

Partial  
TEST REPORT  
No.: 16-1-0120001T02a-C2

According to:  
**CFR Title 47, Part 15, Subpart E**  
**§15.407 (U-NII)**  
for

Actia Nordic AB

VCM  
FCC: 2AGKKVCM

| Laboratory Accreditation and Listings                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div><p>Deutsche<br/>Akkreditierungsstelle<br/>D-PL 12047-01-01<br/>D-PL 12047-01-03<br/>D-PL 12047-01-04</p></div> <p>Accredited EMC-Test Laboratory</p>                                                                                       |
| accredited according to DIN EN ISO/IEC 17025                                                                                                                                                                                                                                                                                                                                                                          |
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| Laboratory Accreditation and Listings                                                                                                                                                                                                                                                                                                                                                                                 |

## Table of contents

|                                                                                            |           |
|--------------------------------------------------------------------------------------------|-----------|
| <b>1. SUMMARY OF TEST RESULTS.....</b>                                                     | <b>3</b>  |
| 1.1. Tests measurement overview according of US CFR Title 47, Subpart 15C Standards: ..... | 3         |
| <b>2. ADMINISTRATIVE DATA .....</b>                                                        | <b>7</b>  |
| 2.1. Identification of the testing laboratory .....                                        | 7         |
| 2.2. Test location .....                                                                   | 7         |
| 2.3. Organizational items .....                                                            | 7         |
| 2.4. Applicant's details .....                                                             | 7         |
| 2.5. Manufacturer's details .....                                                          | 7         |
| <b>3. EQUIPMENT UNDER TEST (EUT).....</b>                                                  | <b>8</b>  |
| 3.1. WLAN 5 GHz 802.11a/n Technical Data Of Main EUT as Declared by Applicant .....        | 8         |
| 3.2. EUT: Type, S/N etc. and short descriptions used in this test report .....             | 9         |
| 3.3. Auxiliary Equipment (AE): Type, S/N etc. and short descriptions .....                 | 9         |
| 3.4. EUT set-ups .....                                                                     | 9         |
| 3.5. EUT operating modes .....                                                             | 10        |
| 3.6. Configuration of cables used for testing .....                                        | 10        |
| 3.7. Worst Case Selection .....                                                            | 10        |
| <b>4. DESCRIPTION OF TEST SYSTEM SET-UP'S .....</b>                                        | <b>11</b> |
| 4.1. Test system set-up for conducted measurements on antenna port .....                   | 11        |
| 4.2. Test system set-up for radiated magnetic field measurements below 30 MHz .....        | 13        |
| 4.3. Test system set-up for radiated electric field measurement 30 MHz to 1 GHz .....      | 14        |
| 4.4. Test system set-up for radiated electric field measurement above 1 GHz .....          | 15        |
| <b>5. MEASUREMENTS .....</b>                                                               | <b>16</b> |
| 5.1. Duty Cycle .....                                                                      | 16        |
| 5.2. RF-Parameter - Transmitter output power (conducted and radiated) .....                | 17        |
| 5.3. RF Parameter –99% occupied Bandwidth .....                                            | 20        |
| 5.4. General Limit - Radiated field strength emissions below 30 MHz .....                  | 22        |
| 5.5. General Limit - Radiated field strength emissions, 30 MHz - 1 GHz.....                | 24        |
| 5.6. General Limit – Radiated field strength emissions, above 1 GHz .....                  | 26        |
| 5.7. RF-Parameter - Radiated Band Edge compliance measurements .....                       | 28        |
| 5.8. Measurement uncertainties .....                                                       | 30        |
| <b>6. INSTRUMENTS AND ANCILLARY.....</b>                                                   | <b>31</b> |
| <b>7. VERSIONS OF TEST REPORTS (CHANGE HISTORY) .....</b>                                  | <b>36</b> |

| Table of Annex                                              |                             |                             |             |
|-------------------------------------------------------------|-----------------------------|-----------------------------|-------------|
| Annex No.                                                   | Contents                    | Reference Description       | Total Pages |
| Annex 1                                                     | Test results                | CETECOM_16-1-0120001T02a-A1 | 68          |
| Annex 2                                                     | External photographs of EUT | CETECOM_16-1-0120001T01a-A2 | 4           |
| Annex 3                                                     | Internal photographs of EUT | CETECOM_16-1-0120001T01a-A3 | 10          |
| Annex 4                                                     | Test set-up photographs     | CETECOM_16-1-0120001T01a-A4 | 7           |
| 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 WLAN technology and operating frequency range at 5150 - 5850 GHz according to IEE 802.11 a/n . 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 1<sup>st</sup> November 2019 standards.

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

| Test cases                      | Port                         | References and Limits        |                                              | EUT set-up | EUT op. mode | Result    |
|---------------------------------|------------------------------|------------------------------|----------------------------------------------|------------|--------------|-----------|
|                                 |                              | FCC Standard                 | Test limit                                   |            |              |           |
| TX-Mode                         |                              |                              |                                              |            |              |           |
| 99% occupied bandwidth          | Antenna terminal (conducted) | 2.1049(h)                    | 99% Power bandwidth                          | 2          | 1            | Pass      |
| 26 dB bandwidth                 | Antenna terminal (conducted) | §15.303 + §15.407(a) (2) (5) | 26 dB spectral density bandwidth             | --         | --           | Remark 1) |
| Duty-Cycle                      | Antenna terminal (conducted) | KDB789033 + ANSI C63.10:2013 | No Limit Criteria                            | --         | --           | Performed |
| Transmitter frequency stability | Antenna terminal (conducted) | § 2.1055 + §15.407(g)        | Operation within designated operational band | --         | --           | Remark 1  |

|                             |                                             |                                                                                                                               |                                                                                                                                                                                                        |    |    |                                             |
|-----------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|---------------------------------------------|
| Maximum output power        | Antenna terminal (conducted)                | §15.407(a)<br>(1)(iv)<br>5.15-5.25 GHz<br>Client devices<br>(2)<br>5.25-5.35 GHz &<br>5.47-5.725 GHz<br>(3)<br>5.725-5.85 GHz | Power Limits (if<br>Antenna Gain < 6<br>dBi)<br>250 mW<br>lesser of 250mW<br>or 11dBm+10logB<br>1 W                                                                                                    | 2  | 1  | Pass                                        |
| Peak Power Spectral density | Antenna terminal (conducted)                | §15.407(a)<br>(1)(iv)<br>5.15-5.25 GHz<br>Client devices<br>(2)<br>5.25-5.35 GHz &<br>5.47-5.725 GHz<br>(3)<br>5.725-5.85 GHz | Power Spectral<br>Density Limits (if<br>Antenna Gain < 6<br>dBi)<br>11dBm/MHz<br>11dBm/MHz<br>30dBm/500kHz                                                                                             | -- | -- | Remark 1)                                   |
| Maximum e.i.r.p. power      | Antenna terminal (conducted) + Antenna Gain | §15.407(a)<br>(1)(iv)<br>5.15-5.25 GHz<br>Client devices<br>(2)<br>5.25-5.35 GHz &<br>5.47-5.725 GHz<br>(3)<br>5.725-5.85 GHz | e.i.r.p. Limits (if<br>Antenna Gain < 6<br>dBi)<br>250 mW + 6 dBi<br>lesser of 250mW<br>or 11dBm+10logB<br>+<br>6 dBi<br>1 W + 6 dBi                                                                   | 2  | 1  | Pass + Applicants declaration: Antenna Gain |
| Antenna gain information    | Antenna terminal (conducted)                | §15.407(a) (1)(2)(3)                                                                                                          | < 6dBi or<br>if Antenna<br>directional Gain ><br>6dBi reduction of<br>Max. power &<br>power spectral<br>density by the<br>amount in dB that<br>the directional gain<br>of the antenna<br>exceeds 6 dBi | -- | -- | Applicants declaration: Antenna Gain        |

|                                                                                                        |                                                |                                                                           |                                                                                                                                                                                                                                                      |    |     |                                                            |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|------------------------------------------------------------|
| General field strength emissions within restricted bands<br><br>+<br><br>Band-Edge compliance radiated | Enclosure + Inter-connecting cables (radiated) | §15.407(b)<br>(1)(2)(3)(4)(5)(6)<br>(7)(8)<br><br>§15.205<br>+<br>§15.209 | 5150-5250 MHz  <br>5250-5350 MHz<br>5470-5725 MHz<br>all emissions outside operating band shall not exceed -27 dBm/MHz e.i.r.p.<br><br>5725-5850 MHz<br>Spectrum Mask acc. to (4)(i)<br>Restricted band limits<br>+<br>General field strength limits | 1  | 1,2 | Pass                                                       |
| Transmit power control<br>+<br>Dynamic frequency selection (DFS)                                       | Antenna terminal (conducted)                   | §15.407<br>(h1)(h2)                                                       | Requirements:<br>Masters<br>Active clients<br>Passive clients                                                                                                                                                                                        | -- | --  | Remark 1)                                                  |
| Discontinuous transmissions<br>+<br>Device security                                                    | FIRMWARE                                       | §15.407(c)<br>+<br>§15.407(i)                                             | No transmissions in case of either absence of information to transmit or operational failure<br>+<br>Protection of firmware by unauthorized parties                                                                                                  | -- | --  | Not tested<br><br>Applicants declaration of implementation |
| AC-Power Lines Conducted Emissions                                                                     | AC-Power lines or Battery Charger              | §15.207(a)                                                                | AC Power line conducted limits                                                                                                                                                                                                                       | -- | --  | Not applicable                                             |

Remark 1) Please refer to separate modular test report MDE\_LESSW\_1302\_FCCa and MDE\_LESSW\_1302\_FCCb  
FCC ID: PV7.WIBEAR11N-DF1

| Specific Absorption Rate (SAR) Measurements<br>(separation distance user to RF-radiating element within 20cm) |                                                              |                                                                      |                                                                                                                                                                                     |               |                    |                                                                        |
|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------|------------------------------------------------------------------------|
| Test cases                                                                                                    | Port                                                         | References & Limits                                                  |                                                                                                                                                                                     | EUT<br>set-up | EUT<br>op.<br>mode | Result                                                                 |
|                                                                                                               |                                                              | FCC Standard                                                         | Test Limit                                                                                                                                                                          |               |                    |                                                                        |
| Specific<br>Absorption<br>Rate (SAR)<br>requirements                                                          | Cabinet<br>+<br>Inter-<br>connecting<br>cables<br>(radiated) | §2.1091<br>§2.1093<br>+<br>IEEE 1528-2013<br>+<br>KDB 865664D01v0r04 | <b>Specific Absorption<br/>Rate (SAR)</b> for<br>Devices Used by the<br>General Public<br><b>(Uncontrolled<br/>Environment)</b><br>: 1.6 W/Kg as<br>averaged over any 1 g<br>tissue | --            | --                 | Refer test report<br>Test report no.:<br>CETECOM_TR16-<br>1-0120001T04 |

Test report 16-1-0120001T02a-C2 dated 2020-08-03 replaces test report 16-1-00120001T02-C2, dated 2019-04-29. The replaced report gets invalid herewith.

.....  
Dipl.-Ing. Niels Jeß  
Head of Compliance Testing

.....  
B.Sc. Mohamed Ahmed  
Responsible for test report

## 2. Administrative Data

### 2.1. Identification of the testing laboratory

|                                  |                                                      |
|----------------------------------|------------------------------------------------------|
| Company name:                    | CETECOM GmbH                                         |
| Address:                         | Im Teelbruch 116<br>45219 Essen - Kettwig<br>Germany |
| Responsible for testing section: | Dipl.-Ing. N. Perez                                  |

### 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: | B.Sc. Mohamed Ahmed       |
| Project leader:              | Dipl.-Ing N. Perez        |
| Receipt of EUT:              | 2017-08-16                |
| Date(s) of test:             | 2016-08-01 to 2020-06-15  |
| Date of report:              | 2020-08-03                |
| -----                        |                           |
| Version of template:         | 13.02 , Mohamed [CETECOM] |

### 2.4. Applicant's details

|                   |                                                   |
|-------------------|---------------------------------------------------|
| Applicant's name: | Actia Nordic AB                                   |
| Address:          | Hammarbacken 4A<br>19149 SOLLENTUNA<br><br>Sweden |
| Contact person:   | Mr. Salah Alazawi                                 |

### 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. WLAN 5 GHz 802.11a/n Technical Data Of Main EUT as Declared by Applicant

|                                                               |                                                                                                                                                                                                                                                                |                                                          |                                                      |
|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|------------------------------------------------------|
| <b>EUT Model</b>                                              | VCM Combo Mid                                                                                                                                                                                                                                                  |                                                          |                                                      |
| <b>EUT Model Type</b>                                         | Vehicle Connectivity Master                                                                                                                                                                                                                                    |                                                          |                                                      |
| <b>Hardware Version</b>                                       | 31444563                                                                                                                                                                                                                                                       |                                                          |                                                      |
| <b>Software Version</b>                                       | C                                                                                                                                                                                                                                                              |                                                          |                                                      |
| <b>Firmware Version</b>                                       | IP21                                                                                                                                                                                                                                                           |                                                          |                                                      |
| Frequency   Channel   B.W.<br>(USA bands only)**              | U-NII 1: 5150-5250 MHz                                                                                                                                                                                                                                         | <input checked="" type="checkbox"/> Ch 36   40   44   48 | <input checked="" type="checkbox"/> Bandwidth 20 MHz |
|                                                               |                                                                                                                                                                                                                                                                | <input checked="" type="checkbox"/> Ch. 38   46          | <input checked="" type="checkbox"/> Bandwidth 40 MHz |
|                                                               |                                                                                                                                                                                                                                                                | <input type="checkbox"/> Ch. 42                          | <input type="checkbox"/> Bandwidth 80 MHz            |
|                                                               | U-NII2A: 5250-5350 MHz                                                                                                                                                                                                                                         | <input checked="" type="checkbox"/> Ch 52   56   60   64 | <input checked="" type="checkbox"/> Bandwidth 20 MHz |
|                                                               |                                                                                                                                                                                                                                                                | <input checked="" type="checkbox"/> Ch. 54   62          | <input checked="" type="checkbox"/> Bandwidth 40 MHz |
|                                                               |                                                                                                                                                                                                                                                                | <input type="checkbox"/> Ch. 58                          | <input type="checkbox"/> Bandwidth 80 MHz            |
|                                                               | U-NII 2C: 5470-5725 MHz                                                                                                                                                                                                                                        | <input checked="" type="checkbox"/> Ch 100   104   108   | <input checked="" type="checkbox"/> Bandwidth 20 MHz |
|                                                               |                                                                                                                                                                                                                                                                | <input checked="" type="checkbox"/> Ch 112   116   120   |                                                      |
|                                                               |                                                                                                                                                                                                                                                                | <input checked="" type="checkbox"/> Ch 124   128   132   |                                                      |
|                                                               |                                                                                                                                                                                                                                                                | <input checked="" type="checkbox"/> Ch 136   140         | <input checked="" type="checkbox"/> Bandwidth 40 MHz |
|                                                               |                                                                                                                                                                                                                                                                | <input checked="" type="checkbox"/> Ch. 102   110   118  |                                                      |
|                                                               |                                                                                                                                                                                                                                                                | <input checked="" type="checkbox"/> Ch 126   134         |                                                      |
|                                                               | U-NII 3: 5725 -5850 MHz                                                                                                                                                                                                                                        | <input type="checkbox"/> Ch 106   122                    | <input type="checkbox"/> Bandwidth 80 MHz            |
|                                                               |                                                                                                                                                                                                                                                                | <input checked="" type="checkbox"/> Ch 149   153   157   | <input checked="" type="checkbox"/> Bandwidth 20 MHz |
|                                                               |                                                                                                                                                                                                                                                                | <input checked="" type="checkbox"/> Ch 161   165         |                                                      |
|                                                               |                                                                                                                                                                                                                                                                | <input checked="" type="checkbox"/> Ch 151   159         | <input checked="" type="checkbox"/> Bandwidth 40 MHz |
|                                                               |                                                                                                                                                                                                                                                                | <input type="checkbox"/> Ch 155                          | <input type="checkbox"/> Bandwidth 80 MHz            |
| <b>Channels Power Settings</b>                                | +15 (According to Applicant's Declaration Max. Rated Power Values)                                                                                                                                                                                             |                                                          |                                                      |
| <b>802.11a – Mode OFDM Modulation   Data Rates</b>            | <input checked="" type="checkbox"/> BPSK   6 Mbps / 9 Mbps<br><input checked="" type="checkbox"/> QPSK   12 Mbps / 18 Mbps<br><input checked="" type="checkbox"/> 16-QAM   24 Mbps / 36 Mbps<br><input checked="" type="checkbox"/> 64-QAM   48 Mbps / 54 Mbps |                                                          |                                                      |
| <b>802.11n – Mode OFDM Modulation   Data Rates</b>            | <input checked="" type="checkbox"/> HT20 (MCS0 – MCS7)   7.2/14.4/21.7/28.9/43.3/57.8/65/72.2 Mbps<br><input checked="" type="checkbox"/> HT40 (MCS0 – MCS7)   15/30/45/60/90/120/135/150 Mbps                                                                 |                                                          |                                                      |
| <b>Antenna Details</b>                                        | <input checked="" type="checkbox"/> External, separate RF-connector                                                                                                                                                                                            |                                                          |                                                      |
| <b>Installed options (not tested within this test report)</b> | <input checked="" type="checkbox"/> 802.11b/g/n<br><input checked="" type="checkbox"/> GPS                                                                                                                                                                     | Installed options (not tested within this test report)   |                                                      |
| <b>Antenna Type</b>                                           | Multiband Antenna Module                                                                                                                                                                                                                                       |                                                          |                                                      |
| <b>ANT1 Gain:</b>                                             | 8.2 dBi                                                                                                                                                                                                                                                        |                                                          |                                                      |
| <b>Cable Pathloss:</b>                                        | 4.9 dB                                                                                                                                                                                                                                                         |                                                          |                                                      |
| <b>Internal Pathloss:</b>                                     | 2.5 dB                                                                                                                                                                                                                                                         |                                                          |                                                      |
| <b>Test Mode Settings</b>                                     | Power Setting for conducted Measurements:<br>UNII 1 2A 2C = 13 and for UNII 3 = 11<br>Power Setting for Radiated Measurement<br>UNII 1, 2A, 2C and 3 = 15                                                                                                      |                                                          |                                                      |
| <b>Power Supply</b>                                           | <input checked="" type="checkbox"/> DC power only: 12 Volt<br><input checked="" type="checkbox"/> Nominal Test Voltage : 12 Volt                                                                                                                               |                                                          |                                                      |
| <b>Special EMI Components</b>                                 | --                                                                                                                                                                                                                                                             |                                                          |                                                      |
| <b>EUT sample type</b>                                        | <input type="checkbox"/> Production                                                                                                                                                                                                                            | <input checked="" type="checkbox"/> Pre-Production       | <input type="checkbox"/> Engineering                 |
| <b>FCC label attached</b>                                     | <input checked="" type="checkbox"/> yes                                                                                                                                                                                                                        | <input type="checkbox"/> no                              |                                                      |
| <b>Documents provided from Customer</b>                       |                                                                                                                                                                                                                                                                |                                                          |                                                      |
| <b>Name</b>                                                   | <b>Version</b>                                                                                                                                                                                                                                                 | <b>Date</b>                                              | <b>Pages</b>                                         |
| Volvo_MAM_Data Sheet                                          | --                                                                                                                                                                                                                                                             | 2016                                                     | 14                                                   |
| Technical Description of VCM (5610_400035)                    | 1.6                                                                                                                                                                                                                                                            | 2020-07-03                                               | 11                                                   |
| Antenna Path Loss (5610_40039)                                | 1.0                                                                                                                                                                                                                                                            | 2018-03-28                                               | 1                                                    |

### 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               | VCM | Vehicle Connectivity Master | 10093027          | C                  | IP21               |
| EUT B               | VCM | Vehicle Connectivity Master | 10408484          | C                  | IP21               |

\*) 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                    | Main harness with power supply cables | --             | --                | --                 | --                 |
| AE 2                    | Multiband Antenna Module              | 31346764       | --                | --                 | --                 |
| AE 3                    | Dell Notebook                         | Latitude E6430 |                   |                    | Windows 7          |

\*) 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 B + AE 1 + (AE3)                 | Conducted measurement set-up<br>AE3 only used for Setting the TX Mode |
| set. 2            | EUT A + AE 1 + AE 2 + Cable 1+ (AE3) | Radiated Set-up<br>AE3 only used for Setting the TX Mode              |

\*) 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.*1) | Description of operating modes | Additional information                                                                                                                                                                            |
|---------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| op. 1                     | TX-Mode                        | With help of special test firmware TX-mode was set-up.<br>(VCM Certification Version 1.2.0.21 saved on AE3)<br>Power Setting for conducted Measurements:<br>UNII 1 2A 2C = 13 and for UNII 3 = 11 |
| op. 2                     | TX-Mode                        | With help of special test firmware TX-mode was set-up.<br>(VCM Certification Version 1.2.0.21 saved on AE3)<br>Power Setting for Radiated Measurement<br>UNII 1, 2A, 2C and 3 = 15                |

\*1) EUT operating mode no. is used to simplify the test report.

### 3.6. Configuration of cables used for testing

| Cable number | Description   | Connections | Cable length |
|--------------|---------------|-------------|--------------|
| Cable 1      | Antenna cable | Fakra       | 2.5m         |

### 3.7. Worst Case Selection

Worst Case Selection based on initial Power Results.

Due to Retest of the power Results Worst Case for Radiated may differ from Conducted Power Results.

Power Setting for Radiated was 15 and higher than the setting of conducted power.

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

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

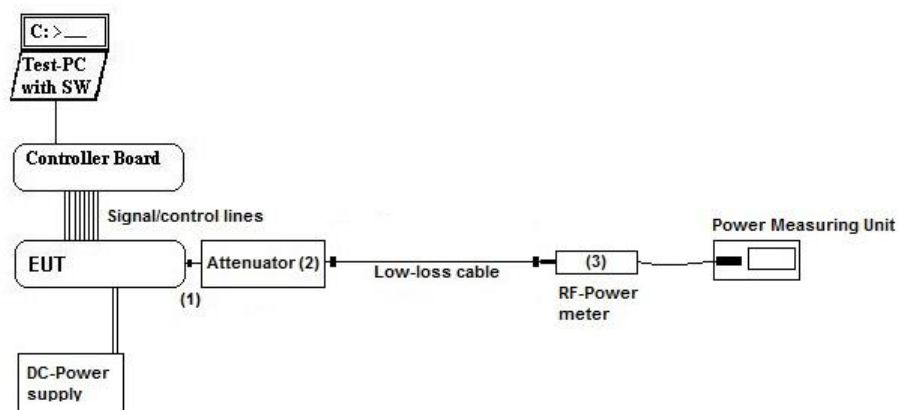
#### Conducted Set-up W1

#### Conducted RF-Setup 1 (W1 Set-up)

##### General description:

The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) then connected to the power meter (3) for conducted power measurements. The specific attenuation loss is determined prior to the measurement within a set-up attenuation measurement. These are then taken into account by correcting the measurement readings.

##### Schematic:



##### Testing method:

ANSI C63.10:2013,  
KDB 789033 D02 General UNII Test Procedures New Rules v02r01

##### Used Equipment

##### Passive Elements

##### Test Equipment

##### Remark:

- ☒ 20 dB Attenuator
- ☒ Low loss RF-cables
- ☒

- ☒ Power Meter
- ☒ DC-Power Supply
- ☒ Spectrum-Analyser

See List of equipment under each test case and chapter 6 for calibration info

##### Measurement uncertainty

See chapter 5.7

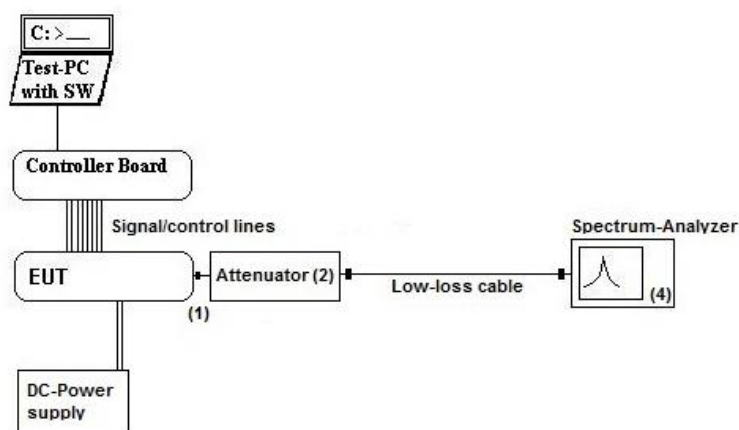
## Conducted Set-up W2

### Conducted RF-Setup 2 (W2 Set-up)

#### General description:

The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) then connected to spectrum-analyzer (4) for RF-conducted measurements. The specific attenuation loss is determined prior to the measurement within a set-up attenuation measurement. These are then taken into account by correcting the measurement readings of the spectrum-analyzer.

#### Schematic:



#### Testing method:

ANSI C63.10:2013,  
KDB 789033 D02 General UNII Test Procedures New Rules v01r03

#### Used Equipment

| Passive Elements                                       | Test Equipment                                        | Remark:                                                                       |
|--------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> 20 dB Attenuator   | <input checked="" type="checkbox"/> Power Meter       | See List of equipment under each test case and chapter 6 for calibration info |
| <input checked="" type="checkbox"/> Low loss RF-cables | <input checked="" type="checkbox"/> DC-Power Supply   |                                                                               |
|                                                        | <input checked="" type="checkbox"/> Spectrum-Analyser |                                                                               |

#### Measurement uncertainty

See chapter 5.7

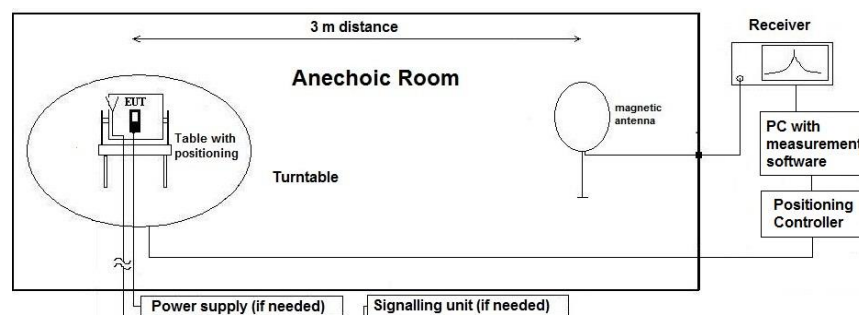
## 4.2. Test system set-up for radiated magnetic field measurements below 30 MHz

**Specification:** ANSI C63.4-2014 §5.3, §8.2.1, §8.3.1.1+§8.3.2.1 , ANSI C63.10-2013 chapter 6.4 (§6.4.4.2)

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

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

**Schematic:**



**Testing method:**

### Exploratory, preliminary measurement

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

### Final measurement on critical frequencies

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

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

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position).

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

**Formula:**

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

$$M = L_T - E_C$$

AF = Antenna factor

C<sub>L</sub> = Cable loss

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

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

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

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

L<sub>T</sub> = Limit

M = Margin

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

**Distance correction:**

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

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

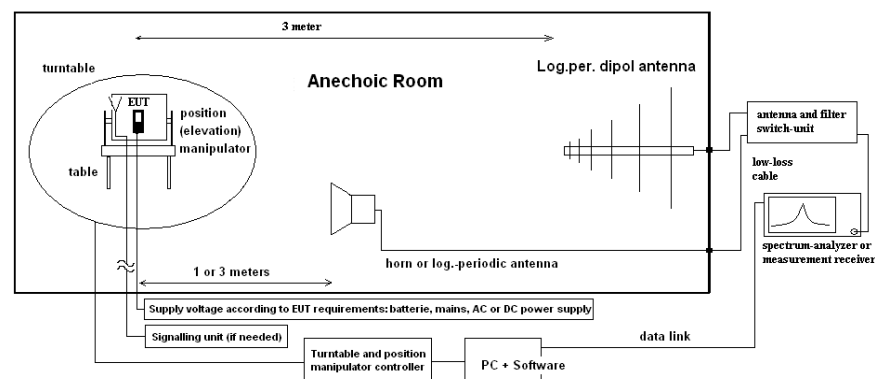


#### 4.4. Test system set-up for radiated electric field measurement above 1 GHz

**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 laying and Standing 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.

## 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 checked="" type="checkbox"/> 693 TS8997     | <input type="checkbox"/>                 | <input type="checkbox"/>             |
| Spectr. Analys.             | <input checked="" type="checkbox"/> 801 FSU           | <input type="checkbox"/> 120 FSEM            | <input type="checkbox"/> 264 FSEK           | <input checked="" type="checkbox"/> 693 TS8997     | <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 type="checkbox"/> 463 HP3245A |
| Supply Voltage              | <input type="checkbox"/> 230 V 50 Hz via public mains |                                              | <input checked="" type="checkbox"/> 12 V DC |                                                    |                                          |                                      |
| Otherwise                   | <input 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 contrast 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 1 channel for all sub-bands. It is assumed that no noticeable changes occur when tested on other channels or climatic conditions.

Calculated with following formulas:

|             |                                                   |                         |                                      |
|-------------|---------------------------------------------------|-------------------------|--------------------------------------|
| Duty cycle: | $x = \frac{T_{x_{on}}}{T_{x_{on}} + T_{x_{off}}}$ | Duty cycle factor [dB]: | $10 \log \left( \frac{1}{x} \right)$ |
|-------------|---------------------------------------------------|-------------------------|--------------------------------------|

#### Results:

|             |   |
|-------------|---|
| Set-up No.: | 1 |
| Op. Mode:   | 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 - Transmitter output power (conducted and radiated)

### 5.2.1. 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 type="checkbox"/> 337 OATS                  |
| receiver        | <input type="checkbox"/> 377 ESCS30                                | <input type="checkbox"/> 001 ESS                 | <input checked="" type="checkbox"/> 347 Radio.lab. |
| otherwise       | <input type="checkbox"/> 600 NRVD                                  | <input type="checkbox"/> 357 NRV-Z1              | <input type="checkbox"/> 489 ESU 40                |
| spectr. analys. | <input type="checkbox"/> 215 FSU                                   | <input type="checkbox"/> 120 FSEM                | <input type="checkbox"/> 620 ESU 26                |
| power supply    | <input type="checkbox"/> 456 EA 3013A                              | <input checked="" type="checkbox"/> 457 EA 3013A | <input type="checkbox"/> 264 FSEK                  |
| otherwise       | <input type="checkbox"/> 459 EA 2032-50                            | <input type="checkbox"/> 268 EA- 3050            | <input type="checkbox"/> 494 AG6632A               |
| Supply voltage  | <input type="checkbox"/> 230 V 50 Hz via public mains              | <input checked="" type="checkbox"/> 12 V DC      | <input type="checkbox"/> 530 10dB Atten            |
|                 | <input type="checkbox"/> 613 20 dB Attenuator                      | <input type="checkbox"/> 248 6 dB Attenuator     | <input type="checkbox"/> 529 Power divider         |
|                 | <input type="checkbox"/> 530 10dB Atten                            | <input type="checkbox"/> K5 Cable                | <input type="checkbox"/> - cable OTA20             |

### 5.2.2. Reference:

|                  |                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC              | <input checked="" type="checkbox"/> Part 15 Subpart C, §15.407(a)(1)(2)(3)(4)                                                                                                                                                                                                                                                                                                              |
| ANSI             | <input checked="" type="checkbox"/> C63.10-2013                                                                                                                                                                                                                                                                                                                                            |
| KDB Guidance no. | <input checked="" type="checkbox"/> KDB 789033 D02 General UNII Test Procedures New Rules v02r01: Subchapter E, Method PM (3)(b)<br><input type="checkbox"/> KDB 662911 D01 Multiple Transmitter Output v02r01 ( MIMO, Smart-antenna)                                                                                                                                                      |
| Limits           | <input checked="" type="checkbox"/> U-NII 1: 5.15-5.25 GHz:<br><b>FCC Outdoor access point:</b> 1W + antenna gain max. 6dBi + Elevation > 30° 21 dBm EIRP<br><b>FCC Indoor Access Point:</b> 1W + antenna gain max. 6dBi<br><b>FCC Mobile &amp; Portable client:</b> 250mW + antenna gain max. 6dBi<br><input checked="" type="checkbox"/> Antenna gain more 6dBi (-> reduction necessary) |
|                  | <input checked="" type="checkbox"/> U-NII2: 5.25-5.35 GHz:<br><b>FCC:</b> lesser of 250mW or 11dBm+10log <sub>10</sub> (B)                                                                                                                                                                                                                                                                 |
|                  | <input checked="" type="checkbox"/> U-NII2extension: 5.470-5.725 GHz:<br><b>FCC:</b> lesser of 250mW or 11dBm+10log <sub>10</sub> (B) + Antenna gain < 6dBi                                                                                                                                                                                                                                |
|                  | <input checked="" type="checkbox"/> U-NII3: 5.725-5.850 GHz:<br><b>FCC</b><br><input checked="" type="checkbox"/> max. conducted power: 1 Watt (30dBm)<br><input type="checkbox"/> Antenna gain less 6dBi<br><input checked="" type="checkbox"/> Antenna gain more 6dBi (-> reduction necessary)                                                                                           |

### 5.2.3. Antenna characteristics:

- ☒ directional gain < 6 dBi (Applicants declaration)
- ☐ directional gain > 6 dBi (measured / applicant's declaration)
- Maximum declared Antenna gain [ isotropic]: 8.2dBi
  - Due to long cables to antenna a pathloss of 4.9 dB is considered
  - Internal Losses are 2.5 dB

### 5.2.4. EUT settings:

The EUT was instructed to send with maximum power (if adjustable) according applicants instructions.

|             |   |
|-------------|---|
| Set-up No.: | 1 |
| Op. Mode:   | 1 |

### 5.2.5. Measurement method:

| Method used                                     | Reference to KDB                                                | Remarks:                                                                                                                                                                                                                                                                    |
|-------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> SA                     | KDB 789033 D02 General UNII Test Procedures<br>New Rules v02r01 | Integration bandwidth method                                                                                                                                                                                                                                                |
| <input checked="" type="checkbox"/> Power Meter | a.) Method PM                                                   | A wideband thermocouple RF-power meter as described by KDB was used.<br><input type="checkbox"/> Duty-Cycle correction necessary<br><input checked="" type="checkbox"/> A value correction is not necessary since the EUT is transmitting continuously at duty-cycle > 98%. |

#### 5.2.5.1.

#### a - 20MHz Bandwidth

| Operational bands:                                                         | U-NII 1                            |                         |                         | U-NII-2A                |                         |                         | U-NII 2C                 |                          |                          | U-NII-3                  |                          |                          |
|----------------------------------------------------------------------------|------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Channel no.:                                                               | Channel 36<br>(5180MHz)            | Channel 40<br>(5200MHz) | Channel 48<br>(5240MHz) | Channel 52<br>(5260MHz) | Channel 56<br>(5280MHz) | Channel 64<br>(5320MHz) | Channel 100<br>(5500MHz) | Channel 116<br>(5580MHz) | Channel 140<br>(5700MHz) | Channel 149<br>(5745MHz) | Channel 157<br>(5785MHz) | Channel 165<br>(5825MHz) |
|                                                                            | a-Mode/13 Power Setting            |                         |                         |                         |                         |                         |                          |                          |                          | a-Mode/11 Power Setting  |                          |                          |
| 6Mbit                                                                      | 10.3                               | 9.7                     | 7.6                     | 7.7                     | 9.1                     | 10.8                    | 11                       | 11.2                     | 11.9                     | 9.6                      | 9.6                      | 9.6                      |
| 9Mbit                                                                      | 10.4                               | 9.7                     | 7.6                     | 7.8                     | 8.9                     | 11                      | 11                       | 11.3                     | 11.7                     | 9.4                      | 9.6                      | 9.5                      |
| 12Mbit                                                                     | 10.4                               | 9.7                     | 7.5                     | 7.6                     | 8.9                     | 10.9                    | 11                       | 11.4                     | 12                       | 9.5                      | 9.3                      | 9.6                      |
| 18Mbit                                                                     | 10.4                               | 9.8                     | 7.6                     | 7.8                     | 9                       | 11                      | 11.2                     | 10.8                     | 12.1                     | 9.1                      | 9.3                      | 9.3                      |
| 24Mbit                                                                     | 10.5                               | 9.8                     | 7.8                     | 7.2                     | 8.9                     | 10.9                    | 11                       | 11.4                     | 12                       | 9.4                      | 9.7                      | 9.7                      |
| 36Mbit                                                                     | 10.1                               | 9.6                     | 7.4                     | 7.5                     | 8.7                     | 10.9                    | 10.9                     | 11.1                     | 11.9                     | 9.6                      | 9.6                      | 9.6                      |
| 48Mbit                                                                     | 10.4                               | 9.7                     | 7.5                     | 7.7                     | 8.9                     | 10.9                    | 11.1                     | 11.3                     | 12                       | 9.1                      | 9.7                      | 9.7                      |
| 54Mbit                                                                     | 10.1                               | 9.7                     | 7.6                     | 7.6                     | 8.8                     | 10.8                    | 11                       | 11.3                     | 11.9                     | 9.5                      | 9.6                      | 9.6                      |
| Operational bands:                                                         | (Outdoor use: EIRP-Limit of 21dBm) |                         |                         | U-NII-2A                |                         |                         | U-NII 2C                 |                          |                          | U-NII 3                  |                          |                          |
| FCC-Limits [dBm]                                                           | 24.00                              |                         |                         | 23.98                   |                         |                         | 23.98                    |                          |                          | 30.00                    |                          |                          |
|                                                                            |                                    |                         |                         |                         |                         |                         |                          |                          |                          |                          |                          |                          |
| Limit Check:                                                               | Limit Check:                       |                         |                         |                         |                         |                         |                          |                          |                          |                          |                          |                          |
| Highest conducted power value over channels and modulations on Fakra Port: | 10.50                              |                         |                         | 11.00                   |                         |                         | 12.10                    |                          |                          | 9.70                     |                          |                          |
| Internal Path Loss                                                         | 2.50                               |                         |                         | 2.50                    |                         |                         | 2.50                     |                          |                          | 2.50                     |                          |                          |
| Highest conducted power value over channels and modulations at the Module  | 13.00                              |                         |                         | 13.50                   |                         |                         | 14.60                    |                          |                          | 12.20                    |                          |                          |
| Declared antenna Gain:                                                     | 8.20                               |                         |                         | 8.20                    |                         |                         | 8.20                     |                          |                          | 8.20                     |                          |                          |
| Cable Loss                                                                 | 4.90                               |                         |                         | 4.90                    |                         |                         | 4.90                     |                          |                          | 4.90                     |                          |                          |
| Margin to Limit:                                                           | 7.70                               |                         |                         | 7.18                    |                         |                         | 6.08                     |                          |                          | 14.50                    |                          |                          |
| E.I.R.P in dBm:                                                            | 13.80                              |                         |                         | 14.30                   |                         |                         | 15.40                    |                          |                          | 13.00                    |                          |                          |
| Verdict:                                                                   | pass                               |                         |                         | pass                    |                         |                         | pass                     |                          |                          | pass                     |                          |                          |

## n - 20MHz Bandwidth

| Operational bands:                                                         | U-NII 1                                       |                         |                         | U-NII-2A              |                         |                         | U-NII 2C                 |                          |                          | U-NII-3                  |                          |                          |
|----------------------------------------------------------------------------|-----------------------------------------------|-------------------------|-------------------------|-----------------------|-------------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Channel no.:                                                               | Channel 36<br>(5180MHz)                       | Channel 40<br>(5200MHz) | Channel 48<br>(5240MHz) | Channel 52<br>5260MHz | Channel 56<br>(5280MHz) | Channel 64<br>(5320MHz) | Channel 100<br>(5500MHz) | Channel 116<br>(5580MHz) | Channel 140<br>(5700MHz) | Channel 149<br>(5745MHz) | Channel 157<br>(5785MHz) | Channel 165<br>(5825MHz) |
|                                                                            | n-Mode/13 Power Setting                       |                         |                         |                       |                         |                         |                          |                          |                          | n-Mode/11 Power Setting  |                          |                          |
| MCS0 - 6.5Mbps                                                             | 10.7                                          | 9.8                     | 7.4                     | 7.5                   | 9.1                     | 11.2                    | 11.3                     | 11.2                     | 11.8                     | 9.5                      | 9.7                      | 9.8                      |
| MCS1 - 13Mbps                                                              | 10.6                                          | 9.7                     | 7.6                     | 7.8                   | 8.9                     | 10.9                    | 11                       | 11                       | 11.8                     | 9.5                      | 9.5                      | 9.6                      |
| MCS2 - 19.5Mbps                                                            | 10.1                                          | 9.5                     | 7.4                     | 7.6                   | 8.8                     | 10.7                    | 10.9                     | 10.8                     | 11.6                     | 9.5                      | 9.5                      | 9.5                      |
| MCS3 - 26Mbps                                                              | 10.2                                          | 9.7                     | 7.4                     | 7.5                   | 8.6                     | 10.8                    | 10.8                     | 10.8                     | 11.7                     | 9.2                      | 9.3                      | 9.5                      |
| MCS4 - 39Mbps                                                              | 10.1                                          | 9.4                     | 7.2                     | 7.6                   | 8.6                     | 10.6                    | 10.7                     | 10.8                     | 11.4                     | 9.1                      | 9.2                      | 9.3                      |
| MCS5 - 52Mbps                                                              | 10.2                                          | 9.4                     | 7.3                     | 7.5                   | 8.9                     | 11                      | 11.2                     | 10.7                     | 11.4                     | 9.1                      | 9.3                      | 9.8                      |
| MCS6 - 58.5Mbps                                                            | 10                                            | 9.4                     | 7.5                     | 7.7                   | 9                       | 10.9                    | 11.2                     | 11.4                     | 12.1                     | 9.7                      | 9.8                      | 9.7                      |
| MCS7 - 65Mbps                                                              | 10.4                                          | 9.8                     | 7.5                     | 7.7                   | 9                       | 11                      | 11.1                     | 10.7                     | 11.4                     | 9.5                      | 9.8                      | 9.8                      |
| Operational bands:                                                         | U-NII 1<br>(Outdoor use: EIRP-Limit of 21dBm) |                         |                         | U-NII-2A              |                         |                         | U-NII 2C                 |                          |                          | U-NII 3                  |                          |                          |
| FCC-Limits [dBm]                                                           | 18.80                                         |                         |                         | 21.78                 |                         |                         | 21.78                    |                          |                          | 27.80                    |                          |                          |
|                                                                            |                                               |                         |                         |                       |                         |                         |                          |                          |                          |                          |                          |                          |
| Limit Check:                                                               | Limit Check:                                  |                         |                         |                       |                         |                         |                          |                          |                          |                          |                          |                          |
| Highest conducted power value over channels and modulations on Fakra Port: | 10.70                                         |                         |                         | 11.20                 |                         |                         | 12.10                    |                          |                          | 9.80                     |                          |                          |
| Internal Path Loss                                                         | 2.50                                          |                         |                         | 2.50                  |                         |                         | 2.50                     |                          |                          | 2.50                     |                          |                          |
| Highest conducted power value over channels and modulations at the Module  | 13.20                                         |                         |                         | 13.70                 |                         |                         | 14.60                    |                          |                          | 12.30                    |                          |                          |
| Declared antenna Gain:                                                     | 8.20                                          |                         |                         | 8.20                  |                         |                         | 8.20                     |                          |                          | 8.20                     |                          |                          |
| Cable Loss                                                                 | 4.90                                          |                         |                         | 4.90                  |                         |                         | 4.90                     |                          |                          | 4.90                     |                          |                          |
| Margin to Limit:                                                           | 2.30                                          |                         |                         | 4.78                  |                         |                         | 3.88                     |                          |                          | 12.20                    |                          |                          |
| E.I.R.P in dBm:                                                            | 14.00                                         |                         |                         | 14.50                 |                         |                         | 15.40                    |                          |                          | 13.10                    |                          |                          |
| Verdict:                                                                   | pass                                          |                         |                         | pass                  |                         |                         | pass                     |                          |                          | pass                     |                          |                          |

## n - 40MHz Bandwidth

| Operational bands:                                                         | U-NII 1                                       |                         | U-NII-2A                |                         | U-NII 2C                 |                          |                          | U-NII-3                  |                          |
|----------------------------------------------------------------------------|-----------------------------------------------|-------------------------|-------------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Channel no.:                                                               | Channel 38<br>(5190MHz)                       | Channel 46<br>(5230MHz) | Channel 54<br>(5270MHz) | Channel 62<br>(5310MHz) | Channel 102<br>(5550MHz) | Channel 118<br>(5590MHz) | Channel 134<br>(5670MHz) | Channel 151<br>(5755MHz) | Channel 159<br>(5815MHz) |
|                                                                            |                                               |                         |                         |                         |                          |                          |                          |                          |                          |
|                                                                            | n-Mode/13 Power Setting                       |                         |                         |                         |                          |                          |                          | n-Mode/11 Power Setting  |                          |
| MCS0 - 6.5Mbps                                                             | 10                                            | 7.9                     | 8.3                     | 10.3                    | 11.3                     | 11.4                     | 12                       | 9.5                      | 9.5                      |
| MCS1 - 13Mbps                                                              | 10                                            | 8                       | 8.2                     | 10.5                    | 11.2                     | 11.3                     | 12.1                     | 9.6                      | 9.5                      |
| MCS2 - 19.5Mbps                                                            | 10                                            | 8                       | 8.2                     | 10.4                    | 11.2                     | 11.4                     | 12                       | 9.4                      | 9.4                      |
| MCS3 - 26Mbps                                                              | 10                                            | 7.8                     | 8.3                     | 10.5                    | 11.2                     | 11.4                     | 12                       | 9.5                      | 9.5                      |
| MCS4 - 39Mbps                                                              | 10.1                                          | 7.9                     | 8.4                     | 10.3                    | 11.1                     | 11.4                     | 12                       | 9.5                      | 9.5                      |
| MCS5 - 52MBps                                                              | 9.8                                           | 7.8                     | 8.2                     | 10.3                    | 11                       | 11.3                     | 12                       | 9.5                      | 9.4                      |
| MCS6 - 58.5MBps                                                            | 9.9                                           | 7.8                     | 8                       | 10.3                    | 11                       | 11.4                     | 12.1                     | 9.6                      | 9.5                      |
| MCS7 - 65MBps                                                              | 9.7                                           | 7.7                     | 7.9                     | 10.2                    | 11.1                     | 11.3                     | 11.9                     | 9.5                      | 9.4                      |
|                                                                            |                                               |                         |                         |                         |                          |                          |                          |                          |                          |
| Operational bands:                                                         | U-NII 1<br>(Outdoor use: EIRP-Limit of 21dBm) |                         | U-NII-2A                |                         | U-NII 2C                 |                          |                          | U-NII 3                  |                          |
| FCC-Limits<br>[dBm]                                                        | 18.80                                         |                         | 21.78                   |                         | 21.78                    |                          |                          | 28.00                    |                          |
|                                                                            |                                               |                         |                         |                         |                          |                          |                          |                          |                          |
| Limit Check:                                                               | Limit Check:                                  |                         |                         |                         |                          |                          |                          |                          |                          |
| Highest conducted power value over channels and modulations on Fakra Port: | 10.1                                          |                         | 10.5                    |                         | 12.1                     |                          |                          | 9.6                      |                          |
| Internal Path Loss                                                         | 2.50                                          |                         | 2.50                    |                         | 2.50                     |                          |                          | 2.50                     |                          |
| Highest conducted power value over channels and modulations at the Module  | 12.60                                         |                         | 13.00                   |                         | 14.6                     |                          |                          | 12.10                    |                          |
| Declared antenna Gain:                                                     | 8.20                                          |                         | 8.20                    |                         | 8.20                     |                          |                          | 8.20                     |                          |
| Cable Loss                                                                 | 4.90                                          |                         | 4.90                    |                         | 4.90                     |                          |                          | 4.90                     |                          |
| Margin to Limit:                                                           | 5.40                                          |                         | 7.98                    |                         | 6.38                     |                          |                          | 15.10                    |                          |
| E.I.R.P in dBm:                                                            | 13.40                                         |                         | 13.80                   |                         | 15.40                    |                          |                          | 12.90                    |                          |
| Verdict:                                                                   | pass                                          |                         | pass                    |                         | pass                     |                          |                          | pass                     |                          |

### 5.2.6. Verdict: Pass

### 5.3. RF Parameter –99% occupied Bandwidth

#### 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 type="checkbox"/> 347 Radio.lab. <input checked="" type="checkbox"/> TS 8997                                                                                 | <input type="checkbox"/>                         | <input type="checkbox"/>                           |
| receiver        | <input type="checkbox"/> 377 ESCS30 <input type="checkbox"/> 001 ESS <input type="checkbox"/> 489 ESU 40                                                                                                                                      | <input type="checkbox"/>                         | <input type="checkbox"/>                           |
| spectr. analys. | <input checked="" type="checkbox"/> 801 FSU <input type="checkbox"/> 120 FSEM <input type="checkbox"/> 264 FSEK <input type="checkbox"/> 489 ESU 40                                                                                           | <input type="checkbox"/>                         | <input type="checkbox"/>                           |
| antenna         | <input type="checkbox"/> 574 BTA-L <input type="checkbox"/> 133 EMCO3115 <input type="checkbox"/> 302 BBHA9170 <input type="checkbox"/> 289 CBL 6141 <input type="checkbox"/> 030 HFH-Z2 <input type="checkbox"/> 477 GPS                     | <input type="checkbox"/>                         | <input type="checkbox"/>                           |
| signaling       | <input type="checkbox"/> 392 MT8820A <input type="checkbox"/> 436 CMU <input type="checkbox"/> 547 CMU                                                                                                                                        | <input type="checkbox"/>                         | <input type="checkbox"/>                           |
| otherwise       | <input type="checkbox"/> 266 NRV-Z31 <input type="checkbox"/> 600 NRVD <input type="checkbox"/> 110 USB LWL <input type="checkbox"/> 482 Filter Matrix <input type="checkbox"/> 378 RadiSense <input type="checkbox"/> 693 TS8997             | <input type="checkbox"/>                         | <input type="checkbox"/>                           |
| DC power        | <input checked="" type="checkbox"/> 671 EA-3013S <input type="checkbox"/> 463 HP3245A <input type="checkbox"/> 459 EA 2032-50 <input type="checkbox"/> 268 EA- 3050 <input type="checkbox"/> 494 AG6632A <input type="checkbox"/> 498 NGPE 40 | <input type="checkbox"/>                         | <input type="checkbox"/>                           |
| otherwise       | <input type="checkbox"/> 331 HC 4055 <input type="checkbox"/> 248 6 dB Attenuator <input type="checkbox"/> 529 Power divider <input type="checkbox"/> - cable OTA20                                                                           | <input type="checkbox"/>                         | <input type="checkbox"/>                           |
| Supply voltage  | <input checked="" type="checkbox"/> 12V DC <input type="checkbox"/> 060 110 V 60 Hz via PAS 5000                                                                                                                                              | <input type="checkbox"/>                         | <input type="checkbox"/>                           |

#### 5.3.2. Test condition and measurement test set-up

|                                |                                                                                                                 |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------|
| link to test system (if used): | <input type="checkbox"/> air link <input checked="" type="checkbox"/> cable connection <input type="checkbox"/> |
| Climatic conditions            | Temperature: (22±3°C) Rel. humidity: (40±20)%                                                                   |

#### 5.3.3. References of occupied and emission bandwidth

|                  |                                                                                                                                                                                                                                                                                                                           |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC              | <input checked="" type="checkbox"/> FCC 2.202 for information<br><input checked="" type="checkbox"/> Part 15 Subpart C, §15.407(e)                                                                                                                                                                                        |
| ANSI             | <input checked="" type="checkbox"/> C63.10-2013                                                                                                                                                                                                                                                                           |
| KDB Guidance no. | <input checked="" type="checkbox"/> 789033 D02 General UNII test procedures v02r01, Subchapter C                                                                                                                                                                                                                          |
| Limits           | <input checked="" type="checkbox"/> necessary for maximum power limits depending of B<br><input checked="" type="checkbox"/> FCC: decision if DFS necessary for decision if due 26dBc emissions falling in 5250-5350MHz band<br><input checked="" type="checkbox"/> FCC §15.407(e ): minimum 500kHz for band 5725-5850MHz |

#### 5.3.4. EUT Settings:

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

#### 5.3.5. Measurement method:

The **99% occupied 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%. The operating modes have been taken the maximum data rates, which had been found out at the output power conducted measurements.

#### 5.3.6. Spectrum-Analyzer Settings: (check if accord. KDB)

|                            |                                                                               |
|----------------------------|-------------------------------------------------------------------------------|
| Span                       | Set as to fully display the emissions and at least 26 dB below the PEAK level |
| Resolution Bandwidth (RBW) | Set to approx 1%                                                              |
| Video Bandwidth (VBW)      | 3 times the resolution bandwidth                                              |
| Sweep time                 | Coupled and low enough to have no gaps within power envelope                  |
| Detector                   | PK (26 dB BW)/Sample (99% OBW)                                                |
| Sweep mode                 | Repetitive Mode, MAX-HOLD                                                     |

### 5.3.7. Measurement Results

#### a mode :

| U-NII Band | Channel | Bandwidth (MHz) | Set up | Op mode | Result |
|------------|---------|-----------------|--------|---------|--------|
| 1          | 36      | 17              | 1      | 1       | Pass   |
| 2A         | 52      | 17              | 1      | 1       | Pass   |
| 2C         | 100     | <b>17.2</b>     | 1      | 1       | Pass   |
| 3          | 149     | 17              | 1      | 1       | Pass   |

#### n mode :

| U-NII Band | Channel | Bandwidth (MHz) | Set up | Op mode | Result |
|------------|---------|-----------------|--------|---------|--------|
| 1          | 36      | 18              | 1      | 1       | Pass   |
| 2A         | 52      | 18              | 1      | 1       | Pass   |
| 2C         | 100     | <b>18.2</b>     | 1      | 1       | Pass   |
| 3          | 149     | 18.2            | 1      | 1       | Pass   |

#### n40 mode :

| U-NII Band | Channel | Bandwidth (MHz) | Set up | Op mode | Result |
|------------|---------|-----------------|--------|---------|--------|
| 1          | 38      | 36.5            | 1      | 1       | Pass   |
| 2A         | 54      | 36.5            | 1      | 1       | Pass   |
| 2C         | 102     | <b>36.8</b>     | 1      | 1       | Pass   |
| 3          | 159     | 36.8            | 1      | 1       | Pass   |

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

### 5.4.1. 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 checked="" type="checkbox"/> 377 ESCS30                     | <input type="checkbox"/> 001 ESS                   | <input type="checkbox"/>                           |
| spectr. analys. | <input type="checkbox"/> 584 FSU                                   | <input type="checkbox"/> 120 FSEM                  | <input type="checkbox"/> 264 FSEK                  |
| antenna         | <input type="checkbox"/> 574 BTA-L                                 | <input type="checkbox"/> 133 EMCO3115              | <input type="checkbox"/> 302 BBHA9170              |
| signaling       | <input type="checkbox"/> 392 MT8820A                               | <input type="checkbox"/> 371 CBT32                 | <input type="checkbox"/> 547 CMU                   |
| otherwise       | <input type="checkbox"/> 400 FTC40x15E                             | <input type="checkbox"/> 401 FTC40x15E             | <input type="checkbox"/> 110 USB LWL               |
| DC power        | <input type="checkbox"/> 456 EA 3013A                              | <input checked="" type="checkbox"/> 457 EA 3013A   | <input type="checkbox"/> 459 EA 2032-50            |
| line voltage    | <input type="checkbox"/> 230 V 50 Hz via public mains              | <input checked="" type="checkbox"/> 12V DC         |                                                    |

### 5.4.2. Requirements

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

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

|                                       |                                               |                                                                                                                                                                                                                 |                                                |
|---------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| Signal link to test system (if used): | <input type="checkbox"/> air link             | <input type="checkbox"/> cable connection                                                                                                                                                                       | <input type="checkbox"/> none                  |
| EUT-grounding                         | <input checked="" type="checkbox"/> none      | <input type="checkbox"/> with power supply                                                                                                                                                                      | <input type="checkbox"/> additional connection |
| Equipment set up                      | <input checked="" type="checkbox"/> table top | <input type="checkbox"/> floor standing                                                                                                                                                                         |                                                |
| Climatic conditions                   | Temperature: (22±3°C) Rel. humidity: (40±20)% |                                                                                                                                                                                                                 |                                                |
| EMI-Receiver or Analyzer Settings     | Scan data                                     | <input checked="" type="checkbox"/> 9 – 150 kHz RBW/VBW = 200 Hz Scan step = 80 Hz<br><input checked="" type="checkbox"/> 150 kHz – 30 MHz RBW/VBW = 9 kHz Scan step = 4 kHz<br><input type="checkbox"/> other: |                                                |
|                                       | Scan-Mode                                     | <input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3dB Spectrum analyser Mode                                                                                                  |                                                |
|                                       | Detector                                      | Peak (pre-measurement) and Quasi-PK/Average (final if applicable)                                                                                                                                               |                                                |
|                                       | Mode:                                         | Repetitive-Scan, max-hold                                                                                                                                                                                       |                                                |
| Sweep-Time                            |                                               | 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"                                                                                                                       |                                                |

### 5.4.4. 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                       |        |
| 2.01a       | Low             | 64  | 9 kHz-30 MHz    | 2          | 2           | a-Mode 54Mbps   PWR 15     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.01b       | Low             | 64  | 9 kHz-30 MHz    | 2          | 2           | a-Mode 54Mbps   PWR 15     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.02a       | Middle          | 140 | 9 kHz-30 MHz    | 2          | 2           | n-Mode(HT20) MCS5   PWR 15 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.02b       | Middle          | 140 | 9 kHz-30 MHz    | 2          | 2           | n-Mode(HT20) MCS5   PWR 15 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.03a       | High            | 159 | 9 kHz-30 MHz    | 2          | 2           | n-Mode(HT40) MCS0   PWR 15 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 2.03b       | High            | 159 | 9 kHz-30 MHz    | 2          | 2           | n-Mode(HT40) MCS0   PWR 15 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: see diagrams in annex 1 for more details

#### 5.4.5. 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  $0.625 \times \lambda$ . Formula 2+3+4 as presented in ANSI C63.10, Chapter 6.4.4 are used for the calculations of proper extrapolation factors.

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

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

### 5.5.1. Test location and equipment

|                 |                                                                                                 |                                                                                            |                                                                        |
|-----------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| test location   | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1)                              | <input type="checkbox"/> Please see Chapter. 2.2.2                                         | <input type="checkbox"/> Please see Chapter. 2.2.3                     |
| test site       | <input checked="" type="checkbox"/> 441 EMI SAR <input checked="" type="checkbox"/> 487 SAR NSA |                                                                                            |                                                                        |
| receiver        | <input checked="" type="checkbox"/> 377 ESCS30 <input type="checkbox"/> 001 ESS                 | <input type="checkbox"/> 489 ESU 40 <input type="checkbox"/> 620 ESU 26                    |                                                                        |
| 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 <input type="checkbox"/> 289 CBL 6141                | <input type="checkbox"/> 030 HFH-Z2 <input type="checkbox"/> 477 GPS   |
| signalling      | <input type="checkbox"/> 392 MT8820A <input type="checkbox"/> 371 CBT32                         | <input type="checkbox"/> 547 CMU <input type="checkbox"/> 594 CMW                          |                                                                        |
| otherwise       | <input type="checkbox"/> 400 FTC40x15E <input type="checkbox"/> 401 FTC40x15E                   | <input type="checkbox"/> 110 USB LWL <input checked="" type="checkbox"/> 482 Filter Matrix |                                                                        |
| DC power        | <input type="checkbox"/> 456 EA 3013A <input checked="" type="checkbox"/> 457 EA 3013A          | <input type="checkbox"/> 459 EA 2032-50 <input type="checkbox"/> 268 EA- 3050              | <input type="checkbox"/> 494 AG6632A <input type="checkbox"/> 498 NGPE |
| line voltage    | <input type="checkbox"/> 230 V 50 Hz via public mains                                           | <input checked="" type="checkbox"/> 12V DC                                                 |                                                                        |

### 5.5.2. Requirements/Limits

|       |                 |                                                                                                                                                                 |                     |
|-------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| FCC   |                 | <input type="checkbox"/> Part 15 Subpart B, §15.109, class B<br><input checked="" type="checkbox"/> Part 15 Subpart C, §15.209 @ frequencies defined in §15.205 |                     |
| ANSI  |                 | <input type="checkbox"/> C63.4-2014<br><input checked="" type="checkbox"/> C63.10-2013                                                                          |                     |
| Limit | Frequency [MHz] | Radiated emissions limits, 3 meters                                                                                                                             |                     |
|       |                 | QUASI Peak [µV/m]                                                                                                                                               | QUASI-Peak [dBµV/m] |
|       | 30 - 88         | 100                                                                                                                                                             | 40.0                |
|       | 88 - 216        | 150                                                                                                                                                             | 43.5                |
|       | 216 - 960       | 200                                                                                                                                                             | 46.0                |
|       | above 960       | 500                                                                                                                                                             | 54.0                |

### 5.5.3. Restricted bands of operation FCC §15.205

| 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 |                     |               |             |

#### 5.5.4. 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:<br>Scan-Mode: <input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3 dB spectrum analyser mode<br>Detector: Peak / Quasi-peak<br>RBW/VBW: 100 kHz/300 kHz<br>Mode: Repetitive-Scan, max-hold<br>Scan step: 30 kHz<br>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"                                                                                                                                                                                                                                                                                                                                                                           |                                            |                                                |

#### 5.5.5. MEASUREMENT RESULTS

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                       |        |
| 3.01a       | Low             | 64  | 30 MHz – 1 GHz  | 2          | 2           | 54Mbit   EUT V   PWR 15       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.01b       | Low             | 64  | 30 MHz – 1 GHz  | 2          | 2           | 54Mbit   EUT H   PWR 15       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.02a       | Middle          | 140 | 30 MHz – 1 GHz  | 2          | 2           | MCS5   HT20   EUT V   PWR 15  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.02b       | Middle          | 140 | 30 MHz – 1 GHz  | 2          | 2           | MCS5   HT20   EUT H   PWR 15  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.03a       | High            | 159 | 30 MHz – 1 GHz  | 2          | 2           | MCS0   HT 40   EUT H   PWR 15 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |
| 3.03b       | High            | 159 | 30 MHz – 1 GHz  | 2          | 2           | MCS0   HT 40   EUT V   PWR 15 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: see diagrams in annex 1 for more details

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

### 5.6.1. 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 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 type="checkbox"/>                         | <input type="checkbox"/>         |
| 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     | <input checked="" type="checkbox"/> 302 BBHA9170 | <input type="checkbox"/> 477 GPS |
| antenna meas    | <input type="checkbox"/> 123 HUF-Z2        | <input type="checkbox"/> 132 HUF-Z3            | <input type="checkbox"/> 030 HFH-Z2                   | <input checked="" type="checkbox"/> 376 BBHA9120E |                                                  | <input type="checkbox"/>         |
| antenna subst   | <input type="checkbox"/> 071 HUF-Z2        | <input type="checkbox"/> 020 EMCO3115          | <input type="checkbox"/> 063 LP 3146                  | <input type="checkbox"/> 303 BBHA9170             | <input type="checkbox"/>                         | <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"/>         |
| 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 checked="" type="checkbox"/> 087 EA3013 | <input type="checkbox"/> 354 NGPE 40                  | <input type="checkbox"/> 349 car battery          | <input type="checkbox"/> 350 Car battery         | <input type="checkbox"/>         |
| line voltage    | <input checked="" type="checkbox"/> 12V DC |                                                | <input type="checkbox"/> 060 120 V 60 Hz via PAS 5000 |                                                   |                                                  |                                  |

### 5.6.2. Requirements/Limits

| <b>FCC</b>                                        | <input type="checkbox"/> Part 15 Subpart B, §15.109 class B<br><input checked="" type="checkbox"/> Part 15 Subpart C, §15.209 for frequencies defined in §15.205<br><input checked="" type="checkbox"/> Part 15 Subpart C, §15.407(b)(1)(2)(3)(4) |             |             |                                                                                                                                                                         |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ANSI</b>                                       | <input type="checkbox"/> C63.4-2014<br><input checked="" type="checkbox"/> C63.10-2013                                                                                                                                                            |             |             |                                                                                                                                                                         |
| Frequency [MHz]                                   | Limits                                                                                                                                                                                                                                            |             |             |                                                                                                                                                                         |
|                                                   | AV [µV/m]                                                                                                                                                                                                                                         | AV [dBµV/m] | Peak [µV/m] | Peak [dBµV/m] or [dBm/MHz]                                                                                                                                              |
| above 1 GHz for frequencies as defined in §15.205 | 500                                                                                                                                                                                                                                               | 54.0        | 5000        | 74.0 dBµV/m                                                                                                                                                             |
| §15.407(b)(1)(2)(3)(4)                            | --                                                                                                                                                                                                                                                | --          | --          | (b)(1): 5.15-5.25GHz: -27dBm eirp<br>(b)(2): 5.25-5.35GHz: -27dBm eirp<br>(b)(3): 5.47-5.725 GHz: -27dBm eirp (-17dBm/MHz eirp)<br>(b)(4): 5.725-5.85GHz: Spectrum mask |
| <b>FCC: Part 15B</b>                              | 500                                                                                                                                                                                                                                               | 54.0        | 5000        | 74.0 dBµV/m                                                                                                                                                             |

### 5.6.3. 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                            |                                                |
| Climatic conditions                   | Temperature: (22±3°C)<br>Rel. humidity: (40±20)%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                            |                                                |
| Spectrum-Analyzer settings            | Scan frequency range: <input checked="" type="checkbox"/> 1 – 18 GHz <input type="checkbox"/> 18 – 25 GHz <input type="checkbox"/> 18 – 40 GHz <input type="checkbox"/> other:<br>Scan-Mode: <input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3 dB Spectrum analyser Mode<br>Detector: Peak and Average<br>RBW/VBW: 1 MHz / 3 MHz<br>Mode: Repetitive-Scan, max-hold<br>Scan step: 400 kHz<br>Sweep-Time: 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"                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                            |                                                |

#### 5.6.4. Measurement Results

| Diagram no. | Carrier Channel |     | Frequency range | Set-up no. | OP-mode no. | Remark                          | Used detector                       |                                     |                          | Result |
|-------------|-----------------|-----|-----------------|------------|-------------|---------------------------------|-------------------------------------|-------------------------------------|--------------------------|--------|
|             | Range           | No. |                 |            |             |                                 | PK                                  | AV                                  | QP                       |        |
| 4.01        | Low             | 36  | 1GHz-7GHz       | 2          | 2           | 54Mbit   EUT V   PWR 15         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.02        | Low             | 36  | 1GHz-7GHz       | 2          | 2           | 54Mbit   EUT H   PWR 15         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.03        | High            | 165 | 1GHz-7GHz       | 2          | 2           | MCS5   HT20   EUT V   PWR 15    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.04        | High            | 165 | 1GHz-7GHz       | 2          | 2           | MCS5   HT20   EUT H   PWR 15    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.05        | Low             | 38  | 1GHz-7GHz       | 2          | 2           | MCS0   HT 40   EUT H   PWR 15   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.06        | Low             | 38  | 1GHz-7GHz       | 2          | 2           | MCS0   HT 40   EUT V   PWR 15   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.07        | High            | 159 | 1GHz-7GHz       | 2          | 2           | MCS0   HT 40   EUT H   PWR 15   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.08        | High            | 159 | 1GHz-7GHz       | 2          | 2           | MCS0   HT 40   EUT V   PWR 15   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.11        | Low             | 36  | 7GHz-18GHz      | 2          | 2           | 54Mbit   EUT V   PWR 15         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.12        | Low             | 36  | 7GHz-18GHz      | 2          | 2           | 54Mbit   EUT H   PWR 15         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.13        | High            | 165 | 7GHz-18GHz      | 2          | 2           | MCS5   HT20   EUT V   PWR 15    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.14        | High            | 165 | 7GHz-18GHz      | 2          | 2           | MCS5   HT20   EUT H   PWR 15    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.15        | Low             | 38  | 7GHz-18GHz      | 2          | 2           | MCS0   HT 40   EUT H   PWR 15   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.16        | Low             | 38  | 7GHz-18GHz      | 2          | 2           | MCS0   HT 40   EUT V   PWR 15   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.17        | High            | 159 | 7GHz-18GHz      | 2          | 2           | MCS0   HT 40   EUT H   PWR 15   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.18        | High            | 159 | 7GHz-18GHz      | 2          | 2           | MCS0   HT 40   EUT V   PWR 15   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.21        | Low             | 36  | 18GHz - 40GHz   | 2          | 2           | 54Mbit   EUT V/V   PWR 15       | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.22        | High            | 165 | 18GHz-40GHz     | 2          | 2           | MCS5   HT 0   EUT H/V   PWR 15  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.23        | Low             | 38  | 18GHz-40GHz     | 2          | 2           | MCS0   HT 40   EUT H/V   PWR 15 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.24        | High            | 159 | 18GHz-40GHz     | 2          | 2           | MCS0   HT 40   EUT H/V   PWR 15 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: see diagrams in annex 1 for more details

## 5.7. RF-Parameter - Radiated Band Edge compliance measurements

### 5.7.1. 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 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 type="checkbox"/>                 | <input type="checkbox"/>         |
| 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  | <input type="checkbox"/> 302 BBHA9170    | <input type="checkbox"/> 477 GPS |
| antenna meas    | <input type="checkbox"/> 123 HUF-Z2                                                              | <input type="checkbox"/> 132 HUF-Z3            | <input type="checkbox"/> 030 HFH-Z2             | <input type="checkbox"/>                       | <input type="checkbox"/>                 | <input type="checkbox"/>         |
| antenna subst   | <input type="checkbox"/> 071 HUF-Z2                                                              | <input type="checkbox"/> 020 EMCO3115          | <input type="checkbox"/> 063 LP 3146            | <input type="checkbox"/> 303 BBHA9170          | <input type="checkbox"/>                 | <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"/>         |
| signaling       | <input type="checkbox"/> 392 MT8820A                                                             | <input type="checkbox"/> 371 CBT32             | <input type="checkbox"/> 547 CMU                | <input type="checkbox"/> 594 CMW               | <input type="checkbox"/>                 | <input type="checkbox"/>         |
| DC power        | <input type="checkbox"/> 086 LNG50-10                                                            | <input checked="" type="checkbox"/> 087 EA3013 | <input type="checkbox"/> 354 NGPE 40            | <input type="checkbox"/> 349 car battery       | <input type="checkbox"/> 350 Car battery | <input type="checkbox"/>         |
| line voltage    | <input checked="" type="checkbox"/> 12V DC <input type="checkbox"/> 060 120 V 60 Hz via PAS 5000 |                                                |                                                 |                                                |                                          |                                  |

### 5.7.2. Requirements/Limits

|             |                                                                                                                                                                                                                                              |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>FCC</b>  | <input type="checkbox"/> Part 15 Subpart B, §15.109 class B<br><input checked="" type="checkbox"/> Part 15 Subpart C, §15.209 @ frequencies defined in §15.205 <input checked="" type="checkbox"/> Part 15 Subpart C, §15.407(b)(1)(2)(3)(4) |
| <b>ANSI</b> | <input type="checkbox"/> C63.4-2014 <input checked="" type="checkbox"/> C63.10-2013, Chapter 6.10.6                                                                                                                                          |

### 5.7.3. 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<br>Scan-Mode: <input type="checkbox"/> 6 dB EMI-Receiver Mode <input checked="" type="checkbox"/> 3 dB Spectrum analyser Mode<br>Detector: Peak and Average<br>RBW/VBW: Left band-edge: 100kHz/300kHz<br>Right band-edge: 1 MHz / 3 MHz<br>Mode: Repetitive-Scan, max-hold<br>Scan step: 40kHz or 400 kHz<br>Sweep-Time: 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

### 5.7.4. Measurement Method

For uncritical results where a measurement resolution bandwidth of 1MHz can clearly show the compliance without influencing the results, a field strength measurement was performed to show compliance.

For critical results a Marker-Delta marker method was used for showing compliance to restricted bands. The method is according ANSI C63.10:2013, Chapter 6.10.6 "Marker-Delta method",. The method consists of three independent steps:

- 1. Step:** Prior to the measurement the fundamental radiated In-Band field strength was performed. The determined value is used as reference value.
- 2. Step:** Second step consist of finding the relative attenuation between the fundamental emission and the maximum local out-of-band emission (within 2 MHz range around the band edge either on the band-edge directly or some modulation product if the level is greater than that on the band-edge) when measured with lower resolution bandwidth.
- 3. Step:** The delta value recorded in step 2 will be subtracted from value recorded in step 1, thus giving the required field strength at the band-edge. This value must fulfil the requirements for radiated spurious emissions in restricted bands in FCC §15.205 with the general limits of FCC §15.209

### 5.7.5. EUT settings

The EUT was instructed to send with maximum power (if adjustable) according to applicants instructions.

|             |   |
|-------------|---|
| Set-up No.: | 2 |
| Op. Mode:   | 2 |

### 5.7.6. Results:for non-restricted bands near-by

#### 5.7.6.1. Non-restricted bands near-by - limits according FCC §15.407

20 MHz

| Diagramm no. | Channel no. | Restricted band ? | Fundamental Value [dBuV/m] |               | Peak-Value at Band-Edge [dBuV/m] | Difference [dB] | Limit [dBc] | Margin [dB] | Verdict | Remark:                             |
|--------------|-------------|-------------------|----------------------------|---------------|----------------------------------|-----------------|-------------|-------------|---------|-------------------------------------|
|              |             |                   | Peak-Value                 | Average-Value |                                  |                 |             |             |         |                                     |
| 9.25         | 36          | no                | 97,009                     | 88,818        | 53,375                           | 43,634          | 20          | 23,634      | PASS    | Ch36 a-Mode 54Mbit Standing ExtAnt  |
| 9.26         | 36          | no                | 95,573                     | 87,874        | 53,656                           | 41,917          | 20          | 21,917      | PASS    | Ch36 a-Mode 54Mbit laying ExtAnt    |
| 9.29         | 100         | no                | 93,228                     | 85,718        | 52,873                           | 40,355          | 20          | 20,355      | PASS    | Ch100 a-Mode 54Mbit Laying ExtAnt   |
| 9.30         | 100         | no                | 95,167                     | 87,002        | 53,695                           | 41,472          | 20          | 21,472      | PASS    | Ch100 a-Mode 54Mbit Standing ExtAnt |
| 9.33         | 149         | no                | 91,827                     | 84,835        | 55,9                             | 35,927          | 20          | 15,927      | PASS    | Ch149 a-Mode 54Mbit Laying ExtAnt   |
| 9.34         | 149         | no                | 93,514                     | 85,356        | 55,9                             | 37,614          | 20          | 17,614      | PASS    | Ch149 a-Mode 54Mbit Standing ExtAnt |
| 9.49         | 36          | no                | 95,427                     | 88,085        | 53,458                           | 41,969          | 20          | 21,969      | PASS    | Ch36 n-Mode MCS5 Laying ExtAnt      |
| 9.50         | 36          | no                | 97,888                     | 89,401        | 53,3                             | 44,588          | 20          | 24,588      | PASS    | Ch36 n-Mode MCS5 Standing ExtAnt    |
| 9.53         | 100         | no                | 93,697                     | 85,189        | 53,626                           | 40,071          | 20          | 20,071      | PASS    | Ch100 n-Mode MCS5 Laying ExtAnt     |
| 9.54         | 100         | no                | 95,969                     | 87,869        | 53,816                           | 42,153          | 20          | 22,153      | PASS    | Ch100 n-Mode MCS5 Standing ExtAnt   |
| 9.57         | 149         | no                | 90,992                     | 83,491        | 57,819                           | 33,173          | 20          | 13,173      | PASS    | Ch149 n-Mode MCS5 Laying ExtAnt     |
| 9.58         | 149         | no                | 91,627                     | 83,879        | 46,8                             | 44,827          | 20          | 24,827      | PASS    | Ch149 n-Mode MCS5 Standing ExtAnt   |

40 MHz

| Diagramm no. | Channel no. | Restricted band ? | Fundamental Value [dBuV/m] |               | Peak-Value at Band-Edge [dBuV/m] | Difference [dB] | Limit [dBc] | Margin [dB] | Verdict | Remark:                           |
|--------------|-------------|-------------------|----------------------------|---------------|----------------------------------|-----------------|-------------|-------------|---------|-----------------------------------|
|              |             |                   | Peak-Value                 | Average-Value |                                  |                 |             |             |         |                                   |
| 9.73         | 38          | no                | 87,338                     | 79,017        | 52,669                           | 35              | 20          | 15          | PASS    | Ch38 n-Mode MCS0 Laying ExtAnt    |
| 9.74         | 38          | no                | 87,463                     | 79,509        | 52,413                           | 35              | 20          | 15          | PASS    | Ch38 n-Mode MCS0 Standing ExtAnt  |
| 9.77         | 102         | no                | 87,145                     | 78,583        | 42,482                           | 45              | 20          | 25          | PASS    | Ch102 n-Mode MCS0 Laying ExtAnt   |
| 9.78         | 102         | no                | 88,398                     | 80,817        | 53,21                            | 35              | 20          | 15          | PASS    | Ch102 n-Mode MCS0 Standing ExtAnt |
| 9.81         | 151         | no                | 85,037                     | 76,941        | 53,3                             | 32              | 20          | 12          | PASS    | Ch151 n-Mode MCS0 Laying ExtAnt   |
| 9.82         | 151         | no                | 85,028                     | 76,289        | 53,3                             | 32              | 20          | 12          | PASS    | Ch151 n-Mode MCS0 Standing ExtAnt |

#### 5.7.6.2. Restricted bands near-by

(\$15.205 with limits accord. FCC §15.209)

20 MHz

| Diagramm no. | Channel no. | Restricted band ? | Fundamental Value [dBuV/m] |               | Value at Band-Edge [dBuV/m] |                | Limits [dBuV/m] |                | Margin [dB] |         | Verdict | Remark:                             |
|--------------|-------------|-------------------|----------------------------|---------------|-----------------------------|----------------|-----------------|----------------|-------------|---------|---------|-------------------------------------|
|              |             |                   | Peak-Value                 | Average-Value | Peak -Value                 | Average -Value | Peak -Value     | Average -Value | Peak        | Average |         |                                     |
| 9.27         | 64          | yes               | 93,379                     | 85,000        | 54,233                      | 43,365         | 74              | 54             | 19,767      | 10,635  | PASS    | Ch64 a-Mode 54Mbit laying ExtAnt    |
| 9.28         | 64          | yes               | 94,466                     | 86,854        | 54                          | 43,699         | 74              | 54             | 20          | 10,301  | PASS    | Ch64 a-Mode 54Mbit Standing ExtAnt  |
| 9.31         | 140         | yes               | 92,423                     | 85,417        | 53,3                        | 43,423         | 74              | 54             | 20,7        | 10,577  | PASS    | Ch140 a-Mode 54Mbit Laying ExtAnt   |
| 9.32         | 140         | yes               | 93,252                     | 86,569        | 53,3                        | 43,445         | 74              | 54             | 20,7        | 10,555  | PASS    | Ch140 a-Mode 54Mbit Standing ExtAnt |
| 9.35         | 165         | yes               | 91,404                     | 84,499        | 55,675                      | 45,147         | 74              | 54             | 18,325      | 8,853   | PASS    | Ch165 a-Mode 54Mbit laying ExtAnt   |
| 9.36         | 165         | yes               | 93,087                     | 84,983        | 55,039                      | 45,089         | 74              | 54             | 18,961      | 8,911   | PASS    | Ch165 a-Mode 54Mbit Standing ExtAnt |
| 9.51         | 64          | yes               | 94,112                     | 87,123        | 55                          | 45             | 74              | 54             | 19          | 9       | PASS    | Ch64 n-Mode MCS5 Laying ExtAnt      |
| 9.52         | 64          | yes               | 94,537                     | 85,952        | 54,184                      | 43,911         | 74              | 54             | 19,816      | 10,089  | PASS    | Ch64 n-Mode MCS5 Standing ExtAnt    |
| 9.55         | 140         | yes               | 92,309                     | 84,079        | 53,3                        | 42,9           | 74              | 54             | 20,7        | 11,1    | PASS    | Ch140 n-Mode MCS5 Laying ExtAnt     |
| 9.56         | 140         | yes               | 92,988                     | 85,964        | 53,3                        | 43,227         | 74              | 54             | 20,7        | 10,773  | PASS    | Ch140 n-Mode MCS5 Standing ExtAnt   |
| 9.59         | 165         | yes               | 91,892                     | 83,724        | 55,729                      | 45,053         | 74              | 54             | 18,271      | 8,947   | PASS    | Ch165 n-Mode MCS5 Laying ExtAnt     |
| 9.60         | 165         | yes               | 92,641                     | 85,032        | 55,429                      | 45,147         | 74              | 54             | 18,571      | 8,853   | PASS    | Ch165 n-Mode MCS5 Standing ExtAnt   |

40 MHz

| Diagramm no. | Channel no. | Restricted band ? | Fundamental Value [dBuV/m] |               | Value at Band-Edge [dBuV/m] |                | Limits [dBuV/m] |                | Margin [dB] |         | Verdict | Remark:                           |
|--------------|-------------|-------------------|----------------------------|---------------|-----------------------------|----------------|-----------------|----------------|-------------|---------|---------|-----------------------------------|
|              |             |                   | Peak-Value                 | Average-Value | Peak -Value                 | Average -Value | Peak -Value     | Average -Value | Peak        | Average |         |                                   |
| 9.75         | 62          | yes               | 87,535                     | 79,251        | 53,399                      | 43,175         | 74              | 54             | 20,601      | 10,825  | PASS    | Ch62 n-Mode MCS0 Laying ExtAnt    |
| 9.76         | 62          | yes               | 85,212                     | 78,553        | 53,3                        | 43,327         | 74              | 54             | 20,7        | 10,673  | PASS    | Ch62 n-Mode MCS0 Standing ExtAnt  |
| 9.79         | 134         | yes               | 84,776                     | 76,426        | 52,935                      | 42,642         | 74              | 54             | 21,065      | 11,358  | PASS    | Ch134 n-Mode MCS0 Laying ExtAnt   |
| 9.80         | 134         | yes               | 86,706                     | 79,11         | 53,3                        | 42,628         | 74              | 54             | 20,7        | 11,372  | PASS    | Ch134 n-Mode MCS0 Standing ExtAnt |
| 9.83         | 159         | yes               | 85,403                     | 77,849        | 54,843                      | 44,471         | 74              | 54             | 19,157      | 9,529   | PASS    | Ch159 n-Mode MCS0 Laying ExtAnt   |
| 9.84         | 159         | yes               | 84,737                     | 76,741        | 54,836                      | 44,499         | 74              | 54             | 19,164      | 9,501   | PASS    | Ch159 n-Mode MCS0 Standing ExtAnt |

#### 5.7.7. Verdict: passed

## 5.8. Measurement uncertainties

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

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

Following table shows expectable uncertainties for each measurement type performed.

| RF-Measurement                            | Reference    | Frequency range                                      | Calculated uncertainty based on a confidence level of 95% |        |      |      |      |    |                      | Remarks                                   |
|-------------------------------------------|--------------|------------------------------------------------------|-----------------------------------------------------------|--------|------|------|------|----|----------------------|-------------------------------------------|
| Conducted emissions (U <sub>CISPR</sub> ) | CISPR 16-2-1 | 9 kHz - 150 kHz<br>150 kHz - 30 MHz                  | 4.0 dB<br>3.6 dB                                          |        |      |      |      |    |                      | -                                         |
| Radiated emissions Enclosure              | CISPR 16-2-3 | 30 MHz - 1 GHz<br>1 GHz - 18 GHz                     | 4.2 dB<br>5.1 dB                                          |        |      |      |      |    |                      | E-Field                                   |
| Disturbance power                         | CISPR 16-2-2 | 30 MHz - 300 MHz                                     | -                                                         |        |      |      |      |    |                      | -                                         |
| Power Output radiated                     | -            | 30 MHz - 4 GHz                                       | 3.17 dB                                                   |        |      |      |      |    |                      | Substitution method                       |
| Power Output conducted                    | -            | Set-up No.                                           | Cel-C1                                                    | Cel-C2 | BT1  | W1   | W2   | -- | -                    |                                           |
|                                           |              | 9 kHz - 12.75 GHz                                    | N/A                                                       | 0.60   | 0.7  | 0.25 | N/A  | -- |                      |                                           |
|                                           |              | 12.75 - 26.5GHz                                      | N/A                                                       | 0.82   | --   | N/A  | N/A  | -- |                      |                                           |
| Conducted emissions on RF-port            | -            | 9 kHz - 2.8 GHz                                      | 0.70                                                      | N/A    | 0.70 | N/A  | 0.69 | -- | N/A - not applicable |                                           |
|                                           |              | 2.8 GHz - 12.75GHz                                   | 1.48                                                      | N/A    | 1.51 | N/A  | 1.43 | -- |                      |                                           |
|                                           |              | 12.75 GHz - 18GHz                                    | 1.81                                                      | N/A    | 1.83 | N/A  | 1.77 | -- |                      |                                           |
|                                           |              | 18 GHz - 26.5GHz                                     | 1.83                                                      | N/A    | 1.85 | N/A  | 1.79 | -- |                      |                                           |
| 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<br>30 MHz - 1 GHz<br>1 GHz - 20 GHz | 5.0 dB<br>4.2 dB<br>3.17 dB                               |        |      |      |      |    |                      | Magnetic field<br>E-field<br>Substitution |

**Table: measurement uncertainties, valid for conducted/radiated measurements**

## 6. Instruments and Ancillary

24. Jun. 20

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

### 6.0.1. Test software and firmware of equipment

| Ref.-No. | Equipment                               | Type                   | Serial-No.  | Version of Firmware or Software during the test                                                 |
|----------|-----------------------------------------|------------------------|-------------|-------------------------------------------------------------------------------------------------|
| 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                                              |
| 119      | RT Harmonics Analyzer dig. Flickermeter | B10                    | G60547      | Firm.= V 3.1DHG                                                                                 |
| 261      | Thermal Power Sensor                    | NRV-Z55                | 825083/0008 | EPROM-Datum 02.12.04, SE EE 1 B                                                                 |
| 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                                                                           |
| 366      | Ultra Compact Simulator                 | UCS 500 M4             | V0531100594 | Firm. UCS 500=001925/3.06a02, rc=ISMIEC 4.10                                                    |
| 377      | EMI Test Receiver                       | ESCS 30                | 100160      | Firm.= 2.30, OTP= 02.01, GRA= 02.36                                                             |
| 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=          |
| 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 |
| 442      | CTC-SAR-EMS                             | System EMS field (SAR) | -           | EMC 32 Version 8.40                                                                             |
| 443      | CTC-FAR-EMI-RSE                         | System CTC-FAR-EMI-    | -           | 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     |
| 584      | Spectrum Analyzer                       | FSU 8                  | 100248      | 2.82_SP3                                                                                        |
| 597      | Univ. Radio Communication Tester        | CMU 200                | 100347      | R&S Test Firmware Base=5.01, GSM=5.02 WCDMA= not installed, Mainboard= µP1=V.850                |
| 620      | EMI Test Receiver                       | ESU 26                 | 100362      | 4.43_SP3                                                                                        |
| 670      | Univ. Radio Communication Tester        | CMU 200                | 106833      | µP1 =V8.50, Firmware = V.20                                                                     |
| 689      | Vector Signal Generator                 | SMU200                 | 100970      | 02.20.360.142                                                                                   |
| 692      | Bluetooth Tester                        | CBT 32                 | 100236      | CBT V 5.40, FW: V.2.41 (FPGA Digital, V. 3.09 FPGA RF)                                          |
| 693      | TS8997                                  | Test System            | --          | 866 FSV3030<br>559 SMU200A<br>687 SMF100A<br>691 OSP120<br>805 OSP 157WX<br>866 FSV3030         |

## 6.0.2. Single instruments and test systems

| Ref.-No. | Equipment                               | Type                          | Serial-No.                | Manufacturer          | Interval of calibration | Remark | Cal due    |
|----------|-----------------------------------------|-------------------------------|---------------------------|-----------------------|-------------------------|--------|------------|
| 005      | AC - LISN (50 Ohm/50µH, test site 1)    | ESH2-Z5                       | 861741/005                | Rohde & Schwarz       | 12 M                    | -      | 13.05.2021 |
| 007      | Single-Line V-Network (50 Ohm/5µH)      | ESH3-Z6                       | 892563/002                | Rohde & Schwarz       | 12 M                    | -      | 13.05.2021 |
| 009      | Power Meter (EMS-radiated)              | NRV                           | 863056/017                | Rohde & Schwarz       | 24 M                    | -      | 23.05.2021 |
| 011      | Insertion Unit (EMS-radiated)           | URV5-Z2                       | 864169/004                | Rohde & Schwarz       | 24 M                    | -      |            |
| 012      | Signal Generator (EMS-cond.)            | SMY 01                        | 839069/027                | Rohde & Schwarz       | 24 M                    | -      | 21.05.2021 |
| 013      | Power Meter (EMS cond.)                 | NRVD                          | 839111/003                | Rohde & Schwarz       | 24 M                    | -      | 20.05.2021 |
| 014      | Insertion Unit (EMS cond.)              | URV5-Z2                       | 838519/029                | Rohde & Schwarz       | 24 M                    | -      | 20.05.2021 |
| 015      | Insertion Unit (EMS cond.)              | URV5-Z4                       | 838570/024                | Rohde & Schwarz       | 24 M                    | -      | 20.05.2021 |
| 016      | Line Impedance Simulating Network       | Op. 24-D                      | B6366                     | Spitzenberger+Spies   | 36 M                    | -      | 22.05.2022 |
| 017      | Digital Radiocommunication Tester       | CMD 60 M                      | 844365/014                | Rohde & Schwarz       | pre-m                   | 3      |            |
| 020      | Horn Antenna 18 GHz (Subst 1)           | 3115                          | 9107-3699                 | EMCO                  | 36/12 M                 | -      | 31.07.2021 |
| 021      | Loop Antenna (H-Field)                  | 6502                          | 9206-2770                 | EMCO                  | 36 M                    | -      | 30.05.2021 |
| 031      | Absorbing Clamp                         | MDS-21                        | 863325/015                | Rohde & Schwarz       | 36 M                    | -      | 30.06.2021 |
| 033      | RF-current probe (100kHz-30MHz)         | ESH2-Z1                       | 879581/18                 | Rohde & Schwarz       | 24 M                    | -      | 23.05.2021 |
| 049      | Current Clamp (injection)               | F-120-2                       | 48                        | FCC                   | 24 M                    | -      | 22.05.2022 |
| 050      | 3-ph Coupling Decoupling Netw. (Burst)  | CDN 300                       | 176                       | Schaffner             | 36 M                    | -      | 30.05.2021 |
| 051      | VHF-Current Probe 20-300 MHz            | ESV-Z1                        | 872421                    | Rohde & Schwarz       | 36 M                    | -      | 30.05.2021 |
| 052      | Notch Filter DECT                       | WRCB 1887,82/1889,55SS        | 12                        | Wainwright Industries | pre-m                   | 2      |            |
| 057      | relay-switch-unit (EMS system)          | RSU                           | 494440/002                | Rohde & Schwarz       | pre-m                   | 1a     |            |
| 058      | capacitive clamp (Burst)                | IP 4                          | 99                        | Haefely               | 36 M                    | -      | 30.05.2021 |
| 060      | power amplifier (DC-2kHz)               | PAS 5000                      | B6363                     | Spitzenberger+Spies   | -                       | 3      |            |
| 065      | attenuator, (6 dB) 50 Ohm, 250W         | AT 50-6-250                   | 521057                    | BNOS Electronics      | 12 M                    | 1b     | 10.04.2021 |
| 066      | notch filter (WCDMA; FDD1)              | WRCT 1900/2200-5/40-10EEK     | 5                         | Wainwright GmbH       | 12 M                    | 1g     | 20.10.2020 |
| 067      | coupling decoupling-network             | CDN 801-M2/M3                 | 272                       | Lüthi                 | 36 M                    | -      | 19.05.2023 |
| 069      | EM - clamp                              | EM101                         | 9535159                   | Lüthi                 | 36 M                    | -      | 27.08.2022 |
| 072      | coupling decoupling-network             | CDN 801-M2/M3                 | 276                       | Lüthi                 | 36 M                    | -      | 19.05.2023 |
| 083      | AC - power supply, 0-10 A               | EAC/MT 27010                  | 910502096                 | EURO TEST             | pre-m                   | 2      |            |
| 084      | AC - power supply, 0-5 A                | ELABO-8-34214                 | -                         | ELABO                 | pre-m                   | 2      |            |
| 085      | AC - power supply, 0-10 A               | R250                          | -                         | Schunterm.&Benningh.  | pre-m                   | 2      |            |
| 086      | DC - power supply, 0 -10 A              | LNG 50-10                     | -                         | Heinzinger Electronic | pre-m                   | 2      |            |
| 087      | DC - power supply, 0 -5 A               | EA-3013 S                     | -                         | Elektro Automatik     | pre-m                   | 2      |            |
| 090      | Helmholtz coil: 2x10 coils in series    | Helmholtz coil: 2x10 coils in | -                         | RWTÜV                 | 24 M                    | 4      | 26.05.2022 |
| 091      | USB-LWL-Converter                       | OLS-1                         | 007/2006                  | Ing. Büro Scheiba     | -                       | 4      |            |
| 094      | artificial head (No.1)                  | 4905                          | 1566990                   | Brüel & Kjaer         | pre-m                   | 2      |            |
| 099      | passive voltage probe                   | ESH2-Z3                       | 299.7810.52               | Rohde & Schwarz       | 36 M                    | -      | 30.05.2021 |
| 100      | passive voltage probe                   | Probe TK 9416                 | without                   | Schwarzbeck           | 36 M                    | -      | 30.05.2021 |
| 110      | USB-LWL-Converter                       | OLS-1                         | -                         | Ing. Büro Scheiba     | -                       | 4      |            |
| 119      | RT Harmonics Analyzer dig. Flickermeter | B10                           | G60547                    | BOCONSULT             | 36 M                    | -      | 22.05.2022 |
| 121      | notch filter GSM 1900                   | WRCB 1879,5/1880,5EE          | 15                        | Wainwright GmbH       | 12 M                    | 1d     | 20.10.2020 |
| 122      | notch filter GSM 1800                   | WRCB 1747/1748                | 12                        | Wainwright GmbH       | 12 M                    | 1c     | 20.10.2020 |
| 131      | RF-Current Probe                        | F-52                          | 19                        | FCC                   | 36 M                    | -      | 22.05.2023 |
| 133      | horn antenna 18 GHz (Meas 1)            | 3115                          | 9012-3629                 | EMCO                  | 36 M                    | 1c     | 08.04.2023 |
| 134      | horn antenna 18 GHz (Subst 2)           | 3115                          | 9005-3414                 | EMCO                  | 36 M                    | -      | 10.03.2020 |
| 142      | attenuator (6 dB) 2 W, 8 GHz            | DGL N                         | -                         | Radiall               | 12 M                    | 1b     | 14.04.2021 |
| 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      |            |
| 254      | high pass GSM1800/1900/DECT             | 5HC 2600/12750-1.5KK          | 23042                     | Trilithic             | 12 M                    | 1c     | 20.10.2020 |
| 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                    | -      | 19.05.2022 |
| 267      | notch filter GSM 850                    | WRCA 800/960-6EEK             | 9                         | Wainwright GmbH       | pre-m                   | 2      |            |
| 268      | AC/DC power supply                      | EA 3050-A                     | 9823636                   | Elektro Automatik     | pre-m                   | -      |            |
| 270      | termination                             | 1418 N                        | BB6935                    | Weinschel             | pre-m                   | 2      |            |
| 271      | termination                             | 1418 N                        | BE6384                    | Weinschel             | pre-m                   | 2      |            |
| 272      | attenuator (20 dB) 50 W                 | Model 47                      | BF6239                    | Weinschel             | pre-m                   | 2      |            |
| 273      | attenuator (10 dB) 100 W                | Model 48                      | BF9229                    | Weinschel             | pre-m                   | 2      |            |
| 274      | attenuator (10 dB) 50 W                 | Model 47 (10 dB) 50 W         | BG0321                    | Weinschel             | pre-m                   | 2      |            |
| 275      | DC-Block                                | Model 7003 (N)                | C5129                     | Weinschel             | pre-m                   | 2      |            |
| 276      | DC-Block                                | Model 7006 (SMA)              | C7061                     | Weinschel             | pre-m                   | 2      |            |
| 279      | power divider                           | 1515 (SMA)                    | LH855                     | Weinschel             | pre-m                   | 2      |            |
| 284      | coupling decoupling network             | CDN 801-M1                    | 1661                      | Lüthi                 | 36 M                    | -      | 19.05.2023 |
| 287      | pre-amplifier 25MHz - 4GHz              | AMF-2D-100M4G-35-10P          | 379418                    | Miteq                 | 12 M                    | 1c     | 20.10.2020 |
| 290      | notch filter GSM 900                    | WRCA 901,9/903,1SS            | 3RR                       | Wainwright GmbH       | 12 M                    | 1c     | 20.10.2020 |
| 291      | high pass filter GSM 850/900            | WHJ 2200-4EE                  | 14                        | Wainwright GmbH       | 12 M                    | 1c     | 20.10.2020 |
| 295      | Racal Digital Radio Test Set            | 6103                          | 1572                      | Racal                 | pre-m                   | 3      |            |
| 296      | audio measurement amplifier             | 2636C (Reserve)               | R=316568/004<br>B=1537541 | Brüel & Kjaer         | pre-m                   | 2      |            |

| Ref.-No. | Equipment                           | Type                       | Serial-No.      | Manufacturer                | Interval of calibration | Remark | Cal due    |
|----------|-------------------------------------|----------------------------|-----------------|-----------------------------|-------------------------|--------|------------|
| 298      | Univ. Radio Communication Tester    | CMU 200                    | 832221/091      | Rohde & Schwarz             | pre-m                   | 3      |            |
| 299      | audio microphone                    | 134                        | -               | Brüel & Kjaer               | pre-m                   | 2      |            |
| 300      | AC LISN (50 Ohm/50µH, 1-phase)      | ESH3-Z5                    | 892 239/020     | Rohde & Schwarz             | 12 M                    | -      | 14.05.2021 |
| 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                    | -      | 15.04.2023 |
| 303      | horn antenna 40 GHz (Subst 1)       | BBHA9170                   | 156             | Schwarzbeck                 | 36 M                    | -      | 20.03.2020 |
| 304      | fix dipole antenna 1,6 GHz          | EMCO 3125-307              | 9907-1001       | ETS                         | pre-m                   | -      |            |
| 305      | fix dipole antenna 1,8-2,0 GHz      | EMCO 3125-306              | 9907-1001       | ETS                         | pre-m                   | -      |            |
| 306      | fix dipole antenna 2,45 GHz         | EMCO 3125-308              | 9907-1001       | ETS                         | pre-m                   | -      |            |
| 307      | fix dipole antenna 3 GHz            | EMCO 3125-309              | 9907-1001       | ETS                         | pre-m                   | -      |            |
| 317      | 1000 Hz calibrator 94 dB SPL        | 4230 94dB                  | 1542286         | Brüel & Kjaer               | 12 M                    | -      |            |
| 323      | Digital Radiocommunication Tester   | CMD 55                     | 825878/0034     | Rohde & Schwarz             | pre-m                   | 3      |            |
| 335      | CTC-EMS-Conducted                   | System EMS Conducted       | -               | Rohde & Schwarz             | 12 M                    | 5      | 14.04.2021 |
| 340      | Digital Radiocommunication Tester   | CMD 55                     | 849709/037      | Rohde & Schwarz             | pre-m                   | 3      |            |
| 341      | Digital Multimeter                  | Fluke 112                  | 81650455        | Fluke                       | 24 M                    | -      | 25.05.2022 |
| 342      | Digital Multimeter                  | Voltcraft M-4660A          | IB 255466       | Voltcraft                   | 24 M                    | -      | 23.05.2021 |
| 344      | adaptor 150/50 Ohm                  | 150/50                     | -               | Krohne                      | 36 M                    | -      | 02.06.2023 |
| 345      | adaptor 150/50 Ohm                  | 150/50                     | -               | Krohne                      | 36 M                    | -      | 02.06.2023 |
| 347      | laboratory site                     | radio lab.                 | -               | -                           | -                       | 5      |            |
| 348      | laboratory site                     | EMI conducted              | -               | -                           | -                       | 5      |            |
| 349      | car battery 12 V                    | car battery 12 V           | without         | -                           | -                       | 3      |            |
| 350      | car battery 12 V                    | car battery 12 V           | without         | -                           | -                       | 3      |            |
| 354      | DC - Power Supply 40A               | NGPE 40/40                 | 448             | Rohde & Schwarz             | pre-m                   | 2      |            |
| 357      | power sensor                        | NRV-Z1                     | 861761/002      | Rohde & Schwarz             | 24 M                    | -      | 21.05.2021 |
| 363      | Kalibrieradapter HF-uns.            | CR 100 A                   | without         | Lüthi                       | 24 M                    | -      | 29.05.2021 |
| 364      | Kalibrieradapter HF-uns.            | CR 100 A                   | 128             | Lüthi                       | 24 M                    | -      | 29.05.2021 |
| 366      | Ultra Compact Simulator             | UCS 500 M4                 | V0531100594     | EM-Test                     | 12 M                    | -      | 14.05.2021 |
| 368      | ROD-Antenna                         | HFH 2-Z1                   | 879283/31       | Rohde & Schwarz             | 60 M                    | -      | 17.07.2019 |
| 373      | Single-Line V-Network (50 Ohm/5µH)  | ESH3-Z6                    | 100535          | Rohde & Schwarz             | 12 M                    | -      | 13.05.2021 |
| 374      | Power Amplifier 0,8-3 GHz           | 60S1G3                     | 306528          | Amplifier Research          | 12 M                    | 1a     | 27.03.2021 |
| 375      | Directional Coupler                 | DC7144M1                   | 306498          | Amplifier Research          | 12 M                    | 1a     | 27.03.2021 |
| 376      | Horn Antenna 6 GHz                  | BBHA9120 E                 | BBHA 9120 E 179 | Schwarzbeck                 | 36 M                    | -      | 08.04.2023 |
| 377      | EMI Test Receiver                   | ESCS 30                    | 100160          | Rohde & Schwarz             | 12 M                    | -      | 13.05.2021 |
| 386      | Coupling Decoupling Network         | CDN USB/p                  | 19397           | Schaffner                   | 36 M                    | -      | 19.05.2023 |
| 387      | Coupling Decoupling Network         | CDN L-801 M2               | 2051            | Lüthi                       | 36 M                    | -      | 19.05.2023 |
| 388      | Coupling Decoupling Network         | CDN L-801 T2               | 1929            | Lüthi                       | 36 M                    | -      | 19.05.2023 |
| 389      | Digital Multimeter                  | Keithley 2000              | 0583926         | Keithley                    | pre-m                   | -      |            |
| 390      | Industry Acoustic System            | MO 2000 Set                | 2127100123      | Sennheiser                  | pre-m                   | 2      |            |
| 394      | Power Amplifier 80-1000 MHz         | BLWA 0810-250/200          | 045610          | Bonn-Elektronik             | -                       | 1a     | 27.03.2021 |
| 396      | Thermo/Hygrometer                   | Thermo/Hygrometer          | -               | Conrad                      | 24 M                    | -      | 09.01.2021 |
| 431      | Model 7405                          | Near-Field Probe Set       | 9305-2457       | EMCO                        | -                       | 4      |            |
| 436      | Univ. Radio Communication Tester    | CMU 200                    | 103083          | Rohde & Schwarz             | 12 M                    | -      | 15.05.2021 |
| 439      | UltraLog-Antenna                    | HL 562                     | 100248          | Rohde & Schwarz             | 36 M                    | -      | 10.03.2020 |
| 440      | CDN for Datacable                   | CDN-UTP                    | CDN-UTP 029     | EMC Partner AG, CH          | 36 M                    | -      | 30.05.2022 |
| 442      | CTC-SAR-EMS                         | System EMS field (SAR)     | -               | ETS-Lindgren / CETECOM      | 12 M                    | 5      | 27.03.2021 |
| 443      | CTC-FAR-EMI-RSE                     | System CTC-FAR-EMI-RSE     | -               | ETS-Lindgren / CETECOM      | 12 M                    | 5      | 20.10.2020 |
| 448      | notch filter WCDMA_FDD II           | WRCT 1850.0/2170.0-5/40-   | 5               | Wainwright Instruments GmbH | 12 M                    | 1c     | 20.10.2020 |
| 449      | notch filter WCDMA FDD V            | WRCT 824.0/894.0-5/40-SSK  | 1               | Wainwright                  | 12 M                    | 1c     | 20.10.2020 |
| 450      | 6dB attenuator N/N                  | 6806.17B 6dB               | -               | Huber & Suhner              | 12 M                    | -      | 30.05.2021 |
| 454      | Oscilloscope                        | HM 205-3                   | 9210 P 29661    | Hameg                       | -                       | 4      |            |
| 455      | Oscilloscope                        | HP 54602B                  | US 350 336 45   | Hawlett Packard             | -                       | 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                    | -      | 15.05.2021 |
| 462      | AF-Generator                        | MX-2020                    | -               | Conrad                      | -                       | 4      |            |
| 463      | Universal source                    | HP3245A                    | 2831A03472      | Agilent                     | -                       | 4      |            |
| 467      | Digital Multimeter                  | Fluke 112                  | 89680306        | Fluke USA                   | 36 M                    | -      | 30.05.2021 |
| 468      | Digital Multimeter                  | Fluke 112                  | 90090455        | Fluke USA                   | 36 M                    | -      | 30.04.2021 |
| 477      | ReRadiating GPS-System              | AS-47                      | -               | Automotive Cons. Fink       | -                       | 3      |            |
| 480      | power meter (Fula)                  | NRVS                       | 838392/031      | Rohde & Schwarz             | 24 M                    | -      | 30.05.2021 |
| 482      | filter matrix                       | Filter matrix SAR 1        | -               | CETECOM (Brl)               | -                       | 1d     |            |
| 484      | pre-amplifier 2,5 - 18 GHz          | AMF-5D-02501800-25-10P     | 1244554         | Miteq                       | 12 M                    | -      | 20.10.2020 |
| 487      | System CTC NSA-Verification SAR-EMI | System EMI field (SAR) NSA | -               | ETS Lindgren / CETECOM      | 24 M                    | -      | 19.05.2021 |
| 489      | EMI Test Receiver                   | ESU40                      | 1000-30         | Rohde & Schwarz             | 12 M                    | -      | 13.05.2021 |
| 491      | ESD Simulator dito                  | ESD dito                   | dito307022      | EM-Test                     | 12 M                    | -      | 13.05.2021 |
| 498      | Power Supply                        | NGPE 40/40                 | 402             | Rohde & Schwarz             | pre-m                   | 2      |            |
| 500      | Industry Acoustic System            | MO 2000 Set                | 100048          | Sennheiser                  | pre-m                   | 2      |            |
| 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      |            |

| Ref.-No. | Equipment                                     | Type                          | Serial-No.      | Manufacturer                | Interval of calibration | Remark | Cal due    |
|----------|-----------------------------------------------|-------------------------------|-----------------|-----------------------------|-------------------------|--------|------------|
| 512      | notch filter GSM 850                          | WRCA 800/960-02/40-GEEK       | SN 24           | Wainwrght                   | 12 M                    | 1c     | 20.10.2020 |
| 517      | relais switch matrix                          | HF Relais Box Keithley System | SE 04           | Keithley                    | pre-m                   | 2      |            |
| 523      | Digital Multimeter                            | L4411A                        | MY46000154      | Agilent                     | 24 M                    | -      | 23.05.2021 |
| 524      | Voltage Drop Simulator                        | VDS 200                       | 0196-16         | EM Test                     | 24 M                    | -      | 21.05.2021 |
| 525      | CDN coupling network                          | CNA 200                       | 1196-01         | EM Test                     | 24 M                    | -      | 21.05.2021 |
| 526      | Burst Generator                               | EFT 200 A                     | 0496-06         | EM Test                     | 24 M                    | -      | 21.05.2021 |
| 527      | Micro Pulse Generator                         | MPG 200 B                     | 0496-05         | EM Test                     | 24 M                    | -      | 21.05.2021 |
| 528      | Load Dump Simulator                           | LD 200B                       | 0496-06         | EM Test                     | 24 M                    | -      | 21.05.2021 |
| 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      |            |
| 533      | Impedance Stabilization Network               | ISN T200A                     | 25706           | Teseq                       | 36 M                    | -      | 20.05.2023 |
| 534      | Impedance Stabilization Network               | ISN T400A                     | 24881           | Teseq                       | 36 M                    | -      | 20.05.2023 |
| 535      | Impedance Stabilization Network               | ISN T800                      | 26321           | Teseq                       | 36 M                    | -      | 20.05.2023 |
| 536      | Impedance Stabilization Network               | ISN ST08                      | 25867           | Teseq                       | 36 M                    | -      | 20.05.2023 |
| 541      | Impedance Stabilization Network               | ISN T8-Cat6                   | 26373           | Teseq Berlin                | 36 M                    | -      | 20.05.2023 |
| 546      | Univ. Radio Communication Tester              | CMU 200                       | 106436          | R&S                         | 12 M                    | -      | 05.08.2020 |
| 548      | Digital-Barometer                             | GBP 2300                      | without         | Greisinger GmbH             | 24 M                    | -      | 17.05.2021 |
| 549      | Log.Per-Antenna                               | HL025                         | 1000060         | Rohde & Schwarz             | 36/12 M                 | -      | 31.07.2021 |
| 550      | System CTC S-VSWR Verification SAR-EMI        | System EMI Field SAR S-VSWR   | -               | ETS Lindgren/CETECOM        | 24 M                    | -      | 02.10.2021 |
| 552      | high pass filter 2,8-18GHz                    | WHKX 2.8/18G-10SS             | 4               | Wainwright                  | 12 M                    | 1c     | 20.10.2020 |
| 558      | System CTC FAR S-VSWR                         | System CTC FAR S-VSWR         | -               | CTC                         | 24 M                    | -      | 08.05.2021 |
| 559      | Vector Signal Generator                       | SMU200A                       | 103736          | Rohde Schwarz               | 24                      | -      | 22.05.2021 |
| 574      | Biconilog Hybrid Antenna                      | BTA-L                         | 980026L         | Frankonia                   | 36/12 M                 | -      | 03.05.2022 |
| 584      | Spectrum Analyzer                             | FSU 8                         | 100248          | Rohde & Schwarz             | pre-m                   | -      |            |
| 592      | CDN-HDMI                                      | CDN-HDMI                      | A3029004        | Frankonia / Dr.Hubert       | 36 M                    | -      | 20.05.2023 |
| 595      | Analog Adder                                  | TS8910                        | -               | Rohde & Schwarz             | pre-m                   | 2      |            |
| 597      | Univ. Radio Communication Tester              | CMU 200                       | 100347          | Rohde & Schwarz             | pre-m                   | -      |            |
| 600      | power meter                                   | NRVD (Reserve)                | 834501/018      | Rohde & Schwarz             | 24 M                    | -      | 30.05.2021 |
| 602      | peak power sensor                             | NRV-Z32 (Reserve)             | 835080          | Rohde & Schwarz             | 24 M                    | -      |            |
| 609      | Sleeve Dipole Antenna                         | 3126-700                      | 00123808        | ETS-Lindgren                | 36/12 M                 | -      | 11.10.2021 |
| 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      |            |
| 615      | Analog Adder                                  | TS8920                        | -               | Rohde & Schwarz             | pre-m                   | 2      |            |
| 620      | EMI Test Receiver                             | ESU 26                        | 100362          | Rohde-Schwarz               | 12 M                    | -      | 13.05.2021 |
| 625      | Generic Test Load USB                         | Generic Test Load USB         | -               | CETECOM                     | -                       | 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      |            |
| 644      | Amplifierer                                   | ZX60-2534M+                   | SN865701299     | Mini-Circuits               | -                       | -      |            |
| 645      | Power Amplifier                               | CBA 230M-080                  | T44236          | TESEQ                       | -                       | 1g     |            |
| 670      | Univ. Radio Communication Tester              | CMU 200                       | 106833          | Rohde & Schwarz             | 24 M                    | -      | 16.06.2022 |
| 671      | DC-power supply 0-5 A                         | EA-3013S                      | -               | Elektro Automatik           | pre-m                   | 2      |            |
| 672      | Digitalmultimeter                             | Keithley 2700                 | 1182075         | Keithley                    | pre-m                   | -      |            |
| 673      | Diditalmultimeter                             | Keithley 2700                 | 1181408         | Keithley                    | pre-m                   | -      |            |
| 674      | Digitalmultimeter                             | Keithley 2700                 | 1182090         | Keithley                    | pre-m                   | -      |            |
| 675      | Digitalmultimeter                             | Keithley 2700                 | 1162865         | Keithley                    | pre-m                   | -      |            |
| 676      | Digitalmultimeter                             | Keithley 2700                 | 1182092         | Keithley                    | 24 M                    | -      | 30.05.2021 |
| 677      | Digitalmultimeter                             | Keithley 2700                 | 1182089         | Keithley                    | pre-m                   | -      |            |
| 678      | Power Meter                                   | NRP                           | 101638          | Rohde&Schwarz               | pre-m                   | -      |            |
| 679      | Power Supply                                  | High Speed Power Supply       | 0783417         | Keithley                    | pre-m                   | -      |            |
| 680      | Power Sensor                                  | NRP-Z21                       | 100622          | Rohde & Schwarz             | pre-m                   | -      |            |
| 682      | Vector Signal Generator                       | SMU 200A                      | 101319          | Rohde & Schwarz             | pre-m                   | -      |            |
| 684      | Widerstand 100 Ohm                            | SL 403-403                    | 72973           | Teseq                       | pre-m                   | -      |            |
| 685      | Widerstand 100 OHM                            | SL 403-403                    | 72974           | Teseq                       | pre-m                   | -      |            |
| 686      | Field Analyzer                                | EHP-200A                      | 160WX30702      | Narda Safety Test Solutions | -                       | -      |            |
| 687      | Signal Generator                              | SMF 100A                      | 102073          | Rohde&Schwarz               | 12 M                    | -      | 07.02.2021 |
| 689      | Vector Signal Generator                       | SMU200                        | 100970          | Rohde&Schwarz               | 24 M                    | -      | 13.05.2022 |
| 690      | Spectrum Analyzer                             | FSU                           | 100302/026      | Rohde&Schwarz               | 24 M                    | -      | 30.05.2021 |
| 691      | Open Switch and control Platform              | OSB120                        | 101056          | Rohde&Schwarz               | 12 M                    | -      | 30.05.2021 |
| 695      | ReRadiating GPS-System                        | AS-47                         | G1406003500001  | Automotive Cons. Fink       | -                       | 3      |            |
| 698      | Sound Calibrator                              | Sound Calibrator 4231         | 2035208         | Brüel & Kjaer               | 12 M                    | -      | 22.05.2021 |
| 700      | Audio Analyzer                                | UPL 16                        | 830695/0016     | Rohde&Schwarz               | 24 M                    | -      | 12.05.2022 |
| 701      | CMW500 wide. Radio Comm.                      | CMW500                        | 158150          | Rohde & Schwarz             | 24 M                    | -      | 05.11.2021 |
| 705      | NRV-Z1                                        | Power Sensor                  | 893350/020      | Rohde & Schwarz             | 12 M                    | -      | 12.05.2021 |
| 706      | NRV-Z1                                        | Power Sensor                  | 830961/001      | Rohde & Schwarz             | 12 M                    | -      | 12.05.2021 |
| 707      | RadiCentre                                    | CTR-1004B                     | 10I00037SN038-1 | D.A.R.E!! Instruments       | 24 M                    | -      |            |
| 708      | Laser powered Electrical Field Strength Probe | RadiSense 6                   | 10I00037SN038   | D.A.R.E.!! Instruments BV   | 24 M                    | -      | 09.05.2021 |

| Ref.-No. | Equipment                            | Type                           | Serial-No.      | Manufacturer                   | Interval of calibration | Remark | Cal due    |
|----------|--------------------------------------|--------------------------------|-----------------|--------------------------------|-------------------------|--------|------------|
| 710      | RF Power Amplifier                   | BLMA 2560-100                  | 1610879         | Bonn Elektronik                | 12 M                    | -      | 27.03.2021 |
| 714      | Signal Analyzer 67GHz                | FSW67                          | 104023          | Rohde & Schwarz                | 12 M                    | -      | 04.07.2021 |
| 718      | Robot                                | Dasy 5 / TX90                  | F11/5GM9A1/A/01 | Stäubli                        | pre-m                   | -      |            |
| 747      | Spectrum Analyzer                    | FSU 26                         | 200152          | Rohde & Schwarz                | 12 M                    | -      | 13.05.2021 |
| 751      | Digital Optical System               | optoCAN-FD Transceiver         | 17-010416       | mk-messtechnik GmbH            | -                       | -      |            |
| 752      | Digital Optical System               | optoCAN-FD Transceiver         | 17-010083       | mk-messtechnik GmbH            | -                       | -      |            |
| 753      | Digital Optical System               | optoCAN-FD Transceiver         | 17-010084       | mk-messtechnik GmbH            | -                       | -      |            |
| 754      | Digital Optical System               | optoCAN-FD Transceiver         | 17-010415       | mk-messtechnik GmbH            | -                       | -      |            |
| 755      | Digital Optical System               | optoLAN-100-MAX                | 17-010795       | mk-messtechnik GmbH            | -                       | -      |            |
| 757      | WIDEBAND RADIO COMMUNICATION         | CMW500                         | 163673          | Rohde&Schwarz                  | 12 M                    | -      | 22.05.2021 |
| 758      | Signal Generator                     | SMU 200A                       | 100754          | Rohde & Schwarz                | 24 M                    | -      | 14.05.2022 |
| 781      | Power Supply                         | PS 2042-10 B                   | 2815450369      | Elektro-Automatik GmbH         | -                       | -      |            |
| 782      | Power Supply                         | PS 2042-10 B                   | 2815450348      | Elektro-Automatik GmbH & Co.KG | -                       | -      |            |
| 801      | Spectrum Analyzer                    | FSU 26                         | 100414          | Rohde & Schwarz                | 12 M                    | -      | 13.05.2021 |
| 784      | Power Supply                         | NGSM 32/10                     | 00196           | Rohde & Schwarz                | 12 M                    | -      |            |
| 785      | RSP                                  | RF Step Attenuator 0...139.9dB | 860712/012      | Rohde & Schwarz                | 12 M                    | -      |            |
| 788      | Precision Omnidirectional Dipole     | POD 618                        | 6182558/Q       | Seibersdorf Laboratories       | 36 M                    | -      | 30.06.2021 |
| 789      | Precision Omnidirectional Dipole     | POD 16                         | 162496/Q        | Seibersdorf Laboratories       | 36 M                    | -      | 30.06.2021 |
| 799      | Transceiver                          | optoLAN-Gb                     | 18-014746       | mk messtechnik                 | pre-m                   | -      |            |
| 802      | Exposure Level Tester                | ELT-400                        | O-0026          | NARDA Safety Solutions         | 24 M                    | -      | 30.01.2021 |
| 803      | Probe                                | ELT probe 3cm²                 | O-0026          | Narda Safety Test Solution     | 24 M                    | -      | 30.01.2021 |
| 805      | Open Switch and control Platform     | OSP-B157WX 8 Port Switch,      | 101264          | Rohde & Schwarz                | 12 M                    | -      | 30.05.2021 |
| 808      | Diode Power Sensor                   | NRV-Z1                         | 829894/001      | Rohde & Schwarz                | 24 M                    | -      | 24.05.2021 |
| 816      | GPIO-USB-HS                          | 187965G-01L                    | 16AE772         | National Instruments           | -                       | -      |            |
| 817      | GPIO-USB-HS                          | 187965G-01L                    | 16AC1EE         | National Instruments           | -                       | -      |            |
| 818      | GPIO-USB-HS                          | 187965G-01L                    | 16AE8D0         | Natinal Instruments            | -                       | -      |            |
| 819      | GPIO-USB-HS                          | 187965G-01L                    | 16AB93C         | National Instruments           | -                       | -      |            |
| 820      | GPIO-USB-HS                          | 187965G-01L                    | 16AE294         | National Instruments           | -                       | -      |            |
| 821      | GPIO-USB-HS                          | 187965G-01L                    | 16ACB9C         | National Instruments           | -                       | -      |            |
| 822      | GPIO-USB-HS                          | 187965G-01L                    | 16AE5B2         | National Instruments           | -                       | -      |            |
| 823      | Broadband Field Meter                | NBM-550                        | H-0929          | NARDA Safety Test Solutions    | 36 M                    | -      | 19.07.2022 |
| 824      | E-Field Probe                        | EF 0691                        | H-0851          | Narda Safety Test Solutions    | 36 M                    | -      | 06.08.2022 |
| 825      | H-Field Probe                        | HF 3061                        | D-0805          | NARDA Safety Test Solutions    | 36 M                    | -      | 06.08.2022 |
| 826      | Electric and magnetic Field Analyzer | EHP-50F                        | 510WY90125      | NARDA Safety Test Solutions    | 36 M                    | -      | 01.10.2022 |
| 827      | Transceiver                          | optoUSB-2.0                    | 19-017001       | mk-messtechnik GmbH            | -                       | -      |            |
| 828      | Transceiver                          | optoUSB-2.0                    | 19-017002       | mk-messtechnik GmbH            | -                       | -      |            |
| 829      | Battery Pack BP-84                   | Battery Pack BP-84             | 19-017271       | mk-messtechnik GmbH            | -                       | -      |            |
| 866      | SIGNAL ANALYZER                      | FSV3030                        | 101247          | Rohde&Schwarz                  | 12 M                    | -      | 02.10.2020 |
| 874      | Signal Generator                     | SMP22                          | 100028          | Rohde & Schwarz                | 36 M                    | -      | 13.05.2023 |
| 880      | Laptop                               | Latitude 7400                  | JVDM2X2         | Dell                           | no                      | -      |            |
| 881      | Laptop                               | Latitude 7400                  | 37RJ2X2         | Dell                           | no                      | -      |            |
| 882      | Laptop                               | Latitude 7400                  | 4GYJ2X2         | DELL                           | no                      | -      |            |
| 885      | Power Supply                         | Power Supply EA3632A           | 75305850        | EA                             | no                      | -      |            |
| 886      | HD Kamera                            | dAV-Cr-HD-30-ww                | 19-018438       | mk Messtechnik                 | no                      | -      |            |
| 887      | HD Camera                            | dAV-Cr-HD-30-ww-PS             | 19-018439       | mk Messtechnik                 | no                      | -      |            |
| 889      | rack mount receiver                  | dAV-Rr-HD 19"                  | 018247          | mk Messtechnik                 | no                      | -      |            |
| 902      | Wideband Radio Communication Tester  | CMW 500                        | 168880          | Rohde & Schwarz                | 12 M                    | -      | 13.05.2021 |

### 6.0.3. Legend

| Note / remarks |    | Calibrated during system calibration:                                                     |
|----------------|----|-------------------------------------------------------------------------------------------|
|                | 1a | System CTC-SAR-EMS (Ref.-No. 442)                                                         |
|                | 1b | System-CTC-EMS-Conducted (Ref.-No. 335)                                                   |
|                | 1c | System CTC-FAR-EMI-RSE (Ref.-No. 443)                                                     |
|                | 1d | System CTC-SAR-EMI (Ref.-No. 441)                                                         |
|                | 1e | System CTC-OATS (EMI radiated) (Ref.-No. 337)                                             |
|                | 1f | System CTC-CTIA-OTA (Ref.-No. 420)                                                        |
|                | 1g | 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                                                           |

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

| Version | Applied changes                                                          | Date of release |
|---------|--------------------------------------------------------------------------|-----------------|
| --      | Initial release                                                          | 2018-08-22      |
| C1      | Measurement Data Update                                                  | 2018-11-09      |
| C2      | Channel Occupied Bandwidth measurement added;<br>ISED References removed | 2019-04-29      |
| C3      | Measurement Data Update : Chapter 5.2                                    | 2020-08-03      |

# End of Report