

TEST REPORT
No.: 6-0315-13-1-3c

According to:
FCC Regulations
Part 22, Part 24, Part 27

IC-Regulations
RSS-132 Issue 3, RSS-133 Issue 6
RSS-139 Issue 2, RSS-Gen Issue 3

for

Peiker Acoustic GmbH & Co. KG

GSM/W-CDMA/LTE Module V1140-101
+ Antenna US34105
(LTE-Mode Band II/IV/V/XVII)

FCC-ID: QWY-V1140-101
IC: 6588A-V1140101







| Laboratory Accreditation and Listings | | | |
|--|--|---|---|
|  DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-01 |  FCC FEDERAL COMMUNICATIONS COMMISSION U.S.A. Reg. No.: 736496 MRA US-EU 0003 |  Industry Canada Reg. No.: 3462D-1 Reg. No.: 3462D-2 Reg. No.: 3462D-3 |  VCEI Voluntary Controls for Electromagnetic Emissions Reg. No.: R-2666 C-2914, T-1967, G-301 |
|  WiFi ALLIANCE AUTHORIZED RF LABORATORY |  CTIA Authorized Test Lab LAB CODE 20011130-00 | | |
| accredited according to DIN EN ISO/IEC 17025 | | | |
| CETECOM GmbH Laboratory Radio Communications & Electromagnetic Compatibility Im Teelbruch 116 • 45219 Essen • Germany Registered in Essen, Germany, Reg. No.: HRB Essen 8984 Tel.: + 49 (0) 20 54 / 95 19-954 • Fax: + 49 (0) 20 54 / 95 19-964 E-mail: info@cetecom.com • Internet: www.cetecom.com | | | |

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The listed attachments are an integral part of this report.

1. Summary of test results

The test results apply exclusively to the test samples as presented in this report. The CETECOM GmbH does not assume responsibility for any conclusions and generalizations taken in conjunction with other specimens or samples of the type of the item presented to tests.

The Equipment Under Test (in this report, hereinafter referred as EUT) supports radiofrequency technologies. The presented wireless module includes GPRS/(E)GPRS, W-CDMA and LTE wireless technology. This test report shows results for LTE technologies only. Other implemented wireless technologies were not considered within this test report.

Following tests have been performed to show compliance with applicable FCC Part 2, Part 22, Subpart H, Part 27, Subpart C and Part 24, Subpart E (Broadband PCS) of the FCC CFR 47 Rules, Edition 1st October 2012 and Canada RSS-132, RSS-133, RSS-139 and RSS-Gen standards.

1.1. TX mode, tests overview according FCC and Canadian RSS-Standards

| No. of Diagram group | Test case | Port | References & Limits | | | EUT set-up | EUT op-mode | Result |
|----------------------|---|--|---|---|--|------------|-------------|------------|
| | | | FCC Standard | RSS Section | Test limit | | | |
| 1 | AC-Power Lines Emissions Conducted (0,15 - 30 MHz) | AC-Power lines (conducted) | §15.207 | RSS-Gen, Issue 3: Chapter 7.2.4 | §15.207 limits IC: Table 4, Chapter 7.2.4 | -- | -- | Remark 1.) |
| 2 | General field strength emissions (9 kHz - 30 MHz) | Cabinet + inter-connecting cables (radiated) | §15.209(a) | RSS-Gen, Issue 3: Chapter 4.11 Chapter 7.2.5, Table 5+6 | 2400/F(kHz) µV/m 24000/F(kHz) µV/m 30 µV/m | -- | -- | Remark 1.) |
| 7 | RF-Power (ERP/EIRP) | | §2.1046 §22.913(a)(2) | RSS-132: 5.4 SRSP-503: 5.1.3 | < 7 Watt (ERP) | 2 | 3 | passed 2.) |
| | | | §24.232(c) | RSS-133:4.1/6.4 SRSP-510: 5.1.2 | < 2 Watt (EIRP) | | 1 | |
| | | | §27.50 (d)(4)(5)(6) | RSS-139: 6.4 | < 1 Watt (EIRP) | | 2 | |
| | | | §27.50(c)(10) | RSS-130: 4.4 | < 3 Watt (ERP) < 5 Watt (IC) | | 4 | |
| 8 | Spurious emissions | §2.1053(a) §2.1057 §22.917(a)(b) §24.238(a)(b) §27.53(h)(3) (ii)(iii) | RSS-132: 4.5.1 & 4.5.2 RSS-133: 6.5.1(a)(b) RSS-139: Issue 2 Chapter 6.5 (i) (ii) | 43+10log(P) dBc | 1+2 | 1+2+3 | Passed 2.) | |
| 9 | Band-Edge compliance | §27.53(g) | RSS-130: Issue 1 Chapter 4.6.1/4.6.2(b) | | 1+2 | 4 | Passed 2.) | |

| | | | | | | | | |
|----|-------------------------|---------------------------------|---|---|------------------------|---|---------|-----------------------|
| 30 | RF Power | Antenna terminal (conducted) | §2.1046 | RSS-130 | < 5 Watt & PAPR < 13dB | 3 | 1+2+3+4 | Passed |
| 34 | 26dB Emission bandwidth | | §2.202 §2.1049 §22.917(a) §24.238(a) §27.53(h)(3) | RSS-Gen:4.6.1 | 99% Power | 1 | 1+2+3+4 | For information only |
| 35 | 99% Occupied bandwidth | | | | | | | |
| 36 | Spurious emissions | | §2.1051 §2.1057 §22.917(a)(b) §24.238(a)(b) §27.53(h)(3) (ii)(iii) | RSS-132: 5.5(i)(ii) RSS-133: 6.5.1(i)(ii) RSS-139: 6.5(i)(ii) | 43+10log(P) dBc | 1 | 1+2+3 | Passed ^{2.)} |
| 37 | Band-Edge compliance | | §27.53(g) | RSS-130: 4.6.1 | | | | |
| 38 | Frequency stability | | §22.355, table C-1 §24.235 §2.1055(a)(2) §27.54 | RSS-132: 5.3 -- RSS-133: 6.3 RSS-139: 6.3 | < ±2.5ppm | 3 | 1+2+3+4 | Passed ^{2.)} |

Remarks: 1.) see separate test report TR6-0315-13-1-3d for tests according FCC Part15C
 2.) for tests according RSS-130 (LTE Band XVII) pls. check also separate test report TR6-0315-13-1-9c for additional measurements

Attestation:

I declare that all measurements were performed by me or under my supervision and that all measurements have been performed and are correct to my best knowledge and belief to Industry Canada standards. All requirements as shown in above table are met in accordance with enumerated standards.

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Responsible for test section

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Dipl.-Ing. C. Lorenz
Responsible for test report

2. Administrative Data

2.1. Identification of the testing laboratory

| | |
|-------------------------------------|--|
| Company name: | CETECOM GmbH |
| Address: | Im Teelbruch 116 45219 Essen - Kettwig Germany |
| Responsible for testing laboratory: | Dipl.-Ing. Niels Jeß |
| Deputy: | Dipl.-Ing. Rachid Acharkaoui |

2.2. Test location

2.2.1. Test laboratory “CTC”

| | |
|---------------|---|
| Company name: | see chapter 2.1. Identification of the testing laboratory |
|---------------|---|

2.3. Organizational items

| | |
|---|--------------------------|
| Responsible for test report and project leader: | Dipl.-Ing. C. Lorenz |
| Receipt of EUT: | 2013-06-05 |
| Date(s) of test: | 2013-06-05 to 2013-07-17 |
| Date of report: | 2013-07-27 |
| Lorenz | |

2.4. Applicant’s details

| | |
|-------------------|--|
| Applicant’s name: | Peiker Acoustic GmbH & Co. KG |
| Address: | Max-Planck-Straße 28-32 61381 Friedrichsdorf/Ts. Germany |
| Contact person: | Mr. Philippe Seguret |

2.5. Manufacturer’s details

| | |
|----------------------|--------------------------------|
| Manufacturer’s name: | please see Applicant's details |
| Address: | please see Applicant's details |

3. Equipment under test (EUT)

3.1. SUMMARY OF RESULTS AND TECHNICAL DATA OF MAIN EUT DECLARED BY APPLICANT-

| | | | |
|---|---|--|--|
| Main function | GSM/W-CDMA/LTE Module | | |
| Type | V1140-101 | | |
| TX-frequency range (E-UTRA operating bands) | LTE Band 2: 1850 - 1910 MHz (Uplink), 1930-1990 MHz (Downlink) LTE Band 4: 1710 - 1755 MHz (Uplink), 2110 - 2155 MHz (Downlink) LTE Band 5: 824 - 849 MHz (Uplink), 869-894 MHz (Downlink) LTE Band 17: 704 - 716 MHz (Uplink), 734 - 746 MHz (Downlink) | | |
| Type of modulation | QPSK, 16-QAM | | |
| Data rates | Cat3, Downlink: max. 100Mbps, Uplink: max. 50Mbps | | |
| Number of channels – Table 5.4.4-1 accord. 3GPP TS36.521-1 | LTE Band 2: UARFCN range 18600 - 19199 LTE Band 4: UARFCN range 19950 - 20399 LTE Band 5: UARFCN range 20400 - 20649 LTE Band 17: UARFCN range 23730 - 23849 | | See Note about channels not to be used depending on channel bandwidths |
| Emission designator(s) (Max. Value across all operating bands) | Channel bandwidth | QPSK Modulation: | 16-QAM Modulation |
| | 1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz | 1M08G7D 2M69G7D 4M47G7D 8M92G7D 13M4G7D 17M8G7D | 1M08W7D 2M69W7D 4M46W7D 8M92W7D 13M4W7D 17M8W7D |
| Antenna Type | <input type="checkbox"/> Integrated <input type="checkbox"/> External, no RF- connector <input checked="" type="checkbox"/> External, separate RF-connector: main TX + secondary RX connector | | |
| Antenna Gain | No information from customer | | |
| MAX PEAK Output Power: Radiated | LTE-Mode 2 LTE-Mode 4 LTE-Mode 5 LTE-Mode 17 | 32.3 dBm (PK) 29.2 dBm (PK) 28.8 dBm (PK) 28.5 dBm (PK) | |
| MAX PEAK Output Power: Conducted | LTE-Mode 2 LTE-Mode 4 LTE-Mode 5 LTE-Mode 17 | 23.67 dBm (AV) 24.03 dBm (AV) 23.35 dBm (AV) 23.17 dBm (AV) | |
| FCC-ID | QWY-V1140-101 | | |
| IC | 6588A-V1140101 | | |
| Installed option | <input checked="" type="checkbox"/> GSM 900 and GSM 1800 Bands (not usable in USA/Canada) <input checked="" type="checkbox"/> GPS (not tested within this test report) | | |
| Power supply | <input checked="" type="checkbox"/> DC power only: 3.7V by external laboratory power supply | | |
| Special EMI components | -- | | |
| EUT sample type | <input type="checkbox"/> Production | <input checked="" type="checkbox"/> Pre-Production | <input type="checkbox"/> Engineering |
| FCC label attached | <input type="checkbox"/> yes | <input checked="" type="checkbox"/> no | |

3.2. EUT: Type, S/N etc. and short descriptions used in this test report

| Short description*) | EUT | Type | S/N serial number | HW hardware status | SW software status |
|---------------------|-----------------------|-----------|------------------------|--------------------|---------------------------|
| EUT A | GSM/W-CDMA/LTE Module | V1140-101 | US#405V1140-101 HW1613 | 3.0 | M9615A-CETWTAZM-5.0.17006 |
| EUT B | Antenna | US34105 | #34105 US | A02 | -- |
| EUT C | Antenna | US34105 | #34105 US | A03 | -- |
| EUT D | GSM/W-CDMA/LTE Module | V1140-101 | US#406V1140-101HW1613 | 3.0 | M9615A-CETWTAZM-5.0.17006 |

*) EUT short description is used to simplify the identification of the EUT in this test report.

3.3. Auxiliary Equipment (AE): Type, S/N etc. and short descriptions

| AE short description *) | Auxiliary Equipment | Type | S/N serial number | HW hardware status | SW software status |
|-------------------------|--------------------------|-------------|-------------------|--------------------|--------------------|
| AE 1 | LTE-NAD Evaluation Board | Test board | -- | -- | -- |
| AE 2 | KL1/B | Microphone | -- | -- | -- |
| AE 3 | Speaker | Loudspeaker | -- | -- | -- |
| AE 4 | USB cable | -- | -- | -- | -- |

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

3.4. EUT set-ups

| EUT set-up no. *) | Combination of EUT and AE | Remarks |
|-------------------|---|--|
| set. 1 | EUT A + EUT B + AE 1 + AE 2 + AE 3 + AE 4 | Radiated and conducted tests performed |
| set. 2 | EUT A + EUT C + AE 1 + AE 2 + AE 3 + AE 4 | Re-Tests performed: radiated tests |
| set. 3 | EUT D + AE 1 + AE 2+ AE 3+ AE 4 | Conducted tests performed: frequency error |

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

3.5. EUT operating modes

| EUT operating mode no. *) | Description of operating modes | Additional information |
|---------------------------|--------------------------------|--|
| 1 | LTE-Band 2 RMC Mode | A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. |
| 2 | LTE-Band 4 RMC Mode | A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. |
| 3 | LTE-Band 5 RMC Mode | A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. |
| 4 | LTE-Band 17 RMC Mode | A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. |

*) EUT operating mode no. is used to simplify the test report.

3.6. Configuration of cables used for testing

| Cable number | Item | Type | S/N serial number | HW hardware status | Cable length |
|--------------|-----------------|---------------|-------------------|--------------------|--------------|
| Cable 1 | Antenna lines | -- | -- | -- | 1.3 m |
| Cable 2 | USB line | -- | -- | -- | 1.5 m |
| Cable 3 | Audio line | -- | -- | -- | 1.5 m |
| Cable 4 | Microphone line | -- | -- | -- | 0.1 m |
| Cable 5 | Power line | DC power line | -- | -- | 1.5m |

Remarks:--

4. Description of test system set-up's

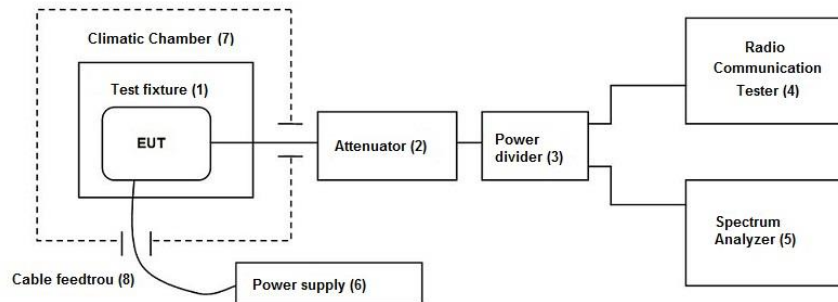
4.1. Test system set-up for conducted measurements on antenna port

Specification: ANSI C63.10:2009

General Description: The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) before it is 0° divided by a power divider (3). One of the signal path is connected to the radio communication tester (4), other branch is connected to the spectrum – analyzer (5). The specific attenuation losses for both signal paths/branches are determined prior to the measurement within a set-up calibration. These are then taken into account by correcting the measurement readings on the spectrum-analyzer.

Schematic: Following modified test set-up schematic apply for tests performed inside the climatic chamber: (Frequency stability)

In case **an external connector is available (test fixture)**, following set-up is used for measurements.



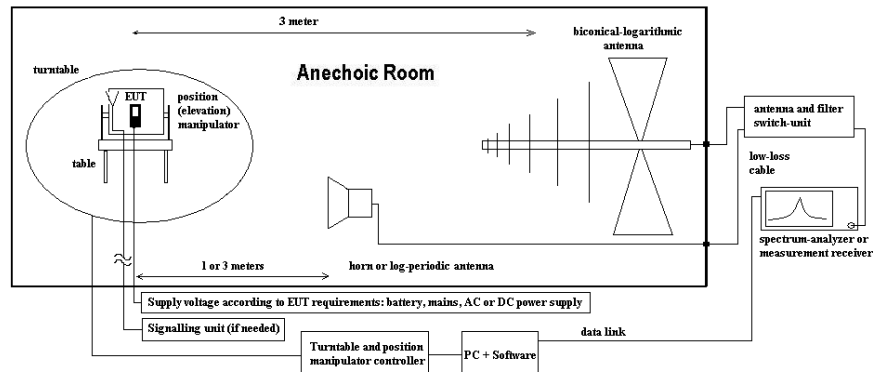
Testing method: Accord. Spec.

4.2. Test system set-up for radiated spurious emission measurements

Specification: ANSI C63.4-2009 chapter 8, ANSI C63.10-2009 chapter 6.5&6.6

General Description: Evaluating the field emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a CISPR 16-4 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 20 GHz and 1 meter above 20 GHz. A logarithmic periodic antenna is used for the frequency range 30 MHz to 20 GHz. From 20 GHz to 40 GHz a horn antenna is used. The antennas are set to fixed antenna height of 1.55 m and the EUT aligned within 3 dB cone of radiation pattern.

Schematic:



Testing method:

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.55 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 45°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by maintaining the EUT's worst-case operation mode, cable position, etc.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined. Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position). The measurement antenna height is fixed to 1.55 m.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

The readings on the spectrum analyzer are corrected with conversion value between field strength and E(I)RP, so the readings shown are equivalent to ERP/EIRP values. Critical measurements near the limit are re-measured with a substitution method accord. ANSI/TIA/EIA 603 C/D

Formula:

$$E_C = E_R + AF + C_L + D_F - G_A \quad (1)$$

$$E_{C(E)IRP} = E_C - 95.2 \text{ dB}$$

$$M = L_T - E_{C(E)IRP}$$

E_C = Electrical field – corrected value

E_R = Receiver reading

M = Margin

L_T = Limit

AF = Antenna factor

C_L = Cable loss

D_F = Distance correction factor (if used)

G_A = Gain of pre-amplifier (if used)

$E_{C(E)IRP}$ = Electrical field corrected for E(I)RP

All units are dB-units, positive margin means value is below limit.

5. Measurements

5.1. RF-Parameter - RF Peak power output radiated

5.1.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

| | | | |
|-----------------|--|--|--|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2 | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| test site | <input type="checkbox"/> 441 EMI SAR | <input type="checkbox"/> 487 SAR NSA | <input checked="" type="checkbox"/> 443 FAR |
| receiver | <input type="checkbox"/> 377 ESCS30 | <input type="checkbox"/> 001 ESS | <input type="checkbox"/> 489 ESU 40 |
| spectr. analys. | <input type="checkbox"/> 584 FSU | <input type="checkbox"/> 120 FSEM | <input checked="" type="checkbox"/> 264 FSEK |
| antenna | <input type="checkbox"/> 574 BTA-L | <input type="checkbox"/> 133 EMCO3115 | <input type="checkbox"/> 302 BBHA9170 |
| signalling | <input type="checkbox"/> 392 MT8820A | <input type="checkbox"/> 436 CMU | <input checked="" type="checkbox"/> 546 CMU |
| otherwise | <input type="checkbox"/> 400 FTC40x15E | <input type="checkbox"/> 401 FTC40x15E | <input type="checkbox"/> 110 USB LWL |
| DC power | <input type="checkbox"/> 456 EA 3013A | <input checked="" type="checkbox"/> 463 HP3245A | <input type="checkbox"/> 459 EA 2032-50 |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | | <input type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000 |

5.1.2. Requirements and limits

| | |
|--------------|--|
| FCC | §2.1046(a), §22.913, § 24.232(c); §27.50(d)(4), §27.50(c)(10) |
| IC | RSS-132: 5.4 + SRSP 503:5.1.3 for FDD Band 5; RSS-133:4.1/6.4 + SRSP-510:5.1.2 for FDD Band 2 RSS-139, Issue 2: 6.4 + PAR PK-AV ≤ 13 dB |
| Limit | Maximum Power Output of the mobile phone should be determined while measured radiated E(IRP). |
| | Limit LTE Band 5: 7 Watt ERP (38.4 dBm) |
| | Limit LTE Band 2: 2 Watt EIRP (33.0 dBm) |
| | Limit LTE Band 4: 1 Watt EIRP (30.0 dBm) |
| | Limit LTE Band 17: FCC 3 Watt ERP (34.7 dBm) |

5.1.3. Test condition and test set-up

| | | | |
|--------------------------------|---|--|--|
| link to test system (if used): | <input checked="" type="checkbox"/> air link | <input type="checkbox"/> cable connection | <input type="checkbox"/> |
| EUT-grounding | <input checked="" type="checkbox"/> none | <input type="checkbox"/> with power supply | <input type="checkbox"/> additional connection |
| Equipment set up | <input checked="" type="checkbox"/> table top | | <input type="checkbox"/> floor standing |
| Climatic conditions | Temperature: (22±3°C) | | Rel. humidity: (40±20)% |
| Test system set-up | Please see chapter "Test system set-up for radiated spurious emission measurements up to 20 GHz" | | |
| Spectrum Analyzer Settings | Parameter: Scan Mode Span RBW VBW Sweep time Sweep mode Detector | Spectrum analyser mode 100 MHz 10 MHz 10 MHz Coupled repetitive Peak | |
| Measurement method | <p>The measurements were performed by using the substitution method (ANSI/TIA/EIA 603C/D) with a spectrum-analyzer. This method can be described like follows:</p> <ol style="list-style-type: none"> choosing of suitable spectrum-analyzer settings for performing the measurements. This settings of the spectrum analyzer must be maintained for both stages of the measurements: EUT emission measurements and also for measurements of the substituted level. The maximum level of the peak power was recorded, while the emissions were maximized by rotating the EUT in three orthogonal axes, which was situated on a non-conductive turntable of 1.55 m height ($P_{MEAS,1}$). This was performed for both measuring antenna polarisations (vertical/horizontal), the maximum of both values is used for further measurements and final substitution ($P_{MEAS,1,MAX}$). As the maximum emission is recorded, the EUT is replaced by a frequency dependant suitable antenna, which is connected to a RF-signal generator, which is transmitting on the determined worst-case frequency as determined in step 2. The RF-signal level of the signal generator is adjusted as long the same worst-case level determined first step is measured at the spectrum analyzer ($P_{SMHU}=P_{MEAS,1,MAX}$). Then the RF-signal cable is disconnected from the antenna and connected to a power-level meter. The level is determined ($P_{MEAS,2}$). The final result is calculated by adding the ERP/EIRP gain of the antenna which substitutes the EUT. $P_{EUT,SUBST} = P_{MEAS,2} + G_{ANTENNA}$ | | |
| Mobile phone settings | <p>A call was established on highest power transmit conditions in RMC mode. MPR was deactivated.</p> <p>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band within the designated range within the allowed channel bandwidths. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.</p> | | |

5.1.4. Results

Worst-Case channel, Signal bandwidth and resource block configuration from conducted tests cases, re-tested in order to have ERP. and EIRP values.

| EUT | | | Set-up 1, Op.Mode 1 | | | | |
|----------------|---------|-------|-------------------------|-----|------------|--|--------|
| Operating Mode | Channel | | Peak Output Power [dBm] | | | Antenna Polarisation for maximum Power | Result |
| | Range | No. | PK | AV | | | |
| LTE Band 2 | Low | 18700 | 30.0 | 1.) | EIRP-Value | V | pass |
| | Middle | 18900 | 30.2 | | | | |
| | High | 19100 | 32.3 | | | | |

Remark: 1.) see conducted measurements for PAR factor

| EUT | | | Set-up 1, Op.Mode 2 | | | | |
|----------------|---------|-------|-------------------------|-----|------------|--|--------|
| Operating Mode | Channel | | Peak Output Power [dBm] | | | Antenna Polarisation for maximum Power | Result |
| | Range | No. | PK | AV | | | |
| LTE Band 4 | Low | 19957 | 29.2 | 1.) | EIRP-Value | V | pass |
| | Middle | 20175 | 28.9 | | | | |
| | High | 20393 | 25.8 | | | | |

Remark: 1.) see conducted measurements for PAR factor

| EUT | | | Set-up 1, Op.Mode 3 | | | | |
|----------------|---------|-------|-------------------------|-----|-----------|--|--------|
| Operating Mode | Channel | | Peak Output Power [dBm] | | | Antenna Polarisation for maximum Power | Result |
| | Range | No. | PK | AV | | | |
| LTE Band 5 | Low | 20415 | 28.8 | 1.) | ERP-Value | H | pass |
| | Middle | 20525 | 27.5 | | | | |
| | High | 20635 | 28.0 | | | | |

Remark: 1.) see conducted measurements for PAR factor

| EUT | | | Set-up 2, Op.Mode 4 | | | | |
|----------------|---------|-------|-------------------------|-----|-----------|--|--------|
| Operating Mode | Channel | | Peak Output Power [dBm] | | | Antenna Polarisation for maximum Power | Result |
| | Range | No. | PK | AV | | | |
| LTE Band 17 | Low | 23755 | 27.8 | 1.) | ERP-Value | H | pass |
| | Middle | 23790 | 27.9 | | | | |
| | High | 23825 | 28.5 | | | | |

Remark: 1.) see conducted measurements for PAR factor

5.2. RF-Parameter - Radiated out of Band RF emissions and Band-Edge

5.2.1. Test location and equipments (for reference numbers please see chapter 'List of test equipment')

| | | | |
|-----------------|--|--|---|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2 | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| test site | <input type="checkbox"/> 441 EMI SAR | <input type="checkbox"/> 487 SAR NSA | <input checked="" type="checkbox"/> 443 FAR |
| receiver | <input type="checkbox"/> 377 ESCS30 | <input type="checkbox"/> 001 ESS | <input type="checkbox"/> 489 ESU 40 |
| spectr. analys. | <input type="checkbox"/> 584 FSU | <input type="checkbox"/> 120 FSEM | <input checked="" type="checkbox"/> 264 FSEK |
| antenna | <input checked="" type="checkbox"/> 608 HL 562 | <input checked="" type="checkbox"/> 549 HL 025 | <input type="checkbox"/> 302 BBHA9170 |
| signaling | <input type="checkbox"/> 017 CMD 65 | <input type="checkbox"/> 323 CMD 55 | <input type="checkbox"/> 340 CMD 55 |
| signaling | <input type="checkbox"/> 392 MT8820A | <input type="checkbox"/> 546 CMU | <input type="checkbox"/> 547 CMU |
| power supply | <input checked="" type="checkbox"/> 611 E3632A | <input type="checkbox"/> 457 EA 3013A | <input type="checkbox"/> 459 EA 2032-50 |
| otherwise | <input type="checkbox"/> 529 6dB divider | <input type="checkbox"/> 530 6dB Att. | <input type="checkbox"/> 110 USB LWL |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | | <input checked="" type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000 |

5.2.2. Requirements and limits

| | |
|--------------|--|
| FCC | §2.1053(a)-radiated , §2.1057(a)(a) , §22.917(a)(b) ; §24.238(a)(b) ; §27.53(h)(1)(3)(i)(ii)(iii) §27.53(g) |
| IC | RSS-132, Issue 2: 4.5.1.2, RSS-133, Issue 4: 6.5.1(a)(i)&(b), RSS-139, Issue 2: 6.5 (i)(ii) |
| Limit | „the power of emissions shall be attenuated below the transmitter output power (p) by at least 43+10Log(P) dB“ -> Resulting limits for all power levels of the Mobile Phone: -13dBm |

5.2.3. Test condition and test set-up

| | | | |
|--------------------------------|--|--|--|
| link to test system (if used): | <input checked="" type="checkbox"/> air link | <input type="checkbox"/> cable connection | <input type="checkbox"/> |
| EUT-grounding | <input checked="" type="checkbox"/> none | <input type="checkbox"/> with power supply | <input type="checkbox"/> additional connection |
| Equipment set up | <input checked="" type="checkbox"/> table top | | <input type="checkbox"/> floor standing |
| Climatic conditions | Temperature: (22±3°C) | | Rel. humidity: (40±20)% |
| Test system set-up | Please see chapter “Test system set-up for radiated spurious emission measurements up to 20 GHz” | | |
| Spectrum Analyzer Settings | Parameters: Scan Mode RBW VBW Sweep time Sweep mode Detector | Spectrum analyser mode 1 MHz 10 MHz Coupled repetitive Peak | |
| Measurement method | The spectrum was scanned from 9 kHz to the 10th harmonic of the highest frequency generated within the equipment. A PEAK detector was used except measurements near the block-edge where a AVERAGE detector applied when results are critical (low margin or limit exceed). Tests have been performed in various settings for the device regarding allocated resource blocks and channels in order to find worst-case configuration. Due to very big amount of possible combinations only certain combinations have been tested. | | |
| Mobile phone settings | A call was established on highest power transmit conditions in RMC mode. MPR was deactivated. The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band within the designated range within the allowed channel bandwidths. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance. | | |

Spectrum-Analyzer settings for LTE band 2

| | Start freq. MHz | Stop freq. MHz | R-BW MHz | V-BW MHz | Sweep time sec. | Att. [dB] | Detector |
|-----------------------|-----------------|----------------|----------|----------|-----------------|-----------|----------|
| Sweep 1 (subrange 1) | 30 | 1000 | 1 | 1 | 10 | 10 | MaxH-PK |
| Sweep 1 (subrange 2) | 1000 | 2800 | 1 | 1 | 15 | 0 | MaxH-PK |
| Sweep 1 (subrange 3) | 2800 | 20000 | 1 | 1 | 60 | 10 | MaxH-PK |
| Sweep 2a (Block-Edge) | 1849 | 1850 | 0.03 | 0.3 | 30 | 35 | MaxH-PK |
| Sweep 2b (Block-Edge) | 1849 | 1850 | 0.03 | 0.3 | 30 | 35 | MaxH-AV |
| Sweep 3a (Block-Edge) | 1910 | 1911 | 0.03 | 0.3 | 30 | 35 | MaxH-PK |
| Sweep 3b (Block-Edge) | 1910 | 1911 | 0.03 | 0.3 | 30 | 35 | MaxH-AV |

Spectrum-analyzer settings for FDD Band 4

| | Start freq. MHz | Stop freq. MHz | R-BW MHz | V-BW MHz | Sweep time sec. | Att. | Detector |
|-----------------------|-----------------|----------------|----------|----------|-----------------|------|----------|
| Sweep 1 (subrange 1) | 30 | 1000 | 1 | 10 | 10 | 10 | MaxH-PK |
| Sweep 1 (subrange 2) | 1000 | 2800 | 1 | 10 | 15 | 0 | MaxH-PK |
| Sweep 1 (subrange 3) | 2800 | 18000 | 1 | 10 | 160 | 10 | MaxH-PK |
| Sweep 2a (Block-Edge) | 1709 | 1710 | 0.03 | 0.3 | 30 | 35 | MaxH-PK |
| Sweep 2b (Block-Edge) | 1709 | 1710 | 0.03 | 0.3 | 30 | 35 | MaxH-AV |
| Sweep 3a (Block-Edge) | 1755 | 1756 | 0.03 | 0.3 | 30 | 35 | MaxH-PK |
| Sweep 3b (Block-Edge) | 1755 | 1756 | 0.03 | 0.3 | 30 | 35 | MaxH-AV |

Spectrum-analyzer settings for LTE Band 5

| | Start freq. MHz | Stop freq. MHz | R-BW MHz | V-BW MHz | Sweep time sec. | Att. | Detector |
|-----------------------|-----------------|----------------|----------|----------|-----------------|------|----------|
| Sweep 1 (subrange 1) | 30 | 1000 | 1 | 1 | 10 | 10 | MaxH-PK |
| Sweep 1 (subrange 2) | 1000 | 2800 | 1 | 1 | 15 | 0 | MaxH-PK |
| Sweep 1 (subrange 3) | 2800 | 9000 | 1 | 1 | 160 | 10 | MaxH-PK |
| Sweep 2a (Block-Edge) | 823 | 824 | 0.02 | 0.2 | 30 | 35 | MaxH-PK |
| Sweep 2b (Block-Edge) | 823 | 824 | 0.02 | 0.2 | 30 | 35 | MaxH-AV |
| Sweep 3a (Block-Edge) | 850 | 851 | 0.02 | 0.2 | 30 | 35 | MaxH-PK |
| Sweep 3b (Block-Edge) | 850 | 851 | 0.02 | 0.2 | 30 | 35 | MaxH-AV |

Spectrum-analyzer settings for LTE Band 17

| | Start freq. MHz | Stop freq. MHz | R-BW MHz | V-BW MHz | Sweep time sec. | Att. | Detector |
|-----------------------|-----------------|----------------|----------|----------|-----------------|------|----------|
| Sweep 1 (subrange 1) | 30 | 1000 | 1 | 1 | 10 | 10 | MaxH-PK |
| Sweep 1 (subrange 2) | 1000 | 2800 | 1 | 1 | 15 | 0 | MaxH-PK |
| Sweep 1 (subrange 3) | 2800 | 9000 | 1 | 1 | 160 | 10 | MaxH-PK |
| Sweep 2a (Block-Edge) | 703 | 704 | 0.05 | 0.5 | 30 | 35 | MaxH-PK |
| Sweep 2b (Block-Edge) | 703 | 704 | 0.05 | 0.5 | 30 | 35 | MaxH-AV |
| Sweep 3a (Block-Edge) | 716 | 717 | 0.05 | 0.5 | 30 | 35 | MaxH-PK |
| Sweep 3b (Block-Edge) | 716 | 717 | 0.05 | 0.5 | 30 | 35 | MaxH-AV |

5.2.4. Results

The results are presented below in summary form only. For more information please see the diagrams enclosed in annex 4.

5.2.4.1. LTE Band 2: Op. Mode 1, Set-up 1

| Diagram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|-------|------------------|-------------|--|-------------------------------------|-------------------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 8.20a | Low | 18607 | 30 MHz to 20 GHz | 1 | Carrier visible on diagram. Not relevant for results QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.20b | Low | 18607 | 30 MHz to 20 GHz | 1 | Carrier visible on diagram. Not relevant for results 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.203a | Low | 18615 | 1849 – 1850 MHz | 1 | Band-Edge compliance QPSK modulation Remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.203b | Low | 18615 | 1849 – 1850 MHz | 1 | Band-Edge compliance QAM modulation Remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.21a | Middle | 18900 | 30 MHz to 20 GHz | 1 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.21b | Middle | 18900 | 30 MHz to 20 GHz | 1 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.22 | High | 19100 | 30 MHz to 20 GHz | 1 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.215a | High | 19185 | 1910 – 1911 MHz | 1 | Band-Edge compliance QPSK modulation Remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.215b | High | 19185 | 1910 – 1911 MHz | 1 | Band-Edge compliance QAM modulation Remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |

Remark1: LTE EUT channel bandwidth of 3MHz was chosen as worst-case as determined within the conducted band-edge measurements

5.2.4.2. LTE Band 2: Op. Mode 1, Set-up 2

| Diagram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|-------|------------------|-------------|--|-------------------------------------|--------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 8.23 | Middle | 18900 | 30 MHz to 20 GHz | 1 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: re-tests with EUT C

5.2.4.3. LTE Band 4: Op. Mode 2, Set-up 1

| Dia-gram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|--------------|-----------------|-------|------------------|-------------|---|-------------------------------------|-------------------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 8.40 | Low | 19957 | 30 MHz to 20 GHz | 2 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.520a | Low | 19965 | 1709 - 1710 MHz | 2 | Band Edge Compliance QPSK modulation, remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.520b | Low | 19965 | 1709 - 1710 MHz | 2 | Band Edge Compliance 16-QAM modulation, remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.41 | Middle | 20175 | 30 MHz to 20 GHz | 2 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.42 | High | 20300 | 30 MHz to 20 GHz | 2 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.532a | High | 20385 | 1755 – 1756 MHz | 2 | Band Edge Compliance QPSK modulation, remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.532b | High | 20385 | 1755 – 1756 MHz | 2 | Band Edge Compliance 16-QAM modulation remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |

Remark1: LTE EUT channel bandwidth of 3MHz was chosen as worst-case as determined within the conducted band-edge measurements

5.2.4.4. LTE Band 4: Op. Mode 2, Set-up 2

| Dia-gram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|--------------|-----------------|-------|---------------------|-------------|---|-------------------------------------|--------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 8.43 | Middle | 20175 | 30 MHz to 12.75 GHz | 2 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark1: re-tests with EUT C

5.2.4.5. LTE Band 5: Op. Mode 3, Set-up 1

| Diagram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|-------|-----------------|-------------|---|-------------------------------------|-------------------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 8.50a | Low | 20407 | 30 MHz to 9 GHz | 3 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.50b | Low | 20407 | 30 MHz to 9 GHz | 3 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.506a | Low | 20415 | 823 – 824 MHz | 3 | Band Edge Compliance QPSK modulation, remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.506b | Low | 20415 | 823 – 824 MHz | 3 | Band Edge Compliance 16-QAM modulation remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.51a | Middle | 20525 | 30 MHz to 9 GHz | 3 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.51b | Middle | 20525 | 30 MHz to 9 GHz | 3 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.52 | High | 20600 | 30 MHz to 9 GHz | 3 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.512a | Low | 20643 | 849 - 850 MHz | 3 | Band Edge Compliance QPSK modulation, remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.514b | Low | 20643 | 849 - 850 MHz | 3 | Band Edge Compliance 16-QAM modulation remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: LTE EUT Signal bandwidth of 3 or 5 MHz was chosen as worst-case as determined within the conducted band-edge measurements

5.2.4.6. LTE Band 5: Op. Mode 3, Set-up 2

| Diagram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|-------|-----------------|-------------|---|-------------------------------------|--------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 8.53 | Middle | 20525 | 30 MHz to 9 GHz | 3 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: re-tests with EUT C

5.2.4.7. LTE Band 17: Op. Mode 4 Set-up 1

| Diagram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|-------|-----------------|-------------|---|-------------------------------------|-------------------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 8.171a | Low | 23755 | 30 MHz to 1 GHz | 4 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.171a | Low | 23755 | 703 - 704 MHz | 4 | Band Edge Compliance QPSK modulation Remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.171b | Low | 23755 | 703 - 704 MHz | 4 | Band Edge Compliance 16-QAM modulation remark 1 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.172 | Middle | 23790 | 30 MHz to 9 GHz | 4 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.173 | High | 23800 | 30 MHz to 9 GHz | 4 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.175a | High | 23825 | 716 – 717 MHz | 4 | Band Edge Compliance QPSK modulation Remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.175b | High | 23825 | 716 – 717 MHz | 4 | Band Edge Compliance 16-QAM modulation remark 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: 1.) LTE EUT channel bandwidth of 5MHz used for measurements as worst-case as determined within the conducted band-edge measurements

5.2.4.8. LTE Band 17: Op. Mode 4 Set-up 2

| Diagram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|-------|-----------------|-------------|---|-------------------------------------|--------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 8.174 | Middle | 23790 | 30 MHz to 9 GHz | 4 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: re-tests with EUT C

5.3. RF-Parameter - RF Peak power output conducted

5.3.1. Test location and equipments (for reference numbers please see chapter 'List of test equipment')

| | | | | | |
|-----------------|--|--|--|--|--|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | | <input type="checkbox"/> Please see Chapter. 2.2.2 | | |
| test site | <input type="checkbox"/> 347 Radio.lab. 1 | <input checked="" type="checkbox"/> Radio.lab. 2 | | | |
| spectr. analys. | <input type="checkbox"/> 584 FSU | <input type="checkbox"/> 489 ESU 40 | <input type="checkbox"/> 264 FSEK | <input type="checkbox"/> 620 ESU 26 | |
| signaling | <input type="checkbox"/> 392 MT8820A | <input type="checkbox"/> 436 CMU | <input type="checkbox"/> 547 CMU | <input checked="" type="checkbox"/> 594 CMW500 | |
| otherwise | <input type="checkbox"/> 400 FTC40x15E | <input type="checkbox"/> 401 FTC40x15E | <input type="checkbox"/> 110 USB LWL | <input type="checkbox"/> 482 Filter Matrix | <input type="checkbox"/> 378 RadiSense |
| DC power | <input type="checkbox"/> 456 EA 3013A | <input type="checkbox"/> 463 HP3245A | <input type="checkbox"/> 459 EA 2032-50 | <input type="checkbox"/> 268 EA- 3050 | <input type="checkbox"/> 494 AG6632A |
| otherwise | <input type="checkbox"/> 331 HC 4055 | <input type="checkbox"/> 530 10 dB Att. | | <input type="checkbox"/> - cable OTA20 | <input checked="" type="checkbox"/> 611 E3632A |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | | <input type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000 | | |

5.3.2. Requirements and limits

| | |
|--------------|---|
| FCC | §2.1046 |
| IC | RSS-132:5.4 + SRSP 503:5.1.3 for FDD Band 5; RSS-133:4.1/6.4 + SRSP-510:5.1.2 for FDD Band 2 RSS-139, Issue 2: 6.4 + PAR PK-AV ≤ 13 dB |
| Limit | Maximum Power Output of the mobile phone should be determined while measured conducted. |
| | Limit LTE Band 5: 7 Watt ERP (38.4 dBm) |
| | Limit LTE Band 2: 2 Watt EIRP (33.0 dBm) |
| | Limit LTE Band 4: 1 Watt EIRP (30.0 dBm) |
| | Limit LTE Band 17: 3 Watt ERP (34.7dBm) |

5.3.3. Test condition and test set-up

| | | |
|-----------------------|--|-------------------------|
| Climatic conditions | Temperature: (22±3°C) | Rel. humidity: (40±20)% |
| Test system set-up | Please see chapter "Test system set-up for conducted measurements on antenna port" | |
| Measurement method | <p>The measurements were performed with the integrated power measurement function of the „radio communication tester CMU200 from Rohde&Schwarz company. In this way spectrum-analyzers instrument limitations can be avoided or minimized. Instead, CMU manufacturers declared measurement error can be considered for this measurement.</p> <p>The attenuation (insertion loss) at the RF Inputs/Outputs of CMU were set according the path loss of the test set-up, determined in a step before starting the measurements. A suitable artificial antenna or RF-connector is provided by the applicant in order to perform the conducted measurements. Any data provided with the artificial antenna or connector, have been taken in account in order to correct the measurement data. (typical 0.3dB for attenuation of antenna connector)</p> <p>Peak and Average Values have been recorded for each channel and band.</p> | |
| Mobile phone settings | <p>A call was established with a suitable communication test unit (CMW500). UE is set TX mode, highest transmit power conditions (RMC-mode), power saving techniques have been disabled (MPR-techniques)</p> <p>Tests have been performed in different EUT bandwidth settings and various settings for allocated RBs.</p> <p>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band within the designated range within the allowed channel bandwidths. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.</p> | |

5.3.4. Measurement Results
5.3.4.1. LTE Band 2 Results

| LTE-Band 2 (FCC Part 24) | | | | QPSK-Modulation | | | 16-QAM-Modulation | | | max- modulation | max. channel | absolute max. value |
|--------------------------|---------------|-----------------------|---------------------------|---------------------|--------------------|-----------------|---------------------|--------------------|-----------------|-----------------|--------------|---------------------|
| channel bandwidth | ARFCN ch. no. | ARFCN-Frequency [MHz] | Resource block allocation | Peak detektor [dBm] | RMS detektor [dBm] | PAR Faktor [dB] | Peak detektor [dBm] | RMS detektor [dBm] | PAR Faktor [dB] | | | |
| 1.4 MHz | 18607 | 1850,7 | 1 RB low | 27,57 | 23,35 | 4,22 | 27,36 | 22,69 | 4,67 | 28,27 | 28,37 | 29,02 |
| | | | 1 RB high | 27,6 | 23,24 | 4,36 | 27,33 | 22,59 | 4,74 | | | |
| | | | 50% RB mid | 28,02 | 23,33 | 4,69 | 28,27 | 22,33 | 0 | | | |
| | | | 100% RB | 27,97 | 22,31 | 5,66 | 28,09 | 21,42 | 6,67 | | | |
| | 18900 | 1880 | 1 RB low | 28,07 | 23,39 | 4,68 | 27,16 | 22,14 | 5,02 | 28,37 | | |
| | | | 1 RB high | 28,06 | 23,35 | 4,71 | 27,05 | 22,1 | 4,95 | | | |
| | | | 50% RB mid | 28,28 | 23,25 | 5,03 | 28,37 | 22,42 | 0 | | | |
| | | | 100% RB | 27,93 | 22,26 | 5,67 | 28,08 | 21,15 | 6,93 | | | |
| | 19193 | 1909,3 | 1 RB low | 26,78 | 22,95 | 3,83 | 26,28 | 21,97 | 4,31 | 27,49 | | |
| | | | 1 RB high | 26,69 | 22,89 | 3,8 | 26,19 | 21,77 | 4,42 | | | |
| | | | 50% RB mid | 27,19 | 23,01 | 4,18 | 27,49 | 21,94 | 0 | | | |
| | | | 100% RB | 27,24 | 21,98 | 5,26 | 27,3 | 21,11 | 6,19 | | | |
| 3 MHz | 18615 | 1851,5 | 1 RB low | 27,71 | 23,44 | 4,27 | 27,09 | 22,37 | 4,72 | 28,4 | | |
| | | | 1 RB high | 27,85 | 23,24 | 4,61 | 27,1 | 22,2 | 4,9 | | | |
| | | | 50% RB mid | 27,57 | 22,28 | 5,29 | 27,96 | 22,52 | 5,44 | | | |
| | | | 100% RB | 28,19 | 22,19 | 6 | 28,4 | 21,27 | 7,13 | | | |
| | 18900 | 1880 | 1 RB low | 27,96 | 23,07 | 4,89 | 27,46 | 22,35 | 5,11 | 28,78 | | |
| | | | 1 RB high | 27,82 | 23,16 | 4,66 | 27,34 | 22,25 | 5,09 | | | |
| | | | 50% RB mid | 27,93 | 22,23 | 5,7 | 28,4 | 22,41 | 5,99 | | | |
| | | | 100% RB | 28,78 | 22,12 | 6,66 | 28,28 | 21,22 | 7,06 | | | |
| | 19185 | 1908,5 | 1 RB low | 26,89 | 23,22 | 3,67 | 27,2 | 22,78 | 4,42 | 27,7 | | |
| | | | 1 RB high | 26,69 | 22,81 | 3,88 | 26,99 | 22,42 | 4,57 | | | |
| | | | 50% RB mid | 26,8 | 22,23 | 4,57 | 27,19 | 22,55 | 4,64 | | | |
| | | | 100% RB | 27,7 | 22 | 5,7 | 27,42 | 21,23 | 6,19 | | | |
| 5 MHz | 18625 | 1852,5 | 1 RB low | 27,54 | 23,5 | 4,04 | 27,74 | 22,73 | 5,01 | 28,43 | | |
| | | | 1 RB high | 27,87 | 23,45 | 4,42 | 28,2 | 22,87 | 5,33 | | | |
| | | | 50% RB mid | 27,91 | 22,34 | 5,57 | 27,86 | 22,24 | 5,62 | | | |
| | | | 100% RB | 28,32 | 22,14 | 6,18 | 28,43 | 21,13 | 7,3 | | | |
| | 18900 | 1880 | 1 RB low | 28,35 | 23,14 | 5,21 | 28,39 | 22,46 | 5,93 | 28,73 | | |
| | | | 1 RB high | 28,07 | 23,18 | 4,89 | 28,08 | 22,41 | 5,67 | | | |
| | | | 50% RB mid | 27,8 | 22,13 | 5,67 | 28,52 | 22,19 | 6,33 | | | |
| | | | 100% RB | 28,73 | 22,04 | 6,69 | 28,69 | 21,05 | 7,64 | | | |
| | 19175 | 1907,5 | 1 RB low | 27,12 | 23,19 | 3,93 | 26,63 | 22,12 | 4,51 | 27,96 | | |
| | | | 1 RB high | 26,72 | 22,8 | 3,92 | 26,25 | 21,74 | 4,51 | | | |
| | | | 50% RB mid | 27,34 | 22,15 | 5,19 | 27,4 | 22,34 | 5,06 | | | |
| | | | 100% RB | 27,96 | 22,06 | 5,9 | 27,7 | 21,16 | 6,54 | | | |

| | | | | | | | | | | | |
|--------|-------|--------|------------|-------|-------|------|-------|-------|------|-------|-------|
| 10 MHz | 18650 | 1855 | 1 RB low | 27,59 | 23,21 | 4,38 | 27,18 | 22,15 | 5,03 | 28,63 | 28,63 |
| | | | 1 RB high | 28,44 | 23,24 | 5,2 | 27,59 | 22,21 | 5,38 | | |
| | | | 50% RB mid | 28,12 | 22,19 | 5,93 | 27,9 | 21,35 | 6,55 | | |
| | | | 100% RB | 28,36 | 22,09 | 6,27 | 28,63 | 21,08 | 7,55 | | |
| | 18900 | 1880 | 1 RB low | 28,36 | 23,16 | 5,2 | 27,35 | 22,11 | 5,24 | 28,36 | |
| | | | 1 RB high | 27,96 | 23,27 | 4,69 | 27,1 | 22,14 | 4,96 | | |
| | | | 50% RB mid | 28,18 | 22,09 | 6,09 | 27,98 | 21,17 | 6,81 | | |
| | | | 100% RB | 28,26 | 21,91 | 6,35 | 28,23 | 21,02 | 7,21 | | |
| | 19150 | 1905 | 1 RB low | 27,57 | 23,18 | 4,39 | 27,01 | 22,07 | 4,94 | 28,02 | |
| | | | 1 RB high | 26,86 | 23,24 | 3,62 | 26,29 | 21,77 | 4,52 | | |
| | | | 50% RB mid | 27,76 | 22,14 | 5,62 | 27,71 | 21,27 | 6,44 | | |
| | | | 100% RB | 27,7 | 22,07 | 5,63 | 28,02 | 21,13 | 6,89 | | |
| 15 MHz | 18675 | 1857,5 | 1 RB low | 27,52 | 23,18 | 4,34 | 27,34 | 22,71 | 4,63 | 28,73 | |
| | | | 1 RB high | 28,33 | 23,25 | 5,08 | 27,93 | 22,75 | 5,18 | | |
| | | | 50% RB mid | 28,17 | 22,08 | 6,09 | 28,18 | 22,36 | 5,82 | | |
| | | | 100% RB | 28,73 | 21,96 | 6,77 | 28,46 | 20,98 | 7,48 | | |
| | 18900 | 1880 | 1 RB low | 28,53 | 23,31 | 5,22 | 27,39 | 22,18 | 5,21 | 28,69 | |
| | | | 1 RB high | 27,88 | 23,31 | 4,57 | 27,02 | 22,13 | 4,89 | | |
| | | | 50% RB mid | 28,22 | 21,93 | 6,29 | 28,56 | 22,29 | 6,27 | | |
| | | | 100% RB | 28,69 | 21,99 | 6,7 | 28,31 | 20,9 | 7,41 | | |
| | 19125 | 1902,5 | 1 RB low | 27,67 | 23,3 | 4,37 | 27,37 | 22,76 | 4,61 | 28,28 | |
| | | | 1 RB high | 26,79 | 23,23 | 3,56 | 26,47 | 22,3 | 4,17 | | |
| | | | 50% RB mid | 27,99 | 22,22 | 5,77 | 28,28 | 22,27 | 6,01 | | |
| | | | 100% RB | 28,2 | 22,11 | 6,09 | 28,02 | 21,22 | 6,8 | | |
| 20 MHz | 18700 | 1860 | 1 RB low | 27,63 | 23,19 | 4,44 | 27,2 | 22,15 | 5,05 | 29,01 | |
| | | | 1 RB high | 28,69 | 23,67 | 5,02 | 27,71 | 22,16 | 5,55 | | |
| | | | 50% RB mid | 28,13 | 22,03 | 6,1 | 28,11 | 22,28 | 5,83 | | |
| | | | 100% RB | 29,01 | 22,01 | 7 | 28,84 | 21,1 | 7,74 | | |
| | 18900 | 1880 | 1 RB low | 28,71 | 23,36 | 5,35 | 27,52 | 22,25 | 5,27 | 29,02 | |
| | | | 1 RB high | 27,93 | 23,42 | 4,51 | 27,1 | 22,26 | 4,84 | | |
| | | | 50% RB mid | 28,31 | 22,08 | 6,23 | 29,02 | 22,18 | 6,84 | | |
| | | | 100% RB | 28,38 | 21,98 | 6,4 | 28,32 | 20,95 | 7,37 | | |
| | 19100 | 1900 | 1 RB low | 27,76 | 23,21 | 4,55 | 27,23 | 22,18 | 5,05 | 28,28 | |
| | | | 1 RB high | 26,96 | 23,34 | 3,62 | 26,43 | 21,9 | 4,53 | | |
| | | | 50% RB mid | 27,87 | 22,06 | 5,81 | 28,15 | 22,31 | 5,84 | | |
| | | | 100% RB | 28,28 | 22,03 | 6,25 | 28,22 | 21,01 | 7,21 | | |

Remark: Maximum determined Peak-Average Ratio: 7.74 dB

5.3.4.2. LTE Band 4 Results

| LTE-Band 4 (FCC Part 27) | | | | QPSK-Modulation | | | 16-QAM-Modulation | | | max- modulation | max- channel | absolute max. value |
|--------------------------|---------------|-----------------------|---------------------------|---------------------|--------------------|-----------------|---------------------|--------------------|-----------------|-----------------|--------------|---------------------|
| channel bandwidth | ARFCN ch. no. | ARFCN-Frequency [MHz] | Resource block allocation | Peak detektor [dBm] | RMS detektor [dBm] | PAR Faktor [dB] | Peak detektor [dBm] | RMS detektor [dBm] | PAR Faktor [dB] | | | |
| 1.4 MHz | 19957 | 1710,7 | 1 RB low | 28,64 | 24,01 | 4,63 | 27,82 | 22,55 | 5,27 | 29,11 | 29,98 | |
| | | | 1 RB high | 28,86 | 24,03 | 4,83 | 27,98 | 22,62 | 5,36 | | | |
| | | | 50% RB mid | 29,11 | 23,96 | 5,15 | N/A | N/A | | | | |
| | | | 100% RB | 28,62 | 22,64 | 5,98 | 28,81 | 21,71 | 7,1 | | | |
| | 20175 | 1732,5 | 1 RB low | 28,69 | 23,33 | 5,36 | 27,52 | 22,21 | 5,31 | 28,92 | | |
| | | | 1 RB high | 28,69 | 23,16 | 5,53 | 27,45 | 22,15 | 5,3 | | | |
| | | | 50% RB mid | 28,92 | 23,31 | 5,61 | N/A | N/A | | | | |
| | | | 100% RB | 28,31 | 22,32 | 5,99 | 28,47 | 21,32 | 7,15 | | | |
| | 20393 | 1754,3 | 1 RB low | 28,83 | 23,12 | 5,71 | 27,7 | 22,14 | 5,56 | 29,98 | | |
| | | | 1 RB high | 28,74 | 23,17 | 5,57 | 27,67 | 22,08 | 5,59 | | | |
| | | | 50% RB mid | 29,39 | 23,18 | 6,21 | N/A | N/A | | | | |
| | | | 100% RB | 29,98 | 23,27 | 6,71 | 28,78 | 21,36 | 7,42 | | | |
| 3 MHz | 19965 | 1711,5 | 1 RB low | 28,7 | 23,99 | 4,71 | 27,93 | 22,62 | 5,31 | 29,43 | 29,73 | |
| | | | 1 RB high | 28,74 | 23,39 | 5,35 | 27,86 | 22,42 | 5,44 | | | |
| | | | 50% RB mid | 28,46 | 22,66 | 5,8 | 28,92 | 22,71 | 6,21 | | | |
| | | | 100% RB | 29,43 | 22,61 | 6,82 | 29,23 | 21,71 | 7,52 | | | |
| | 20175 | 1732,5 | 1 RB low | 28,71 | 23,28 | 5,43 | 27,41 | 22,16 | 5,25 | 28,93 | | |
| | | | 1 RB high | 28,75 | 23,4 | 5,35 | 27,54 | 22,17 | 5,37 | | | |
| | | | 50% RB mid | 28,2 | 22,29 | 5,91 | 28,87 | 22,54 | 6,33 | | | |
| | | | 100% RB | 28,69 | 22,32 | 6,37 | 28,93 | 21,23 | 7,7 | | | |
| | 20385 | 1753,5 | 1 RB low | 28,74 | 23,1 | 5,64 | 27,74 | 22,12 | 5,62 | 29,73 | | |
| | | | 1 RB high | 28,79 | 23,12 | 5,67 | 27,75 | 22,11 | 5,64 | | | |
| | | | 50% RB mid | 28,47 | 22,17 | 6,3 | 29,07 | 22,23 | 6,84 | | | |
| | | | 100% RB | 29,73 | 22,19 | 7,54 | 29,02 | 21,32 | 7,7 | | | |
| 5 MHz | 19975 | 1712,5 | 1 RB low | 29,06 | 24,02 | 5,04 | 28,86 | 22,82 | 6,04 | 29,42 | 29,43 | |
| | | | 1 RB high | 29,21 | 23,33 | 5,88 | 29,2 | 22,46 | 6,74 | | | |
| | | | 50% RB mid | 28,42 | 22,74 | 5,68 | 29,11 | 22,58 | 6,53 | | | |
| | | | 100% RB | 29,42 | 22,4 | 7,02 | 29,25 | 21,3 | 7,95 | | | |
| | 20175 | 1732,5 | 1 RB low | 28,38 | 23,3 | 5,08 | 28,91 | 22,82 | 6,09 | 28,93 | | |
| | | | 1 RB high | 28,34 | 23,26 | 5,08 | 28,84 | 22,75 | 6,09 | | | |
| | | | 50% RB mid | 28,93 | 22,27 | 6,66 | 28,86 | 22,21 | 6,65 | | | |
| | | | 100% RB | 28,79 | 22,2 | 6,59 | 28,9 | 21,16 | 7,74 | | | |
| | 20375 | 1752,5 | 1 RB low | 29,23 | 23,25 | 5,98 | 29,2 | 22,39 | 6,81 | 29,43 | | |
| | | | 1 RB high | 29,25 | 23,23 | 6,02 | 29,25 | 22,36 | 6,89 | | | |
| | | | 50% RB mid | 28,25 | 22,18 | 6,07 | 29,43 | 22,19 | 7,24 | | | |
| | | | 100% RB | 29,23 | 22 | 7,23 | 28,94 | 21,12 | 7,82 | | | |

| | | | | | | | | | | | |
|--------|-------|--------|------------|-------|-------|------|-------|-------|------|-------|-------|
| 10 MHz | 20000 | 1715 | 1 RB low | 28,64 | 23,65 | 4,99 | 27,89 | 22,52 | 5,37 | 29,17 | 29,17 |
| | | | 1 RB high | 28,84 | 23,19 | 5,65 | 27,79 | 22,16 | 5,63 | | |
| | | | 50% RB mid | 29,15 | 22,38 | 6,77 | 29,02 | 21,73 | 7,29 | | |
| | | | 100% RB | 28,83 | 22,24 | 6,59 | 29,17 | 21,27 | 7,9 | | |
| | 20175 | 1732,5 | 1 RB low | 28,9 | 23,27 | 5,63 | 27,52 | 22,1 | 5,42 | 28,9 | |
| | | | 1 RB high | 28,74 | 23,3 | 5,44 | 27,53 | 22,19 | 5,34 | | |
| | | | 50% RB mid | 28,76 | 22,24 | 6,52 | 28,43 | 21,35 | 7,08 | | |
| | | | 100% RB | 28,8 | 22,15 | 6,65 | 28,7 | 21,12 | 7,58 | | |
| | 20350 | 1750 | 1 RB low | 28,76 | 23,19 | 5,57 | 27,8 | 22,16 | 5,64 | 29,16 | |
| | | | 1 RB high | 28,81 | 23,14 | 5,67 | 27,81 | 22,14 | 5,67 | | |
| | | | 50% RB mid | 29,16 | 22,08 | 7,08 | 28,97 | 21,26 | 7,71 | | |
| | | | 100% RB | 28,63 | 22,05 | 6,58 | 29,1 | 21,08 | 8,02 | | |
| 15 MHz | 20025 | 1717,5 | 1 RB low | 28,48 | 23,59 | 4,89 | 28,25 | 23,26 | 4,99 | 29,4 | |
| | | | 1 RB high | 28,54 | 23,18 | 5,36 | 28,16 | 22,77 | 5,39 | | |
| | | | 50% RB mid | 28,95 | 22,24 | 6,71 | 29,37 | 22,47 | 6,9 | | |
| | | | 100% RB | 29,18 | 22,12 | 7,06 | 28,91 | 21,2 | 7,71 | | |
| | 20175 | 1732,5 | 1 RB low | 28,96 | 23,28 | 5,68 | 27,58 | 22,19 | 5,39 | 29,08 | |
| | | | 1 RB high | 28,71 | 23,25 | 5,46 | 27,5 | 22,12 | 5,38 | | |
| | | | 50% RB mid | 28,78 | 22,13 | 6,65 | 29,04 | 22,34 | 6,7 | | |
| | | | 100% RB | 29,08 | 22,15 | 6,93 | 28,77 | 21,14 | 7,63 | | |
| | 20325 | 1747,5 | 1 RB low | 28,45 | 23,26 | 5,19 | 28 | 22,68 | 5,32 | 29,32 | |
| | | | 1 RB high | 28,54 | 23,18 | 5,36 | 28 | 22,58 | 5,42 | | |
| | | | 50% RB mid | 28,7 | 22 | 6,7 | 29,32 | 22,28 | 7,04 | | |
| | | | 100% RB | 28,99 | 22,01 | 6,98 | 28,83 | 21,02 | 7,81 | | |
| 20 MHz | 20050 | 1720 | 1 RB low | 28,74 | 23,74 | 5 | 28,21 | 22,9 | 5,31 | 29,22 | |
| | | | 1 RB high | 28,68 | 23,19 | 5,49 | 27,79 | 22,16 | 5,63 | | |
| | | | 50% RB mid | 28,78 | 22,13 | 6,65 | 29,22 | 22,45 | 6,77 | | |
| | | | 100% RB | 29,22 | 22,07 | 7,15 | 29 | 21,15 | 7,85 | | |
| | 20175 | 1732,5 | 1 RB low | 29,08 | 23,36 | 5,72 | 27,6 | 22,22 | 5,38 | 29,6 | |
| | | | 1 RB high | 28,77 | 23,19 | 5,58 | 27,47 | 22,07 | 5,4 | | |
| | | | 50% RB mid | 28,81 | 22,17 | 6,64 | 29,6 | 22,27 | 7,33 | | |
| | | | 100% RB | 28,92 | 22,11 | 6,81 | 28,84 | 21,11 | 7,73 | | |
| | 20300 | 1745 | 1 RB low | 28,45 | 23,19 | 5,26 | 27,69 | 22,17 | 5,52 | 29,1 | |
| | | | 1 RB high | 28,82 | 23,13 | 5,69 | 27,82 | 22,13 | 5,69 | | |
| | | | 50% RB mid | 28,6 | 22,01 | 6,59 | 29,01 | 22,3 | 6,71 | | |
| | | | 100% RB | 29,1 | 22,03 | 7,07 | 29,06 | 21,07 | 7,99 | | |

Remark: Maximum determined Peak-Average Ratio: 8.02 dB

5.3.4.3. LTE Band 5 Results

| LTE-Band 5 (Part 22) | | | | QPSK-Modulation | | | 16-QAM-Modulation | | | max- modulation | max. channel | absolute max. value |
|----------------------|---------------|-----------------------|---------------------------|---------------------|--------------------|-----------------|---------------------|--------------------|-----------------|-----------------|--------------|---------------------|
| channel bandwidth | ARFCN ch. no. | ARFCN-Frequency [MHz] | Resource block allocation | Peak detektor [dBm] | RMS detektor [dBm] | PAR Faktor [dB] | Peak detektor [dBm] | RMS detektor [dBm] | PAR Faktor [dB] | | | |
| 1.4 MHz | 20407 | 824.7 | 1 RB low | 28,35 | 23,04 | 5,31 | 27,73 | 22,31 | 5,42 | 28,93 | 29,25 | 29,62 |
| | | | 1 RB high | 28,38 | 23,01 | 5,37 | 27,63 | 22,19 | 5,44 | | | |
| | | | 50% RB mid | 28,93 | 23,06 | 5,87 | -- | -- | #### | | | |
| | | | 100% RB | 28,47 | 22,27 | 6,2 | 28,6 | 21,32 | 7,28 | | | |
| | 20525 | 836.5 | 1 RB low | 29,07 | 23,35 | 5,72 | 27,53 | 22,19 | 5,34 | 29,23 | | |
| | | | 1 RB high | 29,09 | 23,26 | 5,83 | 27,58 | 22,27 | 5,31 | | | |
| | | | 50% RB mid | 29,23 | 23,22 | 6,01 | -- | -- | #### | | | |
| | | | 100% RB | 28,48 | 22,36 | 6,12 | 28,71 | 21,41 | 7,3 | | | |
| | 20643 | 848.3 | 1 RB low | 28,6 | 23,06 | 5,54 | 27,57 | 22,03 | 5,54 | 29,25 | | |
| | | | 1 RB high | 28,47 | 22,93 | 5,54 | 27,44 | 21,92 | 5,52 | | | |
| | | | 50% RB mid | 29,25 | 23,12 | 6,13 | -- | -- | -- | | | |
| | | | 100% RB | 28,24 | 22 | 6,24 | 28,69 | 21,28 | 7,41 | | | |
| 3 MHz | 20415 | 825.5 | 1 RB low | 28,38 | 23,03 | 5,35 | 27,51 | 22,17 | 5,34 | 29,48 | | |
| | | | 1 RB high | 28,35 | 22,99 | 5,36 | 27,53 | 22,07 | 5,46 | | | |
| | | | 50% RB mid | 28,31 | 22,19 | 6,12 | 28,83 | 22,36 | 6,47 | | | |
| | | | 100% RB | 29,48 | 22,24 | 7,24 | 28,64 | 21,36 | 7,28 | | | |
| | 20525 | 836.5 | 1 RB low | 28,93 | 23,11 | 5,82 | 27,43 | 22,06 | 5,37 | 29,22 | | |
| | | | 1 RB high | 29,09 | 23,3 | 5,79 | 27,54 | 22,24 | 5,3 | | | |
| | | | 50% RB mid | 28,33 | 22,22 | 6,11 | 29,18 | 22,49 | 6,69 | | | |
| | | | 100% RB | 28,89 | 22,21 | 6,68 | 29,22 | 21,22 | 8 | | | |
| | 20635 | 847.5 | 1 RB low | 28,7 | 23,09 | 5,61 | 27,71 | 22,12 | 5,59 | 29,62 | | |
| | | | 1 RB high | 28,45 | 22,92 | 5,53 | 27,51 | 21,92 | 5,59 | | | |
| | | | 50% RB mid | 28,42 | 22,2 | 6,22 | 28,95 | 22,14 | 6,81 | | | |
| | | | 100% RB | 29,62 | 22,12 | 7,5 | 29,15 | 21,35 | 7,8 | | | |

| | | | | | | | | | | | |
|--------|-------|-------|------------|-------|-------|------|-------|-------|------|-------|-------|
| 5 MHz | 20425 | 826.5 | 1 RB low | 28,13 | 23,14 | 4,99 | 28,65 | 22,62 | 6,03 | 28,86 | 29,47 |
| | | | 1 RB high | 28,19 | 23,12 | 5,07 | 28,78 | 22,69 | 6,09 | | |
| | | | 50% RB mid | 28,86 | 22,12 | 6,74 | 28,76 | 22,17 | 6,59 | | |
| | | | 100% RB | 28,5 | 21,97 | 6,53 | 28,78 | 21,09 | 7,69 | | |
| | 20525 | 836.5 | 1 RB low | 28,28 | 23,03 | 5,25 | 29,13 | 22,64 | 6,49 | 29,29 | |
| | | | 1 RB high | 28,51 | 23,26 | 5,25 | 29,28 | 22,85 | 6,43 | | |
| | | | 50% RB mid | 29,19 | 22,06 | 7,13 | 29,29 | 22,2 | 7,09 | | |
| | | | 100% RB | 28,86 | 22,05 | 6,81 | 29,01 | 21,1 | 7,91 | | |
| | 20625 | 846.5 | 1 RB low | 29,17 | 23,21 | 5,96 | 29,23 | 22,54 | 6,69 | 29,47 | |
| | | | 1 RB high | 28,9 | 22,95 | 5,95 | 28,91 | 22,13 | 6,78 | | |
| | | | 50% RB mid | 28,65 | 22,08 | 6,57 | 29,47 | 22,17 | 7,3 | | |
| | | | 100% RB | 29,17 | 21,97 | 7,2 | 29,22 | 21,06 | 8,16 | | |
| 10 MHz | 20450 | 829 | 1 RB low | 28,42 | 23,09 | 5,33 | 27,56 | 22,07 | 5,49 | 29,02 | 29,48 |
| | | | 1 RB high | 28,66 | 22,89 | 5,77 | 27,67 | 22,04 | 5,63 | | |
| | | | 50% RB mid | 28,67 | 22,1 | 6,57 | 28,75 | 21,33 | 7,42 | | |
| | | | 100% RB | 28,57 | 21,89 | 6,68 | 29,02 | 21,11 | 7,91 | | |
| | 20525 | 836.5 | 1 RB low | 28,43 | 22,92 | 5,51 | 29,29 | 22,89 | 6,4 | 29,48 | |
| | | | 1 RB high | 28,75 | 23,18 | 5,57 | 29,48 | 23,02 | 6,46 | | |
| | | | 50% RB mid | 28,99 | 22,09 | 6,9 | 28,87 | 21,2 | 7,67 | | |
| | | | 100% RB | 28,79 | 22,02 | 6,77 | 29,41 | 21,11 | 8,3 | | |
| | 20600 | 844 | 1 RB low | 29,18 | 23,18 | 6 | 27,52 | 22,09 | 5,43 | 29,18 | |
| | | | 1 RB high | 28,76 | 23,01 | 5,75 | 27,28 | 21,93 | 5,35 | | |
| | | | 50% RB mid | 28,94 | 22,13 | 6,81 | 28,63 | 21,35 | 7,28 | | |
| | | | 100% RB | 28,74 | 22,1 | 6,64 | 28,79 | 21,14 | 7,65 | | |
| | | | | | | | | | | | 29.62 |

Remark: Maximum determined Peak-Average Ration: 8.3 dB

5.3.4.4. LTE Band 17 Results

| LTE-Band 17 (Part 27) | | | | QPSK-Modulation | | | 16-QAM-Modulation | | | max- modulation | max. channel | absolute max. value |
|-----------------------|---------------|-----------------------|---------------------------|---------------------|--------------------|-----------------|---------------------|--------------------|-----------------|-----------------|--------------|---------------------|
| channel bandwidth | ARFCN ch. no. | ARFCN-Frequency [MHz] | Resource block allocation | Peak detektor [dBm] | RMS detektor [dBm] | PAR Faktor [dB] | Peak detektor [dBm] | RMS detektor [dBm] | PAR Faktor [dB] | | | |
| 5 MHz | 23755 | 706,5 | 1 RB low | 28,45 | 23,1 | 5,35 | 29,24 | 22,68 | 6,56 | 29,43 | 29,4 | 29,4 |
| | | | 1 RB high | 28,35 | 23,17 | 5,18 | 29,09 | 22,67 | 6,42 | | | |
| | | | 50% RB mid | 29,36 | 22,03 | 7,33 | 29,43 | 22,05 | 7,38 | | | |
| | | | 100% RB | 28,75 | 22,00 | 6,75 | 28,89 | 20,89 | 8 | | | |
| | 23790 | 710 | 1 RB low | 29,13 | 22,88 | 6,25 | 29,19 | 22,07 | 7,12 | 29,39 | | |
| | | | 1 RB high | 28,53 | 22,82 | 5,71 | 28,52 | 21,99 | 6,53 | | | |
| | | | 50% RB mid | 28,34 | 21,84 | 6,5 | 29,39 | 21,94 | 7,45 | | | |
| | | | 100% RB | 28,52 | 21,73 | 6,79 | 28,95 | 20,78 | 8,17 | | | |
| | 23825 | 713,5 | 1 RB low | 28,13 | 22,82 | 5,31 | 27,19 | 21,81 | 5,38 | 28,9 | | |
| | | | 1 RB high | 27,95 | 22,32 | 5,63 | 27,05 | 21,4 | 5,65 | | | |
| | | | 50% RB mid | 28,91 | 21,77 | 7,14 | 28,64 | 21,97 | 6,67 | | | |
| | | | 100% RB | 28,88 | 21,57 | 7,31 | 28,43 | 20,72 | 7,71 | | | |
| 10 MHz | 23780 | 709 | 1 RB low | 28,73 | 22,84 | 5,89 | 27,76 | 21,93 | 5,83 | 29,31 | | |
| | | | 1 RB high | 28,29 | 22,78 | 5,51 | 27,28 | 21,73 | 5,55 | | | |
| | | | 50% RB mid | 29,31 | 21,85 | 7,46 | 29,14 | 21,01 | 8,13 | | | |
| | | | 100% RB | 28,5 | 21,67 | 6,83 | 28,97 | 20,65 | 8,32 | | | |
| | 23790 | 710 | 1 RB low | 29,11 | 22,95 | 6,16 | 27,54 | 21,89 | 5,65 | 29,11 | | |
| | | | 1 RB high | 28,51 | 22,8 | 5,71 | 27,12 | 21,68 | 5,44 | | | |
| | | | 50% RB mid | 28,85 | 21,8 | 7,05 | 28,46 | 20,93 | 7,53 | | | |
| | | | 100% RB | 28,69 | 21,62 | 7,07 | 28,58 | 20,67 | 7,91 | | | |
| | 23800 | 711 | 1 RB low | 28,74 | 22,76 | 5,98 | 27,64 | 21,75 | 5,89 | 29,03 | | |
| | | | 1 RB high | 28,18 | 22,5 | 5,68 | 27,19 | 21,48 | 5,71 | | | |
| | | | 50% RB mid | 29,03 | 21,82 | 7,21 | 29,03 | 21,11 | 7,92 | | | |
| | | | 100% RB | 28,48 | 21,59 | 6,89 | 28,86 | 20,66 | 8,2 | | | |

Remark: Maximum determined Peak-Average Ration: 8.32 dB

5.4. RF-Parameter - Occupied bandwidth and emission bandwidth

5.4.1. Test location and equipments (for reference numbers please see chapter 'List of test equipment')

| | | | | | |
|-----------------|---|--|--|--|--|
| test site | <input type="checkbox"/> 347 Radio.lab. 1 | <input checked="" type="checkbox"/> Radio.lab. 2 | | | |
| spectr. analys. | <input type="checkbox"/> 584 FSU8 | <input type="checkbox"/> 489 ESU | <input checked="" type="checkbox"/> 620 ESU26 | <input type="checkbox"/> 264 FSEK | |
| attenuator | <input checked="" type="checkbox"/> 530 10 dB | <input type="checkbox"/> | <input type="checkbox"/> | | |
| signaling | <input type="checkbox"/> 392 MT8820A | <input type="checkbox"/> 436 CMU | <input type="checkbox"/> 547 CMU | <input checked="" type="checkbox"/> 594 CMW500 | |
| DC Power | <input checked="" type="checkbox"/> 611 E3632A | <input type="checkbox"/> 087 EA3013 | <input type="checkbox"/> 354 NGPE 40 | <input type="checkbox"/> 086 LNG50-10 | <input checked="" type="checkbox"/> 611 E3632A |
| otherwise | <input checked="" type="checkbox"/> 530 10dB attenuator | | <input checked="" type="checkbox"/> 529 Power div. | | |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | | <input type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000 | | |

5.4.2. Requirements and Limits

| | | |
|------|--|--|
| FCC | CFR47, §2.202(a), §2.1049, §22.917(b), §24.238(b), 27.53(h)(3) | „the occupied bandwidth is the frequency bandwidth, such that, below it lower and above it upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated” |
| IC | RSS-Gen, Issue 3: §4.6.1 | |
| ANSI | C63.10-2009 | |

5.4.3. Test condition and test set-up

| | | | |
|----------------------------|--|--|---|
| Climatic conditions | | Temperature: (22±3°C) | Rel. humidity: (40±20)% |
| Test system set-up | | Please see chapter “Test system set-up for conducted measurements at antenna port” | |
| Spectrum Analyzer Settings | Parameter | Occupied bandwidth: | Emission bandwidth |
| | Scan Mode | Spectrum analyser mode | Spectrum analyser mode |
| | Span | 1.8MHz/4MHz/6MHz /12MHz/17MHz/22MHz | 2MHz/4MHz/7MHz /12MHz/17MHz/22MHz |
| | RBW | 30kHz/50kHz/100kHz/ | 30kHz/50kHz/100kHz/ |
| | VBW | 500kHz/1MHz/ | 300 kHz/500kHz/1MHz/ |
| | Sweep time | 60 Sec | Coupled |
| | Sweep mode | Single max-hold | Repetitive, max-hold |
| | Detector | RMS | PK |
| Measurement method | The used spectrum analyzer FSE or ESU from Rohde & Schwarz contains an integrated function to calculate the occupied bandwidth automatically. From left and right display margin, the upper and lower frequency points where the accumulated power becomes 0.5% of the total power, are calculated. Subtracting the previous determined two frequency points, yields the occupied bandwidth. | | Bandwidth defined between 2 markers with are 26dBc compared to highest In-Band Peak Emission. |
| Mobile phone settings | <p>A call was established with a suitable communication test unit (CMW500). UE is set TX mode, highest transmit power conditions (RMC-mode), power saving techniques have been disabled. All RBs as possible per EUT signal bandwidth have been allocated.</p> <p>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.</p> | | |

5.4.4. Results

5.4.4.1. LTE Band 2: Op. Mode 1, Set-up 2

| Operational Band | Modulation | Signal bandwidth [MHz] | Channel no. | | Occupied bandwidth | | 26 dB Bandwidth | |
|------------------|------------|------------------------|-------------|-------------|--------------------|-------------|-----------------|---------------|
| | | | Range | Channel no. | Diagram no. | Value [MHz] | Diagram no. | Value [MHz] |
| Band 2 | QPSK | 1.4 | Low | 18607 | 35.200 | 1.0817 | 34.200 | 1.3153 |
| | | | Mid | 18900 | 35.201 | -- | 34.201 | 1.298 |
| | | | High | 19193 | 35.202 | -- | 34.202 | 1.286 |
| | | 3 | Low | 18615 | 35.203 | 2.6923 | 34.203 | 3.0576 |
| | | | Mid | 18900 | 35.204 | -- | 34.204 | 3.0384 |
| | | | High | 19185 | 35.205 | -- | 34.205 | 3.057 |
| | | 5 | Low | 18625 | 35.206 | -- | 34.206 | 4.990 |
| | | | Mid | 18900 | 35.207 | 4.461 | 34.207 | 5.009 |
| | | | High | 19175 | 35.208 | -- | 34.208 | 4.942 |
| | | 10 | low | 18650 | 35.209 | 8.923 | 34.209 | 9.826 |
| | | | Mid | 18900 | 35.210 | -- | 34.210 | 9.750 |
| | | | High | 19150 | 35.211 | -- | 34.211 | 9.769 |
| | | 15 | Low | 18675 | 35.212 | 13.403 | 34.212 | 14.657 |
| | | | Mid | 18900 | 35.213 | -- | 34.213 | 14.439 |
| | | | High | 19125 | 35.214 | -- | 34.214 | 14.575 |
| | | 20 | Low | 18700 | 35.215 | -- | 34.215 | 19.073 |
| | | | Mid | 18900 | 35.216 | -- | 34.216 | 18.967 |
| | | | High | 19100 | 35.217 | 17.839 | 34.217 | 19.250 |

Remark: see extract of diagrams with max. values in annex 4

| | | | | | | | | |
|--------|--------|-----|------|-------|--------|--------|--------|---------------|
| Band 2 | 16-QAM | 1.4 | low | 18607 | 35.218 | 1.0817 | 34.218 | 1.3038 |
| | | | mid | 18900 | 35.219 | -- | 34.219 | 1.280 |
| | | | high | 19193 | 35.220 | -- | 34.220 | 1.295 |
| | | 3 | low | 18615 | 35.221 | -- | 34.221 | 3.0641 |
| | | | mid | 18900 | 35.222 | -- | 34.222 | 3.0512 |
| | | | high | 19185 | 35.223 | 2.6858 | 34.223 | 3.064 |
| | | 5 | low | 18625 | 35.224 | -- | 34.224 | 4.9807 |
| | | | mid | 18900 | 35.225 | 4.461 | 34.225 | 5.028 |
| | | | high | 19175 | 35.226 | -- | 34.226 | 4.990 |
| | | 10 | low | 18650 | 35.227 | -- | 34.227 | 9.769 |
| | | | mid | 18900 | 35.228 | 8.923 | 34.228 | 9.769 |
| | | | high | 19150 | 35.229 | -- | 34.229 | 9.730 |
| | | 15 | low | 18675 | 35.230 | -- | 34.230 | 14.439 |
| | | | Mid | 18900 | 35.231 | -- | 34.231 | 14.439 |
| | | | High | 19125 | 35.232 | 13.376 | 34.232 | 14.466 |
| | | 20 | low | 18700 | 35.233 | -- | 34.233 | 19.073 |
| | | | Mid | 18900 | 35.234 | -- | 34.234 | 19.144 |
| | | | High | 19100 | 35.235 | 17.839 | 34.235 | 19.214 |

5.4.4.2. LTE Band 4: Op. Mode 2, Set-up 2

| Operational Band | Modulation | Signal bandwidth [MHz] | Channel no. | | Occupied bandwidth | | 26 dB Bandwidth | |
|------------------|------------|------------------------|-------------|-------------|--------------------|-------------|-----------------|---------------|
| | | | Range | Channel no. | Diagram no. | Value [MHz] | Diagram no. | Value [MHz] |
| Band 4 | QPSK | 1.4 | Low | 19957 | 35.401 | 1.0817 | 34.401 | 1.3125 |
| | | | Mid | 20175 | -- | -- | 34.402 | 1.2836 |
| | | | High | 20393 | -- | -- | 34.403 | 1.2865 |
| | | 3 | Low | 19965 | 35.404 | 2.692 | 34.404 | 3.0576 |
| | | | Mid | 20175 | -- | -- | 34.405 | 3.0512 |
| | | | High | 20385 | -- | -- | 34.406 | 3.0512 |
| | | 5 | Low | 19975 | -- | -- | 34.407 | 4.9711 |
| | | | Mid | 20175 | 35.408 | 4.4711 | 34.408 | 5.0288 |
| | | | High | 20375 | -- | -- | 34.409 | 4.9615 |
| | | 10 | low | 20000 | 35.410 | 8.9230 | 34.410 | 9.8076 |
| | | | Mid | 20175 | -- | -- | 34.411 | 9.750 |
| | | | High | 20350 | -- | -- | 34.412 | 9.7884 |
| | | 15 | Low | 20025 | 35.413 | 13.376 | 34.413 | 14.602 |
| | | | Mid | 20175 | -- | -- | 34.414 | 14.493 |
| | | | High | 20325 | -- | -- | 34.415 | 14.575 |
| | | 20 | Low | 20050 | -- | -- | 34.416 | 19.003 |
| | | | Mid | 20175 | -- | -- | 34.417 | 19.003 |
| | | | High | 20300 | 35.418 | 17.839 | 34.418 | 19.038 |

Remark: see extract of diagrams with max. values in annex 4

| Operational Band | Modulation | Signal bandwidth [MHz] | Channel no. | | Occupied bandwidth | | 26 dB Bandwidth | |
|------------------|------------|------------------------|-------------|-------------|--------------------|-------------|-----------------|-------------|
| | | | Range | Channel no. | Diagram no. | Value [MHz] | Diagram no. | Value [MHz] |
| Band 4 | 16-QAM | 1.4 | Low | 19957 | -- | -- | 34.419 | 1.2807 |
| | | | Mid | 20175 | -- | -- | 34.420 | 1.2894 |
| | | | High | 20393 | 35.421 | 1.0788 | 34.421 | 1.3125 |
| | | 3 | Low | 19965 | -- | -- | 34.422 | 3.0576 |
| | | | Mid | 20175 | 35.423 | 2.6923 | 34.423 | 3.0641 |
| | | | High | 20385 | -- | -- | 34.424 | 3.0576 |
| | | 5 | Low | 19975 | -- | -- | 34.425 | 5.0192 |
| | | | Mid | 20175 | 35.426 | 4.4615 | 34.426 | 5.0834 |
| | | | High | 20375 | -- | -- | 34.427 | 4.9807 |
| | | 10 | low | 20000 | -- | -- | 34.428 | 9.7692 |
| | | | Mid | 20175 | -- | -- | 34.429 | 9.750 |
| | | | High | 20350 | 35.430 | 8.9230 | 34.430 | 9.7692 |
| | | 15 | Low | 20025 | -- | -- | 34.431 | 14.330 |
| | | | Mid | 20175 | -- | -- | 34.432 | 14.466 |
| | | | High | 20325 | 35.433 | 13.403 | 34.433 | 14.738 |
| | | 20 | Low | 20050 | -- | -- | 34.434 | 19.073 |
| | | | Mid | 20175 | -- | -- | 34.435 | 18.897 |
| | | | High | 20300 | 35.436 | 17.839 | 34.436 | 19.214 |

Remark: see extract of diagrams with max. values in annex 4

5.4.4.3. LTE Band 5: Op. Mode 3, Set-up 2

| Operational Band | Modulation | Signal bandwidth [MHz] | Channel no. | | Occupied bandwidth | | 26 dB Bandwidth | |
|------------------|------------|------------------------|-------------|-------------|--------------------|-------------|-----------------|-------------|
| | | | Range | Channel no. | Diagram no. | Value [MHz] | Diagram no. | Value [MHz] |
| Band 5 | QPSK | 1.4 | Low | 20407 | -- | -- | 34.501 | 1.2750 |
| | | | Mid | 20525 | -- | -- | 34.502 | 1.2807 |
| | | | High | 20643 | 35.503 | 1.0817 | 34.503 | 1.3038 |
| | | 3 | Low | 20415 | 35.504 | 2.6858 | 34.504 | 3.0448 |
| | | | Mid | 20525 | -- | -- | 34.505 | 3.0384 |
| | | | High | 20635 | -- | -- | 34.506 | 3.0384 |
| | | 5 | Low | 20425 | -- | -- | 34.507 | 4.9487 |
| | | | Mid | 20525 | -- | -- | 34.508 | 4.9615 |
| | | | High | 20625 | 35.509 | 4.4743 | 34.509 | 5.0128 |
| | | 10 | low | 20450 | -- | -- | 34.510 | 9.5769 |
| | | | Mid | 20525 | -- | -- | 34.511 | 9.5961 |
| | | | High | 20600 | 35.512 | 8.9230 | 34.512 | 9.5769 |

Remark: see extract of diagrams with max. values in annex 4

| Operational Band | Modulation | Signal bandwidth [MHz] | Channel no. | | Occupied bandwidth | | 26 dB Bandwidth | |
|------------------|------------|------------------------|-------------|-------------|--------------------|-------------|-----------------|-------------|
| | | | Range | Channel no. | Diagram no. | Value [MHz] | Diagram no. | Value [MHz] |
| Band 5 | 16-QAM | 1.4 | Low | 20407 | -- | -- | 34.513 | 1.2951 |
| | | | Mid | 20525 | 35.514 | 1.0788 | 34.514 | 1.3153 |
| | | | High | 20643 | -- | -- | 34.515 | 1.2778 |
| | | 3 | Low | 20415 | -- | -- | 34.516 | 3.0512 |
| | | | Mid | 20525 | -- | -- | 34.517 | 3.0512 |
| | | | High | 20635 | 35.518 | 2.6858 | 34.518 | 3.0576 |
| | | 5 | Low | 20425 | -- | -- | 34.519 | 4.9487 |
| | | | Mid | 20525 | 35.520 | 4.4615 | 34.520 | 5.0128 |
| | | | High | 20625 | -- | -- | 34.521 | 4.9615 |
| | | 10 | low | 20450 | -- | -- | 34.522 | 9.5576 |
| | | | Mid | 20525 | -- | -- | 34.523 | 9.5576 |
| | | | High | 20600 | 35.524 | 8.9230 | 34.524 | 9.5576 |

Remark: see extract of diagrams with max. values in annex 4

5.4.4.4. LTE Band 17: Op. Mode 4, Set-up 2

| Operational Band | Modulation | Signal bandwidth [MHz] | Channel no. | | Occupied bandwidth | | 26 dB Bandwidth | |
|------------------|------------|------------------------|-------------|-------------|--------------------|-------------|-----------------|---------------|
| | | | Range | Channel no. | Diagram no. | Value [MHz] | Diagram no. | Value [MHz] |
| Band 17 | QPSK | 5 | Low | 23755 | 35.171 | 4.4743 | 34.171 | 5.0641 |
| | | | Mid | 23790 | -- | -- | 34.172 | 4.9615 |
| | | | High | 23825 | -- | -- | 34.173 | 4.9871 |
| | | 10 | low | 23780 | -- | -- | 34.174 | 9.6538 |
| | | | Mid | 23790 | 35.175 | 8.9230 | 34.175 | 9.7115 |
| | | | High | 23800 | -- | -- | 34.176 | 9.6923 |
| | QAM | 5 | Low | 23755 | -- | -- | 34.177 | 4.9743 |
| | | | Mid | 23790 | 35.178 | 4.4615 | 34.178 | 5.0512 |
| | | | High | 23825 | -- | -- | 34.179 | 4.9743 |
| | | 10 | low | 23780 | 35.180 | 8.9230 | 34.180 | 9.6923 |
| | | | Mid | 23790 | -- | -- | 34.181 | 9.5961 |
| | | | High | 23800 | -- | -- | 34.182 | 9.6730 |

Remark: pls. see extract of diagrams with max. values in annex 4

5.5. RF-Parameter - Conducted out of Band RF emissions and Band Edge

5.5.1. Test location and equipments (for reference numbers please see chapter 'List of test equipment')

| | | | | | | |
|-----------------|--|--|--|---|--------------------------------------|--------------------------------------|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2 | <input type="checkbox"/> Please see Chapter. 2.2.3 | | | |
| test site | <input type="checkbox"/> 347 Radio.lab. 1 | <input checked="" type="checkbox"/> Radio.lab. 2 | | | | |
| spectr. analys. | <input type="checkbox"/> 584 FSU | <input type="checkbox"/> 120 FSEM | <input type="checkbox"/> 264 FSEK | <input checked="" type="checkbox"/> 620 ESU26 | | |
| signaling | <input type="checkbox"/> 017 CMD 65 | <input type="checkbox"/> 323 CMD 55 | <input type="checkbox"/> 340 CMD 55 | | | |
| signaling | <input type="checkbox"/> 392 MT8820A | <input type="checkbox"/> 436 CMU | <input checked="" type="checkbox"/> 594 CMW500 | | | |
| power supply | <input checked="" type="checkbox"/> 611 E3632A | <input type="checkbox"/> 457 EA 3013A | <input type="checkbox"/> 459 EA 2032-50 | <input type="checkbox"/> 268 EA- 3050 | <input type="checkbox"/> 494 AG6632A | <input type="checkbox"/> 498 NGPE 40 |
| otherwise | <input checked="" type="checkbox"/> 529 6dB divider | <input checked="" type="checkbox"/> 530 10dB Att. | <input type="checkbox"/> 431 Near field | | | |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | | <input type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000 | | | |

5.5.2. Requirements and limits

| | |
|--------------|--|
| FCC | §2.1051-conducted, §2.1057, §22.917(a)(b), §24.238(a)(b), §27.53(h)(3)(ii)(iii), §27.53(g) |
| IC | RSS-132, Issue 3: 6.5.1, RSS-133, Issue 4: 6.5.1(i)(ii), RSS-139, Issue 2: 6.5 (i)(ii) |
| Limit | „the power of emissions shall be attenuated below the transmitter output power (p) by at least 43+10Log(P) dB“ |

5.5.3. Test condition and test set-up

| | | |
|----------------------------|---|-------------------------|
| Climatic conditions | Temperature: (22±3°C) | Rel. humidity: (40±20)% |
| Test system set-up | Please see chapter “Test system set-up for conducted measurements on antenna port” | |
| Measurement method | The spectrum was scanned from 9 kHz to the 10th harmonic of the highest frequency generated within the equipment. A PEAK detector was used except measurements near the block-edge where a AVERAGE detector applied. A suitable artificial antenna or RF-connector is provided by the applicant in order to perform the conducted measurements. Any data provided with the artificial antenna or connector, have been taken in account in order to correct the measurement data. (typical 0.3dB for attenuation of antenna connector) | |
| Spectrum-Analyzer settings | See below tables | |
| Mobile phone settings | A call was established with a suitable communication test unit (CMW500). UE is set TX mode, highest transmit power conditions (RMC-mode), power saving techniques have been disabled Tests have been performed in various settings for the device regarding allocated resource blocks and channels in order to find worst-case configuration. Due to very big amount of possible combinations only certain combinations have been tested. The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance. | |

Spectrum-Analyzer settings for LTE Band 2

| | Start freq. MHz | Stop freq. MHz | R-BW kHz | V-BW MHz | Sweep time sec. | Att. [dB] | Detector |
|-----------------------|-----------------|----------------|--------------------------|-------------------|-----------------|-----------|----------|
| Sweep 1 (subrange 1) | 0.009 | 0.150 | 0.0001 | -- ^{1.)} | 10 | 25 | MaxH-PK |
| Sweep 1 (subrange 2) | 0.150 | 1 | 0.009 | -- ^{1.)} | 10 | 25 | MaxH-PK |
| Sweep 1 (subrange 3) | 1 | 30 | 0.1 | -- ^{1.)} | 5 | 25 | MaxH-PK |
| Sweep 2 (subrange 1) | 30 | 19500 | 1 | -- ^{1.)} | >60 | 35 | MaxH-PK |
| Sweep 3a (Block-Edge) | 1849 | 1850 | 20 ^{2.)} to 200 | -- ^{1.)} | 30 | 35 | MaxH-PK |
| Sweep 3b (Block-Edge) | 1849 | 1850 | | -- ^{1.)} | 30 | 35 | MaxH-AV |
| Sweep 4a (Block-Edge) | 1910 | 1911 | | -- ^{1.)} | 30 | 35 | MaxH-PK |
| Sweep 4b (Block-Edge) | 1910 | 1911 | | -- ^{1.)} | 30 | 35 | MaxH-AV |

Remark: 1.) EMI 6dB receiver mode used

2.) according rules approx. 1% of emission bandwidth depending of chosen signal bandwidth

Spectrum-Analyzer Settings LTE Band 4

| | Start freq. MHz | Stop freq. MHz | R-BW kHz | V-BW MHz | Sweep time sec. | Att. | Detector |
|-----------------------|-----------------|----------------|--------------------------|-------------------|-----------------|------|----------|
| Sweep 1 (subrange 1) | 0.009 | 0.150 | 0.0001 | -- ^{1.)} | 10 | 25 | MaxH-PK |
| Sweep 1 (subrange 2) | 0.150 | 1 | 0.009 | -- ^{1.)} | 10 | 25 | MaxH-PK |
| Sweep 1 (subrange 3) | 1 | 30 | 0.1 | -- ^{1.)} | 5 | 25 | MaxH-PK |
| Sweep 2 (subrange 1) | 30 | 18000 | 1 | -- ^{1.)} | >60 | 35 | MaxH-PK |
| Sweep 3a (Block-Edge) | 1709 | 1710 | 20 ^{2.)} to 200 | -- ^{1.)} | 30 | 35 | MaxH-PK |
| Sweep 3b (Block-Edge) | 1709 | 1710 | | -- ^{1.)} | 30 | 35 | MaxH-AV |
| Sweep 4a (Block-Edge) | 1755 | 1756 | | -- ^{1.)} | 30 | 35 | MaxH-PK |
| Sweep 4b (Block-Edge) | 1755 | 1756 | | -- ^{1.)} | 30 | 35 | MaxH-AV |

Remark: 1.) EMI 6dB receiver mode used

2.) according rules approx. 1% of emission bandwidth depending of chosen signal bandwidth

Spectrum-Analyzer Settings LTE Band 5

| | Start freq. MHz | Stop freq. MHz | R-BW kHz | V-BW MHz | Sweep time sec. | Att. | Detector |
|-----------------------|-----------------|----------------|--------------------------|-------------------|-----------------|------|----------|
| Sweep 1 (subrange 1) | 0.009 | 0.150 | 0.0001 | -- ^{1.)} | 10 | 25 | MaxH-PK |
| Sweep 1 (subrange 2) | 0.150 | 1 | 0.009 | -- ^{1.)} | 10 | 25 | MaxH-PK |
| Sweep 1 (subrange 3) | 1 | 30 | 0.1 | -- ^{1.)} | 5 | 25 | MaxH-PK |
| Sweep 2 (subrange 1) | 30 | 9000 | 1 | -- ^{1.)} | >60 | 35 | MaxH-PK |
| Sweep 3a (Block-Edge) | 823 | 824 | 20 ^{2.)} to 100 | -- ^{1.)} | 30 | 35 | MaxH-PK |
| Sweep 3b (Block-Edge) | 823 | 824 | | -- ^{1.)} | 30 | 35 | MaxH-AV |
| Sweep 4a (Block-Edge) | 850 | 851 | | -- ^{1.)} | 30 | 35 | MaxH-PK |
| Sweep 4b (Block-Edge) | 850 | 851 | | -- ^{1.)} | 30 | 35 | MaxH-AV |

Remark: 1.) EMI 6dB receiver mode used

2.) according rules approx. 1% of emission bandwidth depending of chosen signal bandwidth

Spectrum-Analyzer Settings LTE Band 17

| | Start freq. MHz | Stop freq. MHz | R-BW MHz | V-BW MHz | Sweep time sec. | Att. | Detector |
|-----------------------|-----------------|----------------|--------------------------|-------------------|-----------------|------|----------|
| Sweep 1 (subrange 1) | 0.009 | 0.150 | 0.0001 | -- ^{1.)} | 10 | 25 | MaxH-PK |
| Sweep 1 (subrange 2) | 0.150 | 1 | 0.009 | -- ^{1.)} | 10 | 25 | MaxH-PK |
| Sweep 1 (subrange 3) | 1 | 30 | 0.1 | -- ^{1.)} | 5 | 25 | MaxH-PK |
| Sweep 2 (subrange 1) | 30 | 9000 | 1 | -- ^{1.)} | >60 | 35 | MaxH-PK |
| Sweep 3a (Block-Edge) | 703 | 704 | 50 ^{2.)} to 100 | -- ^{1.)} | 30 | 35 | MaxH-PK |
| Sweep 3b (Block-Edge) | 703 | 704 | | -- ^{1.)} | 30 | 35 | MaxH-AV |
| Sweep 4a (Block-Edge) | 716 | 717 | | -- ^{1.)} | 30 | 35 | MaxH-PK |
| Sweep 4b (Block-Edge) | 716 | 717 | | -- ^{1.)} | 30 | 35 | MaxH-AV |

Remark: 1.) EMI 6dB receiver mode used

2.) according rules approx. 1% of emission bandwidth depending of chosen signal bandwidth

5.5.4. Results

The results are presented below in summary form only. For more information please see diagrams enclosed in annex 4.

5.5.4.1. LTE Band 2: Op. Mode 1, Set-up 2

| Diagram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|-------|-------------------|--------------------------------------|--|-------------------------------------|-------------------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 36.20a | Low | 18607 | 9kHz to 30MHz | 1 | QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.20b | | | 9kHz to 30MHz | | 16QAM-Modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.21a | | | 30 MHz to 19.5MHz | | Carrier visible on diagram, not relevant for results QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.21b | | | 30 MHz to 19.5MHz | | Carrier visible on diagram, not relevant for results QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.203a | | 18615 | 1849 – 1850 MHz | | Band Edge Compliance QPSK modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.203b | | 18615 | 1849 – 1850 MHz | | Band Edge Compliance QAM modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.22a | Middle | 18900 | 9kHz to 30MHz | | QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.22b | | | 9kHz to 30MHz | | 16QAM-Modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.23a | | | 30 MHz to 19.5MHz | | Carrier visible on diagram, not relevant for results QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.23b | | | 30 MHz to 19.5MHz | | Carrier visible on diagram, not relevant for results QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.24a | High | 19100 | 9kHz to 30MHz | | QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.25a | | | 30 MHz to 19.5MHz | | QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.24b | | | 9kHz to 30MHz | | QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.25b | | | 30 MHz to 19.5MHz | | QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.215a | | 19185 | 1910 – 1911 MHz | Band-Edge compliance QPSK Modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed | |
| 37.215b | | 19185 | 1910 – 1911 MHz | Band-Edge compliance QAM Modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed | |

Remark:

5.5.4.2. LTE Band 4: Op. Mode 2, Set-up 2

| Diagram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|-------|-------------------|-------------|--|-------------------------------------|-------------------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 36.40a | Low | 19957 | 9kHz to 30MHz | 2 | QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.40b | | | | | 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.43a | | | 30 MHz to 18GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.43b | | | 30 MHz to 18GHz | | Carrier visible on diagram, not relevant for results 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.520a | Low | 19965 | 1709 -1710 MHz | 2 | Band Edge Compliance QPSK modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.520b | | 19965 | 1709 -1710 MHz | | Band Edge Compliance QAM modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.41a | Middle | 20175 | 9kHz to 30MHz | 2 | QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.41b | | 20175 | | | 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.44a | | 20175 | 30 MHz to 18GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.44b | | 20175 | 30 MHz to 18GHz | | Carrier visible on diagram, not relevant for results QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.42a | High | 20393 | 9kHz to 30MHz | 2 | QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.42b | | | | | 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.45a | | | 30 MHz to 19.5MHz | | Carrier visible on diagram, not relevant for results QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.45b | | | 30 MHz to 19.5MHz | | Carrier visible on diagram, not relevant for results QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.532a | High | 20385 | 1755 - 1756 MHz | 2 | Band-Edge compliance QPSK modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.532b | | 20385 | 1755 - 1756 MHz | | Band-Edge compliance QAM modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |

Remark:

5.5.4.3. LTE Band 5: Op. Mode 3, Set-up 2

| Diagram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|-------|-----------------|-------------|--|-------------------------------------|-------------------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 36.50a | Low | 20407 | 9kHz to 30MHz | 3 | QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.56b | | | 9kHz to 30MHz | | 16-QAM Modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.51a | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.57b | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.512a | Low | 20415 | 823 – 824 MHz | 3 | Band Edge Compliance QPSK modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.514b | Low | | 823 – 824 MHz | | Band Edge Compliance QPSK modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.52a | Middle | 20525 | 9kHz to 30MHz | 3 | QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.58b | | | 9kHz to 30MHz | | 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.53a | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.59b | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.54a | High | 20600 | 9kHz to 30MHz | 3 | QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.60b | High | | 9kHz to 30MHz | | 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.55a | High | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.61b | High | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.506a | High | 20625 | 849 – 850 MHz | 3 | Band Edge Compliance QPSK modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.506b | High | | 849 – 850 MHz | | Band Edge Compliance 16-QAM modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |

Remark:

5.5.4.4. LTE Band 17: Op. Mode 4, Set-up 2

| Diagram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|-------|-----------------|-------------|--|-------------------------------------|-------------------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 36.170a | Low | 23755 | 9kHz to 30MHz | 4 | QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.170b | | | 9kHz to 30MHz | | 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.171a | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.171b | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.171a | Low | 23755 | 703 – 704 MHz | 4 | Band-Edge compliance QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.171b | | | 703 – 704 MHz | | Band-Edge compliance 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.172a | Middle | 23790 | 9kHz to 30MHz | 4 | QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.172b | | | 9kHz to 30MHz | | 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.174a | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.174b | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.173a | High | 23800 | 9kHz to 30MHz | 4 | QPSK Modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.173b | | | 9kHz to 30MHz | | 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.175a | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.175b | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results 16-QAM modulation | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.175a | High | 23825 | 716 -717 MHz | 4 | Band-Edge compliance QPSK modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.175b | | | 716 -717 MHz | | Band-Edge compliance 16-QAM modulation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |

Remark:

5.6. RF-Parameter - Frequency stability on temperature and voltage variations

5.6.1. Test location and equipments (for reference numbers please see chapter 'List of test equipment')

| | | | |
|-----------------------|--|--|---|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2 | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| test site | <input type="checkbox"/> 347 Radio.lab.1 | <input checked="" type="checkbox"/> Radio.lab.2 | |
| spectr. analys. | <input type="checkbox"/> 584 FSU | <input type="checkbox"/> 489 ESU 40 | <input type="checkbox"/> 264 FSEK <input type="checkbox"/> 620 ESU 26 |
| signaling | <input type="checkbox"/> 392 MT8820A | <input type="checkbox"/> 436 CMU | <input type="checkbox"/> 547 CMU <input checked="" type="checkbox"/> 594 CMW500 <input type="checkbox"/> 594 CMW500 |
| DC power | <input checked="" type="checkbox"/> 611 E3632A | <input type="checkbox"/> 457 EA 3013A | <input type="checkbox"/> 459 EA 2032-50 <input type="checkbox"/> 268 EA- 3050 <input type="checkbox"/> 494 AG6632A <input type="checkbox"/> 498 NGPE 40 |
| otherwise | <input checked="" type="checkbox"/> 529 6dB divider | <input checked="" type="checkbox"/> 530 10dB Att. | <input type="checkbox"/> 431 Near field |
| Climatic test chamber | <input checked="" type="checkbox"/> 331 HC 4055 | | |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | | <input type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000 |

5.6.2. Requirements and limits

| | |
|--------------|--|
| FCC | §2.1055(a)(1) , §22.355, §24.235, §27.54 |
| IC | RSS-132: 5.3, RSS-133: 6.3; RSS-139, Issue 2: 6.3 |
| Limit | <i>“The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block”</i> |

5.6.3. Test condition and test set-up

| | |
|-----------------------|---|
| Test system set-up | Please see chapter “Test system set-up for conducted measurements on antenna port” The power supply voltage was controlled on the input of the power supply terminals of the EUT. |
| Measurement method | The RF Channel spacing is 100 kHz according LTE-Spec, with a guard band depending of the TX signal bandwidth. Details can be found in standard 3GPP36.521. The aim of the EUT is to function under all extreme conditions within authorized sub-bands in regard to temperature and voltage variations. The frequency deviation was recorded with base station’s build in capability. (CMW500) for both modulations possible: QPSK and 16-QAM As the standard requires that the fundamental emissions stays within the authorized band, a limit of ±0.1ppm is considered low enough to ensure this. However the standard required a more relaxed limit of ±2.5ppm |
| Mobile phone settings | UE is set TX mode, highest transmit power conditions (RMC-mode), power saving techniques have been disabled Tests have been done in RMC operating mode ,maximum power at lowest per bandwidth allowed TX signal bandwidth: 1.4MHz or 5MHz. Both modulations have been tested: QPSK and 16-QAM. Full per signal bandwidth allowed resource-blocks allocation have been used: 6RB(BW=1.4MHz) or 25 RB (BW=5MHz) |

5.6.3.1. Frequency shift of carrier against a voltage range at constant nominal temperature of 20° Celsius

- 1.) determine the carrier frequency for the lowest and highest channel at room temperature and nominal voltage [20°C]
- 2.) The voltage was reduced in 0.1 Volt steps to the lower end point, where the mobile phone stops working. (this shall be specified by the manufacturer) Record the carrier frequency shift within 2 minutes after powering on the mobile phone, to prevent self-heating effects.
- 3.) The voltage was increased in 0.1 Volt steps to the upper declared voltage of the battery. Record the carrier frequency shift within 2 minutes after powering on the mobile phone, to prevent self-heating effects.

5.6.4. Measurement Results:

No tests performed across extreme voltage range: limited approval.

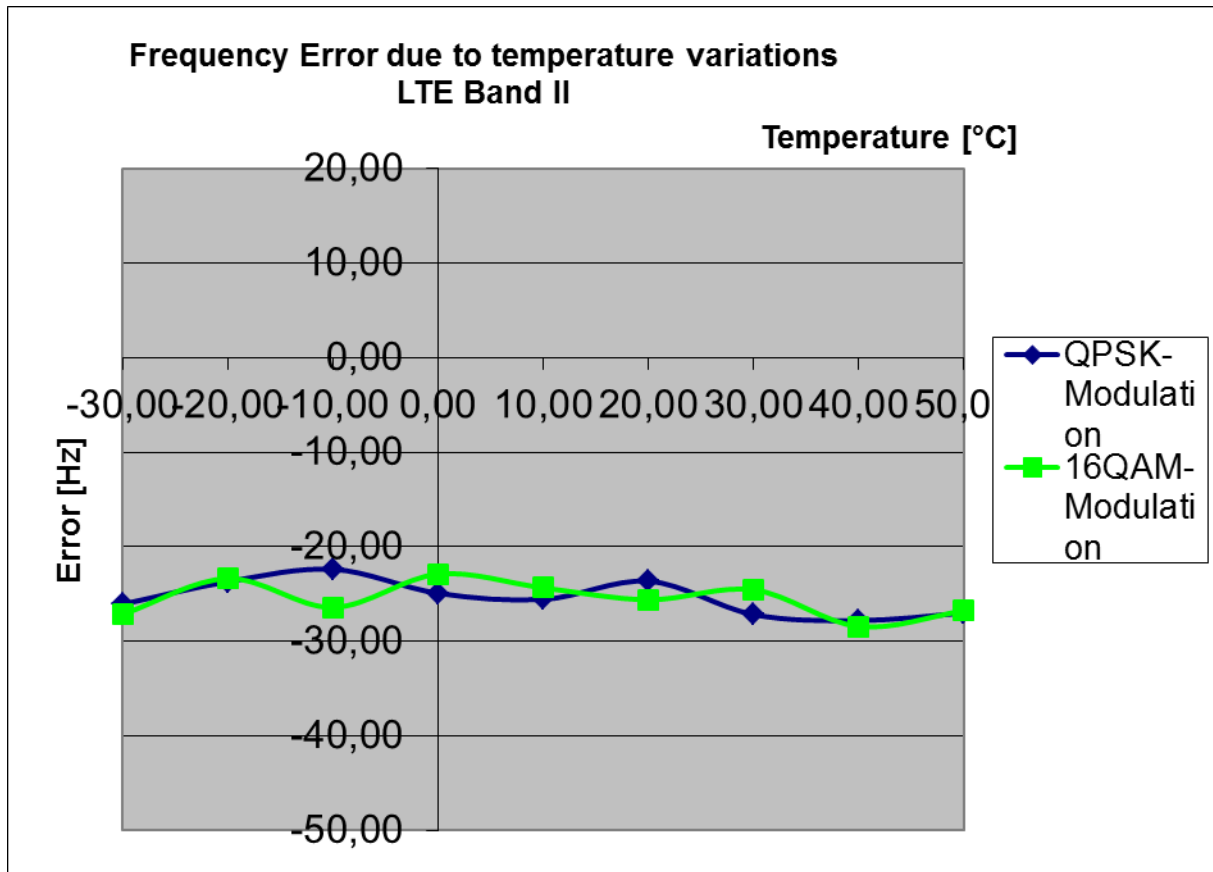
OEM integrators should consult grant and applicants recommendations on power supply design rules.

5.6.4.1. Frequency shift of carrier against temperature at constant power supply voltage

- 1.) determine the carrier frequency for the lowest, middle and highest channel at room temperature and nominal voltage [20°C]
- 2.) expose the mobile station to -30°C, wait sufficient time to have constant temperature.
- 3.) Perform the carrier frequencies measurements in 10°C increments from -30°C to +60°C. For about half hour at the specified temperature the mobile was powered-off. After powering-on, the measurements were made within 2 minute for the channel lower channel, in order to prevent self-warming of the mobile.

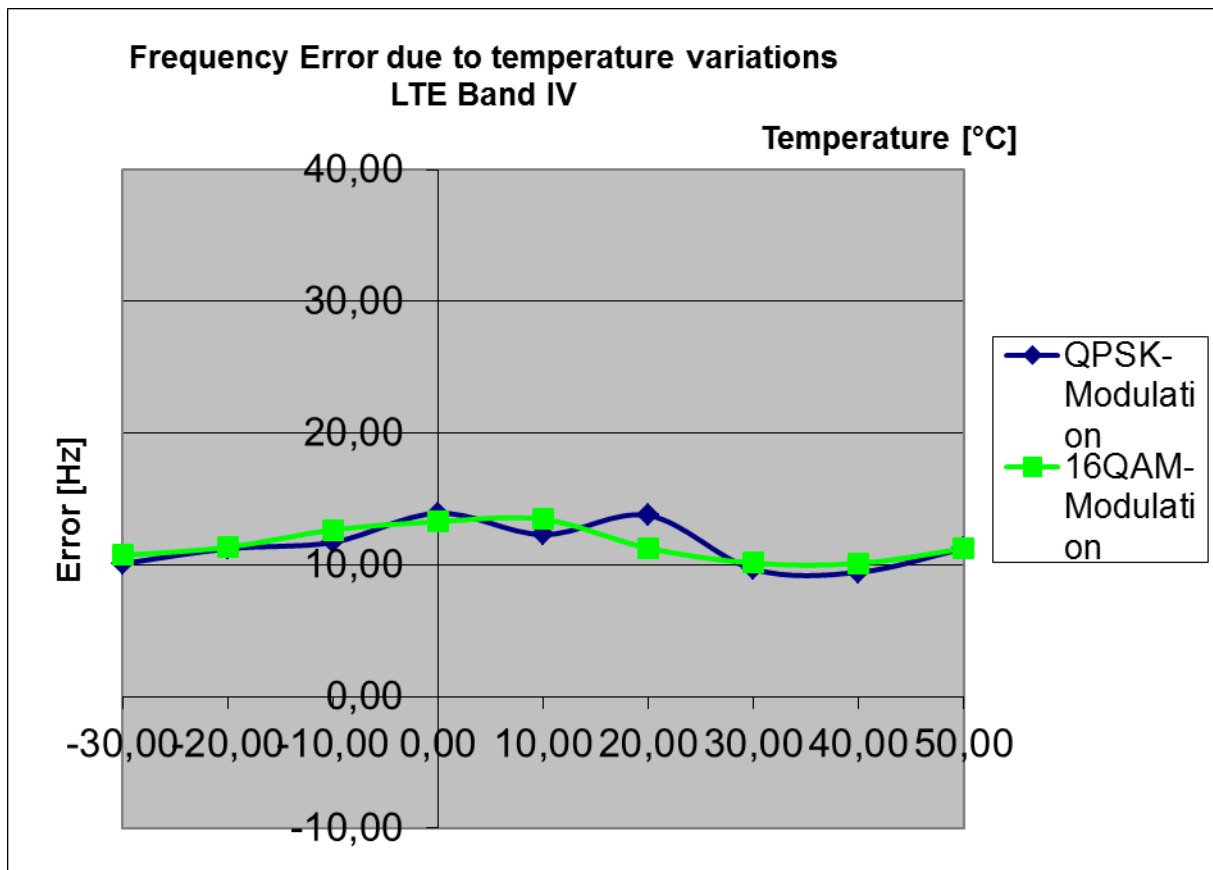
5.6.4.2. LTE Band 2

| Maximum frequency error | | | | | |
|-------------------------|---------------------------|------------------------|-----------------------|-------------------------|--------------------------|
| Temperature | Channel 18900/ BW=1.4 MHz | | | | Verdict Limit=±0.1ppm |
| | QPSK Modulation [Hz] | 16-QAM Modulation [Hz] | QPSK Modulation [ppm] | 16-QAM Modulation [ppm] | |
| -30 | -26,08 | -27,15 | -0,014 | -0,014 | Passed |
| -20 | -23,70 | -23,37 | -0,013 | -0,012 | |
| -10 | -22,39 | -26,42 | -0,012 | -0,014 | |
| 0 | -24,93 | -22,90 | -0,013 | -0,012 | |
| 10 | -25,58 | -24,35 | -0,014 | -0,013 | |
| 20 | -23,65 | -25,61 | -0,013 | -0,014 | |
| 30 | -27,18 | -24,56 | -0,014 | -0,013 | |
| 40 | -27,82 | -28,44 | -0,015 | -0,015 | |
| 50 | -27,02 | -26,78 | -0,014 | -0,014 | |



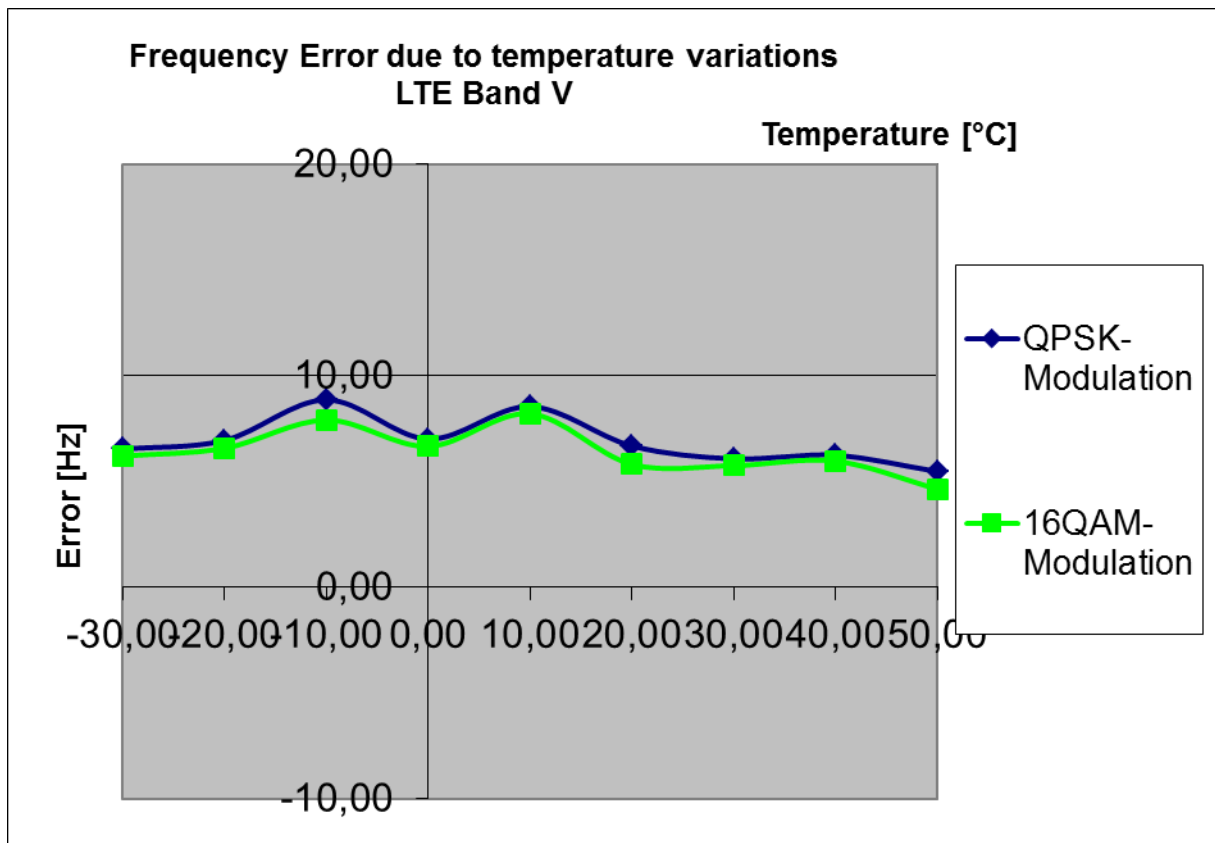
5.6.4.3. LTE Band 4

| Maximum frequency error | | | | | |
|-------------------------|---------------------------|------------------------|-----------------------|-------------------------|--------------------------|
| Temperature | Channel 20175/ BW= 1.4MHz | | | | Verdict Limit=±0.1ppm |
| | QPSK Modulation [Hz] | 16-QAM Modulation [Hz] | QPSK Modulation [ppm] | 16-QAM Modulation [ppm] | |
| -30 | 10,10 | 10,73 | 0,006 | 0,006 | Passed |
| -20 | 11,23 | 11,34 | 0,006 | 0,007 | |
| -10 | 11,72 | 12,66 | 0,007 | 0,007 | |
| 0 | 13,93 | 13,29 | 0,008 | 0,008 | |
| 10 | 12,30 | 13,46 | 0,007 | 0,008 | |
| 20 | 13,75 | 11,27 | 0,008 | 0,007 | |
| 30 | 9,67 | 10,14 | 0,006 | 0,006 | |
| 40 | 9,44 | 10,11 | 0,005 | 0,006 | |
| 50 | 11,26 | 11,24 | 0,006 | 0,006 | |



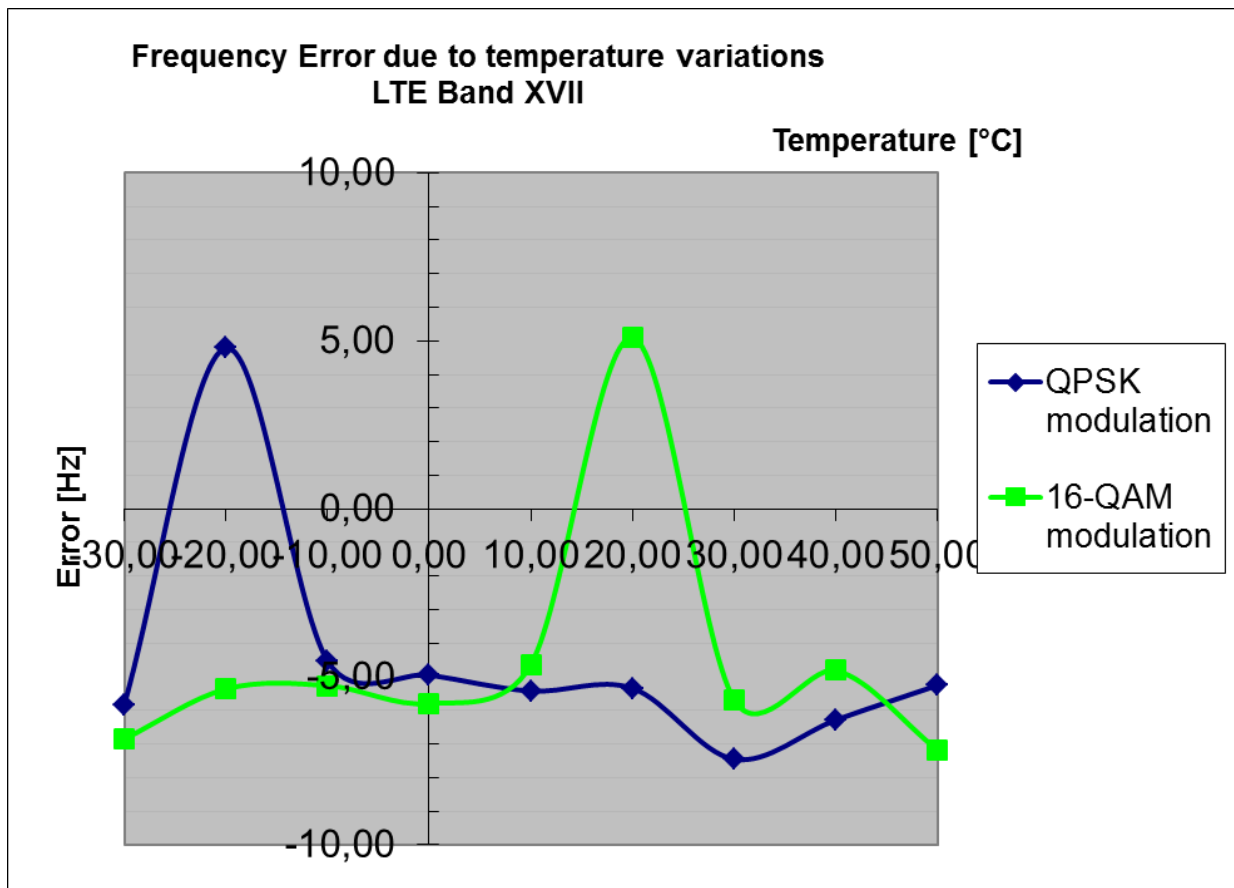
5.6.4.4. LTE Band 5

| Maximum frequency error | | | | | |
|-------------------------|---------------------------|------------------------|-----------------------|-------------------------|---------------------------|
| Temperature | Channel 20525/ BW= 1.4MHz | | | | Verdict Limit=±0.1 ppm |
| | QPSK Modulation [Hz] | 16-QAM Modulation [Hz] | QPSK Modulation [ppm] | 16-QAM Modulation [ppm] | |
| -30 | 6,54 | 6,21 | 0,008 | 0,007 | Passed |
| -20 | 6,95 | 6,58 | 0,008 | 0,008 | |
| -10 | 8,87 | 7,91 | 0,011 | 0,009 | |
| 0 | 7,02 | 6,67 | 0,008 | 0,008 | |
| 10 | 8,55 | 8,21 | 0,010 | 0,010 | |
| 20 | 6,69 | 5,82 | 0,008 | 0,007 | |
| 30 | 6,08 | 5,76 | 0,007 | 0,007 | |
| 40 | 6,25 | 5,97 | 0,007 | 0,007 | |
| 50 | 5,48 | 4,65 | 0,007 | 0,006 | |



5.6.4.5. LTE Band 17

| Maximum frequency error | | | | | |
|-------------------------|------------------------|------------------------|-----------------------|-------------------------|--------------------------|
| Temperature | Channel 23790/ BW=5MHz | | | | Verdict Limit=±0.1ppm |
| | QPSK Modulation [Hz] | 16-QAM Modulation [Hz] | QPSK Modulation [ppm] | 16-QAM Modulation [ppm] | |
| -30 | -5,82 | -6,85 | -0,008 | -0,010 | Passed |
| -20 | 4,79 | -5,36 | 0,007 | -0,008 | |
| -10 | -4,53 | -5,26 | -0,006 | -0,007 | |
| 0 | -4,94 | -5,79 | -0,007 | -0,008 | |
| 10 | -5,42 | -4,63 | -0,008 | -0,007 | |
| 20 | -5,34 | 5,09 | -0,008 | 0,007 | |
| 30 | -7,45 | -5,69 | -0,010 | -0,008 | |
| 40 | -6,28 | -4,81 | -0,009 | -0,007 | |
| 50 | -5,25 | -7,18 | -0,007 | -0,010 | |



5.7. Measurement uncertainties

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved.

For uncertainty determination, each component used in the concrete measurement set-up was taken in account and it's contribution to the overall uncertainty according it's statistical distribution calculated.

Following table shows expectable uncertainties for each measurement type performed.

| RF-Measurement | Frequency range | Calculated uncertainty based on a confidence level of 95% | Remarks: |
|--|-------------------|---|---------------------|
| Power Output conducted | 9 kHz .. 20 GHz | 1.0 dB | -- |
| Power Output radiated | 30 MHz .. 4 GHz | 3.17 dB | Substitution method |
| Conducted emissions on antenna ports | 9 kHz .. 20 GHz | 1.0 dB | -- |
| Radiated emissions enclosure | 150 kHz .. 30 MHz | 5.0 dB | Magnetic field |
| | 30 MHz .. 1 GHz | 4.2 dB | E-Field |
| | 1 GHz .. 20 GHz | 3.17 dB | Substitution method |
| Occupied bandwidth | 9 kHz .. 4 GHz | 0.1272 ppm (Delta Marker) | Frequency error |
| | | 1.0 dB | Power |
| Emission bandwidth | 9 kHz .. 4 GHz | 0.1272 ppm (Delta Marker) | Frequency error |
| | | 1.0 dB | Power |
| Frequency stability | 9 kHz .. 20 GHz | 0.0636 ppm | -- |
| Conducted emissions on AC-mains port (U _{CISPR}) | 9 kHz .. 150 kHz | 4.0 dB | -- |
| | 150 kHz .. 30 MHz | 3.6 dB | -- |

Table: measurement uncertainties, valid for conducted/radiated measurements

6. Abbreviations used in this report

| The abbreviations | |
|-------------------|---|
| ANSI | American National Standards Institute |
| AV , AVG, CAV | Average detector |
| EIRP | Equivalent isotropically radiated power, determined within a separate measurement |
| EGPRS | Enhanced General Packet Radio Service |
| EUT | Equipment Under Test |
| FCC | Federal Communications Commission, USA |
| IC | Industry Canada |
| n.a. | not applicable |
| Op-Mode | Operating mode of the equipment |
| PK | Peak |
| RBW | resolution bandwidth |
| RF | Radio frequency |
| RSS | Radio Standards Specification, Dokuments from Industry Canada |
| Rx | Receiver |
| TCH | Traffic channel |
| Tx | Transmitter |
| QP | Quasi peak detector |
| VBW | Video bandwidth |
| ERP | Effective radiated power |

7. Accreditation details of CETECOM’s laboratories and test sites

| Ref.-No. | Accreditation Certificate | Valid for laboratory area or test site | Accreditation Body |
|---|--|---|---|
| - | D-PL-12047-01-01 | All laboratories and test sites of CETECOM GmbH, Essen | DAkkS, Deutsche Akkreditierungsstelle GmbH |
| 337 487 558 348 348 | 736496 | Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measur. | FCC, Federal Communications Commission Laboratory Division, USA (MRA US-EU 0003) |
| 337 487 550 558 | 3462D-1 3462D-2 3462D-2 3462D-3 | Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR) | IC, Industry Canada Certification and Engineering Bureau |
| 487 550 348 348 | R-2666 G-301 C-2914 T-1967 | Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measur. | VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan |
| OATS = Open Area Test Site, SAR = Semi Anechoic Room, FAR = Fully Anechoic Room | | | |

8. Instruments and Ancillary

8.1. Used equipment “CTC”

The “Ref.-No” in the left column of the following tables allows the clear identification of the laboratory equipment.

8.1.1. Test software and firmware of equipment

| Ref.-No. | Equipment | Type | Serial-No. | Version of Firmware or Software during the test |
|----------|---|------------------------|----------------|---|
| 001 | EMI Test Receiver | ESS | 825132/017 | Firm.= 1.21 , OTP=2.0, GRA=2.0 |
| 012 | Signal Generator (EMS-cond.) | SMY 01 | 839069/027 | Firm.= V 2.02 |
| 013 | Power Meter (EMS cond.) | NRVD | 839111/003 | Firm.= V 1.51 |
| 017 | Digital Radiocommunication Tester | CMD 60 M | 844365/014 | Firmware = V 3.52 .22.01.99, DECT = D2.87 13.01.99 |
| 053 | Audio Analyzer | UPA3 | 860612/022 | Firm. V 4.3 |
| 119 | RT Harmonics Analyzer dig. Flickermeter | B10 | G60547 | Firm.= V 3.1DHG |
| 140 | Signal Generator | SMHU | 831314/006 | Firm.= 3.21 |
| 261 | Thermal Power Sensor | NRV-Z55 | 825083/0008 | EPROM-Datum 02.12.04, SE EE 1 B |
| 262 | Power Meter | NRV-S | 825770/0010 | Firm.= 2.6 |
| 263 | Signal Generator | SMP 04 | 826190/0007 | Firm.=3.21 |
| 264 | Spectrum Analyzer | FSEK 30 | 826939/005 | Bios=2.1, Analyzer= 3.20 |
| 295 | Racal Digital Radio Test Set | 6103 | 1572 | UNIT Firmware= 4.04, SW-Main=4.04, SW-BBP=1.04, SW-DSP=1.02, Hardboot=1.02, Softboot=2.02 |
| 298 | Univ. Radio Communication Tester | CMU 200 | 832221/091 | R&S Test Firmware =3.53 /3.54 (current Testsoftw. f. all band used |
| 323 | Digital Radiocommunication Tester | CMD 55 | 825878/0034 | Firm.= 3.52 .22.01.99 |
| 331 | Climatic Test Chamber -40/+80 Grad | HC 4055 | 43146 | TSI 1.53 |
| 335 | CTC-EMS-Conducted | System EMS Conducted | - | EMC 32 V 8.52 |
| 340 | Digital Radiocommunication Tester | CMD 55 | 849709/037 | Firm.= 3.52 .22.01.99 |
| 355 | Power Meter | URV 5 | 891310/027 | Firm.= 1.31 |
| 365 | 10V Insertion Unit 50 Ohm | URV5-Z2 | 100880 | Eprom Data = 31.03.08 |
| 366 | Ultra Compact Simulator | UCS 500 M4 | V0531100594 | Firm. UCS 500=001925/3.06a02, rc=ISMIEC 4.10 |
| 371 | Bluetooth Tester | CBT32 | 100153 | CBT V5.30+ SW-Option K55, K57 |
| 377 | EMI Test Receiver | ESCS 30 | 100160 | Firm.= 2.30, OTP= 02.01, GRA= 02.36 |
| 378 | Broadband RF Field Monitor | RadiSense III | 03D00013SNO-08 | Firm.= V.03D13 |
| 383 | Signal Generator | SME 03 | 842 828 /034 | Firm.= 4.61 |
| 389 | Digital Multimeter | Keithley 2000 | 0583926 | Firm. = A13 (Mainboard) A02 (Display) |
| 392 | Radio Communication Tester | MT8820A | 6K00000788 | Firm.= 4.50 #005, IPL=4.01#001,OS=4.02#001, GSM=4.41#013, W-CDMA= 4.54#004, scenario= 4.52#002 |
| 436 | Univ. Radio Communication Tester | CMU 200 | 103083 | R&S Test Firmware Base=5.14, Mess-Software= GSM:5.14 WCDMA:5.14 (current Testsoftw. F. all band |
| 441 | CTC-SAR-EMI Cable Loss | System EMI field (SAR) | - | EMC 32 Version 8.52 |
| 442 | CTC-SAR-EMS | System EMS field (SAR) | - | EMC 32 Version 8.40 |
| 443 | CTC-FAR-EMI-RSE | System CTC-FAR-EMI-RSE | - | Spuri 7.2.5 or EMC 32 Ver. 8.53 |
| 444 | CTC-FAR-EMS field | System-EMS-Field (FAR) | - | EMC 32 Version 8.40 |
| 460 | Univ. Radio Communication Tester | CMU 200 | 108901 | R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.,f. all band to be used, |
| 489 | EMI Test Receiver | ESU40 | 1000-30 | Firmware=4.43 SP3, Bios=V5.1-16-3, Spec. =01.00 |
| 491 | ESD Simulator dito | ESD dito | dito307022 | V 2.30 |
| 524 | Voltage Drop Simulator | VDS 200 | 0196-16 | Software Nr. 000037 Version V4.20a01 |
| 526 | Burst Generator | EFT 200 A | 0496-06 | Software Nr. 000034 Version V2.32 |
| 527 | Micro Pulse Generator | MPG 200 B | 0496-05 | Software-Nr. 000030 Version V2.43 |
| 528 | Load Dump Simulator | LD 200B | 0496-06 | Software-Nr. 000031 Version V2.35a01 |
| 546 | Univ. Radio Communication Tester | CMU 200 | 106436 | R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.,f. all band to be used |
| 547 | Univ. Radio Communication Tester | CMU 200 | 835390/014 | R&S Test Firmware Base=V5.1403 (current Testsoftw., f. all band used, GSM = 5.14 WCDMA: = 5.14 |
| 584 | Spectrum Analyzer | FSU 8 | 100248 | 2.82 SP3 |
| 594 | Wideband Radio Communication Tester | CMW 500 | 101757 | Firmware Base=2.0.20.9, LTE=2.0.20.8, CDMA= 2.0.10 |
| 597 | Univ. Radio Communication Tester | CMU 200 | 100347 | R&S Test Firmware Base=5.01, GSM=5.02 WCDMA= not installed, Mainboard= µP1=V.850 |
| 598 | Spectrum Analyzer | FSEM 30 (Reserve) | 831259/013 | Firmware Bios 3.40 , Analyzer 3.40 Sp 2 |
| 620 | EMI Test Receiver | ESU 26 | 100362 | 4.43 SP3 |
| 642 | Wideband Radio Communication Tester | CMW 500 | 126089 | Setup V03.26, Test programm component V02.12.01 |

8.1.2. Single instruments and test systems

| Ref.-No. | Equipment | Type | Serial-No. | Manufacturer | Interval of calibration | Remark | Cal due |
|----------|---|---------------------------|-----------------|-----------------------|-------------------------|--------|------------|
| 001 | EMI Test Receiver | ESS | 825132/017 | Rohde & Schwarz | 12 M | - | 31.03.2014 |
| 005 | AC - LISN (50 Ohm/50µH, test site 1) | ESH2-Z5 | 861741/005 | Rohde & Schwarz | 24/12 M | - | 31.03.2014 |
| 007 | Single-Line V-Network (50 Ohm/5µH) | ESH3-Z6 | 892563/002 | Rohde & Schwarz | 24/12 M | - | 31.03.2014 |
| 009 | Power Meter (EMS-radiated) | NRV | 863056/017 | Rohde & Schwarz | 24 M | - | 31.03.2015 |
| 016 | Line Impedance Simulating Network | Op. 24-D | B6366 | Spitzenberger+Spies | 36 M | - | 31.03.2016 |
| 020 | Horn Antenna 18 GHz (Subst 1) | 3115 | 9107-3699 | EMCO | 36/12 M | - | 31.03.2014 |
| 021 | Loop Antenna (H-Field) | 6502 | 9206-2770 | EMCO | 36 M | - | 31.03.2015 |
| 030 | Loop Antenna (H-field) | HFH-Z2 | 879604/026 | Rohde & Schwarz | 36 M | - | 31.03.2015 |
| 033 | RF-current probe (100kHz-30MHz) | ESH2-Z1 | 879581/18 | Rohde & Schwarz | 24 M | - | 31.03.2015 |
| 057 | relay-switch-unit (EMS system) | RSU | 494440/002 | Rohde & Schwarz | pre-m | 1a | |
| 060 | power amplifier (DC-2kHz) | PAS 5000 | B6363 | Spitzenberger+Spies | - | 3 | |
| 066 | notch filter (WCDMA; FDD1) | WRCT 1900/2200-5/40-10EEK | 5 | Wainwright GmbH | 12 M | 1g | 30.06.2014 |
| 086 | DC - power supply, 0 -10 A | LNG 50-10 | - | Heinzinger Electronic | pre-m | 2 | |
| 087 | DC - power supply, 0 -5 A | EA-3013 S | - | Elektro Automatik | pre-m | 2 | |
| 090 | Helmholtz coil: 2x10 coils in series | - | - | RWTÜV | - | 4 | |
| 091 | USB-LWL-Converter | OLS-1 | 007/2006 | Ing. Büro Scheiba | - | 4 | |
| 099 | passive voltage probe | ESH2-Z3 | 299.7810.52 | Rohde & Schwarz | 36 M | - | 31.03.2015 |
| 100 | passive voltage probe | Probe TK 9416 | without | Schwarzbeck | 36 M | - | 31.03.2015 |
| 110 | USB-LWL-Converter | OLS-1 | - | Ing. Büro Scheiba | - | 4 | |
| 119 | RT Harmonics Analyzer dig. Flickermeter | B10 | G60547 | BOCONSULT | 36 M | - | 31.03.2016 |
| 134 | horn antenna 18 GHz (Subst 2) | 3115 | 9005-3414 | EMCO | pre-m | - | 31.03.2014 |
| 136 | adjustable dipole antenna (Dipole 1) | 3121C-DB4 | 9105-0697 | EMCO | 36 M | - | 31.03.2015 |
| 140 | Signal Generator | SMHU | 831314/006 | Rohde & Schwarz | 24 M | - | 31.03.2014 |
| 248 | attenuator | SMA 6dB 2W | - | Radiall | pre-m | 2 | |
| 249 | attenuator | SMA 10dB 10W | - | Radiall | pre-m | 2 | |
| 252 | attenuator | N 6dB 12W | - | Radiall | pre-m | 2 | |
| 256 | attenuator | SMA 3dB 2W | - | Radiall | pre-m | 2 | |
| 257 | hybrid | 4031C | 04491 | Narda | pre-m | 2 | |
| 260 | hybrid coupler | 4032C | 11342 | Narda | pre-m | 2 | |
| 261 | Thermal Power Sensor | NRV-Z55 | 825083/0008 | Rohde & Schwarz | 24 M | - | 31.03.2014 |
| 262 | Power Meter | NRV-S | 825770/0010 | Rohde & Schwarz | 24 M | - | 31.03.2014 |
| 263 | Signal Generator | SMP 04 | 826190/0007 | Rohde & Schwarz | 36 M | - | 31.03.2016 |
| 264 | Spectrum Analyzer | FSEK 30 | 826939/005 | Rohde & Schwarz | 12 M | - | 31.03.2014 |
| 265 | peak power sensor | NRV-Z33, Model 04 | 840414/009 | Rohde & Schwarz | 24 M | - | 31.03.2014 |
| 266 | peak power sensor | NRV-Z31, Model 04 | 843383/016 | Rohde & Schwarz | 24 M | - | 31.03.2014 |
| 267 | notch filter GSM 850 | WRCA 800/960-6EEK | 9 | Wainwright GmbH | pre-m | 2 | |
| 270 | termination | 1418 N | BB6935 | Weinschel | pre-m | 2 | |
| 271 | termination | 1418 N | BE6384 | Weinschel | pre-m | 2 | |
| 272 | attenuator (20 dB) 50 W | Model 47 | BF6239 | Weinschel | pre-m | 2 | |
| 273 | attenuator (10 dB) 100 W | Model 48 | BF9229 | Weinschel | pre-m | 2 | |
| 274 | attenuator (10 dB) 50 W | Model 47 (10 dB) 50 W | BG0321 | Weinschel | pre-m | 2 | |
| 275 | DC-Block | Model 7003 (N) | C5129 | Weinschel | pre-m | 2 | |
| 276 | DC-Block | Model 7006 (SMA) | C7061 | Weinschel | pre-m | 2 | |
| 279 | power divider | 1515 (SMA) | LH855 | Weinschel | pre-m | 2 | |
| 287 | pre-amplifier 25MHz - 4GHz | AMF-2D-100M4G-35-10P | 379418 | Miteq | 12 M | 1c | 30.06.2014 |
| 291 | high pass filter GSM 850/900 | WHJ 2200-4EE | 14 | Wainwright GmbH | 12 M | 1c | 30.06.2014 |
| 298 | Univ. Radio Communication Tester | CMU 200 | 832221/091 | Rohde & Schwarz | pre-m | 3 | |
| 300 | AC LISN (50 Ohm/50µH, 1-phase) | ESH3-Z5 | 892 239/020 | Rohde & Schwarz | 24/12 M | - | 31.03.2014 |
| 301 | attenuator (20 dB) 50W, 18GHz | 47-20-33 | AW0272 | Lucas Weinschel | pre-m | 2 | |
| 302 | horn antenna 40 GHz (Meas 1) | BBHA9170 | 155 | Schwarzbeck | 36 M | - | 31.03.2014 |
| 303 | horn antenna 40 GHz (Subst 1) | BBHA9170 | 156 | Schwarzbeck | 36 M | - | 31.03.2014 |
| 331 | Climatic Test Chamber -40/+80 Grad | HC 4055 | 43146 | Heraeus Vötsch | 24 M | - | 30.11.2014 |
| 341 | Digital Multimeter | Fluke 112 | 81650455 | Fluke | 24 M | - | 31.03.2014 |
| 342 | Digital Multimeter | Voltcraft M-4660A | IB 255466 | Voltcraft | 24 M | - | 31.03.2015 |
| 347 | laboratory site | radio lab. | - | - | - | 5 | |
| 348 | laboratory site | EMI conducted | - | - | - | 5 | |
| 354 | DC - Power Supply 40A | NGPE 40/40 | 448 | Rohde & Schwarz | pre-m | 2 | |
| 355 | Power Meter | URV 5 | 891310/027 | Rohde & Schwarz | 24 M | - | 31.03.2014 |
| 356 | power sensor | NRV-Z1 | 882322/014 | Rohde & Schwarz | 24 M | - | 31.03.2015 |
| 357 | power sensor | NRV-Z1 | 861761/002 | Rohde & Schwarz | 24 M | - | 31.03.2015 |
| 371 | Bluetooth Tester | CBT32 | 100153 | R&S | 24 M | - | 31.03.2014 |
| 373 | Single-Line V-Network (50 Ohm/5µH) | ESH3-Z6 | 100535 | Rohde & Schwarz | 24/12 M | - | 31.03.2014 |
| 376 | Horn Antenna 6 GHz | BBHA9120 E | BBHA 9120 E 179 | Schwarzbeck | 12 M | - | 31.03.2014 |
| 377 | EMI Test Receiver | ESCS 30 | 100160 | Rohde & Schwarz | 12 M | - | 31.03.2014 |
| 389 | Digital Multimeter | Keithley 2000 | 0583926 | Keithley | 24 M | - | 31.03.2015 |
| 392 | Radio Communication Tester | MT8820A | 6K00000788 | Anritsu | 12 M | - | 31.03.2014 |
| 431 | Model 7405 | Near-Field Probe Set | 9305-2457 | EMCO | - | 4 | |
| 436 | Univ. Radio Communication Tester | CMU 200 | 103083 | Rohde & Schwarz | 12 M | - | 31.03.2014 |
| 441 | CTC-SAR-EMI Cable Loss | System EMI field (SAR) | - | CETECOM | 12 M | 5 | 31.10.2013 |

| Ref.-No. | Equipment | Type | Serial-No. | Manufacturer | Interval of calibration | Remark | Cal due |
|----------|---|-----------------------------|----------------------------|-----------------------------|-------------------------|--------|------------|
| | | Cable | | | | | |
| 443 | CTC-FAR-EMI-RSE | System CTC-FAR-EMI-RSE | - | ETS-Lindgren / CETECOM | 12 M | 5 | 15.07.2014 |
| 448 | notch filter WCDMA_FDD II | WRCT 1850.0/2170.0-5/40- | 5 | Wainwright Instruments GmbH | 12 M | 1c | 30.06.2014 |
| 449 | notch filter WCDMA FDD V | WRCT 824.0/894.0-5/40-8SSK | 1 | Wainwright | 12 M | 1c | 30.06.2014 |
| 454 | Oscilloscope | HM 205-3 | 9210 P 29661 | Hameg | - | 4 | |
| 456 | DC-Power supply 0-5 A | EA 3013 S | 207810 | Elektro Automatik | pre-m | 2 | |
| 459 | DC -Power supply 0-5 A , 0-32 V | EA-PS 2032-50 | 910722 | Elektro Automatik | pre-m | 2 | |
| 460 | Univ. Radio Communication Tester | CMU 200 | 108901 | Rohde & Schwarz | 12 M | - | 31.03.2014 |
| 463 | Universal source | HP3245A | 2831A03472 | Agilent | - | 4 | |
| 466 | Digital Multimeter | Fluke 112 | 89210157 | Fluke USA | 24 M | - | 31.03.2014 |
| 467 | Digital Multimeter | Fluke 112 | 89680306 | Fluke USA | 24 M | - | 31.03.2014 |
| 468 | Digital Multimeter | Fluke 112 | 90090455 | Fluke USA | 24 M | - | 31.03.2014 |
| 477 | ReRadiating GPS-System | AS-47 | - | Automotive Cons. Fink | - | 3 | |
| 480 | power meter (Fula) | NRVS | 838392/031 | Rohde & Schwarz | 24 M | - | 31.03.2015 |
| 482 | filter matrix | Filter matrix SAR 1 | - | CETECOM (Brl) | - | 1d | |
| 484 | pre-amplifier 2,5 - 18 GHz | AMF-5D-02501800-25-10P | 1244554 | Miteq | 12 M | - | 30.06.2014 |
| 487 | System CTC NSA-Verification SAR-EMI | System EMI field (SAR) NSA | - | ETS Lindgren / CETECOM | 24 M | - | 30.06.2015 |
| 489 | EMI Test Receiver | ESU40 | 1000-30 | Rohde & Schwarz | 12 M | - | 31.03.2014 |
| 502 | band reject filter | WRCG 1709/1786-1699/1796- | SN 9 | Wainwright | pre-m | 2 | |
| 503 | band reject filter | WRCG 824/849-814/859- | SN 5 | Wainwright | pre-m | 2 | |
| 512 | notch filter GSM 850 | WRCA 800/960-02/40-6EEK | SN 24 | Wainwright | 12 M | 1c | 30.06.2014 |
| 517 | relais switch matrix | HF Relais Box Keithley | SE 04 | Keithley | pre-m | 2 | |
| 523 | Digital Multimeter | L4411A | MY46000154 | Agilent | 24 M | - | 31.03.2015 |
| 529 | 6 dB Broadband resistive power divider | Model 1515 | LH 855 | Weinschel | pre-m | 2 | |
| 530 | 10 dB Broadband resistive power divider | R 416110000 | LOT 9828 | - | pre-m | 2 | |
| 546 | Univ. Radio Communication Tester | CMU 200 | 106436 | R&S | 12 M | - | 31.03.2014 |
| 547 | Univ. Radio Communication Tester | CMU 200 | 835390/014 | Rohde & Schwarz | 12 M | - | 31.03.2014 |
| 548 | Digital-Barometer | GBP 2300 | without | Greisinger GmbH | 36 M | - | 30.06.2015 |
| 549 | Log-Per-Antenna | HL025 | 1000060 | Rohde & Schwarz | 36/12 M | - | 31.03.2015 |
| 552 | high pass filter 2,8-18GHz | WHKX 2.8/18G-10SS | 4 | Wainwright | 12 M | 1c | 30.06.2014 |
| 558 | System CTC FAR S-VSWR | System CTC FAR S-VSWR | - | CTC | 24 M | - | 31.07.2015 |
| 574 | Biconilog Hybrid Antenna | BTA-L | 980026L | Frankonia | 36/12 M | - | 31.03.2016 |
| 584 | Spectrum Analyzer | FSU 8 | 100248 | Rohde & Schwarz | 24 M | - | 31.03.2014 |
| 594 | Wideband Radio Communication Tester | CMW 500 | 101757 | Rohde & Schwarz | 24 M | - | 31.03.2014 |
| 597 | Univ. Radio Communication Tester | CMU 200 | 100347 | Rohde & Schwarz | 12 M | - | 31.03.2014 |
| 598 | Spectrum Analyzer | FSEM 30 (Reserve) | 831259/013 | Rohde & Schwarz | 24 M | - | 13.01.2015 |
| 600 | power meter | NRVD (Reserve) | 834501/018 | Rohde & Schwarz | 24 M | - | 31.03.2015 |
| 601 | medium-sensitivity diode sensor | NRV-Z5 (Reserve) | 8435323/003 | Rohde & Schwarz | 24 M | - | 31.03.2015 |
| 602 | peak power sensor | NRV-Z32 (Reserve) | 835080 | Rohde & Schwarz | 24 M | - | 31.03.2015 |
| 608 | UltraLog-Antenna | HL 562 | 830547/009 | Rohde & Schwarz | 36/12 M | - | 31.03.2014 |
| 611 | DC power supply | E3632A | KR 75305854 | Agilent | pre-m | 2 | |
| 612 | DC power supply | E3632A | MY 40001321 | Agilent | pre-m | 2 | |
| 613 | Attenuator | R416120000 20dB 10W | Lot. 9828 | Radiall | pre-m | 2 | |
| 616 | Digitalmultimeter | Fluke 177 | 88900339 | Fluke | 24 M | - | 31.03.2014 |
| 617 | Power Splitter/Combiner | ZFSC-2-2-S+ | S F987001108 | Mini Circuits | - | 2 | |
| 618 | Power Splitter/Combiner | 50PD-634 | 600994 | JFW Industries USA | - | 2 | |
| 619 | Power Splitter/Combiner | 50PD-634 | 600995 | JFW Industries, USA | - | 3 | |
| 620 | EMI Test Receiver | ESU 26 | 100362 | Rohde-Schwarz | 12 M | - | 01.03.2014 |
| 621 | Step Attenuator 0-139 dB | RSP | 100017 | Rohde & Schwarz | pre-m | 2 | |
| 625 | Generic Test Load USB | Generic Test Load USB | - | CETECOM | - | 2 | |
| 627 | data logger | OPUS 1 | 201.0999.9302.6.4.1.4 3 | G. Luftt GmbH | 24 M | - | 30.05.2014 |
| 634 | Spectrum Analyzer | FSM (HF-Unit) | 826188/010 | Rohde & Schwarz | pre-m | 2 | |
| 636 | Thermal Imaging camera | Ti32 | Ti32-12060213 | Fluke Corporation | 24 M | - | 31.07.2014 |
| 637 | High Speed HDMI with Ethernet 1m | HDMI cable with Ethernet 1m | - | KogiLink | - | 2 | |
| 638 | HDMI Kabel with Ethernet 1,5 m flach | HDMI cable with Ethernet | - | Reichelt | - | 2 | |
| 640 | HDMI cable 2m rund | HDMI cable 2m rund | - | Reichelt | - | 2 | |
| 641 | HDMI cable with Ethernet | Certified HDMI cable with | - | PureLink | - | 2 | |
| 642 | Wideband Radio Communication Tester | CMW 500 | 126089 | Rohde&Schwarz | 24 M | - | 31.03.2014 |
| 644 | Amplifierer | ZX60-2534M+ | SN865701299 | Mini-Circuits | - | - | |
| 670 | Univ. Radio Communication Tester | CMU 200 | 106833 | Rohde & Schwarz | 12 M | - | 31.03.2014 |
| 671 | DC-power supply 0-5 A | EA-3013S | - | Elektro Automatik | pre-m | 2 | |
| 678 | Power Meter | NRP | 101638 | Rohde&Schwarz | pre-m | - | |
| 683 | Spectrum Analyzer | FSU | 200571 | Rohde & Schwarz | pre-m | - | |
| 686 | Field Analyzer | EHP-200A | 160WX30702 | Narda Safety Test Solutions | 24 M | - | 18.07.2015 |

8.1.3. Legend

| Note / remarks | | Calibrated during system calibration: |
|----------------|-----|---|
| | 1a | System CTC-SAR-EMS (Ref.-No. 442) |
| | 1b | System-CTC-EMS-Conducted (Ref.-No. 335) |
| | 1c | System CTC-FAR-EMI-RSE (Ref.-No . 443) |
| | 1d | System CTC-SAR-EMI (Ref.-No . 441) |
| | 1e | System CTC-OATS (EMI radiated) (Ref.-No. 337) |
| | 1 f | System CTC-CTIA-OTA (Ref.-No . 420) |
| | 1 g | System CTC-FAR-EMS (Ref.-No . 444) |
| | 2 | Calibration or equipment check immediately before measurement |
| | 3 | Regulatory maintained equipment for functional check or support purpose |
| | 4 | Ancillary equipment without calibration e.g. mechanical equipment or monitoring equipment |
| | 5 | Test System |

| | | |
|-------------------------|---------|---|
| Interval of calibration | 12 M | 12 month |
| | 24 M | 24 month |
| | 36 M | 36 month |
| | 24/12 M | Calibration every 24 months, between this every 12 months internal validation |
| | 36/12 M | Calibration every 36 months, between this every 12 months internal validation |
| | Pre-m | Check before starting the measurement |
| | - | Without calibration |