AGREEMENT

between the Administrations of

Austria,
Belgium,
the Czech Republic,
Germany,
France,
Hungary,
the Netherlands,
Croatia,
Italy,
Liechtenstein,
Lithuania,
Luxembourg,
Poland,
Romania,
the Slovak Republic,
Slovenia
and
Switzerland

on the co-ordination of frequencies between 29.7 MHz and 43.5 GHz for the fixed service and the land mobile service.

(HCM Agreement)

Berlin, 8th September 2022

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Preamble

The representatives of the administrations of Austria, Belgium, the Czech Republic, Germany, France, Hungary, the Netherlands, Croatia, Italy, Liechtenstein, Lithuania, Luxembourg, Poland, Romania, the Slovak Republic, Slovenia and Switzerland have concluded the present Agreement, under Article 6 of the Radio Regulations, on the co-ordination of frequencies between 29.7 MHz and 43.5 GHz for the purposes of preventing mutual harmful interference to the Fixed and Land Mobile Services and optimising the use of the frequency spectrum above all on the basis of mutual agreements.

This Agreement is referred to as HCM Agreement (Berlin 2022).

Article 1

1 Definitions

The definitions used in this Agreement shall be those of Article 1 of the Radio Regulations as well as those listed in this Section.

1.1 Administrations

AUT Bundesministerium für Landwirtschaft, Regionen und Tourismus
(Federal Ministry for Agriculture, Regions and Tourism)

BEL Belgisch Instituut voor Postdiensten en Telecommunicatie
Institut Belge des services Postaux et des Télécommunications
(Belgian Institute for Postal services and Telecommunications)

CZE Český telekomunikační úřad
(Czech Telecommunication Office)

D Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen
(Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway)

F Agence Nationale des Fréquences
(National Frequencies Agency)

HNG Nemzeti Média- és Hírközlési Hatóság
(National Media and Infocommunications Authority)

HOL Agentschap Telecom
(Radio Communications Agency Netherlands)

HRV Hrvatska regulatorma agencija za mrežne djelatnosti
(Croatian Regulatory Authority for Network Industries)

I Ministero dello Sviluppo Economico – Dipartimento Comunicazioni
(The Ministry of Economic Development – Department of Communication)

LIE Amt für Kommunikation
(Office for Communications)

LTU Lietuvos Respublikos ryšių reguliavimo tarnyba
(Communications Regulatory Authority of the Republic of Lithuania)

LUX Institut Luxembourgeois de Régulation
(Luxembourg Regulator)

POL Urząd Komunikacji Elektronicznej
(Office of Electronic Communications)

ROU Autoritatea Naţională pentru Administrare şi Reglementare în Comunicaţii
(National Authority for Management and Regulation in Communications of Romania)

SVK Úrad pre reguláciu elektronických komunikácií a poštových služieb
(Regulatory Authority for Electronic Communications and Postal Services)

SVN Agencija za komunkacijska omrežja in storitve Republike Slovenije (Agency for communication networks and services of the Republic of Slovenia)

SUI Bundesamt für Kommunikation
Office fédéral de la communication
(Federal Office of Communications)

1.2 Frequencies

1.2.1 Frequencies in the bands listed below for the Land Mobile Service in the countries concerned shall be co-ordinated under the terms of this Agreement.

29,7	-	47	MHz	
68	-	74,8	MHz	
75,2	-	87,5	MHz	
146	-	149,9	MHz	
150,05	-	174	MHz	
380	-	385	MHz	for emergency and security systems only
390	-	395	MHz	for emergency and security systems only
406,1	-	430	MHz	
440	-	470	MHz	
694	-	960	MHz	for GSM and IMT terrestrial systems only
1452	-	1492	MHz	for IMT terrestrial systems only
1710	-	1785	MHz	for GSM and IMT terrestrial systems only
1805	-	1880	MHz	for GSM and IMT terrestrial systems only
1900	-	1920	MHz	
1920	-	1980	MHz	for IMT terrestrial systems only
2010	-	2025	MHz	
2110	-	2170	MHz	for IMT terrestrial systems only
2500	-	2690	MHz	
3400	-	3800	MHz	

1.2.2 For the Land Mobile Service in frequency bands other than those defined in 1.2.1 and for all other services in these frequency bands, the co-ordination procedure set out in this Agreement may be used, and, if necessary, the technical parameters shall be agreed separately.

1.2.3 Frequencies in the bands listed below, used in the countries concerned for the Fixed Service shall be co-ordinated under the terms of this Agreement.

1350	-	1375	MHz	10,15	-	10,65	GHz
1375	-	1400	MHz	10,7	-	11,7	GHz
1427	-	1452	MHz	12,75	-	13,25	GHz
1492	-	1525	MHz	14,5	-	14,62	GHz
2025	-	2110	MHz	15,23	-	15,35	GHz
2200	-	2290	MHz	17,7	-	19,7	GHz
3410	-	3600	MHz	22	-	22,6	GHz
3600	-	4200	MHz	22,6	-	23	GHz
5925	-	6425	MHz	23	-	23,6	GHz
6425	-	7125	MHz	24,5	-	26,5	GHz
7125	-	7725	MHz	27,5	-	29,5	GHz
7725	-	7975	MHz	31	-	31,3	GHz
8025	-	8275	MHz	31,8	-	33,4	GHz
8275	-	8500	MHz	37	-	39,5	GHz
				40,5	-	43,5	GHz

1.2.3.1 The co-ordination procedure laid down in this Agreement for the Fixed Service is only valid if in both countries involved in the co-ordination process the respective frequency band is allocated to the Fixed Service and the respective frequency falls under the responsibility of the Administrations.

1.2.4 For frequencies below 1 GHz and listed under 1.2.1, used in the countries concerned for the Fixed Service, the co-ordination procedure and the technical provisions set out in this Agreement for the Land Mobile Service shall be used.

1.2.5 For frequencies above 1 GHz used in the countries concerned for the Fixed Service in frequency bands other than those listed in the frequency table given in paragraph 1.2.3, the co-ordination procedure set out in this Agreement for the Fixed Service may be used, and, if necessary, the technical parameters shall be agreed separately between Administrations concerned. This applies also for frequencies above 43.5 GHz if there is a common understanding between Administrations.

1.2.6 Short Range Devices (SRDs) as defined in ERC/REC 70-03 are not subject to this Agreement.

1.3 Frequency categories

1.3.1 Frequencies requiring co-ordination

Frequencies which Administrations are required to co-ordinate with the other Administrations affected (see 1.6) before a station is put into service.

1.3.2 Preferential frequencies

Frequencies which the Administrations concerned may assign, without prior co-ordination, on the basis of bi- or multilateral agreements under the terms laid down therein.

1.3.3 Shared frequencies

Frequencies which may be shared without prior co-ordination, on the basis of bi- or multilateral agreements under the terms laid down therein.

1.3.4 Frequencies for planned radio communication networks in the Land Mobile Service

Frequencies which the Administrations must co-ordinate with a view to the subsequent introduction of coherent radio communication networks in the Land Mobile Service, where the number of locations multiplied by the number of frequencies exceeds 36.

1.3.5 Frequencies used on the basis of geographical network plans

Frequencies used for the Land Mobile Service, in the countries concerned on the basis of a geographical network plan prepared and adopted in advance, taking into account the technical characteristics set out in that plan.

1.3.6 Frequencies using preferential codes

Frequencies which the Administrations concerned may assign, without prior co-ordination, on the basis of bi- or multilateral agreements under the terms laid down therein.

1.3.7 Frequencies used on the basis of arrangements between operators

Frequencies laid down in arrangements between operators may be used without prior co-ordination, on the condition that there is an existing agreement signed by the Administrations concerned authorising such arrangements. These arrangements between operators may also include the use of the codes.

A copy of each bi- or multilateral agreement mentioned in Sections 1.3.2, 1.3.3, 1.3.6 and 1.3.7, if not confidential, should be sent in electronic form to the Managing Administration which will inform all other Administrations by placing it on the server.

1.4 Frequency Register

The Frequency Register shall be made up of lists set out by every Administration indicating its co-ordinated frequencies, its assigned preferential frequencies, its shared frequencies, its frequencies co-ordinated for planned radio communication networks, and its frequencies used on the basis of geographical network plans and frequencies using preferential codes. A list of the details to be included in the Frequency Register is given in Annex 2A and Annex 2B. All frequency assignments in this register shall be protected according to their status of co-ordination. There are as many lists as affected countries.

1.5 Harmful interference

Harmful interference shall be construed as any emission which causes serious degradation in the quality of the traffic of a radio communication service, or repeatedly disrupts or interrupts that service by exceeding the maximum permissible interference field strength specified for the Land Mobile Service in Annex 1 or in the case of the Fixed Service exceeding the maximum permissible threshold degradation in Annex 9.

1.6 Administration affected

Any Administration whose station could suffer from harmful interference as a result of the planned use of a frequency, or whose station could cause harmful interference to a planned receiving station of the requesting Administration.

1.7 HCM Programs

1.7.1 The HCM (Harmonised Calculation Method) Programs are programs developed for the harmonised application of the calculation methods as provided in the Annexes of this Agreement.

The Technical Working Group HCM was given the task by the administrations to manage the HCM Programs for the Mobile Service and the Fixed Service.

Each ‘HCM Program’ means the source code, the DLL, the test program (*.EXE) and the program documentation.

Every Administration is free to use the source code, the DLL, or the test program. In case of dispute, official DLL utilized via the test program will be used as a reference.

The managing Administration is responsible for the maintenance and registration of the HCM server.

All the provisions of this Agreement will apply, making use of the HCM program for the respective service, using a topo-database and border lines.

The existing database and border lines available on the HCM-server and further described in the user manual are a basis for bi- or multilateral agreements.

If more detailed topographical database and border line data are needed, they shall be mutually agreed between Administrations carrying out co-ordinations with each other.

1.7.2 A new version of a HCM program has to be implemented by all Administrations at the same point in time to avoid keeping different versions for different neighbouring countries. Because the HCM software is only a subroutine, this subroutine has to be implemented in national surrounding programs. The following procedure is set up:

The Managing Administration announces new HCM program versions and the exact date of the implementation of them. The new HCM program is put on the data server of this Agreement for download. The version history is updated.

If an error is reported, TWG may give instructions to correct this error and task the relevant sub working group to provide a new program version.

The implementation phase is one month.

1.7.2.1 If modifications are done to the interface to the surrounding program (modifications of the surrounding program are required), a grace period of one year after the official announcement of the new version is granted.

1.7.3 For the harmonized application of the calculation method laid down in the Annexes to this Agreement new versions of the HCM programs will be developed.

1.8 Data Exchange

1.8.1 If modifications are done to the Annex 2A or Annex 2B (modifications of the surrounding program are required), a grace period of one year after the official announcement of the new version is granted.

Article 2

2 General

2.1 This Agreement shall in no way affect the rights and obligations of the Administrations arising from the Constitution and Convention of the International Telecommunication Union (ITU), the administrative Regulations and Agreements concluded within the framework of the ITU as well as other pertinent inter-governmental agreements.

2.2 Administrations shall assign frequencies exclusively in accordance with the provisions of this Agreement. If co-ordination is required, it shall be done prior to the putting into operation of the radio station affected.

2.3 If necessary, the Administrations may agree on provisions that are different from or supplementary to the provisions of this Agreement, which, however, must not adversely affect Administrations that are not concerned.

2.4 The Fixed and Land Mobile Services where administrations may not or can not give information on the use, for example where the services are different or do not come under the responsibility of the Administrations or where the usage is restricted for national defence purposes or for services where information is not available shall not be governed by the provisions of this Agreement unless otherwise provided for.

2.5 In the case of the Land Mobile Service the effective radiated power and the effective antenna height of stations shall be chosen so that their range is confined to the area to be covered. Excessive antenna heights and transmitter outputs shall be avoided by using several locations and low effective antenna heights. Directional antennas shall be used in order to minimise the potential of interference to the neighbouring country. The maximum cross-border ranges of harmful interference for frequencies requiring co-ordination are given in Annex 1.

2.6 The effective radiated power and the antenna height of stations in the Fixed Service shall be chosen according to the radio links lengths and the required quality of service. Excessive antenna heights, excessive transmitter outputs and too low antenna directivities shall be avoided in order to minimise the potential of interference to the country affected.

Article 3

3 **Technical provisions**

The request for co-ordination of a station and the evaluation of this request shall be made in accordance with the following technical provisions:

3.1 In case of the Land Mobile Service the maximum permissible interference field strength is given in Annex 1.

In case of the Fixed Service, the maximum permissible threshold degradation is given in Annex 9.

3.2 Where in the case of the Land Mobile Service the nominal frequencies are different, the permissible interference field strength shall be increased as indicated in Annex 3A.

In case of the Fixed Service the interference level at the receiver input shall be decreased according to Annex 9 by the Masks Discrimination (MD) and the Net Filter Discrimination (NFD) as given in Annex 3B.

3.3 The interference field strength shall be determined in the case of the Land Mobile Service in accordance with Annex 5.

In the case of the Fixed Service, the threshold degradation shall be determined using Annex 9 where the basic transmission loss is calculated in accordance with Annex 10.

3.4 Administrations may agree to apply parameters other than the set values.

Article 4

4 Procedures

4.1 Frequencies requiring co-ordination

In the case of the Land Mobile Service a transmitting frequency shall be co-ordinated if the transmitter produces a field strength, at the border of the country of the Administration affected, which, at a height of 10 m above ground level, exceeds the maximum permissible interference field strength as defined in Annex 1. A receiving frequency shall be co-ordinated if the receiver requires protection.

It is strongly recommended to co-ordinate radio-relay links in the Fixed Service if the shortest distance from the border of at least one station is less or equal to the one defined in Annex 11. All stations which may cause harmful interference to stations in other countries or need protection shall be co-ordinated regardless of the distance.

4.1.1 Any Administration wishing to take into operation a station shall circulate a request for co-ordination to all Administrations affected for their comment. This request shall include the characteristics in accordance with Annex 2A and Annex 2B.

4.1.2 If, for the purpose of technically evaluating this request, the Administration affected requires information that is lacking or needs to be supplemented in accordance with Annex 2A and Annex 2B, it shall ask for this information within 30 days upon receipt of the request for co-ordination. After this request, complete information concerning a request for co-ordination shall be sent by the requesting administration within 30 days, otherwise the coordination request shall be deemed null and void.

4.1.3 Having received complete information concerning a request for co-ordination, the Administration affected shall evaluate this information in accordance with the provisions of this Agreement. It shall notify the requesting Administration of the outcome within 45 days.

4.1.4 If the Administration which initiated the co-ordination procedure does not receive a reply within 45 days, it may send a reminder. The Administrations affected shall respond to this reminder within 20 days.

4.1.5 If the Administration affected again fails to respond within the period fixed under Section 4.1.4, it shall be deemed to have given its consent, and the station shall be considered co-ordinated.

4.1.6 The periods specified under Sections 4.1.3 and 4.1.4 may be changed by mutual consent.

4.1.7 Any co-ordinated frequency assignment shall be notified to the Administrations affected as soon as the corresponding station is put into operation but not later than 180 days upon approval. Following such notification of the assignment, this assignment shall be updated in the Frequency Register.

If no notification of assignment is given within 180 days, the Administration affected shall send a reminder to the Administration that has asked for co-ordination. If no notification of assignment is given within another 30 days, the request for co-ordination shall be deemed null and void.

No notification shall be required if the frequency registers are exchanged semi-annually in accordance with Section 4.9.1.

4.1.8 The Administration wishing to change the technical characteristics of stations registered in the Frequency Register, shall notify the Administrations affected of its intentions. Co-ordination shall be required if this change causes the probability of interference to increase in the affected country. If the situation remains unchanged with regard to interference or if it improves, the Administrations affected shall only be informed of such a change. The entry in the Frequency Register shall be corrected accordingly.

4.1.9 In special cases, the Administrations may assign frequencies for temporary use (up to 45 days) without co-ordination provided this does not cause harmful interference to co-ordinated stations. As soon as possible, the Administration affected shall be notified of the planned taking into operation. Such stations shall immediately be taken out of operation if they cause harmful interference to co-ordinated stations of the affected country. These assignments shall be made on preferential frequencies as far as possible.

4.1.10 If an assignment is no longer in force, the competent Administration shall notify the affected Administration within three months and the entry in the Frequency Register has to be deleted.

4.2 Preferential frequencies

4.2.1 Frequencies in the frequency bands specified in Section 1.2 may be defined by prior bi- or multilateral agreements concluded in the framework of this agreement as preferential frequencies for given Administrations.

4.2.2 The Administration which has been granted a preferential right may put stations operating on preferential frequencies within the terms of the relevant bi- or multilateral agreements into use without prior co-ordination.
If the conditions for the protection of the receiver in the mobile service are not defined in bi- or multilateral agreements, section 2.2 of Annex 1 will apply.

4.2.3 Preferential frequencies granted to an Administration shall have priority rights over assignments made to other Administrations concerned.

4.2.4 The entry into service of stations using preferential frequencies shall be notified to the Administrations affected, unless otherwise laid down in bi- or multilateral agreements. The notification shall include the characteristics as set out in Annex 2A and Annex 2B. These frequencies and their technical characteristics shall be entered with status “P” into the Frequency Register. No response to such a notification is required.

4.2.5 Preferential frequencies to be assigned on conditions other than those agreed in bi- or multilateral agreements mentioned in Section 1.3.2 shall be co-ordinated in accordance with Section 4.1.

4.2.6 Following a positive co-ordination procedure in accordance with Section 4.1, Administrations may bring into use another Administration's preferential frequencies. These shall have the same rights as frequencies co-ordinated in accordance with Section 4.1.

4.2.7 If the existing radio networks of one Administration cause harmful interference to the stations operated by another Administration on frequencies to which it has a preferential right, or if, in particular cases, frequency assignments not enjoying preferential rights have to be adjusted, the Administrations concerned shall determine the transition period by mutual consent.

4.3 Frequencies for planned radio communication networks in the Land Mobile Service

4.3.1 Prior to the co-ordination of a planned radio communication network the Administrations may embark on a consultative procedure in order to facilitate the taking into operation of this new network. The request for consultation shall include the planning criteria as well as the following data:

- planned frequencies (transmitting and receiving frequency of the station);
- coverage area of the entire radio communication network;
- class of the station;
- the coverage area of a station;
- effective radiated power;
- maximum effective antenna height;
- designation of the emission;
- network development plan;
- antenna characteristics for stations belonging to the network.

The Administration affected shall acknowledge receipt of the request for consultation and communicate its reply within 60 days.

In complicated planning issues this consultation may require a bi- or multilateral consultation meeting in order to assist the Administration planning a radio communication network in coming to a quicker solution.

4.3.2 To co-ordinate frequencies for a planned radio communication network the Administration affected shall apply, no sooner than three years prior to the planned taking into operation of the network, the procedure described in Section 4.1 together with the following changes:

4.3.2.1 The receipt of the request for co-ordination shall be acknowledged.

4.3.2.2 If there is no prior consultation the Administration affected shall submit its reply within 180 days from the day of the receipt of the request for co-ordination. Any request for co-ordination following a consultation process shall be responded to within 120 days.

4.3.2.3 The Administration requesting co-ordination shall notify to the Administration affected the date at which the radio communication network will be taken into operation.

4.3.3 Stations forming part of the radio communication network shall be entered into the Frequency Register together with the date of the termination of the co-ordination procedure, and enjoy the same rights as the stations co-ordinated in accordance with Section 4.1.

4.3.4 Co-ordination shall be null and void for those co-ordinated stations which have not been taken into operation within 30 months of the termination of the co-ordination procedure.

4.4 Frequencies used on the basis of geographical network plans in the Land Mobile Service

4.4.1 Geographical network plans covering certain parts of the frequency bands indicated in Section 1.2 may be prepared and co-ordinated, divergence from the defined parameters being permissible, subject to prior agreement reached between the Administrations affected. These frequencies shall be entered in the Frequency

Register. On the basis of the geographical network plans adopted in this fashion, an Administration shall be authorised to put stations into service without prior co-ordination with the Administration with which the plan has been agreed.

4.4.2 Frequencies used on the basis of geographical network plans and intended to be assigned on conditions other than those agreed between Administrations concerned, shall be co-ordinated in accordance with Section 4.1.

4.5 Frequencies using preferential codes

4.5.1 Preferential code groups or preferential code group blocks may be agreed between Administrations concerned where centre frequencies are aligned.

4.5.2 The Administration which has been granted a preferential right may put stations operating on preferential code groups or preferential code group blocks within the terms of the relevant bi- or multilateral agreements into use without prior co-ordination.

4.5.3 Preferential code groups or preferential code group blocks granted to an Administration shall have priority rights over assignments made to other Administrations concerned.

4.5.4 The entry into service of stations using preferential code groups or preferential code group blocks shall be notified to the Administrations affected, including the characteristics as set out in Annex 2A, unless otherwise laid down in bi- or multilateral agreements. These frequencies and their technical characteristics shall be entered with status “P” in the Frequency Register.
No response to such notification is required.

4.5.5 Frequencies using preferential code groups or preferential code group blocks which have to be assigned on conditions other than those agreed in bi-or multilateral agreements mentioned in Section 1.3.6 shall be co-ordinated in accordance with Section 4.1.

4.5.6 Following a positive co-ordination procedure in accordance with Section 4.1, Administrations may bring into use frequencies using another Administration's preferential code groups or preferential code group blocks. These shall have the same rights as frequencies co-ordinated in accordance with Section 4.1.

4.5.7 If the existing radio networks of one Administration cause harmful interference to the stations operated by another Administration on frequencies using preferential code groups or preferential code group blocks, or if, in particular cases, frequency assignments not enjoying preferential code groups rights or preferential code group blocks rights, have to be adjusted, the Administrations concerned shall determine the transition period by mutual consent.

4.6 Frequencies used on the basis of arrangements between operators

4.6.1 Operators in neighbouring countries are allowed to conclude mutual arrangements on the condition that the Administrations concerned have signed an agreement authorizing such arrangements.

4.6.2 Arrangements between operators may deviate from the technical parameters or other conditions laid down in the annexes of this Agreement or in relevant bi- or multilateral agreements between the Administrations concerned.

4.7 Evaluation of requests for co-ordination

4.7.1 In evaluating the requests for co-ordination, the Administration affected shall take into account the following frequencies:

- frequencies entered in the Frequency Register;
- frequencies used on the basis of bi- or multilateral agreements;
- frequencies awaiting an answer to a co-ordination request (in chronological order of requests).

4.7.2 A request for co-ordination of a transmitting frequency in the Land Mobile Service may only be rejected if the respective station:

4.7.2.1 produces an interference field strength exceeding the maximum permissible value as given in Annex 1 at a station entered in the Frequency Register or

4.7.2.2 intends to use a frequency without meeting the conditions agreed upon bi- or multilaterally or

4.7.2.3 produces an interference field strength exceeding the maximum permissible value as given in Annex 1 in the case of a station awaiting an answer to a co-ordination request or

4.7.2.4 does not meet the conditions governing the maximum cross-border ranges of harmful interference as given in Annex 1.

4.7.3 Within the Land Mobile Service the request for protection of a receiver may only be rejected if:

4.7.3.1 at least one of the co-ordinated transmitters of the Administration affected produces at the respective receiver an interference field strength which is higher than the maximum permissible interference field strength given in Annex 1 or

4.7.3.2 the protection of the receiver would restrict the use of a preferential frequency of the Administration affected under the conditions agreed upon bi- or multilaterally or

4.7.3.3 one of the transmitters awaiting an answer to a co-ordination request of the Administration affected produces at the respective receiver an interference field strength which is higher than the maximum permissible interference field strength given in Annex 1 or

4.7.3.4 the conditions governing the receiver protection as given in Annex 1 Section 2.2 are not met.

4.7.4 A request for co-ordination of a transmitter frequency in the Fixed Service may only be rejected if the respective station:

4.7.4.1 produces a threshold degradation exceeding the maximum permissible value given in Annex 9 at a station entered in the Frequency Register or

4.7.4.2 is intended for using a frequency without meeting the conditions agreed upon bi- or multilaterally or

4.7.4.3 produces a threshold degradation exceeding the maximum permissible value given in Annex 9 in the case of a station awaiting an answer to a co-ordination request.

4.7.5 Within the Fixed Service, the protection of a receiver may only be rejected if:

4.7.5.1 the request for co-ordination for the associated transmitter has been refused,

4.7.5.2 the protection of the receiver would restrict the use of a preferential frequency of the Administration affected under the conditions agreed upon bi- or multilaterally in accordance with Section 1.3.2.

4.7.6 If protection from interference cannot be guaranteed, a request for co-ordination must be accepted with "G" (Appendix 9 to Annex 2A and Annex 2B).

4.7.7 In case a request for co-ordination is rejected or a conditional reply is given to such a request, the reasons shall be given for this, indicating, if appropriate, either the radio station to be protected or the radio station which could cause harmful interference to the planned radio station.

4.7.8 An Administration making reference to Section 2.4 of this Agreement may only respond to a request for co-ordination by indicating "C" or "G" in accordance with Appendix 9 to Annex 2A and Annex 2B. No reason needs to be given for "G" in accordance with Section 4.7.7; reference to Section 2.4 shall be sufficient.

4.8 Evaluation in connection with tests

In order to make more efficient use of the radio spectrum, to avoid possible harmful interference and facilitate the enhancement of existing networks, the following procedure may be used:

4.8.1 If the Administrations affected arrive at different results in their evaluations of the interference situation, or if the request for co-ordination currently being processed justifies a trial basis, they shall agree to open the service on a trial basis. Stations falling into the above cases shall be given a temporary status “D” in accordance with Appendix 9 to Annex 2A and Annex 2B, until final status can be accomplished.

4.8.2 The provisions on measurement procedures are given in Annex 7.

4.8.3 On completion of the tests a final decision shall be communicated to the requesting Administration within 30 days, indicating the measured values of the interference field strength.

4.9 Exchange of Lists

4.9.1 Each Administration shall prepare an up-to-date Frequency Register in accordance with Section 1.4. The List corresponding to each affected Administration contained in the Frequency Register shall be exchanged bilaterally at least once every six months.

4.9.2 The Administrations shall undertake to use the data appearing in the Lists of other Administrations for service purposes only. These Lists may not be communicated to other Administrations or other third parties without the consent of the Administration affected.

Article 5

5 **Report of harmful interference**

Any harmful interference which is observed shall be reported to the Administration of the country in which the interfering station is located, in accordance with Annex 7. If harmful interference occurs on frequencies entered in the Frequency Register, the Administrations concerned shall endeavour to achieve a mutually satisfactory solution as soon as possible.

Article 6

6 **Revision of this Agreement**

This Agreement may be expanded or amended at any time at the initiative of any Administration, subject to approval by the other Administrations. Planned amendments shall be communicated to the Managing Administration, which shall undertake to obtain the assent of the other Administrations through the appropriate channels. If assent is sought by correspondence, a reply shall be requested within one month. If any Administration fails to respond within this period, the Managing Administration will send a reminder, to which the Administration shall reply within one month. If this Administration again fails to respond, it shall be deemed to have given its consent.

Article 7

7 **Accession to this Agreement**

Any European administration which needs to co-ordinate with at least one Administration may accede to this Agreement. A declaration to that effect shall be addressed to the Managing Administration. Upon approval by all Administrations, the accession shall take effect the day on which the requesting administration signs this Agreement. If approval is sought by correspondence, a reply shall be requested within three months. If any Administration fails to respond within this period, the Managing Administration will send a reminder, to which the Administration in question shall reply within one month. If this Administration again fails to respond, it shall be deemed to have given its consent.

Article 8

8 **Withdrawal from this Agreement**

Any Administration may withdraw from the Agreement by the end of a calendar month by giving notice of its intention at least six months before. A declaration to that effect shall be addressed to the Managing Administration.

Article 9

9 **Status of co-ordinations prior to this Agreement**

The new provisions shall not apply to frequency utilisations already agreed between Administrations prior to this Agreement being concluded. These frequencies shall be recorded in the Frequency Register.

In the case of the Fixed Service, information on frequency utilisation before 01.01.2005 within the co-ordination distances as defined in Annex 11 should be exchanged between the Administrations concerned. This frequency utilisation will be concluded as co-ordinated and shall be recorded in the Frequency Register.

Article 10

10 Languages of this Agreement

This Agreement exists in the English language original and will be translated into French and German, each version being equally authentic.

Article 11

11 Entry into force of this Agreement

This Agreement shall enter into force on 01 January 2023.

Article 12

12 Revocation of the Agreement agreed by correspondence in 2020

On 01 January 2023, the Agreement on the co-ordination of frequencies between 29.7 MHz and 43.5 GHz for the Fixed Service and the Land Mobile Service, agreed by correspondence in 2020, shall cease to be effective. Bi- and multilateral agreements concluded within the framework of previous versions of the Agreement remain valid.

Annex 1

Maximum permissible interference field strengths and maximum cross-border ranges of harmful interference for frequencies requiring co-ordination in the Land Mobile Service

1 Maximum permissible interference field strength values

The interference field strength shall not exceed the values given in column 2 of the table.

2 Cross-border ranges of harmful interference

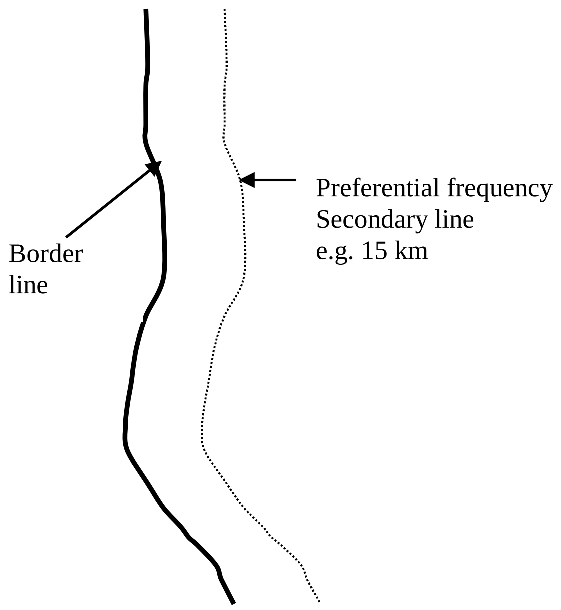
Administrations shall endeavour to reduce the cross-border range of harmful interference caused by their stations and extending into the territory of an administration affected to a minimum as indicated in Section 2.5 of the Agreement.

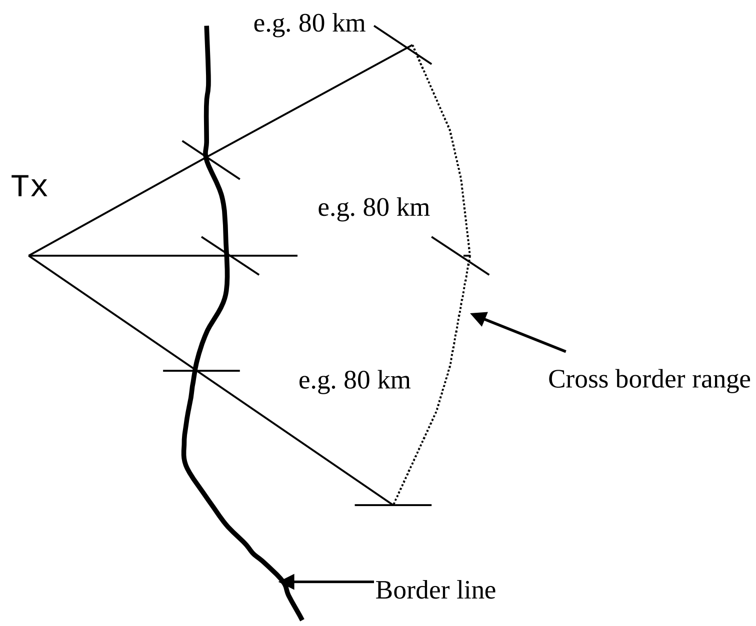
2.1 Limitation of harmful interference caused by transmitters

The cross-border range of harmful interference caused by transmitters which have to be coordinated is dependent on the frequency range and shall not exceed the values given in column 3 of the table. The values given in column 2 of the table shall be used as limits for the permissible interference field strength at the distances from the border specified in column 3 of the table. The values apply to a height of 10 m above ground level.

To define the points of maximum cross-border range of harmful interference, these points are located at a distance as defined in column 3 of the table, starting at the border points of the requesting administration into the direction of the affected administration, following the same direction as from the station to those border points.

In case of preferential frequencies the calculation shall be performed on a secondary line. Each point of this secondary line is at least at a distance from any border-line point as defined in the respective agreements.





2.2 Limitation of protection of receivers

Protection for receivers can only be claimed if a reference transmitter, located at the site and the height of the receiver concerned, generates a field strength which does not exceed the values specified in column 2 of the table at a height of 10 m above ground level and at a distance specified in column 3 of the table. For this calculation the 10% of time curves have to be used.

The ERP of the reference transmitter is dependent on the frequency range as given in column 4 of the table and shall be increased by the antenna gain of the receiver in the actual direction.

(1) Frequency range (MHz)	(2) Permissible interference field strength (relative to 1 µV/m)	(3) Maximum cross-border range of harmful interference (km)	(4) ERP of the reference transmitter (dBW)	(5) Applies to the System	(6) Reference bandwidth	(7) Reference
29.7 - 47	0 dB	100	3	Analog & Digital Land mobile	25 kHz	T/R 25-08
68 - 74.8	+6 dB	100	9	Analog & Digital Land mobile	25 kHz	T/R 25-08
75.2 - 87.5	+6 dB	100	9	Analog & Digital Land mobile	25 kHz	T/R 25-08
146 - 149.9	+12 dB	80	12	Analog & Digital Land mobile	25 kHz	T/R 25-08
150.05 - 174	+12 dB	80	12	Analog & Digital Land mobile	25 kHz	T/R 25-08
380 - 385	+18 dB	50	14	Emergency & Security	25 kHz	T/R 25-08
390 - 395	+18 dB	50	14	Emergency & Security	25 kHz	T/R 25-08
406.1 - 430	+20 dB	50	16	Analog & Digital Land mobile	25 kHz	T/R 25-08

(1)	(2)	(3)	(4)	(5)	(6)	(7)
440 - 470	+20 dB	50	16	Analog & Digital Land mobile	25 kHz	T/R 25-08
694 - 790	+26 dB [1]	not applicable	not applicable	IMT terrestrial	5 MHz	ECC/REC/(15)01
790 - 862	+26 dB	not applicable	not applicable	IMT terrestrial	5 MHz	ECC/REC/(11)04
870 - 960	+26 dB	30	13	GSM	200 kHz	ECC/REC/(05)08
880 - 960	+38 dB [1]	not applicable	not applicable	IMT terrestrial	5 MHz	ECC/REC/(08)02
1452 - 1492	+50 dB [1 2]	not applicable	not applicable	IMT terrestrial	5 MHz	ECC/REC/(15)01
1710 - 1785	+35 dB	15	13	GSM	200 kHz	ECC/REC/(05)08
1805 - 1880	+35 dB	15	13	GSM	200 kHz	ECC/REC/(05)08
1710 - 1785	+50 dB [1]	not applicable	not applicable	IMT terrestrial	5 MHz	ECC/REC/(08)02
1805 - 1880	+50 dB [1]	not applicable	not applicable	IMT terrestrial	5 MHz	ECC/REC/(08)02
1900 - 1920	+30 dB [1]	not applicable	not applicable		25 kHz	not existent
1920 - 1980	+46 dB	not applicable	not applicable	IMT terrestrial	5 MHz	ERC/REC/(01)01
2010 - 2025	+30 dB [1]	not applicable	not applicable		25 kHz	not existent
2110 - 2170	+46 dB	not applicable	not applicable	IMT terrestrial	5 MHz	ERC/REC/(01)01
2500 - 2690	+39 dB [1]	not applicable	not applicable	IMT terrestrial	5 MHz	ECC/REC/(11)05
3400 - 3800	+41 dB [1]	not applicable	not applicable	IMT terrestrial	5 MHz	ECC/REC/(15)01

Remark: In the band 2010 - 2025 MHz, the European Commission Decision no. 2016/339 of 8 March 2016 is applicable. This decision refers to the harmonisation of the 2010-2025 MHz frequency band for portable or mobile wireless video links and cordless cameras used for programme making and special events. The designation of the 2010-2025 MHz frequency band for these applications is done on a non-exclusive basis.

For IMT systems: In case the transmitter bandwidth is higher than the reference bandwidth, the following value should be added for line calculations:

10 x $\log_{10}$ (transmitter bandwidth in MHz/5 MHz) dB.

For digital wide band land mobile applications below 470 MHz *(channel bandwidth: > 25 kHz)* the following value should be added for line calculations:

6 x $\log_{10}$ (channel bandwidth in kHz/25 kHz) dB if the interferer is a wideband system.

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[1] Limit is applicable for the aggregate power of all carriers of the respective base station within a bandwidth of 5 MHz. Co-ordinations should be handled within the framework of additional bi- or multilateral Agreements.

[2] This value is taken from the bands 1710-1785/1805-1880 MHz for IMT terrestrial systems only case (ECC/REC/(08)02).

Annex 2 A (V1.0)

Data exchange in the Land Mobile Service

DATA EXCHANGE

1 Procedures

1.1 Overall list

According to point 1.4 and 4.9 of the Agreement, frequency registers (overall list) have to be exchanged twice a year using disc or CD-ROM or other mutually agreed media.

1.2 Co-ordination or notification

Co-ordination requests, answers to co-ordination requests or notifications may be exchanged on disc or CD-ROM or other mutually agreed media.
Data to be exchanged during the co-ordination procedure may be of the following type:

- new entries
- modifications
- deletions
- answers

1.3 Common to 1.1 and 1.2

Each list is to be included in a separate data file. A list can be divided into several files. Each file consists of the following data subgroups:

- a file header as described in Appendix 2
- the data records as described in Appendix 3.

It is possible to transmit several files on a single carrier.

Because the file structure for the Fixed Service and the Land Mobile Service differs, a unique code is required to determine the content of the file in case of electronic data exchange.

Therefore parts of the filename are fixed:
For the Land Mobile Service all filenames start with ‘M_’,

The corresponding structure is described in Appendix 1.

Optionally the data exchange can be handled by using XML, according to Appendix 11 of this Annex. The implementation shall be based on bi- or multilateral agreements and therefore §1.8 of the Main Text does not apply to changes on Appendix 11 and all incurred definitions.

2 Transmission media

The following transmission media are preferred but others may be agreed bilaterally:

- E-mail
- Common Disc Media

Paper is limited to the coordination process but generally should be avoided.

2.1 E-Mail

The following specifications are recommended when e-Mail is used:

- Correspond via a separate e-mail address only e.g. coordination@administration.landcode.
- The most important part of the e-mail is a data file as defined in this Annex
- State reference number (s) in the e-mail subject field (field 13X)
- If the coordination file contains more reference numbers as fit in the subject field, the message body of the e–mail may be used
- For documentation reasons and error identification, the coordination request (s) may be annexed in txt, Word or PDF format additionally
- Agree the name(s) of the data file(s) on a bi- or multilateral basis and start it with 'M_'.
- Formulate additional text in English, other languages are subject to bilateral agreements
- Mark the requests with a person responsible for questions
- Confirm incoming electronic coordination requests by email
- Report errors or problems via the "reply function" to the original message
- Send answers to coordination requests by fax (legal aspects) or if it was adopted bi- or multilaterally, by e-mail.

Details of the file structure are given in Appendix 1.
The record format is defined in Appendix 3.

2.2 Common Disc Media

The following specifications have to be met when discs are used:

- MS-DOS format (extended by long file names), ISO9660 (with extensions) or UFS
- IBM-PC 8-bit ASCII character code

Details of the file structure are given in Appendix 1.
The record format is defined in Appendix 3.

3 Description of format character explanation of the appendices

X	alphanumeric
9	numeric, leading zeros and trailing zeros after the decimal point may be left blank
V	explicit decimal point
S	indicates a signed numeric value, missing sign means +, the sign is right justified to the number.
DD	day (numerical; range: 01-31)
MM	month (numerical; range: 01-12)
YYYY	year (numerical; range: >1900)
CCC	country code according to the Appendix 1 of Section 9 of the Radiocommunication Data Dictionary
ZZ	year of initial co-ordination (numerical; last two digits of the year only)
PPPPPP	process identification (alphanumeric)
FF	frequency order number or link order number (numeric)
R	number of associated records (numeric)
O	order number of record (numeric)

3.1 Alphanumeric fields

Alphanumeric fields are left justified.
The character set is ASCII.

3.1.1 General alphanumeric fields

The following characters are allowed:

(Space)
(-)
0...9
A...Z

3.1.2 Special alphanumeric fields

The following characters can be used in:

the fields of the file header,
the field 4A (name of station),
the field 13Z (Remarks)

Hex	Sign		Hex	Sign		Hex	Sign		Hex	Sign		Hex	Sign		Hex	Sign
20	(Space)		30	0		40	@		50	P		60	`		70	p
21	!		31	1		41	A		51	Q		61	a		71	q
22	"		32	2		42	B		52	R		62	b		72	r
23	#		33	3		43	C		53	S		63	c		73	s
24	$		34	4		44	D		54	T		64	d		74	t
25	%		35	5		45	E		55	U		65	e		75	u
26	&		36	6		46	F		56	V		66	f		76	v
27	'		37	7		47	G		57	W		67	g		77	w
28	(		38	8		48	H		58	X		68	h		78	x
29	)		39	9		49	I		59	Y		69	i		79	y
2A	*		3A	:		4A	J		5A	Z		6A	j		7A	z
2B	+					4B	K		5B	[		6B	k		7B	{
2C	,		3C	<		4C	L		5C	\		6C	l			
2D	-		3D	=		4D	M		5D	]		6D	m		7D	}
2E	.		3E	>		4E	N		5E	^		6E	n		7E	~
2F	/		3F	?		4F	O		5F	_		6F	o		A7	§

Note: 3B (;) 7C (|) are not allowed

3.2 Numerical fields

Numerical fields are right justified.

Zeros may be omitted if they don’t change the value.

The first Zero behind the decimal point may not be omitted.

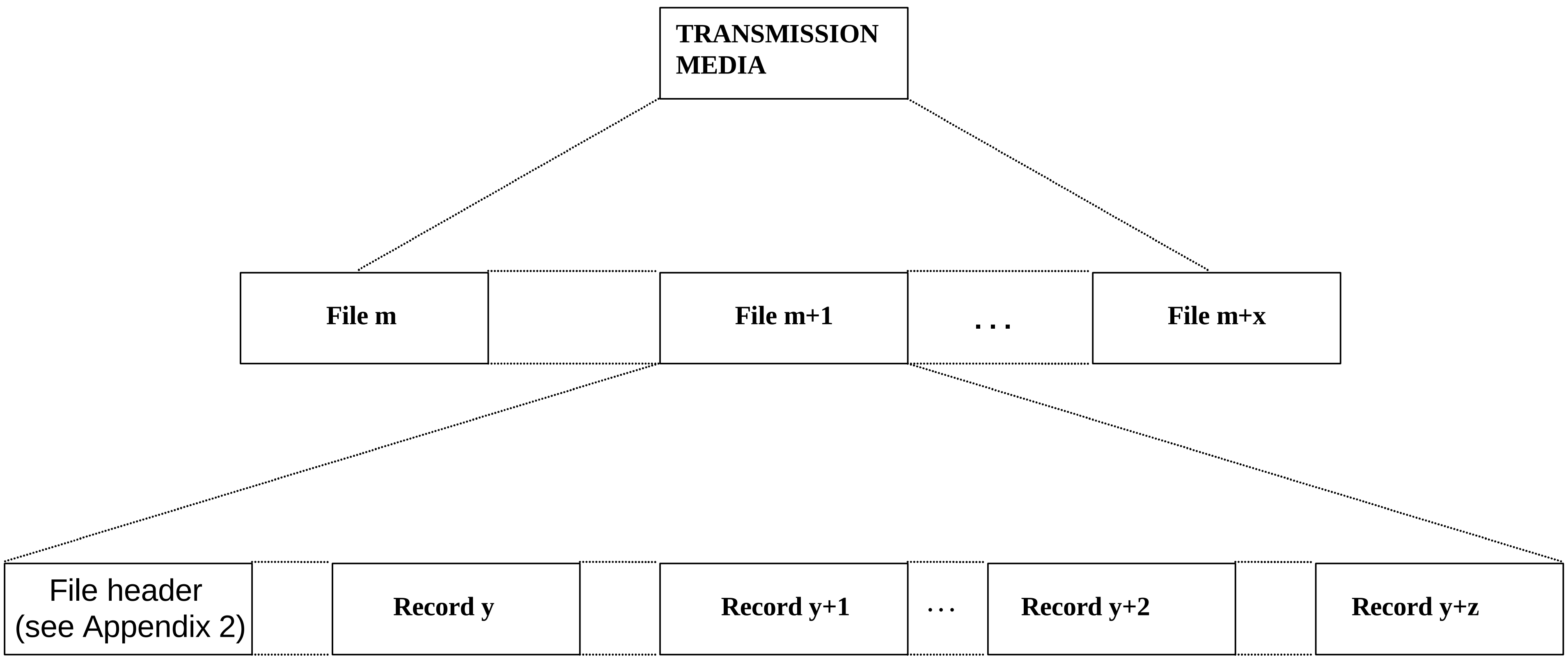
The character set is ASCII.
Allowed are:

(Space)
(-) (+) (.)
0...9

List of Appendices to Annex 2 A

File structure

Appendix 1 to Annex 2 A



No record separator e.g. CR/LF is used.

Appendix 2 to Annex 2 A

RECORD DESCRIPTION FILE HEADER

DATA ITEM	STORAGE FORMAT (fixed length)	RECORD POSITION	REMARKS
File number on media	99	001 - 002	
File contents	X(80)	003 - 082	
File contents code [1)]	X	083 - 083	
Originating Country	X(3)	084 - 086	As given in Appendix 1 of Section 1 of the Radiocommunication Data Dictionary
E-mail address	X(40)	087 - 126	
Phone	X(20)	127 - 146	
Telefax	X(20)	147 - 166	
Name of responsible person	X(20)	167 - 186	
Number of records	9(6)	187 - 192	
Writing date	DDMMYYYY	193 - 200	
Destination country	X(3)	201 - 203	
Unique file number	999999	204 - 209	
File version	9V9	210 - 212	1.0 (Version of Annex 2A)
Reserved for future use	X(7)	213 - 219	

1)

O overall list (only statuses C, E, F, G, H, P)
D deletions (only statuses W, R)
N new entries (only statuses A, B, D, P)
A answer (only statuses C, D, E, F, G, H, Z)
M modifications (only status M)

Fixed record length without separators.

Appendix 3 to Annex 2 A

DATA TABLE DESCRIPTION

column-number	column-name
1	Field identification
2	Field name (characteristic)
3	Storage format
4	Definition (possible values)
5	Remarks
6	Record position
7	Length of the data element
8	Validation
9	Related information

General remark:
An administration with which co-ordination is sought is not allowed to change the content of any field except of field 13Y which must be changed and field 13Z which can be changed e.g. to notify the reason(s) for disagreement (indication of a co-ordination reference etc.). If comments need more characters than provided in 13Z, paper or another medium has to be used.

Data exchange fields and record format

1	2	3	4	5	6	7	8	9
1A	Transmitting frequency Frequency unit	9(5)V9(5) X	 Frequency unit K: kHz, M: MHz, G: GHz		001 – 011 012 – 012	11 1	1A/1Y: at least one of the two fields has to be filled in In case of only Rx, 1A is Complete blank	If 1A is blank, 8B1 has to be blank
1Z	Frequency category	X	valid values: see appendix 4		013 – 013	1		1A filled in: 1Z is linked to 1A 1A blank: 1Z is linked to 1Y
6A	Class of station	X(2)	valid values: see appendix 5		014 - 015	2		1A filled in: 6A is linked to 1A 1A blank: 6A is linked to 1Y
6B	Nature of service	X(2)	valid values: see appendix 6		016 - 017	2		1A filled in: 6B is linked to 1A 1A blank: 6B is linked to 1Y
6Z	Category of use	X(2)	valid values: see appendix 7		018 - 019	2		1A filled in: 6Z is linked to 1A 1A blank: 6Z is linked to 1Y
10Z	Channel occupation	9	valid values: 0: not continuous 1: continuous see Annex 5		020 - 020	1		
2C	Date of bringing into use	DDMMYYYY			021 - 028	8	Blank or filled in in connection with 1Z, 2Z, 13Y	Linked to 1Z, 2Z, 13Y
4A	Name of station	X(20)	For abbreviations see Appendix 8		029 - 048	20	In computer programs 4A is not checked	1A filled in:4A is linked to 1A 1A blank: 4A is linked to 1Y
4B	Country	X(3)	Country where the station is located		049 - 051	3	Blank is not allowed	

1	2	3	4	5	6	7	8	9
4C	Geographical co-ordinates of the station or centre of the operating area	9(3)X9(2)9(2) 9(2)X9(2)9(2)	3 characters : degrees longitude 1 character : E(East) or W(West) 2 characters : minutes longitude 2 characters : seconds longitude 2 characters : degrees latitude 1 character : N(North) or S(South) 2 characters : minutes latitude 2 characters : seconds latitude	Co-ordinates are to be indicated with seconds and based on WGS 84	052 - 066	15	Mandatory for all coordination requests and notifications	1A filled in: 4C is linked to 1A 1A blank : 4C is linked to 1Y
4D	Radius of the operating area	9(5)	In kilometres, blank is not allowed		067 - 071	5	If 6A does not start with "M" 4D is always 0	linked to 4C
4Z	Height of the station site above sea level	9(4) or S9(3)	In meters		072 - 075	4	Only valid if 6A starts with "F"	linked to 6A and 4C
7A	Designation of emission	X(9)	First 4 characters: necessary bandwidth following 5 characters: class of emission (see Art.2 and Appendix 1 of the RR)		076 - 084	9	First 7 characters are mandatory, the following 2 characters are optional (or blank)	For UMTS or IMT 2000, all 9 character are mandatory For TETRA 7A is 25K0G7W
8B1	Maximal radiated power of the station	S9(3)V9	In dBW Omitted in case of only Rx		085 - 090	6	If 1A is missing, 8B1 has to be missing too	linked to 1A
8B2	Type of reference antenna	X	X=E for e.r.p., X=I for e.i.r.p. Mandatory		091 - 091	1		linked to 8B1 if present linked to 9G if present
9A	Azimuth of maximum radiation	9(3)V9	In degrees with one decimal from 000.0 to 359.9 or blank	For non directional horizontal antenna type 9A is blank	092 - 096	5	If 6A starts with "M", 9A is always blank	1A filled in: 9A is linked to 1A 1A blank: 9A is linked to 1Y 9A is linked to 6A and 9XH
9B	Mechanical elevation angle of the antenna in direction of maximum radiation	S99V9	In degrees with one decimal from –90.0 to 90.0 or blank	Negative elevation points towards the ground. For non directional vertical antenna type 9B is blank	097 - 101	5	For antennas with 9XV = TA this field contains the electrical tilt	1A filled in: 9B is linked to 1A 1A blank : 9B is linked to 1Y 9B is linked to 9XV
9D	Polarization	X(2)	Mandatory Codes as given in Appendix 10		102 - 103	2		1A filled in: 9D is linked to 1A 1A blank : 9D is linked to 1Y

1	2	3	4	5	6	7	8	9
9G	Gain of the antenna in the direction of 9A and 9B	99V9	In dB Mandatory in case of Rx		104 - 107	4		linked to 1Y, 8B2, 9A, 9B 9XH, 9XV
9Y	Height of antenna above ground	9(4)	In meters		108 - 111	4		1A filled in: 9Y is linked to 1A 1A blank : 9Y is linked to 1Y
9XH	Type of antenna horizontal	9(3)X(2)9(2)	see Annex 6		112 - 118	7	If 9A is blank, 9XH is 000ND00	linked to 9A
9XV	Type of antenna vertical	9(3)X(2)9(2)	see Annex 6		119 - 125	7	If 9B is blank, 9XV is 000ND00 000ND00 should be avoided for non mobile stations	linked to 9B
1Y	Transmitting frequency of the corresponding receiving station or receiving frequency Frequency unit	9(5)V9(5) X	Frequency unit: K: kHz, M: MHz, G: GHz Omitted in case of only Tx		126 - 136 137 - 137	11 1	Obligatory if 1A is not filled in	
13Z	Remarks	X(50)		Data necessary for calculations are not allowed	138 - 187	50		For UMTS/ IMT 2000 the code group is filled in ‘CODE GROUP = xxx’
13Y	Status of co-ordination	X	see Appendix 9		188 - 188	1	Mandatory	
2W	Date of co-ordination request	DDMMYYYY		In overall list not needed	189 - 196	8		
2Z	Final date of achieving co-ordination	DDMMYYYY	May be omitted		197 - 204	8		

1	2	3	4	5	6	7	8	9
13X	Co-ordination reference	CCC ZZ PPPPPP FF R O	C: country code as given in App.1 Section 9 of the RDD Z: year of initial co-ordination P: process identification F: frequency order number R: number of associated records O: order number of record	C: country requesting co-ordination F: several co-ordinations for one site	205 - 219	15	The co-ordination reference is unique F, O and R are numerical values greater than 0, O less/equal R	

The record length is fixed to 219 bytes, no record separator is used.
“Empty” in this table means that all character positions in this field are filled with space characters.

Additional explanation of field 13X for the Land Mobile Service

CCC	Country requesting co-ordination
ZZ	Last two digits of the year of initial co-ordination request
PPPPPP	Process identification The only constraint for PPPPPP is to obtain a unique co-ordination reference.
FF	Frequency order number Used with "01" in the case the process number differs for each channel/frequency. If the process number is always the same it numbers the different channels or frequencies of the same network.
R	Number of associated records If the leading character of 13X up to the position "R" are the same in several records, "R" represents the count of these records. This is the only way to combine records belonging to one network.
O	Order number of record is the numbering of records mentioned in “R“. O starts with 1 and ends with the value given in “R“.

In case of R is not sufficient for record count within one process identification, FF, R and O together may be used to keep the record unique.

Appendix 4 to Annex 2 A

FIELD 1Z : FREQUENCY CATEGORIES

1 Preferential frequencies

2 Frequencies requiring co-ordination

3 Frequencies used on the basis of geographical network plans

4 Frequencies for a planned radiocommunications network

5 Shared frequencies

6 Reserved for bi- or multilateral use

7 Frequencies using preferential codes

8 Frequencies used on the basis of arrangements between operators

Appendix 5 to Annex 2 A

FIELD 6A : CLASS OF STATION

FB Base station

FC Coast station

FL Land station

FP Port station

FS Land station established solely for safety of life

FW Mobile station with a radius of service area of 0 km and an effective antenna height of the co-ordinates of the particular place as specified in Annex 5, point 2.5

FX Fixed station

ML Land mobile station i.e. mobile station in the land mobile service

MO Mobile station i.e. station in the mobile service intended to be used while in motion or during halts at unspecified points (maximum operating height determined in field 9Y)

MR Radiolocation mobile station

MS Ship station

If other codes are required, use the codes listed in Appendix 5 (Section 9.5) of the Radiocommunication Data Dictionary

Appendix 6 to Annex 2 A

FIELD 6B : NATURE OF THE SERVICE

CO Station open to official correspondence exclusively

CP Station open to public correspondence

CR Station open to limited public correspondence

CV Station open exclusively to correspondence of a private agent

OT Station open exclusively to operational traffic of the service concerned

If other codes are required, use the codes listed in Appendix 13 (Section 9.13) of the Radiocommunication Data Dictionary

Appendix 7 to Annex 2 A

FIELD 6Z : CATEGORY OF USE

A	Airport services
B	Railways (excluding mountain railways)
C	Diplomatic corps
D	Mountain railways
E	Production, transport and distribution of energy (electricity, gas, water)
F	Fire services
G	Military
H	Radio relay networks
HH	Local call
I	Demonstration
K	Public transport
L	Subscriber installations, public mobile services, stand-by links
M	Navigation (in ports, on the Rhine, etc.)
N	Tests and research
O	Not allocated
P	Public security services (Police, customs, etc.)
Q	Entries not falling within other categories on this list (cordless microphones, etc.)
R	Ancillary broadcasting services (studio, news reporting)
S	Rescue services (ambulances, doctors, water and mountain rescue)
T	Other services provided by telecommunications administrations
U	Industrial operators
V	Road traffic service
W	Taxi and car hire firms
X	Other private services
Y	Reserved specific applications, not allocated
Z	Other private multiple-use networks

These codes can be combined (maximum two characters):
e.g. XP- private police service

Appendix 8 to Annex 2 A

FIELD 4A : ABBREVIATIONS NORMALLY USED WHEN THE NAME OF THE STATION EXCEEDS 20 CHARACTERS AND CODES

Abbreviations	Explanation
B	Bay
BRDG	Bridge
C	Cape
CL	Central
CP	Camp
CY	City
DPT	Department
E	East
ET	State
FT	Fort
FIR	Fire Tower
GF	Gulf
GR	Grand
GT	Great
HLL	Hill
HR	Harbour
I	Island(s)
INTR	Usage in the whole country
JN	Junction
L	Lake
LSTN	Light station
MT	Mount
MTN	Mountain(s)
N	New
NO	North
NTL	National
PK	Peak
PMPSTN	Pump station
PT	Port (see HR)
RV	River
S	Saint
STN	Station
SO	South
TR	Tower
V	Vila, Villa, Ville
VLY	Valley
W	West

If additional abbreviations are required, use those listed in Appendix 7 (Section 9.7) of the Radiocommunication Data Dictionary

Appendix 9 to Annex 2 A

FIELD 13Y : STATUS OF CO-ORDINATION

A For information : the assignment described is not submitted to a co-ordination procedure and to any protection requirement.

B Request for agreement.

C Agreed without reservation.

D Temporary status: Coordination subject to operational tests to show that coexistence is possible.

E Agreement on a non-interference basis (NIB); revocation of the agreement and any request to cease the emissions in question requires proof that harmful interference has been caused to assignments whose status has already been established, which should normally be described in an associated notice.

F Agreed, subject to a requirement identical or analogous to the requirement of RR 4.4. (Protection of primary allocated services)

G Agreed, without any reservation as to interference which may be caused by the assignment described; the applicant is, however, informed that there is a risk of interference from assignments whose status has already been established, and that the responsibility for any such risk is his; one or more associated notices may be sent.

H E+G

M Request for agreement following a modified co-ordination after an answer coded E, G, H or Z.

P Assignment according to preferential frequency agreements (1.3.2 of the Agreement) or geographical network plans (1.3.5 of the Agreement) or shared frequency agreements (1.3.3 of the Agreement) or frequencies using preferential codes (1.3.6 of the Agreement) or frequencies used on the basis of arrangements between operators (1.3.7 of the Agreement).

R Deletion of co-ordinated assignment.

W Withdrawal of the co-ordination request.

Z Request for agreement refused.

Appendix 10 to Annex 2 A

FIELD 9D : POLARIZATION

SYMBOLS USED TO INDICATE POLARIZATION

Polarization	Symbol	Definition
Horizontal linear	H	The electric field intensity vector is in the horizontal plane.
Vertical linear	V	The magnetic field intensity vector is in the horizontal plane.
Right - hand slant	SR	The electric field intensity vector is in the plane rotated 45 degrees clockwise from the vertical position, as seen from the transmitting point.
Left – hand slant	SL	The electric field intensity vector is in the plane rotated 45 degrees anti-clockwise from the vertical position, as seen from the transmitting point.
Right - hand circular or direct	CR	The electric field intensity vector, observed in any fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a right-hand or clockwise direction
Left – hand circular or indirect	CL	The electric field intensity vector, observed in any fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a left-hand or anti-clockwise direction
Dual	D	When substantially equal-amplitude vertically- and horizontally-polarized components are radiated without particular control of the phase relation between them. Typically, the vertically-and horizontally polarized sources may be displaced one from the other so that the resultant polarization varies between circular and slant, according to the azimuth angle.
Mixed	M	The collective term applies when both vertical and horizontal components are radiated, embracing slant circular and dual polarization.

Appendix 11 to Annex 2 A

Data exchange based on the XML format

The information exchanged according to this appendix should be in line with that exchanged with a fixed length file-format.

The details of the format for the XML data exchange are fixed in a schema file (*.XSD file).
Beside the information defined in the Appendix 2 and Appendix 3 of this annex, the schema defines a format for the schema file version. The latest version of the schema file is available on the HCM server. It has to be noted that this version number may change without bringing any changes to the Appendix 2 and 3 of this annex (e.g. for fixing format errors in the schema file).

All exchanged files must be in line with this schema file.

It should also be noted that although XML allows more characters to be used, the content should be limited to those introduced in the appendices of this annex and applicable to the fixed length file-format.

Special attention should be given to the following items in the schema file:

- The <sequence> indicator specifies that the child elements must appear in a specific order
- Header elements are not optional and cannot be empty.

For further details, see the schema files.

Annex 2 B

Data exchange in the Fixed Service

DATA EXCHANGE

1 Procedures

1.1 Overall list

According to point 1.4 and 4.9 of the Agreement, frequency registers (overall list) have to be exchanged twice a year using disc or CD-ROM or other mutually agreed media.

1.2 Co-ordination or notification

Co-ordination requests, answers to co-ordination requests or notifications may be exchanged on disc or CD-ROM or other mutually agreed media.
Data to be exchanged during the co-ordination procedure may be of the following type:

- new entries
- modifications
- deletions
- answers

1.3 Common to 1.1 and 1.2

Each list is to be included in a separate data file. A list can be divided into several files. Each file consists of the following data subgroups:

- a file header as described in Appendix 2
- the data records as described in Appendix 3.

It is possible to transmit several files on a single carrier.

Because the file structure for the Fixed Service and the Land Mobile Service differs, a unique code is required to determine the content of the file in case of electronic data exchange.

Therefore parts of the filename are fixed:
For the Fixed Service all filenames start with 'F_'.

The corresponding structure is described in Appendix 1.

2 Transmission media

The following transmission media may be agreed bilaterally:

- E-mail
- Common Disc Formats
- FTP
- HTTPS

For co-ordination procedures other media, such as printed paper transmission or data links, can be used.

2.2 Common Disc Formats

The following specifications have to be met when discs are used:

- MS-DOS format
- IBM-PC 8-bit ASCII character code
- For the Fixed Service:
    - variable length of data record
    - data items are separated with semicolons
    - the end of each record is marked with a carriage return

Details of the file structure are given in Appendix 1. The record format is defined in Appendix 3.

2.3 E-mail

The following specifications are recommended when e-mail is used:

- Correspond via a separate e-mail address only e.g. coordination@administration.landcode.
- The most important part of the e-mail is a data file as defined in this Annex
- State reference number (s) in the e-mail subject field (field 13X)
- If the coordination file contains more reference numbers as fit in the subject field, the message body of the e–mail may be used
- For documentation reasons and error identification, the additional information to the coordination request(s), if needed, should be annexed in txt, Word, Excel, editing PDF or JPEG format
- Agree the name (s) of the data file (s) on a bi- or multilateral basis and start it with ‘F_’.
- Formulate additional text in English, other languages are subject to bilateral agreements
- Mark the requests with a person responsible for questions
- Confirm incoming electronic coordination requests by e-mail
- Report errors or problems via the “reply function” to the original message
- Send answers to coordination requests by e-mail or in addition by fax or letter if legally needed

Details of the file structure are given in Appendix 1. The record format is defined in Appendix 3.

2.4 FTP

The following specifications are recommended when FTP is used between two countries:

- Each affected country puts in service an FTP space in which is defined an entry point for the requesting countries (by an account). In that entry point, two subdivisions are made, one for the requests from the other country and one for the replies on those requests by the affected country.
- The request folder is writeable (no modify nor delete permission) for the requesting country and readable for the affected country. The reply folder is readable for the requesting country and writeable for the affected country.
- The requesting country puts up his requests by using filenames indicating date, time and administration of the request
(format F_YYYYMMDD-HHMM-ADM.TXT). For documentation reasons and clarifications, additional Word or PDF documents may be added by using the same filename with different extension.
- The requesting country can send corrections to the original file by using the same filename and adding _CORRECTION to the name.
- Replies are put up by using filenames consisting of the original filename and adding date, time and administration of the reply in the same way as for the request. As such multiple replies are possible on one complex request.
- When the affected country detects errors in the format of the file or has other problems with the files received, the affected country puts up a reply textfile in the reply folder describing the problem and with the filename in the format F_YYYYMMDD-HHMM-ADM_ERROR.TXT)

Details of the file structure are given in Appendix 1. The record format is defined in Appendix 3.

2.5 https

The following specifications are recommended when https is used between two countries:

Using this method the system can exchange information within an encrypted communication channel, while the authentication of users is carried out by digital certificates. The system can be accessed from simple web browsers, as well as by automated systems.
This method has server-client architecture, in which the central web server provides the services for the users of different administrations. The information exchange is carried out over https protocol, which provides an encrypted tunnel between the user and the web server.

2.5.1 Web interface (manual access)
The users of different administrations access the system by an URL via a web page. After a successful user authentication they may choose from three different menu items:

- Submit coordination information
  In this menu item the user can select an Annex 2A file on the computer and upload it onto the server. During the upload process the system checks syntactically and semantically the data. In case of error(s), the user receives an error message giving the description of the found problem. In case the upload is finished successfully, the system requests a digital signature from the user for the data that is currently stored in a temporary area. The user creates the digital signature utilizing the key pair and associated certificate (provided by a recognized Certificate Authority) stored in the web browser or in a smart card. The successful digital signature generates the transaction which will be processed by the system.
- Download coordination information
  In this menu item the user can download the coordination answers received from different administrations into a single file onto the computer.
- (Own) User Activity
  In this menu point the user can check log entries regarding own activity.

The user administration of the system is carried out by administrative web pages available only for the IT personnel that operate the system (Centralized user management). Through these web pages the system administrator can register the different administrations into the system, can define the users of the administrations and associates the public key of the user to the login name of the user.

2.5.2 Machine to machine (automated) interface based on SOAP/XML
(SOAP = Simple Object Access Protocol)
The same information exchange as through the manual interface is available through SOAP messages. The SOAP messages carry all information as well as the digital signature referring to the information.
In case of error free SOAP message submission, the system generates a digitally signed SOAP response which contains the transaction IDs, and other parameters of the submitted SOAP message (e.g., transaction ID, name of station).
The system generates the SOAP messages containing the coordination responses on a daily base. The automated system of the member administrations downloads the message, checks the trustworthiness of the message while the central system logs the successful download.

Details of the file structure are given in Appendix 1. The record format is defined in Appendix 3.

3 Description of format character explanation of the appendices

X	alphanumeric
9	numeric, leading zeros and trailing zeros after the decimal point may be left blank
V	explicit decimal point
S	indicates a signed numeric value, missing sign means +, the sign is right justified to the number.
DD	day (numerical; range: 01-31)
MM	month (numerical; range: 01-12)
YYYY	year (numerical; range: >1900)
CCC	country code according to the Appendix 1 of Section 9 of the Radiocommunication Data Dictionary
ZZ	year of initial co-ordination (numerical; last two digits of the year only)
PPPPPP	process identification (alphanumeric)
FF	frequency order number or link order number (numeric)
R	number of associated records (numeric)
O	order number of record (numeric)

3.1 Alphanumeric fields

The character set is ASCII.

3.1.1 General alphanumeric fields

The following characters are allowed:

(Space)
(-)
0...9
A...Z
a...z

3.1.2 Special alphanumeric fields

The following characters can be used in:

the fields of the file header,
the field 4A (name of station),
the fields 7H, 7I, 9XM, 9XT
the field 13Z (Remarks)

Hex	Sign		Hex	Sign		Hex	Sign		Hex	Sign		Hex	Sign		Hex	Sign
20	(Space)		30	0		40	@		50	P		60	`		70	p
21	!		31	1		41	A		51	Q		61	a		71	q
22	"		32	2		42	B		52	R		62	b		72	r
23	#		33	3		43	C		53	S		63	c		73	s
24	$		34	4		44	D		54	T		64	d		74	t
25	%		35	5		45	E		55	U		65	e		75	u
26	&		36	6		46	F		56	V		66	f		76	v
27	'		37	7		47	G		57	W		67	g		77	w
28	(		38	8		48	H		58	X		68	h		78	x
29	)		39	9		49	I		59	Y		69	i		79	y
2A	*		3A	:		4A	J		5A	Z		6A	j		7A	z
2B	+					4B	K		5B	[		6B	k		7B	{
2C	,		3C	<		4C	L		5C	\		6C	l			
2D	-		3D	=		4D	M		5D	]		6D	m		7D	}
2E	.		3E	>		4E	N		5E	^		6E	n		7E	~
2F	/		3F	?		4F	O		5F	_		6F	o		A7	§

Note: 3B (;) 7C (|) are not allowed

3.2 Numerical fields

Zeros may be omitted if they don’t change the value.

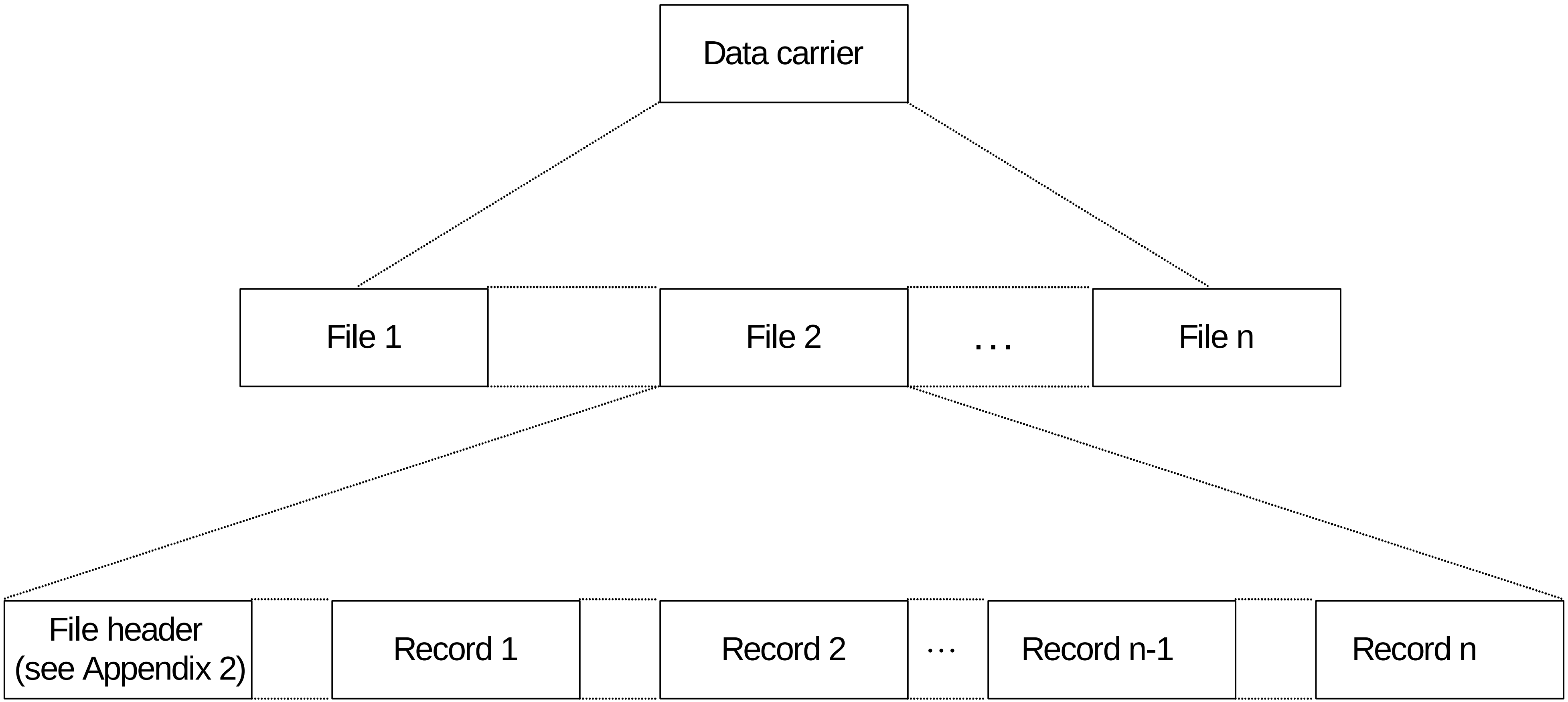
The first Zero behind the decimal point may not be omitted.

The character set is ASCII.
Allowed are:

(Space)
(-) (+) (.)
0...9

List of Appendices to Annex 2 B

Appendix 1 to Annex 2 B



CR (or CR/LF) shall terminate the file header and each record.

Appendix 2 to Annex 2 B

RECORD DESCRIPTION FILE HEADER

DATA ITEM	STORAGE FORMAT (maximum length)	REMARKS
File number	99	
File contents	X(80)	
File contents code 1)	X	
Country	X(3)	As given in Appendix 1 of Section 1 of the Radiocommunication Data Dictionary
Name of the responsible person	X(40)	
Phone	X(20)	
Telefax	X(20)	
E-mail	X(40)	
Number of records	9(6)	
Writing date	DDMMYYYY	

1) **O overall list (only statuses C, E, F, G, H, P)**
D deletions (only statuses W, R)
N new entries (only statuses A, B, D, P)
A answer (only statuses C, D, E, F, G, H, Z)

Semicolon is used as separator between data fields in both the file header and the record,

The end of a record and of the file header contains a carriage return (CR or CR/LF).

Appendix 3 to Annex 2 B

DATA TABLE DESCRIPTION

column-number	column-name
1	Field identification
2	Field name (characteristic)
3	Storage format
4	Definition (possible values)
5	Remarks
6	Maximum length of the data element
7	Validation
8	Related information

General remark: An administration with which co-ordination is sought is not allowed to change the content of any field except of field 13Y which must be changed and field 13Z which can be changed e.g. to notify the reason(s) for disagreement (indication of a co-ordination reference etc.). If comments need more characters than provided in 13Z, paper or another medium has to be used.

Data exchange record format for the Fixed Service

1	2	3	4	5	6	7	8
0A	Type of entry	X(3)	Tx=transmitter Rx=receiver Ptx=passive transmitter Prx=passive receiver		3	mandatory	
1A	Frequency	9(5)V9(5)			11	mandatory	
1A1	Frequency unit	X	k: kHz, M: MHz, G: GHz		1	mandatory	
1Z	Frequency category	X	see Appendix 4		1	mandatory	
6A	Class of station	X(2)	see Appendix 5		2		
6B	Nature of service	X(2)	see Appendix 6		2		
6Z	Category of use	X(2)	see Appendix 7		2		
2C	Date of bringing into use	DDMMYYYY			8		
4A	Name of station	X(40)	for abbreviations see Appendix 8		40	in computer programs 4A is not checked	
4B	Country	X(3)		Country of 4C	3	mandatory	
1	2	3	4	5	6	7	8

4C	Geographical co-ordinates	9(3)X9(2)9(2)9(2) 9(2)X9(2)9(2)9(2)	3 characters : degrees longitude 1 character : E(East) or W(West) 2 characters : minutes longitude 2 characters : seconds longitude in digits and maximum 2 extra decimals with the maximum of 5999 which means 59.99 and less than 60 seconds 2 characters : degrees latitude 1 character : N(North) or S(South) 2 characters : minutes latitude 2 characters : seconds latitude in digits and maximum 2 extra decimals with the maximum of 5999 which means 59.99 and less than 60 seconds	co-ordinates are to be indicated with seconds and based on WGS 84	15	Mandatory, field for the seconds may be extended up to 2 extra digits for higher accuracy between 0 and 99	
4Z	Height of the station site above sea level	9(4) or S9(3)	in meters		4	mandatory	
7A	Designation of emission	X(9)	first 4 characters: necessary bandwidth following 5 characters: class of emission (see Art.2 and Appendix 1 of the RR		9	first 7 characters are mandatory	
7H	Equipment manufacturer name	X(20)			20	mandatory *	
7I	Equipment type	X(20)			20	mandatory *	
7K	Max. capacity of the link	X(10)		see Appendix 11 If missing, value is set to “X”	10		

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
7G	Transmitter spectrum mask or receiver selectivity mask frequency attenuation frequency attenuation frequency attenuation frequency attenuation frequency attenuation frequency attenuation	 9(6)V9(5) 9(2)V9 9(6)V9(5) 9(2)V9 9(6)V9(5) 9(2)V9 9(6)V9(5) 9(2)V9 9(6)V9(5) 9(2)V9 9(6)V9(5) 9(2)V9	see Annex 3B figure 7 all frequencies in MHz. all attenuations in dB. The HCM Program generates new elements in accordance with Annex 3B par.3.3	If missing, data is taken from Appendix 12. To handle mask with bandwidth >999MHz If both fields 7G and 7G1 are missing the default values for the equipment with lowest class number is used	 11 4 11 4 11 4 11 4 11 4 11 4	If not missing, at least two pairs of frequencies and attenuations are mandatory; the last attenuation has to be ≥ 40 dB	
7G1	Equipment Class	X(3)	see Appendix 12 to Annex 2B	(old field NFD 1)	4	See EN 302 217-2-2 V1.4.1	
7G2	Free, for future use			(Old field NFD 2)	4		
7G3	Channel spacing	9(4)V9(4)	in MHz	To handle channels with bandwidth >999MHz If not known, administrations can derive it from the designation of emission, see Appendix 12	7	mandatory	
8B	Maximum permitted transmitter power	S9(3)V9	in dBW		6	mandatory for transmitter	
8B3	ATPC	9(2)	dynamic range in dB	If missing, default value is “0”	2		
9A	Azimuth	9(3)V9	in degrees with one decimal from 000.0 – 360.0		5	mandatory	

9B	Elevation	S9(2)V9	in degrees with one decimal	negative elevation points towards the ground	5	mandatory	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
9D	Polarization	X(1)	only 'H' or 'V' is permissible		1	mandatory	
9H	Receiver noise power level (FkTB)	S9(3)	in dBW		4	mandatory for receiver	
9L	Branches and line losses	9(2)V9	in dB	If missing, default value is „0“	4		
9Y	Height of antenna above ground	9(4) or S9(3)	in meters		4	mandatory	
13Z	Remarks	X(50)		data necessary for calculations are not allowed	50		
13Y	Status of co-ordination	X	see Appendix 9		1		
2W	Date of co-ordination request	DDMMYYYY	empty or filled in according to 1Z, 13Y	in overall list not needed	8		
2Z	Final date of achieving co-ordination	DDMMYYYY	empty or filled in according to 1Z, 13Y		8		
13X	Co-ordination reference	CCC YYYY PPPPPPP FF RR OO	C: country code as given in App.1 Sect.9 of the RDD Y: year of initial co-ordination P: process identification F: link order number R: number of associated records O: order number of record	C: country requesting co-ordination F: several co-ordinations for one link	20	mandatory the co-ordination reference is unique F,O and R are numerical values greater than 0 O less/equal R	

9XM	Antenna manufacturer name	X(20)			20	mandatory *	
9XT	Antenna type	X(20)			20	mandatory *	
9XFL	Lower antenna frequency	9(3)V9(3)	in GHz		6		
9XFU	Upper antenna frequency	9(3)V9(3)	in GHz		6		
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
9X1	Antenna gain	9(2)V9	in dB	Can be calculated from antenna diameter **	4	mandatory	
9X	Antenna data Copolar radiation pattern Number of mask data Table of angles and attenuations Crosspolar radiation pattern Number of mask data Table of angles and attenuations	 X(2) 9(3) 9(3)V9(2);9(2)V9 X(2) 9(3) 9(3)V9(2);9(2)V9	 If 9D =”V”: VV or CP If 9D = “H”: HH or CP angles in degrees, attenuation in dB If 9D =”V”: VH or XP If 9D = “H”: HV or XP angles in degrees, attenuation in dB	If missing, data is taken from Appendix 13	 2 3 10 2 3 10		 depending on the polarization in 9D Starting with the attenuation value for 0 degree, all remarkable intermediate values, at least up to 180 degrees, have to be supplied. If values between 180 degrees and 360 degrees (or negative degree values) are missing, the antenna pattern is symmetric. depending on the polarization in 9D Starting with the attenuation value for 0 degree, all remarkable intermediate values, at least up to 180 degrees, have to be supplied. If values between 180 degrees and 360 degrees (or negative degree values) are missing, the antenna pattern is symmetric.

* Manufacturer and type have to be unique identifier. In case of default data, these data items are marked with “DEFAULT”. It is not necessary that unique identifier have to be real names of manufacturer or type.

** Using formula: $G = 10 * \log\left(\frac{(D\pi f)^2 * 0.55}{c^2}\right)$ D = diameter [m], f = frequency [Hz], c = speed of light [$3*10^8$ m/s]

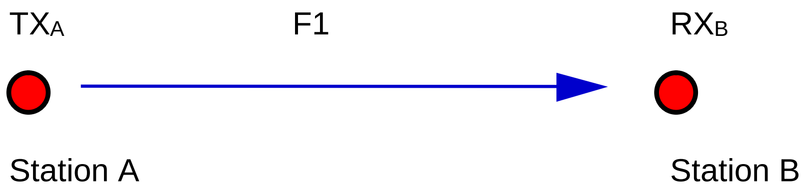
Additional explanation of field 13X in the Fixed Service

CCC	Country requesting co-ordination
YYYY	4 digits of the year of initial co-ordination
PPPPPPP	Process identification The only constraint for PPPPPPP is to obtain a unique co-ordination reference
FF	Assignment order number in the process Used with “01“ in the case the process number differs for each channel assignment. If the process number is always the same it numbers the different assignments of the same process
RR	Number of the associated records.
OO	Order number of the record in the assignment

Examples :
These examples will be used as guidelines for the filling of the Field 13X.

1/ Unidirectional link

country : D
Year : 2005
Process Identification : 1234567
FF : 01
RR : 02



There are 2 records :

TX_A record 1 :

0A	…	1A	…	4C	…	13X						
						CCC	YYYY	PPPPPP P	FF	RR	OO	Rem.
TX		17540.0		Pt A		D	2005	1234567	01	02	01	

RX_B record 2 :

0A	…	1A	…	4C	…	13X						
						CCC	YYYY	PPPPPP P	FF	RR	OO	Rem.
RX		17540.0		Pt B		D	2005	1234567	01	02	02	

For this link, the 2 records may neither be in the same file nor successive in the same file. That means that the process identification shall not be reused by one administration during the same year.

For those administrations willing to develop a link policy management, this link shall be identified by these 2 records.

How to select these 2 records?

a) Identify the records with the same CCCYYYYPPPPPPP in field 13X : you should have an even number of such records ;
b) If there are only 2 records : these 2 records shall have the same 1A
c) If there are more than 2 records: each links shall be identified by the pair of records having the same 1A. If, by chance, there are more than 2 records having the same 1A (the frequency is reused), the combinations of FF, RR and OO will be used to identify the corresponding links. The selections may be cross-checked with 0A : the pair shall have 1 TX and 1 RX.

If the administration ask many frequencies for this link in a same time, FF will be used to identified each frequency, for instance:

Link between station A and station B with F1 :
D 20051234567010201 for TX_A on F1
D 20051234567010202 for RX_B on F1

Link between Station A and Station B with F2 :
D 20051234567020201 for TX_A on F2
D 20051234567020202 for RX_B on F2

Link between Pt A and Pt B with F3 :
D 20051234567030201 for TX_A on F3
D 20051234567030202 for RX_B on F3

Station TX_A

0A :	TX
1A :	17540.00000
1A1 :	M
1Z :	2
6A :	FX
6B :	CV
6Z :	X
2C :	
4A :	GLEWITZ-A
4B :	D
4C :	012E554053N5530
4Z :	60
7A :	28M0D7W
7H :	BAPT
7I :	D34/28------BAPT-9
7K :	E3
7G :	11.00000
	2.0
	19.00000
	23.0
	25.00000
	23.0
	45.00000
	45.0
7G1 :	
7G2 :	
7G3 :	28.000
8B :	+34.0
8B3 :	0
9A :	348.6
9B :	-0.1
9D :	V
9H :	
9L :	0.0
9Y :	43
13Z :	TEST DATA
13Y	B
2W	28042005
2Z :	
13X	D 20051234567010201
9XM :	CCIR
9XT :	CCIR28000-1.20/43.0
9XFL :	
9XFU :	
9X1 :	43.0

9X

CP	
9	
0.0	0.0
0.6	3.0
2.0	16.2
5.0	26.1
10.0	33.7
15.0	38.1
20.0	41.2
48.0	50.7
180.0	50.7
XP	
6	
0.0	15.0
2.0	31.0
5.0	41.0
10.0	48.0
15.0	51.0
180.0	51.0

Station RX_B

0A :	RX
1A :	17540.00000
1A1 :	M
1Z :	2

6A : FX

6B : CV

6Z : X

2C :

4A : GRANSEBIETH-A

4B : D

4C : 012E244554N0402

4Z : 75

7A : 28M0D7W

7H : BAPT

7I : D34/28------BAPT-9

7K : E3

7G : 11.00000
2.0
19.00000
23.0
25.00000
23.0
45.00000
45.0

7G1 :

7G2 :

7G3 : 28.000

8B :

8B3 :

9A : 168.6

9B : +0.1

9D : V

9H : -95

9L : 0.0

9Y : 43

13Z : TEST DATA

13Y : B

2W : 28042005

2Z :

13X : D 20051234567010202

9XM : CCIR

9XT : CCIR28000-1.20/43.0

9XFL :

9XFU :

9X1 : 43.0

9X : CP
9

0.0	0.0
0.6	3.0
2.0	16.2
5.0	26.1
10.0	33.7
15.0	38.1
20.0	41.2
48.0	50.7
180.0	50.7

XP
6

0.0	15.0
2.0	31.0
5.0	41.0
10.0	48.0
15.0	51.0
180.0	51.0

Fixed Service records:

TX;17540.0;M;2;FX;CV;X;;GLEWITZ-A;D;

012E554053N5530;60;28M0D7W;BAPT;D34/28------BAPT-9;E3;

11.0;2.0;19.0;23.0;25.0;23.0;45.0;45.0;;;;;

;;28.0;+34.0;0;348.6;-0.1;V;;0.0;43;TEST DATA;

B;28042005;;D 20051234567010201;CCIR;CCIR28000-1.20/43.0;

;;43.0;CP;9;0.0;0.0;0.6;3.0;2.0;16.2;5.0;26.1;

10.0;33.7;15.0;38.1;20.0;41.2;48.0;50.7;180.0;50.7;

XP;6;0.0;15.0;2.0;31.0;5.0;41.0;10.0;48.0;

15.0;51.0;180.0;51.0CR

RX;17540.0;M;2;FX;CV;X;;GRASEBIET-A;D;

012E524454N0402;75;28M0D7W;BAPT;D34/28------BAPT-9;E3;

11.0;2.0;19.0;23.0;25.0;23.0;45.0;45.0;;;;;

;;28.0;;;168.6;+0.1;V;-95;0.0;43;TEST DATA;

B;28042005;;D 20051234567010202;CCIR;CCIR28000-1.20/43.0;

;;43.0;CP;9;0.0;0.0;0.6;3.0;2.0;16.2;5.0;26.1;

1	0	.	0	;	3	3	.	7	;	1	5	.	0	;	3	8	.	1	;	2	0	.	0	;	4	1	.	2	;	4	8	.	0	;	5	0	.	7	;	1	8	0	.	0	;	5	0	.	7	;

X	P	;	6	;	0	.	0	;	1	5	.	0	;	2	.	0	;	3	1	.	0	;	5	.	0	;	4	1	.	0	;	1	0	.	0	;	4	8	.	0	;

1	5	.	0	;	5	1	.	0	;	1	8	0	.	0	;	5	1	.	0	CR

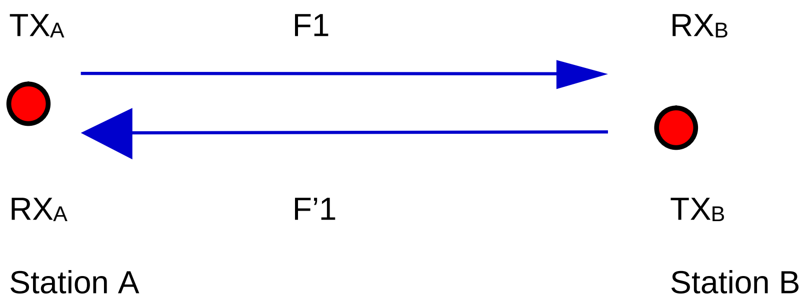
⇑

carriage return

Remark: Because of missing space on the paper, all 4 records are broken into several lines. In the data exchange, each record is only one line!

2/ Bidirectional link

country : D
Year : 2005
Process Identification : 1234568
FF : 01
RR : 04



There are 4 records :

TX_A record 1 :

0A	…	1A	…	4C	…	13X						
						CCC	YYYY	PPPPPPP	FF	RR	OO	Rem.
TX		27562.5		Pt A		D	2005	1234568	01	04	01	

RX_B record 2 :

0A	…	1A	…	4C	…	13X						
						CCC	YYYY	PPPPPPP	FF	RR	OO	Rem.
RX		27562.5		Pt B		D	2005	1234568	01	04	02	

TX_B record 3 :

0A	…	1A	…	4C	…	13X						
						CCC	YYYY	PPPPPPP	FF	RR	OO	Rem.
TX		28570.5		Pt B		D	2005	1234568	01	04	03	

RX_A record 4 :

0A	…	1A	…	4C	…	13X						
						CCC	YYYY	PPPPPPP	FF	RR	OO	Rem.
RX		28570.5		Pt A		D	2005	1234568	01	04	04	

For the link management purpose, this bidirectional link shall be identified by these 4 records.

The selection of these 4 records will follow the same process as mentioned above in §2 as far as the identification of pairs of records is concerned. Then the 2 pairs representing the bidirectional link are associated using the parameter 4C.

If the administration ask many frequencies for this link in a same time, FF will be used to identified each frequency, for instance :

Link between PtA and PtB with F1/ F'1 :

D 20051234568010401 for TX_A on F1
D 20051234568010402 for RX_B on F1
D 20051234568010403 for TX_B on F'1
D 20051234568010404 for RX_A on F'1

Link between PtA and PtB with F2/ F'2 :

D 20051234568020401 for TX_A on F2
D 20051234568020402 for RX_B on F2
D 20051234568020403 for TX_B on F'2
D 20051234568020404 for RX_A on F'2

Link between PtA and PtB with F3/ F'3 :

D 20051234568030401 for TX_A on F3
D 20051234568030402 for RX_B on F3
D 20051234568030403 for TX_B on F'3
D 20051234568030404 for RX_A on F'3

Station TX$_A$

0A : TX

1A : 27562.50000

1A1 : M

1Z : 2

6A : FX

6B : CV

6Z : X

2C :

4A : GLEWITZ-A

4B : D

4C : 012E554053N5530

4Z : 60

7A : 28M0D7W

7H : BAPT

7I : D34/28------BAPT-9

7K : E3

7G :
11.00000
2.0
19.00000
23.0
25.00000
23.0
45.00000
45.0

7G1 :

7G2 :

7G3 : 28.000

8B : +34.0

8B3 : 0

9A : 348.6

9B : -0.1

9D : V

9H :

9L : 0.0

9Y : 43

13Z : TEST DATA

13Y B

2W 28042005

2Z :

13X D 20051234568010401

9XM : CCIR

9XT : CCIR28000-1.20/43.0

9XFL :

9XFU :

9X1 : 43.0

9X CP
9

0.0	0.0
0.6	3.0
2.0	16.2
5.0	26.1
10.0	33.7
15.0	38.1
20.0	41.2
48.0	50.7
180.0	50.7

XP
6

0.0	15.0
2.0	31.0
5.0	41.0
10.0	48.0
15.0	51.0
180.0	51.0

Station RX_B

0A : RX
1A : 27562.50000
1A1 : M
1Z : 2
6A : FX
6B : CV
6Z : X
2C :
4A : GRANSEBIETH-A
4B : D
4C : 012E244554N0402
4Z : 75
7A : 28M0D7W
7H : BAPT
7I : D34/28------BAPT-9
7K : E3
7G :
11.00000
2.0
19.00000
23.0
25.00000
23.0
45.00000
45.0

7G1 :
7G2 :
7G3 : 28.000
8B :
8B3 :
9A : 168.6

9B : +0.1
9D : V
9H : -95
9L : 0.0
9Y : 43
13Z : TEST DATA
13Y B
2W 28042005
2Z :
13X D 200512345680104 02
9XM : CCIR
9XT : CCIR28000-1.20/43.0
9XFL :
9XFU :
9X1 : 43.0
9X CP

9

0.0	0.0
0.6	3.0
2.0	16.2
5.0	26.1
10.0	33.7
15.0	38.1
20.0	41.2
48.0	50.7
180.0	50.7

XP

6

0.0	15.0
2.0	31.0
5.0	41.0
10.0	48.0
15.0	51.0
180.0	51.0

Station TX_B

0A : TX
1A : 28570.50000
1A1 : M
1Z : 2
6A : FX
6B : CV
6Z : X
2C :
4A : GRASEBIETH-A
4B : D
4C : 012E5244554N0402
4Z : 75
7A : 28M0D7W
7H : BAPT
7I : D34/28------BAPT-9
7K : E3
7G :
11.00000
2.0
19.00000
23.0
25.00000
23.0
45.00000
45.0

7G1 :
7G2 :
7G3 : 28.000
8B : +34.0
8B3 : 0
9A : 168.6

9B : +0.1
9D : V
9H :
9L : 0.0
9Y : 43
13Z : TEST DATA
13Y B
2W 28042005
2Z :
13X D 20051234568010403
9XM : CCIR
9XT : CCIR28000-1.20/43.0
9XFL :
9XFU :
9X1 : 43.0
9X CP
9

0.0	0.0
0.6	3.0
2.0	16.2
5.0	26.1
10.0	33.7
15.0	38.1
20.0	41.2
48.0	50.7
180.0	50.7

XP
6

0.0	15.0
2.0	31.0
5.0	41.0
10.0	48.0
15.0	51.0
180.0	51.0

Station RX$_A$

0A :	RX
1A :	28570.50000
1A1 :	M
1Z :	2
6A :	FX
6B :	CV
6Z :	X
2C :	
4A :	GLEWITZ-A
4B :	D
4C :	012E554053N55530
4Z :	60
7A :	28M0D7W
7H :	BAPT
7I :	D34/28------BAPT-9
7K :	E3
7G :	11.00000
	2.0
	19.00000
	23.0
	25.00000
	23.0
	45.00000
	45.0
7G1 :	
7G2 :	
7G3 :	28.000
8B :	
8B3 :	
9A :	348.6
9B :	-0.1
9D :	V
9H :	-95
9L :	0.0
9Y :	43
13Z :	TEST DATA
13Y :	B
2W :	28042005
2Z :	
13X :	D 20011234568010404
9XM :	CCIR
9XT :	CCIR28000-1.20/43.0
9XFL :	
9XFU :	
9X1 :	43.0
9X	CP

9

0.0	0.0
0.6	3.0
2.0	16.2
5.0	26.1
10.0	33.7
15.0	38.1
20.0	41.2
48.0	50.7
180.0	50.7

XP

6

0.0	15.0
2.0	31.0
5.0	41.0
10.0	48.0
15.0	51.0
180.0	51.0

Fixed Service records:

```
TX;27562.5;M;2;FX;CV;X;;GLEWITZ-A;D;
012E5540553N5530;60;28M0D7W;BAPT;D34/28------BAPT-9;E3;
11.0;2.0;19.0;23.0;25.0;23.0;45.0;45.0;;;;;
;;28.0;+34.0;0;348.6;-0.1;V;;0.0;43;TEST DATA;
B;28042005;;D  20051234568010401;CCIR;CCIR28000-1.20/43.0;
;;43.0;CP;9;0.0;0.0;0.6;3.0;2.0;16.2;5.0;26.1;
10.0;33.7;15.0;38.1;20.0;41.2;48.0;50.7;180.0;50.7;
XP;6;0.0;15.0;2.0;31.0;5.0;41.0;10.0;48.0;
15.0;51.0;180.0;51.0 CR

RX;27562.5;M;2;FX;CV;X;;GRASEBIET-A;D;
012E5244554N0402;75;28M0D7W;BAPT;D34/28------BAPT-9;E3;
11.0;2.0;19.0;23.0;25.0;23.0;45.0;45.0;;;;;
;;28.0;;;168.6;+0.1;V;-95;0.0;43;TEST DATA;
B;28042005;;D  20051234568010402;CCIR;CCIR28000-1.20/43.0;
;;43.0;CP;9;0.0;0.0;0.6;3.0;2.0;16.2;5.0;26.1;
10.0;33.7;15.0;38.1;20.0;41.2;48.0;50.7;180.0;50.7;
XP;6;0.0;15.0;2.0;31.0;5.0;41.0;10.0;48.0;
15.0;51.0;180.0;51.0 CR

TX;28570.5;M;2;FX;CV;X;;GRASEBIET-A;D;
012E5244554N0402;75;28M0D7W;BAPT;D34/28------BAPT-9;E3;
11.0;2.0;19.0;23.0;25.0;23.0;45.0;45.0;;;;;
```

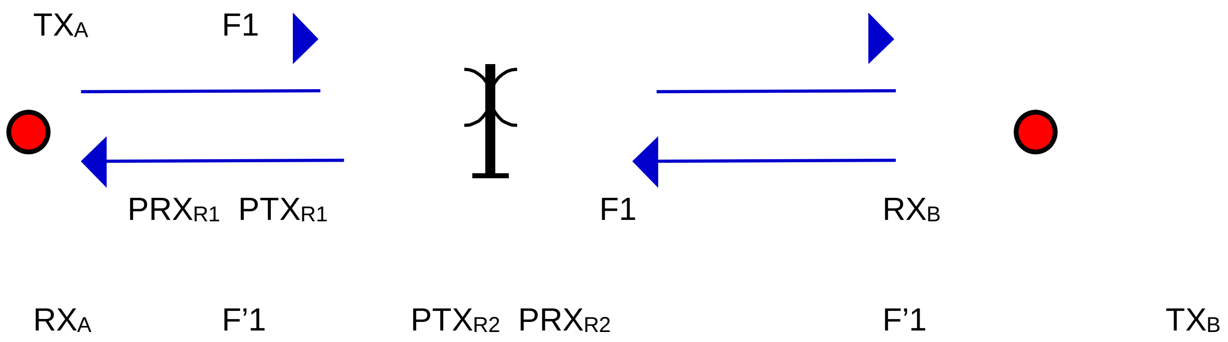
```
;;28.0;+34.0;0;168.6;+0.1;V;;0.0;43;TEST DATA;
B;28042005;;D  20051234568010403;CCIR;CCIR28000-1.20/43.0;
;;43.0;CP;9;0.0;0.0;0.6;3.0;2.0;16.2;5.0;26.1;
10.0;33.7;15.0;38.1;20.0;41.2;48.0;50.7;180.0;50.7;
XP;6;0.0;15.0;2.0;31.0;5.0;41.0;10.0;48.0;
15.0;51.0;180.0;51.0CR

RX;28570.5;M;2;FX;CV;X;;GLEWITZ-A;D;
012E5540 53N5530;60;28M0D7W;BAPT;D34/28------BAPT-9;E3;
11.0;2.0;19.0;23.0;25.0;23.0;45.0;45.0;;;;;
;;28.0;;;348.6;-0.1;V;-95;0.0;43;TEST DATA;
B;28042005;;D  20051234568010404;CCIR;CCIR28000-1.20/43.0;
;;43.0;CP;9;0.0;0.0;0.6;3.0;2.0;16.2;5.0;26.1;
10.0;33.7;15.0;38.1;20.0;41.2;48.0;50.7;180.0;50.7;
XP;6;0.0;15.0;2.0;31.0;5.0;41.0;10.0;48.0;
15.0;51.0;180.0;51.0CR
                    ⇑
              carriage return
```

Remark: Because of missing space on the paper, all 4 records are broken into several lines.
In the data exchange, each record is only one line!

3/ Bidirectional link with passive repeater

country :	POL
Year :	2005
Process Identification :	1234569

FF : 01
RR : 08



Station A passive repeater R Station B

TX_A record 1 :

0A	…	1A	…	4C	…	13X						
						CCC	YYYY	PPPPPPP	FF	RR	OO	Rem.
TX		14431.0		Pt A		F	2005	0001251	01	08	01	

PRX_{R1} record 2 :

0A	…	1A	…	4C	…	13X						
						CCC	YYYY	PPPPPPP	FF	RR	OO	Rem.
PRX		14431.0		Pt R		F	2005	0001251	01	08	02	

PTX_{R1} record 3 :

0A	…	1A	…	4C	…	13X						
						CCC	YYYY	PPPPPPP	FF	RR	OO	Rem.
PTX		14431.0		Pt R		F	2005	0001251	01	08	03	

RX_B record 4 :

0A	…	1A	…	4C	…	13X						
						CCC	YYYY	PPPPPPP	FF	RR	OO	Rem.
RX		14431.0		Pt B		F	2005	0001251	01	08	04	

TX_B record 5 :

0A	…	1A	…	4C	.	13X						
						CCC	YYYY	PPPPPPP	FF	RR	OO	Rem.
TX		14291.0		Pt B		F	2005	0001251	01	08	05	

PRX_{R2} record 6 :

0A	…	1A	.	4C	…	13X						
						CCC	YYYY	PPPPPPP	FF	RR	OO	Rem.
PRX		14291.0		Pt R		F	2005	0001251	01	08	06	

PTX_{R2} record 7 :

0A	…	1A	…	4C	…	13X						
						CCC	YYYY	PPPPPPP	FF	RR	OO	Rem.
PTX		14291.0		Pt R		F	2005	0001251	01	08	07	

RX_A record 8 :

0A	…	1A	…	4C	…	13X						
						CCC	YYYY	PPPPPPP	FF	RR	OO	Rem.
RX		14291.0		Pt A		F	2005	0001251	01	08	08	

This bidirectional link with passive repeater shall be identified by these 8 records.

If the administration ask many frequencies for this link in a same time, FF will be used to identified each frequency, for instance:

Link between PtA and PtB with F1/ F’1 :

F 20050001251010801 for TX_A on F1

F 20050001251010802 for PRX_{R1} on F1

F 20050001251010803 for PTX_{R1} on F1
F 20050001251010804 for RX_B on F1
F 20050001251010805 for TX_B on F’1
F 20050001251010806 for PRX_{R2} on F’1
F 20050001251010807 for PTX_{R2} on F’1
F 20050001251010808 for RX_A on F’1

Link between PtA and PtB with F2/ F’2 :
F 20050001251020801 for TX_A on F2
F 20050001251020802 for PRX_{R1} on F2
F 20050001251020803 for PTX_{R1} on F2
F 20050001251020804 for RX_B on F2
F 20050001251020805 for TX_B on F’2
F 20050001251020806 for PRX_{R2} on F’2
F 20050001251020807 for PTX_{R2} on F’2
F 20050001251020808 for RX_A on F’2

Link between PtA and PtB with F3/ F’3 :
F 20050001251030801 for TX_A on F3
F 20050001251030802 for PRX_{R1} on F3
F 20050001251030803 for PTX_{R1} on F3
F 20050001251030804 for RX_B on F3
F 20050001251030805 for TX_B on F’3
F 20050001251030806 for PRX_{R2} on F’3
F 20050001251030807 for PTX_{R2} on F’3
F 20050001251030808 for RX_A on F’3

Appendix 4 to Annex 2 B

FIELD 1Z : FREQUENCY CATEGORIES

1 Preferential frequencies

2 Frequencies requiring co-ordination

3 Frequencies used on the basis of geographical network plans
(only used in the Land Mobile Service)

4 Frequencies for a planned radiocommunications network
(only used in the Land Mobile Service)

5 Shared frequencies

6 not used

7 Frequencies using preferential codes
(only used in the Land Mobile Service)

8 Frequencies used on the basis of arrangements between operators

Appendix 5 to Annex 2 B

FIELD 6A : CLASS OF STATION

FX Fixed station

If other codes are required, use the codes listed in Appendix 5 of Section 9 of the Radiocommunication Data Dictionary

Appendix 6 to Annex 2 B

FIELD 6B : NATURE OF THE SERVICE

CO Station open to official correspondence exclusively

CP Station open to public correspondence

CR Station open to limited public correspondence

CV Station open exclusively to correspondence of a private agency

OT Station open exclusively to operational traffic of the service concerned

If other codes are required, use the codes listed in Appendix 13 of Section 9 of the Radiocommunication Data Dictionary

Appendix 7 to Annex 2 B

FIELD 6Z : CATEGORY OF USE

A	Airport services
B	Railways (excluding mountain railways)
C	Diplomatic corps
D	Mountain railways
E	Production, transport and distribution of energy (electricity, gas, water)
F	Fire services
G	Military
H	Radio relay networks
HH	Local call
I	Demonstration
K	Public transport
L	Subscriber installations, public mobile services, stand-by links
M	Navigation (in ports, on the Rhine, etc.)
N	Tests and research
O	Not allocated
P	Public security services (Police, customs, etc.)
Q	Entries not falling within other categories on this list (cordless microphones, etc.)
R	Ancillary broadcasting services (studio, news reporting)
S	Rescue services (ambulances, doctors, water and mountain rescue)
T	Other services provided by telecommunications administrations
U	Industrial operators
V	Road traffic service
W	Taxi and car hire firms
X	Other private services
Y	Reserved specific applications, not allocated
Z	Other private multiple-use networks

These codes can be combined (maximum two characters):
e.g. XP- private police service

Appendix 8 to Annex 2 B

FIELD 4A : ABBREVIATIONS NORMALLY USED WHEN THE NAME OF THE STATION EXCEEDS 20 CHARACTERS AND CODES

Abbreviations	Explanation
B	Bay
BRDG	Bridge
C	Cape
CL	Central
CP	Camp
CY	City
DPT	Department
E	East
ET	State
FT	Fort
FIR	Fire Tower
GF	Gulf
GR	Great
HLL	Hill
HR	Harbour
I	Island(s)
INTR	Usage in the whole country
JN	Junction
L	Lake
LSTN	Light station
MT	Mount
MTN	Mountain(s)
N	New
NO	North
NTL	National
PK	Peak
PMSTN	Pump station
PT	Port (see HR)
RV	River
S	Saint
STN	Station
SO	South
TR	Tower
V	Town (see CY)
VLY	Valley
W	West

If additional abbreviations are required, use those listed in Appendix 7 of Section 9 of the Radiocommunication Data Dictionary

Appendix 9 to Annex 2 B

FIELD 13Y : STATUS OF CO-ORDINATION

A For information : the assignment described is not submitted to a co-ordination procedure and to any protection requirement.

B Request for agreement.

C Agreed without reservation.

D Temporary status: Coordination subject to operational tests to show that coexistence is possible.

E Agreement on a non-interference basis (NIB); revocation of the agreement and any request to cease the emissions in question requires proof that harmful interference has been caused to assignments whose status has already been established, which should normally be described in an associated notice.

F Agreed, subject to a requirement identical or analogous to the requirement of RR 4.4.

G Agreed, without any reservation as to interference which may be caused by the assignment described; the applicant is, however, informed that there is a risk of interference from assignments whose status has already been established, and that the responsibility for any such risk is his; one or more associated notices may be sent.

H E+G

P Assignment according to preferential frequency agreements (1.3.2 of the Agreement) or geographical network plans (1.3.5 of the Agreement) or shared frequency agreements (1.3.3 of the Agreement) or frequencies using preferential codes (1.3.6 of the Agreement) or frequencies used on the basis of arrangements between operators (1.3.7 of the Agreement).

R Deletion of co-ordination.

W Withdrawal of the co-ordination request.

Y Request for agreement refused, but an alternative suggestion is formulated in column 13Z.

Z Request for agreement refused.

Notes:
Statuses B, C, E, G , Z are mostly used.
Status E can only be used for transmitters (Tx or Ptx).
Status G is limited to receivers (Rx or Prx).
For frequency bands where administrations may not or can not give information on the use status G 2.4 is applicable.
Explanatory note for the status G:
Agreed but protection from interference cannot be guaranteed to the receiver under request from assignments whose status has already been established and the applicant is informed that the responsibility for any such risk is his; one or more explanatory notices may be sent.

Appendix 10 to Annex 2 B
FIELD 9D : POLARIZATION

SYMBOLS USED TO INDICATE POLARIZATION

Polarization	Symbol	Definition
Horizontal linear	H	The electric field intensity vector is in the horizontal plane.
Vertical linear	V	The magnetic field intensity vector is in the horizontal plane.

Appendix 11 to Annex 2 B

FIELD 7K: MAX. CAPACITY OF THE LINK

Contents of the field 7K	
E1	2 Mbit/s
2E1	2 x 2 Mbit/s
4E1	4 x 2 Mbit/s
8E1	8 x 2 Mbit/s
16E1	16 x 2 Mbit/s
17E1	17 x 2 Mbit/s
E2	8 Mbit/s
2E2	2 x 8 Mbit/s
E3	34 Mbit/s
2E3	2 x 34 Mbit/s
E3 + E1	34 + 2 Mbit/s
E4	140 Mbit/s
2E4	2 x 140 Mbit/s
STM1	155 Mbit/s
2STM1	2 x 155 Mbit/s
N	Other capacity (N in Mbit/s)
X	Unknown

N - other capacity
Maximum capacity of the link is to be given in Mbit/s for example: 0.25, 200; 100; 45; 500; 2368; 990; 180; 247; 2 x 183, 2 x 1000 and so on.

Appendix 12 to Annex 2 B

FIELD 7G: TABLE OF DEFAULT VALUES OF TRANSMITTER SPECTRUM MASKS AND RECEIVER SELECTIVITY MASKS

.

Frequency band, system and class					TX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1 (dB)	f2 (MHz)	a2(dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5(dB)	f6 MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
1350 - 1517	B	2	0.025	0.032	0.00617	0	0.01064	2	0.01245	6.9	0.01383	13.1	0.01536	28	0.04	48
1350 - 1517	B	2	0.075	0.096	0.01851	0	0.03192	2	0.03735	6.9	0.0415	13.1	0.04608	28	0.12	48
1350 - 1517	B	2	0.25	0.325	0.06173	0	0.10644	2	0.12453	6.9	0.13837	13.1	0.15364	28	0.4	48
1350 - 1517	B	2	0.5	0.65	0.12347	0	0.21288	2	0.24906	6.9	0.27674	13.1	0.30728	28	0.8	48
1350 - 1517	B	2	1	1.3	0.24694	0	0.42575	2	0.49813	6.9	0.55348	13.1	0.61456	28	1.6	48
1350 - 1517	B	2	2	2.6	0.49387	0	0.8515	2	0.99626	6.9	1.10695	13.1	1.22913	28	3.2	48
1350 - 1517	UM	2	3.5	4	0.9728	0	1.52	2	1.7176	6.4	1.8848	11.7	2.1022	24	6	46
1350 - 1517	B	4L	0.025	0.064	0.00828	0	0.01104	2	0.01236	8	0.01325	16.1	0.01405	33	0.04	56
1350 - 1517	B	4L	0.075	0.19	0.02443	0	0.03301	2	0.03697	7.7	0.03994	16.5	0.04235	33	0.12	56
1350 - 1517	B	4L	0.25	0.65	0.08287	0	0.1105	2	0.12376	8	0.1326	16.1	0.14062	33	0.4	56
1350 - 1517	B	4L	0.5	1.3	0.16575	0	0.221	2	0.24752	8	0.2652	16.1	0.28125	33	0.8	56
1350 - 1517	B	4L	1	2.6	0.3315	0	0.442	2	0.49504	8	0.5304	16.1	0.5625	33	1.6	56
1350 - 1517	B	4L	2	5.2	0.663	0	0.884	2	0.99008	8	1.0608	16.1	1.125	33	3.2	56
1350 - 1517	UM	4L	3.5	8	0.9782	0	1.46	2	1.6644	7.2	1.8104	13.5	1.9768	29	7	56
2025 - 2670	B	2	0.5	0.65	0.1287	0	0.2145	2	0.24882	6.9	0.2767	13.4	0.3053	28	0.8	48
2025 - 2670	B	2	1	1.3	0.2574	0	0.429	2	0.49764	6.9	0.55341	13.4	0.6106	28	1.6	48
2025 - 2670	B	2	2	2.6	0.5148	0	0.858	2	0.99528	6.9	1.10682	13.4	1.2212	28	3.2	48
2025 - 2670	UM	2	1.75	2	0.4864	0	0.76	2	0.8588	6.4	0.9424	11.7	1.0511	24	3	46
2025 - 2670	UM	2	3.5	4	0.9728	0	1.52	2	1.7176	6.4	1.8848	11.7	2.1022	24	6	46
2025 - 2670	UM	2	7	8	1.9456	0	3.04	2	3.4352	6.4	3.7696	11.7	4.2044	24	12	46
2025 - 2670	UM	2	14	16	3.66	0	6	2	6.84	6.3	7.56	11.7	8.48	24	24	46
2025 - 2670	B	4L	0.5	1.3	0.14476	0	0.21288	2	0.24481	7.8	0.26609	15.3	0.286	33	0.8	56
2025 - 2670	B	4L	1	2.6	0.28951	0	0.42575	2	0.48961	7.8	0.53219	15.3	0.57199	33	1.6	56
2025 - 2670	B	4L	2	5.2	0.57902	0	0.8515	2	0.97922	7.8	1.06438	15.3	1.14398	33	3.2	56
2025 - 2670	UM	4L	1.75	4	0.511	0	0.73	2	0.8249	7.3	0.8906	13.6	0.9665	29	3.5	56
2025 - 2670	UM	4L	3.5	8	0.9782	0	1.46	2	1.6644	7.2	1.8104	13.5	1.9768	29	7	56
2025 - 2670	UM	4L	7	16	0.72	0	2.4	2	3.096	7.1	3.72	15.5	4.15	29	14	56
2025 - 2670	UM	4L	14	32	1.5708	0	4.76	2	6.0928	7.1	7.0924	13.6	8.0892	29	28	56
3410 - 11700	UM	2	1.75	2	0.4864	0	0.76	2	0.8588	6.4	0.9424	11.7	1.0511	24	3	46
3410 - 11700	UM	2	3.5	4	0.9728	0	1.52	2	1.7176	6.4	1.8848	11.7	2.1022	24	6	46
3410 - 11700	UM	2	7 … 11.7	8	1.9456	0	3.04	2	3.4352	6.4	3.7696	11.7	4.2044	24	12	46
3410 - 11700	UM	2	14 … 15	16	3.66	0	6	2	6.84	6.3	7.56	11.7	8.48	24	24	46
3410 - 11700	UM	2	28 … 30	32	8.6112	0	12.48	2	13.9776	6.7	15.1008	12	16.6288	25	45	47
3410 - 11700	UM	4L	1.75	4	0.511	0	0.73	2	0.8249	7.3	0.8906	13.6	0.9665	29	3.5	56
3410 - 11700	UM	4L	3.5	8	0.9782	0	1.46	2	1.6644	7.2	1.8104	13.5	1.9768	29	7	56
3410 - 11700	UM	4L	7 … 11.7	16	0.72	0	2.4	2	3.096	7.1	3.72	15.5	4.15	29	14	56
3410 - 11700	UM	4L	14 … 15	32	1.5708	0	4.76	2	6.0928	7.1	7.0924	13.6	8.0892	29	28	56
3410 - 11700	UM	4L	28 … 30	64	8.3496	0	11.76	2	13.1712	7	14.3472	14.5	15.4504	29	56	57
3410 - 11700	UM	4L	20	45	2.51831	0	6.80625	2	8.78006	7.7	10.20938	15.8	11.29419	34	30	56
3410 - 11700	UM	4H	14 … 15	49	3.15119	0	5.341	2	6.35579	7.8	7.10353	16.3	7.67081	34	27.5	56
3410 - 11700	UM	4H	28 … 30	98	8.8935	0	11.858	2	13.28096	8	14.2296	16.1	15.1025	35	55	57
3410 - 11700	UM	4H	56 … 60	196	17.787	0	23.716	2	26.56192	8	28.4592	16.1	30.205	35	110	57
3410 - 11700	UM	5HA	28 … 30	137	9.29643	0	12.23214	2	13.7	8.3	14.67857	17.7	15.44786	37	54	57
3410 - 11700	UM	5LA	56 … 60	235	19.30133	0	25.06667	2	28.07467	8.7	29.82933	17.3	31.392	37	108	57
3410 - 11700	UM	5H	7	34	2.54903	0	3.10857	2	3.38834	8.3	3.57486	17.7	3.73811	37	13.5	56
3410 - 11700	UM	5H	14 … 15	68	5.0031	0	6.17667	2	6.79433	8.8	7.16493	18.2	7.49023	37	27	56
3410 - 11700	UM	5HB	28 … 30	137	9.07331	0	11.93857	2	13.3712	8.3	14.32629	17.7	15.08383	38	54	57
3410 - 11700	UM	5LB	40	168	8.624	0	15.4	2	18.788	8.3	20.944	16.9	22.576	37	87	62
3410 - 11700	UM	5HB	56 … 60	274	17.37943	0	23.48571	2	26.53886	8.3	28.65257	18.4	30.152	38	108	57
3410 - 11700	UM	5LB	80	336	14.5432	0	29.68	2	37.3968	8.5	42.1456	17.2	45.6168	38	154	62
3410 - 11700	UM	6LA	28 … 30	156	9.4848	0	12.48	2	13.9776	8.3	14.976	17.7	15.7552	37	54	57
3410 - 11700	UM	6HA	40	252	6.3812	0	14.84	2	18.9952	8.2	21.8148	17.2	23.6988	37	87	62
3410 - 11700	UM	6LA	56 … 60	313	20.75777	0	25.62688	2	28.18956	8.8	29.72718	18.2	31.05598	37	108	57
3410 - 11700	UM	6HA	80	504	15.5652	0	30.52	2	37.8448	8.2	42.728	16.8	46.2748	37	154	62
3410 - 11700	UM	6L	7	39	2.48771	0	3.07125	2	3.37838	8.8	3.56265	18.2	3.72479	37	13.5	56
3410 - 11700	UM	6L	14 … 15	78	3.2175	0	5.3625	2	6.435	8.3	7.13212	17.3	7.6475	37	27	56
3410 - 11700	UM	6LB	28 … 30	156	8.541	0	11.7	2	13.338	8.7	14.391	18.7	15.139	38	54	57
3410 - 11700	UM	6HB	40	252	8.379	0	14.7	2	17.934	8.5	19.992	17.9	21.421	38	87	62
3410 - 11700	UM	6LB	56 … 60	313	19.96549	0	24.64875	2	27.11362	8.8	28.59255	18.2	29.89201	38	108	57

Frequency band, system and class					TX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1(dB)	f2 (MHz)	a2(dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4(dB)	f5 (MHz)	a5(dB)	f6 MHz	a6(dB)
MHz		Field 7G1	MHz	(Mbit/s)												
3410 - 11700	UM	6HB	80	504	22.0248	0	31.92	2	37.0272	8.6	40.2192	18	42.6152	38	154	62
12750 - 15350	UM	2	1.75	2	0.4864	0	0.76	2	0.8588	6.4	0.9424	11.7	1.0511	24	3	46
12750 - 15350	UM	2	3.5	4	0.9728	0	1.52	2	1.7176	6.4	1.8848	11.7	2.1022	24	6	46
12750 - 15350	UM	2	7	8	1.9456	0	3.04	2	3.4352	6.4	3.7696	11.7	4.2044	24	12	46
12750 - 15350	UM	2	14	16	3.66	0	6	2	6.84	6.3	7.56	11.7	8.48	24	24	46
12750 - 15350	UM	2	28	32	8.6112	0	12.48	2	13.9776	6.7	15.1008	12	16.6288	25	45	47
12750 - 15350	UM	2	56	64	16.2624	0	24.64	2	27.8432	6.6	30.3072	12	33.5776	25	90	47
12750 - 15350	UM	4L	1.75	4	0.511	0	0.73	2	0.8249	7.3	0.8906	13.6	0.9665	29	3.5	56
12750 - 15350	UM	4L	3.5	8	0.9782	0	1.46	2	1.6644	7.2	1.8104	13.5	1.9768	29	7	56
12750 - 15350	UM	4L	7	16	0.72	0	2.4	2	3.096	7.1	3.72	15.5	4.15	29	14	56
12750 - 15350	UM	4L	14	32	1.5708	0	4.76	2	6.0928	7.1	7.0924	13.6	8.0892	29	28	56
12750 - 15350	UM	4L	28	64	8.3496	0	11.76	2	13.1712	7	14.3472	14.5	15.4504	29	56	57
12750 - 15350	UM	4L	56	128	16.6992	0	23.52	2	26.3424	7	28.6944	14.5	30.9008	29	112	57
12750 - 15350	UM	4H	14	49	3.15119	0	5.341	2	6.35579	7.8	7.10353	16.3	7.67081	34	27.5	56
12750 - 15350	UM	4H	28	98	8.8935	0	11.858	2	13.28096	8	14.2296	16.1	15.1025	35	55	57
12750 - 15350	UM	4H	56	196	17.787	0	23.716	2	26.56192	8	28.4592	16.1	30.205	35	110	57
12750 - 15350	UM	5HA	28	137	9.29643	0	12.23214	2	13.7	8.3	14.67857	17.7	15.44786	37	54	57
12750 - 15350	UM	5LA	56	235	19.30133	0	25.06667	2	28.07467	8.7	29.82933	17.3	31.392	37	108	57
12750 - 15350	UM	5H	7	34	2.54903	0	3.10857	2	3.38834	8.3	3.57486	17.7	3.73811	37	13.5	56
12750 - 15350	UM	5H	14	68	5.0031	0	6.17667	2	6.79433	8.8	7.16493	18.2	7.49023	37	27	56
12750 - 15350	UM	5HB	28	137	9.07331	0	11.93857	2	13.3712	8.3	14.32629	17.7	15.08383	38	54	57
12750 - 15350	UM	5HB	56	274	17.37943	0	23.48571	2	26.53886	8.3	28.65257	18.4	30.152	38	108	57
12750 - 15350	UM	6LA	28	156	9.4848	0	12.48	2	13.9776	8.3	14.976	17.7	15.7552	37	54	57
12750 - 15350	UM	6LA	56	313	20.75777	0	25.62688	2	28.18956	8.8	29.72718	18.2	31.05598	37	108	57
12750 - 15350	UM	6L	7	39	2.48771	0	3.07125	2	3.37838	8.8	3.56265	18.2	3.72479	37	13.5	56
12750 - 15350	UM	6H	14	88	4.57111	0	5.37778	2	5.808	8.9	6.07689	19.6	6.32444	37	27	56
12750 - 15350	UM	6HB	28	176	7.80267	0	11.14667	2	12.81867	8.3	13.93333	17.7	14.77067	38	54	57
12750 - 15350	UM	6HB	56	352	17.09156	0	22.48889	2	25.18756	8.3	26.98667	17.7	28.44622	38	108	57
17700 - 19700	UM	2	1.75	2	0.4864	0	0.76	2	0.8588	6.4	0.9424	11.7	1.0511	24	3	46
17700 - 19700	UM	2	3.5	4	0.9728	0	1.52	2	1.7176	6.4	1.8848	11.7	2.1022	24	6	46
17700 - 19700	UM	2	7	8	1.9456	0	3.04	2	3.4352	6.4	3.7696	11.7	4.2044	24	12	46
17700 - 19700	UM	2	13.75 … 14	16	3.9	0	6	2	6.78	6.5	7.38	11.5	8.2375	24	24	46

Frequency band, system and class					TX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1 (dB)	f2 (MHz)	a2(dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5(dB)	f6 MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
17700 - 19700	UM	2	27.5 … 28	32	7.9728	0	12.08	2	13.6504	6.6	14.8584	12	16.4622	25	45	47
17700 - 19700	UM	2	55 … 56	64	15.9456	0	24.16	2	27.3008	6.6	29.7168	12	32.9244	25	90	47
17700 - 19700	UM	2	110 … 112	128	29.0848	0	47.68	2	54.3552	6.3	60.5536	12.4	67.3752	25	180	47
17700 - 19700	UM	4L	1.75	4	0.5625	0	0.75	2	0.8325	7.4	0.8925	14.5	0.955	29	3.1	51
17700 - 19700	UM	4L	3.5	8	1.08	0	1.5	2	1.68	7.3	1.815	14.2	1.955	29	6.2	51
17700 - 19700	UM	4L	7	16	2.16	0	3	2	3.36	7.3	3.63	14.2	3.91	29	12.4	51
17700 - 19700	UM	4L	13.75 … 14	32	4.62	0	6	2	6.6	7.3	7.02	13.8	7.5175	29	24.8	51
17700 - 19700	UM	4L	27.5 … 28	64	8.5264	0	11.68	2	12.9648	7	14.016	13.9	15.1086	29	49	52
17700 - 19700	UM	4L	55 … 56	128	17.0528	0	23.36	2	25.9296	7	28.032	13.9	30.2172	29	98	52
17700 - 19700	UM	4L	110 … 112	256	10.848	0	36.16	2	46.6464	7.1	56.048	15.5	62.572	29	196	52
17700 - 19700	UM	4H	13.75 … 14	49	4.7824	0	5.978	2	6.5758	8.3	6.93448	16.1	7.3111	34	24.15	51
17700 - 19700	UM	4H	27.5 … 28	98	9.44524	0	11.956	2	13.1516	8	13.98852	16.5	14.74176	35	48.3	52
17700 - 19700	UM	4H	55 … 56	196	18.89048	0	23.912	2	26.3032	8	27.97704	16.5	29.48352	35	96.6	52
17700 - 19700	UM	4H	110 … 112	392	24.80184	0	43.512	2	52.64952	8.2	58.7412	16.7	63.32216	35	193.2	52
17700 - 19700	UM	5HA	27.5 … 28	137	9.66339	0	12.23214	2	13.57768	8.7	14.43393	19	15.07589	37	47	52
17700 - 19700	UM	5HA	55 … 56	274	19.32679	0	24.46429	2	27.15536	8.7	28.86786	19	30.15179	37	94	52
17700 - 19700	UM	5HA	110 … 112	548	21.77909	0	41.88286	2	51.93474	8.3	58.21717	16.7	63.08663	37	188	52
17700 - 19700	UM	5H	7	34	2.89631	0	3.25429	2	3.44954	9.1	3.54717	16.9	3.68226	37	11.75	51
17700 - 19700	UM	5H	13.75 … 14	68	5.1884	0	6.17667	2	6.6708	8.3	6.97963	16.7	7.30243	37	23.5	51
17700 - 19700	UM	5HB	27.5 … 28	137	10.77211	0	12.52571	2	13.40251	8.3	14.0288	19	14.55431	38	47	52
17700 - 19700	UM	5HB	55 … 56	274	19.90023	0	24.26857	2	26.45274	8.3	27.90886	17.7	29.18691	38	94	52
17700 - 19700	UM	5HB	110 … 112	548	24.06503	0	41.49143	2	50.20463	8.3	56.01343	17.7	60.01783	38	188	52
17700 - 19700	UM	6LA	27.5 … 28	156	11.4972	0	13.065	2	13.8489	8.3	14.3715	17.7	14.9078	37	47	52
17700 - 19700	UM	6LA	55 … 56	313	21.10794	0	25.43125	2	27.72006	8.8	28.99162	17.2	30.30456	37	94	52
17700 - 19700	UM	6LA	110 … 112	627	17.69316	0	41.14688	2	52.668	8.2	60.48591	17.2	65.70059	37	188	52
17700 - 19700	UM	6L	7	39	2.77802	0	3.19312	2	3.41664	9	3.54437	18.4	3.67823	37	11.75	51
17700 - 19700	UM	6H	13.75 … 14	88	3.234	0	5.13333	2	6.10867	8.6	6.72467	17.9	7.17017	39	23.5	51
17700 - 19700	UM	6HB	27.5 … 28	176	7.80267	0	10.26667	2	11.49867	8.3	12.32	17.7	13.00567	38	47	52
17700 - 19700	UM	6HB	55 … 56	352	15.60533	0	20.53333	2	22.99733	8.3	24.64	17.7	26.01133	38	94	52
17700 - 19700	UM	6HB	110 … 112	705	31.1375	0	41.51667	2	46.91383	8.7	50.23517	18	52.99583	38	188	52
22000 - 29500	UM	2	1.75	2	0.4864	0	0.76	2	0.8588	6.4	0.9424	11.7	1.0511	24	3	46
22000 - 29500	UM	2	3.5	4	0.9728	0	1.52	2	1.7176	6.4	1.8848	11.7	2.1022	24	6	46

Frequency band, system and class					TX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1 (dB)	f2 (MHz)	a2(dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5(dB)	f6 MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
22000 - 29500	UM	2	7	8	1.9456	0	3.04	2	3.4352	6.4	3.7696	11.7	4.2044	24	12	46
22000 - 29500	UM	2	14	16	3.66	0	6	2	6.84	6.3	7.56	11.7	8.48	24	24	46
22000 - 29500	UM	2	28	32	8.6112	0	12.48	2	13.9776	6.7	15.1008	12	16.6288	25	45	47
22000 - 29500	UM	2	56	64	16.2624	0	24.64	2	27.8432	6.6	30.3072	12	33.5776	25	90	47
22000 - 29500	UM	2	112	128	37.1424	0	50.88	2	55.968	6.5	60.5472	12.7	65.7376	25	180	47
22000 - 29500	UM	4L	1.75	4	0.5625	0	0.75	2	0.8325	7.4	0.8925	14.5	0.955	29	3.1	51
22000 - 29500	UM	4L	3.5	8	1.08	0	1.5	2	1.68	7.3	1.815	14.2	1.955	29	6.2	51
22000 - 29500	UM	4L	7	16	2.16	0	3	2	3.36	7.3	3.63	14.2	3.91	29	12.4	51
22000 - 29500	UM	4L	14	32	3.9168	0	5.76	2	6.5088	6.9	7.1424	14.2	7.7432	29	24.8	51
22000 - 29500	UM	4L	28	64	8.3496	0	11.76	2	13.1712	7	14.3472	14.5	15.4504	29	49	52
22000 - 29500	UM	4L	56	128	16.6992	0	23.52	2	26.3424	7	28.6944	14.5	30.9008	29	98	52
22000 - 29500	UM	4L	112	256	15.2	0	40	2	50	6.9	58	13.4	65.92	29	196	52
22000 - 29500	UM	4H	14	49	3.51232	0	5.488	2	6.42096	7.9	7.07952	16.4	7.60368	34	24.15	51
22000 - 29500	UM	4H	28	98	10.00188	0	12.348	2	13.45932	7.9	14.32368	18.2	14.97412	35	48.3	52
22000 - 29500	UM	4H	56	196	20.00376	0	24.696	2	26.91864	7.9	28.64736	18.2	29.94824	35	96.6	52
22000 - 29500	UM	4H	112	392	22.62624	0	43.512	2	53.51976	8	60.48168	16.7	65.51776	35	193.2	52
22000 - 29500	UM	5HA	28	137	10.7682	0	12.81929	2	13.84483	8.3	14.48579	16.7	15.15037	37	47	52
22000 - 29500	UM	5HA	56	274	14.3028	0	22.70286	2	26.78937	8.1	29.74074	17.9	31.66291	37	94	52
22000 - 29500	UM	5HA	112	548	28.6056	0	45.40571	2	53.57874	8.1	59.48149	17.9	63.32583	37	188	52
22000 - 29500	UM	5H	7	34	2.89631	0	3.25429	2	3.44954	9.1	3.54717	16.9	3.68226	37	11.75	51
22000 - 29500	UM	5H	14	68	5.2836	0	6.29	2	6.7932	8.3	7.1077	16.7	7.4364	37	23.5	51
22000 - 29500	UM	5HB	28	137	7.83249	0	11.35143	2	13.16766	8.6	14.3028	18	15.15037	38	47	52
22000 - 29500	UM	5HB	56	274	12.25954	0	21.13714	2	25.57594	8.3	28.53514	17.7	30.57474	38	94	52
22000 - 29500	UM	5HB	112	548	31.32994	0	45.40571	2	52.67063	8.6	57.2112	18	60.60149	38	188	52
22000 - 29500	UM	6HA	28	176	7.97867	0	11.73333	2	13.61067	8.3	14.784	16.7	15.768	37	47	52
22000 - 29500	UM	6HA	56	352	15.95733	0	23.46667	2	27.22133	8.3	29.568	16.7	31.536	37	94	52
22000 - 29500	UM	6HA	112	705	24.56533	0	43.86667	2	53.51733	8.3	59.65867	16.9	64.288	37	188	52
22000 - 29500	UM	6L	7	39	2.77802	0	3.19312	2	3.41664	9	3.54437	18.4	3.67823	37	11.75	51
22000 - 29500	UM	6L	14	78	3.13511	0	5.31375	2	6.3765	8.1	7.12042	17.5	7.63239	37	23.5	51
22000 - 29500	UM	6HB	28	176	7.63644	0	10.75556	2	12.36889	8.6	13.33689	17.4	14.15467	38	47	52
22000 - 29500	UM	6HB	56	352	11.90933	0	20.53333	2	24.84533	8.3	27.72	17.7	29.71733	38	94	52
22000 - 29500	UM	6HB	112	705	26.32	0	41.125	2	48.5275	8.3	53.4625	17.7	57.05	38	188	52

Frequency band, system and class					TX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1 (dB)	f2 (MHz)	a2(dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5(dB)	f6 MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
31000 - 57000	UM	2	1.75	2	0.4864	0	0.76	2	0.8588	6.4	0.9424	11.7	1.0511	24	3	46
31000 - 57000	UM	2	3.5	4	0.9728	0	1.52	2	1.7176	6.4	1.8848	11.7	2.1022	24	6	46
31000 - 57000	UM	2	7	8	1.9456	0	3.04	2	3.4352	6.4	3.7696	11.7	4.2044	24	12	46
31000 - 57000	UM	2	14	16	3.66	0	6	2	6.84	6.3	7.56	11.7	8.48	24	24	46
31000 - 57000	UM	2	28	32	8.6112	0	12.48	2	13.9776	6.7	15.1008	12	16.6288	25	45	47
31000 - 57000	UM	2	56	64	16.2624	0	24.64	2	27.8432	6.6	30.3072	12	33.5776	25	90	47
31000 - 57000	UM	2	112	128	33.9456	0	49.92	2	56.9088	7.4	61.9008	14.2	67.0144	30	180	47
31000 - 57000	UM	4L	1.75	4	0.5625	0	0.75	2	0.8325	7.4	0.8925	14.5	0.955	29	2.6	46
31000 - 57000	UM	4L	3.5	8	0.36	0	1.2	2	1.548	7.1	1.86	15.5	2.075	29	5.2	46
31000 - 57000	UM	4L	7	16	2.25	0	3	2	3.33	7.4	3.57	14.5	3.82	29	10.4	46
31000 - 57000	UM	4L	14	32	1.68	0	4.8	2	6.096	7.1	7.104	13.8	8.06	29	20.8	46
31000 - 57000	UM	4L	28	64	9.92	0	12.4	2	13.516	7.6	14.26	14.2	15.16	29	42	47
31000 - 57000	UM	4L	56	128	21.76	0	25.6	2	27.392	7.8	28.416	13.6	30	29	84	47
31000 - 57000	UM	4L	112	256	13.776	0	39.36	2	49.9872	7.1	58.2528	13.8	66.064	29	168	47
31000 - 57000	UM	4H	14	49	4.4688	0	5.88	2	6.5268	7.7	6.9972	15.8	7.4312	34	20.85	46
31000 - 57000	UM	4H	28	98	10.7457	0	12.642	2	13.52694	7.8	14.15904	16.1	14.8183	35	41.7	47
31000 - 57000	UM	4H	56	196	21.4914	0	25.284	2	27.05388	7.8	28.31808	16.1	29.6366	35	83.4	47
31000 - 57000	UM	4H	112	392	26.5972	0	45.08	2	54.096	8.1	59.9564	16.3	64.6828	35	166.8	47
31000 - 57000	UM	5HA	28	137	5.54654	0	10.66643	2	13.22637	8.3	14.82634	16.7	16.06631	37	40	47
31000 - 57000	UM	5HA	56	274	11.09309	0	21.33286	2	26.45274	8.3	29.65267	16.7	32.13263	37	80	47
31000 - 57000	UM	5HA	112	548	21.55989	0	42.27429	2	52.42011	8.2	59.184	16.8	64.10869	37	188	47
31000 - 57000	UM	5H	7	34	2.6316	0	3.13286	2	3.38349	8.3	3.54013	16.7	3.70411	37	10	46
31000 - 57000	UM	5H	14	68	5.17367	0	6.23333	2	6.79433	8.8	7.106	17.2	7.433	37	20	46
31000 - 57000	UM	5HB	28	137	10.73004	0	12.62357	2	13.63346	8.9	14.26464	19.6	14.79711	38	40	47
31000 - 57000	UM	5HB	56	274	12.79971	0	21.33286	2	25.59943	8.3	28.3727	17.3	30.426	38	80	47
31000 - 57000	UM	5HB	112	548	27.126	0	43.05714	2	51.238	8.6	56.40486	17.9	60.10829	38	188	47
31000 - 57000	UM	6HA	28	176	4.51733	0	10.26667	2	13.14133	8.3	14.98933	17.1	16.296	37	40	47
31000 - 57000	UM	6HA	56	352	9.03467	0	20.53333	2	26.28267	8.3	29.97867	17.1	32.592	37	80	47
31000 - 57000	UM	6HA	112	705	18.095	0	41.125	2	52.64	8.3	60.0425	17.1	65.275	37	188	47
31000 - 57000	UM	6L	7	39	2.51842	0	3.07125	2	3.34766	8.3	3.53194	17.7	3.69408	37	10	46
31000 - 57000	UM	6H	14	88	4.57111	0	5.37778	2	5.808	8.9	6.07689	19.6	6.32444	40	20	46
31000 - 57000	UM	6HB	28	176	7.80267	0	10.26667	2	11.60133	9.1	12.32	17.7	13.01067	39	40	47
31000 - 57000	UM	6HB	56	352	15.60533	0	20.53333	2	23.20267	9.1	24.64	17.7	26.02133	39	80	47

Frequency band, system and class					TX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1 (dB)	f2 (MHz)	a2(dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5(dB)	f6 MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
31000 - 57000	UM	6HB	112	705	23.8525	0	41.125	2	50.1725	8.7	55.93	19	59.5175	41	188	47
71000 - 86000	UM	1	62.5	35	16.11925	0	26.425	2	29.596	5.7	32.50275	10	37.35575	20	90.7	42
71000 - 86000	UM	1	125	71	31.737	0	52.895	2	59.77135	5.9	65.5898	10.2	75.303	21	181.3	43
71000 - 86000	UM	1	250	142	63.474	0	105.79	2	119.5427	5.9	131.1796	10.2	150.606	21	362.5	43
71000 - 86000	UM	1	500	284	143.3916	0	217.26	2	241.1586	5.9	262.8846	10.6	296.1284	21	725	39.9
71000 - 86000	UM	1	750	426	189.144	0	315.24	2	356.2212	5.9	390.8976	10.2	448.836	21	1087.5	38.2
71000 - 86000	UM	1	1000	568	252.192	0	420.32	2	474.9616	5.9	521.1968	10.2	598.448	21	1450	37
71000 - 86000	UM	1	1250	710	307.8915	0	521.85	2	589.6905	5.8	652.3125	10.4	748.3085	21	1812.5	36
71000 - 86000	UM	1	1500	852	360.7368	0	621.96	2	702.8148	5.7	783.6696	10.6	898.1832	21	2175	35.2
71000 - 86000	UM	1	1750	994	448.6916	0	735.56	2	823.8272	5.7	912.0944	10.5	1039.9284	21	2537.5	34.5
71000 - 86000	UM	1	2000	1136	500.976	0	834.96	2	943.5048	5.9	1035.3504	10.2	1188.944	21	2900	33.9
71000 - 86000	UM	2	62.5	71	17.1536	0	26.8025	2	29.75078	5.7	32.43102	9.9	37.0764	20	90.7	42
71000 - 86000	UM	2	125	142	34.5344	0	53.96	2	59.8956	5.7	65.8312	10.4	74.6356	21	181.3	43
71000 - 86000	UM	2	250	285	70.395	0	108.3	2	120.213	5.8	131.043	10.2	148.705	21	362.5	43
71000 - 86000	UM	2	500	570	137.712	0	215.175	2	238.84425	5.7	262.5135	10.4	297.638	21	725	39.9
71000 - 86000	UM	2	750	855	201.99375	0	320.625	2	359.1	5.9	394.36875	10.7	446.75625	21	1087.5	38.2
71000 - 86000	UM	2	1000	1140	279.7275	0	430.35	2	477.6885	5.8	520.7235	10.2	590.9725	21	1450	37
71000 - 86000	UM	2	1250	1425	349.65938	0	537.9375	2	597.11062	5.8	650.90437	10.2	738.71562	21	1812.5	36
71000 - 86000	UM	2	1500	1710	321.7365	0	607.05	2	698.1075	5.9	783.0945	10.6	907.3635	21	2175	35.2
71000 - 86000	UM	2	1750	1995	429.62325	0	728.175	2	822.83775	5.8	910.21875	10.4	1044.22675	21	2537.5	34.5
71000 - 86000	UM	2	2000	2280	479.37	0	826.5	2	933.945	5.7	1041.39	10.6	1193.63	21	2900	33.9
71000 - 86000	UM	3	62.5	106	17.755	0	26.5	2	29.15	5.7	31.8	10.3	35.87	20	90.7	42
71000 - 86000	UM	3	125	212	27.59533	0	50.17333	2	57.1976	5.8	63.72013	10.2	74.00133	21	181.3	43
71000 - 86000	UM	3	250	425	75.8625	0	108.375	2	119.2125	6	127.8825	10.2	143.3875	21	362.5	43
71000 - 86000	UM	3	500	850	145.46333	0	213.91667	2	235.30833	5.8	256.7	10.7	287.37	21	725	39.9
71000 - 86000	UM	3	750	1275	226.1	0	323	2	355.3	6	381.14	10.2	427.4	21	1087.5	38.2
71000 - 86000	UM	3	1000	1700	299.48333	0	427.83333	2	470.61667	6	504.84333	10.2	566.18333	21	1450	37
71000 - 86000	UM	3	1250	2125	382.21667	0	538.33333	2	586.78333	5.8	635.23333	10.6	706.95	21	1812.5	36
71000 - 86000	UM	3	1500	2550	388.2375	0	616.25	2	690.2	5.9	757.9875	10.7	859.2625	21	2175	35.2
71000 - 86000	UM	3	1750	2975	432.51542	0	709.04167	2	794.12667	5.7	879.21167	10.5	1003.06792	21	2537.5	34.5
71000 - 86000	UM	3	2000	3400	514.08	0	816	2	913.92	5.9	1003.68	10.7	1137.92	21	2900	33.9
71000 - 86000	UM	4L	62.5	142	6.43438	0	22.1875	2	28.17812	6.6	33.28125	12.8	38.56562	27	78.5	42

Frequency band, system and class					TX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1(dB)	f2 (MHz)	a2(dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4(dB)	f5 (MHz)	a5(dB)	f6 MHz)	a6(dB)
MHz		Field 7G1	MHz	(Mbit/s)												
71000 - 86000	UM	4L	125	284	12.425	0	44.375	2	57.24375	6.9	68.78125	14.7	77.575	28	157	43
71000 - 86000	UM	4L	250	570	82.251	0	111.15	2	123.3765	7.2	132.2685	13.6	142.549	28	314	43
71000 - 86000	UM	4L	500	1140	141.075	0	213.75	2	243.675	7	267.1875	13.7	291.425	28	448	39.9
71000 - 86000	UM	4L	750	1710	169.974	0	303.525	2	358.1595	7	400.653	13.5	444.576	28	942	38.2
71000 - 86000	UM	4L	1000	2280	309.5955	0	436.05	2	488.376	7	527.6205	13.4	572.5045	28	1256	36.9
71000 - 86000	UM	4L	1250	2850	315.10312	0	516.5625	2	599.2125	7	661.2	13.2	730.52188	28	1570	36
71000 - 86000	UM	4L	1500	3420	378.12375	0	619.875	2	719.055	7	793.44	13.2	876.62625	28	1884	35.2
71000 - 86000	UM	4L	1750	3990	430.92	0	718.2	2	833.112	6.9	926.478	13.4	1022.98	28	2198	34.5
71000 - 86000	UM	4L	2000	4560	572.85	0	855	2	966.15	6.8	1060.2	13.5	1157.15	28	2512	36.9
71000 - 86000	UM	4H	62.5	219	10.5777	0	22.995	2	28.28385	7.2	32.193	13.9	36.0373	30	87	45
71000 - 86000	UM	4H	125	438	52.6257	0	59.13	2	62.0865	7.6	64.4517	16.9	66.8843	31	174	46
71000 - 86000	UM	4H	250	875	89.6	0	112	2	122.08	7.6	129.92	16.1	136.9	31	348	46
71000 - 86000	UM	4H	500	1750	102.06	0	189	2	226.8	7.3	255.15	14.6	280.94	31	1250	42.9
71000 - 86000	UM	4H	750	2625	144.585	0	283.5	2	343.035	7.3	388.395	14.4	429.915	31	1044	41.2
71000 - 86000	UM	4H	1000	3500	336.875	0	437.5	2	481.25	7.3	516.25	15.4	548.125	31	1392	39.9
71000 - 86000	UM	4H	1250	4375	245.7	0	472.5	2	571.725	7.4	647.325	14.9	711.8	31	1740	39
71000 - 86000	UM	4H	1500	5250	309.015	0	572.25	2	686.7	7.3	772.5375	14.6	850.485	31	2088	38.2
71000 - 86000	UM	4H	1750	6125	377.3	0	673.75	2	801.7625	7.3	902.825	15	987.7	31	2436	37.5
71000 - 86000	UM	4H	2000	7000	588	0	840	2	949.2	7.3	1033.2	14.8	1112	31	2784	39.9
71000 - 86000	UM	5LA	62.5	262	9.39925	0	22.925	2	29.11475	7.7	33.4705	15.3	37.07575	33	87	47
71000 - 86000	UM	5LA	125	525	18.83438	0	45.9375	2	58.34062	7.7	67.52812	16	74.29062	34	174	48
71000 - 86000	UM	5LA	250	1050	98.91875	0	116.375	2	124.52125	7.8	130.34	16.1	136.33125	34	348	48
71000 - 86000	UM	5LA	500	2100	197.8375	0	232.75	2	249.0425	7.8	260.68	16.1	272.6625	34	696	45.9
71000 - 86000	UM	5LA	750	3150	144.375	0	288.75	2	355.1625	7.7	404.25	16.1	440.625	34	1044	44.2
71000 - 86000	UM	5LA	1000	4200	168.525	0	374.5	2	471.87	7.9	539.28	16.1	590.475	34	1392	42.9
71000 - 86000	UM	5LA	1250	5250	222.075	0	472.5	2	590.625	7.9	670.95	15.8	735.425	34	1740	42
71000 - 86000	UM	5LA	1500	6300	266.49	0	567	2	708.75	7.9	805.14	15.8	882.51	34	2088	41.2
71000 - 86000	UM	5LA	1750	7350	310.905	0	661.5	2	826.875	7.9	939.33	15.8	1029.595	34	2436	40.5
71000 - 86000	UM	5LA	2000	8400	575.96	0	847	2	974.05	7.8	1067.22	16.7	1138.04	34	2784	42.9
71000 - 86000	UM	5LB	62.5	262	16.35317	0	23.36167	2	26.6323	7.8	28.96847	16.1	30.99517	33	87	47
71000 - 86000	UM	5LB	125	525	29.56625	0	47.6875	2	56.27125	7.9	61.99375	15.7	67.05875	34	174	48
71000 - 86000	UM	5LB	250	1050	59.1325	0	95.375	2	112.5425	7.9	123.9875	15.7	134.1175	34	348	48
71000 - 86000	UM	5LB	500	2100	158.3225	0	190.75	2	206.01	7.9	217.455	17.2	228.1775	34	696	45.9

Frequency band, system and class					TX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1 (dB)	f2 (MHz)	a2(dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5(dB)	f6 MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
71000 - 86000	UM	5LB	750	3150	239.79375	0	275.625	2	292.1625	7.7	305.94375	18.4	318.95625	34	1044	44.2
71000 - 86000	UM	5LB	1000	4200	238.7	0	385	2	458.15	8.3	508.2	18.2	541.3	38	1392	42.9
71000 - 86000	UM	5LB	1250	5250	276.19375	0	468.125	2	566.43125	8.5	627.2875	17.5	672.55625	38	1740	42
71000 - 86000	UM	5LB	1500	6300	357.21	0	567	2	674.73	8.6	742.77	17.9	791.79	38	2088	41.2
71000 - 86000	UM	5LB	1750	7350	420.60375	0	667.625	2	794.47375	8.6	874.58875	17.9	932.14625	39	2436	40.5
71000 - 86000	UM	5LB	2000	8400	509.6	0	784	2	925.12	8.6	1011.36	17.4	1078.4	38	2784	42.9
71000 - 86000	UM	5HA	62.5	306	12.02143	0	24.04286	2	29.81314	8	33.90043	17	36.68929	36	87	47
71000 - 86000	UM	5HA	125	612	24.04286	0	48.08571	2	60.10714	8.3	67.80086	17	73.37857	37	174	48
71000 - 86000	UM	5HA	250	1225	87.36	0	112	2	124.32	8.3	132.16	16.9	139.14	37	348	48
71000 - 86000	UM	5HA	500	2450	174.72	0	224	2	248.64	8.3	264.32	16.9	278.28	37	696	48
71000 - 86000	UM	5HA	750	3675	151.515	0	291.375	2	361.305	8.3	405.01125	16.7	438.735	37	1044	47.2
71000 - 86000	UM	5HA	1000	4900	368.55	0	455	2	500.5	8.8	527.8	18.2	551.45	37	1392	45.9
71000 - 86000	UM	5HA	1250	6125	210.65625	0	468.125	2	594.51875	8.2	678.78125	16.9	738.09375	37	1740	45
71000 - 86000	UM	5HA	1500	7350	303.03	0	582.75	2	722.61	8.3	810.0225	16.7	877.47	37	2088	44.2
71000 - 86000	UM	5HA	1750	8575	294.91875	0	655.375	2	832.32625	8.2	950.29375	16.9	1033.33125	37	2436	43.5
71000 - 86000	UM	5HA	2000	9800	611.31	0	861	2	990.15	8.6	1067.64	17.4	1130.69	37	2784	45.9
71000 - 86000	UM	5HB	62.5	306	12.6225	0	22.95	2	27.999	8.2	31.4415	17.1	33.9025	36	87	47
71000 - 86000	UM	5HB	125	612	29.33229	0	48.08571	2	57.222	8.1	63.47314	17	68.08914	37	174	48
71000 - 86000	UM	5HB	250	1225	51.0125	0	92.75	2	113.155	8.2	127.0675	17.1	136.9875	37	348	48
71000 - 86000	UM	5HB	500	2450	180.81	0	220.5	2	240.345	8.3	253.575	17.7	265.19	37	696	48
71000 - 86000	UM	5HB	750	3675	171.675	0	286.125	2	343.35	8.3	380.54625	17.3	408.075	37	1044	47.2
71000 - 86000	UM	5HB	1000	4900	373.38	0	444.5	2	480.06	8.3	502.285	16.7	525.62	37	1392	45.9
71000 - 86000	UM	5HB	1250	6125	283.5	0	472.5	2	567	8.3	628.425	17.3	674	37	1740	45
71000 - 86000	UM	5HB	1500	7350	322.77	0	556.5	2	673.365	8.3	751.275	17.7	805.23	37	2088	44.2
71000 - 86000	UM	5HB	1750	8575	416.745	0	661.5	2	780.57	8.1	866.565	17.9	923.755	37	2436	43.5
71000 - 86000	UM	5HB	2000	9800	776.58	0	903	2	966.21	8.3	1011.36	19	1049.42	37	2784	45.9
71000 - 86000	UM	6LA	62.5	350	9.64688	0	22.96875	2	29.85938	8.6	34.22344	18.3	36.91562	39	87	47
71000 - 86000	UM	6LA	125	700	19.4775	0	46.375	2	60.2875	8.6	69.09875	18.3	74.5225	40	174	48
71000 - 86000	UM	6LA	250	1400	44.415	0	94.5	2	120.96	8.8	137.025	18.5	147.085	40	348	48
71000 - 86000	UM	6LA	500	2800	88.83	0	189	2	241.92	8.8	274.05	18.5	294.17	40	696	48
71000 - 86000	UM	6LA	750	4200	133.245	0	283.5	2	362.88	8.8	411.075	18.5	441.255	40	1044	48
71000 - 86000	UM	6LA	1000	5600	444.36	0	483	2	507.15	10.7	516.81	20.2	531.64	40	1392	48
71000 - 86000	UM	6LA	1250	7000	222.075	0	472.5	2	604.8	8.8	685.125	18.5	735.425	40	1740	48

Frequency band, system and class					TX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1 (dB)	f2 (MHz)	a2(dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5(dB)	f6 MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
71000 - 86000	UM	6LA	1500	8400	266.49	0	567	2	725.76	8.8	822.15	18.5	882.51	40	2088	47.2
71000 - 86000	UM	6LA	1750	9800	310.905	0	661.5	2	846.72	8.8	959.175	18.5	1029.595	40	2436	46.5
71000 - 86000	UM	6LA	2000	11200	541.45	0	833	2	982.94	8.6	1082.9	19	1144.55	40	2784	48
71000 - 86000	UM	6LB	62.5	350	13.7025	0	23.625	2	28.8225	8.7	31.89375	17.7	34.1725	39	87	47
71000 - 86000	UM	6LB	125	700	26.215	0	46.8125	2	57.57938	8.7	64.13313	18.1	68.66	40	174	48
71000 - 86000	UM	6LB	250	1400	52.43	0	93.625	2	115.15875	8.7	128.26625	18.1	137.32	40	348	48
71000 - 86000	UM	6LB	500	2800	104.86	0	187.25	2	230.3175	8.7	256.5325	18.1	274.64	40	696	48
71000 - 86000	UM	6LB	750	4200	157.29	0	280.875	2	345.47625	8.7	384.79875	18.1	411.96	40	1044	48
71000 - 86000	UM	6LB	1000	5600	383.775	0	451.5	2	487.62	8.9	510.195	19.6	529.225	40	1392	48
71000 - 86000	UM	6LB	1250	7000	262.15	0	468.125	2	575.79375	8.7	641.33125	18.1	686.6	40	1740	48
71000 - 86000	UM	6LB	1500	8400	337.6275	0	572.25	2	698.145	9	772.5375	18.8	821.8725	40	2088	47.2
71000 - 86000	UM	6LB	1750	9800	340.85625	0	643.125	2	803.90625	8.9	900.375	18.7	962.89375	40	2436	46.5
71000 - 86000	UM	6LB	2000	11200	419.44	0	749	2	921.27	8.7	1026.13	18.1	1098.56	40	2784	48

Frequency band, system and class				Netto Bitrate	RX MASKS											
Band	System	Equipment Class	Channel Separation		f1 (MHz)	a1(dB)	f2 (MHz)	a2 (dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5 (dB)	f6 (MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
1350 - 1517	B	2	0.025	0.032	0.00617	0	0.01064	2	0.01287	8.3	0.01436	17.7	0.01536	38	0.02357	54
1350 - 1517	B	2	0.075	0.096	0.01851	0	0.03192	2	0.03862	8.3	0.04309	17.7	0.04608	38	0.07071	54
1350 - 1517	B	2	0.25	0.325	0.06173	0	0.10644	2	0.12879	8.3	0.14369	17.7	0.15364	38	0.22571	54
1350 - 1517	B	2	0.5	0.65	0.12347	0	0.21288	2	0.25758	8.3	0.28738	17.7	0.30728	38	0.43179	54
1350 - 1517	B	2	1	1.3	0.24694	0	0.42575	2	0.51516	8.3	0.57476	17.7	0.61456	38	0.86357	54
1350 - 1517	B	2	2	2.6	0.49387	0	0.8515	2	1.03032	8.3	1.14952	17.7	1.22913	38	1.72714	54
1350 - 1517	UM	2	3.5	4	0.9728	0	1.52	2	1.7784	7.9	1.9608	16.4	2.1022	35	2.56667	52
1350 - 1517	B	4L	0.025	0.064	0.00828	0	0.01104	2	0.01259	9.4	0.01347	20.5	0.01405	44.5	0.02327	62
1350 - 1517	B	4L	0.075	0.19	0.02443	0	0.03301	2	0.03796	9.7	0.0406	20.9	0.04235	44.5	0.06982	62
1350 - 1517	B	4L	0.25	0.65	0.08287	0	0.1105	2	0.12597	9.4	0.13481	20.5	0.14062	44.5	0.22273	62
1350 - 1517	B	4L	0.5	1.3	0.16575	0	0.221	2	0.25194	9.4	0.26962	20.5	0.28125	44.5	0.42606	62
1350 - 1517	B	4L	1	2.6	0.3315	0	0.442	2	0.50388	9.4	0.53924	20.5	0.5625	44.5	0.85212	62
1350 - 1517	B	4L	2	5.2	0.663	0	0.884	2	1.00776	9.4	1.07848	20.5	1.125	44.5	1.70424	62
1350 - 1517	UM	4L	3.5	8	0.9782	0	1.46	2	1.7228	9.1	1.8834	20.4	1.9768	42.5	2.88276	62
2025 - 2670	B	2	0.5	0.65	0.1287	0	0.2145	2	0.2574	8.3	0.28528	17.3	0.3053	38	0.43179	54
2025 - 2670	B	2	1	1.3	0.2574	0	0.429	2	0.5148	8.3	0.57057	17.3	0.6106	38	0.86357	54
2025 - 2670	B	2	2	2.6	0.5148	0	0.858	2	1.0296	8.3	1.14114	17.3	1.2212	38	1.72714	54
2025 - 2670	UM	2	1.75	2	0.4864	0	0.76	2	0.8892	7.9	0.9804	16.4	1.0511	35	1.28333	52
2025 - 2670	UM	2	3.5	4	0.9728	0	1.52	2	1.7784	7.9	1.9608	16.4	2.1022	35	2.56667	52
2025 - 2670	UM	2	7	8	1.9456	0	3.04	2	3.5568	7.9	3.9216	16.4	4.2044	35	5.13333	52
2025 - 2670	UM	2	14	16	3.66	0	6	2	7.14	8.1	7.86	15.9	8.48	35	10.26667	52
2025 - 2670	B	4L	0.5	1.3	0.14476	0	0.21288	2	0.25119	9.5	0.27248	20.2	0.286	44.5	0.42606	62
2025 - 2670	B	4L	1	2.6	0.28951	0	0.42575	2	0.50238	9.5	0.54496	20.2	0.57199	44.5	0.85212	62
2025 - 2670	B	4L	2	5.2	0.57902	0	0.8515	2	1.00477	9.5	1.08992	20.2	1.14398	44.5	1.70424	62
2025 - 2670	UM	4L	1.75	4	0.511	0	0.73	2	0.8541	9.5	0.9198	19.6	0.9665	42.5	1.44138	62
2025 - 2670	UM	4L	3.5	8	0.9782	0	1.46	2	1.7228	9.1	1.8834	20.4	1.9768	42.5	2.88276	62
2025 - 2670	UM	4L	7	16	0.72	0	2.4	2	3.312	9.1	3.84	19	4.15	42.5	5.76552	62
2025 - 2670	UM	4L	14	32	1.5708	0	4.76	2	6.4736	9	7.616	21.7	8.0892	42.5	11.53103	62
3410 - 11700	UM	2	1.75	2	0.4864	0	0.76	2	0.8892	7.9	0.9804	16.4	1.0511	35	1.28333	52
3410 - 11700	UM	2	3.5	4	0.9728	0	1.52	2	1.7784	7.9	1.9608	16.4	2.1022	35	2.56667	52
3410 - 11700	UM	2	7 … 11.7	8	1.9456	0	3.04	2	3.5568	7.9	3.9216	16.4	4.2044	35	5.13333	52
3410 - 11700	UM	2	14 … 15	16	3.66	0	6	2	7.14	8.1	7.86	15.9	8.48	35	10.26667	52
3410 - 11700	UM	2	28 … 30	32	8.6112	0	12.48	2	14.352	8.1	15.6	16.4	16.6288	36	20.432	53
3410 - 11700	UM	4L	1.75	4	0.511	0	0.73	2	0.8541	9.5	0.9198	19.6	0.9665	42.5	1.44138	62
3410 - 11700	UM	4L	3.5	8	0.9782	0	1.46	2	1.7228	9.1	1.8834	20.4	1.9768	42.5	2.88276	62
3410 - 11700	UM	4L	7 … 11.7	16	0.72	0	2.4	2	3.312	9.1	3.84	19	4.15	42.5	5.76552	62
3410 - 11700	UM	4L	14 … 15	32	1.5708	0	4.76	2	6.4736	9	7.616	21.7	8.0892	42.5	11.53103	62
3410 - 11700	UM	4L	28 … 30	64	8.3496	0	11.76	2	13.6416	9.2	14.7	19.3	15.4504	43	21.92414	63
3410 - 11700	UM	4L	20	45	2.51831	0	6.80625	2	9.18844	9.3	10.54969	20	11.29419	45	18.77273	62
3410 - 11700	UM	4H	14 … 15	49	3.15119	0	5.341	2	6.56943	9.4	7.26376	20.4	7.67081	45	14.45455	62
3410 - 11700	UM	4H	28 … 30	98	8.8935	0	11.858	2	13.6367	10.2	14.46676	20.5	15.1025	46	27.75	63
3410 - 11700	UM	4H	56 … 60	196	17.787	0	23.716	2	27.2734	10.2	28.93352	20.5	30.205	46	55.5	63
3410 - 11700	UM	5HA	28 … 30	137	9.29643	0	12.23214	2	13.94464	9.9	14.92321	23.7	15.44786	47	26.45833	67
3410 - 11700	UM	5LA	56 … 60	235	19.30133	0	25.06667	2	28.576	10.4	30.33067	23.3	31.392	47	51.66667	64
3410 - 11700	UM	5H	7	34	2.54903	0	3.10857	2	3.45051	10.4	3.60594	21.2	3.73811	46.5	6.52273	62
3410 - 11700	UM	5H	14 … 15	68	5.0031	0	6.17667	2	6.8561	9.8	7.23	21.9	7.49023	46.5	13.04545	62
3410 - 11700	UM	5HB	28 … 30	137	9.07331	0	11.93857	2	13.60997	9.9	14.56506	23.7	15.08383	47.5	25.54167	65
3410 - 11700	UM	5LB	40	168	8.624	0	15.4	2	19.404	10	21.56	22.9	22.576	49.5	37.6	68
3410 - 11700	UM	5HB	56 … 60	274	17.37943	0	23.48571	2	27.00857	9.7	28.88743	20.9	30.152	47.5	51.91667	67
3410 - 11700	UM	5LB	80	336	14.5432	0	29.68	2	38.584	10	43.3328	22.3	45.6168	47.5	72.2	63
3410 - 11700	UM	6LA	28 … 30	156	9.4848	0	12.48	2	14.2272	9.9	15.2256	23.7	15.7552	47	27.08333	70
3410 - 11700	UM	6HA	40	252	6.3812	0	14.84	2	19.8856	10.1	23.3	49.5	23.6988	49.5	39.29167	73
3410 - 11700	UM	6LA	56 … 60	313	20.75777	0	25.62688	2	28.44583	9.8	29.98344	21.7	31.05598	47	54.16667	70
3410 - 11700	UM	6HA	80	504	15.5652	0	30.52	2	39.0656	9.6	43.9488	21.9	46.2748	47	78.58333	73
3410 - 11700	UM	6L	7	39	2.48771	0	3.07125	2	3.40909	9.8	3.59336	21.7	3.72479	46.5	6.52273	62
3410 - 11700	UM	6L	14 … 15	78	3.2175	0	5.3625	2	6.59588	9.7	7.293	22.1	7.6475	46.5	13.04545	62
3410 - 11700	UM	6LB	28 … 30	156	8.541	0	11.7	2	13.572	10	14.508	21.2	15.139	47.5	26.58333	70
3410 - 11700	UM	6HB	40	252	8.379	0	14.7	2	18.522	10.3	20.433	22.7	21.421	50	39.1	73

Frequency band, system and class					RX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1(dB)	f2 (MHz)	a2 (dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5 (dB)	f6 (MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
3410 - 11700	UM	6LB	56 … 60	313	19.96549	0	24.64875	2	27.36011	9.8	28.83904	21.7	29.89201	47.5	53.16667	70
3410 - 11700	UM	6HB	80	504	22.0248	0	31.92	2	37.6656	9.8	40.8576	22.4	42.6152	47.5	78.2	73
12750 - 15350	UM	2	1.75	2	0.4864	0	0.76	2	0.8892	7.9	0.9804	16.4	1.0511	35	1.28333	52
12750 - 15350	UM	2	3.5	4	0.9728	0	1.52	2	1.7784	7.9	1.9608	16.4	2.1022	35	2.56667	52
12750 - 15350	UM	2	7	8	1.9456	0	3.04	2	3.5568	7.9	3.9216	16.4	4.2044	35	5.13333	52
12750 - 15350	UM	2	14	16	3.66	0	6	2	7.14	8.1	7.86	15.9	8.48	35	10.26667	52
12750 - 15350	UM	2	28	32	8.6112	0	12.48	2	14.352	8.1	15.6	16.4	16.6288	36	20.432	53
12750 - 15350	UM	2	56	64	16.2624	0	24.64	2	28.8288	8.3	31.5392	17.2	33.5776	36	40.864	53
12750 - 15350	UM	4L	1.75	4	0.511	0	0.73	2	0.8541	9.5	0.9198	19.6	0.9665	42.5	1.44138	62
12750 - 15350	UM	4L	3.5	8	0.9782	0	1.46	2	1.7228	9.1	1.8834	20.4	1.9768	42.5	2.88276	62
12750 - 15350	UM	4L	7	16	0.72	0	2.4	2	3.312	9.1	3.84	19	4.15	42.5	5.76552	62
12750 - 15350	UM	4L	14	32	1.5708	0	4.76	2	6.4736	9	7.616	21.7	8.0892	42.5	11.53103	62
12750 - 15350	UM	4L	28	64	8.3496	0	11.76	2	13.6416	9.2	14.7	19.3	15.4504	43	21.92414	63
12750 - 15350	UM	4L	56	128	16.6992	0	23.52	2	27.2832	9.2	29.4	19.3	30.9008	43	43.84828	63
12750 - 15350	UM	4H	14	49	3.15119	0	5.341	2	6.56943	9.4	7.26376	20.4	7.67081	45	14.45455	62
12750 - 15350	UM	4H	28	98	8.8935	0	11.858	2	13.6367	10.2	14.46676	20.5	15.1025	46	27.75	63
12750 - 15350	UM	4H	56	196	17.787	0	23.716	2	27.2734	10.2	28.93352	20.5	30.205	46	55.5	63
12750 - 15350	UM	5HA	28	137	9.29643	0	12.23214	2	13.94464	9.9	14.92321	23.7	15.44786	47	26.45833	67
12750 - 15350	UM	5LA	56	235	19.30133	0	25.06667	2	28.576	10.4	30.33067	23.3	31.392	47	51.66667	64
12750 - 15350	UM	5H	7	34	2.54903	0	3.10857	2	3.45051	10.4	3.60594	21.2	3.73811	46.5	6.52273	62
12750 - 15350	UM	5H	14	68	5.0031	0	6.17667	2	6.8561	9.8	7.2267	21.7	7.49023	46.5	13.04545	62
12750 - 15350	UM	5HB	28	137	9.07331	0	11.93857	2	13.60997	9.9	14.56506	23.7	15.08383	47.5	25.54167	65
12750 - 15350	UM	5HB	56	274	17.37943	0	23.48571	2	27.00857	9.7	28.88743	20.9	30.152	47.5	51.91667	67
12750 - 15350	UM	6LA	28	156	9.4848	0	12.48	2	14.2272	9.9	15.2256	23.7	15.7552	47	27.08333	70
12750 - 15350	UM	6LA	56	313	20.75777	0	25.62688	2	28.44583	9.8	29.98344	21.7	31.05598	47	54.16667	70
12750 - 15350	UM	6L	7	39	2.48771	0	3.07125	2	3.40909	9.8	3.59336	21.7	3.72479	46.5	6.52273	62
12750 - 15350	UM	6H	14	88	4.57111	0	5.37778	2	5.86178	10.2	6.13067	25.6	6.32444	46.5	13.15909	63
12750 - 15350	UM	6HB	28	176	7.80267	0	11.14667	2	13.15307	10.2	14.15627	22.1	14.77067	47.5	27.20833	73
12750 - 15350	UM	6HB	56	352	17.09156	0	22.48889	2	25.63733	9.9	27.43644	23.7	28.44622	47.5	54.41667	73
17700 - 19700	UM	2	1.75	2	0.4864	0	0.76	2	0.8892	7.9	0.9804	16.4	1.0511	35	1.28333	52
17700 - 19700	UM	2	3.5	4	0.9728	0	1.52	2	1.7784	7.9	1.9608	16.4	2.1022	35	2.56667	52
17700 - 19700	UM	2	7	8	1.9456	0	3.04	2	3.5568	7.9	3.9216	16.4	4.2044	35	5.13333	52

Frequency band, system and class							RX MASKS											
Band	System	Equipment Class	Channel Separation			Netto Bitrate	f1 (MHz)	a1(dB)	f2 (MHz)	a2 (dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5 (dB)	f6 (MHz)	a6 (dB)
MHz		Field 7G1	MHz			(Mbit/s)												
17700 - 19700	UM	2	13.75	…	14	16	3.9	0	6	2	7.02	8.1	7.68	16.1	8.2375	35	10.26667	52
17700 - 19700	UM	2	27.5	…	28	32	7.9728	0	12.08	2	14.1336	8.3	15.4624	17.2	16.4622	36	20.432	53
17700 - 19700	UM	2	55	…	56	64	15.9456	0	24.16	2	28.2672	8.3	30.9248	17.2	32.9244	36	40.864	53
17700 - 19700	UM	2	110	…	112	128	29.0848	0	47.68	2	56.7392	8.1	62.9376	17	67.3752	36	81.728	53
17700 - 19700	UM	4L	1.75			4	0.5625	0	0.75	2	0.8475	8.7	0.9075	18	0.955	40	1.38966	57
17700 - 19700	UM	4L	3.5			8	1.08	0	1.5	2	1.725	9	1.86	19	1.955	40	2.77931	57
17700 - 19700	UM	4L	7			16	2.16	0	3	2	3.45	9	3.72	19	3.91	40	5.55862	57
17700 - 19700	UM	4L	13.75	…	14	32	4.62	0	6	2	6.72	8.7	7.2	19.8	7.5175	40	11.11724	57
17700 - 19700	UM	4L	27.5	…	28	64	8.5264	0	11.68	2	13.3152	8.7	14.3664	18.7	15.1086	40.5	21.48966	60
17700 - 19700	UM	4L	55	…	56	128	17.0528	0	23.36	2	26.6304	8.7	28.7328	18.7	30.2172	40.5	42.97931	60
17700 - 19700	UM	4L	110	…	112	256	10.848	0	36.16	2	49.5392	8.8	57.856	19	62.572	40.5	85.37931	59
17700 - 19700	UM	4H	13.75	…	14	49	4.7824	0	5.978	2	6.63558	9.2	7.05404	22.1	7.3111	42.5	13.77273	57
17700 - 19700	UM	4H	27.5	…	28	98	9.44524	0	11.956	2	13.39072	9.6	14.22764	22.5	14.74176	43.5	27.75	63
17700 - 19700	UM	4H	55	…	56	196	18.89048	0	23.912	2	26.78144	9.6	28.45528	22.5	29.48352	43.5	55.5	63
17700 - 19700	UM	4H	110	…	112	392	24.80184	0	43.512	2	53.95488	9.4	59.61144	19.2	63.32216	43.5	108	60
17700 - 19700	UM	5HA	27.5	…	28	137	9.66339	0	12.23214	2	13.7	9.6	14.55625	22.5	15.07589	44.5	26.45833	67
17700 - 19700	UM	5HA	55	…	56	274	19.32679	0	24.46429	2	27.4	9.6	29.1125	22.5	30.15179	44.5	52.91667	67
17700 - 19700	UM	5HA	110	…	112	548	21.77909	0	41.88286	2	53.19123	9.5	59.47366	20.2	63.08663	44.5	105.83333	67
17700 - 19700	UM	5H	7			34	2.89631	0	3.25429	2	3.48209	11	3.57971	22.9	3.68226	44	6.23864	57
17700 - 19700	UM	5H	13.75	…	14	68	5.1884	0	6.17667	2	6.73257	9.5	7.0414	20.2	7.30243	44	12.47727	57
17700 - 19700	UM	5HB	27.5	…	28	137	10.77211	0	12.52571	2	13.52777	9.6	14.15406	25	14.55431	45	25.54167	65
17700 - 19700	UM	5HB	55	…	56	274	19.90023	0	24.26857	2	26.69543	9.3	28.15154	21.2	29.18691	45	51.91667	67
17700 - 19700	UM	5HB	110	…	112	548	24.06503	0	41.49143	2	51.44937	9.6	56.84326	20.6	60.01783	45	103.83333	67
17700 - 19700	UM	6LA	27.5	…	28	156	11.4972	0	13.065	2	13.97955	9.9	14.50215	23.7	14.9078	44.5	27.08333	70
17700 - 19700	UM	6LA	55	…	56	313	21.10794	0	25.43125	2	27.97438	10	29.24594	20.7	30.30456	44.5	54.16667	70
17700 - 19700	UM	6LA	110	…	112	627	17.69316	0	41.14688	2	54.31388	9.4	61.72031	20.3	65.70059	44.5	108.33333	70
17700 - 19700	UM	6L	7			39	2.77802	0	3.19312	2	3.44858	10.5	3.5763	24.4	3.67823	44	6.40909	60
17700 - 19700	UM	6H	13.75	…	14	88	3.234	0	5.13333	2	6.21133	9.5	6.82733	21.4	7.17017	45	13.15909	63
17700 - 19700	UM	6HB	27.5	…	28	176	7.80267	0	10.26667	2	11.704	9.9	12.42267	20.2	13.00567	45	27.20833	73
17700 - 19700	UM	6HB	55	…	56	352	15.60533	0	20.53333	2	23.408	9.9	24.84533	20.2	26.01133	45	54.41667	73
17700 - 19700	UM	6HB	110	…	112	705	31.1375	0	41.51667	2	47.329	9.4	50.65033	20.5	52.99583	45	108.83333	73
22000 - 29500	UM	2	1.75			2	0.4864	0	0.76	2	0.8892	7.9	0.9804	16.4	1.0511	35	1.28333	52

Frequency band, system and class					**RX MASKS**											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1(dB)	f2 (MHz)	a2 (dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5 (dB)	f6 (MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
22000 - 29500	UM	2	3.5	4	0.9728	0	1.52	2	1.7784	7.9	1.9608	16.4	2.1022	35	2.56667	52
22000 - 29500	UM	2	7	8	1.9456	0	3.04	2	3.5568	7.9	3.9216	16.4	4.2044	35	5.13333	52
22000 - 29500	UM	2	14	16	3.66	0	6	2	7.14	8.1	7.86	15.9	8.48	35	10.26667	52
22000 - 29500	UM	2	28	32	8.6112	0	12.48	2	14.352	8.1	15.6	16.4	16.6288	36	20.432	53
22000 - 29500	UM	2	56	64	16.2624	0	24.64	2	28.8288	8.3	31.5392	17.2	33.5776	36	40.864	53
22000 - 29500	UM	2	112	128	37.1424	0	50.88	2	57.4944	8	62.0736	16.8	65.7376	36	81.728	53
22000 - 29500	UM	4L	1.75	4	0.5625	0	0.75	2	0.8475	8.7	0.9075	18	0.955	40	1.38966	57
22000 - 29500	UM	4L	3.5	8	1.08	0	1.5	2	1.725	9	1.86	19	1.955	40	2.77931	57
22000 - 29500	UM	4L	7	16	2.16	0	3	2	3.45	9	3.72	19	3.91	40	5.55862	57
22000 - 29500	UM	4L	14	32	3.9168	0	5.76	2	6.7392	8.9	7.3152	18.2	7.7432	40	11.11724	57
22000 - 29500	UM	4L	28	64	8.3496	0	11.76	2	13.524	8.6	14.7	19.3	15.4504	40.5	21.48966	60
22000 - 29500	UM	4L	56	128	16.6992	0	23.52	2	27.048	8.6	29.4	19.3	30.9008	40.5	42.97931	60
22000 - 29500	UM	4L	112	256	15.2	0	40	2	53.2	8.9	62	21.1	65.92	40.5	85.95862	60
22000 - 29500	UM	4H	14	49	3.51232	0	5.488	2	6.5856	9.3	7.18928	19.3	7.60368	42.5	13.77273	57
22000 - 29500	UM	4H	28	98	10.00188	0	12.348	2	13.70628	9.8	14.44716	21.7	14.97412	43.5	27.75	63
22000 - 29500	UM	4H	56	196	20.00376	0	24.696	2	27.41256	9.8	28.89432	21.7	29.94824	43.5	55.5	63
22000 - 29500	UM	4H	112	392	22.62624	0	43.512	2	55.26024	9.5	61.78704	20.2	65.51776	43.5	108	60
22000 - 29500	UM	5HA	28	137	10.7682	0	12.81929	2	13.97302	9.5	14.61399	20.2	15.15037	44.5	26.45833	67
22000 - 29500	UM	5HA	56	274	14.3028	0	22.70286	2	27.47046	9.5	30.1948	21.4	31.66291	44.5	52.91667	67
22000 - 29500	UM	5HA	112	548	28.6056	0	45.40571	2	54.94091	9.5	60.3896	21.4	63.32583	44.5	105.83333	67
22000 - 29500	UM	5H	7	34	2.89631	0	3.25429	2	3.48209	11	3.57971	22.9	3.68226	44	6.23864	57
22000 - 29500	UM	5H	14	68	5.2836	0	6.29	2	6.8561	9.5	7.1706	20.2	7.4364	44	12.47727	57
22000 - 29500	UM	5HB	28	137	7.83249	0	11.35143	2	13.39469	9.8	14.41631	19.9	15.15037	45	25.54167	65
22000 - 29500	UM	5HB	56	274	12.25954	0	21.13714	2	26.21006	9.6	28.95789	20.6	30.57474	45	51.91667	67
22000 - 29500	UM	5HB	112	548	31.32994	0	45.40571	2	53.57874	9.8	57.66526	19.9	60.60149	45	103.83333	67
22000 - 29500	UM	6HA	28	176	7.97867	0	11.73333	2	13.84533	9.5	15.01867	20.2	15.768	44.5	27.70833	73
22000 - 29500	UM	6HA	56	352	15.95733	0	23.46667	2	27.69067	9.5	30.03733	20.2	31.536	44.5	55.41667	73
22000 - 29500	UM	6HA	112	705	24.56533	0	43.86667	2	54.83333	9.6	60.97467	21	64.288	44.5	110.83333	73
22000 - 29500	UM	6L	7	39	2.77802	0	3.19312	2	3.44858	10.5	3.5763	24.4	3.67823	44	6.40909	60
22000 - 29500	UM	6L	14	78	3.13511	0	5.31375	2	6.53591	9.4	7.2267	20.4	7.63239	44	12.81818	60
22000 - 29500	UM	6HB	28	176	7.63644	0	10.75556	2	12.584	9.9	13.552	21.8	14.15467	45	27.20833	73
22000 - 29500	UM	6HB	56	352	11.90933	0	20.53333	2	25.46133	9.6	28.13067	20.6	29.71733	45	54.41667	73
22000 - 29500	UM	6HB	112	705	26.32	0	41.125	2	49.35	9.3	54.285	21.2	57.05	45	108.83333	73

Frequency band, system and class					**RX MASKS**											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1(dB)	f2 (MHz)	a2 (dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5 (dB)	f6 (MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
31000 - 57000	UM	2	1.75	2	0.4864	0	0.76	2	0.8892	7.9	0.9804	16.4	1.0511	35	1.28333	52
31000 - 57000	UM	2	3.5	4	0.9728	0	1.52	2	1.7784	7.9	1.9608	16.4	2.1022	35	2.56667	52
31000 - 57000	UM	2	7	8	1.9456	0	3.04	2	3.5568	7.9	3.9216	16.4	4.2044	35	5.13333	52
31000 - 57000	UM	2	14	16	3.66	0	6	2	7.14	8.1	7.86	15.9	8.48	35	10.26667	52
31000 - 57000	UM	2	28	32	8.6112	0	12.48	2	14.352	8.1	15.6	16.4	16.6288	36	20.432	53
31000 - 57000	UM	2	56	64	16.2624	0	24.64	2	28.8288	8.3	31.5392	17.2	33.5776	36	40.864	53
31000 - 57000	UM	2	112	128	33.9456	0	49.92	2	57.9072	8.3	62.8992	16.7	67.0144	36	81.728	53
31000 - 57000	UM	4L	1.75	4	0.5625	0	0.75	2	0.8475	8.7	0.9075	18	0.955	37.5	1.33793	52
31000 - 57000	UM	4L	3.5	8	0.36	0	1.2	2	1.62	8.3	1.92	19	2.075	37.5	2.67586	52
31000 - 57000	UM	4L	7	16	2.25	0	3	2	3.39	8.7	3.63	18	3.82	37.5	5.35172	52
31000 - 57000	UM	4L	14	32	1.68	0	4.8	2	6.336	8.2	7.58	21.4	8.06	37.5	10.70345	52
31000 - 57000	UM	4L	28	64	9.92	0	12.4	2	13.64	8.3	14.508	18.6	15.16	38	21.48966	60
31000 - 57000	UM	4L	56	128	21.76	0	25.6	2	27.648	8.9	28.928	19.6	30	38	42.97931	60
31000 - 57000	UM	4L	112	256	13.776	0	39.36	2	52.3488	8.5	61.008	18.4	66.064	38	85.95862	60
31000 - 57000	UM	4H	14	49	4.4688	0	5.88	2	6.6444	9.1	7.1148	20.2	7.4312	40	13.22727	53
31000 - 57000	UM	4H	28	98	10.7457	0	12.642	2	13.65336	8.9	14.28546	19.6	14.8183	41	27.75	63
31000 - 57000	UM	4H	56	196	21.4914	0	25.284	2	27.30672	8.9	28.57092	19.6	29.6366	41	55.5	63
31000 - 57000	UM	4H	112	392	26.5972	0	45.08	2	54.9976	9	60.858	18.8	64.6828	41	108	60
31000 - 57000	UM	5HA	28	137	5.54654	0	10.66643	2	13.4397	9.1	15.03966	18.8	16.06631	42	26.45833	67
31000 - 57000	UM	5HA	56	274	11.09309	0	21.33286	2	26.8794	9.1	30.07933	18.8	32.13263	42	52.91667	67
31000 - 57000	UM	5HA	112	548	21.55989	0	42.27429	2	53.2656	8.9	60.02949	19	64.10869	42	105.83333	67
31000 - 57000	UM	5H	7	34	2.6316	0	3.13286	2	3.41481	9.5	3.57146	20.2	3.70411	41.5	6.23864	57
31000 - 57000	UM	5H	14	68	5.17367	0	6.23333	2	6.79433	8.8	7.17	20.8	7.433	41.5	12.47727	57
31000 - 57000	UM	5HB	28	137	10.73004	0	12.62357	2	13.75969	10.2	14.26464	19.6	14.79711	42.5	25.54167	65
31000 - 57000	UM	5HB	56	274	12.79971	0	21.33286	2	26.02609	9.2	28.79936	20.2	30.426	42.5	51.91667	67
31000 - 57000	UM	5HB	112	548	27.126	0	43.05714	2	51.66857	9	56.83543	19.5	60.10829	42.5	103.83333	67
31000 - 57000	UM	6HA	28	176	4.51733	0	10.26667	2	13.34667	9	15.19467	19	16.296	42	27.70833	73
31000 - 57000	UM	6HA	56	352	9.03467	0	20.53333	2	26.69333	9	30.38933	19	32.592	42	55.41667	73
31000 - 57000	UM	6HA	112	705	18.095	0	41.125	2	53.4625	9	60.865	19	65.275	42	110.83333	73
31000 - 57000	UM	6L	7	39	2.51842	0	3.07125	2	3.37838	9.3	3.56265	21.2	3.69408	41.5	6.40909	60
31000 - 57000	UM	6H	14	88	4.57111	0	5.37778	2	5.86178	10.2	6.13067	25.6	6.32444	46	13.15909	63
31000 - 57000	UM	6HB	28	176	7.80267	0	10.26667	2	11.704	9.9	12.42267	20.2	13.01067	45	27.20833	73

Frequency band, system and class					RX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1(dB)	f2 (MHz)	a2 (dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5 (dB)	f6 (MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
31000 - 57000	UM	6HB	56	352	15.60533	0	20.53333	2	23.408	9.9	24.84533	20.2	26.02133	45	54.41667	73
31000 - 57000	UM	6HB	112	705	23.8525	0	41.125	2	50.995	9.6	56.7525	22.5	59.5175	47	108.83333	73
71000 - 86000	UM	1	62.5	35	16.11925	0	26.425	2	30.91725	7.4	34.3525	14.9	37.35575	31	45.395	53
71000 - 86000	UM	1	125	71	31.737	0	52.895	2	62.4161	7.6	69.29245	15.1	75.303	32	89.35238	53
71000 - 86000	UM	1	250	142	63.474	0	105.79	2	124.8322	7.6	138.5849	15.1	150.606	32	178.85714	53
71000 - 86000	UM	1	500	284	143.3916	0	217.26	2	249.849	7.4	273.7476	14.7	296.1284	30.4	357.71429	53
71000 - 86000	UM	1	750	426	189.144	0	315.24	2	368.8308	7.2	409.812	14.2	448.836	29.6	536.57143	53
71000 - 86000	UM	1	1000	568	252.192	0	420.32	2	491.7744	7.2	546.416	14.2	598.448	29	715.42857	53
71000 - 86000	UM	1	1250	710	307.8915	0	521.85	2	610.5645	7.1	678.405	13.6	748.3085	28.5	894.28571	53
71000 - 86000	UM	1	1500	852	360.7368	0	621.96	2	727.6932	6.9	808.548	13.1	898.1832	28.1	1073.14286	53
71000 - 86000	UM	1	1750	994	448.6916	0	735.56	2	853.2496	7	941.5168	13.2	1039.9284	27.8	1252	53
71000 - 86000	UM	1	2000	1136	500.976	0	834.96	2	968.5536	6.9	1077.0984	13.4	1188.944	27.4	1430.85714	53
71000 - 86000	UM	2	62.5	71	17.1536	0	26.8025	2	31.0909	7.5	34.3072	15.2	37.0764	31	45.395	53
71000 - 86000	UM	2	125	142	34.5344	0	53.96	2	62.5936	7.5	69.0688	15.2	74.6356	32	89.35238	53
71000 - 86000	UM	2	250	285	70.395	0	108.3	2	125.628	7.7	137.541	15	148.705	32	178.85714	53
71000 - 86000	UM	2	500	570	137.712	0	215.175	2	249.603	7.5	273.27225	14.2	297.638	30.4	357.71429	53
71000 - 86000	UM	2	750	855	201.99375	0	320.625	2	371.925	7.3	410.4	14.4	446.75625	29.6	536.57143	53
71000 - 86000	UM	2	1000	1140	279.7275	0	430.35	2	494.9025	7.3	542.241	14	590.9725	29	715.42857	53
71000 - 86000	UM	2	1250	1425	349.65938	0	537.9375	2	613.24875	6.9	677.80125	14	738.71562	28.5	894.28571	53
71000 - 86000	UM	2	1500	1710	321.7365	0	607.05	2	722.3895	6.9	813.447	13.3	907.3635	28.1	1073.14286	53
71000 - 86000	UM	2	1750	1995	429.62325	0	728.175	2	844.683	6.7	946.6275	13.6	1044.22675	27.8	1252	53
71000 - 86000	UM	2	2000	2280	479.37	0	826.5	2	967.005	6.9	1074.45	13.1	1193.63	27.4	1430.85714	53
71000 - 86000	UM	3	62.5	106	17.755	0	26.5	2	30.475	7.6	33.125	14.5	35.87	31	46.025	55
71000 - 86000	UM	3	125	212	27.59533	0	50.17333	2	60.208	7.5	67.734	15.2	74.00133	32	90.5619	55
71000 - 86000	UM	3	250	425	75.8625	0	108.375	2	123.5475	7.8	133.30125	14.8	143.3875	32	181.28571	55
71000 - 86000	UM	3	500	850	145.46333	0	213.91667	2	243.865	7.4	265.25667	14.2	287.37	30.4	362.57143	55
71000 - 86000	UM	3	750	1275	226.1	0	323	2	364.99	7.3	394.06	13.6	427.4	29.6	543.85714	55
71000 - 86000	UM	3	1000	1700	299.48333	0	427.83333	2	483.45167	7.3	521.95667	13.6	566.18333	29	725.14286	55
71000 - 86000	UM	3	1250	2125	382.21667	0	538.33333	2	602.93333	7	651.38333	13.4	706.95	28.5	906.42857	55
71000 - 86000	UM	3	1500	2550	388.2375	0	616.25	2	708.6875	6.9	782.6375	13.5	859.2625	28.1	1087.71429	55
71000 - 86000	UM	3	1750	2975	432.51542	0	709.04167	2	822.48833	7	907.57333	13.2	1003.06792	27.8	1269	55
71000 - 86000	UM	3	2000	3400	514.08	0	816	2	938.4	6.9	1036.32	13.5	1137.92	27.4	1450.28571	55

Frequency band, system and class					RX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1(dB)	f2 (MHz)	a2 (dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5 (dB)	f6 (MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
71000 - 86000	UM	4L	62.5	142	6.43438	0	22.1875	2	29.50938	7.8	35.5	18.3	38.56562	34.5	46.85556	57
71000 - 86000	UM	4L	125	284	12.425	0	44.375	2	59.4625	7.9	71	17.7	77.575	35.5	92.31429	57
71000 - 86000	UM	4L	250	570	82.251	0	111.15	2	125.5995	8.3	134.4915	16.5	142.549	35.5	184.73214	57
71000 - 86000	UM	4L	500	1140	141.075	0	213.75	2	250.0875	8.3	273.6	17.2	291.425	35.5	332.82143	57
71000 - 86000	UM	4L	750	1710	169.974	0	303.525	2	364.23	7.6	409.75875	15.9	444.576	33.5	554.19643	57
71000 - 86000	UM	4L	1000	2280	309.5955	0	436.05	2	492.7365	7.5	536.3415	15.8	572.5045	32.4	738.92857	57
71000 - 86000	UM	4L	1250	2850	315.10312	0	516.5625	2	604.37812	7.4	671.53125	14.9	730.52188	32	923.66071	57
71000 - 86000	UM	4L	1500	3420	378.12375	0	619.875	2	725.25375	7.4	805.8375	14.9	876.62625	31.6	1108.39286	57
71000 - 86000	UM	4L	1750	3990	430.92	0	718.2	2	847.476	7.6	940.842	15.1	1022.98	31.2	1293.125	57
71000 - 86000	UM	4L	2000	4560	572.85	0	855	2	983.25	7.6	1077.3	15.6	1157.15	32.4	1477.85714	57
71000 - 86000	UM	4H	62.5	219	10.5777	0	22.995	2	29.20365	8.3	33.34275	17.7	36.0373	37.5	57.5	60
71000 - 86000	UM	4H	125	438	52.6257	0	59.13	2	62.6778	9.1	65.043	22.9	66.8843	38.5	110.38462	60
71000 - 86000	UM	4H	250	875	89.6	0	112	2	123.2	8.3	131.04	18.6	136.9	38.5	220.76923	60
71000 - 86000	UM	4H	500	1750	102.06	0	189	2	232.47	8.3	260.82	17.3	280.94	37	547.46154	60
71000 - 86000	UM	4H	750	2625	144.585	0	283.5	2	351.54	8.2	396.9	16.8	429.915	36.1	662.30769	60
71000 - 86000	UM	4H	1000	3500	336.875	0	437.5	2	485.625	8	520.625	17.3	548.125	35.4	883.07692	60
71000 - 86000	UM	4H	1250	4375	245.7	0	472.5	2	581.175	8	656.775	16.7	711.8	35	1103.84615	60
71000 - 86000	UM	4H	1500	5250	309.015	0	572.25	2	698.145	8	783.9825	16.3	850.485	34.6	1324.61538	60
71000 - 86000	UM	4H	1750	6125	377.3	0	673.75	2	815.2375	8	909.5625	15.9	987.7	34.2	1545.38462	60
71000 - 86000	UM	4H	2000	7000	588	0	840	2	966	8.3	1041.6	16.1	1112	35.4	1766.15385	60
71000 - 86000	UM	5LA	62.5	262	9.39925	0	22.925	2	30.03175	8.8	34.3875	18.5	37.07575	40	59.25	63.5
71000 - 86000	UM	5LA	125	525	18.83438	0	45.9375	2	60.17812	8.8	68.90625	18.5	74.29062	41	113.61538	63.5
71000 - 86000	UM	5LA	250	1050	98.91875	0	116.375	2	125.685	8.9	131.50375	19.6	136.33125	41	227.23077	63.5
71000 - 86000	UM	5LA	500	2100	197.8375	0	232.75	2	251.37	8.9	263.0075	19.6	272.6625	40	454.46154	63.5
71000 - 86000	UM	5LA	750	3150	144.375	0	288.75	2	363.825	8.7	410.025	18	440.625	39.1	681.69231	63.5
71000 - 86000	UM	5LA	1000	4200	168.525	0	374.5	2	479.36	8.5	546.77	17.8	590.475	38.4	908.92308	63.5
71000 - 86000	UM	5LA	1250	5250	222.075	0	472.5	2	600.075	8.5	680.4	17.5	735.425	38	1136.15385	63.5
71000 - 86000	UM	5LA	1500	6300	266.49	0	567	2	720.09	8.5	816.48	17.5	882.51	37.6	1363.38462	63.5
71000 - 86000	UM	5LA	1750	7350	310.905	0	661.5	2	833.49	8.2	952.56	17.5	1029.595	37.2	1590.61538	63.5
71000 - 86000	UM	5LA	2000	8400	575.96	0	847	2	982.52	8.3	1075.69	18.2	1138.04	38.4	1817.84615	63.5
71000 - 86000	UM	5LB	62.5	262	16.35317	0	23.36167	2	27.09953	8.9	29.4357	19.6	30.99517	40	56.43333	63.5
71000 - 86000	UM	5LB	125	525	29.56625	0	47.6875	2	57.225	8.8	63.42438	19.7	67.05875	41	108.69615	63.5
71000 - 86000	UM	5LB	250	1050	59.1325	0	95.375	2	114.45	8.8	126.84875	19.7	134.1175	41	216.90385	63.5

Frequency band, system and class					RX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1(dB)	f2 (MHz)	a2 (dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5 (dB)	f6 (MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
71000 - 86000	UM	5LB	500	2100	158.3225	0	190.75	2	207.9175	8.8	219.3625	20.7	228.1775	40	467.38462	67
71000 - 86000	UM	5LB	750	3150	239.79375	0	275.625	2	294.91875	9	305.94375	18.4	318.95625	39.1	650.71154	63.5
71000 - 86000	UM	5LB	1000	4200	238.7	0	385	2	465.85	9.3	512.05	19.7	541.3	44	867.61538	63.5
71000 - 86000	UM	5LB	1250	5250	276.19375	0	468.125	2	575.79375	9.4	636.65	20.4	672.55625	44	1084.51923	63.5
71000 - 86000	UM	5LB	1500	6300	357.21	0	567	2	686.07	9.5	748.44	19.5	791.79	44	1301.42308	63.5
71000 - 86000	UM	5LB	1750	7350	420.60375	0	667.625	2	807.82625	9.5	887.94125	21.4	932.14625	45	1518.32692	63.5
71000 - 86000	UM	5LB	2000	8400	509.6	0	784	2	940.8	9.6	1027.04	21	1078.4	44	1735.23077	63.5
71000 - 86000	UM	5HA	62.5	306	12.02143	0	24.04286	2	30.53443	9	34.38129	19.2	36.68929	41.5	61	67
71000 - 86000	UM	5HA	125	612	24.04286	0	48.08571	2	61.06886	9	68.76257	19.2	73.37857	42.5	116.84615	67
71000 - 86000	UM	5HA	250	1225	87.36	0	112	2	125.44	9.1	133.28	19.4	139.14	42.5	233.69231	67
71000 - 86000	UM	5HA	500	2450	174.72	0	224	2	250.88	9.1	266.56	19.4	278.28	42.5	445.92308	67
71000 - 86000	UM	5HA	750	3675	151.515	0	291.375	2	367.1325	9.1	410.83875	18.8	438.735	42.1	701.07692	67
71000 - 86000	UM	5HA	1000	4900	368.55	0	455	2	500.5	8.8	532.35	21.7	551.45	41.4	934.76923	67
71000 - 86000	UM	5HA	1250	6125	210.65625	0	468.125	2	603.88125	8.8	688.14375	18.9	738.09375	41	1168.46154	67
71000 - 86000	UM	5HA	1500	7350	303.03	0	582.75	2	728.4375	8.7	821.6775	18.8	877.47	40.6	1402.15385	67
71000 - 86000	UM	5HA	1750	8575	294.91875	0	655.375	2	845.43375	8.8	963.40125	18.9	1033.33125	40.2	1635.84615	67
71000 - 86000	UM	5HA	2000	9800	611.31	0	861	2	998.76	9.2	1076.25	19.3	1130.69	41.4	1869.53846	67
71000 - 86000	UM	5HB	62.5	306	12.6225	0	22.95	2	28.458	8.9	31.9005	19.6	33.9025	41.5	58.06667	67
71000 - 86000	UM	5HB	125	612	29.33229	0	48.08571	2	58.18371	9	64.43486	20	68.08914	42.5	111.73846	67
71000 - 86000	UM	5HB	250	1225	51.0125	0	92.75	2	115.9375	9.3	128.9225	19.6	136.9875	42.5	222.96154	67
71000 - 86000	UM	5HB	500	2450	180.81	0	220.5	2	242.55	9.3	255.78	21.2	265.19	42.5	467.38462	67
71000 - 86000	UM	5HB	750	3675	171.675	0	286.125	2	349.0725	9.2	386.26875	20.2	408.075	42.1	701.07692	67
71000 - 86000	UM	5HB	1000	4900	373.38	0	444.5	2	484.505	9.5	506.73	20.2	525.62	41.4	891.84615	67
71000 - 86000	UM	5HB	1250	6125	283.5	0	472.5	2	571.725	8.8	633.15	18.6	674	41	1114.80769	67
71000 - 86000	UM	5HB	1500	7350	322.77	0	556.5	2	678.93	8.7	756.84	19	805.23	40.6	1337.76923	67
71000 - 86000	UM	5HB	1750	8575	416.745	0	661.5	2	793.8	9	866.565	17.9	923.755	40.2	1560.73077	67
71000 - 86000	UM	5HB	2000	9800	776.58	0	903	2	975.24	9.6	1011.36	19	1049.42	41.4	1783.69231	67
71000 - 86000	UM	6LA	62.5	350	9.64688	0	22.96875	2	30.31875	9.2	34.45312	19.3	36.91562	43	62.75	70.5
71000 - 86000	UM	6LA	125	700	19.4775	0	46.375	2	61.215	9.2	71.88125	27.8	74.5225	44	120.07692	70.5
71000 - 86000	UM	6LA	250	1400	44.415	0	94.5	2	121.905	9.2	137.97	19.7	147.085	44	240.15385	70.5
71000 - 86000	UM	6LA	500	2800	88.83	0	189	2	243.81	9.2	275.94	19.7	294.17	44	458.03846	70.5
71000 - 86000	UM	6LA	750	4200	133.245	0	283.5	2	365.715	9.2	413.91	19.7	441.255	44	720.46154	70.5
71000 - 86000	UM	6LA	1000	5600	444.36	0	483	2	507.15	10.7	516.81	20.2	531.64	44	960.61538	70.5

Frequency band, system and class					RX MASKS											
Band	System	Equipment Class	Channel Separation	Netto Bitrate	f1 (MHz)	a1(dB)	f2 (MHz)	a2 (dB)	f3 (MHz)	a3 (dB)	f4 (MHz)	a4 (dB)	f5 (MHz)	a5 (dB)	f6 (MHz)	a6 (dB)
MHz		Field 7G1	MHz	(Mbit/s)												
71000 - 86000	UM	6LA	1250	7000	222.075	0	472.5	2	609.525	9.2	689.85	19.7	735.425	44	1200.76923	70.5
71000 - 86000	UM	6LA	1500	8400	266.49	0	567	2	731.43	9.2	827.82	19.7	882.51	43.6	1440.92308	70.5
71000 - 86000	UM	6LA	1750	9800	310.905	0	661.5	2	853.335	9.2	965.79	19.7	1029.595	43.2	1681.07692	70.5
71000 - 86000	UM	6LA	2000	11200	541.45	0	833	2	999.6	9.6	1091.23	21	1144.55	44	1921.23077	70.5
71000 - 86000	UM	6LB	62.5	350	13.7025	0	23.625	2	29.05875	9.2	32.13	19	34.1725	43	59.7	70.5
71000 - 86000	UM	6LB	125	700	26.215	0	46.8125	2	58.51562	9.6	64.60125	19.4	68.66	44	114.78077	70.5
71000 - 86000	UM	6LB	250	1400	52.43	0	93.625	2	117.03125	9.6	129.2025	19.4	137.32	44	229.01923	70.5
71000 - 86000	UM	6LB	500	2800	104.86	0	187.25	2	234.0625	9.6	258.405	19.4	274.64	44	480.30769	70.5
71000 - 86000	UM	6LB	750	4200	157.29	0	280.875	2	351.09375	9.6	387.6075	19.4	411.96	44	720.46154	70.5
71000 - 86000	UM	6LB	1000	5600	383.775	0	451.5	2	492.135	10.2	510.195	19.6	529.225	44	916.07692	70.5
71000 - 86000	UM	6LB	1250	7000	262.15	0	468.125	2	585.15625	9.6	646.0125	19.4	686.6	44	1145.09615	70.5
71000 - 86000	UM	6LB	1500	8400	337.6275	0	572.25	2	703.8675	9.4	778.26	20.4	821.8725	43.6	1374.11538	70.5
71000 - 86000	UM	6LB	1750	9800	340.85625	0	643.125	2	810.3375	9.3	906.80625	20	962.89375	43.2	1603.13462	70.5
71000 - 86000	UM	6LB	2000	11200	419.44	0	749	2	936.25	9.6	1033.62	19.4	1098.56	44	1832.15385	70.5

Appendix 13 to Annex 2 B

FIELD 9X: TABLE OF DEFAULT VALUES FOR COPOLAR AND CROSSPOLAR ANTENNA RADIATION PATTERN

GAIN	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.
20	0.0	0.0	2.7	0.3	5.4	1.3	8.1	3.0	10.0	4.6	13.6	8.5	23.3	8.5	29.0	10.9	35.0	12.9	41.0	14.6	42.3	15.0	48.0	26.3	180.0	26.3
20.1	0.0	0.0	2.6	0.3	5.3	1.3	8.0	3.0	10.0	4.7	13.5	8.5	23.0	8.5	29.0	11.0	35.0	13.1	41.0	14.8	41.7	15.0	48.0	26.5	180.0	26.5
20.2	0.0	0.0	2.6	0.3	5.3	1.4	7.9	3.0	10.0	4.8	13.3	8.6	22.8	8.6	29.0	11.2	35.0	13.2	41.0	14.9	41.2	15.0	48.0	26.6	180.0	26.6
20.3	0.0	0.0	2.6	0.3	5.2	1.3	7.9	3.1	10.0	4.9	13.2	8.6	22.5	8.6	28.0	11.0	35.0	13.4	40.6	15.0	41.0	15.1	48.0	26.8	180.0	26.8
20.4	0.0	0.0	2.6	0.3	5.2	1.4	7.8	3.1	10.0	5.1	13.1	8.6	22.3	8.6	28.0	11.1	35.0	13.5	40.0	15.0	41.0	15.2	48.0	26.9	180.0	26.9
20.5	0.0	0.0	2.5	0.3	5.1	1.3	7.7	3.1	10.0	5.2	12.9	8.6	22.0	8.6	28.0	11.3	35.0	13.7	39.5	15.0	41.0	15.4	48.0	27.1	180.0	27.1
20.6	0.0	0.0	2.5	0.3	5.1	1.4	7.6	3.1	10.0	5.3	12.8	8.7	21.7	8.7	28.0	11.4	34.0	13.5	38.9	15.0	41.0	15.5	48.0	27.2	180.0	27.2
20.7	0.0	0.0	2.5	0.3	5.0	1.4	7.6	3.1	10.0	5.4	12.7	8.7	21.5	8.7	28.0	11.6	34.0	13.7	38.4	15.0	41.0	15.7	48.0	27.4	180.0	27.4
20.8	0.0	0.0	2.5	0.3	5.0	1.4	7.5	3.1	10.0	5.5	12.5	8.7	21.2	8.7	27.0	11.3	34.0	13.8	37.9	15.0	41.0	15.8	48.0	27.5	180.0	27.5
20.9	0.0	0.0	2.4	0.3	4.9	1.4	7.4	3.1	9.9	5.6	12.4	8.7	21.0	8.7	27.0	11.5	34.0	14.0	37.4	15.0	41.0	16.0	48.0	27.7	180.0	27.7
21	0.0	0.0	2.4	0.3	4.9	1.4	7.3	3.1	9.8	5.6	12.3	8.8	20.8	8.8	27.0	11.6	34.0	14.1	36.8	15.0	41.0	16.1	48.0	27.8	180.0	27.8
21.1	0.0	0.0	2.4	0.3	4.8	1.4	7.3	3.2	9.7	5.6	12.2	8.8	20.5	8.8	27.0	11.8	34.0	14.3	36.3	15.0	41.0	16.3	48.0	28.0	180.0	28.0
21.2	0.0	0.0	2.4	0.3	4.8	1.4	7.2	3.1	9.6	5.6	12.0	8.8	20.3	8.8	27.0	11.9	34.0	14.4	35.8	15.0	41.0	16.4	48.0	28.1	180.0	28.1
21.3	0.0	0.0	2.3	0.3	4.7	1.4	7.1	3.1	9.5	5.6	11.9	8.8	20.1	8.8	27.0	12.1	34.0	14.6	35.3	15.0	41.0	16.6	48.0	28.3	180.0	28.3
21.4	0.0	0.0	2.3	0.3	4.7	1.4	7.0	3.1	9.4	5.6	11.8	8.9	19.8	8.9	26.0	11.8	33.0	14.4	34.9	15.0	41.0	16.7	48.0	28.4	180.0	28.4
21.5	0.0	0.0	2.3	0.3	4.6	1.4	7.0	3.2	9.3	5.6	11.7	8.9	19.6	8.9	26.0	12.0	33.0	14.5	34.4	15.0	40.0	16.6	48.0	28.6	180.0	28.6
21.6	0.0	0.0	2.3	0.4	4.6	1.4	6.9	3.2	9.2	5.6	11.6	8.9	19.4	8.9	26.0	12.1	33.0	14.7	33.9	15.0	40.0	16.8	48.0	28.7	180.0	28.7
21.7	0.0	0.0	2.2	0.3	4.5	1.4	6.8	3.2	9.1	5.6	11.5	8.9	19.2	8.9	26.0	12.3	33.0	14.8	33.4	15.0	40.0	16.9	48.0	28.9	180.0	28.9
21.8	0.0	0.0	2.2	0.3	4.5	1.4	6.8	3.2	9.0	5.6	11.3	9.0	18.9	9.0	26.0	12.4	33.0	15.0	33.0	15.0	40.0	17.1	48.0	29.0	180.0	29.0
21.9	0.0	0.0	2.2	0.3	4.4	1.4	6.7	3.2	8.9	5.7	11.2	9.0	18.7	9.0	26.0	12.6	32.5	15.0	33.0	15.1	40.0	17.2	48.0	29.2	180.0	29.2
22	0.0	0.0	2.2	0.4	4.4	1.4	6.6	3.2	8.8	5.7	11.1	9.0	18.5	9.0	25.0	12.3	32.1	15.0	33.0	15.3	40.0	17.4	48.0	29.3	180.0	29.3
22.1	0.0	0.0	2.1	0.3	4.3	1.4	6.5	3.2	8.7	5.7	11.0	9.0	18.3	9.0	25.0	12.4	31.6	15.0	33.0	15.4	40.0	17.5	48.0	29.5	180.0	29.5
22.2	0.0	0.0	2.1	0.3	4.3	1.4	6.5	3.2	8.7	5.8	10.9	9.1	18.1	9.1	25.0	12.6	31.2	15.0	33.0	15.6	40.0	17.7	48.0	29.6	180.0	29.6
22.3	0.0	0.0	2.1	0.3	4.3	1.4	6.4	3.2	8.6	5.8	10.8	9.1	17.9	9.1	25.0	12.7	30.8	15.0	32.0	15.4	40.0	17.8	48.0	29.8	180.0	29.8
22.4	0.0	0.0	2.1	0.4	4.2	1.4	6.4	3.3	8.5	5.8	10.7	9.1	17.7	9.1	25.0	12.9	30.4	15.0	32.0	15.6	40.0	18.0	48.0	29.9	180.0	29.9
22.5	0.0	0.0	2.1	0.4	4.2	1.4	6.3	3.3	8.4	5.8	10.6	9.1	17.5	9.1	25.0	13.0	29.9	15.0	32.0	15.7	40.0	18.1	48.0	30.1	180.0	30.1
22.6	0.0	0.0	2.0	0.3	4.1	1.4	6.2	3.2	8.3	5.8	10.5	9.2	17.3	9.2	25.0	13.2	29.5	15.0	32.0	15.9	40.0	18.3	48.0	30.2	180.0	30.2
22.7	0.0	0.0	2.0	0.3	4.1	1.4	6.2	3.3	8.2	5.8	10.3	9.2	17.1	9.2	24.0	12.9	29.1	15.0	32.0	16.0	40.0	18.4	48.0	30.4	180.0	30.4
22.8	0.0	0.0	2.0	0.4	4.0	1.4	6.1	3.3	8.1	5.8	10.2	9.2	16.9	9.2	24.0	13.0	28.7	15.0	32.0	16.2	40.0	18.6	48.0	30.5	180.0	30.5
22.9	0.0	0.0	2.0	0.4	4.0	1.4	6.0	3.2	8.1	5.9	10.1	9.2	16.7	9.2	24.0	13.2	28.3	15.0	32.0	16.3	40.0	18.7	48.0	30.7	180.0	30.7
23	0.0	0.0	2.0	0.4	4.0	1.5	6.0	3.3	8.0	5.9	10.0	9.3	16.5	9.3	24.0	13.3	32.0	16.5	40.0	18.9	44.3	20.0	48.0	30.8	180.0	30.8
23.1	0.0	0.0	1.9	0.3	3.9	1.4	5.9	3.3	7.9	5.9	9.9	9.3	16.3	9.3	24.0	13.5	32.0	16.6	40.0	19.0	43.7	20.0	48.0	31.0	180.0	31.0

GAIN	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.
23.2	0.0	0.0	1.9	0.3	3.9	1.5	5.9	3.4	7.8	5.9	9.8	9.3	16.1	9.3	24.0	13.6	32.0	16.8	40.0	19.2	43.1	20.0	48.0	31.1	180.0	31.1
23.3	0.0	0.0	1.9	0.4	3.8	1.4	5.8	3.3	7.7	5.8	9.7	9.3	15.9	9.3	24.0	13.8	32.0	16.9	40.0	19.3	42.5	20.0	48.0	31.3	180.0	31.3
23.4	0.0	0.0	1.9	0.4	3.8	1.5	5.7	3.3	7.7	6.0	9.6	9.4	15.8	9.4	23.0	13.5	31.0	16.7	39.0	19.2	41.9	20.0	48.0	31.4	180.0	31.4
23.5	0.0	0.0	1.9	0.4	3.8	1.5	5.7	3.4	7.6	6.0	9.5	9.4	15.6	9.4	23.0	13.6	31.0	16.9	39.0	19.4	41.3	20.0	48.0	31.6	180.0	31.6
23.6	0.0	0.0	1.8	0.3	3.7	1.4	5.6	3.3	7.5	5.9	9.4	9.4	15.4	9.4	23.0	13.8	31.0	17.0	39.0	19.5	40.8	20.0	48.0	31.7	180.0	31.7
23.7	0.0	0.0	1.8	0.3	3.7	1.5	5.6	3.4	7.4	5.9	9.3	9.4	15.2	9.4	23.0	13.9	31.0	17.2	39.0	19.7	40.2	20.0	48.0	31.9	180.0	31.9
23.8	0.0	0.0	1.8	0.4	3.7	1.5	5.5	3.3	7.4	6.1	9.3	9.5	15.0	9.5	23.0	14.1	31.0	17.3	39.0	19.8	39.7	20.0	48.0	32.0	180.0	32.0
23.9	0.0	0.0	1.8	0.4	3.6	1.5	5.4	3.3	7.3	6.0	9.2	9.5	14.9	9.5	23.0	14.2	31.0	17.5	39.0	20.0	39.1	20.0	48.0	32.2	180.0	32.2
24	0.0	0.0	1.8	0.4	3.6	1.5	5.4	3.4	7.2	6.0	9.1	9.5	14.7	9.5	23.0	14.4	31.0	17.6	38.6	20.0	39.0	20.1	48.0	32.3	180.0	32.3
24.1	0.0	0.0	1.7	0.3	3.5	1.5	5.3	3.3	7.1	6.0	9.0	9.5	14.5	9.5	22.0	14.0	31.0	17.8	38.1	20.0	39.0	20.3	48.0	32.5	180.0	32.5
24.2	0.0	0.0	1.7	0.4	3.5	1.5	5.3	3.4	7.1	6.1	8.9	9.6	14.4	9.6	22.0	14.2	31.0	17.9	37.5	20.0	39.0	20.4	48.0	32.6	180.0	32.6
24.3	0.0	0.0	1.7	0.4	3.5	1.5	5.2	3.4	7.0	6.1	8.8	9.6	14.2	9.6	22.0	14.3	31.0	18.1	37.0	20.0	39.0	20.6	48.0	32.8	180.0	32.8
24.4	0.0	0.0	1.7	0.4	3.4	1.5	5.2	3.4	6.9	6.0	8.7	9.6	14.0	9.6	22.0	14.5	31.0	18.2	36.5	20.0	39.0	20.7	48.0	32.9	180.0	32.9
24.5	0.0	0.0	1.7	0.4	3.4	1.5	5.1	3.4	6.8	6.0	8.6	9.6	13.9	9.6	22.0	14.6	30.0	18.0	36.0	20.0	39.0	20.9	48.0	33.1	180.0	33.1
24.6	0.0	0.0	1.7	0.4	3.4	1.5	5.1	3.5	6.8	6.1	8.5	9.7	13.7	9.7	22.0	14.8	30.0	18.2	35.5	20.0	39.0	21.0	48.0	33.2	180.0	33.2
24.7	0.0	0.0	1.6	0.3	3.3	1.5	5.0	3.4	6.7	6.1	8.4	9.7	13.6	9.7	22.0	14.9	30.0	18.3	35.0	20.0	39.0	21.2	48.0	33.4	180.0	33.4
24.8	0.0	0.0	1.6	0.4	3.3	1.5	5.0	3.5	6.6	6.1	8.4	9.7	13.4	9.7	22.0	15.1	30.0	18.5	34.5	20.0	39.0	21.3	48.0	33.5	180.0	33.5
24.9	0.0	0.0	1.6	0.4	3.3	1.6	4.9	3.4	6.6	6.2	8.3	9.7	13.3	9.7	21.0	14.7	30.0	18.6	34.1	20.0	39.0	21.5	48.0	33.7	180.0	33.7
25	0.0	0.0	1.6	0.4	3.2	1.5	4.9	3.5	6.5	6.2	8.2	9.8	13.1	9.8	21.0	14.9	30.0	18.8	33.6	20.0	39.0	21.6	48.0	33.8	180.0	33.8
25.1	0.0	0.0	1.6	0.4	3.2	1.5	4.8	3.4	6.4	6.1	8.1	9.8	13.0	9.8	21.0	15.0	30.0	18.9	33.1	20.0	39.0	21.8	48.0	34.0	180.0	34.0
25.2	0.0	0.0	1.6	0.4	3.2	1.6	4.8	3.5	6.4	6.2	8.0	9.8	12.8	9.8	21.0	15.2	30.0	19.1	32.7	20.0	39.0	21.9	48.0	34.1	180.0	34.1
25.3	0.0	0.0	1.5	0.4	3.1	1.5	4.7	3.4	6.3	6.2	7.9	9.8	12.7	9.8	21.0	15.3	30.0	19.2	32.2	20.0	39.0	22.1	48.0	34.3	180.0	34.3
25.4	0.0	0.0	1.5	0.4	3.1	1.5	4.7	3.5	6.2	6.1	7.9	9.9	12.5	9.9	21.0	15.5	30.0	19.4	31.8	20.0	39.0	22.2	48.0	34.4	180.0	34.4
25.5	0.0	0.0	1.5	0.4	3.1	1.6	4.6	3.5	6.2	6.3	7.8	9.9	12.4	9.9	21.0	15.6	30.0	19.5	31.4	20.0	39.0	22.4	48.0	34.6	180.0	34.6
25.6	0.0	0.0	1.5	0.4	3.0	1.5	4.6	3.5	6.1	6.2	7.7	9.9	12.2	9.9	21.0	15.8	30.0	19.7	30.9	20.0	39.0	22.5	48.0	34.7	180.0	34.7
25.7	0.0	0.0	1.5	0.4	3.0	1.5	4.5	3.5	6.0	6.2	7.6	9.9	12.1	9.9	21.0	15.9	30.0	19.8	30.5	20.0	39.0	22.7	48.0	34.9	180.0	34.9
25.8	0.0	0.0	1.5	0.4	3.0	1.6	4.5	3.5	6.0	6.3	7.5	10.0	11.9	10.0	21.0	16.1	30.0	20.0	30.1	20.0	39.0	22.8	48.0	35.0	180.0	35.0
25.9	0.0	0.0	1.4	0.4	2.9	1.5	4.4	3.5	5.9	6.2	7.5	10.0	11.8	10.0	20.0	15.7	29.0	19.7	29.7	20.0	39.0	23.0	48.0	35.2	180.0	35.2
26	0.0	0.0	1.4	0.4	2.9	1.5	4.4	3.6	5.9	6.4	7.4	10.0	11.7	10.0	20.0	15.9	29.0	19.9	29.3	20.0	38.0	22.8	48.0	35.3	180.0	35.3
26.1	0.0	0.0	1.4	0.4	2.9	1.6	4.3	3.5	5.8	6.3	7.3	10.0	11.5	10.0	20.0	16.0	28.9	20.0	29.0	20.0	38.0	23.0	48.0	35.5	180.0	35.5
26.2	0.0	0.0	1.4	0.4	2.8	1.5	4.3	3.6	5.7	6.2	7.2	10.1	11.4	10.1	20.0	16.2	28.5	20.0	29.0	20.2	38.0	23.1	48.0	35.6	180.0	35.6
26.3	0.0	0.0	1.4	0.4	2.8	1.5	4.2	3.5	5.7	6.4	7.2	10.1	11.3	10.1	20.0	16.3	28.1	20.0	29.0	20.3	38.0	23.3	48.0	35.8	180.0	35.8

GAIN	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.
26.4	0.0	0.0	1.4	0.4	2.8	1.6	4.2	3.5	5.6	6.3	7.1	10.1	11.2	10.1	20.0	16.5	27.7	20.0	29.0	20.5	38.0	23.4	48.0	35.9	180.0	35.9
26.5	0.0	0.0	1.4	0.4	2.8	1.6	4.2	3.6	5.6	6.5	7.0	10.1	11.0	10.1	20.0	16.6	27.3	20.0	29.0	20.6	38.0	23.6	48.0	36.1	180.0	36.1
26.6	0.0	0.0	1.3	0.4	2.7	1.5	4.1	3.5	5.5	6.4	6.9	10.2	10.9	10.2	20.0	16.8	26.9	20.0	29.0	20.8	38.0	23.7	48.0	36.2	180.0	36.2
26.7	0.0	0.0	1.3	0.4	2.7	1.6	4.1	3.6	5.5	6.5	6.9	10.2	10.8	10.2	20.0	16.9	26.6	20.0	29.0	20.9	38.0	23.9	48.0	36.4	180.0	36.4
26.8	0.0	0.0	1.3	0.4	2.7	1.6	4.0	3.5	5.4	6.4	6.8	10.2	10.6	10.2	20.0	17.1	26.2	20.0	29.0	21.1	38.0	24.0	48.0	36.5	180.0	36.5
26.9	0.0	0.0	1.3	0.4	2.6	1.5	4.0	3.6	5.3	6.3	6.7	10.2	10.5	10.2	19.0	16.6	25.8	20.0	29.0	21.2	38.0	24.2	48.0	36.7	180.0	36.7
27	0.0	0.0	1.3	0.4	2.6	1.6	4.0	3.7	5.3	6.5	6.7	10.3	10.4	10.3	19.0	16.8	29.0	21.4	38.0	24.3	40.4	25.0	48.0	36.8	180.0	36.8
27.1	0.0	0.0	1.3	0.4	2.6	1.6	3.9	3.6	5.2	6.4	6.6	10.3	10.3	10.3	19.0	16.9	29.0	21.5	38.0	24.5	39.8	25.0	48.0	37.0	180.0	37.0
27.2	0.0	0.0	1.3	0.4	2.6	1.6	3.9	3.7	5.2	6.5	6.5	10.3	10.2	10.3	19.0	17.1	29.0	21.7	38.0	24.6	39.3	25.0	48.0	37.1	180.0	37.1
27.3	0.0	0.0	1.2	0.4	2.5	1.5	3.8	3.6	5.1	6.4	6.5	10.3	10.1	10.3	19.0	17.2	29.0	21.8	38.0	24.8	38.8	25.0	48.0	37.3	180.0	37.3
27.4	0.0	0.0	1.2	0.4	2.5	1.6	3.8	3.7	5.1	6.6	6.4	10.4	9.9	10.4	19.0	17.4	29.0	22.0	38.0	24.9	38.2	25.0	48.0	37.4	180.0	37.4
27.5	0.0	0.0	1.2	0.4	2.5	1.6	3.7	3.5	5.0	6.5	6.3	10.4	9.8	10.4	19.0	17.5	28.0	21.8	37.7	25.0	38.0	25.1	48.0	37.6	180.0	37.6
27.6	0.0	0.0	1.2	0.4	2.5	1.7	3.7	3.6	5.0	6.6	6.3	10.4	9.7	10.4	19.0	17.7	28.0	21.9	37.2	25.0	38.0	25.2	48.0	37.7	180.0	37.7
27.7	0.0	0.0	1.2	0.4	2.4	1.6	3.7	3.7	4.9	6.5	6.2	10.4	9.6	10.4	19.0	17.8	28.0	22.1	36.7	25.0	38.0	25.4	48.0	37.9	180.0	37.9
27.8	0.0	0.0	1.2	0.4	2.4	1.6	3.6	3.6	4.9	6.7	6.1	10.5	9.5	10.5	19.0	18.0	28.0	22.2	36.2	25.0	38.0	25.5	48.0	38.0	180.0	38.0
27.9	0.0	0.0	1.2	0.4	2.4	1.6	3.6	3.7	4.8	6.5	6.1	10.5	9.4	10.5	19.0	18.1	28.0	22.4	35.7	25.0	38.0	25.7	48.0	38.2	180.0	38.2
28	0.0	0.0	1.2	0.4	2.4	1.7	3.6	3.8	4.8	6.7	6.0	10.5	9.3	10.5	19.0	18.3	28.0	22.5	35.2	25.0	38.0	25.8	48.0	38.3	180.0	38.3
28.1	0.0	0.0	1.1	0.4	2.3	1.6	3.5	3.6	4.7	6.6	6.0	10.5	9.2	10.5	18.0	17.9	28.0	22.7	34.7	25.0	38.0	26.0	48.0	38.5	180.0	38.5
28.2	0.0	0.0	1.1	0.4	2.3	1.6	3.5	3.7	4.7	6.7	5.9	10.6	9.1	10.6	18.0	18.0	28.0	22.8	34.2	25.0	38.0	26.1	48.0	38.6	180.0	38.6
28.3	0.0	0.0	1.1	0.4	2.3	1.6	3.4	3.6	4.6	6.6	5.8	10.6	9.0	10.6	18.0	18.2	28.0	23.0	33.8	25.0	38.0	26.3	48.0	38.8	180.0	38.8
28.4	0.0	0.0	1.1	0.4	2.3	1.7	3.4	3.7	4.6	6.7	5.8	10.6	8.9	10.6	18.0	18.3	28.0	23.1	33.3	25.0	38.0	26.4	48.0	38.9	180.0	38.9
28.5	0.0	0.0	1.1	0.4	2.2	1.6	3.4	3.8	4.5	6.6	5.7	10.6	8.8	10.6	18.0	18.5	28.0	23.3	32.8	25.0	38.0	26.6	48.0	39.1	180.0	39.1
28.6	0.0	0.0	1.1	0.4	2.2	1.6	3.3	3.6	4.5	6.8	5.7	10.7	8.7	10.7	18.0	18.6	28.0	23.4	32.4	25.0	38.0	26.7	48.0	39.2	180.0	39.2
28.7	0.0	0.0	1.1	0.4	2.2	1.7	3.3	3.7	4.4	6.6	5.6	10.7	8.6	10.7	18.0	18.8	28.0	23.6	31.9	25.0	38.0	26.9	48.0	39.4	180.0	39.4
28.8	0.0	0.0	1.1	0.4	2.2	1.7	3.3	3.8	4.4	6.8	5.5	10.7	8.5	10.7	18.0	18.9	28.0	23.7	31.5	25.0	38.0	27.0	48.0	39.5	180.0	39.5
28.9	0.0	0.0	1.0	0.4	2.1	1.6	3.2	3.7	4.3	6.6	5.5	10.7	8.4	10.7	18.0	19.1	28.0	23.9	31.1	25.0	38.0	27.2	48.0	39.7	180.0	39.7
29	0.0	0.0	1.0	0.4	2.1	1.6	3.2	3.7	4.3	6.8	5.4	10.8	8.3	10.8	18.0	19.2	28.0	24.0	30.6	25.0	38.0	27.3	48.0	39.8	180.0	39.8
29.1	0.0	0.0	1.0	0.4	2.1	1.7	3.2	3.8	4.2	6.6	5.4	10.8	8.2	10.8	18.0	19.4	28.0	24.2	30.2	25.0	38.0	27.5	48.0	40.0	180.0	40.0
29.2	0.0	0.0	1.0	0.4	2.1	1.7	3.1	3.7	4.2	6.8	5.3	10.8	8.1	10.8	18.0	19.5	28.0	24.3	29.8	25.0	38.0	27.6	48.0	40.1	180.0	40.1
29.3	0.0	0.0	1.0	0.4	2.1	1.7	3.1	3.8	4.2	6.9	5.3	10.8	8.0	10.8	18.0	19.7	28.0	24.5	29.4	25.0	38.0	27.8	48.0	40.3	180.0	40.3
29.4	0.0	0.0	1.0	0.4	2.0	1.6	3.1	3.9	4.1	6.7	5.2	10.9	7.9	10.9	17.0	19.2	27.0	24.2	29.0	25.0	38.0	27.9	48.0	40.4	180.0	40.4
29.5	0.0	0.0	1.0	0.4	2.0	1.6	3.0	3.7	4.1	6.9	5.1	10.9	7.8	10.9	17.0	19.3	27.0	24.4	28.6	25.0	38.0	28.1	48.0	40.6	180.0	40.6

GAIN	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.
29.6	0.0	0.0	1.0	0.4	2.0	1.7	3.0	3.8	4.0	6.7	5.1	10.9	7.7	10.9	17.0	19.5	27.0	24.5	28.2	25.0	37.0	27.9	48.0	40.7	180.0	40.7
29.7	0.0	0.0	1.0	0.4	2.0	1.7	3.0	3.9	4.0	6.9	5.0	10.9	7.6	10.9	17.0	19.6	27.0	24.7	27.8	25.0	37.0	28.1	48.0	40.9	180.0	40.9
29.8	0.0	0.0	0.9	0.4	1.9	1.6	2.9	3.7	3.9	6.7	5.0	11.0	7.5	11.0	17.0	19.8	27.0	24.8	27.4	25.0	37.0	28.2	48.0	41.0	180.0	41.0
29.9	0.0	0.0	0.9	0.4	1.9	1.6	2.9	3.8	3.9	6.8	4.9	11.0	7.5	11.0	17.0	19.9	27.0	25.0	27.0	25.0	37.0	28.4	48.0	41.2	180.0	41.2
30	0.0	0.0	0.9	0.4	1.9	1.7	2.9	3.9	3.9	7.0	4.9	11.0	7.4	11.0	17.0	20.1	27.0	25.1	37.0	28.5	42.3	30.0	48.0	41.3	180.0	41.3
30.1	0.0	0.0	0.9	0.4	1.9	1.7	2.9	4.0	3.8	6.8	4.8	11.0	7.3	11.0	17.0	20.2	27.0	25.3	37.0	28.7	41.7	30.0	48.0	41.5	180.0	41.5
30.2	0.0	0.0	0.9	0.4	1.9	1.7	2.8	3.8	3.8	7.0	4.8	11.1	7.2	11.1	17.0	20.4	27.0	25.4	37.0	28.8	41.2	30.0	48.0	41.6	180.0	41.6
30.3	0.0	0.0	0.9	0.4	1.8	1.6	2.8	3.9	3.7	6.8	4.7	11.1	7.1	11.1	17.0	20.5	27.0	25.6	37.0	29.0	40.6	30.0	48.0	41.8	180.0	41.8
30.4	0.0	0.0	0.9	0.4	1.8	1.6	2.8	4.0	3.7	6.9	4.7	11.1	7.0	11.1	17.0	20.7	27.0	25.7	37.0	29.1	40.0	30.0	48.0	41.9	180.0	41.9
30.5	0.0	0.0	0.9	0.4	1.8	1.7	2.7	3.8	3.7	7.1	4.6	11.1	7.0	11.1	17.0	20.8	27.0	25.9	37.0	29.3	39.5	30.0	48.0	42.1	180.0	42.1
30.6	0.0	0.0	0.9	0.4	1.8	1.7	2.7	3.9	3.6	6.9	4.6	11.2	6.9	11.2	17.0	21.0	27.0	26.0	37.0	29.4	38.9	30.0	48.0	42.2	180.0	42.2
30.7	0.0	0.0	0.9	0.4	1.8	1.8	2.7	3.9	3.6	7.0	4.5	11.2	6.8	11.2	17.0	21.1	27.0	26.2	37.0	29.6	38.4	30.0	48.0	42.4	180.0	42.4
30.8	0.0	0.0	0.8	0.4	1.7	1.6	2.6	3.7	3.5	6.8	4.5	11.2	6.7	11.2	17.0	21.3	27.0	26.3	37.0	29.7	37.9	30.0	48.0	42.5	180.0	42.5
30.9	0.0	0.0	0.8	0.4	1.7	1.6	2.6	3.8	3.5	6.9	4.5	11.2	6.6	11.2	17.0	21.4	27.0	26.5	37.0	29.9	37.4	30.0	48.0	42.7	180.0	42.7
31	0.0	0.0	0.8	0.4	1.7	1.7	2.6	3.9	3.5	7.1	4.4	11.3	6.6	11.3	16.0	20.9	27.0	26.6	36.8	30.0	37.0	30.0	48.0	42.8	180.0	42.8
31.1	0.0	0.0	0.8	0.4	1.7	1.7	2.6	4.0	3.4	6.9	4.4	11.3	6.5	11.3	16.0	21.1	27.0	26.8	36.3	30.0	37.0	30.2	48.0	43.0	180.0	43.0
31.2	0.0	0.0	0.8	0.4	1.7	1.8	2.5	3.8	3.4	7.0	4.3	11.3	6.4	11.3	16.0	21.2	27.0	26.9	35.8	30.0	37.0	30.3	48.0	43.1	180.0	43.1
31.3	0.0	0.0	0.8	0.4	1.7	1.8	2.5	3.9	3.4	7.2	4.3	11.3	6.3	11.3	16.0	21.4	27.0	27.1	35.3	30.0	37.0	30.5	48.0	43.3	180.0	43.3
31.4	0.0	0.0	0.8	0.4	1.6	1.6	2.5	4.0	3.3	6.9	4.2	11.4	6.3	11.4	16.0	21.5	27.0	27.2	34.9	30.0	37.0	30.6	48.0	43.4	180.0	43.4
31.5	0.0	0.0	0.8	0.4	1.6	1.7	2.5	4.1	3.3	7.1	4.2	11.4	6.2	11.4	16.0	21.7	27.0	27.4	34.4	30.0	37.0	30.8	48.0	43.6	180.0	43.6
31.6	0.0	0.0	0.8	0.4	1.6	1.7	2.4	3.8	3.3	7.3	4.1	11.4	6.1	11.4	16.0	21.8	27.0	27.5	33.9	30.0	37.0	30.9	48.0	43.7	180.0	43.7
31.7	0.0	0.0	0.8	0.4	1.6	1.7	2.4	3.9	3.2	7.0	4.1	11.4	6.1	11.4	16.0	22.0	27.0	27.7	33.4	30.0	37.0	31.1	48.0	43.9	180.0	43.9
31.8	0.0	0.0	0.8	0.4	1.6	1.8	2.4	4.0	3.2	7.1	4.1	11.5	6.0	11.5	16.0	22.1	27.0	27.8	33.0	30.0	37.0	31.2	48.0	44.0	180.0	44.0
31.9	0.0	0.0	0.8	0.5	1.6	1.8	2.4	4.1	3.2	7.3	4.0	11.5	5.9	11.5	16.0	22.3	27.0	28.0	32.5	30.0	37.0	31.4	48.0	44.2	180.0	44.2
32	0.0	0.0	0.7	0.4	1.5	1.6	2.3	3.9	3.1	7.0	4.0	11.5	5.9	11.5	16.0	22.4	26.0	27.7	32.1	30.0	37.0	31.5	48.0	44.3	180.0	44.3
32.1	0.0	0.0	0.7	0.4	1.5	1.7	2.3	4.0	3.1	7.2	3.9	11.5	5.8	11.5	16.0	22.6	26.0	27.9	31.6	30.0	37.0	31.7	48.0	44.5	180.0	44.5
32.2	0.0	0.0	0.7	0.4	1.5	1.7	2.3	4.0	3.1	7.3	3.9	11.6	5.7	11.6	16.0	22.7	26.0	28.0	31.2	30.0	37.0	31.8	48.0	44.6	180.0	44.6
32.3	0.0	0.0	0.7	0.4	1.5	1.8	2.3	4.1	3.0	7.0	3.8	11.6	5.7	11.6	16.0	22.9	26.0	28.2	30.8	30.0	37.0	32.0	48.0	44.8	180.0	44.8
32.4	0.0	0.0	0.7	0.4	1.5	1.8	2.2	3.9	3.0	7.2	3.8	11.6	5.6	11.6	16.0	23.0	26.0	28.3	30.4	30.0	37.0	32.1	48.0	44.9	180.0	44.9
32.5	0.0	0.0	0.7	0.4	1.5	1.8	2.2	4.0	3.0	7.4	3.8	11.6	5.5	11.6	16.0	23.2	26.0	28.5	29.9	30.0	37.0	32.3	48.0	45.1	180.0	45.1
32.6	0.0	0.0	0.7	0.4	1.4	1.6	2.2	4.1	2.9	7.1	3.7	11.7	5.5	11.7	16.0	23.3	26.0	28.6	29.5	30.0	37.0	32.4	48.0	45.2	180.0	45.2
32.7	0.0	0.0	0.7	0.4	1.4	1.7	2.2	4.2	2.9	7.2	3.7	11.7	5.4	11.7	16.0	23.5	26.0	28.8	29.1	30.0	37.0	32.6	48.0	45.4	180.0	45.4

GAIN	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.
32.8	0.0	0.0	0.7	0.4	1.4	1.7	2.1	3.9	2.9	7.4	3.7	11.7	5.3	11.7	16.0	23.6	26.0	28.9	28.7	30.0	37.0	32.7	48.0	45.5	180.0	45.5
32.9	0.0	0.0	0.7	0.4	1.4	1.8	2.1	4.0	2.8	7.0	3.6	11.7	5.3	11.7	16.0	23.8	26.0	29.1	28.3	30.0	37.0	32.9	48.0	45.7	180.0	45.7
33	0.0	0.0	0.7	0.5	1.4	1.8	2.1	4.1	2.8	7.2	3.6	11.8	5.2	11.8	15.0	23.2	26.0	29.2	27.9	30.0	37.0	33.0	48.0	45.8	180.0	45.8
33.1	0.0	0.0	0.7	0.5	1.4	1.8	2.1	4.1	2.8	7.4	3.5	11.8	5.2	11.8	15.0	23.4	26.0	29.4	27.6	30.0	37.0	33.2	48.0	46.0	180.0	46.0
33.2	0.0	0.0	0.7	0.5	1.4	1.9	2.1	4.2	2.8	7.5	3.5	11.8	5.1	11.8	15.0	23.5	26.0	29.5	27.2	30.0	37.0	33.3	48.0	46.1	180.0	46.1
33.3	0.0	0.0	0.6	0.4	1.3	1.7	2.0	3.9	2.7	7.2	3.5	11.8	5.0	11.8	15.0	23.7	26.0	29.7	26.8	30.0	37.0	33.5	48.0	46.3	180.0	46.3
33.4	0.0	0.0	0.6	0.4	1.3	1.7	2.0	4.0	2.7	7.3	3.4	11.9	5.0	11.9	15.0	23.8	26.0	29.8	26.4	30.0	37.0	33.6	48.0	46.4	180.0	46.4
33.5	0.0	0.0	0.6	0.4	1.3	1.7	2.0	4.1	2.7	7.5	3.4	11.9	4.9	11.9	15.0	24.0	26.0	30.0	26.1	30.0	37.0	33.8	48.0	46.6	180.0	46.6
33.6	0.0	0.0	0.6	0.4	1.3	1.8	2.0	4.2	2.6	7.1	3.4	11.9	4.9	11.9	15.0	24.1	25.7	30.0	26.0	30.1	37.0	33.9	48.0	46.7	180.0	46.7
33.7	0.0	0.0	0.6	0.4	1.3	1.8	1.9	3.9	2.6	7.3	3.3	11.9	4.8	11.9	15.0	24.3	25.4	30.0	26.0	30.3	37.0	34.1	48.0	46.9	180.0	46.9
33.8	0.0	0.0	0.6	0.4	1.3	1.9	1.9	4.0	2.6	7.5	3.3	12.0	4.8	12.0	15.0	24.4	25.0	30.0	26.0	30.4	37.0	34.2	48.0	47.0	180.0	47.0
33.9	0.0	0.0	0.6	0.4	1.3	1.9	1.9	4.1	2.6	7.6	3.3	12.0	4.7	12.0	15.0	24.6	24.7	30.0	26.0	30.6	37.0	34.4	48.0	47.2	180.0	47.2
34	0.0	0.0	0.6	0.4	1.2	1.7	1.9	4.2	2.5	7.2	3.2	12.0	4.6	12.0	15.0	24.7	24.3	30.0	26.0	30.7	37.0	34.5	48.0	47.3	180.0	47.3
34.1	0.0	0.0	0.6	0.4	1.2	1.7	1.9	4.3	2.5	7.4	3.2	12.0	4.6	12.0	15.0	24.9	24.0	30.0	26.0	30.9	37.0	34.7	48.0	47.5	180.0	47.5
34.2	0.0	0.0	0.6	0.4	1.2	1.7	1.8	3.9	2.5	7.6	3.2	12.1	4.5	12.1	15.0	25.0	23.7	30.0	26.0	31.0	37.0	34.8	48.0	47.6	180.0	47.6
34.3	0.0	0.0	0.6	0.4	1.2	1.8	1.8	4.0	2.4	7.1	3.1	12.1	4.5	12.1	15.0	25.2	23.3	30.0	26.0	31.2	37.0	35.0	48.0	47.8	180.0	47.8
34.4	0.0	0.0	0.6	0.5	1.2	1.8	1.8	4.1	2.4	7.3	3.1	12.1	4.4	12.1	15.0	25.3	23.0	30.0	26.0	31.3	37.0	35.1	48.0	47.9	180.0	47.9
34.5	0.0	0.0	0.6	0.5	1.2	1.9	1.8	4.2	2.4	7.5	3.1	12.1	4.4	12.1	15.0	25.5	22.7	30.0	26.0	31.5	37.0	35.3	48.0	48.1	180.0	48.1
34.6	0.0	0.0	0.6	0.5	1.2	1.9	1.8	4.3	2.4	7.7	3.0	12.2	4.3	12.2	15.0	25.6	22.4	30.0	26.0	31.6	37.0	35.4	48.0	48.2	180.0	48.2
34.7	0.0	0.0	0.5	0.3	1.1	1.6	1.7	3.9	2.3	7.2	3.0	12.2	4.3	12.2	15.0	25.8	22.1	30.0	26.0	31.8	37.0	35.6	48.0	48.4	180.0	48.4
34.8	0.0	0.0	0.5	0.3	1.1	1.7	1.7	4.0	2.3	7.4	3.0	12.2	4.2	12.2	15.0	25.9	21.8	30.0	26.0	31.9	37.0	35.7	48.0	48.5	180.0	48.5
34.9	0.0	0.0	0.5	0.4	1.1	1.7	1.7	4.1	2.3	7.5	2.9	12.2	4.2	12.2	15.0	26.1	21.5	30.0	26.0	32.1	37.0	35.9	48.0	48.7	180.0	48.7
35	0.0	0.0	0.5	0.4	1.1	1.8	1.7	4.2	2.3	7.7	2.9	12.3	4.1	12.3	15.0	26.2	21.2	30.0	26.0	32.2	37.0	36.0	48.0	48.8	180.0	48.8
35.1	0.0	0.0	0.5	0.4	1.1	1.8	1.7	4.3	2.2	7.2	2.9	12.3	4.1	12.3	15.0	26.4	20.9	30.0	26.0	32.4	37.0	36.2	48.0	49.0	180.0	49.0
35.2	0.0	0.0	0.5	0.4	1.1	1.8	1.7	4.4	2.2	7.4	2.8	12.3	4.0	12.3	15.0	26.5	20.6	30.0	26.0	32.5	37.0	36.3	48.0	49.1	180.0	49.1
35.3	0.0	0.0	0.5	0.4	1.1	1.9	1.6	4.0	2.2	7.6	2.8	12.3	4.0	12.3	15.0	26.7	20.3	30.0	26.0	32.7	37.0	36.5	48.0	49.3	180.0	49.3
35.4	0.0	0.0	0.5	0.4	1.1	1.9	1.6	4.1	2.2	7.7	2.8	12.4	4.0	12.4	15.0	26.8	20.0	30.0	26.0	32.8	37.0	36.6	48.0	49.4	180.0	49.4
35.5	0.0	0.0	0.5	0.4	1.1	2.0	1.6	4.2	2.2	7.9	2.8	12.4	3.9	12.4	14.0	26.2	19.8	30.0	26.0	33.0	37.0	36.8	48.0	49.6	180.0	49.6
35.6	0.0	0.0	0.5	0.4	1.0	1.7	1.6	4.3	2.1	7.4	2.7	12.4	3.9	12.4	14.0	26.4	19.5	30.0	25.0	32.7	37.0	36.9	48.0	49.7	180.0	49.7
35.7	0.0	0.0	0.5	0.4	1.0	1.7	1.6	4.4	2.1	7.5	2.7	12.4	3.8	12.4	14.0	26.5	19.2	30.0	25.0	32.8	37.0	37.1	48.0	49.9	180.0	49.9
35.8	0.0	0.0	0.5	0.4	1.0	1.8	1.6	4.5	2.1	7.7	2.7	12.5	3.8	12.5	14.0	26.7	19.0	30.0	25.0	33.0	36.0	36.9	48.0	50.0	180.0	50.0
35.9	0.0	0.0	0.5	0.4	1.0	1.8	1.5	4.0	2.1	7.9	2.6	12.5	3.7	12.5	14.0	26.8	18.7	30.0	25.0	33.1	36.0	37.1	48.0	50.2	180.0	50.2

GAIN	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.
36	0.0	0.0	0.5	0.5	1.0	1.8	1.5	4.1	2.0	7.3	2.6	12.5	3.7	12.5	14.0	27.0	18.4	30.0	25.0	33.3	36.0	37.2	48.0	50.3	180.0	50.3
36.1	0.0	0.0	0.5	0.5	1.0	1.9	1.5	4.2	2.0	7.5	2.6	12.5	3.7	12.5	14.0	27.1	18.2	30.0	25.0	33.4	36.0	37.4	48.0	50.5	180.0	50.5
36.2	0.0	0.0	0.5	0.5	1.0	1.9	1.5	4.3	2.0	7.7	2.6	12.6	3.6	12.6	14.0	27.3	17.9	30.0	25.0	33.6	36.0	37.5	48.0	50.6	180.0	50.6
36.3	0.0	0.0	0.5	0.5	1.0	2.0	1.5	4.4	2.0	7.9	2.5	12.6	3.6	12.6	14.0	27.4	17.7	30.0	25.0	33.7	36.0	37.7	48.0	50.8	180.0	50.8
36.4	0.0	0.0	0.5	0.5	1.0	2.0	1.5	4.5	2.0	8.0	2.5	12.6	3.5	12.6	14.0	27.6	17.4	30.0	25.0	33.9	36.0	37.8	48.0	50.9	180.0	50.9
36.5	0.0	0.0	0.4	0.3	0.9	1.7	1.4	4.0	1.9	7.4	2.5	12.6	3.5	12.6	14.0	27.7	17.2	30.0	25.0	34.0	36.0	38.0	48.0	51.1	180.0	51.1
36.6	0.0	0.0	0.4	0.3	0.9	1.7	1.4	4.1	1.9	7.6	2.5	12.7	3.4	12.7	14.0	27.9	17.0	30.0	25.0	34.2	36.0	38.1	48.0	51.2	180.0	51.2
36.7	0.0	0.0	0.4	0.3	0.9	1.7	1.4	4.2	1.9	7.8	2.4	12.7	3.4	12.7	14.0	28.0	16.7	30.0	25.0	34.3	36.0	38.3	48.0	51.4	180.0	51.4
36.8	0.0	0.0	0.4	0.4	0.9	1.8	1.4	4.3	1.9	8.0	2.4	12.7	3.4	12.7	14.0	28.2	16.5	30.0	25.0	34.5	36.0	38.4	48.0	51.5	180.0	51.5
36.9	0.0	0.0	0.4	0.4	0.9	1.8	1.4	4.4	1.9	8.1	2.4	12.7	3.3	12.7	14.0	28.3	16.3	30.0	25.0	34.6	36.0	38.6	48.0	51.7	180.0	51.7
37	0.0	0.0	0.4	0.4	0.9	1.9	1.4	4.5	1.8	7.5	2.4	12.8	3.3	12.8	14.0	28.5	16.1	30.0	25.0	34.8	36.0	38.7	48.0	51.8	180.0	51.8
37.1	0.0	0.0	0.4	0.4	0.9	1.9	1.3	4.0	1.8	7.7	2.3	12.8	3.3	12.8	14.0	28.6	15.8	30.0	25.0	34.9	36.0	38.9	48.0	52.0	180.0	52.0
37.2	0.0	0.0	0.4	0.4	0.9	2.0	1.3	4.1	1.8	7.8	2.3	12.8	3.2	12.8	14.0	28.8	15.6	30.0	25.0	35.1	36.0	39.0	48.0	52.1	180.0	52.1
37.3	0.0	0.0	0.4	0.4	0.9	2.0	1.3	4.2	1.8	8.0	2.3	12.8	3.2	12.8	14.0	28.9	15.4	30.0	25.0	35.2	36.0	39.2	48.0	52.3	180.0	52.3
37.4	0.0	0.0	0.4	0.4	0.9	2.1	1.3	4.3	1.8	8.2	2.3	12.9	3.1	12.9	14.0	29.1	15.2	30.0	25.0	35.4	36.0	39.3	48.0	52.4	180.0	52.4
37.5	0.0	0.0	0.4	0.4	0.8	1.7	1.3	4.4	1.7	7.5	2.2	12.9	3.1	12.9	14.0	29.2	15.0	30.0	25.0	35.5	36.0	39.5	48.0	52.6	180.0	52.6
37.6	0.0	0.0	0.4	0.4	0.8	1.7	1.3	4.5	1.7	7.7	2.2	12.9	3.1	12.9	14.0	29.4	14.8	30.0	25.0	35.7	36.0	39.6	48.0	52.7	180.0	52.7
37.7	0.0	0.0	0.4	0.4	0.8	1.7	1.3	4.6	1.7	7.8	2.2	12.9	3.0	12.9	14.0	29.5	14.6	30.0	25.0	35.8	36.0	39.8	48.0	52.9	180.0	52.9
37.8	0.0	0.0	0.4	0.4	0.8	1.8	1.2	4.0	1.7	8.0	2.2	13.0	3.0	13.0	14.0	29.7	14.4	30.0	25.0	36.0	36.0	39.9	48.0	53.0	180.0	53.0
37.9	0.0	0.0	0.4	0.5	0.8	1.8	1.2	4.1	1.7	8.2	2.1	13.0	3.0	13.0	14.0	29.8	14.2	30.0	25.0	36.1	36.0	40.1	48.0	53.2	180.0	53.2
38	0.0	0.0	0.4	0.5	0.8	1.9	1.2	4.2	1.6	7.4	2.1	13.0	2.9	13.0	14.0	30.0	14.0	30.0	25.0	36.3	36.0	40.2	48.0	53.3	180.0	53.3
38.1	0.0	0.0	0.4	0.5	0.8	1.9	1.2	4.3	1.6	7.6	2.1	13.0	2.9	13.0	13.8	30.0	14.0	30.1	25.0	36.4	36.0	40.4	48.0	53.5	180.0	53.5
38.2	0.0	0.0	0.4	0.5	0.8	1.9	1.2	4.4	1.6	7.8	2.1	13.1	2.9	13.1	13.6	30.0	14.0	30.3	25.0	36.6	36.0	40.5	48.0	53.6	180.0	53.6
38.3	0.0	0.0	0.4	0.5	0.8	2.0	1.2	4.5	1.6	8.0	2.0	13.1	2.8	13.1	13.4	30.0	14.0	30.4	25.0	36.7	36.0	40.7	48.0	53.8	180.0	53.8
38.4	0.0	0.0	0.4	0.5	0.8	2.0	1.2	4.6	1.6	8.2	2.0	13.1	2.8	13.1	13.2	30.0	14.0	30.6	25.0	36.9	36.0	40.8	48.0	53.9	180.0	53.9
38.5	0.0	0.0	0.4	0.5	0.8	2.1	1.2	4.7	1.6	8.3	2.0	13.1	2.8	13.1	13.0	30.0	14.0	30.7	25.0	37.0	36.0	41.0	48.0	54.1	180.0	54.1
38.6	0.0	0.0	0.3	0.3	0.7	1.6	1.1	4.0	1.5	7.5	2.0	13.2	2.7	13.2	12.9	30.0	14.0	30.9	25.0	37.2	36.0	41.1	48.0	54.2	180.0	54.2
38.7	0.0	0.0	0.3	0.3	0.7	1.7	1.1	4.1	1.5	7.7	2.0	13.2	2.7	13.2	12.7	30.0	14.0	31.0	25.0	37.3	36.0	41.3	48.0	54.4	180.0	54.4
38.8	0.0	0.0	0.3	0.3	0.7	1.7	1.1	4.2	1.5	7.9	1.9	13.2	2.7	13.2	12.5	30.0	14.0	31.2	25.0	37.5	36.0	41.4	48.0	54.5	180.0	54.5
38.9	0.0	0.0	0.3	0.3	0.7	1.8	1.1	4.3	1.5	8.0	1.9	13.2	2.6	13.2	12.3	30.0	14.0	31.3	25.0	37.6	36.0	41.6	48.0	54.7	180.0	54.7
39	0.0	0.0	0.3	0.3	0.7	1.8	1.1	4.4	1.5	8.2	1.9	13.3	2.6	13.3	12.2	30.0	14.0	31.5	25.0	37.8	36.0	41.7	48.0	54.8	180.0	54.8
39.1	0.0	0.0	0.3	0.3	0.7	1.8	1.1	4.5	1.5	8.4	1.9	13.3	2.6	13.3	12.0	30.0	13.0	30.8	25.0	37.9	36.0	41.9	48.0	55.0	180.0	55.0

GAIN	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.
39.2	0.0	0.0	0.3	0.3	0.7	1.9	1.1	4.6	1.4	7.5	1.9	13.3	2.6	13.3	11.8	30.0	13.0	31.0	25.0	38.1	36.0	42.0	48.0	55.1	180.0	55.1
39.3	0.0	0.0	0.3	0.4	0.7	1.9	1.1	4.7	1.4	7.7	1.8	13.3	2.5	13.3	11.7	30.0	13.0	31.1	25.0	38.2	36.0	42.2	48.0	55.3	180.0	55.3
39.4	0.0	0.0	0.3	0.4	0.7	2.0	1.0	4.0	1.4	7.9	1.8	13.4	2.5	13.4	11.5	30.0	13.0	31.3	25.0	38.4	36.0	42.3	48.0	55.4	180.0	55.4
39.5	0.0	0.0	0.3	0.4	0.7	2.0	1.0	4.1	1.4	8.0	1.8	13.4	2.5	13.4	11.4	30.0	13.0	31.4	25.0	38.5	36.0	42.5	48.0	55.6	180.0	55.6
39.6	0.0	0.0	0.3	0.4	0.7	2.1	1.0	4.2	1.4	8.2	1.8	13.4	2.4	13.4	11.2	30.0	13.0	31.6	25.0	38.7	36.0	42.6	48.0	55.7	180.0	55.7
39.7	0.0	0.0	0.3	0.4	0.7	2.1	1.0	4.3	1.4	8.4	1.8	13.4	2.4	13.4	11.0	30.0	13.0	31.7	25.0	38.8	36.0	42.8	48.0	55.9	180.0	55.9
39.8	0.0	0.0	0.3	0.4	0.6	1.6	1.0	4.4	1.3	7.4	1.7	13.5	2.4	13.5	10.9	30.0	13.0	31.9	25.0	39.0	36.0	42.9	48.0	56.0	180.0	56.0
39.9	0.0	0.0	0.3	0.4	0.6	1.6	1.0	4.5	1.3	7.6	1.7	13.5	2.4	13.5	10.7	30.0	13.0	32.0	25.0	39.1	36.0	43.1	48.0	56.2	180.0	56.2
40	0.0	0.0	0.3	0.4	0.6	1.7	1.0	4.6	1.3	7.8	1.7	13.5	2.3	13.5	10.6	30.0	13.0	32.2	25.0	39.3	36.0	43.2	48.0	56.3	180.0	56.3
40.1	0.0	0.0	0.3	0.4	0.6	1.7	1.0	4.7	1.3	8.0	1.7	13.5	2.3	13.5	10.4	30.0	13.0	32.3	25.0	39.4	36.0	43.4	48.0	56.5	180.0	56.5
40.2	0.0	0.0	0.3	0.4	0.6	1.7	1.0	4.8	1.3	8.2	1.7	13.6	2.3	13.6	10.3	30.0	13.0	32.5	25.0	39.6	36.0	43.5	48.0	56.6	180.0	56.6
40.3	0.0	0.0	0.3	0.4	0.6	1.8	0.9	4.0	1.3	8.3	1.7	13.6	2.3	13.6	10.2	30.0	13.0	32.6	25.0	39.7	36.0	43.7	48.0	56.8	180.0	56.8
40.4	0.0	0.0	0.3	0.5	0.6	1.8	0.9	4.1	1.3	8.5	1.6	13.6	2.2	13.6	10.0	30.0	13.0	32.8	25.0	39.9	36.0	43.8	48.0	56.9	180.0	56.9
40.5	0.0	0.0	0.3	0.5	0.6	1.9	0.9	4.2	1.2	7.4	1.6	13.6	2.2	13.6	9.9	30.0	13.0	32.9	25.0	40.0	36.0	44.0	48.0	57.1	180.0	57.1
40.6	0.0	0.0	0.3	0.5	0.6	1.9	0.9	4.3	1.2	7.6	1.6	13.7	2.2	13.7	9.7	30.0	13.0	33.1	25.0	40.2	36.0	44.1	48.0	57.2	180.0	57.2
40.7	0.0	0.0	0.3	0.5	0.6	1.9	0.9	4.4	1.2	7.8	1.6	13.7	2.1	13.7	9.6	30.0	13.0	33.2	25.0	40.3	36.0	44.3	48.0	57.4	180.0	57.4
40.8	0.0	0.0	0.3	0.5	0.6	2.0	0.9	4.5	1.2	8.0	1.6	13.7	2.1	13.7	9.5	30.0	13.0	33.4	25.0	40.5	36.0	44.4	48.0	57.5	180.0	57.5
40.9	0.0	0.0	0.3	0.5	0.6	2.0	0.9	4.6	1.2	8.2	1.6	13.7	2.1	13.7	9.3	30.0	13.0	33.5	25.0	40.6	36.0	44.6	48.0	57.7	180.0	57.7
41	0.0	0.0	0.3	0.5	0.6	2.1	0.9	4.7	1.2	8.4	1.5	13.8	2.1	13.8	9.2	30.0	13.0	33.7	25.0	40.8	36.0	44.7	48.0	57.8	180.0	57.8
41.1	0.0	0.0	0.3	0.5	0.6	2.1	0.9	4.8	1.2	8.5	1.5	13.8	2.1	13.8	9.1	30.0	13.0	33.8	25.0	40.9	36.0	44.9	48.0	58.0	180.0	58.0
41.2	0.0	0.0	0.3	0.5	0.6	2.2	0.9	4.9	1.2	8.7	1.5	13.8	2.0	13.8	9.0	30.0	13.0	34.0	25.0	41.1	36.0	45.0	48.0	58.1	180.0	58.1
41.3	0.0	0.0	0.2	0.2	0.5	1.6	0.8	4.0	1.1	7.5	1.5	13.8	2.0	13.8	8.8	30.0	13.0	34.1	25.0	41.2	36.0	45.2	48.0	58.3	180.0	58.3
41.4	0.0	0.0	0.2	0.3	0.5	1.6	0.8	4.1	1.1	7.7	1.5	13.9	2.0	13.9	8.7	30.0	13.0	34.3	25.0	41.4	36.0	45.3	48.0	58.4	180.0	58.4
41.5	0.0	0.0	0.2	0.3	0.5	1.6	0.8	4.2	1.1	7.9	1.5	13.9	2.0	13.9	8.6	30.0	13.0	34.4	25.0	41.5	36.0	45.5	48.0	58.6	180.0	58.6
41.6	0.0	0.0	0.2	0.3	0.5	1.7	0.8	4.3	1.1	8.1	1.4	13.9	1.9	13.9	8.5	30.0	13.0	34.6	25.0	41.7	36.0	45.6	48.0	58.7	180.0	58.7
41.7	0.0	0.0	0.2	0.3	0.5	1.7	0.8	4.4	1.1	8.2	1.4	13.9	1.9	13.9	8.4	30.0	13.0	34.7	25.0	41.8	36.0	45.8	48.0	58.9	180.0	58.9
41.8	0.0	0.0	0.2	0.3	0.5	1.7	0.8	4.5	1.1	8.4	1.4	14.0	1.9	14.0	8.2	30.0	13.0	34.9	24.0	41.5	36.0	45.9	48.0	59.0	180.0	59.0
41.9	0.0	0.0	0.2	0.3	0.5	1.8	0.8	4.6	1.1	8.6	1.4	14.0	1.9	14.0	8.1	30.0	13.0	35.0	24.0	41.7	36.0	46.1	48.0	59.2	180.0	59.2
42	0.0	0.0	0.2	0.3	0.5	1.8	0.8	4.7	1.1	8.8	1.4	14.0	1.9	14.0	8.0	30.0	13.0	35.2	24.0	41.8	36.0	46.2	48.0	59.3	180.0	59.3
42.1	0.0	0.0	0.2	0.3	0.5	1.9	0.8	4.8	1.0	7.5	1.4	14.0	1.8	14.0	7.9	30.0	13.0	35.3	24.0	42.0	36.0	46.4	48.0	59.5	180.0	59.5
42.2	0.0	0.0	0.2	0.3	0.5	1.9	0.8	4.9	1.0	7.6	1.4	14.1	1.8	14.1	7.8	30.0	13.0	35.5	24.0	42.1	36.0	46.5	48.0	59.6	180.0	59.6
42.3	0.0	0.0	0.2	0.3	0.5	2.0	0.8	5.0	1.0	7.8	1.3	14.1	1.8	14.1	7.7	30.0	13.0	35.6	24.0	42.3	36.0	46.7	48.0	59.8	180.0	59.8

GAIN	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.
42.4	0.0	0.0	0.2	0.3	0.5	2.0	0.7	3.9	1.0	8.0	1.3	14.1	1.8	14.1	7.6	30.0	13.0	35.8	24.0	42.4	36.0	46.8	48.0	59.9	180.0	59.9
42.5	0.0	0.0	0.2	0.3	0.5	2.0	0.7	4.0	1.0	8.2	1.3	14.1	1.7	14.1	7.5	30.0	13.0	35.9	24.0	42.6	36.0	47.0	48.0	60.1	180.0	60.1
42.6	0.0	0.0	0.2	0.3	0.5	2.1	0.7	4.1	1.0	8.4	1.3	14.2	1.7	14.2	7.4	30.0	13.0	36.1	24.0	42.7	36.0	47.1	48.0	60.2	180.0	60.2
42.7	0.0	0.0	0.2	0.3	0.5	2.1	0.7	4.2	1.0	8.6	1.3	14.2	1.7	14.2	7.3	30.0	13.0	36.2	24.0	42.9	36.0	47.3	48.0	60.4	180.0	60.4
42.8	0.0	0.0	0.2	0.4	0.5	2.2	0.7	4.3	1.0	8.8	1.3	14.2	1.7	14.2	7.2	30.0	13.0	36.4	24.0	43.0	36.0	47.4	48.0	60.5	180.0	60.5
42.9	0.0	0.0	0.2	0.4	0.5	2.2	0.7	4.4	1.0	9.0	1.3	14.2	1.7	14.2	7.1	30.0	13.0	36.5	24.0	43.2	36.0	47.6	48.0	60.7	180.0	60.7
43	0.0	0.0	0.2	0.4	0.4	1.5	0.7	4.5	0.9	7.4	1.2	14.3	1.6	14.3	7.0	30.0	13.0	36.7	24.0	43.3	36.0	47.7	48.0	60.8	180.0	60.8
43.1	0.0	0.0	0.2	0.4	0.4	1.5	0.7	4.6	0.9	7.6	1.2	14.3	1.6	14.3	6.9	30.0	13.0	36.8	24.0	43.5	36.0	47.9	48.0	61.0	180.0	61.0
43.2	0.0	0.0	0.2	0.4	0.4	1.5	0.7	4.7	0.9	7.8	1.2	14.3	1.6	14.3	6.8	30.0	13.0	37.0	24.0	43.6	36.0	48.0	48.0	61.1	180.0	61.1
43.3	0.0	0.0	0.2	0.4	0.4	1.6	0.7	4.8	0.9	8.0	1.2	14.3	1.6	14.3	6.7	30.0	13.0	37.1	24.0	43.8	36.0	48.2	48.0	61.3	180.0	61.3
43.4	0.0	0.0	0.2	0.4	0.4	1.6	0.7	4.9	0.9	8.2	1.2	14.4	1.6	14.4	6.6	30.0	13.0	37.3	24.0	43.9	36.0	48.3	48.0	61.4	180.0	61.4
43.5	0.0	0.0	0.2	0.4	0.4	1.7	0.7	5.1	0.9	8.4	1.2	14.4	1.6	14.4	6.5	30.0	13.0	37.4	24.0	44.1	36.0	48.5	48.0	61.6	180.0	61.6
43.6	0.0	0.0	0.2	0.4	0.4	1.7	0.7	5.2	0.9	8.5	1.2	14.4	1.5	14.4	6.4	30.0	13.0	37.6	24.0	44.2	36.0	48.6	48.0	61.7	180.0	61.7
43.7	0.0	0.0	0.2	0.4	0.4	1.7	0.6	3.9	0.9	8.7	1.2	14.4	1.5	14.4	6.3	30.0	13.0	37.7	24.0	44.4	36.0	48.8	48.0	61.9	180.0	61.9
43.8	0.0	0.0	0.2	0.4	0.4	1.8	0.6	4.0	0.9	9.0	1.1	14.5	1.5	14.5	6.2	30.0	13.0	37.9	24.0	44.5	36.0	48.9	48.0	62.0	180.0	62.0
43.9	0.0	0.0	0.2	0.5	0.4	1.8	0.6	4.1	0.9	9.2	1.1	14.5	1.5	14.5	6.2	30.0	13.0	38.0	24.0	44.7	36.0	49.1	48.0	62.2	180.0	62.2
44	0.0	0.0	0.2	0.5	0.4	1.9	0.6	4.2	0.8	7.4	1.1	14.5	1.5	14.5	6.1	30.0	13.0	38.2	24.0	44.8	36.0	49.2	48.0	62.3	180.0	62.3
44.1	0.0	0.0	0.2	0.5	0.4	1.9	0.6	4.3	0.8	7.6	1.1	14.5	1.5	14.5	6.0	30.0	13.0	38.3	24.0	45.0	36.0	49.4	48.0	62.5	180.0	62.5
44.2	0.0	0.0	0.2	0.5	0.4	1.9	0.6	4.4	0.8	7.8	1.1	14.6	1.4	14.6	5.9	30.0	13.0	38.5	24.0	45.1	36.0	49.5	48.0	62.6	180.0	62.6
44.3	0.0	0.0	0.2	0.5	0.4	2.0	0.6	4.5	0.8	7.9	1.1	14.6	1.4	14.6	5.8	30.0	13.0	38.6	24.0	45.3	36.0	49.7	48.0	62.8	180.0	62.8
44.4	0.0	0.0	0.2	0.5	0.4	2.0	0.6	4.6	0.8	8.1	1.1	14.6	1.4	14.6	5.7	30.0	13.0	38.8	24.0	45.4	36.0	49.8	48.0	62.9	180.0	62.9
44.5	0.0	0.0	0.2	0.5	0.4	2.1	0.6	4.7	0.8	8.3	1.1	14.6	1.4	14.6	5.7	30.0	13.0	38.9	24.0	45.6	36.0	50.0	48.0	63.1	180.0	63.1
44.6	0.0	0.0	0.2	0.5	0.4	2.1	0.6	4.8	0.8	8.5	1.1	14.7	1.4	14.7	5.6	30.0	13.0	39.1	24.0	45.7	36.0	50.1	48.0	63.2	180.0	63.2
44.7	0.0	0.0	0.2	0.5	0.4	2.2	0.6	4.9	0.8	8.7	1.0	14.7	1.4	14.7	5.5	30.0	13.0	39.2	24.0	45.9	36.0	50.3	48.0	63.4	180.0	63.4
44.8	0.0	0.0	0.2	0.6	0.4	2.2	0.6	5.0	0.8	8.9	1.0	14.7	1.3	14.7	5.4	30.0	13.0	39.4	24.0	46.0	36.0	50.4	48.0	63.5	180.0	63.5
44.9	0.0	0.0	0.2	0.6	0.4	2.3	0.6	5.1	0.8	9.1	1.0	14.7	1.3	14.7	5.4	30.0	13.0	39.5	24.0	46.2	36.0	50.6	48.0	63.7	180.0	63.7
45	0.0	0.0	0.2	0.6	0.4	2.3	0.6	5.2	0.8	9.3	1.0	14.8	1.3	14.8	5.3	30.0	13.0	39.7	24.0	46.3	36.0	50.7	48.0	63.8	180.0	63.8
45.1	0.0	0.0	0.1	0.1	0.3	1.3	0.5	3.7	0.7	7.3	1.0	14.8	1.3	14.8	5.2	30.0	13.0	39.8	24.0	46.5	36.0	50.9	48.0	64.0	180.0	64.0
45.2	0.0	0.0	0.1	0.2	0.3	1.4	0.5	3.8	0.7	7.5	1.0	14.8	1.3	14.8	5.1	30.0	13.0	40.0	24.0	46.6	36.0	51.0	48.0	64.1	180.0	64.1
45.3	0.0	0.0	0.1	0.2	0.3	1.4	0.5	3.9	0.7	7.6	1.0	14.8	1.3	14.8	5.1	30.0	12.0	39.3	24.0	46.8	36.0	51.2	48.0	64.3	180.0	64.3
45.4	0.0	0.0	0.1	0.2	0.3	1.4	0.5	4.0	0.7	7.8	1.0	14.9	1.3	14.9	5.0	30.0	12.0	39.4	24.0	46.9	36.0	51.3	48.0	64.4	180.0	64.4
45.5	0.0	0.0	0.1	0.2	0.3	1.5	0.5	4.1	0.7	8.0	1.0	14.9	1.2	14.9	4.9	30.0	12.0	39.6	24.0	47.1	36.0	51.5	48.0	64.6	180.0	64.6

GAIN	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.
45.6	0.0	0.0	0.1	0.2	0.3	1.5	0.5	4.2	0.7	8.2	0.9	14.9	1.2	14.9	4.9	30.0	12.0	39.7	24.0	47.2	36.0	51.6	48.0	64.7	180.0	64.7
45.7	0.0	0.0	0.1	0.2	0.3	1.5	0.5	4.3	0.7	8.4	0.9	14.9	1.2	14.9	4.8	30.0	12.0	39.9	24.0	47.4	36.0	51.8	48.0	64.9	180.0	64.9
45.8	0.0	0.0	0.1	0.2	0.3	1.6	0.5	4.4	0.7	8.6	0.9	15.0	1.2	15.0	4.7	30.0	12.0	40.0	24.0	47.5	36.0	51.9	48.0	65.0	180.0	65.0
45.9	0.0	0.0	0.1	0.2	0.3	1.6	0.5	4.5	0.7	8.8	0.9	15.0	1.2	15.0	4.7	30.0	12.0	40.2	24.0	47.7	36.0	52.1	48.0	65.2	180.0	65.2
46	0.0	0.0	0.1	0.2	0.3	1.7	0.5	4.6	0.7	9.0	0.9	15.0	1.2	15.0	4.6	30.0	12.0	40.3	24.0	47.8	36.0	52.2	48.0	65.3	180.0	65.3
46.1	0.0	0.0	0.1	0.2	0.3	1.7	0.5	4.7	0.7	9.2	0.9	15.0	1.2	15.0	4.5	30.0	12.0	40.5	24.0	48.0	36.0	52.4	48.0	65.5	180.0	65.5
46.2	0.0	0.0	0.1	0.2	0.3	1.7	0.5	4.8	0.7	9.4	0.9	15.1	1.1	15.1	4.5	30.0	12.0	40.6	24.0	48.1	36.0	52.5	48.0	65.6	180.0	65.6
46.3	0.0	0.0	0.1	0.2	0.3	1.8	0.5	4.9	0.7	9.6	0.9	15.1	1.1	15.1	4.4	30.0	12.0	40.8	24.0	48.3	36.0	52.7	48.0	65.8	180.0	65.8
46.4	0.0	0.0	0.1	0.2	0.3	1.8	0.5	5.0	0.6	7.2	0.9	15.1	1.1	15.1	4.3	30.0	12.0	40.9	24.0	48.4	36.0	52.8	48.0	65.9	180.0	65.9
46.5	0.0	0.0	0.1	0.2	0.3	1.9	0.5	5.1	0.6	7.4	0.9	15.1	1.1	15.1	4.3	30.0	12.0	41.1	24.0	48.6	36.0	53.0	48.0	66.1	180.0	66.1
46.6	0.0	0.0	0.1	0.2	0.3	1.9	0.5	5.3	0.6	7.6	0.8	15.2	1.1	15.2	4.2	30.0	12.0	41.2	24.0	48.7	36.0	53.1	48.0	66.2	180.0	66.2
46.7	0.0	0.0	0.1	0.2	0.3	1.9	0.5	5.4	0.6	7.8	0.8	15.2	1.1	15.2	4.2	30.0	12.0	41.4	24.0	48.9	36.0	53.3	48.0	66.4	180.0	66.4
46.8	0.0	0.0	0.1	0.2	0.3	2.0	0.4	3.5	0.6	7.9	0.8	15.2	1.1	15.2	4.1	30.0	12.0	41.5	24.0	49.0	36.0	53.4	48.0	66.5	180.0	66.5
46.9	0.0	0.0	0.1	0.2	0.3	2.0	0.4	3.6	0.6	8.1	0.8	15.2	1.1	15.2	4.1	30.0	12.0	41.7	24.0	49.2	36.0	53.6	48.0	66.7	180.0	66.7
47	0.0	0.0	0.1	0.2	0.3	2.1	0.4	3.7	0.6	8.3	0.8	15.3	1.0	15.3	4.0	30.0	12.0	41.8	24.0	49.3	36.0	53.7	48.0	66.8	180.0	66.8
47.1	0.0	0.0	0.1	0.2	0.3	2.1	0.4	3.8	0.6	8.5	0.8	15.3	1.0	15.3	3.9	30.0	12.0	42.0	24.0	49.5	36.0	53.9	48.0	67.0	180.0	67.0
47.2	0.0	0.0	0.1	0.2	0.3	2.2	0.4	3.9	0.6	8.7	0.8	15.3	1.0	15.3	3.9	30.0	12.0	42.1	24.0	49.6	36.0	54.0	48.0	67.1	180.0	67.1
47.3	0.0	0.0	0.1	0.2	0.3	2.2	0.4	4.0	0.6	8.9	0.8	15.3	1.0	15.3	3.8	30.0	12.0	42.3	24.0	49.8	36.0	54.2	48.0	67.3	180.0	67.3
47.4	0.0	0.0	0.1	0.3	0.3	2.3	0.4	4.1	0.6	9.1	0.8	15.4	1.0	15.4	3.8	30.0	12.0	42.4	24.0	49.9	36.0	54.3	48.0	67.4	180.0	67.4
47.5	0.0	0.0	0.1	0.3	0.3	2.3	0.4	4.1	0.6	9.3	0.8	15.4	1.0	15.4	3.8	30.0	12.0	42.5	24.0	50.0	36.0	54.4	48.0	67.5	180.0	67.5
47.6	0.0	0.0	0.1	0.3	0.3	2.4	0.4	4.2	0.6	9.5	0.8	15.4	1.0	15.4	3.7	30.0	12.0	42.6	24.0	50.1	36.0	54.5	48.0	67.6	180.0	67.6
47.7	0.0	0.0	0.1	0.3	0.3	2.4	0.4	4.3	0.6	9.8	0.8	15.4	1.0	15.4	3.7	30.0	12.0	42.7	24.0	50.2	36.0	54.6	48.0	67.7	180.0	67.7
47.8	0.0	0.0	0.1	0.3	0.2	1.1	0.4	4.4	0.5	6.9	0.7	15.5	1.0	15.5	3.6	30.0	12.0	42.8	24.0	50.3	36.0	54.7	48.0	67.8	180.0	67.8
47.9	0.0	0.0	0.1	0.3	0.2	1.1	0.4	4.5	0.5	7.1	0.7	15.5	1.0	15.5	3.6	30.0	12.0	42.9	24.0	50.4	36.0	54.8	48.0	67.9	180.0	67.9
48	0.0	0.0	0.1	0.3	0.2	1.2	0.4	4.7	0.5	7.3	0.7	15.5	1.0	15.5	3.6	30.0	12.0	43.0	24.0	50.5	36.0	54.9	48.0	68.0	180.0	68.0
48.1	0.0	0.0	0.1	0.3	0.2	1.2	0.4	4.8	0.5	7.4	0.7	15.5	0.9	15.5	3.5	30.0	12.0	43.1	24.0	50.6	36.0	55.0	48.0	68.1	180.0	68.1
48.2	0.0	0.0	0.1	0.3	0.2	1.2	0.4	4.9	0.5	7.6	0.7	15.6	0.9	15.6	3.5	30.0	12.0	43.2	24.0	50.7	36.0	55.1	48.0	68.2	180.0	68.2
48.3	0.0	0.0	0.1	0.3	0.2	1.2	0.4	5.0	0.5	7.8	0.7	15.6	0.9	15.6	3.5	30.0	12.0	43.3	24.0	50.8	36.0	55.2	48.0	68.3	180.0	68.3
48.4	0.0	0.0	0.1	0.3	0.2	1.3	0.4	5.1	0.5	8.0	0.7	15.6	0.9	15.6	3.4	30.0	12.0	43.4	24.0	50.9	36.0	55.3	48.0	68.4	180.0	68.4
48.5	0.0	0.0	0.1	0.3	0.2	1.3	0.4	5.2	0.5	8.2	0.7	15.6	0.9	15.6	3.4	30.0	12.0	43.5	24.0	51.0	36.0	55.4	48.0	68.5	180.0	68.5
48.6	0.0	0.0	0.1	0.3	0.2	1.3	0.4	5.3	0.5	8.3	0.7	15.7	0.9	15.7	3.4	30.0	12.0	43.6	24.0	51.1	36.0	55.5	48.0	68.6	180.0	68.6
48.7	0.0	0.0	0.1	0.3	0.2	1.4	0.4	5.5	0.5	8.5	0.7	15.7	0.9	15.7	3.4	30.0	12.0	43.7	24.0	51.2	36.0	55.6	48.0	68.7	180.0	68.7

AIN	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.	ANGLE	ATTN.
48.8	0.0	0.0	0.1	0.3	0.2	1.4	0.4	5.6	0.5	8.7	0.7	15.7	0.9	15.7	3.3	30.0	12.0	43.8	24.0	51.3	36.0	55.7	48.0	68.8	180.0	68.8
48.9	0.0	0.0	0.1	0.4	0.2	1.4	0.3	3.2	0.5	8.9	0.7	15.7	0.9	15.7	3.3	30.0	12.0	43.9	24.0	51.4	36.0	55.8	48.0	68.9	180.0	68.9
49	0.0	0.0	0.1	0.4	0.2	1.5	0.3	3.3	0.5	9.1	0.7	15.8	0.9	15.8	3.3	30.0	12.0	44.0	24.0	51.5	36.0	55.9	48.0	69.0	180.0	69.0
49.1	0.0	0.0	0.1	0.4	0.2	1.5	0.3	3.4	0.5	9.4	0.6	15.8	0.9	15.8	3.2	30.0	12.0	44.1	24.0	51.6	36.0	56.0	48.0	69.1	180.0	69.1
49.2	0.0	0.0	0.1	0.4	0.2	1.5	0.3	3.4	0.5	9.6	0.6	15.8	0.9	15.8	3.2	30.0	12.0	44.2	24.0	51.7	36.0	56.1	48.0	69.2	180.0	69.2
49.3	0.0	0.0	0.1	0.4	0.2	1.6	0.3	3.5	0.5	9.8	0.6	15.8	0.9	15.8	3.2	30.0	12.0	44.3	24.0	51.8	36.0	56.2	48.0	69.3	180.0	69.3
49.4	0.0	0.0	0.1	0.4	0.2	1.6	0.3	3.6	0.5	10.0	0.6	15.9	0.9	15.9	3.1	30.0	12.0	44.4	24.0	51.9	36.0	56.3	48.0	69.4	180.0	69.4
49.5	0.0	0.0	0.1	0.4	0.2	1.6	0.3	3.7	0.4	6.6	0.6	15.9	0.9	15.9	3.1	30.0	12.0	44.5	24.0	52.0	36.0	56.4	48.0	69.5	180.0	69.5
49.6	0.0	0.0	0.1	0.4	0.2	1.7	0.3	3.8	0.4	6.7	0.6	15.9	0.9	15.9	3.1	30.0	12.0	44.6	24.0	52.1	36.0	56.5	48.0	69.6	180.0	69.6
49.7	0.0	0.0	0.1	0.4	0.2	1.7	0.3	3.9	0.4	6.9	0.6	15.9	0.9	15.9	3.1	30.0	12.0	44.7	24.0	52.2	36.0	56.6	48.0	69.7	180.0	69.7
49.8	0.0	0.0	0.1	0.4	0.2	1.8	0.3	4.0	0.4	7.0	0.6	16.0	0.8	16.0	3.0	30.0	12.0	44.8	24.0	52.3	36.0	56.7	48.0	69.8	180.0	69.8
49.9	0.0	0.0	0.1	0.5	0.2	1.8	0.3	4.1	0.4	7.2	0.6	16.0	0.8	16.0	3.0	30.0	12.0	44.9	24.0	52.4	36.0	56.8	48.0	69.9	180.0	69.9
50	0.0	0.0	0.1	0.5	0.2	1.8	0.3	4.1	0.4	7.4	0.6	16.0	0.8	16.0	3.0	30.0	12.0	45.0	24.0	52.5	36.0	56.9	48.0	70.0	180.0	70.0

CP: copolar antenna radiation pattern all the angles and attenuations in one row (for appropriate maximum antenna gain) should be taken.

XP: crosspolar antenna radiation pattern, values in shaded fields should be disregarded (i.e. only the white fields should be taken into account). Attenuation in the main axis (i.e. 0 degrees) for crosspolar antenna diagram is given in the following table (depending on maximum antenna gain):

Maximum antenna gain [dBi]		Attenuation for angle of 0 degrees in XPD [dB]
From:	To:	
20	22.9	15
23	26.9	20
27	29.9	25
30	50	30

Annex 3 A

Determination of the correction factor for the permissible interference field strength at different nominal frequencies in the Land Mobile Service.

1. Determination of the correction factor for the permissible interference field strength at different nominal frequencies in the Land Mobile Service.

The correction factor for the permissible interfering field strength at different nominal frequencies of the transmitting channel causing the interference and the receiving channel experiencing interference is determined by formulas.
The curves for narrow band systems, derived from measurements of a few radio stations in the 1990's, are replaced by normalized equations. For TETRA and wideband systems other normalized equations have been developed. For these new systems, the following designated normalized equations should be used.

2. Definitions for all Systems

Ω	normalized frequency
Delta f	frequency difference between interferer and victim [Hz]
B1	occupied bandwidth of the system with the higher bandwidth [Hz]
B2	occupied bandwidth of the system with the lower bandwidth [Hz]
$a_{corr\text{-}B1}$	correction factor in case B1 = B2 [dB]
$a_{corr\text{-}Sinus}$	correction factor in case the interferer is a sine (unmodulated) carrier [dB]
a_{corr}	resulting correction factor [dB]

For all cases below (except for 4.3 TETRA versus TETRA case) the following interpolation equation is valid:

$$\mathbf{\Omega = Delta\ f / B1 \text{ where } B1 \geq B2}$$

$\mathbf{a_{corr} = a_{corr\text{-}Sinus} - [a_{corr\text{-}Sinus} - a_{corr\text{-}B1}] * B2/B1}$ (An upper limit of 70 dB should be applied.)

3. Narrowband Systems (without TETRA Systems)

For cases including narrowband systems i.e. with a bandwidth ≤ **25 kHz** the following formulas should be used.

a_{corr} for interferer with identical bandwidth:

$a_{corr\text{-}B1} = 0$ dB	for $\Omega < 0.5$
$a_{corr\text{-}B1} = (47\Omega - 24)$ dB	for $0.5 \leq \Omega \leq 1$
$a_{corr\text{-}B1} = (80\Omega - 55)$ dB	for $1 < \Omega \leq 1.3$
$a_{corr\text{-}B1} = (38\Omega)$ dB	for $\Omega > 1.3$

a_{corr} for sine interferer:

$a_{corr\text{-}Sinus} = 0$ dB	for $\Omega < 0.5$
$a_{corr\text{-}Sinus} = (88\Omega - 44)$ dB	for $0.5 \leq \Omega \leq 1.3$
$a_{corr\text{-}Sinus} = (12\Omega + 55)$ dB	for $\Omega > 1.3$

4. TETRA versus other Narrowband Systems

For cases where a TETRA system (designation of emission: 25K0G7W) is interfering with or interfered by a narrowband system with a bandwidth ≤ **25 kHz** the following formulas should be used.

4.1 TETRA = Interferer

a_{corr} for interferer with identical bandwidth:

$a_{corr\text{-}B1} = 0$ dB	for $\Omega < 0{,}5$
$a_{corr\text{-}B1} = (32\Omega - 16)$ dB	for $0.5 \leq \Omega \leq 1$
$a_{corr\text{-}B1} = (112\Omega - 96)$ dB	for $1 < \Omega \leq 1.4$
$a_{corr\text{-}B1} = (41\Omega)$ dB	for $\Omega > 1.4$

a_{corr} for sine interferer:

$a_{corr\text{-}Sinus} = 0$ dB	for $\Omega < 0.4$
$a_{corr\text{-}Sinus} = (50\Omega - 21)$ dB	for $0.4 \leq \Omega \leq 0.7$
$a_{corr\text{-}Sinus} = (225\Omega - 145)$ dB	for $0.7 < \Omega \leq 1$
$a_{corr\text{-}Sinus} = (-20\Omega + 100)$ dB	for $\Omega > 1$

4.2 TETRA = Victim

a_{corr} for interferer with identical bandwidth:

$a_{corr\text{-}B1} = 0$ dB	for $\Omega < 0{,}45$
$a_{corr\text{-}B1} = (55\Omega - 23)$ dB	for $0.45 \leq \Omega \leq 0.63$
$a_{corr\text{-}B1} = (180\Omega - 100)$ dB	for $0.63 < \Omega \leq 0.93$
$a_{corr\text{-}B1} = (12.5\Omega + 57)$ dB	for $\Omega > 0.93$

a_{corr} for sine interferer:

$a_{corr\text{-}Sinus} = 0$ dB	for $\Omega < 0.45$
$a_{corr\text{-}Sinus} = (225\Omega - 101)$ dB	for $0.45 \leq \Omega \leq 0.7$
$a_{corr\text{-}Sinus} = (13\Omega + 58$ dB	for $\Omega > 0.7$

4.3 TETRA versus TETRA (25 kHz)

Between TETRA systems (designation of emission: 25K0G7W), the correction factor (a_{corr}) for different frequency offsets (Δf) is given by the following formulas:

$a_{corr} = 0$ dB	for $\Delta f < 25$ kHz
$a_{corr} = 45$ dB	for 25 kHz $\leq \Delta f \leq$ 50 kHz
$a_{corr} = 70$ dB	for $\Delta f > 50$ kHz

5. Wideband Systems

For cases where systems with a bandwidth **≥ 200 kHz** are involved the following formulas should be used.

a_{corr} for interferer with identical bandwidth:

$a_{corr\text{-}B1} = 0$ dB	for $\Omega < 0.5$
$a_{corr\text{-}B1} = (33.3\Omega - 16.7)$ dB	for $0.5 \leq \Omega \leq 2$
$a_{corr\text{-}B1} = (10\Omega + 30)$ dB	for $\Omega > 2$

a_{corr} for sine interferer:

$a_{corr\text{-}Sinus} = 0$ dB	for $\Omega < 0{,}5$
$a_{corr\text{-}Sinus} = (66.7\Omega - 33.3)$ dB	for $0.5 \leq \Omega \leq 1.25$
$a_{corr\text{-}Sinus} = (20\Omega + 25)$ dB	for $1.25 < \Omega \leq 1.75$
$a_{corr\text{-}Sinus} = (4.8\Omega + 51.6)$ dB	for $\Omega > 1.75$

6. For Systems with a Bandwidth > 25 kHz and < 200 kHz

For cases where the highest bandwidth B_x, of at least one of the two systems involved is > 25 kHz and < 200 kHz the correction factor should be evaluated using the following interpolation formula:

$$a_{Bx} = a_{NB} + \frac{a_{WB} - a_{NB}}{200 - 25} * (B_x - 25)$$

With:
B_x: *Bandwidth of the system in the range > 25kHz and < 200kHz*
a_{NB}: *correction in dB calculated based on the narrowband formula*
a_{WB}: *correction in dB calculated based on the wideband formula*
a_{Bx}: *resulting correction in dB*

The correction factors a_{NB} and a_{WB} are calculated according paragraphs 3 and 5.

Annex 3 B

Determination of the Masks Discrimination and the Net Filter Discrimination in the Fixed Service

The calculations of the masks discrimination and the net filter discrimination are based on the relation of two powers. Because these powers are represented by areas, only the areas are taken into account for the determination of the masks discrimination and the net filter discrimination.

1. Masks Discrimination – MD

The Masks Discrimination (MD) expresses the reduction (in dB) of the interference power caused by the filter shape of the transmitter spectrum density mask and the receiver selectivity mask.

MD is calculated as follows :

MD = 10 log (TX area/ overlapping area at co-channel)

1.1 calculation of the TX area

An example of a transmitter spectrum density mask is given in Figure 1. The mask can be split up into different elements. The areas of these elements are relative power portions to the transmitter power. The area within the entire mask represents the TX area.

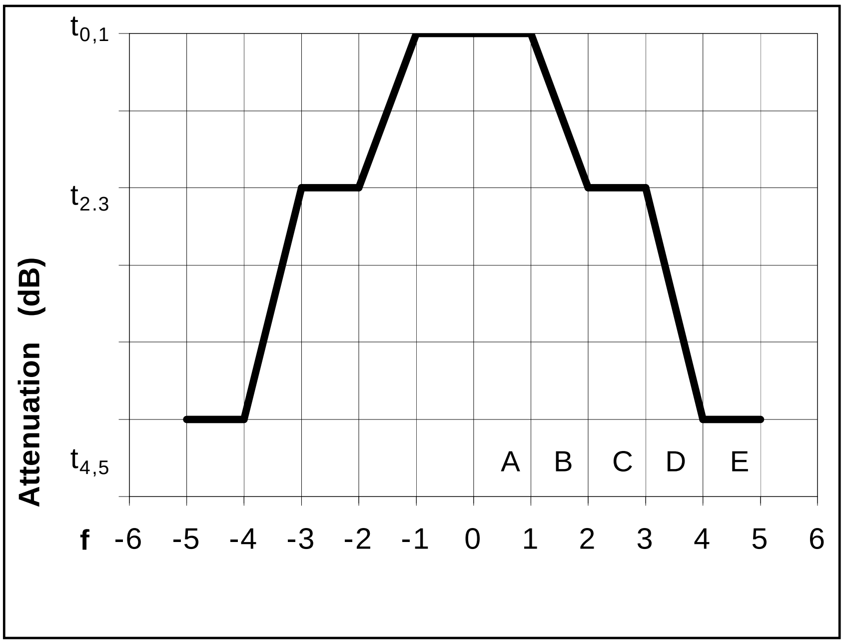


Figure 1

Flat elements have to be calculated using formula 2.1 with r_i= 0 (see below), slope elements have to be calculated using formula 2.2 with r_i= 0 (see below).

1.2 Calculation of the overlapping area at co channel

An example of the overlapping area at co channel between transmitter spectrum density mask and receiver selectivity mask is given in Figure 2.

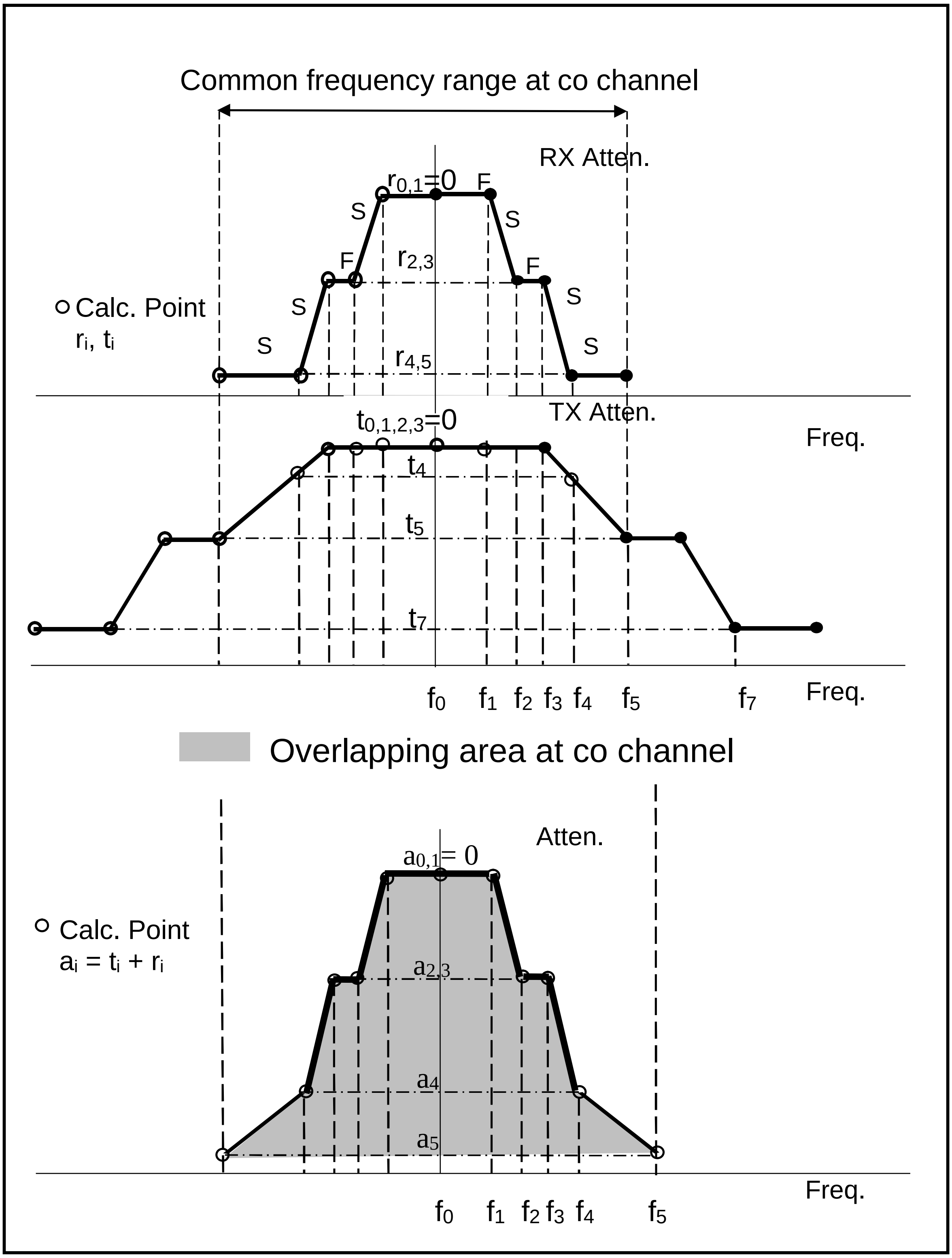


Figure 2

The common frequency range at co channel has to be split into flat and slope partial elements. Flat element (F) is a partial element where both masks are flat. Slope element (S) is a partial element where at least in one partial element a slope is detected.

Flat elements have to be calculated using formula 2.1; slope elements have to be calculated using formula 2.2.
The overlapping area is the sum of all partial elements calculated using formulas 2.1 and 2.2 in the common frequency range at co channel.

2. Net Filter Discrimination – NFD

The Net Filter Discrimination (NFD) expresses the reduction (in dB) of the interference power if the transmitter and receiver frequencies are different.

The NFD value can be determined by measurement or by calculation.

2.1 Method based on measurement

The principle of the measurement method is to plot the test channel receiver input level required for a specified BER (e.g. 10^{-3}) as a function of the signal (carrier) to interference ratio (C/I). The testing arrangement is in Figure 3.

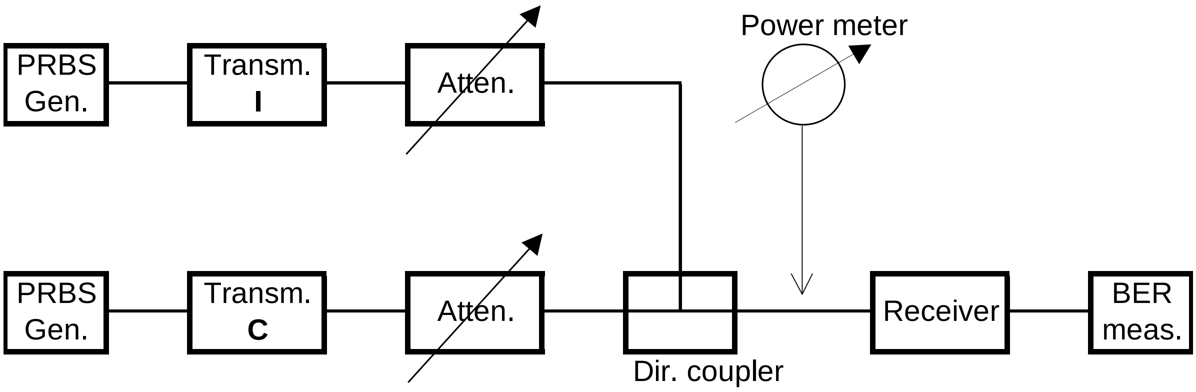


Figure 3

PRBS: Pseudo Random Bitrate Signal

By plotting two curves, one for co-channel interference and the other for the adjacent channel interference, the horizontal shift between them at the specified receiver input level (see Figure 4) is the NFD.

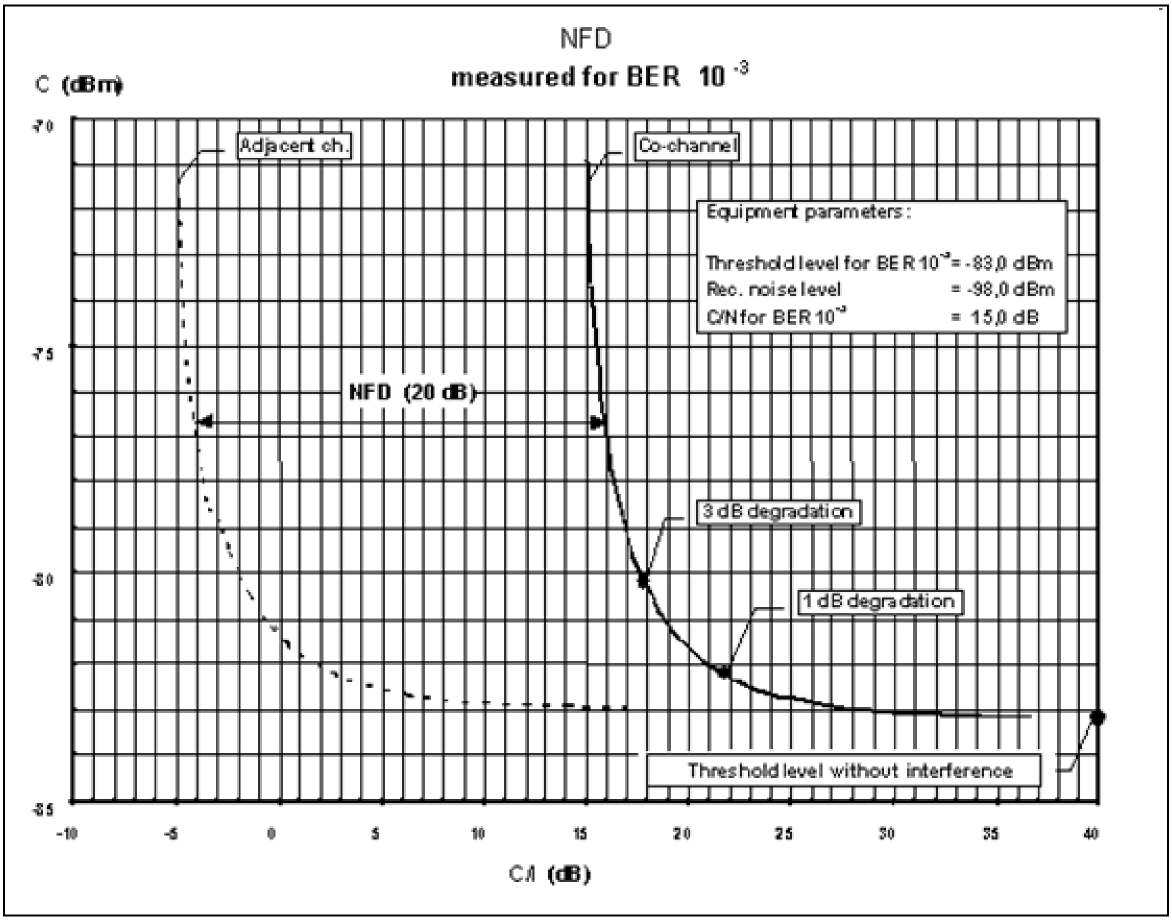


Figure 4

Using the curves, the NFD value can be determined from two points, one on each of the two curves, corresponding to a given carrier level, e.g. for the 3 dB degradation points.

2.2 Method based on calculation

The NFD is defined according to ETSI TR 101 854 as:

NFD = 10 log (Pc/Pa)

Where:
Pc is the total power received after co-channel RF, IF and base band filtering.
Pa is the total power received after offset RF, IF and base band filtering.

For calculation of the power ratio (Pc/Pa) in the common frequency case the overlapping area is considered only.

For the calculation of Pc and Pa the same transmitter power is used and therefore the formula for NFD can be

NFD = 10 log (overlapping area at co-channel / overlapping area at frequency offset)

Pc is calculated taking the overlapping area of TX spectrum density mask and RX selectivity mask at same operational frequency

An example of the overlapping area at co channel between transmitter spectrum density mask and receiver selectivity mask is given in Figure 5.

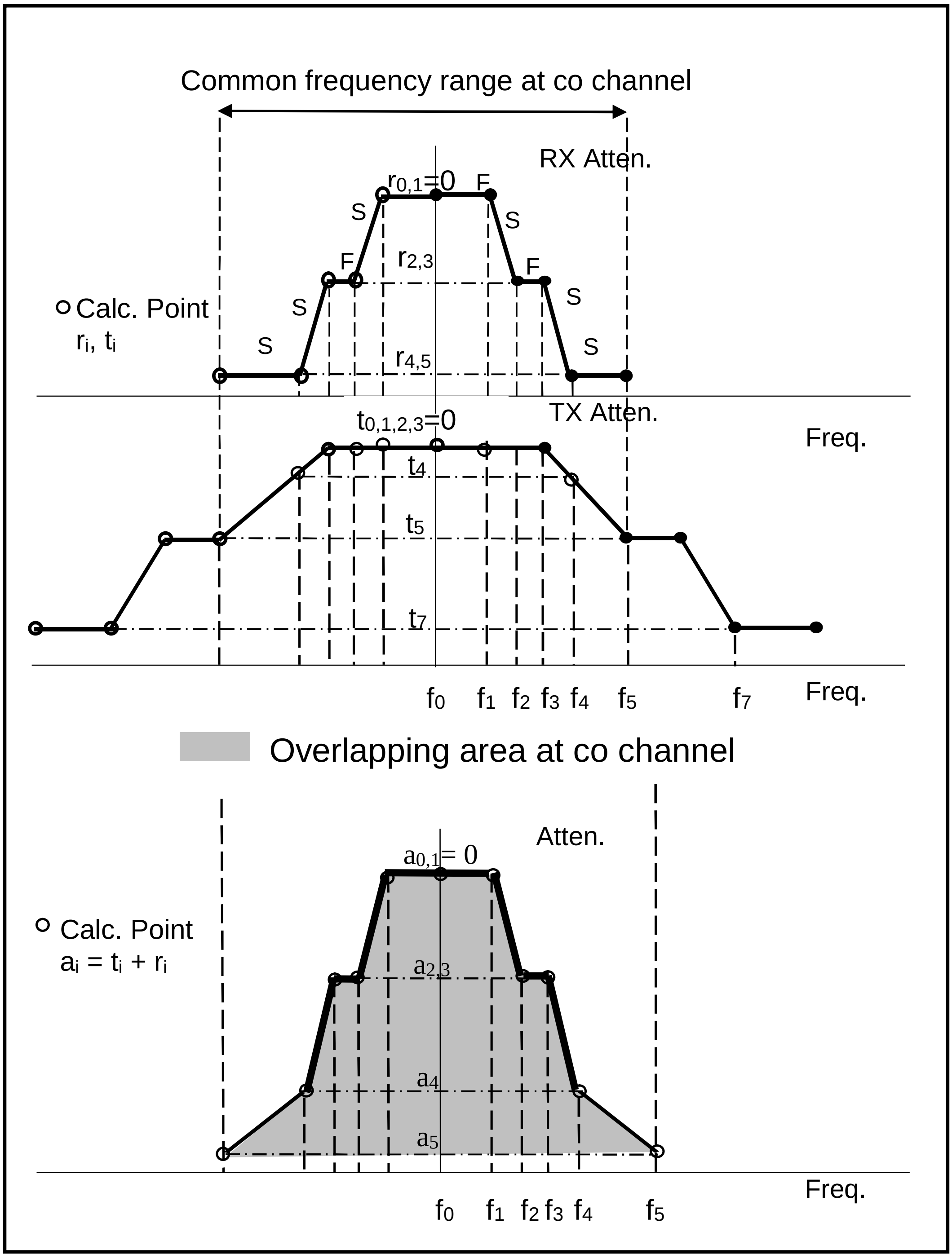


Figure 5

The calculation method is based on integration of the spectrum density of the transmitter spectrum density mask and the receiver selectivity mask in the common frequency range at co channel.

The common frequency range at co channel has to be split into flat and slope partial elements. Flat element (F) is a partial element where both masks are flat, Slope element (S) is an partial element where at least in one partial element a slope is detected.

Flat elements have to be calculated using formula 2.1, slope elements have to be calculated using formula 2.2.

The overlapping area at co channel is the sum of all partial elements calculated using formulas 2.1 and 2.2 in the common frequency range of both masks.

Pa is calculated taking the overlapping area of TX spectrum density mask and RX selectivity mask with the frequency offset:

The common frequency range is the part where both masks are overlapping each other.

An example of the common frequency range at frequency offset between transmitter spectrum density mask and receiver selectivity mask is given in Figure 6.

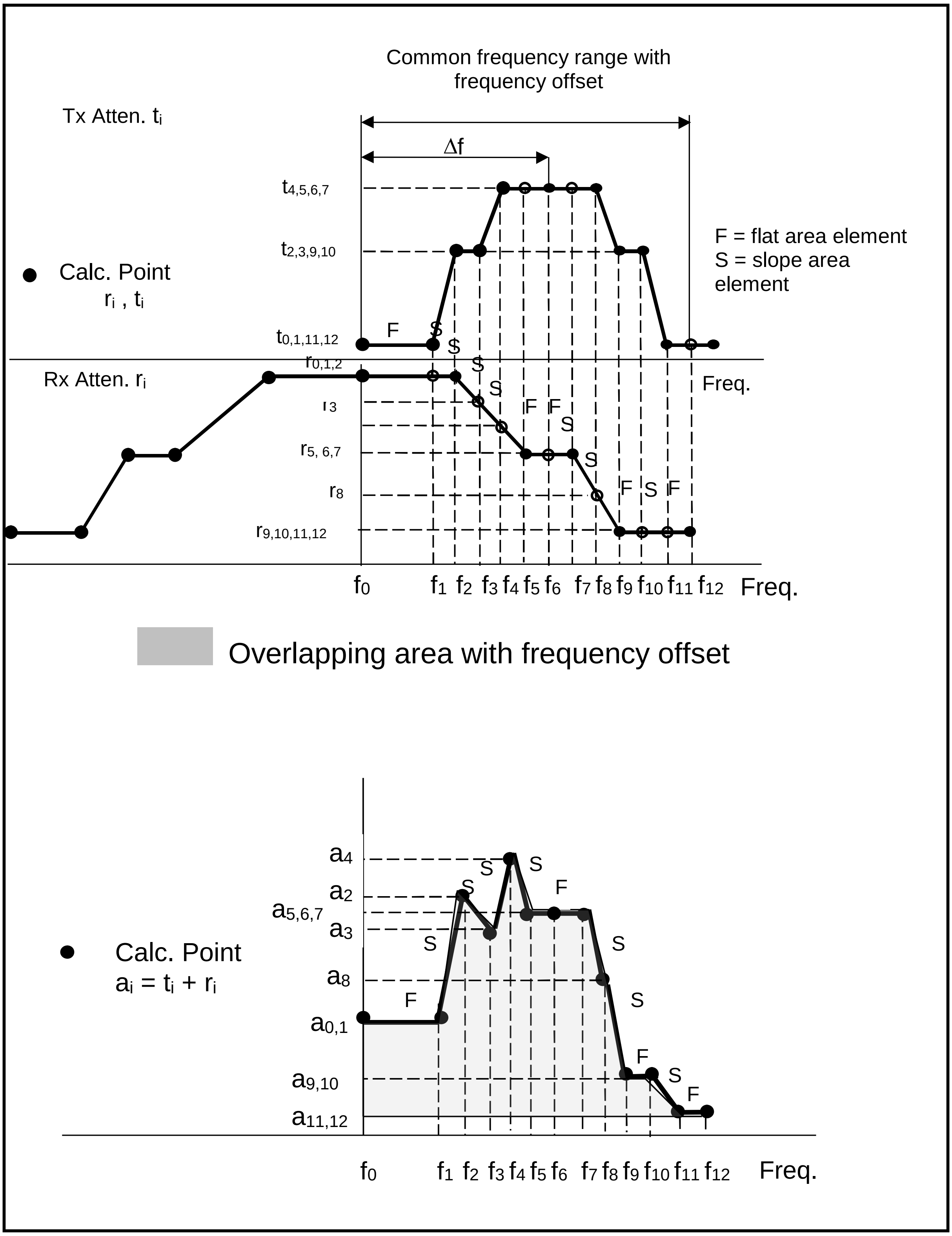


Figure 6

The calculation method is based on integration of the spectrum density of the transmitter spectrum density mask and the receiver selectivity mask in the common frequency range.

The common frequency range has to be split into flat and slope partial elements. Flat element (F) is a partial element where both masks are flat, Slope element (S) is an partial element where at least in one partial element a slope is detected.

Flat elements have to be calculated using formula 2.1, slope elements have to be calculated using formula 2.2.
The overlapping area is the sum of all partial elements calculated using formulas 2.1 and 2.2 in the common frequency range of both masks.

Flat element areas (F) can be calculated according to following formula:

$$F = \left(f_c 10^{\frac{-b}{10}} \right) \qquad (2.1)$$

where:

for the element F

$f_c = f_{i+1} - f_i$ with $f_{i+1} > f_i$ $\qquad b = t_i + r_i = t_{i+1} + r_{i+1}$

where:

b sum of the attenuation of the transmitter (t_i) and receiver (r_i) masks at the beginning or at the end of an element (dB),

f_{i+1} frequency at the end of the element (MHz),
f_i frequency at the beginning of the element (MHz),
f_c bandwidth of the element (MHz),
F partial elements areas under the spectrum masks in the common frequency range.

Slope element areas (S) can be calculated according to following formula:

$$S = \frac{10^{-\frac{b}{10}}}{\frac{\ln(10)}{10} a} \left(1 - 10^{-\frac{a}{10} f_c} \right) \qquad (2.2)^*$$

* only if a is different to 0.

For the element S $\quad a = (t_i + r_i – b)/f_c \qquad f_c = f_{i+1} - f_i$ with $f_{i+1} > f_i \qquad b = t_{i+1} + r_{i+1}$

If the two corresponding elements of the masks represent inverted inclinations, the parameter a may turns to 0. When a=0, the formula (2.1) shall be applied.

where:

b sum of the attenuation of the transmitter (t_i) and receiver (r_i) masks at the end of an element (dB),
t_i transmitter mask attenuation at the beginning of an element (dB),
r_i receiver selectivity mask attenuation at the beginning of the element (dB),
f_i frequency at the beginning of the element (MHz),
f_c bandwidth of the element (MHz),
S partial elements areas under the spectrum masks in the common frequency range.

t_{i+1} transmitter mask attenuation at the end of the element (dB),
r_{i+1} receiver selectivity mask attenuation at the end of the element (dB),
f_{i+1} frequency at the end of the element (MHz),

$$F = \left(f_c 10^{\frac{-b}{10}} \right) \tag{2.1}$$

where:

for the element F $\quad f_c = \left| f_i - f_{i+1} \right| \quad b = t_i + r_i$

where:

b sum of the attenuation of the transmitter (t_i) and receiver (r_i) masks at the beginning of an element (dB),

f_i frequency at the beginning and at the end of the element (MHz),
f_c bandwidth of the element (MHz),
F partial elements areas under the spectrum masks in the common frequency range.

Slope element areas (S) can be calculated according to following formula:

$$S = \frac{10^{-\frac{b}{10}}}{\frac{\ln(10)}{10} a} \left(1 - 10^{-\frac{a}{10} f_c} \right) \tag{2.2}$$

for the element S $\quad a = \frac{t_i - t_{i-1} + r_i - r_{i-1}}{f_c} \quad f_c = \left| f_i - f_{i-1} \right| \quad b = t_{i-1} + r_{i-1}$

where:

b sum of the attenuation of the transmitter and receiver masks at the beginning of an element (dB),
t_i transmitter mask attenuation at the beginning and at the end of an element (dB),
r_i receiver selectivity mask attenuation at the beginning and at the end of the element (dB),
f_i frequency at the beginning and at the end of the element (MHz),
f_c bandwidth of the element (MHz),
S partial elements areas under the spectrum masks in the common frequency range.

3. Necessary data for the calculation of MD and NFD

3.1 Transmitter spectrum density mask

For the calculation, the real spectrum density mask shall be used and described in Paragraph 3.3.1. If this mask is not available, the relevant ETSI transmitter mask shall be used.

3.2 Receiver selectivity mask

For the calculation, the real receiver selectivity mask shall be used and described in Paragraph 3.3.1. If this mask is not available, the relevant ETSI transmitter mask of the accompanying transmitter can be used as receiver selectivity mask.

3.3 Necessary data for the data exchange procedure

3.3.1 Up to six points but at least two points of each, the transmitter spectrum density mask and the receiver selectivity mask, have to be provided (see Figure 7).

- Each point is defined by its frequency (MHz) and its attenuation (dB).
- The centre frequency is automatically considered and therefore is not a part of the data exchange procedure.
- The last point must be set for the attenuation of ≥ 40 dB.
- If the last point is closer than 2.5 channel spacing, the program will create a point at 2.5 channel spacing with the same attenuation as the last point.
- From the last point to 3.5 channel spacing 5 dB slope shall be taken into account by the program in case, that the last point is closer than 3.5 channel spacing.

Fehler! Es ist nicht möglich, durch die Bearbeitung von Feldfunktionen Objekte zu erstellen.

1 unit in Figure 7 corresponds to half of channel size.

Figure 7

Annex 4

Propagation curves in the Land Mobile Service

Based on Recommendation ITU-R P.1546-5 (09/2013)

The interfering field strength is determined at the receiving site by means of the following propagation curves, which have been taken from Recommendation ITU-R P.1546[1]. The curves represent the interfering field strength values for 50 % of the locations and for 50 %, 10 % and 1 % of the time for different propagation paths and for a receiving antenna height h_2 of 10 m. Exceptionally the curves for land propagation for 2000 MHz (Figure 17 to 19) are derived from the 600 MHz curves under consideration of a special steepness factor with the provision to approach to results from measurements.

The curves are given for values of h_1 of 10, 20, 37.5, 75, 150, 300, 600 and 1200 m.

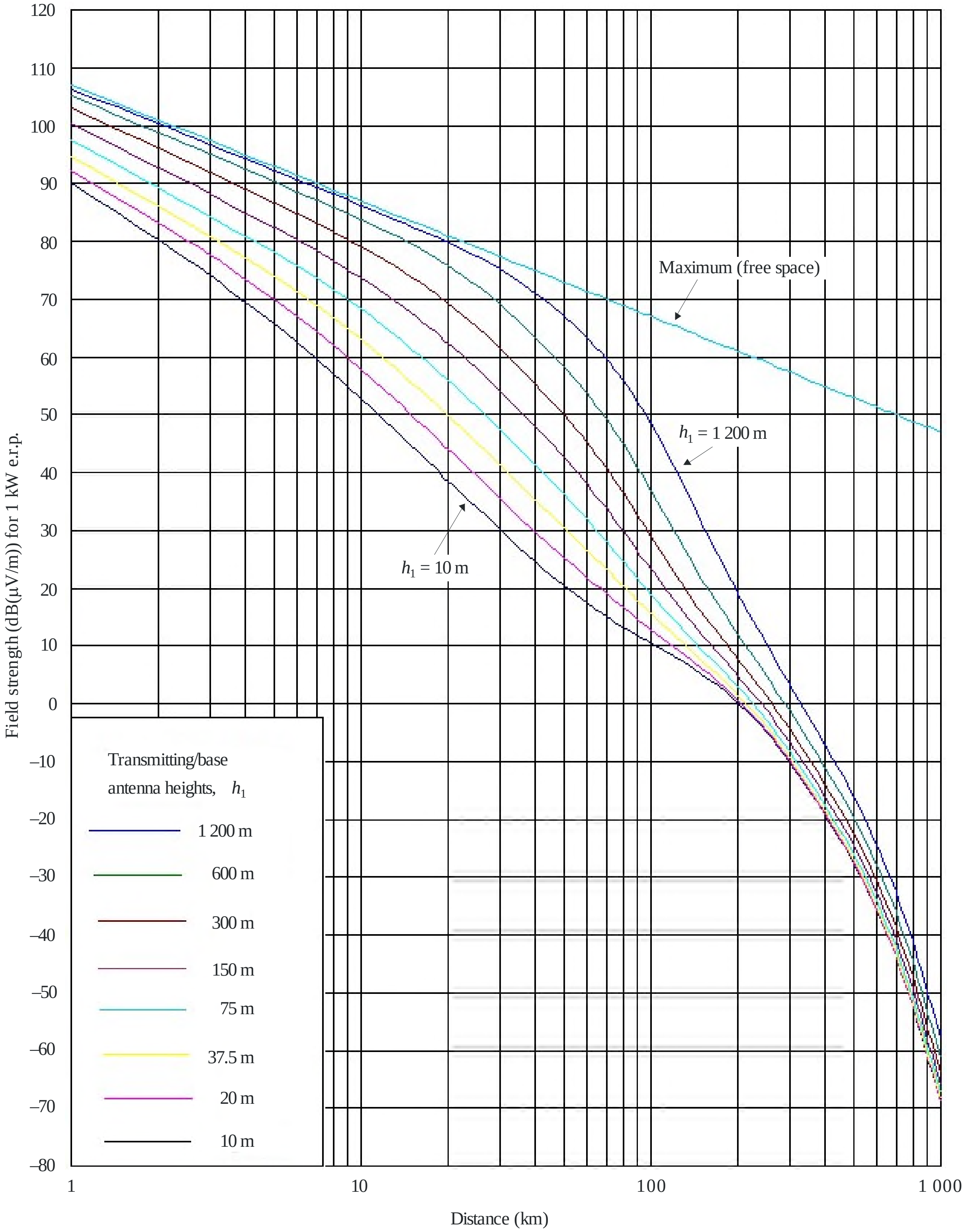
The curves for 50 % of time probability shall be used only to establish the relation between measured values and calculations (see Annex 7 of the Agreement).

The propagation curves for the frequency 100 MHz (FIGURES 1 to 8) shall be applied if frequencies between 29.7 and 300 MHz are concerned; the propagation curves for the frequency 600 MHz (FIGURES 9 to 16) shall be applied if frequencies between 300 and 1000 MHz are concerned; and the propagation curves for the frequency 2000 MHz (FIGURES 17 to 24) shall be applied for frequencies above 1000 MHz.

[1] Exceptionally the curves for 2000 MHz land paths (Fig. 17-19) were taken from document SWG-MS(2012)-21.

FIGURE 1

100 MHz, land path, 50% time



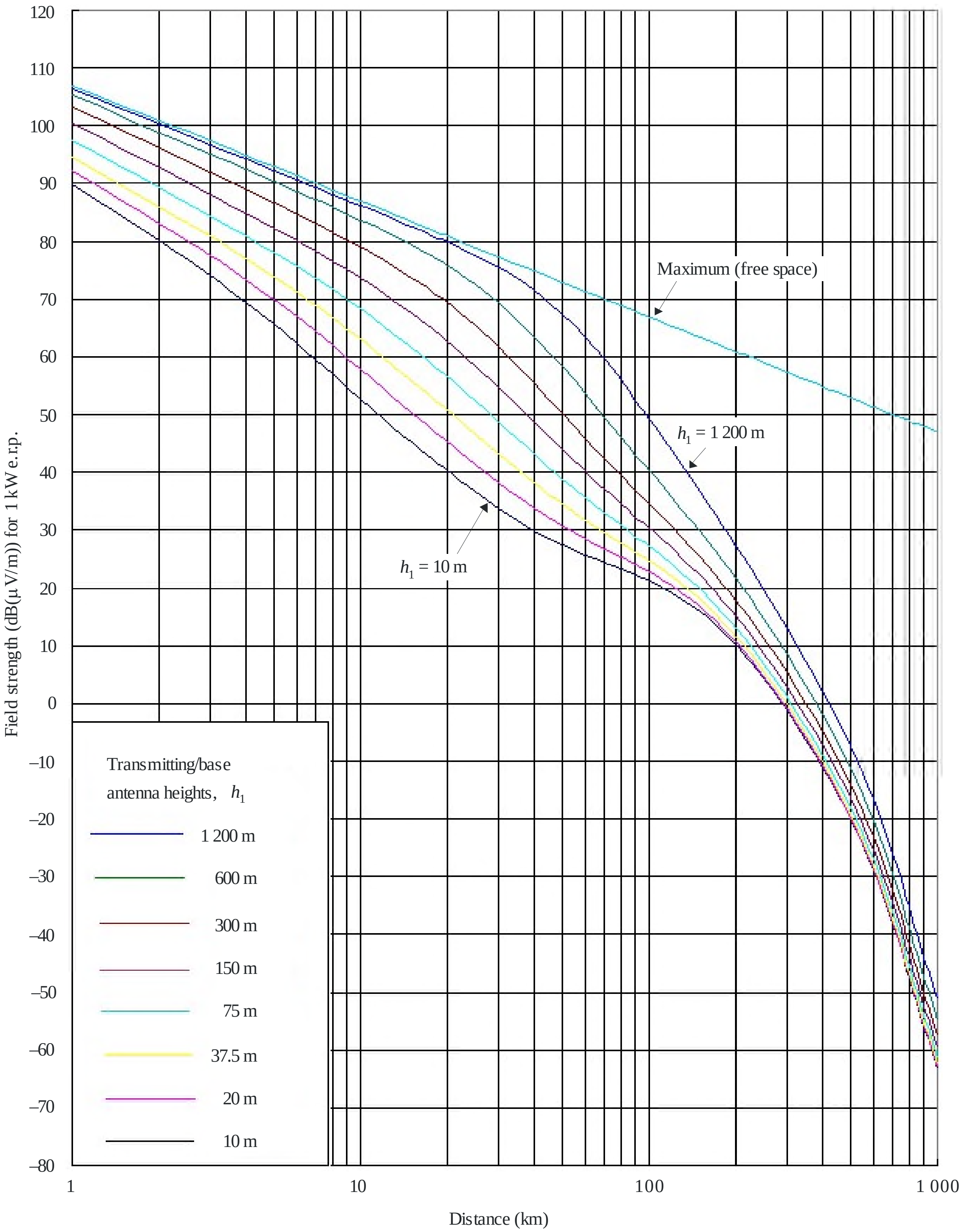
50% of locations

h_2: representative clutter height

P.1546-01

FIGURE 2

100 MHz, land path, 10% time



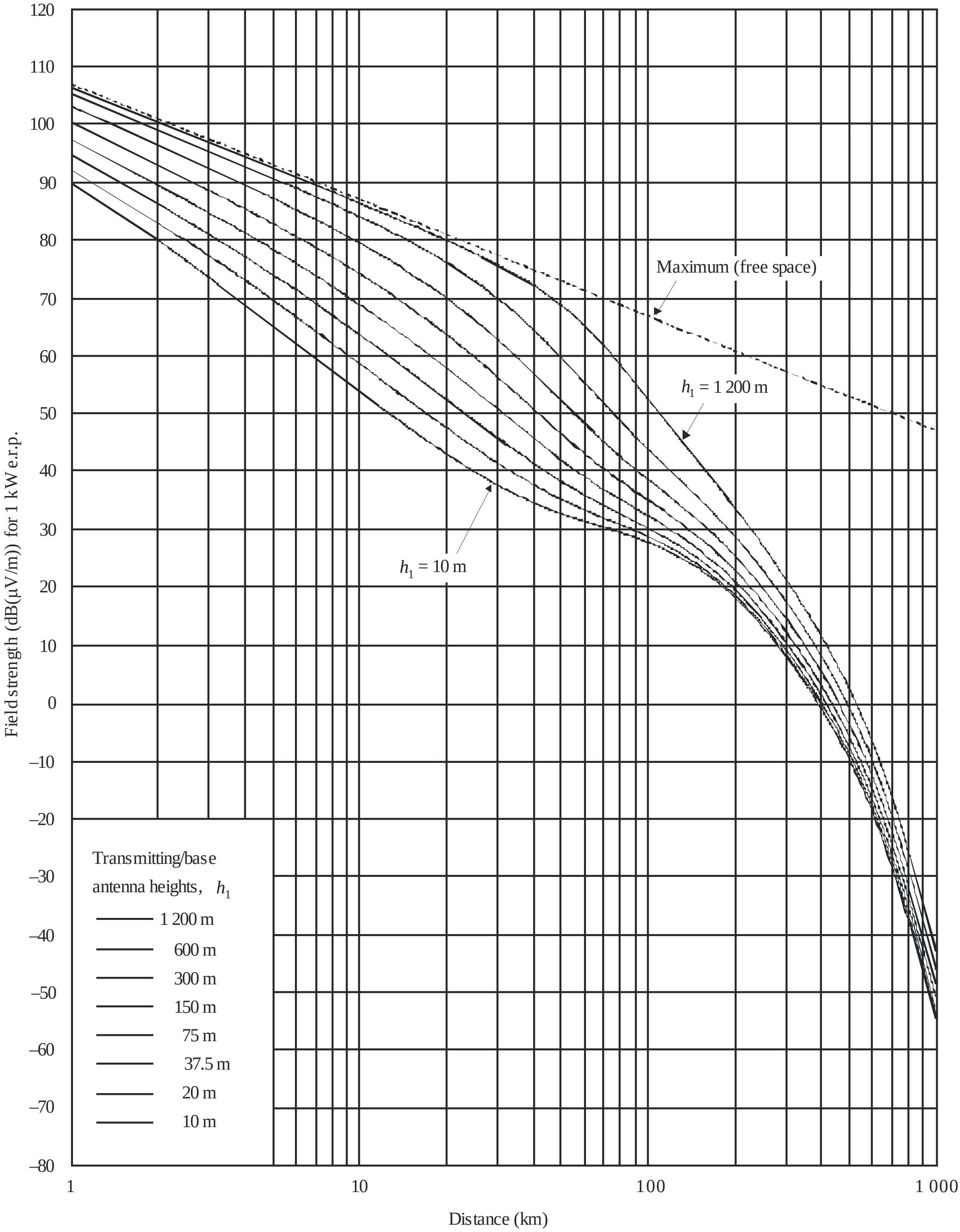
50% of locations

h_2: representative clutter height

P.1546-02

FIGURE 3

100 MHz, land path, 1% time



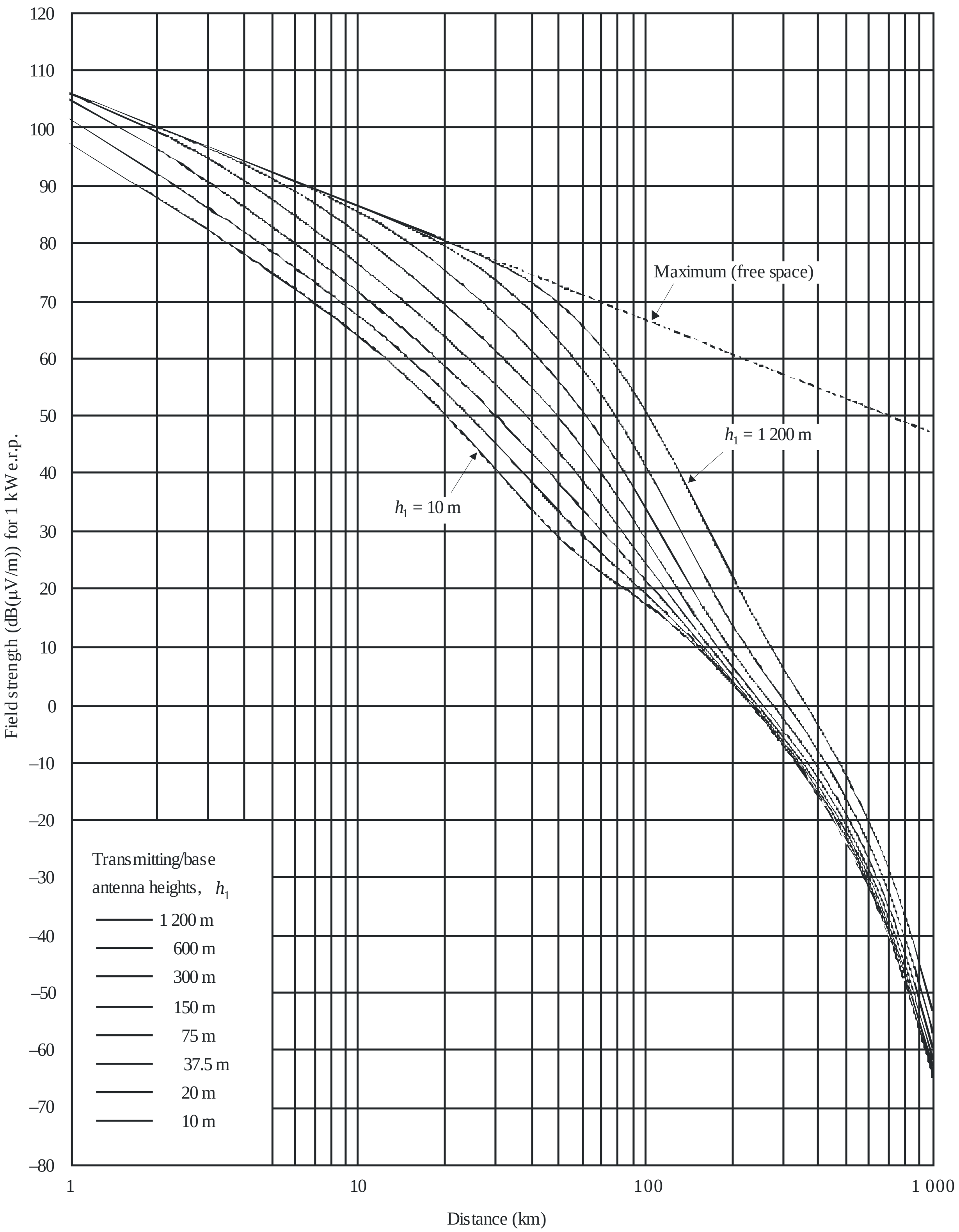
50% of locations

h_2: representative clutter height

P.1546-03

FIGURE 4

100 MHz, sea path, 50% time



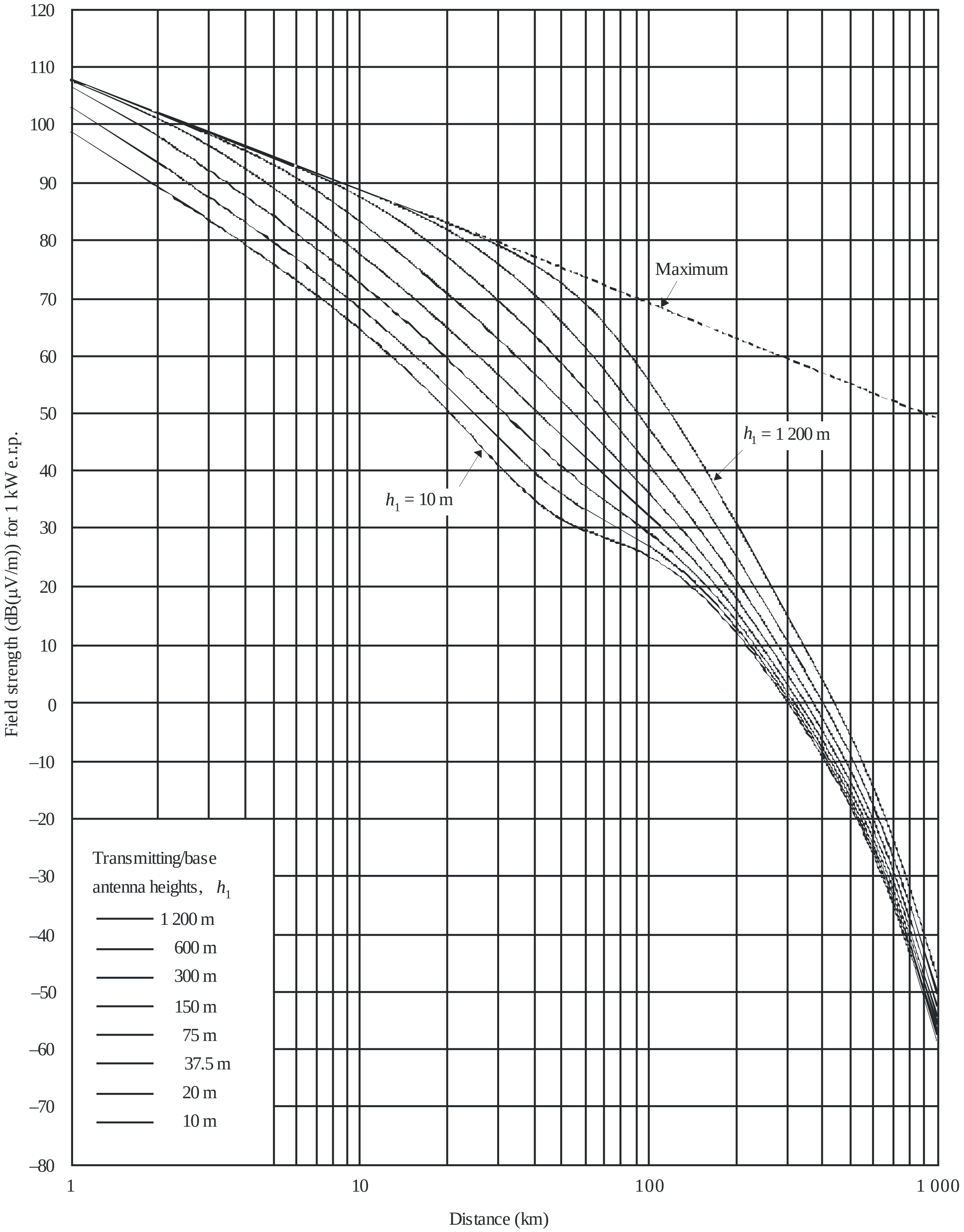
50% of locations

h_2 = 10 m

P.1546-04

FIGURE 5

100 MHz, cold sea path, 10% time



50% of locations

h_2 = 10 m

P.1546-05

FIGURE 6

100 MHz, cold sea path, 1% time

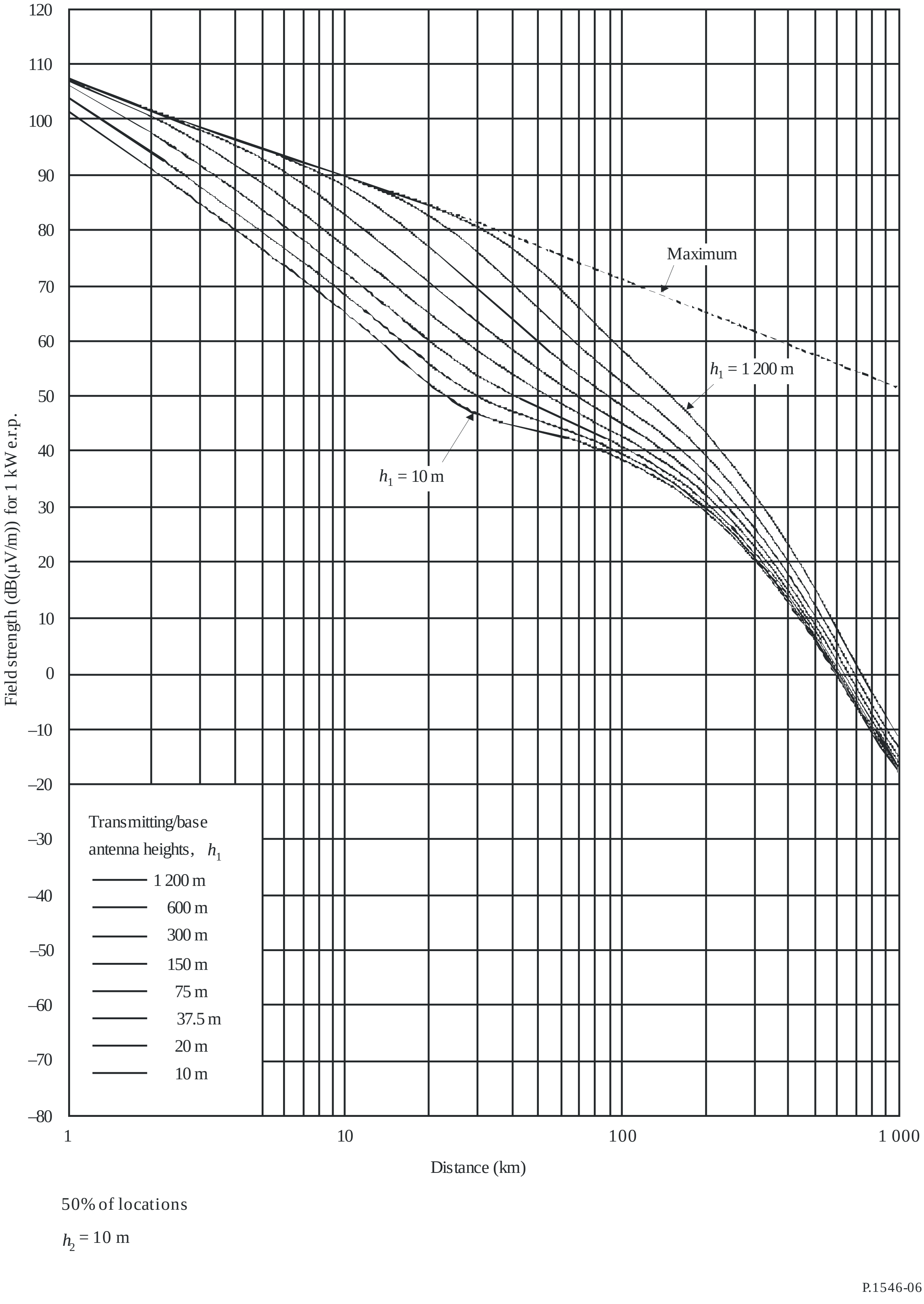
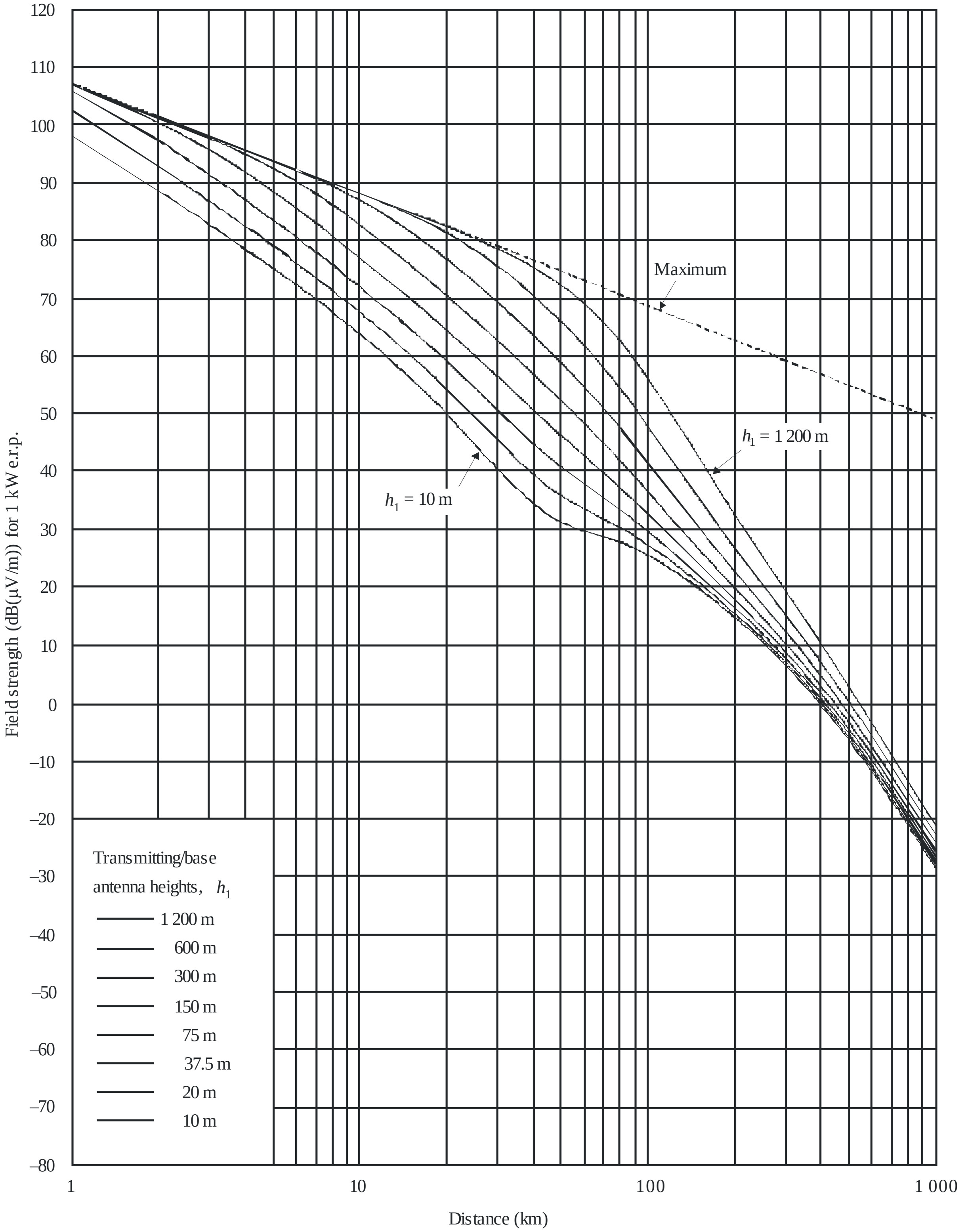


FIGURE 7

100 MHz, warm sea path, 10% time



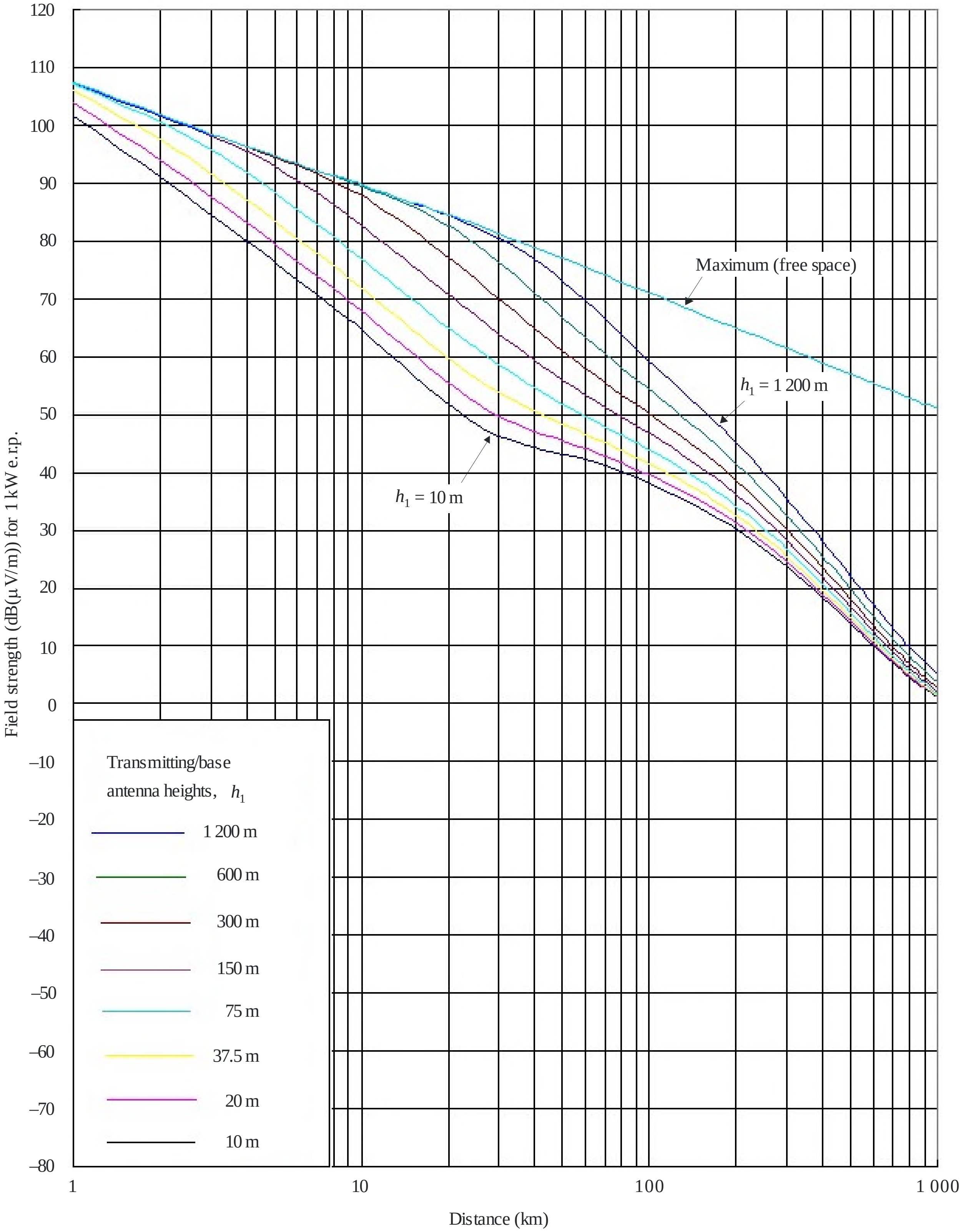
50% of locations

h_2 = 10 m

P.1546-07

FIGURE 8

100 MHz, warm sea path, 1% time



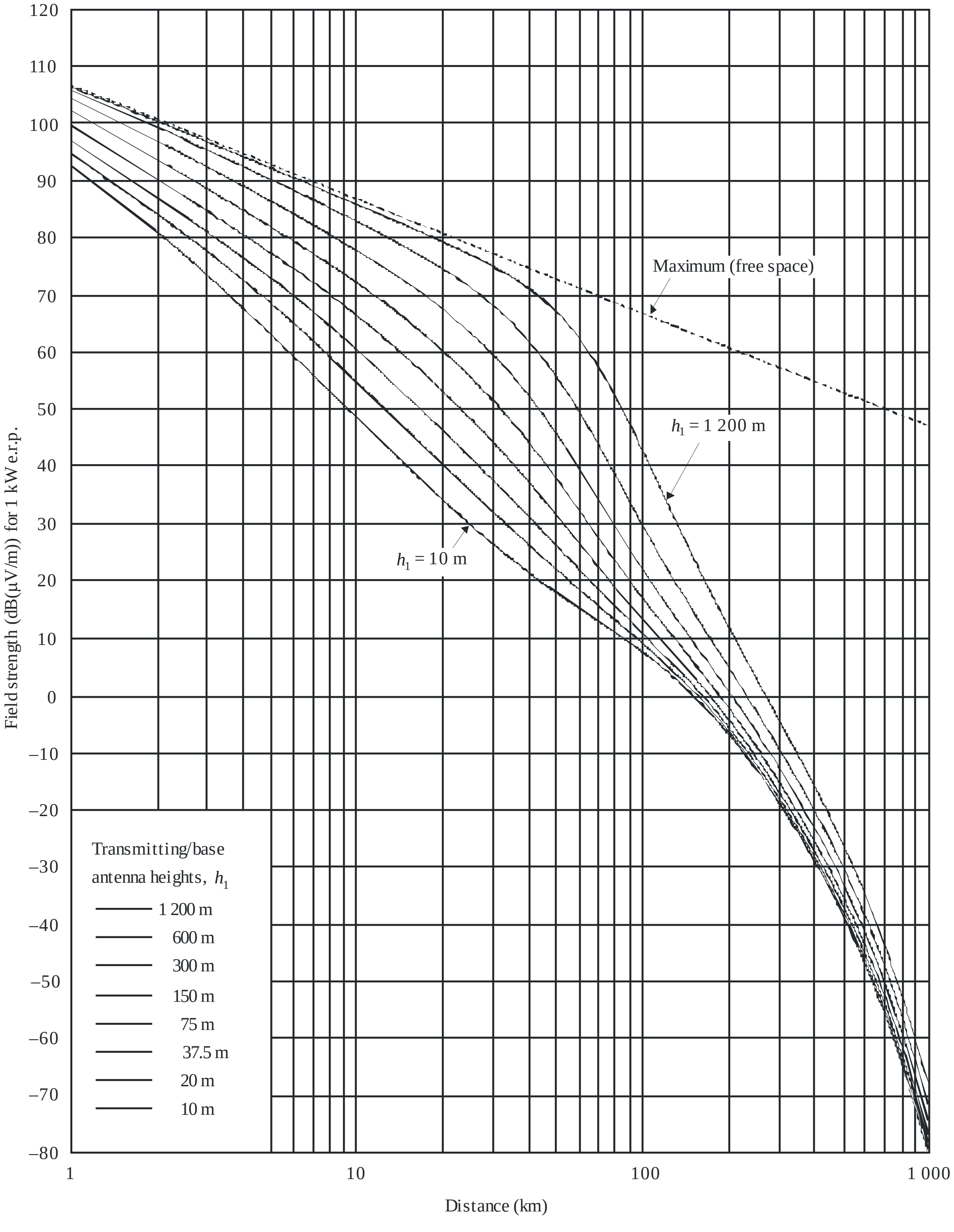
50% of locations

h_2 = 10 m

P.1546-08

FIGURE 9

600 MHz, land path, 50% time



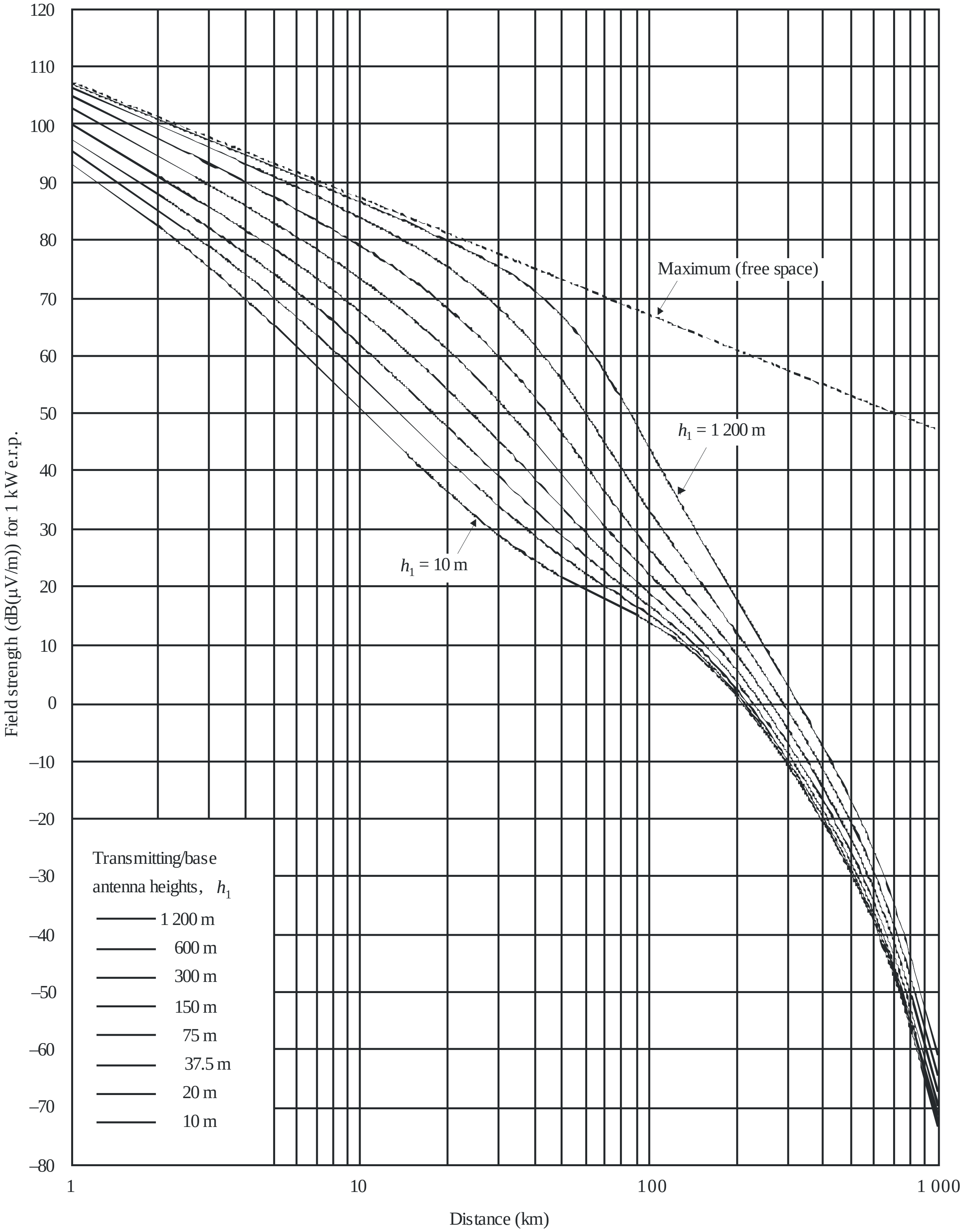
50% of locations

h_2: representative clutter height

P.1546-09

FIGURE 10

600 MHz, land path, 10% time



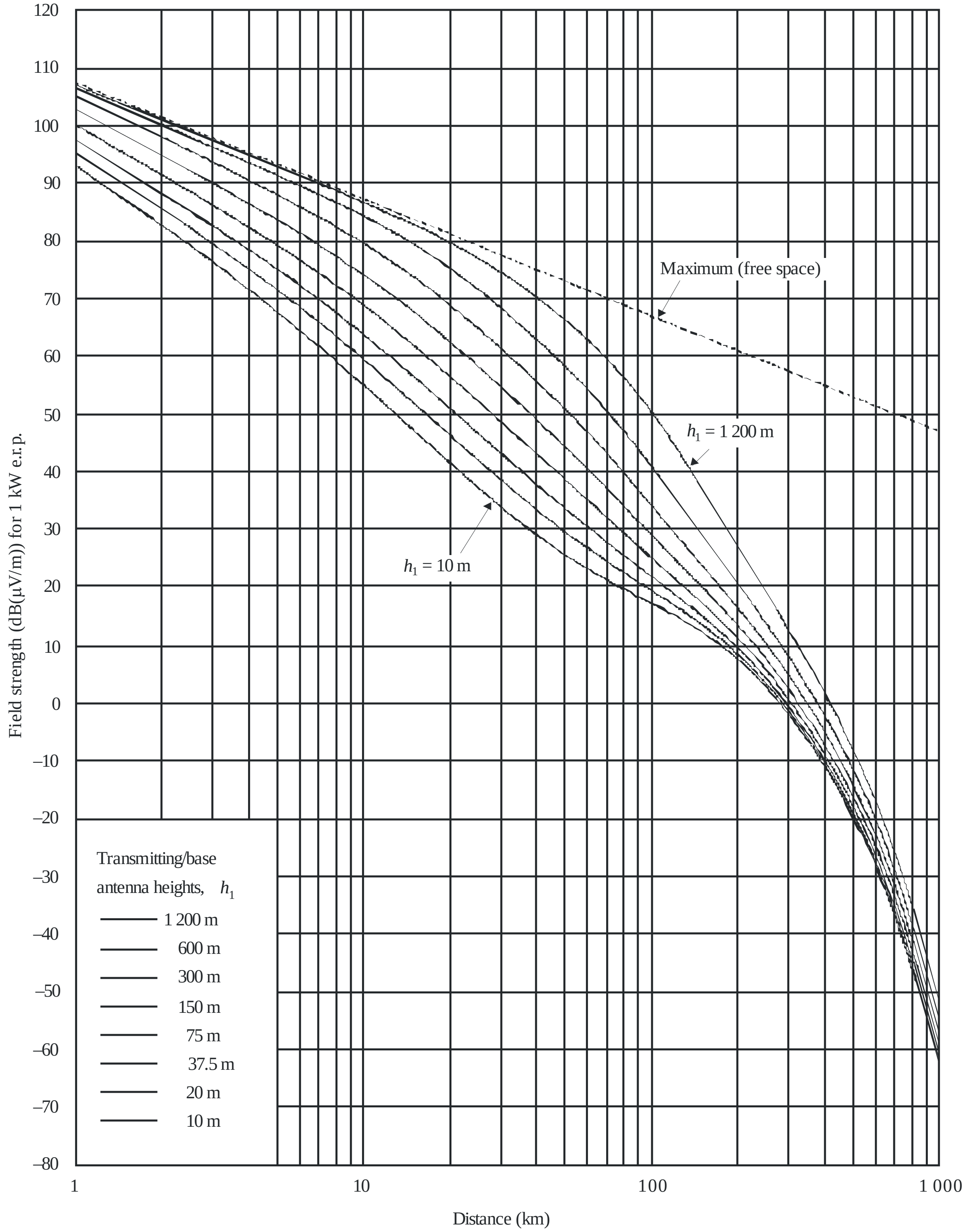
50% of locations

h_2: representative clutter height

P.1546-10

FIGURE 11

600 MHz, land path, 1% time



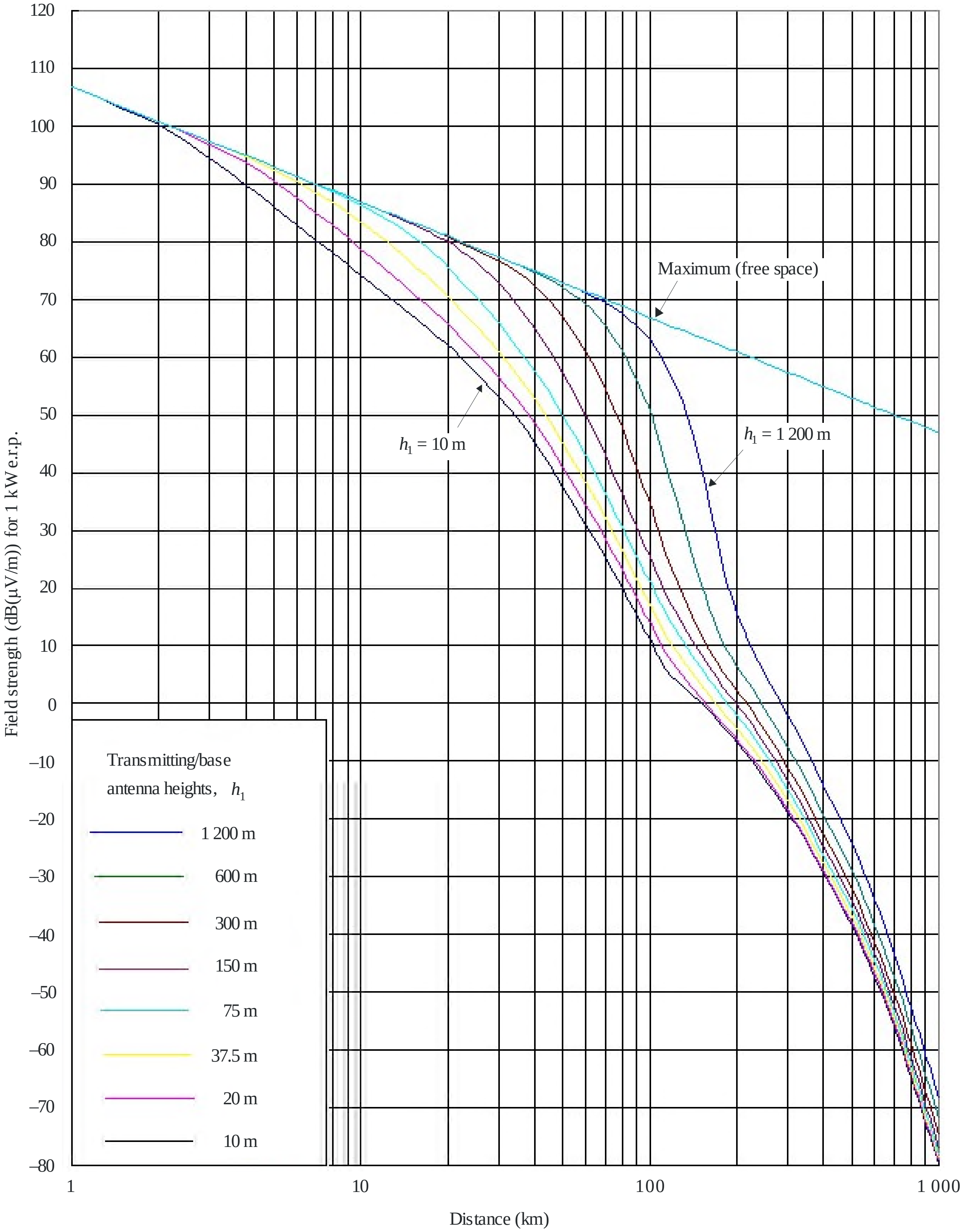
50% of locations

h_2: representative clutter height

P.1546-11

FIGURE 12

600 MHz, sea path, 50% time



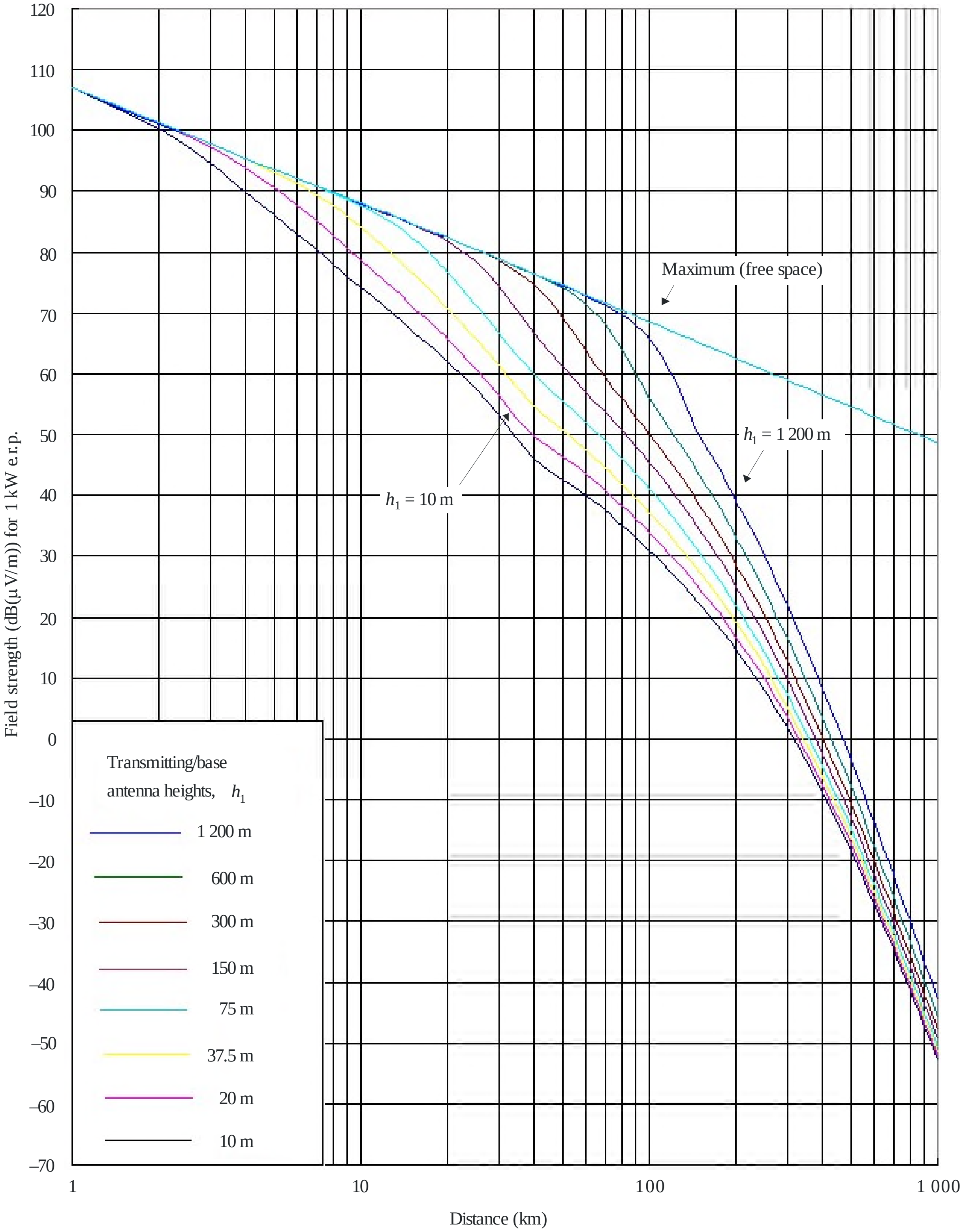
50% of locations

h_2 = 10 m

P.1546-12

FIGURE 13

600 MHz, cold sea path, 10% time



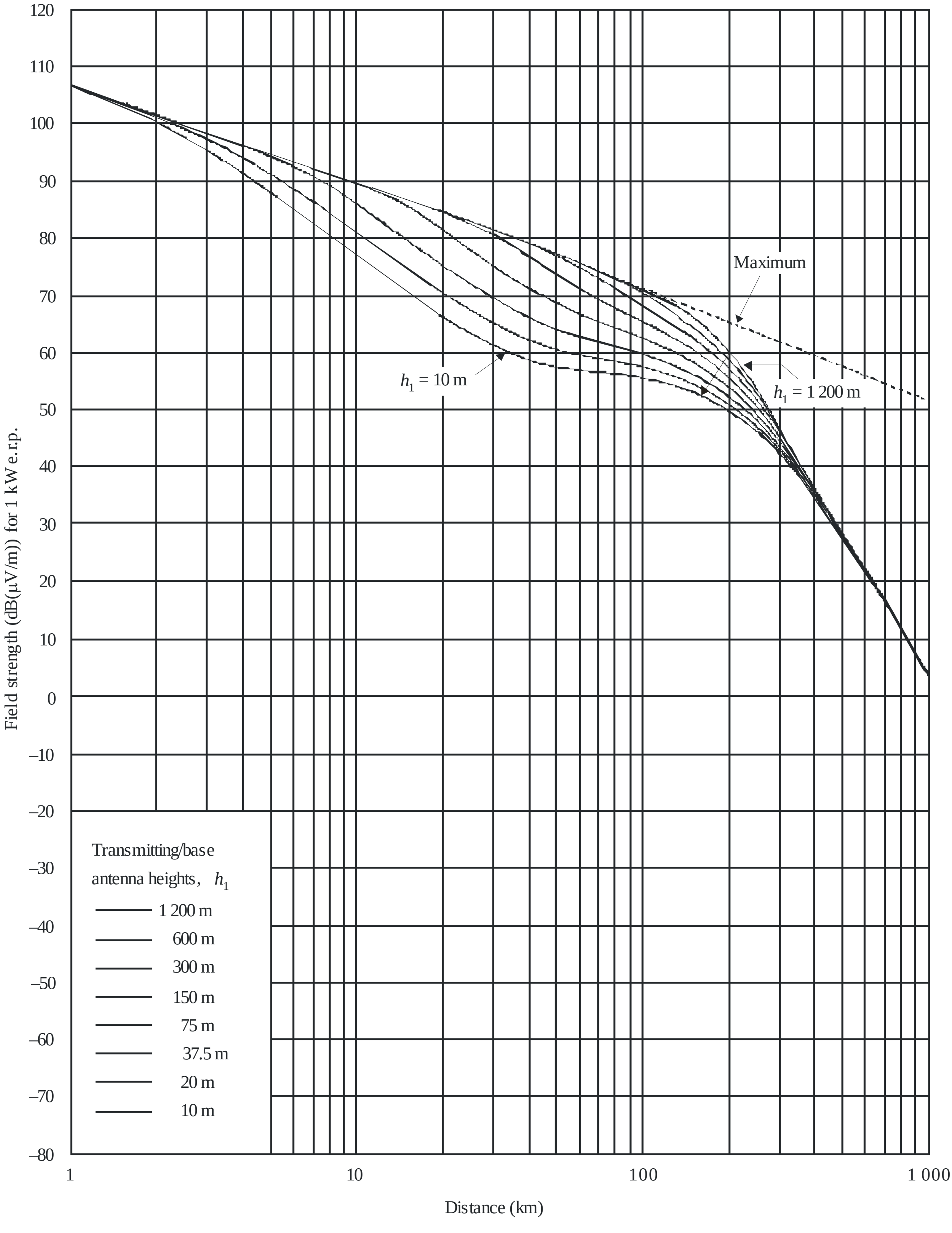
50% of locations

h_2 = 10 m

P.1546-13

FIGURE 14

600 MHz, cold sea path, 1% time



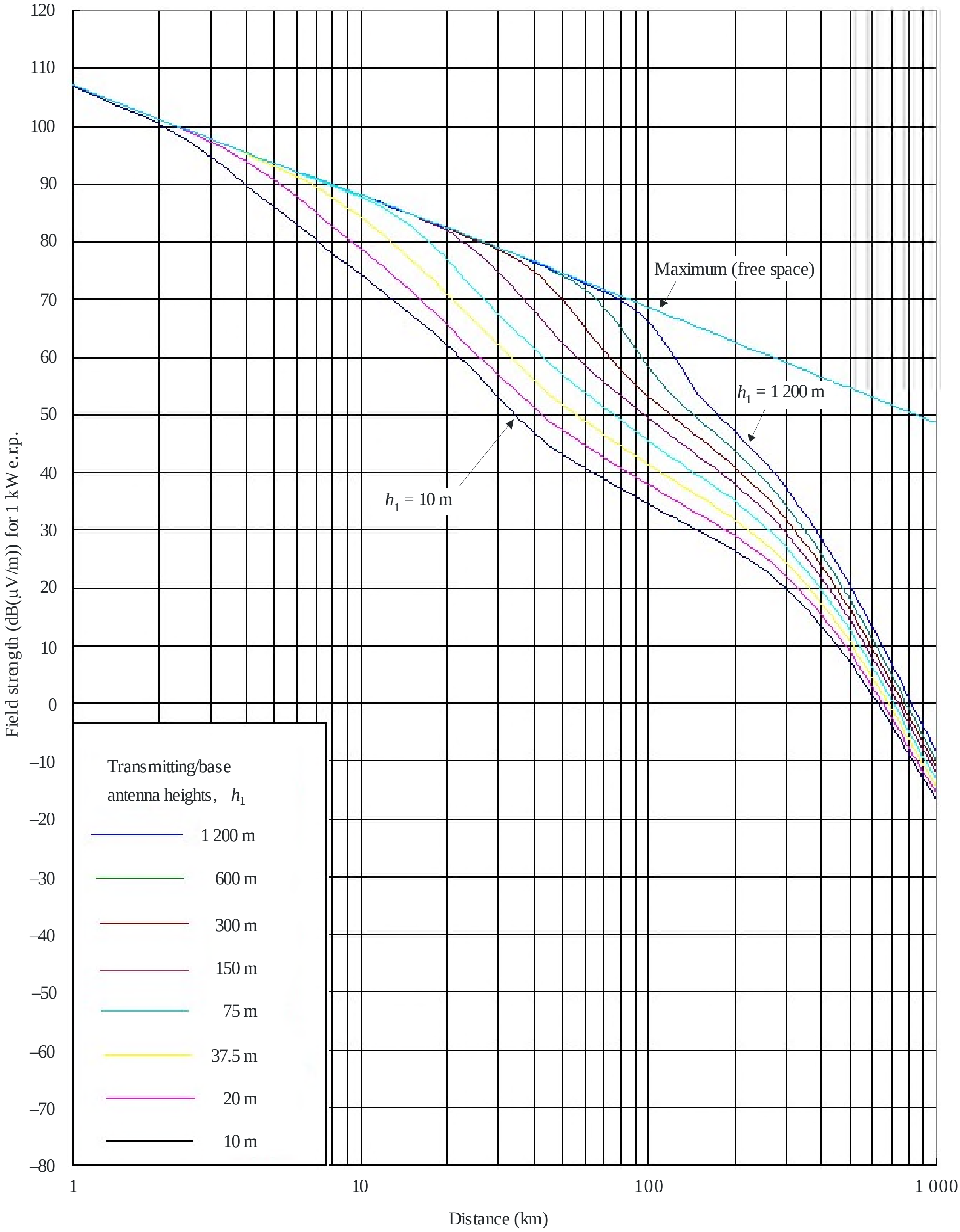
50% of locations

h_2 = 10 m

P.1546-14

FIGURE 15

600 MHz, warm sea path, 10% time



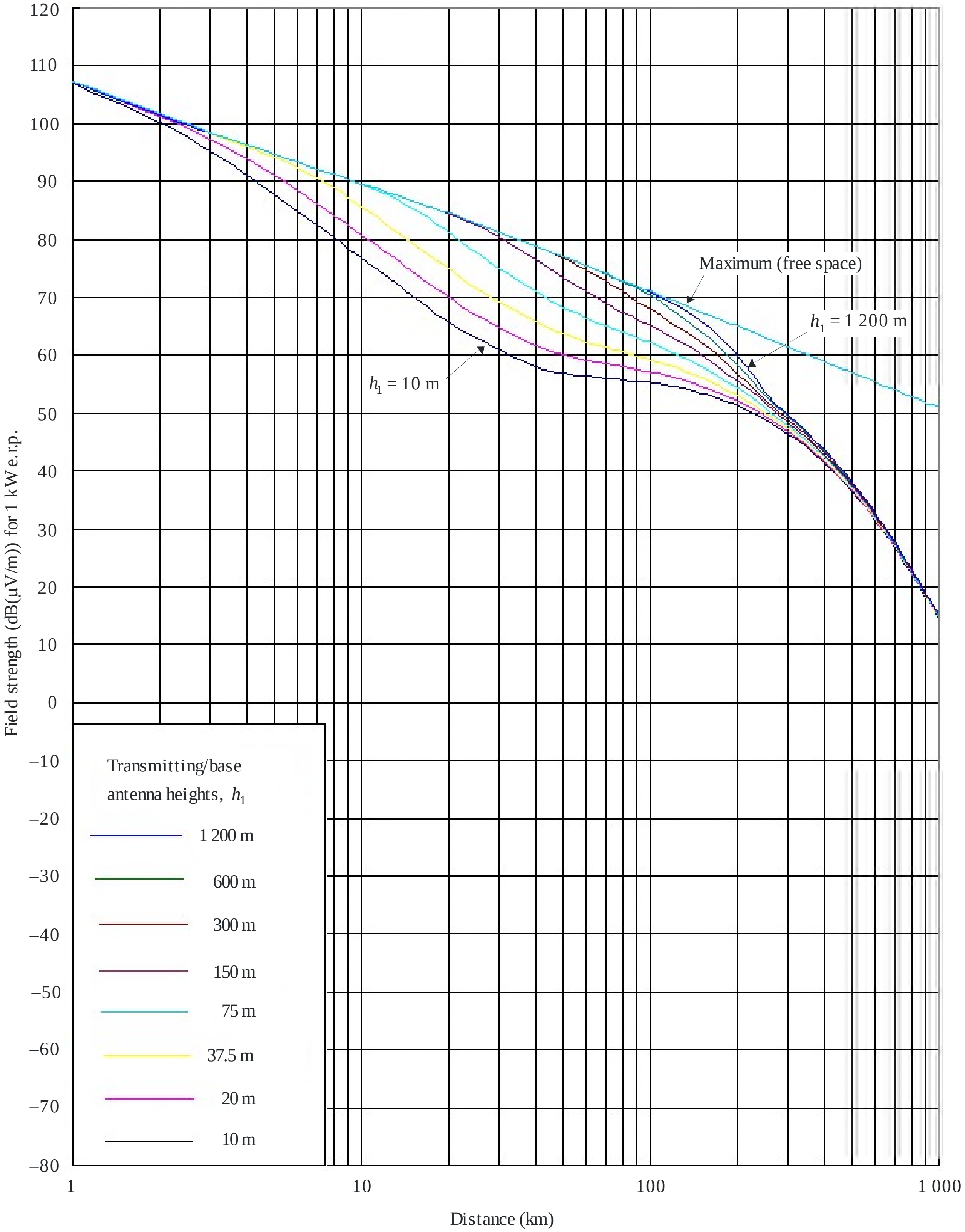
50% of locations

h_2 = 10 m

P.1546-15

FIGURE 16

600 MHz, warm sea path, 1% time



50% of locations

h_2 = 10 m

P.1546-16

Figure 17
2000 MHz, land, 50% time

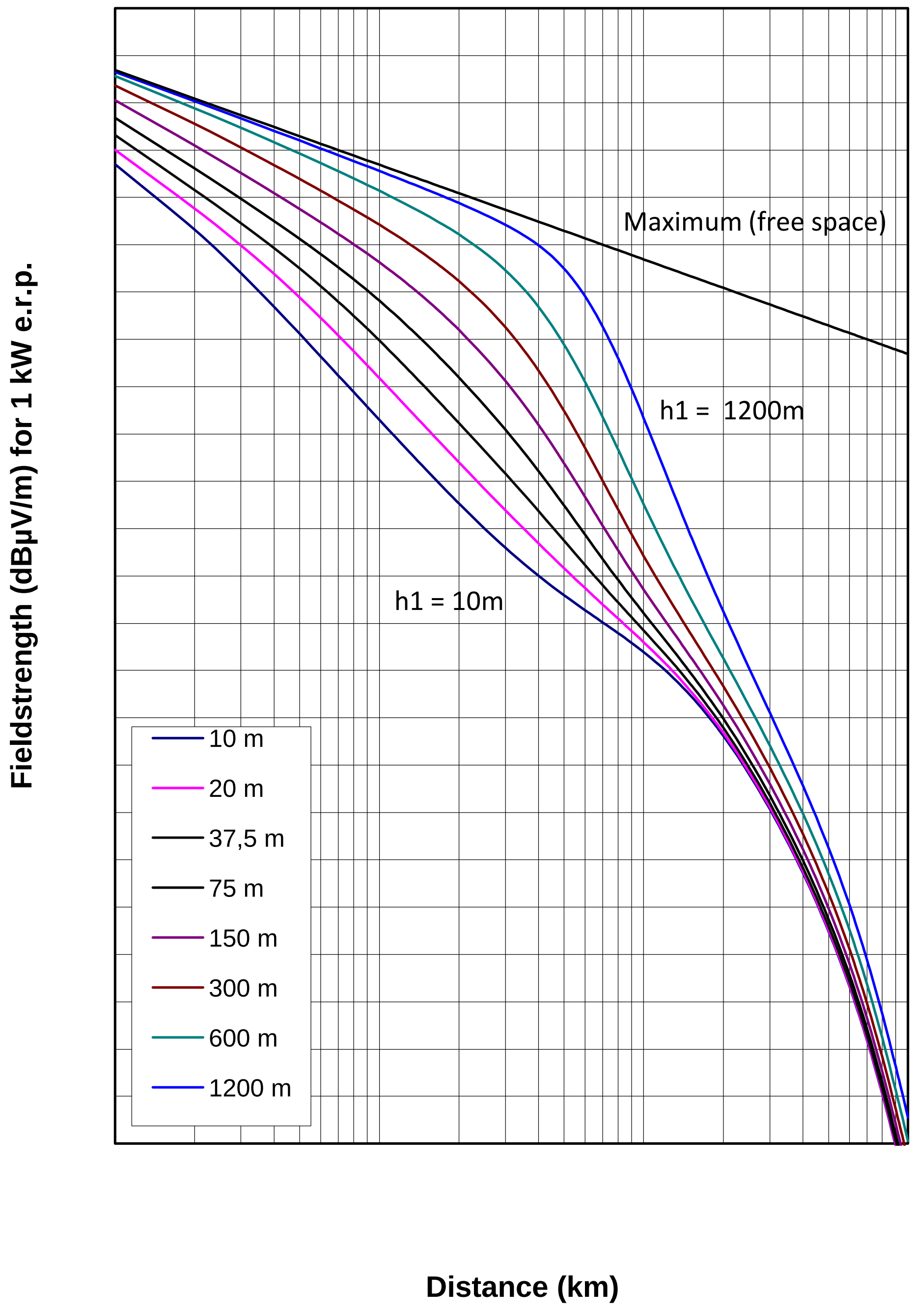


Figure 18
2000 MHz, land, 10% time

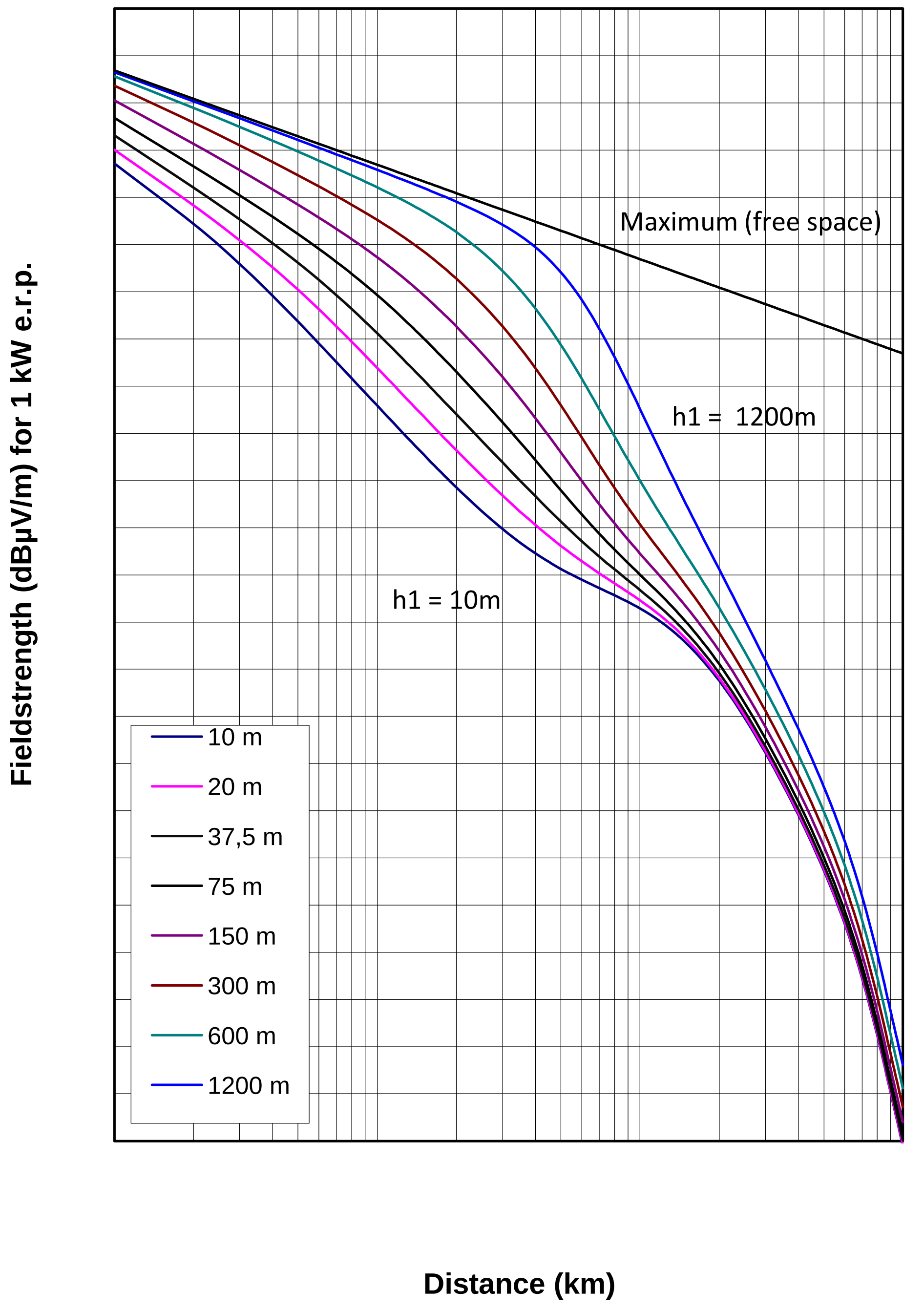


Figure 19
2000 MHz, land, 1% time

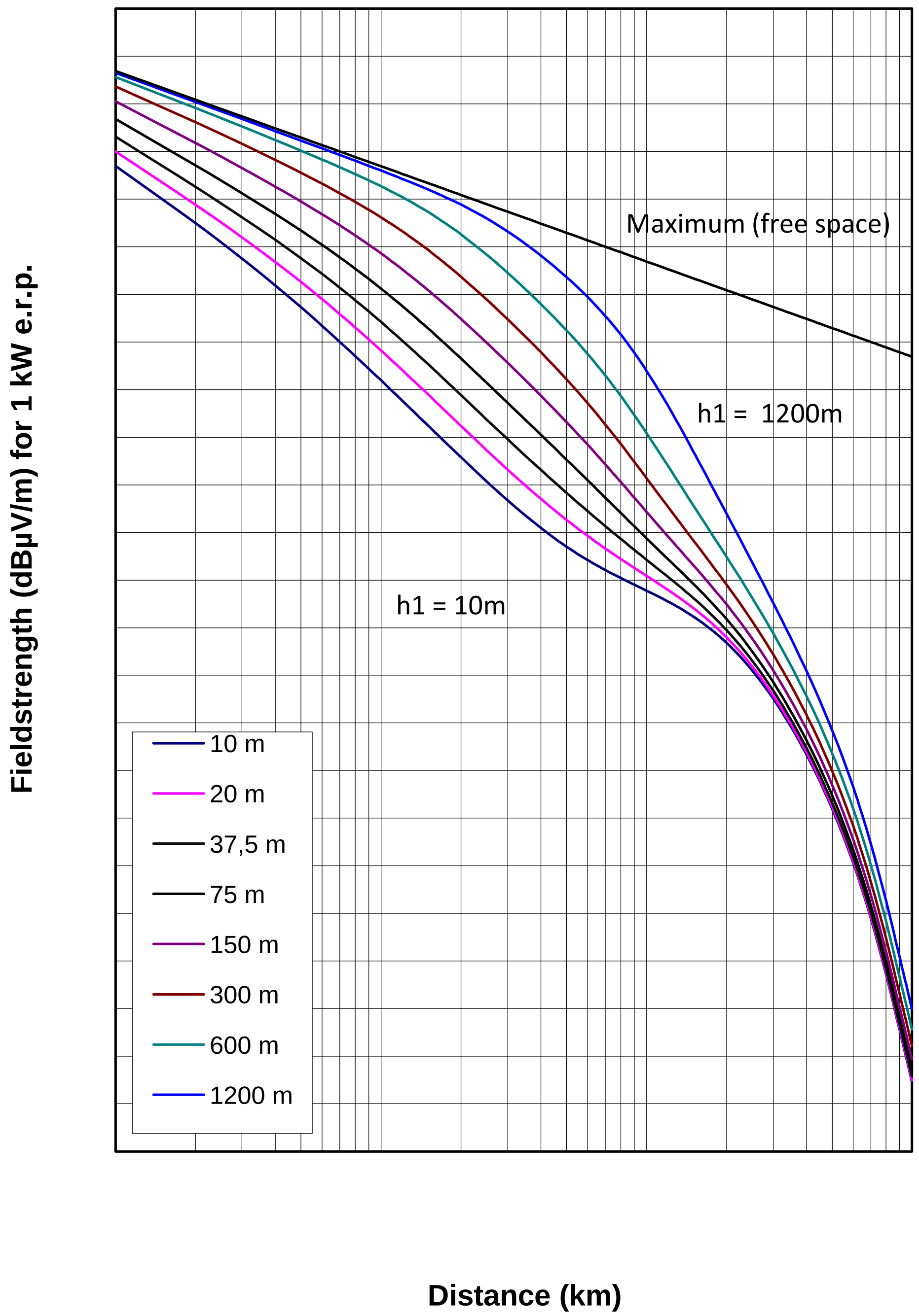
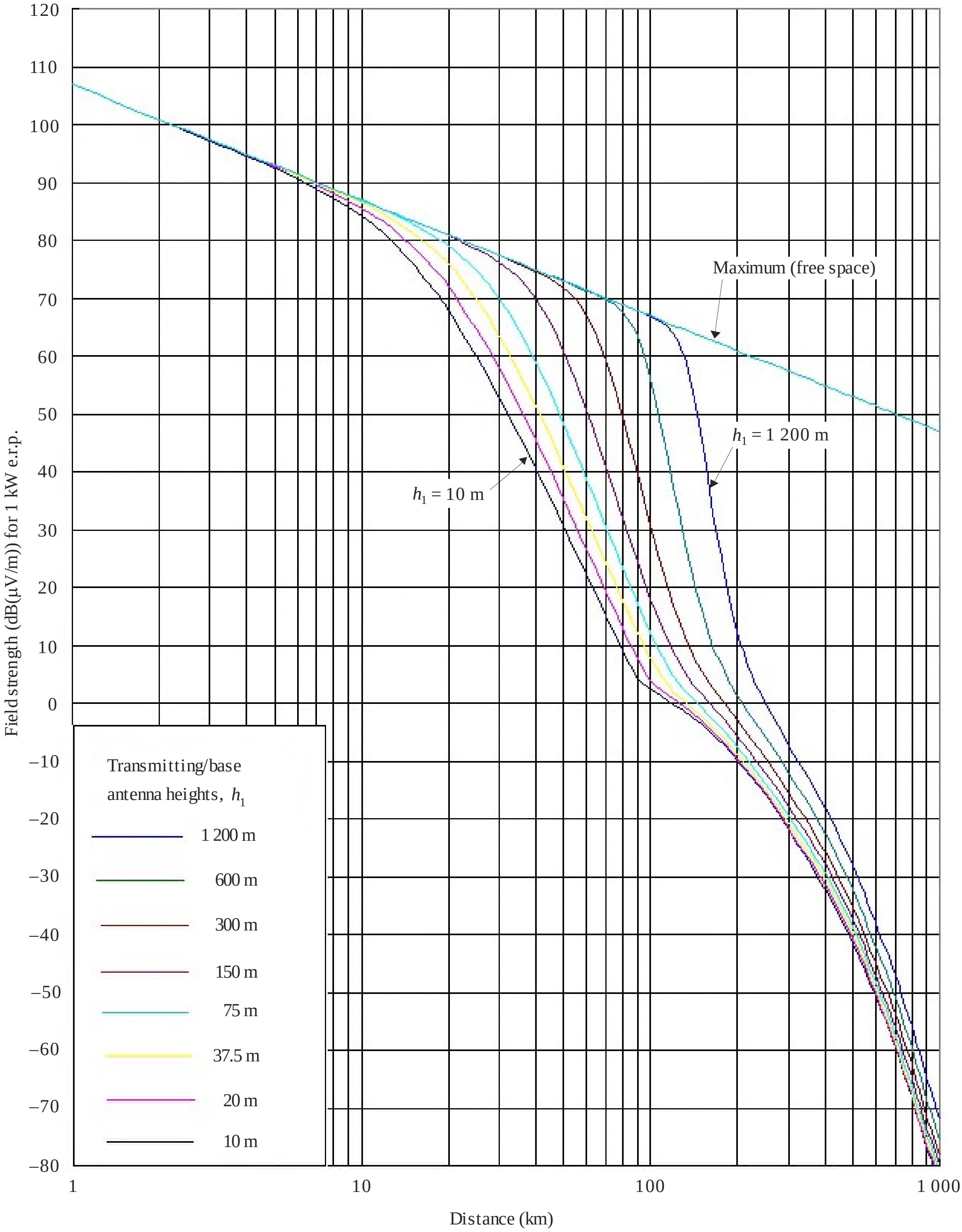


FIGURE 20

2 000 MHz, sea path, 50% time



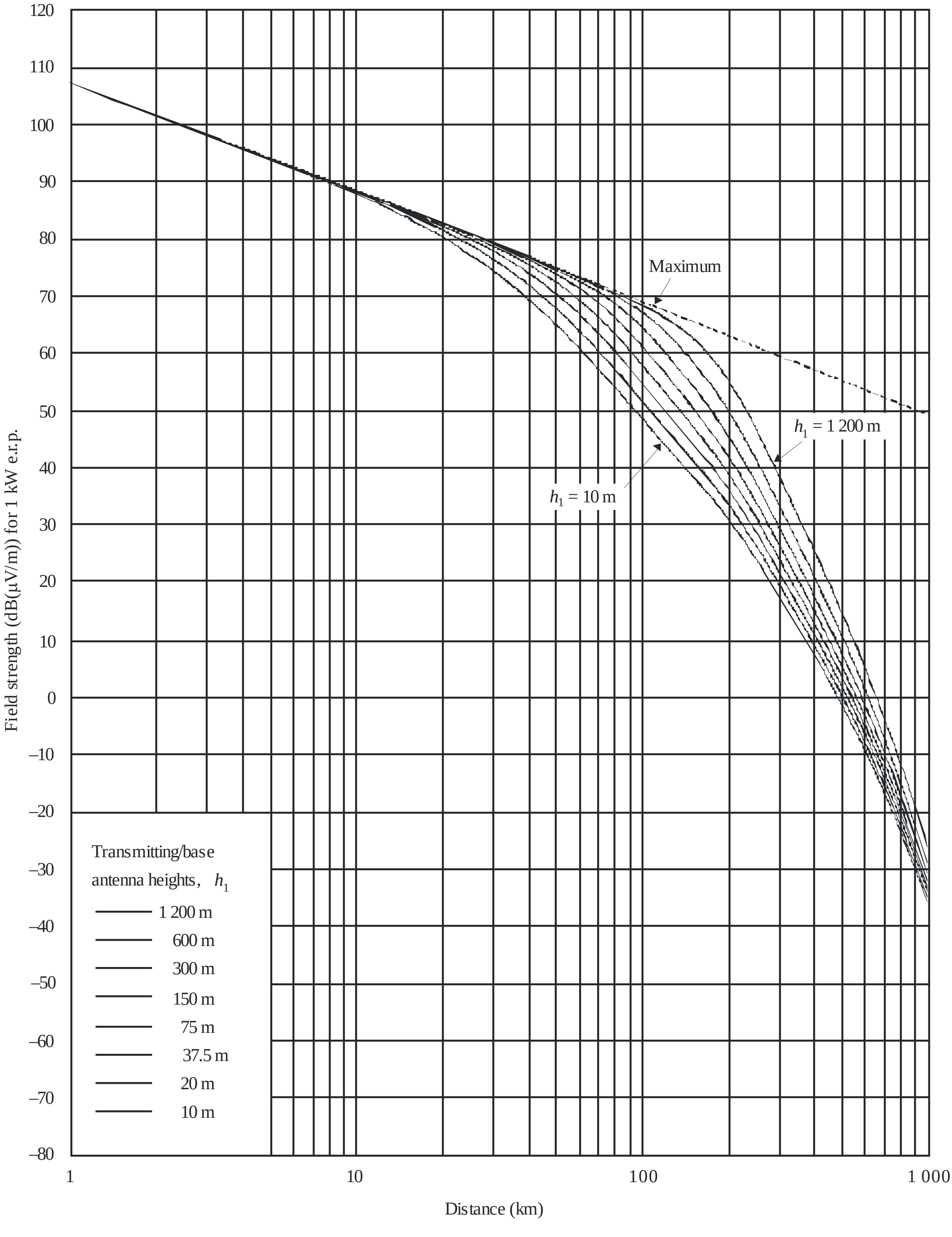
50% of locations

h_2 = 10 m

P.1546-20

FIGURE 21

2 000 MHz, cold sea path, 10% time



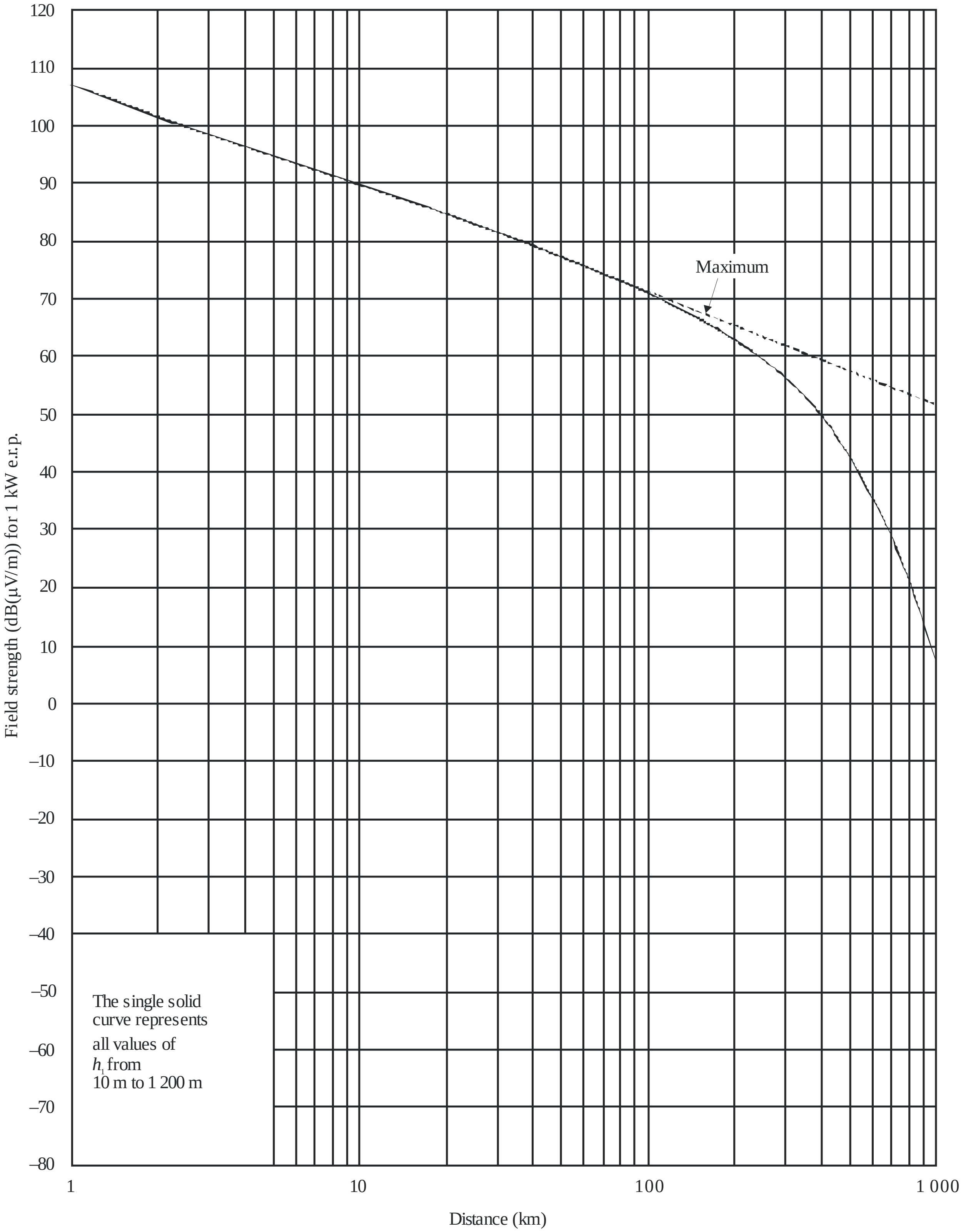
50% of locations

h_2 = 10 m

P.1546-21

FIGURE 22

2 000 MHz, cold sea path, 1% time



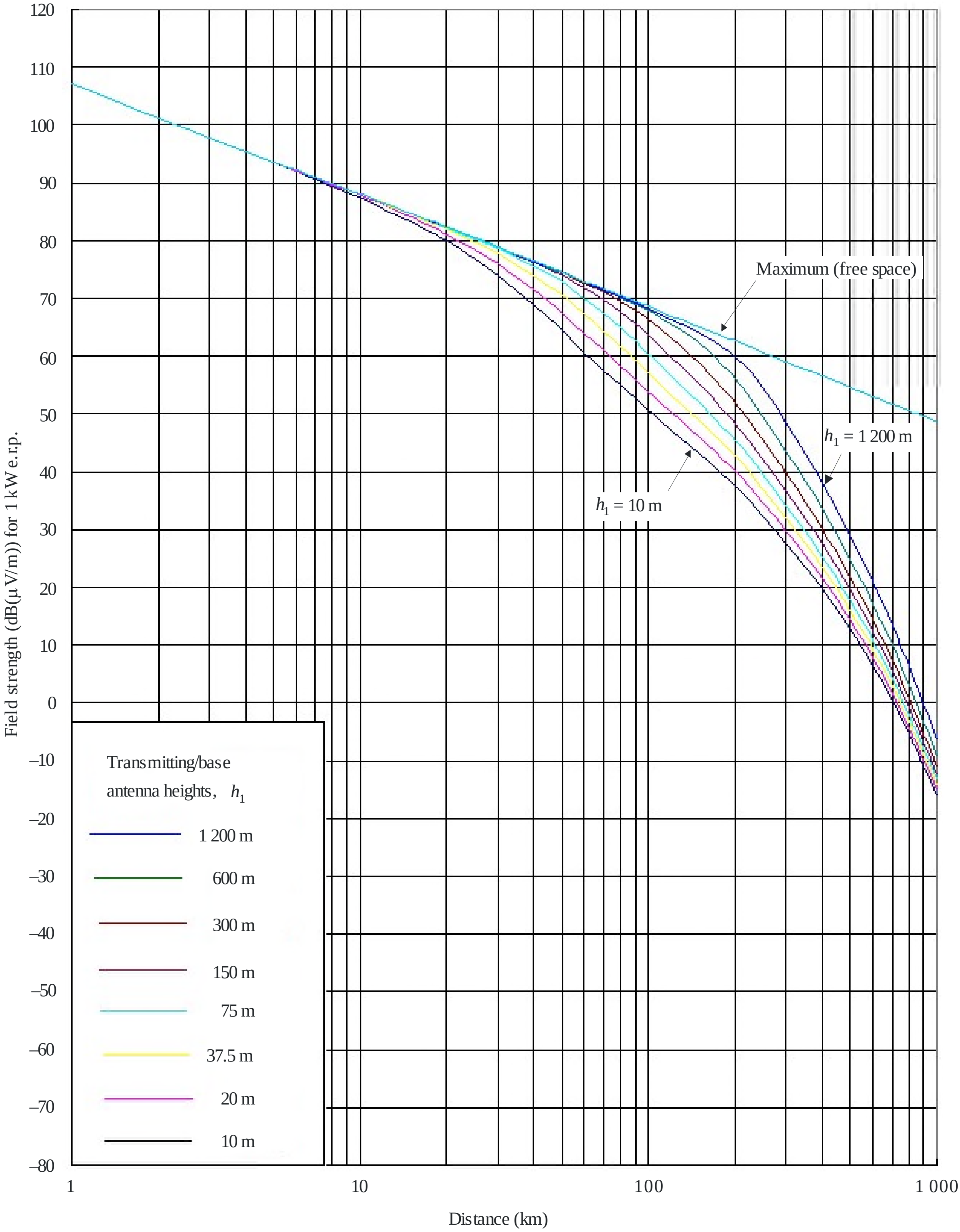
50% of locations

h_2 = 10 m

P.1546-22

FIGURE 23

2 000 MHz, warm sea path, 10% time



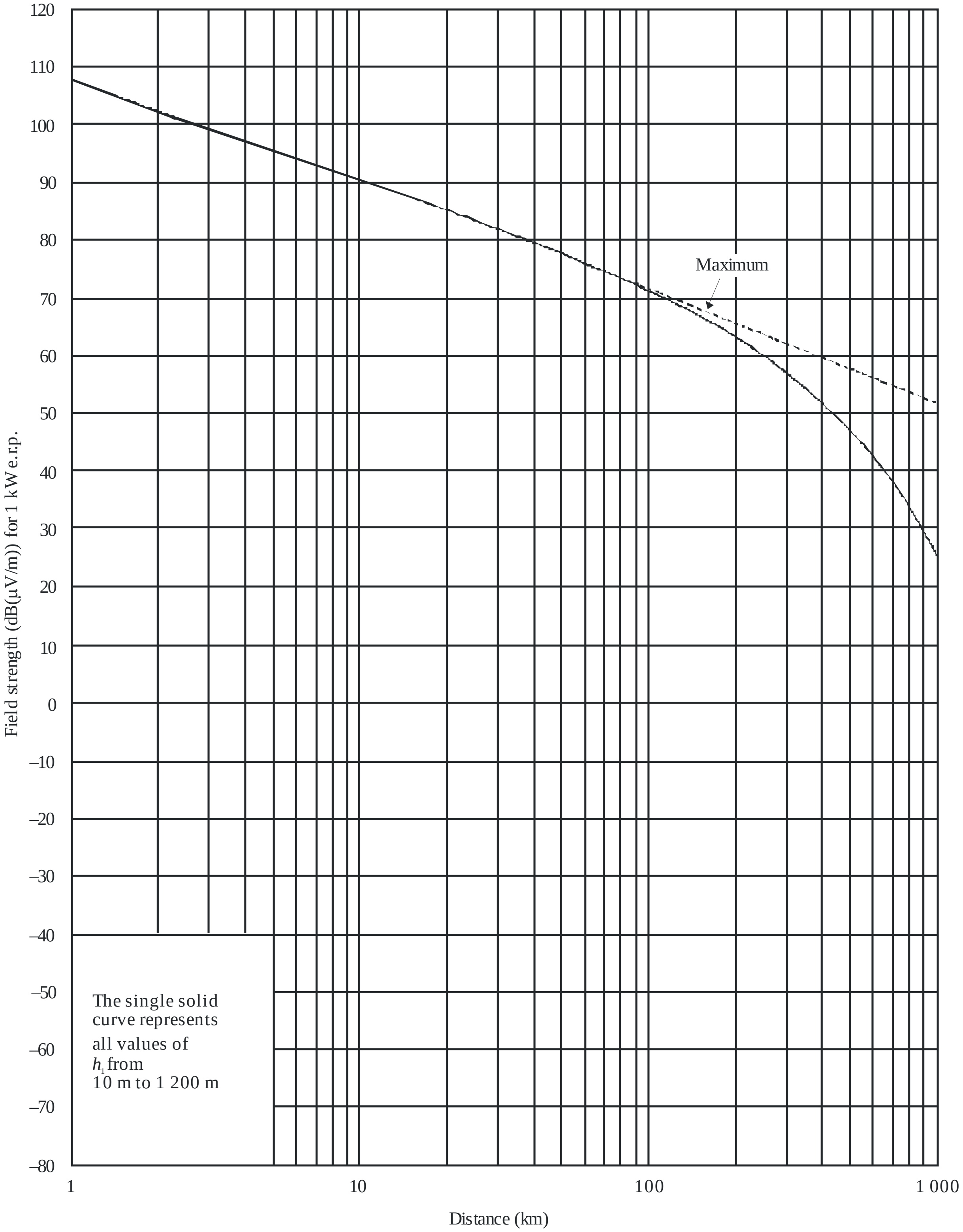
50% of locations

h_2 = 10 m

P.1546-23

FIGURE 24

2 000 MHz, warm sea path, 1% time



50% of locations

h_2 = 10 m

P.1546-24

Annex 5

Determination of the interference field strength in the Land Mobile Service

1 General

1.1 This calculation method is based on Recommendation ITU-R P.1546, taking into account aspects of frequency co-ordination.

1.2 When there is no obstacle within the 1st order Fresnel zone, the field strength shall be determined using the free-space attenuation. The formulas for calculating the Fresnel zone and the free-space field strength are contained in Appendix 1.

1.3 The interference field strength at the receiving location shall be determined using the propagation curves given in Annex 4.

For signals with a transmitting to non-transmitting ratio of less than 1:10 and a cycle repetition time of more than 30 sec, the curves for 10 % of the time have to be applied (no continuous carrier). In other cases the 1% curves shall be used (continuous carrier).

1.4 For harmonized systems using harmonized spectrum only the 10 % curves have to be used.

2. Consideration of different interference situations

In practice, different interference situations occur which call for different calculation methods.

2.1 A base station or a fixed station causes interference to another base station or fixed station

In order to protect a base station or a fixed station from a new station to be installed in a neighbouring country, the interference field strength is determined in relation to the location of the radio station affected.

2.2 A base station or a fixed station causes interference to a mobile station

In order to protect mobile stations from a base station or a fixed station, the interference field strength is determined in relation to the closest point on the edge of the area of operation of the mobile stations.

2.3 A mobile station causes interference to another mobile station

In order to protect mobiles from each other, the interference field strength to be determined is calculated by means of the length of the propagation path between the points closest to the edges of the areas of operation of the mobile stations.

2.4 A mobile station causes interference to a base station or a fixed station

In order to protect a base station or a fixed station from a mobile station, the interference field strength is determined in relation to the edge of the zone of operation of the mobile station closest to the location of the base station or the fixed station affected.

2.5 Assumed position of the mobile station

As an exception to the provisions of 2.2, 2.3 and 2.4 in cases where the operation of a mobile station from a particular place of action causes or suffers from a higher interference field strength than from places at the edge of the zone of operation, the particular place of action shall be taken as the basis for calculation purposes.

As an exception to the provisions of 2.2, 2.3 and 2.4, in cases where the radius of the zone of operation is cut by the borderline in the direction of the affected station, the position of the mobile is limited to the borderline*.*

3. Factors to be taken into consideration

The accuracy with which the interference field strength at the receiving location is determined is largely dependent on the extent to which the actual conditions along the propagation path (via correction factors θ Tx, θ Rx, Δh) and the technical characteristics of the transmitter and receiver stations are taken into account. The accuracy when calculating the field strength increases with the attention paid to special conditions.

To be able to provide reciprocity for calculations on propagation paths along sloping terrain, the profile used for further calculations is based on the connecting line between the terrain heights of the transmitter and the receiver location (normalized profile).

The inter-dependence between the parameters θ and h1 is summarised in the following table. For the correction factor according to the clearance angle only negative values are applied.

$h_{eff\ Tx}$	$h_{eff\ Rx}$	Use Δh	Use normalized profile	Use θTx	Use θRx	h1
≥3m	≥3m	Y	Y	Y	Y	$h1 = h_{eff\ Tx} * h_{eff\ Rx} / 10m$
≥3m	<3m	Y	Y	Y	Y	$h1 = h_{eff\ Tx} * 0.3$
<3m	≥3m	Y	Y	Y	Y	$h1 = h_{eff\ Rx} * 0.3$
<3m	<3m	Y	Y	Y	Y	h1 = 1m
ML	≥3m	Y	Y	N	Y	$h1 = h_m * h_{eff\ Rx} / 10m$
ML	<3m	Y	Y	N	Y	$h1 = h_m * 0.3$
≥3m	ML	Y	Y	Y	N	$h1 = h_m * h_{eff\ Tx} / 10m$
<3m	ML	Y	Y	Y	N	$h1 = h_m * 0.3$
ML	ML	Y	Y	N	N	$h1 = h_{m\ Tx} * h_{m\ Rx} / 10m$
≥3m	coordination line	Y	N	Y	N	$h1 = h_{eff\ Tx} * h2 / 10m$
<3m	coordination line	Y	N	Y	N	h1 = h2 * 0.3
ML	coordination line	N	N	N	N	$h1 = h_m * h2 / 10m$

where
- θ Tx — Clearance angle at the transmitter site
- θ Rx — Clearance angle at the receiver site
- h1 — Effective antenna height for the curves in Annex 4
- $h_{eff\ Tx}$ — Effective antenna height of the transmitter
- $h_{eff\ Rx}$ — Effective antenna height of the receiver
- h2 — Receiver antenna height
- ML — Mobile station (4D > 0)

h_m is taken from the input value for the mobile antenna height. If missing or less than 3 m it is set to 3 m.

The curves of Annex 4, which represent the interfering field strength values, apply to h1.
The value of h1 is determined by using the previous table. A process of interpolation and extrapolation is given in Appendix 2.

The following factors shall be taken into consideration

3.1 Terrain clearance angle

If the terrain between the transmitter station and the receiving location is marked by ascents or descents, the interference field strength determined for the receiving location has to be corrected. The clearance angle (see Appendix 4) shall be determined for a maximum distance of 16 km. The correction factors for clearance angles in the range of 0° to +40° are given in Appendix 4.

If the distance between transmitter and receiver is less than 16 km, the clearance angle correction factor will be determined according to the equation: $\Delta = \Delta (d) * d / 16$

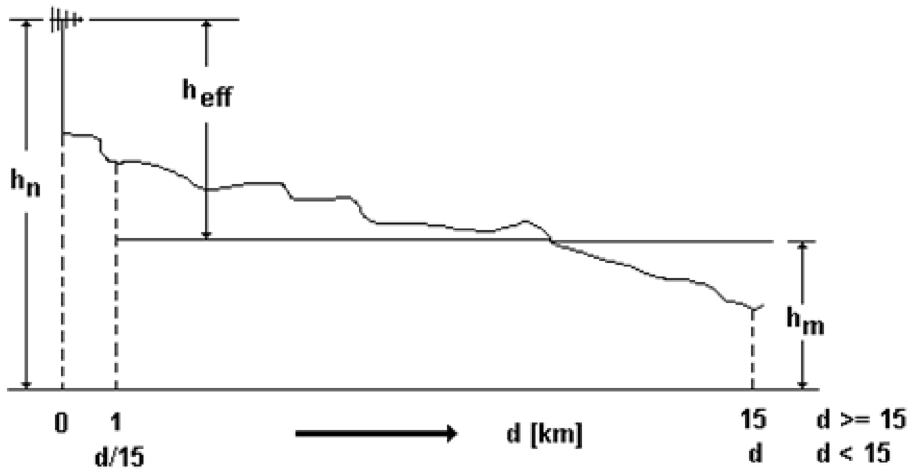
Δ (d):	correction factor due to clearance angle calculated for the distance between transmitter and receiver
Δ :	correction factor due to clearance angle
d :	distance between transmitter and receiver

3.2 Effective antenna height

The effective height of an antenna h_{eff} is defined as the height above the average terrain level in the range 1 to 15 km from the starting point in the direction of the end point:

$$h_{eff} = h_n - h_m$$

where h_{eff} = effective antenna height in m
h_n = physical height of the antenna above sea level in m
h_m = average height of the terrain in m



The average height of the terrain h_m is calculated by using the following equation:

$$h_m = \frac{\sum_{i=0}^{140} h_i}{141}$$

For h_i, the heights at (1000 + i * 100) m from the starting point in the direction of the end point shall be taken.

If the path from the starting point to the end point is shorter than 15 km, only height samples from d/15 to d are taken into account.

3.2.1 Effective antenna height of the transmitter

The effective antenna height of a transmitter ($h_{eff\ Tx}$) is defined as the height above the average terrain level in the range defined in 3.2 from the transmitter in the direction of the receiver location.

The effective antenna height of the transmitter has to be taken into account for calculating h1 (see table in 3).

3.2.2 Effective antenna height of the receiver

The effective antenna height of a receiver ($h_{eff\ Rx}$) is defined as the height above the average terrain level in the range defined in 3.2 from the receiver in the direction of the transmitting location.

The effective antenna height of the receiver has to be taken into account for calculating h1 (see table in 3).

3.3 Terrain irregularity Δh

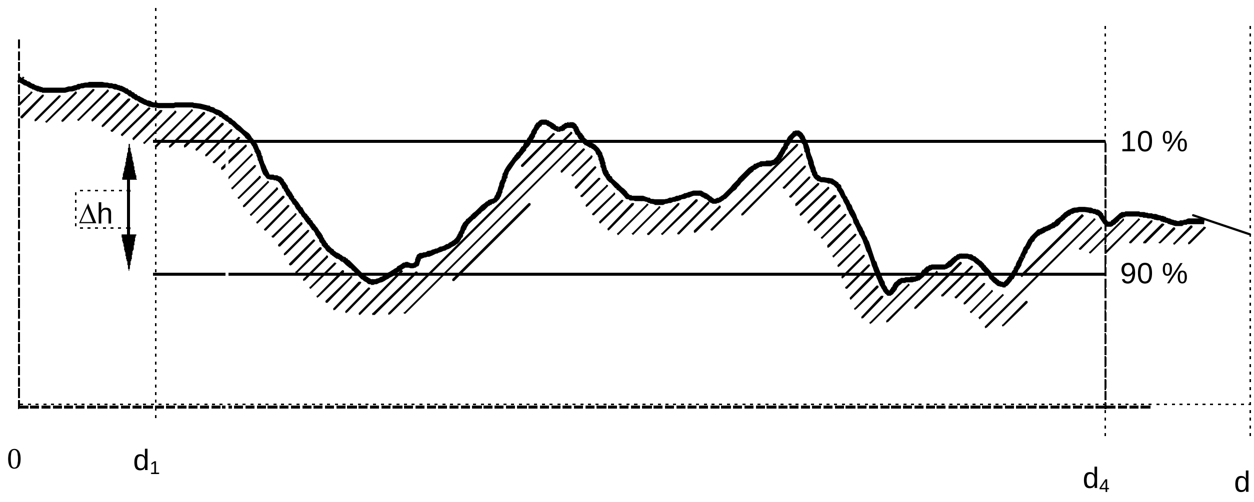
The irregularity of the terrain is defined as follows depending on the distance d between transmitter and receiver. Correction factors for the terrain irregularity shall not be applied to sea-path propagation paths.

For d < 10 km:

No terrain irregularity is taken into account for distances shorter than 10 km.

For 10 km ≤ d ≤ 50 km:

Terrain irregularity Δh Condition: 10 km $\leq$ d $\leq$ 50 km

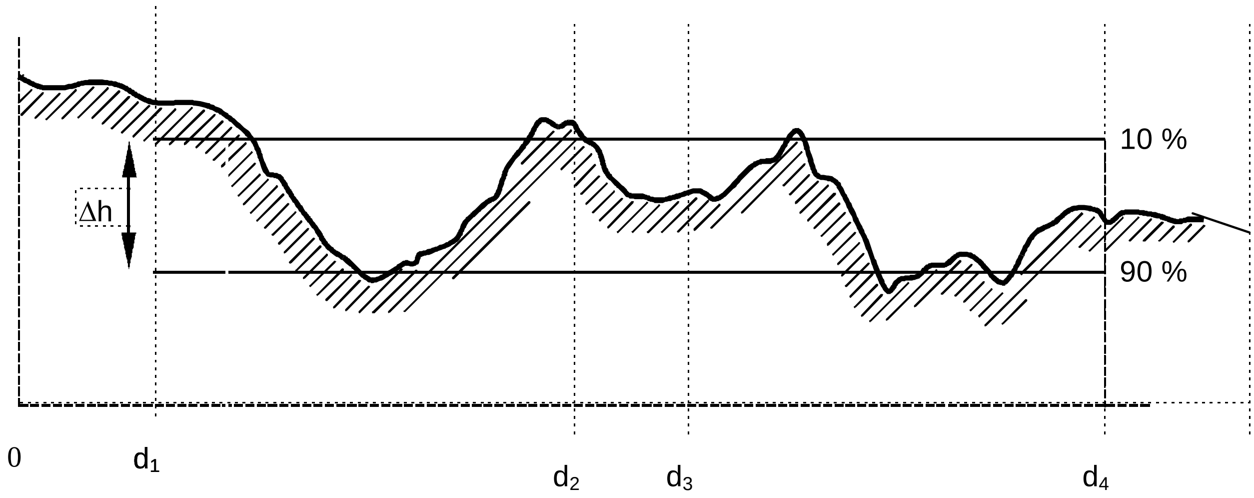


d_1 = 4.5 km
d_4 = d - 4.5 km

For d > 50 km:

The irregularity of the terrain Δh is defined as the difference between the heights exceeded by 10 % and 90 % respectively of the terrain heights measured in the range 4.5 km to 25 km and in the range d - 25 km to d - 4.5 km from the transmitter in the direction of the receiving location.

Terrain irregularity Δh Condition: d > 50 km



d_1 = 4.5 km
d_2 = 25 km
d_3 = d - 25 km
d_4 = d - 4.5 km

The propagation curves for propagation paths over land are based on Δh = 50 m. If the measure of terrain irregularity deviates from Δh = 50 m, correction factors have to be applied to the interference field strengths derived from the propagation curves. The appropriate correction factors are given in Appendix 3. If the distance between transmitter and receiver is greater than 200 km, the value for d = 200 km is used.

3.4 Correction factors for frequencies

Propagation curves, clearance angle corrections and terrain irregularity corrections apply only to the frequencies 100 MHz, 600 MHz and 2 GHz. For other frequencies, inter- or extrapolations according to Appendix 2 are required.

3.5 Antenna diagram

If directional or tilted antennas are used as transmitting antennas at the interfering base station or fixed station, these factors shall be taken into account in the determination of the interference field strength. In case of directional antennas, the angle orientation is taken into account clockwise.

If directional or tilted antennas are used as receiving antennas, the gain of the receiving antenna in the direction of the interference shall be subtracted from the maximum permissible interference field strength.

Annex 6 contains the diagrams of some typical directional antennas. These diagrams shall be used to derive the decrease of the maximum effective radiated power in relation to the receiving location or the reduction of the interference signal at the receiver. A method for combining the horizontal and vertical antenna patterns is given in Annex 8.

3.6 Mixed path propagation

When paths occur over zones of different propagation characteristics, the following method is used which takes account of the different characteristics of the various parts of the path:

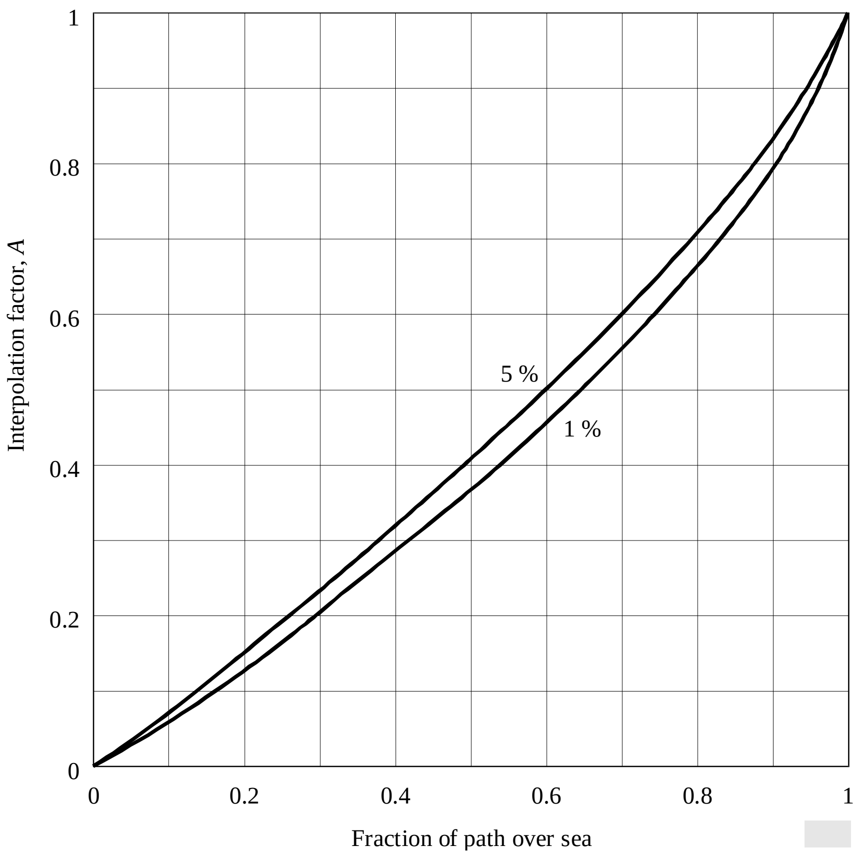
a) For percentages of time < 10%, the following procedure for calculating the field strength for paths crossing a land/sea boundary is used:

$$E_{m,t} = E_{l,t} + A\,(E_{s,t} - E_{l,t})$$

where

$E_{m,t}$	field strength for mixed path for t% of the time
$E_{l,t}$	field strength for land path equal in length to the mixed path for t% of the time
$E_{s,t}$	field strength for sea path equal in length to the mixed path for t% of the time
A	interpolation factor as given in the figure

Interpolation for mixed land/sea paths



b) For percentages of time ≥ 10%, the following procedure is to be used:

$$Em,t = \sum_i \frac{d_i}{d_T} E_{i,t}$$

where:	$E_{m,t}$	Field strength for mixed path for t% of time
	$E_{i,t}$	Field strength for path in zone i equal in length to the mixed path for t% of time
	d_i	Length of path in zone i and
	d_T	Length of total path.

Appendix 1 to Annex 5

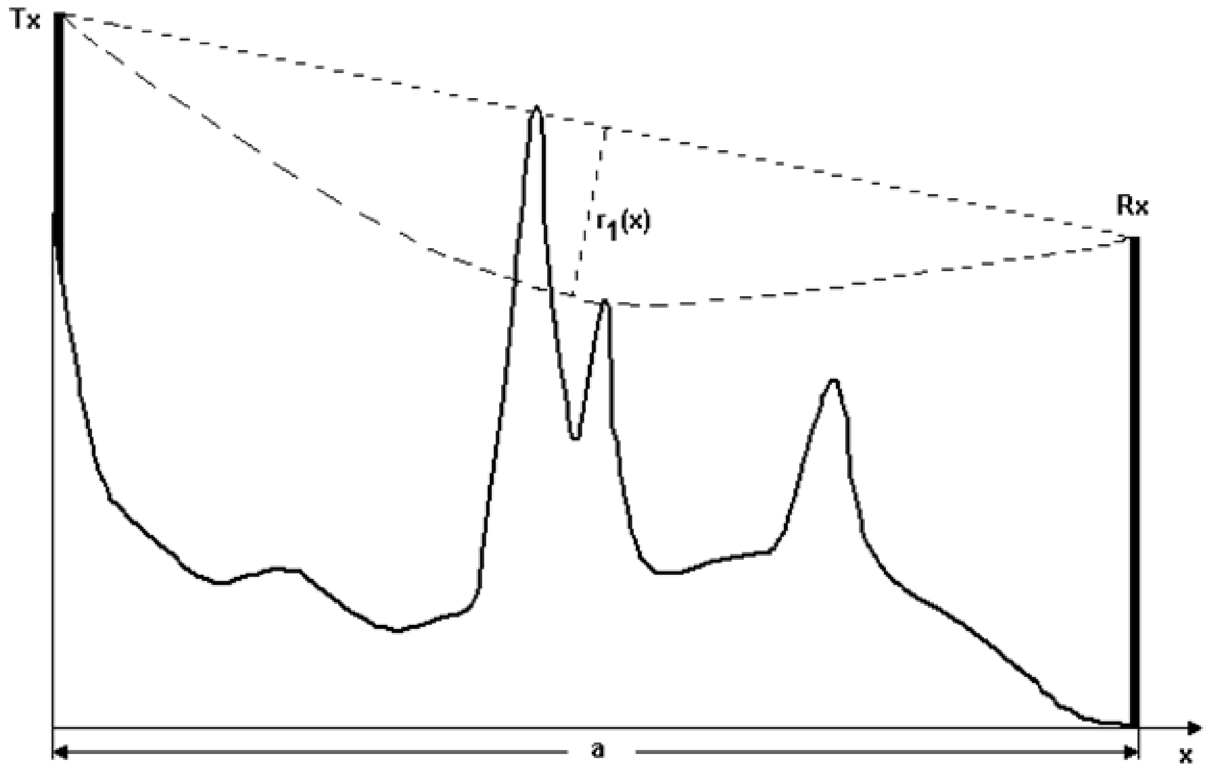


Figure 1: Fresnel Zone

Calculation of the first order Fresnel zone:

Fresnel zone $r_1(x) = -\sqrt{x * \frac{(a-x) * \lambda}{a}} = -1.73 * 10^4 * \sqrt{\frac{x * (a-x)}{f * a}}$

λ represents the wavelength. The other symbols are depicted in Figure 1. All values are to be entered into the formulas as base units (paths in meters, the frequency f in Hertz).

Calculation of the free space field strength

$F_{free\,\mathrm{space}}(1\,\mathrm{kWerp}) = 107\ \mathrm{dB}\mu\mathrm{V/m} - 20 * \log_{10} d$ (d in km)

Appendix 2 to Annex 5

1. Inter- or extrapolation of field strength according to h_1

1.1 10m ≤ h_1 ≤ 3000 m

If h_1 has precisely one of the values of 10, 20, 37.5, 75, 150, 300, 600 or 1200 m, the field strength can be directly read off the curves in Annex 4. Otherwise the field strength has to be inter- or extrapolated according to the following formula:

$E = E_{inf} + (E_{sup} – E_{inf}) \log(h_1 / h_{inf}) / \log (h_{sup} / h_{inf})$

where:

h_{inf}:	600 m if h_1 > 1200 m, otherwise the nearest nominal effective height below h_1
h_{sub}:	1200 m if h_1 > 1200 m, otherwise the nearest nominal effective height above h_1
E_{inf}:	field strength for h_{inf} at the required distance
E_{sub}:	field strength for h_{sub} at the required distance

h_1 is limited to 3000 m, and the field strength is limited to the free space field strength.

1.2 0 m ≤ h_1 < 10 m

The procedure for extrapolating field strength at a required distance d [km] for values of h_1 in the range 0 m to 10 m is based on smooth-Earth horizon distances in km written as $d_H(h) = 4.1\sqrt{h}$, where h is the required value of antenna height h_1 in meters.

For d < $d_H(h_1)$ the field strength is given by the 10 m height curve at its horizon distance plus ΔE, where ΔE is the difference in field strength on the 10 m height curve at distances d and h_1 horizon distance.

For d ≥ $d_H(h_1)$ the field strength is given by the 10 m height curve at distance Δd beyond its horizon distance, where Δd is the difference between d and the h_1 horizon distance.

This may be expressed in the following formulae where $E_{10}(d)$ is the field strength in dBµV/m taken from the 10 m height curve for a distance d [km]:

$$E = E_{10}(d_H(10)) + E_{10}(d) – E_{10}(d_H(h_1)) \qquad \text{dBµV/m} \qquad d < d_H(h_1)$$

$$E = E_{10}(d_H(10) + d – d_H(h_1)) \qquad \text{dBµV/m} \qquad d \geq d_H(h_1)$$

If in the last equation $d_H(10) + d – d_H(h_1)$ exceeds 1000 km, even though d ≤ 1000 km, E_{10} may be found from linear extrapolation for log(distance) of the curve, given by:

$$E_{10} = E_{inf} + (E_{sup} – E_{inf}) \log(d / D_{inf}) / \log(D_{sup} / D_{inf}) \qquad \text{dbµV/m}$$

where:

D_{inf}:	penultimate tabulation distance [km]
D_{sup}:	final tabulation distance [km]
E_{inf}:	field strength at penultimate tabulation distance [dbµV/m]
E_{sup}:	field strength at final tabulation distance [dbµV/m]

2. Interpolation of field strength as a function of the distance

The figures in Annex 4 show field strength plotted against distance d [km] in the range from 1 km to 1000 km. No interpolation for distance is needed if field strengths can be read directly from these graphs. For intermediate values of d, interpolation is required according to the following formula:

$$E = E_{inf} + (E_{sup} – E_{inf}) \log(d / d_{inf}) / \log(d_{sup} / d_{inf}) \qquad \text{dBµV/m}$$

where:

- d: distance for which the prediction is required
- d_{inf}: nearest tabulation distance less than d
- d_{sup}: nearest tabulation distance greater than d
- E_{inf}: field strength value for d_{inf}
- E_{sup}: field strength value for d_{sup}

With d < 1 km, the free space field strength should be calculated.

3. Inter- or extrapolation of the field strength as a function of the frequency

Field strength values for a given frequency have to be interpolated between the values for the nominal frequency values 100, 600 and 2000 MHz. In the case of frequencies below 100 MHz or above 2000 MHz, the interpolation must be replaced by an extrapolation from the two nearest nominal frequency values.

The used formula is:

$$E = E_{inf} + (E_{sup} – E_{inf}) \log(f / f_{inf}) / \log(f_{sup} / f_{inf}) \qquad \text{dBµV/m}$$

where:

- f: frequency for which the prediction is required [MHz]
- f_{inf}: lower nominal frequency (100 MHz if f < 100 MHz, 600 MHz if f > 2000 MHz)
- f_{sup}: higher nominal frequency (600 MHz if f < 100 MHz, 2000 MHz if f > 2000 MHz)
- E_{inf}: field strength value for f_{inf}
- E_{sup}: field strength value for f_{sup}

Appendix 3 to Annex 5

Attenuation correction factor curves

This Appendix contains the correction curves according to terrain irregularity ∆h for frequencies 100 MHz (FIGURE 1), 600 MHz (FIGURE 2) and 2000 MHz (FIGURE 3).

FIGURE 1

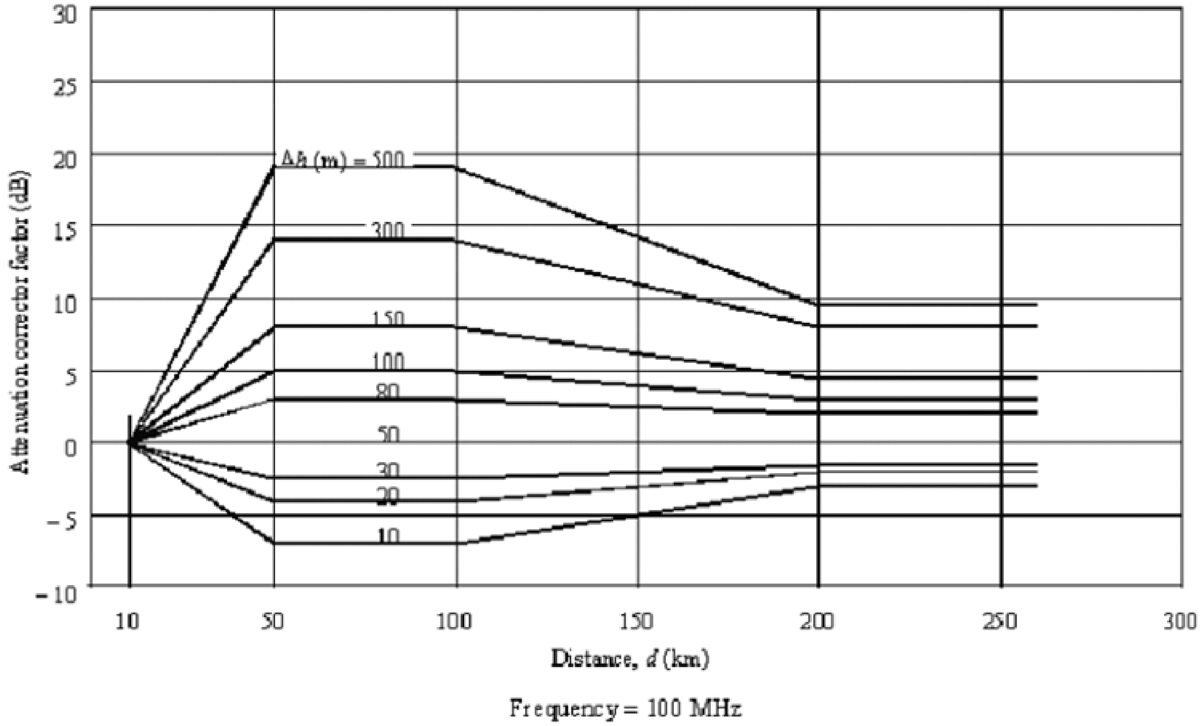


FIGURE 2

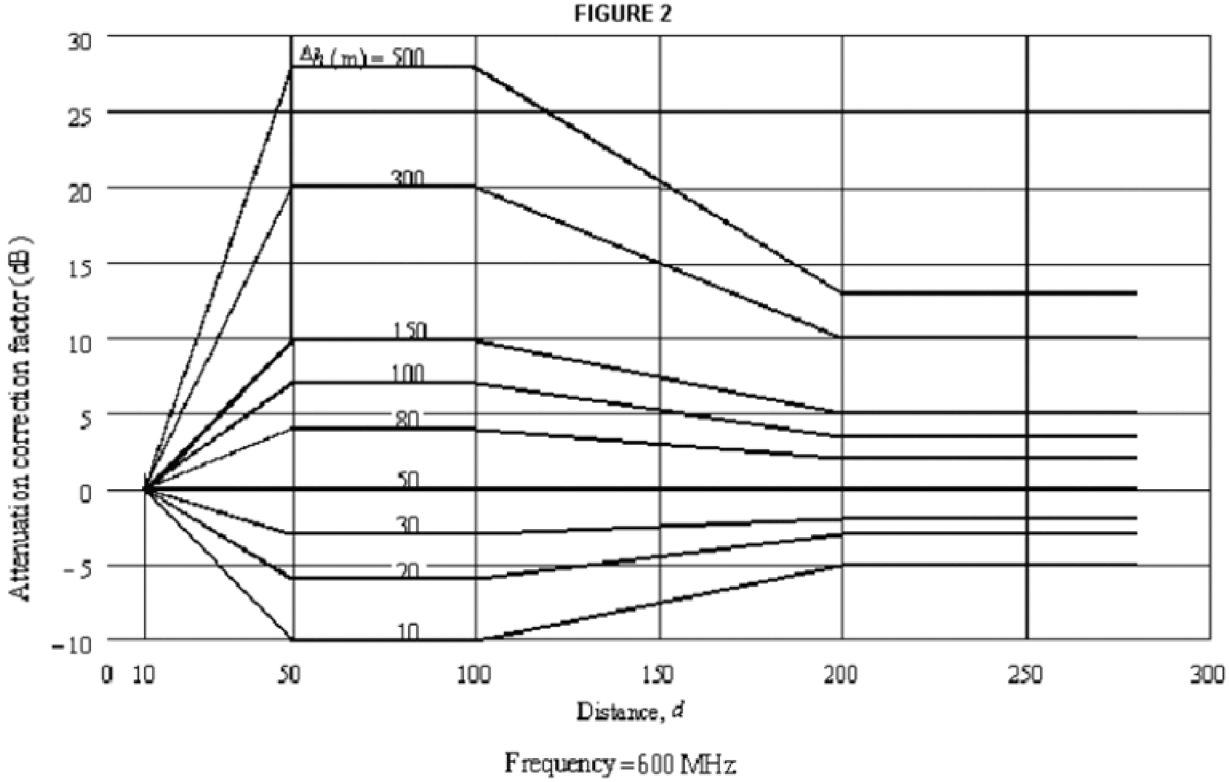
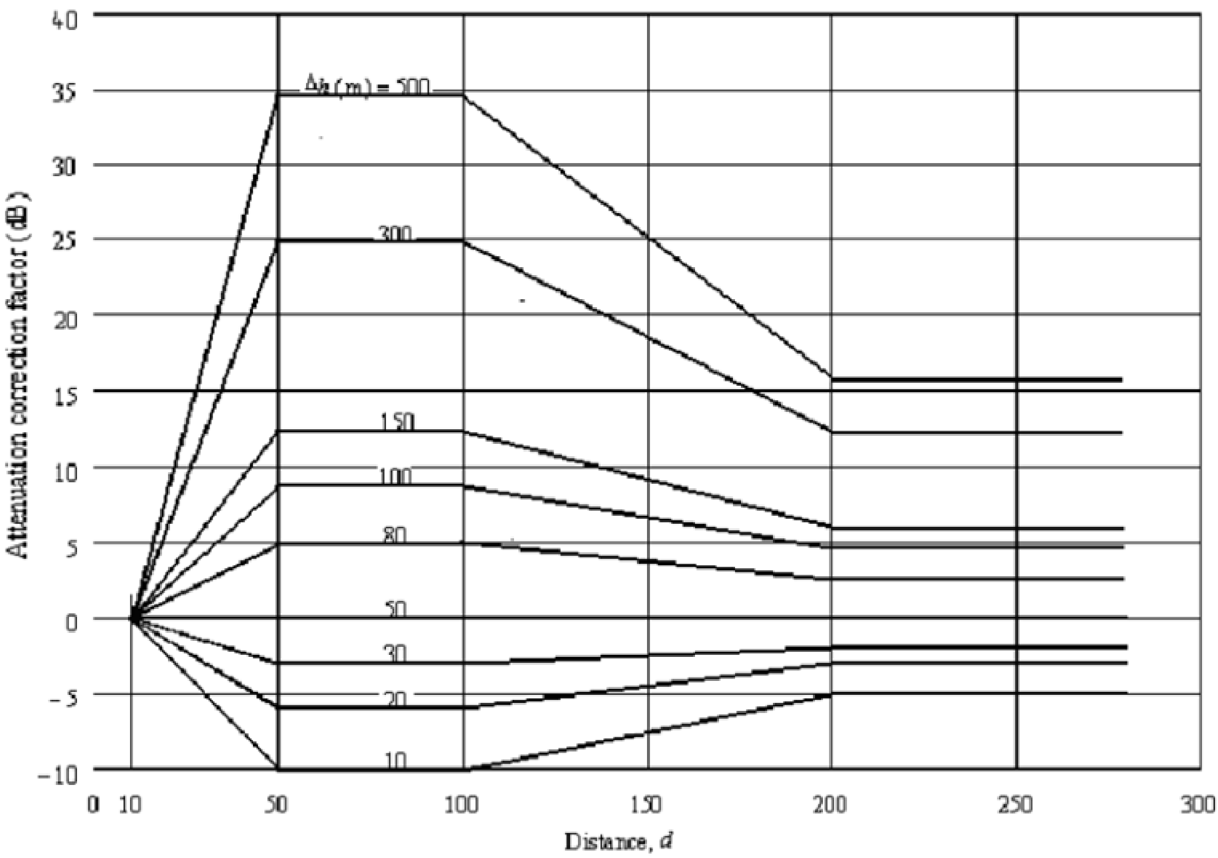


FIGURE 3



Frequency = 2000 MHz

Correction factors according to Δh [dB]

Δh [m]	100 MHz 50 km	100 MHz 200 km	600 MHz 50 km	600 MHz 200 km	2000 MHz 50 km	2000 MHz 200 km
10	-7.0	-3.0	-10.0	-5.0	-10.0	-5.0
20	-4.0	-2.0	-6.0	-3.0	-6.0	-3.0
30	-2.5	-1.5	-3.0	-2.0	-3.0	-3.0
50	0.0	0.0	0.0	0.0	0.0	0.0
80	3.0	2.0	4.0	2.0	5.0	2.5
100	5.0	3.0	7.0	3.5	8.7	4.3
150	8.0	4.5	10.0	5.0	12.4	6.2
300	14.0	7.0	20.0	10.0	24.8	12.4
500	19.0	9.5	28.0	13.0	34.7	16.1

Inter- or extrapolation of the correction factor according to terrain irregularity as a function of the frequency

The correction factor according to terrain irregularity for a given frequency has to be interpolated between the values of the nominal frequency values 100, 600 and 2000 MHz. In the case of frequencies below 100 MHz or above 2000 MHz, the interpolation must be replaced by an extrapolation from the two nearest nominal frequency values.

The used formula is:

$$C = C_{inf} + (C_{sup} - C_{inf}) \log(f / f_{inf}) / \log(f_{sup} / f_{inf}) \qquad \text{dB}\mu\text{V/m}$$

where:

- f: frequency for which the correction factor is required [MHz]
- f_{inf}: lower nominal frequency (100 MHz if f < 100 MHz, 600 MHz if f > 2000 MHz)
- f_{sup}: higher nominal frequency (600 MHz if f < 100 MHz, 2000 MHz if f > 2000 MHz)
- C_{inf}: correction factor according to terrain irregularity for f_{inf}
- C_{sup}: correction factor according to terrain irregularity for f_{sup}

Appendix 4 to Annex 5

Terrain clearance angle correction factor

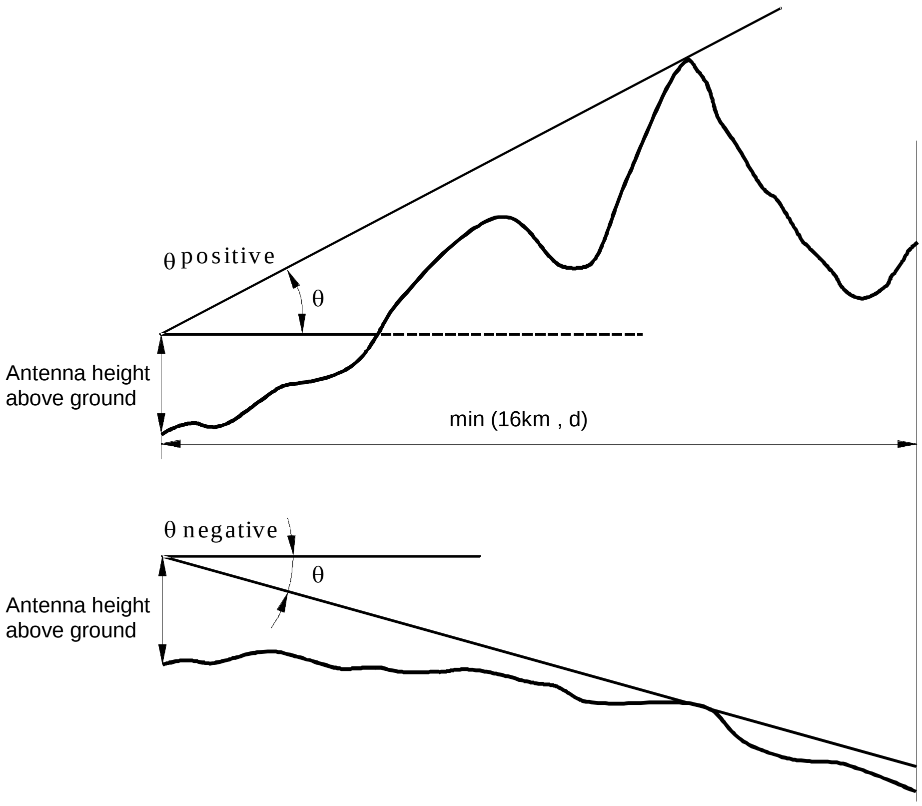


FIGURE 1: Terrain Clearance Angle

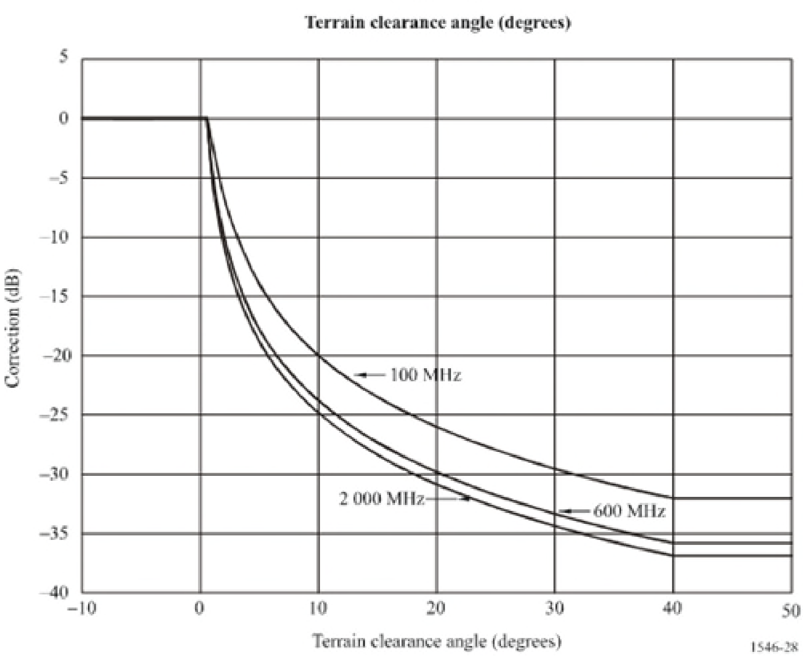


FIGURE 2: Terrain Clearance Angle Correction

Figure 2 is only for information. The correction according to the terrain clearance angle should be calculated as follows:

For distances greater than or equal to 16 km

For 100 MHz the equation is:

$$Correction = 9.1 - \left[6.9 + 20\log\left(\sqrt{(v - 0.1)^2 + 1} + v - 0.1 \right) \right]$$

$$v = 37.2 * \theta \qquad \theta \text{ (rad)},$$

with limiting values of 0 dB at small angles and -32 dB at 40 degrees.

For 600 MHz the equation is:

$$Correction = 13.1 - \left[6.9 + 20\log\left(\sqrt{(v - 0.1)^2 + 1} + v - 0.1 \right) \right]$$

$$v = 91.2 * \theta \qquad \theta \text{ (rad)},$$

with limiting values of 0 dB at small angles and -35 dB at 40 degrees.

For 2000 MHz the equation is:

$$Correction = 17.3 - \left[6.9 + 20\log\left(\sqrt{(v - 0.1)^2 + 1} + v - 0.1 \right) \right]$$

$$v = 167 * \theta \qquad \theta \text{ (rad)},$$

with limiting values of 0 dB at small angles and -36 dB at 40 degrees.

For distances up to 16 km:

Correction = correction calculated above * d / 16 km.

Inter- or extrapolation of the terrain clearance angle correction as a function of the frequency

Terrain clearance angle correction for a given frequency has to be interpolated between the values for the nominal frequency values 100, 600 and 2000 MHz. In the case of frequencies below 100 MHz or above 2000 MHz, the interpolation must be replaced by an extrapolation from the two nearest nominal frequency values.

The used formula is:

$$TCA\_c = TCA\_c_{inf} + (TCA\_c_{sup} - TCA\_c_{inf}) \log(f / f_{inf}) / \log(f_{sup} / f_{inf}) \qquad \text{dB}$$

where:

f:	frequency for which the prediction is required	[MHz]
f_{inf}:	lower nominal frequency (100 MHz if f < 100 MHz, 600 MHz if f > 2000 MHz)	
f_{sup}:	higher nominal frequency (600 MHz if f < 100 MHz, 2000 MHz if f > 2000 MHz)	
TCA_c_{inf}:	terrain clearance angle correction for f_{inf}	
TCA_c_{sup}:	terrain clearance angle correction for f_{sup}	

Annex 6

Coding instructions for antenna diagrams in the Land Mobile Service

Coding instructions for antenna diagrams

1 General

1.1 For the description of the characteristics of antenna diagrams for the co-ordination procedure a character string consisting of three digits, two letters and two digits is used in accordance with CEPT Recommendation T/R 25-08.

The character string is structured as follows:

000	xx	00
1^{st} - 3^{rd} character	4^{th} - 5^{th} character	6^{th} - 7^{th} character

This string has to be transmitted in one block: 000XX00.

1.2 This string will be used

1.2.1 for the description of the characteristics of an antenna belonging to the Administration preparing the co-ordination request, and

1.2.2 for the illustration of the characteristics of an antenna belonging to another Administration when evaluating that Administration's co-ordination request.

1.3 Generally the horizontal diagram shall be considered under 9XH. If there is an elevation in the vertical diagram, the angle of the elevation shall be listed under position 9B of the co-ordination request. The vertical diagram shall be described in the same manner as the horizontal diagram and shall be listed under 9XV.

1.4 Appendices 1 and 2 of this Annex contain graphical illustrations for nine typical groups of antenna diagrams which are representative of the types of antenna used in practice. They are identified by the following two-letter codes: EA, EB, EC, DE, KA, LA, CA, CB, and CC. The formulas for the graphical illustrations are given in Appendix 3, Appendix 4 and Appendix 5 contain the descriptions of the V - type and W - type antenna diagrams. Appendices 6 and 8 contain graphical illustrations of TA and Px type antenna diagrams (vertical diagrams for antennas with electrical tilt), the formulas are given in Appendix 7.

1.5 If the parameter 9XV (vertical antenna diagram) is TA antenna code then it means 3D antenna radiation pattern is electrically tilted and tilt is given in field 9B. For Px antenna codes (antenna with electrical and mechanical tilt) the electrical tilt is given in the antenna code and the field 9B contains the mechanical elevation.

1.6 For every station, only one antenna type should be defined, valid in all directions where other countries may be affected.

2 Composition of the string for the typical groups of antenna diagrams

2.1 For the diagrams of groups EA, EB, EC, DE and LA (Appendix 1), the following data have to be coded in the string:

1st - 3rd character:	These characters describe the angle range of a directional diagram for which the radiated power has decreased to 50% of its maximum value. This angle has to be determined once from the direction of the maximum gain to that direction which represents 50 % of the radiated power (in the diagram 1/√2 = 0.707 of the field strength). Example: 030 for an angle of 30 degrees.
4th - 5th character:	These characters describe the group of the antenna diagram, e.g. EA, EB, etc. For omni directional antennas, ND shall be used.
6th - 7th character:	These characters describe the circle enveloping the side lobes not contained within the basic pattern defined by the first five characters. The two characters can be derived from the attenuation indicated by this circle in the antenna diagram, multiplied by 100. If only the front-to-back ratio (f:b ratio) is given, these digits can be calculated by using the equation:

$$\textit{two digits} = 10^{2-\frac{\text{f:b ratio}}{20}} \qquad \text{(f:b ratio in dB)}$$

2.2 For the antenna diagrams of groups CA, CB, CC and KA (Appendix 2) the following data have to be coded in the string:

1st - 3rd character:	These characters do not describe an angle, as in 2.1 for the antenna diagrams mentioned above. Instead these digits describe the notch factor. They can be derived from the values of the attenuation in the antenna diagram, multiplied by 100.
4th - 5th character:	These characters describe the group of the antenna diagram, eg. CA, CB, etc.
6th - 7th character:	For antenna types with or without insignificant side lobes, these digits have the value 00. If the side lobes exceed the diagram lines described by the digits 1 - 3, the greatest side lobe has to be considered. In this case the digits 6 – 7 are calculated in the same manner as described under item 2.1, digits 6 – 7.

2.3 For the diagrams of group TA the following data have to be coded in the string:

1st - 3rd character:	These characters describe the angle range multiplied by 10 of a directional diagram for which the radiated power has decreased to 50% of its maximum value. This angle has to be determined once from the direction of the maximum gain to that direction which represents 50 % of the radiated power (in the diagram 1/√2 = 0.707 of the field strength). Example: 300 for an angle of 30 degrees.
4th - 5th character:	These characters describe the group of the antenna diagram, e.g. TA.

6th - 7th character: These characters describe the circle enveloping the side lobes not contained within the basic pattern defined by the first five characters. The two characters can be derived from the attenuation indicated by this circle in the antenna diagram, multiplied by 100. If only the front-to-back ratio (f:b ratio) is given, these digits can be calculated by using the equation:

$$two\ digits = 10^{2 - \frac{\text{f:b ratio}}{20}} \qquad \text{(f:b ratio in dB)}$$

2.4 For the diagrams of group **P**x the following data have to be coded in the string:

1st - 3rd character: These characters describe the angle range multiplied by 10 of a directional diagram for which the radiated power has decreased to 50% of its maximum value. This angle has to be determined once from the direction of the maximum gain to that direction which represents 50 % of the radiated power (in the diagram 1/√2 = 0.707 of the field strength). Example: 300 for an angle of 30 degrees.

4th character: This character describes an electrically and mechanically tilted antenna.

5th character: This character describes the electrical tilt of the antenna in coded form (A=0°, B=-1°, ..., Z=-25°)

6th - 7th character: These characters describe the circle enveloping the side lobes not contained within the basic pattern defined by the first five characters. The two characters can be derived from the attenuation indicated by this circle in the antenna diagram, multiplied by 100. If only the front-to-back ratio (f:b ratio) is given, these digits can be calculated by using the equation:

$$two\ digits = 10^{2 - \frac{\text{f:b ratio}}{20}} \qquad \text{(f:b ratio in dB)}$$

2.5 For all the diagrams shown in the figures of Appendices 1 and 2, lines other than those drawn in the diagram are permitted, such that they do not exceed the edge of the outmost diagram. Example: For antenna type EA, only angles of 65 degrees, 45 degrees, 30 degrees and 15 degrees have been marked but any other angle between 0 and 65 degrees is permitted.

3 Forming a character string from a given antenna diagram

3.1 For an omni directional antenna, the string is expressed by 000ND00.

3.2 For other antenna types, the diagram to be drawn is compared with the diagrams given in Appendices 1 and 2. The character string shall be based on the diagram in these Appendices that most closely resembles the diagram to be described. The numeric values of the attenuation factor can be found in the tables in Appendices 1 and 2. The attenuation represented by the resulting antenna type must not exceed the real antenna attenuation by more than 1 dB in the direction of any of the affected countries. In other directions there is no limit.

3.3 Antenna types CA, CB, CC, and DE have several main beams. In these cases the procedure as described in 2.1 and 2.2 is applied. However a character string needs to be given for only one of the main lobes.

4 Deriving an antenna diagram from a given character string

4.1 The two-letter code indicates the antenna type.

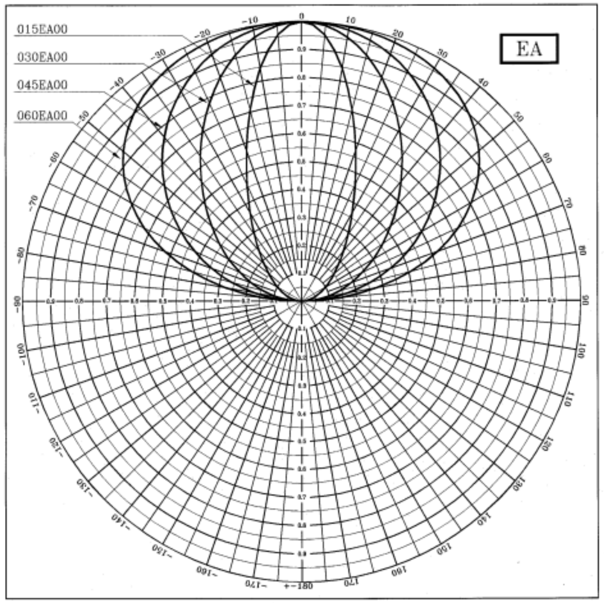
4.2 The half-power angle, side lobe and notch attenuation may be derived from the digits in the character string.

4.3 For other angles worst case attenuation values can be taken from the tables in Appendices 1 and 2 or be calculated using the following equation:

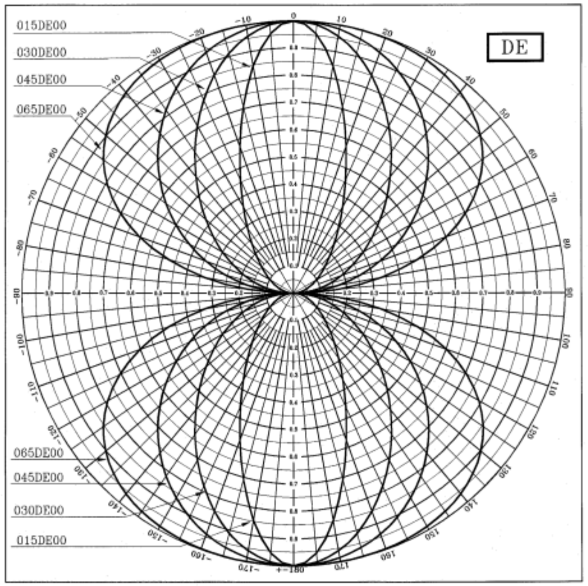
attenuation factor (dB) = 20 * log (numeric value in the diagram)

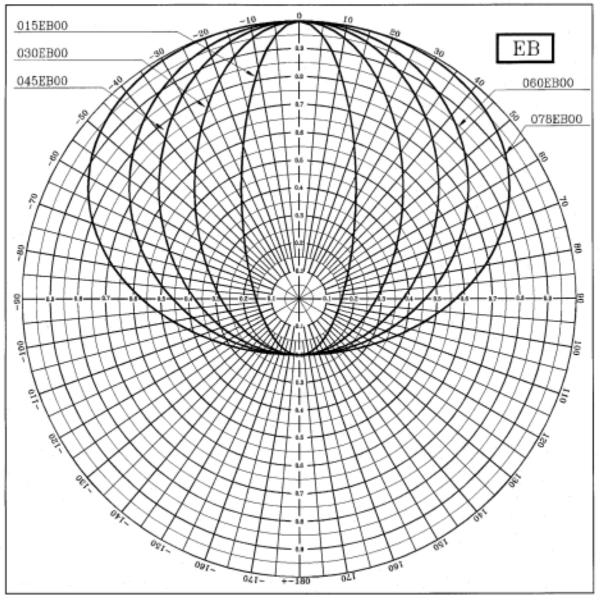
The range of this value is always between 0 and 1

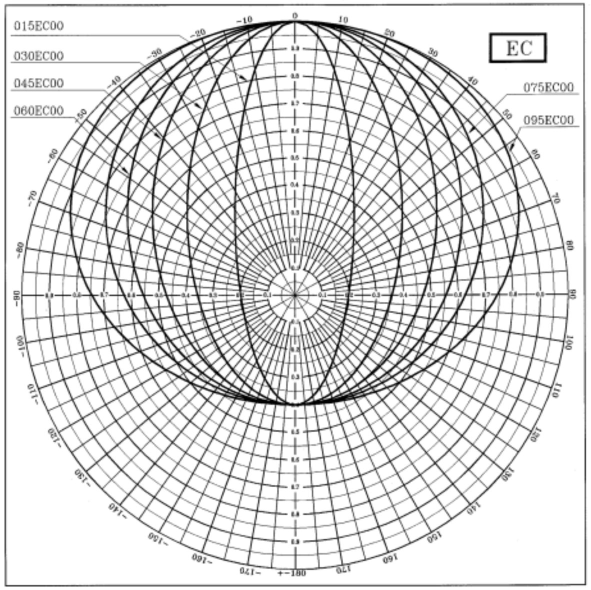
Appendix 1 to Annex 6

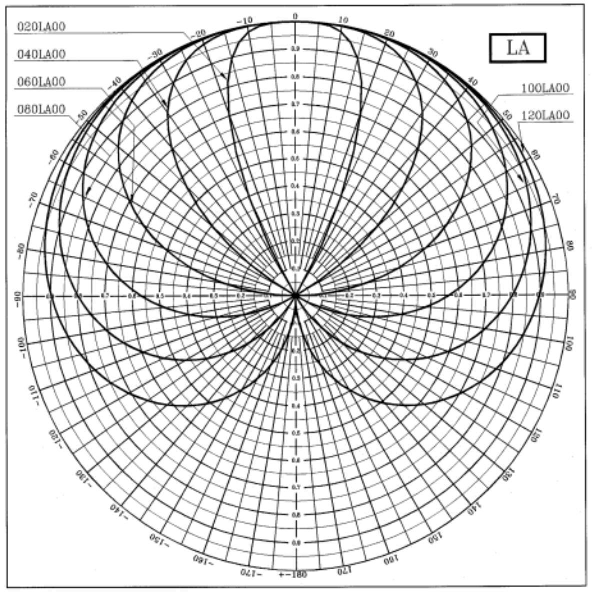


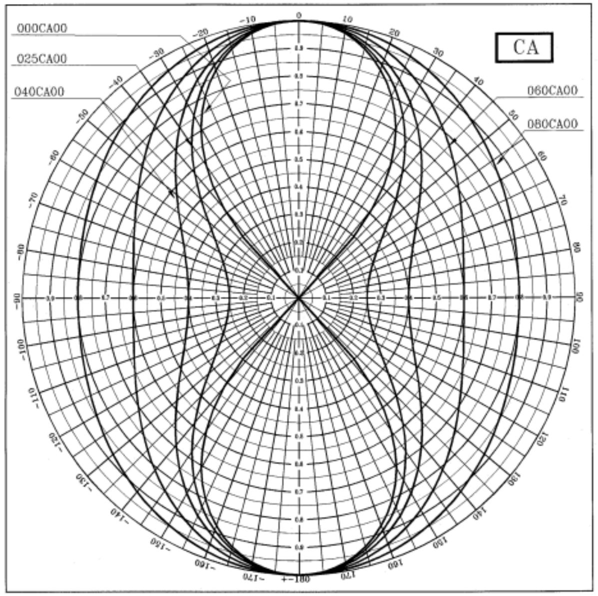
Numerical value	Side lobe attenuation
90	0.9 = -1 dB
80	0.8 = -2 dB
70	0.7 = -3 dB
60	0.6 = -4.5 dB
50	0.5 = -6 dB
40	0.4 = -8 dB
30	0.3 = -10.5 dB
20	0.2 = -14.5 dB
10	0.1 = -20 dB
05	0.05 = -26 dB

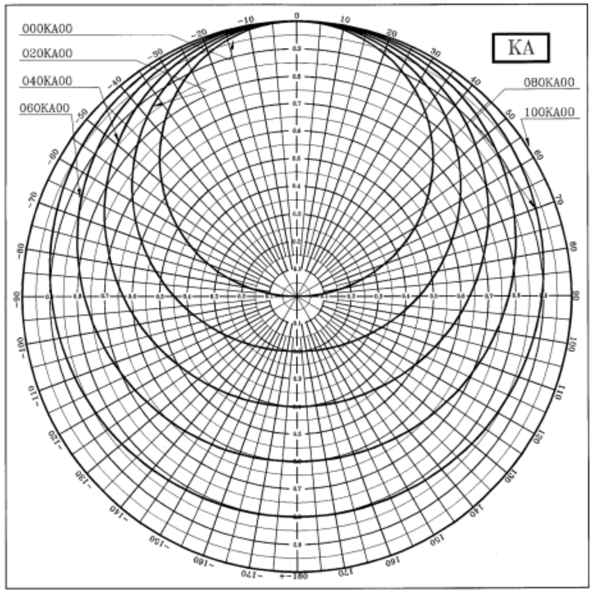




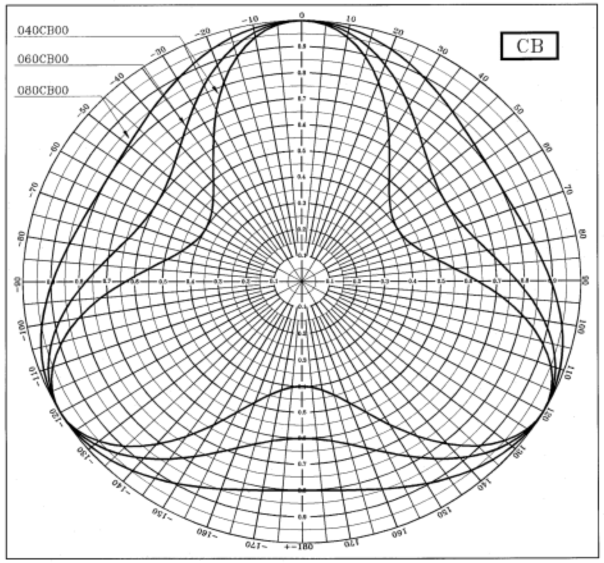


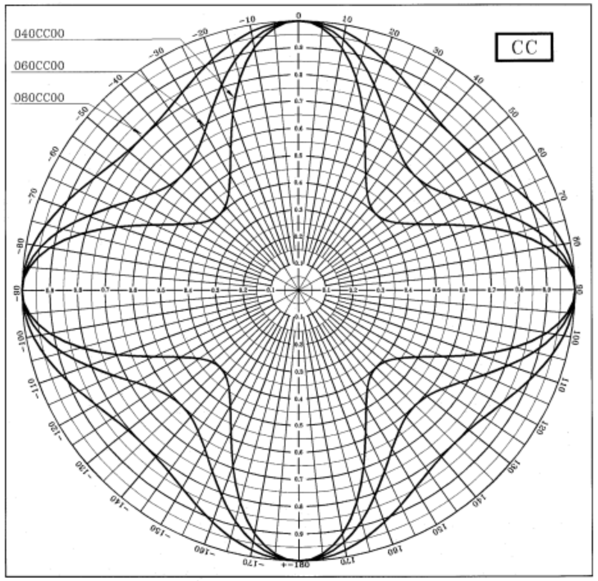




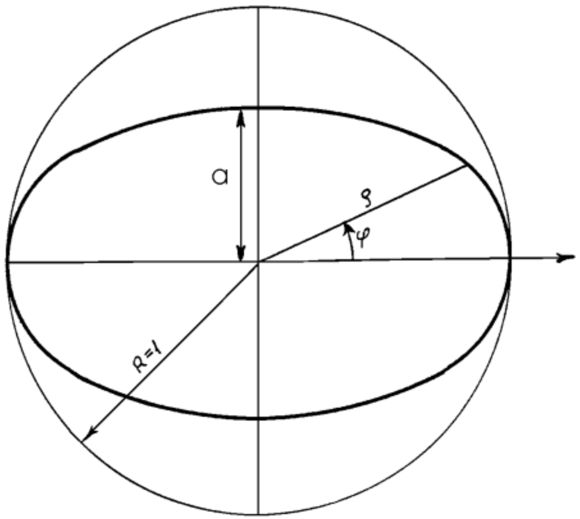


Numerical value	Side lobe attenuation	
90	0.9 =	-1 dB
80	0.8 =	-2 dB
70	0.7 =	-3 dB
60	0.6 =	-4.5 dB
50	0.5 =	-6 dB
40	0.4 =	-8 dB
30	0.3 =	-10.5 dB
20	0.2 =	-14.5 dB
10	0.1 =	-20 dB
05	0.05 =	-26 dB





CA



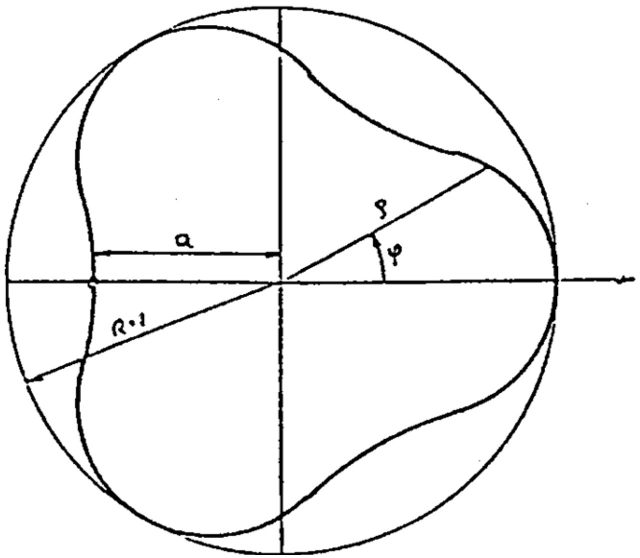
$$\varsigma = \sqrt{\frac{\left(1-a^2\right)\cos(2\varphi)+\sqrt{\left(1-a^2\right)^2\cos^2(2\varphi)+4a^2}}{2}}$$

Definition range:

$0 \le a \le 1$

$-180° \le \varphi \le 180°$

CB



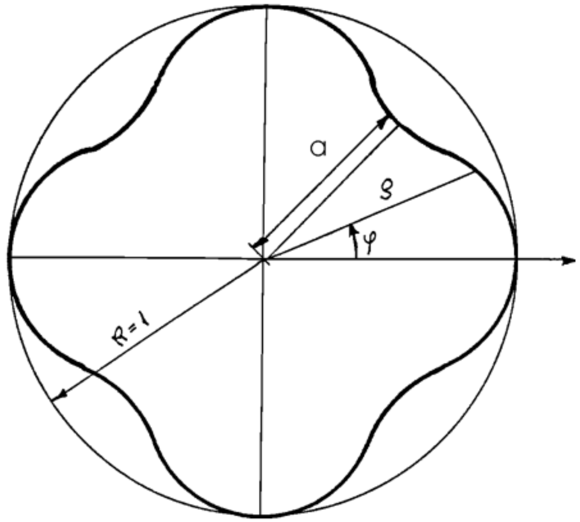
$$\varsigma = \sqrt{\frac{\left(1-a^2\right)\cos(3\varphi)+\sqrt{\left(1-a^2\right)^2\cos^2(3\varphi)+4a^2}}{2}}$$

Definition range:

$0 \le a \le 1$

$-180° \le \varphi \le 180°$

CC



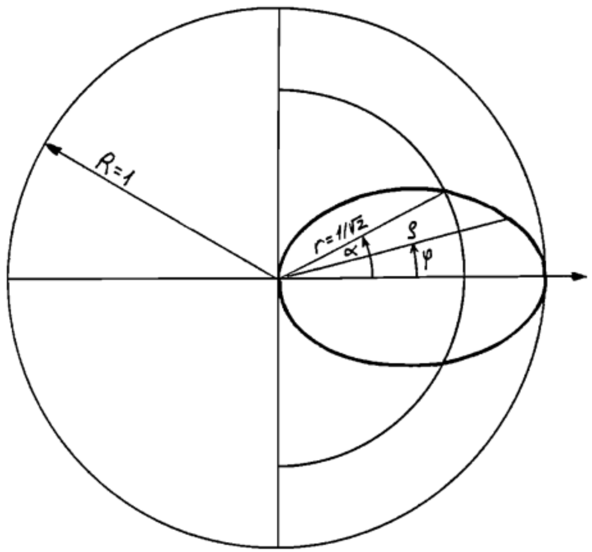
$$\varsigma = \sqrt{\frac{\left(1-a^2\right)\cos(4\varphi)+\sqrt{\left(1-a^2\right)^2\cos^2(4\varphi)+4a^2}}{2}}$$

Definition range:

$0 \le a \le 1$

$-180° \le \varphi \le 180°$

EA



$$\varsigma = \frac{4b^2 \cos\varphi}{(4b^2 - 1)\cos^2\varphi + 1}$$

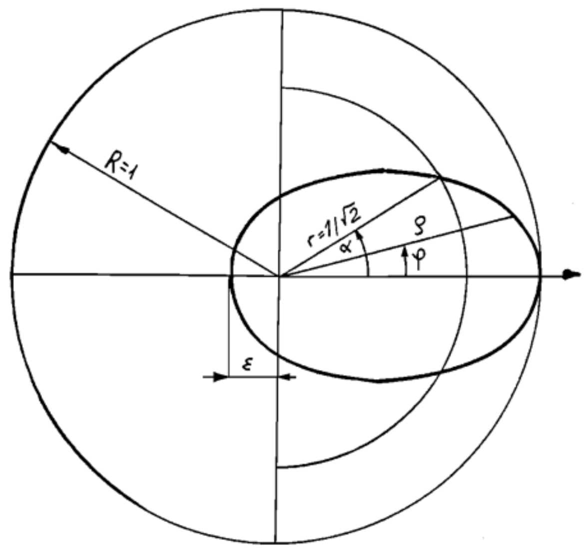
$$b^2 = \frac{1}{2} * \frac{1 - \cos^2\alpha}{1 - (\sqrt{2}\cos\alpha - 1)^2}$$

Definition range:

$0° \le \alpha \le 65°$

$-90° \le \varphi \le 90°$

EB



$$\varsigma = \frac{1.6b^2 \cos\varphi + 2.4\sqrt{b^2(b^2 - 0.2)\cos^2\varphi + 0.2b^2}}{(4b^2 - 1.44)\cos^2\varphi + 1.44}$$

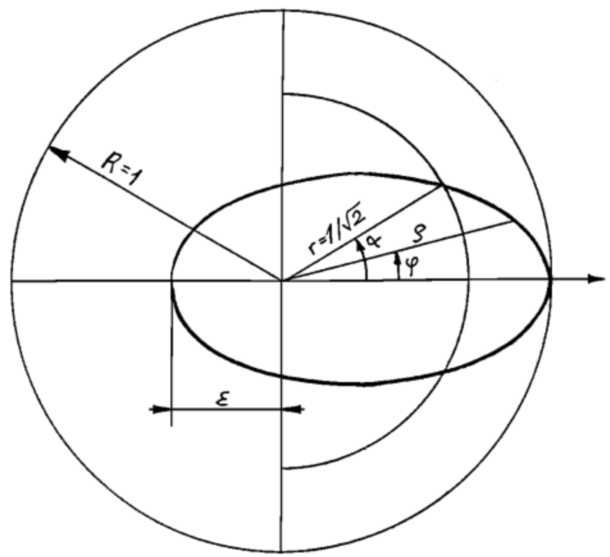
$$b^2 = 0.72 * \frac{1 - \cos^2\alpha}{1.44 - (\sqrt{2}\cos\alpha - 0.8)^2}$$

Definition range:

$0° \le \alpha \le 79°$

$-180 \le \varphi \le 180$

EC



$$\varsigma = \frac{1.2b^2 \cos\varphi + 2.8\sqrt{b^2(b^2 - 0.4)\cos^2\varphi + 0.4b^2}}{(4b^2 - 1.96)\cos^2\varphi + 1.96}$$

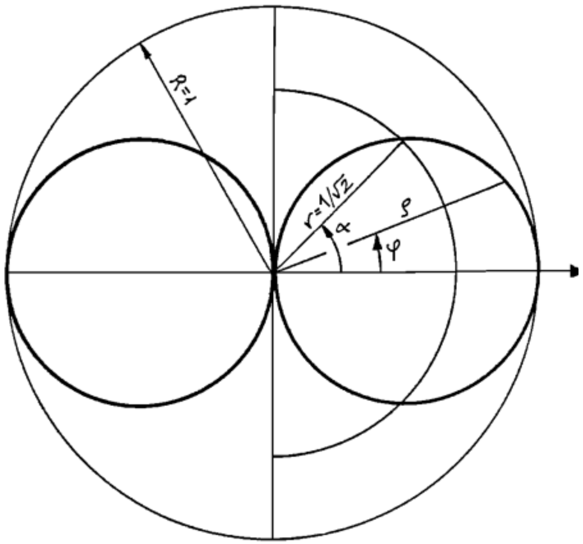
$$b^2 = 0.98 * \frac{1 - \cos^2\alpha}{1.96 - (\sqrt{2}\cos\alpha - 0.6)^2}$$

Definition range:

$0° \le \alpha \le 96°$

$-180° \le \varphi \le 180°$

DE



$$\varsigma = Abs\left(\frac{4b^2\cos\varphi}{(4b^2-1)\cos^2\varphi+1}\right)$$

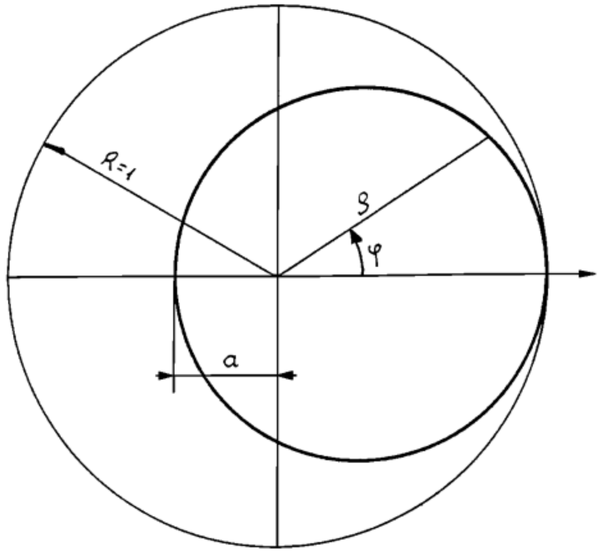
$$b^2 = \frac{1\text{-}\cos^2\alpha}{2-(2\cos\alpha-\sqrt{2})^2}$$

Definition range:

$0° \leq \alpha \leq 65°$

$-180° \leq \varphi \leq 180°$

KA



$$\varsigma = \frac{(1-a)\cos\varphi+\sqrt{(1-a)^2\cos^2\varphi+4a}}{2}$$

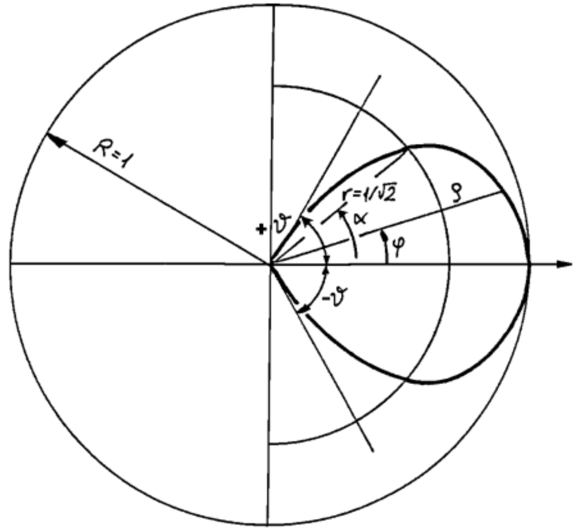
Definition range:

$0 \leq a \leq 1$

a = 0 $90° \leq \varphi \leq 90°$

a>0 $-180° \leq \varphi \leq 180°$

LA



$$\varsigma = \cos((1-\cos(\frac{60}{a})\cdot\varphi))\cdot 90)$$

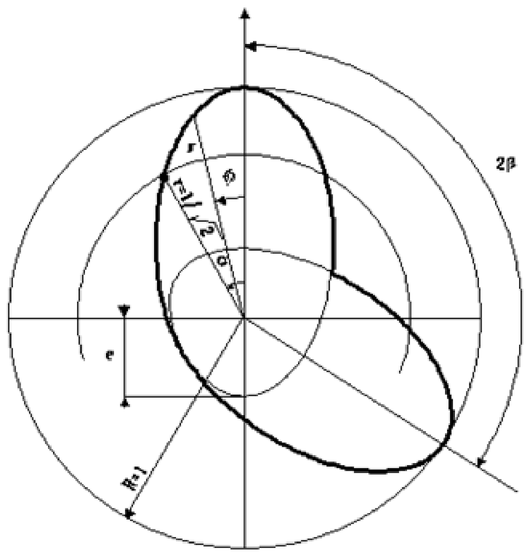
$$\upsilon = \pm\frac{3a}{2}$$

Definition range:

$0 \leq a \leq 120°$

$-1.5a \leq \varphi \leq 1.5a$

V-type antenna diagrams (VA, VB, ... VH, VI)



This type of symmetrical radiation pattern diagram has two main beams based on shifted ellipses. The ellipse components may be shifted and their half angle of radiation can be used as parameter. The scale of the shift is expressed by the second letter of the type code. The parameters cannot be specified in the conventional way because of the given format of the type code as well as the determined number of characters being contained in the type code string. Thus, the first group of digits must be divided in two parts so that the code can represent more independent data elements. However, this solution implies that coarser steps of the parameters must be contended with. The half value of the half-power angle can be varied with five-degree steps, its minimum and maximum being 15 degrees and 60 degrees, respectively.

The shift of the ellipses can be specified within the range of 0.00 to 0.40 in 9 steps of 0.05 each.

The notation of the type is mnnVArr
…
mnnV I rr

With

- m = a one-digit number describing the half value of the half-power angle
- nn = a two-digit number representing the half value of the angle between the two main beams
- rr = a two-digit number, the value of which is one hundred times the radius of the circle enveloping the side lobes.

<u>Interpretation and range of the parameters:</u>

$\alpha = m * 5 + 15$ is the half value of the half-power angle.

$0 \leq \alpha \leq 65^o$ is automatically fulfilled because α falls within 15 and 60 degrees due to the range of "m".

$\beta = nn$ is half of the opening angle between the main beams.

$0 \leq \beta$ There are no limitations of the maximum of the opening angle. However, it is reasonable to limit the half opening angle to be not greater than 90 degrees.

$R_o = rr/100$ is the enveloping radius of the side lobes.

$0 \leq r_o < 1.0$ is automatically fulfilled.

e is the shift of the extremity of the ellipses.

$0 \leq e \leq 1/\sqrt{2}$ is automatically fulfilled.

e	4^{th} and 5^{th} characters of the string
0.00	VA
0.05	VB
0.10	VC
0.15	VD
0.20	VE
0.25	VF
0.30	VG
0.35	VH
0.40	V I

The basic relations are :

IF e=0 THEN e= 1E-5

$$k_5 = \left(\frac{1+e}{2}\right)^2$$

$$b^2 = \frac{k_5}{2} * \frac{1-\cos^2(\alpha)}{k_5 - \left(\frac{\cos(\alpha)}{\sqrt{2}} - \frac{1-e}{2}\right)^2}$$

$$k_4 = b^2 - k_5$$

$$k_3 = b^2 * e * k_5$$

$$k_2 = b^4 * k_5 - k_3$$

$$k_1 = b^2 * \frac{1-e}{2}$$

$$r_i = \frac{k_1 * \cos(x) + \sqrt{k_2 * \cos^2(x) + k_3}}{k_4 * \cos^2(x) + k_5}$$

The relative gain of the i-th beam (i=1,2)

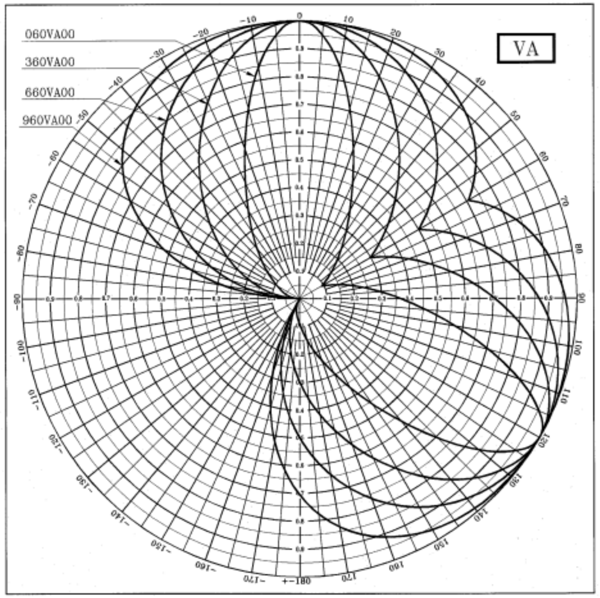
In the above equations x is the running angle coordinate of the beams.

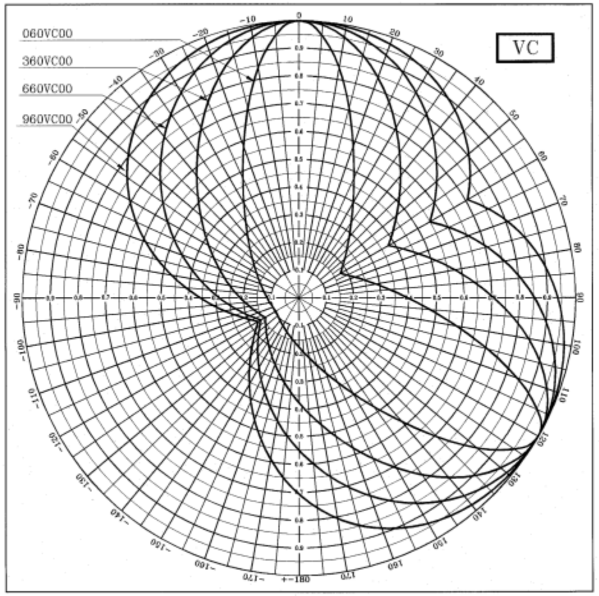
r_1=fnct(ϕ)	is the relative gain of beam 1
r_2=fnct(ϕ-2*β)	is the relative gain of beam 2
with ϕ	being the current angle

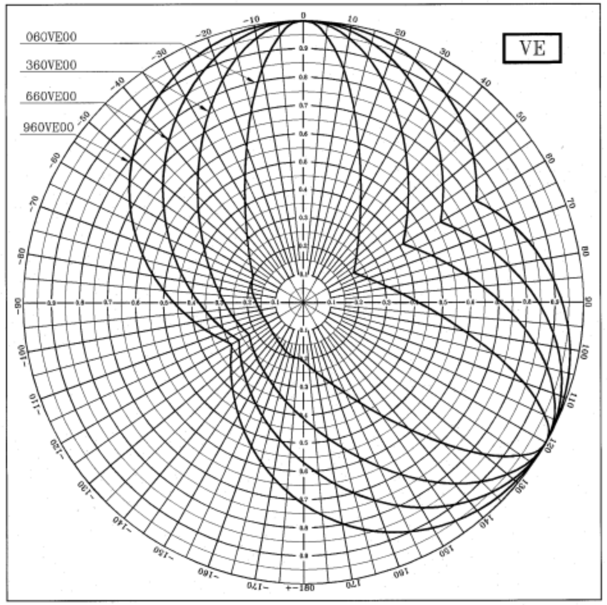
The resulting pattern is formed by taking the maximum from r_1, r_2 and r_o calculated for any given direction.

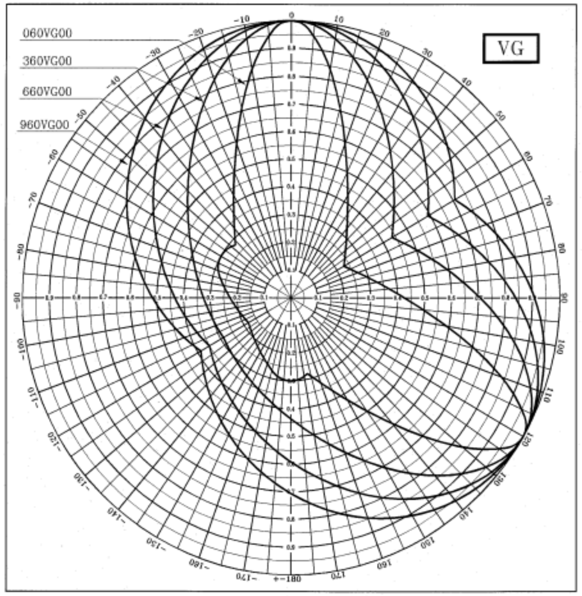
The field 9A of the database must contain the azimuth of that main beam axis with respect to which the other one can be reached by a positive angular turn of less than 180 degrees.

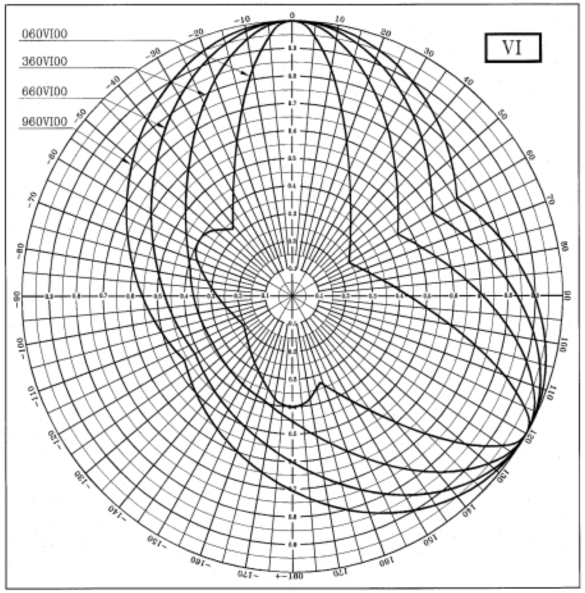
Examples of the V type antenna







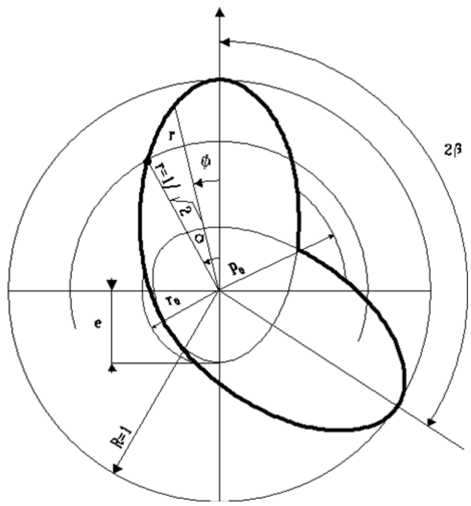




W-type antenna diagrams
(WA, WB, ... WH, WI)

This type of symmetrical radiation pattern diagram has two main beams. The basic curve is the same as in the case of the V-type, the difference lies in the enveloping radius having one value in the front direction and another in the back direction. The range of the enveloping radius is

0.35 to 0.80 in the front direction and
0.00 to 0.45 in the back direction.



The notation of the type is mnnWArp
…
mnnW I rp

With	m	=	a one-digit number describing the half value of the half-power angle.
	nn	=	a two-digit number representing the half value of the angle between the two main beams.
	r	=	a one-digit number characterising the radius of the circle enveloping the side lobes on the back side.
	p	=	a one-digit number characterising the radius of the circle enveloping the side lobes on the front side.

Interpretation and range of the parameters:

$\alpha = m * 5 + 15$ — is the half value of the half-power angle.
$0 \leq \alpha \leq 65^{o}$ — is automatically fulfilled because α falls within 15 and 60 degrees due to the range of "m".

$\beta = nn$ — is half of the opening angle between the main beams.
$0 \leq \beta$ — There are no limitations on the maximum of the opening angle. However, it is reasonable to limit the half opening angle to be not greater than 90 degrees.

$r_o = r/20$ — is the enveloping radius of the side lobes in the back direction.
$0 \leq r_o < 1.0$ — is automatically fulfilled.

$p_o = p/20 + 0.35$ — is the enveloping radius of the side lobes in the front direction.
$0 \leq p_o < 1.0$ — is automatically fulfilled.

e — is the shift of the extremity of the ellipses.
$0 \leq e \leq 1/\sqrt{2}$ — is automatically fulfilled.

e	4th and 5th characters of the string
0.00	WA
0.05	WB
0.10	WC
0.15	WD
0.20	WE
0.25	WF
0.30	WG
0.35	WH
0.40	WI

<u>The basic relations are :</u>

IF e=0 THEN e = 1E-5

$$k_5 = \left(\frac{1+e}{2}\right)^2$$

$$b^2 = \frac{k_5}{2} * \frac{1-\cos^2(\alpha)}{k_5 - \left(\frac{\cos(\alpha)}{\sqrt{2}} - \frac{1-e}{2}\right)^2}$$

$$k_4 = b^2 - k_5$$

$$k_3 = b^2 * e * k_5$$

$$k_2 = b^4 * k_5 - k_3$$

$$k_1 = b^2 * \frac{1-e}{2}$$

$$r_i = \frac{k_1 * \cos(x) + \sqrt{k_2 * \cos^2(x) + k_3}}{k_4 * \cos^2(x) + k_5}$$

The relative gain of the i-th beam (i=1,2)

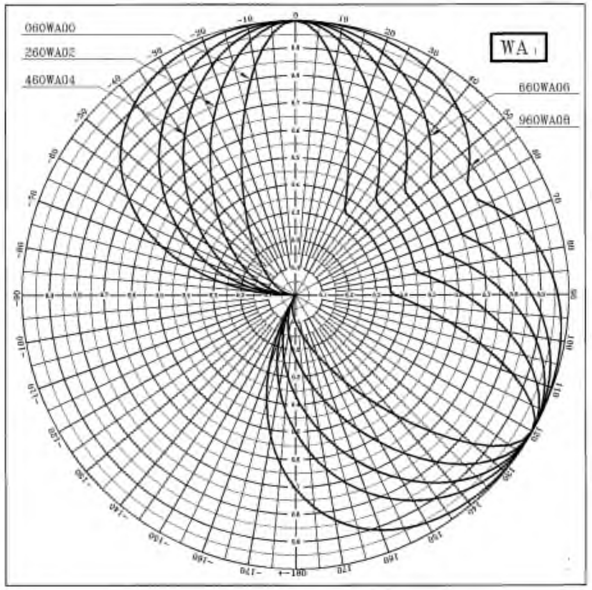
In the above equations, x is the running angle coordinate of the beams.

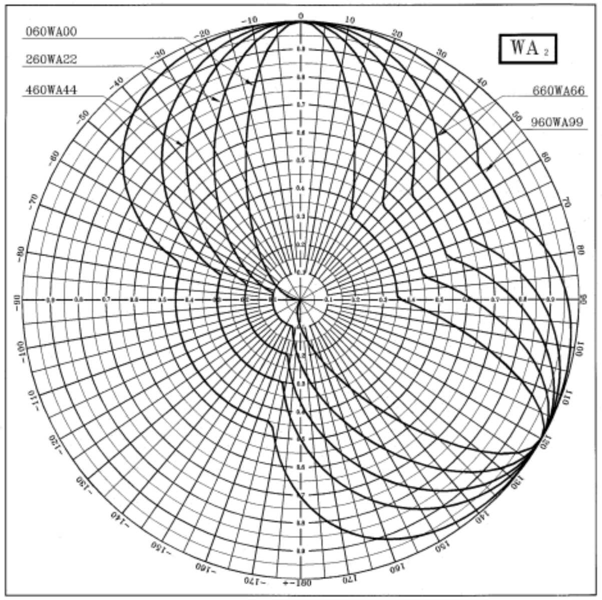
r_1=fnct(ϕ)	is the relative gain of beam 1
r_2=fnct(ϕ-2*β)	is the relative gain of beam 2
with ϕ	being the current angle

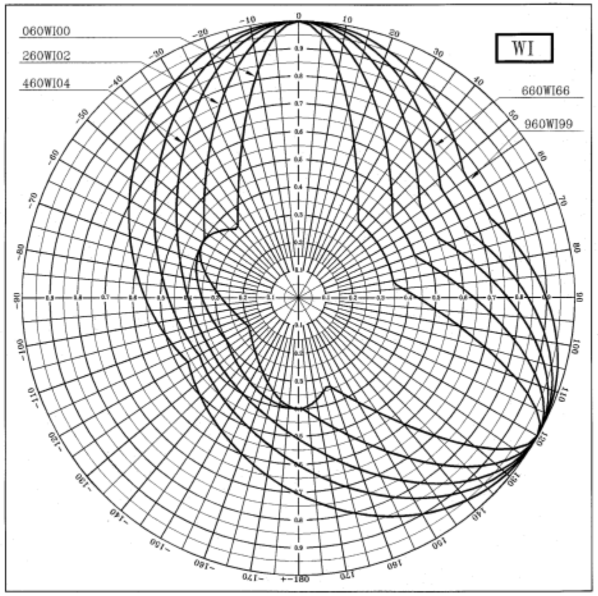
The resulting pattern is formed by taking the maximum from r_1, r_2 and p_o calculated for any given direction within the angular range of less than 180 degrees between the two main beams and taking the greatest from r_1, r_2 and r_o calculated for any other given direction.

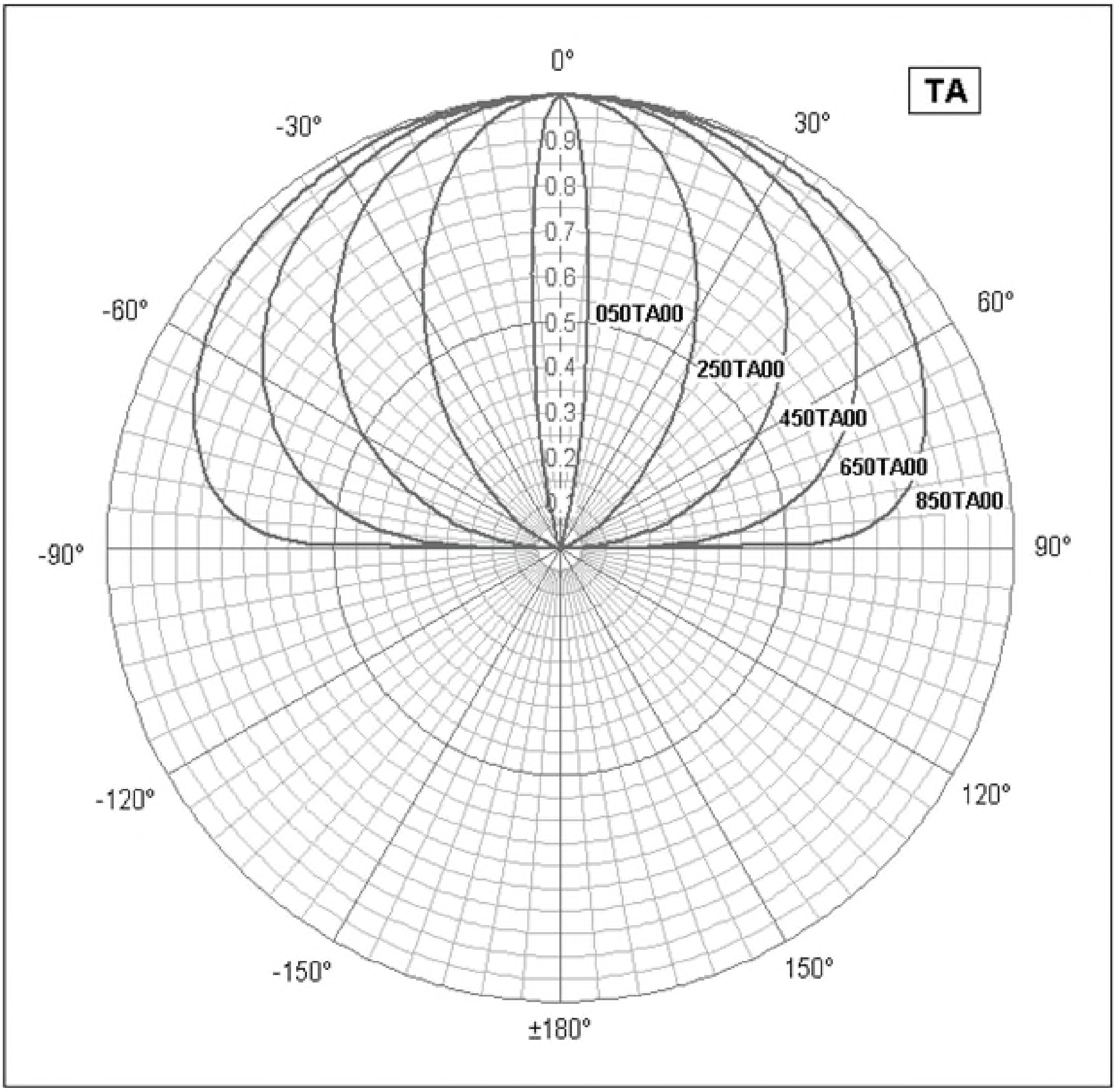
The field 9A of the data base must contain the azimuth of that main beam axis with respect to which the other one can be reached by a positive angular turn of less than 180 degrees.

Examples of the W type antenna

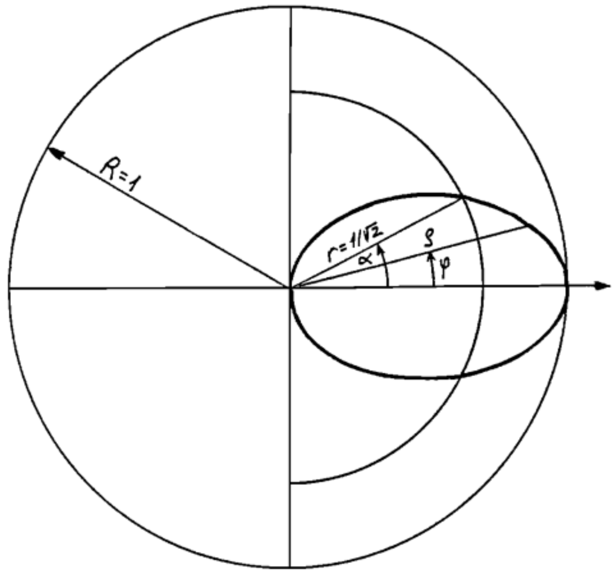








Numerical value	Side lobe attenuation	
90	0.9 =	-1 dB
80	0.8 =	-2 dB
70	0.7 =	-3 dB
60	0.6 =	-4.5 dB
50	0.5 =	-6 dB
40	0.4 =	-8 dB
30	0.3 =	-10.5 dB
20	0.2 =	-14.5 dB
10	0.1 =	-20 dB
05	0.05 =	-26 dB



$\rho = \cos^{n} \varphi$ ..... for $\cos(\varphi) \geq 0$

$\rho = 0$ .... for $\cos(\varphi) < 0$

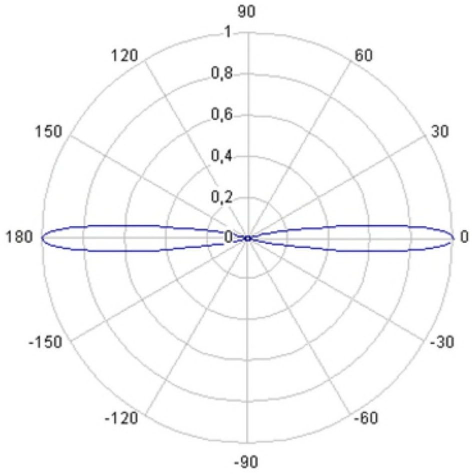
$n = -0.1505 / \log_{10}(\cos \alpha)$

Definition range:

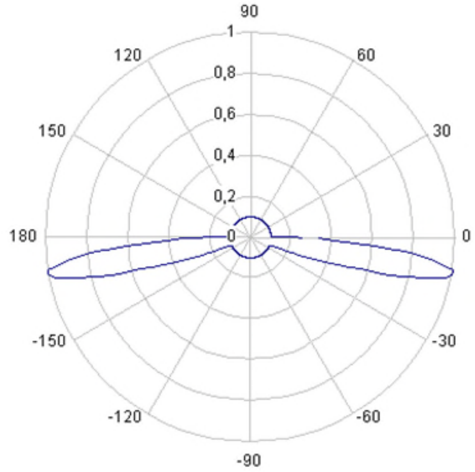
$0.1° \leq \alpha \leq 89.0°$

$0° \leq \varphi \leq \pm 180°$

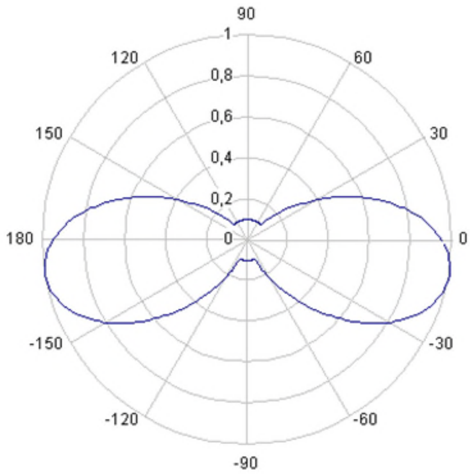
Appendix 8 to Annex 6



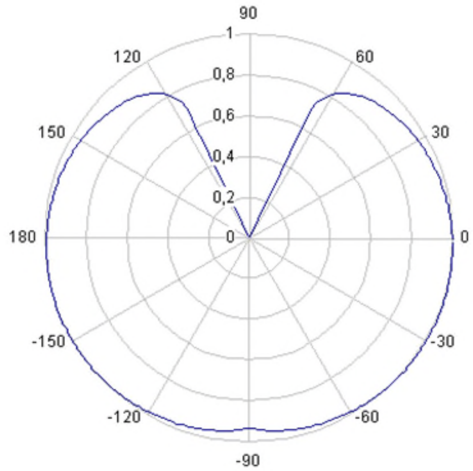
050PA00



050PK10



250PK10



890PZ00

Numerical value	Side lobe attenuation	
90	0.9 =	-1 dB
80	0.8 =	-2 dB
70	0.7 =	-3 dB
60	0.6 =	-4.5 dB
50	0.5 =	-6 dB
40	0.4 =	-8 dB
30	0.3 =	-10.5 dB
20	0.2 =	-14.5 dB
10	0.1 =	-20 dB
05	0.05 =	-26 dB

Annex 7

Provisions on measurement procedures
in the Fixed Service and the Land Mobile Service

PROVISIONS ON MEASUREMENT PROCEDURES

1. General

Administrations concerned should agree upon measurements in the following cases:

1.1 in cases of disagreement concerning the results of evaluation related to a specific coordination request
(see section 4.8.2 of this Agreement)

1.2 to facilitate the enhancement of existing networks
(see section 4.8 of this Agreement)

1.3 in cases of harmful interference between coordinated links
(see section 5 of this Agreement)

After receipt of the request for the application of the procedures mentioned above in points 1.1, 1.2 and 1.3, Administrations concerned shall endeavor that their Monitoring Services work closely together on the bases of internationally agreed measurement procedures.

2. Measurements

Measurements shall be made according the latest version of the relevant CEPT/ECC/ERC Recommendation.

3. Report

The Monitoring Services of the Administrations involved shall cooperate closely to draft a report of the measurement results.

The results of measurements will be presented using the relevant form given in Appendices 1 and 2, depending upon the cases stated above.

Appendix 1 to Annex 7

MEASUREMENT REPORT ON COORDINATION BASED ON TESTS

ASSIGNMENTS

<u>Existing assignment</u>

Coordination reference no. (13x): ____________________________

Frequency (1a): ____________________________

Location (4a): ____________________________

Coordinates (4c): ____________________________

Polarization (9d): ____________________________

<u>Requested assignment</u>

Coordination reference no. (13x): ____________________________

Frequency (1a): ____________________________

Location (4a): ____________________________

Coordinates (4c): ____________________________

Polarization (9d): ____________________________

TYPE OF MEASUREMENT

[ ] Fixed point, number of points: ______

[ ] Measurements over longer time periods

[ ] Mobile

MEASUREMENT DATA

Number of the measurement: ____________________________

Measured frequency: ____________________________

Measured bandwidth: ____________________________

Date(s) of measurement: ____________________________

Time period: ____________________________

MEASUREMENT DATA (continued)

Location: ___________________________

Geographical coordinates (deg/min/sec): ___________________________

Altitude measurement location: __________ m above sea level

Height measurement antenna: _________ m above ground level

Polarization of measurement antenna: ___________________________

Customer's antenna: [ ] yes [ ] no

Description of the transmission path[1]: ____________________________

____

____

Propagation conditions: _____________________________

____

____

Remarks: _____________________________

____

____

MEASUREMENT RESULTS

In case of measurement over a longer time period:

Quasi-maximum value (10 %): _____ dBμV/m

Quasi-minimum value (90 %): _____ dBμV/m

MEASURED VALUE[2]: _____ dBμV/m

[1] to be indicated on a map, attached to this report in the case of mobile field strength measurements

[2] in case of measurement over longer time period or mobile measurement the median value should be mentioned

Appendix 2 to Annex 7

MEASUREMENT REPORT ON HARMFUL INTERFERENCE

ASSIGNMENTS

Interfering assignment

Administration: ___________________________

(b) Frequency: ___________________________

(h) Supposed location: ___________________________

or

Direction to interfered assignment: ___________________________

(c+d) Designation of emission (7a): ___________________________

(e) Measured field strength: _____ dBµV/m

(f-x) other: ___________________________

Remarks: ___________________________

____

____

Interfered assignment

Administration reference no. (13x): ___________________________

Frequency (1a): ___________________________

Location (4a): ___________________________

Coordinates (4c): ___________________________

Class of station (6a): ___________________________

TYPE OF MEASUREMENT

[ ] Fixed point, number of points: _____

[ ] Measurements over longer time periods

[ ] Mobile

MEASUREMENT DATA

Number of the measurement:	___________________________
Measured frequency:	___________________________
Measured bandwidth:	___________________________
Date(s) of measurement:	___________________________
Time period:	___________________________
Location:	___________________________
Geographical coordinates (deg/min/sec):	___________________________
Altitude measurement location:	_________ m above sea level
Height measurement antenna:	________ m above ground level
Polarization of measurement antenna:	___________________________
Customer's antenna:	[ ] yes [ ] no
Description of the transmission path[1]:	___________________________
	___________________________
	___________________________
Propagation conditions:	___________________________
	___________________________
	___________________________
Remarks:	___________________________
	___________________________
	___________________________

MEASUREMENT RESULTS

In case of measurement over a longer time period:

Quasi-maximum value (10 %): _____ dBµV/m

Quasi-minimum value (90 %): _____ dBµV/m

MEASURED VALUE[2]: _____ dBµV/m

[1] to be indicated on a map, attached to this report in the case of mobile field strength measurements

[2] in case of measurement over longer time period or mobile measurement the median value should be mentioned

Annex 8A

Method for combining the horizontal and vertical antenna patterns in the land mobile service

1 The calculation of the 3-D antenna radiation pattern.

The following description outlines how to calculate the 3-D antenna radiation pattern from the following input data of the Tx and Rx antennas:

- the partial horizontal and vertical antenna codes, respectively 9XH and 9XV,
- the azimuth and elevation angles of maximum radiation, respectively 9A, 9B,
- the azimuth and elevation angles of direction in which the resulting attenuation of 3-D antenna radiation pattern has to be calculated (propagation path).

In a first step the two vectors (antenna direction and propagation path) are combined to one vector, represented by horizontal and vertical difference angle (hda, vda) that can be applied to the antenna in its basic position. This is done by plain spherical coordinate transformation. This step takes care of the azimuth and mechanical tilt (elevation) of the antenna.

If the antenna has additional electrical tilt, it can now simply be applied to the resulting vertical difference angle as it is independent of the azimuth.

With the resulting horizontal and vertical difference angle, the values for horizontal and vertical attenuation can be calculated according to the relevant antenna codes.

The generally applied combination method to obtain the 3D-attenuation value is the geometrical sum. Due to reasons described in chapter 2, special cases have to be considered and taken care of to avoid inconsistencies.

2 Combination of the partial horizontal and vertical radiation patterns into resulting 3-D radiation pattern

The resulting 3-D antenna radiation pattern is fully defined only in the two basic horizontal and vertical planes by the *hCode* and the *vCode*. The attenuation in random directions can only be evaluated by either a simple or a sophisticated approximation. The *hCode* and the *vCode* represent two upright cross-sections of resulting 3-D antenna radiation pattern, and therefore their back lobe attenuations have to be equal, as is demonstrated in Fig.2.

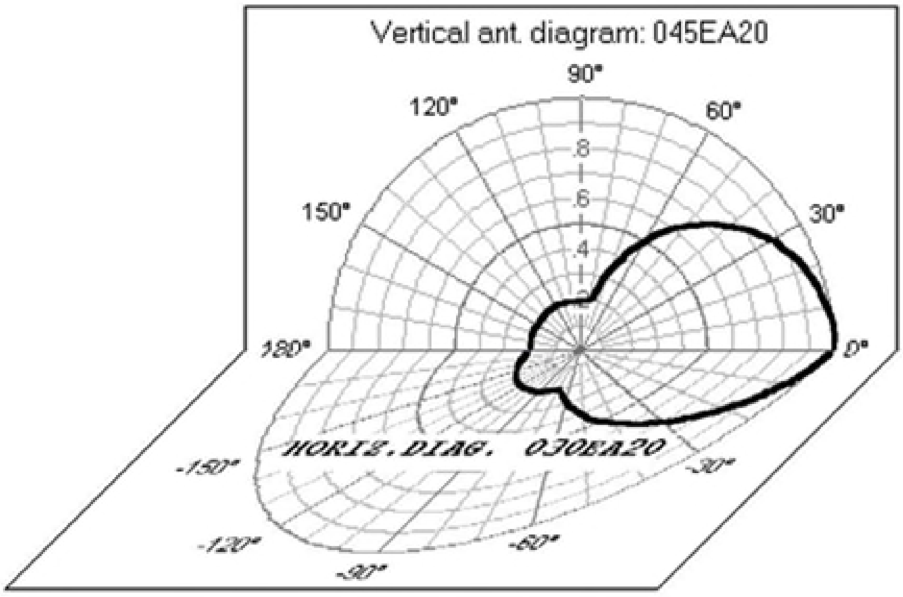


Fig.2.

The existing reality is that some co-ordination requests contain mathematically incompatible antenna codes, as demonstrated in Fig.3.

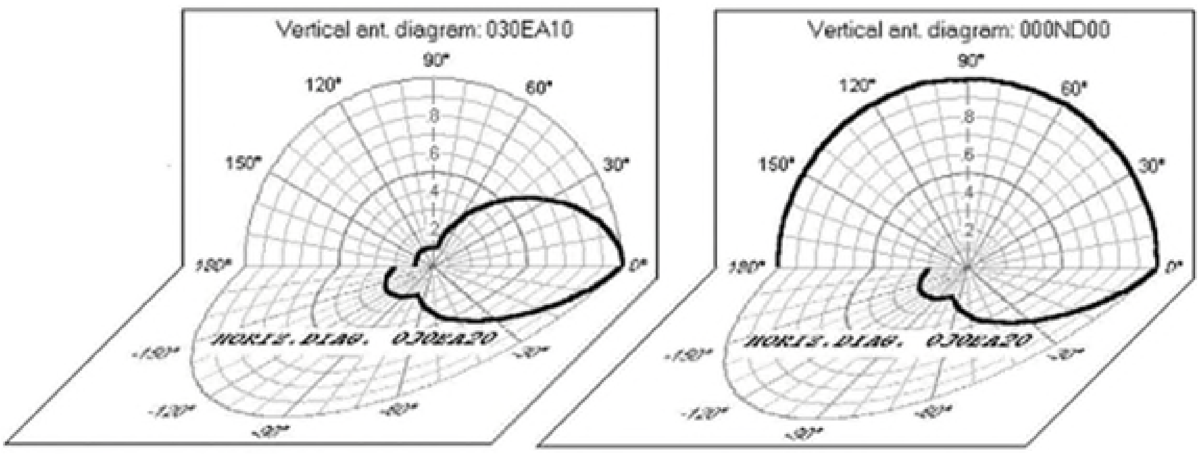


Fig.3.

One of reasons for this is that the applicant of the co-ordination request wants to express the intention that he does not want to claim any restrictions due to the vertical antenna code *000ND00* in conjunction with some directive horizontal antenna code. But this interpretation is nonsense from the mathematical point of view because it causes the ambiguity and the discontinuity of the resulting 3-D radiation pattern, as was demonstrated on Fig.3.

The first step of combining the antenna diagrams is therefore to check whether they are compatible. If they are not compatible, then the vertical antenna diagram is adapted to conjunct the horizontal antenna diagram. The matching of both antenna diagrams together is performed by means of the following smoothing bridge function:

$A_{VD\_back} = A_{VD\_back\_O} * SQR(\sin^2 vda + rb * \cos^2 vda)$ …….. [5]

where: A_{VD_back} is the attenuation of the matched vertical antenna back branch
$A_{VD\_back\_O}$ is the attenuation of the original (unchanged) vertical antenna back branch
rb is back attenuation ratio of the original vertical and horizontal antenna diagrams at the angle *vda* = ± 180 deg.

The smoothing bridge function affects the back branch of the vertical antenna diagram only where it creates a new diagram shape, while its forward branch remains unchanged.

The result of the matching adaptation process is demonstrated in the example given in Fig.4.

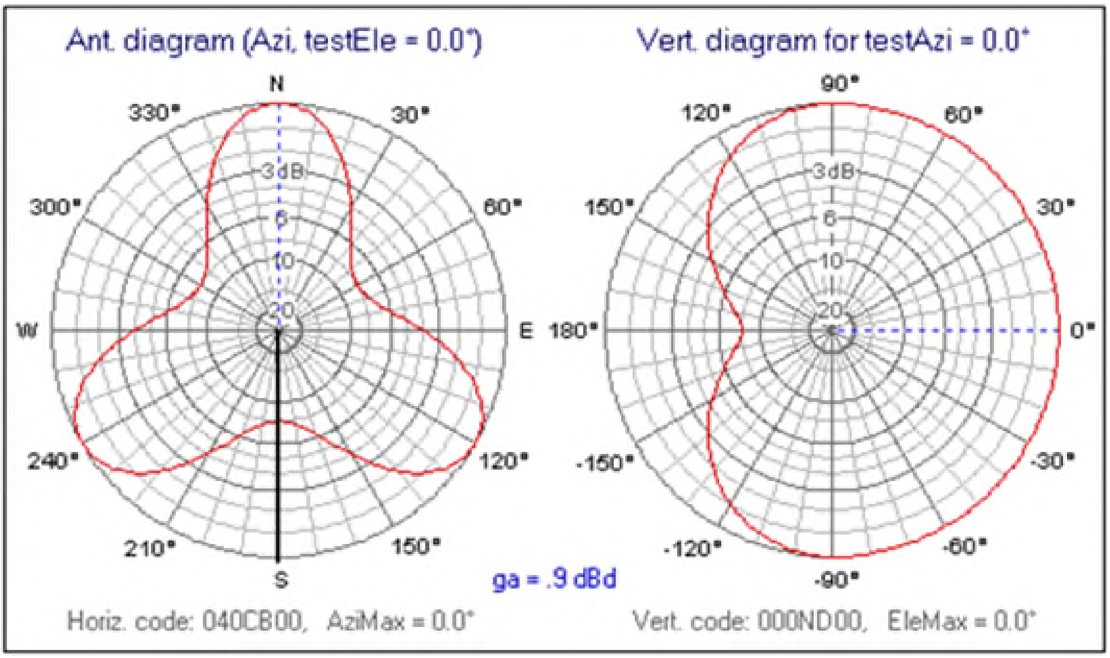


Fig.4.

The back branch of the vertical antenna diagram with *vda* angle range from +90 to ± 180 deg. and from -90 to ± 180 deg. was continuously adapted to the existing back attenuation of the horizontal diagram for *hda* = 180 deg. The forward branch of the vertical antenna diagram remained omni-directional i.e. it remained unchanged.

In the second step of the combination of the antenna diagrams, the resulting vertical antenna diagram is interpolated over different azimuth angles *hda.* The vertical antenna diagram consists of a forward and a back branch. The forward branch and the back branch of the vertical antenna diagram are eventually matched. (See Fig. 5)

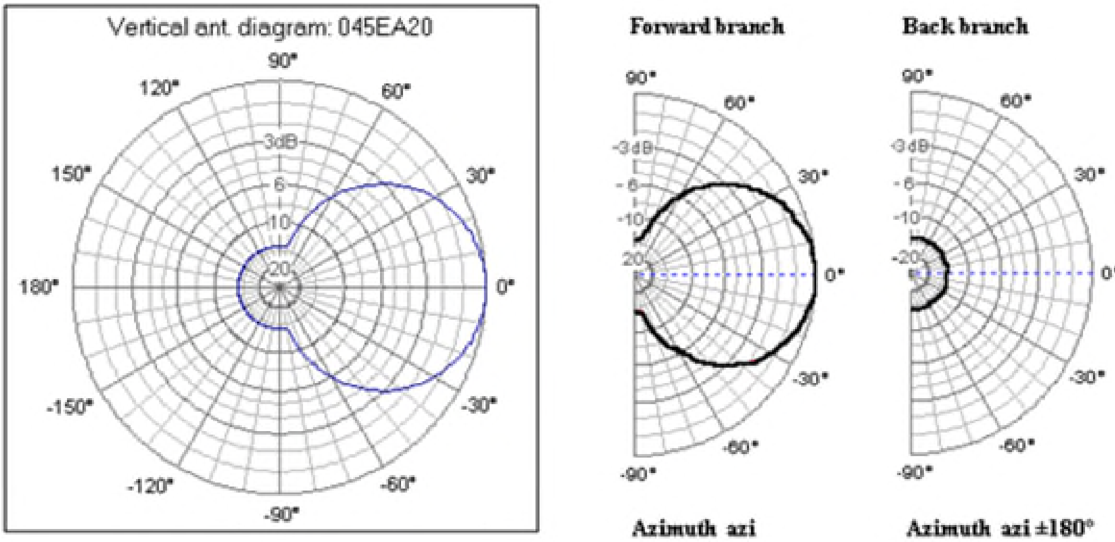


Fig.5.

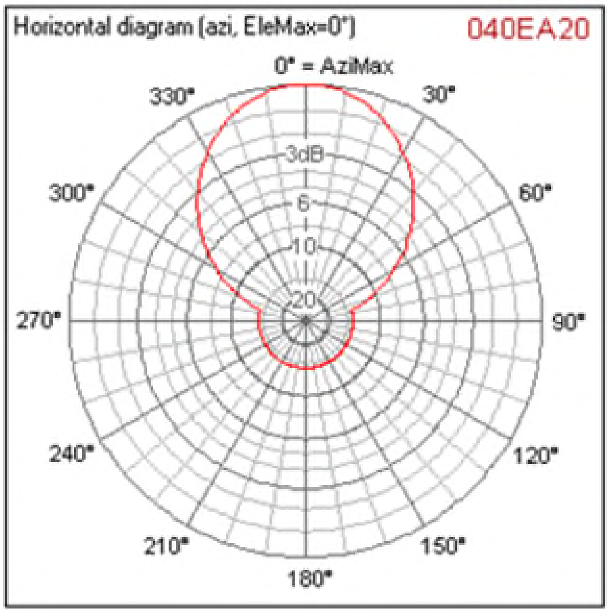
Two different types of interpolation are used: proportional and linear. The suitability of the interpolation type depends on the horizontal antenna diagram shape.

The proportional interpolation of the source vertical antenna sub-diagrams is used for a directive multiple-lobe or for a one-lobe horizontal antenna diagram. The interpolation weight coefficient *w* is developed from the attenuation of the horizontal antenna diagram in the mentioned angle of *hda* and it is described by formula:

w = (1 – h) / (1 – hb)

where: *h* is the attenuation of the horizontal antenna diagram in the azimuth *hda*
hb is the attenuation of the horizontal antenna diagram in the back direction (hda = 180 deg.)

Proportional interpolation assures, for example as given in Fig.4., that the vertical antenna diagrams will be identical in the symmetry *hda* axes of horizontal antenna diagrams 0, 120, 240 deg. The one-lobe directional horizontal antenna diagram case is shown in Fig.6.



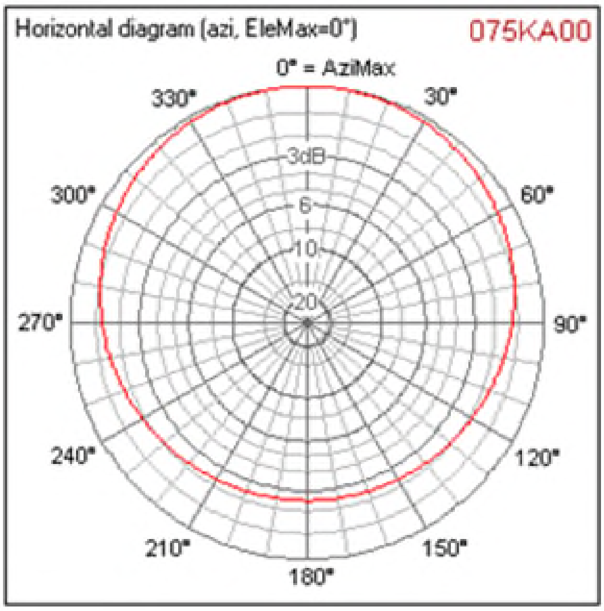


Fig.6. **Fig.7.**

Proportional interpolation type assures in the case of Fig.6. that the back branches of all vertical antenna diagrams will be identical in the *hda* azimuth range from 80 to 280 deg. due to constant attenuation of the horizontal antenna diagram there.

Linear interpolation is used for slightly directive horizontal antenna diagrams only. An example of typical slightly directive horizontal antenna diagram is given in Fig.7.
The interpolation weight coefficient *w* is developed from the angle interval between the forward azimuth angle and the back azimuth angle of *hda,* and it is described by formula:

$$w = ABS(hda / 180)$$

The third step of the combination of partial antenna diagrams makes final checking whether the interpolated vertical antenna diagram and the horizontal antenna are compatible altogether in the evaluated azimuth *hda*. The reason for this last checking is demonstrated in Fig.8. If the pre-analyzed antenna diagrams are not compatible in some azimuth, then the partial vertical antenna diagram has to be adapted to the partial horizontal antenna diagram.

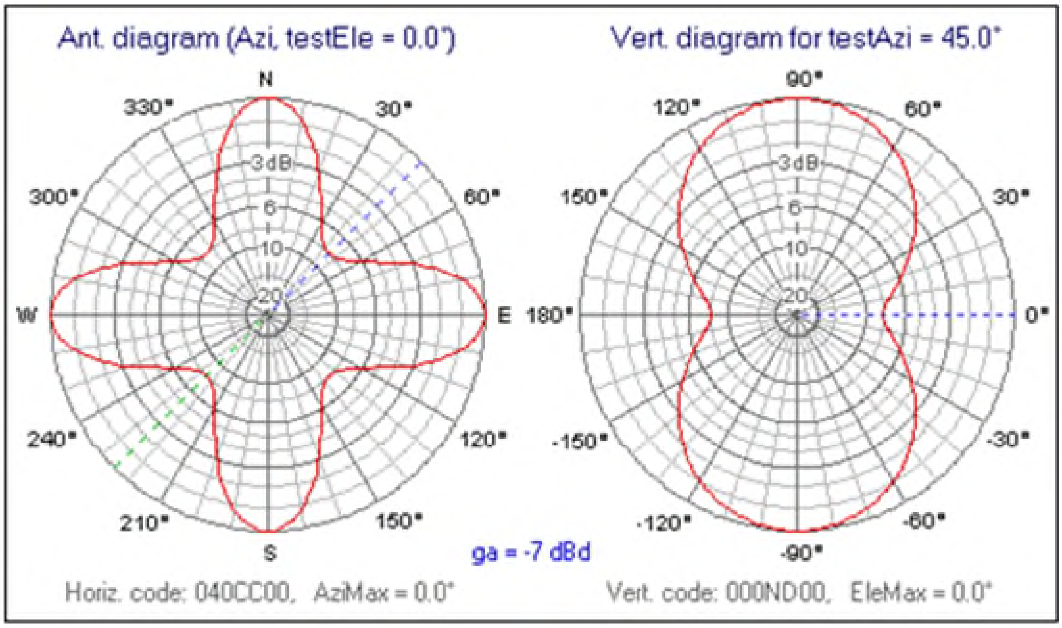


Fig.8.

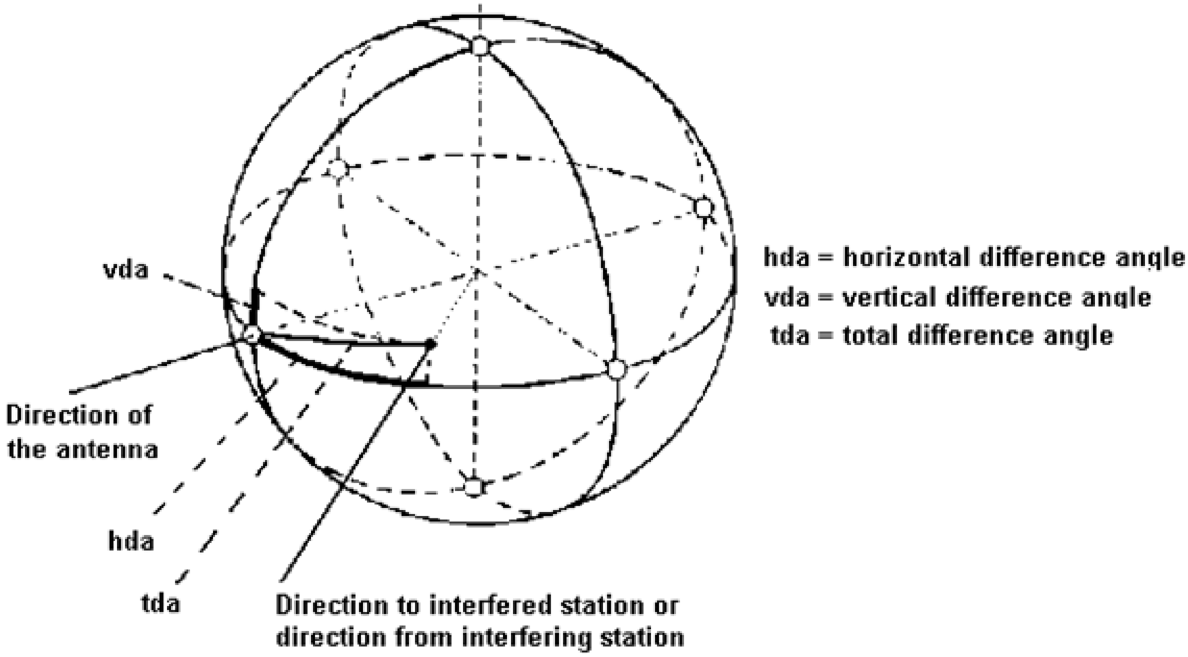
The demo example, given in Fig.8., describes the case where both partial input antenna diagrams are compatible and both source vertical diagram branches are identical i.e. omni-directional. The pre-calculated omni-directional vertical diagram has to therefore be matched to the horizontal antenna diagram shape in azimuths where the attenuations of partial antenna diagrams are different, for example in the azimuth of *hda* = 45 deg.

The matching of both partial antenna diagrams together is performed by means of a smoothing bridge function analogous to [5] described above.

Annex 8B

Method for combining the horizontal and vertical antenna patterns in the Fixed Service

Three dimensional antenna pattern:



Vertical difference angle vda = Antenna_elevation(9B) – E_{TR},

where E_{TR} – vertical angle of the link e.g. between the antennas of interferer and interfered with stations.
In case of line of sight,

for interferer E_{TR} is calculated as follows:

$E_{TR} = (h_r – h_t)$ / distance – distance / ($2\ a_e$)   rad,

where
h_t – interferer (transmitter) antenna height above sea level,
h_r – interfered with (receiver) antenna height above sea level,
a_e – effective Earth radius,
distance – the distance between interferer and interfered with stations,

for interfered with station E_{TR} is calculated as follows:

$E_{TR} = (h_t - h_r)$ / distance – distance / ($2\ a_e$),   rad,

In case of transhorizon path,

for interferer E_{TR} is calculated as follows:

$E_{TR} = \Theta_t / 1000$ rad,

where
Θ_t – interferer (transmitter) radio horizon angle (mrad),

for interfered with station E_{TR} is calculated as follows:

$E_{TR} = \Theta_r / 1000$ rad,

where
Θ_r – interfered with (receiver) radio horizon angle (mrad).

The maximum difference angle in the horizontal plane (hda) is ±180 degrees, the maximum difference angle in the vertical plane (vda) is also ±180 degrees. The resulting total difference angle (tda) is between 0 and 180 degrees. The tda value is calculated using formula:

$tda = \arccos (\sin(Ant_{vert}) * \sin(vda) + \cos(Ant_{vert}) * \cos(vda) * \cos(hda-Ant_{hor}))$

where
Ant_{vert} = difference angle between antenna elevation and elevation of the link and
Ant_{hor} = difference angle between antenna azimuth and azimuth of the link.

Because Ant_{vert} and Ant_{hor} are 0, the resulting formula is:

tda = arccos (cos(vda) * cos(hda))

Taking into account this total difference angle, the antenna attenuation for the horizontal plane (A_{hor}) and for the vertical plane (A_{vert}) are calculated.

If the horizontal antenna pattern is not symmetrical and the horizontal difference angle (hda) is negative (or between 180 and 360 degrees), the attenuation for the horizontal plane is calculated using the negative total difference angle (-tda).

If the vertical antenna pattern is not symmetrical and the vertical difference angle (vda) is negative (or between 180 and 360 degrees), the attenuation for the vertical plane is calculated using the negative total difference angle (-tda).

If both values for attenuation are equal, the resulting attenuation ($A_{resulting}$) is equal to one of those values:

$A_{resulting} = A_{hor}$ or

$A_{resulting} = A_{vert}$

If the horizontal attenuation is greater than the vertical attenuation, the resulting attenuation ($A_{resulting}$) is:

$$A_{resulting} = A_{vert} + (A_{hor} - A_{vert}) * \mathrm{Abs(hda)} / (\mathrm{Abs(hda)} + \mathrm{Abs(vda)})$$

If the vertical attenuation is greater than the horizontal attenuation, the resulting attenuation ($A_{resulting}$) is:

$$A_{resulting} = A_{hor} + (A_{ver} - A_{hor}) * \mathrm{Abs(vda)} / (\mathrm{Abs(hda)} + \mathrm{Abs(vda)})$$

This value $A_{resulting}$ is used for further calculations.

Annex 9

Threshold Degradation in the Fixed Service

Permissible Threshold Degradation

1 Definition of Threshold Degradation (TD)

The Threshold of a radio receiver is defined as the level of the wanted signal received for a given Bit Error Rate (BER).

In presence of an interfering signal (I), the level of the received wanted signal must be increased to preserve the same BER.

For a given BER, the difference between the increased threshold level value due to interference, and the threshold value without interference, is the Threshold Degradation (TD).

TD is assumed to be equivalent to the noise level increase, due to the interfering signal at the input of the receiver.

2 Permissible Threshold Degradation

The Permissible Threshold Degradation caused to one fixed-link receiver by one foreign fixed-link transmitter must not exceed 1 dB.

3 Calculation of Threshold Degradation

The calculation of TD is a two-step process.
First, the interfering power level (I) at the input of the receiver must be calculated.
Then, the TD due to this interfering signal is calculated and compared to the 1 dB permissible value.

Figure 1 illustrates the mechanism of the interference caused by transmitter X on receiver U.

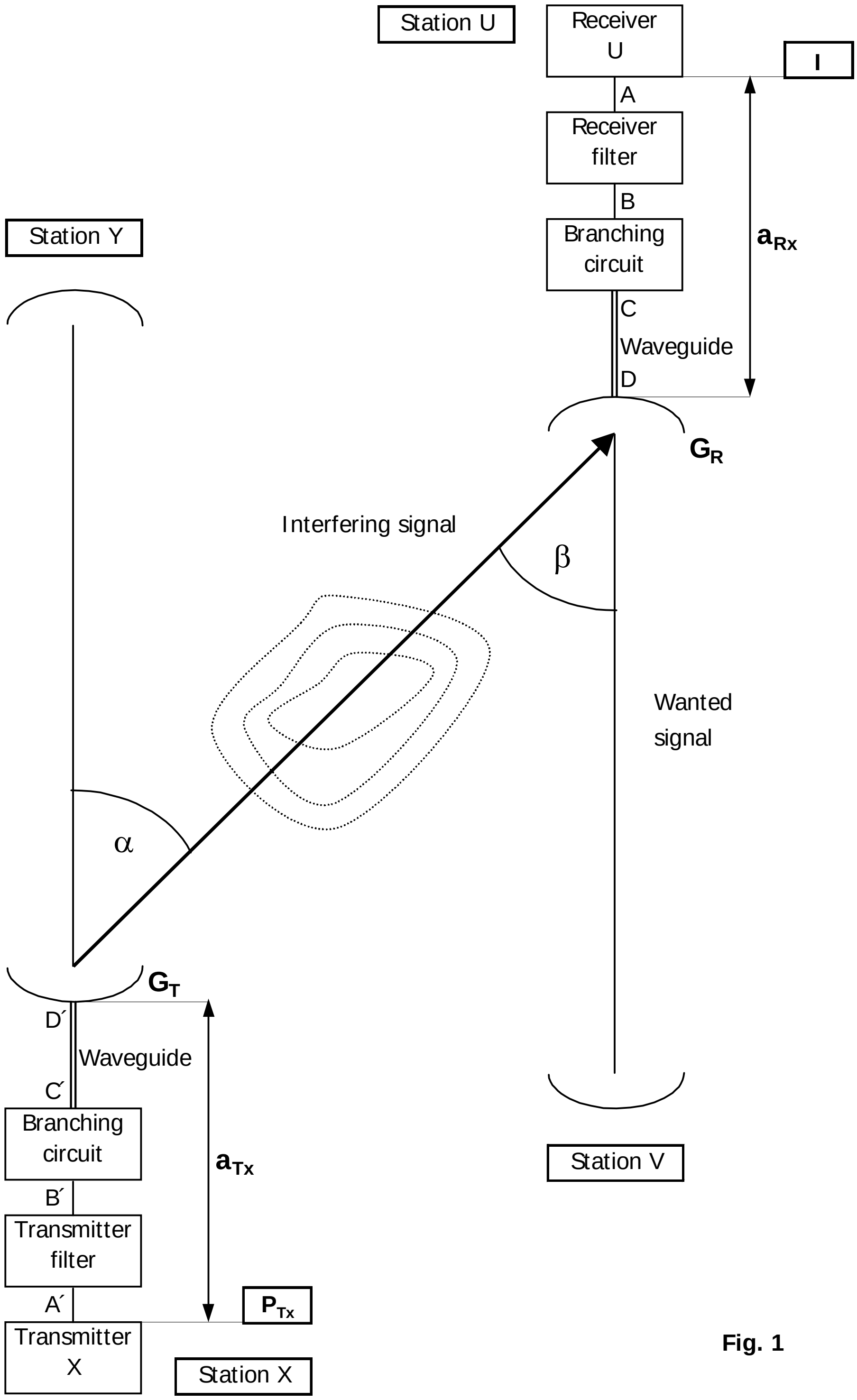


Fig. 1

3.1 Calculation of the interfering power level I

a) The technical data necessary for the calculation of different intermediate parameters, and finally the interfering signal power level (I) at the input of an interfered receiver, are listed below:

Interfered receiver:

- f_{Rx} (MHz) : receiver frequency
- geographical coordinates
- terrain height (m) above sea level
- antenna height (m) above terrain level
- main beam direction of the antenna
- G_R (dB) : receiver antenna gain
- a_{Rx} (dB) : receiver attenuation between points D and A (all losses between the antenna flange and the input of the receiver)
- co-polar and cross polar receiver antenna radiation pattern
- receiver selectivity mask (possibly assumed, see Annex 3 B)
- polarisation

Interfering transmitter:

- f_{Tx} (MHz) : transmitter frequency
- P_{Tx} (dBW) : transmitter power level
- geographical coordinates
- terrain height (m) above sea level
- antenna height (m) above terrain level
- main beam direction of the antenna
- G_T (dB) : transmitter antenna gain
- a_{Tx} (dB) : transmitter attenuation between points D' and A' (all losses between the antenna flange and the output of the transmitter)
- Co-polar and cross polar transmitter antenna radiation pattern
- Transmitter spectrum mask (see Annex 3 B)
- ATPC (dB) : dynamic range of automatically transmitter power control (when applicable)
- polarisation

b) The interfering power level (I) at the receiver input at the station U can be determined using:

$$I = P_{Tx} - a_{tot} \qquad \text{(dBW)} \qquad (1.1)$$

where
a_{tot} [dB] total attenuation between transmitter output (point A´) and receiver input (point A)

$$a_{tot} = a_{Tx} - G_{Tx} + a_{prop} - G_{Rx} + a_{Rx} + a_{ant} + MD + NFD + ATPC \qquad (dB) \qquad (1.2)$$

where

NFD (dB) Net Filter Discrimination (see Annex 3B for calculation)

MD (dB) Masks Discrimination (see Annex 3B for calculation)

a_{prop} [dB] propagation attenuation between antennas that can be calculated on the basis of the results of calculation covered in the Annex 10, in conformity with the type of path.

a_{ant} [dB] attenuation which is a function of both antenna radiation patterns and polarisation discrimination

The aggregated antennas attenuation a_{ant} due to both antenna radiation patterns and polarisation discriminations can be determined using the following formula:

$$a_{ant} = a_{antH} - 20\log\left(1 + 10^{\frac{a_{antH} - a_{antV}}{20}}\right) \qquad (dB),$$

where:

a_{antH} aggregated antennas (transmitting and receiving) attenuation for signal of H polarisation,

a_{antV} aggregated antennas attenuation for signal of V polarisation.

a_{antH} and a_{antV} for different configuration of antennas polarisation can be determined by formulas given in the Table 1 where the following notation is applied:

aT_{H-H} attenuation of the transmitter antenna of polarisation H relating to the signal of H polarisation in the direction of the receiver,

aT_{V-V} attenuation of the transmitter antenna of polarisation V relating to the signal of V polarisation in the direction of the receiver,

aT_{H-V} attenuation of the transmitter antenna of polarisation H relating to signal with V polarisation in the direction of the receiver,

aT_{V-H} attenuation of the transmitter antenna of polarisation V relating to signal with H polarisation in the direction of the receiver,

aR_{H-H} attenuation of the receiver antenna of polarisation H relating to the signal of H polarisation in the direction of the transmitter,

aR_{V-V} attenuation of the receiver antenna of polarisation V relating to the signal of V polarisation in the direction of the transmitter,

aR_{H-V} attenuation of the receiver antenna of polarisation H relating to the signal of V polarisation in the direction of the transmitter,

aR_{V-H} attenuation of the receiver antenna of polarisation V relating to the signal of H polarisation in the direction of the transmitter,

Table 1

a_{antH} and a_{antV} for different configuration of antennas polarisation

Transmitter antenna Polarisation	Receiver antenna polarisation	
	H	V
H	$a_{antH} = aT_{H-H} + aR_{H-H}$ $a_{antV} = aT_{H-V} + aR_{H-V}$	$a_{antH} = aT_{H-H} + aR_{V-H}$ $a_{antV} = aT_{H-V} + aR_{V-V}$
V	$a_{antH} = aT_{V-H} + aR_{H-H}$ $a_{antV} = aT_{V-V} + aR_{H-V}$	$a_{antH} = aT_{V-H} + aR_{V-H}$ $a_{antV} = aT_{V-V} + aR_{V-V}$

3.2 Calculation of TD due to I

a) Input data

I (dBW) : interfering power level at the receiver input coming from one interfering source (see 3.1.b).

FkTB or N (dBW) : noise power level in the interfered receiver bandwidth.

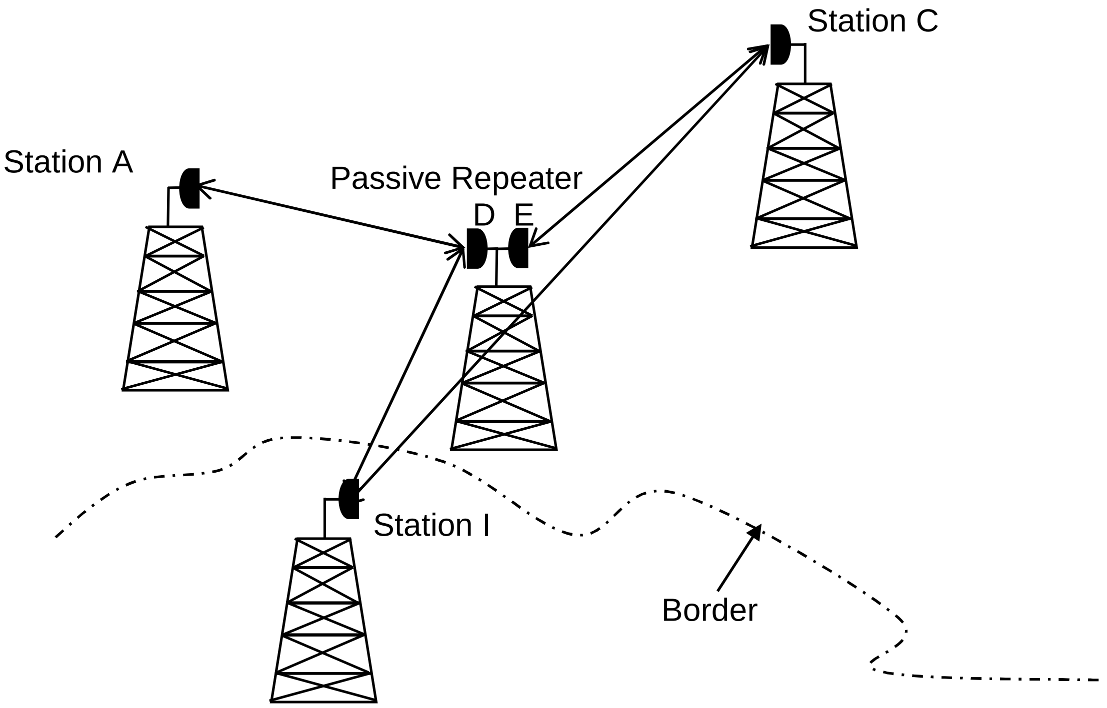
b) Calculation:

TD (dB) , threshold degradation of the interfered receiver

$$TD = 10 \log (1 + 10^{(I - N) / 10}) \qquad (1.3)$$

3.3 Calculation method for radio relays with passive repeaters

3.3.1 Back to Back antenna type



Victim: link ADEC

Interferer: station I

Fig 1

The calculation method of the threshold degradation is based on the method described below.

The mechanism of the interference caused by the transmitter I on the receiver C is illustrated in Fig. 2 The total interfering power can be split up into two parts, resulting of the sum of the interference power caused by the transmitter I on the direct path and the power interference contribution due to the back to back repeater.

For the calculation with the back to back passive repeater type, it is necessary to change only the formula for the total attenuation between transmitter output and receiver input (formula (12)).

$$\mathbf{a_{tot} = a_{Tx} - G_{Tx} + a_{propID} - G_D + a_{antID} + a_{DE} - G_E + a_{propEC} - G_C + a_{antEC} + a_{Rx} + MD + NFD + ATPC}$$

where

a_{propID} [dB] propagation attenuation between antennas I and D that can be calculated on the basis of the result of calculation covered in Annex 10. In conformity with the type of path.

a_{propEC} [dB] propagation attenuation between antennas E and C that can be calculated on the basis of the result of calculation covered in Annex 10. In conformity with the type of path.

a_{antID} [dB] attenuation which is a function of antennas I and D radiation patterns and polarisation discrimination.

a_{antEC}[dB] attenuation which is a function of antennas E and C radiation patterns and polarisation discrimination.

a_{DE} [dB] attenuation between antennas D and E (wave guide attenuation).

3.3.2 Plane reflector

Interference at the reflector only needs to be considered if it arrives from the same direction as the wanted signal. Consequently, plane reflectors have to be taken into account in the national coordination process, but can be neglected during international coordination.

Annex 10

Determination of the basic transmission loss in the Fixed Service

PREDICTION PROCEDURE FOR THE EVALUATION OF BASIC TRANSMISSION LOSS

1 Introduction

The prediction procedure provided in this chapter is based on the Recommendation ITU-R P.452-13[1]. The method includes a complementary set of propagation models, which ensure that the predictions embrace all the significant propagation mechanisms relevant to long-term interference. Methods for analysing the radio-meteorological and topographical features of the path are provided so that predictions can be prepared for any practical interference path falling within the scope of the procedure.
The prediction is achieved in four steps described in the sections 3, 4, 5 and 6.

2 Bases for the models used in the prediction

It is assumed that interference, which is significant during a small percentage of time (short-term) can not deteriorate the performance and the ability of the transmission. As a result of that assumption, only long-term interference is taken into account, and therefore the time percentage, for which the calculated basic transmission loss is not exceeded, is taken as 20%.
Accordingly, the procedure uses four propagation models listed below:
line-of-sight (including signal enhancements due to multipath and focusing effects);
diffraction (embracing smooth-Earth, irregular terrain and sub-path cases);
tropospheric scatter;
surface ducting and layer reflection.
Depending on the type of path, as determined by a path profile analysis, one or more of these models are exercised in order to provide the required prediction of basic transmission loss.
The propagation prediction models predict the average annual distribution of basic transmission loss.
As the radio-meteorological and topographical features for the terrain of all signatory's countries appeared to be almost the same, the common values were adopted. The values for such parameters are as follows:

ΔN :	the average radio-refractive index lapse-rate through the lowest 1 km of the atmosphere, (N-units/km) = 45
N_0:	the sea-level surface refractivity, (N-units)= 325
p :	Pressure = 1013 hPa
t :	temperature = 15 °C

[1] RECOMMENDATION ITU-R P.452-13 Prediction procedure for the evaluation of microwave interference between stations on the surface of the Earth at frequencies above about 0.7 GHz

3 Step 1 of the prediction procedure: Preparation of the input data

The basic input data required for the procedure is given in Table1. All other information required is derived from these basic data during the execution of the procedure.

TABLE 1

Basic input data

Parameter	Preferred resolution	Description
f	0.00001	Frequency (GHz)
φ_t, φ_r	1	Latitude of station (seconds)
p	1	Required time percentage(s) for which the calculated basic transmission loss is not exceeded
ψ_t, ψ_r	1	Longitude of station (seconds)
h_{tg}, h_{rg}	1	Antenna centre height above ground level (m)
h_{ts}, h_{rs}	1	Antenna centre height above mean sea level (m)
G_t, G_r	0.1	Antenna gain in the direction of the horizon along the great-circle interference path (dBi)

NOTE 1 For the interfering and interfered-with stations:
t: interferer
r: interfered-with station

4 Step 2 of the prediction procedure: Radiometeorological data

The values of radio-meteorological parameters, which could be determined as common to all countries of West, South and Central Europe are given in § 2. In the prediction procedure the time percentage for which refractive index lapse-rates exceeding 100 N-units/km can be expected in the first 100 m of the lower atmosphere, β_0 (%) must be evaluated. This parameter is used to estimate the relative incidence of fully developed anomalous propagation at the latitude under consideration. The value of β_0 to be used is that appropriate to the path centre latitude. Point incidence of anomalous propagation, β_0 (%), for the path centre location is determined using:

$$\text{(i)}\quad \beta_0 = \begin{cases} 10^{-0.015|\varphi|+1.67}\mu_1\mu_4 \quad \% & \text{for } |\varphi| \le 70° \\ 4.17\mu_1\mu_4 \quad \% & \text{for } |\varphi| > 70° \end{cases} \qquad (1.)$$

where

φ : path centre latitude (degrees) which is not greater than 70° and not less than -70°

The parameter μ_1 depends on the degree to which the path is over land (inland and/or coastal) and water, and is given by:

$$\mu_1 = \left[10^{\frac{-d_{tm}}{16 - 6.6\,\tau}} + \left[10^{-(0.496 + 0.354\,\tau)} \right]^5 \right]^{0.2} \tag{2.}$$

where the value of μ_1 shall be limited to $\mu_1 \leq 1$,
with:

$$\tau = \left[1 - e^{-\left(4.12 \times 10^{-4} \times d_{lm}^{2.41}\right)} \right] \tag{3.}$$

where

d_{tm} : longest continuous land (inland + coastal) section of the great-circle path (km)

d_{lm} : longest continuous inland section of the great-circle path (km)

The radioclimatic zones to be used for the derivation of d_{tm} and d_{lm} are defined in Table 2.

$$\mu_4 = \begin{cases} 10^{(-0.935 + 0.0176\,|\varphi|)\log \mu_1} & \text{for } |\varphi| \leq 70° \\ 10^{0.3 \log \mu_1} & \text{for } |\varphi| > 70° \end{cases} \tag{4.}$$

TABLE 2

Radio-climatic zones

Zone type	Code	Definition
Coastal land	A1	Coastal land and shore areas, i.e. land adjacent to the sea up to an altitude of 100 m relative to mean sea or water level, but limited to a distance of 50 km from the nearest sea area. Where precise 100 m data is not available an approximate value may be used
Inland	A2	All land, other than coastal and shore areas defined as “coastal land” above
Sea	B	Seas, oceans and other large bodies of water (i.e. covering a circle of at least 100 km in diameter)

Large bodies of inland water

A “large” body of inland water, to be considered as lying in Zone B, is defined as one having an area of at least 7 800 km^2, but excluding the area of rivers. Islands within such bodies of water are to be included as water within the calculation of this area if they have elevations lower than 100 m above the mean water level for more than 90% of their area. Islands that do not meet these criteria should be classified as land for the purposes of the water area calculation.

Large inland lake or wet-land areas

Large inland areas of greater than 7 800 km^2, which contain many small lakes or a river network should be declared as “coastal” Zone A1 by administrations if the area comprises more than 50% water, and more than 90% of the land is less than 100 m above the mean water level. Climatic regions pertaining to Zone A1, large inland bodies of water and large inland lake and wetland regions, are difficult to determine unambiguously. Therefore administrations are requested to register with the TWG HCM those regions within their territorial boundaries that they wish identified as belonging to one of these categories. In the absence of registered information to the contrary, all land areas will be considered to pertain to climate Zone A2.

Effective Earth's radius

The median effective Earth radius factor k_{50} for the path is determined using:

$$k_{50} = \frac{157}{157 \pm \Delta N} \tag{5.}$$

Assuming a true Earth radius of 6 371 km and the average radio-refractive index Δ N (N-units/km) for West, South and Central Europe of 45, the median value of effective Earth radius a_e [km] can be determined from:

$$a_e = 6371 \cdot k_{50} \tag{6.}$$

The effective Earth radius [km] exceeded for $\beta_{0\%}$ time, a_β, is given by:

$$a_\beta = 6\,371 \cdot k_\beta \tag{7.}$$

where k_β = 3.0 is an estimate of the effective Earth radius factor exceeded for β_0% time.

5 Step 3 of the prediction procedure: Path profile analysis

Values for a number of path-related parameters necessary for the calculations, as indicated in Tables 3 and 4, must be derived via an initial analysis of the path profile based on the value of a_e given by equation (6.). For path profile analysis, a path profile of terrain heights above mean sea level is required. Having thus analysed the profile, the path will also have been classified into transhorizontal or line of sight.

TABLE 3

Parameter values to be derived from the path profile analysis

Parameter	Description
d	Great-circle path distance (km)
d_{lt}, d_{lr}	For a transhorizon path, distance from the transmit and receive antennas to their respective horizons (km).). For a line-of-sight path, each is set to the distance from the terminal to the profile point identified as the principal edge in the diffraction method for 50% time.
θ_t, θ_r	For a transhorizon path, transmit and receive horizon elevation angles respectively (mrad). For a line-of-sight path, each is set to the elevation angle of the other terminal.
θ	Path angular distance (mrad)
h_{ts}, h_{rs}	Antenna centre height above mean sea level (m)
d_b	Aggregate length of the path sections over water (km)
ω	Fraction of the total path over water: $\omega = d_b / d$ (8.) where d is the great-circle distance (km) For totally overland paths $\omega = 0$
d_{ct}, d_{cr}	Distance over land from the transmit and receive antennas to the coast along the great-circle interference path (km). Set to zero for a terminal on a ship or sea platform.

5.1 Construction of path profile

Based on the geographical co-ordinates of the interfering (φ_t, ψ_t) and interfered-with (φ_r, ψ_r) stations, terrain heights (above mean sea level) along the great-circle path should be derived from a topographical database or from appropriate large-scale contour maps. The preferred distance resolution of the profile is that giving an integer number of steps of 0.1 km. The profile should include the ground heights at the interfering and interfered-with station locations as the start and end points. To the heights along the path should be added the necessary Earth's curvature, based on the value of a_e found in equation (6.).

For the purposes of this Annex the point of the path profile at the interferer is considered as point 0, and the point at the interfered-with station is considered as point n. The path profile therefore consists of n + 1 points. Figure 1 gives an example of a path profile of terrain heights above mean sea level, showing the various parameters related to the actual terrain.

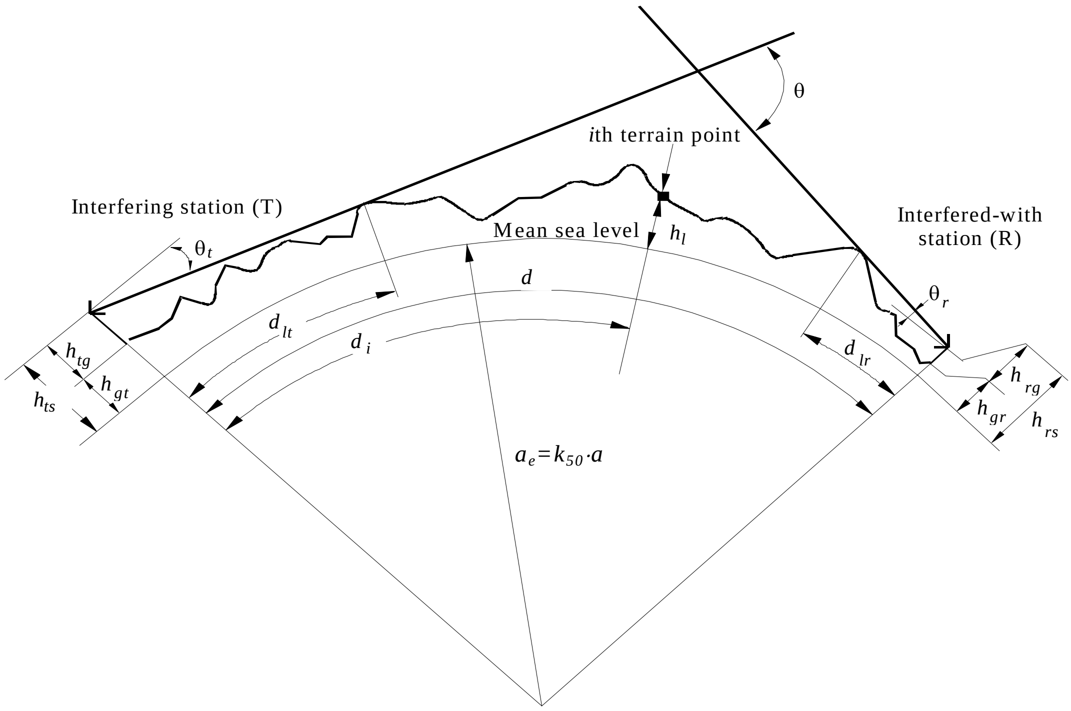
Table 4 defines parameters used or derived during the path profile analysis.

The path length, d (km), should be calculated according to the formula related to the great circle distance:

$$d = 6371 \cdot \arccos(\sin(\varphi_t)\sin(\varphi_r) + \cos(\varphi_t)\cos(\varphi_r)\cos(\psi_t - \psi_r)) \quad (9.)$$

FIGURE 1

Example of a (trans-horizon) path profile



Note 1– The value of θ_t as drawn will be negative.

TABLE 4

Path profile parameter definitions

Parameter	Description
a_e	Effective Earth's radius (km)
d	Great-circle path distance (km)
d_i	Great-circle distance of the *i*-th terrain point from the interferer (km)
d_{ii}	Incremental distance for regular path profile data (km)
f	Frequency (GHz)
λ	Wavelength (m)
h_{ts}	Interferer antenna height (m) above mean sea level (amsl)
h_{rs}	Interfered-with antenna height (m) (amsl)
θ_t	For a transhorizon path, horizon elevation angle above local horizontal (mrad), measured from the interfering antenna. For a line-of-sight path this should be the elevation angle of the interfered-with antenna
θ_r	For a transhorizon path, horizon elevation angle above local horizontal (mrad), measured from the interfered-with antenna. For a line-of-sight path this should be the elevation angle of the interfering antenna

5.2 Path classification

The path must be classified into line-of-sight or transhorizon. The path profile must be used to determine whether the path is line-of-sight or transhorizon based on the median effective Earth's radius of a_e.

A path is trans-horizon if the physical horizon elevation angle as seen by the interfering antenna (relative to the local horizontal) is greater than the angle (again relative to the interferer's local horizontal) subtended by the interfered-with antenna.
The test for the trans-horizon path condition is thus:

$$\theta_{\max} > \theta_{td} \qquad \text{(mrad)} \qquad (10.)$$

where:

$$\theta_{\max} = \max_{i=1}^{n-1}(\theta_i) \qquad \text{(mrad)} \qquad (11.)$$

θ_i : elevation angle to the i th terrain point

$$\theta_i = \frac{h_i - h_{ts}}{d_i} - \frac{10^3 d_i}{2a_e} \qquad \text{(mrad)} \qquad (12.)$$

where:

h_i : height of the i th terrain point (m) amsl

h_{ts} : interferer antenna height (m) amsl

d_i : distance from interferer to the i th terrain element (km)

$$\theta_{td} = \frac{h_{rs} - h_{ts}}{d} - \frac{10^3 d}{2a_e} \qquad \text{(mrad)} \qquad (13.)$$

where:

h_{rs} : interfered-with antenna height (m) amsl

d : total great-circle path distance (km)

a_e : median effective Earth's radius appropriate to the path (equation (6.)).

Derivation of parameters from the path profile for trans-horizon paths

The parameters to be derived from the path profile are those contained in Table 4.

Interfering antenna horizon elevation angle, θ_t

The interfering antenna's horizon elevation angle is the maximum antenna horizon elevation angle when equation (11.) is applied to the n – 1 terrain profile heights.

$$\theta_t = \theta_{\max} \qquad \text{(mrad)} \qquad (14.)$$

with θ_{max} as determined in equation (11.).

Interfering antenna horizon distance, d_{lt}

The horizon distance is the minimum distance from the transmitter at which the maximum antenna horizon elevation angle is calculated from equation (11.).

$$d_{lt} = d_i \qquad \text{(km)} \ \textit{for} \ \max(\theta_i) \qquad (15.)$$

Interfered-with antenna horizon elevation angle, θ_r

The receive antenna horizon elevation angle is the maximum antenna horizon elevation angle when equation (11.) is applied to the n – 1 terrain profile heights.

$$\theta_r = \max_{j=1}^{n-1}(\theta_j) \qquad \text{(mrad)} \qquad (16.)$$

$$\theta_j = \frac{h_{ji} - h_{rs}}{d - d_j} - \frac{10^3 (d - d_j)}{2a_e} \qquad \text{(mrad)} \qquad (17.)$$

Angular distance θ (mrad)

The angular distance θ is calculated using formula :

$$\theta = \frac{10^3 d}{a_e} + \theta_t + \theta_r \qquad \textit{(mrad)} \qquad (18.)$$

Interfered-with antenna horizon distance, d_{lr}

The horizon distance is the minimum distance from the receiver at which the maximum antenna horizon elevation angle is calculated from equation (11.).

$$d_{lr} = d - d_j \qquad \text{(km)} \quad \text{for} \quad \max(\Theta_j) \qquad (19.)$$

6 Step 4 of the prediction procedure: Calculation of propagation predictions

Basic transmission loss, L_b (dB), not exceeded for the required annual percentage time, p, is evaluated as described in the following sub-sections.

6.1 Line-of-sight propagation (including short-term effects)

The following should be evaluated for both line-of-sight and transhorizon paths.
Basic transmission loss due to free-space propagation and attenuation by atmospheric gases:

$$L_{bfsg} = 92.5 + 20 \log f + 20 \log d + A_g \quad \text{dB} \tag{20.}$$

where:

A_g : total gaseous absorption (dB):

$$A_g = [\gamma_o + \gamma_w(\rho)]d \quad \text{(dB)} \tag{21.}$$

where:

γ_o, $\gamma_w(\rho)$: specific attenuation due to dry air and water vapour, respectively, and are found from the equations (23.), (24.)

ρ : water vapour density:

$$\rho = 7.5 + 2.5\,\omega \quad (\text{g/m}^3) \tag{22.}$$

ω : fraction of the total path over water.

For dry air, the attenuation γ_o (dB/km) is given by Recommendation ITU-R P.676-7 as follows:

$$\gamma_o = \left[\frac{7.2\, r_t^{2.8}}{f^2 + 0.34\, r_p^2\, r_t^{1.6}} + \frac{0.62\,\xi_3}{(54 - f)^{1.16\xi_1} + 0.83\,\xi_2} \right] f^2 r_p^2 \times 10^{-3} \tag{23.}$$

where:

- f : frequency (GHz)
- r_p = p / 1013
- r_t = 288/(273 + t)
- p : pressure (hPa) - see § 2
- t : temperature (°C) see § 2.

$$\xi_1 = \varphi(r_p, r_t, 0.0717, -1.8132, 0.0156, -1.6515)$$

$$\xi_2 = \varphi(r_p, r_t, 0.5146, -4.6368, -0.1921, -5.7416)$$

$$\xi_3 = \varphi(r_p, r_t, 0.3414, -6.5851, 0.2130, -8.5854)$$

$$\varphi(r_p, r_t, a, b, c, d) = r_p^a r_t^b \exp[c(1 - r_p) + d(1 - r_t)]$$

For water vapour, the attenuation γ_w (dB/km) is given by:

$$\gamma_w = \left\{ \frac{3.98\eta_1 \exp[2.23(1-r_t)]}{(f-22.235)^2 + 9.42\eta_1^2} g(f,22) + \frac{11.96\eta_1 \exp[0.7(1-r_t)]}{(f-183.31)^2 + 11.14\eta_1^2} \right.$$
$$+ \frac{0.081\eta_1 \exp[6.44(1-r_t)]}{(f-321.226)^2 + 6.29\eta_1^2} + \frac{3.66\eta_1 \exp[1.6(1-r_t)]}{(f-325.153)^2 + 9.22\eta_1^2}$$
$$+ \frac{25.37\eta_1 \exp[1.09(1-r_t)]}{(f-380)^2} + \frac{17.4\eta_1 \exp[1.46(1-r_t)]}{(f-448)^2} \qquad (24.)$$
$$+ \frac{844.6\eta_1 \exp[0.17(1-r_t)]}{(f-557)^2} g(f,557) + \frac{290\eta_1 \exp[0.41(1-r_t)]}{(f-752)^2} g(f,752)$$
$$\left. + \frac{8.3328\times 10^4 \eta_2 \exp[0.99(1-r_t)]}{(f-1\,780)^2} g(f,1\,780) \right\} f^2 r_t^{2.5} \rho \times 10^{-4}$$

where:

$$\eta_1 = 0.955 r_p r_t^{0.68} + 0.006\rho$$

$$\eta_2 = 0.735\, r_p r_t^{0.5} + 0.0353\, r_t^4 \rho$$

$$g(f, f_i) = 1 + \left(\frac{f - f_i}{f + f_i} \right)^2$$

Corrections for multipath and focusing effects at p and β_0 percentage times:

$$E_{sp} = 2.6\,[1 - \exp(-0.1\,\{d_{lt} + d_{lr}\})]\,\log(p/50) \quad \text{dB} \qquad (25.)$$

$$E_{s\beta} = 2.6\,[1 - \exp(-0.1\,\{d_{lt} + d_{lr}\})]\,\log(\beta_0/50) \quad \text{dB} \qquad (26.)$$

Basic transmission loss not exceeded for time percentage, p%, due to line-of-sight propagation:

$$L_{b0p} = L_{bfsg} + E_{sp} \quad \text{dB} \qquad (27.)$$

Basic transmission loss not exceeded for time percentage, β_0%, due to line-of-sight propagation:

$$L_{b0\beta} = L_{bfsg} + E_{s\beta} \quad \text{dB} \qquad (28.)$$

6.2 Diffraction

The diffraction model calculates the following quantities required in § 6.5:

- L_{dp}: diffraction loss not exceeded for p% time
- L_{bd50}: median basic transmission loss associated with diffraction
- L_{bd}: basic transmission loss associated with diffraction not exceeded for p% time.

The diffraction loss is calculated for all paths using a hybrid method based on the Deygout construction and an empirical correction. This method provides an estimate of diffraction loss for all types of paths, including over-sea or over-inland or coastal land, and irrespective of whether the land is smooth or rough.

This method should be used, even if the edges identified by the Deygout construction are adjacent profile points.

This method also makes extensive use of an approximation to the single knife-edge diffraction loss as a function of the dimensionless parameter, ν, given by:

$$J(\nu) = 6.9 + 20\log\left(\sqrt{(\nu - 0.1)^2 + 1} + \nu - 0.1 \right) \qquad (29.)$$

Note that $J(-0.78) \approx 0$, and this defines the lower limit at which this approximation should be used. $J(\nu)$ is set to zero for $\nu<-0.78$.

6.2.1 Median diffraction loss

The median diffraction loss, L_{d50} (dB), is calculated using the median value of the effective Earth radius, a_e, given by equation (6.).

Median diffraction loss for the principal edge

Calculate a correction, ζ_m, for overall path slope given by:

$$\zeta_m = \cos\left(\tan^{-1}\left(10^{-3}\frac{h_{rs}-h_{ts}}{d}\right)\right) \tag{30.}$$

Find the main (i.e. principal) edge, and calculate its diffraction parameter, ν_{m50}, given by:

$$\nu_{m50} = \max_{i=1}^{n-1}\left(\zeta_m H_i \sqrt{\frac{2\times10^{-3}d}{\lambda d_i(d-d_i)}}\right), \tag{31.}$$

where the vertical clearance, H_i, is:

$$H_i = h_i + 10^3\frac{d_i(d-d_i)}{2a_e}\frac{h_{ts}(d-d_i)+h_{rs}d_i}{d} \tag{32.}$$

and

- $h_{ts,rs}$: transmitter and receiver heights above sea level (m) (see Table3.)
- λ : wavelength (m) = $0.3/f$
- f : frequency (GHz)
- d : path length (km)
- d_i : distance of the i-th profile point from transmitter (km) (see § 5.2)
- h_i : height of the i-th profile point above sea level (m) (see § 5.2).

Set i_{m50} to the index of the profile point with the maximum value, ν_{m50}.
Calculate the median knife-edge diffraction loss for the main edge, L_{m50}, given by:

$$\begin{aligned} L_{m50} &= J(\nu_{m50}) && \text{if } \nu_{m50} \geq -0.78 \\ &= 0 && \text{otherwise} \end{aligned} \tag{33.}$$

If L_{m50} = 0, the median diffraction loss, L_{d50}, and the diffraction loss not exceeded for β_0% time, $L_{d\beta}$, are both zero and no further diffraction calculations are necessary.

Otherwise possible additional losses due to secondary edges on the transmitter and receiver sides of the principal edge should be investigated, as follows.

Median diffraction loss for transmitter-side secondary edge

If i_{m50} = 1, there is no transmitter-side secondary edge, and the associated diffraction loss, L_{t50}, should be set to zero. Otherwise, the calculation proceeds as follows. Calculate a correction, ζ_t, for the slope of the path from the transmitter to the principal edge:

$$\zeta_t = \cos\left(\tan^{-1}\left(10^{-3}\frac{h_{i\,m50}-h_{ts}}{d_{i\,m50}}\right)\right) \tag{34.}$$

Find the transmitter-side secondary edge and calculate its diffraction parameter, ν_{t50}, given by:

$$\nu_{t50} = \max_{i=1}^{i_{m50}-1}\left(\zeta_t H_i \sqrt{\frac{2\times10^{-3} d_{i_{m50}}}{\lambda d_i\left(d_{i_{m50}}-d_i\right)}}\right) \tag{35.}$$

where:

$$H_i = h_i + 10^3 \frac{d_i\left(d_{i_{m50}}-d_i\right)}{2a_e} - \frac{h_{ts}\left(d_{i_{m50}}-d_i\right)+h_{i_{m50}} d_i}{d_{i_{m50}}} \tag{36.}$$

Set i_{t50} to the index of the profile point for the transmitter-side secondary edge (i.e. the index of the terrain height array element corresponding to the value ν_{t50}).
Calculate the median knife-edge diffraction loss for the transmitter-side secondary edge, L_{t50}, given by:

$$\begin{aligned} L_{t50} &= J(\nu_{t50}) && \text{for } \nu_{t50} \geq -0.78 \text{ and } i_{m50} > 2 \\ &= 0 && \text{otherwise} \end{aligned} \tag{37.}$$

Median diffraction loss for the receiver-side secondary edge

If i_{m50} = n-1, there is no receiver-side secondary edge, and the associated diffraction loss, L_{r50}, should be set to zero. Otherwise the calculation proceeds as follows. Calculate a correction, ζ_r, for the slope of the path from the principal edge to the receiver:

$$\zeta_r = \cos\left(\tan^{-1}\left(10^{-3}\frac{h_{rs}-h_{i_{m50}}}{d-d_{i_{m50}}}\right)\right) \tag{38.}$$

Find the receiver-side secondary edge and calculate its diffraction parameter, ν_{r50}, given by:

$$\nu_{r50} = \max_{i=i_{m50}+1}^{n-1}\left(\zeta_r H_i \sqrt{\frac{2\times10^{-3}\left(d-d_{i_{m50}}\right)}{\lambda\left(d_i-d_{i_{m50}}\right)\left(d-d_i\right)}}\right) \tag{39.}$$

where:

$$H_i = h_i + 10^3 \frac{\left(d_i-d_{i_{m50}}\right)\left(d-d_i\right)}{2a_e} - \frac{h_{i_{m50}}\left(d-d_i\right)+h_{rs}\left(d_i-d_{i_{m50}}\right)}{d-d_{i_{m50}}} \tag{40.}$$

Set i_{r50} to the index of the profile point for the receiver-side secondary edge (i.e. the index of the terrain height array element corresponding to the value ν_{r50}).
Calculate the median knife-edge diffraction loss for the receiver-side secondary edge, L_{r50}, given by:

$$\begin{aligned} L_{r50} &= J(\nu_{r50}) && \text{for } \nu_{r50} \geq -0.78 \text{ and } i_{m50} < n-1 \\ &= 0 && \text{otherwise} \end{aligned} \tag{41.}$$

Combination of the edge losses for median Earth curvature

Calculate the median diffraction loss, L_{d50}, given by:

$$\begin{aligned} L_{d50} &= L_{m50} + \left(1-\mathrm{e}^{-\frac{L_{m50}}{6}}\right)\left(L_{t50}+L_{r50}+10+0.04d\right) && \text{for } \nu_{m50} > -0.78 \\ &= 0 && \text{otherwise} \end{aligned} \tag{42.}$$

In equation (42.) L_{t50} will be zero if the transmitter-side secondary edge does not exist and, similarly, L_{r50} will be zero if the receiver-side secondary edge does not exist.
If L_{d50} = 0, then the diffraction loss not exceeded for β_0% time will also be zero.
If the prediction is required only for p = 50%, no further diffraction calculations will be necessary (see § 6.2.3). Otherwise, the diffraction loss not exceeded for β_0% time must be calculated, as

follows.

6.2.2 The diffraction loss not exceeded for β_0% of the time

The diffraction loss not exceeded for β_0% time is calculated using the effective Earth radius exceeded for β_0% time, a_β, given by equation (7.). For this second diffraction calculation, the same edges as those found for the median case should be used for the Deygout construction.

The calculation of this diffraction loss then proceeds as follows.

Principal edge diffraction loss not exceeded for β_0% time

Find the main (i.e. principal) edge diffraction parameter, $\nu_{m\beta}$, given by:

$$\nu_{m\beta} = \zeta_m H_{im\beta}\sqrt{\frac{2\times10^{-3}d}{\lambda d_{im50}\left(d-d_{im50}\right)}} \tag{43.}$$

where:

$$H_{im\beta} = h_{im50} + 10^3 \frac{d_{im50}\left(d-d_{im50}\right)}{2a_\beta} - \frac{h_{ts}\left(d-d_{im50}\right)+h_{rs}d_{im50}}{d} \tag{44.}$$

Calculate the knife-edge diffraction loss for the main edge, $L_{m\beta}$, given by:

$$\begin{aligned} L_{m\beta} &= J\left(\nu_{m\beta}\right) && \text{for } \nu_{m\beta} \geq -0.78 \\ &= 0 && \text{otherwise} \end{aligned} \tag{45.}$$

Transmitter-side secondary edge diffraction loss not exceeded for β_0% time

If $L_{t50} = 0$, then $L_{t\beta}$ will be zero. Otherwise calculate the transmitter-side secondary edge diffraction parameter, $\nu_{t\beta}$, given by:

$$\nu_{t\beta} = \zeta_t H_{it\beta}\sqrt{\frac{2\times10^{-3}d_{im50}}{\lambda d_{it50}\left(d_{im50}-d_{it50}\right)}} \tag{46.}$$

where:

$$H_{it\beta} = h_{it50} + 10^3 \frac{d_{it50}\left(d_{im50}-d_{it50}\right)}{2a_\beta} - \frac{h_{ts}\left(d_{im50}-d_{it50}\right)+h_{im50}d_{it50}}{d_{im50}} \tag{47.}$$

Calculate the knife-edge diffraction loss for the transmitter-side secondary edge, $L_{t\beta}$, given by:

$$\begin{aligned} L_{t\beta} &= J\left(\nu_{t\beta}\right) && \text{for } \nu_{t\beta} \geq -0.78 \\ &= 0 && \text{otherwise} \end{aligned} \tag{48.}$$

Receiver-side secondary edge diffraction loss not exceeded for β_0% time

If $L_{r50} = 0$, then $L_{r\beta}$ will be zero. Otherwise, calculate the receiver-side secondary edge diffraction parameter, $\nu_{r\beta}$, given by:

$$\nu_{r\beta} = \zeta_r H_{ir\beta}\sqrt{\frac{2\times10^{-3}\left(d-d_{im50}\right)}{\lambda\left(d_{ir50}-d_{im50}\right)\left(d-d_{ir50}\right)}} \tag{49.}$$

where:

$$H_{ir\beta} = h_{ir50} + 10^3 \frac{(d_{ir50} - d_{im50})(d - d_{ir50})}{2a_\beta} - \frac{h_{im50}(d - d_{ir50}) + h_{rs}(d - d_{im50})}{d - d_{im50}} \quad (50.)$$

Calculate the knife-edge diffraction loss for the receiver-side secondary edge, $L_{r\beta}$, given by:

$$\begin{aligned} L_{r\beta} &= J(\nu_{r\beta}) && \text{for } \nu_{r\beta} \geq -0.78 \\ &= 0 && \text{otherwise} \end{aligned} \quad (51.)$$

Combination of the edge losses not exceeded for β_0% time

Calculate the diffraction loss not exceeded for β_0% of the time, $L_{d\beta}$, given by:

$$\begin{aligned} L_{d\beta} &= L_{m\beta} + \left(1 - e^{-\frac{L_{m\beta}}{6}}\right)\left(L_{t\beta} + L_{r\beta} + 10 + 0.04d\right) && \text{for } \nu_{m\beta} > -0.78 \\ &= 0 && \text{otherwise} \end{aligned} \quad (52.)$$

6.2.3 The diffraction loss not exceeded for *p*% of the time

The application of the two possible values of effective Earth radius factor is controlled by an interpolation factor, F_i, based on a log-normal distribution of diffraction loss over the range $\beta_0\% < p < 50\%$. given by:

$$F_i = 0 \quad p = 50\% \quad (53.)$$

$$= \frac{I\left(\frac{p}{100}\right)}{I\left(\frac{\beta_0}{100}\right)} \quad \text{for } 50\% > p > \beta_0\% \quad (54.)$$

$$= 1 \quad \text{for } \beta_0\% \geq p \quad (55.)$$

where $I(x)$ is the inverse cumulative normal function. An approximation for $I(x)$ which may be used with confidence for $x < 0.5$ is given in (59.).

The diffraction loss, L_{dp}, not exceeded for p% time, is now given by:

$$L_{dp} = L_{d50} + F_i\,(L_{d\beta} - L_{d50}) \quad \text{dB} \quad (56.)$$

where L_{d50} and $L_{d\beta}$ are defined by equations (42.) and (52.), respectively, and F_i is defined by equations (53. to 55.), depending on the values of p and β_0.
The median basic transmission loss associated with diffraction, L_{bd50}, is given by:

$$L_{bd50} = L_{bfsg} + L_{d50} \quad \text{dB} \quad (57.)$$

where L_{bfsg} is given by equation (20.).
The basic transmission loss associated with diffraction not exceeded for p% time is given by:

$$L_{bd} = L_{b0p} + L_{dp} \quad \text{dB} \quad (58.)$$

where L_{b0p} is given by equation (27.).

The following approximation to the inverse cumulative normal distribution function is valid for $0.000001 \leq x \leq 0.5$ and is in error by a maximum of 0.00054. It may be used with confidence for the interpolation function in equation (54.). If $x < 0.000001$, which implies $\beta_0 < 0.0001\%$, x should be set to 0.000001. The function I(x) is then given by:

$$I(x) = \xi(x) - T(x) \tag{59.}$$

where:

$$T(x) = \sqrt{-2\ln(x)} \tag{60.}$$

$$\xi(x) = \frac{(C_2 \cdot T(x) + C_1) \cdot T(x) + C_0}{[(D_3 \cdot T(x) + D_2)T(x) + D_1]T(x) + 1} \tag{61.}$$

$$C_0 = 2.515516698 \tag{62.}$$

$$C_1 = 0.802853 \tag{63.}$$

$$C_2 = 0.010328 \tag{64.}$$

$$D_1 = 1.432788 \tag{65.}$$

$$D_2 = 0.189269 \tag{66.}$$

$$D_3 = 0.001308 \tag{67.}$$

6.3 Tropospheric scatter

The basic transmission loss due to troposcatter, L_{bs} (p) (dB) not exceeded for any time percentage, p, is given by:

$$L_{bs} = 190 + L_f + 20\log d + 0.573\theta - 0.15 N_0 + L_c + A_g - 10.1[-\log(p/50)]^{0.7} \tag{68.}$$

where:

L_f : frequency dependent loss:

$$L_f = 25\log f - 2.5[\log(f/2)]^2 \quad \text{(dB)} \tag{69.}$$

L_c : aperture to medium coupling loss (dB):

$$L_c = 0.051 \cdot e^{0.055(G_t + G_r)} \quad \text{(dB)} \tag{70.}$$

A_g: gaseous absorption derived from equation (21.) using ρ = 3 g/m^3 for the whole path length

6.4 Ducting/layer reflection

The prediction of the basic transmission loss, L_{ba} (dB) occurring during periods of anomalous propagation (ducting and layer reflection) is based on the following function:

$$L_{ba} = A_f + A_d(p) + A_g \quad \text{dB} \tag{71.}$$

where:

A_f : total of fixed coupling losses (except for local clutter losses) between the antennas and the anomalous propagation structure within the atmosphere:

A_f = 102.45 + 20 log f + 20 log (d_{lt} + d_{lr}) + A_{st} + A_{sr} + A_{ct} + A_{cr} dB (72.)

A_{st}, A_{sr} : site-shielding diffraction losses for the interfering and interfered-with stations respectively:

$$A_{st,sr} = \begin{cases} 20\log\left[1+0.361\theta''_{t,r}\left(f \cdot d_{lt,lr}\right)^{1/2}\right] + 0.264\,\theta''_{t,r}\ f^{1/3} & \text{dB} \quad \text{for } \theta''_{t,r} > 0 \quad \text{mrad} \\ 0 & \text{dB} \quad \text{for } \theta''_{t,r} \le 0 \quad \text{mrad} \end{cases} \tag{73.}$$

where:

$$\theta''_{t,r} = \theta_{t,r} - 0.1\,d_{lt,lr} \qquad \text{mrad} \tag{74.}$$

A_{ct}, A_{cr} : over-sea surface duct coupling corrections for the interfering and interfered-with stations respectively:

$$A_{ct,cr} = -3\,\mathrm{e}^{-0.25 d_{ct,cr}^2}\left[1+\tanh\ (0.07(50-h_{ts,rs}))\right] \quad \text{dB} \quad \text{for} \quad \omega \ge 0.75$$

$$d_{ct,cr} \le d_{lt,lr} \tag{75.}$$

$$d_{ct,cr} \le 5 \text{ km}$$

$$A_{ct,cr} = 0 \qquad \text{dB} \qquad \text{for all other conditions} \tag{76.}$$

It is useful to note the limited set of conditions under which equation (75.) is needed.

A_d (p) : time percentage and angular-distance dependent losses within the anomalous propagation mechanism:

$$A_d(p) = \gamma_d \ \ \theta' + A(p) \qquad \text{dB} \tag{77.}$$

where:

γ_d : specific attenuation:

$$\gamma_d = 5 \times 10^{-5}\, a_e \ \ f^{1/3} \qquad \text{dB/mrad} \tag{78.}$$

θ´: angular distance (corrected where appropriate (via equation (79.)) to allow for the application of the site shielding model in equation (73.)):

$$\theta' = \frac{10^3 d}{a_e} + \theta'_t + \theta'_r \qquad \text{mrad} \tag{79.}$$

$$\theta'_{t,r} = \begin{cases} \theta_{t,r} & \text{for } \theta_{t,r} \le 0.1 d_{lt,lr} \quad \text{mrad} \\ 0.1 d_{lt,lr} & \text{for } \theta_{t,r} > 0.1 d_{lt,lr} \quad \text{mrad} \end{cases} \tag{80.}$$

A(p) : time percentage variability (cumulative distribution):

$$A(p) = -12 + (1.2 + 3.7 \times 10^{-3} d)\log\left(\frac{p}{\beta}\right) + 12\left(\frac{p}{\beta}\right)^{\Gamma} \qquad \text{dB} \tag{81.}$$

$$\Gamma = \frac{1.076}{(2.0058 - \log\beta)^{1.012}} \times \mathrm{e}^{-\left(9.51 - 4.8\log\beta + 0.198(\log\beta)^2\right) \times 10^{-6} \cdot d^{1.13}} \tag{82.}$$

$$\beta = \beta_0 \cdot \mu_2 \cdot \mu_3 \qquad \% \qquad (83.)$$

μ_2 : correction for path geometry:

$$\mu_2 = \left[\frac{500}{a_e} \frac{d^2}{\left(\sqrt{h_{te}} + \sqrt{h_{re}}\right)^2} \right]^{\alpha} \qquad (84.)$$

The value of μ_2 shall not exceed 1.

$$\alpha = -0.6 - \varepsilon \cdot 10^{-9} \cdot d^{3.1} \cdot \tau \qquad (85.)$$

where:

ε = 3.5

τ : is defined in equation (3.)
and the value of α shall not be allowed to reduce below –3.4

μ_3 : correction for terrain roughness:

$$\mu_3 = \begin{cases} 1 & \text{for } h_m \le 10 \text{ m} \\ \exp\left[-4.6 \times 10^{-5} \, (h_m - 10) \, (43 + 6 d_I)\right] & \text{for } h_m > 10 \text{ m} \end{cases} \qquad (86.)$$

$d_I = \min(d - d_{lt} - d_{lr}, 40)$ km (87.)

A_g : total gaseous absorption determined from equation (21.).

6.5 The overall prediction

The following procedure should be applied to the results of the foregoing calculations for all paths.
Calculate an interpolation factor, F_j, to take account of the path angular distance:

$$F_j = 1.0 - 0.5\left(1.0 + \tanh\left(3.0 \, \xi \frac{(\theta - \Theta)}{\Theta}\right)\right) \qquad (88.)$$

where:

Θ = 0.3
ξ = 0.8
θ : path angular distance (mrad) (defined in Table 3).

Calculate an interpolation factor, F_k, to take account of the great circle path distance:

$$F_k = 1.0 - 0.5\left(1.0 + \tanh\left(3.0 \, \kappa \frac{(d - d_{sw})}{d_{sw}}\right)\right) \qquad (89.)$$

where:

d : great circle path length (km) (defined in Table 3)
d_{sw} : fixed parameter determining the distance range of the associated blending, set to 20
κ : fixed parameter determining the blending slope at the ends of the range, set to 0.5.

Calculate a notional minimum basic transmission loss, L_{minb0p} (dB) associated with line-of-sight propagation and over-sea sub-path diffraction.

$$L_{\min b0p} = \begin{cases} L_{b0p} + (1-\omega)L_{dp} & \text{for } p < \beta_0 \\ L_{bd50} + (L_{b0\beta} + (1-\omega)L_{dp} - L_{bd50}) \cdot F_i & \text{for } p \geq \beta_0 \end{cases} \quad \text{dB} \tag{90.}$$

where:

L_{b0p} : notional line-of-sight basic transmission loss not exceeded for *p*% time, given by equation (27.)

$L_{b0\beta}$: notional line-of-sight basic transmission loss not exceeded for β% time, given by equation (28.)

L_{dp} : diffraction loss not exceeded for *p*% time, calculated using the method in § 6.2.

Calculate a notional minimum basic transmission loss, L_{minbap} (dB), associated with line-of-sight and transhorizon signal enhancements:

$$L_{minbap} = \eta \ln\left(\exp\left(\frac{L_{ba}}{\eta} \right) + \exp\left(\frac{L_{b0p}}{\eta} \right) \right) \quad \text{dB} \tag{91.}$$

where:

L_{ba}: ducting/layer reflection basic transmission loss not exceeded for *p*% time, given by equation (71.)

L_{b0p}: notional line-of-sight basic transmission loss not exceeded for *p*% time, given by equation (27.)

η = 2.5

Calculate a notional basic transmission loss, L_{bda} (dB), associated with diffraction and line-of-sight or ducting/layer-reflection enhancements:

$$L_{bda} = \begin{cases} L_{bd} & \text{for } L_{minbap} > L_{bd} \\ L_{minbap} + (L_{bd} - L_{minbap})F_k & \text{for } L_{minbap} \leq L_{bd} \end{cases} \quad \text{dB} \tag{92.}$$

where:

L_{bd} : basic transmission loss for diffraction not exceeded for *p*% time from equation (58.).

F_k : interpolation factor given by equation (89.) according to the values of *p* and β_0.

Calculate a modified basic transmission loss, L_{bam} (dB), which takes diffraction and line-of-sight or ducting/layer-reflection enhancements into account

$$L_{bam} = L_{bda} + (L_{minb0p} - L_{bda})\, F_j \quad \text{dB} \tag{93.}$$

Calculate the final basic transmission loss not exceed for *p*% time, L_b (dB), as given by:

$$L_b = -5\log\left(10^{-0.2L_s} + 10^{-0.2L_{bam}}\right) \quad \text{dB} \tag{94.}$$

Annex 11

Trigger for co-ordination in the Fixed Service

1. Co-ordination distance

1.1 The co-ordination distance depends on the frequency range. The distances in the following table are recommended:

Frequency range [GHz]	Co-ordination distance [km]
1 - 5	200*
>5 - 10	150*
>10 - 12	100
>12 - 20	80
>20 - 24.5	60
>24.5 - 30	40
>30 - 39.5	30
>39.5 - 43.5	20

* The co-ordination distance for frequencies below 10 GHz is limited to 100 km for antenna heights below 300m above sea level.

1.2 The concerned administrations are those whose territories are situated at a distance from the radio-relay station requesting co-ordination less or equal to the one defined in 1.1.