



TECHNICAL REPORT

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

Reference

RTR/ATTM-0432

Keywords

DFRS, FWA, radio, regulation

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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 harmonized 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NOTE: The previous versions of the present document were developed for similar purpose related to the now superseded ETSI EG 201 399 [i.10] V2.1.1 and Directive 1999/5/EC [i.11] repealed in June 2016 by Directive 2014/53/EU [i.2].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: "Electromagnetic compatibility and Radio spectrum Matters (ERM); 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: "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-dependent 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 1999/5/EC Directive, 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 covering Directive 1999/5/EC [i.11] and not revised for covering Directive 2014/53/EU.

3 Definitions, symbols and abbreviations

3.1 Definitions

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

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

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 standardisation of the physical radio layer (e.g. modulation format, digital codings, synchronisation 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 (see notes 1 and 2).

NOTE 1: In various mobile systems standardisation organisation 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).

dedicated antenna: 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, as defined in ETSI EN 302 217-1 [i.8].

digital fixed radio systems (DFRS): Point-to-point (P-P) or Point-to-multipoint (P-MP) or Multipoint-to-multipoint (MP-MP) radio equipment (see notes 1 and 2), 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 "*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

harmonized radio frequency band: commonly referred as a portion of the frequency spectrum that CEPT/ECC and/or European Commission allocates to a specific service through CEPT/ECC and/or European Commission 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] art. 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] art. 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] art. 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	decibels 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
BER	Bit Error Ratio
CEPT	Conférence Européenne des administrations des Postes et des Télécommunications (European Conference of Postal and Telecommunications administrations)
CW	Continuous Wave
DFRS	Digital Fixed Radio Systems
EC	European Community
ECC	European Communication Committee.
EIRP	Effective Isotropic Radiation Power
ERC	European Radiocommunication Committee

NOTE: Now renamed ECC.

EU	European Union
FDMA	Frequency Division Multiple Access
FH	Frequency Hopping
FWA	Fixed Wireless Access
FWS	Fixed Wireless Systems
GSM	Global System Mobile
HDFS	High Density applications in the Fixed Service

NOTE: These are some FS bands in the range 31,8 GHz to 66 GHz subject to footnote 5.547 in Radio Regulations [i.3].

HS	Harmonised Standard
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
QoS	Quality of Service
R&TTE	Radio equipment and Telecommunications Terminal Equipment and the mutual recognition of their conformity
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 ATTM)
XPD	X(cross) Polar Discrimination

4 General principles

The objective of a harmonized 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 harmonized 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) Power limits and (B) 5.2.3) 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:</p> <ul style="list-style-type: none"> • 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 art. 21 or some footnote of Radio Regulation [i.3]). • 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) 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 tolerance 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>2) BLOCK ASSIGNMENT:</p> <ul style="list-style-type: none"> • 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>3) LICENSE EXEMPT OR LIGHT LICENSING:</p> <ul style="list-style-type: none"> • Requirement: From Directive 2014/53/EU [i.2] assessment point of view, harmonised standards define the maximum output power, in terms of either EIRP or power density generally defined by the applicable regulatory instruments (European Commission Decision and/or ECC Decision or ECC Recommendations). Moreover, ETSI WG TM4 may define additional limitations (e.g. in terms of power and antenna directivity) necessary for improving, in average, the efficient use of the band in dense network deployment. • Rationale: These band access methods are typically used in some specific bands. • In general, those bands are regulated through European Commission Decisions and/or ECC Decisions or ECC Recommendations, which give emission limits and other requirements for accessing the band; no specific coordination is applied among different users. 	<p>A1) Maximum power and EIRP</p> <p>A2) Combined output power and EIRP limits</p> <p>B) Nominal transmitter output power and tolerance</p>	<p>Y</p> <p>NOTE 0: Requirements A1) and B) in all cases.</p> <p>Additional requirement A2) only in bands where link by link planning is not the unique licensing method</p>

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)	5.2.4) Spectrum mask	<p>Common practice for DFRS is to define a mask for spectral density relative to actual centre frequency ranging up to 2,5 times of the actual radio-frequency channel separation (see note), from which adjacent channel interference may be derived in conjunction with the receiver sensitivity to like-interference.</p> <p>Spectrum mask is the main tool to control interference to other like systems operating in adjacent channels as well as, when deployed close to the band boundary, to other systems in adjacent bands. For this reason also other factors possibly affecting the interfering potential should be considered as follows:</p> <ul style="list-style-type: none"> • interfering power from discrete spectral lines additional to the integrated density power of the mask; • potential impact on spectrum mask due to automatic controls on the output frequency and power. 	<p>1)Radio Frequency spectrum mask, 2) Discrete CW components exceeding the spectrum mask limit 3) Transmit power and frequency control (RTPC/ ATPC and RFC)</p>	<p>Y</p> <p>NOTE 1: The spectrum mask for DFRS is extended over the whole <i>OOB domain</i>; therefore, it is alternative to limits of <i>unwanted emissions</i> in the <i>OOB domain</i>. NOTE 2: In cases where channel separation is not defined, the Occupied Bandwidth (defined for FS systems in Recommendation IT U-R F.1191 [i.4]) is used as CS alternative.</p>
		<p>Adjacent allocated band(s) emission limitations. In bands where no specific channel arrangements are defined, or guards bands at the band edges are not provided or are of very limited size; wide band emissions at the band edge might generate sensible <i>unwanted emission</i> spill-over into adjacent bands; it should be suitable limited. In some cases, European Commission Decisions or ECC Decisions or Recommendations directly provide limits of all <i>unwanted emissions</i> (either in <i>OOB domain</i> only or also in the <i>spurious domain</i>) that falls in adjacent bands for the protection of particularly sensitive systems with primary allocation in that adjacent band. These limits are also considered relevant from Directive 2014/53/EU [i.2] point of view.</p>	<p>Emissions limitations outside the allocated band</p>	<p>Y</p> <p>NOTE: When the need is identified.</p>
3.2 (transmitting)	5.2.5) Frequency stability	Frequency deviation from the nominal assigned/selected channel centre frequency.	Radio frequency tolerance	Y

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)	5.2.6) Inter-modulation attenuation	DFRS commonly use non-reciprocal passive circuits (e.g. isolators) at transmitter output for guaranteeing the required return loss and for preventing intermodulation phenomena on the final active power devices of transmitter. The output power of DFRS is commonly rather low, therefore also any intermodulation produced by these non-reciprocal devices is irrelevant. Moreover DFRS antennas are passive and usually highly directive; the expected interference from other DFRS systems sharing the same network area re-entering from the antenna port is very low. Therefore this parameter has never been considered relevant. However in case of systems that will eventually adopt active antennas this parameter may become relevant and should be further studied and eventually defined to comply with Directive 2014/53/EU [i.2].	To be defined whenever necessary	Y (active antennas only) N (all other cases)
3.2 (transmitting)	5.2.7.1) Unwanted emissions in the out-of-band domain	Emission limitations in the <i>OOB domain</i> .	See Spectrum mask	Y NOTE 4: Covered by alternative spectrum mask method
3.2 (transmitting)	5.2.7.2) Unwanted emissions in the Spurious domain	They are relevant as defined by CEPT/ERC Recommendation 74-01 [i.7] or ETSI EN 301 390 [i.6] (which, for multipoint application, is more stringent in a specific portion of the HDFS frequency range). When relevant, also the "Emissions limitations outside the allocated band" (see above) would become the most stringent.	Unwanted emissions in the spurious domain-external	Y
3.2 (transmitting)	5.2.8) Time domain characteristics	Time domain characteristics are e.g. the duty cycle, turn-on and turn-off, frequency hopping cycle, dynamic changes of modulation scheme and others of a transmitter. When relevant, European Commission Decisions or ECC Decisions or Recommendations may specify such limits. Dynamic changes of modulation are regulated in DFRS HS through the use of the definitions of " <i>reference modes</i> " and the consequent behaviour of " <i>mixed-mode</i> " system. At the time of publication of the present document, no other cases are identified for DFRS operations.	None	N
3.2 (transmitting)	5.2.9) Transmitter Transients	Transmitters can have dynamic variation in power (e.g. ACM, ATPC, TDMA operation, etc.), frequency (e.g. RFC, FH or FDMA with dynamic "channel" allocation, etc.) or modulation format (adaptive modulation in <i>mixed-mode</i> operation) it is relevant that during these transition the required spectrum parameters (Licensed power, Spectrum mask, frequency tolerance, etc.) should not be exceeded or should be controlled by specific requirements.	- Automatic Transmit Power Control (ATPC), - Remote Frequency Control (RFC) - Dynamic Change of Modulation Order	Y
3.2 (receiving)	5.3.2) Sensitivity	This parameter is the base on which, through proper frequency co-ordination techniques to assure the efficient use of the spectrum, the required QoS and availability for DFRS in public core and access networks, offering high network performance (e.g. for leased lines), may be assessed and calculated in presence of interference. This parameter is the only system parameter at the receive site, which enables to assess the co-channel rejection and the adjacent selectivity (see below). Also in license exempt bands, this parameter, would affect the level of transmitted power for keeping suitable QoS; better values would permit, in average, reduction of interference situation with consequent improved efficiency in the use of the band.	BER as a function of receiver input signal level (RSL)	Y

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 (receiving)	5.3.3) Co-channel rejection	In link-by-link licensed bands this parameter is required to define the amount of frequency reuse still assuring the required QoS for fixed radio in communication networks (e.g. in a nodal station or in systems on a geographical area). Also in all other cases this parameter defines the ability of the systems to support interference; better values would improve interference situation with consequent improved efficiency in the use of the band. Therefore this parameter is relevant for from Directive 2014/53/EU [i.2] point of view to ensure the efficient use of the spectrum. The actual performance is described in terms of bit/block error ratio (BER) threshold degradation.	Co-channel interference sensitivity or Co-channel "external" interference sensitivity	Y
5.3.4 Receiver Selectivity				
3.2 (receiving)	5.3.4.1) General	Receiver selectivity is a generic concept that should be tailored to the specific radio application in order to provide " <i>efficient use of the spectrum</i> " and " <i>protect its level of performance against the risk of harmful interference</i> ". Therefore, the assessment should be based on the "performance" of the radio system, which, for fixed radio systems, is generally based on evaluation of BER under specific propagation situation (through the properly designed link fade margin). Such performance should be maintained under suitable (i.e. representing the expected situation in field) interference scenario. Therefore, all selectivity-related characteristics are described in terms of receiver threshold degradation under specific C/I ratio at various representative frequency offset near and far from the operating frequency. A "selectivity" figure could be extrapolated by the difference between the performances, at the same degree of threshold degradation, of required co-channel C/I and the C/I required at other representative frequencies.		
3.2 (receiving)	5.3.4.2.1) Adjacent channel selectivity (single signal)	In link-by-link licensed bands this parameter is required for frequency co-ordination among different DFRS operated in the same geographical area by network operators (e.g. more than one). It defines the amount of frequency separation (e.g. at P-P nodal stations) or the amount of geographical separation (e.g. in MP systems deployment) for adjacent channel, still assuring the required QoS for DFRS in communication networks. Therefore this parameter is relevant from the Directive 2014/53/EU [i.2] point of view to ensure the efficient use of the spectrum.	B1) Adjacent channel interference sensitivity B2) 2 nd adjacent channel interference sensitivity	Y
3.2 (receiving)	5.3.4.2.2) Spurious response rejection	This parameter is complementary to the next (blocking) dealing only with specific frequency(ies) response that may have been excluded from it due to different sensitivity than the generic rejection capability required under the "blocking or desensitisation" It is "optional" but relevant if there are frequencies specifically identified (e.g. a known interference at a specific frequency and level) excluded from the previous "blocking or desensitisation" and mentioned here.	To be defined whenever necessary	Y (if eventually identified by the relevant EN)
3.2 (receiving)	5.3.4.3.1) - Blocking	This parameter is relevant for showing the receiver capability of supporting interference, at any frequencies outside an exclusion bandwidth, with a level reasonably higher than its sensitivity level. Therefore it is relevant also for the Directive 2014/53/EU [i.2]. ETSI EN 301 390 [i.6] contains technical requirements valid for all P-P and MP systems as well as the exclusion bandwidth and the frequency range of assessment.	CW Spurious Interference sensitivity or Receivers immunity at antenna port	Y

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 (receiving)	5.3.4.3.2) Radio frequency Inter-modulation	<p>This parameter covers the receivers capability of rejecting (withstanding) more than one interfering signals, spaced by two or several channels that may possibly create 3rd order intermodulation products which fall in band of the main receive signal.</p> <p>This parameter is not relevant for systems which foresee multichannel branching with relatively narrow RF filters for each channel; it may be relevant only for systems with an RF duplexer pass-band relatively large compared to the RF-channel bandwidth.</p> <p>However, this parameter is understood as derived from mobile systems requirements, where the receivers have to withstand a large amount of unwanted adjacent channel signals (interferer) due to relatively wide band RF-filtering (e.g. in portable terminals) in conjunction with antennas having poor or no directivity at all, resulting in relatively high interference level into the receiver, and where the interference scenario is continuously changing with possible danger of random blocking because of intermodulation among adjacent carriers.</p> <p>On the contrary, the interference scenario for DFRS is stable in the time and antennas are directive, resulting in relatively low interference level into the receiver (usually confined within assessed levels for blocking requirement) and all possible interference are of different level with one of them predominant in level.</p> <p>Therefore, it will be commonly considered not essential unless for specific cases presently not identified.</p>	Front-end non-linearity requirements (two-tone CW spurious interference)	N (Common choice) Y (special cases to be identified)
3.2 (receiving)	5.3.4.3.3) Adjacent channel selectivity (multiple signals)	This is not relevant for the typical DFRS receiver technology, for which one adjacent interfering channel usually predominate over other interfering signals.	None	N
3.2 (receiving)	5.3.4.4) Other receiver effects	<p>ETSI EG 203 336 [i.1] mentions other effects that might impair receiver performance (dynamic range, reciprocal mixing and desensitisation).</p> <p>Taking also into account that the receiver selectivity/sensitivity to interference is evaluated in terms of true BER threshold degradation, which takes into account all impairing effects, none of them are relevant for the typical technology or practical use in DFRS operations.</p>	None	N
3.2 (receiving)	5.3.5) Unwanted emissions in the spurious domain	They are relevant as defined by CEPT/ERC Recommendation 74-01 [i.7] or the more stringent ETSI EN 301 390 [i.6].	Spurious emissions-external	Y

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
5.4	Protocol elements. interference mitigation techniques and type of modulation			
3.2 (Protocol elements. interference mitigation techniques and type of modulation)	5.4.2) Transmitter Power Control (TPC)	At the time of publication of the present document no European Commission Decisions or ECC Decisions or Recommendations impose automatic TPC (ATPC) for DFRS systems. Whenever this would happen, or in particular cases where the DFRS experts would consider appropriate for improving spectrum utilisation in some bands (typically for uncoordinated use), specific ATPC operation would be relevant and included in the HS.	Combined TX power output and EIRP limits	Y (specifically identified cases)
	5.4.3) Listen Before Talk (LBT)	This parameter may be relevant only in case sharing procedure is required by relevant European Commission Decisions or ECC Decisions or Recommendations for enabling the transmission in not co-ordinated frequency bands. In other cases may be relevant only in case of standardized radio frequency interface for interoperability of equipment from different manufacturers (e.g. GSM-like <i>air interface interoperability</i>), presently not foreseen by TM4 standards. At the time of publication of the present document this is not required by any European Commission Decisions or ECC Decisions or Recommendations for any DFRS application.	Interference avoidance requirement	Y (for systems requiring sharing procedure) N (all other cases)
	5.4.4) Operation under the control of a network	Only MP systems provides network control protocols for proper terminals operation; however, having no <i>air interface interoperability</i> and operating in block assignment to unique user, they are left to manufacturer responsibility only and there is no need to include them in HS.	None	N
3.2 (antennas)	5.5 Antennas	See clause 5.3 in present document		

5.2 DFRS which do require *air interface interoperability*

Presently, no such cases are foreseen in any ETSI standard for DFRS.

Whenever required, detailed analysis, beyond the parameters relevant for general frequency co-ordination purpose eventually reported in table 1, is left for future study.

5.3 DFRS Antennas

5.3.1 General

ETSI EG 203 336 [i.1] clause 5.5 states that "For other equipment that contains an *integral antenna* or is supplied with a *dedicated antenna*, the TB should consider whether radiated and/or conducted requirements are appropriate.

Where the antenna is supplied separately from the radio equipment, Technical Bodies should not include antenna characteristics in the Harmonised Standard.

If the ETSI Technical Body decides to standardize the characteristics of antennas, these may be included a non-harmonised EN or other ETSI deliverable.

5.3.2 P-P antenna parameters in HS

5.3.2.1 General approach

From the considerations in clause 5.3.1, antenna parameters play a significant role for P-P DFRS conformity to essential requirements under article 3.2. However, in the DFRS market two cases are possible:

- 1) Radio equipment and antenna are provided by the radio equipment manufacturer as an *integral/integrated* or *dedicated antenna* product.
- 2) Radio equipment and antennas are produced and placed on the FS market as separate stand-alone products by specialised suppliers; the end user may purchase such antenna and its integration with the radio equipment is directly made on the radio station through RF cables or waveguides, outside the radio equipment manufacturer control.

For analysing the essentiality or not of FS antenna parameters with respect to Directive 2014/53/EU [i.2] article 3.2 requirement, the following consideration apply:

- Following Directive 2014/53/EU [i.2], article 2 definition of radio equipment, a *stand-alone antenna* is considered an "accessory" of the radio equipment.
- Therefore, FS *stand-alone antennas* are not within the scope of Directive 2014/53/EU [i.2]. However, if these antennas do not fulfil the appropriate technical requirements, there could be an increased risk of harmful interference and a reduced level of efficient spectrum use.
- A number of provisions within Directive 2014/53/EU (e.g. article 10.8, article 18.2 and Annex VI.8) [i.2] require that radio manufacturers should define and inform the end user of the relevant technical characteristics of any accessory "*which allow the radio equipment to operate as intended*".
- Therefore, whenever antennas technical parameters are considered necessary, the HS should also contain the necessary guidelines for *stand-alone antennas*; e.g. listing antennas conforming to ETSI EN 302 217-4 [i.9] as the only possible antenna "accessory" fulfilling essential requirements in article 3.2 of Directive 2014/53/EU [i.2].

5.3.2.2 P-P antenna parameters in HS

In the case where the radio is supplied with either an *integral/integrated* or *dedicated antenna* then the following parameters should be defined within the HS:

- Radiation Pattern Envelope (RPE):
 - RPE describes the directional attenuation with respect to the bore sight direction and is the basis for all DFRS networks planning. Different RPE classes are usually provided.
- Gain (boresight direction):
 - In bands where link-by-link licensing is generally applied, the absolute value of this parameter is not deemed essential under Directive 2014/53/EU [i.2]. However, as antenna gain is required for the frequency co-ordination process in order to evaluate the link EIRP (associated to the absolute transmitter power) the value is usually determined during the link design phase.
- Cross-Polar Discrimination (XPD):
 - XPD is relevant for frequency co-ordination in link-by-link licensed frequency bands, Furthermore this parameter is important, in LoS links operation, to ensure the efficient use of the spectrum because the relatively high XPD of DFRS antennas would permit the crosspolar frequency reuse also for more sensitive high efficient modulation formats. Consequently, in most bands it is considered relevant from Directive 2014/53/EU [i.2] point of view.

5.3.3 MP antenna parameters in HS

Provided that MP systems are predominantly deployed under "block assignment license" to a single operator, the maximisation of spectrum usage is left to the owner of the block and might be pursued in various manner, including proprietary passive and active antennas (see note). It will not affect other operators eventually protected at the block edge by the block license rules.

NOTE: It is reminded that when active antenna are used, other requirements (e.g. spectrum masks and spurious emissions should be in any case respected).

Therefore MP antenna parameters are not considered an essential characteristic for the MP system.

However, ETSI EN 302 326-3 [i.12] still contain characteristics of a number of MP antennas (directional, sectorial and omnidirectional) that can be used as reference whenever needed for administrative or technical purpose.

Annex A: Bibliography

- TCAM (8)51: "ADCO Report to TCAM8" (see note).
- TCAM (7)48: "Contribution on antennas (IT)" (see note).
- TCAM (17)57: "Application of R&TTE antenna (UK)" (see note).
- TCAM (20)02: "Minutes TCAM 19" (see note).

NOTE: TCAM documents relevant to antennas parameters for radio equipment under 1999/5/EC Directive [i.11].

Annex B: Change History

Version	Major variants with respect to previous version
1.1.1	First Publication following the entering into force of Directive 1999/5/EC. Based on ETSI EG 201 399 guidelines
1.2.1	Revision including clarification on antenna parameters relevance and certification procedure following several TCAM discussion and decision on the antenna treatment under the Directive 1999/5/EC
2.1.1	Overall updating due to entering into force of Directive 2014/53/EU repealing Directive 1999/5/EC. Based on ETSI EG 203 336 guidelines

History

Document history		
V1.1.1	January 2000	Publication
V1.2.1	May 2008	Publication
V1.3.1	January 2010	Publication
V2.1.1	July 2016	Publication