

# TEST REPORT

No.: 16-1-0050601T36a

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

peiker acoustic GmbH & Co. KG

GSM/ WCDMA/ LTE Telematics ROW Module  
 V1233-0

FCC-ID: QWY-V1233-0

| Laboratory Accreditation and Listings                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                  |                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Deutsche<br>Akkreditierungsstelle<br>D-PL-12047-01-01<br><br>Accredited EMC-Test Laboratory                                                                                                                                                                                                                                         | <br>Industry Canada<br>Reg. No.: 3462D-1<br>Reg. No.: 3462D-2<br>Reg. No.: 3462D-3                            | <br>Voluntary Controls for Electromagnetic<br>Emissions<br><br>Reg. No.:<br>R-20013, C-20009,<br>T-20006, G-20013 |
|                                                                                                                                                                                                                                                      |  <br>Lab Code: 20011130-00 | <br>MRA US-EU 0003                                                                                                |
| accredited according to DIN EN ISO/IEC 17025                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                  |                                                                                                                                                                                                        |
| <p align="center"> <b>CETECOM GmbH</b><br/>           Laboratory Radio Communications &amp; Electromagnetic Compatibility<br/>           Im Teelbruch 116 • 45219 Essen • Germany<br/>           Registered in Essen, Germany, Reg. No.: HRB Essen 8984<br/>           Tel.: + 49 (0) 20 54 / 95 19-954 • Fax: + 49 (0) 20 54 / 95 19-964<br/>           E-mail: info@cetecom.com • Internet: www.cetecom.com         </p> |                                                                                                                                                                                                  |                                                                                                                                                                                                        |
| Laboratory Accreditation and Listings                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                  |                                                                                                                                                                                                        |

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The listed attachments are an integral part of this report.

## 1. Summary of test results

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

**The 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. This test report shows results for W-CDMA technologies only. Other implemented wireless technologies were not considered within this test report.

Following tests have been performed to show compliance with applicable FCC Part 2, Part 22, Subpart H, Part 24, Subpart E (Broadband PCS) of the FCC CFR Title 47 Rules, Edition 4<sup>th</sup> November 2016.

### 1.1. Tests overview of US CFR Title 47 Part 22/24/27 Standards

| No. of Diagram group | Test case                                             | Port                                              | References & Limits                                     |                                                       | EUT set-up | EUT op-mode | Result              |
|----------------------|-------------------------------------------------------|---------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------|------------|-------------|---------------------|
|                      |                                                       |                                                   | FCC Standard                                            | Test limit                                            |            |             |                     |
| 1                    | AC-Power Lines Emissions Conducted<br>(0,15 - 30 MHz) | AC-Power lines<br>(conducted)                     | § 15.207                                                | §15.207 limits<br><br>IC: Table 3                     | --         | --          | Remark 1.)          |
| 2                    | General field strength emissions<br>(9 kHz - 30 MHz)  | Enclosure + Inter-connecting cables<br>(radiated) | §15.209(a)                                              | 2400/F(kHz) µV/m<br>24000/F(kHz) µV/m<br>30 µV/m      | --         | 1+2         | passed              |
| 7                    | RF-Power (ERP/EIRP)                                   |                                                   | §2.1046<br>§22.913(a)(2)<br>§24.232(c)                  | < 7 Watt (ERP)<br><br>< 2 Watt (EIRP)                 | --         | --          | Passed (calculated) |
| 8                    | Spurious emissions                                    |                                                   | §2.1053(a)<br>§2.1057<br>§22.917(a)(b)<br>§24.238(a)(b) | Required attenuation below P(dBW):<br>43+10log(P) dBc | 2          | 1+2         | passed              |
| 9                    | Band-Edge compliance                                  |                                                   |                                                         |                                                       | 2          | 1+2         | passed              |

| No. of Diagram group | Test case               | Port                                | References & Limits                              |                                                                    | EUT set-up | EUT op-mode | Result     |
|----------------------|-------------------------|-------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|------------|-------------|------------|
|                      |                         |                                     | FCC Standard                                     | Test limit                                                         |            |             |            |
| 30                   | RF Power                | Antenna terminal<br><br>(conducted) | §2.1046                                          | < 7 Watt (ERP)<br><br>< 2 Watt (EIRP)                              | 1          | 1+2         | passed     |
| 34                   | 26dB Emission bandwidth |                                     | §2.202<br>§2.1049(h)<br>§22.917(a)<br>§24.238(a) | 99% Power                                                          | 1          | 1+2         | passed     |
| 35                   | 99% Occupied bandwidth  |                                     |                                                  |                                                                    | 1          | 1+2         | passed     |
| 36                   | Spurious emissions      |                                     | §2.1051<br>§2.1057                               | Required attenuation below P(dBW):<br>43+10log(P) dBc              | 1          | 1+2         | passed     |
| 37                   | Band-Edge compliance    |                                     | §22.917(a)(b)<br>§24.238(a)(b)                   |                                                                    | 1          | 1+2         | passed     |
| 38                   | Frequency stability     |                                     | §2.1055(a)(2)<br><br>§22.355                     | <b>FCC:</b><br>< ±2.5ppm                                           | 3          | 1+2         | Passed 2.) |
|                      |                         |                                     | table C-1<br>§24.235                             | <b>FCC:</b> fundamental emissions stay within the authorized bands |            |             |            |
|                      |                         |                                     |                                                  | <b>FCC:</b> fundamental emissions stay within the authorized bands |            |             |            |

Remarks: 1.) not applicable since car environment

2.) Tests only performed across extreme voltage rang for information: limited approval

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



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Date: 2017.09.20  
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B.Eng. Martin Nunier  
Responsible for test report

## 2. Administrative Data

### 2.1. Identification of the testing laboratory

|                                     |                                                      |
|-------------------------------------|------------------------------------------------------|
| Company name:                       | CETECOM GmbH                                         |
| Address:                            | Im Teelbruch 116<br>45219 Essen - Kettwig<br>Germany |
| Responsible for testing laboratory: | Dipl.-Ing. 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: | M. Nunier                |
| Receipt of EUT:                                 | 2017-01-18               |
| Date(s) of test:                                | 2017-01-20 to 2017-07-14 |
| Date of report:                                 | 2017-08-31               |
| -----                                           |                          |
| Version of template:                            | 13.02                    |

### 2.4. Applicant's details

|                   |                                                                   |
|-------------------|-------------------------------------------------------------------|
| Applicant's name: | peiker acoustic GmbH & Co. KG                                     |
| Address:          | Max-Planck-Straße 28-32<br>61381 Friedrichsdorf/ts<br><br>Germany |
| Contact person:   | Philippe Seguret                                                  |

### 2.5. Manufacturer's details

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

### 3. Equipment under test (EUT)

#### 3.1. TECHNICAL 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)<br><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<br><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<br><input checked="" type="checkbox"/> FDD Band 5: UARFCN range 4132 – 4183 – 4233                                                                                                                                                                                        |                                                                                                                                            |                                      |
| UMTS-HSPA connectivity                                                                                          | <input checked="" type="checkbox"/> Uplink speed: 5.76 Mb/s (category 6)<br><input type="checkbox"/> Uplink speed:                                                                                                                                                                                                                                        |                                                                                                                                            |                                      |
| Emission designator(s)                                                                                          | 4M18F9W                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                            |                                      |
| Antenna Type                                                                                                    | <input type="checkbox"/> External - dedicated, no RF- connector<br><input checked="" type="checkbox"/> External, separate RF-connector: normal usage                                                                                                                                                                                                      |                                                                                                                                            |                                      |
| Antenna Gain Tx (main)                                                                                          | <input type="checkbox"/> Not applicable<br><input checked="" type="checkbox"/> from data sheet “BMW_Multibandantenna_Max Gain Tel GNSS_en”<br>699MHz – 716MHz: 8.3dBi<br>824MHz – 849MHz: 7.8dBi<br>1710MHz – 1755MHz: 7.3dBi<br>1850MHz – 1910MHz: 8.9dBi<br>2500MHz – 2570MHz: 6.8dBi<br><input type="checkbox"/> No information from customer          |                                                                                                                                            |                                      |
| Path Losses                                                                                                     | <input checked="" type="checkbox"/> from data sheet “TEL1_NAD_to_TEL1_TRUNK_table”<br>W-CDMA FDDV: 2.96dB<br>W-CDMA FDDII: 5.55dB<br>W-CDMA FDDIV: 5.10dB                                                                                                                                                                                                 |                                                                                                                                            |                                      |
| MAX PEAK Output Power[dBm]:<br>Conducted                                                                        | FDD-Mode 2<br>FDD-Mode 5                                                                                                                                                                                                                                                                                                                                  | 26.7(PK) / 23.0(AV)<br>26.7(PK) / 23.1(AV)                                                                                                 |                                      |
| PEAK EIRP [dBm]:<br>Radiated                                                                                    | FDD-Mode 2<br>FDD-Mode 5                                                                                                                                                                                                                                                                                                                                  | (Peak Output Power + Antenna Gain – Path losses)<br>26.7dBm + 8.9dBi – 5.55dB = dBm= 30.05dBm<br>26.7dBm + 7.8dBi – 2.96dB = dBm= 31.54dBm |                                      |
| PEAK ERP [dBm]:<br>Radiated                                                                                     | FDD-Mode 2<br>FDD-Mode 5                                                                                                                                                                                                                                                                                                                                  | (PEAK EIRP – 2.15)<br>30.05dBm – 2.15 = 27.90dBm<br>31.54dBm – 2.15= 29.39dBm                                                              |                                      |
| Installed option                                                                                                | <input checked="" type="checkbox"/> GSM 900 and GSM 1800 Bands (not usable in USA/Canada)<br><input checked="" type="checkbox"/> W-CDMA Band I and Band VIII (not usable in USA/Canada)<br><input checked="" type="checkbox"/> W-LAN (not tested within this test report)<br><input checked="" type="checkbox"/> GPS (not tested within this test report) |                                                                                                                                            |                                      |
| Power supply                                                                                                    | <input checked="" type="checkbox"/> DC power only: 12 Volt V <sub>NOM</sub> (car environment)                                                                                                                                                                                                                                                             |                                                                                                                                            |                                      |
| Special EMI components                                                                                          | --                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                            |                                      |
| Does EUT contain devices susceptible to magnetic fields, e.g. Hall elements, electrodynamics microphones, etc.? | <input type="checkbox"/> yes<br><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. EUT: Type, S/N etc. and short descriptions used in this test report

| Short description*) | EUT                                   | Type                 | S/N serial number | HW hardware status | SW software status     |
|---------------------|---------------------------------------|----------------------|-------------------|--------------------|------------------------|
| EUT A               | GSM/ WCDMA/ LTE Telematics ROW Module | V1233-0              | 004402580050122   | V1233-0_Ver.1      | MPSS.TH.2.0.2-00220    |
| EUT B               | Kathrein Cellular/GNSS antenna        | Model No: 9396828-02 | 50110256          | --                 | --                     |
| EUT C               | Kathrein Cellular antenna             | Model No: 9396827-02 | 50110255          | --                 | --                     |
| EUT D               | GSM/ WCDMA/ LTE Telematics ROW Module | V1233-0              | 004402580050197   | V1233-0_Ver.1      | MPSS.TH.2.0.2.c4-00018 |

\*) 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                    | Loudspeaker          | KL3 / 4-Ohm        | -                 | -                   | -                       |
| AE 2                    | Microphone           | ME 39              | -                 | -                   | -                       |
| AE 3                    | DC cable             | --                 | --                | --                  | --                      |
| AE 4                    | Dell Laptop Computer | DELL Latitude D610 | EMC#3             | Pentium IV Centrino | Windows XP Professional |

\*) 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 + AE 3                              | RF-Conducted Measurement set-up        |
| set. 2            | EUT A + EUT 2 + EUT 3+ AE 1 + AE 2 + AE 3 | RF-radiated measurement set-up         |
| set. 3            | EUT D + AE3                               | Frequency stability measurement set-up |

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

### 3.5. EUT operating modes

| EUT operating mode no.*) | Description of operating modes | Additional information                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| op. 1                    | FDD-Band 2<br>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.<br>The input signal to the receiver is modulated with normal test modulation.<br>The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link according Table E5.1/Table E5.1A as described in 3GPP TS34.121, Annex E. |
| op. 2                    | FDD-Band 5<br>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.<br>The input signal to the receiver is modulated with normal test modulation.<br>The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link 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.

### 3.6. Configuration of cables used for testing

| Cable number | Item              | Type | S/N serial number | HW hardware status | Cable length |
|--------------|-------------------|------|-------------------|--------------------|--------------|
| Cable 1      | Microphone line   | --   | --                | --                 | <3m          |
| Cable 2      | Speaker line      | --   | --                | --                 | <3m          |
| Cable 3      | DC cable          | --   | --                | --                 | <3m          |
| Cable 4      | GPS antenna cable | --   | --                | --                 | <3m          |
| Cable 5      | Antenna cable TRX | --   | --                | --                 | <3m          |
| Cable 6      | Antenna cable DRX | --   | --                | --                 | <3m          |

## 4. Description of test system set-up's

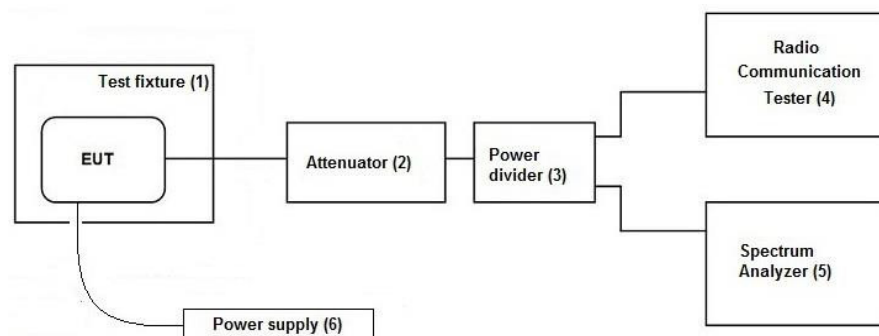
### 4.1. Test system set-up for conducted measurements on antenna port

#### Cellular Conducted RF-Setup 1 (Cel-1 Set-up)

**Tests Specification:** Conducted spurious emissions, Emission Bandwidth

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

#### Schematic:

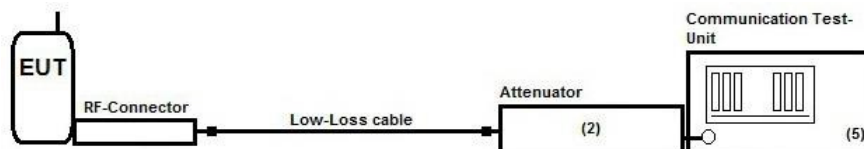


| Used Equipment:          | Passive Elements                                                                | Test Equipment                                                                    | Remark:                                                                       |
|--------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
|                          | <input checked="" type="checkbox"/> 10 dB Attenuator (#530)                     | <input checked="" type="checkbox"/> CMU200 Communication Test-Unit for GSM/W-CDMA | See List of equipment under each test case and chapter 8 for calibration info |
|                          | <input checked="" type="checkbox"/> Low loss RF-cables                          | <input checked="" type="checkbox"/> DC-Power Supply                               |                                                                               |
|                          | <input checked="" type="checkbox"/> 6 dB resistive power divider/coupler (#529) | <input checked="" type="checkbox"/> Spectrum-Analyser                             |                                                                               |
| Testing method:          | ANSI C63.10:2013, KDB 971168 D01 v02r02                                         |                                                                                   |                                                                               |
| Measurement uncertainty: | See chapter Measurement Uncertainties (Cel-1)                                   |                                                                                   |                                                                               |

## 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"/> CMU200Communication Test-Unit for GSM/W-CDMA | See List of equipment under each test case and chapter 8 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)

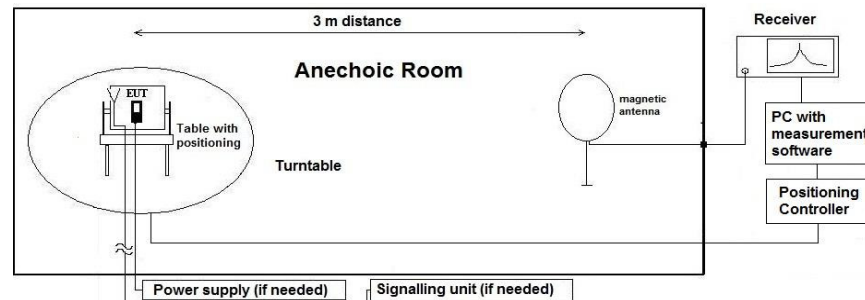
## 4.2. Test system set-up for radiated magnetic field measurements below 30 MHz

**Specification:** ANSI C63.4-2014 §5.3, §8.2.1, §8.3.1.1+§8.3.2.1 , 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<sub>L</sub> = Cable loss

D<sub>F</sub> = Distance correction factor

E<sub>C</sub> = Electrical field – corrected value

E<sub>R</sub> = Receiver reading

G<sub>A</sub> = Gain of pre-amplifier (if used)

L<sub>T</sub> = 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

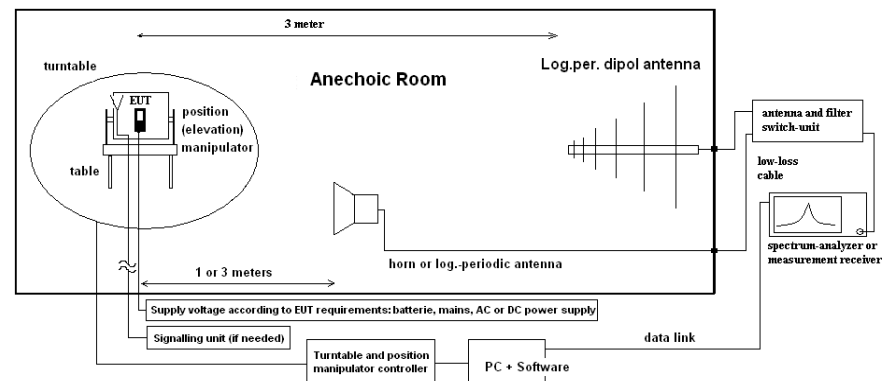
**Specification:**

ANSI C63.4-2014 chapter 8.3, ANSI C63.10-2013 chapter 6.6.3.3 & 6.6.4, ANSI C63.26-2015, Chapter 4.6.3.3

**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 it's characteristics was recorded with an EMI-receiver, broadband antenna and software.

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

**Final measurement on critical frequencies**

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

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself 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:**

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

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

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

$E_C$  = Electrical field – corrected value

$E_R$  = Receiver reading

$M$  = Margin

$L_T$  = Limit

$AF$  = Antenna factor

$C_L$  = Cable loss

$D_F$  = Distance correction factor (if used)

$G_A$  = Gain of pre-amplifier (if used)

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

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

## 5. Measurements

### 5.1. RF-Parameter - RF Peak power output 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 type="checkbox"/> 489 ESU 40                    | <input type="checkbox"/> 264 FSEK       | <input type="checkbox"/> 620 ESU 26        |                                        |
| signaling       | <input type="checkbox"/> 392 MT8820A                               | <input type="checkbox"/> 436 CMU                       | <input type="checkbox"/> 547 CMU        | <input type="checkbox"/> 460 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 checked="" type="checkbox"/> 611 E3636A                     | <input type="checkbox"/> 463 HP3245A                   | <input type="checkbox"/> 459 EA 2032-50 | <input type="checkbox"/> 268 EA- 3050      | <input type="checkbox"/> 494 AG6632A   |
| otherwise       | <input type="checkbox"/> 331 HC 4055                               | <input type="checkbox"/> 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 type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000 |                                         |                                            |                                        |

#### 5.1.2. Requirements and limits

|               |                                                                                                                                                                                               |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>FCC</b>    | <input checked="" type="checkbox"/> §2.1046<br><input checked="" type="checkbox"/> §22.913(a)(2)<br><input checked="" type="checkbox"/> § 24.232(c)<br><input type="checkbox"/> § 27.50(d)(4) |
| <b>ANSI</b>   | C62.26-2015                                                                                                                                                                                   |
| <b>KDB</b>    | 971168 D01 v02r02, October 2014                                                                                                                                                               |
| <b>Limits</b> | 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 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&amp;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 1, Op. Mode 1 |    |                    |      |                    |    |                |        |
| Test case                                                  | Power value [dBm]    |    |                    |      |                    |    | Limit<br>[dBm] | Result |
|                                                            | UARFCN no.<br>9262   |    | UARFCN no.<br>9400 |      | UARFCN no.<br>9538 |    |                |        |
|                                                            | PK                   | AV | PK                 | AV   | PK                 | AV |                |        |
| Release 99<br>12.2kbps RMC                                 | 26.7                 | 23 | 26.8               | 22.9 | 26.7               | 23 | 33             | Passed |
| Peak-to-Average power<br>ratio on 0.1% probability<br>[dB] | 3.38                 |    | 3.27               |      | 3.42               |    | 13             | Passed |

Remark:

- 1.) values within applicant's declared power range (tune-up range)

| FDD Band 5                 |                      |    |                    |      |                    |      |                    |        |
|----------------------------|----------------------|----|--------------------|------|--------------------|------|--------------------|--------|
| EUT                        | Set-up 1, Op. Mode 2 |    |                    |      |                    |      |                    |        |
| Test case                  | Power value [dBm]    |    |                    |      |                    |      | Limit<br><br>[dBm] | Result |
|                            | UARFCN no.<br>4132   |    | UARFCN no.<br>4185 |      | UARFCN no.<br>4233 |      |                    |        |
|                            | PK                   | AV | PK                 | AV   | PK                 | AV   |                    |        |
| Release 99<br>12.2kbps RMC | 26.4                 | 23 | 26.7               | 23.1 | 26.7               | 22.9 | 38.4               | Passed |
| Peak-to Average ratio [dB] | 3.06                 |    | 3.29               |      | 3.4                |      | 13                 | Passed |

Remark:

- 1.) values within applicant's declared power range (tune-up range)

## 5.2. RF-Parameter - Occupied bandwidth and emission bandwidth

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

|                 |                                                       |                                                        |                                                 |                                               |  |
|-----------------|-------------------------------------------------------|--------------------------------------------------------|-------------------------------------------------|-----------------------------------------------|--|
| test site       | <input type="checkbox"/> 347 Radio.lab. 1             | <input checked="" type="checkbox"/> Radio.lab. 2       |                                                 |                                               |  |
| spectr. analys. | <input type="checkbox"/> 584 FSU                      | <input type="checkbox"/> 489 ESU                       | <input type="checkbox"/> 264 FSEK               | <input checked="" type="checkbox"/> 620 ESU26 |  |
| attenuator      | <input checked="" type="checkbox"/> 530 10 dB         | <input type="checkbox"/>                               | <input type="checkbox"/>                        |                                               |  |
| signaling       | <input type="checkbox"/> 392 MT8820A                  | <input type="checkbox"/> 436 CMU                       | <input checked="" type="checkbox"/> 547 CMU     |                                               |  |
| DC Power        | <input checked="" type="checkbox"/> 611 E3636A        | <input type="checkbox"/> 087 EA3013                    | <input checked="" type="checkbox"/> 354 NGPE 40 | <input type="checkbox"/> 086 LNG50-10         |  |
| otherwise       | <input checked="" type="checkbox"/> 529 6dB divider   | <input checked="" type="checkbox"/> 530 10dB           |                                                 |                                               |  |
| line voltage    | <input type="checkbox"/> 230 V 50 Hz via public mains | <input type="checkbox"/> 060 120 V/ 60 Hz via PAS 5000 |                                                 |                                               |  |

### 5.2.2. Requirements and Limits

|      |                                                                                                                                                                                                               |                                                                                                                                                                                                                    |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC  | CFR47, §2.202(a), §2.1049(h)<br><input checked="" type="checkbox"/> FDD-Band 5: §22.917(b)<br><input checked="" type="checkbox"/> FDD-Band 2: §24.238(b)<br><input type="checkbox"/> FDD-Band 4: §27.53(h)(3) | „the <b>occupied bandwidth</b> is the frequency bandwidth, such that, below it lower and above it upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated” |
| ANSI | C63.26-2015                                                                                                                                                                                                   |                                                                                                                                                                                                                    |
| KDB  | 971168 D01 v02r02, Chapter 4                                                                                                                                                                                  |                                                                                                                                                                                                                    |

### 5.2.3. Test condition and test set-up

|                            |                                                                         |                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                        |
|----------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Climatic conditions        |                                                                         | Temperature: (22±3°C)                                                                                                                                                                                                                                                                                                                                                                        | Rel. humidity: (40±20)%                                                                                |
| Test system set-up         |                                                                         | Please see chapter “Test system set-up for conducted measurements at antenna port”                                                                                                                                                                                                                                                                                                           |                                                                                                        |
| Spectrum Analyzer Settings | Parameter                                                               | Occupied bandwidth:                                                                                                                                                                                                                                                                                                                                                                          | Emission bandwidth                                                                                     |
|                            | Scan Mode<br>Span<br>RBW<br>VBW<br>Sweep time<br>Sweep mode<br>Detector | Spectrum analyser mode<br>6 MHz<br>50 kHz<br>300 kHz<br>Coupled (Auto)<br>Repetitive, max-hold<br>Peak                                                                                                                                                                                                                                                                                       | Spectrum analyser mode<br>6 MHz<br>50 kHz<br>300 kHz<br>Coupled (Auto)<br>Repetitive, max-hold<br>Peak |
| Measurement method         |                                                                         | The used spectrum analyzer FSE or ESU from Rohde & Schwarz contains an integrated function to calculate the occupied bandwidth automatically. From left and right display margin, the upper and lower frequency points where the accumulated power becomes 0.5% of the total power, are calculated. Subtracting the previous determined two frequency points, yields the occupied bandwidth. | Bandwidth defined between 2 markers with are 26dBc compared to highest In-Band Peak Emission.          |
| EUT settings               |                                                                         | A call was established on highest power transmit conditions in RMC99 mode.<br><br>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the wireless device, should be sufficient to demonstrate compliance.                                                                          |                                                                                                        |

## 5.2.4. Results

| Operating band      | Channel no.                    |      | Occupied 99% bandwidth [MHz] | 26 dBc Emission bandwidth [MHz] |
|---------------------|--------------------------------|------|------------------------------|---------------------------------|
|                     | Range                          | No.  |                              |                                 |
| Set-up 1, Op-Mode 1 |                                |      |                              |                                 |
| FDD Band 2          | Channel Low<br>(1852.4 MHz)    | 9262 | 4.15                         | 4.687                           |
|                     | Channel Middle<br>(1880.0 MHz) | 9400 | 4.15                         | 4.732                           |
|                     | Channel High<br>(1907.6 MHz)   | 9538 | 4.15                         | 4.695                           |
| Set-up 1, Op-Mode 2 |                                |      |                              |                                 |
| FDD Band 5          | Channel Low<br>(826.4 MHz)     | 4132 | 4.13                         | 4.71                            |
|                     | Channel Middle<br>(836.6 MHz)  | 4185 | 4.13                         | 4.687                           |
|                     | Channel High<br>(846.6 MHz)    | 4233 | 4.14                         | 4.703                           |

Remarks: see diagrams in separate annex 1

### 5.3. RF-Parameter - Conducted 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"/> 347 Radio.lab. 1 <input checked="" type="checkbox"/> Radio.lab. 2                                                                                                                                                   |                                                    |                                                    |
| spectr. analys. | <input type="checkbox"/> 584 FSU <input type="checkbox"/> 120 FSEM <input type="checkbox"/> 264 FSEK <input checked="" type="checkbox"/> 489 ESU                                                                                             |                                                    |                                                    |
| signaling       | <input type="checkbox"/> 017 CMD 65 <input type="checkbox"/> 323 CMD 55 <input type="checkbox"/> 340 CMD 55                                                                                                                                  |                                                    |                                                    |
| signaling       | <input type="checkbox"/> 392 MT8820A <input type="checkbox"/> 436 CMU <input checked="" type="checkbox"/> 670 CMU                                                                                                                            |                                                    |                                                    |
| power supply    | <input checked="" type="checkbox"/> 611 E3636A <input type="checkbox"/> 457 EA 3013A <input type="checkbox"/> 459 EA 2032-50 <input type="checkbox"/> 268 EA- 3050 <input type="checkbox"/> 494 AG6632A <input type="checkbox"/> 498 NGPE 40 |                                                    |                                                    |
| otherwise       | <input checked="" type="checkbox"/> 529 6dB divider <input checked="" type="checkbox"/> 530 10dB Att. <input type="checkbox"/> 431 Near field                                                                                                |                                                    |                                                    |
| line voltage    | <input type="checkbox"/> 230 V 50 Hz via public mains <input type="checkbox"/> 060 120 V/ 60 Hz via PAS 5000                                                                                                                                 |                                                    |                                                    |

#### 5.3.2. Requirements and limits

|              |                                                                                                                                                                    |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>FCC</b>   | §2.1051<br>§2.1057<br><input checked="" type="checkbox"/> §22.917(a)(b)<br><input checked="" type="checkbox"/> §24.238(a)(b)<br><input type="checkbox"/> §27.53(h) |
| <b>ANSI</b>  | C63.26-2015                                                                                                                                                        |
| <b>Limit</b> | „the power of emissions shall be attenuated below the transmitter output power (p) by at least 43+10Log(P) dB“                                                     |

#### 5.3.3. Test condition and test set-up

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Climatic conditions        | Temperature: (22±3°C) Rel. humidity: (40±20)%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Test system set-up         | Please see chapter “Test system set-up for conducted measurements on antenna port”                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Measurement method         | The 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.<br><br>A suitable artificial antenna or RF-connector is provided by the applicant in order to perform the conducted measurements. Any data provided with the artificial antenna or connector, have been taken in account in order to correct the measurement data. (typical 0.3dB for attenuation of antenna connector) |
| Spectrum-Analyzer settings | See below tables                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Mobile phone settings      | A call was established on highest power transmit conditions in RMC99 mode.<br><br>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.                                                                                                                                                                                                                            |

#### Spectrum-Analyzer settings for 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) | 0.009           | 0.150          | 0.0001   | -- <sup>1.)</sup> | 10              | 25        | MaxH-PK  |
| Sweep 1 (subrange 2) | 0.150           | 1              | 0.009    | -- <sup>1.)</sup> | 10              | 25        | MaxH-PK  |
| Sweep 1 (subrange 3) | 1               | 30             | 0.1      | -- <sup>1.)</sup> | 5               | 25        | MaxH-PK  |
| Sweep 2 (subrange 1) | 30              | 19500          | 1        | -- <sup>1.)</sup> | >60             | 35        | MaxH-PK  |
| Sweep 3a (Band-Edge) | 1849            | 1850           | 0.05     | -- <sup>1.)</sup> | 30              | 35        | MaxH-PK  |
| Sweep 3b (Band-Edge) | 1849            | 1850           | 0.05     | -- <sup>1.)</sup> | 30              | 35        | MaxH-AV  |
| Sweep 4a (Band-Edge) | 1910            | 1911           | 0.05     | -- <sup>1.)</sup> | 30              | 35        | MaxH-PK  |
| Sweep 4b (Band-Edge) | 1910            | 1911           | 0.05     | -- <sup>1.)</sup> | 30              | 35        | MaxH-AV  |

Remark: 1.) EMI 6dB receiver mode used

### Spectrum-Analyzer Settings FDD Band 5

|                      | Start<br>freq.<br>MHz | Stop<br>freq.<br>MHz | R-BW<br>MHz | V-BW<br>MHz       | Sweep<br>time<br>sec. | Att. | Detector |
|----------------------|-----------------------|----------------------|-------------|-------------------|-----------------------|------|----------|
| Sweep 1 (subrange 1) | 0.009                 | 0.150                | 0.0001      | -- <sup>1.)</sup> | 10                    | 25   | MaxH-PK  |
| Sweep 1 (subrange 2) | 0.150                 | 1                    | 0.009       | -- <sup>1.)</sup> | 10                    | 25   | MaxH-PK  |
| Sweep 1 (subrange 3) | 1                     | 30                   | 0.1         | -- <sup>1.)</sup> | 5                     | 25   | MaxH-PK  |
| Sweep 2 (subrange 1) | 30                    | 9000                 | 1           | -- <sup>1.)</sup> | >60                   | 35   | MaxH-PK  |
| Sweep 3a (Band-Edge) | 823                   | 824                  | 0.05        | -- <sup>1.)</sup> | 30                    | 35   | MaxH-PK  |
| Sweep 3b (Band-Edge) | 823                   | 824                  | 0.05        | -- <sup>1.)</sup> | 30                    | 35   | MaxH-AV  |
| Sweep 4a (Band-Edge) | 850                   | 851                  | 0.05        | -- <sup>1.)</sup> | 30                    | 35   | MaxH-PK  |
| Sweep 4b (Band-Edge) | 850                   | 851                  | 0.05        | -- <sup>1.)</sup> | 30                    | 35   | MaxH-AV  |

Remark: 1.) EMI 6dB receiver mode used

### 5.3.4. Results

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

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

| Dia-<br>gram<br>no. | Carrier Channel |      | Frequency range   | OP-<br>mode<br>no. | Remark                                               | Used detector                       |                          |                          | Result |
|---------------------|-----------------|------|-------------------|--------------------|------------------------------------------------------|-------------------------------------|--------------------------|--------------------------|--------|
|                     | Range           | No.  |                   |                    |                                                      | PK                                  | AV                       | QP                       |        |
| 36.60               | Low             | 9262 | 9kHz to 30MHz     | 1                  | --                                                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.61               | Low             |      | 30 MHz to 19.5MHz |                    | Carrier visible on diagram, not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.60               | Low             |      | 1849 – 1850 MHz   |                    | Band Edge Compliance                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.62               | Middle          | 9400 | 9kHz to 30MHz     |                    | --                                                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.63               | Middle          |      | 30 MHz to 19.5MHz |                    | Carrier visible on diagram, not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.64               | High            |      | 9kHz to 30MHz     |                    | --                                                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.65               | High            | 9538 | 30 MHz to 19.5MHz |                    | Carrier visible on diagram, not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.61               | High            |      | 1910 – 1911 MHz   |                    | Band-Edge compliance                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: --

#### 5.3.4.2. FDD Band 5: Op. Mode 3, Set-up 1

| Dia-<br>gram<br>no. | Carrier Channel |      | Frequency range | OP-<br>mode<br>no. | Remark                                               | Used detector                       |                          |                          | Result |
|---------------------|-----------------|------|-----------------|--------------------|------------------------------------------------------|-------------------------------------|--------------------------|--------------------------|--------|
|                     | Range           | No.  |                 |                    |                                                      | PK                                  | AV                       | QP                       |        |
| 36.40               | Low             | 4132 | 9kHz to 30MHz   | 3                  | --                                                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.41               | Low             |      | 30 MHz to 9GHz  |                    | Carrier visible on diagram, not relevant for results | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.40               | Low             |      | 823 – 824 MHz   |                    | Band Edge Compliance                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.42               | Middle          | 4185 | 9kHz to 30MHz   |                    | --                                                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.43               | Middle          |      | 30 MHz to 9GHz  |                    | Carrier visible on diagram,                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.44               | High            |      | 9kHz to 30MHz   |                    | --                                                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 36.45               | High            | 4233 | 30 MHz to 9GHz  |                    | Carrier visible on diagram,                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 37.41               | High            |      | 849 – 850 MHz   |                    | Band-Edge compliance                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: --

## 5.4. RF-Parameter - Frequency stability on temperature and voltage variations

### 5.4.1. 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 checked="" type="checkbox"/> 347 Radio.lab.1 <input type="checkbox"/> Radio.lab.2              |                                                                                           | <input type="checkbox"/>                                                  |
| spectr. analys.       | <input type="checkbox"/> 584 FSU <input type="checkbox"/> 489 ESU 40                                  | <input type="checkbox"/> 264 FSEK <input type="checkbox"/> 620 ESU 26                     | <input type="checkbox"/>                                                  |
| signaling             | <input type="checkbox"/> 392 MT8820A <input type="checkbox"/> 436 CMU                                 | <input checked="" type="checkbox"/> 547 CMU                                               |                                                                           |
| DC power              | <input type="checkbox"/> 456 EA 3013A <input type="checkbox"/> 457 EA 3013A                           | <input type="checkbox"/> 459 EA 2032-50 <input type="checkbox"/> 268 EA- 3050             | <input type="checkbox"/> 494 AG6632A <input type="checkbox"/> 498 NGPE 40 |
| otherwise             | <input checked="" type="checkbox"/> 529 6dB divider <input checked="" type="checkbox"/> 530 10dB Att. | <input type="checkbox"/> 431 Near field <input checked="" type="checkbox"/> 341 Fluke 112 |                                                                           |
| Climatic test chamber | <input checked="" type="checkbox"/> 331 HC 4055 <input checked="" type="checkbox"/> 331 VT 4002       | <input checked="" type="checkbox"/> 627 OPUS 1                                            |                                                                           |
| line voltage          | <input type="checkbox"/> 230 V 50 Hz via public mains                                                 | <input type="checkbox"/> 060 110 V/ 60 Hz via PAS 5000                                    |                                                                           |

### 5.4.2. Requirements and limits

|              |                                                                                                                                                                                               |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>FCC</b>   | §2.1055(a)(1)<br><input checked="" type="checkbox"/> FDD Band 5: §22.355, Table C-1<br><input checked="" type="checkbox"/> FDD Band 2: §24.235<br><input type="checkbox"/> FDD Band 4: §27.54 |
| <b>ANSI</b>  | C63.26-2015, chapter 5.6                                                                                                                                                                      |
| <b>Limit</b> | <i>"The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block"</i>                                                      |

### 5.4.3. Test condition and test set-up

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test system set-up    | Please see chapter "Test system set-up for conducted measurements on antenna port"<br><br>In order to maintain the voltage constant over the time period of the tests, a dummy battery was connected to a laboratory power supply. The power supply voltage was controlled on the input of the power supply terminals of the EUT.                                                                                                                                       |
| Measurement method    | The RF Channel spacing is 200 kHz according W-CDMA-Spec, with a guard band. The aim of the EUT is to function under all extreme conditions within authorized sub-bands in regard to temperature and voltage variations. The frequency deviation was recorded with base station's build in capability. (CMU)<br><br>As the standard requires that the fundamental emissions stays within the authorized band, a limit of 0.1ppm is considered low enough to ensure this. |
| Mobile phone settings | A call was established on highest power transmit conditions in RMC99 mode.<br><br>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the mobile phone, should be sufficient to demonstrate compliance.<br><br>Tests have been done in Rel99, 12.2 kbps RMC operating mode.                                                                                    |

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

Tests only performed across extreme voltage range for information: limited approval

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

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

#### 5.4.4. Measurement Results:

##### 5.4.4.1. FDD Band 2

| FDD Band 2 - Channel 9262 |                               |                         |        |                                  |
|---------------------------|-------------------------------|-------------------------|--------|----------------------------------|
| Voltage<br>[V]            | Nominal<br>Frequency<br>[MHz] | Maximum frequency error |        | Verdict<br><br>Limit= +/- 0.1ppm |
|                           |                               | [Hz]                    | [ppm]  |                                  |
| 3,91                      | 1,852E+09                     | -7,39                   | -0,004 | passed                           |
| 4,00                      |                               | -6,16                   | -0,003 |                                  |
| 4,10                      |                               | -6,13                   | -0,003 |                                  |

| FDD Band 2 - Channel 9400 |                               |                         |        |                                  |
|---------------------------|-------------------------------|-------------------------|--------|----------------------------------|
| Voltage<br>[V]            | Nominal<br>Frequency<br>[MHz] | Maximum frequency error |        | Verdict<br><br>Limit= +/- 0.1ppm |
|                           |                               | [Hz]                    | [ppm]  |                                  |
| 3,91                      | 1,880E+09                     | -5,36                   | -0,003 | passed                           |
| 4,00                      |                               | -5,17                   | -0,003 |                                  |
| 4,10                      |                               | -5,94                   | -0,003 |                                  |

| FDD Band 2 - Channel 9538 |                               |                         |        |                                  |
|---------------------------|-------------------------------|-------------------------|--------|----------------------------------|
| Voltage<br>[V]            | Nominal<br>Frequency<br>[MHz] | Maximum frequency error |        | Verdict<br><br>Limit= +/- 0.1ppm |
|                           |                               | [Hz]                    | [ppm]  |                                  |
| 3,91                      | 1,9076E+09                    | -5,63                   | -0,003 | passed                           |
| 4,00                      |                               | -5,65                   | -0,003 |                                  |
| 4,10                      |                               | -4,87                   | -0,003 |                                  |

#### 5.4.4.2. FDD Band 5

##### FDD Band V - Channel 4132

| Voltage<br>[V] | Nominal<br>Frequency<br>[MHz] | Maximum frequency error |       | Verdict<br><br>Limit= +/- 2.5ppm |
|----------------|-------------------------------|-------------------------|-------|----------------------------------|
|                |                               | [Hz]                    | [ppm] |                                  |
| 3,91           | 8,264E+08                     | 3,34                    | 0,004 | passed                           |
| 4,00           |                               | 3,57                    | 0,004 |                                  |
| 4,10           |                               | 3,37                    | 0,004 |                                  |

##### FDD Band V - Channel 4183

| Voltage<br>[V] | Nominal<br>Frequency<br>[MHz] | Maximum frequency error |        | Verdict<br><br>Limit= +/- 2.5ppm |
|----------------|-------------------------------|-------------------------|--------|----------------------------------|
|                |                               | [Hz]                    | [ppm]  |                                  |
| 3,91           | 8,366E+08                     | 4,09                    | 0,005  | passed                           |
| 4,00           |                               | 2,46                    | 0,003  |                                  |
| 4,10           |                               | -4,09                   | -0,005 |                                  |

##### FDD Band V - Channel 4233

| Voltage<br>[V] | Nominal<br>Frequency<br>[MHz] | Maximum frequency error |        | Verdict<br><br>Limit= +/- 2.5ppm |
|----------------|-------------------------------|-------------------------|--------|----------------------------------|
|                |                               | [Hz]                    | [ppm]  |                                  |
| 3,91           | 8,466E+08                     | 4,14                    | 0,005  | passed                           |
| 4,00           |                               | 3,98                    | 0,005  |                                  |
| 4,10           |                               | -3,69                   | -0,004 |                                  |

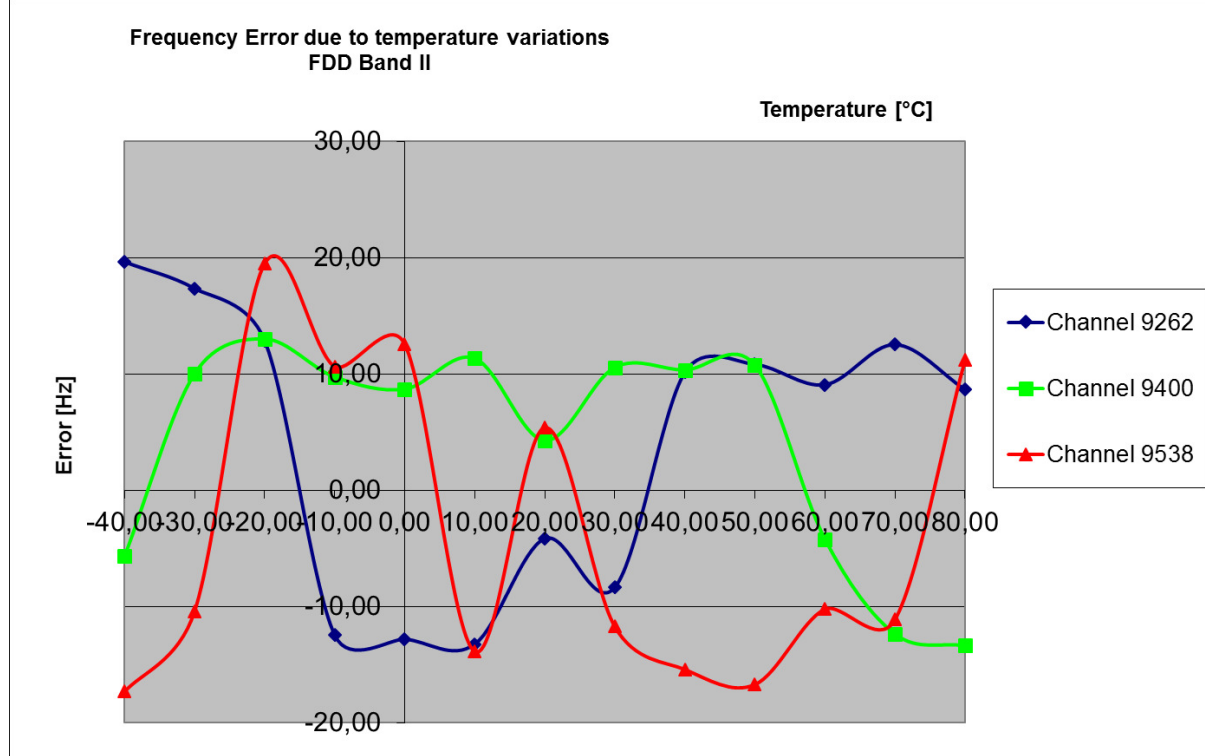
#### 5.4.4.3. Frequency shift of carrier against temperature at constant power supply voltage

- 1.) determine the carrier frequency for the lowest, middle and highest channel at room temperature and nominal voltage [20°C]
- 2.) expose the mobile station to -30°C, wait sufficient time to have constant temperature.
- 3.) Perform the carrier frequencies measurements in 10°C increments from -40°C to +80°C. For about half hour at the specified temperature the mobile was powered-off. After powering-on, the measurements were made within 2 minute for the channel lower channel, in order to prevent self-warming of the mobile.

#### 5.4.4.4. FDD Band 2

CRM-FDD Band 2

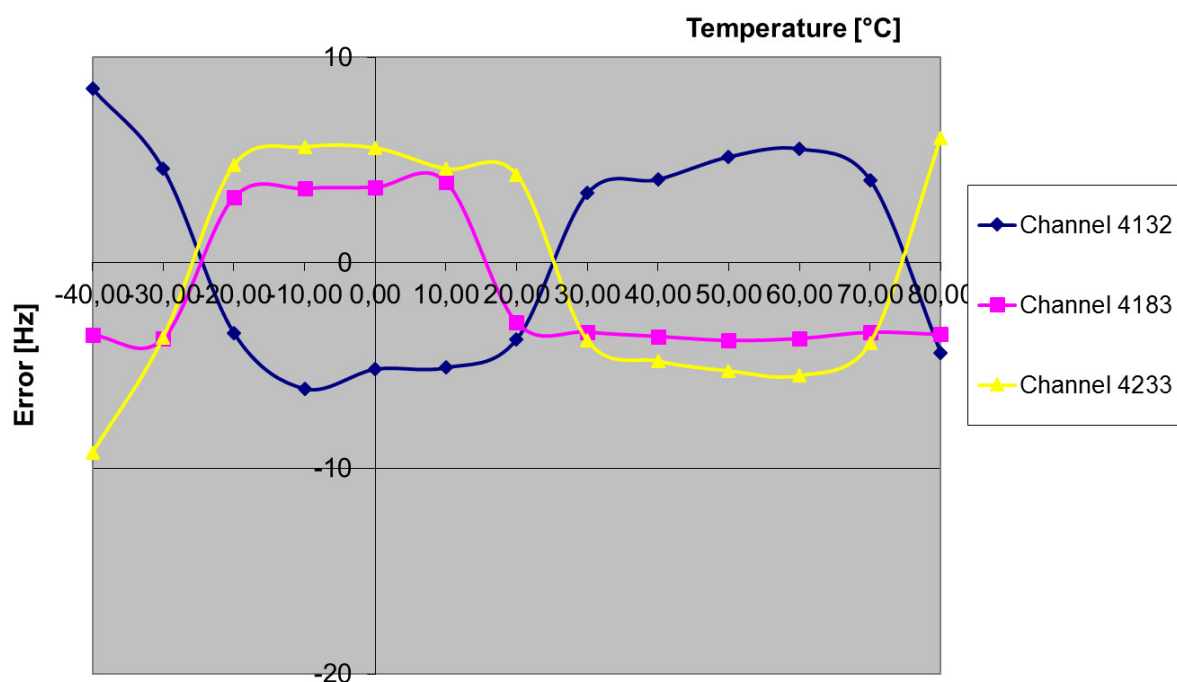
| Temperature | Maximum frequency error |              |              |              |              |              | Verdict |
|-------------|-------------------------|--------------|--------------|--------------|--------------|--------------|---------|
|             | Channel 9262            | Channel 9400 | Channel 9538 | Channel 9262 | Channel 9400 | Channel 9538 |         |
|             | [Hz]                    |              |              | [ppm]        |              |              |         |
| -40         | 19,64                   | -5,66        | -17,32       | 0,011        | -0,003       | -0,009       | PASS    |
| -30         | 17,35                   | 10,03        | -10,41       | 0,009        | 0,005        | -0,005       |         |
| -20         | 12,88                   | 13,02        | 19,49        | 0,007        | 0,007        | 0,010        |         |
| -10         | -12,45                  | 9,75         | 10,64        | -0,007       | 0,005        | 0,006        |         |
| 0           | -12,8                   | 8,7          | 12,56        | -0,007       | 0,005        | 0,007        |         |
| 10          | -13,23                  | 11,35        | -13,87       | -0,007       | 0,006        | -0,007       |         |
| 20          | -4,15                   | 4,27         | 5,39         | -0,002       | 0,002        | 0,003        |         |
| 30          | -8,35                   | 10,57        | -11,73       | -0,005       | 0,006        | -0,006       |         |
| 40          | 10,15                   | 10,35        | -15,41       | 0,005        | 0,006        | -0,008       |         |
| 50          | 10,82                   | 10,76        | -16,71       | 0,006        | 0,006        | -0,009       |         |
| 60          | 9,08                    | -4,21        | -10,22       | 0,005        | -0,002       | -0,005       |         |
| 70          | 12,53                   | -12,36       | -11,12       | 0,007        | -0,007       | -0,006       |         |
| 80          | 8,67                    | -13,37       | 11,2         | 0,005        | -0,007       | 0,006        |         |



**5.4.4.5. FDD Band 5**

| Temperature | Maximum frequency error |              |              |              |              |              | Verdict<br><br>Limit=±0.1ppm |
|-------------|-------------------------|--------------|--------------|--------------|--------------|--------------|------------------------------|
|             | Channel 4132            | Channel 4183 | Channel 4233 | Channel 4132 | Channel 4183 | Channel 4233 |                              |
|             | [Hz]                    |              |              | [ppm]        |              |              |                              |
| -40         | 8,48                    | -3,52        | -9,23        | 0,010        | -0,004       | -0,011       | PASS                         |
| -30         | 4,58                    | -3,69        | -3,62        | 0,006        | -0,004       | -0,004       |                              |
| -20         | -3,4                    | 3,19         | 4,76         | -0,004       | 0,004        | 0,006        |                              |
| -10         | -6,12                   | 3,63         | 5,65         | -0,007       | 0,004        | 0,007        |                              |
| 0           | -5,17                   | 3,69         | 5,6          | -0,006       | 0,004        | 0,007        |                              |
| 10          | -5,1                    | 3,95         | 4,58         | -0,006       | 0,005        | 0,005        |                              |
| 20          | -3,72                   | -2,9         | 4,3          | -0,005       | -0,003       | 0,005        |                              |
| 30          | 3,39                    | -3,36        | -3,77        | 0,004        | -0,004       | -0,004       |                              |
| 40          | 4,06                    | -3,57        | -4,78        | 0,005        | -0,004       | -0,006       |                              |
| 50          | 5,16                    | -3,77        | -5,25        | 0,006        | -0,005       | -0,006       |                              |
| 60          | 5,55                    | -3,68        | -5,48        | 0,007        | -0,004       | -0,006       |                              |
| 70          | 4,04                    | -3,37        | -3,88        | 0,005        | -0,004       | -0,005       |                              |
| 80          | -4,36                   | -3,48        | 6,09         | -0,005       | -0,004       | 0,007        |                              |

Frequency Error for Temperature Variations -  
FDD Band V



## 5.5. General Limit - Radiated field strength emissions below 30 MHz

### 5.5.1. 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 type="checkbox"/> 547 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"/> 060 120 V 60 Hz via PAS 5000 | <input type="checkbox"/> 289 CBL 6141              |

### 5.5.2. Requirements

|                 |                                       |                       |              |                                                           |
|-----------------|---------------------------------------|-----------------------|--------------|-----------------------------------------------------------|
| FCC             | Part 15, Subpart C, §15.205 & §15.209 |                       |              |                                                           |
| 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 |

### 5.5.3. 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<br><input checked="" type="checkbox"/> 150 kHz – 30 MHz      RBW/VBW = 9 kHz      Scan step = 4 kHz<br><input type="checkbox"/> other: |                                            |                                                |
|                                       | Scan-Mode      | <input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3dB Spectrum analyser Mode                                                                                                                      |                                            |                                                |
|                                       | Detector Mode: | Peak (pre-measurement) and Quasi-PK/Average (final if applicable)                                                                                                                                                                   |                                            |                                                |
|                                       | Sweep-Time     | Repetitive-Scan, max-hold<br>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”                                                                                                                                           |                                            |                                                |

### 5.5.4. Measurement Results

The results are presented below in summary form only. For more information please consult the diagrams included in annex 1.

The EUT is put on operation on middle channel only. If critical peaks are found (Margin <10 dB) the lowest and highest channels will be performed too. For more information please see the diagrams.

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    | 2          | 1           |        | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.50        | Low             | 4132 | 9 kHz-30 MHz    | 2          | 2           |        | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.21        | Middle          | 9400 | 9 kHz-30 MHz    | 2          | 1           |        | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.51        | Middle          | 4183 | 9 kHz-30 MHz    | 2          | 2           |        | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.22        | High            | 9538 | 9 kHz-30 MHz    | 2          | 1           |        | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.52        | High            | 4233 | 9 kHz-30 MHz    | 2          | 2           |        | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

### 5.5.5. 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 Extrapolation formulas valid for EUT's with maximum dimension of 0.625xLambda. Formula 2+3+4 as presented in ANSI C63.10, Chapter 6.4.4 are used for the calculations of proper extrapolation factors.

| Frequency<br>-Range | f [kHz/MHz] | Lambda [m] | Far-Field<br>Point [m] | Distance Limit<br>accord. 15.209 [m] | 1st Condition<br>(d <sub>meas</sub> <<br>D <sub>near-field</sub> ) | 2'te Condition<br>(Limit distance<br>bigger d <sub>near-field</sub> ) | Distance Correction<br>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                                 |

## 5.6. RF-Parameter - Radiated out of Band RF emissions and Band Edge

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

|                 |                                                                    |                                                        |                                                    |
|-----------------|--------------------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------|
| test location   | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2     | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| test site       | <input type="checkbox"/> 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 type="checkbox"/> 060 120 V/ 60 Hz via PAS 5000 | <input type="checkbox"/> 268 EA- 3050              |
|                 |                                                                    |                                                        | <input type="checkbox"/> 494 AG6632A               |
|                 |                                                                    |                                                        | <input type="checkbox"/> 477 GPS                   |
|                 |                                                                    |                                                        | <input type="checkbox"/> 498 NGPE 40               |
|                 |                                                                    |                                                        | <input type="checkbox"/> 431 Near field            |

### 5.6.2. Requirements and limits

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

### 5.6.3. 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.<br><br>According chapter 4.2                                      |                                            |                                                |
| EUT settings                   | A call was established on highest power transmit conditions in RMC99 mode.<br>The measurements were made at the low, middle and high carrier frequencies of each of the supported operating band. Choosing three TX-carrier frequencies of the wireless device, should be sufficient to demonstrate compliance. |                                            |                                                |

### Spectrum-Analyzer settings for FDD band 2

|                      | Start freq.<br>MHz | Stop freq.<br>MHz | R-BW<br>MHz | V-BW<br>MHz | Sweep time<br>sec. | Att.<br>[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.<br>MHz | Stop freq.<br>MHz | R-BW<br>MHz | V-BW<br>MHz | Sweep time<br>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              |             |             | 30                 | 35   | MaxH-AV  |
| Sweep 3a (Band-Edge) | 1755               | 1756              |             |             | 30                 | 35   | MaxH-PK  |
| Sweep 3b (Band-Edge) | 1755               | 1756              |             |             | 30                 | 35   | MaxH-AV  |

### Spectrum-analyzer settings for FDD Band 5

|                      | Start freq.<br>MHz | Stop freq.<br>MHz | R-BW<br>MHz | V-BW<br>MHz | Sweep time<br>sec. | Att. | Detector |
|----------------------|--------------------|-------------------|-------------|-------------|--------------------|------|----------|
| Sweep 1 (subrange 1) | 30                 | 1000              | 1           | 1           | 10                 | 10   | MaxH-PK  |
| Sweep 1 (subrange 2) | 1000               | 2800              | 1           | 1           | 15                 | 0    | MaxH-PK  |
| Sweep 1 (subrange 3) | 2800               | 12000             | 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  |

## 5.6.4. Results

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

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

| Diagram no.    | Carrier Channel |      | Frequency range    | OP-mode no. | Remark                                                                                    | Used detector                       |                                     |                          | Result |
|----------------|-----------------|------|--------------------|-------------|-------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|--------------------------|--------|
|                | Range           | No.  |                    |             |                                                                                           | PK                                  | AV                                  | QP                       |        |
| 8.20a<br>8.20b | Low             | 9262 | 30 MHz to 19.5 GHz | 1           | Carrier visible on diagram.<br>Not relevant for results<br>a – laying<br>b - standing     | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | passed |
| 9.20a<br>9.20b | Low             |      | 1849 – 1850 MHz    |             | Band Edge Compliance<br>a – laying<br>b - standing                                        | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | passed |
| 8.21a<br>8.21b | Middle          | 9400 | 30 MHz to 19.5 GHz |             | Carrier visible on diagram. -<br>> Not relevant for results<br>a – laying<br>b - standing | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | passed |
| 8.22a<br>8.22b | High            | 9538 | 30 MHz to 19.5 GHz |             | Carrier visible on diagram.<br>Not relevant for results<br>a – laying<br>b - standing     | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | passed |
| 9.21a<br>9.21b | High            |      | 1910 – 1911 MHz    |             | Band-Edge compliance:<br>a – laying<br>b - standing                                       | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: --

### 5.6.4.2. FDD Band 5: Op. Mode 3, Set-up 2

| Dia-gram no.   | Carrier Channel |      | Frequency range | OP-mode no. | Remark                                                                                | Used detector                       |                          |                          | Result |
|----------------|-----------------|------|-----------------|-------------|---------------------------------------------------------------------------------------|-------------------------------------|--------------------------|--------------------------|--------|
|                | Range           | No.  |                 |             |                                                                                       | PK                                  | AV                       | QP                       |        |
| 8.50a<br>8.50b | Low             | 4132 | 30 MHz to 9 GHz | 2           | Carrier visible on diagram.<br>Not relevant for results<br>a – laying<br>b - standing | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.50a<br>9.50b | Low             |      | 823 – 824 MHz   |             | Band Edge Compliance<br>a – laying<br>b - standing                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.51a<br>8.51b | Middle          | 4183 | 30 MHz to 9 GHz |             | Carrier visible on diagram.<br>Not relevant for results<br>a – laying<br>b - standing | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 8.52a<br>8.52b | High            | 4233 | 30 MHz to 9 GHz |             | Carrier visible on diagram.<br>Not relevant for results<br>a – laying<br>b - standing | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 9.51a<br>9.51b | High            |      | 849 – 850 MHz   |             | Band-Edge compliance<br>a – laying<br>b - standing                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: a mathematical correction of used RBW=30kHz for measurements to required 1% RBW of EBW was used

## 5.7. Measurement uncertainties

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

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

Following table shows expectable uncertainties for each measurement type performed.

| RF-Measurement                            | Reference    | Frequency range                     | Calculated uncertainty based on a confidence level of 95% |        |      |      |      |    |                      | Remarks                                   |
|-------------------------------------------|--------------|-------------------------------------|-----------------------------------------------------------|--------|------|------|------|----|----------------------|-------------------------------------------|
| Conducted emissions (U <sub>CISPR</sub> ) | CISPR 16-2-1 | 9 kHz - 150 kHz<br>150 kHz - 30 MHz | 4.0 dB<br>3.6 dB                                          |        |      |      |      |    |                      | -                                         |
| Radiated emissions Enclosure              | CISPR 16-2-3 | 30 MHz - 1 GHz<br>1 GHz - 18 GHz    | 4.2 dB<br>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 | -- |                      |                                           |
| Power density                             | -            | 1 – 2.8GHz                          | 1.40 dB                                                   |        |      |      |      |    |                      | --                                        |
| 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<br>E-field<br>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<br>487<br>558<br>348<br>348                                                 | (MRA US-EU 0003)                            | Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS)<br>Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR)<br>Radiated Measurements above 1 GHz, 3 m (FAR)<br>Mains Ports Conducted Interference Measurements<br>Telecommunication Ports Conducted Interference Measur. | FCC, Federal Communications Commission<br>Laboratory Division, USA                          |
| 337<br>487<br>550<br>558                                                        | 3462D-1<br>3462D-2<br>3462D-2<br>3462D-3    | Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS)<br>Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR)<br>Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR)<br>Radiated Measurements above 1 GHz, 3 m (FAR)                                                           | IC, Industry Canada Certification and Engineering Bureau                                    |
| 487<br>550<br>348<br>348                                                        | R- 4452<br>G- 20013<br>C- 20009<br>T- 20006 | Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR)<br>Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR)<br>Mains Ports Conducted Interference Measurements<br>Telecommunication Ports Conducted Interference 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

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

### 8.0.1. 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 | 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 (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)                                          |

## 8.0.2. 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                    | -      | 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 |
| 020      | Horn Antenna 18 GHz (Subst 1)           | 3115                   | 9107-3699              | EMCO                       | 36/12 M                 | -      | 31.07.2017 |
| 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                    | -      | 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 |
| 467      | Digital Multimeter                      | Fluke 112              | 89680306               | Fluke USA                  | 36 M                    | -      | 30.04.2018 |

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| Ref.-No. | Equipment                               | Type                        | Serial-No.             | Manufacturer                | Interval of calibration | Remark | Cal due    |
|----------|-----------------------------------------|-----------------------------|------------------------|-----------------------------|-------------------------|--------|------------|
| 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 |
| 549      | Log.Per-Antenna                         | HL025                       | 1000060                | Rohde & Schwarz             | 36/12 M                 | -      | 31.07.2018 |
| 557      | System CTC-OTA-2                        | R&S TS8991                  | -                      | Rohde & Schwarz             | 12 M                    | 5      | 30.09.2016 |
| 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. Luft 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 | -                      | 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                    | -      | 24.05.2018 |
| 644      | Amplifier                               | 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          | -                       | -      |            |

### 8.0.3. 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                                                           |

## 9. Versions of test reports (change history)

| Version | Applied changes | Date of release |
|---------|-----------------|-----------------|
| --      | Initial release | 2017-08-31      |
| --      | --              | --              |