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Universal Mobile Telecommunications System (UMTS);
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5G;
NR, E-UTRA, UTRA and GSM/EDGE;
Multi-Standard Radio (MSR) Base Station (BS)
conformance testing
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Contents

| | |
|--|----|
| Intellectual Property Rights | 2 |
| Legal Notice | 2 |
| Modal verbs terminology..... | 2 |
| Foreword..... | 10 |
| 1 Scope | 11 |
| 2 References | 11 |
| 3 Definitions, symbols and abbreviations | 12 |
| 3.1 Definitions | 12 |
| 3.2 Symbols..... | 14 |
| 3.3 Abbreviations | 16 |
| 4 General test conditions and declarations | 17 |
| 4.1 Measurement uncertainties and test requirements | 17 |
| 4.1.1 General..... | 17 |
| 4.1.2 Acceptable uncertainty of Test System..... | 17 |
| 4.1.2.1 Measurement of transmitter | 18 |
| 4.1.2.2 Measurement of receiver | 19 |
| 4.1.3 Interpretation of measurement results | 21 |
| 4.2 Base Station classes..... | 21 |
| 4.3 Regional requirements..... | 22 |
| 4.4 Operating bands and band categories | 23 |
| 4.4.1 Band category 1 aspects (BC1)..... | 25 |
| 4.4.2 Band category 2 aspects (BC2)..... | 25 |
| 4.4.3 Band category 3 aspects (BC3)..... | 25 |
| 4.5 Channel arrangement..... | 26 |
| 4.5.1 Channel spacing..... | 26 |
| 4.5.1A CA Channel spacing | 26 |
| 4.5.2 Channel raster | 26 |
| 4.5.3 Carrier frequencies and numbering..... | 26 |
| 4.6 Manufacturer's declarations of regional and optional requirements | 27 |
| 4.6.1 Operating band and frequency range | 27 |
| 4.6.2 Spurious emissions category..... | 27 |
| 4.6.3 Additional operating band unwanted emissions | 27 |
| 4.6.4 Co-existence with other systems..... | 27 |
| 4.6.5 Co-location with other Base Stations..... | 28 |
| 4.7 Capability set definition and manufacturer's declarations of supported RF configurations | 28 |
| 4.7.1 Definition of Capability Sets (CS)..... | 28 |
| 4.7.2 Manufacturer's declarations of supported RF configurations | 29 |
| 4.8 MSR test configurations | 30 |
| 4.8.1 TC1: UTRA multicarrier operation | 31 |
| 4.8.1.1 TC1a generation..... | 31 |
| 4.8.1.2 TC1b generation..... | 31 |
| 4.8.1.3 TC1 power allocation..... | 31 |
| 4.8.1a NTC1: UTRA multicarrier non-contiguous operation | 31 |
| 4.8.1a.1 NTC1a generation..... | 31 |
| 4.8.1a.2 NTC1 power allocation..... | 32 |
| 4.8.2 TC2: E-UTRA multicarrier operation..... | 32 |
| 4.8.2.1 TC2 generation..... | 32 |
| 4.8.2.2 TC2 power allocation..... | 32 |
| 4.8.2a NTC2: E-UTRA multicarrier non-contiguous operation | 32 |
| 4.8.2a.1 NTC2 generation..... | 32 |
| 4.8.2a.2 NTC2 power allocation | 33 |
| 4.8.3 TC3: UTRA and E-UTRA multi RAT operation..... | 33 |
| 4.8.3.1 TC3a generation..... | 33 |
| 4.8.3.2 TC3b generation..... | 33 |

| | | |
|-----------|---|----|
| 4.8.3.3 | TC3 power allocation | 33 |
| 4.8.3a | NTC3: UTRA and E-UTRA multi RAT non-contiguous operation | 33 |
| 4.8.3a.1 | NTC3a generation | 34 |
| 4.8.3a.2 | NTC3 power allocation | 34 |
| 4.8.4 | TC4: BC2 transmitter operation | 34 |
| 4.8.4.1 | TC4a generation | 35 |
| 4.8.4.2 | TC4b generation | 35 |
| 4.8.4.3 | TC4c generation | 35 |
| 4.8.4.4 | TC4d generation | 36 |
| 4.8.4.5 | TC4e generation | 36 |
| 4.8.4.6 | TC4 power allocation | 36 |
| 4.8.4a | NTC4: Non-contiguous multi RAT operations with GSM for the transmitter | 36 |
| 4.8.4a.1 | NTC4a generation | 37 |
| 4.8.4a.2 | NTC4b generation | 37 |
| 4.8.4a.3 | NTC4c generation | 38 |
| 4.8.4a.4 | NTC4 power allocation | 39 |
| 4.8.5 | TC5: BC2 receiver operation | 39 |
| 4.8.5.1 | TC5a generation | 39 |
| 4.8.5.2 | TC5b generation | 39 |
| 4.8.5a | NTC5: Non-contiguous multi RAT operations with GSM for the receiver | 39 |
| 4.8.5a.1 | NTC5a generation | 39 |
| 4.8.5a.2 | NTC5b generation | 39 |
| 4.8.5a.3 | NTC5c generation | 40 |
| 4.8.6 | TC6: Single carrier for receiver tests | 40 |
| 4.8.6.1 | TC6a generation | 40 |
| 4.8.6.2 | TC6b generation | 40 |
| 4.8.6.3 | TC6c generation | 40 |
| 4.9 | RF channels and test models | 40 |
| 4.9.1 | RF channels | 40 |
| 4.9.2 | Test models | 41 |
| 4.10 | BS configurations | 41 |
| 4.10.1 | Transmit configurations | 41 |
| 4.10.1.1 | Transmission with multiple transmitter antenna connectors | 42 |
| 4.10.2 | Receive configurations | 42 |
| 4.10.2.1 | Reception with multiple receiver antenna connectors, receiver diversity | 42 |
| 4.10.3 | Duplexers | 42 |
| 4.10.4 | Power supply options | 43 |
| 4.10.5 | Ancillary RF amplifiers | 43 |
| 4.10.6 | BS with integrated Iuant BS modem | 43 |
| 4.10.7 | BS using antenna arrays | 44 |
| 4.10.7.1 | Receiver tests | 44 |
| 4.10.7.2 | Transmitter tests | 44 |
| 4.11 | Format and interpretation of tests | 45 |
| 5 | Applicability of requirements and test configurations | 46 |
| 5.1 | Multi-RAT capable Base Stations | 47 |
| 5.2 | Single-RAT Multi-carrier capable Base Stations | 52 |
| 6 | Transmitter characteristics | 56 |
| 6.1 | General | 56 |
| 6.2 | Base Station output power | 57 |
| 6.2.1 | Base Station maximum output power | 57 |
| 6.2.1.1 | Definition and applicability | 57 |
| 6.2.1.2 | Minimum requirement | 57 |
| 6.2.1.3 | Test purpose | 57 |
| 6.2.1.4 | Method of test | 57 |
| 6.2.1.4.1 | Initial conditions | 57 |
| 6.2.1.4.2 | Procedure | 57 |
| 6.2.1.5 | Test requirements | 57 |
| 6.2.2 | E-UTRA DL RS power | 58 |
| 6.2.2.1 | Definition and applicability | 58 |
| 6.2.2.2 | Minimum requirement | 58 |

| | | |
|-----------|--------------------------------------|----|
| 6.2.2.3 | Test purpose | 58 |
| 6.2.2.4 | Method of test | 58 |
| 6.2.2.5 | Test requirements | 58 |
| 6.2.3 | UTRA FDD primary CPICH power | 58 |
| 6.2.3.1 | Definition and applicability | 58 |
| 6.2.3.2 | Minimum requirement | 58 |
| 6.2.3.3 | Test purpose | 58 |
| 6.2.3.4 | Method of test | 58 |
| 6.2.3.5 | Test requirements | 59 |
| 6.2.3A | UTRA FDD secondary CPICH power | 59 |
| 6.2.3A.1 | Definition and applicability | 59 |
| 6.2.3A.2 | Minimum requirement | 59 |
| 6.2.3A.3 | Test purpose | 59 |
| 6.2.3A.4 | Method of test | 59 |
| 6.2.3A.5 | Test requirements | 59 |
| 6.2.4 | UTRA TDD primary CCPCH power | 59 |
| 6.2.4.1 | Definition and applicability | 59 |
| 6.2.4.2 | Minimum requirement | 59 |
| 6.2.4.3 | Test purpose | 59 |
| 6.2.4.4 | Method of test | 59 |
| 6.2.4.5 | Test requirements | 60 |
| 6.3 | Output power dynamics | 60 |
| 6.3.1 | Definition and applicability | 60 |
| 6.3.2 | Minimum Requirement | 60 |
| 6.3.3 | Test purpose | 60 |
| 6.3.4 | Method of test | 60 |
| 6.3.5 | Test Requirement | 60 |
| 6.4 | Transmit ON/OFF power | 60 |
| 6.4.1 | Definition and applicability | 60 |
| 6.4.2 | Minimum Requirement | 61 |
| 6.4.3 | Test purpose | 61 |
| 6.4.4 | Method of test | 61 |
| 6.4.4.1 | Initial conditions | 61 |
| 6.4.4.2 | Procedure | 61 |
| 6.4.5 | Test requirement | 61 |
| 6.5 | Transmitted signal quality | 62 |
| 6.5.1 | Modulation quality | 62 |
| 6.5.1.1 | Definition and applicability | 62 |
| 6.5.1.2 | Minimum Requirement | 62 |
| 6.5.1.3 | Test purpose | 62 |
| 6.5.1.4 | Method of test | 62 |
| 6.5.1.4.1 | Initial conditions | 62 |
| 6.5.1.4.2 | Procedure | 62 |
| 6.5.1.5 | Test Requirements | 63 |
| 6.5.1.5.1 | E-UTRA test requirement | 63 |
| 6.5.1.5.2 | UTRA FDD test requirement | 63 |
| 6.5.1.5.3 | UTRA TDD test requirement | 63 |
| 6.5.1.5.4 | GSM/EDGE test requirement | 63 |
| 6.5.2 | Frequency error | 63 |
| 6.5.2.1 | Definition and applicability | 63 |
| 6.5.2.2 | Minimum Requirement | 63 |
| 6.5.2.3 | Test purpose | 63 |
| 6.5.2.4 | Method of test | 63 |
| 6.5.2.5 | Test Requirements | 63 |
| 6.5.2.5.1 | E-UTRA test requirement | 63 |
| 6.5.2.5.2 | UTRA FDD test requirement | 63 |
| 6.5.2.5.3 | UTRA TDD test requirement | 63 |
| 6.5.2.5.4 | GSM/EDGE test requirement | 64 |
| 6.5.3 | Time alignment error | 64 |
| 6.5.3.1 | Definition and applicability | 64 |
| 6.5.3.2 | Minimum requirement | 64 |
| 6.5.3.3 | Test purpose | 64 |

| | | |
|-------------|---|----|
| 6.5.3.4 | Method of test | 64 |
| 6.5.3.5 | Test requirement | 64 |
| 6.6 | Unwanted emissions..... | 64 |
| 6.6.1 | Transmitter spurious emissions..... | 65 |
| 6.6.1.1 | Definition and applicability..... | 65 |
| 6.6.1.2 | Minimum requirement | 65 |
| 6.6.1.3 | Test purpose | 65 |
| 6.6.1.4 | Method of test | 65 |
| 6.6.1.4.1 | Initial conditions | 65 |
| 6.6.1.4.2 | Procedure..... | 65 |
| 6.6.1.5 | Test requirements..... | 65 |
| 6.6.1.5.1 | Spurious emissions (Category A)..... | 66 |
| 6.6.1.5.2 | Spurious emissions (Category B)..... | 66 |
| 6.6.1.5.3 | Additional test requirement for BC2 (category B)..... | 66 |
| 6.6.1.5.4 | Protection of the BS receiver of own or different BS..... | 67 |
| 6.6.1.5.5 | Additional spurious emission requirements..... | 67 |
| 6.6.1.5.6 | Co-location with other Base Stations | 72 |
| 6.6.2 | Operating band unwanted emissions | 75 |
| 6.6.2.1 | Definition and applicability..... | 75 |
| 6.6.2.2 | Minimum requirement | 76 |
| 6.6.2.3 | Test purpose | 76 |
| 6.6.2.4 | Method of test | 76 |
| 6.6.2.4.1 | Initial conditions | 76 |
| 6.6.2.4.2 | Procedure..... | 76 |
| 6.6.2.5 | Test requirement | 77 |
| 6.6.2.5.1 | Test requirements for Band Categories 1 and 3..... | 77 |
| 6.6.2.5.2 | Test requirements for Band Category 2..... | 79 |
| 6.6.2.5.3 | Test requirements for GSM/EDGE single-RAT requirements..... | 80 |
| 6.6.2.5.4 | Test requirements for additional requirements | 80 |
| 6.6.2.5.4.1 | Limits in FCC Title 47..... | 80 |
| 6.6.2.5.4.2 | Unsynchronized operation for BC3 | 80 |
| 6.6.2.5.4.3 | Protection of DTE..... | 81 |
| 6.6.2.5.4.4 | Co-existence with services in adjacent frequency bands | 81 |
| 6.6.3 | Occupied bandwidth | 81 |
| 6.6.3.1 | Definition and applicability..... | 81 |
| 6.6.3.2 | Minimum requirements..... | 81 |
| 6.6.3.3 | Test purpose | 82 |
| 6.6.3.4 | Method of test | 82 |
| 6.6.3.5 | Test requirement | 82 |
| 6.6.4 | Adjacent Channel Leakage power Ratio (ACLR) | 82 |
| 6.6.4.1 | Definition and applicability..... | 82 |
| 6.6.4.2 | Minimum requirement | 82 |
| 6.6.4.3 | Test purpose | 82 |
| 6.6.4.4 | Method of test | 82 |
| 6.6.4.4.1 | Initial conditions | 83 |
| 6.6.4.4.2 | Procedure..... | 83 |
| 6.6.4.5 | Test requirements..... | 83 |
| 6.6.4.5.1 | E-UTRA test requirement..... | 83 |
| 6.6.4.5.2 | UTRA FDD test requirement | 83 |
| 6.6.4.5.3 | UTRA TDD test requirement | 84 |
| 6.6.4.5.4 | Cumulative ACLR requirement in non-contiguous spectrum | 84 |
| 6.7 | Transmitter intermodulation..... | 85 |
| 6.7.1 | Definition and applicability | 85 |
| 6.7.2 | Minimum requirement | 85 |
| 6.7.3 | Test purpose..... | 85 |
| 6.7.4 | Method of test..... | 85 |
| 6.7.4.1 | Initial conditions | 85 |
| 6.7.4.2 | Procedure | 86 |
| 6.7.4.2.1 | General minimum requirement test procedure | 86 |
| 6.7.4.2.2 | Additional minimum requirement (BC1 and BC2) test procedure | 86 |
| 6.7.4.2.3 | Additional minimum requirement (BC3) test procedure | 87 |
| 6.7.5 | Test requirements..... | 88 |

| | | |
|---------|---|-----|
| 6.7.5.1 | General test requirement | 88 |
| 6.7.5.2 | Additional test requirement (BC1 and BC2)..... | 88 |
| 6.7.5.3 | Additional test requirement (BC3)..... | 88 |
| 7 | Receiver characteristics | 88 |
| 7.1 | General | 88 |
| 7.2 | Reference sensitivity level..... | 88 |
| 7.2.1 | Definition and applicability | 88 |
| 7.2.2 | Minimum requirement | 89 |
| 7.2.3 | Test purpose..... | 89 |
| 7.2.4 | Method of test | 89 |
| 7.2.5 | Test requirements..... | 89 |
| 7.3 | Dynamic range | 89 |
| 7.3.1 | Definition and applicability | 89 |
| 7.3.2 | Minimum requirement | 89 |
| 7.3.3 | Test purpose..... | 89 |
| 7.3.4 | Method of test | 89 |
| 7.3.5 | Test requirements..... | 90 |
| 7.4 | In-band selectivity and blocking | 90 |
| 7.4.1 | Definition and applicability | 90 |
| 7.4.2 | Minimum requirement | 90 |
| 7.4.3 | Test purpose..... | 90 |
| 7.4.4 | Method of test | 90 |
| 7.4.4.1 | Initial conditions | 90 |
| 7.4.4.2 | Procedure for general blocking | 90 |
| 7.4.4.3 | Procedure for narrowband blocking..... | 91 |
| 7.4.4.4 | Procedure for additional narrowband blocking for GSM/EDGE..... | 91 |
| 7.4.4.5 | Procedure for GSM/EDGE AM suppression..... | 91 |
| 7.4.4.6 | Procedure for additional BC3 blocking requirement..... | 91 |
| 7.4.5 | Test requirements..... | 91 |
| 7.4.5.1 | General blocking test requirement | 91 |
| 7.4.5.2 | General narrowband blocking test requirement | 92 |
| 7.4.5.3 | Additional narrowband blocking test requirement for GSM/EDGE..... | 93 |
| 7.4.5.4 | GSM/EDGE test requirements for AM suppression | 93 |
| 7.4.5.5 | Additional BC3 blocking test requirement..... | 93 |
| 7.5 | Out-of-band blocking | 93 |
| 7.5.1 | Definition and applicability | 93 |
| 7.5.2 | Minimum requirement | 94 |
| 7.5.3 | Test purpose..... | 94 |
| 7.5.4 | Method of test | 94 |
| 7.5.4.1 | Initial conditions | 94 |
| 7.5.4.2 | Procedure | 94 |
| 7.5.5 | Test requirements..... | 94 |
| 7.5.5.1 | General out-of-band blocking test requirements | 94 |
| 7.5.5.2 | Co-location test requirements..... | 95 |
| 7.6 | Receiver spurious emissions..... | 98 |
| 7.6.1 | Definition and applicability | 98 |
| 7.6.2 | Minimum requirements..... | 98 |
| 7.6.3 | Test purpose..... | 98 |
| 7.6.4 | Method of test | 98 |
| 7.6.4.1 | Initial conditions | 98 |
| 7.6.4.2 | Procedure | 98 |
| 7.6.5 | Test requirements..... | 99 |
| 7.6.5.1 | General test requirements..... | 99 |
| 7.6.5.2 | Additional test requirement for BC2 (Category B) | 99 |
| 7.7 | Receiver intermodulation | 99 |
| 7.7.1 | Definition and applicability | 99 |
| 7.7.2 | Minimum requirement | 99 |
| 7.7.3 | Test purpose..... | 100 |
| 7.7.4 | Method of test | 100 |
| 7.7.4.1 | Initial conditions | 100 |
| 7.7.4.2 | Procedure for general and narrowband intermodulation | 100 |

| | | |
|--|--|------------|
| 7.7.4.3 | Procedure for additional narrowband intermodulation for GSM/EDGE..... | 100 |
| 7.7.5 | Test requirements..... | 100 |
| 7.7.5.1 | General intermodulation test requirement..... | 100 |
| 7.7.5.2 | General narrowband intermodulation test requirement..... | 101 |
| 7.7.5.3 | Additional narrowband intermodulation test requirement for GSM/EDGE..... | 102 |
| 7.8 | In-channel selectivity..... | 103 |
| 7.8.1 | Definition and applicability..... | 103 |
| 7.8.2 | Minimum requirement..... | 103 |
| 7.8.3 | Test purpose..... | 103 |
| 7.8.4 | Method of testing..... | 103 |
| 7.8.5 | Test requirements..... | 103 |
| 8 | Performance requirements..... | 103 |
| Annex A (normative): Characteristics of interfering signals | | 104 |
| A.1 | UTRA FDD interfering signal..... | 104 |
| A.2 | UTRA TDD interfering signal..... | 104 |
| A.3 | E-UTRA interfering signal..... | 104 |
| Annex B (normative): Environmental requirements for the BS equipment | | 105 |
| B.1 | General..... | 105 |
| B.2 | Normal test environment..... | 105 |
| B.3 | Extreme test environment..... | 105 |
| B.3.1 | Extreme temperature..... | 105 |
| B.4 | Vibration..... | 106 |
| B.5 | Power supply..... | 106 |
| B.6 | Measurement of test environments..... | 106 |
| Annex C (informative): Test Tolerances and Derivation of test requirements..... | | 107 |
| C.1 | Measurement of transmitter..... | 108 |
| C.2 | Measurement of receiver..... | 111 |
| Annex D (informative): Measurement system set-up..... | | 112 |
| D.1 | Transmitter..... | 112 |
| D.1.1 | Base station output power, transmitter ON/OFF power, modulation quality, transmitter spurious emissions and operating band unwanted emissions..... | 112 |
| D.1.2 | Transmitter intermodulation..... | 112 |
| D.2 | Receiver..... | 113 |
| D.2.1 | Blocking characteristics..... | 113 |
| D.2.2 | Receiver spurious emissions..... | 113 |
| D.2.3 | Receiver intermodulation..... | 113 |
| Annex E (normative): E-UTRA Test model for BC3 CS3 BS..... | | 114 |
| E.0 | BC3 CS3 Test model description..... | 114 |
| E.1 | E-UTRA Test Model 1.1 (E-TM1.1_BC3CS3)..... | 115 |
| E.2 | E-UTRA Test Model 1.2 (E-TM1.2_BC3CS3)..... | 115 |
| E.3 | E-UTRA Test Model 2 (E-TM2_BC3CS3)..... | 115 |
| E.4 | E-UTRA Test Model 3.1 (E-TM3.1_BC3CS3)..... | 115 |
| E.5 | E-UTRA Test Model 3.2 (E-TM3.2_BC3CS3)..... | 115 |
| E.6 | E-UTRA Test Model 3.3 (E-TM3.3_BC3CS3)..... | 115 |

Annex F (informative): **Change history**116
History121

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1 Scope

The present document specifies the Radio Frequency (RF) test methods and conformance requirements for E-UTRA, UTRA and GSM/EDGE Multi-Standard Radio (MSR) Base Station (BS). These have been derived from, and are consistent with the E-UTRA, UTRA and GSM/EDGE MSR BS specification defined in [2].

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] 3GPP TS 37.104: "E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception".
- [3] 3GPP TS 25.104: "Base Station (BS) radio transmission and reception (FDD) ".
- [4] 3GPP TS 25.105: "Base Station (BS) radio transmission and reception (TDD) ".
- [5] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception".
- [6] 3GPP TS 45.005: "Radio transmission and reception".
- [7] ITU-R Recommendation M.1545, "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000".
- [8] "Title 47 of the Code of Federal Regulations (CFR)", Federal Communications Commission.
- [9] 3GPP TS 36.141: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing".
- [10] 3GPP TS 25.141: "Base Station (BS) conformance testing (FDD) ".
- [11] 3GPP TS 51.021: "Base Station System (BSS) equipment specification; Radio aspects".
- [12] 3GPP TS 25.142: "Base Station (BS) conformance testing (TDD) ".
- [13] Recommendation ITU-R SM.329-10, "Unwanted emissions in the spurious domain".
- [14] 3GPP TR 25.942: "Radio Frequency (RF) system scenarios".
- [15] ITU-R recommendation SM.328: "Spectra and bandwidth of emissions".
- [16] IEC 60721: "Classification of environmental conditions".
- [17] IEC 60721-3-3: "Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use at weather protected locations".
- [18] IEC 60721-3-4: "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 4: Stationary use at non-weather protected locations".

- [19] ETSI EN 300 019-1-3, *European Standard (Telecommunications series)*, “Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weather protected locations”
- [20] ETSI EN 300 019-1-4, *European Standard (Telecommunications series)*, “Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weather protected locations”.
- [21] IEC 60068-2-1 (2007): "Environmental testing - Part 2: Tests. Tests A: Cold".
- [22] IEC 60068-2-2 (2007): "Environmental testing - Part 2: Tests. Tests B: Dry heat".
- [23] IEC 60068-2-6 (2007): "Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal)".

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 TR 21.905 [1].

Band category: A group of operating bands for which the same MSR scenarios apply

Base Station RF bandwidth: The bandwidth in which a Base Station transmits and receives multiple carriers and/or RATs simultaneously

Base Station RF bandwidth edge: The frequency of one of the edges of the Base Station RF bandwidth

Carrier: The modulated waveform conveying the E-UTRA, UTRA or GSM/EDGE physical channels

Carrier aggregation: aggregation of two or more E-UTRA component carriers in order to support wider transmission bandwidths

Carrier aggregation band: a set of one or more operating bands across which multiple E-UTRA carriers are aggregated with a specific set of technical requirements.

NOTE: Carrier aggregation band(s) for an E-UTRA BS is declared by the manufacturer according to the designations in Tables 5.5-2 to 5.5-3 of TS 36.104 [5]

Channel bandwidth: The bandwidth supporting a single E-UTRA, UTRA or GSM/EDGE RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

Contiguous carriers: a set of two or more carriers configured in a spectrum block where there are no RF requirements based on co-existence for un-coordinated operation within the spectrum block.

Carrier power: The power at the antenna connector in the channel bandwidth of the carrier averaged over at least one subframe for E-UTRA, at least one slot for UTRA and the useful part of the burst for GSM/EDGE.

Contiguous spectrum: Spectrum consisting of a contiguous block of spectrum with no sub-block gaps.

Downlink operating band: The part of the operating band designated for downlink.

Inter-band carrier aggregation: carrier aggregation of E-UTRA component carriers in different operating bands.

NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

Intra-band contiguous carrier aggregation: contiguous E-UTRA carriers aggregated in the same operating band.

Intra-band non-contiguous carrier aggregation: non-contiguous E-UTRA carriers aggregated in the same operating band.

Lower RF bandwidth edge: The frequency of the lower edge of the Base Station RF bandwidth, used as a frequency reference point for transmitter and receiver requirements

Lower sub-block edge: The frequency at the lower edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

Maximum Base Station RF bandwidth: The maximum RF bandwidth supported by a BS within an operating band.

NOTE: The Maximum Base Station RF bandwidth for BS configured for contiguous and non-contiguous operation is declared separately.

Maximum carrier output power: Carrier power available at the antenna connector for a specified reference condition.

Maximum RAT output power: The sum of the power of all carriers of the same RAT available at the antenna connector for a specified reference condition.

Maximum throughput: The maximum achievable throughput for a reference measurement channel.

Maximum total output power: The sum of the power of all carriers available at the antenna connector for a specified reference condition.

Measurement bandwidth: The bandwidth in which an emission level is specified.

MSR Base Station: Base Station characterized by the ability of its receiver and transmitter to process two or more carriers in common active RF components simultaneously in a declared RF bandwidth, where at least one carrier is of a different RAT than the other carrier(s).

Non-contiguous spectrum: Spectrum consisting of two or more sub-blocks separated by sub-block gap(s).

Occupied bandwidth: 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 $\beta/2$ of the total mean power of a given emission.

Operating band: A frequency range in which E-UTRA, UTRA or GSM/EDGE operates (paired or unpaired), that is defined with a specific set of technical requirements.

NOTE: The operating band(s) for a BS is declared by the manufacturer.

Sub-block: This is one contiguous allocated block of spectrum for use by the same Base Station. There may be multiple instances of sub-blocks within an RF bandwidth.

Sub-block bandwidth: The bandwidth of one sub-block.

Sub-block gap: A frequency gap between two consecutive sub-blocks within an RF bandwidth, where the RF requirements in the gap are based on co-existence for un-coordinated operation.

Synchronized operation: Operation of TDD in two different systems, where no simultaneous uplink and downlink occur.

RAT power: The sum of all carrier powers for all carriers of the same type.

Rated carrier output power: The mean power level per carrier that the manufacturer has declared to be available at the antenna connector.

Rated RAT output power: The mean power level per RAT that the manufacturer has declared to be available at the antenna connector.

Rated total output power: The total mean power level that the manufacturer has declared to be available at the antenna connector.

RRC filtered mean power: The mean power of a UTRA carrier as measured through a root raised cosine filter with roll-off factor α and a bandwidth equal to the chip rate of the radio access mode.

NOTE: The RRC filtered mean power of a perfectly modulated UTRA signal is 0.246 dB lower than the mean power of the same signal.

Throughput: The number of payload bits successfully received per second for a reference measurement channel in a specified reference condition.

Total output power: The sum of all carrier powers for all carriers transmitted by the BS.

Transmission bandwidth: Bandwidth of an instantaneous E-UTRA transmission from a UE or BS, measured in Resource Block units.

Transmission bandwidth configuration: The highest E-UTRA transmission bandwidth allowed for uplink or downlink in a given channel bandwidth, measured in Resource Block units.

Transmitter ON period: The time period during which the BS transmitter is transmitting data and/or reference symbols.

Transmitter OFF period: The time period during which the BS transmitter is not allowed to transmit.

Transmitter transient period: The time period during which the transmitter is changing from the OFF period to the ON period or vice versa.

Unsynchronized operation: Operation of TDD in two different systems, where the conditions for synchronized operation are not met.

Uplink operating band: The part of the operating band designated for uplink.

Upper RF bandwidth edge: The frequency of the upper edge of the Base Station RF bandwidth, used as a frequency reference point for transmitter and receiver requirements.

Upper sub-block edge: The frequency at the upper edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

3.2 Symbols iTech STANDARD PREVIEW

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

| | |
|---------------------------|---|
| α | Roll-off factor |
| β | Percentage of the mean transmitted power emitted outside the occupied bandwidth on the assigned channel |
| BW_{Channel} | Channel bandwidth (for E-UTRA) |
| BW_{Config} | Transmission bandwidth configuration (for E-UTRA), expressed in MHz, where $BW_{\text{Config}} = N_{\text{RB}} \times 180$ kHz in the uplink and $BW_{\text{Config}} = 15$ kHz + $N_{\text{RB}} \times 180$ kHz in the downlink. |
| BW_{RF} | Base Station RF bandwidth, where $BW_{\text{RF}} = F_{\text{BW RF,high}} - F_{\text{BW RF,low}}$ |
| $BW_{\text{RF,max}}$ | Maximum Base Station RF bandwidth |
| CA_X | CA for band X where X is the applicable E-UTRA operating band |
| CA_X-Y | CA for band X and Band Y where X and Y are the applicable E-UTRA operating band |
| DwPTS | Downlink part of the special subframe (for E-UTRA TDD operation) |
| f | Frequency |
| Δf | Separation between the Base Station RF bandwidth edge frequency and the nominal -3dB point of the measuring filter closest to the carrier frequency |
| Δf_{max} | The largest value of Δf used for defining the requirement |
| F_{C} | Carrier centre frequency |
| F_{filter} | Filter centre frequency |
| f_{offset} | Separation between the Base Station RF bandwidth edge frequency and the centre of the measuring filter |
| $f_{\text{offset,max}}$ | The maximum value of f_{offset} used for defining the requirement |
| $F_{\text{block,high}}$ | Upper sub-block edge, where $F_{\text{block,high}} = F_{\text{C,block,high}} + F_{\text{offset,RAT}}$ |
| $F_{\text{block,low}}$ | Lower sub-block edge, where $F_{\text{block,low}} = F_{\text{C,block,low}} - F_{\text{offset,RAT}}$ |
| $F_{\text{BW RF,high}}$ | Upper RF bandwidth edge, where $F_{\text{BW RF,high}} = F_{\text{C,high}} + F_{\text{offset,RAT}}$ |
| $F_{\text{BW RF,low}}$ | Lower RF bandwidth edge, where $F_{\text{BW RF,low}} = F_{\text{C,low}} - F_{\text{offset,RAT}}$ |
| $F_{\text{C,block,high}}$ | Center frequency of the highest transmitted/received carrier in a sub-block. |
| $F_{\text{C,block,low}}$ | Center frequency of the lowest transmitted/received carrier in a sub-block. |
| $F_{\text{C,high}}$ | Center frequency of the highest transmitted/received carrier. |
| $F_{\text{C,low}}$ | Center frequency of the lowest transmitted/received carrier. |
| $F_{\text{offset,RAT}}$ | Frequency offset from the centre frequency of the <i>highest</i> transmitted/received carrier to the <i>upper</i> RF bandwidth edge or sub-block edge, or from the centre frequency of the <i>lowest</i> transmitted/received carrier to the <i>lower</i> RF bandwidth edge or sub-block edge for a specific RAT. |
| $F_{\text{DL,low}}$ | The lowest frequency of the downlink operating band |