

TEST REPORT

No.: 17-1-0105501T03a

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

IC-Regulations
 RSS-132 Issue 3, RSS-133 Issue 6,
 RSS-Gen Issue 4

for

Daimler Trucks North America

7 620 000 296
 CTPMIDDTNA4G

FCC: 2AKC8CTP10777001
 ISED: 22221-CTP10777001
 PMN: CTPMIDDTNA
 HVIN: CTPMIDDTNA
 FVIN: 17.02.S.016







| Laboratory Accreditation and Listings | | | |
|--|---|---|--|
|  Deutsche Akkreditierungsstelle D-PL-12047-01-01 |  FEDERAL COMMUNICATIONS COMMISSION • 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 |
|  AUTHORIZED RF LABORATORY |  Authorized TM Test Lab 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. Also we refer on special conditions which the applicant should fulfill according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.

The Equipment Under Test (in this report, hereinafter referred as EUT) supports radiofrequency technologies. Delta tests apply to check for conformance against valid standards due already approved cellular wireless module with FCC-ID: XPYTOBYL200. Due no modifications on the WCDMA Part of the module only radiated tests have been performed in three channels for radiated spurious emission tests and two extreme channels for radiated band-edge emission tests. In addition power verification tests have been performed too.

Following tests have been performed to show compliance with applicable FCC Part 2, Part 22, Subpart H and Part 24, Subpart E (Broadband PCS) of the FCC CFR Title 47 Rules, Edition 4th November 2015 standards and Canada RSS-132 Issue 3, RSS-133 Issue 6, and RSS-Gen Issue 4 standards.

1.1. TX mode, Test overview of FCC Canada IC (RSS) Standards

| No. of Diagram group | Test case | Port | References & Limits | | | EUT set-up | EUT op-mode | Result |
|----------------------|---|---|---|--|---|------------|-------------|--------|
| | | | FCC Standard | RSS Section | Test limit | | | |
| 1 | AC-Power Lines Emissions Conducted (0,15 - 30 MHz) | AC-Power lines (conducted) | §15.207 | RSS-Gen, Issue 4: Chapter 8.8 | §15.207 limits IC: Table 3 | -- | -- | |
| 2 | General field strength emissions (9 kHz - 30 MHz) | Enclosure + Inter-connecting cables (radiated) | §15.209(a) | RSS-Gen, Issue 4: Chapter 8.9, Table 5+6 | 2400/F(kHz) µV/m 24000/F(kHz) µV/m 30 µV/m | 1 | 1,2,3 | passed |
| 7 | RF-Power (ERP/EIRP) | | §2.1046 §22.913(a)(2) §24.232(c) | RSS-132, Issue 3: Chapter 5.4 SRSP-503: 5.1.3 RSS-133, Issue 6 Chapter 4.1/6.4 SRSP-510: 5.1.2 | < 7 Watt (ERP) < 2 Watt (EIRP) | 1 | 1,2,3 | passed |
| 8 | Spurious emissions | | §2.1053(a) §2.1057 §22.917(a)(b) §24.238(a)(b) | RSS-132: Chapter 5.5(i)(ii) | Required attenuation below P(dBW): 43+10log(P) dBc | 1 | 1,2,3 | passed |
| 9 | Band-Edge compliance | | | RSS-133: Chapter 6.5.1(i)(ii) | | 1 | 1,2,3 | passed |

| No. of Diagram group | Test case | Port | References & Limits | | | EUT set-up | EUT op-mode | Result |
|----------------------|-------------------------|-------------------------------------|---|---|---|------------|-------------|--------------------|
| | | | FCC Standard | RSS Section | Test limit | | | |
| 30 | RF Power | Antenna terminal (conducted) | §2.1046 | RSS-132: Chapter 5.4 SRSP-503: 5.1.3 RSS-133: Chapter 4.1/6.4 SRSP-510: 5.1.2 | < 7 Watt (ERP) < 2 Watt (EIRP) | 2 | 1,2,3 | passed |
| 34 | 26dB Emission bandwidth | | §2.202 §2.1049(h) §22.917(a) §24.238(a) §27.53(h) | RSS-Gen., Issue 4: Chapter 6.6 | 99% Power | -- | -- | See initial TR 1.) |
| 35 | 99% Occupied bandwidth | | | | | -- | -- | See initial TR 1.) |
| 36 | Spurious emissions | | §2.1051 §2.1057 | RSS-132, Issue 3: 5.5(i)(ii) RSS-133, Issue 6: 6.5.1(i)(ii) RSS-139, Issue 3 Chapt. 6.6 (i) (ii) | Required attenuation below P(dBW): 43+10log(P) dBc | -- | -- | See initial TR 1.) |
| 37 | Band-Edge compliance | | §22.917(a)(b) §24.238(a)(b) §27.53(h) | | | -- | -- | See initial TR 1.) |
| 38 | Frequency stability | | §2.1055(a)(2) §22.355 | RSS-132, Issue 3: Chapter 5.3 | FCC/IC: < ±2.5ppm | -- | -- | See initial TR 1.) |
| | | | table C-1 §24.235 | RSS-133, Issue 6: Chapter 6.3 | FCC/IC: fundamental emissions stay within the authorized bands IC: < ±2.5ppm | | | |
| | | | §27.54 | RSS-139, Issue 3: Chapter 6.4 | FCC/IC: fundamental emissions stay within the authorized bands | | | |

Remarks:

- Please refer to modular test reports of FCC-ID: XPYTOBYL200

1.2. RX mode, tests overview according FCC Part 15B 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 conducted Emissions | AC-Power lines | § 15.107 § 15.207 | RSS-Gen, Issue 8: Chapter 8.8 | FCC §15.107 class B limits §15.207 limits RSS-Gen: Table 3 | | | N/A Remark 3 |
| 3 | Receiver radiated emissions | Cabinet + Interconnecting cables | § 15.109 § 15.33 § 15.35 | RSS-132, Issue 3: 6.6 RSS-Gen, Issue 4: 5.3 RSS 133, Issue 6: 6.6 | FCC 15.109 class B limits RSS-Gen: Chapter 5.3+Chapter 7.1.2 | -- | -- | Passed Remark 2 |
| 50 | Receiver conducted Emissions | Antenna terminal | §2.1051 | RSS-Gen: 7.1.3 RSS-132: 5.6 RSS-133: 6.6 | IC: < 2 nW (f< 1 GHz) < 5 nW (f> 1 GHz) | -- | -- | Remark 1 |

Remarks:

1. Please refer to modular test reports of FCC-ID: XPYTOBYL200
2. See separate test report no. CETECOM_TR17-1-0105501T01a for measurements according Part 15, Subpart B / RSS-Gen (ICES-003)
3. not applicable since powered within car-environment

1.3. 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.

.....
Dipl.-Ing. Rachid Acharkaoui
Responsible for test section

.....
Dipl.-Ing. Ninovic 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: | Dipl.-Ing. N. Perez |
| Project leader: | Dipl.-Ing. N. Perez |
| Receipt of EUT: | 2017-08-17 |
| Date(s) of test: | 2017-08-18 to 2017-10-05 |
| Date of report: | 2017-10-05 |
| ----- | |
| 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: | Robert Bosch Car Multimedia Portugal, S.A. |
| Address: | Rua Max Grundig 35 4705-820 Braga Portugal |

3. Equipment under test (EUT)

3.1. 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 4: 1712.4–1752.6 MHz (Uplink), 2110-2155 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 4: UARFCN range 1312 – 1450 – 1513 <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=fy%2FvVplxCthQV%2Bcew9PD2Q%3D%3D&fcc_id=XPYTOBYL200 | | |
| 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 ^{*1)} | GSM850/FDD Band 5/LTE B5: 0dBi GSM1900 / FDD Band 2/ LTE B5: 0dBi FDD Band 4/ LTE B4: 0dBi | | |
| Max. Output Power: | | | |
| Conducted FDD-Mode 2 | 25.73dBm (peak) / 22.51dBm (AV) | | |
| Conducted FDD-Mode 4 | 26.01dBm (Peak) / 22.73dBm (AV) | | |
| Conducted FDD-Mode 5 | 25.73dBm (Peak) / 22.39dBm (AV) | | |
| Peak EIRP: | = Peak Max Output Power + Antenna Gain | | |
| Conducted FDD-Mode 2 | 25.73dBm + 0dBi = 25.73dBm | | |
| Conducted FDD-Mode 4 | 26.01dBm + 0dBi = 26.01dBm | | |
| Conducted FDD-Mode 5 | 25.73dBm + 0dBi = 25.73dBm | | |
| Peak ERP: | = Peak EIRP – 2.15dBi | | |
| Conducted FDD-Mode 2 | 25.73dBm – 2.15dBi = 23.58dBm | | |
| Conducted FDD-Mode 4 | 26.01dBm – 2.15dBi = 23.86dBm | | |
| Conducted FDD-Mode 5 | 25.73dBm – 2.15dBi = 23.58dBm | | |

| | | | |
|---|---|--|--------------------------------------|
| Installed option | <input checked="" type="checkbox"/> GSM 900 and GSM 1800 Bands (not usable in USA/Canada) <input checked="" type="checkbox"/> W-CDMA Band I and Band VIII (not usable in USA/Canada) | | |
| Power supply | <input checked="" type="checkbox"/> DC power only: 24V DC via battery | | |
| Special EMI components | -- | | |
| Does EUT contain devices susceptible to magnetic fields, e.g. Hall elements, electrodynamics 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 | |

Remark: ^{*1)} please refer to antenna data sheet "D126-0153A - HCEL-AG-0205A Installation Instruction Rev1"

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

| Short description*) | EUT | Type | S/N serial number | HW hardware status | SW software status |
|---------------------|---|---|-------------------|--------------------|--------------------|
| EUT A | CTPMIDDTNA4G | 7 620 000 296 | 2960006201 | 0601G01 | 17.02.S.016 |
| EUT B | HCEL-AG-0205-01 / 955-180-001 (DTNA PN 66-03942-002) | 4G LTE/GNSS Low Profile Adhesive Mount Antenna | -- | -- | -- |
| EUT C | HWLN-AX-0115A-01 | WiFi Low Profile Adhesive Mount Antenna | -- | -- | -- |

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

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

| AE short description *) | Auxiliary Equipment | Type | S/N serial number | HW hardware status | SW software status |
|-------------------------|----------------------------|------|-------------------|--------------------|--------------------|
| AE 1 | Cable harness with loadbox | -- | Harness#1 | -- | -- |
| AE 2 | Cable harness reduced | -- | Harness#2 | -- | -- |

*) 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 + EUT C + EUT D + AE 1 | Used for radiated measurements. |
| set. 2 | EUT A + AE 2 | Used for conducted RF-measurements |

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

777

3.5. EUT operating modes

| EUT operating mode no. *) | Description of operating modes | Additional information |
|---------------------------|--------------------------------|---|
| op. 1 | 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. 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. |
| op. 2 | FDD-Band 4 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. 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. |
| op. 3 | FDD-Band 5 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. 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. |
| op. 4 | FDD-Band 2 HSUPA Test 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: 21 Other settings are made according chapter 3.6.2 |
| op. 5 | FDD-Band 4 HSUPA Test 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: 21 Other settings are made according chapter 3.6.2 |
| op. 6 | FDD-Band 5 HSUPA Test 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: 21. Other settings are made according chapter 3.6.2 |

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

3.6. RMC99, HSDPA and HSUPA FDD SETTINGS

Output power considerations for WCDMA mobile equipment

The maximum output power is verified for Low, Middle and High channels according the general descriptions in section 5.2 of 3GPP TS34.121. Following table shows the references to the relative chapter.

| Test | Rel99 | HSDPA | | HSUPA |
|------------|-------|-------|-------|-------|
| Max. Power | 5.2 | 5.2A | 5.2AA | 5.2B |

3.6.1. 3GPP Release 99

The default test configuration and radio link is 12.2 kbps Reference Measurement Channel configured in test loop mode 1. This RMC defines one code channel in I-branch (DPDCH) and one code channel on the Q-branch (DPCCH). Compressed mode is switched off.

The uplink contains one DPCCH and up to 6 DPDCH channels. The radio link contain simultaneous data, voice, data, video and packet data and signalling. The nominal maximum output power are defined according to the power class of the EUT. All the parameters are defined using the UL reference measurement channel (12.2kbps), as specified in clause C2.1 of 3GPP TS34.121.

C.2.1 UL reference measurement channel (12,2 kbps)

The parameters for the 12,2 kbps UL reference measurement channel are specified in table C.2.1.1, table C 2.1.2, table C 2.1.3 and table C.2.1.4. The channel coding for information is shown in figure C.2.1

Table C.2.1.1: UL reference measurement channel physical parameters (12,2 kbps)

| Parameter | Level | Unit |
|--|-------|------|
| Information bit rate | 12,2 | kbps |
| DPDCH | 60 | kbps |
| DPCCH | 15 | kbps |
| DPCCH Slot Format #i | 0 | - |
| DPCCH/DPDCH power ratio | -5,46 | dB |
| TFCI | On | - |
| Repetition | 23 | % |
| NOTE: Slot Format #2 is used for closed loop tests in clause 7.6.2. Slot Format #2 and #5 are used for site selection diversity transmission tests in subclause 7.6.3. | | |

Table C.2.1.2: UL reference measurement channel using RLC-TM for DTCH, transport channel parameters (12,2 kbps)

| Higher Layer | RAB/Signalling RB | | RAB | SRB |
|--------------|---|-----------|--------------------|--------------------|
| RLC | Logical channel type | | DTCH | DCCH |
| | RLC mode | | TM | UM/AM |
| | Payload sizes, bit | | 244 | 88/80 |
| | Max data rate, bps | | 12200 | 2200/2000 |
| | PDU header, bit | | N/A | 8/16 |
| | TrD PDU header, bit | | 0 | N/A |
| MAC | MAC header, bit | | 0 | 4 |
| | MAC multiplexing | | N/A | Yes |
| Layer 1 | TrCH type | | DCH | DCH |
| | Transport Channel Identity | | 1 | 5 |
| | TB sizes, bit | | 244 | 100 |
| | TFS | TF0, bits | 0*244 | 0*100 |
| | | TF1, bits | 1*244 | 1*100 |
| | TTI, ms | | 20 | 40 |
| | Coding type | | Convolution Coding | Convolution Coding |
| | Coding Rate | | 1/3 | 1/3 |
| | CRC, bit | | 16 | 12 |
| | Max number of bits/TTI after channel coding | | 804 | 360 |

| | | | |
|--|---|-----|-----|
| | Uplink: Max number of bits/radio frame before rate matching | 402 | 90 |
| | RM attribute | 256 | 256 |

Table C.2.1.3: UL reference measurement channel, TFCS (12.2 kbps)

| | |
|-----------|---|
| TFCS size | 4 |
| TFCS | (DTCH, DCCH)= (TF0, TF0), (TF1, TF0), (TF0, TF1), (TF1, TF1) |

In order to measure the maximum output power the base station set and send continuously power control commands to the EUT. TPC bits were set all up ("1").

Physical channels during connection for non-HSDPA test cases

The following clauses describe the downlink Physical Channels that are transmitted during a connection i.e., when measurements are done. For these measurements the offset between DPCH and SCH shall be zero chips at base station meaning that SCH is overlapping with the first symbols in DPCH in the beginning of DPCH slot structure.

E.3.1 Measurement of Tx Characteristics

Table E.3.1 is applicable for measurements on the Transmitter Characteristics (clause 5) with the exception of clauses 5.3 (frequency error), 5.4.1, 5.4.4 and 5.5.2.

Table E.3.1: Downlink Physical Channels transmitted during a connection

| Physical Channel | Power |
|------------------|----------------------------|
| for | -93 dBm / 3,84MHz |
| CPICH | CPICH_Ec / DPCH_Ec= 7 dB |
| P-CCPCH | P-CCPCH_Ec / DPCH_Ec= 5 dB |
| SCH | SCH_Ec / DPCH_Ec = 5 dB |
| PICH | PICH_Ec / DPCH_Ec= 2 dB |
| DPCH | -103,3 dBm / 3,84MHz |

E.3.2 Measurement of Rx Characteristics

Table E.3.2.1 is applicable for measurements on the *Receiver Characteristics* (clause 6) including clauses 5.3 of 3GPP, Frequency Error.

Table E.3.2.2 describes the downlink Physical Channels that are required for the test of Spurious Emissions (clause 6.8). The UE is in the CELL_FACH state during the measurement.

Table E.3.2.2: Downlink Physical Channels transmitted during the RX Spurious Emissions test

| Physical Channel | Power |
|------------------|------------------------------|
| CPICH | -86dBm / 3,84MHz |
| P-CCPCH | P-CCPCH_Ec/ CPICH_Ec= -2 dB |
| SCH | SCH_Ec / CPICH_Ec= -2 dB |
| PICH | PICH_Ec / CPICH_Ec= -5 dB |
| S-CCPCH | S-CCPCH_Ec / CPICH_Ec= -2 dB |

3.6.2. 3GPP Release 6 (HSUPA Option)

HSUPA introduced in Release 6 of the 3GPP standards is an improved step for WCDMA standards. Its objective is to enhance the uplink data transmission rate, reduce overall delay in the system and to increase the cell capacity. A new transport channel E-DCH carries the data to physical layer.

The test requirements and procedures for testing all variations of WCDMA are described in 3GPP TS34.121

The general configuration consists of:

1. enable the packet switched data transmission
2. set the mode to HSUPA Test mode and activate the HSPA channels
3. configure the HSDPA channels
4. configure the general power settings

E.5A.0 Downlink Physical Channels for connection set-up

Table E.5A.0: Levels for connection setup

| Parameter During Connection setup | Unit | Value |
|--------------------------------------|------|-------|
| P-CPICH E_c/I_{or} | dB | -10 |
| P-CCPCH and SCH E_c/I_{or} | dB | -12 |
| PICH E_c/I_{or} | dB | -15 |
| HS-PDSCH | dB | off |
| HS-SCCH_1 | dB | off |
| DPCH E_c/I_{or} | dB | -5 |
| E-HICH | dB | off |
| E-AGCH | dB | off |
| E-RGCH | dB | off |
| OCNS E_c/I_{or} | dB | -3.1 |

E.5A.1 Downlink Physical Channels for measurement

Table E.5A.1 is applicable for tests in subclause 5.2B, 5.2D, 5.2E, 5.9B, 5.10B, 5.13.2B, and 5.13.2C. Table E.5A.2 is applicable for tests in subclause 10.2.1, 10.3.1, 10.4.1. and 10.4.1A. Table E.5A.3 is applicable for tests in subclause 10.2.2, 10.3.2 and 10.3.2A.

Table E.5A.1: Downlink Physical Channel parameters for E-DCH the Transmitter Characteristics tests

| Parameter During Measurement | Unit | Value | Remark |
|--|------|--|--|
| P-CPICH E_c/I_{or} | dB | -10 | |
| P-CCPCH and SCH E_c/I_{or} | dB | -12 | |
| PICH E_c/I_{or} | dB | -15 | |
| HS-PDSCH | dB | -3 | During TTIs, in which the HS-PDSCH is not allocated to the UE via HS-SCCH signalling, the HS-PDSCH shall be transmitted continuously with constant power |
| HS-SCCH_1 | dB | -8 | During TTIs, in which the HS-SCCH is not allocated to the UE the HS-SCCH shall be transmitted continuously with constant power. |
| DPCH E_c/I_{or} | dB | -10 | |
| E-AGCH | dB | -20 | |
| E-HICH | dB | -20 | |
| E-RGCH | dB | DTX'd | |
| OCNS E_c/I_{or} | dB | Necessary power so that total transmit power spectral density of Node B (I_{or}) adds to one | OCNS interference consists of 6 dedicated data channels as specified in table E.5A.4 |
| NOTE 1: For dynamic power correction required to compensate for the presence of transient channels, e.g. control channels, a subset of the OCNS DPCH channels may be used. | | | |
| NOTE 2: For 5.2B, 5.9B, 5.10B, the power levels are selected high enough to keep the DTX reporting ratio very small and to ensure that the radio link is maintained during the test. | | | |

The standard defines five HSUPA test configurations, named subtests with different absolute grant (AG) DELTA_E_DPCCH and BETA values. Each sub-test has its own reference TFCI and gain settings. The settings for each subtests can be found in TS34.121, Table C.11.1.3. In order to perform the test correctly these parameters must be set-up before tests for each sub-test.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

| Sub-test | β_c | β_d | β_d (SF) | β_c/β_d | β_{HS} (Note 1) | β_{ec} | β_{ed} (Note 5) (Note 6) | β_{ed} (SF) | β_{ed} (Codes) | CM (dB) (Note 2) | MPR (dB) (Note 2) | AG Index (Note 6) | E-TFCI |
|----------|----------------|----------------|----------------|-------------------|-----------------------|--------------|--|-------------------|----------------------|------------------|-------------------|-------------------|--------|
| 1 | 11/15 (Note 3) | 15/15 (Note 3) | 64 | 11/15 (Note 3) | 22/15 | 209/225 | 1309/225 | 4 | 1 | 1.0 | 0.0 | 20 | 75 |
| 2 | 6/15 | 15/15 | 64 | 6/15 | 12/15 | 12/15 | 94/75 | 4 | 1 | 3.0 | 2.0 | 12 | 67 |
| 3 | 15/15 | 9/15 | 64 | 15/9 | 30/15 | 30/15 | β_{ed1} : 47/15 β_{ed2} : 47/15 | 4 4 | 2 | 2.0 | 1.0 | 15 | 92 |
| 4 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 2/15 | 56/75 | 4 | 1 | 3.0 | 2.0 | 17 | 71 |
| 5 | 15/15 (Note 4) | 15/15 (Note 4) | 64 | 15/15 (Note 4) | 30/15 | 24/15 | 134/15 | 4 | 1 | 1.0 | 0.0 | 21 | 81 |

Note 1: ΔACK , $\Delta NACK$ and $\Delta CQI = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{ec}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

| Sub-test | β_c | β_d | β_d (SF) | β_c/β_d | β_{HS} (Note1) | β_{ec} | β_{ed} (Note 5) (Note 6) | β_{ed} (SF) | β_{ed} (Codes) | CM (dB) (Note 2) | MPR (dB) (Note 2) | AG Index (Note 6) | E-TFCI |
|----------|----------------|----------------|----------------|-------------------|----------------------|--------------|--|-------------------|----------------------|------------------|-------------------|-------------------|--------|
| 1 | 11/15 (Note 3) | 15/15 (Note 3) | 64 | 11/15 (Note 3) | 22/15 | 209/225 | 1309/225 | 4 | 1 | 1.0 | 0.0 | 20 | 75 |
| 2 | 6/15 | 15/15 | 64 | 6/15 | 12/15 | 12/15 | 94/75 | 4 | 1 | 3.0 | 2.0 | 12 | 67 |
| 3 | 15/15 | 9/15 | 64 | 15/9 | 30/15 | 30/15 | β_{ed1} : 47/15 β_{ed2} : 47/15 | 4 4 | 2 | 2.0 | 1.0 | 15 | 92 |
| 4 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 2/15 | 56/75 | 4 | 1 | 3.0 | 2.0 | 17 | 71 |
| 5 | 15/15 (Note 4) | 15/15 (Note 4) | 64 | 15/15 (Note 4) | 30/15 | 24/15 | 134/15 | 4 | 1 | 1.0 | 0.0 | 21 | 81 |

Note 1: ΔACK , $\Delta NACK$ and $\Delta CQI = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{ec}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Table C.11.1.4: β values for transmitter characteristics tests with HS-DPCCH and E-DCH with 16QAM

| Sub-test | β_o | β_d | β_d (SF) | β_o/β_d | β_{HS} (Note 1) | β_{eo} | β_{ed} (Note 4) (Note 5) | β_{ed} (SF) | β_{ed} (Codes) | CM (dB) (Note 2) | MPR (dB) (Note 2) | Alt. AG Index (Note 5) | E-TFCI | E-TFCI (boost) |
|----------|----------------|----------------|----------------|-------------------|-----------------------|--------------|--|-------------------|----------------------|------------------|-------------------|------------------------|--------|----------------|
| 1 | 11/15 (Note 3) | 15/15 (Note 3) | 64 | 11/15 (Note 3) | 22/15 | 209/225 | 1309/225 | [4] | [1] | [1.0] | [0.0] | 18 | 75 | 75 |
| 2 | 6/15 | 15/15 | 64 | 6/15 | 12/15 | 12/15 | 94/75 | [4] | [1] | [3.0] | [2.0] | 10 | 67 | 67 |
| 3 | 15/15 | 9/15 | 64 | 15/9 | 30/15 | 30/15 | β_{ed1} : 47/15 β_{ed2} : 47/15 | [4] | [2] | [2.0] | [1.0] | 13 | 92 | 92 |
| 4 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 2/15 | 56/75 | [4] | [1] | [3.0] | [2.0] | 15 | 71 | 71 |

Note 1: Δ_{ACK} , Δ_{NACK} and $\Delta_{CQI} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$.

Note 2: CM = 1 for $\beta_o/\beta_d = 12/15$, $\beta_{HS}/\beta_c = 24/15$. For all other combinations of DPDCCH, DPCCH, HS-DPCCH, E-DPDCCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_o/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF0) to $\beta_c = 10/15$ and $\beta_d = 15/15$.

Note 4: In case of testing by UE using E-DPDCCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Required values for **DELTA E-DPCCH**:

| Subtest | DELTA E DPCCH |
|---------|---------------|
| 1 | 6 |
| 2 | 8 |
| 3 | 8 |
| 4 | 5 |
| 5 | 7 |

Table C11.3.1 is also important for setting the **UL-RLC SDU SIZE** parameter. This should be for all E-DCH tests set to 2936bits.

The general set-up procedure to measure the maximum power is according 3GPP 34.121, section 5.2B. It is reproduced here:

1. configure the desired subtest no., set-up all necessary parameters
2. set the UE power lower (approx. 6dB) then maximum output power
3. build up a HSUPA call
4. monitor the E-TFCI parameter transmitted and compare it with the 3GPP requirements

| Subtest | 1 | 2 | 3 | 4 | 5 |
|-----------------|----|----|----|----|----|
| Expected E-TFCI | 75 | 67 | 92 | 71 | 81 |

5. increase UE transmit power (TPC commands +1) until E-TFCI is reducing
6. reduce UE power 1 dB and check if the target E-TFCI is transmitted, if not reduce power again.
7. record the value as maximum power

References

1. SAR measurement procedures for 3G Devices CDMA2000/Ev-Do/WCDMA/HSDPA Rev. 2.0
2. 3GPP TS34.121: Terminal conformance specification, Radio Transmission and reception (FDD)
3. Application Note from Rohde&Schwarz "1CM62/09.2009-1CM73_1E"
4. CMU200 operating manual; Software Options CMU-K61..K69

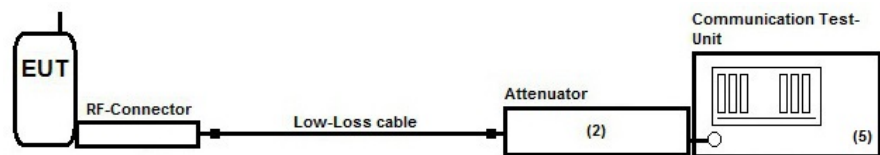
4. Description of test system set-up's

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

Cellular Conducted RF-Setup 2 (Cel-2 Set-up)

Tests Specification: Conducted Carrier power, Frequency Error

Schematic: Following modified test set-up apply for tests performed inside the climatic chamber (frequency stability) or conducted RF-carrier power-measurement. The EUT RF-Signal is directly connected over suitable RF-connector over low-loss cable and an attenuator (2) to the cellular radio communication test-unit. (5)



Testing method: ANSI C63.10:2013, KDB 971168 D01 v02r02

| Used Equipment | Passive Elements | Test Equipment | Remark: |
|----------------|---|---|---|
| | <input checked="" type="checkbox"/> 20 dB Attenuator (#613) | <input checked="" type="checkbox"/> CMU200 | See List of equipment under each test case and chapter 5.7 for calibration info |
| | <input checked="" type="checkbox"/> Low loss RF-cables | <input checked="" type="checkbox"/> DC-Power Supply | |

Measurement uncertainty See chapter Measurement Uncertainties (Cel-2)

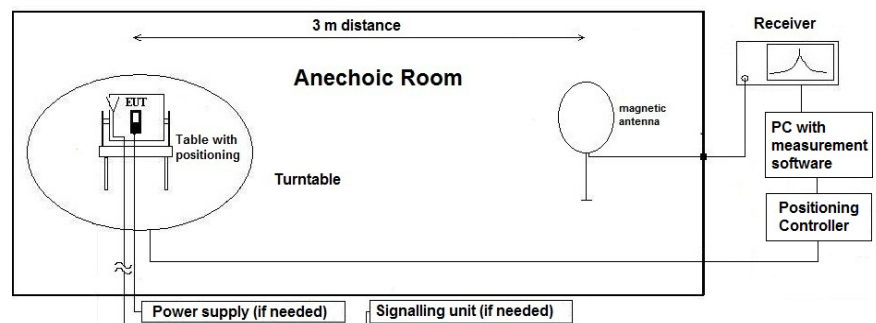
4.2. Test system set-up for radiated magnetic field measurements below 30 MHz

Specification: ANSI C63.10-2013 chapter 6.4 (§6.4.4.2)

General Description: Evaluating the radiated field emissions are done first by an exploratory emission measurement and a final measurement for most critical frequencies determined.

The loop antenna was placed at 1 m height above ground plane and 3 m measurement distance from set-up for investigations. Because of reduced measurement distance, correction data were applied, as stated in chapter “General Limit - Radiated field strength emissions below 30 MHz“. The tests are performed in the semi anechoic room recognized by the regulatory commission.

Schematic:



Testing method:

Exploratory, preliminary measurement

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (step 90°, range 0° to 360°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT), the emission spectrum was recorded. The loop antenna was moved at least to 2-perpendicular axes (antenna vector in direction of EUT and parallel to EUT) in order to maximize the emissions. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a data reduction table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case. 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).

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

Formula:

$$E_C = E_R + AF + C_L + D_F - G_A$$

$$M = L_T - E_C$$

AF = Antenna factor

C_L = Cable loss

D_F = Distance correction factor

E_C = Electrical field – corrected value

E_R = Receiver reading

G_A = Gain of pre-amplifier (if used)

L_T = Limit

M = Margin

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

Distance correction:

Reference for applied correction (extrapolating) factors due to reduced measurement distance:

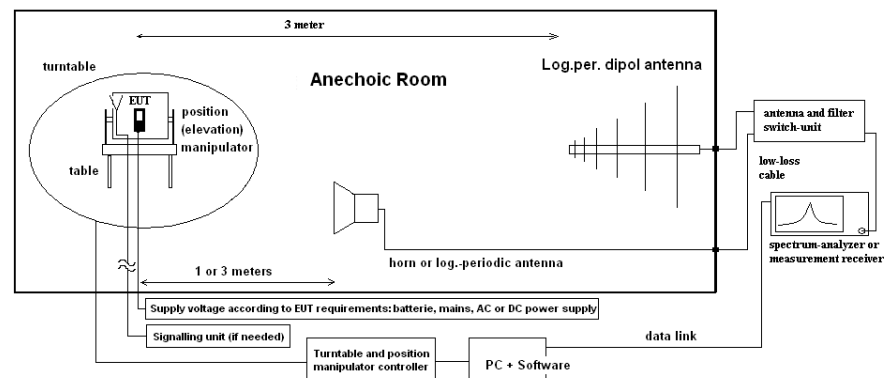
ANSI C63.10:2013, §6.4.4.2 - Equations (2) + (3) + (4)

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

Specification: ANSI C63.4-2014 chapter 8.3, ANSI C63.10-2013 chapter 6.6.3.3 & 6.6.4

General Description: Evaluating the 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 16-1-4:2010 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. A logarithmic periodic antenna is used for the frequency range 30 MHz to 1 GHz. Horn antennas are used for frequency range 1 GHz to 40 GHz. The EUT is aligned within 3 dB beam width of the measurement antenna with three orthogonal axis measurements on the EUT.

Schematic:



Testing method:

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.50 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 45°) and the EUT itself on 3-orthogonal axis (the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software. The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies

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

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined. Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself over 3-orthogonal axis and the height for EUT with large dimensions.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out. The readings on the spectrum analyzer are corrected with conversion value between field strength and E(I)RP, so the readings shown are equivalent to ERP/EIRP values. Critical measurements near the limit are re-measured with a substitution method accord. ANSI/TIA/EIA 603 C/D

Formula:

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

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

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

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)

$E_{C(E)RP}$ = 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 conducted and PAPR-Value

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

| | | | | | |
|-----------------|--|--|---|---|---|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2 | | | |
| test site | <input type="checkbox"/> 347 Radio.lab. 1 | <input checked="" type="checkbox"/> Radio.lab. 2 | | | |
| spectr. analys. | <input type="checkbox"/> 584 FSU | <input checked="" type="checkbox"/> 489 ESU 40 | <input type="checkbox"/> 264 FSEK | <input type="checkbox"/> 620 ESU 26 | |
| signaling | <input type="checkbox"/> 392 MT8820A | <input checked="" type="checkbox"/> 436 CMU | <input type="checkbox"/> 547 CMU | <input checked="" type="checkbox"/> 670 CMU | |
| otherwise | <input type="checkbox"/> 400 FTC40x15E | <input type="checkbox"/> 401 FTC40x15E | <input type="checkbox"/> 110 USB LWL | <input type="checkbox"/> 482 Filter Matrix | <input type="checkbox"/> 378 RadiSense |
| DC power | <input type="checkbox"/> 611 E3636A | <input type="checkbox"/> 463 HP3245A | <input type="checkbox"/> 459 EA 2032-50 | <input type="checkbox"/> 268 EA- 3050 | <input checked="" type="checkbox"/> 494 AG6632A |
| otherwise | <input type="checkbox"/> 331 HC 4055 | <input type="checkbox"/> 248 6 dB Att. | <input type="checkbox"/> 529 Power div. | <input type="checkbox"/> - cable OTA20 | <input type="checkbox"/> 498 NGPE 40 |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | <input checked="" type="checkbox"/> 24V DC | | | |

5.1.2. Requirements and limits

| | |
|---------------|---|
| FCC | <input checked="" type="checkbox"/> § 2.1046 <input checked="" type="checkbox"/> § 22.913(a)(2) <input checked="" type="checkbox"/> § 24.232(c) <input checked="" type="checkbox"/> § 27.50(d)(4) |
| IC | <input checked="" type="checkbox"/> RSS-132, Issue 3: 5.4 + SRSP 503:5.1.3 for FDD 5 <input checked="" type="checkbox"/> RSS-133, Issue 6: 4.1/6.4 + SRSP-510:5.1.2 for FDD 2 <input checked="" type="checkbox"/> RSS-139, Issue 3: 6.5 for FDD 4 |
| ANSI | C63.26-2015 |
| KDB | 971168 D01 v02r02, October 2014 |
| Limits | Maximum Power Output of the wireless device should be determined while measured radiated E(I)RP <input checked="" type="checkbox"/> Limit FDD Band 5: 7 Watt ERP (38.4 dBm) <input checked="" type="checkbox"/> Limit FDD Band 2: 2 Watt EIRP (33.0 dBm) <input checked="" type="checkbox"/> Limit FDD Band 4: 1 Watt EIRP (30.0 dBm) PAPR ≤ 13dB |

5.1.3. 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" ANRITSU | |
| Measurement method | <p>The measurements were performed with the integrated power measurement function of the „radio communication tester CMU200 from Rohde&Schwarz company. In this way spectrum-analyzers instrument limitations can be avoided or minimized. Instead, CMU manufacturers declared measurement error can be considered for this measurement.</p> <p>The attenuation (insertion loss) at the RF Inputs/Outputs of CMU were set according the path loss of the test set-up, determined in a step before starting the measurements. A suitable artificial antenna or RF-connector is provided by the applicant in order to perform the conducted measurements. Any data provided with the artificial antenna or connector, have been taken in account in order to correct the measurement data. (typical 0.3dB for attenuation of antenna connector)</p> <p>Peak and Average Values have been recorded for each channel on test set-up Cel-1. The Peak-to - Average-Power Ratio is determined by devices integrated CCDF capability with corresponding settings. (see annex 1 plots)</p> | |
| EUT settings | <p>A call was established on highest power transmit conditions in GMSK and RMC99 mode.</p> <p>UE is set TX mode, highest transmit power conditions, DTX, MPR or other power saving techniques have been disabled</p> <p>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the wireless device, should be sufficient to demonstrate compliance.</p> | |

5.1.4. Measurement Results

| FDD Band 2 | | | | | | | | |
|--|----------------------|-------|--------------------|-------|--------------------|-------|----------------|--------|
| EUT | Set-up 2, Op. Mode 1 | | | | | | | |
| Test case | Power value [dBm] | | | | | | Limit [dBm] | Result |
| | UARFCN no. 9262 | | UARFCN no. 9400 | | UARFCN no. 9538 | | | |
| | PK | AV | PK | AV | PK | AV | | |
| Release 99 12.2kbps RMC | 25.73 | 22.49 | 25.73 | 22.51 | 25.59 | 22.16 | 33 | Passed |
| Peak-to-Average power ratio on 0.1% probability [dB] | 2.98 | | 3.01 | | 3.16 | | 13 | Passed |

Remark: see annex 1 for CCDF-diagrams

| FDD Band 2 | | | | | | | | |
|---------------|----------------------|------|--------------------|------|--------------------|------|--------------------|--------|
| EUT | Set-up 2, Op. Mode 4 | | | | | | | |
| Test case | Power value [dBm] | | | | | | Limit [dBm] | Result |
| | UARFCN no. 9262 | | UARFCN no. 9400 | | UARFCN no. 9538 | | | |
| | PK ^{1.)} | AV | PK ^{1.)} | AV | PK ^{1.)} | AV | | |
| HSPA subset 1 | -- | 20.3 | -- | 20.8 | -- | 20.7 | 33 | Passed |
| HSPA subset 2 | -- | 20.4 | -- | 20.9 | -- | 20.8 | 33 | Passed |
| HSPA subset 3 | -- | 20.3 | -- | 20.8 | -- | 20.2 | 33 | Passed |
| HSPA subset 4 | -- | 19.1 | -- | 19.4 | -- | 18.8 | 33 | Passed |
| HSPA subset 5 | -- | 22.0 | -- | 22.6 | -- | 22.0 | 33 | Passed |

Remark:

- 1.) For HSUPA only power verification on average was performed as RMC mode results are worst case modulation scheme.

| FDD Band 4 | | | | | | | | |
|----------------------------|----------------------|-------|--------------------|-------|--------------------|-------|--------------------|--------|
| EUT | Set-up 2, Op. Mode 2 | | | | | | | |
| Test case | Power value [dBm] | | | | | | Limit [dBm] | Result |
| | UARFCN no. 1312 | | UARFCN no. 1450 | | UARFCN no. 1513 | | | |
| | PK | AV | PK | AV | PK | AV | | |
| Release 99 12.2kbps RMC | 25.52 | 22.25 | 26.01 | 22.73 | 25.24 | 21.95 | 38.4 | Passed |
| Peak-to Average ratio [dB] | 3.11 | | 3.05 | | 2.98 | | 13 | Passed |

Remark: see annex 1 for CCDF-diagrams

| FDD Band 4 | | | | | | | | |
|---------------|----------------------|------|--------------------|------|--------------------|------|--------------------|--------|
| EUT | Set-up 2, Op. Mode 5 | | | | | | | |
| Test case | Power value [dBm] | | | | | | Limit [dBm] | Result |
| | UARFCN no. 1312 | | UARFCN no. 1450 | | UARFCN no. 1513 | | | |
| | PK ^{1.)} | AV | PK ^{1.)} | AV | PK ^{1.)} | AV | | |
| HSPA subset 1 | -- | 20.3 | -- | 20.6 | -- | 19.8 | 33 | Passed |
| HSPA subset 2 | -- | 20.4 | -- | 20.7 | -- | 19.9 | 33 | Passed |
| HSPA subset 3 | -- | 20.1 | -- | 20.3 | -- | 19.7 | 33 | Passed |
| HSPA subset 4 | -- | 18.8 | -- | 19.1 | -- | 18.5 | 33 | Passed |
| HSPA subset 5 | -- | 21.8 | -- | 22.1 | -- | 21.4 | 33 | Passed |

Remark:

- 1.) For HSUPA only power verification on average was performed as RMC mode results are worst case modulation scheme.

| FDD Band 5 | | | | | | | | |
|----------------------------|----------------------|-------|--------------------|-------|--------------------|-------|--------------------|--------|
| EUT | Set-up 2, Op. Mode 3 | | | | | | | |
| Test case | Power value [dBm] | | | | | | Limit [dBm] | Result |
| | UARFCN no. 4132 | | UARFCN no. 4185 | | UARFCN no. 4233 | | | |
| | PK | AV | PK | AV | PK | AV | | |
| Release 99 12.2kbps RMC | 25.66 | 22.39 | 25.03 | 21.55 | 25.73 | 22.38 | 38.4 | Passed |
| Peak-to Average ratio [dB] | 3.27 | | 3.25 | | 3.02 | | 13 | Passed |

Remark: see annex 1 for CCDF-diagrams

| FDD Band 5 | | | | | | | | |
|---------------|----------------------|------|--------------------|------|--------------------|------|--------------------|--------|
| EUT | Set-up 2, Op. Mode 6 | | | | | | | |
| Test case | Power value [dBm] | | | | | | Limit [dBm] | Result |
| | UARFCN no. 4132 | | UARFCN no. 4185 | | UARFCN no. 4233 | | | |
| | PK ^{1.)} | AV | PK ^{1.)} | AV | PK ^{1.)} | AV | | |
| HSPA subset 1 | -- | 20.6 | -- | 19.9 | -- | 20.4 | 33 | Passed |
| HSPA subset 2 | -- | 20.7 | -- | 20.0 | -- | 20.5 | 33 | Passed |
| HSPA subset 3 | -- | 20.6 | -- | 19.8 | -- | 20.3 | 33 | Passed |
| HSPA subset 4 | -- | 19.3 | -- | 18.5 | -- | 19.1 | 33 | Passed |
| HSPA subset 5 | -- | 22.3 | -- | 21.5 | -- | 22.1 | 33 | Passed |

Remark:

- 2.) For HSUPA only power verification on average was performed as RMC mode results are worst case modulation scheme.

5.2. General Limit - Radiated field strength emissions below 30 MHz

5.2.1. Test location and equipment

| | | | |
|-----------------|--|--|--|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2 | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| test site | <input checked="" type="checkbox"/> 441 EMI SAR | <input type="checkbox"/> 487 SAR NSA | <input type="checkbox"/> 347 Radio.lab. |
| receiver | <input type="checkbox"/> 377 ESCS30 | <input checked="" type="checkbox"/> 001 ESS | <input type="checkbox"/> |
| spectr. analys. | <input type="checkbox"/> 584 FSU | <input type="checkbox"/> 120 FSEM | <input type="checkbox"/> 264 FSEK |
| antenna | <input type="checkbox"/> 574 BTA-L | <input type="checkbox"/> 133 EMCO3115 | <input type="checkbox"/> 302 BBHA9170 |
| signaling | <input type="checkbox"/> 392 MT8820A | <input type="checkbox"/> 371 CBT32 | <input checked="" type="checkbox"/> 436 CMU |
| otherwise | <input type="checkbox"/> 400 FTC40x15E | <input type="checkbox"/> 401 FTC40x15E | <input type="checkbox"/> 110 USB LWL |
| DC power | <input type="checkbox"/> 456 EA 3013A | <input type="checkbox"/> 457 EA 3013A | <input type="checkbox"/> 459 EA 2032-50 |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | <input checked="" type="checkbox"/> 24V DC | |

5.2.2. Requirements

| | | | | |
|-----------------|---------------------------------------|-----------------------|--------------|---|
| FCC | Part 15, Subpart C, §15.205 & §15.209 | | | |
| IC | RSS-Gen: Issue 4: §8.9 Table 5 | | | |
| ANSI | C63.10-2013 | | | |
| Frequency [MHz] | Field strength limit | | Distance [m] | Remarks |
| | [µV/m] | [dBµV/m] | | |
| 0.009 – 0.490 | 2400/f (kHz) | 67.6 – 20Log(f) (kHz) | 300 | Correction factor used due to measurement distance of 3 m |
| 0.490 – 1.705 | 24000/f (kHz) | 87.6 – 20Log(f) (kHz) | 30 | Correction factor used due to measurement distance of 3 m |
| 1.705 – 30 | 30 | 29.5 | 30 | Correction factor used due to measurement distance of 3 m |

5.2.3. Test condition and test set-up

| | | | |
|---------------------------------------|---|---|--|
| Signal link to test system (if used): | <input checked="" type="checkbox"/> air link | <input type="checkbox"/> cable connection | <input type="checkbox"/> none |
| EUT-grounding | <input checked="" type="checkbox"/> none | <input type="checkbox"/> with power supply | <input type="checkbox"/> additional connection |
| Equipment set up | <input checked="" type="checkbox"/> table top | <input type="checkbox"/> floor standing | |
| Climatic conditions | Temperature: (22±3°C) | | Rel. humidity: (40±20)% |
| EMI-Receiver or Analyzer Settings | Scan data | <input checked="" type="checkbox"/> 9 – 150 kHz RBW/VBW = 200 Hz Scan step = 80 Hz <input checked="" type="checkbox"/> 150 kHz – 30 MHz RBW/VBW = 9 kHz Scan step = 4 kHz <input type="checkbox"/> other: | |
| | Scan-Mode | <input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3dB Spectrum analyser Mode | |
| | Detector | Peak (pre-measurement) and Quasi-PK/Average (final if applicable) | |
| | Mode: Sweep-Time | Repetitive-Scan, max-hold Coupled – calibrated display if continuous signal otherwise adapted to EUT's individual transmission duty-cycle | |
| General measurement procedures | | Please see chapter "Test system set-up radiated magnetic field measurements below 30 MHz" | |

5.2.4. Measurement Results

The results are presented below in summary form only. For more information please consult the diagrams included in annex 1. A representative choice of operating modes shows compliance.

Table of measurement results:

| Diagram No. | Carrier Channel | | Frequency range | Set-up no. | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|------|-----------------|------------|-------------|--------|-------------------------------------|--------------------------|--------------------------|--------|
| | Range | No. | | | | | PK | AV | QP | |
| 2.20 | Low | 9262 | 9 kHz-30 MHz | 1 | 1 | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.21 | Mid | 9400 | 9 kHz-30 MHz | 1 | 1 | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.22 | High | 9538 | 9 kHz-30 MHz | 1 | 1 | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.30 | Low | 1312 | 9 kHz-30 MHz | 1 | 2 | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.31 | Mid | 1450 | 9 kHz-30 MHz | 1 | 2 | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.32 | High | 1513 | 9 kHz-30 MHz | 1 | 2 | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.40 | Low | 4132 | 9 kHz-30 MHz | 1 | 3 | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.41 | Mid | 4185 | 9 kHz-30 MHz | 1 | 3 | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.42 | High | 4233 | 9 kHz-30 MHz | 1 | 3 | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

5.2.5. Correction factors due to reduced meas. distance ($f < 30$ MHz)

The used correction factors when the measurement distance is reduced compared to regulatory measurement distance, are calculated according to Extrapolation formulas valid for EUT's with maximum dimension of $0.625 \times \text{Lambda}$. Formula 2+3+4 as presented in ANSI C63.10, Chapter 6.4.4 are used for the calculations of proper extrapolation factors.

| Frequency -Range | f [kHz/MHz] | Lambda [m] | Far-Field Point [m] | Distance Limit accord. 15.209 [m] | 1st Condition (d _{meas} < D _{near-field}) | 2te Condition (Limit distance bigger d _{near-field}) | Distance Correction accord. Formula |
|---------------------|-------------|------------|------------------------|--------------------------------------|--|--|--|
| kHz | 9,00E+03 | 33333,33 | 5305,17 | 300 | fulfilled | not fulfilled | -80,00 |
| | 1,00E+04 | 30000,00 | 4774,65 | | fulfilled | not fulfilled | -80,00 |
| | 2,00E+04 | 15000,00 | 2387,33 | | fulfilled | not fulfilled | -80,00 |
| | 3,00E+04 | 10000,00 | 1591,55 | | fulfilled | not fulfilled | -80,00 |
| | 4,00E+04 | 7500,00 | 1193,66 | | fulfilled | not fulfilled | -80,00 |
| | 5,00E+04 | 6000,00 | 954,93 | | fulfilled | not fulfilled | -80,00 |
| | 6,00E+04 | 5000,00 | 795,78 | | fulfilled | not fulfilled | -80,00 |
| | 7,00E+04 | 4285,71 | 682,09 | | fulfilled | not fulfilled | -80,00 |
| | 8,00E+04 | 3750,00 | 596,83 | | fulfilled | not fulfilled | -80,00 |
| | 9,00E+04 | 3333,33 | 530,52 | | fulfilled | not fulfilled | -80,00 |
| | 1,00E+05 | 3000,00 | 477,47 | | fulfilled | not fulfilled | -80,00 |
| | 1,25E+05 | 2400,00 | 381,97 | | fulfilled | not fulfilled | -80,00 |
| | 2,00E+05 | 1500,00 | 238,73 | | fulfilled | fulfilled | -78,02 |
| | 3,00E+05 | 1000,00 | 159,16 | | fulfilled | fulfilled | -74,49 |
| | 4,00E+05 | 750,00 | 119,37 | | fulfilled | fulfilled | -72,00 |
| | 4,90E+05 | 612,24 | 97,44 | | fulfilled | fulfilled | -70,23 |
| | 5,00E+05 | 600,00 | 95,49 | | fulfilled | not fulfilled | -40,00 |
| | 6,00E+05 | 500,00 | 79,58 | | fulfilled | not fulfilled | -40,00 |
| MHz | 7,00E+05 | 428,57 | 68,21 | 30 | fulfilled | not fulfilled | -40,00 |
| | 8,00E+05 | 375,00 | 59,68 | | fulfilled | not fulfilled | -40,00 |
| | 9,00E+05 | 333,33 | 53,05 | | fulfilled | not fulfilled | -40,00 |
| | 1,00 | 300,00 | 47,75 | | fulfilled | not fulfilled | -40,00 |
| | 1,59 | 188,50 | 30,00 | | fulfilled | not fulfilled | -40,00 |
| | 2,00 | 150,00 | 23,87 | | fulfilled | fulfilled | -38,02 |
| | 3,00 | 100,00 | 15,92 | | fulfilled | fulfilled | -34,49 |
| | 4,00 | 75,00 | 11,94 | | fulfilled | fulfilled | -32,00 |
| | 5,00 | 60,00 | 9,55 | | fulfilled | fulfilled | -30,06 |
| | 6,00 | 50,00 | 7,96 | | fulfilled | fulfilled | -28,47 |
| | 7,00 | 42,86 | 6,82 | | fulfilled | fulfilled | -27,13 |
| | 8,00 | 37,50 | 5,97 | | fulfilled | fulfilled | -25,97 |
| | 9,00 | 33,33 | 5,31 | | fulfilled | fulfilled | -24,95 |
| | 10,00 | 30,00 | 4,77 | | fulfilled | fulfilled | -24,04 |
| | 10,60 | 28,30 | 4,50 | | fulfilled | fulfilled | -23,53 |
| | 11,00 | 27,27 | 4,34 | | fulfilled | fulfilled | -23,21 |
| | 12,00 | 25,00 | 3,98 | | fulfilled | fulfilled | -22,45 |
| | 13,56 | 22,12 | 3,52 | | fulfilled | fulfilled | -21,39 |
| | 15,00 | 20,00 | 3,18 | | fulfilled | fulfilled | -20,51 |
| | 15,92 | 18,85 | 3,00 | | fulfilled | fulfilled | -20,00 |
| | 17,00 | 17,65 | 2,81 | | not fulfilled | fulfilled | -20,00 |
| | 18,00 | 16,67 | 2,65 | | not fulfilled | fulfilled | -20,00 |
| | 20,00 | 15,00 | 2,39 | | not fulfilled | fulfilled | -20,00 |
| | 21,00 | 14,29 | 2,27 | | not fulfilled | fulfilled | -20,00 |
| | 23,00 | 13,04 | 2,08 | | not fulfilled | fulfilled | -20,00 |
| | 25,00 | 12,00 | 1,91 | | not fulfilled | fulfilled | -20,00 |
| | 27,00 | 11,11 | 1,77 | | not fulfilled | fulfilled | -20,00 |
| | 29,00 | 10,34 | 1,65 | | not fulfilled | fulfilled | -20,00 |
| | 30,00 | 10,00 | 1,59 | | not fulfilled | fulfilled | -20,00 |

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

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

| | | | |
|-----------------|--|--|--|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2 | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| test site | <input type="checkbox"/> 441 EMI SAR | <input type="checkbox"/> 487 SAR NSA | <input checked="" type="checkbox"/> 443 FAR |
| receiver | <input type="checkbox"/> 377 ESCS30 | <input type="checkbox"/> 001 ESS | <input type="checkbox"/> 489 ESU 40 |
| spectr. analys. | <input type="checkbox"/> 584 FSU | <input type="checkbox"/> 120 FSEM | <input checked="" type="checkbox"/> 264 FSEK |
| antenna | <input checked="" type="checkbox"/> 439 HL 562 | <input checked="" type="checkbox"/> 549 HL 025 | <input type="checkbox"/> 302 BBHA9170 |
| signaling | <input type="checkbox"/> 017 CMD 65 | <input type="checkbox"/> 323 CMD 55 | <input type="checkbox"/> 340 CMD 55 |
| signaling | <input type="checkbox"/> 392 MT8820A | <input checked="" type="checkbox"/> 546 CMU | <input type="checkbox"/> 547 CMU |
| power supply | <input checked="" type="checkbox"/> 611 E3636A | <input type="checkbox"/> 457 EA 3013A | <input type="checkbox"/> 459 EA 2032-50 |
| otherwise | <input type="checkbox"/> 529 6dB divider | <input type="checkbox"/> 530 6dB Att. | <input type="checkbox"/> 110 USB LWL |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | <input checked="" type="checkbox"/> 24V DC | <input type="checkbox"/> 482 Filter Matrix |

5.3.2. Requirements and limits

| | |
|--------------|--|
| FCC | General: §2.1053(a) , §2.1057(a) <input checked="" type="checkbox"/> FDD Band 5: Part 22: §22.917(a)(b) <input checked="" type="checkbox"/> FDD Band 2: Part 24: §24.238(a)(b) <input checked="" type="checkbox"/> FDD Band 4: Part 27: §27.53(h) |
| IC | <input checked="" type="checkbox"/> FDD Band 5: RSS-132, Issue 3: 5.5(i)(ii) <input checked="" type="checkbox"/> FDD Band 2: RSS-133, Issue 6: 6.5.1(i)(ii) <input checked="" type="checkbox"/> FDD Band 4: RSS-139, Issue 3: 6.6 (i)(ii) |
| Limit | „the power of emissions shall be attenuated below the transmitter output power (p) by at least 43+10Log(P) dB“ -> Resulting limits for all power levels of the Mobile Phone: -13dBm |

5.3.3. Test condition and test set-up

| | | | |
|--------------------------------|---|--|--|
| link to test system (if used): | <input checked="" type="checkbox"/> air link | <input type="checkbox"/> cable connection | <input type="checkbox"/> |
| EUT-grounding | <input checked="" type="checkbox"/> none | <input type="checkbox"/> with power supply | <input type="checkbox"/> additional connection |
| Equipment set up | <input checked="" type="checkbox"/> table top | <input type="checkbox"/> floor standing | |
| Climatic conditions | Temperature: (22±3°C) | | Rel. humidity: (40±20)% |
| Test system set-up | Please see chapter “Test system set-up for radiated spurious emission measurements up to 20 GHz” | | |
| 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 Band-Edge where a AVERAGE detector applied for critical measurements. According chapter 4.2 | | |
| EUT settings | A call was established on highest power transmit conditions in RMC99 mode. 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 wireless device, should be sufficient to demonstrate compliance. | | |

Spectrum-Analyzer settings for FDD 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 (Band-Edge) | 1849 | 1850 | 0.05 | 0.5 | 30 | 35 | MaxH-PK |
| Sweep 2b (Band-Edge) | 1849 | 1850 | | | 30 | 35 | MaxH-AV |
| Sweep 3a (Band-Edge) | 1910 | 1911 | | | 30 | 35 | MaxH-PK |
| Sweep 3b (Band-Edge) | 1910 | 1911 | | | 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 | 20000 | 1 | 10 | 160 | 10 | MaxH-PK |
| Sweep 2a (Band-Edge) | 1709 | 1710 | 0.05 | 0.5 | 30 | 35 | MaxH-PK |
| Sweep 2b (Band-Edge) | 1709 | 1710 | 0.05 | 0.5 | 30 | 35 | MaxH-AV |
| Sweep 3a (Band-Edge) | 1755 | 1756 | 0.05 | 0.5 | 30 | 35 | MaxH-PK |
| Sweep 3b (Band-Edge) | 1755 | 1756 | 0.05 | 0.5 | 30 | 35 | MaxH-AV |

Spectrum-analyzer settings for FDD 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 | 0.1 | 1 | 10 | 10 | MaxH-PK |
| Sweep 1 (subrange 2) | 1000 | 2800 | 0.1 | 1 | 15 | 0 | MaxH-PK |
| Sweep 1 (subrange 3) | 2800 | 12000 | 0.1 | 1 | 160 | 10 | MaxH-PK |
| Sweep 2a (Band-Edge) | 823 | 824 | 0.05 | 0.5 | 30 | 35 | MaxH-PK |
| Sweep 2b (Band-Edge) | 823 | 824 | | | 30 | 35 | MaxH-AV |
| Sweep 3a (Band-Edge) | 850 | 851 | | | 30 | 35 | MaxH-PK |
| Sweep 3b (Band-Edge) | 850 | 851 | | | 30 | 35 | MaxH-AV |

5.3.4. Results

The results are presented below in summary form only. For more information please see each diagram enclosed in annex 1.

5.3.4.1. FDD Band 2: Op. Mode 1, Set-up 1

| Diagram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|------|------------------|-------------|---|-------------------------------------|--------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 8.20 | Low | 9262 | 30 MHz to 18 GHz | 1 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.20 | Low | | 1849 – 1850 MHz | | Band Edge Compliance | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.21 | Middle | 9400 | 30 MHz to 18 GHz | | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.22 | High | 9538 | 30 MHz to 18 GHz | | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.21 | High | | 1910 – 1911 MHz | | Band-Edge compliance: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: --

5.3.4.2. FDD Band 4: Op. Mode 2, Set-up 1

| Diagram no. | Carrier Channel | | Frequency range | OP-mode no. | Remark | Used detector | | | Result |
|-------------|-----------------|------|------------------|-------------|---|-------------------------------------|--------------------------|--------------------------|--------|
| | Range | No. | | | | PK | AV | QP | |
| 8.30 | Low | 1312 | 30 MHz to 18 GHz | 2 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.30 | Low | | 1849 – 1850 MHz | | Band Edge Compliance | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.31 | Middle | 1450 | 30 MHz to 18 GHz | | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.32 | High | 1513 | 30 MHz to 18 GHz | | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.31 | High | | 1910 – 1911 MHz | | Band-Edge compliance: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: --

5.3.4.3. FDD 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 | |
| 8.40 | Low | 4132 | 30 MHz to 9GHz | 3 | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.40 | Low | | 823 – 824 MHz | | Band Edge Compliance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.41 | Middle | 4185 | 30 MHz to 9 GHz | | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.42 | High | 4233 | 30 MHz to 9 GHz | | Carrier visible on diagram. Not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.41 | High | | 849 – 850 MHz | | Band-Edge compliance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: --

5.4. 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 to its 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 150 kHz - 30 MHz | 4.0 dB 3.6 dB | | | | | | | - |
| Radiated emissions Enclosure | CISPR 16-2-3 | 30 MHz - 1 GHz 1 GHz - 18 GHz | 4.2 dB 5.1 dB | | | | | | | E-Field |
| 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 | 0.7 | 0.25 | N/A | -- | - | |
| | | 12.75 - 26.5GHz | N/A | 0.82 | -- | N/A | N/A | -- | | |
| Conducted emissions on RF-port | - | 9 kHz - 2.8 GHz | 0.70 | N/A | 0.70 | N/A | 0.69 | -- | N/A - not applicable | |
| | | 2.8 GHz - 12.75GHz | 1.48 | N/A | 1.51 | N/A | 1.43 | -- | | |
| | | 12.75 GHz - 18GHz | 1.81 | N/A | 1.83 | N/A | 1.77 | -- | | |
| | | 18 GHz - 26.5GHz | 1.83 | N/A | 1.85 | N/A | 1.79 | -- | | |
| 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

6. Abbreviations used in this report

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

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

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

8. Instruments and Ancillary

8.1. Used equipment "CTC"

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

8.1.1. Test software and firmware of equipment

| Ref.-No. | Equipment | Type | Serial-No. | Version of Firmware or Software during the test |
|----------|---|------------------------|----------------|---|
| 001 | EMI Test Receiver | ESS | 825132/017 | Firm.= 1.21 , OTP=2.0, GRA=2.0 |
| 012 | Signal Generator (EMS-cond.) | SMY 01 | 839069/027 | Firm.= V 2.02 |
| 013 | Power Meter (EMS cond.) | NRVD | 839111/003 | Firm.= V 1.51 |
| 017 | Digital Radiocommunication Tester | CMD 60 M | 844365/014 | Firmware = V 3.52 .22.01.99, DECT = D2.87 13.01.99 |
| 053 | Audio Analyzer | UPA3 | 860612/022 | Firm. V 4.3 |
| 119 | RT Harmonics Analyzer dig. Flickermeter | B10 | G60547 | Firm.= V 3.1DHG |
| 140 | Signal Generator | SMHU | 831314/006 | Firm.= 3.21 |
| 261 | Thermal Power Sensor | NRV-Z55 | 825083/0008 | EPROM-Datum 02.12.04, SE EE 1 B |
| 262 | Power Meter | NRV-S | 825770/0010 | Firm.= 2.6 |
| 263 | Signal Generator | SMP 04 | 826190/0007 | Firm.=3.21 |
| 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 | 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) |

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 | - | 16.05.2018 |
| 005 | AC - LISN (50 Ohm/50µH, test site 1) | ESH2-Z5 | 861741/005 | Rohde & Schwarz | 12 M | - | 15.05.2018 |
| 007 | Single-Line V-Network (50 Ohm/5µH) | ESH3-Z6 | 892563/002 | Rohde & Schwarz | 12 M | - | 17.05.2018 |
| 009 | Power Meter (EMS-radiated) | NRV | 863056/017 | Rohde & Schwarz | 24 M | - | 15.05.2019 |
| 016 | Line Impedance Simulating Network | Op. 24-D | B6366 | Spitzenberger+Spies | 36 M | - | 30.05.2019 |
| 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 | - | 15.05.2019 |
| 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 | |
| 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 |
| 133 | horn antenna 18 GHz (Meas 1) | 3115 | 9012-3629 | EMCO | 36 M | 1c | 10.03.2020 |
| 134 | horn antenna 18 GHz (Subst 2) | 3115 | 9005-3414 | EMCO | 36 M | - | 10.03.2020 |
| 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 | |
| 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 | - | 17.05.2018 |
| 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 | - | 14.03.2020 |
| 303 | horn antenna 40 GHz (Subst 1) | BBHA9170 | 156 | Schwarzbeck | 36 M | - | 20.03.2020 |
| 331 | Climatic Test Chamber -40/+180 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 | - | 17.05.2019 |
| 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 | - | 24.05.2019 |
| 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 | - | 17.05.2018 |
| 377 | EMI Test Receiver | ESCS 30 | 100160 | Rohde & Schwarz | 12 M | - | 15.05.2018 |
| 392 | Radio Communication Tester | MT8820A | 6K00000788 | Anritsu | 12 M | - | 18.05.2018 |
| 405 | Thermo-/Hygrometer | OPUS 10 THI | 126.0604.0003.3.3.3.22 | LUFFT Mess u. Regeltechnik | 24 M | - | 30.03.2019 |
| 431 | Model 7405 | Near-Field Probe Set | 9305-2457 | EMCO | - | 4 | |
| 436 | Univ. Radio Communication Tester | CMU 200 | 103083 | Rohde & Schwarz | 12 M | - | 24.05.2018 |
| 439 | UltraLog-Antenna | HL 562 | 100248 | Rohde & Schwarz | 36 M | - | 10.03.2020 |
| 443 | CTC-FAR-EMI-RSE | System CTC-FAR-EMI-RSE | - | ETS-Lindgren / CETECOM | 12 M | 5 | 30.09.2017 |
| 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 | |
| 463 | Universal source | HP3245A | 2831A03472 | Agilent | - | 4 | |
| 466 | Digital Multimeter | Fluke 112 | 89210157 | Fluke USA | 24 M | - | 30.05.2018 |

| Ref.-No. | Equipment | Type | Serial-No. | Manufacturer | Interval of calibration | Remark | Cal due |
|----------|---|-----------------------------|------------------------|-----------------------------|-------------------------|--------|------------|
| 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 | - | 16.05.2019 |
| 482 | filter matrix | Filter matrix SAR 1 | - | CETECOM (Brl) | - | 1d | |
| 487 | System CTC NSA-Verification SAR-EMI | System EMI field (SAR) NSA | - | ETS Lindgren / CETECOM | 24 M | - | 31.09.2017 |
| 489 | EMI Test Receiver | ESU40 | 1000-30 | Rohde & Schwarz | 12 M | - | 18.05.2019 |
| 502 | band reject filter | WRCG 1709/1786-1699/1796- | SN 9 | Wainwright | pre-m | 2 | |
| 503 | band reject filter | WRCG 824/849-814/859- | SN 5 | Wainwright | pre-m | 2 | |
| 512 | notch filter GSM 850 | WRCA 800/960-02/40-6EEK | SN 24 | Wainwright | 12 M | 1c | 30.06.2017 |
| 517 | relais switch matrix | HF Relais Box Keithley | SE 04 | Keithley | pre-m | 2 | |
| 523 | Digital Multimeter | L4411A | MY46000154 | Agilent | 24 M | - | 18.05.2019 |
| 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 | - | 30.03.2018 |
| 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 |
| 574 | Biconilog Hybrid Antenna | BTA-L | 980026L | Frankonia | 36/12 M | - | 31.03.2019 |
| 584 | Spectrum Analyzer | FSU 8 | 100248 | Rohde & Schwarz | pre-m | - | |
| 597 | Univ. Radio Communication Tester | CMU 200 | 100347 | Rohde & Schwarz | pre-m | - | |
| 600 | power meter | NRVD (Reserve) | 834501/018 | Rohde & Schwarz | 24 M | - | 17.05.2019 |
| 601 | medium-sensitivity diode sensor | NRV-Z5 (Reserve) | 8435323/003 | Rohde & Schwarz | 24 M | - | 15.05.2019 |
| 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 P987001108 | 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 | - | 16.05.2018 |
| 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 | 201.0999.9302.6.4.1.43 | G. Lufft GmbH | 24 M | - | 30.03.2019 |
| 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 | - | KogitLink | - | 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 | - | 24.05.2018 |
| 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 | - | 17.05.2018 |
| 686 | Field Analyzer | EHP-200A | 160WX30702 | Narda Safety Test Solutions | 24 M | - | 29.03.2019 |
| 687 | Signal Generator | SMF 100A | 102073 | Rohde&Schwarz | 12 M | - | 17.05.2018 |
| 688 | Pre Amp | JS-18004000-40-8P | 1750117 | Miteq | pre-m | - | |
| 690 | Spectrum Analyzer | FSU | 100302/026 | Rohde&Schwarz | 12 M | - | 16.05.2018 |
| 691 | OSP120 Base Unit | OSP120 | 101183 | Rohde & Schwarz | 12 M | - | 22.05.2018 |
| 692 | Bluetooth Tester | CBT 32 | 100236 | Rohde & Schwarz | 36 M | - | 29.05.2020 |
| 697 | Power Splitter | ZN4PD-642W-S+ | 165001445 | Mini-Circuits | - | 2 | |
| 703 | INNCO Antennen Mast | MA 4010-KT080-XPET-ZSS3 | MA4170-KT100-XPET- | INNCO | pre-m | - | |
| 704 | INNCON Controller | CO 3000-4port | CO3000/933/38410516/L | INNCO Systems GmbH | pre-m | - | |
| 711 | Harmonic Mixer 90 GHz - 140GHz | RPG FS-Z140 | 101004 | RPG | 12 M | - | 22.02.2018 |
| 712 | Harmonic Mixer 75 GHz - 110GHz | FS-Z110 | 101468 | Rohde & Schwarz | 12 M | - | 22.02.2018 |
| 713 | Harmonic Mixer, 50 GHz - 75GHz | FS-Z75 | 101022 | Rohde & Schwarz | 12 M | - | 22.05.2018 |
| 714 | Signal Analyzer 67GHz | FSW67 | 104023 | Rohde & Schwarz | 24 M | - | 03.03.2019 |
| 715 | Harmonic Mixer, 140 GHz - 220GHz | FS-Z220 | 101009 | RPG Radiometer Physics | 12 M | - | 03.08.2018 |
| 716 | Harmonic Mixer 220 GHz to 325 GHz | FS-Z325 | 101005 | RPG Radiometer Physics | 12 M | - | 13.02.2018 |
| 747 | Spectrum Analyzer | FSU 26 | 200152 | Rohde & Schwarz | 12 M | - | 18.05.2018 |
| 748 | Pickett-Potter Horn Antenna | FH-PP 4060 | 010001 | Radiometer Physics | - | - | |
| 749 | Pickett-potter Horn Antenna | FH-PP 60-90 | 010003 | Radiometer Physics | - | - | |
| 750 | Pickett-Potter Horn Antenna | FH-PP 140-220 | 010011 | Radiometer Physics | - | - | |

| 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 |

9. Versions of test reports (change history)

| Version | Applied changes | Date of release |
|---------|-----------------|-----------------|
| -- | Initial release | 2017-10-05 |
| | | |
| | | |
| | | |