# T E S T  R E P O R T
# 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 Acustic 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 | Reg. No.: 736496<br>MRA US-EU 0003 | Industry Canada<br>Reg. No.: 3462D-1<br>Reg. No.: 3462D-2<br>Reg. No.: 3462D-3 | Voluntary Controls for Electromagnetic Emissions<br>Reg. No.:<br>R-2666 C-2914,<br>T-1967, G-301 |
| WiFi ALLIANCE AUTHORIZED RF LABORATORY | CTIA Authorized Test Lab<br>LAB CODE 20011130-00 | | |
| accredited according to DIN EN ISO/IEC 17025 | | | |

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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<br><br>(0,15 - 30 MHz) | AC-Power lines<br><br>(conducted) | §15.207 | RSS-Gen, Issue 3: Chapter 7.2.4 | §15.207 limits<br><br>IC: Table 4, Chapter 7.2.4 | -- | -- | Remark 1.) |
| 2 | General field strength emissions (9 kHz - 30 MHz) | Cabinet + inter-connecting cables<br><br>(radiated) | §15.209(a) | RSS-Gen, Issue 3: Chapter 4.11 Chapter 7.2.5, Table 5+6 | 2400/F(kHz) µV/m<br><br>24000/F(kHz) µV/m<br><br>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)<br>< 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<br><br>RSS-133: 6.5.1(a)(b)<br><br>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 | | 1 | 4 | Passed [2.)] |
| 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.

D. Franke
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<br>45219 Essen - Kettwig<br>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 Acustic GmbH & Co. KG |
| Address: | Max-Planck-Straße 28-32<br>61381 Friedrichsdorf/Ts.<br><br>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<br>(E-UTRA operating bands) | LTE Band 2: 1850 - 1910 MHz (Uplink), 1930-1990 MHz (Downlink)<br>LTE Band 4: 1710 - 1755 MHz (Uplink), 2110 - 2155 MHz (Downlink)<br>LTE Band 5: 824 - 849 MHz (Uplink), 869-894 MHz (Downlink)<br>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<br><br>– Table 5.4.4-1 accord. 3GPP TS36.521-1 | LTE Band 2: UARFCN range 18600 - 19199<br>LTE Band 4: UARFCN range 19950 - 20399<br>LTE Band 5: UARFCN range 20400 - 20649<br>LTE Band 17: UARFCN range 23730 - 23849 | See Note about channels not to be used depending on channel bandwidths | |
| Emission designator(s)<br>(Max. Value across all operating bands) | Channel bandwidth | QPSK Modulation: | 16-QAM Modulation |
| | 1.4 MHz | 1M08G7D | 1M08W7D |
| | 3 MHz | 2M69G7D | 2M69W7D |
| | 5 MHz | 4M47G7D | 4M46W7D |
| | 10 MHz | 8M92G7D | 8M92W7D |
| | 15 MHz | 13M4G7D | 13M4W7D |
| | 20 MHz | 17M8G7D | 17M8W7D |
| Antenna Type | ☐ Integrated<br>☐ External, no RF- connector<br>☒ External, separate RF-connector: main TX + secondary RX connector | | |
| Antenna Gain | No information from customer | | |
| MAX PEAK Output Power:<br>Radiated LTE-Mode 2<br>LTE-Mode 4<br>LTE-Mode 5<br>LTE-Mode 17 | <br>32.3 dBm (PK)<br>29.2 dBm (PK)<br>28.8 dBm (PK)<br>28.5 dBm (PK) | | |
| MAX PEAK Output Power:<br>Conducted LTE-Mode 2<br>LTE-Mode 4<br>LTE-Mode 5<br>LTE-Mode 17 | <br>23.67 dBm (AV)<br>24.03 dBm (AV)<br>23.35 dBm (AV)<br>23.17 dBm (AV) | | |
| FCC-ID | QWY-V1140-101 | | |
| IC | 6588A-V1140101 | | |
| Installed option | ☒ GSM 900 and GSM 1800 Bands (not usable in USA/Canada)<br>☒ GPS (not tested within this test report) | | |
| Power supply | ☒ DC power only: 3.7V by external laboratory power supply | | |
| Special EMI components | -- | | |
| EUT sample type | ☐ Production | ☒ Pre-Production | ☐ Engineering |
| FCC label attached | ☐ yes | ☒ no | |

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

| Short descrip-tion*) | 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 descrip-tion *) | 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<br><br>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.<br>The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation.<br>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<br><br>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.<br>The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation.<br>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<br><br>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.<br>The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation.<br>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<br><br>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.<br>The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation.<br>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

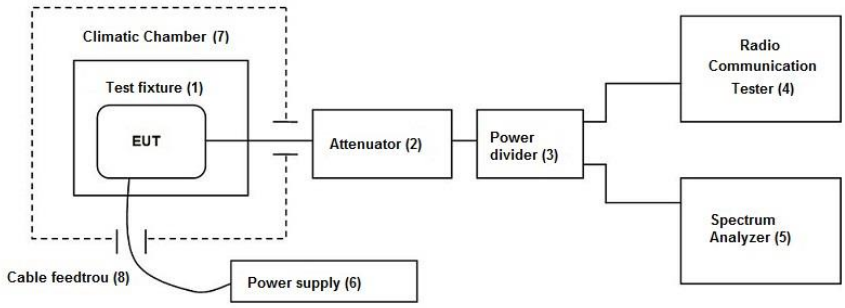
## 4.1. Test system set-up for conducted measurements on antenna port

**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.



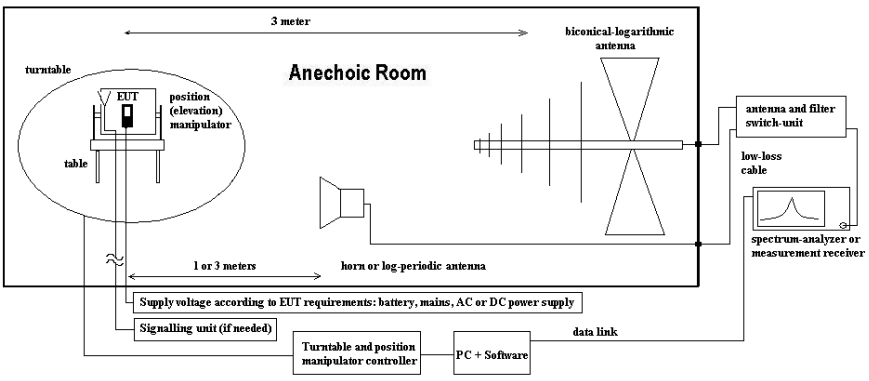

**Testing method:** Accord. Spec.

## 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 it's 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 it's 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:**

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

$Ec_{E(I)RP} = Ec - 95.2\ dB$

$M = L_T - Ec_{E(I)RP}$

$E_C$ = 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)
$Ec_{E(I)RP}$ = 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 | ☒ CETECOM Essen (Chapter. 2.2.1) | | ☐ Please see Chapter. 2.2.2 | | ☐ Please see Chapter. 2.2.3 | |
| test site | ☐ 441 EMI SAR | ☐ 487 SAR NSA | ☒ 443 FAR | | ☐ | ☐ |
| receiver | ☐ 377 ESCS30 | ☐ 001 ESS | ☐ 489 ESU 40 | ☐ 620 ESU 26 | ☐ | ☐ |
| spectr. analys. | ☐ 584 FSU | ☐ 120 FSEM | ☒ 264 FSEK | ☐ | ☐ | ☐ |
| antenna | ☐ 574 BTA-L | ☐ 133 EMCO3115 | ☐ 302 BBHA9170 | ☒ 608 HL 562 | ☒ 549 HL025 | |
| signalling | ☐ 392 MT8820A | ☐ 436 CMU | ☒ 546 CMU | | | |
| otherwise | ☐ 400 FTC40x15E | ☐ 401 FTC40x15E | ☐ 110 USB LWL | ☐ 482 Filter Matrix | ☐ 378 RadiSense | |
| DC power | ☐ 456 EA 3013A | ☒ 463 HP3245A | ☐ 459 EA 2032-50 | ☐ 268 EA- 3050 | ☐ 494 AG6632A | ☐ 498 NGPE 40 |
| line voltage | ☐ 230 V 50 Hz via public mains | | ☐ 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<br>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(I)RP. |
| | 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): | | ☒ air link | ☐ cable connection | ☐ |
| EUT-grounding | | ☒ none | ☐ with power supply | ☐ additional connection |
| Equipment set up | | ☒ table top | | ☐ 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:**<br><br>Scan Mode<br>Span<br>RBW<br>VBW<br>Sweep time<br>Sweep mode<br>Detector | Spectrum analyser mode<br>100 MHz<br>10 MHz<br>10 MHz<br>Coupled<br>repetitive<br>Peak | | |
| Measurement method | | 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:<br>1. 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.<br>2. 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 ($P_{MEAS,1,MAX}$).<br>3. 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.<br>4. 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 ($P_{SMHU}=P_{MEAS,1,MAX}$)<br>5. Than the RF-signal cable is disconnected from the antenna and connected to a power-level meter. The level is determined ($P_{MEAS,2}$).<br>6. 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 | | A call was established on highest power transmit conditions in RMC mode. MPR was deactivated.<br><br>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. | | |

### 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 | ☒ CETECOM Essen (Chapter. 2.2.1) | | ☐ Please see Chapter. 2.2.2 | | ☐ Please see Chapter. 2.2.3 | |
| test site | ☐ 441 EMI SAR | ☐ 487 SAR NSA | ☒ 443 FAR | ☐ 347 Radio.lab.1 | ☐ 347 Radio.lab.2 | |
| receiver | ☐ 377 ESCS30 | ☐ 001 ESS | ☐ 489 ESU 40 | ☐ ESU 26 | | |
| spectr. analys. | ☐ 584 FSU | ☐ 120 FSEM | ☒ 264 FSEK | | | |
| antenna | ☒ 608 HL 562 | ☒ 549 HL 025 | ☐ 302 BBHA9170 | ☐ 289 CBL 6141 | ☐ 030 HFH-Z2 | ☐477 GPS |
| signaling | ☐ 017 CMD 65 | ☐ 323 CMD 55 | ☐ 340 CMD 55 | | | |
| signaling | ☐ 392 MT8820A | ☐ 546 CMU | ☐ 547 CMU | ☒ 642 CMW500 | | |
| power supply | ☒ 611 E3632A | ☐ 457 EA 3013A | ☐ 459 EA 2032-50 | ☐ 268 EA- 3050 | ☐ 494 AG6632A | ☐498 NGPE 40 |
| otherwise | ☐ 529 6dB divider | ☐ 530 6dB Att. | ☐ 110 USB LWL | ☐ 482 Filter Matrix | ☐ 431 Near field | |
| line voltage | ☐ 230 V 50 Hz via public mains | | ☒ 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“<br>-> 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): | | ☒ air link | ☐ cable connection | ☐ |
| EUT-grounding | | ☒ none | ☐ with power supply | ☐ additional connection |
| Equipment set up | | ☒ table top | | ☐ 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:**<br>Scan Mode<br>RBW<br>VBW<br>Sweep time<br>Sweep mode<br>Detector | Spectrum analyser mode<br>1 MHz<br>10 MHz<br>Coupled<br>repetitive<br>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.<br><br>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

| Dia-gram 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 | ☒ | ☐ | ☐ | passed |
| 8.20b | Low | 18607 | 30 MHz to 20 GHz | 1 | Carrier visible on diagram. Not relevant for results 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 9.203a | Low | 18615 | 1849 – 1850 MHz | 1 | Band-Edge compliance QPSK modulation Remark 1 | ☒ | ☒ | ☐ | passed |
| 9.203b | Low | 18615 | 1849 – 1850 MHz | 1 | Band-Edge compliance QAM modulation Remark 1 | ☒ | ☒ | ☐ | passed |
| 8.21a | Middle | 18900 | 30 MHz to 20 GHz | 1 | Carrier visible on diagram. Not relevant for results | ☒ | ☐ | ☐ | passed |
| 8.21b | Middle | 18900 | 30 MHz to 20 GHz | 1 | Carrier visible on diagram. Not relevant for results | ☒ | ☐ | ☐ | passed |
| 8.22 | High | 19100 | 30 MHz to 20 GHz | 1 | Carrier visible on diagram. Not relevant for results | ☒ | ☐ | ☐ | passed |
| 9.215a | High | 19185 | 1910 – 1911 MHz | 1 | Band-Edge compliance QPSK modulation Remark 1 | ☒ | ☒ | ☐ | passed |
| 9.215b | High | 19185 | 1910 – 1911 MHz | 1 | Band-Edge compliance QAM modulation Remark 1 | ☒ | ☒ | ☐ | 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

| Dia-gram 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 | ☒ | ☐ | ☐ | 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 | ☒ | ☐ | ☐ | passed |
| 9.520a | Low | 19965 | 1709 - 1710 MHz | 2 | Band Edge Compliance QPSK modulation, remark 1 | ☒ | ☒ | ☐ | passed |
| 9.520b | Low | 19965 | 1709 - 1710 MHz | 2 | Band Edge Compliance 16-QAM modulation, remark1 | ☒ | ☒ | ☐ | passed |
| 8.41 | Middle | 20175 | 30 MHz to 20 GHz | 2 | Carrier visible on diagram. Not relevant for results | ☒ | ☐ | ☐ | passed |
| 8.42 | High | 20300 | 30 MHz to 20 GHz | 2 | Carrier visible on diagram. Not relevant for results | ☒ | ☐ | ☐ | passed |
| 9.532a | High | 20385 | 1755 – 1756 MHz | 2 | Band Edge Compliance QPSK modulation, remark 1 | ☒ | ☒ | ☐ | passed |
| 9.532b | High | 20385 | 1755 – 1756 MHz | 2 | Band Edge Compliance 16-QAM modulation remark 1 | ☒ | ☒ | ☐ | 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 | ☒ | ☐ | ☐ | passed |

Remark1: re-tests with EUT C

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

| Dia-gram 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 | ☒ | ☐ | ☐ | passed |
| 8.50b | Low | 20407 | 30 MHz to 9 GHz | 3 | Carrier visible on diagram. Not relevant for results | ☒ | ☐ | ☐ | passed |
| 9.506a | Low | 20415 | 823 – 824 MHz | 3 | Band Edge Compliance QPSK modulation, remark 1 | ☒ | ☒ | ☐ | passed |
| 9.506b | Low | 20415 | 823 – 824 MHz | 3 | Band Edge Compliance 16-QAM modulation remark 1 | ☒ | ☒ | ☐ | passed |
| 8.51a | Middle | 20525 | 30 MHz to 9 GHz | 3 | Carrier visible on diagram. Not relevant for results | ☒ | ☐ | ☐ | passed |
| 8.51b | Middle | 20525 | 30 MHz to 9 GHz | 3 | Carrier visible on diagram. Not relevant for results | ☒ | ☐ | ☐ | passed |
| 8.52 | High | 20600 | 30 MHz to 9 GHz | 3 | Carrier visible on diagram. Not relevant for results | ☒ | ☐ | ☐ | passed |
| 9.512a | Low | 20643 | 849 - 850 MHz | 3 | Band Edge Compliance QPSK modulation, remark 1 | ☒ | ☒ | ☐ | passed |
| 9.514b | Low | 20643 | 849 - 850 MHz | 3 | Band Edge Compliance 16-QAM modulation remark 1 | ☒ | ☒ | ☐ | 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

| Dia-gram 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 | ☒ | ☐ | ☐ | passed |

Remark: re-tests with EUT C

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

| Dia-gram 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 | ☒ | ☐ | ☐ | passed |
| 9.171a | Low | 23755 | 703 - 704 MHz | 4 | Band Edge Compliance QPSK modulation Remark 1 | ☒ | ☒ | ☐ | passed |
| 9.171b | Low | 23755 | 703 - 704 MHz | 4 | Band Edge Compliance 16-QAM modulation remark 1 | ☒ | ☐ | ☐ | passed |
| 8.172 | Middle | 23790 | 30 MHz to 9 GHz | 4 | Carrier visible on diagram. Not relevant for results | ☒ | ☐ | ☐ | passed |
| 8.173 | High | 23800 | 30 MHz to 9 GHz | 4 | Carrier visible on diagram. Not relevant for results | ☒ | ☐ | ☐ | passed |
| 9.175a | High | 23825 | 716 – 717 MHz | 4 | Band Edge Compliance QPSK modulation Remark 1 | ☒ | ☒ | ☐ | passed |
| 9.175b | High | 23825 | 716 – 717 MHz | 4 | Band Edge Compliance 16-QAM modulation remark 1 | ☒ | ☒ | ☐ | 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

| Dia-gram 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 | ☒ | ☐ | ☐ | 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 | ☒ CETECOM Essen (Chapter. 2.2.1) | | ☐ Please see Chapter. 2.2.2 | | | |
| test site | ☐ 347 Radio.lab. 1 | ☒ Radio.lab. 2 | | | | |
| spectr. analys. | ☐ 584 FSU | ☐ 489 ESU 40 | ☐ 264 FSEK | ☐ 620 ESU 26 | | |
| signaling | ☐ 392 MT8820A | ☐ 436 CMU | ☐ 547 CMU | ☒ 594 CMW500 | | |
| otherwise | ☐ 400 FTC40x15E | ☐ 401 FTC40x15E | ☐ 110 USB LWL | ☐ 482 Filter Matrix | ☐ 378 RadiSense | |
| DC power | ☐ 456 EA 3013A | ☐ 463 HP3245A | ☐ 459 EA 2032-50 | ☐ 268 EA- 3050 | ☐ 494 AG6632A | ☒ 611 E3632A |
| otherwise | ☐ 331 HC 4055 | ☐ 530 10 dB Att. | | ☐ - cable OTA20 | | ☒ 530 10 dB Att. |
| line voltage | ☐ 230 V 50 Hz via public mains | | ☐ 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<br>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 | 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.<br><br>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)<br><br>Peak and Average Values have been recorded for each channel and band. | |
| Mobile phone settings | A call was established with a suitable communication test unit (CMW500).<br>UE is set TX mode, highest transmit power conditions (RMC-mode), power saving techniques have been disabled (MPR-techniques)<br><br>Tests have been performed in different EUT bandwidth settings and various settings for allocated RBs.<br><br>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. | |

### 5.3.4. Measurement Results
### 5.3.4.1. LTE Band 2 Results

| LTE-Band 2 (FCC Part 24) | | | | QPSK-Modulation | | | 16-QAM-Modulation | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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] | max- modulation | max. channel | absolute max. value |
| 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 | 28,78 | |
| | | | 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 | 28,73 | |
| | | | 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 | 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** | **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 Ration: 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 | 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** | **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 | 29,6 | |
| | | | 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 Ration: 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 | 29,62 | |
| | | | 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 | 29.62 |
| | | | 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 | | | |

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 | | |
| | | | 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 | **29,4** | |
| | | | 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 | 29,31 | **29,4** |
| | | | 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 | ☐ 347 Radio.lab. 1 | ☒ Radio.lab. 2 | | | | |
| spectr. analys. | ☐ 584 FSU8 | ☐ 489 ESU | ☒ 620 ESU26 | ☐ 264 FSEK | | |
| attenuator | ☒ 530 10 dB | ☐ | ☐ | | | |
| signaling | ☐ 392 MT8820A | ☐ 436 CMU | ☐ 547 CMU | ☒ 594 CMW500 | | |
| DC Power | ☒ 611 E3632A | ☐ 087 EA3013 | ☐ 354 NGPE 40 | ☐ 086 LNG50-10 | ☒ 611 E3632A | |
| otherwise | ☒ 530 10dB attenuator | | ☒ 529 Power div. | | | |
| line voltage | ☐ 230 V 50 Hz via public mains | | ☐ 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 | | A call was established with a suitable communication test unit (CMW500).<br>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.<br><br>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. | |

### 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 | ☒ CETECOM Essen (Chapter. 2.2.1) | | ☐ Please see Chapter. 2.2.2 | | ☐ Please see Chapter. 2.2.3 | |
| test site | ☐ 347 Radio.lab. 1 | ☒ Radio.lab. 2 | | | | |
| spectr. analys. | ☐ 584 FSU | ☐ 120 FSEM | ☐ 264 FSEK | ☒ 620 ESU26 | | |
| signaling | ☐ 017 CMD 65 | ☐ 323 CMD 55 | ☐ 340 CMD 55 | | | |
| signaling | ☐ 392 MT8820A | ☐ 436 CMU | ☒ 594 CMW500 | | | |
| power supply | ☒ 611 E3632A | ☐ 457 EA 3013A | ☐ 459 EA 2032-50 | ☐ 268 EA- 3050 | ☐ 494 AG6632A | ☐ 498 NGPE 40 |
| otherwise | ☒ 529 6dB divider | ☒ 530 10dB Att. | ☐ 431 Near field | | | |
| line voltage | ☐ 230 V 50 Hz via public mains | | ☐ 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.<br><br>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).<br>UE is set TX mode, highest transmit power conditions (RMC-mode), power saving techniques have been disabled<br><br>Tests have been performed in various settings for the device regarding allocated ressource blocks and channels in order to find worst-case configuration. Due to very big amount of possible combinations only certain combinations have been tested.<br><br>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 | ☒ | ☐ | ☐ | passed |
| 36.20b | | | 9kHz to 30MHz | | 16QAM-Modulation | ☒ | ☐ | ☐ | passed |
| 36.21a | | | 30 MHz to 19.5MHz | | Carrier visible on diagram, not relevant for results QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.21b | | | 30 MHz to 19.5MHz | | Carrier visible on diagram, not relevant for results QPSK modulation | ☒ | ☐ | ☐ | passed |
| 37.203a | | 18615 | 1849 – 1850 MHz | | Band Edge Compliance QPSK modulation | ☐ | ☒ | ☐ | passed |
| 37.203b | | 18615 | 1849 – 1850 MHz | | Band Edge Compliance QAM modulation | ☐ | ☒ | ☐ | passed |
| 36.22a | Middle | 18900 | 9kHz to 30MHz | | QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.22b | | | 9kHz to 30MHz | | 16QAM-Modulation | ☒ | ☐ | ☐ | passed |
| 36.23a | | | 30 MHz to 19.5MHz | | Carrier visible on diagram, not relevant for results QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.23b | | | 30 MHz to 19.5MHz | | Carrier visible on diagram, not relevant for results QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.24a | High | 19100 | 9kHz to 30MHz | | QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.25a | | | 30 MHz to 19.5MHz | | QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.24b | | | 9kHz to 30MHz | | QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.25b | | | 30 MHz to 19.5MHz | | QAM modulation | ☒ | ☐ | ☐ | passed |
| 37.215a | | 19185 | 1910 – 1911 MHz | | Band-Edge compliance QPSK Modulation | ☐ | ☒ | ☐ | passed |
| 37.215b | | 19185 | 1910 – 1911 MHz | | Band-Edge compliance QAM Modulation | ☐ | ☒ | ☐ | 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 | ☒ | ☐ | ☐ | passed |
| 36.40b | | | | | 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.43a | | | 30 MHz to 18GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.43b | | | 30 MHz to 18GHz | | Carrier visible on diagram, not relevant for results 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 37.520a | Low | 19965 | 1709 -1710 MHz | 2 | Band Edge Compliance QPSK modulation | ☐ | ☒ | ☐ | passed |
| 37.520b | | 19965 | 1709 -1710 MHz | | Band Edge Compliance QAM modulation | ☐ | ☒ | ☐ | passed |
| 36.41a | Middle | 20175 | 9kHz to 30MHz | 2 | QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.41b | | 20175 | | | 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.44a | | 20175 | 30 MHz to 18GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.44b | | 20175 | 30 MHz to 18GHz | | Carrier visible on diagram, not relevant for results QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.42a | High | 20393 | 9kHz to 30MHz | 2 | QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.42b | | | | | 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.45a | | | 30 MHz to 19.5MHz | | Carrier visible on diagram, not relevant for results QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.45b | | | 30 MHz to 19.5MHz | | Carrier visible on diagram, not relevant for results QAM modulation | ☒ | ☐ | ☐ | passed |
| 37.532a | High | 20385 | 1755 - 1756 MHz | 2 | Band-Edge compliance QPSK modulation | ☐ | ☒ | ☐ | passed |
| 37.532b | | 20385 | 1755 - 1756 MHz | | Band-Edge compliance QAM modulation | ☐ | ☒ | ☐ | 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 | ☒ | ☐ | ☐ | passed |
| 36.56b | | | 9kHz to 30MHz | | 16-QAM Modulation | ☒ | ☐ | ☐ | passed |
| 36.51a | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.57b | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 37.512a | Low | 20415 | 823 – 824 MHz | 3 | Band Edge Compliance QPSK modulation | ☐ | ☒ | ☐ | passed |
| 37.514b | Low | | 823 – 824 MHz | | Band Edge Compliance QPSK modulation | ☐ | ☒ | ☐ | passed |
| 36.52a | Middle | 20525 | 9kHz to 30MHz | 3 | QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.58b | | | 9kHz to 30MHz | 3 | 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.53a | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.59b | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.54a | High | 20600 | 9kHz to 30MHz | 3 | QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.60b | High | | 9kHz to 30MHz | | 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.55a | High | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results | ☒ | ☐ | ☐ | passed |
| 36.61b | High | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results | ☒ | ☐ | ☐ | passed |
| 37.506a | High | 20625 | 849 – 850 MHz | 3 | Band Edge Compliance QPSK modulation | ☐ | ☒ | ☐ | passed |
| 37.506b | High | | 849 – 850 MHz | | Band Edge Compliance 16-QAM modulation | ☐ | ☒ | ☐ | 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 | ☒ | ☐ | ☐ | passed |
| 36.170b | | | 9kHz to 30MHz | | 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.171a | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.171b | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 37.171a | Low | 23755 | 703 – 704 MHz | 4 | Band-Edge compliance QPSK modulation | ☒ | ☐ | ☐ | passed |
| 37.171b | | | 703 – 704 MHz | | Band-Edge compliance 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.172a | Middle | 23790 | 9kHz to 30MHz | 4 | QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.172b | | | 9kHz to 30MHz | | 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.174a | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.174b | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.173a | High | 23800 | 9kHz to 30MHz | 4 | QPSK Modulation | ☒ | ☐ | ☐ | passed |
| 36.173b | | | 9kHz to 30MHz | | 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 36.175a | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results QPSK modulation | ☒ | ☐ | ☐ | passed |
| 36.175b | | | 30 MHz to 9GHz | | Carrier visible on diagram, not relevant for results 16-QAM modulation | ☒ | ☐ | ☐ | passed |
| 37.175a | High | 23825 | 716 -717 MHz | 4 | Band-Edge compliance QPSK modulation | ☐ | ☒ | ☐ | passed |
| 37.175b | | | 716 -717 MHz | | Band-Edge compliance 16-QAM modulation | ☐ | ☒ | ☐ | 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 | ☒ CETECOM Essen (Chapter. 2.2.1) | | ☐ Please see Chapter. 2.2.2 | | ☐ Please see Chapter. 2.2.3 | |
| test site | ☐ 347 Radio.lab.1 | ☒ Radio.lab.2 | | | ☐ | ☐ |
| spectr. analys. | ☐ 584 FSU | ☐ 489 ESU 40 | ☐ 264 FSEK | ☐ 620 ESU 26 | ☐ | ☐ |
| signaling | ☐ 392 MT8820A | ☐ 436 CMU | ☐ 547 CMU | ☒ 594 CMW500 | ☐ 594 CMW500 | |
| DC power | ☒ 611 E3632A | ☐ 457 EA 3013A | ☐ 459 EA 2032-50 | ☐ 268 EA- 3050 | ☐ 494 AG6632A | ☐ 498 NGPE 40 |
| otherwise | ☒ 529 6dB divider | ☒ 530 10dB Att. | ☐ 431 Near field | | | |
| Climatic test chamber | ☒ 331 HC 4055 | | | | | |
| line voltage | ☐ 230 V 50 Hz via public mains | | ☐ 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** | *"The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block"* |

### 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"<br><br>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<br><br>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<br><br>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:

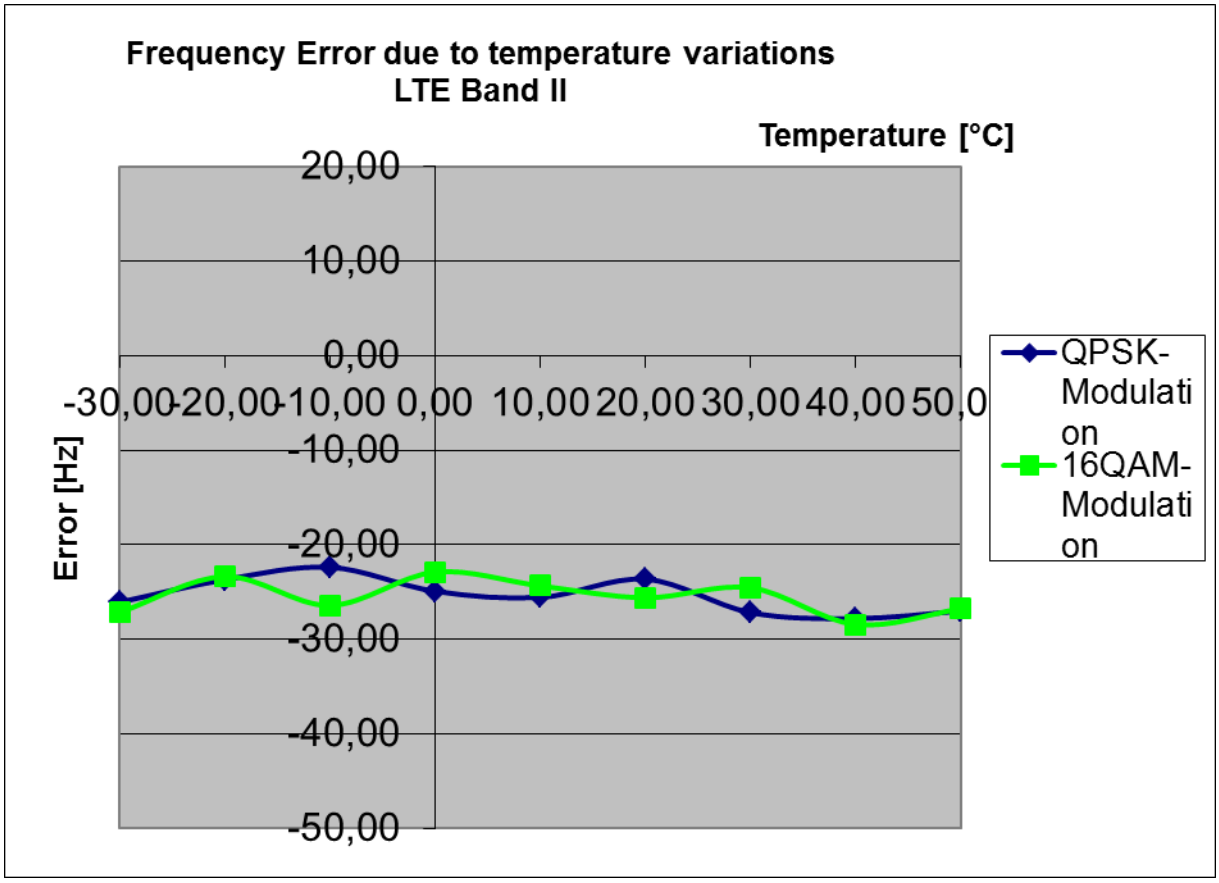
No tests performed across extreme voltage range: limited approval.
OEM integrators should consult grant and applicants recommendations on power supply design rules.

### 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.

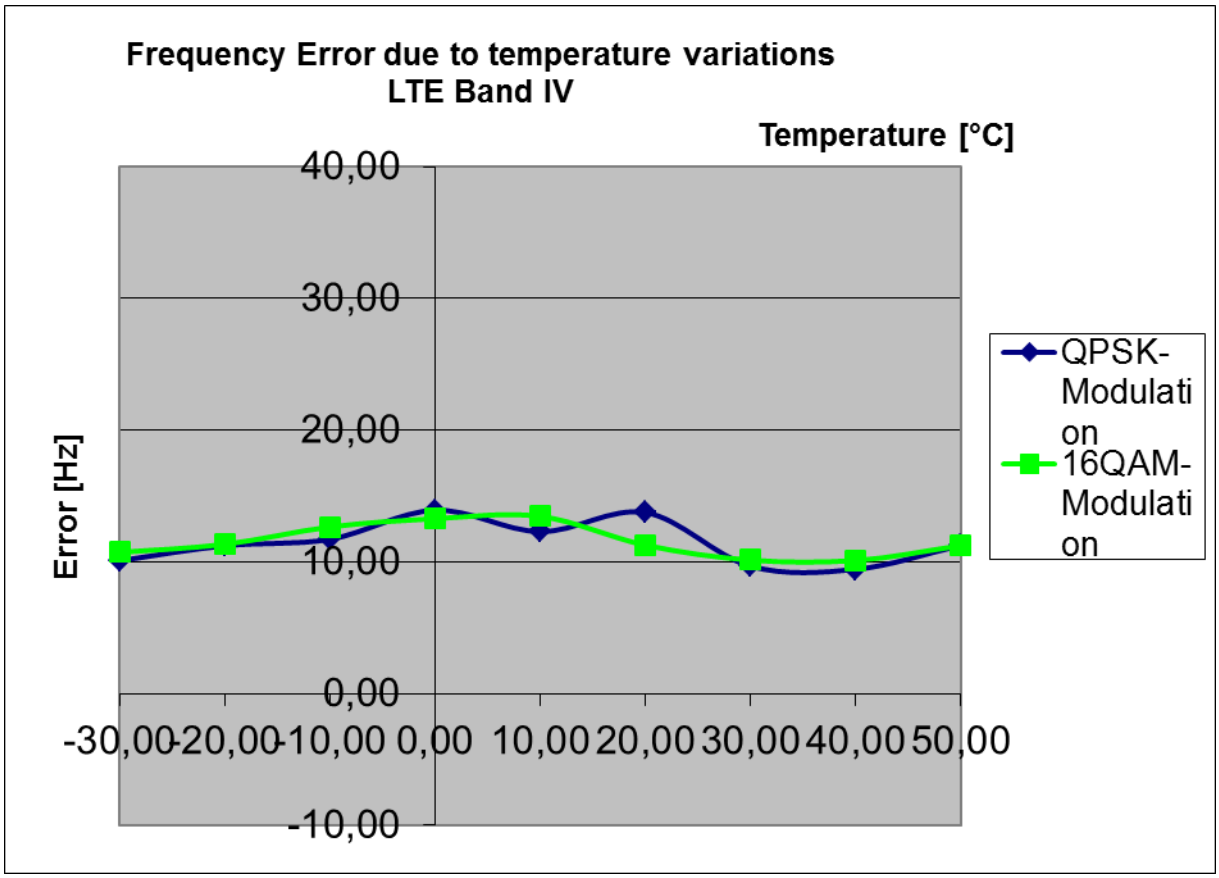
### 5.6.4.2. LTE Band 2

| | Maximum frequency error | | | | |
|---|---|---|---|---|---|
| | Channel 18900/ BW=1.4 MHz | | | | |
| Temperature | QPSK Modulation [Hz] | 16-QAM Modulation [Hz] | QPSK Modulation [ppm] | 16-QAM Modulation [ppm] | Verdict<br>Limit=±0.1ppm |
| -30 | -26,08 | -27,15 | -0,014 | -0,014 | |
| -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 | Passed |
| 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 | |



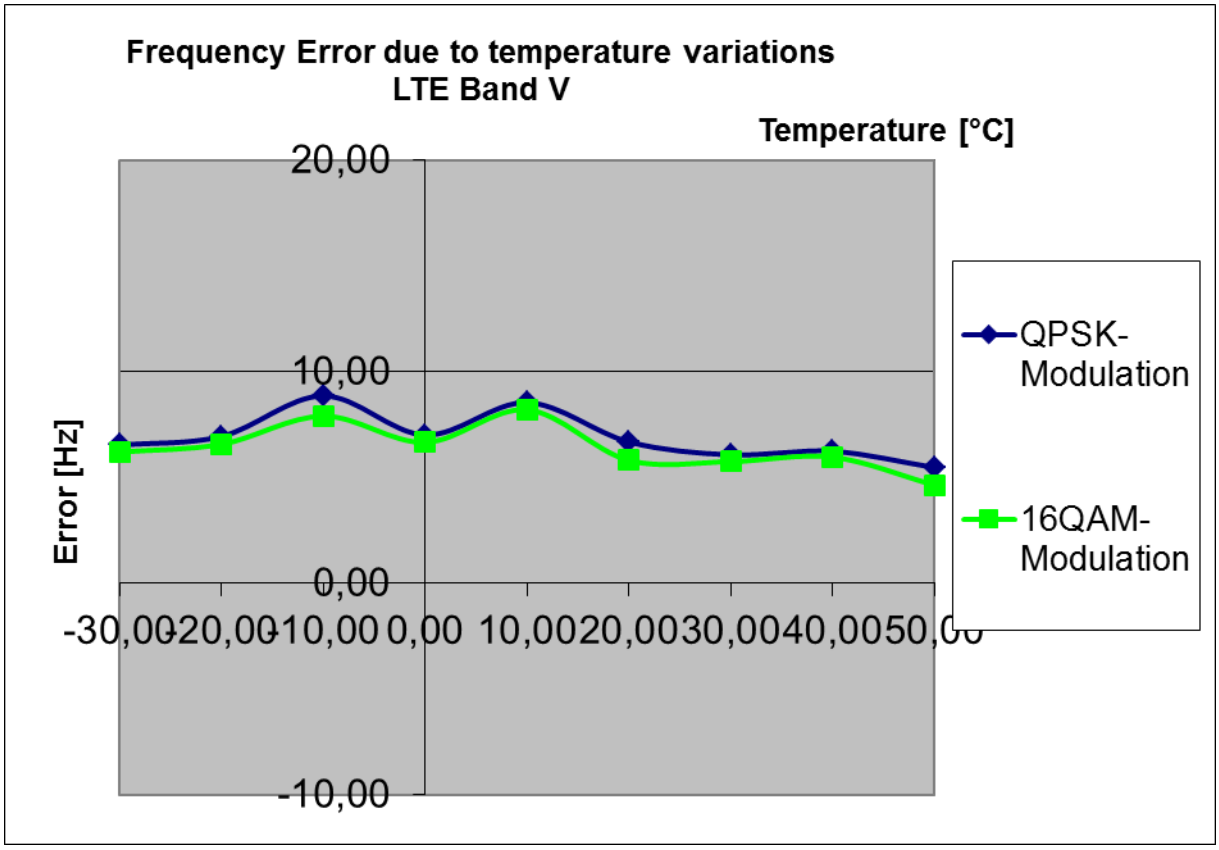
### 5.6.4.3. LTE Band 4

| Temperature | Maximum frequency error<br>Channel 20175/ BW= 1.4MHz<br>QPSK Modulation [Hz] | 16-QAM Modulation [Hz] | QPSK Modulation [ppm] | 16-QAM Modulation [ppm] | Verdict<br>Limit=±0.1ppm |
|---|---|---|---|---|---|
| -30 | 10,10 | 10,73 | 0,006 | 0,006 | |
| -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 | Passed |
| 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 | |



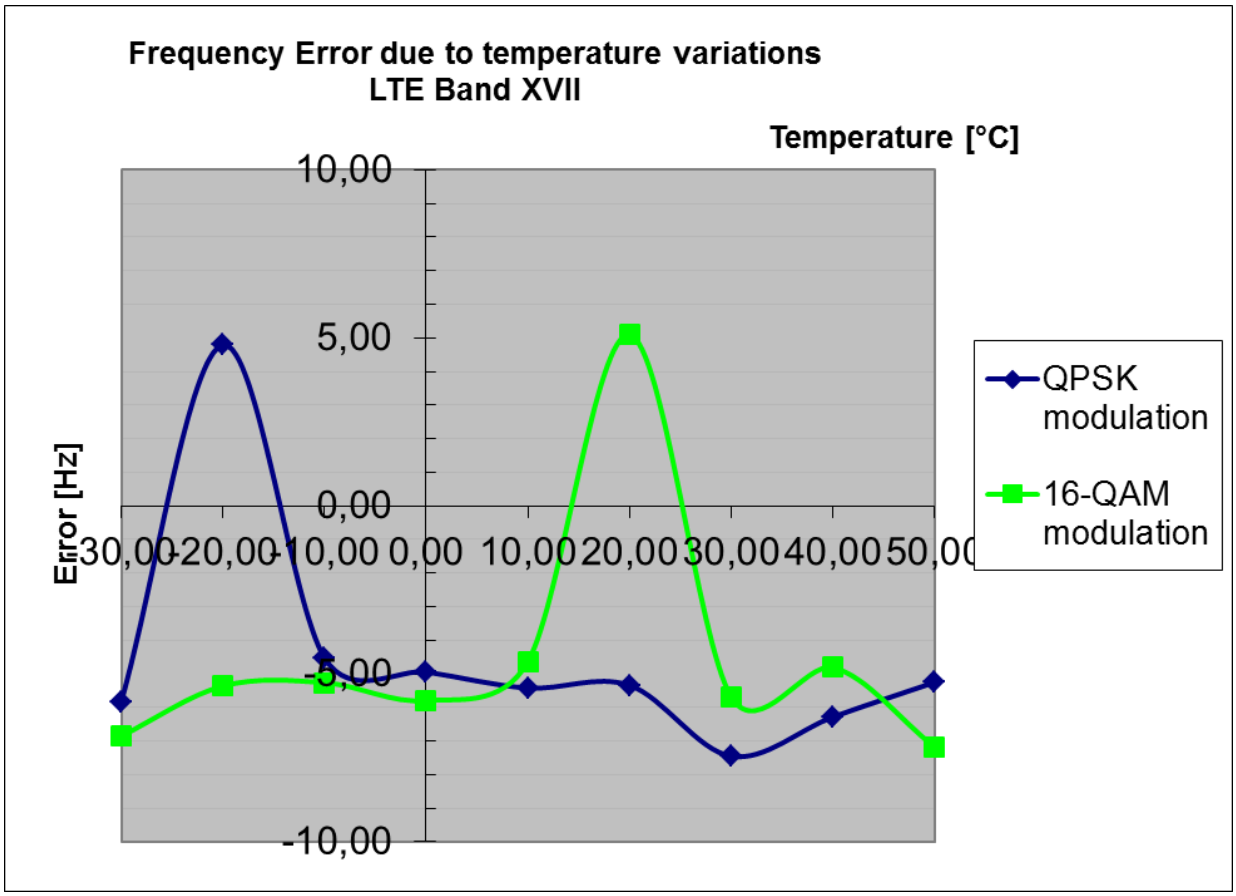
### 5.6.4.4. LTE Band 5

| Temperature | Maximum frequency error<br>Channel 20525/ BW= 1.4MHz<br>QPSK Modulation [Hz] | 16-QAM Modulation [Hz] | QPSK Modulation [ppm] | 16-QAM Modulation [ppm] | Verdict<br>Limit=±0.1ppm |
|---|---|---|---|---|---|
| -30 | 6,54 | 6,21 | 0,008 | 0,007 | |
| -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 | Passed |
| 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

| Temperature | Maximum frequency error<br>Channel 23790/ BW=5MHz<br>QPSK Modulation [Hz] | 16-QAM Modulation [Hz] | QPSK Modulation [ppm] | 16-QAM Modulation [ppm] | Verdict<br>Limit=±0.1ppm |
|---|---|---|---|---|---|
| -30 | -5,82 | -6,85 | -0,008 | -0,010 | |
| -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 | Passed |
| 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<br>487<br>558<br>348<br>348 | 736496 | Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS)<br>Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR)<br>Radiated Measurements above 1 GHz, 3 m (FAR)<br>Mains Ports Conducted Interference Measurements<br>Telecommunication Ports Conducted Interference Measurem. | FCC, Federal Communications Commission<br>Laboratory Division, USA<br>(MRA US-EU 0003) |
| 337<br>487<br>550<br>558 | 3462D-1<br>3462D-2<br>3462D-2<br>3462D-3 | Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS)<br>Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR)<br>Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR)<br>Radiated Measurements above 1 GHz, 3 m (FAR) | IC, Industry Canada Certification and Engineering Bureau |
| 487<br>550<br>348<br>348 | R-2666<br>G-301<br>C-2914<br>T-1967 | Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR)<br>Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR)<br>Mains Ports Conducted Interference Measurements<br>Telecommunication Ports Conducted Interference Measurem. | 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 | Wainwrght | 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. Lufft 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 |