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TECHNICAL SPECIFICATION

**5G;
NR;
Ambient IoT device radio transmission and reception
(3GPP TS 38.191 version 19.2.0 Release 19)**

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Foreword

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Sample Document

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1 Scope

The present document establishes the minimum RF characteristics for Ambient IoT device.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] Void
- [3] 3GPP TS 38.291: "NR; Ambient IoT Physical layer".
- [4] ITU-R Recommendation SM.329, "Unwanted emissions in the spurious domain".
- [5] 3GPP TS 38.870: "Enhanced Over-the-Air (OTA) test methods for NR FR1 Total Radiated Power (TRP) and Total Radiated Sensitivity (TRS)".
- [6] 3GPP TS 38.391: "NR; Ambient IoT Medium Access Control (MAC) protocol".

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3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

3.2 Symbols

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

BW_{Channel}	<i>channel bandwidth</i>
BW_{Config}	<i>Transmission bandwidth</i> , where $BW_{\text{Config}} = N_{\text{RB}} \times \text{SCS} \times 12$
$BW_{\text{GB,low}}$	The minimum guard band defined in clause 5.3.1 for lowest assigned component carrier
$BW_{\text{GB,high}}$	The minimum guard band defined in clause 5.3.1 for highest assigned component carrier
Δf	Separation between the <i>channel edge</i> frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency
ΔF_{Global}	Global frequency raster granularity
Δf_{max}	$f_{\text{offsetmax}}$ minus half of the bandwidth of the measuring filter
Δf_{OOB}	Δ Frequency of Out Of Band emission ΔF_{Raster} Channel raster granularity
F_C	<i>RF reference frequency</i> on the channel raster, given in table 5.4.1.2-1

$F_{DL,low}$	The lowest frequency of the downlink <i>operating band</i>
$F_{DL,high}$	The highest frequency of the downlink <i>operating band</i>
f_{offset}	Separation between the <i>channel edge</i> frequency and the centre of the measuring
$f_{offset_{max}}$	The offset to the frequency Δf_{OBUe} outside the downlink <i>operating band</i>
F_{OOB}	The boundary between the A-IoT out of band emission and spurious emission domains
F_{REF}	RF reference frequency
$F_{REF-Offs}$	Offset used for calculating F_{REF}
$F_{UL,low}$	The lowest frequency of the uplink <i>operating band</i>
$F_{UL,high}$	The highest frequency of the uplink <i>operating band</i>
$GB_{Channel}$	Minimum guard band defined in clause 5.3.1
n_{PRB}	Physical resource block number
N_{RB}	<i>Transmission bandwidth configuration</i> , expressed in resource blocks
N_{REF}	A-IoT Absolute Radio Frequency Channel Number (A-IoT-ARFCN)
$N_{REF-Offs}$	Offset used for calculating N_{REF}
$P_{REFSENS}$	Conducted Reference Sensitivity power level

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

1SB	Single sideband
2SB	Double sideband
ACLR	Adjacent Channel Leakage Ratio
ACS	Adjacent Channel Selectivity
AWGN	Additive White Gaussian Noise
A-IoT	Ambient IoT
A-IoT RAN	Ambient IoT Radio Access Network
BPSK	Binary phase-shift keying
BS	Base Station
BW	Bandwidth
CFO	Carrier-frequency offset
CP	Cyclic prefix
CW	Carrier-wave
CW2D	Carrier-wave, or carrier-wave node, to device
D2R	Device to reader
ED	Envelope detector
E-UTRA	Evolved UTRA
FAR	False alarm rate
FEC	Forward error-correction code
FR	Frequency Range
FRC	Fixed Reference Channel
IF	Intermediate frequency
IoT	Internet of Things
LPWA	Low-power, wide-area
MCS	Modulation and coding scheme
MDR	Missed detection rate
OOK	On-off keying
PDRCH	Physical device-to-reader channel
PRDCH	Physical reader-to-device channel
R2D	Reader to device
RE	Resource Element
REFSENS	Reference Sensitivity
RF	Radio frequency
RFID	Radio frequency identification
R-TAS	R2D timing acquisition signal
SCS	Sub-Carrier Spacing
SER	Sample error rate
SFO	Sampling-frequency offset

UEM	Unwanted Emissions Mask
ZIF	Zero IF

4 General

4.1 Relationship between minimum requirements and test requirements

The present document is a Single-RAT specification for NR Ambient IoT device, covering RF characteristics and minimum performance requirements. Conformance to the present specification is demonstrated by fulfilling the test requirements specified in the conformance specification TS 5xx [2].

The Minimum Requirements given in this specification make no allowance for measurement uncertainty. The test specification TS 38.5xx [2] defines test tolerances. These test tolerances are individually calculated for each test. The test tolerances are used to relax the minimum requirements in this specification to create test requirements. For some requirements, including regulatory requirements, the test tolerance is set to zero.

The measurement results returned by the test system are compared - without any modification - against the test requirements as defined in TS 38.5xx [2].

4.2 Applicability of minimum requirements

- In this specification 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
- For specific scenarios for which an additional requirement is specified, in addition to meeting the general requirement, the Ambient IoT device is mandated to meet the additional requirements.
- 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

The channel arrangements presented in this clause are based on the operating bands and channel bandwidths defined in the present release of specifications.

NOTE: Other operating bands and channel bandwidths may be considered in future Releases.

5.2 Operating bands

Ambient IoT is designed to operate in the NR operating bands defined in Table 5.2-1.