

TEST REPORT
No.: 17-1-0264601T03b

According to:
FCC Regulations
Part 15.247

for

Agilion GmbH

Wireless Mesh Gateway Pulse | Phase 6032502
Communication and Real Time Location System

FCC-ID: SCF6032502

| Laboratory Accreditation and Listings | | |
|--|---|--|
|  Deutsche Akkreditierungsstelle D-PL-12047-01-01 Accredited EMC-Test Laboratory |  Industry Canada Reg. No.: 3462D-1 Reg. No.: 3462D-2 Reg. No.: 3462D-3 |  Voluntary Controls for Electromagnetic Emissions Reg. No.: R-20013, C-20009, T-20006, G-20013 |
|  AUTHORIZED RF LABORATORY |  Lab Code: 20011130-00 |  MRA US-EU 0003 |
| accredited according to DIN EN ISO/IEC 17025 | | |
| <p>CETECOM GmbH Laboratory Radio Communications & Electromagnetic Compatibility Im Teelbruch 116 • 45219 Essen • Germany Registered in Essen, Germany, Reg. No.: HRB Essen 8984 Tel.: + 49 (0) 20 54 / 95 19-954 • Fax: + 49 (0) 20 54 / 95 19-964 E-mail: info@cetecom.com • Internet: www.cetecom.com</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. 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 presented Equipment Under Test (in this report, hereinafter referred as EUT) supports radiofrequency technologies with similar ZigBee technology and operating frequency range at 2.405 to 2.480 GHz. Other implemented wireless technologies were not considered within this test report.

Following test cases have been performed to show compliance with valid Part 15.207/15.209/15.247 of the FCC CFR Title 47 Rules, Edition November 2017.

1.1. Tests measurement overview according of US CFR Title 47, Subpart 15C

| Test cases | Port | References & Limits | | | EUT set-up | EUT operating mode | Result |
|---|--|-----------------------------------|--|--|------------|--------------------|----------------------|
| | | FCC Standard | | Test Limit | | | |
| Timing of transmitter (pulsed operation) | Antenna Terminal or enclosure | §15.35 | | -- | 1 | 1 | -- |
| 6 dB bandwidth | Antenna terminal (conducted) | §15.247(a)(2) | | ≥ 500 kHz for DTS systems | 1 | 1 | passed |
| 99% occupied bandwidth | Antenna terminal (conducted) | 2.1049(h) | | 99% Power bandwidth | 1 | 1 | for Information only |
| Transmitter Peak output power | Antenna terminal (conducted) | §15.247(b)(3) | | 1 Watt Peak | 1 | 1 | passed |
| Transmitter Peak output power radiated | Enclosure + Inter-connecting cables (radiated) | §15.247(b)(4) | | < 4 Watt (EIRP) for antenna with directional gain less 6dBi | 1 | 1 | passed |
| Out-Of-Band RF- emissions | Antenna terminal (conducted) | §15.247 (d) | | 20 dBc | 1 | 1 | passed |
| Band-Edge emissions | | | | | | | |
| Power spectral density | Antenna terminal (conducted) | §15.247(e) | | 8dBm in any 3 kHz band | 1 | 1 | passed |
| General field strength emissions + restricted bands | Enclosure + Inter-connecting cables (radiated) | §15.247 (d) §15.205 §15.209 | | Emissions in restricted bands must meet the general field-strength radiated limits | 2 | 1 | passed |
| AC-Power Lines | AC-Power lines | §15.207 | | FCC §15.107 class B limits §15.207 limits | 2 | 1 | passed |
| Conducted Emissions | | | | | | | |

| RF-Exposure Evaluation | | | | | | | |
|---|--|----------------------------------|--|--|------------|--------------------|--|
| Test cases | Port | References & Limits | | | EUT set-up | EUT operating mode | Result |
| | | FCC Standard | | Test Limit | | | |
| Radio frequency radiation exposure requirements | Cabinet + Inter-connecting cables (radiated) | §1.1310(b) §2.1091 §2.1093 | | SAR-Limits FCC: 1.1310(b) | -- | -- | N/A (distance > 20cm to user –see manual) |
| | | | | RF-Field Strength Limits FCC: “general population/ uncontrolled” environment Table 1 | | | See separate test report/ evaluation 17-1-0264601T06 |

Remark: --

Dipl.-Ing. Rachid Acharkaoui
Responsible for test sectionDipl.-Ing. C. Lorenz
Responsible for test report

2. Administrative Data

2.1. Identification of the testing laboratory

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

2.2. Test location

2.2.1. Test laboratory “CTC”

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

2.3. Organizational items

| | |
|---|-----------------------|
| Responsible for test report and project leader: | Dipl.-Ing. C. Lorenz |
| Receipt of EUT: | 2018 - January |
| Date(s) of test: | 2018 January/February |
| Date of report: | 2018-03-22 |
| ----- | |
| Version of template: | 13.02 |

2.4. Applicant's details

| | |
|-------------------|---------------------------------------|
| Applicant's name: | Agilion GmbH |
| Address: | Blankenauer Str. 74 09113 Chemnitz |
| | Germany |
| Contact person: | Mr. Sven Sieber |

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

| | |
|-----------------------------------|--|
| Main function | Similar to Wireless Zigbee technology (IEEE 802.15.4) |
| Type | Wireless Mesh Gateway Pulse Phase |
| Frequency range | <input type="checkbox"/> 915 MHz band <input checked="" type="checkbox"/> 2.4 GHz band |
| Type of modulation | Digital (DTS) (Phase) |
| Number of channels | 2405 to 2480 MHz with 5 MHz channel space |
| Antenna Type | <input checked="" type="checkbox"/> Integrated <input type="checkbox"/> External, no RF- connector <input type="checkbox"/> External, separate RF-connector |
| Antennas transmit mode | <input type="checkbox"/> 1 antenna <input checked="" type="checkbox"/> 2 diversity antennas – switched diversity mode (one moment in time one antenna is used) <input type="checkbox"/> 2 or more smart antenna system without beamforming <input type="checkbox"/> 2 or more smart antenna system with beamforming |
| MAX Field strength (radiated): | 104.0 dB μ V/m@3m distance and 2440 MHz (Channel 18) (calculated) |
| Power settings for test purposes: | Channel 11-12-18: 15 setting in software Channel 26: 27 setting in software |
| Installed options | |
| Power supply | <input checked="" type="checkbox"/> over PoE adapter: 120V/60 Hz <input checked="" type="checkbox"/> DC power only: 24 Volt |
| 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 | Wireless Mesh Gateway Pulse Phase | 6032502 | A43477 | 0583 | 2.0.8 |
| EUT B | Wireless Mesh Gateway Pulse Phase | 6032502 | A33787 | 0583 | 2.0.8 |

*) 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 | PoE Adapter | TL-POE150S | 214348000006 | -- | -- |
| AE 2 | ITE Power supply AC/DC | MU24-1480050-C5 | DL21PL | Input: 110-240V AC 50/60Hz 1.0A Output: 48.0 V DC, 0.5A | -- |
| AE 3 | Notebook | HP Probook 6560b | Invent-No. IT-NB-0002 | -- | Windows 7 + Testmodes MESH PPP SW V1.0.0 |
| AE 4 | USB Cable with debug interface | -- | -- | -- | -- |
| AE 5 | DC Power cable | -- | -- | -- | -- |

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

3.4. EUT set-ups

| EUT set-up no.*) | Combination of EUT and AE | Remarks |
|------------------|---------------------------------|--|
| set. 1 | EUT A + AE 1 + AE 2+AE 3 + AE 4 | Conducted RF-setup, AE3 and AE4 used temporary for RF-connection set-up |
| set. 2 | EUT B + AE 1 + AE 2+AE 3 + AE 4 | Set-up with PoE power supply (120V AC/60Hz), AE3 and AE4 used temporary for RF-connection set-up |
| set. 3 | EUT B + AE 3 + AE 4+AE 5 | Set-up with DC power supply (26V DC), AE3 and AE4 used temporary for RF-connection 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 | TX, on (RFR2-Mode setting) | Continuous TX-Mode, set-up by special software and with help of PC. Power setting=15 for all channels except channel 26 where a value of 27 apply. Duty-Cycle=100% Internal Setting RFR2 Mode on AE3 with specific control software. |

*) 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 | DC power cable | Un-shielded | -- | -- | 3m |
| Cable 2 | Ethernet | CAT5e | -- | -- | 1m |

4. Description of test system set-up's

4.1. Test system set-up for AC power-line conducted emission measurements

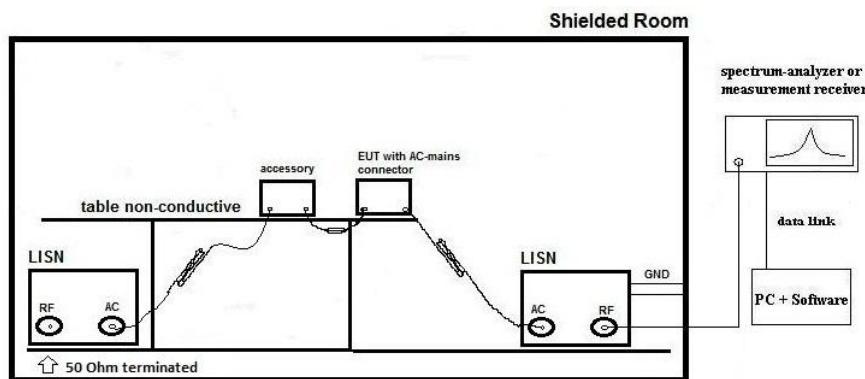
Specification: ANSI C63.4-2014 chapter 7, ANSI C63.10-2013, chapter 6.2

General Description: The radio frequency voltage conducted back into the AC power line in the frequency range 150 kHz to 30 MHz has to be investigated. Compliance should be tested by measuring the radio frequency voltage between each power line and ground at the power terminals in the stated frequency range.

A 50 Ohm / 50 μ H line impedance stabilization network (LISN) is used coupling the interface to the measurement equipment. The EUT power input leads are connected through the LISN to the AC-power source. The LISN enclosure is electrically connected to the ground plane. The measuring instrument is connected to the coaxial output of the LISN.

Tabletop devices were set-up on a 80 cm height above reference ground plane, floor standing equipment 10 cm raised above ground plane. Measurements have been performed on each phase line and neutral line of the devices AC-power lines. The EUT was power supplied with 120 V/60 Hz. The EUT was tested in the defined operating mode and installed (connected) to accessory equipment according the general description of use given by the applicant.

Schematic:



Only schematic view, we refer to figure 6, 7 and 8 of ANSI C63.4-2009 for more details.

Testing method:

Exploratory, preliminary measurements as a first step, determines the worst-case phase line (neutral or phase) as well as the most critical operating mode of the equipment. A complete frequency-sweep with PK-Detector is performed on each current-carrying conductor.

Formula:

$$V_C = V_R + C_L \quad (1)$$

$$M = L_T - V_C \quad (2)$$

Final testing for power phases and critical frequencies (Margin to AV- or QP limit lower than 3 dB) as a second step includes measurements with receivers detector set to Quasi-Peak and Average.

V_C = measured Voltage –corrected value

V_R = Receiver reading

C_L = Cable loss

M = Margin

L_T = Limit

Values are in dB, positive margin means value is below limit.

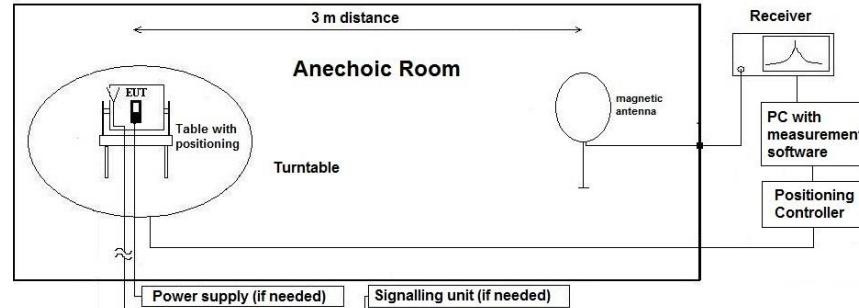
4.2. Test system set-up for radiated magnetic field measurements below 30 MHz

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_L = Cable loss

D_F = Distance correction factor

E_C = Electrical field – corrected value

E_R = Receiver reading

G_A = Gain of pre-amplifier (if used)

L_T = Limit

M = Margin

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

Distance correction:

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

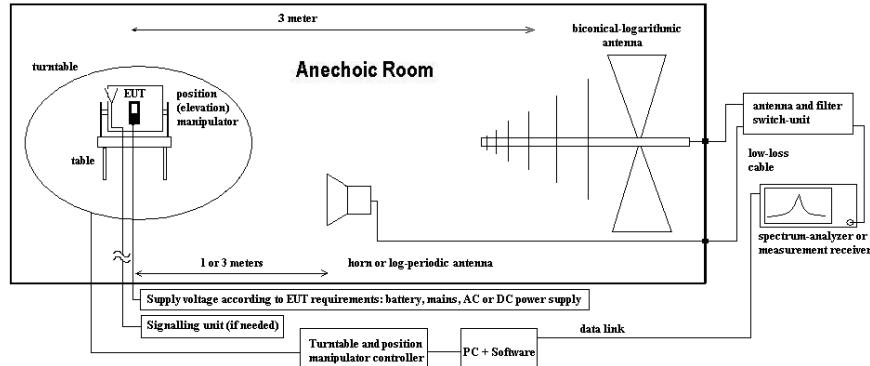
ANSI C63.10:2013, §6.4.4.2 - Equations (2) + (3) + (4)

4.3. Test system set-up for radiated electric field measurement 30 MHz to 1 GHz

Specification: ANSI C63.4-2014 chapter 8.2.3, ANSI C63.10-2013 chapter 6.5

General Description: Evaluating the field emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a NSA-compliant semi anechoic room (SAR) recognized by the regulatory commissions.

Schematic:



Testing method:

Exploratory, preliminary measurements

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 (range 0° to 360°, step 90°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and it's characteristics was recorded with an EMI-receiver, broadband antenna and software.

Measurement antenna: horizontal and vertical, heights: 1,0 m and 1,82 m as worst-case determined by an exploratory emission measurements. 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.

Formula:

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

$$M = L_T - E_C \quad (2)$$

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. either on 10m OATS or 3m semi-anechoic room.

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

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position). The measurement antenna height between 1 m and 4 m.

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

AF = Antenna factor

C_L = Cable loss

D_F = Distance correction factor (if used)

E_C = Electrical field – corrected value

E_R = Receiver reading

G_A = Gain of pre-amplifier (if used)

L_T = Limit

M = Margin

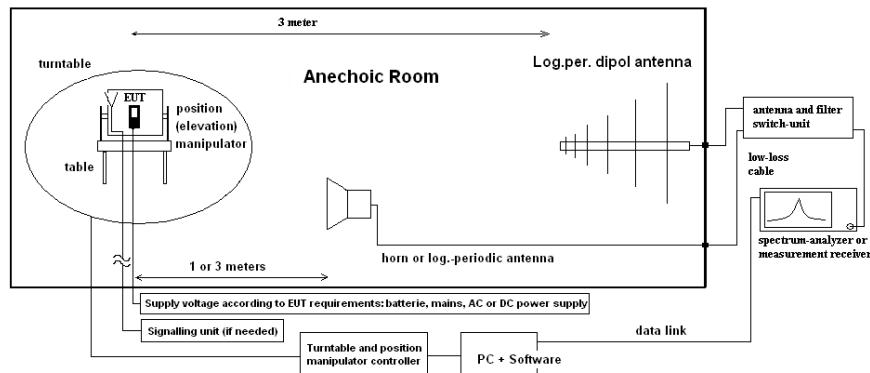
All units are dB-units, positive margin means value is below limit.

4.4. Test system set-up for radiated electric field measurement above 1 GHz

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

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

Schematic:



Testing method:

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.55 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 15°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software. The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies

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

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined. Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself 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. On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

Formula:

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

$$M = L_T - E_C \quad (2)$$

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)

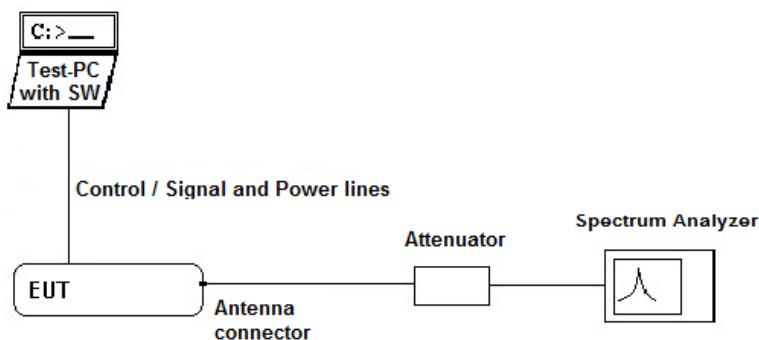
All units are dB-units, positive margin means value is below limit.

4.5. Test system set-up for conducted RF-measurement at antenna port

Specification: ANSI C63.13-2013

General Description: In order to avoid overload, the EUT's RF-signal is first attenuated before it is connected to the spectrum – analyzer/ power meter. The specific attenuation is determined prior to the measurement within a set-up calibration. The power measurement is done either with a suitable power meter or a spectrum analyzer. The value is taken into account by correcting the measurement readings on the spectrum-analyzer either by a transducer factor (TDF) or an relative offset to reference level.

Schematic:



Testing method for DTS devices: ANSI C63.10: 2013 Chapter 11.9.2.3.1+ KDB DTS558074 D01 v04

5. Measurements

5.1. Duty-Cycle

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

| Ambient Climatic conditions | Temperature: (22±2)°C | | Rel. humidity: (45±15)% | | | |
|-----------------------------|---|--|---|--|--|---|
| test site | <input type="checkbox"/> 441 EMI SAR | <input type="checkbox"/> 348 EMI cond. | <input type="checkbox"/> 443 EMI FAR | <input checked="" type="checkbox"/> 347 Radio.lab. | <input type="checkbox"/> 337 OATS | <input type="checkbox"/> |
| equipment | <input type="checkbox"/> 331 HC 4055 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| spectr. analys. | <input checked="" type="checkbox"/> 683 FSU26 | <input type="checkbox"/> 120 FSEM | <input type="checkbox"/> 264 FSEK | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| power meter | <input type="checkbox"/> 262 NRV-S | <input type="checkbox"/> 266 NRV-Z31 | <input type="checkbox"/> 265 NRV-Z33 | <input type="checkbox"/> 261 NRV-Z55 | <input type="checkbox"/> 356 NRV-Z1 | <input type="checkbox"/> |
| multimeter | <input type="checkbox"/> 341 Fluke 112 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| DC power | <input type="checkbox"/> 086 LNG50-10 | <input type="checkbox"/> 087 EA3013 | <input type="checkbox"/> 354 NGPE 40 | <input type="checkbox"/> 349 car battery | <input type="checkbox"/> 350 Car battery | <input checked="" type="checkbox"/> 463 HP3245A |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | | <input type="checkbox"/> 060 120 V 60 Hz via PAS 5000 | | | |
| otherwise | <input checked="" type="checkbox"/> 530 Attenuator 10dB | <input checked="" type="checkbox"/> K4 Cable | | | | |

Method of measurement: conducted
 radiated

A special firmware program is used for test purposes. In opposite to normal operating mode a higher duty-cycle is set in order to facilitate the measurements. This is maximized at the extent possible.

The necessary duty-cycle correction factor is determined on nominal conditions on one channel in each operable frequency-band. It is assumed that no noticeable changes occur when tested on other channels or climatic conditions.

Results:

Diagrams show a duty-cycle of 1.

- The results were corrected in order to evaluate for worst-case result each time when average values are necessary for example average radiated emissions or similar
- No correction necessary: Duty-Cycle > 98%

5.2. RF-Parameter - 6 dB Bandwidth and 99% occupied bandwidth

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

| | | | | | | |
|----------------------|---|--|--|--|---|--------------------------|
| test site | <input type="checkbox"/> 441 EMI SAR | <input type="checkbox"/> 348 EMI cond. | <input type="checkbox"/> 443 EMI FAR | <input checked="" type="checkbox"/> 347 Radio.lab. | <input type="checkbox"/> 337 OATS | <input type="checkbox"/> |
| spectr. analys. | <input type="checkbox"/> 584 FSU | <input type="checkbox"/> 120 FSEM | <input type="checkbox"/> 264 FSEK | <input type="checkbox"/> 489 ESU | <input checked="" type="checkbox"/> 683 FSU26 | <input type="checkbox"/> |
| attenuator | <input checked="" type="checkbox"/> 530 10 dB | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| signaling | <input type="checkbox"/> 392 MT8820A | <input type="checkbox"/> 436 CMU | <input type="checkbox"/> 547 CMU | | | |
| DC power | <input type="checkbox"/> 463 HP3245A | <input type="checkbox"/> 087 EA3013 | <input type="checkbox"/> 354 NGPE 40 | <input type="checkbox"/> 086 LNG50-10 | <input type="checkbox"/> | <input type="checkbox"/> |
| Power supply voltage | <input type="checkbox"/> V DC | | <input checked="" type="checkbox"/> 060 120 V 60 Hz via PAS 5000 and AE1 | | | |
| Others | <input type="checkbox"/> 613 20dB Attenuator | | <input checked="" type="checkbox"/> cable K5 | | | |

5.2.2. References of occupied and emission bandwidth

§15.247(a)(2), RSS-247, Chapter 5.2(1); RSS-Gen Issue 4: Chapter 4.6.2

(2) DSSS Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.2.3. Test condition and measurement test set-up

| | | | |
|---------------------------------------|--|--|--|
| Signal link to test system (if used): | <input type="checkbox"/> air link | <input type="checkbox"/> cable connection | <input checked="" 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)% |
| General measurement procedures | Please see chapter "Test system set-up for conducted RF-measurement at antenna Port" (W2 Set-up) | | |

5.2.4. EUT Settings:

The EUT was instructed to transmit with maximum power (if adjustable) according applicants declared and applicable settings.

Different modulation characteristics have been checked, e.g. data rates which EUT can operate if applicable.

5.2.5. Measurement method:

Three carrier frequencies (low/middle/high) were used for showing the compliance with this requirement. A delta Marker method was set to measure the bandwidth compared to the highest In-Band power. The operating modes have been varied (e.g. data rate, modulation scheme, etc.). If applicable the hopping-mode is switched off.

Also the **99% emission bandwidth** was measured. Two markers are placed on frequency points such that left to lower f-marker and right to higher f-marker only 1% of the TX-power is contained. Between the markers, 99% of the power is laying. The RBW value is readjusted and the measurement repeated until the RBW/EBW ratio is around 1%.

5.2.6. Spectrum-Analyzer settings:

| | |
|----------------------------|---|
| Span | Set as to fully display the emissions + 30% |
| Scale display | approximate 30dB below the maximum PEAK level |
| Resolution Bandwidth (RBW) | <input checked="" type="checkbox"/> KDB558074 D01 v04 |
| Video Bandwidth (VBW) | Minimum 3 times the resolution bandwidth |
| Sweep time | Auto -coupled |
| Detector | Peak detector |
| Sweep mode | Repetitive Mode, MAX-HOLD, trace stabilization |

5.2.7. Results:

For graphical results pls. see annex 1 to this test report.

6dB BANDWIDTH:

| Set-up no.: 1 Op. Mode: 1 | 6dB BANDWIDTH [MHz] | | | |
|---|--------------------------------|---------------------------|-----------------------------------|---------------------------------|
| $T_{NOM} = 21^\circ\text{C}$ V_{NOM} | Low channel = 11 (2405 MHz) | Channel = 12 (2410MHz) | Middle channel = 18 (2440 MHz) | High channel = 26 (2480 MHz) |
| Measured value | 1.753 | 1.753 | 1.753 | 1.753 |

Remark: For graphical results pls. see annex 1 to this test report.

99% OCCUPIED BANDWIDTH:

| Set-up no.: 1 Op. Mode: 1 | 99% Bandwidth [MHz] | | | |
|---|--------------------------------|---------------------------|-----------------------------------|---------------------------------|
| $T_{NOM} = 21^\circ\text{C}$ V_{NOM} | Low channel = 11 (2405 MHz) | Channel = 12 (2410MHz) | Middle channel = 18 (2440 MHz) | High channel = 26 (2480 MHz) |
| Measured value | 2.46753 | 2.41987 | 2.46794 | 2.53205 |

Remark: For graphical results pls. see annex 1 to this test report.

VERDICT: DTS system requirements for 6dB-bandwidth according §15.247 (BW > 500kHz) passed

5.3. Maximum peak conducted output power

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

| | | | |
|-----------------|--|--|--|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> 443 System CTC-FAR-EMI- | <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"/> 347 Radio.lab. |
| 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 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"/> 436 CMU | <input type="checkbox"/> 547 CMU |
| otherwise | <input checked="" type="checkbox"/> 266 NRV-Z31 | <input checked="" type="checkbox"/> 600 NRVD | <input type="checkbox"/> 110 USB LWL |
| DC power | <input type="checkbox"/> 456 EA 3013A | <input checked="" type="checkbox"/> 463 HP3245A | <input type="checkbox"/> 482 Filter Matrix |
| | | | <input type="checkbox"/> 378 RadiSense |
| | | | <input type="checkbox"/> 693 TS8997 |
| | | | <input type="checkbox"/> 268 EA- 3050 |
| | | | <input type="checkbox"/> 494 AG6632A |
| | | | <input type="checkbox"/> 498 NGPE 40 |
| otherwise | <input type="checkbox"/> 331 HC 4055 | <input type="checkbox"/> 248 6 dB Attenuator | <input type="checkbox"/> 529 Power divider |
| | | | <input checked="" type="checkbox"/> - cable OTA20 |
| | <input checked="" type="checkbox"/> 513 20dB Attenuator | | <input type="checkbox"/> K 4 Cable kit |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | <input checked="" type="checkbox"/> 060 120 V 60 Hz via PAS 5000 and AE1 | |

5.3.2. Reference

| | |
|---------------|--|
| FCC | <input checked="" type="checkbox"/> §15.247(b) (3) + KDB 558074 D01 DTS Meas Guidance v04 |
| ISED | <input type="checkbox"/> RSS-247, Chapter 5.4(4) |
| ANSI | <input checked="" type="checkbox"/> ANSI 63.10:2013 |
| Specification | <i>For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.</i> |

5.3.3. EUT settings:

The EUT was instructed to send with maximum power (if adjustable) according applicants instructions. Different modulation characteristics have been checked, e.g. data rates which EUT can operate.

5.3.4. Test condition and measurement test set-up

| | | | |
|---------------------------------------|--|--|--|
| Signal link to test system (if used): | <input type="checkbox"/> air link | <input type="checkbox"/> cable connection | <input checked="" 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 1.5m height | <input type="checkbox"/> floor standing | |
| Climatic conditions | Temperature: (22±3°C) | Rel. humidity: (40±20)% | |
| General measurement procedures | Please see chapter "Test system set-up for conducted RF-measurement at antenna Port" (W1 Set-up) | | |

5.3.5. Measurement method and analyzer settings:

The measurement was performed in non-hopping transmission mode with the carrier set to lowest/middle and highest channel. The power was also checked for different data rates, modulation scheme or packet types if applicable.

MEASUREMENT METHOD/ SPECTRUM-ANALYZER SETTINGS:

| | | |
|----------------------------------|--------------------------------------|--|
| Measurement Method ¹⁾ | §15.247(b) (3) Maximum Peak | 1.) <input type="checkbox"/> PK1-Method (§11.9.1): RBW > 6dB-bandwidth of the signal, ANSI 63.10: 2013, chapter 11.9.1.1 2.) <input type="checkbox"/> PK2-Method (§5.2.1.2): Channel integration method (ANSI 63.10:2013) 3.) <input checked="" type="checkbox"/> PK1-Method (§9.1.2 KDB): Peak Power Meter Method <small>remark 1.)</small> |
| | §15.247(b) (3) Maximum Average | 4.) <input type="checkbox"/> AVG1 - power averaging over EBW + integrated band power measurement 5.) <input type="checkbox"/> AVG2 - trace averaging over EBW + integrated band power measurement 6.) <input type="checkbox"/> RMS power meter method |
| | MIMO | 7.) <input type="checkbox"/> Method as described in Chapter 3.8 was used for measurements on two available RF-Antenna ports. |
| Center Frequency | | Nominal channel frequency |
| Span | | 30% higher then the EBW measured before |
| Resolution Bandwidth (RBW) | | 1MHz |
| Video Bandwidth (VBW) | | 3MHz |
| Sweep time | | coupled |
| Detector | | Peak, Max hold mode for method PK1/PK2 or RMS and trace average for method AVG1/AVG2 |
| Sweep Mode | | Repetitive mode, allow trace to stabilize |
| Analyzer-Mode | | <input type="checkbox"/> normal <input type="checkbox"/> activated channel integration method with limits set to the EBW of the signal |

Remark 1: guidance 558074 D01 measurement DTS guidance v04 + KDB 662911 D01, v02r01

5.3.6. RESULTS

APPLICANT'S DECLARED ANTENNA CHARACTERISTICS:

Directional Gain < 6 dBi (measured: difference between measured conducted and radiated eirp. power)
 Directional Gain > 6 dBi (measured / applicant's declaration) -> conducted power reduction necessary

- Maximum declared antenna gain [isotropic]: 2 dBi for operating band 2.4GHz

| Max. Peak power (conducted) [dBm] | | | | |
|--------------------------------------|--------------------------------|---------------------------|-----------------------------------|---------------------------------|
| Set-up no: 1 (check!) | Low channel = 11 (2405 MHz) | Channel = 12 (2410MHz) | Middle channel = 18 (2440 MHz) | High channel = 26 (2480 MHz) |
| Op-Mode: 1 (check!) | | | | |
| Measured Level RF-Port 1 | 6.0 | 5.8 | 6.1 | 6.5 |
| Measured Level RF-Port 2 | 5.8 | 6.6 | 6.8 | 4.3 |
| Limit | 1 Watt (30dBm) Peak | | | |

Remark:

- 1.) External Path Loss -> set as either as correction factor in spectrum-analyzer or activated as transducer table
- 2.) reported values are for each RF-Port individual, no MIMO technology involved according applicants declaration

Calculated field strength at 3m distance: 6.8dBm (max. value across channels and ports) + 95.2dB + 2dB
antenna gain = 104.0 dBuV/m @ 3m

5.3.6.1. VERDICT: Maximum value of 6.8 dBm Peak (4.78 mW) -> pass

5.4. RF-Parameter - Power Spectral Density

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

| | | | |
|-----------------|--|--|--|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2 | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| test site | <input type="checkbox"/> 441 EMI SAR | <input type="checkbox"/> 487 SAR NSA | <input type="checkbox"/> 337 OATS |
| receiver | <input type="checkbox"/> 377 ESCS30 | <input type="checkbox"/> 001 ESS | <input checked="" type="checkbox"/> 347 Radio.lab. |
| spectr. analys. | <input type="checkbox"/> 489 ESU | <input type="checkbox"/> 120 FSEM | <input checked="" type="checkbox"/> 264 FSEK |
| power supply | <input type="checkbox"/> 463 HP3245A | <input type="checkbox"/> 457 EA 3013A | <input type="checkbox"/> 463 |
| otherwise | <input checked="" type="checkbox"/> 530 10dB Attenuator | | <input checked="" type="checkbox"/> cable K4 |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | | <input checked="" type="checkbox"/> 060 120 V 60 Hz via PAS 5000 and AE1 |

5.4.2. REFERENCES: §15.247(e), RSS-247, Chapter 5.2(2)

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.4.3. TEST CONDITION AND MEASUREMENT TEST SET-UP

| | | | |
|---------------------------------------|--|--|--|
| Signal link to test system (if used): | <input type="checkbox"/> air link | <input type="checkbox"/> cable connection | <input checked="" 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)% | |
| General measurement procedures | Please see chapter "Test system set-up for conducted RF-measurement at antenna Port" (W2 Set-up) | | |

5.4.4. EUT SETTINGS:

The EUT was instructed to send with maximum power (if adjustable) according applicants instructions. Different modulation characteristics have been checked, e.g. data rates which EUT can operate.

5.4.5. MEASUREMENT METHOD/ SPECTRUM-ANALYZER SETTINGS

| | | |
|--------------------------------|--|--|
| Measurement Method | <input type="checkbox"/> ANSI 63.10:2013 | <input checked="" type="checkbox"/> PKPSD-Method; <input type="checkbox"/> AVGPSD Method |
| | <input checked="" type="checkbox"/> guidance 558074 D01 measurement DTS guidance v04 | |
| Center Frequency | Nominal channel frequency | |
| Span | 5..30% higher then the EBW measured before | |
| Resolution Bandwidth (RBW) | ≥ 3 kHz (at least 3 times RBW) - pls. see diagram | |
| Video Bandwidth (VBW) | > 10 kHz - pls. see diagram | |
| Sweep time | coupled | |
| Detector | Peak, Max hold mode for method PKPSD or RMS method AVGPSD | |
| Sweep Mode | Repetitive mode, allow trace to stabilize (PKPSD) or single (AVGPSD) | |
| Addition of correction factors | external measuring set-up path-loss | |

Remarks:--

5.4.6. RESULTS

| Set-up no.: 1 Op. Mode: 1 | POWER SPECTRAL DENSITY [dBm/3 kHz] | | | |
|---------------------------------|---------------------------------------|---------------------------|--------------------------------------|---------------------------------|
| | Low channel = 11 (2405 MHz) | Channel = 12 (2410MHz) | Middle channel = 18 (2440 MHz) | High channel = 26 (2480 MHz) |
| Measured max frequency [MHz] | 2405.109091 | 2410.109091 | 2440.468182 | 2480.468182 |
| Measured Level [dBm] | -7.346 | -7.343 | -7.045 | -7.999 |
| Limit | < 8dBm/3 kHz | | | |

Remark:

- 1.) see diagrams for details on frequency in separate annex A1

5.4.7. VERDICT: PASSED

5.5. 20 dBc power specification

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

| | | | |
|-----------------|--|---|--|
| test location | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input checked="" type="checkbox"/> 443 System CTC-FAR-EMI- | <input type="checkbox"/> Please see Chapter. 2.2.3 |
| test site | <input type="checkbox"/> 441 EMI SAR | <input type="checkbox"/> 487 SAR NSA | <input type="checkbox"/> 337 OATS |
| receiver | <input type="checkbox"/> 377 ESCS30 | <input type="checkbox"/> 001 ESS | <input checked="" type="checkbox"/> 489 ESU |
| spectr. analys. | <input type="checkbox"/> 489 ESU | <input type="checkbox"/> 120 FSEM | <input type="checkbox"/> 264 FSEK |
| power supply | <input checked="" type="checkbox"/> 463 HP3245A | <input type="checkbox"/> 457 EA 3013A | <input type="checkbox"/> 459 EA 2032-50 |
| otherwise | <input checked="" type="checkbox"/> 530 10 dB Attenuator | | <input checked="" type="checkbox"/> cable K4 |

5.5.2. Reference: §15.247, §15.205 / RSS-247, Chapter 5.5

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

5.5.3. Test condition and measurement test set-up

| | | | |
|---------------------------------------|---|--|--|
| Signal link to test system (if used): | <input type="checkbox"/> air link | <input type="checkbox"/> cable connection | <input checked="" 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 1.5m height | | <input type="checkbox"/> floor standing |
| Climatic conditions | Temperature: (22±3°C) | | Rel. humidity: (40±20)% |
| Spectrum-Analyzer settings | Scan frequency range: <input type="checkbox"/> 1 – 18 GHz <input type="checkbox"/> 18 – 25 GHz <input type="checkbox"/> 18 – 40 GHz <input checked="" type="checkbox"/> other: see diagrams Scan-Mode <input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3 dB Spectrum analyser Mode Detector RBW/VBW Mode: Scan step Sweep-Time | <input type="checkbox"/> Peak and Average 100kHz/300kHz <input type="checkbox"/> Repetitive-Scan, max-hold 40kHz <input type="checkbox"/> Coupled – calibrated display if CW signal otherwise adapted to EUT's individual duty-cycle | |
| General measurement procedures | Please see chapter "Test system set-up for radiated electric field measurements above 1 GHz" for general measurements procedures in anechoic chamber. | | |

5.5.4. EUT settings

For FHHS-systems hopping mode was switched-off so fixed three different channels could be measured. The EUT was instructed to send with maximum power (if adjustable) according to applicants instructions.

5.5.5. Measurement method

According guidance 558074 D01 measurement DTS guidance V04: the frequency spectrum was investigated for **conducted** spurious emissions values lower than 20dB related to the RF-carrier power value. Three carrier frequencies (low/middle/high channel) were used for showing the compliance with this requirement. First a In-Band Reference level measurement of the carrier was performed. The video bandwidth (VBW) was chosen 10 times the resolution bandwidth (RBW). The frequency scan was up to 10 times the highest channel frequency within the operational mode. The spectrum-analyzer was set to MAX-PEAK Detector, MAX-Hold Mode, trace stabilization mode.

5.5.6. Table of Measurement results:

| Op-Mode: 1 | RF-Conducted test: 20 dBc spurious emissions | | | | | | |
|-----------------------|--|--|-------------|---|-------------|---|-------------|
| | Frequency Range | Low channel =12 (2410 MHz) Level Reference (In-Band) = 10.69 dBm Limit = -9.31 dBm | | Middle channel = 26 (2440 MHz) Level Reference (In-Band) = 10.94 dBm Limit= -9.06 dBm | | High channel = 26 (2480MHz) Level Reference (In-Band)= 10.26 dBm Limit= -9.74 dBm | |
| | | Frequency [MHz] | Value [dBc] | Frequency [MHz] | Value [dBc] | Frequency [MHz] | Value [dBc] |
| 30MHz to 2.8 GHz | -- | >30 | -- | >30 | -- | >30 | |
| 2.8 to 18 GHz | -- | >30 | -- | >30 | -- | >30 | |
| 18 – 25GHz (radiated) | -- | Noise level ^{3.)} | -- | Noise level ^{3.)} | -- | Noise level ^{3.)} | |
| Band-Edge | -- | >20 | N/A | | -- | >20 | |

Remarks:

- 1.) see diagrams in separate document A1
- 2.) the limit on the diagrams is 20dB under the reference level measured In-Band for each channel
- 3.) performed radiated, Ref-Level calculations: E-Field max.-Value = $10.69\text{dBm} + 104.7\text{dB}|_{d,\text{meas}=1\text{m}} = 115.39\text{dBuV/m}$ -> Limit = 95.39dBuV/m
- 4.) Band-Edge results can be found in Annex 1

5.5.7. Test result: pass

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

5.6.1. 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 |
| signalling | <input type="checkbox"/> 757 CMW500 | <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 type="checkbox"/> 060 120 V 60 Hz via PAS 5000 | |

5.6.2. Requirements

| FCC | Part 15, Subpart C, §15.205 & §15.209 | | |
|--------------------|---------------------------------------|-----------------------|---------|
| ISED | RSS-Gen: Issue 4: §8.9 Table 5 | | |
| ANSI | C63.10-2013 | | |
| Frequency [MHz] | Field strength limit [μ V/m] | Distance [m] | Remarks |
| 0.009 – 0.490 | 2400/f (kHz) | 67.6 – 20Log(f) (kHz) | 300 |
| 0.490 – 1.705 | 24000/f (kHz) | 87.6 – 20Log(f) (kHz) | 30 |
| 1.705 – 30 | 30 | 29.5 | 30 |

5.6.3. Test condition and test set-up

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

5.6.4. 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 | |
| 2.05 | Low | 11 | 9 kHz-30 MHz | 2 | 1 | Laying position, PoE (AE1) power supply, antenna 0 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.06 | | | | | | Standing position, PoE (AE1) power supply, antenna 0 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.11 | | | | | | Laying position, PoE (AE1) power supply, antenna 1 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.12 | | | | | | Standing position, PoE (AE1) power supply, antenna 1 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.07 | Middle | 18 | 9 kHz-30 MHz | 2 | 1 | Standing position, PoE (AE1) power supply, antenna 1 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.08 | | | | | | Laying position, PoE (AE1) power supply, antenna 1 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.13 | | | | | | standing position, PoE (AE1) power supply, antenna 0 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.14 | | | | | | Laying position, PoE (AE1) power supply, antenna 0 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.09 | High | 26 | 9 kHz-30 MHz | 3 | 1 | Laying position (Worst-Case), 24V DC power supply, antenna 1 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.10 | | | | | | Standing position (Worst-Case), 24V DC power supply, antenna 1 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.15 | | | | | | Laying position (Worst-Case), 24V DC power supply, antenna 0 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.16 | | | | | | Standing position (Worst-Case), 24V DC power supply, antenna 0 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark:

- 1.) first antenna designated 0, second antenna designated 1 – tests run consecutively

5.6.5. 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 -Range | f [kHz/MHz] | Lambda [m] | Far-Field Point [m] | Distance Limit accord. 15.209 [m] | 1st Condition (d _{meas} < D _{near_field}) | 2 nd Condition (Limit distance bigger d _{near_field}) | Distance Correction accord. Formula |
|------------------|-------------|------------|---------------------|-----------------------------------|--|--|-------------------------------------|
| kHz | 9.00E+03 | 33333,33 | 5305,17 | 300 | fulfilled | not fulfilled | -80,00 |
| | 1.00E+04 | 30000,00 | 4774,65 | | fulfilled | not fulfilled | -80,00 |
| | 2.00E+04 | 15000,00 | 2387,33 | | fulfilled | not fulfilled | -80,00 |
| | 3.00E+04 | 10000,00 | 1591,55 | | fulfilled | not fulfilled | -80,00 |
| | 4.00E+04 | 7500,00 | 1193,66 | | fulfilled | not fulfilled | -80,00 |
| | 5.00E+04 | 6000,00 | 954,93 | | fulfilled | not fulfilled | -80,00 |
| | 6.00E+04 | 5000,00 | 795,78 | | fulfilled | not fulfilled | -80,00 |
| | 7.00E+04 | 4285,71 | 682,09 | | fulfilled | not fulfilled | -80,00 |
| | 8.00E+04 | 3750,00 | 596,83 | | fulfilled | not fulfilled | -80,00 |
| | 9.00E+04 | 3333,33 | 530,52 | | fulfilled | not fulfilled | -80,00 |
| | 1.00E+05 | 3000,00 | 477,47 | | fulfilled | not fulfilled | -80,00 |
| | 1.25E+05 | 2400,00 | 381,97 | | fulfilled | not fulfilled | -80,00 |
| | 2.00E+05 | 1500,00 | 238,73 | | fulfilled | fulfilled | -78,02 |
| | 3.00E+05 | 1000,00 | 159,16 | | fulfilled | fulfilled | -74,49 |
| | 4.00E+05 | 750,00 | 119,37 | | fulfilled | fulfilled | -72,00 |
| | 4.90E+05 | 612,24 | 97,44 | | fulfilled | fulfilled | -70,23 |
| | 5.00E+05 | 600,00 | 95,49 | 30 | fulfilled | not fulfilled | -40,00 |
| | 6.00E+05 | 500,00 | 79,58 | | fulfilled | not fulfilled | -40,00 |
| | 7.00E+05 | 428,57 | 68,21 | | 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 |
| MHz | 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 |

5.7. General Limit - Radiated field strength emissions, 30 MHz - 1 GHz

5.7.1. 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 checked="" type="checkbox"/> 487 SAR NSA | |
| receiver | <input type="checkbox"/> 377 ESCS30 | <input checked="" type="checkbox"/> 001 ESS | <input type="checkbox"/> 489 ESU 40 |
| spectr. analys. | <input type="checkbox"/> 584 FSU | <input type="checkbox"/> 120 FSEM | <input type="checkbox"/> 264 FSEK |
| antenna | <input checked="" type="checkbox"/> 574 BTA-L | <input type="checkbox"/> 133 EMCO3115 | <input type="checkbox"/> 302 BBHA9170 |
| signalling | <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 type="checkbox"/> 268 EA- 3050 |
| | | | <input checked="" type="checkbox"/> 060 120 V 60 Hz via PAS 5000 |

5.7.2. Requirements/Limits

| | | | |
|-------|-----------------|---|---------------------------|
| FCC | | <input type="checkbox"/> Part 15 Subpart B, §15.109, class B <input checked="" type="checkbox"/> Part 15 Subpart C, §15.209 @ frequencies defined in §15.205 | |
| ISED | | <input checked="" type="checkbox"/> RSS-Gen., Issue 4, Chapter 8.9, Table 4+6 (licence-exempt radio apparatus) <input type="checkbox"/> RSS-Gen., Issue 4, Chapter 7.1.2, Table 2 (receiver) <input type="checkbox"/> ICES-003, Issue 6, Table 5 (Class B) <input checked="" type="checkbox"/> RSS-247, Issue 1, Chapter 5 | |
| ANSI | | <input type="checkbox"/> C63.4-2014 <input checked="" type="checkbox"/> C63.10-2013 | |
| Limit | Frequency [MHz] | Radiated emissions limits, 3 meters | |
| | | QUASI Peak [μ V/m] | QUASI-Peak [dB μ V/m] |
| | 30 - 88 | 100 | 40.0 |
| | 88 - 216 | 150 | 43.5 |
| | 216 - 960 | 200 | 46.0 |
| | above 960 | 500 | 54.0 |

5.7.3. Restricted bands of operation (FCC §15.205/ RSS-Gen, Issue 4 Chapter 8.9, Table 4)

| MHz | MHz | MHz | GHz |
|-------------------|---------------------|---------------|-------------|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| 0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.20725-4.20775 | 37.5-38.25 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 73-74.6 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 74.8-75.2 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 108-121.94 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 123-138 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 149.9-150.05 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.52475-156.52525 | 2690-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 156.7-156.9 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 162.0125-167.17 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 167.72-173.2 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 240-285 | 3600-4400 | -- |
| 13.36-13.41 | 322-335.4 | -- | -- |

Remark: only spurious emissions are allowed within these frequency bands not exceeding the limits per §15.209

5.7.4. Test condition and measurement test set-up

| | | | | |
|---------------------------------------|-----------------------|---|--|--|
| Signal link to test system (if used): | | <input type="checkbox"/> air link | <input type="checkbox"/> cable connection | <input checked="" 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 0.8m height | <input type="checkbox"/> floor standing | |
| Climatic conditions | | Temperature: (22±3°C) | Rel. humidity: (40±20)% | |
| EMI-Receiver (Analyzer) Settings | Scan frequency range: | <input checked="" type="checkbox"/> 30 – 1000 MHz | <input type="checkbox"/> other: | |
| | Scan-Mode | <input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode | <input type="checkbox"/> 3 dB spectrum analyser mode | |
| | Detector | Peak / Quasi-peak | | |
| | RBW/VBW | 100 kHz/300 kHz | | |
| | Mode: | Repetitive-Scan, max-hold | | |
| | Scan step | 80 kHz | | |
| | Sweep-Time | Coupled – calibrated display if continuous tx-signal otherwise adapted to EUT's individual duty-cycle | | |
| General measurement procedures | | Please see chapter "Test system set-up for electric field measurement in the range 30 MHz to 1 GHz" | | |

5.7.5. MEASUREMENT RESULTS

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

Table of measurement results:

| Dia-gram no. | Carrier Channel | | Frequency range | Set-up no. | OP-mode no. | Remark | Used detector | | | Result |
|--------------|-----------------|-----|-----------------|------------|-------------|--|-------------------------------------|--------------------------|--------------------------|--------|
| | Range | No. | | | | | PK | AV | QP | |
| 3.03 | Low | 11 | 30 MHz – 1 GHz | 2 | 1 | Laying position, PoE (AE1) used as power, supply, antenna 1 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.06 | Low | 11 | | 2 | 1 | standing position, PoE (AE1) used as power, antenna 1 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.02 | Middle | 18 | | 2 | 1 | Laying position, PoE (AE1) used as power supply, antenna 1 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.05 | Middle | 18 | | 2 | 1 | standing position, PoE (AE1) used as power, antenna 1 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.01 | High | 26 | | 3 | 1 | Laying position 24V DC as power supply, antenna 1 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.04 | High | 26 | | 3 | 1 | standing position 24V DC as power supply, antenna 1 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remarks:

- 1.) Antenna 1 active (second antenna)
- 2.) PWR Level 15 set-up in software

Table of measurement results:

| Dia-gram no. | Carrier Channel | | Frequency range | Set-up no. | OP-mode no. | Remark | Used detector | | | Result |
|--------------|-----------------|-----|-----------------|------------|-------------|---|-------------------------------------|--------------------------|--------------------------|--------|
| | Range | No. | | | | | PK | AV | QP | |
| 3.09 | Low | 11 | 30 MHz – 1 GHz | 2 | 1 | Laying position, PoE (AE1) used as power supply, antenna 0 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.12 | Low | 11 | | 2 | 1 | standing position, PoE (AE1) used as power supply, antenna 0 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.08 | Middle | 18 | | 2 | 1 | Laying position, PoE (AE1) used as power supply, antenna 0 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.11 | Middle | 18 | | 2 | 1 | standing position, PoE (AE1) used as power supply, antenna 0 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.07 | High | 26 | | 3 | 1 | Laying position 24V DC as power supply, antenna 0 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.10 | High | 26 | | 3 | 1 | standing position 24V DC as power supply, antenna 0 active | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remarks:

- 1.) Antenna 0 active (first antenna)
- 2.) PWR Level 15 set-up in software

5.8. General Limit – Radiated field strength emissions, above 1 GHz

5.8.1. Test location and equipment FAR

| | | | | | | |
|-----------------|---|--|--|--|---|----------------------------------|
| test site | <input type="checkbox"/> 441 EMI SAR | <input type="checkbox"/> 348 EMI cond. | <input checked="" type="checkbox"/> 443 EMI FAR | <input type="checkbox"/> 347 Radio.lab. | <input checked="" type="checkbox"/> 337 OATS | <input type="checkbox"/> |
| spectr. analys. | <input type="checkbox"/> 584 FSU | <input type="checkbox"/> 120 FSEM | <input type="checkbox"/> 264 FSEK | <input checked="" type="checkbox"/> 489 ESU 40 | <input checked="" type="checkbox"/> 302 BBHA9170 | <input type="checkbox"/> 477 GPS |
| antenna meas | <input type="checkbox"/> 574 BTA-L | <input type="checkbox"/> 289 CBL 6141 | <input type="checkbox"/> 608 HL 562 | <input checked="" type="checkbox"/> 549 HL025 | | |
| antenna meas | <input type="checkbox"/> 123 HUF-Z2 | <input type="checkbox"/> 132 HUF-Z3 | <input type="checkbox"/> 030 HFH-Z2 | <input type="checkbox"/> 376 BBHA9120E | | |
| Antenna meas | <input type="checkbox"/> 071 HUF-Z2 | <input type="checkbox"/> 020 EMCO3115 | <input type="checkbox"/> 063 LP 3146 | <input checked="" type="checkbox"/> 303 BBHA9170 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| multimeter | <input type="checkbox"/> 341 Fluke 112 | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| signalling | <input type="checkbox"/> 392 MT8820A | <input type="checkbox"/> 371 CBT32 | <input type="checkbox"/> 547 CMU | <input type="checkbox"/> 594 CMW | | |
| DC power | <input type="checkbox"/> 086 LNG50-10 | <input type="checkbox"/> 087 EA3013 | <input type="checkbox"/> 354 NGPE 40 | <input type="checkbox"/> 349 car battery | <input checked="" type="checkbox"/> 350 Car battery | <input type="checkbox"/> |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | | <input checked="" type="checkbox"/> 060 120 V 60 Hz via PAS 5000 | | | |

5.8.2. Requirements/Limits

| | | | | |
|--|--|----------------------|----------------------|------------------------|
| FCC | <input type="checkbox"/> Part 15 Subpart B, §15.109 class B <input checked="" type="checkbox"/> Part 15 Subpart C, §15.209 for frequencies defined in §15.205 <input type="checkbox"/> Part 15 Subpart C, §15.407(b)(1)(2)(3)(4) | | | |
| ISED | <input checked="" type="checkbox"/> RSS-Gen., Issue 4, Chapter 8.9, Table 4+6 (transmitter licence exempt) <input checked="" type="checkbox"/> RSS-Gen., Issue 4, Chapter 8.9, Table 2 (receiver) <input type="checkbox"/> ICES-003, Issue 6, Chapter 6.2.2, Table 7 (class B) <input type="checkbox"/> RSS-247, Issue 2, Chapter 6 | | | |
| ANSI | <input type="checkbox"/> C63.4-2014 <input checked="" type="checkbox"/> C63.10-2013 | | | |
| Frequency [MHz] | Limits | | | |
| above 1 GHz for frequencies as defined in §15.205 or RSS-Gen., Issue 4, §8.10 - Table 6 | AV [μ V/m] | AV [dB μ V/m] | Peak [μ V/m] | Peak [dB μ V/m] |
| | 500 | 54.0 | 5000 | 74.0 |

5.8.3. Test condition and measurement test set-up

| | | | |
|---------------------------------------|---|--|--|
| Signal link to test system (if used): | <input type="checkbox"/> air link | <input type="checkbox"/> cable connection | <input checked="" 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 1.5m height | | <input type="checkbox"/> floor standing |
| Climatic conditions | Temperature: (22±3°C) | Rel. humidity: (40±20)% | |
| Spectrum-Analyzer settings | Scan frequency range: Scan-Mode Detector RBW/VBW Mode: Scan step Sweep-Time | <input checked="" type="checkbox"/> 1 – 18 GHz <input type="checkbox"/> 18 – 25 GHz <input type="checkbox"/> 18 – 40 GHz <input type="checkbox"/> other: <input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3 dB Spectrum analyser Mode Peak and Average 1 MHz / 3 MHz Repetitive-Scan, max-hold 400 kHz Coupled – calibrated display if CW signal otherwise adapted to EUT's individual duty-cycle | |
| General measurement procedures | Please see chapter "Test system set-up for radiated electric field measurements above 1 GHz" | | |

5.8.4. Measurement Results

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

| Dia-gram no. | Carrier Channel | | Frequency range | Set-up no. | OP-mode no. | Remark | Used detector | | | Result |
|--------------|-----------------|-----|-----------------|------------|-------------|---|-------------------------------------|-------------------------------------|--------------------------|--------|
| | Range | No. | | | | | PK | AV | QP | |
| 4.04 | Low | 11 | 1-18GHz | 3 | 1 | 24V DC power supply used, antenna 1 active | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.07 | Low | | | 3 | 1 | 24V DC power supply used, antenna 0 active | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.13 | Low | 11 | 18-25GHz | 3 | 1 | 24V DC power supply used, antenna 1 active | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.16 | Low | | | 3 | 1 | 24V DC power supply used, antenna 0 active | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.05 | Middle | 18 | 1-18GHz | 2 | 1 | PoE (AE1) power supply used, antenna 1 active | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.08 | Middle | | | 2 | 1 | PoE (AE1) power supply used, antenna 0 active | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.14 | Middle | 18 | 18-25GHz | | | PoE (AE1) power supply used, antenna 1 active | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.17 | Middle | | | | | PoE (AE1) power supply used, antenna 0 active | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.06 | High | 26 | 1-18GHz | 3 | 1 | PoE (AE1) power supply used, antenna 1 active | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.09 | High | | | 3 | 1 | PoE (AE1) power supply used, antenna 0 active | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.15 | High | 26 | 18-25GHz | 3 | 1 | PoE (AE1) power supply used, antenna 1 active | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.18 | High | | | 3 | 1 | PoE (AE1) power supply used, antenna 0 active | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: first antenna designated 0, second antenna designated 1 – tests run consecutively

5.9. General Limit - Conducted emissions on AC-Power lines

5.9.1. 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 type="checkbox"/> 333 EMI field | <input checked="" type="checkbox"/> 348 EMI cond. | |
| receiver | <input type="checkbox"/> 001 ESS | <input checked="" type="checkbox"/> 377 ESCS 30 | <input type="checkbox"/> 489 ESU 40 <input type="checkbox"/> 620 ESU 26 |
| LISN | <input checked="" type="checkbox"/> 005 ESH2-Z5 | <input type="checkbox"/> 007 ESH3-Z6 | <input type="checkbox"/> 300 ESH3-Z5 & 50Ω used for AE <input type="checkbox"/> no LISN for AE |
| signalling | <input type="checkbox"/> 392 MT8820A | <input type="checkbox"/> 436 CMU | <input type="checkbox"/> 547 CMU <input type="checkbox"/> 594 CMW |
| line voltage | <input type="checkbox"/> 230 V 50 Hz via public mains | <input checked="" type="checkbox"/> 060 120 V 60 Hz via PAS 5000 and AE1 | |

5.9.2. Requirements

| FCC | Part 15, Subpart B, §15.207 | | |
|-------|---------------------------------------|-------------------|----------------|
| ISED | RSS-Gen Issue 4, Chapter 8.8, Table 3 | | |
| ANSI | C63.10-2013 | | |
| Limit | Frequency [MHz] | QUASI-Peak [dBµV] | AVERAGE [dBµV] |
| | 0.15 – 0.5 | 66 to 56* | 56 to 46* |
| | 0.5 – 5 | 56 | 46 |
| | 5 – 30 | 60 | 50 |

Remark: * decreases with the logarithm of the frequency

5.9.3. Test condition and test set-up

| | | | | | | | | | |
|---------------------------------------|--|--|--|--|--|--|---------------------------------|---|--|
| Signal link to test system (if used): | <input type="checkbox"/> air link | <input type="checkbox"/> cable connection | <input checked="" 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 (40 cm distance to reference ground plane (wall)) | <input type="checkbox"/> floor standing | EUT stands isolated on reference ground plane (floor) | | | | | | |
| Climatic conditions | Temperature: (22±3°C) | Rel. humidity: (40±20)% | | | | | | | |
| EMI-Receiver or Analyzer settings | <table border="0"> <tr> <td>Scan data</td> <td><input type="checkbox"/> 9 – 150 kHz, RBW = 200 Hz, Step = 61 Hz</td> </tr> <tr> <td></td> <td><input checked="" type="checkbox"/> 150 kHz – 30 MHz RBW = 9 kHz, Step = 4 kHz</td> </tr> <tr> <td></td> <td><input type="checkbox"/> other:</td> </tr> </table> | Scan data | <input type="checkbox"/> 9 – 150 kHz, RBW = 200 Hz, Step = 61 Hz | | <input checked="" type="checkbox"/> 150 kHz – 30 MHz RBW = 9 kHz, Step = 4 kHz | | <input type="checkbox"/> other: | 6 dB EMI-Receiver Mode Peak detector, Repetitive-Scan, max-hold, sweep-time 50 µs per frequency point Average & Quasi-peak detector at critical frequencies | |
| Scan data | <input type="checkbox"/> 9 – 150 kHz, RBW = 200 Hz, Step = 61 Hz | | | | | | | | |
| | <input checked="" type="checkbox"/> 150 kHz – 30 MHz RBW = 9 kHz, Step = 4 kHz | | | | | | | | |
| | <input type="checkbox"/> other: | | | | | | | | |
| General measurement procedures | Please see chapter "Test system set-up for AC power line conducted emissions measurements" | | | | | | | | |

5.9.4. Measurement results

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

| EUT | | set-up no.: | set-up 2 | | |
|-------------|-----------------------------------|--|------------|---|--------|
| Diagram No. | EUT operating mode no. or command | Used Detector | Power line | Additional (scan-) information or remarks | Result |
| 1.01 | EUT operating mode 1 | <input checked="" type="checkbox"/> Peak (pre-scan) <input checked="" type="checkbox"/> AV (final) <input type="checkbox"/> QP (final) | L1/ N | Channel 18, antenna 1 active | passed |
| 1.02 | EUT operating mode 1 | <input checked="" type="checkbox"/> Peak (pre-scan) <input checked="" type="checkbox"/> AV (final) <input type="checkbox"/> QP (final) | L1/ N | Channel 18, antenna 2 active | passed |

5.10. Measurement uncertainties

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

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

Following table shows expectable uncertainties for each measurement type performed.

| RF-Measurement | Reference | Frequency range | Calculated uncertainty based on a confidence level of 95% | | | | | | Remarks | |
|--------------------------------|--------------|-------------------------------------|---|--------|------|------|------|----|---|--|
| Conducted emissions (U CISPR) | CISPR 16-2-1 | 9 kHz - 150 kHz 150 kHz - 30 MHz | 4.0 dB 3.6 dB | | | | | | - | |
| Radiated emissions Enclosure | CISPR 16-2-3 | 30 MHz - 1 GHz 1 GHz - 18 GHz | 4.2 dB 5.1 dB | | | | | | E-Field | |
| Disturbance power | CISPR 16-2-2 | 30 MHz - 300 MHz | - | | | | | | - | |
| Power Output radiated | - | 30 MHz - 4 GHz | 3.17 dB | | | | | | Substitution method | |
| Power Output conducted | - | Set-up No. | Cel-C1 | Cel-C2 | BT1 | W1 | W2 | -- | - | |
| | | 9 kHz - 12.75 GHz | N/A | 0.60 | 0.7 | 0.25 | N/A | -- | | |
| | | 12.75 - 26.5GHz | N/A | 0.82 | -- | N/A | N/A | -- | | |
| Conducted emissions on RF-port | - | 9 kHz - 2.8 GHz | 0.70 | N/A | 0.70 | N/A | 0.69 | -- | N/A - not applicable | |
| | | 2.8 GHz - 12.75GHz | 1.48 | N/A | 1.51 | N/A | 1.43 | -- | | |
| | | 12.75 GHz - 18GHz | 1.81 | N/A | 1.83 | N/A | 1.77 | -- | | |
| | | 18 GHz - 26.5GHz | 1.83 | N/A | 1.85 | N/A | 1.79 | -- | | |
| 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 E-field Substitution | |
| | | 30 MHz - 1 GHz | 4.2 dB | | | | | | | |
| | | 1 GHz - 20 GHz | 3.17 dB | | | | | | | |

Table: measurement uncertainties, valid for conducted/radiated measurements

6. Abbreviations used in this report

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

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

| Ref.-No. | Accreditation Certificate | Valid for laboratory area or test site | Accreditation Body |
|---------------------------------|---|---|---|
| - | D-PL-12047-01-01 | All laboratories and test sites of CETECOM GmbH, Essen | DAkkS, Deutsche Akkreditierungsstelle GmbH |
| 337 487 558 348 348 | (MRA US-EU 0003) | Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurem. | FCC, Federal Communications Commission Laboratory Division, USA |
| 337 487 550 558 | -- 3462D-2 3462D-2 3462D-3 | Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR) | ISED, Industry Canada Certification and Engineering Bureau |
| 487 550 348 348 | R- 4452 G- 20013 C- 20009 T- 20006 | Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurem. | VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan |

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

8. Instruments and Ancillary

8.1. Used equipment “CTC”

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

8.1.1. Test software and firmware of equipment

| Ref.-No. | Equipment | Type | Serial-No. | Version of Firmware or Software during the test |
|----------|---|------------------------|----------------|---|
| 001 | EMI Test Receiver | ESS | 825132/017 | Firm.= 1.21 , OTP=2.0, GRA=2.0 |
| 012 | Signal Generator (EMS-cond.) | SMY 01 | 839069/027 | Firm.= V 2.02 |
| 013 | Power Meter (EMS cond.) | NRVD | 839111/003 | Firm.= V 1.51 |
| 017 | Digital Radiocommunication Tester | CMD 60 M | 844365/014 | Firmware = V 3.52 .22.01.99, DECT = D2.87 13.01.99 |
| 053 | Audio Analyzer | UPA3 | 860612/022 | Firm. V 4.3 |
| 119 | RT Harmonics Analyzer dig. Flickermeter | B10 | G60547 | Firm.= V 3.1DHG |
| 140 | Signal Generator | SMHU | 831314/006 | Firm.= 3.21 |
| 261 | Thermal Power Sensor | NRV-Z55 | 825083/0008 | EPROM-Datum 02.12.04, SE EE 1 B |
| 262 | Power Meter | NRV-S | 825770/0010 | Firm.= 2.6 |
| 263 | Signal Generator | SMP 04 | 826190/0007 | Firm.=3.21 |
| 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 | Eeprom 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= μ P1=V.850 |
| 598 | Spectrum Analyzer | FSEM 30 | 831259/013 | Firmware Bios 3.40 , Analyzer 3.40 Sp 2 |
| 607 | Signal Generator | SMR 20 | 832033/011 | V1.25 |
| 620 | EMI Test Receiver | ESU 26 | 100362 | 4.43_SP3 |
| 642 | Wideband Radio Communication Tester | CMW 500 | 126089 | Setup V03.26, Test programm component V03.02.20 |
| 670 | Univ. Radio Communication Tester | CMU 200 | 106833 | μ P1 =V8.50, Firmware = V.20 |
| 689 | Vector Signal Generator | SMU200 | 100970 | 02.20.360.142 |
| 692 | Bluetooth Tester | CBT 32 | 100236 | CBT V 5.40, FW: V.2.41 (FPGA Digital, V. 3.09 FPGA RF) |

8.1.2. Single instruments and test systems

| Ref.-No. | Equipment | Type | Serial-No. | Manufacturer | Interval of calibration | Remark | Cal due |
|----------|---|-----------------------|-----------------------|----------------------------|-------------------------|--------|------------|
| 001 | EMI Test Receiver | ESS | 825132/017 | Rohde & Schwarz | 12 M | - | 16.05.2018 |
| 005 | AC - LISN (50 Ohm/50µH, test site 1) | ESH2-Z5 | 861741/005 | Rohde & Schwarz | 12 M | - | 15.05.2018 |
| 007 | Single-Line V-Network (50 Ohm/5µH) | ESH3-Z6 | 892563/002 | Rohde & Schwarz | 12 M | - | 17.05.2018 |
| 009 | Power Meter (EMS-radiated) | NRV | 863056/017 | Rohde & Schwarz | 24 M | - | 15.05.2019 |
| 016 | Line Impedance Simulating Network | Op. 24-D | B6366 | Spitzenberger+Spies | 36 M | - | 30.05.2019 |
| 021 | Loop Antenna (H-Field) | 6502 | 9206-2770 | EMCO | 36 M | - | 30.04.2018 |
| 030 | Loop Antenna (H-field) | HFH-Z2 | 879604/026 | Rohde & Schwarz | 36 M | - | 30.04.2018 |
| 033 | RF-current probe (100kHz-30MHz) | ESH2-Z1 | 879581/18 | Rohde & Schwarz | 24 M | - | 15.05.2019 |
| 057 | relay-switch-unit (EMS system) | RSU | 494440/002 | Rohde & Schwarz | pre-m | 1a | |
| 060 | power amplifier (DC-2kHz) | PAS 5000 | B6363 | Spitzenberger+Spies | - | 3 | |
| 086 | DC - power supply, 0-10 A | LNG 50-10 | - | Heinzingen 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-Band | Model 7003 (N) | C5129 | Weinschel | pre-m | 2 | |
| 276 | DC-Band | 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 | 126.0604.0003.3.3.3.2 | 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 |
| 454 | Oscilloscope | HM 205-3 | 9210 P 29661 | Hameg | - | 4 | |
| 456 | DC-Power supply 0-5 A | EA 3013 S | 207810 | Elektro Automatik | pre-m | 2 | |
| 459 | DC -Power supply 0-5 A , 0-32 V | EA-PS 2032-50 | 910722 | Elektro Automatik | pre-m | 2 | |
| 460 | Univ. Radio Communication Tester | CMU 200 | 108901 | Rohde & Schwarz | 12 M | - | 16.06.2018 |
| 463 | Universal source | HP3245A | 2831A03472 | Agilent | - | 4 | |
| 466 | Digital Multimeter | Fluke 112 | 89210157 | Fluke USA | 24 M | - | 30.05.2018 |

| Ref.-No. | Equipment | Type | Serial-No. | Manufacturer | Interval of calibration | Remark | Cal due |
|----------|---|-----------------------------|-------------------------|-----------------------------|-------------------------|--------|------------|
| 467 | Digital Multimeter | Fluke 112 | 89680306 | Fluke USA | 36 M | - | 30.04.2018 |
| 468 | Digital Multimeter | Fluke 112 | 90090455 | Fluke USA | 36 M | - | 30.04.2018 |
| 477 | ReRadiating GPS-System | AS-47 | - | Automotive Cons. Fink | - | 3 | |
| 480 | power meter (Fula) | NRVS | 838392/031 | Rohde & Schwarz | 24 M | - | 16.05.2019 |
| 482 | filter matrix | Filter matrix SAR 1 | - | CETECOM (BrL) | - | 1d | |
| 487 | System CTC NSA-Verification SAR-EMI | System EMI field (SAR) NSA | - | ETS Lindgren / CETECOM | 24 M | - | 31.03.2019 |
| 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 | |
| 517 | relais switch matrix | HF Relais Box Keithley | SE 04 | Keithley | pre-m | 2 | |
| 523 | Digital Multimeter | L4411A | MY46000154 | Agilent | 24 M | - | 18.05.2019 |
| 529 | 6 dB Broadband resistive power divider | Model 1515 | LH 855 | Weinschel | pre-m | 2 | |
| 530 | 10 dB Broadband resistive power divider | R 416110000 | LOT 9828 | - | pre-m | 2 | |
| 546 | Univ. Radio Communication Tester | CMU 200 | 106436 | R&S | 12 M | - | 30.03.2018 |
| 547 | Univ. Radio Communication Tester | CMU 200 | 835390/014 | Rohde & Schwarz | 12 M | - | 05.07.2018 |
| 549 | Log-Per-Antenna | HL025 | 1000060 | Rohde & Schwarz | 36/12 M | - | 31.07.2018 |
| 550 | System CTC S-VSWR Verification SAR-EMI | System EMI Field SAR S-VSWR | - | ETS Lindgren/CETECOM | 24 M | - | 30.03.2019 |
| 557 | System CTC-OTA-2 | R&S TS8991 | - | Rohde & Schwarz | 12 M | 5 | 30.09.2016 |
| 558 | System CTC FAR S-VSWR | System CTC FAR S-VSWR | - | CTC | 24 M | - | 08.08.2019 |
| 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 F987001108 | Mini Circuits | - | 2 | |
| 618 | Power Splitter/Combiner | 50PD-634 | 600994 | JFW Industries USA | - | 2 | |
| 619 | Power Splitter/Combiner | 50PD-634 | 600995 | JFW Industries, USA | - | 3 | |
| 620 | EMI Test Receiver | ESU 26 | 100362 | Rohde-Schwarz | 12 M | - | 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 | 201.0999.9302.6.4.1.4 3 | 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 | CO3000/933/3841051 6/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 |

| Ref.-No. | Equipment | Type | Serial-No. | Manufacturer | Interval of calibration | Remark | Cal due |
|----------|-----------------------------|---------------|------------|--------------------|-------------------------|--------|------------|
| 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 | - | - | |
| 757 | CMW500 wide, Radio Comm. | CMW500 | 158150 | Rohde & Schwarz | 12 M | - | 01.05.2017 |

8.1.3. Legend

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

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

9. Versions of test reports (change history)

| Version | Applied changes | Date of release |
|---------|-----------------|-----------------|
| -- | Initial release | 2018-03-22 |
| -- | -- | -- |
| -- | -- | -- |