



**Fixed Radio Systems;
Generic definitions, terminology and applicability
of essential requirements covering article 3.2 of
Directive 2014/53/EU to Fixed Radio Systems**

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM).

Modal verbs terminology

In the present document "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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1 Scope

The present document, is intended for complementing the ETSI EG 203 336 [i.1] for specific guidance related to *Digital Fixed Radio Systems* (DFRS) in the production of candidate harmonised standards covering Directive 2014/53/EU [i.2]. Consequently the present document should always be used in conjunction with ETSI EG 203 336 [i.1] whenever DFRS are concerned.

NOTE: The previous versions of the present document were developed for similar purpose related to the now superseded ETSI EG 201 399 [i.10] V2.1.1 and Directive 1999/5/EC [i.11] repealed in June 2016 by Directive 2014/53/EU [i.2].

The present document identifies, among the generic technical parameters, relevant for the article 3.2 of the Directive, presently quoted by ETSI EG 203 336 [i.1], those which are relevant and applicable and those that are considered not applicable, for the various typologies of DFRS. Taking also into account the general principle of avoiding overregulation, they are justified through specific peculiarities of the DFRS technologies employed.

Moreover it gives the cross reference from the generic terminology used in ETSI EG 203 336 [i.1] and that currently used within the Fixed Radio technical community.

Considerations about technical parameters related to article 3.1 (health, safety and EMC) and article 3.3 (interworking and other special requirements) of Directive 2014/53/EU [i.2] are outside the scope of the present document.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI EG 203 336 (V1.2.1): "Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".
- [i.2] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.
- [i.3] ITU Radio Regulations.
- [i.4] Recommendation ITU-R F.1191: "Necessary and occupied bandwidths and unwanted emissions of digital fixed service systems".
- [i.5] Recommendation ITU-R F.1399: "Vocabulary of terms for wireless access".
- [i.6] ETSI EN 301 390: "Fixed Radio Systems; Point-to-point and Multipoint Systems; Unwanted emissions in the spurious domain and receiver immunity limits at equipment/antenna port of Digital Fixed Radio Systems".
- [i.7] CEPT/ERC Recommendation 74-01 (May 2019): "Spurious Emissions".

- [i.8] ETSI EN 302 217-1: "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 1: Overview, common characteristics and system-independent requirements".
- [i.9] ETSI EN 302 217-4: "Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4: Antennas".
- [i.10] ETSI EG 201 399 (V2.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of Harmonized Standards for application under the R&TTE Directive".
- NOTE: Version under Directive 1999/5/EC [i.11], superseded, for use under Directive 2014/53/EU [i.2], by preliminarily version V3.1.1 and finally by ETSI EG 203 336 [i.1].
- [i.11] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.
- NOTE: Repealed by Directive 2014/53/EU [i.2].
- [i.12] ETSI EN 302 326-3: "Fixed Radio Systems; Multipoint equipment and antennas; Part 3: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive for Multipoint Radio Antennas".
- NOTE: HS under Directive 1999/5/EC [i.11] and no longer needed for covering Directive 2014/53/EU [i.2]. At the moment of publication of the present document, the EN is under revision as a not HS EN.
- [i.13] Electronics Notes: "What is Reciprocal Mixing: measurement & specification".
- NOTE: Available at <https://www.electronics-notes.com/articles/radio/radio-receiver-sensitivity/reciprocal-mixing.php>.

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

- NOTE: The definitions hereby identified are generally used in the present document with the use of *italic characters* (e.g. *dedicated antenna*).

active antenna: antenna that contains active electronic components independently from their directional characteristics

air interface interoperability: capability of DFRS terminals from different manufacturers can be connected as terminals of the same P-P radio link or the same P-MP cell

- NOTE: It requires standardization of the physical radio layer (e.g. modulation format, digital codings, synchronization procedures, etc.) and part or all of the higher network layers protocols.

backhauling network: part of fixed network interconnecting the Base Stations (BS) of a mobile network, collecting/distributing data traffic from/to those BS to/from core network access points

- NOTE 1: In various mobile systems standardization organization terminologies, specific links in the backhauling networks can be identified with different terms (e.g. backhaul, midhaul or fronthaul) depending on the specific structure of the mobile BSs.

- NOTE 2: Various backhauling network structures are possible (e.g. links interconnected in chains, trees or rings).

bandwidth adaptive systems: From ETSI EN 302 217-1 [i.8]: "System, the capacity of which may be dynamically changed by means of bandwidth reduction during adverse propagation conditions".

dedicated antenna: From ETSI EN 302 217-1 [i.8]: "Antenna specifically designed for being attached to the radio equipment (i.e. with special mechanical fixing to the antenna port of the specific radio supplied), but can be separated from the equipment (typically for transport purpose) using normal tools".

Digital Fixed Radio Systems (DFRS): Point-to-Point (P-P) or Point-to-MultiPoint (P-MP) or MultiPoint-to-MultiPoint (MP-MP) radio equipment, which may be used in fixed locations as part of public or private networks in the core, backhauling or access segments

NOTE 1: It is equivalent to the ITU-R definition of Fixed Wireless Systems (FWS) and comprises Fixed Wireless Access (FWA) systems and, in specific cases, their optional extension to Nomadic Wireless Access (NWA) (see note 3).

NOTE 2: The two latter generically identified as MultiPoint (MP) systems.

NOTE 3: NWA systems are defined in Recommendation ITU-R F.1399 [i.5] as (quoting from it) *"Wireless access application in which the location of the end-user termination may be in different places but it must be stationary while in use"*.

essential parameter: radio frequency characteristic related to the essential requirements under article 3.2 of Directive 2014/53/EU [i.2] capable of being expressed in terms of quantifiable technical parameters

frequency tolerance: From Radio Regulations [i.3] article 1.151: *"The maximum permissible departure by the centre frequency of the frequency band occupied by an emission from the assigned frequency or, by the characteristic frequency of an emission from the reference frequency"*.

harmonized radio frequency band: commonly referred as a portion of the frequency spectrum that CEPT/ECC and/or European Commission (EC) allocates to a specific service through CEPT/ECC and/or European Commission (EC) Decision

NOTE: It should be noted that, presently, no radio frequency band allocation to Fixed Service is harmonized.

integral (integrated) antenna: From ETSI EN 302 217-1 [i.8]: *"Antenna which is declared as part of the radio equipment by the manufacturer; it is not physically separable from the equipment, unless it is returned to the manufacturer premises"*.

mixed-mode system: From ETSI EN 302 217-1 [i.8]: *"System having the capability for stations to operate, according network and operator needs (e.g. according propagation variations), on different modulation orders and/or different error correction coding, switching dynamically between them within the same assigned radio frequency channel, adapting the system capacity accordingly (multirate operation)"*.

Out-Of-Band (OOB) domain: From Radio Regulations [i.3] article 1.146A: *"The frequency range, immediately outside the necessary bandwidth but excluding the spurious domain, in which out-of-band emissions generally predominate. Out-of-band emissions, defined based on their source, occur in the out-of-band domain and, to a lesser extent, in the spurious domain. Spurious emissions likewise may occur in the out-of-band domain as well as in the spurious domain"*.

radio equipment: From Article 2 of Directive 2014/53/EU [i.2]: *"Radio equipment means an electrical or electronic product, which intentionally emits and/or receives radio waves for the purpose of radio communication and/or radiodetermination, or an electrical or electronic product which must be completed with an accessory, such as antenna, so as to intentionally emit and/or receive radio waves for the purpose of radio communication and/or radiodetermination"*.

reference mode (reference spectral efficiency class and channel separation): From ETSI EN 302 217-1 [i.8]: *"In mixed-mode systems, it identifies the operative mode, which characteristics (i.e. system capacity, spectral efficiency class over a given channel separation) are used (i.e. declared in the licensing process) in the link per link coordination analysis (see note)"*.

NOTE: It provides the reference availability objective commonly used for the whole network (i.e. the typical 99,99 % or any other generally used by the administration concerned for the frequency coordination of licensed P-P links). When also *bandwidth adaptive* operation is active, the *reference mode* is always related to the widest *channel separation* used.

spurious domain: From Radio Regulations [i.3] article 1.146B: *"The frequency range beyond the out-of-band domain in which spurious emissions generally predominate"*.

stand-alone antenna: From ETSI EN 302 217-1 [i.8]: *"Antenna designed independently from the fixed radio equipment, by the same or a different manufacturer and connected to the radio equipment in the field through standard cables or waveguide"*.

unwanted emissions: From Radio Regulations [i.3] article 1.146: "*Consist of spurious emissions and out-of-band emissions*".

3.2 Symbols

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

dBi	decibel relative to isotropic radiator
GHz	GigaHertz

3.3 Abbreviations

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

ACM	Adaptive Code and Modulation
ATPC	Automatic Transmission Power Control
BEM	Bloch Edge Mask
BER	Bit Error Ratio
CEPT	Conférence Européenne des administrations des Postes et des Télécommunications (European Conference of Postal and Telecommunications administrations)
CS	Channel Separation
CW	Continuous Wave
DFRS	Digital Fixed Radio Systems
EC	European Commission
ECC	European Communication Committee
EIRP	Effective Isotropic Radiation Power
EMC	ElectroMagnetic Compatibility
ERC	European Radiocommunication Committee

NOTE: Now renamed ECC.

EU	European Union
FDMA	Frequency Division Multiple Access
FH	Frequency Hopping
FS	Fixed Service
FWA	Fixed Wireless Access
FWS	Fixed Wireless Systems
GSM	Global System Mobile
HS	Harmonised Standard
LBT	Listen Before Talk
LO	Local Oscillator
MP	MultiPoint

NOTE: Term including both P-MP and MP-MP.

MP-MP	MultiPoint-to-MultiPoint
NWA	Nomadic Wireless Access
OOB	Out-Of-Band
P-MP	Point-to-MultiPoint
P-P	Point-to-Point
QAM	Quadrature Amplitude Modulation
QoS	Quality of Service
R&TTE	Radio equipment and Telecommunications Terminal Equipment
RF	Radio Frequency
RFC	Remote Frequency Control
RPE	Radiation Pattern Envelope
RSL	Received Signal Level
RTPC	Remote Transmit Power Control
TCAM	Telecommunication Conformity Assessment and Market surveillance committee
TDMA	Time Division Multiple Access
TPC	Transmission Power Control

WG TM4	Working group TM4 of ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (TC ATTMM)
XPD	X(cross) Polar Discrimination

4 General principles

The objective of a harmonised standard covering Directive 2014/53/EU [i.2] for DFRS is to define clear and unambiguous provisions for fulfilling the essential requirements referred in that Directive, which are applicable to the system concerned.

To aid the ETSI Technical Bodies in the production of candidate harmonised standards, ETSI produced the ETSI EG 203 336 [i.1] that expands the general concepts of essential requirements into a more detailed subdivision and gives guidance for identifying the technical parameters relevant to the essential requirement under consideration.

However, particularly in the parts that refer to article 3.2 "... *effectively uses and supports the efficient use of radio spectrum ...*" of the Directive 2014/53/EU [i.2], ETSI EG 203 336 [i.1] uses terminology and concepts that, when applied to a specific family of radio systems such as the Fixed Radio, proves to be still too generic; therefore further guidance, more technically based on the technology and terminology used by the relevant technical community, is reported in the present document. Therefore the present document should always be used in conjunction with the ETSI EG 203 336 [i.1] whenever Fixed Digital Radio Systems (DFRS) are concerned.

Whenever a technical parameter mentioned in ETSI EG 203 336 [i.1] is partially or not applicable for DFRS, technical justifications is also given.

5 Application of technical parameters in ETSI EG 203 336 to DFRS

5.0 Introduction

The content of the present document follows the guidance structure of ETSI EG 203 336 [i.1], clause 5. For each technical parameter considerations are given on the applicability, DFRS based requirement identification (terminology) and other useful background is given.

5.1 DFRS which do not require *air interface interoperability*

From the guidance given by the ETSI EG 203 336 [i.1], a more detailed applicability to DFRS of transmitter, receiver and other parameters related to essential requirements may be derived as shown in table 1.

Table 1: Essential requirements and parameters relevant to DFRS which do not require *air interface interoperability*; related background and terminology for parameters reported in ETSI EG 203 336 [i.1]

Essential Requirement	Technical parameters (clause in ETSI EG 203 336 [i.1])	Relevance as standardized parameter for DFRS	Alternative WG TM4 requirements terminology	Essential parameter Y=yes N=no and notes
3.2 (transmitting)	(A) 5.2.2) Transmitter Power limits and (B) 5.2.3) Transmitter Power accuracy	<p>Transmitter power have different impact on the use of the spectrum depending on the regulatory regime in the operating band (e.g. link-by-link licensing, block assignment, light licensing or license exempt) and type of DFRS systems permitted (e.g. P-P and/or P-MP).</p> <p>According to these distinctions different approaches to the relevant technical parameters should be adopted:</p> <p>1) LINK-BY-LINK LICENSED BANDS: Requirement: From Directive 2014/53/EU [i.2] assessment point of view, harmonised standards define only the maximum output power, in terms of either EIRP or power density (usually that in articles 21.3 and 21.5 of Radio Regulations [i.3]). Other specific bands limitations in other articles and some footnotes of Radio Regulations [i.3] (sometimes implying antenna azimuth angles limitation are generally fixed on link-by-link license. Rationale: In practice, a radio system, within those limits, may be designed in order to transmit, with suitable power setting methods, the appropriate transmission power to fulfil the performance, availability and interference requirements for which it is designed. In actual links deployment, the link-by-link planning process would define the actual power needed for that specific link (in terms of nominal EIRP, based on the needed antenna gain) for fulfil the required QoS and maintain the planned interference levels to nearby links. Therefore from the essential requirements point of view, relevant is the power variation on the nominal activation (licensed) value (including ATPC effects), within Remote and/or Automatic Transmit Power Control (RTPC/ATPC) ranges, if any, to guarantee stable frequency co-ordination.</p> <p>2) BLOCK ASSIGNMENT: Requirement: From Directive 2014/53/EU [i.2] assessment point of view, equipment operating in this regulatory regime is not different from the previous case. Rationale: It should be noted that, in most cases, the block assignment, for P-P, is used in some countries as alternative to link by link licensing, while for P-MP is the most common method. In this case there is no link-by-link power limitation, which will eventually be decided by the block owner itself; however, the block usage rules may define maximum in-block and out-of-block (e.g. BEM) power limitations; these are not intended "technical requirements" for Directive 2014/53/EU [i.2] assessment, but "licensing conditions".</p>	<p>A1) Transmitter maximum power and EIRP</p> <p>A2) Transmitter combined power output and EIRP limits</p> <p>B) Transmitter output power environmental variation</p>	<p>Y</p> <p>NOTE: Requirements A1) and B) in all cases. A2) Additional requirement only in bands where link by link planning is not the unique licensing method</p>