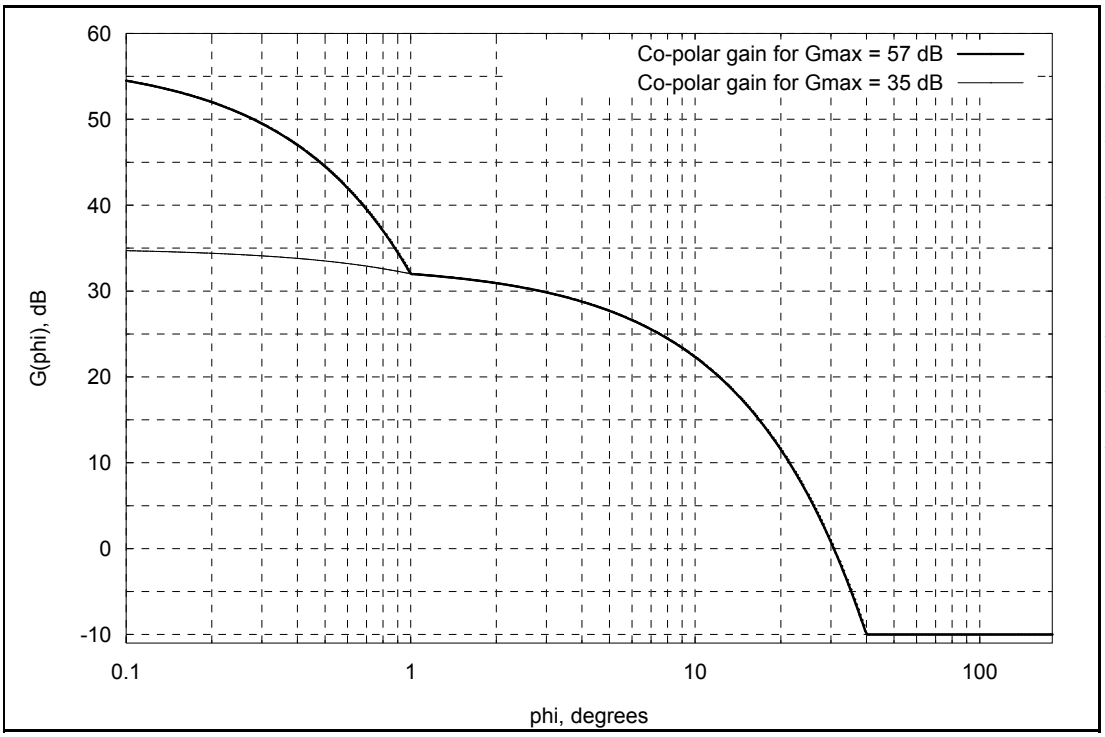
G_j is off-axis gain corresponding to φ_j.

Pattern Information

Earth station antenna pattern which is given by a table: a list of off-axis angles and a list of antenna off-axis gains.

Linear interpolation is applied to calculate antenna gains for intermediate angles.

Example



Gmax = 57
NumPoints = 3
Angle(1) = 1.
Gain(1) = 32.
Angle(2) = 40.
Gain(2) = -10.
Angle(3) = 180.
Gain(3) = -10.

Gmax = 35
NumPoints = 3
Angle(1) = 1.
Gain(1) = 32.
Angle(2) = 40.
Gain(2) = -10.
Angle(3) = 180.
Gain(3) = -10.

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	REQUIRED
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthTableStruct)

Required Specific Parameters

npoints, angle_gain

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6025	STDC_ERR_GMAX_LT_G	Both	Gmax () is less than Gain value ().
-6024	STDC_ERR_ANGORDER	Both	Angle I+1 () is less than or equal to angle I (). Wrong angles order.
-6023	STDC_ERR_ENDANG	Both	End angle () is out of limits [180:180].
-6022	STDC_ERR_STARTANG	Both	Start angle () is out of limits (0:End angle).
-6021	STDC_ERR_NUMPTS	Both	Number of points () is out of limits [1:29].

6. ANTENNA PATTERNS FROM ADMINISTRATIONS

6.1 Earth station antenna patterns

ID	**201**
Name	**APELUX201V01**
Type	Earth
	Transmitting

Description Transmitting earth station antenna pattern submitted by LUX for analyses under Appendix 30A.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☐
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: DBL-TYP1, DBL-TYP2
GIMS: -
R1448: -

Version	0 0 1
Revision Date	2003-05-23

References

Co-Polar Component

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 29 - 25 \log \varphi$ for $\varphi_r \le \varphi < \varphi_b$

$G = -10$ for $\varphi_b \le \varphi \le 180°$

where:

$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta\pi^2}}$, where η is the efficiency of 0.61.

$\varphi_r = 15.85\ (D/\lambda)^{-0.6}$.

$G_1 = 29 - 25 \log \varphi_r = -1 + 15 \log (D/\lambda)$.

$\varphi_m = 20\ \lambda/D\ \sqrt{G_{max} - G_1}$.

$\varphi_b = 10^{\left(\frac{39}{25}\right)}$.

Cross-Polar Component

$G_x = G_{max} - 30$ for $0° \le \varphi < \varphi_x$

$G_x = 29 - 25 \log \varphi$ for $\varphi_x \le \varphi < \varphi_b$

$G_x = -10$ for $\varphi_b \le \varphi \le 180°$

where:

$\varphi_x = 10^{\left(\frac{59 - G_{max}}{25}\right)}$.

$\varphi_b = 10^{\left(\frac{39}{25}\right)}$.

Pattern Information

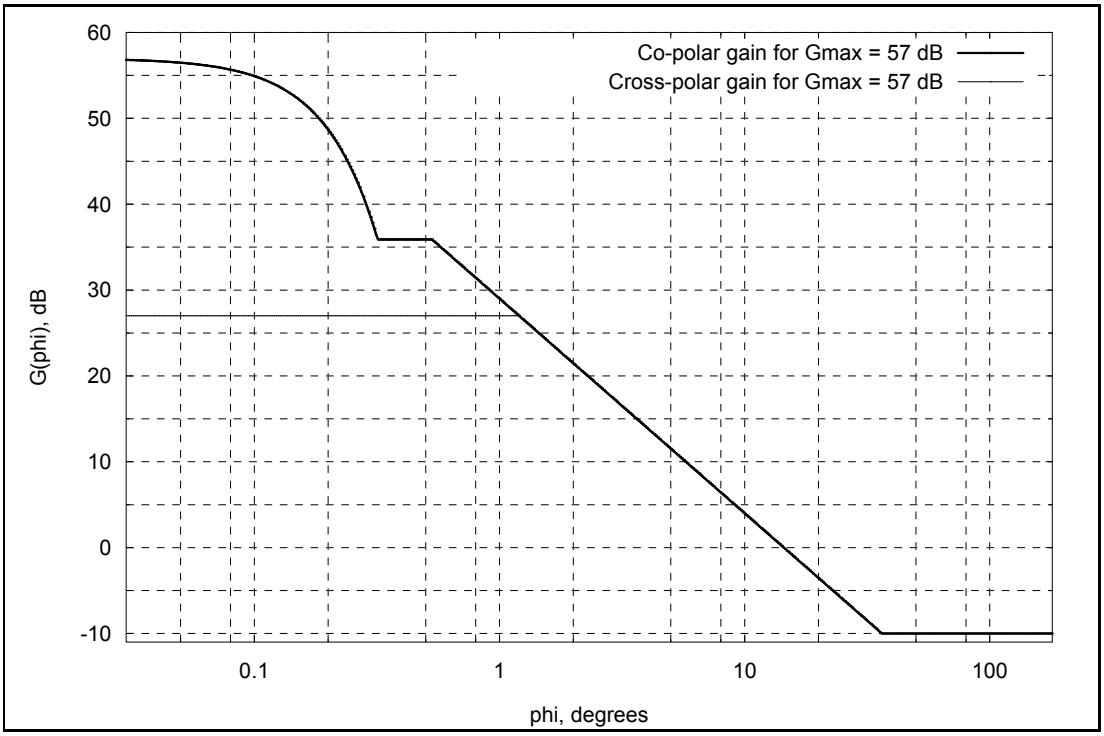
Transmitting earth station antenna pattern is used for uplinks for analyses under Appendix 30A.

It is based on a pattern submitted by LUX administration. As submitted by the administration, there are two antenna types, DBL-TYP1, with a diameter of 5 meters, and DBL-TYP2, with a diameter of 2.5 meters.

In implementing the formulas, the patterns were based on the maximum gain, rather than diameter, so that the same formulas are used for both, with the calculated values being determined by the maximum gain.

The co-polar component is equal to the Appendix 30B antenna pattern for D/lambda > 100 with coefA = 29 and Efficiency = 0.61. (Efficiency value 0.61 is fixed.)

Example



Gmax = 57
Phi m, out = 0.32
Phi r, out = 0.53
Phi b, out = 36.31
D/lambda, out = 288.53
G1, out = 35.9

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6013	STDC_ERR_C0_LT_CX	Cross-polar	Co-polar curve () is less than cross-polar curve (). (at plateau level) Gmax is too b
-6008	STDC_ERR_ANG2_LT_ANG1	Cross-polar	Phi b () is less than Phi x ().
6009	STDC_WAR_PHIR_LT_PHIM	Co-polar	Phi r () is less than Phi m ().

ID	**202**
Name	**APELUX202V01**
Type	Earth
	Receiving

Description Receiving earth station antenna pattern submitted by LUX for community reception for analyses under Appendix 30.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☐
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: DBLTVROC0001
GIMS: -
R1448: -

Version	0	0	1
Revision Date	2003-05-23		

References

Co-Polar Component

$G = G_{max} - 2.95 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 29 - 25 \log \varphi$ for $\varphi_r \le \varphi < \varphi_b$

$G = -5$ for $\varphi_b \le \varphi \le 70°$

$G = 0$ for $70° \le \varphi \le 180°$

where:

$D/\lambda = 96.942890$ is a fixed value.

G_{max} is a fixed value of 47 dB.

$\varphi_r = 85\ \lambda/D$.

$G_1 = 29 - 25 \log \varphi_r$.

$$\varphi_m = \lambda/D \sqrt{\frac{G_{max} - G_1}{0.00295}}\ .$$

$$\varphi_b = 10^{\left(\frac{34}{25}\right)}\ .$$

Cross-Polar Component

$G_x = G_{max} - 25$ for $0° \le \varphi < \varphi_1$

$$G_x = G_{max} - 25 + 5 \left(\frac{\varphi - 0.25\varphi_0}{0.19\varphi_0} \right)$$ for $\varphi_1 \le \varphi < \varphi_2$

$G_x = G_{max} - 20$ for $\varphi_2 \le \varphi < \varphi_o$

$$G_x = G_{max} - 20 - 40 \left(\frac{\varphi}{\varphi_0} - 1 \right)$$ for $\varphi_o \le \varphi < \varphi_3$

$G_x = G_{max} - 30$ for $\varphi_3 \le \varphi < \varphi_x$

$G_x = G$ for $\varphi_x \le \varphi < 180°$

where:

$$\varphi_0 = 2\ \lambda/D \sqrt{\frac{3.0}{0.00295}}\ .$$

$\varphi_1 = 0.25\ \varphi_0$.

$\varphi_2 = 0.44\ \varphi_0$.

$\varphi_3 = 1.25\ \varphi_0$.

$$\varphi_x = 10^{\left(\frac{59 - G_{max}}{25}\right)}\ .$$

Pattern Information

Receiving earth station antenna pattern is used for downlinks for analyses under Appendix 30.

It is based on a pattern submitted by LUX administration. This pattern is for community reception.

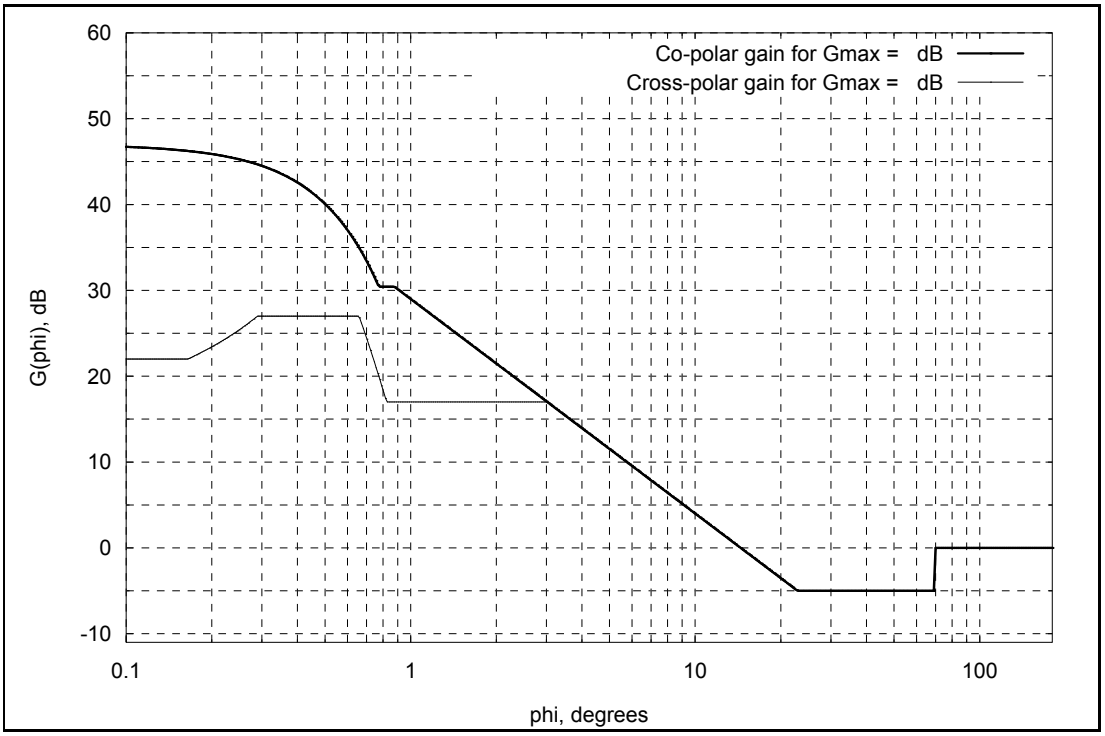
D/lambda = 96.942890, a fixed value for this pattern. A fixed value of maximum gain of 47 dB is used.

The diameter is assumed to be 2.4 m.

The co-polar component equal to the co-polar component in APELUX203V pattern for individual reception.

The cross-polar component is similar to the cross-polar component in APELUX203V01 pattern for individual reception: it is 3 dB greater for all angles until the intersection with the co-polar component.

Example



Phi m, out = 0.77
Phi r, out = 0.88
Phi b, out = 22.91
D/lambda, out = 96.94
G1, out = 30.43

Pattern Input Parameters

GainMax	NOVALUE
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

ID	**203**
Name	**APELUX203V01**
Type	Earth
	Receiving

Description Receiving earth station antenna pattern submitted by LUX for individual reception for analyses under Appendix 30.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☐
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: DBLTVROI0001
GIMS: -
R1448: -

Version	0 0 1
Revision Date	2003-05-23

References

Co-Polar Component

$G = G_{max} - 2.95 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 29 - 25 \log \varphi$ for $\varphi_r \le \varphi < \varphi_b$

$G = -5$ for $\varphi_b \le \varphi \le 70°$

$G = 0$ for $70° \le \varphi \le 180°$

where:

λ is the wavelength (0.02476 m) corresponding to the fixed frequency of 12 109.5 MHz.

$\varphi_r = 85\ \lambda/D$.

$G_1 = 29 - 25 \log \varphi_r$.

$\varphi_m = \lambda/D \sqrt{\frac{G_{max} - G_1}{0.00295}}$.

$\varphi_b = 10^{\left(\frac{34}{25}\right)}$.

Cross-Polar Component

$G_x = G_{max} - 22$ for $0° \le \varphi < \varphi_1$

$G_x = G_{max} - 22 + 5\left(\frac{\varphi - 0.25\varphi_0}{0.19\varphi_0}\right)$ for $\varphi_1 \le \varphi < \varphi_2$

$G_x = G_{max} - 17$ for $\varphi_2 \le \varphi < \varphi_o$

$G_x = G_{max} - 17 - 40\left(\frac{\varphi}{\varphi_0} - 1\right)$ for $\varphi_o \le \varphi < \varphi_3$

$G_x = G_{max} - 27$ for $\varphi_3 \le \varphi < \varphi_x$

$G_x = G$ for $\varphi_x \le \varphi < 180°$

where:

$\varphi_0 = 2\ \lambda/D \sqrt{\frac{3.0}{0.00295}}$.

$\varphi_1 = 0.25\ \varphi_0$.

$\varphi_2 = 0.44\ \varphi_0$.

$\varphi_3 = 1.25\ \varphi_0$.

$\varphi_x = 10^{\left(\frac{56 - G_{max}}{25}\right)}$.

Pattern Information

Receiving earth station antenna pattern is used for downlinks for analyses under Appendix 30.

It is based on patterns submitted by LUX administration. This pattern is for individual reception.

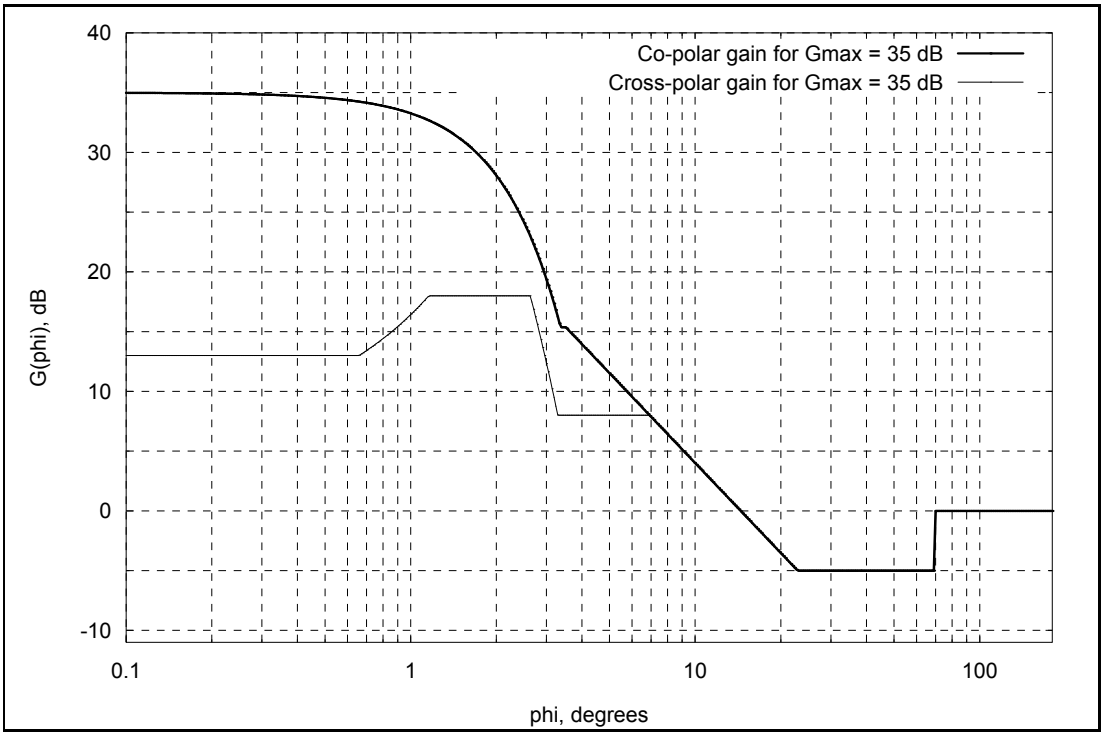
The precise pattern is created by the specification of the maximum gain and antenna diameter.

For this pattern a fixed reference frequency of 12 109.5 MHz is used.

The co-polar component is equal to the co-polar component in APELUX202V01 pattern for community reception.

The cross-polar component is similar to the cross-polar component in APELUX202V01 pattern for community reception: it is 3 dB smaller for all angles until the intersection with the co-polar component.

Example



Gmax = 35
Diameter = 0.6
Phi m, out = 3.37
Phi r, out = 3.51
Phi b, out = 22.91
D/lambda, out = 24.24
G1, out = 15.38

Pattern Input Parameters

GainMax	REQUIRED
Diameter	REQUIRED
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6008	STDC_ERR_ANG2_LT_ANG1	Cross-polar	Phi3 () is less than Phi x ().
-6004	STDC_ERR_CXCO_NOTINTERS	Cross-polar	Gmax () is less than 22 (). Cross-polar pattern does not intersect with co-polar pat
-6001	STDC_ERR_GMAX_LT_G1	Co-polar	Gmax () is less than G1 (). Square root of negative value.
6009	STDC_WAR_PHIR_LT_PHIM	Co-polar	Phi r () is less than Phi m ().

ID	**204**
Name	**APELUX204V01**
Type	Earth
	Receiving and Transmitting

Description Earth station antenna pattern submitted by LUX for both uplinks and downlinks for analyses under Appendix 30B.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☐
Region 2 ☐ Relative Gain ☐
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: MIX1
GIMS: -
R1448: -

Version	0	0	1
Revision Date	2003-05-23		

References

Co-Polar Component

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 29 - 25 \log \varphi$ for $\varphi_r \le \varphi < 20°$

$G = 32 - 25 \log \varphi$ for $20° \le \varphi < \varphi_b$

$G = -10$ for $\varphi_b \le \varphi \le 180°$

where:

$$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta\pi^2}}\ .$$

$G_1 = -1 + 15 \log (D/\lambda)$.

$\varphi_r = 15.85\ (D/\lambda)^{-0.6}$.

$\varphi_m = 20\ \lambda/D\ \sqrt{G_{max} - G_1}$.

$\varphi_b = 48°$.

Pattern Information

Earth station antenna pattern is used for both uplinks and downlinks for analyses under Appendix 30B.

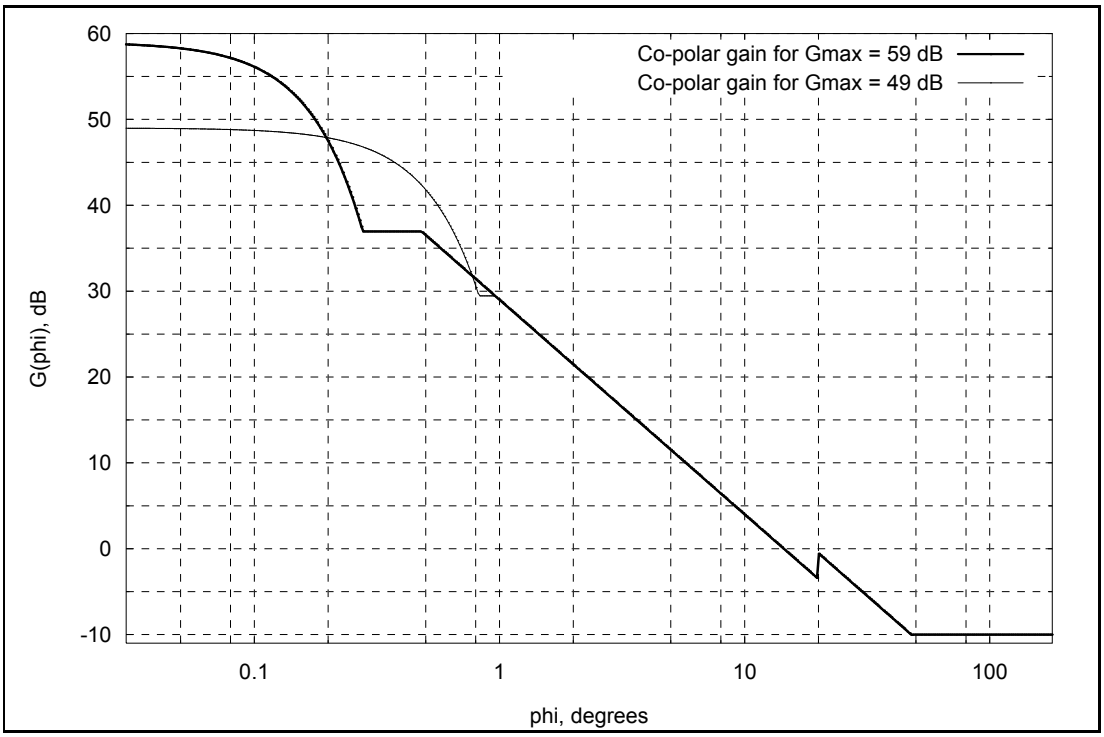
It is based on a pattern submitted by LUX administration. The algorithm has been expanded to describe a complete pattern using the same pattern as Appendix 30B (with coefA=29) in the undefined areas.

The pattern differs from Appendix 30B pattern in that it has:
29 - 25 log (phi) up to angle of 20 degrees
32 - 25 log (phi) from angle of 20 degrees to 48 degrees.
In the other parts, the pattern is the same as in Appendix 30B.

Note that this pattern has a discontinuity of 3 dB (positive step) at 20 degrees; this is supposed to happen.

Pattern is valid only for D/lambda > 100.

Example



Gmax = 59
Efficiency = 0.7
Phi m, out = 0.28
Phi r, out = 0.48
Phi b, out = 48.
D/lambda, out = 339.08
G1, out = 36.95

Gmax = 49
Efficiency = 0.7
Phi m, out = 0.82
Phi r, out = 0.96
Phi b, out = 48.
D/lambda, out = 107.23
G1, out = 29.45

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	REQUIRED
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6002	STDC_ERR_DLAMBDA	Both	D/lambda () is less than 100 ().
-6001	STDC_ERR_GMAX_LT_G1	Both	Gmax () is less than G1 (). Square root of negative value.

ID	**205**
Name	**APELUX205V01**
Type	Earth
	Receiving and Transmitting

Description Earth station antenna pattern submitted by LUX for both uplinks and downlinks for analyses under Appendix 30B.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☐
Region 2 ☐ Relative Gain ☐
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: MIX2
GIMS: -
R1448: -

Version	0	0	1
Revision Date	2003-05-23		

References

Co-Polar Component

$G = G_{max} - 2.5 \times 10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 29 - 25 \log \varphi$ for $\varphi_r \le \varphi < 7°$

$G = 7.9$ for $7° \le \varphi \le 9°$

$G = 32 - 25 \log \varphi$ for $9° \le \varphi < \varphi_b$

$G = -10$ for $\varphi_b \le \varphi \le 180°$

where:

$$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta\pi^2}} .$$

$G_1 = -1 + 15 \log (D/\lambda)$.

$\varphi_r = 1°$ for $D/\lambda \ge 100$,

$= 100\ \lambda/D$ for $D/\lambda < 100$.

$\varphi_m = 20\ \lambda/D \sqrt{G_{max} - G_1}$.

$\varphi_b = 48°$.

Pattern Information

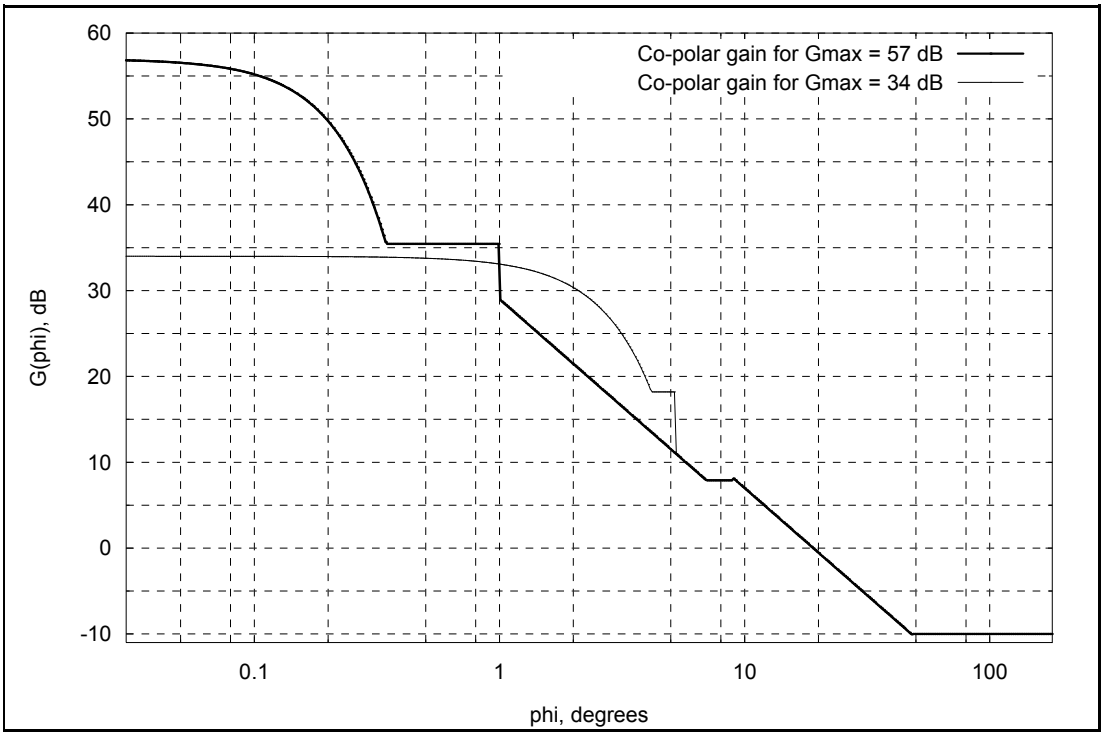
Earth station antenna pattern is used for both uplinks and downlinks for analyses under Appendix 30B.

It is based on a pattern submitted by LUX administration.

For D/lambda > 100 there is a discontinuity (negative step) in the pattern at 1 degrees:
(15 log D/l - 30). This step is:
0 dB for D/lambda = 100
1.2 dB for D/lambda = 120.3
10.5 dB for D/lambda = 500

For D/lambda < 100 there is a discontinuity (negative step) in the pattern at Phi r:
(20 - 10 log D/l). This step is:
0 dB for D/lambda = 100
0.46 dB for D/lambda = 90
8.24 dB for D/lambda = 15

Example



Gmax = 57
Efficiency = 0.7
Phi m, out = 0.34
Phi r, out = 1.
Phi b, out = 48.
D/lambda, out = 269.34
G1, out = 35.45

Gmax = 34
Efficiency = 0.7
Phi m, out = 4.17
Phi r, out = 5.24
Phi b, out = 48.
D/lambda, out = 19.07
G1, out = 18.2

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	REQUIRED
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
-6008	STDC_ERR_ANG2_LT_ANG1	Both	7 () is less than Phi r ().
-6001	STDC_ERR_GMAX_LT_G1	Both	Gmax () is less than G1 (). Square root of negative value.

ID	**207**
Name	**APENOR207V01**
Type	Earth Transmitting

Description Earth station transmitting antenna pattern for analyses under Appendix 30B for the BIFROST terminal type I transmitting antenna.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☐
Region 2 ☐ Relative Gain ☐
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: BIFROST-TES1
GIMS: -
R1448: -

Version 0 0 1
Revision Date 2003-05-23

References

Co-Polar Component

$G = 50.7 - 42.3\ \varphi^2$	for $0° \le \varphi < 0.634°$
$G = 33.7$	for $0.634° \le \varphi < 0.649°$
$G = 29 - 25 \log \varphi$	for $0.649° \le \varphi < 48°$
$G = -10$	for $48° \le \varphi \le 180°$

Pattern Information

Earth station transmitting antenna pattern is used for analyses under Appendix 30B.

It is based on a pattern submitted by NOR administration for the BIFROST terminal type I transmitting earth antenna (3m antenna, antenna efficiency is 0.7) in 1995.

Maximum antenna gain is 50.7 dB.

The pattern has a discontinuity (positive step) of 3.03 dB at 48 degrees.

Example

Pattern Input Parameters

GainMax	NOVALUE
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	NOVALUE
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Low Level Validation Rules

ID	**208**
Name	**APENOR208V01**
Type	Earth
	Transmitting

Description Earth station transmitting antenna pattern for analyses under Appendix 30B for the BIFROST terminal type II transmitting antenna.

Start Date

End Date

Region 1 ☐ Cross Polar Gain ☐
Region 2 ☐ Relative Gain ☑
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: BIFROST-TES2
GIMS: -
R1448: -

Version	0	0	1
Revision Date	2003-05-23		

References

Co-Polar Component

$G = G_{max}$ for $0 \leq (\varphi/\varphi_0) \leq 0.25$

$G = G_{max} - 12\,(\varphi/\varphi_0)^2$ for $0.25 < (\varphi/\varphi_0) \leq 1.0363$

$G = G_{max} - 12.5 - 25 \log (\varphi/\varphi_0)$ for $1.0363 < (\varphi/\varphi_0)$

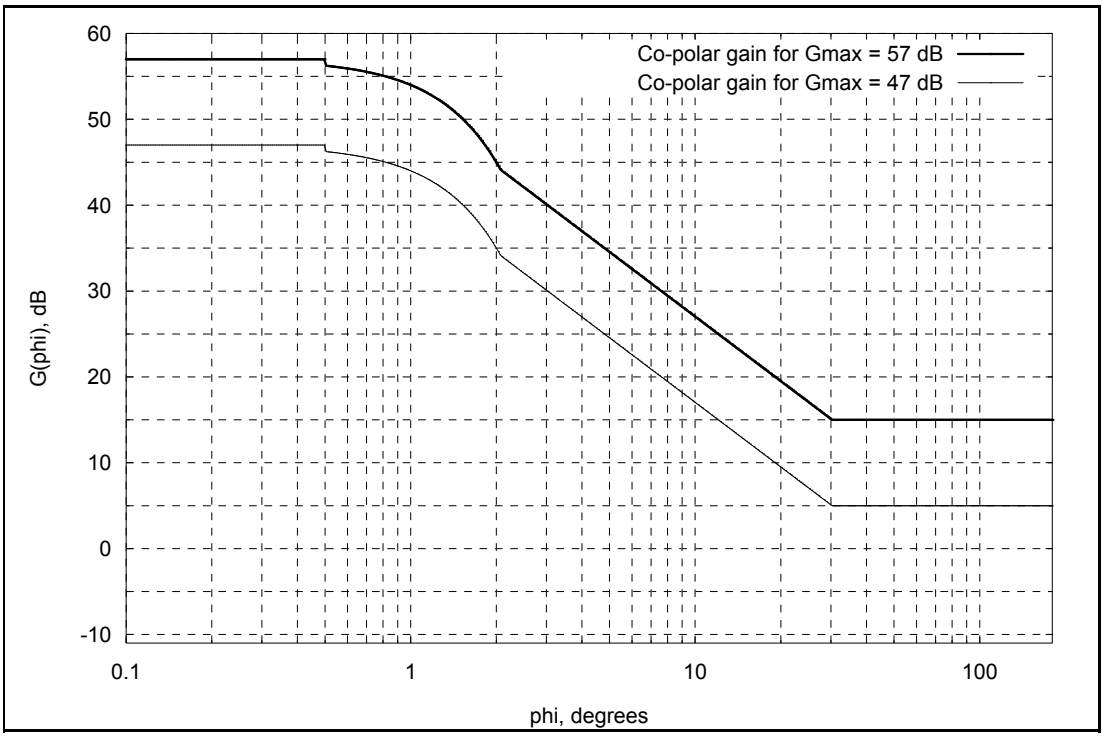
If $G < G_{max} - 42$: $G = G_{max} - 42$

Pattern Information

Earth station transmitting antenna pattern is used for analyses under Appendix 30B.

It is based on a pattern submitted by NOR administration for the BIFROST terminal type II transmitting earth antenna (1m antenna, antenna efficiency is 0.7) in 1995.

Example



Gmax = 57
Phi0 = 2

Gmax = 47
Phi0 = 2

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Specific Parameters Structure Size

0

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6006	STDC_WAR_PHI0	Both	Phi0 () is out of limits [0.1:5.0].

ID	**209**
Name	**APENOR209V01**
Type	Earth
	Transmitting

Description Earth station transmitting antenna pattern for analyses under Appendix 30B for the BIFROST terminal type I transmitting antenna.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☐
Region 2 ☐ Relative Gain ☐
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: BIFROST-TES3
GIMS: -
R1448: -

Version 0 0 1
Revision Date 2003-05-23

References

Co-Polar Component

$G = 50.7 - 42.3\ \varphi^2$	for $0° \le \varphi < 0.634°$
$G = 30.7$	for $0.634° \le \varphi < 0.854°$
$G = 29 - 25 \log \varphi$	for $0.854° \le \varphi < 48°$
$G = -10$	for $48° \le \varphi \le 180°$

Pattern Information

Earth station transmitting antenna pattern is used for analyses under Appendix 30B.

It is based on a pattern submitted by NOR administration for the BIFROST terminal type I transmitting earth antenna (3m antenna, antenna efficiency is 0.7) in 1995.

Maximum antenna gain is 50.7 dB.

The pattern has a discontinuity (positive step) of 3.03 dB at 48 degrees.

The pattern has a discontinuity (negative step) of 3 dB at 0.634 degrees.

Example

Pattern Input Parameters

GainMax	NOVALUE
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	NOVALUE
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Low Level Validation Rules

ID 210
Name APENOR210V01
Type Earth
Receiving

Description Earth station receiving antenna pattern for analyses under Appendix 30B for the BIFROST receiving antenna.

Start Date

End Date

Region 1 ☐ Cross Polar Gain ☐
Region 2 ☐ Relative Gain ☐
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: BIFROST-RES
GIMS: -
R1448: -

Version 0 0 1
Revision Date 2003-05-23

References

Co-Polar Component

$G = G_{max}$ for $0 \leq (\varphi/\varphi_0) \leq 0.25$

$G = G_{max} - 12\,(\varphi/\varphi_0)^2$ for $0.25 < (\varphi/\varphi_0) \leq 0.86$

$G = G_{max} - 10.5 - 25 \log (\varphi/\varphi_0)$ for $0.86 < (\varphi/\varphi_0)$

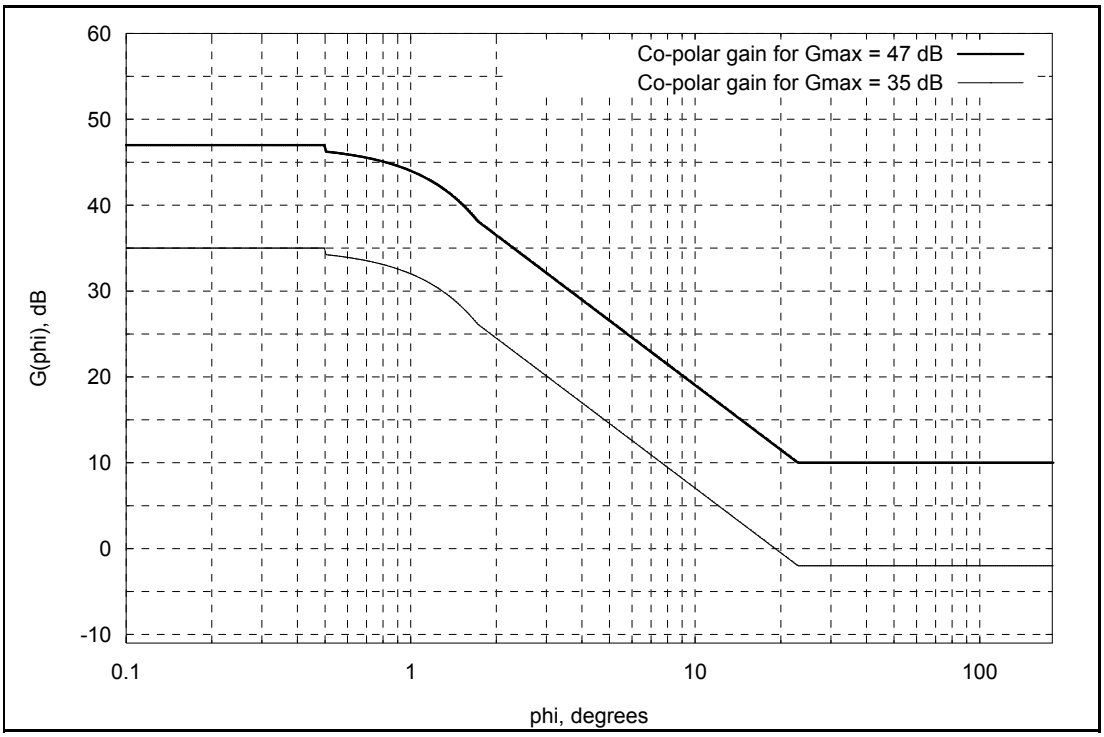
If $G < G_{max} - 37$: $G = G_{max} - 37$

Pattern Information

Earth station receiving antenna pattern is used for analyses under Appendix 30B.

It is based on a pattern submitted by NOR administration for the BIFROST receiving earth antenna (1m antenna, antenna efficiency is 0.7) in 1995.

Example



Gmax = 47
Phi0 = 2

Gmax = 35
Phi0 = 2

Pattern Input Parameters

GainMax	REQUIRED
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Specific Parameters Structure Size

0

Required Specific Parameters

-

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6006	STDC_WAR_PHI0	Both	Phi0 () is out of limits [0.1:5.0].

ID	**211**
Name	**APEUSA211V01**
Type	Earth Transmitting

Description Earth station transmitting antenna pattern for analyses under Appendix 30A for USABSS-14 and USABSS-15 networks.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☐
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: -
GIMS: -
R1448: -

Version 0 0 1
Revision Date 2004-06-14

References

Co-Polar Component

$G = G_{max} - 2.5x10^{-3} (D/\lambda\ \varphi)^2$ for $0° \le \varphi < \varphi_m$

$G = G_1$ for $\varphi_m \le \varphi < \varphi_r$

$G = 29 - 25 \log \varphi$ for $\varphi_r \le \varphi < 7°$

$G = 7.9$ for $7° \le \varphi \le 9°$

$G = \max(32 - 25 \log \varphi, -10)$ for $9° \le \varphi \le 180°$

where:

G_{max} = 65 dB.

η = 0.55.

$$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta\pi^2}}.$$

G_1 = –1 + 15 log (D/λ).

φ_r = 1°.

$\varphi_m = 20\ \lambda/D\ \sqrt{G_{max} - G_1}$.

$\varphi_b = 10^{\left(\frac{42}{25}\right)}$.

Cross-Polar Component

$G_x = G_{max} - 2.5x10^{-3} (D/\lambda\ \varphi)^2 - 30$ for $0° \le \varphi < \varphi_m/2$

$G_x = G_{max} - 2.5x10^{-3} (D/\lambda\ \varphi)^2 - 20$ for $\varphi_m/2 \le \varphi < \varphi_m$

$G_x = G_1 - 20$ for $\varphi_m \le \varphi < \varphi_r$

$G_x = 19 - 25 \log \varphi$ for $\varphi_r \le \varphi < 6.92°$

$G_x = \min(-2, G)$ for $6.92° \le \varphi \le 180°$

where:

G_{max} = 65 dB.

η = 0.55.

$$D/\lambda = \sqrt{\frac{10^{\left(\frac{G_{max}}{10}\right)}}{\eta\pi^2}}.$$

G_1 = –1 + 15 log (D/λ).

φ_r = 1°.

$\varphi_m = 20\ \lambda/D\ \sqrt{G_{max} - G_1}$.

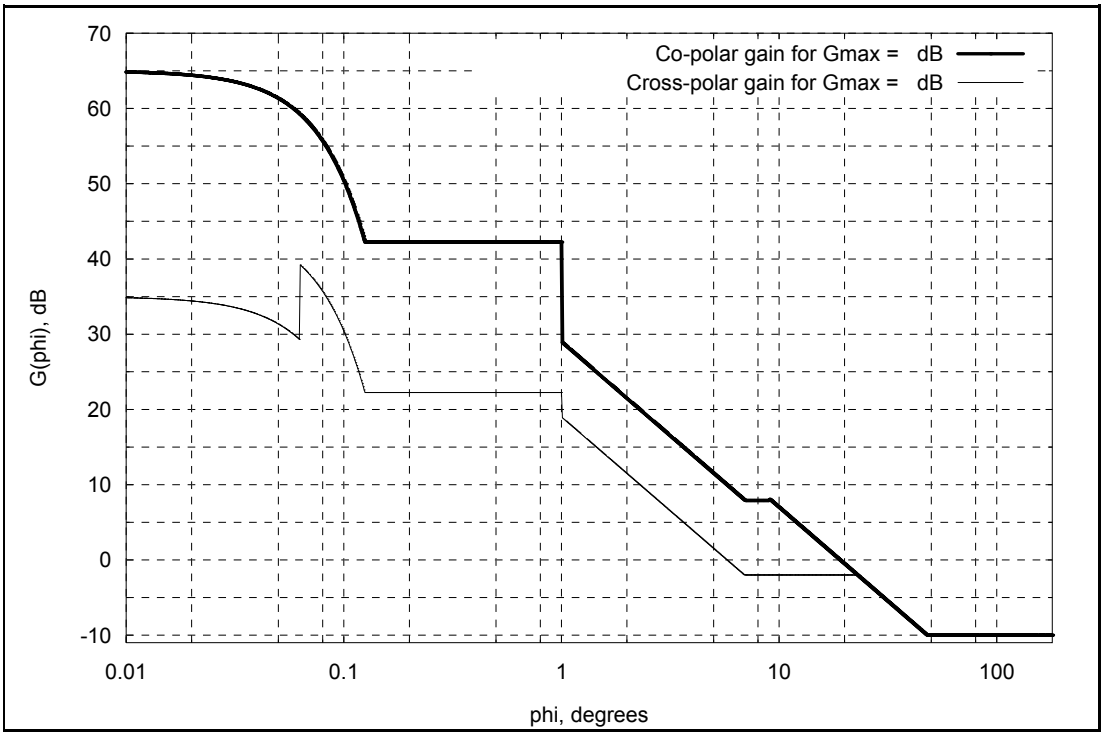
Pattern Information

Earth station transmitting antenna pattern is used for analyses under Appendix 30A.

Antenna pattern is submitted by USA administration for feeder links of USABSS-14 and USABSS-15 networks which were submitted in 07.03.2002 and 03.06.2002 respectively. Antenna diameter is 13.2 meters and the half power beamwidth is 0.09 degrees. Antenna efficiency is 55%. Maximum antenna gain is 65 dB.

The co-polar compont is equal to the co-polar component of APELUX205V1 pattern.

Example



Gmax = 65

Gmin, inout = -10.
Phi m, out = 0.13
Phi r, out = 1.
Phi b, out = 47.86
D/lambda, out = 763.25
G1, out = 42.24

Pattern Input Parameters

GainMax	NOVALUE
Diameter	NOVALUE
Frequency	NOVALUE
Efficiency	NOVALUE
Specific	OPTIONAL
Phi	REQUIRED
Phi0	NOVALUE

Specific Parameters Structure Size

sizeof(STDT_EarthSpecificStruct)

Required Specific Parameters

-

Low Level Validation Rules

6.2 Space station antenna patterns

ID	**601**
Name	**APSF__601V01**
Type	Space
	Transmitting
	Fast Roll-Off

Description Fast roll-off transmitting space station antenna pattern for RADIOSAT-3 submitted by France.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☑
Region 2 ☐ Relative Gain ☑
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: RADTSS
GIMS: RADSAT3, RADSAT3X
R1448: -

Version 0 0 2
Revision Date 2003-06-11

References

Co-Polar Component

$$G = G_{max} - 12\,(\varphi/\varphi_0)^2 \qquad \text{for } 0 \le (\varphi/\varphi_0) \le 0.5$$

$$G = G_{max} - 12 \left(\frac{\frac{\varphi}{\varphi_0} - x}{\frac{B_{min}}{\varphi_0}} \right)^2 \qquad \text{for } 0.5 < (\varphi/\varphi_0) \le \left(\frac{1.45}{\varphi_0} B_{min} + x \right)$$

$$G = G_{max} - 25.23 + 40 \log \left(\frac{1.45}{\varphi_0} B_{min} + x \right) - 40 \log (\varphi/\varphi_0)$$

$$\text{for } \left(\frac{1.45}{\varphi_0} B_{min} + x \right) < (\varphi/\varphi_0)$$

where:

$$x = 0.5\,(1 - B_{min} / \varphi_0\,)$$

Cross-Polar Component

$G_x = G_{max} - 30$

If $G_x > G$: $G_x = G$

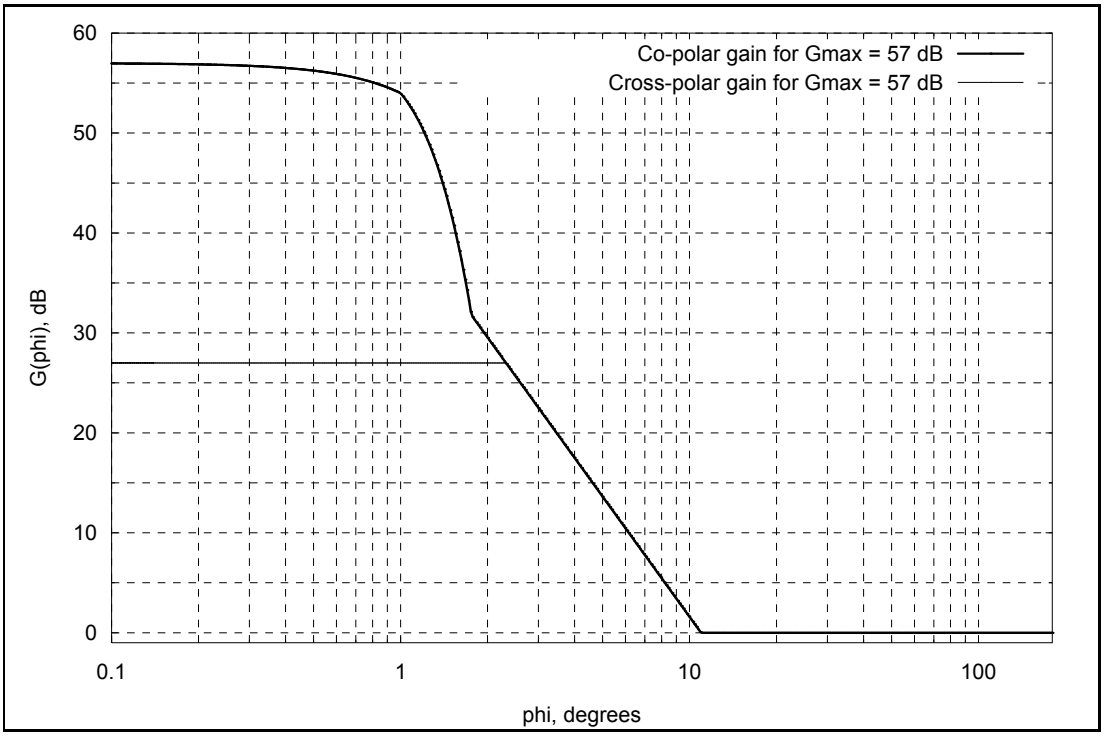
Pattern Information

Fast roll-off transmitting space station antenna pattern for RADIOSAT-3 submitted by French administration.

The pattern is similar to APSRR_402V01 pattern in the main lobe and has slightly different co-polar pattern for the far side-lobe.

"Beamlet" value is fixed to 0.8 degrees in the pattern code.

Example



Gmax = 57
Phi0 = 2

Pattern Input Parameters

GainMax	OPTIONAL
Beamlet	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Low Level Validation Rules

Code	Constant	Component	Low Level Validation Event Message
6032	STDC_WAR_CX_IS_0	Cross-polar	Gmax () is less than 30 (). Cx pattern is zero. Gmax is too low.

ID 605
Name APSNOR605V01
Type Space
Receiving and Transmitting

Description Space station antenna pattern (transmitting and receiving) submitted by NOR for analyses under Appendix 30B.

Start Date

End Date

Region 1 ☐ Cross Polar Gain ☐
Region 2 ☐ Relative Gain ☐
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: BIFROST-SS1
GIMS: -
R1448: -

Version 0 0 1
Revision Date 2003-05-23

References

Co-Polar Component

$G = G_{max} - 12\,(\varphi/\varphi_0)^2$ for $0 \le (\varphi/\varphi_0) \le 1.58$

$G = G_{max} - 30$ for $1.58 < (\varphi/\varphi_0) \le 3.16$

$G = G_{max} - 17.5 - 25 \log (\varphi/\varphi_0)$ for $3.16 < (\varphi/\varphi_0)$

If G > 35 dB: G = 35 dB.

Pattern Information

Space station antenna pattern (transmitting and receiving) is used for analyses under Appendix 30B.

It is based on a pattern submitted by NOR administration for the BIFROST space antenna in 1995.

The co-polar curve is similar to APSRR_405V01 pattern for the maximum antenna gain of 41 dB, but has a ceiling at 35 dB.

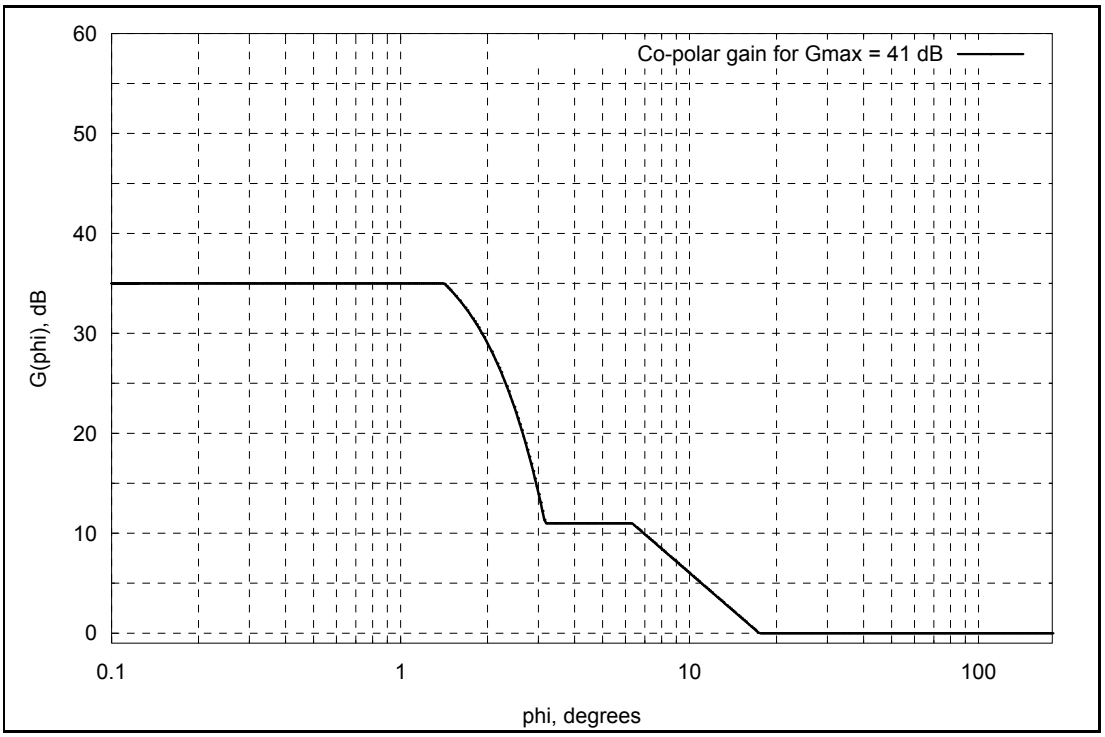
This pattern corresponds to the input Gmax = 41 dB, but the actual on-axis gain is 35 dB.

Ceiling level of 35 dB is fixed for this pattern.

Only absolute antenna gain is provided for this pattern (relative gain is not provided).

Phi0 does not correspond to -3 dB contour.

Example



Gmax = 41
Phi0 = 2

Pattern Input Parameters

GainMax	REQUIRED
Beamlet	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Low Level Validation Rules

ID	**606**
Name	**APSNOR606V01**
Type	Space
	Receiving and Transmitting

Description Space station antenna pattern (transmitting and receiving) submitted by NOR for analyses under Appendix 30B.

Start Date **End Date**

Region 1 ☐ Cross Polar Gain ☐
Region 2 ☐ Relative Gain ☑
Region 3 ☐

Obsolete Pattern Names/Options

MSPACE: BIFROST-SS2
GIMS: -
R1448: -

Version	0	0	1
Revision Date	2003-05-23		

References

Co-Polar Component

$G = G_{max}$ for $0 \le (\varphi/\varphi_0) \le (1/\sqrt{6})$

$G = G_{max} + 6 - 12\,(\sqrt{3}\,\varphi/\varphi_0)^2$ for $(1/\sqrt{6}) < (\varphi/\varphi_0) \le (1.58/\sqrt{3})$

$G = G_{max} - 24$ for $(1.58/\sqrt{3}) < (\varphi/\varphi_0) \le (3.16/\sqrt{3})$

$G = G_{max} - 11.5 - 25 \log(\sqrt{3}\,\varphi/\varphi_0)$ for $(3.16/\sqrt{3}) < (\varphi/\varphi_0)$

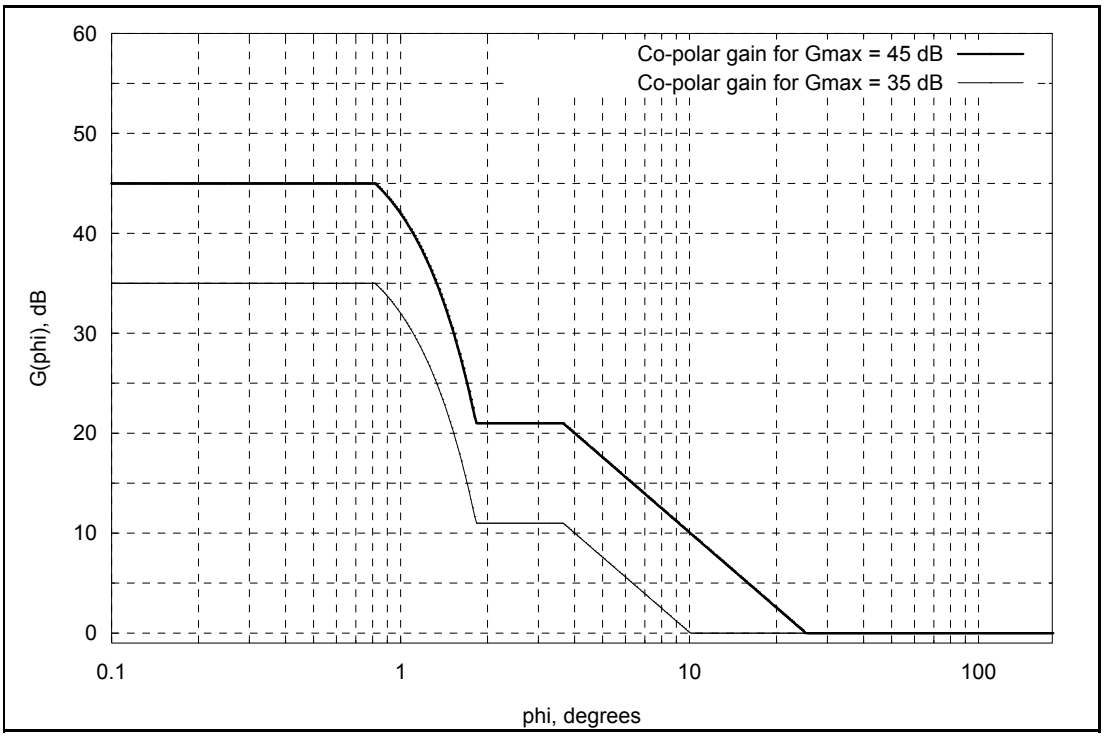
Pattern Information

Space station antenna pattern (transmitting and receiving) is used for analyses under Appendix 30B.

It is based on a pattern submitted by NOR administration for the BIFROST space antenna in 1995.

This pattern corresponds to maximum antenna gain of 35 dB.

Example



Gmax = 45
Phi0 = 2

Gmax = 35
Phi0 = 2

Pattern Input Parameters

GainMax	OPTIONAL
Beamlet	NOVALUE

Specific Parameters Structure Size

0

Required Specific Parameters

-

Specific	NOVALUE
Phi	REQUIRED
Phi0	REQUIRED

Low Level Validation Rules