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DECT-2020 New Radio (NR); Part 2: Radio reception and transmission requirements; Release 1

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ETSI650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
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Foreword

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The present document is part 2 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

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 (RD). 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.

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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".
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- [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.

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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".

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
$\text{Band}_{\text{high edge}}$	High edge of the band for blocking signal
$\text{BW}_{\text{Interferer}}$	Bandwidth of the interfering signal
$\text{Band}_{\text{low edge}}$	Lower edge of the band for blocking signal
f	Frequency
F_c	Carrier centre frequency
$F_{\text{Interferer}}$	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
$P_{\text{Interferer}}$	Received power of the interfering signal
ΔP	Power step size in dB between power control commands
$\text{RX}_{\text{channelmax}}$	Maximum receiver wanted signal level
$\text{RX}_{\text{sensitivity}}$	Minimum receiver reference sensitivity
$\text{SNR}_{\text{PACKET}}(n)$	Signal to Noise Ratio of packet (n)

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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.

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4.2 Relationship between minimum requirements and test requirements

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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

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 is 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 is 1,728 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:

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

Where:

$F_0 = 450,144 \text{ MHz}$; and

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

For band 13, 14, 15, 16 and 17 the carrier centre frequency is defined by:

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

Where:

$F_0 = 3\,000,596 \text{ MHz}$; and $n = 2\,952, 2\,953, 2\,954, \dots, 4\,615$.

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 1 899,936	1 657 to 1 678
2	1 900,8 to 1 919,808	1 679 to 1 701
3	2 401,056 to 2 483,272	2 258 to 2 352
4	902,88 to 927,936	524 to 553
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	1 910,304 to 1 929,312	1 690 to 1 712
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	5 725,652 to 5 874,26	4 526 to 4 615

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 μ s. 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 the 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.