CISPR TR 31

Edition 3.0 2024-11

TECHNICAL REPORT

colour inside

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

Description of the radio services database

CISPR TR 31:2024-11(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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DESCRIPTION OF THE RADIO SERVICES DATABASE

FOREWORD

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CISPR 31 has been prepared by CISPR subcommittee H: Limits for the protection of radio services, of IEC technical committee CISPR: International special committee on radio interference. It is a Technical Report.

This third edition cancels and replaces the second edition published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) A new Clause 3 covers a line of essential definitions of radio parameters, the knowledge of which is necessary to get qualified input data for inclusion of essential requirements in the present radio services database (RSD) maintained by CISPR and IEC.

b) The radio parameters and conditions of use of radio receivers listed in Table 1 of this edition of CISPR TR 31 are provided now with instructive advice in its new Subclauses 5.1 and 5.2, on selection of data for input to the RSD and retrieval of that data for consideration and use with the limits setting model as in CISPR TR 16-4-4 which was missing in the previous edition of CISPR TR 31.

c) Finally, another new informative Annex B informs, to the extent necessary, on the principles of ITU-R on determination of data for the minimum usable field strength (to be inserted in Column (E) of the RSD) and of the associated tolerable disturbance at the antenna of the radio reception system or other self-contained radio receiver (also to be used as input with the limits-setting model in CISPR TR 16-4-4), which concerns only parties who are concerned with designing and projecting of radio-communication/broadcast networks and with coverage planning of related radio services. Knowledge of these fundamental principles also by CISPR experts will ensure that only valid data will get future input to the RSD maintained by CISPR and IEC.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
CIS/H/509/DTR	CIS/H/520/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

DESCRIPTION OF THE RADIO SERVICES DATABASE

1 Scope

This Technical Report covers the rationale behind the database containing the characteristics of radio services. The database is a "living document " in the format of a spreadsheet file in the EMC Zone of the IEC web site:

https://www.iec.ch/emc/radio-services-database

As new input for the IEC Radio Services Database arrives, this Technical Report provides guidance and support for the systematic collation of data on those radio services which are relevant for determination of CISPR limits according to CISPR TR 16-4-4. All interested parties are invited to contribute with relevant data to the database, e.g., via the National Committees represented in CISPR/H.

The objective of the database is to register those characteristics which are relevant for derivation and specification of limits for disturbances from electric and/or electronic equipment, systems and installations. Committees responsible for generic and/or product emission EMC standards use this information together with CISPR TR 16-4-4.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-151:2001, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-151 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
RF protection ratio
R_p
minimum value of the radio-frequency (RF) signal-to-noise (S/N) ratio required to obtain the specified radio reception quality under specified conditions and at the specified point (here: RF protection ratio at the antenna of the radio station or other kind of self-contained radio receiver)

Note 1 to entry: The specified conditions include the field strength of the wanted radio signal according to 3.1.2.

Note 2 to entry: For digital radio services, the RF protection ratio can also be given as minimum value of the required RF carrier-to-noise (C/N) ratio.

Note 3 to entry: For performance tests on radio receivers at standardised test sites, the specified point will be the RF antenna port and input of the receiver, see also 3.1.4.

[SOURCE: ITU-R Vocabulary V.573, Term F22, modified (addition of "radio-frequency (RF)", "radio" and "(here: RF protection ratio at the antenna of the radio station or other kind of self-contained radio receive)", replacement of "signal-to-interference (S/I)"by "signal-to-noise (S/N)", replacement of Notes to entry)]

3.1.2
minimum usable field strength
E_{min}
<of a wanted radio signal> minimum value of the field-strength or power flux-density at the antenna of the radio station necessary to permit the specified reception quality, under the specified receiving conditions, in the presence of natural and man-made noise (see Recommendation ITU-R P.372 [4]), but in the absence of interference from other transmitters

Note 1 to entry: The specified quality is determined in particular by the RF protection ratio against noise, and for fluctuating noise, by the percentage of time during which this protection ratio must be ensured.

Note 2 to entry: The receiving conditions include, amongst others:

– the type of **radio** transmission, and frequency band used;

– the receiving equipment characteristics (as e.g. receiving antenna gain, receiver characteristics, siting);

– receiver operating conditions, particularly the geographical zone, the time and the season.

Note 3 to entry: Where there is no ambiguity, the term "minimum field strength" can be used.

Note 4 to entry: The term "minimum usable field strength" corresponds to the term "minimum field strength to be protected" which appears in many ITU texts.

[SOURCE: ITU-R Vocabulary V.573, Term F31, modified (addition of "at the antenna of the radio station")]

3.1.3
necessary bandwidth
for a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions

Note 1 to entry: Emissions in this band are commonly referred to as within the intended emission bandwidth.

[SOURCE: ITU-R Radio Regulations (2020), Article 1.152, modified – Addition of Note 1 to entry]

3.1.4
minimum usable signal strength
MUS
minimum value of the wanted radio signal's strength at the RF input of the radio station's receiver necessary to get reasonably discernible discrimination between the content of radio transmission and receiving-system-internal circuit noise, under specified test conditions, in the absence of external radio noise and interference from other transmitters

Note 1 to entry: The specified conditions concern performance tests (type tests) on receivers of a given category intended for use with the service and verification of compliance with the requirements specified in radio standards and other specifications, as e.g., Recommendations of ITU-R for reference receivers, like e.g., MUS and the required co-channel RF protection ratio, see 3.1.1. For the latter the "specified point " as in 3.1.1 is the RF antenna port and input of the receiver.

Note 2 to entry: Verification of compliance with specified requirements concerns the suitability of the receiver for use with the service in respect of:

– the required RF protection ratio (3.1.1) and necessary bandwidth (3.1.3) for the type of radio transmission, and the frequency band used for the service, and

– the receiver's minimum usable signal strength or sensitivity (MUS) in terms of the wanted radio signal's power or voltage needed at the receiver's antenna port, the former being lower-bounded in the receiver's passband by its internal (thermal) circuit noise power floor.

Note 3 to entry: For self-contained radio receiver categories and for individual receiving stations in stationary use, performance tests or checks can also concern verification of compliance with the required minimum usable field strength or power flux density according to 3.1.2, either on a test site (i.e., in an SAC or FAR) in absence of external noise and interference, or also *in situ*, at the installation site of the station concerned in presence of rather negligible levels of external noise and interference.

3.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

CW NB	Continuous Wave Narrow Band
EM	Electromagnetic
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
FAR	Fully Anechoic Room
GBB	Gaussian Broad Band
IBB	Impulsive Broad Band
IN	Impulsive Noise
ITU-R	International Telecommunication Union Radiocommunication Sector
MMN	Man-Made-Noise
MUS	Minimum Usable (signal) Strength
RA	Radiocommunication Assembly (ITU-R)
RF	Radio-frequency
RFI	Radio-frequency Interference
RRC	Regional Radiocommunication Conference (of members of ITU-R)
Rx	Radio receiver
SAC	Semi-Anechoic Chamber
SCN	Single-Carrier Noise
S/N	Signal-to-Noise (ratio)
S/I	Signal-to-Interference (ratio)
WGN	White Gaussian Noise
WRC	World Radiocommunication Conference (of members of ITU-R)

4 Global advice on usage of the database

4.1 General

The database contains objective radio system characteristics and subjective information on typical intended usage.

In order to obtain concise and objective data it is necessary to define which out of the various data from the many available planning parameters for radio services need be included in the radio database, together with further information about the conditions in typical use of the radio services and in particular its radio receivers.

The structure of the database and its data are kept up-to-date and maintained solely by CISPR/H. In the database, parameters are given on a line-by-line basis. If a radio service offers/specifies radio parameters for different modes of radio reception, then the respective data are found in separate lines in the database, which commonly belong then to the same service. Hence duplication of several data entries can be observed in such cases.

4.2 Input to the database

Input can be made by using the template (Annex A reporting form) and by forwarding the input to the CISPR H Secretariat. An example for up-to-date input in the spreadsheet forming the Radio Services Database is found in Annex A.

4.3 Use of data from the database for limits determination

The database is found at the IEC web site https://www.iec.ch/emc/radio-services-database and is freely accessible. Product committees preparing EMC emission standards need to consider in which frequency ranges their equipment are likely to generate emissions. The relevant frequency ranges in this database can be consulted in order to identify which radio services can be affected and which are the related levels of tolerable interference. CISPR TR 16-4-4 states the principles of setting emission limits based on the information in the database.

5 Outline of the database and explanations to its content

5.1 Outline of the database

An overview of the structure and outline of the database is shown in Table 1. Column (1) of this table covers the ascending letter denoting the respective data column in the database, column (2) the concise denotation of the radio parameter's characteristics, and column (3) a brief description of that characteristic. Further explanations to several radio parameters and other information in the database are also found in 5.2.

Table 1 – Terms used in the headers of the database and explanations on their purpose

Characteristics		Explanation / purpose
(1)	(2)	(3)
(A)	Radio service (name)	Identification of the radio service, name, abbreviation, or the like
(B)	Reference document (specification)	Document that was used as the source or reference to obtain the relevant radio parameters for this entry to the database. There can be multiple reference documents.
(C)	Frequency start [MHz]	Lower edge frequency of the frequency band assigned to the respective radio service in MHz
(D)	Frequency stop [MHz]	Upper edge frequency of the frequency band assigned to the respective radio service in MHz
(E)	Minimum usable field strength [dB(µV/m)]	Minimum usable field strength according to 3.1.2. See also Clause B.1. The protected field strength is also known as the minimum usable field strength or field strength at the edge of coverage.
(F)	RF co-channel protection ratio [dB]	RF protection ratio according to 3.1.1. (i) Ratio of the wanted radio signal's field strength according to (E) to the just still tolerable value of the co-channel disturbance field strength experienced by the extraneous radio noise in the given EM environment category, for provision of the pre-defined reception quality of the given radio service, as confirmed by international treaties, where applicable. (ii) Ratio of the receiving station's minimum usable signal strength (MUS) according to 3.1.4, to the station's system-internal circuit noise, in absence of external noise and interference, for provision of the pre-defined reception quality at the output of the radio station, as specified in standards and other specifications used for performance tests on radio receivers. The ratio as in (i) and (ii) will come with one-and-the-same numerical value. The numerical value of the RF protection ratio must be attributed to the RFI/EMI waveform it belongs to and hence the abbreviation of that waveform must be added, the choices being GBB, IBB, or CW NB.
(G)	Receiving antenna gain [dBi] (Fixed value, or statistical mean value)	The gain in the main lobe of the receiving antenna specified in decibel above the gain of an isotropic radiator [dBi]. For radio interference/compatibility studies a reference antenna is usually available. In absence of a reference antenna use the typical antenna gain of receiving stations or other self-contained radio receivers used in practice with this radio service.
(H)	Signal bandwidth [kHz]	Radio frequency bandwidth for the noise power at the RF input stage of the receiver in kHz between the "–3 dB" points, identical with the necessary bandwidth according to 3.1.3.
(I)	Isolation distance [m] (Statistical minimum value, lower bound of the distribution of expected distances)	Minimum expected distance between the antenna of a receiver or receiving station and a potential disturbance source. EXAMPLE 1 A macro cell base station in a 20-metre-high tower will typically not have a disturbance source in the main beam within 20 metres distance. EXAMPLE 2 A handheld radio receiver used in the same environment as a potential disturbance source can have a typical minimum distance of 30 cm or even less, to that source. The term ‘Isolation distance' is not to be confused with the term ‘Protection distance', which has a predefined fixed width/length not showing any statistical variation range.
(J)	Radio reception mode	Indication whether radio reception takes place preferably in stationary conditions, or in conditions of motion. Stationary use of receivers is indicated by an entry "fixed" and use of receivers in motion by an entry "mobile ". If there is no preference, then insert "fixed/mobile".
(K)	Receiver population density [km^{-2}]	Typical density in receivers per square kilometre.

Characteristics		Explanation / purpose
(1)	(2)	(3)
	(Statistical mean value)	
(L)	Operation Period [% per day] (Statistical mean value)	For the radio service, expected or observed percentage of time where the transmitter is active, in a time frame of 24 hours.
(M)	Modulation	Indicate the modulation scheme (abbreviation) and whether the receiver/receiving system is used in a duplex or simplex radio transmission system.
(N)	Is it a safety-related service	Is the service part of a security or safety system?
(O)	Usage	Typical area of use of the radio service restricted to one country, one region, or is it used worldwide?
(P)	Environment Category	Category of the electromagnetic environment envisaged for the radio service's customary usage. The categories being "city", "residential", "rural" or "quite rural".

5.2 Additional information on the characteristics used in the radio service database

The information found hereafter gives guidance on how to avoid mistakes in data input in the database which can be caused by ambiguity converting the meaning-into-words used as headers for the columns of data compiled in the spreadsheet covering the database. Such ambiguity can occur as a result of the provision of the data for the database, or likewise as a result of the retrieval from the database for use of these data in the model for the determination of CISPR limits. Information is given for some of the entries only; they refer to the respective columns in the spreadsheet covering the database.

(B) For limits calculation/estimation by CISPR, preferably confirmed parameter data and information of accomplished coverage planning processes for radio services must be used. Endorsed and proven data are found regularly in the Final Acts of WRCs and RRCs of ITU-R [1][1] and [2], or other regional associations of administrations. Hence preference must be given to references to International Treaties of ITU-R and/or comparable Directives of other regional regulatory associations. If for a given radio service coverage planning does not apply, reference must be made to other relevant recommendations/ specifications of ITU-R endorsed by its Radiocommunications Assembly (RA), where applicable.

(E) The protected field strength denotes the minimum value of the wanted radio signal's field strength directly at the antenna of the radio reception system in stationary use or other self-contained radio receiver intended for mobile/portable use in the outdoor domain or also for indoor radio reception, necessary for provision of radio reception with at least the minimum specified or otherwise just still tolerable reception quality and performance. The protected field strength hence shows the same fixed numerical value and level, independent of the intended or specified mode of radio reception.

1 Numbers in square brackets refer to the Bibliography.

(F) The only protection ratio of interest for CISPR is the "radio-frequency co-channel protection ratio" at the receiver's RF input (e.g., at the receiving system's antenna, where it relates to field strengths or power flux densities, or directly at the antenna port of the receiver, where it relates to voltages or powers). In all cases, the RF protection ratio comes with the same fixed numerical value, independent of the intended or specified mode(s) of radio reception.

In that ratio, the noise at the receiver's RF input can be system-internal circuit noise only, see 3.1.4, or the sum of system-internal noise and external radio noise, see 3.1.2. External noise consists of the combination of natural noise and man-made noise (MMN), the latter being white Gaussian noise aggregated from unwanted emanations (or "unintended radiation") [5] of multiple sources operated in the given EM environment category. In all cases, the RF protection ratio comes with the same fixed numerical value, independent of the internal or external nature of the noise dominating the noise floor at the receiver's RF input.

If not specified in international treaties and agreements, data of specified RF protection ratios against noise-like co-channel disturbance can be retrieved or concluded from radio standards used for functional performance tests (type tests) on receiver categories intended for use with the service of interest.

For the given RF protection ratio, also add information concerning to which RFI/EMI waveform it belongs, selected from Gaussian broadband (GBB), impulsive broadband (IBB), or continuous wave narrowband (CW NB) disturbance characteristics. Any entries are made in the form < *xy* dB > plus abbreviation < GBB >, < IBB >, or also < CW NB > only.

For intended input of other kind of most critical waveforms, enter the numerical value of the protection ratio in dB together with an appropriate abbreviation for the waveform. The proposal for the new entry submitted to CISPR/H needs to cover the definition for the added most critical RFI/EMI waveform.

NOTE An example for data in column (F) can read: RF protection ratio for the most critical RFI/EMI waveform: < ** dB (CW NB) >.

(G) Coverage planning of radio services is usually done for radio reception in stationary conditions (fixed mode radio reception), and also considers mobile mode radio reception. Consequently, antennas for fixed radio reception usually have higher gain and directivity than antennas fitted on vehicles for mobile radio reception or built-in or integral antennas of portable or hand-held radio receivers. Data for the "Receiving antenna gain" must hence be carefully selected in line with the mode of radio reception (either "fixed" or "mobile") the coverage planning was made for. Where necessary, use separate lines in the Radio Services' Database, for entry of data for the antenna gain of receivers used in fixed mode, and for receivers used in mobile mode radio reception.

(I) In practice, individual isolation distances observed between a radio station and electric/electronic equipment operated in immediate vicinity to that radio station will be spread about a rather large range. This fact can be covered in the database in either input of data for the typical statistically smallest or minimum isolation distance, or for the typical range of observed individual isolation distances. Hence data in column (H) are either given in the format < *xy* metres >, or < *xy* metres to *yz* metres >. Where necessary, use separate lines in the spreadsheet of the database, for entry of data for the typical isolation distance observed with receivers used in fixed mode and with receivers used in mobile mode radio reception.

(J) In some cases, it does not suffice just to state whether respective radio receivers are intended for fixed or mobile use. The planning standards for radio services can cover more specific modes of operation which are of relevance for limits calculation according to the CISPR model. Input for the database distinguishes between use of receivers in fixed reception installations (fixed), outdoor mobile or portable use (mobile), or indoor use (indoor). Hence, any entry of information in column (J) can only read either < fixed >, or < mobile >, or < indoor >. If there exists more than one specified mode of radio reception, then use separate lines in the spreadsheet of the database to accurately identify them line-by-line, in conjunction with the necessary entries of data in the other corresponding columns (G) and (I) of the database. Note that the corresponding numerical data and information in the other columns will be the same, since not depending on the respective mode of radio reception.

(M) Information about the least robust modulation scheme which relates to the RF protection ratio found in column (F) in the database and about the mode of operation of the radio transmission system is given using respective abbreviations according to the classification in the ITU-R Radio Regulations (2020), Volume 1 – Articles, Section VI – Characteristics of emissions and radio equipment. Commonly used abbreviations for the modulation schemes are acceptable.

Annex A
(informative)

Reporting Form

When submitting entries to the radio services database, the information must be as complete as possible. Hence, it is recommended to use Table A.1 as a Reporting Form in order to consider all necessary characteristics. One form sheet covers the data for the radio parameters of one dedicated radio service in the assigned frequency band. Further advice for the data to be provided in the Reporting Form is found in Table 1. Please return the required information either on a disc or by e-mail.

Alternatively, you also can use the formatted spreadsheet forming the database in order to submit new content and data for incorporation in the Radio Services Database. Just download that spreadsheet and use it as template for your input. In any case, mark your new entries for attention of CISPR H.

The following characteristics and information must be included (see Table A.1).

Table A.1 – Reporting form

	Characteristics[a]	Input column	Remarks
(A)	Radio system (name)		
(B)	Reference document (specification)		
(C)	Frequency start (MHz)		
(D)	Frequency stop (MHz)		
(E)	Minimum usable field strength E_{min} [dB(µV/m)]		
(F)	RF co-channel protection ratio R_p (dB)		
(G)	Receiving antenna gain G_r (dBi)		
(H)	Rx bandwidth B_{Rx} (kHz)		
(I)	Isolation distance d (m)		
(J)	Radio reception mode		
(K)	Receiver population density [km^{-2}] (Statistical mean value)		
(L)	Operation period [% per day]		
(M)	Modulation		
(N)	Is it a safety-related service?		
(O)	Usage		
(P)	Environment category		

[a] See Table 1 and 5.2 for detailed information.

An example of up-to-date input data for a line of radio services into the spreadsheet forming the database is found in Figure A.1.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Radio service	Ref. Document	Frequency start [MHz]	Frequency stop [MHz]	Minimum usable field strength [dB(µV/m)]	RF co-channel protection ratio [dB]	Receiving antenna gain [dBi]	Rx Bandwidth [kHz]	Isolation Distance [m]	Radio reception mode	Receiver population density [km^{-2}]	Operation Period [% per day]	Modulation	Safety Related	Usage	Environment category
LF	BS.560/FA.75	0,1485	0,255	72	30	0	9	3	Fixed		100,0%	AM	No	Europe+ Africa	
MF	BS.560/FA.75	0,5265	1,607	60	30	0	9	3	Fixed		100%	AM	No	worldwide	
HF	RR 2020	9,4	9,9	44	27	0	9	3	Fixed		100%	AM/ DRM	IRDR	worldwide	
Amateur Radio		14	14,35	-11	10	10	2,7	10	both		10%	J3E	In some countries	worldwide	
FM	Rec.ITU-R-BS.704	87,5	108	30	36		200	1	Portable		100,0%	FM	No	Worldwide	
Amateur Radio		144	148	-21	10	16	25	3	both		10,0%	FM	in some countries	worldwide	
DAB	Rec.ITU-R-BS.1660	174	240 (values at 174 MHz)	34	12	-6	1500	1	Portable		100%	COFDM	No	Worldwide	
DVB-T2	Rec.BT.2033ITU-R	174	240 (values at 174 MHz)	35	20	7	7000	3	Fixed		100%	OFDM, QAM	No	Worldwide	
DVB-T2	Rec.ITU-R	470	790	42	20	9	8000	3	Fixed		100,0%	OFDM,	No	worldwide	
DECT	EN 175-2300	1880	1900	60	10	0	1000	3	both		100,0%	GSMK-TDMA	No	worldwide	

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NOTE The protection ratio in Figure A.1 is a value for a disturbance belonging to Gaussian broadband noise (GBB) category if not specified.

Figure A.1 – Example for entries of data in the Radio Services Database based on the principles defined in Clause 5

Annex B
(informative)

Determination of the minimum usable field strength and associated tolerable disturbance field strength from sources other than radio equipment, at the antenna of radio stations according to the radio standards and recommendations of ITU-R

B.1 Determination of the minimum usable field strength

Determination of the wanted radio signal's minimum usable field strength (see 3.1.2) to be provided for an adequate protection of radio reception from EMI/RFI in the respective service area usually is sole business for the provider of the radio service. Nonetheless, the basics of spectrum utilization for radio services need to be known in order to understand the metrics in calculation of limits by CISPR.

According to the ITU radio standards, the minimum usable field strength desired at the location of the antenna of the radio reception system and to be specified for provision of radio reception with excellent quality is obtained by addition of the corresponding value of the required co-channel RF signal-to-noise (S/N) ratio (RF protection ratio, see 3.1.1) to the statistical mean value of the radio noise observed in the given electromagnetic environment category.

$$E_{\text{min}} = \bar{E}_{\text{environmental radio noise}} + R_{\text{p}} \tag{B.1}$$

where the value of this RF protection ratio is to be chosen in accordance with the typical RF characteristics of the reference receiver (as, e.g., its typical minimum usable sensitivity) and the intended modulation scheme(s). Values for the required minimum RF S/N ratio for the type of receiver or radio reception system concerned are regularly found in respective recommendations of ITU-R or also in standards and specifications of radio receivers of other recognised standardisation institutions. Values for the typical external background noise in the field are found e.g. in ITU-R Recommendation P.372-15 (2021).

International or regional coordination in utilization of the available frequency spectrum by different parties can however result then in some agreed compromises or discounts in the 'excellent reception quality' provided by the RF protection ratio used in Formula (B.1), in favour of more efficient use of the frequency spectrum, e.g. by accommodation of an extended number of radio transmitters [8]. These latter "corrected" RF protection ratios can regularly be found in the Final Acts of WRCs and RRCs of ITU-R, but belong then only to protection of radio reception against locally/regionally prevailing unwanted emissions (or radio-frequency interference – RFI) from other "foreign" radio transmitters which are properly controlled by other ITU-R specifications. This protection ratio refers to the minimum value of the RF signal-to-interference (S/I) ratio required to obtain another less stringent specified and tolerable minimum reception quality only, in presence of the radio noise observed in the electromagnetic environment and of interference from other "foreign" transmitters and comes as

$$R_{\text{p}}^{'} = E_{\text{min}} - \left(\bar{E}_{\text{environmental radio noise+ interference}}\right) \tag{B.2}$$

Note that the discounts in radio reception quality represented in $R_{\text{p}}^{'}$ and consented to by the parties dealing with utilization of the frequency spectrum do not have any consequences on the minimum usable field strength E_{min} calculated in the first place according to Formula (B.1).