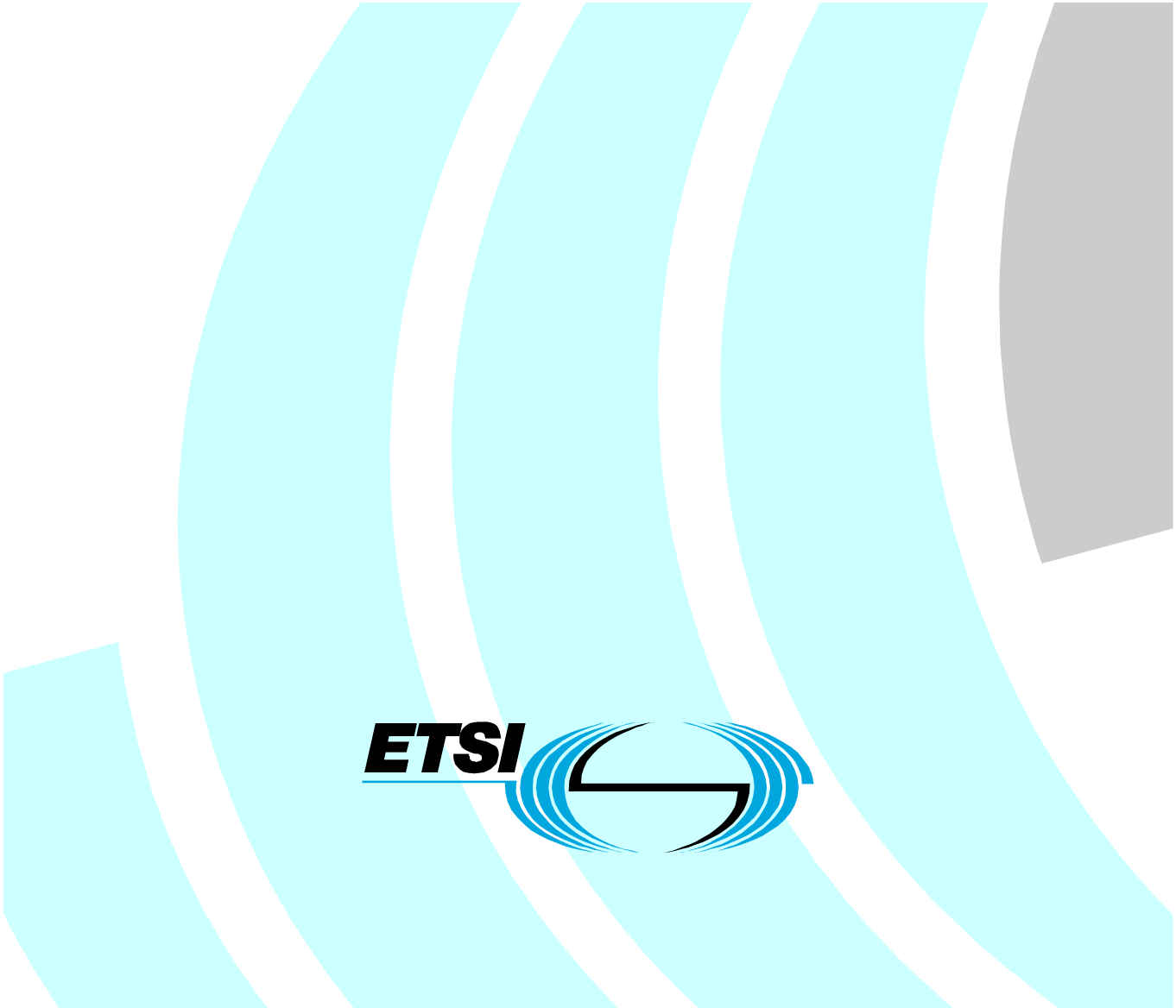
ETSI TR 102 243-1 V1.1.1 (2004-05)

Technical Report

Fixed Radio Systems;
Representative values for transmitter power and antenna gain to support inter- and intra-compatibility and sharing analysis;
Part 1: Digital point-to-point systems



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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM).

Introduction

A consequence of the development of the multipart EN 302 217 [2], intended to superseding a number of older Point-to-point equipment and antennas ENs hereby referenced as "source ENs"; EN 302 217 [2] has reconsidered all previous requirements in the light of Directive 1999/5/EC (R&TTE Directive) [1] in order to clearly split them between those that are relevant to article 3.2 of R&TTE Directive [1] and other requirements that might still part of ETSI normative (as in previous regime before R&TTE Directive coming into force) or even considered informative for the EN users.
In particular EN 302 217 [2] recognized that, besides the 58 GHz frequency band and cases specifically mentioned in Radio Regulations, limits for TX output power does not fall in any of the above categories. Regulatory bodies are generally fixing limits for the licensing but no ECC common view is expressed in any ECC Decision; on the other side it seems not ETSI role to pose limits to technology evolution and market demands.

As a consequence the "maximum" power figures, historically fixed in those older "source ENs", have been removed from the requirements in EN 302 217 [2], which ask for "supplier declaration" of actual TX power and its tolerance to be used as limits for assessment against R&TTE Directive [1], article 3.2 requirements.

However, those values were often used as base for intra and inter-services coexistence and sharing studies. It was therefore considered that information about "typical-maximum" TX power (i.e. those coming from practical technology and practical system deployment constraints) would still be usefully maintained in the present document for any such purpose.

Having devoided them from regulatory HEN "hard-limits", the present document gives information more close to actual reality of Fixed Service (FS) currently deployed; this would lead to much more balanced sharing studies and planning assumptions, leaving the very seldom cases, potentially exceeding those values to real "special cases" to be treated on case-by-case according the principles of "proportionality" introduced by the "New Approach" set of EU Directives.

Together with TX power information, it was considered necessary to give also similar antenna gain information for the definition, of "typical-maximum" E.I.R.P. that, in the same fashion, would give the complete information needed for the mentioned sharing/planning studies.

In the band 57 GHz to 59 GHz the peak value of the O_2 ray absorption results in very specific propagation conditions with a high potential of frequency reuse; for this reason CEPT has approved ERC Recommendation 12-09 [3] for an uncoordinated use of the band. The use of the band could be further optimized by the implementation of features like automatic channel selection.

1 Scope

The present document summarizes, in relation to the various frequency bands and sub-system types given in the multipart EN 302 217 [2], information in relation to current practical bounds coming from technology and deployment practice about:

- Typical-maximum TX power (see note).
- Typical-maximum antenna size and gain.
- Exceptional antenna size and gain.

NOTE: This is not intended as the power available in equipment currently on the market; it indicates the level that is reasonably achievable by FS technology in each band and might be rendered available standing suitable market opportunities justifying the cost/benefit trade off.

Antenna gain is also related to its expected typical antenna size, which nowadays, for its ambiental impact, is another important factor limiting, in practice, most of FS deployments.

The above values are here reported in lack of any ECC harmonized regulations. In the event that such ECC regulations would come into force, it would supersede any less restrictive information given in the present document.

In the band 57 GHz to 59 GHz CEPT promotes an uncoordinated use of the band: see ERC Recommendation 12-09 [3].

2 References

For the purposes of this Technical Report (TR), the following references apply:

[1] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

[2] ETSI EN 302 217 (all parts): "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas".

[3] CEPT/ERC/REC 12-09: "Radio frequency channel arrangement for fixed service systems operating in the band 57,0 - 59,0 GHz which do not require frequency planning".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

absolute maximum transmitter power: maximum permitted power requested in Point-to-point ENs, which constitute the "source ENs" for the multipart EN 302 217 [2]. It was judged as "not relevant" to "essential parameters" under article 3.2 of the R&TTE Directive [1], and removed from the requirements in the new Harmonized EN 302 217-2-2 [2]. It is assumed that no system in the past might have exceeded that value.

exceptional size/gain: maximum antenna dish size and its practical associated gain that are still found in most antenna supplier standard catalogues (at the date of publication of TR 102 243-1). It then excludes any possible special design dedicated to a specific link.

typical maximum output power: typical current (i.e. only for recent and new deployment of systems potentially available on the market) maximum power achievable in Point-to-point FS technology; in TR 102 243-1 it is separately indicated for the various system sub-types, which are defined in EN 302 217-2-1 [2] and EN 302 217-2-2 [2].

typical maximum antenna size/gain: typical current (i.e. only for recent and new deployment of systems currently on the market) maximum antenna dish size and its practical associated gain in point-to-point FS technology (e.g. limited in many cases by ambiental and tower infrastructures constraints); in TR 102 243-1 it is separately indicated for the various system sub-types, which are defined in EN 302 217-2-1 [2] and EN 302 217-2-2 [2].

3.2 Symbols

For the purposes of the present document, the following symbols apply:

dB	deciBel
dBi	deciBels relative to an isotropic radiator
dBm	deciBels relative to 1 milliWatt
GHz	GigaHertz
kbit/s	kilo-bits per second
m	meter
Mbit/s	Mega-bits per second
MHz	MegaHertz
O_2	Oxigen

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ACAP	Adjacent Channel Alternate Polarization
ACCP	Adjacent Channel Co-Polarization
ATPC	Automatic Transmit Power Control
AU	Administrative Unit
CCDP	Co-Channel Dual Polarized
CEPT	Conférence des administrations Européennes des Postes et Télécommunications
EC	European Community
ECC	Electronic Communication Committee of the CEPT
E.I.R.P.	Equivalent Isotropically Radiated Power
ERC	European Radiocommunications Committee of the CEPT, presently become ECC
FS	Fixed Service
HEN	Harmonized European Standard
PDH	Plesiochronous Digital Hierarchy
R&TTE	Radio equipment and Telecommunications Terminal Equipment
RTPC	Remote Transmit Power Control
SDH	Synchronous Digital Hierarchy
sSTM-1k	Synchronous Transport Module of k times VC-12 equivalent payload (k=1, 2, 4, 8, 16)
sSTM-2n	Synchronous Transport Module of n times VC-2 equivalent payload (n=1, 2, 4)
STM-0	Synchronous Transport Module Level 0 (51,840 Mbit/s AU-3 equivalent payload)
STM-1	Synchronous Transport Module Level 1 (155,520 Mbit/s)
STM-4	Synchronous Transport Module Level 4 (622,080 Mbit/s)
Sub-STM-0	Generic term for a number of low capacity SDH transport modules (sSTM-1k or sSTM-2n) defined by ITU-T Recommendation G.708
TX	Transmit or Transmitter
VC	Virtual Container

4 Parameters to be used in sharing and compatibility analyses

4.1 Technology/Application limited maximum transmit power

The following tables provide technology/application limited maximum transmit power to be used in sharing and compatibility analyses. These maximum transmit powers, expressed in dBm, are defined at reference point C' (see figure 1 of EN 302 217-1 [2]),including the transmitter power tolerance and, if applicable, ATPC/RTPC influence.

In addition typical feeder loss, if any are considered of typical use in that application, are also indicated.

Systems A, B, C, D and E, further detailed in annexes A, B, C, D and E of EN 302 217-2-2 [2], are hereby summarized.

System A (frequency bands 1,4 GHz to 2,6 GHz)
relevant sub-systems:

A.1 Low capacity point-to-point digital radio systems operating in the 1,4 GHz frequency band.

A.2 Low and medium capacity point-to-point digital radio systems operating in the frequency range 2,1 GHz to 2,6 GHz.

System B (frequency bands from 3 GHz to 11 GHz with ~ 30 MHz or lower channel separations)
relevant sub-systems:

B.1 Low and medium capacity PDH and STM-0 digital radio systems.

B.2 High capacity digital radio systems carrying 1 × STM-1 signals and operating in frequency bands with about 30 MHz channel separation and alternated arrangements.

B.3 High capacity digital radio systems carrying SDH signals (up to 2 × STM-1) in frequency bands with about 30 MHz channel separation and using Adjacent Channel Co- Polar arrangements (ACCP) or Co-Channel Dual Polar (CCDP) operation.

System C (frequency bands from 3 GHz to 11 GHz with 40 MHz channel separations)
relevant sub-systems:

C.1 High capacity fixed radio systems carrying SDH signals (up to 2 × STM-1) in frequency bands with 40 MHz channel separation and using Adjacent Channel Co-Polar arrangements (ACCP); or Co-channel Dual Polarized (CCDP) operation.

C.2 High capacity digital radio systems carrying STM-4 in two 40 MHz channels or 2 × STM-1 in a 40 MHz channel with alternate (ACAP) channel arrangements.

C.3 High capacity digital radio systems transmitting STM-4 or 4 × STM-1 in a 40 MHz radio frequency channel using Co-Channel Dual Polarized (CCDP) operation.

System D (frequency bands 13 GHz, 15 GHz and 18 GHz)
relevant sub-systems:

D.1 Low and medium capacity Plesiochronous Digital Hierarchy (PDH) radio systems operating in the 13 GHz, 15 GHz and 18 GHz frequency bands.

D.2 Radio systems for the transmission of Sub-STM-0 digital signals operating in the 18 GHz frequency band.

D.3 STM-0 digital radio systems operating in the 13 GHz, 15 GHz and 18 GHz frequency bands with about 28 MHz co-polar (ACCP) and 14 MHz cross-polar (ACAP) channel separation.

D.4 STM-0 digital radio systems operating in the 13 GHz, 15 GHz and 18 GHz frequency bands with about 14 MHz co-polar (ACCP) channel separation.

D.5 High capacity digital radio systems carrying 1 × STM-1 signals and operating in frequency bands with about 30 MHz channel separation and alternated arrangements (ACAP) operating in the 13 GHz and 15 GHz frequency bands.

D.6 High capacity digital radio systems carrying SDH signals (up to 2 × STM-1) in frequency bands with about 30 MHz channel separation and using Adjacent Channel Co-Polar (ACCP) arrangements or Co-Channel Dual Polarized (CCDP) operation operating in the 13 GHz and 15 GHz frequency bands.

D.7 Radio systems for the transmission of STM-1 digital signals operating in the 18 GHz frequency band with channel separation of 55 MHz and 27,5 MHz.

D.8 High capacity digital radio systems carrying STM-4, 4 × STM-1 or 2 × STM-1 signals in bands with 55/56 MHz channel separation operating in the 15 GHz and 18 GHz frequency bands.

System E (frequency bands from 23 GHz to 55 GHz)
relevant sub-systems:

E.1 Radio systems for the transmission of digital signals operating in the 23 GHz frequency band.

E.2 Radio system for the transmission of digital signals operating in the frequency range 24,5 GHz to 29,5 GHz.

E.3 Radio systems for the transmission of digital signals operating in the 31 GHz, 32 GHz and 38 GHz frequency bands.

E.4 High capacity digital radio systems, carrying STM-4, 4 × STM-1 or 2 × STM-1 signals in bands with 55/56 MHz channel separation, operating in the frequency range 23 GHz to 38 GHz.

E.5 Low and medium capacity digital radio systems operating in the 50 GHz frequency band.

E.6 Radio systems for the transmission of digital signals operating in the 52 GHz frequency band.

E.7 Radio systems for the transmission of digital signals operating in the 55 GHz frequency band.

Maximum power output and E.I.R.P. of 58 GHz band systems is still considered relevant to "essential requirements" under article 3.2 of R&TTE Directive [1] and limits (see note 1) are reported in Harmonized EN 302 217-3 [2].

NOTE 1: Currently +10 dBm output power and +45 dBm E.I.R.P. at the date of publication of the present document.

The essential requirements of article 3.2 of R&TTE Directive [1] in term of Transmit power are given in clause 4.2.1 of EN 302 217-2-2 [2].

NOTE 2: The transmitter power tolerance is defined in clause 4.2.3 and in annexes A, B, C, D and E of EN 302 217-2-2 [2] depending on the considered type of system.

NOTE 3: The absolute maximum transmitter power values quoted in tables 1 to 5 are those included in the former set of "source ENs" developed by ETSI WG TM4.

Table 1: Power parameters in frequency bands from 1,4 GHz to 2,7 GHz (Systems A)

Power parameters	System A.1	System A.2
Absolute maximum transmitter power historically provided by ETSI "source ENs"	+40 dBm	
Typical transmitter highest power for real equipment	+33 dBm	+33 dBm
Typical feeder loss (coaxial 7/8 inch)	2,8 dB/50 m	3,3 dB/50 m

Table 2: Power parameters in the frequency bands from 3 GHz to 11 GHz (channel separation up to 30 MHz) (Systems B)

Power parameters	System B.1	System B.2	System B.3
Absolute maximum transmitter power historically provided by ETSI "source ENs"	+40 dBm	+38 dBm	
Typical transmitter highest power for real equipment	+27 dBm	+32 dBm	+32 dBm
Typical feeder loss (elliptical waveguide)	4 GHz: 3 dB/100 m L6 GHz: 4 dB/100 m 7 GHz: 6 dB/100 m 8 GHz: 7 dB/100 m		
Feeder length	Typical 50 m		
NOTE: Radio Regulations 5.482 applies to systems operating in the band 10,6 GHz to 10,68 GHz.			

Table 3: Power parameters frequency bands from 3 GHz to 11 GHz (channel separation 40 MHz) (Systems C)

Power parameters	System C.1	System C.2	System C.3
Absolute maximum transmitter power historically provided by ETSI "source ENs"	+38 dBm	+37 dBm	+41 dBm
Typical transmitter highest power for real equipment	+32 dBm	tbd	tbd
Typical feeder loss (elliptical waveguide)	4 GHz: 3 dB/100 m U6 GHz: 6 dB/100 m 11 GHz: 10,5 dB/100 m		
Feeder length	Typical 50 m		
NOTE: Radio Regulations 5.482 applies to systems operating in the band 10,6 GHz to 10,68 GHz.			

Table 4: Power parameters in the frequency bands 13 GHz, 15 GHz and 18 GHz

Power parameters	System D.1	System D.2	System D.3	System D.4	System D.5 (B.2)	System D.6 (B.3)	System D.7	System D.8
Absolute maximum transmitter power historically provided by ETSI "source ENs"	+40 dBm	+25 dBm	+30 dBm	+40 dBm	+38 dBm		+30 dBm	
Typical transmitter highest power for real equipment	+27 dBm	+25 dBm	+27 dBm	+27 dBm	+28 dBm	+28 dBm	+25 dBm	+25 dBm
Typical feeder loss (elliptical waveguide)	13 GHz: 12,5 dB/100 m 15 GHz: 15 dB/100 m 18 GHz: 20,5 dB/100 m							
Feeder length	Outdoor radio systems with integrated antennas: no feeder loss Full indoor systems; typically: - Up to 40 m at 13 GHz; - Up to 25 m at 15 GHz; - Up to 15 m at 18 GHz.							
NOTE: Radio Regulations 5.522A applies to systems operating in the band 18,6 GHz to 18,8 GHz.								

Table 5: Power parameters in the frequency bands from 23 GHz to 55 GHz

Power parameters	System E.1	System E.2	System E.3	System E.4	System E.5	System E.6	System E.7
Absolute maximum transmitter power historically provided by ETSI "source ENs"	+30 dBm					+10 dBm (note 1)	+9 dBm
Typical transmitter highest power for real equipment	+25 dBm	+25 dBm	+23 dBm	+20 dBm	+13 dBm	+13 dBm	+9 dBm (note 2)
Typical feeder loss (elliptical waveguide)	23 GHz: 29 dB/100 m 26 GHz/28 GHz: 33 dB/100 m 32 GHz: 46 dB/100 m 38 GHz: 60 dB/100 m						
Feeder length	Outdoor radio systems with integrated antennas: no feeder loss Non integrated antenna systems with flexible waveguide; typically: 5 m to 10 m at 23 GHz 5 m at 26 GHz/28 GHz/32 GHz/38 GHz)						
NOTE 1: The "source EN" for this 52 GHz band is the only example of limits lower than what considered achievable (i.e. the same power of system E.5 in 50 GHz band). NOTE 2: Radio Regulations 5.557A applies to systems operating in the band 55,78 GHz to 56,26 GHz band.							

4.2 Typical application limited antenna gain and diameter to be used in sharing or compatibility analyses

Table 6: Antenna parameter in frequency bands from 1,4 GHz to 2,7 GHz

Antenna parameter	System A.1	System A.2
Typical maximum antenna diameter/gain	1,4 GHz 2,4 m/29 dBi 4 m/34 dBi (exceptional)	2,7 GHz 2,4 m/34 dBi 4 m/38 dBi (exceptional)

Table 7: Antenna parameter in the frequency bands from 3 GHz to 11 GHz (channel separation up to 30 MHz)

Frequency range	Antenna parameter	System B.1	System B.2	System B.3
3 GHz to 5 GHz	Typical maximum antenna size/gain	3 m/41 dBi 4,6 m/45 dBi (exceptional)	3,7 m/43 dBi 4,6 m/45 dBi (exceptional)	
5 GHz to 8,5 GHz	Typical maximum antenna size/gain	2,4 m/44 dBi 4,6 m/49 dBi (exceptional)	3 m/46 dBi 4,6 m/49 dBi (exceptional)	
8,5 GHz to 11 GHz	Typical maximum antenna size/gain	2,4 m/46 dBi 3 m/48 dBi (exceptional)	2,4 m/46 dBi 3 m/48 dBi (exceptional)	

Table 8: Antenna parameter in the frequency bands from 3 GHz to 11 GHz (channel separation 40 MHz)

Frequency band	Antenna parameter	System C.1	System C.2	System C.3
4 GHz and 5 GHz	Typical maximum antenna size/gain	3,7 m/43 dBi 4,6 m/45 dBi (exceptional)		
U6 GHz	Typical maximum antenna size/gain	3 m/44 dBi 4,6 m/48 (exceptional)		
11 GHz	Typical maximum antenna size/gain	3 m/48 dBi 3,7 m/50 dBi (exceptional)		

Table 9: Antenna parameter in the frequency bands 13 GHz, 15 GHz and 18 GHz

System	System D.1	System D.2	System D.3 System D.4	System D.5 System D.6	System D.7	System D.8
Frequency band	13, 15, 18	18	13, 15, 18	13, 15	18	15, 18
Typical maximum antenna size/gain	13 GHz 3 m/50 dBi 18 GHz 1,8 m/48 dBi	0,6 m/40 dBi	13 GHz 3 m/50 dBi 18 GHz 1,8 m/48 dBi	13 GHz 3 m/50 dBi 15 GHz 2,4 m/49 dBi	1,8 m/48 dBi	15 GHz 2,4 m/49 dBi 18 GHz 1,8 m/48 dBi
Exceptional size/gain			13 GHz 15 GHz 18 GHz	3,7 m/51 dBi 3 m/51 dBi 2,4 m/51 dBi		

Table 10: Antenna parameter in the frequency bands from 23 GHz to 55 GHz

Antenna parameter	System E.1 (23 GHz)	System E.2 (26 GHz/28 GHz)	System E.3 (31 GHz/32 GHz /38 GHz)	System E.4 (23 GHz/26 GHz/ 28 GHz/32 GHz/ 38 GHz)	System E.5 (50 GHz)	System E.6 (52 GHz)	System E.7 (55 GHz)
Typical maximum antenna size/gain	1,2 m/47dBi	26 GHz 0,6 m/42 dBi 28 GHz 0,6 m/42,5 dBi	31 GHz 0,6 m/43 dBi 38 GHz 0,6 m/45 dBi	23 GHz 0,6 m/42 dBi 38 GHz 0,6 m/45 dBi	0,3 m/42 dBi		0,3 m/43 dBi
Exceptional size/gain	1,8 m/51dBi	26 GHz 1,2 m/47,5 dBi 28 GHz 1,2 m/48 dBi	31 GHz 1,2 m/48,5 dBi 38 GHz 1,2 m/51 dBi	23 GHz 1,2 m/47 dBi 38 GHz 1,2 m/51 dBi	--		--

History

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