

# TEST REPORT

No.: 19-1-0142201T09a

According to:  
**FCC Regulations Title 47, Part 15**  
**Subpart B (Unintentional radiators)**  
§15.109

**ISED-Regulations**  
ICES-003, Issue 6

for

**GROHE AG**

**Rainshower 310 SmartConnect (26646)**  
**Remote Control**

**FCC ID: WFK-RCBT001**  
**IC ID: 7787A-RCBT001**

## Laboratory Accreditation and Listings



Accredited EMC-Test Laboratory

accredited according to DIN EN ISO/IEC 17025:2018

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The listed attachments are an integral part of this report.

## 1. Summary of test results

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

**Also we refer on special conditions which the applicant should fulfill according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.**

The Equipment Under Test (in this report, hereinafter referred as EUT) is a digital device with no support of radiofrequency technologies. A typical operating mode (one or more) as used in the real usage was tested or a special test program simulating this was used. Pls. see chapter Operating-Mode for more details.

Following tests have been performed to show compliance with applicable FCC Part 15, Subpart B (Unintentional Radiators) of the CFR 47 Rules, Edition 1<sup>st</sup> October 2018 and Canadian ICES-003, Issue 6.

### 1.1. TEST OVERVIEW ACCORDING FCC PART 15B AND CANADIAN RSS- OR ICES STANDARDS

| No. of Diagram group | Test Cases                        | Port                              | References, Standards & Limits |                                |                                                                                 | EUT set-up | EUT op-mode | Result |
|----------------------|-----------------------------------|-----------------------------------|--------------------------------|--------------------------------|---------------------------------------------------------------------------------|------------|-------------|--------|
|                      |                                   |                                   | FCC                            | ISED                           | Limits                                                                          |            |             |        |
| 3                    | Radiated emissions 30 MHz - 1 GHz | Cabinet + Inter-connecting cables | §15.109                        | ICES-003, Issue 6 (ANSI C63.4) | <input type="checkbox"/> Class A<br><input checked="" type="checkbox"/> Class B | 1          | 1           | passed |
| 4                    | Radiated emissions above 1 GHz    | Cabinet + Inter-connecting cables | §15.109                        | ICES-003, Issue 6 (ANSI C63.4) | <input type="checkbox"/> Class A<br><input checked="" type="checkbox"/> Class B | 1          | 1           | passed |

Remark:

### 1.2. ATTESTATION

I declare that all measurements were performed by me or under my supervision and that all measurements have been performed and are correct to my best knowledge and belief to Innovation, Science and Economic Development Canada standards. All requirements as shown in above table are met in accordance with enumerated standards.

  
 markus.  
 ridder@cetecom.  
 com  
 2020.02.13 13:  
 27:01 +01'00'  
 .....  
 Markus Ridder  
 Responsible for test section

  
 CN = Hicham Laayouni  
 email = hicham.  
 laayouni@cetecom.com  
 C = DE O = CETECOM  
 2020.02.14 09:15:45 +  
 01'00'  
 .....  
 H. Laayouni  
 Responsible for test report

## 2. Administrative Data

### 2.1. Identification of the testing laboratory

|                                     |                                                      |
|-------------------------------------|------------------------------------------------------|
| Company name:                       | CETECOM GmbH                                         |
| Address:                            | Im Teelbruch 116<br>45219 Essen - Kettwig<br>Germany |
| Responsible for testing laboratory: | Volker Wittmann                                      |
| Deputy:                             | Ninovic Perez                                        |

### 2.2. Test location

#### 2.2.1. Test laboratory "CETECOM GmbH"

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

### 2.3. Organizational items

|                                                 |                          |
|-------------------------------------------------|--------------------------|
| Responsible for test report and project leader: | H. Laayouni              |
| Receipt of EUT:                                 | 2020-01-21               |
| Date(s) of test:                                | 2020-01-22 to 2020-02-05 |
| Date of report:                                 | 2020-02-12               |
| -----                                           |                          |
| Version of template:                            | 13.03                    |

### 2.4. Applicant's details

|                   |                                                      |
|-------------------|------------------------------------------------------|
| Applicant's name: | GROHE AG                                             |
| Address:          | Industriepark Edelburg<br>58675 Hemer<br><br>Germany |
| Contact person:   | Ralf Oberste-Lehn                                    |

### 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. 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<br>S31        | Rainshower 310<br>SmartConnect (26646) | Remote Control | 0Z051-4119-<br>00137-21 | GH_RC-1V3          | n/a                |

#### 3.2. 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                    | Lithium Battery<br>3 V, 225 mAh | CR2032 | -                 | -                  | -                  |

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

#### 3.3. EUT set-ups

| EUT set-up no. *) | Combination of EUT and AE | Remarks |
|-------------------|---------------------------|---------|
| set. 1            | EUT A + AE 1              | -       |

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

#### 3.4. EUT operating modes

| EUT operating mode no. *) | Description of operating modes | Additional information |
|---------------------------|--------------------------------|------------------------|
| op. 1                     | Run-Mode                       | Max load mode          |

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

### 3.5. Additional declaration and description of EUT

(Applicant's declaration, ☐ = not selected, ☒ = selected)

|                                                                                                                                                                                                                                        |    |                                                                                                                                                                                                                                                                                |                                                                                                                                                 |                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| EUT A                                                                                                                                                                                                                                  |    | <input type="checkbox"/> table-top<br><input type="checkbox"/> floor-standing<br><input checked="" type="checkbox"/> wall-mounted<br><input type="checkbox"/> not defined                                                                                                      | typical use<br><input type="checkbox"/> portable use<br><input checked="" type="checkbox"/> fixed use<br><input type="checkbox"/> vehicular use | typical operating cycle of EUT.<br><input checked="" type="checkbox"/> < 0.5 sec.<br><input type="checkbox"/> : |
| Place of use                                                                                                                                                                                                                           |    | <input checked="" type="checkbox"/> Residential, commercial and light industry<br><input type="checkbox"/> Industrial environment<br><input type="checkbox"/> vehicular use                                                                                                    |                                                                                                                                                 |                                                                                                                 |
| Highest internal frequency generated by EUT and required upper frequency of radiated disturbance measurement                                                                                                                           |    | <input type="checkbox"/> below 1.705 MHz      -> up to 30 MHz<br><input type="checkbox"/> 1.705 MHz – 108 MHz      -> up to 1 GHz<br><input type="checkbox"/> 108 MHz -500 MHz      -> up to 2 GHz<br><input checked="" type="checkbox"/> 500 MHz 1000 MHz      -> up to 5 GHz |                                                                                                                                                 |                                                                                                                 |
| <b>Power line:</b><br><input type="checkbox"/> AC <input type="checkbox"/> L1, <input type="checkbox"/> L2, <input type="checkbox"/> L3, <input type="checkbox"/> N<br><input checked="" type="checkbox"/> DC, Battery 3 V DC (CR2032) |    | EUT-grounding:<br><input checked="" type="checkbox"/> none<br><input type="checkbox"/> with power supply<br><input type="checkbox"/> additional:                                                                                                                               |                                                                                                                                                 |                                                                                                                 |
| <b>Other Ports</b><br>(description of interconnecting cables)<br>Connector                                                                                                                                                             |    | possible total cable length                                                                                                                                                                                                                                                    | shielding                                                                                                                                       | connected during test                                                                                           |
| 1.--                                                                                                                                                                                                                                   | -- | <input checked="" type="checkbox"/> < 3 m <input type="checkbox"/> > 3 m<br><input type="checkbox"/> : other                                                                                                                                                                   | <input type="checkbox"/> screened<br><input type="checkbox"/> unscreened                                                                        | <input type="checkbox"/> yes<br><input type="checkbox"/> no                                                     |
| Does EUT contain devices susceptible to magnetic fields, e.g. Hall elements, electrostatics, microphones, etc.?                                                                                                                        |    |                                                                                                                                                                                                                                                                                |                                                                                                                                                 | <input type="checkbox"/> yes<br><input checked="" type="checkbox"/> no                                          |
| Is mounting position / usual operating position defined?                                                                                                                                                                               |    |                                                                                                                                                                                                                                                                                |                                                                                                                                                 | <input type="checkbox"/> yes<br><input checked="" type="checkbox"/> no                                          |

### 3.6. Configuration of cables used for testing

| Cable number | Item | Type | S/N serial number | HW hardware status | Cable length |
|--------------|------|------|-------------------|--------------------|--------------|
| Cable 1      | --   | --   | --                | --                 | --           |

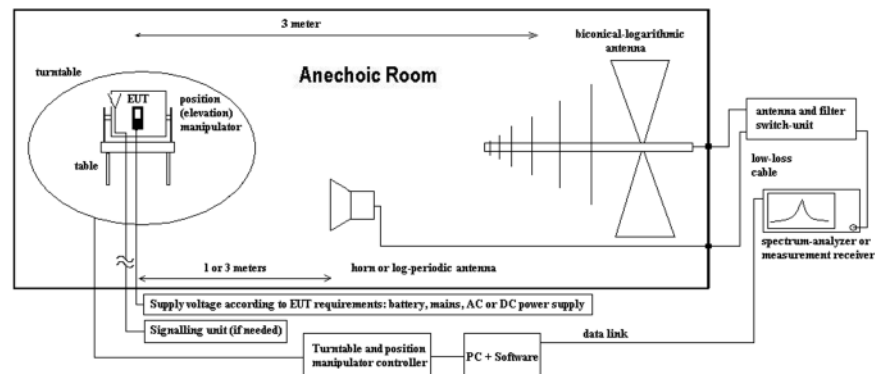
#### 4. Description of test system set-up's

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

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

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

**Schematic:**



### Testing method:

### Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 90°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

Measurement antenna: horizontal and vertical, heights: 1.0 m and 1.82 m as worst-case determined by an exploratory emission measurements. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

### Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by maintaining the EUT's worst-case operation mode, cable position, etc. either on 10 m OATS or 3 m semi-anechoic room.

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

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

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

**Formula:**

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

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

AF = Antenna factor

$$C_L = \text{Cable loss}$$

$D_F$  = Distance correction factor (if used)

$E_C$  = Electrical field – corrected value

$E_R$  = Receiver reading

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

$$L_T = \text{Limit}$$

M = Margin

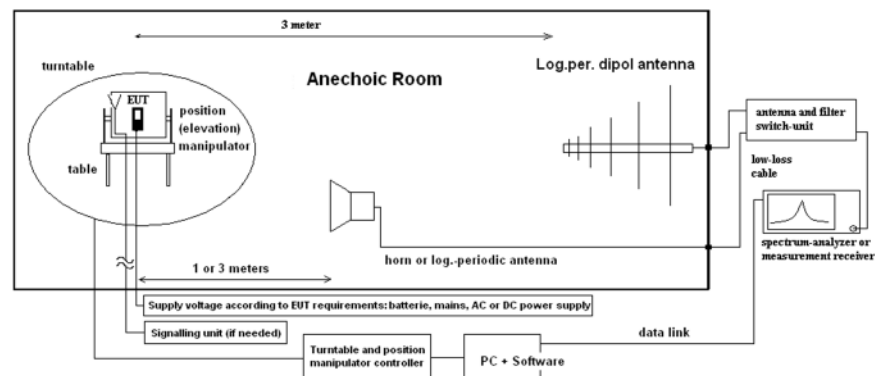
All units are dB-units, positive margin means value is below limit.

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

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

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

**Schematic:**



**Testing method:**

### Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.55 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 15°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

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

### Final measurement on critical frequencies

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

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

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

**Formula:**

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

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

$E_C$  = Electrical field – corrected value

$E_R$  = Receiver reading

$M$  = Margin

$L_T$  = Limit

$AF$  = Antenna factor

$C_L$  = Cable loss

$D_F$  = Distance correction factor (if used)

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

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

## 5. Measurements

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

#### 5.1.1. Test location and equipment

|                 |                                                                    |                                                       |                                                                                                                                                      |
|-----------------|--------------------------------------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| test location   | <input checked="" type="checkbox"/> CETECOM Essen (Chapter. 2.2.1) | <input type="checkbox"/> Please see Chapter. 2.2.2    | <input type="checkbox"/> Please see Chapter. 2.2.3                                                                                                   |
| test site       | <input checked="" type="checkbox"/> 441 EMI SAR                    | <input checked="" type="checkbox"/> 487 SAR NSA       |                                                                                                                                                      |
| receiver        | <input type="checkbox"/> 377 ESCS30                                | <input checked="" type="checkbox"/> 001 ESS           | <input type="checkbox"/> 489 ESU 40 <input type="checkbox"/> 620 ESU 26                                                                              |
| spectr. analyz. | <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     |
| signaling       | <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 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 checked="" type="checkbox"/> 3 V Battery                    | <input type="checkbox"/> 060 120 V 60 Hz via PAS 5000 |                                                                                                                                                      |

#### 5.1.2. Requirements/Limits

|                  |                 |                                                                                                                                                                                                                                                                                                                                                                                                   |                     |
|------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>FCC</b>       |                 | <input checked="" type="checkbox"/> Part 15 Subpart B, §15.109, class B<br><input type="checkbox"/> Part 15 Subpart C, §15.209 @ frequencies defined in §15.205                                                                                                                                                                                                                                   |                     |
| <b>ISED (IC)</b> |                 | <input type="checkbox"/> RSS-Gen., Issue 5, Chapter 8.9, Table 5+6+7 (license-exempt radio apparatus)<br><input type="checkbox"/> RSS-Gen., Issue 5, Chapter 7.3, Table 3 (receiver)<br><input checked="" type="checkbox"/> ICES-003, Issue 6, Table 4(class A)/Table 5(Class B)<br><input type="checkbox"/> RSS-247, Issue 2, Chapter 5.5 <input type="checkbox"/> RSS-247, Issue 2, Chapter 6.2 |                     |
| <b>ANSI</b>      |                 | <input type="checkbox"/> C63.4-2014<br><input checked="" type="checkbox"/> C63.10-2013                                                                                                                                                                                                                                                                                                            |                     |
| <b>Limit</b>     | 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                |

#### 5.1.3. 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 0.8 m height                                                      | <input type="checkbox"/> floor standing    |                                                |
| Climatic conditions                   |                       | Temperature: (22±3° C)                                                                                          | Rel. humidity: (40±20)% rH                 |                                                |
| EMI-Receiver<br>(Analyzer) Settings   | Scan frequency range: | <input checked="" type="checkbox"/> 30 – 1000 MHz <input type="checkbox"/> other:                               |                                            |                                                |
|                                       | Scan-Mode             | <input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3 dB spectrum analyzer mode |                                            |                                                |
|                                       | Detector              | Peak / Quasi-peak                                                                                               |                                            |                                                |
|                                       | RBW/VBW               | 100 kHz/300 kHz                                                                                                 |                                            |                                                |
|                                       | Mode:                 | Repetitive-Scan, max-hold                                                                                       |                                            |                                                |
|                                       |                       | Scan step                                                                                                       |                                            |                                                |
|                                       |                       | 80 kHz                                                                                                          |                                            |                                                |
|                                       |                       | Sweep-Time                                                                                                      |                                            |                                                |
|                                       |                       | Coupled – calibrated display if continuous tx-signal otherwise adapted to EUT's individual duty-cycle           |                                            |                                                |
| General measurement procedures        |                       | Please see chapter "Test system set-up for electric field measurement in the range 30 MHz to 1 GHz"             |                                            |                                                |

#### 5.1.4. MEASUREMENT RESULTS

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

| Diagram no. | Frequency range | Set-up no. | Op-mode no. | Remark         | Used detector                       |                          |                                     | Result |
|-------------|-----------------|------------|-------------|----------------|-------------------------------------|--------------------------|-------------------------------------|--------|
|             |                 |            |             |                | PK                                  | AV                       | QP                                  |        |
| 3.01a       | 30 MHz – 1 GHz  | 1          | 1           | EUT A laying   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | passed |
| 3.01b       | 30 MHz – 1 GHz  | 1          | 1           | EUT A standing | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | passed |

Remark: see diagrams in annex 1 for more details

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

### 5.2.1. 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                |                          |
| spectr. analyz. | <input type="checkbox"/> 584 FSU                | <input type="checkbox"/> 120 FSEM      | <input type="checkbox"/> 264 FSEK                     | <input checked="" type="checkbox"/> 489 ESU 40 | <input checked="" type="checkbox"/> 714 FSW      |                          |
| 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 |                          |
| antenna subst   | <input type="checkbox"/> 071 HUF-Z2             | <input type="checkbox"/> 020 EMCO3115  | <input type="checkbox"/> 063 LP 3146                  |                                                | <input type="checkbox"/> 303 BBHA9170            |                          |
| signaling       | <input type="checkbox"/> 392 MT8820A            | <input type="checkbox"/> 371 CBT32     | <input type="checkbox"/> 547 CMU200                   | <input type="checkbox"/> 594 CMW               |                                                  |                          |
| DC power        | <input type="checkbox"/> 086 LNG50-10           | <input type="checkbox"/> 087 EA3013    | <input type="checkbox"/> 354 NGPE 40                  | <input type="checkbox"/> 349 car battery       | <input type="checkbox"/> 350 Car battery         | <input type="checkbox"/> |
| line voltage    | <input checked="" type="checkbox"/> 3 V Battery |                                        | <input type="checkbox"/> 060 120 V 60 Hz via PAS 5000 |                                                |                                                  |                          |

### 5.2.2. Requirements/Limits

|                                               |                                                                                                                                                                                                                                                                                                                                                                                                                   |             |             |                            |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|----------------------------|
| <b>FCC</b>                                    | <input checked="" type="checkbox"/> Part 15 Subpart B, §15.109 class B<br><input type="checkbox"/> Part 15 Subpart C, §15.209 for frequencies defined in §15.205<br><input type="checkbox"/> Part 15 Subpart C, §15.407(b)(1)(2)(3)(4)                                                                                                                                                                            |             |             |                            |
| <b>ISED</b>                                   | <input type="checkbox"/> RSS-Gen., Issue 5, Chapter 8.9, Table 5+6+7 (transmitter license exempt)<br><input type="checkbox"/> RSS-Gen., Issue 5, Chapter 7.3, Table 3 (receiver)<br><input checked="" type="checkbox"/> ICES-003, Issue 6, Chapter 6.2.2, Table 7(class B), Table 6 (Class A)<br><input type="checkbox"/> RSS-247, Issue 2, Chapter 5.5<br><input type="checkbox"/> RSS-247, Issue 2, Chapter 6.2 |             |             |                            |
| <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] |
| <b>FCC: Part 15B</b><br><b>ISED: ICES-003</b> | 500                                                                                                                                                                                                                                                                                                                                                                                                               | 54.0        | 5000        | 74.0 dBµV/m                |

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

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                            |                                                |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------|
| Signal link to test system (if used): | <input type="checkbox"/> air link                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <input type="checkbox"/> cable connection  | <input checked="" type="checkbox"/> none       |
| EUT-grounding                         | <input checked="" type="checkbox"/> none                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <input type="checkbox"/> with power supply | <input type="checkbox"/> additional connection |
| Equipment set up                      | <input checked="" type="checkbox"/> table top 1.5 m height                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <input type="checkbox"/> floor standing    |                                                |
| Climatic conditions                   | Temperature: (22±3° C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                            | Rel. humidity: (40±20)% rH                     |
| Spectrum-Analyzer settings            | Scan frequency range: <input checked="" type="checkbox"/> 1 – 16 GHz <input checked="" type="checkbox"/> 15 – 26 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 analyzer 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"                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                            |                                                |

### 5.2.4. Measurement Results

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

| Diagram no. | Frequency range | Set-up no. | Op-mode no. | Remark | Used detector                       |                                     |                          | Result |
|-------------|-----------------|------------|-------------|--------|-------------------------------------|-------------------------------------|--------------------------|--------|
|             |                 |            |             |        | PK                                  | AV                                  | QP                       |        |
| 4.01a       | 1 GHz - 16 GHz  | 1          | 1           | --     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |
| 4.01b       | 15 GHz – 26 GHz | 1          | 1           | --     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | passed |

Remark: see diagrams in annex 1 for more details

### 5.3. Measurement uncertainties

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

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

Following table shows expectable uncertainties for each measurement type performed.

| RF-Measurement                            | Reference    | Frequency range                     | Calculated uncertainty based on a confidence level of 95% |        |      |      |      |    |                      | Remarks                                   |
|-------------------------------------------|--------------|-------------------------------------|-----------------------------------------------------------|--------|------|------|------|----|----------------------|-------------------------------------------|
| Conducted emissions (U <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 GHz - 26.5 GHz                | 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 - 12.75 GHz                 | 1.48                                                      | N/A    | 1.51 | N/A  | 1.43 | -- |                      |                                           |
|                                           |              | 12.75 GHz – 18 GHz                  | 1.81                                                      | N/A    | 1.83 | N/A  | 1.77 | -- |                      |                                           |
|                                           |              | 18 GHz - 26.5 GHz                   | 1.83                                                      | N/A    | 1.85 | N/A  | 1.79 | -- |                      |                                           |
| Power density                             | -            | 30 MHz - 2.8 GHz                    | 1.40 dB                                                   |        |      |      |      |    |                      | --                                        |
| Occupied bandwidth                        | -            | 9 kHz - 4 GHz                       | 0.1272 ppm (Delta Marker)                                 |        |      |      |      |    |                      | Frequency error                           |
|                                           |              |                                     | 1.0 dB                                                    |        |      |      |      |    |                      | Power                                     |
| Emission bandwidth                        | -            | 9 kHz - 4 GHz                       | 0.1272 ppm (Delta Marker)                                 |        |      |      |      |    |                      | Frequency error                           |
|                                           | -            |                                     | See above: 0.70 dB                                        |        |      |      |      |    |                      | Power                                     |
| Frequency stability                       | -            | 9 kHz - 20 GHz                      | 0.0636 ppm                                                |        |      |      |      |    |                      | -                                         |
| Radiated emissions Enclosure              | -            | 150 kHz - 30 MHz                    | 5.0 dB                                                    |        |      |      |      |    |                      | Magnetic field<br>E-field<br>Substitution |
|                                           |              | 30 MHz - 1 GHz                      | 4.2 dB                                                    |        |      |      |      |    |                      |                                           |
|                                           |              | 1 GHz - 20 GHz                      | 3.17 dB                                                   |        |      |      |      |    |                      |                                           |

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

## 6. Abbreviations used in this report

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

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

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

## 8. Instruments and Ancillary

### 8.1. Used equipment

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

#### 8.1.1. Test software and firmware of equipment

| Ref.-No. | Equipment                               | Type                   | Serial-No.     | Version of Firmware or Software during the test                                                    |
|----------|-----------------------------------------|------------------------|----------------|----------------------------------------------------------------------------------------------------|
| 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                                                                    |
| 262      | Power Meter                             | NRV-S                  | 825770/0010    | Firm.= 2.6                                                                                         |
| 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                                                                |
| 378      | Broadband RF Field Monitor              | RadiSense III          | 03D00013SNO-08 | Firm.= V.03D13                                                                                     |
| 389      | Digital Multimeter                      | Keithley 2000          | 0583926        | Firm. = A13 (Mainboard) A02 (Display)                                                              |
| 392      | Radio Communication Tester              | MT8820A                | 6K00000788     | Firm.= 4.50 #005, IPL=4.01#001,OS=4.02#001, GSM=4.41#013, W-CDMA= 4.54#004, scenario= 4.52#002     |
| 436      | Univ. Radio Communication Tester        | CMU 200                | 103083         | R&S Test Firmware Base=5.14, Mess-Software= GSM:5.14 WCDMA:5.14 (current Testsoftw. F. all band to |
| 441      | CTC-SAR-EMI Cable Loss                  | System EMI field (SAR) | -              | EMC 32 Version 8.52                                                                                |
| 442      | CTC-SAR-EMS                             | System EMS field (SAR) | -              | EMC 32 Version 8.40                                                                                |
| 443      | CTC-FAR-EMI-RSE                         | System CTC-FAR-EMI-RSE | -              | Spuri 7.2.5 or EMC 32 Ver. 9.15.00                                                                 |
| 444      | CTC-FAR-EMS field                       | System-EMS-Field (FAR) | -              | EMC 32 Version 9.15.00                                                                             |
| 460      | Univ. Radio Communication Tester        | CMU 200                | 108901         | R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.,f. all band to be used,       |
| 489      | EMI Test Receiver                       | ESU40                  | 1000-30        | Firmware=4.43 SP3, Bios=V5.1-16-3, Spec. =01.00                                                    |
| 491      | ESD Simulator dito                      | ESD dito               | dito307022     | V 2.30                                                                                             |
| 524      | Voltage Drop Simulator                  | VDS 200                | 0196-16        | Software Nr: 000037 Version V4.20a01                                                               |
| 526      | Burst Generator                         | EFT 200 A              | 0496-06        | Software Nr. 000034 Version V2.32                                                                  |
| 527      | Micro Pulse Generator                   | MPG 200 B              | 0496-05        | Software-Nr. 000030 Version V2.43                                                                  |
| 528      | Load Dump Simulator                     | LD 200B                | 0496-06        | Software-Nr. 000031 Version V2.35a01                                                               |
| 546      | Univ. Radio Communication Tester        | CMU 200                | 106436         | R&S Test Firmware Base=5.14, GSM=5.14 WCDMA=5.14 (current Testsoftw.,f. all band to be used        |
| 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                   |
| 607      | Signal Generator                        | SMR 20                 | 832033/011     | V1.25                                                                                              |
| 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)                                             |
| 699      | Audio Analyzer                          | UPL16                  | 833494/005     | 3.06                                                                                               |

### 8.1.2. 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                    | -      | 23.05.2020 |
| 007      | Single-Line V-Network (50 Ohm/5µH)      | ESH3-Z6               | 892563/002   | Rohde & Schwarz       | 12 M                    | -      | 23.05.2020 |
| 009      | Power Meter (EMS-radiated)              | NRV                   | 863056/017   | Rohde & Schwarz       | 24 M                    | -      | 23.05.2021 |
| 016      | Line Impedance Simulating Network       | Op. 24-D              | B6366        | Spitzenberger+Spies   | 36 M                    | -      | 22.05.2022 |
| 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 |
| 033      | RF-current probe (100 kHz-30 MHz)       | ESH2-Z1               | 879581/18    | Rohde & Schwarz       | 24 M                    | -      | 23.05.2021 |
| 057      | relay-switch-unit (EMS system)          | RSU                   | 494440/002   | Rohde & Schwarz       | pre-m                   | 1 a    |            |
| 060      | power amplifier (DC-2 kHz)              | PAS 5000              | B6363        | Spitzenberger+Spies   | -                       | 3      |            |
| 086      | DC - power supply, 0 -10 A              | LNG 50-10             | -            | Heinzinger Electronic | pre-m                   | 2      |            |
| 087      | DC - power supply, 0 -5 A               | EA-3013 S             | -            | Elektro Automatik     | pre-m                   | 2      |            |
| 091      | USB-LWL-Converter                       | OLS-1                 | 007/2006     | Ing. Büro Scheiba     | -                       | 4      |            |
| 099      | passive voltage probe                   | ESH2-Z3               | 299.7810.52  | Rohde & Schwarz       | 36 M                    | -      | 30.05.2021 |
| 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 |
| 133      | horn antenna 18 GHz (Meas 1)            | 3115                  | 9012-3629    | EMCO                  | 36 M                    | 1 c    | 10.03.2020 |
| 134      | horn antenna 18 GHz (Subst 2)           | 3115                  | 9005-3414    | EMCO                  | 36 M                    | -      | 10.03.2020 |
| 248      | attenuator                              | SMA 6dB 2W            | -            | Radiall               | pre-m                   | 2      |            |
| 249      | attenuator                              | SMA 10dB 10W          | -            | Radiall               | pre-m                   | 2      |            |
| 252      | attenuator                              | N 6dB 12W             | -            | Radiall               | pre-m                   | 2      |            |
| 256      | attenuator                              | SMA 3dB 2W            | -            | Radiall               | pre-m                   | 2      |            |
| 257      | hybrid                                  | 4031C                 | 04491        | Narda                 | pre-m                   | 2      |            |
| 260      | hybrid coupler                          | 4032C                 | 11342        | Narda                 | pre-m                   | 2      |            |
| 261      | Thermal Power Sensor                    | NRV-Z55               | 825083/0008  | Rohde & Schwarz       | 24 M                    | -      | 30.05.2020 |
| 262      | Power Meter                             | NRV-S                 | 825770/0010  | Rohde & Schwarz       | 24 M                    | -      | 30.05.2020 |
| 265      | peak power sensor                       | NRV-Z33, Model 04     | 840414/009   | Rohde & Schwarz       | 24 M                    | -      | 30.05.2020 |
| 266      | Peak Power Sensor                       | NRV-Z31, Model 04     | 843383/016   | Rohde & Schwarz       | 24 M                    | -      | 30.05.2020 |
| 267      | notch filter GSM 850                    | WRCA 800/960-6EEK     | 9            | Wainwright GmbH       | pre-m                   | 2      |            |
| 270      | termination                             | 1418 N                | BB6935       | Weinschel             | pre-m                   | 2      |            |
| 271      | termination                             | 1418 N                | BE6384       | Weinschel             | pre-m                   | 2      |            |
| 272      | attenuator (20 dB) 50 W                 | Model 47              | BF6239       | Weinschel             | pre-m                   | 2      |            |
| 273      | attenuator (10 dB) 100 W                | Model 48              | BF9229       | Weinschel             | pre-m                   | 2      |            |
| 274      | attenuator (10 dB) 50 W                 | Model 47 (10 dB) 50 W | BG0321       | Weinschel             | pre-m                   | 2      |            |
| 275      | DC-Block                                | Model 7003 (N)        | C5129        | Weinschel             | pre-m                   | 2      |            |
| 276      | DC-Block                                | Model 7006 (SMA)      | C7061        | Weinschel             | pre-m                   | 2      |            |
| 279      | power divider                           | 1515 (SMA)            | LH855        | Weinschel             | pre-m                   | 2      |            |
| 298      | Univ. Radio Communication Tester        | CMU 200               | 832221/091   | Rohde & Schwarz       | pre-m                   | 3      |            |
| 300      | AC LISN (50 Ohm/50µH, 1-phase)          | ESH3-Z5               | 892 239/020  | Rohde & Schwarz       | 12 M                    | -      | 22.05.2020 |
| 301      | attenuator (20 dB) 50W, 18 GHz          | 47-20-33              | AW0272       | Lucas Weinschel       | pre-m                   | 2      |            |
| 302      | horn antenna 40 GHz (Meas 1)            | BBHA9170              | 155          | Schwarzbeck           | 36 M                    | -      | 14.03.2020 |
| 303      | horn antenna 40 GHz (Subst 1)           | BBHA9170              | 156          | Schwarzbeck           | 36 M                    | -      | 20.03.2020 |
| 331      | Climatic Test Chamber -40/+180 Grad     | HC 4055               | 43146        | Heraeus Vötsch        | 24 M                    | -      | 10.01.2021 |
| 341      | Digital Multimeter                      | Fluke 112             | 81650455     | Fluke                 | 24 M                    | -      | 30.05.2020 |
| 342      | Digital Multimeter                      | Voltcraft M-4660A     | IB 255466    | Voltcraft             | 24 M                    | -      | 23.05.2021 |
| 347      | laboratory site                         | radio lab.            | -            | -                     | -                       | 5      |            |
| 348      | laboratory site                         | EMI conducted         | -            | -                     | -                       | 5      |            |
| 354      | DC - Power Supply 40A                   | NGPE 40/40            | 448          | Rohde & Schwarz       | pre-m                   | 2      |            |
| 357      | power sensor                            | NRV-Z1                | 861761/002   | Rohde & Schwarz       | 24 M                    | -      | 21.05.2021 |
| 373      | Single-Line V-Network (50 Ohm/5µH)      | ESH3-Z6               | 100535       | Rohde & Schwarz       | 12 M                    | -      | 22.05.2020 |
| 377      | EMI Test Receiver                       | ESCS 30               | 100160       | Rohde & Schwarz       | 12 M                    | -      | 22.05.2020 |
| 389      | Digital Multimeter                      | Keithley 2000         | 0583926      | Keithley              | pre-m                   | -      |            |
| 392      | Radio Communication Tester              | MT8820A               | 6K00000788   | Anritsu               | 12 M                    | -      | 01.07.2020 |
| 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                    | -      | 25.05.2020 |
| 439      | UltraLog-Antenna                        | HL 562                | 100248       | Rohde & Schwarz       | 36 M                    | -      | 10.03.2020 |
| 454      | Oscilloscope                            | HM 205-3              | 9210 P 29661 | Hameg                 | -                       | 4      |            |
| 456      | DC-Power supply 0-5 A                   | EA 3013 S             | 207810       | Elektro Automatik     | pre-m                   | 2      |            |
| 459      | DC -Power supply 0-5 A , 0-32 V         | EA-PS 2032-50         | 910722       | Elektro Automatik     | pre-m                   | 2      |            |
| 460      | Univ. Radio Communication Tester        | CMU 200               | 108901       | Rohde & Schwarz       | 12 M                    | -      | 30.05.2020 |
| 463      | Universal source                        | HP3245A               | 2831A03472   | Agilent               | -                       | 4      |            |
| 466      | Digital Multimeter                      | Fluke 112             | 89210157     | Fluke USA             | 24 M                    | -      | 30.05.2020 |

| Ref.-No. | Equipment                               | Type                          | Serial-No.          | Manufacturer                | Interval of calibration | Remark | Cal due    |
|----------|-----------------------------------------|-------------------------------|---------------------|-----------------------------|-------------------------|--------|------------|
| 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)               | -                       | 1 d    |            |
| 484      | pre-amplifier 2.5 - 18 GHz              | AMF-5D-02501800-25-10P        | 1244554             | Miteq                       | 12 M                    | -      | 16.11.2019 |
| 487      | System CTC NSA-Verification SAR-EMI     | System EMI field (SAR) NSA    | -                   | ETS Lindgren / CETECOM      | 24 M                    | -      | 16.04.2021 |
| 489      | EMI Test Receiver                       | ESU40                         | 1000-30             | Rohde & Schwarz             | 12 M                    | -      | 30.06.2020 |
| 502      | band reject filter                      | WRCG 1709/1786-1699/1796-     | SN 9                | Wainwright                  | pre-m                   | 2      |            |
| 503      | band reject filter                      | WRCG 824/849-814/859-         | SN 5                | Wainwright                  | pre-m                   | 2      |            |
| 512      | notch filter GSM 850                    | WRCA 800/960-02/40-6EEK       | SN 24               | Wainwright                  | 12 M                    | 1 c    | 16.11.2019 |
| 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 |
| 529      | 6 dB Broadband resistive power divider  | Model 1515                    | LH 855              | Weinschel                   | pre-m                   | 2      |            |
| 530      | 10 dB Broadband resistive power divider | R 416110000                   | LOT 9828            | -                           | pre-m                   | 2      |            |
| 546      | Univ. Radio Communication Tester        | CMU 200                       | 106436              | R&S                         | 12 M                    | -      | 05.08.2020 |
| 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 |
| 557      | System CTC-OTA-2                        | R&S TS8991                    | -                   | Rohde & Schwarz             | 12 M                    | 5      | 24.01.2020 |
| 574      | Biconilog Hybrid Antenna                | BTA-L                         | 980026L             | Frankonia                   | 36/12 M                 | -      | 03.05.2022 |
| 584      | Spectrum Analyzer                       | FSU 8                         | 100248              | Rohde & Schwarz             | pre-m                   | -      |            |
| 594      | Wideband Radio Communication Tester     | CMW 500                       | 101757              | Rohde & Schwarz             | 12 M                    | -      | 26.06.2020 |
| 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                    | -      |            |
| 611      | DC power supply                         | E3632A                        | KR 75305854         | Agilent                     | pre-m                   | 2      |            |
| 612      | DC power supply                         | E3632A                        | MY 40001321         | Agilent                     | pre-m                   | 2      |            |
| 613      | Attenuator                              | R416120000 20dB 10W           | Lot. 9828           | Radiall                     | pre-m                   | 2      |            |
| 616      | Digitalmultimeter                       | Fluke 177                     | 88900339            | Fluke                       | 24 M                    | -      | 30.05.2020 |
| 617      | Power Splitter/Combiner                 | ZFSC-2-2-S+                   | S F987001108        | Mini Circuits               | -                       | 2      |            |
| 618      | Power Splitter/Combiner                 | 50PD-634                      | 600994              | JFW Industries USA          | -                       | 2      |            |
| 619      | Power Splitter/Combiner                 | 50PD-634                      | 600995              | JFW Industries, USA         | -                       | 3      |            |
| 620      | EMI Test Receiver                       | ESU 26                        | 100362              | Rohde-Schwarz               | 12 M                    | -      | 30.05.2020 |
| 621      | Step Attenuator 0-139 dB                | RSP                           | 100017              | Rohde & Schwarz             | pre-m                   | 2      |            |
| 625      | Generic Test Load USB                   | Generic Test Load USB         | -                   | CETECOM                     | -                       | 2      |            |
| 634      | Spectrum Analyzer                       | FSM (HF-Unit)                 | 826188/010          | Rohde & Schwarz             | pre-m                   | 2      |            |
| 637      | High Speed HDMI with Ethernet 1 m       | HDMI cable with Ethernet 1 m  | -                   | KogiLink                    | -                       | 2      |            |
| 638      | HDMI Kabel with Ethernet 1.5 m flach    | HDMI cable with Ethernet      | -                   | Reichelt                    | -                       | 2      |            |
| 640      | HDMI cable 2 m rund                     | HDMI cable 2 m rund           | -                   | Reichelt                    | -                       | 2      |            |
| 641      | HDMI cable with Ethernet                | Certified HDMI cable with     | -                   | PureLink                    | -                       | 2      |            |
| 644      | Amplifierer                             | ZX60-2534 m+                  | SN865701299         | Mini-Circuits               | -                       | -      |            |
| 670      | Univ. Radio Communication Tester        | CMU 200                       | 106833              | Rohde & Schwarz             | 24 M                    | -      | 30.05.2020 |
| 671      | DC-power supply 0-5 A                   | EA-3013S                      | -                   | Elektro Automatik           | pre-m                   | 2      |            |
| 678      | Power Meter                             | NRP                           | 101638              | Rohde&Schwarz               | pre-m                   | -      |            |
| 683      | Spectrum Analyzer                       | FSU 26                        | 200571              | Rohde & Schwarz             | 12 M                    | -      | 30.05.2020 |
| 686      | Field Analyzer                          | EHP-200A                      | 160WX30702          | Narda Safety Test Solutions | -                       | -      |            |
| 687      | Signal Generator                        | SMF 100A                      | 102073              | Rohde&Schwarz               | 12 M                    | -      | 30.05.2020 |
| 688      | Pre Amp                                 | JS-18004000-40-8P             | 1750117             | Miteq                       | pre-m                   | -      |            |
| 690      | Spectrum Analyzer                       | FSU                           | 100302/026          | Rohde&Schwarz               | 24 M                    | -      | 30.05.2021 |
| 691      | OSP120 Base Unit                        | OSP120                        | 106833              | Rohde & Schwarz             | 12 M                    | -      | 30.05.2020 |
| 692      | Bluetooth Tester                        | CBT 32                        | 100236              | Rohde & Schwarz             | 36 M                    | -      | 29.05.2020 |
| 693      | TS8997                                  | CTC-Radio Lab 1_TS8997        | -                   | Rohde&Schwarz               | 12 M                    | 5      | 07.01.2020 |
| 697      | Power Splitter                          | ZN4PD-642W-S+                 | 165001445           | Mini-Circuits               | -                       | 2      |            |
| 701      | CMW500 wide. Radio Comm.                | CMW500                        | 158150              | Rohde & Schwarz             | 24 M                    | -      | 05.11.2021 |
| 703      | INNCO Antennen Mast                     | MA 4010-KT080-XPET-ZSS3       | MA4170-KT100-XPET-  | INNCO                       | pre-m                   | -      |            |
| 704      | INNCON Controller                       | CO 3000-4port                 | CO3000/933/38410516 | INNCO Systems               | pre-m                   | -      |            |

| Ref.-No. | Equipment                         | Type                           | Serial-No.    | Manufacturer                  | Interval of calibration | Remark | Cal due    |
|----------|-----------------------------------|--------------------------------|---------------|-------------------------------|-------------------------|--------|------------|
|          |                                   |                                | /L            | GmbH                          |                         |        |            |
| 711      | Harmonic Mixer 90 GHz - 140 GHz   | RPG FS-Z140                    | 101004        | RPG                           | 36 M                    | -      | 22.02.2020 |
| 712      | Harmonic Mixer 75 GHz - 110 GHz   | FS-Z110                        | 101468        | Rohde & Schwarz               | 12 M                    | -      | 04.11.2020 |
| 713      | Harmonic Mixer, 50 GHz - 75 GHz   | FS-Z75                         | 101022        | Rohde & Schwarz               | 24 M                    | -      | 05.07.2021 |
| 714      | Signal Analyzer 67 GHz            | FSW67                          | 104023        | Rohde & Schwarz               | 12 M                    | -      | 04.07.2020 |
| 715      | Harmonic Mixer, 140 GHz - 220 GHz | FS-Z220                        | 101009        | RPG Radiometer Physics        | 36 M                    | -      | 03.08.2020 |
| 716      | Harmonic Mixer 220 GHz to 325 GHz | FS-Z325                        | 101005        | RPG Radiometer Physics        | 36 M                    | -      | 13.02.2020 |
| 747      | Spectrum Analyzer                 | FSU 26                         | 200152        | Rohde & Schwarz               | 12 M                    | -      | 04.07.2020 |
| 748      | Pickett-Potter Horn Antenna       | FH-PP 4060                     | 010001        | Radiometer Physics            | 36 M                    | -      |            |
| 750      | Pickett-Potter Horn Antenna       | FH-PP 220                      | 010011        | Radiometer Physics            | 36 M                    | -      |            |
| 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                    | -      | 30.05.2020 |
| 758      | Signal Generator                  | SMU 200A                       | 100754        | Rohde & Schwarz               | 24 M                    | -      | 11.10.2020 |
| 781      | Power Supply                      | PS 2042-10 B                   | 2815450369    | Elektro-Automatik GmbH        | -                       | -      |            |
| 782      | Power Supply                      | PS 2042-10 B                   | 2815450348    | lektro-Automatik GmbH & Co.KG | -                       | -      |            |
| 783      | Spectrum Analyzer                 | FSU 26                         | 100414        | Rohde & Schwarz               | 12 M                    | -      | 30.05.2020 |
| 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                    | -      |            |
| 786      | SAR Probe                         | ES3DV3                         | 3340          | Speag                         | 36 M                    | -      | 14.02.2021 |
| 787      | OSP                               | OSP B157WX                     | 101264        | Rohde & Schwarz               | 24 M                    | -      | 30.05.2020 |
| 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 |
| 790      | Horn Antenna                      | ASY-SGH-124-SMA                | 29F14182337   | Antenna System Solutions      | 36 M                    | -      | 08.10.2021 |
| 791      | Pickett-Potter Horn Antenna       | FH-PP-325                      | 10024         | Radiometer Physics            | 36 M                    | -      |            |
| 792      | Pickett-Potter Horn Antenna       | FH-PP 075                      | 10006         | Radiometer Physics            | 36 M                    | -      |            |
| 793      | Pickett-Potter Horn Antenna       | FH-PP 140                      | 10008         | Radiometer Physics            | 36 M                    | -      |            |
| 794      | Pickett-Potter Horn Antenna       | FH-PP 110                      | 10014         | Radiometer Physics            | 36 M                    | -      |            |
| 795      | SGH Antenna                       | SGH-26-WR10                    | 1144          | Antenal S.L.                  | 36 M                    | -      |            |
| 798      | WR-22 Rectangular Gain Horn       | SAR-2309-22-S2                 | 13254-01      | SAGE Millimeter, Inc.         | 36 M                    | -      |            |
| 799      | Transceiver                       | optoLAN-Gb                     | 18-014746     | mk messtechnik                | pre-m                   | -      |            |
| 801      | Spectrum Analyzer                 | FSP 13                         | 100960        | Rohde & Schwarz               | 24 M                    | -      | 14.01.2021 |
| 802      | Exposure Level Tester             | ELT-400                        | O-0026        | NARDA Safety Solutions        | 24 M                    | -      | 30.01.2021 |
| 803      | Probe                             | ELT probe 3 cm <sup>2</sup>    | O-0026        | Narda Safety Test Solution    | 24 M                    | -      | 30.01.2021 |
| 805      | Thermo-Hygrometer                 | Web-Thermo-Hygrometer          | 02749814      | W&T                           | 24 M                    | -      |            |
| 806      | AC2600 Smart Wifi Router          | Netgear Nighthawk x4S          | 5K5188590067B | Netgear                       | -                       | -      |            |
| 807      | Direct Coupler                    | Direct Coupler C-05020-10      | 511           | ET Industries                 | -                       | -      |            |
| 808      | Diode Power Sensor                | NRV-Z1                         | 829894/001    | Rohde & Schwarz               | 24 M                    | -      | 24.05.2021 |
| 809      | Standard gain Horn Antenna        | WR-159 Horn Antenna            | -             | Pasternack Enterprises Inc.   | -                       | -      |            |
| 810      | Horn Antenna WR90                 | 90-HA20                        | J202064946    | TACTRON Elektronik GmbH &     | -                       | -      |            |
| 811      | Waveguide to Coax Adapter         | ADP-WC-WR90-SMA-F              | J504072436    | TACTRON elektronik GmbH &     | -                       | -      |            |
| 812      | 1-18 GHz Amplifier                | ASG18B-4010                    | -             | Wright Technologies, Inc.     | pre-m                   | -      |            |
| 813      | Band Reject Filter                | WRCJV10-5855-5875-5905-        | 10            | Wainwright Instruments GmbH   | pre-m                   | -      |            |
| 814      | Band Reject Filter                | WRCJV10-5855-5875-5905-        | 11            | Wainwright Instruments GmbH   | pre-m                   | -      |            |
| 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           | -                       | -      |            |

| Ref.-No. | Equipment                            | Type               | Serial-No. | Manufacturer                | Interval of calibration | Remark | Cal due    |
|----------|--------------------------------------|--------------------|------------|-----------------------------|-------------------------|--------|------------|
| 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         | -                       | -      |            |
| 830      | SIGNAL ANALYZER                      | FSV3030            | 101247     | Rohde&Schwarz               | 12 M                    | -      | 02.10.2020 |
| 831      | Rubidium Frequency Standard          | 8040B CS-Rub5      | 100050     | Rohde & Schwarz             | 36 M                    | -      |            |
| 832      | Climatic Chamber                     | VT4002             | 521/79152  | Vötsch Industrietechnik     | 12 M                    | -      | 13.02.2020 |
| 833      | Climatic Chamber                     | VT4002             | 521/79863  | Vötsch industrietechnik     | 12 M                    | -      | 13.02.2020 |

### 8.1.3. Legend

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

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

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

| Version | Applied changes | Date of release |
|---------|-----------------|-----------------|
| --      | Initial release | 2020-02-12      |

**END OF TEST REPORT**