

TEST REPORT
No.: 16-1-0141801T07e-C2

According to:
FCC Regulations
 Part 1.1310
 Part 2.1091

for

Daimler Trucks North America

CTPBASEDTNA ECU

FCC-ID: 2AKC8CTP054631







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

Table of contents

| | |
|--|-----------|
| 1. SUMMARY OF TEST RESULTS | 3 |
| 1.1. TX mode, tests overview FCC Part 2.1091 | 3 |
| 2. ADMINISTRATIVE DATA | 4 |
| 2.1. Identification of the testing laboratory | 4 |
| 2.2. Test location | 4 |
| 2.3. Organizational items | 4 |
| 2.4. Applicant's details | 4 |
| 2.5. Manufacturer's details | 4 |
| 3. EQUIPMENT UNDER TEST (EUT) | 5 |
| 3.1. TECHNICAL GSM DATA OF MAIN EUT DECLARED BY APPLICANT | 5 |
| 3.2. TECHNICAL W-CDMA DATA OF MAIN EUT DECLARED BY APPLICANT | 6 |
| 3.3. EUT: Type, S/N etc. and short descriptions used in this test report | 7 |
| 3.4. Auxiliary Equipment (AE): Type, S/N etc. and short descriptions | 7 |
| 3.5. EUT set-ups | 7 |
| 3.6. EUT operating modes | 8 |
| 4. MEASUREMENTS | 9 |
| 4.1. Radio Frequency Exposure Evaluation §2.1091 | 9 |
| 4.2. Results for fixed and mobile operations | 12 |
| 4.3. Measurement uncertainties | 14 |
| 5. ABBREVIATIONS USED IN THIS REPORT | 15 |
| 6. ACCREDITATION DETAILS OF CETECOM'S LABORATORIES AND TEST SITES | 15 |
| 7. INSTRUMENTS AND ANCILLARY | 16 |
| 8. TEST REPORT VERSION | 19 |

Table of annex

Total pages

| | |
|---|---|
| Annex 2: Internal EUT photographs (separate document) CETECOM-TR16-1-0141801T07b-C1-A2 | 4 |
| Annex 3: External EUT photographs (separate document) CETECOM-TR16-1-0141801T07b-C1-A3 | 6 |
| Annex 4: Test set-up photographs (separate document) CETECOM-TR16-1-0141801T07b-C1-A4 | 6 |

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 Cellular radiofrequency technologies with build in GSM850/1900 and WCDMA FDDII/V (integrated cellular module: FCC ID: XPYLISAU201)
 Following tests have been performed to show compliance with applicable FCC Part 2.1091 and FCC Part 1.1310 of the FCC CFR 47 Rules.


1.1. TX mode, tests overview FCC Part 2.1091

| No. of Diagram group | Test Cases | Port | References & Limits | | EUT set-up | EUT op-mode | Result |
|----------------------|---|------------------------------|-------------------------------|--|------------|-------------|---------------------|
| | | | FCC Standard | Test limits | | | |
| -- | RF Power (conducted) | Antenna terminal (conducted) | §2.1046 | N/A | 2 | 1 to 6 | Pass Remark 1+2 |
| -- | RF Power (radiated) | Cabinet | §2.1046 §22.913(a)(2) | < 7 Watt ERP | 1 | 1 to 6 | Pass Remark 1+2 |
| | | | §24.232(c) | < 2Watt (EIRP) | | | |
| | | | §27.50(c)(10) | < 3 Watt (ERP) | | | |
| | | | §27.50(d) | < 1 Watt (EIRP) | | | |
| -- | Radio frequency Exposure Evaluation (MPE) | Cabinet | §1.1310 §2.1091 §2.1093 | FCC: §1.1310 Table 1, Limits for General Population | 1 | 1 to 6 | Pass, Remark 1+2 |

Remark:


- 1.) See separate test reports & corresponding annexes for following installed technologies
 GSM850/1900: CETECOM_TR16-1-0141801T07b-C1
 W-CDMA FDD Band 2 & FDD Band 5: CETECOM_TR16-1-0141801T07c-C2
- 2.) Calculations based on Tune-Up Info delivered by applicant

The current version of the Test Report CETECOM_TR16-1-0141801T07e-C2 replaces the Test Report CETECOM_TR16-1-0141801T07e-C1 dated 2017-01-06. The replaced test report is herewith invalid.



Digitally signed by christian.
 lorenz@cetecom.com
 DN: cn=christian.lorenz@cetecom.com
 Date: 2017.01.12 13:26:56 +01'00'

.....
 Dipl.-Ing. Ch. Lorenz
 Responsible for test section



Ninovic Perez
 2017.01.12 11:22:02 +01'00'

.....
 Dipl.-Ing N. Perez
 Responsible for test report

2. Administrative Data

2.1. Identification of the testing laboratory

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

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 N. Perez |
| Receipt of EUT: | 2016-12-01 |
| Date(s) of test: | 2017-01-02 to 2017-01-03 |
| Date of report: | 2017-01-12 |
| ----- | |
| Version of template: | 13.02 |

2.4. Applicant's details

| | |
|-------------------|--|
| Applicant's name: | Daimler Trucks North America |
| Address: | 4747 N. Channel Ave. Portland, OR 97217 U.S.A. |
| Contact person: | Mr. Jürgen Weber |

2.5. Manufacturer's details

| | |
|----------------------|--|
| Manufacturer's name: | Bosch Car Multimedia Portugal, S.A. |
| Address: | Rua Max Grundig 35 4705-820 Braga Portugal |

3. Equipment under test (EUT)

3.1. TECHNICAL GSM DATA OF MAIN EUT DECLARED BY APPLICANT

| | | | |
|---|---|--|--------------------------------------|
| GSM Frequency range (US/Canada -bands) | <input checked="" type="checkbox"/> GSM 850: 824 – 849 MHz (Uplink), 869-894 MHz (Downlink) <input checked="" type="checkbox"/> GSM1900: 1850-1910 MHz (Uplink), 1930-1990 MHz (Downlink) | | |
| Type of modulation | <input checked="" type="checkbox"/> GSM,GPRS, GMSK <input checked="" type="checkbox"/> EGPRS-Mode: 8-PSK | | |
| Number of channels (USA/Canada -bands) | <input checked="" type="checkbox"/> GSM 850: 128 – 251, 125 channels <input checked="" type="checkbox"/> GSM1900: 512 – 810, 300 channels | | |
| Test Channel frequencies | <input checked="" type="checkbox"/> GSM/E-GPRS 850 MHz Band: Channel 128/192/251 <input checked="" type="checkbox"/> GSM/E-GPRS 1900 MHz Band: Channel 512/661/810 | | |
| Emission designator(s) | See original module's grant: https://apps.fcc.gov/oetcf/tcb/reports/Tcb731GrantForm.cfm?mode=COPY&RequestTimeout=500&tcb_code=&application_id=Hk1TVyJTKQ%2FaW09nbfO1bA%3D%3D&fcc_id=XPYLISAU201 | | |
| Antenna Type | <input type="checkbox"/> Integrated (enclosure) <input type="checkbox"/> External - dedicated, no RF- connector <input checked="" type="checkbox"/> External, separate RF-connector | | |
| Antenna Gain Tx <small>(Measured as difference max E(IRP) and conducted power value)</small> | GSM850/FDD Band 5: 0dBi GSM1900 / FDD Band 2: 0dBi | | |
| Peak Output Power : Conducted GSM 850 Conducted EDGE850 | 32.5 dBm (Peak) /32.3 dBm (AV) 29.7 dBm (Peak) /27.0 dBm (AV) | | |
| Peak Output Power : Conducted GSM 1900 Conducted EDGE 1900 | 29.2 dBm (Peak) / 29.0 dBm (AV), 28.2 dBm (Peak) / 25.5 dBm (AV) | | |
| Max. ERP/EIRP Power GSM 850: GSM 1900: | 32.5 dBm + 0dBi = 32.5 dBm EIRP 29.2 dBm + 0dBi = 29.2 dBm EIRP | | |
| Installed option | <input checked="" type="checkbox"/> GSM 850 and GSM 1900 Bands (USA/Canada) <input checked="" type="checkbox"/> GSM 900 and GSM 1800 Bands (not usable in USA/Canada) <input checked="" type="checkbox"/> W-CDMA FDD Band II and Band V (USA/Canada) <input checked="" type="checkbox"/> W-CDMA Band I and Band VIII (not usable in USA/Canada) <input checked="" type="checkbox"/> GPS | | |
| Power supply | <input checked="" type="checkbox"/> DC power only: 12 / 24 Volt <input checked="" type="checkbox"/> Nominal Test Voltage : 12 Volt via real car battery | | |
| Special EMI components | -- | | |
| Does EUT contain devices susceptible to magnetic fields, e.g. Hall elements, electrostatic microphones, etc.? | <input type="checkbox"/> yes <input checked="" type="checkbox"/> no | | |
| EUT sample type | <input type="checkbox"/> Production | <input checked="" type="checkbox"/> Pre-Production | <input type="checkbox"/> Engineering |
| FCC label attached | <input type="checkbox"/> yes | <input checked="" type="checkbox"/> no | |

3.2. TECHNICAL W-CDMA DATA OF MAIN EUT DECLARED BY APPLICANT

| | | | |
|---|---|--|--------------------------------------|
| TX-frequency range | <input checked="" type="checkbox"/> FDD Band 2: 1852.4–1907.6 MHz (Uplink), 1930-1990 MHz (Downlink) <input checked="" type="checkbox"/> FDD Band 5: 826.4-846.6 MHz (Uplink), 869-894 MHz (Downlink) | | |
| Type of modulation | <input checked="" type="checkbox"/> FDD-Mode Release99: QPSK <input checked="" type="checkbox"/> FDD Mode Release 5+6: 16QAM additional | | |
| Number of channels | <input checked="" type="checkbox"/> FDD Band 2: UARFCN range 9262 – 9400 – 9538 <input checked="" type="checkbox"/> FDD Band 5: UARFCN range 4132 – 4185 – 4233 | | |
| UMTS-HSPA connectivity | <input checked="" type="checkbox"/> Uplink speed: 5.76 Mb/s (category 6) <input type="checkbox"/> Uplink speed: | | |
| Emission designator(s) | See original module's grant: https://apps.fcc.gov/oetcf/tcb/reports/Tcb731GrantForm.cfm?mode=COPY&RequestTimeout=500&tcb_code=&application_id=Hk1TVyJTKQ%2FaW09nbfO1bA%3D%3D&fcc_id=XPYLISAU201 | | |
| Antenna Type | <input type="checkbox"/> Integrated (enclosure) <input type="checkbox"/> External - dedicated, no RF- connector <input checked="" type="checkbox"/> External, separate RF-connector | | |
| Antenna Gain Tx | GSM850/FDD Band 5: 0dBi GSM1900 / FDD Band 2: 0dBi | | |
| Peak Output Power: Conducted FDD-Mode 2 Conducted FDD-Mode 5 | 24.4 dBm (peak) / 21.2 dBm (AV) 26.5 dBm (peak) / 23.5 dBm (AV) | | |
| Peak ERP/EIRP: Conducted FDD-Mode 2 Conducted FDD-Mode 5 | 24.4dBm + 0dBi = 24.4 dBm EIRP 26.5dBm + 0dBi = 26.5 dBm EIRP | | |
| Installed option | <input checked="" type="checkbox"/> GSM 850 and GSM 1900 Bands (USA/Canada) <input checked="" type="checkbox"/> GSM 900 and GSM 1800 Bands (not usable in USA/Canada) <input checked="" type="checkbox"/> W-CDMA FDD Band II and Band V (USA/Canada) <input checked="" type="checkbox"/> W-CDMA Band I and Band VIII (not usable in USA/Canada) <input checked="" type="checkbox"/> GPS | | |
| Power supply | <input checked="" type="checkbox"/> DC power only: 12 / 24 Volt <input checked="" type="checkbox"/> Nominal Test Voltage : 12 Volt via real car battery | | |
| Special EMI components | -- | | |
| Does EUT contain devices susceptible to magnetic fields, e.g. Hall elements, electrostatic microphones, etc.? | <input type="checkbox"/> yes <input checked="" type="checkbox"/> no | | |
| EUT sample type | <input type="checkbox"/> Production | <input checked="" type="checkbox"/> Pre-Production | <input type="checkbox"/> Engineering |
| FCC label attached | <input type="checkbox"/> yes | <input checked="" type="checkbox"/> no | |

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

| Short description*) | EUT | Type | S/N serial number | HW hardware status | SW software status |
|---------------------|---------------|--|-------------------|--------------------|------------------------|
| EUT A | CTPBASEDTNA | ECU | 2800003466 | 6794G05 | DAIMLER_CT P_16.095.2. |
| EUT B | HCEL-AG-0184B | GSM/ GNSS Low Profile Adhesive Mount Antenna | -- | -- | -- |

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

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

| AE short description *) | Auxiliary Equipment | Type | S/N serial number | HW hardware status | SW software status |
|-------------------------|--------------------------------|------|-------------------|--------------------|--------------------|
| AE 1 | Main wiring long with load box | -- | -- | -- | -- |
| AE 2 | Main wiring short | -- | -- | -- | -- |

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

3.5. EUT set-ups

| EUT set-up no. *) | Combination of EUT and AE | Remarks |
|-------------------|---------------------------|------------------------------------|
| set. 1 | EUT A + EUT B + AE 2 | Used for radiated measurements. |
| set. 2 | EUT A + AE 1 | Used for conducted RF-measurements |

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

3.6. EUT operating modes

| EUT operating mode no.*) | Description of operating modes | Additional information |
|--------------------------|--|--|
| op. 1 | GPRS 850 TCH mode TCH=128/192/251 | A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). USF_Duty CYCLE set to 100%, coding scheme CS-1 for GMSK modulation, slot 3 active, uplink gamma: 3 (33dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. |
| op. 2 | E-GPRS 850 TCH mode TCH=128/192/251 | A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 33 dBm (power class 4; power control level 5). USF_Duty CYCLE set to 100%, coding scheme MCS-5 for 8PSK modulation, slot 3 active, uplink gamma: 6 (27dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. |
| op. 3 | GPRS 1900 TCH mode TCH=512/661/810 | A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 30 dBm (power class 1; power control level 0). USF_Duty CYCLE set to 100%, coding scheme CS-1 for GMSK modulation, slot 3 active, uplink gamma: 3 (30dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. |
| op. 4 | E-GPRS 1900 TCH mode PCL=0 (max. power) TCH=512/661/810 | A communication link is established between the mobile station and the test simulator. The transmitter is operated at its maximum rated output power: 26 dBm (power class 1; power control level 0). USF_Duty CYCLE set to 100%, coding scheme MCS-5 for 8-PSK modulation, slot 3 active, uplink gamma: 5 (26dBm). The input signal to the receiver is modulated with normal test modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link. |
| op. 5 | FDD-Band 2 12.2 kbps RMC | 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: 21 dBm or 24dBm nominal. The input signal to the receiver is modulated with normal test modulation. |
| op. 6 | FDD-Band 5 12.2 kbps RMC | The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link according Table E5.1/Table E5.1A as described in 3GPP TS34.121, Annex E. |

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

4. Measurements

4.1. Radio Frequency Exposure Evaluation §2.1091

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

| | | | |
|---------------|---|--|--|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2 | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| | For Evaluation instruments are not needed. Results are determined by calculation based on applicants delivered Tune-Up procedure. | | |

4.1.2. Requirements

| | |
|--------------|---|
| FCC: §1.1310 | <i>The criteria used for the evaluation of human exposure to radio frequency radiation is table 1 according FCC §1.1310 and table chapter 4.2 of RSS-102 standard and it is subject for evaluation of the RF exposure prior to equipment authorization. As the mobile equipment is authorized under Part 22 (Subpart H) and Part 24 of the FCC Rules, it is subject for evaluation of the RF exposure prior to equipment authorization.</i> |
| FCC § 2.1091 | <i>Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation." For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits given in Table 1 of Appendix A.</i> |

4.1.2.1. Valid for FCC

| Table 1: LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) | | | | |
|---|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| Frequency range [MHz] | Electric field strength [V/m] | Magnetic field strength [A/m] | Power density [mW/cm ²] | Averaging time [minutes] |
| 30 - 300 | 61.4 | 0.163 | 1.0 | 6 |
| 300 - 1500 | - | - | f/300 | 6 |
| 1500 - 100,000 | - | - | 5 | 6 |
| (B) Limits for General Population / Uncontrolled Exposure | | | | |
| 0.3 – 1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34 – 30 | 824/f | 2.19/f | *(180/f ²) | 30 |
| 30 - 300 | 27.5 | 0.073 | 0.2 | 30 |
| 300 - 1500 | - | - | f/1500 | 30 |
| 1500 – 100,0 | - | - | 1.0 | 30 |

For given Power density limit at a single frequency (accord. Table 1 Limits) the maximum antenna gain can be calculated.

The used equation to predict the power density in the far-field of one single radiating antenna can be made by following equation:

$$S = \frac{EIRP}{4\pi R^2} = \frac{P * G}{4\pi R^2}$$

$$G_{NUMERIC} = \frac{S * 4\pi R^2}{P}$$

4.1.3. General Limits:

| | |
|--------------------|--|
| FCC: §1.1307 | <i>Cellular Radiotelephone Service (subpart H of part 22) Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 1000 W ERP (1640 W EIRP)</i> |
| FCC §1.1307 | <i>Personal Communications Services (part 24) Broadband PCS (subpart E): non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 2000 W ERP (3280 W EIRP)</i> |
| FCC §1.1310 | <i>LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) Table 1(B) Limits for General Population/Uncontrolled Exposure 300–1500 MHz: $f/1500$ mW/cm² 1500–100,000 MHz: 1.0 mW/cm²</i> |
| FCC §2.1091 | <i>Subject to routine evaluation is required when the device operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more, or if they operate at frequencies above 1.5 GHz and their ERP is 3 watts or more.</i> |
| FCC §24.232 | <i>(a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna height up to 300 meters HAAT. b) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power, ...</i> |
| FCC §22.913 | <i>(a) Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.</i> |
| FCC §27.50 (C)(10) | <i>(10) Portable stations (hand-held devices) are limited to 3 watts ERP; and</i> |
| FCC §27.50(d) | <i>(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band are limited to 1 watt EIRP.</i> |
| KDBs | <i>No. 447498 D01 v06</i> |

4.1.4. Evaluation Method

Valid for GSM/GPRS/EDGE mode:

- The power was considered on 3 frequencies (lowest/middle/highest) within each operable bands
- 4 TX slots are maximum possible for this device and calculated as worst-case
- A duty-cycle correction factor of $10 \cdot \log_{10}$ (max. number of possible active slots / 8 slots) were applied

Valid for W-CDMA/LTE Mode:

- The power was considered for 3 frequencies (lowest/middle/highest) within each operable FDD-band (see separate report for W-CDMA technology)
- No duty-cycle correction factor is applicable

4.1.5. Cellular (licensed services) references for evaluation

Please find in the following tables the calculations based on **applicants or manufacturer's documents**:

3.75G HSPA Wireless Module: Original MPE-Report for Wireless-Module with FCC-ID XPYLISAU201:

“MDE_UBLOX_1519_MPEa” dated 2015-09-08 Version 000, which can be found under:

https://apps.fcc.gov/oetcf/eas/reports/ViewExhibitReport.cfm?mode=Exhibits&RequestTimeout=500&calledFromFrame=N&application_id=Hk1TVyJTKQ%2FaW09nbfO1bA%3D%3D&fcc_id=XPYLISAU201

Reported power conducted including tune-up info for GSM and W-CDMA operating mode are considered herewith.

Cellular Antenna data-sheet: “D126-0107B 1890 Installation Instruction”

4.2. Results for fixed and mobile operations

4.2.1. Results for lower operational band: GSM850 and FDD Band 5

4.2.1.1. MPE results

| Distance | 20 | cm | | | | | | | | | | |
|------------------|----------------------|---|--------------|--|------------|----------------------|---|---------------------------|-----------------------|-----------------------|---------------------------------------|---|
| Operating Mode | Frequency on channel | Declared maximum conducted output power | Antenna Gain | Calculated maximum ERP (declared+ Tune-up+ antenna Gain) | Duty cycle | Declared Maximum ERP | Equivalent ERP (maximum ERP x duty cycle) | MPE Limit accord. Table 1 | MPE-Value | Margin to limit: | Fraction for Co-Location calculations | Max. Fraction-Value within Frequency-Band |
| | (MHz) | (dBm) | (dBi) | (dBm) | % | (W) | (mW) | (mW/cm ²) | (mW/cm ²) | (mW/cm ²) | | |
| GSM/GPRS | 824,2 | 33,5 | 0 | 33,5 | 50% | 2,239 | 1119 | 0,5495 | 0,2227 | 0,3268 | 0,4053 | 0,4053 |
| | 837,0 | 33,5 | 0 | 33,5 | | 2,239 | 1119 | 0,5580 | 0,2227 | 0,3353 | 0,3991 | |
| | 848,8 | 33,5 | 0 | 33,5 | | 2,239 | 1119 | 0,5659 | 0,2227 | 0,3432 | 0,3935 | |
| WCDMA FDD Band 5 | 826,4 | 25,0 | 0 | 25,0 | 100% | 0,316 | 316 | 0,5509 | 0,0629 | 0,4880 | 0,1142 | 0,1142 |
| | 836,4 | 25,0 | 0 | 25,0 | | 0,316 | 316 | 0,5576 | 0,0629 | 0,4947 | 0,1128 | |
| | 846,6 | 25,0 | 0 | 25,0 | | 0,316 | 316 | 0,5644 | 0,0629 | 0,5015 | 0,1115 | |

| Maximum calculated MPE value: | | |
|---|--------|-----------------------|
| Lowest MPE-Limit in Frequency-Band: | 0,5495 | [mW/cm ²] |
| Highest MPE value in frequency-band: | 0,2227 | [mW/cm ²] |
| Lowest margin to limit in frequency band: | 0,3268 | [mW/cm ²] |

4.2.2. Results for upper operational band: FDD 2 and GSM1900

4.2.2.1. MPE results

| Safety-Distance | 20 | cm | | | | | | | | | | |
|-------------------------------|----------------------------|---|--------------------|--|----------------|--------------------------|--|---|---------------------------------|--------------------------------------|---------------------------------------|---|
| Operation Mode | Frequency on channel (MHz) | Declared maximum conducted output power (dBm) | Antenna Gain (dBi) | Declared maximum ERP (Measured+ Tune-up+ Antenna Gain) (dBm) | Duty cycle (%) | Declared Maximum ERP (W) | Equivalent ERP (maximum ERP x duty cycle) (mW) | MPE Limit accord. Table 1 (mW/cm ²) | MPE-Value (mW/cm ²) | Margin to limit: (W/m ²) | Fraction for Co-Location calculations | Max. Fraction-Value within Frequency-Band |
| GSM/GPRS (PK-Burst value) | 1850,2 | 32,0 | 0,0 | 32,0 | 50% | 1,585 | 792 | 1,0000 | 0,1577 | 0,8423 | 0,157652 | 0,1576522 |
| | 1880,0 | 32,0 | 0,0 | 32,0 | | 1,585 | 792 | 1,0000 | 0,1577 | 0,8423 | 0,157652 | |
| | 1909,8 | 32,0 | 0,0 | 32,0 | | 1,585 | 792 | 1,0000 | 0,1577 | 0,8423 | 0,157652 | |
| W-CDMA FDD Band 2 (RMS-Value) | 1852,4 | 25,0 | 0,0 | 25,0 | 100% | 0,316 | 316 | 1,0000 | 0,0629 | 0,9371 | 0,062912 | 0,0629115 |
| | 1880,0 | 25,0 | 0,0 | 25,0 | | 0,316 | 316 | 1,0000 | 0,0629 | 0,9371 | 0,062912 | |
| | 1907,6 | 25,0 | 0,0 | 25,0 | | 0,316 | 316 | 1,0000 | 0,0629 | 0,9371 | 0,062912 | |

| Maximum calculated MPE value: | | |
|--------------------------------------|--------|-----------------------|
| Lowest MPE-Limit in frequency-band: | 1,0000 | [mW/cm ²] |
| Highest MPE value in frequency-band: | 0,1577 | [mW/cm ²] |
| Margin to limit in frequency-band: | 0,8423 | [mW/cm ²] |

4.3. 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 | Reference | Frequency range | Calculated uncertainty based on a confidence level of 95% | | | | | Remarks |
|---|--------------|--------------------|---|--------|-----|----|----|---|
| Conducted emissions (U _{CISPR}) | CISPR 16-2-1 | 9 kHz - 150 kHz | 4.0 dB | | | | | - |
| | | 150 kHz - 30 MHz | 3.6 dB | | | | | |
| Radiated emissions Enclosure | CISPR 16-2-3 | 30 MHz - 1 GHz | 4.2 dB | | | | | E-Field |
| | | 1 GHz - 18 GHz | 5.1 dB | | | | | |
| Disturbance power | CISPR 16-2-2 | 30 MHz - 300 MHz | - | | | | | - |
| Power Output radiated | - | 30 MHz - 4 GHz | 3.17 dB | | | | | Substitution method |
| Power Output conducted | - | Set-up No. | Cel-C1 | Cel-C2 | BT1 | W1 | W2 | - |
| | | 9 kHz - 12.75 GHz | N/A | 0.60 | -- | -- | -- | |
| | | 12.75 - 26.5GHz | N/A | 0.82 | -- | -- | -- | |
| Conducted emissions on RF-port | - | 9 kHz - 2.8 GHz | 0.70 | N/A | -- | -- | -- | N/A - not applicable |
| | | 2.8 GHz - 12.75GHz | 1.48 | N/A | -- | -- | -- | |
| | | 12.75 GHz - 18GHz | 1.81 | N/A | -- | -- | -- | |
| | | 18 GHz - 26.5GHz | 1.83 | N/A | -- | -- | -- | |
| 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 |
| | | | See above: 0.70 dB | | | | | Power |
| Frequency stability | - | 9 kHz - 20 GHz | 0.0636 ppm | | | | | - |
| Radiated emissions Enclosure | - | 150 kHz - 30 MHz | 5.0 dB | | | | | Magnetic field E-field Substitution |
| | | 30 MHz - 1 GHz | 4.2 dB | | | | | |
| | | 1 GHz - 20 GHz | 3.17 dB | | | | | |

Table: measurement uncertainties, valid for conducted/radiated measurements

5. 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 |

6. Accreditation details of CETECOM's laboratories and test sites

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

OATS = Open Area Test Site, SAR = Semi Anechoic Room, FAR = Fully Anechoic Room

7. Instruments and Ancillary

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

7.0.1. 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 | B 10 | 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 |
| 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 |
| 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 |
| 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. 9.15.00 |
| 444 | CTC-FAR-EMS field | System-EMS-Field (FAR) | - | EMC 32 Version 9.15.00 |
| 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 |
| 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 |
| 607 | Signal Generator | SMR 20 | 832033/011 | V1.25 |
| 620 | EMI Test Receiver | ESU 26 | 100362 | 4.43_SP3 |
| 642 | Wideband Radio Communication Tester | CMW 500 | 126089 | Setup V03.26, Test programm component V03.02.20 |
| 670 | Univ. Radio Communication Tester | CMU 200 | 106833 | µP1 =V8.50, Firmware = V.20 |
| 689 | Vector Signal Generator | SMU200 | 100970 | 02.20.360.142 |
| 692 | Bluetooth Tester | CBT 32 | 100236 | CBT V 5.40, FW: V.2.41 (FPGA Digital, V. 3.09 FPGA RF) |

7.0.2. 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 | - | 30.05.2017 |
| 005 | AC - LISN (50 Ohm/50µH, test site 1) | ESH2-Z5 | 861741/005 | Rohde & Schwarz | 12 M | - | 30.05.2017 |
| 007 | Single-Line V-Network (50 Ohm/5µH) | ESH3-Z6 | 892563/002 | Rohde & Schwarz | 12 M | - | 30.05.2017 |
| 009 | Power Meter (EMS-radiated) | NRV | 863056/017 | Rohde & Schwarz | 24 M | - | 30.04.2017 |
| 016 | Line Impedance Simulating Network | Op. 24-D | B6366 | Spitzenberger+Spies | 36 M | - | 30.05.2019 |
| 020 | Horn Antenna 18 GHz (Subst 1) | 3115 | 9107-3699 | EMCO | 36/12 M | - | 31.03.2017 |
| 021 | Loop Antenna (H-Field) | 6502 | 9206-2770 | EMCO | 36 M | - | 30.04.2018 |
| 030 | Loop Antenna (H-field) | HFH-Z2 | 879604/026 | Rohde & Schwarz | 36 M | - | 30.04.2018 |
| 033 | RF-current probe (100kHz-30MHz) | ESH2-Z1 | 879581/18 | Rohde & Schwarz | 24 M | - | 30.04.2017 |
| 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 | 30.06.2017 |
| 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 | |
| 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 | - | 30.04.2018 |
| 100 | passive voltage probe | Probe TK 9416 | without | Schwarzbeck | 36 M | - | 30.04.2018 |
| 110 | USB-LWL-Converter | OLS-1 | - | Ing. Büro Scheiba | - | 4 | |
| 119 | RT Harmonics Analyzer dig. Flickermeter | B10 | G60547 | BOCONSULT | 36 M | - | 30.05.2019 |
| 136 | adjustable dipole antenna (Dipole 1) | 3121C-DB4 | 9105-0697 | EMCO | 36 M | - | 30.04.2018 |
| 140 | Signal Generator | SMHU | 831314/006 | Rohde & Schwarz | 24 M | - | 30.05.2018 |
| 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 | - | 30.05.2018 |
| 262 | Power Meter | NRV-S | 825770/0010 | Rohde & Schwarz | 24 M | - | 30.05.2018 |
| 263 | Signal Generator | SMP 04 | 826190/0007 | Rohde & Schwarz | 36 M | - | 30.05.2019 |
| 265 | peak power sensor | NRV-Z33, Model 04 | 840414/009 | Rohde & Schwarz | 24 M | - | 30.05.2018 |
| 266 | Peak Power Sensor | NRV-Z31, Model 04 | 843383/016 | Rohde & Schwarz | 24 M | - | 30.05.2018 |
| 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 | 30.06.2017 |
| 291 | high pass filter GSM 850/900 | WHJ 2200-4EE | 14 | Wainwright GmbH | 12 M | 1c | 30.06.2017 |
| 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 | 12 M | - | 30.05.2017 |
| 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 | - | 31.03.2017 |
| 303 | horn antenna 40 GHz (Subst 1) | BBHA9170 | 156 | Schwarzbeck | 36 M | - | 31.03.2017 |
| 331 | Climatic Test Chamber -40/+80 Grad | HC 4055 | 43146 | Heraeus Vötsch | 24 M | - | 30.10.2018 |
| 341 | Digital Multimeter | Fluke 112 | 81650455 | Fluke | 24 M | - | 30.05.2018 |
| 342 | Digital Multimeter | Voltcraft M-4660A | IB 255466 | Voltcraft | 24 M | - | 30.04.2017 |
| 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 | - | 30.05.2018 |
| 357 | power sensor | NRV-Z1 | 861761/002 | Rohde & Schwarz | 24 M | - | 30.04.2017 |
| 371 | Bluetooth Tester | CBT32 | 100153 | R&S | 36 M | - | 30.05.2019 |
| 373 | Single-Line V-Network (50 Ohm/5µH) | ESH3-Z6 | 100535 | Rohde & Schwarz | 12 M | - | 30.05.2017 |
| 377 | EMI Test Receiver | ESCS 30 | 100160 | Rohde & Schwarz | 12 M | - | 30.05.2017 |
| 389 | Digital Multimeter | Keithley 2000 | 0583926 | Keithley | 24 M | - | 30.04.2017 |
| 392 | Radio Communication Tester | MT8820A | 6K00000788 | Anritsu | 12 M | - | 30.05.2017 |
| 431 | Model 7405 | Near-Field Probe Set | 9305-2457 | EMCO | - | 4 | |
| 436 | Univ. Radio Communication Tester | CMU 200 | 103083 | Rohde & Schwarz | 12 M | - | 30.04.2017 |
| 439 | UltraLog-Antenna | HL 562 | 100248 | Rohde & Schwarz | 36 M | - | 31.03.2017 |
| 441 | CTC-SAR-EMI Cable Loss | System EMI field (SAR) Cable | - | CETECOM | 12 M | 5 | 05.06.2017 |
| 443 | CTC-FAR-EMI-RSE | System CTC-FAR-EMI-RSE | - | ETS-Lindgren / CETECOM | 12 M | 5 | 30.06.2017 |
| 448 | notch filter WCDMA_FDD II | WRCT 1850.0/2170.0-5/40- | 5 | Wainwright Instruments GmbH | 12 M | 1c | 30.06.2017 |
| 449 | notch filter WCDMA FDD V | WRCT 824.0/894.0-5/40-8SSK | 1 | Wainwright | 12 M | 1c | 30.06.2017 |

| Ref.-No. | Equipment | Type | Serial-No. | Manufacturer | Interval of calibration | Remark | Cal due |
|----------|---|-----------------------------|----------------------------|-----------------------------|-------------------------|--------|------------|
| 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 | - | 30.04.2017 |
| 463 | Universal source | HP3245A | 2831A03472 | Agilent | - | 4 | |
| 466 | Digital Multimeter | Fluke 112 | 89210157 | Fluke USA | 24 M | - | 30.05.2018 |
| 467 | Digital Multimeter | Fluke 112 | 89680306 | Fluke USA | 36 M | - | 30.04.2018 |
| 468 | Digital Multimeter | Fluke 112 | 90090455 | Fluke USA | 36 M | - | 30.04.2018 |
| 477 | ReRadiating GPS-System | AS-47 | - | Automotive Cons. Fink | - | 3 | |
| 480 | power meter (Fula) | NRVS | 838392/031 | Rohde & Schwarz | 24 M | - | 30.04.2017 |
| 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 | - | 30.07.2017 |
| 487 | System CTC NSA-Verification SAR-EMI | System EMI field (SAR) NSA | - | ETS Lindgren / CETECOM | 24 M | - | 31.07.2017 |
| 489 | EMI Test Receiver | ESU40 | 1000-30 | Rohde & Schwarz | 12 M | - | 30.05.2017 |
| 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 | 30.06.2017 |
| 517 | relais switch matrix | HF Relais Box Keithley | SE 04 | Keithley | pre-m | 2 | |
| 523 | Digital Multimeter | L4411A | MY46000154 | Agilent | 24 M | - | 30.04.2017 |
| 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 | - | 30.05.2017 |
| 547 | Univ. Radio Communication Tester | CMU 200 | 835390/014 | Rohde & Schwarz | 12 M | - | 30.04.2017 |
| 549 | Log.Per-Antenna | HL025 | 1000060 | Rohde & Schwarz | 36/12 M | - | 31.07.2018 |
| 550 | System CTC S-VSWR Verification SAR-EMI | System EMI Field SAR S-VSWR | - | ETS Lindgren/CETECOM | 24 M | - | 31.07.2017 |
| 552 | high pass filter 2,8-18GHz | WHKX 2.8/18G-10SS | 4 | Wainwright | 12 M | 1c | 30.06.2017 |
| 557 | System CTC-OTA-2 | R&S TS8991 | - | Rohde & Schwarz | 12 M | 5 | 30.09.2016 |
| 558 | System CTC FAR S-VSWR | System CTC FAR S-VSWR | - | CTC | 24 M | - | 31.07.2017 |
| 574 | Biconilog Hybrid Antenna | BTA-L | 980026L | Frankonia | 36/12 M | - | 31.03.2019 |
| 584 | Spectrum Analyzer | FSU 8 | 100248 | Rohde & Schwarz | pre-m | - | |
| 594 | Wideband Radio Communication Tester | CMW 500 | 101757 | Rohde & Schwarz | 12 M | - | 30.04.2017 |
| 597 | Univ. Radio Communication Tester | CMU 200 | 100347 | Rohde & Schwarz | pre-m | - | |
| 598 | Spectrum Analyzer | FSEM 30 (Reserve) | 831259/013 | Rohde & Schwarz | 24 M | - | 30.04.2017 |
| 600 | power meter | NRVD (Reserve) | 834501/018 | Rohde & Schwarz | 24 M | - | 30.04.2017 |
| 601 | medium-sensitivity diode sensor | NRV-Z5 (Reserve) | 8435323/003 | Rohde & Schwarz | 24 M | - | 30.04.2017 |
| 602 | peak power sensor | NRV-Z32 (Reserve) | 835080 | Rohde & Schwarz | 24 M | - | |
| 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 | - | 30.05.2018 |
| 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 | - | 30.05.2017 |
| 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. Luft GmbH | 24 M | - | 30.04.2017 |
| 634 | Spectrum Analyzer | FSM (HF-Unit) | 826188/010 | Rohde & Schwarz | pre-m | 2 | |
| 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 | 12 M | - | 07.07.2017 |
| 644 | Amplifierer | ZX60-2534M+ | SN865701299 | Mini-Circuits | - | - | |
| 670 | Univ. Radio Communication Tester | CMU 200 | 106833 | Rohde & Schwarz | 24 M | - | 30.05.2018 |
| 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 26 | 200571 | Rohde & Schwarz | 12 M | - | 30.05.2017 |
| 686 | Field Analyzer | EHP-200A | 160WX30702 | Narda Safety Test Solutions | 24 M | - | 30.04.2017 |
| 687 | Signal Generator | SMF 100A | 102073 | Rohde&Schwarz | 12 M | - | 30.05.2017 |
| 688 | Pre Amp | JS-18004000-40-8P | 1750117 | Miteq | pre-m | - | |
| 690 | Spectrum Analyzer | FSU | 100302/026 | Rohde&Schwarz | 12 M | - | 30.05.2017 |
| 692 | Bluetooth Tester | CBT 32 | 100236 | Rohde & Schwarz | 36 M | - | 31.03.2017 |
| 693 | TS8997 | CTC-Radio Lab 1_TS8997 | - | Rohde&Schwarz | 12 M | 5 | 06.06.2017 |

| Ref.-No. | Equipment | Type | Serial-No. | Manufacturer | Interval of calibration | Remark | Cal due |
|----------|--------------------------|-------------------------|------------------------|--------------------|-------------------------|--------|------------|
| 697 | Power Splitter | ZN4PD-642W-S+ | 165001445 | Mini-Circuits | - | 2 | |
| 701 | CMW500 wide. Radio Comm. | CMW500 | 158150 | Rohde & Schwarz | 12 M | - | 01.05.2017 |
| 703 | INNCO Antennen Mast | MA 4010-KT080-XPET-ZSS3 | MA4170-KT100-XPET- | INNCO | pre-m | - | |
| 704 | INNCON Controller | CO 3000-4port | CO3000/933/3841051 6/L | INNCO Systems GmbH | pre-m | - | |

7.0.3. 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 |

8. Test report version

| Version | Applied changes | Date of release |
|---------|-----------------------|-----------------|
| -- | Initial release | 2017-01-06 |
| C1 | Typos corrected | 2017-01-10 |
| C2 | Typo page 5 corrected | 2017-01-11 |