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Part 2: Radio reception and transmission requirements;
Release 1

Reference

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Digital Enhanced Cordless Telecommunications (DECT).

The present document is part 2 of a multi-part deliverable specifying the DECT-2020 New Radio (NR) technology. Full details of the entire series can be found in part 1 [1].

DECT-2020 NR is recognized in Recommendation ITU-R M.2150 [i.2] as a component RIT fulfilling the IMT-2020 requirements of the IMT-2020 use scenarios Ultra Reliable Low Latency Communication (URLLC) and massive Machine Type Communication (mMTC). The Set of Radio Interface Technology (SRIT) called "DECT 5G SRIT" is involving 3GPP NR and DECT-2020 NR.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**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 establishes the minimum RF requirements for DECT-2020 New Radio (NR) Radio Devices (RDs). For clarity these requirements cover both Fixed Termination point (FT) as well as Portable Termination point (PT).

2 References

2.1 Normative 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.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

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 necessary for the application of the present document.

[1] ETSI TS 103 636-1: "DECT-2020 New Radio (NR); Part 1: Overview; Release 1".

[2] ETSI TS 103 636-3: "DECT-2020 New Radio (NR); Part 3: Physical layer; Release 1".

[3] ETSI TS 103 636-4: "DECT-2020 New Radio (NR); Part 4: MAC layer; Release 1".

[4] Recommendation ITU-R M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000".

[5] Recommendation ITU-R SM.329: "Unwanted emissions in the spurious domain".

[6] IEC 60068-2-1: "Environmental testing - Part 2-1: Tests - Test A: Dry Cold".

[7] IEC 60068-2-2: "Environmental testing - Part 2-2: Tests - Test B: Dry heat".

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 TR 100 028-1 (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1".

[i.2] Recommendation ITU-R M.2150: "Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2020 (IMT-2020)".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

network ID: network identity as defined in ETSI TS 103 636-4 [3]

transmitter ID: transmitter short radio identity ID as defined in ETSI TS 103 636-4 [3]

3.2 Symbols

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

α	Leaky integrator filter forgetting factor
$Band_{high\ edge}$	High edge of the band for blocking signal
$BW_{Interferer}$	Bandwidth of the interfering signal
$Band_{low\ edge}$	Lower edge of the band for blocking signal
f	Frequency
F_c	Carrier centre frequency
$F_{Interferer}$	Frequency offset of the interfering signal from the centre frequency of the desired signal
F_o	Reference carrier centre frequency
F_{OOB}	Δ Frequency of the Out of Band emission
n	Carrier number
$P_{Interferer}$	Received power of the interfering signal
ΔP	Power step size in dB between power control commands
$RX_{channelmax}$	Maximum receiver wanted signal level
$RX_{sensitivity}$	Minimum receiver reference sensitivity
$SNR_{PACKET}(n)$	Signal to Noise Ratio of packet (n)

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TS 103 636-1 [1] and the following apply:

NOTE: An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in ETSI TS 103 636-1 [1].

ACS	Adjacent Channel Selectivity
EVM	Error Vector Magnitude
FT	Fixed Termination point
IDFT	Inverse Discrete Fourier Transform
NR	New Radio
OFDM	Orthogonal Frequency Domain Modulation
PPM	Parts Per Million
PT	Portable Termination point
RD	Radio Device
RF	Radio Frequency
RMS	Root Mean Square
RSSI	Received Signal Strength Indication
SNR	Signal to Noise Ratio

4 General

4.1 Introduction

The present document defines the minimum requirements for DECT-2020 NR radio devices.

Radio channel arrangements, operating channel bandwidths and supported bands are defined in clause 5. The present document defines operating bandwidths 1,728 MHz, 3,456 MHz and 6,912 MHz. The channel numbering scheme enables to assign channels from 450 MHz up to 5 875 MHz band operating enabling to support up to 17 different operating bands.

For transmitter operation the present document specifies 23 dBm, 19 dBm and 10 dBm maximum output power classes which adapt to different type of application requirement and support battery powered use cases. The transmitter emission masks performance meets the industry requirements. In addition, the transmitter output power can be adjusted down to -40 dBm level, which enables the support for high equipment density use cases. The RX-TX transition time is defined to operate within the Guard Interval (GI), which enables a very competitive low latency operation with hybrid ARQ operation.

Receiver requirement defines the minimum performance for the radio device with hybrid ARQ support. The reference sensitivity levels scales depending on operating bandwidths.

Measurement requirements are defined for channel access purposes and to support radio environment quality reporting.

Radio requirements testing are considered by defining reference channels such that the requirement verification is possible with simple test.

The requirements are defined keeping in mind the state of art performance, low power consumption and competitive implementation cost.

4.2 Relationship between minimum requirements and test requirements

The present document provides DECT-2020 New Radio RF characteristics and minimum performance requirements.

The Minimum Requirements given in the present document make no allowance for measurement uncertainty. Measurement uncertainties for a given requirement may be studied from ETSI TR 100 028-1 [i.1]. These test tolerances are individually defined and/or calculated for each test. The test tolerances are used to relax the minimum requirements in the present document to create test requirements. For some requirements the test tolerances may be set to zero.

The measurement results returned by the test system are compared - without any modification - against the test requirements as defined by the shared risk principle.

The shared risk principle is defined in Recommendation ITU-R M.1545 [4].

4.3 Applicability of minimum requirements

a) In the present document, the Minimum Requirements are specified as general requirements and additional requirements. Where the Requirement is specified as a general requirement, the requirement is mandated to be met in all scenarios.

b) The spurious emissions power requirements are for the long-term average of the power. For the purpose of reducing measurement uncertainty it is acceptable to average the measured power over a period of time sufficient to reduce the uncertainty due to the statistical nature of the signal.

5 Operating bands and channel arrangement

5.1 General

This clause defines the DECT-2020 operating frequency bands, channel bandwidth(s) for communication and operating channel frequencies for the present document release. This clause also defines the radio device reference time accuracy requirement.

5.2 Operating bands

Radio device operating band numbering is defined in table 5.2-1. Radio device may implement one or more band support depending its capabilities.

Table 5.2-1: Operating band numbering

Band number	Receiving band (MHz)	Transmitting band (MHz)
1	1 880 to 1 900	1 880 to 1 900
2	1 900 to 1 920	1 900 to 1 920
3	2 400 to 2 483,5	2 400 to 2 483,5
4	902 to 928	902 to 928
5	450 to 470	450 to 470
6	698 to 806	698 to 806
7	716 to 728	716 to 728
8	1 432 to 1 517	1 432 to 1 517
9	1 910 to 1 930	1 910 to 1 930
10	2 010 to 2 025	2 010 to 2 025
11	2 300 to 2 400	2 300 to 2 400
12	2 500 to 2 620	2 500 to 2 620
13	3 300 to 3 400	3 300 to 3 400
14	3 400 to 3 600	3 400 to 3 600
15	3 600 to 3 700	3 600 to 3 700
16	4 800 to 4 990	4 800 to 4 990
17	5 725 to 5 875	5 725 to 5 875
18	5 150 to 5 350	5 150 to 5 350
19	5 470 to 5 725	5 470 to 5 725

5.3 Operating channel bandwidths

5.3.1 General

This clause defines the transmission channel bandwidths for this release.

NOTE: Additional channel bandwidths option may be added in the future releases.

5.3.2 Channel bandwidth

DECT-2020 NR supports flexible physical layer numerology defined in ETSI TS 103 636-3 [2], clause 4.3, table 4.3-1.

Table 5.3.2-1: Channel bandwidth

Parameter	Operating channel bandwidth I	Operating channel bandwidth II	Operating channel bandwidth III
Nominal channel bandwidth (MHz)	1,728	3,456	6,912
Transmission channel bandwidth (MHz)	1,539	3,051	6,075

5.4 Channel arrangement

5.4.1 Channel spacing

The minimum channel spacing shall be 1,728 MHz between adjacent channels centre to centre frequencies. In wider operating bandwidth cases the channel centre frequencies can be adjusted with 0,864 MHz in bands 1 to 12. For bands 13 to 16 the minimum channel centre frequency step size shall be 1,728 MHz. For bands 17 to 19 the minimum channel centre frequency step size shall be 2 MHz.

5.4.2 Channel raster

The radio transmission is possible with defined channel centre frequencies. Absolute centre frequencies are defined covering the frequency range from 450 MHz to 5 875 MHz. The absolute channel numbers are signalled with 13-bits frequency channel IE defined in ETSI TS 103 636-4 [3].

For bands 1, 2 and 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 the carrier centre frequency is defined by:

$$F_c = F_0 + n \times 0{,}864\ MHz$$

Where:

F_0 = 450,144 MHz; and

$n = 1, 2, 3, \ldots, 2\,951$.

For bands 13, 14, 15 and 16 the carrier centre frequency is defined by:

$$F_c = F_0 + (n - 2\,952) \times 1{,}728\ MHz$$

Where:

F_0 = 3 000,596 MHz; and $n = 2\,952, 2\,953, 2\,954, \ldots, 4\,104$.

For bands 17, 18 and 19 the carrier centre frequency is defined by:

$$F_c = F_0 + (n - 4104) \times 2\ MHz$$

Where:

F_0 = 5 150 MHz; and $n = 4\,105, 4\,106, 4\,107, \ldots, 4\,466$.

The absolute channel numbering range and respective band edge channel frequency are shown in table 5.4.2-1.

Table 5.4.2-1: Absolute channel number range

Band number	Channel centre frequencies/MHz	Absolute channel frequency numbering
1	1 881,792 to 1 899,072	1 657 to 1 677
2	1 901,664 to 1 918,994	1 680 to 1 700
3	2 401,056 to 2 482,272	2 258 to 2 352
4	902,88 to 927,072	524 to 552
5	451,008 to 469,152	1 to 22
6	698,976 to 805,248	288 to 411
7	717,12 to 727,488	309 to 321
8	1 432,512 to 1 516,32	1 137 to 1 234
9	1 911,168 to 1 928,448	1 691 to 1 711
10	2 010,528 to 2 024,352	1 806 to 1 822
11	2 300,832 to 2 399,328	2 142 to 2 256
12	2 501,28 to 2 619,648	2 374 to 2 511
13	3 301,268 to 3 399,764	3 126 to 3 183
14	3 401,492 to 3 598,484	3 184 to 3 298
15	3 600,212 to 3 698,708	3 299 to 3 356
16	4 801,172 to 4 989,524	3 994 to 4 103
17	5 726 to 5 874	4 392 to 4 466
18	5 152 to 5 348	4 105 to 4 203
19	5 472 to 5 724	4 265 to 4 391

5.4.3 Operating channel change time

5.4.3.1 Operating channel change time definition

RD may change frequency during the operation to reduce interference or requested by the other party for better communication quality. The operating channel change time is defined as a time when the frequency channel change request is received by the RD to the time when RD is ready to transmit in a new frequency. The operating frequency change time includes the channel access monitoring time in the new frequency.

5.4.3.2 Operating channel change time requirement

The maximum time allowed for RD to change operating channel is 200 µs. The operating channel change time includes channel sensing measurement.

5.5 Reference time

5.5.1 General

The reference time is a notional clock to which the timing of the radio frames is related.

5.5.2 Reference time accuracy

The radio device reference time accuracy requirement is defined in table 5.5.2-1.

Table 5.5.2-1: Reference time accuracy requirement

	Accuracy requirement	Extreme condition
Reference time category I	10 ppm	15 ppm
Reference time category II	25 ppm	30 ppm
NOTE 1: Category I requirement is general requirement for radio devices. NOTE 2: Category II requirement is intended for battery powered radio devices.		

6 Transmitter characteristics

6.1 General

Transmitter characteristics are specified at the antenna connector of the Radio Device (RD) with single antenna transmissions. The RD having integral antenna, a reference antenna gains of 0 dBi is assumed.

NOTE: Additional power classes may be added in later releases.

6.2 Transmitter power

6.2.1 Maximum output power

The maximum output power is defined as the mean power over subslot. The subslot duration is defined in ETSI TS 103 636-3 [2], clause 4.4. The maximum transmitter output power for Radio Device is defined in table 6.2.1-1.

Table 6.2.1-1: Maximum output power

RD power class	Operating channel bandwidth/MHz			Output power tolerance (dB)
	1,728	3,456	6,912	
	Output power (dBm)			
Class I	23	23	23	±2
Class II	19	19	19	±2
Class III	10	10	10	±2
NOTE 1: The measurement bandwidth for the output power for 1,728 MHz operating bandwidth is 1,539 MHz. NOTE 2: The measurement bandwidth for the output power for 3,456 MHz operating bandwidth is 3,051 MHz. NOTE 3: The measurement bandwidth for the output power for 6,912 MHz operating bandwidth is 6,075 MHz. NOTE 4: Common test parameters are defined in table A.2.1-1 for 1,728 MHz operating channel bandwidth, table A.3.1-1 for 3,456 MHz operating channel bandwidth and table A.4.1-1 for 6,912 MHz operating channel bandwidth operation.				

The back-off allowance for higher modulation is defined in table 6.2.1-2.

Table 6.2.1-2: Back-off margin for higher order modulation

Modulation class	Maximum back-off (dB)	Output power tolerance (dB)
16-QAM	< 5	±3 dB
64-QAM	< 10	±3 dB
NOTE: The measurement bandwidth and time are defined in table 6.2.1-1.		

6.3 Transmitter power control

6.3.1 Absolute power tolerance

Absolute power tolerance is the ability of the radio device transmitter to set its initial output power to a specific value for the first transmission slot with a transmission gap larger than 100 ms. In the case of a RACH transmission, the absolute tolerance is specified for the first preamble.

The minimum requirement for absolute power tolerance is given in table 6.3.1-1 over the power range from the maximum output power as defined in clause 6.2.1 and the minimum output power as defined in clause 6.3.3. The absolute power is measured with common test parameters defined in table A.2.1-1 for 1,728 MHz operating channel bandwidth, table A.3.1-1 for 3,456 MHz operating channel bandwidth and table A.4.1-1 for 6,912 MHz operating channel bandwidth operation.

Table 6.3.1-1: Absolute power tolerance

Conditions	Tolerance
Normal	±9,0 dB
Extreme	±12,0 dB

6.3.2 Relative power tolerance

The relative power tolerance is the ability of the radio device transmitter to set its output power in a target slot relatively to the power of the most recently transmitted reference slot(s) if the transmission gap between these slots is ≤ 100 ms.

The power step (ΔP) is defined as the difference in the radio device transmit power between the intended slot and reference slots. The error is the difference between ΔP and the power change measured at the radio device antenna port. The relative power control tolerance is measured using common test parameters defined in table A.2.1-1 for 1,728 MHz operating channel bandwidth, table A.3.1-1 for 3,456 MHz operating channel bandwidth and table A.4.1-1 for 6,912 MHz operating channel bandwidth operation.

The power control step error for the transmitter are defined in table 6.3.2-1. The power control execution time may vary based on the available power control commands.

Table 6.3.2-1: Relative power tolerance

	Maximum power control step size ΔP (dB)	Power tolerance (dB)	Dynamic range (dBm)
Radio Device	ΔP ≤ ±5	±3	0 to Maximum power (dBm)
	±5 < ΔP ≤ ±10	±4	
	±10 <ΔP ≤ ±20	±5	
	ΔP ≤ ± 10	±5	-40 to 0 (dBm)
	±10 < ΔP ≤ ±40	±6	
NOTE 1: The measurement bandwidth for the output power is defined in table 6.2.1-1 for the respective channel operating bandwidth. NOTE 2: Accuracy requirement is defined in normal conditions. NOTE 3: For extreme conditions an additional ±2,0 dB relaxation to limits is allowed.			

6.3.3 Minimum output power

The minimum controlled output power of the radio device is defined as the power in the channel bandwidth, when the power is set to a minimum value.

The minimum output power is defined as the mean power in one subslot. The subslot duration is defined in ETSI TS 103 636-3 [2], clause 4.4. The minimum output power shall not exceed the values specified in table 6.3.3-1.

Table 6.3.3-1: Minimum output power

Parameter/Unit	Channel bandwidth/MHz		
	1,728	3,456	6,912
Minimum output power/ dBm	-40		

6.3.4 Transmit OFF power

Transmit OFF power is defined as the mean power when the transmitter is OFF. The transmitter is OFF when the radio device is not allowed to transmit or during periods when it is not transmitting in the radio frame. During active HARQ process the radio device is not considered to be OFF.

The transmit OFF power is defined as the mean power in a duration of at least one frame 10 ms excluding any transient periods. The transmit OFF power shall not exceed the values specified in table 6.3.4-1.

Table 6.3.4-1: Transmit OFF power

Parameter/Unit	Channel bandwidth/MHz		
	1,728	3,456	6,912
Minimum OFF power/dBm	-50		
NOTE: The measurement bandwidth and time are defined in table 6.2.1-1.			

6.3.5 Transmit ON/OFF time mask

The transmit ON/OFF time mask defines the observation period between Transmit OFF and ON power and between Transmit ON and OFF power. The subslot duration is defined in ETSI TS 103 636-3 [2], clause 4.4.

The OFF-power measurement period is defined in a duration of at least one slot excluding any transient periods. The ON power is defined as the mean power over one or more consecutive slots excluding any transient period.

There are no additional requirements on RD transmit power beyond that which is required in clause 6.3.3 and clause 6.5.3.

The TX ON/OFF transient period length shall be no longer than Guard Interval (GI) defined in ETSI TS 103 636-3 [2], clause 5.2.1.

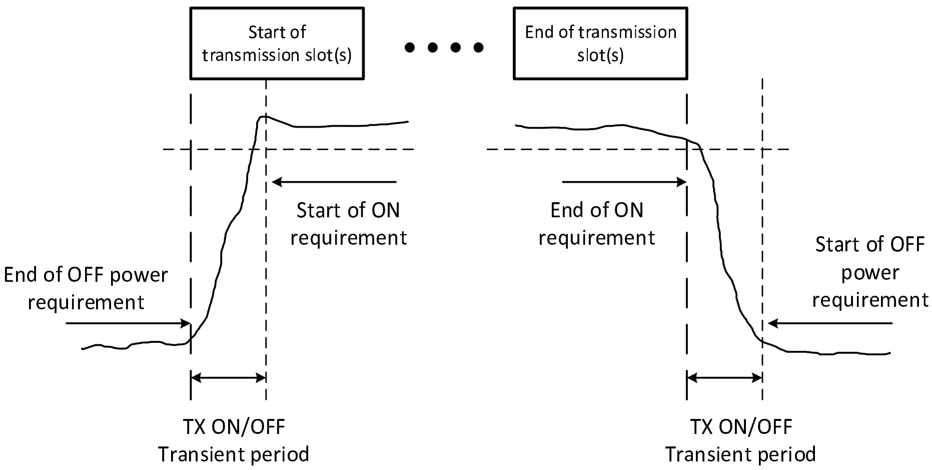

Figure 6.3.5-1: Transmit ON/OFF time mask

6.4 Transmit signal quality

6.4.1 Frequency error

RD modulated transmitter carrier frequency accuracy shall be within ±0,2 ppm observed over sub slot compared to the received carrier frequency. The subslot duration is defined in ETSI TS 103 636-3 [2], clause 4.4.

6.4.2 Transmit modulation quality

The Error Vector Magnitude (EVM) is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM, the measured waveform is corrected by the sample timing offset and Radio Frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further modified by selecting the absolute phase and absolute amplitude of the Tx chain. The EVM result is defined after the front-end IDFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a percentage.

The RD EVM is an RMS value measured over subslot excluding any transient of output power. The subslot duration is defined in ETSI TS 103 636-3 [2], clause 4.4.

The minimum requirements for Error Vector Magnitude are defined in table 6.4.2-1.

Table 6.4.2-1: Minimum Error Vector Magnitude requirements

Modulation	Average EVM level (%)	Power level (dBm)
QPSK or BPSK	17,5	Maximum rated output power
16-QAM	12,5	Maximum rated power - 5 dB
64-QAM	8	Maximum rated power - 10 dB
NOTE: Additional modulation levels may be added to later releases.		

6.5 Transmitter spectrum emission requirements

6.5.1 General

Radio equipment transmitter spectrum emissions are occupied channel emissions, out of band and spurious emissions. The relation of these emission components is illustrated in figure 6.5.1-1.

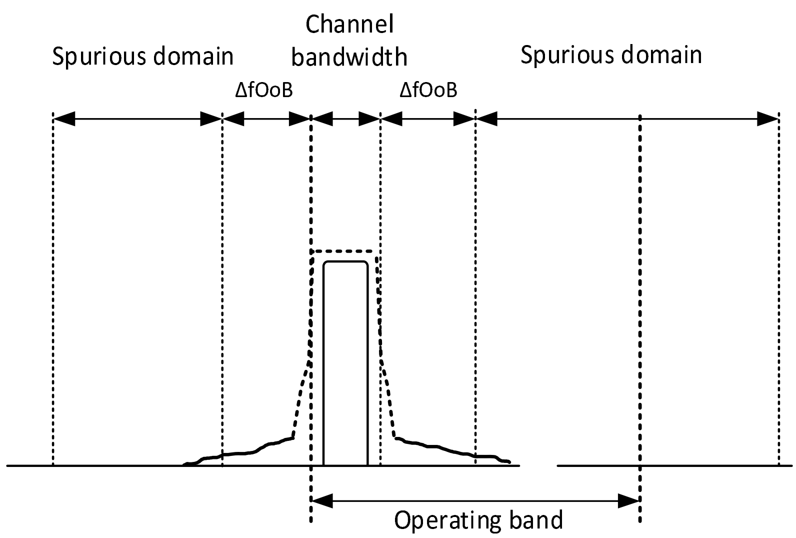

Figure 6.5.1-1: Transmitter RF spectrum

6.5.2 Occupied channel BW

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage β/2 of the total mean transmitted power.

The value of β/2 shall be taken as 0,5 %.

The occupied bandwidth shall be less than the nominal channel bandwidth as defined in table 5.3.2-1.

6.5.3 Out of band emissions

The Out of band emissions are unwanted emissions immediately outside the assigned channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions.

The spectrum emission mask of the RD applies to frequencies (Δf_{OOB}) starting from the ± edge of the assigned channel. For frequencies offset greater than Δf_{OOB} as specified in tables 6.5.3-1, 6.5.3-2 and 6.5.3-3 the spurious requirements in clause 6.5.4 are applicable.

Table 6.5.3-1: Spectrum emission limit for 1,728 MHz channel bandwidth

Spectrum emission limit (dBm)		
Δf_{OOB}/MHz	**1,728 MHz channel bandwidth**	**Measurement bandwidth**
±0 to 0,0945	-10	30 kHz
±0,0945 to 1,6335	-10	1 MHz
±1,6335 to 1,8225	-13	1 MHz
±1,8225 to 3,3615	-20	1 MHz
±3,3615 to 3,456	-23	1 MHz

Table 6.5.3-2: Spectrum emission limit for 3,456 MHz channel bandwidth

Spectrum emission limit (dBm)		
Δf_{OOB}/MHz	**3,456 MHz channel bandwidth**	**Measurement bandwidth**
±0 to 0,2025	-10	30 kHz
±0,2025 to 3,2535	-10	1 MHz
±3,2535 to 3,6585	-13	1 MHz
±3,6585 to 6,7095	-20	1 MHz
±6,7095 to 6,912	-23	1 MHz

Table 6.5.3-3: Spectrum emission limit for 6,912 MHz channel bandwidth

Spectrum emission limit (dBm)		
Δf_{OOB}/MHz	**6,912 MHz channel bandwidth**	**Measurement bandwidth**
±0 to 0,4185	-10	30 kHz
±0,4185 to 6,4935	-10	1 MHz
±6,4935 to 7,3305	-13	1 MHz
±7,3305 to 13,4055	-20	1 MHz
±13,4055 to 13,824	-23	1 MHz

6.5.4 Spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions unless otherwise stated. The spurious emission limits are specified in terms of general requirements in-line with Recommendation ITU-R SM.329 [5].

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in table 6.5.3-1 from the edge of the channel bandwidth. The spurious emission limits in table 6.5.4-1 apply for all transmitter bands and channel bandwidths.

Table 6.5.4-1: Spurious emission limits

Frequency Range	Maximum Level	Measurement bandwidth
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz
30 MHz ≤ f < 1 000 MHz	-36 dBm	100 kHz
1 GHz ≤ f < 12,75 GHz	-30 dBm	1 MHz
12,75 GHz ≤ f < 5th harmonic of the upper frequency edge in GHz	-30 dBm	1 MHz

7 Receiver characteristics

7.1 General

Receiver characteristics are specified at the antenna connector(s) of the Radio Equipment. For REs with an integral antenna only, a reference antenna(s) with a gain of 0 dBi is assumed for each antenna port(s). RD with an integral antenna(s) can convert power levels into field strength requirements by assuming 0 dBi gain antenna.

The levels of the test signal applied to the antenna connector are defined in the respective clauses below.

The receiver test signal(s) configurations are defined in annex A.

7.2 Reference sensitivity

The reference sensitivity power level is the minimum mean power applied to RD antenna port. RD throughput shall meet or exceed the requirements for the specified reference measurement channel.

The throughput shall be ≥ 90 % of the maximum throughput of the reference measurement channel as specified in table 9.2.2-1.

Table 7.2-1: Minimum receiver reference sensitivity ($RX_{sensitivity}$) requirement

Frequency band	Channel bandwidth (MHz)			Unit
	1,728	3,456	6,912	
Band 1	-99,7	-96,7	-93,7	dBm
Band 2	-99,7	-96,7	-93,7	dBm
Band 3	-99,7	-96,7	-93,7	dBm
Band 4	-99,7	-	-	dBm

7.3 Maximum input level

The maximum input rower is the mean power received at the RD antenna port, at which the throughput shall meet or exceed the minimum requirements for the specified reference measurement channel.

The throughput shall be ≥ 90 % of the maximum throughput of the reference measurement channels as specified in table 9.2.2-1.

Table 7.3-1: Maximum own signal ($RX_{channelmax}$) level requirement

Frequency band	Channel bandwidth (MHz)			Unit
	1,728	3,456	6,912	
Band 1	-20	-20	-20	dBm
Band 2	-20	-20	-20	dBm
Band 3	-20	-20	-20	dBm
Band 4	-20	-20	-20	dBm

7.4 Adjacent Channel Selectivity

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive own signal assigned to a channel frequency in the presence of an adjacent channel signal interference at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

The RD shall fulfil the minimum requirement specified in table 7.4-1 for all values of an adjacent channel interferer up to -30 dBm. ACS performance is measured the lower and upper range of test parameters as defined in table 7.4-1. The throughput shall be ≥ 90 % of the maximum throughput of the reference measurement channels as specified in table 9.2.2-1.

Table 7.4-1: Adjacent Channel Selectivity requirement

Rx Parameter	Channel bandwidth (MHz)			Units
	1,728	**3,456**	**6,912**	
Own signal input level	$RX_{sensitivity}$ + 14 dB			dBm
$P_{Interferer}$	$RX_{sensitivity}$ + 39 dB	$RX_{sensitivity}$ + 39 dB	$RX_{sensitivity}$ + 39 dB	dBm
$BW_{Interferer}$	1,728	3,456	6,912	MHz
$F_{Interferer}$ (offset)	1,728 or -1,728	3,456 or -3,456	6,912 or -6,912	MHz

7.5 Blocking characteristics

7.5.1 General

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those where a spurious response occurs.

7.5.2 In band blocking characteristics

In-band blocking is defined for an unwanted interfering signal falling into the RD operating band or into the first adjacent channel below or above the RD receive band at which the relative throughput shall meet or exceed the minimum requirement for the specified measurement channels. The test parameters are defined in table 7.5.2-1.

The throughput shall be ≥ 90 % of the maximum throughput of the reference measurement channels as specified in table 9.2.2-1.

Table 7.5.2-1: In-band blocking requirement

Rx Parameter	Channel bandwidth (MHz)			Units
	1,728	**3,456**	**6,912**	
Own signal input level	$RX_{sensitivity}$ + 6 dB			dBm
$P_{Interferer}$	$RX_{sensitivity}$ + 52 dB	$RX_{sensitivity}$ + 52 dB	$RX_{sensitivity}$ + 52 dB	dBm
$BW_{Interferer}$	1,728	3,456	6,912	MHz
$F_{Interferer}$ (offset from operating channel edge)	2,592 + additional channel frequency step or -2,592 - additional channel frequency step	5,184 + additional channel frequency step or -5,184 - additional channel frequency step	10,368 + additional channel frequency step or -10,368 - additional channel frequency step	MHz

7.5.3 Out of band blocking characteristics

Out-of-band band blocking is defined for an unwanted CW interfering signal falling more than adjacent channel below or above the RD receive band. For the first adjacent channel below or above the receive band the appropriate in-band blocking or Adjacent Channel Selectivity in clause 7.4 and clause 7.5.2 shall be applied. Out of band blocking test parameters are defined in tables 7.5.3-1, 7.5.3-2 and 7.5.3-3 for respective operating channel bandwidth.

The throughput shall be ≥ 90 % of the maximum throughput of the reference measurement channels as specified in table 9.2.2-1.

Table 7.5.3-1: Out of band blocking requirement for 1,728 MHz channel bandwidth

Band	**Rx Parameter**	**Channel bandwidth (MHz)**			**Units**
1, 2, 3, 4		1,728			
	Own signal input level	$\text{RX}_{\text{sensitivity}}$ + 6 dB			dBm
		Range 1	Range 2	Range 3	
		$\text{Band}_{\text{low edge}}$ - 15 to $\text{Band}_{\text{low edge}}$ - 60	$\text{Band}_{\text{low edge}}$ - 60 to $\text{Band}_{\text{low edge}}$ - 85	$\text{Band}_{\text{low edge}}$ - 85 to 1	MHz
	$\text{F}_{\text{Interferer}}$ (CW)	$\text{Band}_{\text{high edge}}$ + 15 to $\text{Band}_{\text{high edge}}$ + 60	$\text{Band}_{\text{high edge}}$ + 60 to $\text{Band}_{\text{high edge}}$ + 85	$\text{Band}_{\text{high edge}}$ + 85 to 12 750	MHz
	$\text{P}_{\text{Interferer}}$	-44	-30	-15	dBm

Table 7.5.3-2: Out of band blocking requirement for 3,456 MHz channel bandwidth

Band	**Rx Parameter**	**Channel bandwidth (MHz)**			**Units**
1, 2, 3, 4		3,456			
	Own signal input level	$\text{RX}_{\text{sensitivity}}$ + 6 dB			dBm
		Range 1	Range 2	Range 3	
		$\text{Band}_{\text{low edge}}$ - 15 to $\text{Band}_{\text{low edge}}$ - 60	$\text{Band}_{\text{low edge}}$ - 60 to $\text{Band}_{\text{low edge}}$ - 85	$\text{Band}_{\text{low edge}}$ - 85 to 1	MHz
	$\text{F}_{\text{Interferer}}$ (CW)	$\text{Band}_{\text{high edge}}$ + 15 to $\text{Band}_{\text{high edge}}$ + 60	$\text{Band}_{\text{high edge}}$ + 60 to $\text{Band}_{\text{high edge}}$ + 85	$\text{Band}_{\text{high edge}}$ + 85 to 12 750	MHz
	$\text{P}_{\text{Interferer}}$	-44	-30	-15	dBm

Table 7.5.3-3: Out of band blocking requirement for 6,912 MHz channel bandwidth

Band	**Rx Parameter**	**Channel bandwidth (MHz)**			**Units**
1, 2, 3, 4		6,912			
	Own signal input level	$\text{RX}_{\text{sensitivity}}$ + 6 dB			dBm
		Range 1	Range 2	Range 3	
		$\text{Band}_{\text{low edge}}$ - 15 to $\text{Band}_{\text{low edge}}$ - 60	$\text{Band}_{\text{low edge}}$ - 60 to $\text{Band}_{\text{low edge}}$ - 85	$\text{Band}_{\text{low edge}}$ - 85 to 1	MHz
	$\text{F}_{\text{Interferer}}$ (CW)	$\text{Band}_{\text{high edge}}$ + 15 to $\text{Band}_{\text{high edge}}$ + 60	$\text{Band}_{\text{high edge}}$ + 60 to $\text{Band}_{\text{high edge}}$ + 85	$\text{Band}_{\text{high edge}}$ + 85 to 12 750	MHz
	$\text{P}_{\text{Interferer}}$	-44	-30	-15	dBm

7.6 Spurious response

Spurious response is a measure of the receiver's ability to receive a wanted signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency at which a response is obtained i.e. for which the out of band blocking limit as specified in clause 7.5.3 is not met. Spurious response test parameters are defined in table 7.6-1.

The RD throughput shall be ≥ 90 % of the maximum throughput of the reference measurement channels as specified in table 9.2.2-1.

Table 7.6-1: Spurious response requirement

Rx Parameter	**Channel bandwidth (MHz)**			**Units**
	1,728	**3,456**	**6,912**	
Own signal input level	$\text{RX}_{\text{sensitivity}}$ + 6 dB			dBm
$\text{P}_{\text{Interferer}}$ (CW)	-44	-44	-44	dBm
$\text{F}_{\text{Interferer}}$ (offset)	Spurious response frequencies			MHz
Number of spurious response frequencies	24 (in Out of Band range 1, 2 and 3)			pcs
NOTE: Out of Band ranges are defined in tables 7.5.3-1 to 7.5.3-3.				

7.7 Spurious emissions

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the RD antenna connector.

The power of any narrow band CW spurious emission shall not exceed the maximum level specified in table 7.7-1.

Table 7.7-1: General receiver spurious emission requirements

Frequency band	Measurement bandwidth	Maximum level
30 MHz ≤ f < 1 GHz	100 kHz	-57 dBm
1 GHz ≤ f ≤ 12,75 GHz	1 MHz	-47 dBm

8 Radio Device measurements

8.1 General

This clause defines the measurement requirements for Radio Device (RD) in terms how they are measured and measurement times, the dynamic range and accuracy requirements. Unless otherwise noted, the reference point for these measurements is antenna port(s).

8.2 Received signal strength (RSSI-1) measurement

8.2.1 General

RSSI-1 measurement is intended to assess the channel use. The RSSI-1 measurement is a linear average of received power observed during 1 OFDM symbol with a measurement bandwidth of transmission channel bandwidth defined in table 5.3.2-1.

8.2.2 Measurement accuracy and dynamic range

The reported measurement accuracy shall be within the limits stated in the table 8.2.2-1 in 95 % of the reported values.

Table 8.2.2-1: RSSI-1 power measurement requirement

RSSI-1 measurement requirement		
RSSI-1 measured power/dBm	Accuracy in normal conditions	Accuracy in extreme conditions
$RX_{sensitivity}$ < RSSI-1 ≤ ($RX_{sensitivity}$ + 10 dB)	±5,5 dB	±8,5 dB
($RX_{sensitivity}$ + 10 dB) < RSSI-1 ≤ ($RX_{sensitivity}$ + 60 dB)	±3,5 dB	±6,5 dB
($RX_{sensitivity}$ + 60 dB) < RSSI-1 ≤ ($RX_{sensitivity}$ + 70 dB)	±5,5 dB	±8,5 dB

8.2.3 RSSI-1 measurement report mapping

The RD shall use the measurement results signalling mapping defined in the table 8.2.3-1.

Table 8.2.3-1: RSSI-1 measurement report mapping

Reported value	Measured value	Value
RSSI_1_ 182	RSSI_1 < -110	dBm
RSSI_1_ 181	-109,5 < RSSI_1 ≤ -110	dBm
RSSI_1_ 180	-109 < RSSI_1 ≤ -109,5	dBm
…	…	…
RSSI_1_ 03	-21,5 < RSSI_1 ≤ -21	dBm
RSSI_1_ 02	-21 < RSSI_1 ≤ -20,5	dBm
RSSI_1_ 01	-20,5 < RSSI_1	dBm

8.3 Demodulated signal strength (RSSI-2) measurement

8.3.1 General

The RSSI-2 signal strength measurement is intended to measure signal strength of detected and demodulated DECT-2020 packet and shall be mapped to respective transmitter and network ID.

Individual $RSSI\text{-}2_{PACKET}(n)$ measurements from packet (n) can be averaged over multiple received packets with a leaky integrator $RSSI\_2(n) = (1-\alpha)\times RSSI\text{-}2\ (n-1) + \alpha\times RSSI\text{-}2_{PACKET}(n)$ having a forgetting factor $\alpha = 0,1$. Radio device may measure multiple signals in the same radio frame.

8.3.2 Measurement accuracy and dynamic range

The reported measurement accuracy shall be within the limits stated in table 8.3.2-1 in 95 % of the reported values.

Table 8.3.2-1: RSSI-2 power measurement requirement

RSSI-2 measurement requirement		
RSSI-1 measured power/dBm	**Accuracy in normal conditions**	**Accuracy in extreme conditions/dB**
$RX_{sensitivity}$ < RSSI-2 ≤ ($RX_{sensitivity}$ + 10 dB)	±4 dB	±6
($RX_{sensitivity}$ + 10 dB) < RSSI-2 ≤ ($RX_{sensitivity}$ + 60 dB)	±2 dB	±4
($RX_{sensitivity}$ + 60 dB) < RSSI-2 ≤ ($RX_{sensitivity}$ + 70 dB)	±4	±6

8.3.3 RSSI-2 measurement report mapping

The RD shall use the measurement results signalling mapping defined in table 8.3.3-1.

Table 8.3.3-1: RSSI-2 measurement report mapping

Reported value	Measured value	Value
RSSI_2_ 182	RSSI_2 < -110	dBm
RSSI_2_ 181	-109,5 < RSSI_2 ≤ -110	dBm
RSSI_2_ 180	-109 < RSSI_2 ≤ -109,5	dBm
…	…	…
RSSI_2_ 03	-21,5 < RSSI_2 ≤ -21	dBm
RSSI_2_ 02	-21 < RSSI_2 ≤ -20,5	dBm
RSSI_2_ 01	-20,5 < RSSI_2	dBm

8.4 Demodulated signal to noise quality value (SNR)

8.4.1 General

The received signal to noise quality is intended to measure radio device signal quality from detected and demodulated DECT-2020 packet and shall be mapped to respective transmitter and network ID.

Individual $SNR_{PACKET}(n)$ measurements from packet (n) can be averaged with a leaky integrator:
$SNR(n) = (1-\alpha)\cdot SNR(n-1) + \alpha\cdot SNR_{PACKET}(n)$ having a forgetting factor α=0,1.

8.4.2 Measurement accuracy and dynamic range

The reported measurement accuracy shall be within the limits in table 8.4.2-1 in 95 % of the reported values.

Table 8.4.2-1: SNR measurement requirement

SNR measurement requirement		
SNR range	Accuracy	RSSI-2 power level/dBm
5 dB < SNR ≤ 30 dB	±1 dB	($RX_{sensitivity}$ + 5 dB) < RSSI-2 ≤ ($RX_{sensitivity}$ + 60 dB)
NOTE: The upper bound of the SNR measurement reporting is linked to RD radio capabilities and the highest modulation and coding class support.		

8.4.3 Demodulated signal to noise quality measurement report mapping

The RD shall use the measurement results signalling mapping defined in table 8.4.3-1.

Table 8.4.3-1: Demodulated signal to noise quality measurement report mapping

Reported value	Measured value	Value
SNR_ 201	SNR > 45	dB
SNR_ 200	45,75 < SNR ≤ 45	dB
SNR_ 199	45,5 < SNR ≤ 45,75	dB
…	…	…
SNR_ 03	-4,25 < SNR ≤ -4,5	dB
SNR_ 02	-4,5 < SNR ≤ -4,75	dB
SNR_ 01	-4,75 < SNR	dB

9 Radio channel decoding performance

9.1 Introduction

This clause defines the minimum performance requirements for the physical channels specified in ETSI TS 103 636-3 [2]. The minimum RD performance requirements in this clause are specified by using the measurement channels and propagation conditions specified in annex A. These measurement channels are based on symmetrical traffic allocation in each direction, 16,7 % slot allocation in each direction.

In this clause defines Fixed Radio Channel (FRC) which is also used for the clause 6 and 7 tests as a test signal. In this channel the modulation and coding class is static. Physical channel decoding performance may be also tested in different propagation conditions with variable modulation and coding.

Test cases may be defined with different channel bandwidth to verify the same target FRC conditions with the same propagation conditions, correlation matrix and antenna configuration.

The maximum physical layer bitrate capabilities are introduced in ETSI TS 103 636-3 [2], annex C.

9.2 Fixed Reference Channel performance

9.2.1 General

Common test parameters are defined in table A.2.1-1 for 1,728 MHz operating channel bandwidth, table A.3.1-1 for 3,456 MHz operating channel bandwidth and table A.4.1-1 for 6,912 MHz operating channel bandwidth operation.

The reference maximum throughput performance is defined as average bitrate over a 10 ms radio frame.

9.2.2 Single receiver requirements

The receiver minimum throughput performance requirement is defined in table 9.2.2-1.

Table 9.2.2-1: Single receiver minimum throughput requirement

Parameter	Operating channel bandwidth			Unit
	1,728 MHz	3,456 MHz	6,912 MHz	
Minimum throughout	> 112,48	> 270,56	> 586,72	kbps
Input signal level	-70	-70	-70	dBm/MHz
Propagation condition	static	static	static	

Annex A (informative): Reference measurement channel for testing

A.1 General

In this annex the reference channels for receiver and transmitter performance measurement are defined. Unless otherwise stated channels may be used for both receiver and transmitter measurements.

A.2 Reference measurement channels for 1,728 MHz operating bandwidth

A.2.1 Fixed reference measurement channel with QPSK channel

Table A.2.1-1: Fixed reference channel for receiver requirements

Parameter	Value	Unit
Operating bandwidth	1,728	MHz
Subcarrier scaling factor μ = 1	27	kHz
Fourier transform scaling factor β	1	
Modulation	QPSK	
Coding	1/2	
Allocated slot(s) in radio frame for DL and UL	4 DL + 4UL	
Number of HARQ processes	2	
Maximum number of HARQ transmissions	1	
Transport block size	37	bytes
Max averaged throughput over one radio frame (10 ms)	118,4 The payload bitrate is 296 bits/slot	kbps
NOTE: The radio frame slot allocation pattern is defined in table A.2.1-2.		

Table A.2.1-2: Radio frame slot allocation

Radio frame 0 ms to 5 ms												
# slot	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Direction	DL	-	UL	-	DL	-	UL	-	DL	-	UL	-
Radio frame 5 ms to 10 ms												
# slot	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Direction	DL	-	UL	-	-	-	-	-	-	-	-	-

A.2.2 Reference measurement channel with 16-QAM channel

Table A.2.2-1: Fixed reference channel for receiver requirements

Parameter	Value	Unit
Operating bandwidth	1,728	MHz
Subcarrier scaling factor μ = 1	27	kHz
Fourier transform scaling factor β	1	
Modulation	16-QAM	
Coding	3/4	
Allocated slot(s) in radio frame for DL and UL	4 DL + 4UL	
Number of HARQ processes	2	
Maximum number of HARQ transmissions	1	
Transport block size	117	bytes
Max averaged throughput over one radio frame (10 ms)	374	kbps
NOTE: The radio frame slot allocation pattern is defined in table A.2.2-2.		

Table A.2.2-2: Radio frame slot allocation

Radio frame 0 ms to 5 ms												
# slot	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Direction	DL	-	UL	-	DL	-	UL	-	DL	-	UL	-
Radio frame 5 ms to 10 ms												
# slot	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Direction	DL	-	UL	-	-	-	-	-	-	-	-	-

A.3 Reference measurement channels for 3,456 MHz operating bandwidth

A.3.1 Fixed reference measurement channel with QPSK channel

Table A.3.1-1: Fixed reference channel for receiver requirements

Parameter	Value	Unit
Operating bandwidth	3,456	MHz
Subcarrier scaling factor μ = 1	27	kHz
Fourier transform scaling factor β	2	
Modulation	QPSK	
Coding	1/2	
Allocated slot(s) in radio frame for DL and UL	4 DL + 4UL	
Number of HARQ processes	2	
Maximum number of HARQ transmissions	1	
Transport block size	89	bytes
Max averaged throughput over one radio frame (10 ms)	284,8 The payload bitrate is 712 bits/slot.	kbps
NOTE: The radio frame slot allocation pattern is defined in table A.3.1-2.		

Table A.3.1-2: Radio frame slot allocation

Radio frame 0 ms to 5 ms												
# slot	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Direction	DL	-	UL	-	DL	-	UL	-	DL	-	UL	-
Radio frame 5 ms to 10 ms												
# slot	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Direction	DL	-	UL	-	-	-	-	-	-	-	-	-

A.3.2 Reference measurement channel with 16-QAM channel

Table A.3.2-1: Fixed reference channel for receiver requirements

Parameter	Value	Unit
Operating bandwidth	3,456	MHz
Subcarrier scaling factor μ = 1	27	kHz
Fourier transform scaling factor β	2	
Modulation	16-QAM	
Coding	3/4	
Allocated slot(s) in radio frame for DL and UL	4 DL + 4UL	
Number of HARQ processes	2	
Maximum number of HARQ transmissions	1	
Transport block size	263	bytes
Max averaged throughput over one radio frame (10 ms)	841,6	kbps
NOTE: The radio frame slot allocation pattern is defined in table A.3.2-2.		

Table A.3.2-2: Radio frame slot allocation

Radio frame 0 ms to 5 ms												
# slot	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Direction	DL	-	UL	-	DL	-	UL	-	DL	-	UL	-
Radio frame 5 ms to 10 ms												
# slot	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Direction	DL	-	UL	-	-	-	-	-	-	-	-	-

A.4 Reference measurement channels for 6,912 MHz operating bandwidth

A.4.1 Fixed Reference measurement Channel (FRC) with QPSK channel

Table A.4.1-1: Fixed reference channel for receiver requirements

Parameter	Value	Unit
Operating bandwidth	6,912	MHz
Subcarrier scaling factor µ = 1	27	kHz
Fourier transform scaling factor β	4	
Modulation	QPSK	
Coding	1/2	
Allocated slot(s) in radio frame for DL and UL	4 DL + 4UL	
Number of HARQ processes	2	
Maximum number of HARQ transmissions	1	
Transport block size	193	bytes
Max averaged throughput over one radio frame (10 ms)	617,6 The payload bitrate is 1 544 bits/slot.	kbps
NOTE: The radio frame slot allocation pattern is defined in table A.4.1-2.		

Table A.4.1-2: Radio frame slot allocation

Radio frame 0 ms to 5 ms												
# slot	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Direction	DL	-	UL	-	DL	-	UL	-	DL	-	UL	-
Radio frame 5 ms to 10 ms												
# slot	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Direction	DL	-	UL	-	-	-	-	-	-	-	-	-

A.4.2 Reference measurement channel with 16-QAM channel

Table A.4.2-1: Fixed reference channel for receiver requirements

Parameter	Value	Unit
Operating bandwidth	6,912	MHz
Subcarrier scaling factor µ = 1	27	kHz
Fourier transform scaling factor β	4	
Modulation	16-QAM	
Coding	3/4	
Allocated slot(s) in radio frame for DL and UL	4 DL + 4UL	
Number of HARQ processes	2	
Maximum number of HARQ transmissions	1	
Transport block size	580	bytes
Max averaged throughput over one radio frame (10 ms)	1,856	Mbps
NOTE: The radio frame slot allocation pattern is defined in table A.4.2-2.		

Table A.4.2-2: Radio frame slot allocation

Radio frame 0 ms to 5 ms												
# slot	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Direction	DL	-	UL	-	DL	-	UL	-	DL	-	UL	-
Radio frame 5 ms to 10 ms												
# slot	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Direction	DL	-	UL	-	-	-	-	-	-	-	-	-

A.5 Propagation condition

A.5.1 General

The multipath propagation conditions consist of several parts:

- A delay profile in the form of a "tapped delay-line", characterized by a number of taps at fixed positions on a sampling grid. The profile can be further characterized by the r.m.s. delay spread and the maximum delay spanned by the taps.
- A combination of channel model parameters that include the Delay profile and the Doppler spectrum, that is characterized by a classical spectrum shape and a maximum Doppler frequency.
- A set of correlation matrices defining the correlation between radio devices antennas in case of multi-antenna systems.
- The propagation conditions used for the performance measurements in multi-path fading environment are indicated as channel mode such as EPA [number] where 'number' indicates the maximum Doppler frequency (Hz).

A.5.2 Extended Pedestrian A (EPA) channel model

EPA delay profile is defined in table A.5.2-1. The Doppler frequency is 5 Hz.

Table A.5.2-1: Extended Pedestrian A model (EPA)

Excess tap delay (ns)	Relative power (dB)
0	0,0
30	-1,0
70	-2,0
90	-3,0
110	-8,0
190	-17,2
410	-20,8

Annex B (normative): Radio Device minimum capabilities

B.1 Introduction

Radio device categories define a set of radio functionalities, such as number of RX-TX antenna ports, operating bandwidth(s), maximum bitrates, number of HARQ processes.

The complete definition of minimum functionality for a radio device class is a combination of requirements stated in ETSI TS 103 636-3 [2] and ETSI TS 103 636-4 [3] respective annexes and this annex. Device class information is signalled at connection setup to ensure interoperability within desired applications.

B.2 Radio Device Class (1.1.1A)

B.2.1 Maximum output power

Device shall support maximum transmitter outpower class III defined in table 6.2.1-1.

B.2.2 Operating channel bandwidth

Device shall support operating channel bandwidth I as defined in table 5.3.2-1.

B.2.3 MIMO support

Device does not support MIMO.

B.3 Radio Device Class (1.1.1B)

B.3.1 Maximum output power

Device shall support maximum transmitter outpower class II defined in table 6.2.1-1.

B.3.2 Operating channel bandwidth

Device shall support operating channel bandwidth I and II as defined in table 5.3.2-1.

B.3.3 MIMO support

Device does not support MIMO.

Annex C (normative): Environmental conditions

C.1 General

Annex C specifies the environmental requirements of the radio devices. These requirements in this annex apply to all types of radio devices.

The requirements of the present document shall be fulfilled within these operational conditions.

C.2 Temperature

Radio device shall fulfil all requirements in the full temperature range defined in table C.2-1.

Table C.2-1: Operating temperature ranges

+15 °C to +35 °C	for normal conditions (with relative humidity of 25 % to 75 %)
-10 °C to +55 °C	for extreme conditions (see IEC publications 60068-2-1 [6] and IEC 60068-2-2 [7])

Outside this temperature range the radio device, if powered on, shall not make ineffective use of the radio frequency spectrum.

C.3 Voltage

The radio device shall fulfil all the requirements in the full voltage range defined in table C.3-1.

The manufacturer shall declare the low and high extreme voltages and the approximate the shutdown voltage when applicable in test case. Radio device may have one or more of the power sources indicated in table C.3-1, in this case these extreme voltage limits apply.

Table C.3-1: Operating voltage ranges

Power source	Extreme Voltage (LOW)	Extreme Voltage (HIGH)	Normal conditions Voltage
AC mains	0,9 × Nominal	1,1 × Nominal	Nominal
Regulated battery (lead acid)	0,9 × Nominal	1,3 × Nominal	1,1 × Nominal
Non-regulated batteries: Lithium Mercury/nickel & cadmium Other	 0,95 × Nominal 0,90 × Nominal 0,85 × Nominal	 1,1 × Nominal Nominal	 1,1 × Nominal Nominal Nominal

Outside this temperature range the radio device, if powered on, shall not make ineffective use of the radio frequency spectrum. The radio device shall inhibit all RF transmissions when the power supply voltage is below the manufacturer declared shutdown voltage.

C.4 Vibration

The radio device shall fulfil all requirements during vibration defined in table C.4-1.

Table C.4-1: Vibration

Frequency	ASD (Acceleration Spectral Density) random vibration
5 Hz to 20 Hz	0,96 m^2/s^3
20 Hz to 500 Hz	0,96 m^2/s^3 at 20 Hz, thereafter -3 dB/Octave

Outside this vibration range the radio device, if powered on, shall not make ineffective use of the radio frequency spectrum.

History

Document history		
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