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TECHNICAL SPECIFICATION

**DECT-2020 New Radio (NR);
Part 2: Radio reception and transmission requirements;
Release 2**

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RTS/DECT-00382

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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 covering the DECT-2020 New Radio (NR) technology. Full details of the entire series can be found in part 1 [i.3].

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 URLLC and 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] Void.

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

[3] ETSI TS 103 636-4: "DECT-2020 New Radio (NR); Part 4: MAC layer; Release 2".

[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: Cold".

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

[8] ETSI TS 103 636-5: "DECT-2020 New Radio (NR); Part 5: DLC and Convergence layers; Release 2".

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.

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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)".

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

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]

transmitted packet: transmission of physical layer packet of given length defined in ETSI TS 103 636-3 [2] and 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
β	Fourier transform scaling factor
B_N	Nominal channel bandwidth
B_T	Transmission bandwidth
B_G	Guard band $(B_N - B_T)$
$Band_{high\ edge}$	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
Δf_{oob}	Δ Frequency of the Out of Band emission
n	Carrier number
$P_{Interferer}$	Received power of the interfering signal
P_{MAX}	Maximum transmission power of the RD power class as specified in table 6.2.1-1.
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)
μ	Subcarrier scaling factor

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TS 103 636-1 [i.3] 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 [i.3].

ACS	Adjacent Channel Selectivity
ACLR	Adjacent Channel Leakage Rejection
EVM	Error Vector Magnitude
FT	Fixed Termination point
FRC	Fixed Reference Channel
DFT	Discrete Fourier Transform
IDFT	Inverse Discrete Fourier Transform
MBW	Measurement BandWidth
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 22 different operating bands.

For transmitter operation the present document specifies 23 dBm, 21 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 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	1 920 to 1 930	1 920 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
20	3 800 to 4 200	3 800 to 4 200
21	3 700 to 3 800	3 700 to 4 200
22	1 910 to 1 930	1 910 to 1 930

5.3 Operating channel bandwidths

5.3.1 General

This clause defines the transmission 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		
(μ, β)	(1,1)	(1,2)	(2,1)	(1,4)	(2,2)	(4,1)
Transmission bandwidth (MHz)	1,539	3,051	3,078	6,075	6,102	6,156

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 and band 22. For bands 13 to 16 and bands 20 to 21, 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, 12 and 22 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, …, 2 951.

For bands 13, 14, 15, 16, 20 and 21 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, …, 4 104.

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

$$F_c = F_0 + (n - 4\,104) \times 2\ MHz$$

Where:

F_0 = 5 150 MHz; and n = 4 105, 4 106, 4 107, …, 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	Channel raster/MHz
1	1 881,792 to 1 899,072	1 657 to 1 677	0,864
2	1 901,664 to 1 918,994	1 680 to 1 700	0,864
3	2 401,056 to 2 482,272	2 258 to 2 352	0,864
4	902,88 to 927,072	524 to 552	0,864
5	451,008 to 469,152	1 to 22	0,864
6	698,976 to 805,248	288 to 411	0,864
7	717,12 to 727,488	309 to 321	0,864
8	1 432,512 to 1 516,32	1 137 to 1 234	0,864
9	1 921,86 to 1 928,448	1 703 to 1 711	0,864
10	2 010,528 to 2 024,352	1 806 to 1 822	0,864
11	2 300,832 to 2 399,328	2 142 to 2 256	0,864
12	2 501,28 to 2 619,648	2 374 to 2 511	0,864
13	3 301,268 to 3 399,764	3 126 to 3 183	1,728
14	3 401,492 to 3 598,484	3 184 to 3 298	1,728
15	3 600,212 to 3 698,708	3 299 to 3 356	1,728
16	4 801,172 to 4 989,524	3 994 to 4 103	1,728
17	5 726 to 5 874	4 392 to 4 466	2,000
18	5 152 to 5 348	4 105 to 4 203	2,000
19	5 472 to 5 724	4 265 to 4 391	2,000
20	3 802,388 to 4 198,1	3 416 to 3 645	1,728
21	3 700,436 to 3 798,932	3 357 to 3 414	1,728
22	1 911,168 to 1 928,448	1 691 to 1 711	0,864
NOTE: The actual operating channel raster (channel grid) and RF bandwidth restriction in each band may vary depending on relevant regulatory requirements.			

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
Normal contitions	±10 ppm
Extreme conditions	±15 ppm

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 of the transmitted packet. 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)		
	1,728	3,456	6,912
	Output power (dBm)		
Class I	23	23	23
Class II	21	21	21
Class III	19	19	19
Class IV	10	10	10
NOTE 1: The measurement bandwidth equals to the transmission bandwidth of the operating channel bandwidth defined in table 5.3.2-1. NOTE 2: 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. NOTE 3: Transmission output power tolerance is defined in table 6.3.1-1.			

6.3 Transmitter power control

6.3.1 Absolute power tolerance

Absolute power tolerance is the ability of the radio device transmitter to set output power to a specific value. Packet transmission power is signalled in Physical Layer Control Field ETSI TS 103 636-4 [3], clause 6.2.

Transmission power shall be measured as an average over the active period of the transmitted packet. The minimum requirement for absolute power tolerance is given in table 6.3.1-1 for all power levels supported by the device according to the used transmit power table, ETSI TS 103 636-4 [3] clause 6.2 and device power class defined in clause 6.2.1.

The absolute power shall be 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. The Measurement BandWidth is defined in table 6.2.1-1

Table 6.3.1-1: Absolute power tolerance

Power level	Tolerance	Extreme conditions
>= 0 dBm	±2,0 dB	±3,0 dB
< 0 dBm	±3,0 dB	±4,0 dB

6.3.2 Void

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. Transmission power tolerance is defined in clause 6.3.1, table 6.3.1-1.

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 of 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)	OFF power < -50		
NOTE: The Measurement BandWidth is 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 before and after the transmission excluding any transient periods. The ON power is defined as the mean power over one or more consecutive slots excluding any transient period.

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.

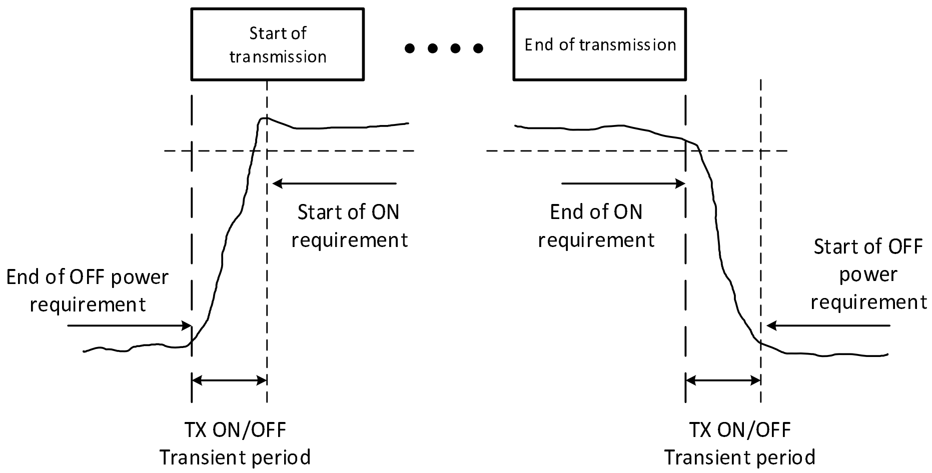

Figure 6.3.5-1: Transmit ON/OFF time mask

6.4 Transmit signal quality

6.4.1 Frequency error

RD modulated transmitter carrier frequency accuracy observed over the transmitted packet shall be within ±10,0 ppm compared to the selected absolute carrier centre frequency as specified in clause 5.4.2.

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. The EVM result is defined after the receiver FFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a percentage.

The EVM is measured over all occupied subcarriers $k = 0, \dots, N_{occ} - 1$ of all OFDM symbols $i = 0, \dots, N_{sym} - 1$ of the transmitted packet and $N = N_{occ} \times N_{sym}$

$$EVM[\%] = 100 * \sqrt{\frac{1}{N}\sum_{i,k}\left|r_{i,k} - a_{i,k}\right|^2 / \frac{1}{N}\sum_{i,k}\left|a_{i,k}\right|^2}$$

Where $a_{i,k}$ is the ideal symbol and $r_{i,k}$ is received symbol corrected by phase and clock errors as well as channel transfer function.

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	> -40
16-QAM	12,5	> -40
64-QAM	8	> -40
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.

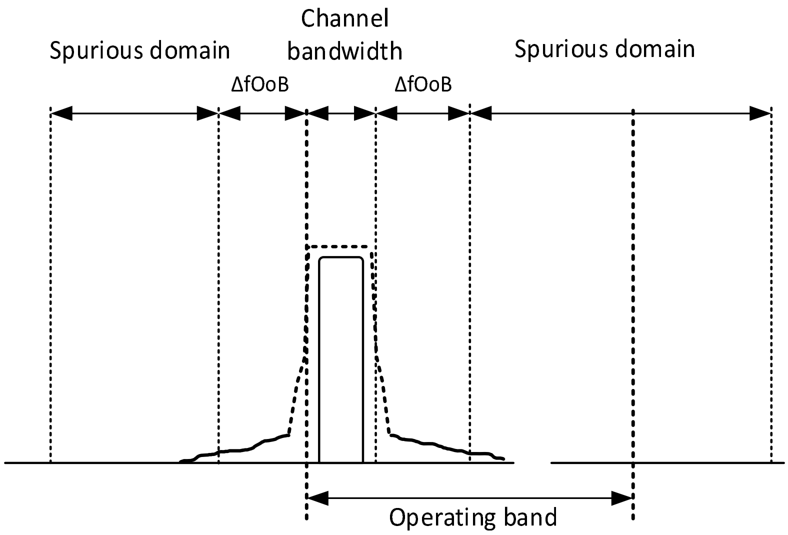

Figure 6.5.1-1: Transmitter RF spectrum

6.5.2 Occupied channel BW

Occupied bandwidth is a measure of the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel.

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 (from $F_c + B_N/2$ or from $F_c - B_N/2$) of the assigned channel. For frequencies offset greater than Δf_{oob} as specified in table 6.5.3-2 the spurious requirements in clause 6.5.4 are applicable.

Table 6.5.3-1: Spectrum emission limits 30kHz measurement bandwidth

Δf_{oob}		Limit (dBm)	Measurement BandWidth (MBW)
$B_G/2 \geq$ 1 MHz	$B_G/2$ < 1 MHz		
-	0 to $B_G/2$	$-10 - 10log10(B_N/1{,}728)$	30 kHz
-	–0 to $-B_G/2$	$-10 - 10log10(B_N/1{,}728)$	30 kHz
0 to 1 MHz	$B_G/2$ to 1 MHz	$-21 - 10log10(B_N/1{,}728)$	30 kHz
0 to –1 MHz	$-B_G/2$ to –1 MHz	$-21 - 10log10(B_N/1{,}728)$	30 kHz
NOTE 1: The first center frequency for a 30 kHz measurement filter is at Δf_{oob}= 0,015 MHz, which is $B_N/2$ + 0,015MHz from the carrier center frequency. NOTE 2: The first center frequency for a 30 kHz measurement filter in the range from $B_G/2$ to 1MHz is at Δf_{oob} = $B_G/2 + 0{,}015$ MHz, which is $B_N/2 + B_G/2 + 0{,}015$ MHz from the carrier center frequency. NOTE 3: Symmetrically similarly as in notes 1 and 2 in negative Δf_{oob} frequencies.			

Table 6.5.3-2: Spectrum emission limits 1 MHz measurement bandwidth

Δf_{oob}	Limit (dbm)		Measurement BandWidth (MBW)
	$B_N \leq 6.912\ MHz$	$B_N > 6.912\ MHz$	
1 MHz to B_N	-10	$-10 - 10log10(B_N/6{,}912)$	1 MHz
-1 MHz to $-B_N$	-10	$-10 - 10log10(B_N/6{,}912)$	1 MHz
B_N to $2B_N$	-25	$-25 - 10log10(B_N/6{,}912)$	1 MHz
$-B_N$ to $-2B_N$	-25	$-25 - 10log10(B_N/6{,}912)$	1 MHz
NOTE 1: The first center frequency for a 1 MHz measurement filter in the range 1 MHz to B_N is at Δf_{oob}= 1,5 MHz. NOTE 2: The first center frequency for a 1 MHz measurement filter in the range B_N to $2B_N$ at Δf_{oob}= $B_N + 0{,}5$ MHz. NOTE 3: Symmetrically similarly as in notes 1 and 2 in negative Δf_{oob} frequencies.			

As a general rule, the resolution bandwidth of the measuring equipment should be equal to the Measurement BandWidth (MBW). However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the MBW or rectangular type channel filter with very steep transition response can be used. When the resolution bandwidth is smaller than the MBW, the result should be integrated over the MBW in order to obtain the equivalent noise bandwidth of the MBW.

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.

The spurious emissions shall be measured during the time period where the transmitter is active excluding any transient periods.

For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range shall be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

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 < 5^{th} harmonic of the upper frequency edge in GHz	-30 dBm	1 MHz

6.5.5 Adjacent Channel Leakage Ratio

Adjacent Channel Leakage Ratio (ACLR) is used as a measure of the amount of transmission power leaking into adjacent channels. ACLR is the ratio of the filtered mean power centered on the assigned channel frequency to the filtered mean power centered on an adjacent channel frequency with measurement bandwidth equal to the transmission bandwidth.

ACLR is measured with square window on adjacent channel. A DFT of the transmission signal is taken and the energy of the appropriate bins used to calculate the adjacent channel powers.

ACLR requirement of table 6.5.5-1 shall be met for all transmission powers from -40dBm to P_{MAX}.

Table 6.5.5-1: Adjacent channel leakage ratio limit

Limit (dBc)
-30

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 Fixed Reference Channel (FRC) measurement as specified in clause 9.2.1

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

Bands	Channel bandwidth (MHz)			Unit
	1,728	**3,456**	**6,912**	
1-12 and 22	-99,7	-96,7	-93,7	dBm
13-15, 20 and 21	-97,7	-94,7	-91,7	dBm
16-19	-95,7	-92,7	-89,7	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 Fixed Reference Channel (FRC) measurement as specified in clause 9.2.1

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

Channel bandwidth (MHz)			Unit
1,728	**3,456**	**6,912**	
-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 while maintaining the 25 dB relative power difference between own signal and interferer. 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 Fixed Reference Channel (FRC) measurement as specified in clause 9.2.1

Interference signal shall have identical signal characteristics (e.g. nominal transmission bandwidth, occupied transmission bandwidth, subcarrier width, Fourier transform size) as wanted signal. Interference signal shall have QPSK modulated random data on all occupied subcarriers and the transmit signal shall be transmit pulse-shaped with square root raised cosine filter with roll-off 0,125.

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
NOTE: The interferer offset is from own signal center frequency to interferer center frequency.				

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 Fixed Reference Channel (FRC) measurement as specified in clause 9.2.1.

The interferer signal is modulated with data and has the same bandwidth and characteristic as the wanted signal modulated with data. The first interferer offset should be (measured from own signal center frequency):
2 x BW(own_signal). The meassurements are repeated when interferer offset is increased with maximum step size of BW(own_signal) until the interferer center frequency is Band(low edge) - 15 MHz + BW(own_signal) / 2 and Band(high edge) + 15 MHz - BW(own_signal) / 2.

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)	±N x 1,728, N>=2	±N x 3,456, N>=2	±N x 6,912, N>=2	MHz
NOTE 1: The interferer signal characteristic is same as the wanted signal modulated with data. NOTE 2: The interferer offset is from own signal center frequency to interferer center frequency. NOTE 3: Maximum interferer offset is [Band(low edge) - 15 MHz + BW(interferer) / 2 and Band(high edge) + 15 MHz) - BW(interferer) / 2].				

7.5.3 Out of band blocking characteristics

Out-of-band band blocking is defined for an unwanted CW interfering signal falling more than 15 MHz below or above the RD receive band. 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. Blocker signal step size is 1 MHz.

The throughput shall be ≥ 90 % of the maximum throughput of the Fixed Reference Channel (FRC) measurement as specified in clause 9.2.1.

For the measurement points defined in tables 7.5.3-1, 7.5.3-2 and 7.5.3-3 it is allowed to have a number of spurios response exceptions. The number of exceptions is a maximum of 24 or 8 x BW/1,728 MHz, whatever is greater depending on the nominal channel bandwidth BW. For these exceptions the requirement of clause 7.6 is applicable.

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

Band	RX Parameter	Channel bandwidth (MHz)			Units
All bands		1,728			
	Own signal input level	$RX_{sensitivity}$ + 6 dB			dBm
		Range 1	Range 2	Range 3	
		$Band_{low\ edge}$ - 15 to $Band_{low\ edge}$ - 60	$Band_{low\ edge}$ - 60 to $Band_{low\ edge}$ - 85	$Band_{low\ edge}$ - 85 to 1	MHz
	$F_{Interferer}$ (CW)	$Band_{high\ edge}$ + 15 to $Band_{high\ edge}$ + 60	$Band_{high\ edge}$ + 60 to $Band_{high\ edge}$ + 85	$Band_{high\ edge}$ + 85 to 12 750	MHz
	$P_{Interferer}$	-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
All bands		3,456			
	Own signal input level	$RX_{sensitivity}$ + 6 dB			dBm
		Range 1	Range 2	Range 3	
		$Band_{low\ edge}$ - 15 to $Band_{low\ edge}$ - 60	$Band_{low\ edge}$ - 60 to $Band_{low\ edge}$ - 85	$Band_{low\ edge}$ - 85 to 1	MHz
	$F_{Interferer}$ (CW)	$Band_{high\ edge}$ + 15 to $Band_{high\ edge}$ + 60	$Band_{high\ edge}$ + 60 to $Band_{high\ edge}$ + 85	$Band_{high\ edge}$ + 85 to 12 750	MHz
	$P_{Interferer}$	-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
All bands		6,912			
	Own signal input level	$RX_{sensitivity}$ + 6 dB			dBm
	$F_{Interferer}$ (CW)	Range 1	Range 2	Range 3	
		$Band_{low\ edge}$ - 15 to $Band_{low\ edge}$ - 60	$Band_{low\ edge}$ - 60 to $Band_{low\ edge}$ - 85	$Band_{low\ edge}$ - 85 to 1	MHz
		$Band_{high\ edge}$ + 15 to $Band_{high\ edge}$ + 60	$Band_{high\ edge}$ + 60 to $Band_{high\ edge}$ + 85	$Band_{high\ edge}$ + 85 to 12 750	MHz
	$P_{Interferer}$	-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 Fixed Reference Channel (FRC) measurement as specified in clause 9.2.1.

Table 7.6-1: Spurious response requirement

RX Parameter	Channel bandwidth (MHz)			Units
	1,728	**3,456**	**6,912**	
Own signal input level	$RX_{sensitivity}$ + 6 dB			dBm
$P_{Interferer}$ (CW)	-44	-44	-44	dBm
$F_{Interferer}$ (offset)	Spurious response frequencies			MHz
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.

The spurious emissions shall be measured during the time period where the receiver is active.

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

7.8 Receiver intermodulation

Intermodulation response rejection is a measure of the capability of the receiver to receive a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal.

The RD shall fulfil the minimum requirement specified in table 7.8-1. The throughput shall be ≥ 90 % of the maximum throughput of the Fixed Reference Channel (FRC) measurement as specified in clause 9.2.1.

Table 7.8-1: Receiver intermodulation requirement

RX Parameter	Channel bandwidth (MHz)			Units
	1,728	3,456	6,912	
Own signal input level	$RX_{sensitivity}$ + 6 dB			dBm
$P_{Interferer\ 1}$ (CW)	-46	-46	-46	dBm
$P_{Interferer\ 2}$ (Modulated)	-46	-46	-46	dBm
$BW_{Interferer\ 2}$	1,728	3,456	6,912	MHz
$F_{Interferer\ 1}$ (Offset)	3,456 or -3,456	6,912 or -6,912	13,824 or -13,824	MHz
$F_{Interferer\ 2}$ (Offset)	2 × $F_{Interferer\ 1}$ (Offset)			
NOTE 1: The interferer signal characteristic is same as the wanted signal modulated with data. NOTE 2: The interferer offset is from own signal centre frequency to interferer centre frequency.				

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.

Individual RSSI-1_{PACKET}(n) measurements from packet n can be averaged over multiple received packets with a leaky integrator $RSSI\text{-}1(n) = (1-\alpha)\times RSSI\text{-}1(n-1) + \alpha\times RSSI\text{-}1_{PACKET}(n)$.

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
$RX_{sensitivity}$ < RSSI-1 ≤ ($RX_{sensitivity}$ + 10 dB)	±5,5 dB
($RX_{sensitivity}$ + 10 dB) < RSSI-1 ≤ ($RX_{sensitivity}$ + 60 dB)	±3,5 dB
($RX_{sensitivity}$ + 60 dB) < RSSI-1 ≤ ($RX_{sensitivity}$ + 70 dB)	±5,5 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	Reported value (dBm)	Measured Value (dBm)
0xFF	-1	-1,5 < x
0xFE	-2	-1,5 ≤ x < -2,5
0xFD	-3	-2,5 ≤ x < -3,5
…	…	…
0x74	-140	x < -139,5
0x73	Reserved	Reserved
0x72	Reserved	Reserved
…	…	…

Reported value is calculated from signed integer RSSI by masking out the sign bits:

$\mathrm{RSSI}_{\mathrm{REPORTED}} = (\mathrm{UInt8})(0\mathrm{x}00\mathrm{FF}\ \&\ \mathrm{RSSI}_{\mathrm{dBM}})$, where '&' denotes the bitwise AND operation.

The reported value is converted back to signed integer RSSI value by adding the sign bits back:

$\mathrm{RSSI}_{\mathrm{dBM}} = 0\mathrm{xFF}00 \mid \mathrm{RSSI}_{\mathrm{REPORTED}}$, where '|' denotes the bitwise OR operation.

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-2_{PACKET}(n) measurements from packet (n) can be averaged over multiple received packets with a leaky integrator RSSI_2(n) = (1-α)×RSSI-2 (n-1) + α×RSSI-2_{PACKET}(n).

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

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	Reported value (dBm)	Measured value (dBm)
0xFF	-1	-1,5 < x
0xFE	-2	-1,5 ≤ x < -2,5
0xFD	-3	-2,5 ≤ x < -3,5
…	…	…
0x74	-140	x < -139,5
0x73	Reserved	Reserved
0x72	Reserved	Reserved
…	…	…

Reported value is calculated from signed integer RSSI by masking out the sign bits:

$\mathrm{RSSI_{REPORTED}} = (\mathrm{UInt8})(\mathrm{0x00FF}\ \&\ \mathrm{RSSI_{dBM}})$, where '&' denotes the bitwise AND operation.

The reported value is converted back to signed integer RSSI value by adding the sign bits back:

$\mathrm{RSSI_{dBM}} = \mathrm{0xFF00} \mid \mathrm{RSSI_{REPORTED}}$, where '|' denotes the bitwise OR operation.

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 $\mathrm{SNR_{PACKET}}(n)$ measurements from packet n can be averaged over multiple received packets with a leaky integrator $\mathrm{SNR}(n) = (1-\alpha)\times\mathrm{SNR}(n-1) + \alpha\times\mathrm{SNR_{PACKET}}(n)$.

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	
5 dB < SNR ≤ 25 dB	±3 dB	

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	Reported value (dB)	Measured value (dB)
0x7F	63,5	63,25 ≤ x
0x7E	63,0	62,75 ≤ x < 63,25
0x7D	62,5	62,25 ≤ x < 62,75
…	…	…
0x01	0.5	0,25 ≤ x < 0,75
0x00	0	-0,25 ≤ x < 0,25
0xFF	-0.5	-0,75 ≤ x < -0,25
…	…	…
0xE0	-16.0	x < -15,75
0xDF	Reserved	Reserved
…	…	…
0x82	Reserved	Reserved
0x81	Reserved	Reserved
0x80	Reserved	Reserved

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.

This clause defines Fixed Radio Channel (FRC) which is also used for clauses 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 Fixed Reference Channel with QPSK

Common test parameters QPSK Fixed Reference Channel are defined in clause A.2.1 for 1,728 MHz operating channel bandwidth, clause A.3.1 for 3,456 MHz operating channel bandwidth and clause A.4.1 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 requirement for the receiver's throughput performance is defined to be at least 90 % of the maximum throughput averaged over one radio frame for Fixed Refence Channel (FRC), as defined in clause 9.2.1.

Table 9.2.2-1: Single receiver minimum throughput requirement

Parameter	Operating channel bandwidth	Unit
	1,728 MHz	
μ, β	(1,1)	
MCS1 maximum throughput	177,6	kbps
MCS1 minimum throughput	> 168,72	kbps
Input signal level	-70	dBm/MHz
Propagation condition	static	

Parameter	Operating channel bandwidth		Unit
	3,456 MHz	3,456 MHz	
μ, β	(1,2)	(2,1)	
MCS1 maximum throughput	427,2	456	kbps
MCS1 minimum throughput	> 405,84	> 433,2	kbps
Input signal level	-70	-70	dBm/MHz
Propagation condition	static	static	

Parameter	Operating channel bandwidth			Unit
	6,912 MHz	6,912 MHz	6,912 MHz	
μ, β	(1,4)	(2,2)	(4,1)	
MCS1 maximum throughput	926,4	984	1060,8	kbps
MCS1 minimum throughput	> 880,08	> 934,8	> 1007,8	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.

Radio slot allocation for Fixed Reference Channel (FRC) measurements is defined in table A.1-1.

Table A.1-1: Radio frame slot allocation for Fixed Reference Channel measurements

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	-	DL	-	UL	-	DL	-	UL	-

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

A.2.1 Fixed Reference Channel measurement with QPSK

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	6 DL + 6 UL	
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)	177,6	kbps
NOTE: The radio frame slot allocation pattern is defined in table A.1-1.		

A.2.2 Fixed Reference Channel measurement with 16-QAM

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	6 DL + 6UL	
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)	561,6	kbps
NOTE: The radio frame slot allocation pattern is defined in table A.1-1.		

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

A.3.1 Fixed Reference Channel measurement with QPSK

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	6 DL + 6 UL	
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)	427,2	kbps
NOTE: The radio frame slot allocation pattern is defined in table A.1-1.		

Table A.3.1-2: Fixed Reference Channel for receiver requirements

Parameter	Value	Unit
Operating bandwidth	3,456	MHz
Subcarrier scaling factor µ = 2	56	kHz
Fourier transform scaling factor β	1	
Modulation	QPSK	
Coding	1/2	
Allocated slot(s) in radio frame for DL and UL	6 DL + 6 UL	
Number of HARQ processes	2	
Maximum number of HARQ transmissions	1	
Transport block size	95	bytes
Max averaged throughput over one radio frame (10 ms)	456	kbps
NOTE: The radio frame slot allocation pattern is defined in table A.1-1.		

A.3.2 Fixed Reference Channel measurement with 16-QAM

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	6 DL + 6 UL	
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)	1,262	Mbps
NOTE: The radio frame slot allocation pattern is defined in table A.1-1.		

Table A.3.2-2: Fixed Reference Channel for receiver requirements

Parameter	Value	Unit
Operating bandwidth	3,456	MHz
Subcarrier scaling factor µ = 2	56	kHz
Fourier transform scaling factor β	1	
Modulation	16-QAM	
Coding	3/4	
Allocated slot(s) in radio frame for DL and UL	6 DL + 6 UL	
Number of HARQ processes	2	
Maximum number of HARQ transmissions	1	
Transport block size	287	bytes
Max averaged throughput over one radio frame (10 ms)	1,378	Mbps
NOTE: The radio frame slot allocation pattern is defined in table A.1-1.		

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

A.4.1 Fixed Reference Channel measurement with QPSK

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	6 DL + 6 UL	
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)	926,4	kbps
NOTE: The radio frame slot allocation pattern is defined in table A.1-1.		

Table A.4.1-2: Fixed Reference Channel for receiver requirements

Parameter	Value	Unit
Operating bandwidth	6,912	MHz
Subcarrier scaling factor µ = 2	56	kHz
Fourier transform scaling factor β	2	
Modulation	QPSK	
Coding	1/2	
Allocated slot(s) in radio frame for DL and UL	6 DL + 6 UL	
Number of HARQ processes	2	
Maximum number of HARQ transmissions	1	
Transport block size	205	bytes
Max averaged throughput over one radio frame (10 ms)	984	kbps
NOTE: The radio frame slot allocation pattern is defined in table A.1-1.		

Table A.4.1-3: Fixed Reference Channel for receiver requirements

Parameter	Value	Unit
Operating bandwidth	6,912	MHz
Subcarrier scaling factor µ = 4	112	kHz
Fourier transform scaling factor β	1	
Modulation	QPSK	
Coding	1/2	
Allocated slot(s) in radio frame for DL and UL	6 DL + 6 UL	
Number of HARQ processes	2	
Maximum number of HARQ transmissions	1	
Transport block size	221	bytes
Max averaged throughput over one radio frame (10 ms)	1060,8	kbps
NOTE: The radio frame slot allocation pattern is defined in table A.1-1.		

A.4.2 Fixed Reference Channel measurement with 16-QAM

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	6 DL + 6 DL	
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)	2,784	Mbps
NOTE: The radio frame slot allocation pattern is defined in table A.1-1.		

Table A.4.2-2: Fixed Reference Channel for receiver requirements

Parameter	Value	Unit
Operating bandwidth	6,912	MHz
Subcarrier scaling factor μ = 2	56	kHz
Fourier transform scaling factor β	2	
Modulation	16-QAM	
Coding	3/4	
Allocated slot(s) in radio frame for DL and UL	6 DL + 6UL	
Number of HARQ processes	2	
Maximum number of HARQ transmissions	1	
Transport block size	620	bytes
Max averaged throughput over one radio frame (10 ms)	2,976	Mbps
NOTE: The radio frame slot allocation pattern is defined in table A.1-1.		

Table A.4.2-3: Fixed Reference Channel for receiver requirements

Parameter	Value	Unit
Operating bandwidth	6,912	MHz
Subcarrier scaling factor μ = 4	112	kHz
Fourier transform scaling factor β	1	
Modulation	16-QAM	
Coding	3/4	
Allocated slot(s) in radio frame for DL and UL	6 DL + 6UL	
Number of HARQ processes	2	
Maximum number of HARQ transmissions	1	
Transport block size	684	bytes
Max averaged throughput over one radio frame (10 ms)	3,283	Mbps
NOTE: The radio frame slot allocation pattern is defined in table A.1-1.		

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 rms 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 Capabilities

B.1 Introduction

Radio device class defines 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 radio device class is a combination of requirements stated in ETSI TS 103 636-3 [2], ETSI TS 103 636-4 [3] and ETSI TS 103 636-5 [8] respective annexes and the present annex. Device capabilities are signalled at connection setup to ensure interoperability between radio devices as defined in ETSI TS 103 636-4 [3].

B.2 Radio Device Capabilities

B.2.1 Maximum output power

Device shall support maximum transmitter output power class IV, class III, class II or class I defined in table 6.2.1-1.

B.2.2 RX Gain value

Device shall support a RX gain value from the value range: -6 dB, -4 dB, -2 dB or 0 dB as defined in ETSI TS 103 636-4 [3].

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 publications IEC 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.

Annex D (informative): Change history

Meeting #	Document #	Title
TC DECT meeting # 94	DECT(22)000151	On transmitter relative frequency accuracy requirement
TC DECT meeting # 96	DECT(22)000250r1	Corrections on annex B radio device capabilities in ETSI TS 103 636-2
TC DECT meeting # 96	DECT(22)000249	Additional information on emission mask measurements in ETSI TS 103 636-2
TC DECT meeting # 97	DECT(23)000036	TS 103 636 -2 Additional frequency band supporting operation on 3,8 to 4,2 GHz
TC DECT meeting # 97	DECT(23)000057r2	TS 103 636-2 Corrections and Additions
TC DECT meeting # 97	DECT(23)000067	TS 103 636-2 Transmitter frequency error
TC DECT meeting # 98	DECT(23)000102	Receiver intermodulation requirement for TS 103 636 part 2
TC DECT meeting # 98	DECT(23)000111	Receiver sensitivity requirement update for TS 103 636 part 2
TC DECT meeting # 98	DECT(23)000106r2	RSSI value reporting
TC DECT meeting # 98	DECT(23)000105r2	SNR value reporting
TC DECT meeting # 98	DECT(23)000107r1	SNR measurement tolerance
TC DECT telco 16.8.2023	DECT(23)000154	TS 103 636-2 Additional frequency band supporting operation on 3,7 to 3,8 GHz
TC DECT telco 15.11. 2023	DECT(23)000224	Modification of band 9 frequency range and introduction of band 22
TC DECT Telco 13.12.2023	DECT(23)000240r4	Transmitter emission requirements -Partial CR implementation based on agreement in DECT(23)000247 TC DECT Telco 13.12,2023 meeting report.
TC DECT meeting #100	DECT(24)000012r1	Addition of channel raster information in frequency band table
TC DECT meeting #100	DECT(24)000034	Interfernce signal definition for ACS requirement
TC DECT meeting #100	DECT(24)000035	Averaging over packets in SNR and RSSI estimation
TC DECT meeting #102	DECT(24)000149	Corrections to reference sensitivity requirements in ETSI TS 103 636-2 v2.0.4
TC DECT meeting #103	DECT(24)000238	Corrections to single receiver requirement in clause 9.2.2

History

Document history		
V2.1.1	October 2024	Publication