# T E S T  R E P O R T
# No.: 19-1-0137401T07a-C1

According to:
**FCC Regulations Title 47, Part 15**
**Subpart B (Unintentional radiators)**
§15.107, §15.109

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

for

Bosch Healthcare Solutions GmbH

Vivatmo pro (Base Station)
System for quantitative measurement of fractional nitric oxide (FeNO) in human breath

FCC ID: 2AVQ9VMPBS1
Reg. number IC: 25928-VMPBS1

| Laboratory Accreditation and Listings |
|---|
| ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-01 D-PL-12047-01-03 D-PL-12047-01-04<br><br>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. | | | |

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 2019 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 | IC | Limits | | | |
| 1 | AC Power Lines<br><br>Conducted emissions 0.15 – 30 MHz | AC Power lines | §15.107 | ICES-003, Issue 5 (ANSI C63.4) | ☐ Class A<br>☒ Class B | 1 | 1 | passed |
| 3 | Radiated emissions 30 MHz-1 GHz | Cabinet + Inter-connecting cables | §15.109 | ICES-003, Issue 5 (ANSI C63.4) | ☐ Class A<br>☒ Class B<br>☐ Class A<br>☒ Class B | 1 | 1 | .passed |
| 4 | Radiated emissions above 1 GHz | Cabinet + Inter-connecting cables | §15.109 | ICES-003, Issue 5 (ANSI C63.4) | ☐ Class A<br>☒ 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 Industry Canada standards. All requirements as shown in above table are met in accordance with enumerated standards.

Test report 19-1-0137401T07a-C1, dated 202-04-29 is replacing original report 19-1-0137401T07a, dated 2020-04-02. The replaced test report gets invalid herewith.

Digital signiert von:
Christian Lorenz
Datum: 2020.04.29
13:28:41 +02'00'

CN = Hicham Laayouni
email = hicham.
laayouni@cetecom.com
C = DE O = CETECOM
2020.04.29 13:24:22 +
02'00'

| | |
|---|---|
| ..... | ..... |
| Dipl.-Ing. Ch. Lorenz | B.Sc. H. Laayouni |
| Responsible for test section | 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: | B.Sc. H. Laayouni |
| Receipt of EUT: | 2019-11-06 |
| Date(s) of test: | 2019-11-11 to 2019-12-12 |
| Date of report: | 2020-04-02 |
| --- | |
| Version of template: 13.03 | |

## 2.4. Applicant's details

| | |
|---|---|
| Applicant's name: | Bosch Healthcare Solutions GmbH |
| Address: | Stuttgarter Str. 130<br>71332 Waiblingen<br><br>Germany |
| Contact person: | Mr. Markus Thürsam |

## 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 S25 | Vivatmo pro (Base Station) | System for quantitative measurement of fractional nitric oxide (FeNO) in human breath | b827eb034258 | F09G100168 | Linux-Version: 4.4.35, SW-Version: 1.2.0 |

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

## 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 | Power cable for Vivatmo pro (Base Station) | UE36LCP-240150SPA | - | - | - |
| AE 2 | Samsung printer | - | - | - | - |
| AE 3 | Dymo Labelwriter | 450 | | | |

*) 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 + AE 2 | used for radiated measurements below 1 GHz |
| set. 2 | EUT A + AE 1 + AE 3 | used for conducted measurement and for radiated measurements above 1 GHz |

*) 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 | USB and Ethernet connection active during the measurements |

*) 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 | ☒ table-top<br>☐ floor-standing<br>☐ wall-mounted<br>☐ not defined | typical use<br>☐ portable use<br>☒ fixed use<br>☐ vehicular use | typical operating cycle of EUT.<br>☒ < 0.5 sec.<br>☐ : |
| Place of use | ☒ Residential, commercial and light industry<br>☐ Industrial environment<br>☐ vehicular use | | |
| Highest internal frequency generated by EUT and required upper frequency of radiated disturbance measurement | ☐ less than 108 MHz -> up to 1 GHz<br>☐ 108 MHz - 500 MHz -> up to 2 GHz<br>☐ 500 MHz - 1 GHz -> up to 5 or 6 GHz<br>☒ 2.4 GHz -> up to 26.5 GHz | | |
| **Power line**:<br>☒ AC ☐ L1, ☐ L2, ☐ L3, ☐ N<br>☒60 Hz ☐ 12 V, ☐ 24 V, ☒ 120 V, ☐ 400 V<br>☐ DC ☐ | EUT-grounding:<br>☐ none<br>☒ with power supply<br>☐ additional: | (in case of deviation during tests the single details are described on chapter 4) | |

| **Other Ports** (description of interconnecting cables) | Connector | possible total cable length | shielding | connected during test |
|---|---|---|---|---|
| 1. Ethernet cable | Ethernet | ☒ < 3m ☐> 3m<br>☐ : other | ☒ screened<br>☐ unscreened | ☒ yes<br>☐ no |
| Does EUT contain devices susceptible to magnetic fields, e.g. Hall elements, electrodynamics microphones, etc.? | | | | ☐ yes<br>☒ no |
| Is mounting position / usual operating position defined? | | | | ☐ yes<br>☒ no |

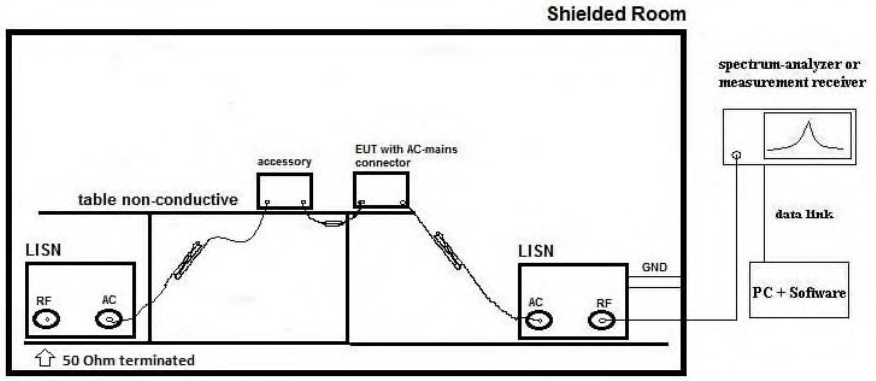
# 4. Description of test system set-up's

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

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

**General Description:** The radio frequency voltage conducted back into the AC power line in the frequency range 150 kHz to 30 MHz has to be investigated. Compliance should be tested by measuring the radio frequency voltage between each power line and ground at the power terminals in the stated frequency range.
A 50 Ohm / 50 µH line impedance stabilization network (LISN) is used coupling the interface to the measurement equipment. The EUT power input leads are connected through the LISN to the AC-power source. The LISN enclosure is electrically connected to the ground plane. The measuring instrument is connected to the coaxial output of the LISN.
Tabletop devices were set-up on a 80 cm height above reference ground plane, floor standing equipment 10 cm raised above ground plane. Measurements have been performed on each phase line and neutral line of the devices AC-power lines. The EUT was power supplied with 120 V/60 Hz. The EUT was tested in the defined operating mode and installed (connected) to accessory equipment according the general description of use given by the applicant.

**Schematic:**




Only schematic view

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

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

**Formula:**

$V_C = V_R + C_L$ (1)

$M = L_T - V_C$ (2)

$V_C$ = measured Voltage –corrected value
$V_R$ = Receiver reading
$C_L$ = Cable loss
M = Margin
$L_T$ = Limit

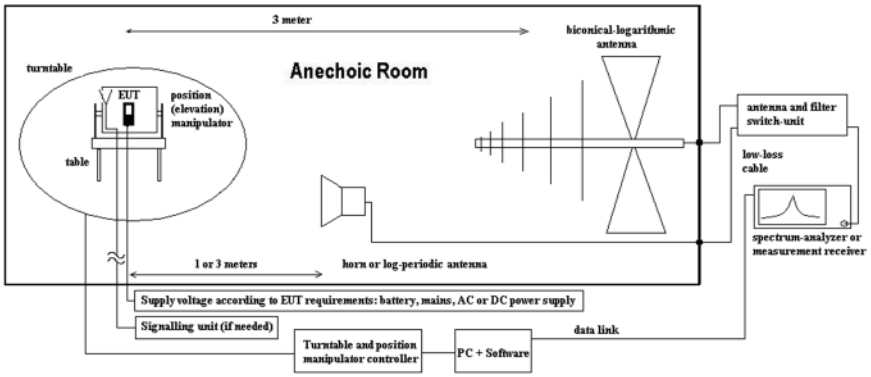
Values are in dB, positive margin means value is below limit.

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

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

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

**Schematic:**




**Testing method:**

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

Measurement antenna: horizontal and vertical, heights: 1,0 m and 1,82 m as worst-case determined by an exploratory emission measurements. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

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

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

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

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

**Formula:**

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

$M = L_T - E_C$ (2)

AF = Antenna factor
$C_L$ = Cable loss
$D_F$ = Distance correction factor (if used)
$E_C$ = Electrical field – corrected value
$E_R$ = Receiver reading
$G_A$ = Gain of pre-amplifier (if used)
$L_T$ = Limit
M = Margin

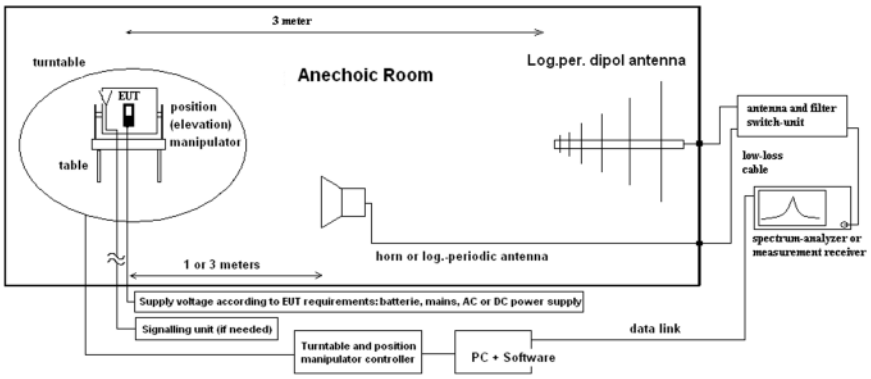
All units are dB-units, positive margin means value is below limit.

## 4.3. 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 it's characteristics was recorded with an EMI-receiver, broadband antenna and software.
The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

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

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

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

**Formula:**

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

$M = L_T - E_C$ (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 - Conducted emissions on AC-Power lines

### 5.1.1. Test location and equipment

| | | | | | | |
|---|---|---|---|---|---|---|
| test location | ☒ CETECOM Essen (Chapter 2.2.1) | | ☐ Please see Chapter 2.2.2 | | ☐ Please see Chapter 2.2.3 | |
| test site | ☐ 333 EMI field | ☒ 348 EMI cond. | | | | |
| receiver | ☐ 001 ESS | ☒ 377 ESCS 30 | ☐ 489 ESU 40 | ☐ 620 ESU 26 | | |
| LISN | ☒ 005 ESH2-Z5 | ☐ 007 ESH3-Z6 | ☐ 300 ESH3-Z5 & 50Ω used for AE | | ☐ no LISN for AE | |
| signaling | ☐ 436 CMU | ☐ 547 CMU | | ☐ 594 CMW | | |
| line voltage | ☐ 230 V 50 Hz via public mains | | ☒ 060 120 V 60 Hz via PAS 5000 | | | |

### 5.1.2. FCC-requirements un-intentional radiators:

| FCC | | Part 15, Subpart B, §15.107 | | | |
|---|---|---|---|---|---|
| ANSI | | C63.4-2014, § 5.2, 6, 7 | | | |
| Limit | Frequency [MHz] | ☒ Conducted limit Class B | | ☐ Conducted limit Class A | |
| | | QUASI-Peak [dBµV] | AVERAGE [dBµV] | QUASI-Peak [dBµV] | AVERAGE [dBµV] |
| | 0.15 – 0.5 | 66 to 56* | 56 to 46* | 79 | 66 |
| | 0.5 – 5 | 56 | 46 | 73 | 60 |
| | 5 – 30 | 60 | 50 | 73 | 60 |
| Remark: * decreases with the logarithm of the frequency | | | | | |

### 5.1.3. Canadian requirements:

| RSS | ☐ RSS Gen, Issue 5, Chapter 8.8<br>☒ ICES-003, Issue 6: Table 1 (Class A limits) or Table 2 (Class B limits) | | | |
|---|---|---|---|---|
| ANSI | ☐ Option i): Limits/Methods accord. CAN/CSA-CISPR 22-10<br>☒ Option ii): ICES-003, Issue 6 limits + Methods accord. C63.4-2014, Section 3b<br>☐ Option iii): Limits accord. ICES-003, Issue 6 + Methods C63.4-2014, Section 3b | | | |
| CAN/CSA -CISPR 22-10 | ☐ Option i): Limits/Methods accord. CAN/CSA-CISPR 22-10 | | | |
| Limit | Frequency [MHz] | ☒ Conducted limit Class B (Table 2) | | ☐ Conducted limit Class A (Table 1) | |
| | | QUASI-Peak [dBµV] | AVERAGE [dBµV] | QUASI-Peak [dBµV] | AVERAGE [dBµV] |
| | 0.15 – 0.5 | 66 to 56* | 56 to 46* | 79 | 66 |
| | 0.5 – 5 | 56 | 46 | 73 | 60 |
| | 5 – 30 | 60 | 50 | 73 | 60 |
| Remark: * decreases with the logarithm of the frequency | | | | | |

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

| Signal link to test system (if used): | | ☐ air link | ☐ cable connection | ☒ none |
|---|---|---|---|---|
| EUT-grounding | | ☐ none | ☒ with power supply | ☐ additional connection |
| Equipment set up | | ☒ table top<br>(40 cm distance to reference ground plane (wall) | | ☐ floor standing<br>EUT stands isolated on reference ground plane (floor) |
| Climatic conditions | | Temperature: (22±3°C) | | Rel. humidity: (40±20)% |
| EMI-Receiver or Analyzer settings | Scan data | ☐ 9 – 150 kHz, RBW = 200 Hz, Step = 61 Hz<br>☒ 150 kHz – 30 MHz RBW = 9 kHz, Step = 4 kHz<br>☐ other: | | |
| | Scan-Mode<br>Pre-measurement<br>Final measurement | 6 dB EMI-Receiver Mode<br>Peak detector, Repetitive-Scan, max-hold, sweep-time 50 µs per frequency point<br>Average & Quasi-peak detector at critical frequencies | | |
| General measurement procedures | | Please see chapter "Test system set-up for AC power line conducted emissions measurements" | | |

### 5.1.5. Measurement results

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

| **EUT** set-up no.: | | | set-up 2 | | |
|---|---|---|---|---|---|
| Diagram No. | EUT operating mode no. or commend | Used Detector | Power line | Additional (scan-) information or remarks | Result |
| 1.01 | EUT operating mode 1 | ☒ Peak (pre-scan)<br>☒ AV (final)<br>☐ QP (final) | L1/ N | -- | passed |

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

### 5.2.1. Test location and equipment

| | | | | | | |
|---|---|---|---|---|---|---|
| test location | ☒ CETECOM Essen (Chapter. 2.2.1) | | ☐ Please see Chapter. 2.2.2 | | ☐ Please see Chapter. 2.2.3 | |
| test site | ☒ 441 EMI SAR | ☒ 487 SAR NSA | | | | |
| receiver | ☐ 377 ESCS30 | ☒ 001 ESS | ☐ 489 ESU 40 | ☐ 620 ESU 26 | | |
| spectr. analyz. | ☐ 584 FSU | ☐ 120 FSEM | ☐ 264 FSEK | | | |
| antenna | ☒ 574 BTA-L | ☐ 133 EMCO3115 | ☐ 302 BBHA9170 | ☐ 289 CBL 6141 | ☐ 030 HFH-Z2 | ☐ 477 GPS |
| signaling | ☐ 392 MT8820A | ☐ 371 CBT32 | ☐ 547 CMU | ☐ 594 CMW | | |
| otherwise | ☐ 400 FTC40x15E | ☐ 401 FTC40x15E | ☐ 110 USB LWL | ☒ 482 Filter Matrix | | |
| DC power | ☐ 456 EA 3013A | ☐ 457 EA 3013A | ☐ 459 EA 2032-50 | ☐ 268 EA- 3050 | ☐ 494 AG6632A | ☐ 498 NGPE |
| line voltage | ☐ 230 V 50 Hz via public mains | | ☒ 060 120 V 60 Hz via PAS 5000 | | | |

### 5.2.2. Requirements/Limits

| | | | |
|---|---|---|---|
| **FCC** | | ☒ Part 15 Subpart B, §15.109, class B<br>☐ Part 15 Subpart C, §15.209 @ frequencies defined in §15.205 | |
| **ISED (IC)** | | ☐ RSS-Gen., Issue 5, Chapter 8.9, Table 5+6+7 (license-exempt radio apparatus)<br>☐ RSS-Gen., Issue 5, Chapter 7.3, Table 3 (receiver)<br>☒ ICES-003, Issue 6, Table 4(class A)/Table 5(Class B)<br>☐ RSS-247, Issue 2, Chapter 5.5 ☐ RSS-247, Issue 2, Chapter 6.2 | |
| **ANSI** | | ☒ C63.4-2014<br>☐ C63.10-2013 | |
| **Limit** | Frequency [MHz] | Radiated emissions limits, 3 meters | |
| | | QUASI Peak [µV/m] | QUASI-Peak [dBµV/m] |
| | 30 - 88 | 100 | 40.0 |
| | 88 - 216 | 150 | 43.5 |
| | 216 - 960 | 200 | 46.0 |
| | above 960 | 500 | 54.0 |

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

| | | | | |
|---|---|---|---|---|
| Signal link to test system (if used): | | ☐ air link | ☐ cable connection | ☒ none |
| EUT-grounding | | ☒ none | ☐ with power supply | ☐ additional connection |
| Equipment set up | | ☒ table top 0.8m height | | ☐ floor standing |
| Climatic conditions | | Temperature: (22±3)° C | | Rel. humidity: (40±20)% rH |
| EMI-Receiver (Analyzer) Settings | Scan frequency range: | ☒ 30 – 1000 MHz ☐ other: | | |
| | Scan-Mode | ☒ 6 dB EMI-Receiver Mode ☐ 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" | | |

### 5.2.4. MEASUREMENT RESULTS

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

| Dia-gram no. | Frequency range | Set-up no. | OP-mode no. | Remark | Used detector | | | Result |
|---|---|---|---|---|---|---|---|---|
| | | | | | PK | AV | QP | |
| 3.01 | 30 MHz – 1 GHz | 1 | 1 | - | ☒ | ☐ | ☒ | passed |

Remark: see diagrams in annex 1 for more details

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

### 5.3.1. Test location and equipment FAR

| | | | | | | |
|---|---|---|---|---|---|---|
| test site | ☐441 EMI SAR | ☐348 EMI cond. | ☒443 EMI FAR | ☐347 Radio.lab. | ☐ 337 OATS | |
| spectr. analyz. | ☐584 FSU | ☐120 FSEM | ☐264 FSEK | ☒489 ESU 40 | ☒ 714 FSW | |
| antenna meas | ☐574 BTA-L | ☐289 CBL 6141 | ☐608 HL 562 | ☒549 HL025 | ☒ 302 BBHA9170 | |
| antenna subst | ☐071 HUF-Z2 | ☐020 EMCO3115 | ☐063 LP 3146 | | ☐ 303 BBHA9170 | |
| signaling | ☐392 MT8820A | ☐371 CBT32 | ☐547 CMU200 | ☐594 CMW | | |
| DC power | ☐086 LNG50-10 | ☐087 EA3013 | ☐354 NGPE 40 | ☐349 car battery | ☐ 350 Car battery | ☐ |
| line voltage | ☐ 230 V 50 Hz via public mains | | ☐ 060 120 V 60 Hz via PAS 5000 | | | |

### 5.3.2. Requirements/Limits

| | | | | |
|---|---|---|---|---|
| **FCC** | ☒ Part 15 Subpart B, §15.109 class B<br>☐ Part 15 Subpart C, §15.209 for frequencies defined in §15.205<br>☐ Part 15 Subpart C, §15.407(b)(1)(2)(3)(4) | | | |
| **ISED** | ☐ RSS-Gen., Issue 5, Chapter 8.9, Table 5+6+7 (transmitter license exempt)<br>☐ RSS-Gen., Issue 5, Chapter 7.3, Table 3 (receiver)<br>☒ ICES-003, Issue 6, Chapter 6.2.2, Table 7(class B), Table 6 (Class A)<br>☐ RSS-247, Issue 2, Chapter 5.5<br>☐ RSS-247, Issue 2, Chapter 6.2 | | | |
| **ANSI** | ☐ C63.4-2014<br>☒ C63.10-2013 | | | |
| Frequency [MHz] | Limits | | | |
| | AV [µV/m] | AV [dBµV/m] | Peak [µV/m] | Peak [dBµV/m] or [dBm/MHz] |
| **FCC:** Part 15B<br>**ISED:** ICES-003 | 500 | 54.0 | 5000 | 74.0 dBµV/m |

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

| | | | | |
|---|---|---|---|---|
| Signal link to test system (if used): | | ☐ air link | ☐ cable connection | ☒ none |
| EUT-grounding | | ☒ none | ☐ with power supply | ☐ additional connection |
| Equipment set up | | ☒ table top 1.5m height | | ☐ floor standing |
| Climatic conditions | | Temperature: (22±3)° C | | Rel. humidity: (40±20)% rH |
| Spectrum-Analyzer settings | Scan frequency range: | ☒ 1 – 15 GHz ☒ 15 – 26 GHz ☐ 18 – 40 GHz ☐ other: | | |
| | Scan-Mode | ☒ 6 dB EMI-Receiver Mode ☐ 3 dB Spectrum analyzer Mode | | |
| | Detector | Peak and Average | | |
| | RBW/VBW | 1 MHz / 3 MHz | | |
| | Mode: | Repetitive-Scan, max-hold | | |
| | Scan step | 400 kHz | | |
| | 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" | | |

### 5.3.4. Measurement Results

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

| Dia-gram no. | Frequency range | Set-up no. | OP-mode no. | Remark | Used detector | | | Result |
|---|---|---|---|---|---|---|---|---|
| | | | | | PK | AV | QP | |
| 4.01 | 1 GHz – 15GHz | 1 | 1 | -- | ☒ | ☒ | ☐ | passed |
| 4.02 | 15 GHz – 26.5 GHz | 1 | 1 | -- | ☒ | ☒ | ☐ | passed |

## 5.4. Measurement uncertainties

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved.
For uncertainty determination, each component used in the concrete measurement set-up was taken in account and it is contribution to the overall uncertainty according it's statistical distribution calculated.

Following table shows expectable uncertainties for each measurement type performed.

| RF-Measurement | Reference | Frequency range | Calculated uncertainty based on a confidence level of 95% | | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Conducted emissions ($U_{CISPR}$) | CISPR 16-2-1 | 9 kHz - 150 kHz<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 | -<br>- | 9 kHz - 4 GHz | 0.1272 ppm (Delta Marker) | | | | | | Frequency error |
| | | | See above: 0.70 dB | | | | | | Power |
| Frequency stability | - | 9 kHz - 20 GHz | 0.0636 ppm | | | | | | - |
| Radiated emissions Enclosure | - | 150 kHz - 30 MHz<br>30 MHz - 1 GHz<br>1 GHz - 20 GHz | 5.0 dB<br>4.2 dB<br>3.17 dB | | | | | | Magnetic field<br>E-field<br>Substitution |

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

# 6. 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 |
| ERP | Effective radiated power |
| FCC | Federal Communications Commission, USA |
| IC | Industry Canada |
| n.a. | not applicable |
| Op-Mode | Operating mode of the equipment |
| PK | Peak |
| QP | Quasi peak detector |
| RBW | resolution bandwidth |
| RF | Radio frequency |
| RSS | Radio Standards Specification, Documents from Industry Canada |
| Rx | Receiver |
| TCH | Traffic channel |
| Tx | Transmitter |
| VBW | Video bandwidth |

# 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

28. Jan. 20

## 8.1. Used equipment "CETECOM GmbH"

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 (100kHz-30MHz) | ESH2-Z1 | 879581/18 | Rohde & Schwarz | 24 M | - | 23.05.2021 |
| 057 | relay-switch-unit (EMS system) | RSU | 494440/002 | Rohde & Schwarz | pre-m | 1a | |
| 060 | power amplifier (DC-2kHz) | PAS 5000 | B6363 | Spitzenberger+Spies | - | 3 | |
| 086 | DC - power supply, 0 -10 A | LNG 50-10 | - | Heinzinger Electronic | pre-m | 2 | |
| 087 | DC - power supply, 0 -5 A | EA-3013 S | - | Elektro Automatik | pre-m | 2 | |
| 091 | USB-LWL-Converter | OLS-1 | 007/2006 | Ing. Büro Scheiba | - | 4 | |
| 099 | passive voltage probe | ESH2-Z3 | 299.7810.52 | Rohde & Schwarz | 36 M | - | 30.05.2021 |
| 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 |
| 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, 18GHz | 47-20-33 | AW0272 | Lucas Weinschel | pre-m | 2 | |
| 302 | horn antenna 40 GHz (Meas 1) | BBHA9170 | 155 | Schwarzbeck | 36 M | - | 14.03.2020 |
| 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 |
| 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 |
| 467 | Digital Multimeter | Fluke 112 | 89680306 | Fluke USA | 36 M | - | 30.05.2021 |
| 468 | Digital Multimeter | Fluke 112 | 90090455 | Fluke USA | 36 M | - | 30.04.2021 |
| 477 | ReRadiating GPS-System | AS-47 | - | Automotive Cons. Fink | - | 3 | |
| 480 | power meter (Fula) | NRVS | 838392/031 | Rohde & Schwarz | 24 M | - | 30.05.2021 |
| 482 | filter matrix | Filter matrix SAR 1 | - | CETECOM (Brl) | - | 1d | |

| Ref.-No. | Equipment | Type | Serial-No. | Manufacturer | Interval of calibration | Remark | Cal due |
|---|---|---|---|---|---|---|---|
| 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 | |
| 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 |
| 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 1m | HDMI cable with Ethernet 1m | - | KogiLink | - | 2 | |
| 638 | HDMI Kabel with Ethernet 1,5 m flach | HDMI cable with Ethernet | - | Reichelt | - | 2 | |
| 640 | HDMI cable 2m rund | HDMI cable 2m rund | - | Reichelt | - | 2 | |
| 641 | HDMI cable with Ethernet | Certified HDMI cable with | - | PureLink | - | 2 | |
| 644 | Amplifierer | ZX60-2534M+ | SN865701299 | Mini-Circuits | - | - | |
| 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 | CO3000/933/3841 0516/L | INNCO Systems GmBh | pre-m | - | |
| 711 | Harmonic Mixer 90 GHz - 140GHz | RPG FS-Z140 | 101004 | RPG | 36 M | - | 22.02.2020 |
| 712 | Harmonic Mixer 75 GHz - 110GHz | FS-Z110 | 101468 | Rohde & Schwarz | 12 M | - | 04.11.2020 |
| 713 | Harmonic Mixer, 50 GHz - 75GHz | FS-Z75 | 101022 | Rohde & Schwarz | 24 M | - | 05.07.2021 |
| 714 | Signal Analyzer 67GHz | FSW67 | 104023 | Rohde & Schwarz | 12 M | - | 04.07.2020 |
| 715 | Harmonic Mixer, 140 GHz - 220GHz | FS-Z220 | 101009 | RPG Radiometer Physics | 36 M | - | 03.08.2020 |
| 747 | Spectrum Analyzer | FSU 26 | 200152 | Rohde & Schwarz | 12 M | - | 04.07.2020 |
| 748 | Pickett-Potter Horn Antenna | FH-PP 4060 | 010001 | Radiometer Physiscs | 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 | - | - | |

| Ref.-No. | Equipment | Type | Serial-No. | Manufacturer | Interval of calibration | Remark | Cal due |
|---|---|---|---|---|---|---|---|
| 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 Labaratories | 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 | Anteral 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 3cm² | 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-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 | GPIB-USB-HS | 187965G-01L | 16AE772 | National Instruments | - | - | |
| 817 | GBIP-USB-HS | 187965G-01L | 16AC1EE | National Instruments | - | - | |
| 818 | GPIB-USB-HS | 187965G-01L | 16AE8D0 | Natinal Instruments | - | - | |
| 819 | GPIB-USB-HS | 187965G-01L | 16AB93C | National Instruments | - | - | |
| 820 | GPIB-USB-HS | 187965G-01L | 16AE294 | National Instruments | - | - | |
| 821 | GPIB-USB-HS | 187965G-01L | 16ACB9C | National Instruments | - | - | |
| 822 | GPIB-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 |

### 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 | 2020-04-02 |
| C1 | The frequency range of radiated disturbance measurement on page 13 corrected. | 2020-04-29 |

## END OF TEST REPORT