

# Test Report

## 1-8898-24-01-05\_TR1-R05

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                   |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------|
| Number of pages:                                 | 35                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Date of Report: | 2026-Jul-22       |
| Testing company:                                 | cetecom advanced GmbH<br>Untertuerkheimer Str. 6-10<br>66117 Saarbruecken<br>GERMANY                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Applicant:      | Busch & Müller KG |
| Product:                                         | Remote Control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                   |
| Model:                                           | Blucon 456BT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                   |
| FCC ID:                                          | 2BUW5-456BT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | IC:             | 35329-456BT       |
|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | PMN             | 456BT             |
|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | HVIN            | V06               |
|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | FVIN            | 1.0.0             |
| Testing has been carried out in accordance with: | <p><b>FCC Regulations</b><br/><b>Title 47 CFR, Chapter I, Subchapter A, Part 15</b><br/><b>Subpart C Intentional Radiators</b><br/>§ 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz</p> <p><b>ISED-Regulations</b><br/><b>Radio Standards Specification</b><br/><b>RSS-Gen, Issue 5</b><br/>General Requirements for Compliance of Radio Apparatus<br/><b>RSS-247, Issue 4</b><br/>Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Device</p> |                 |                   |
| Tested Technology:                               | BLE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                   |
| Test Results:                                    | <p><input checked="" type="checkbox"/> <b>The EUT complies with the requirements in respect of all parameters subject to the test.</b></p> <p>The test results relate only to devices specified in this document</p> <p>The current version of Test Report 1-8898-24-01-05_TR1-R05 replaces the test report 1-8898-24-01-05_TR1-R04 dated 2026-Jul-21. The replaced test report is herewith invalid.</p>                                                                                                                                              |                 |                   |
| Signatures:                                      | <div></div> <div>Martin Nunier<br/>Coordinator Area<br/>Authorization of test report</div> <div>Salih Öztan<br/>Lab Manager<br/>Responsible of test report</div>                                                                                                                                                                                                                                                                                                                                                                                      |                 |                   |

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| Annex 2                                        | Internal photographs of EUT | To be provided by customer   | --          |
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| The listed attachments are separate documents. |                             |                              |             |

# 1 General information

## 1.1 Disclaimer and Notes

The test results of this test report relate exclusively to the test item specified in this test report as specified in chapter 2.7. cetecom advanced does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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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.

## 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 of the above requirements are met in accordance with enumerated standards.

### 1.3 Summary of Test Results

The EUT integrates a BLE transmitter. Other implemented wireless technologies were not considered within this test report.

| Test case                                        | Reference Clause<br>FCC ☒ | Reference<br>Clause ISED ☒                                    | Page | Remark | Result |
|--------------------------------------------------|---------------------------|---------------------------------------------------------------|------|--------|--------|
| Duty-Cycle                                       | §15.35(c)                 | RSS-Gen Issue 5, §8.2                                         | 11   | --     | PASSED |
| Minimum Emission Bandwidth 6 dB                  | §15.247 5.2(a)            | RSS-247, Issue 4,<br>§6.3.1(a)<br>RSS-Gen Issue 5,: §6.7      | 15   | --     | PASSED |
| Occupied Channel Bandwidth 99%                   | 2.1049(h)                 | RSS-Gen Issue 5, §6.7                                         | 16   | --     | PASSED |
| Peak output power (Sweep)                        | §15.247(b)(3)             | RSS-247, Issue 4,<br>§6.2.3.2(a)                              | 13   | --     | PASSED |
| Transmitter Peak output power radiated           | §15.247(b)(4)(c)(i)       | RSS-247, Issue 4,<br>§6.2.3.2(c)                              | --   | --     | NP     |
| Emissions in non-restricted frequency bands      | §15.247(d)                | RSS-247, Issue 4, §5.5                                        | 18   | --     | PASSED |
| Radiated Band-Edge emissions                     | §15.205(b)<br>§15.247(d)  | RSS-Gen: Issue 5<br>§8.9, §8.10<br>RSS-247, Issue 4, §6.6     | 30   | --     | PASSED |
| Power spectral density                           | §15.247(e)                | RSS-247, Issue 4,<br>§6.3.1(b)                                | 14   | --     | PASSED |
| Radiated field strength emissions below 30 MHz   | §15.205(a)<br>§15.209(a)  | RSS-Gen: Issue 5<br>§8.9 Table 6                              | 22   | --     | PASSED |
| Radiated field strength emissions 30 MHz – 1 GHz | §15.209<br>§15.247(d)     | RSS-Gen: Issue 5<br>§8.9 Table 5<br>RSS-247, Issue 4, §6.6    | 25   | --     | PASSED |
| Radiated field strength emissions above 1 GHz    | §15.209(a)<br>§15.247(d)  | RSS-Gen: Issue 5:<br>§8.9 Table 5+7<br>RSS-247, Issue 4, §6.6 | 28   | --     | PASSED |
| AC-Power Lines Conducted Emissions               | §15.207                   | RSS-Gen Issue 5:<br>§8.8 Table 4                              | --   | --     | NP     |

PASSED

The EUT complies with the essential requirements in the standard.

FAILED

The EUT does not comply with the essential requirements in the standard.

N/A

Test case does not apply to the test object.

NP

The test was not performed by the cetecom advanced laboratory.

Decision Rule: cetecom advanced GmbH follows [ILAC G8:2019 chapter 4.2.1 \(Simple Acceptance Rule\)](#).

## 1.4 Summary of Test Methods

| Test case                                       | Test method                                                                                                    |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Duty-Cycle                                      | ANSI C63.10:2020, §11.6(b)                                                                                     |
| Minimum Emission Bandwidth 6 dB                 | ANSI C63.10:2020, §6.9.2, §11.8                                                                                |
| Occupied Channel Bandwidth 99%                  | ANSI C63.10:2020, §6.9.3                                                                                       |
| Peak output power (Sweep)                       | ANSI C63.10:2020, §11.9                                                                                        |
| Power spectral density                          | ANSI C63.10:2020, §11.10                                                                                       |
| Emissions in non-restricted frequency bands     | ANSI C63.10:2020, §11.11, §6.10.5                                                                              |
| Radiated Band-Edge emissions                    | ANSI C63.10-2020; "Marker-Delta method", §6.10.5, §12.7.4.4.2                                                  |
| Transmitter Peak output power radiated          | Result calculated with measured conducted RF-power value and stated/measured antenna gain for band of interest |
| Radiated field strength emissions below 30 MHz  | ANSI C63.10-2020 §6.3, §6.4                                                                                    |
| Radiated field strength emissions 30 MHz- 1 GHz | ANSI C63.4-2014 §8.2.3, ANSI C63.10-2020 §6.3, §6.5                                                            |
| Radiated field strength emissions above 1 GHz   | ANSI C63.4-2014 §8.3, ANSI C63.10-2020 §6.3, §6.6                                                              |
| AC-Power Lines Conducted Emissions              | ANSI C63.4-2014 §7, ANSI C63.10-2020 §6.2                                                                      |

And reference also to Test methods in KDB558074

## 2 Administrative Data

### 2.1 Identification of the Testing Laboratory

|                              |                                                             |
|------------------------------|-------------------------------------------------------------|
| Company name:                | cetecom advanced GmbH                                       |
| Address:                     | Untertuerkheimer Str. 6-10<br>66117 Saarbruecken<br>Germany |
| Accreditation scope:         | <b>DAkkS Webpage:</b> <a href="#">FCC ISED</a>              |
| IC Lab company No. / CAB ID: | 3462D / DE0001                                              |
| Test location 1:             | Im Teelbruch 116; 45219 Essen                               |
| Test location 2:             | --                                                          |

### 2.2 General limits for environmental conditions

|                     |           |
|---------------------|-----------|
| Temperature:        | 22±2 °C   |
| Relative. humidity: | 45±15% rH |

### 2.3 Test Laboratories sub-contracted

|               |    |
|---------------|----|
| Company name: | -- |
|---------------|----|

### 2.4 Organizational Items

|                              |                            |
|------------------------------|----------------------------|
| Responsible testing manager: | Salih Öztan                |
| Receipt of EUT:              | 2025-Jun-26                |
| Date(s) of test:             | 2025-Jun-26 to 2026-Feb-02 |
| Version of template:         | 24.1101                    |

### 2.5 Applicant's details

|                         |                                                    |
|-------------------------|----------------------------------------------------|
| Applicant's name:       | Busch & Müller KG                                  |
| Address:                | Auf dem Bamberg 1<br>58540 Meinerzhagen<br>Germany |
| Contact Person:         | Vito Huhn                                          |
| Contact Person's Email: | dr.v.huhn@bumm.de                                  |

### 2.6 Manufacturer's details

|                      |                                                    |
|----------------------|----------------------------------------------------|
| Manufacturer's name: | Busch & Müller KG                                  |
| Address:             | Auf dem Bamberg 1<br>58540 Meinerzhagen<br>Germany |

## 2.7 Equipment under Test (EUT)

| EUT No. *) | Sample No. | Product        | Model        | Type | SN  | HW  | SW    |
|------------|------------|----------------|--------------|------|-----|-----|-------|
| EUT 1      | 57.182     | Remote Control | Blucon 456BT | N/A  | N/A | V06 | 1.0.0 |
| EUT 2      | 57.174     | Remote Control | Blucon 456BT | N/A  | N/A | V06 | 1.0.0 |
| EUT 3      | 57.175     | Remote Control | Blucon 456BT | N/A  | N/A | V06 | 1.0.0 |
| EUT 4      | 59.197     | Remote Control | Blucon 456BT | N/A  | N/A | V06 | 1.0.0 |
| EUT 5      | 59.072     | Remote Control | Blucon 456BT | N/A  | N/A | V06 | 1.0.0 |

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

## 2.8 Untested Variant (VAR)

| VAR No. *) | Sample No. | Product | Model | Type | SN | HW | SW |
|------------|------------|---------|-------|------|----|----|----|
|------------|------------|---------|-------|------|----|----|----|

\*) The listed additional untested model variant(s) (VAR) is/are not object of evaluation of compliance. For further information please see Annex 5: Declaration of applicant of model differences.

If the table above does not show any other line than the headline, no untested variants are available.

## 2.9 Auxiliary Equipment (AE)

| AE No. *) | Sample No. | Auxiliary Equipment | Model | SN | HW | SW |
|-----------|------------|---------------------|-------|----|----|----|
|-----------|------------|---------------------|-------|----|----|----|

\*) AE short description is used to simplify the identification of the auxiliary equipment in this test report. If the table above does not show any other line than the headline, no AE was used during testing nor was taken into account for evaluation

## 2.10 Connected cables (CAB)

| CAB No. *) | Sample No. | Cable Type | Connectors / Details | Length |
|------------|------------|------------|----------------------|--------|
|------------|------------|------------|----------------------|--------|

\*) CAB short description is used to simplify the identification of the connected cables in this test report. If the table above does not show any other line than the headline, no cable was used during testing nor was taken into account for evaluation

## 2.11 Software (SW)

| SW No. *) | Sample No. | SW Name | SW Status |
|-----------|------------|---------|-----------|
|-----------|------------|---------|-----------|

\*) SW short description is used to simplify the identification of the used software in this test report. If the table above does not show any other line than the headline, no SW was used during testing nor was taken into account for evaluation.

## 2.12 EUT set-ups

| set-up no. *) | Combination of EUT and AE | Description                                                       |
|---------------|---------------------------|-------------------------------------------------------------------|
| 1             | EUT 1                     | Used for radiated measurements<br>Configured on low channel only  |
| 2             | EUT 2                     | Used for radiated measurements<br>Configured on mid channel only  |
| 3             | EUT 3                     | Used for radiated measurements<br>Configured on high channel only |
| 4             | EUT 4                     | Used for radiated measurements<br>Freely configurable             |
| 5             | EUT 5                     | Used for conducted measurements<br>Freely configurable            |

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

## 2.13 EUT operation modes

| EUT operating mode no. *) | Operating modes | Additional information                                                                                                                    |
|---------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| op. 1                     | BLE_TX-Mode     | With help of special test firmware TX-mode was set-up.<br>We refer to applicants information/papers for details about necessary commands. |

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

### 3 Equipment under test (EUT)

#### 3.1 General Data of Main EUT as Declared by Applicant

|                                                                                              |                                             |                                                                        |                           |
|----------------------------------------------------------------------------------------------|---------------------------------------------|------------------------------------------------------------------------|---------------------------|
| Firmware                                                                                     | <input type="checkbox"/> for normal use     | <input checked="" type="checkbox"/> Special version for test execution |                           |
| Power supply                                                                                 | <input type="checkbox"/> AC Mains           | -                                                                      |                           |
|                                                                                              | <input type="checkbox"/> DC Mains           | -                                                                      |                           |
|                                                                                              | <input checked="" type="checkbox"/> Battery | Lithium Ion battery                                                    |                           |
| Operational conditions                                                                       | T <sub>nom</sub> = +21 °C                   | T <sub>min</sub> = -20 °C                                              | T <sub>max</sub> = +60 °C |
| EUT sample type                                                                              | Pre-Production                              |                                                                        |                           |
| Size [LxWxH]                                                                                 | 5.03 cm x 3.01 cm x 2.45 cm                 |                                                                        |                           |
| Interfaces/Ports                                                                             | -                                           |                                                                        |                           |
| For further details refer Applicants Declaration & following technical documents             |                                             |                                                                        |                           |
| For further details regarding radio parameters, please refer to Bluetooth Core Specification |                                             |                                                                        |                           |

#### 3.2 Detailed Technical data of Main EUT as Declared by Applicant

|                                                                                  |                                                                                                                                                                                                                                                                                                                     |                                                     |  |
|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--|
| Frequency Band                                                                   | 2.4 GHz ISM Band (2400 MHz - 2483.5 MHz)                                                                                                                                                                                                                                                                            |                                                     |  |
| Number of Channels<br>(USA/Canada -bands)                                        | 40 (37 Hopping + 3 Advertising)                                                                                                                                                                                                                                                                                     |                                                     |  |
| Nominal Channel Bandwidth                                                        | 1 MHz                                                                                                                                                                                                                                                                                                               |                                                     |  |
| Type of Modulation   Data Rate                                                   | <input checked="" type="checkbox"/> GFSK   1 Mbit/s                                                                                                                                                                                                                                                                 | <input checked="" type="checkbox"/> GFSK   2 Mbit/s |  |
|                                                                                  | <input type="checkbox"/> GFSK   500 kbit/s                                                                                                                                                                                                                                                                          | <input type="checkbox"/> GFSK   125 kbit/s          |  |
| Other wireless options                                                           | <input type="checkbox"/> a/n/ac mode (not tested within this report)<br><input type="checkbox"/> b/g/n mode (not tested within this report)<br><input type="checkbox"/> Bluetooth EDR (not tested within this report)<br><input type="checkbox"/> Cellular transceiver (2G/3G/4G/5G/GPS, not tested in this report) |                                                     |  |
| Power Setting                                                                    | 0 dBm                                                                                                                                                                                                                                                                                                               |                                                     |  |
| Max. Conducted Output Power                                                      | GFSK -1.61 dBm                                                                                                                                                                                                                                                                                                      |                                                     |  |
| EIRP Power (Calculated EIRP)                                                     | GFSK -1.61 dBm + 0 dBi = -1.61 dBm                                                                                                                                                                                                                                                                                  |                                                     |  |
| Antenna Type                                                                     | PCB-antenna                                                                                                                                                                                                                                                                                                         |                                                     |  |
| Antenna Gain                                                                     | 0 dBi                                                                                                                                                                                                                                                                                                               |                                                     |  |
| FCC label attached                                                               | No                                                                                                                                                                                                                                                                                                                  |                                                     |  |
| Test firmware / software and storage location                                    | EUT 1-5                                                                                                                                                                                                                                                                                                             |                                                     |  |
| For further details refer Applicants Declaration & following technical documents |                                                                                                                                                                                                                                                                                                                     |                                                     |  |
| Description of Reference Document (supplied by applicant)                        | Version                                                                                                                                                                                                                                                                                                             | Total Pages                                         |  |
| --                                                                               | --                                                                                                                                                                                                                                                                                                                  | --                                                  |  |

#### 3.3 Modifications on Test sample

|                                    |    |
|------------------------------------|----|
| Additions/deviations or exclusions | -- |
|------------------------------------|----|

## 4 Measurements

### 4.1 Duty-Cycle

#### Testing method:

The measurement is made according to relevant reference clauses:  
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

The necessary duty-cycle correction factor is determined on nominal conditions on middle channel only. It is assumed that no noticeable changes occur when tested on other channels or climatic conditions.

#### EUT settings

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

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

The necessary duty-cycle correction factor is determined on nominal conditions on one channel in each operable frequency-band. It is assumed that no noticeable changes occur when tested on other channels or climatic conditions. The Duty-Cycle was constant, means without variations.

Formula to calculate Duty-Cycle:

|                                                                          |                        |                                               |
|--------------------------------------------------------------------------|------------------------|-----------------------------------------------|
| Duty cycle calculations:<br><br>$x = \frac{TX_{ON}}{TX_{ON} + TX_{OFF}}$ | Duty cycle factor: DC= | Regarding power: $10 * \log(1/x)$ dB          |
|                                                                          |                        | Regarding field strength: $20 * \log(1/x)$ dB |

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

#### 4.1.1 Measurement Location

|           |                                       |
|-----------|---------------------------------------|
| Test site | 120910 - Radio Laboratory 1 (TS 8997) |
|-----------|---------------------------------------|

#### 4.1.2 Result

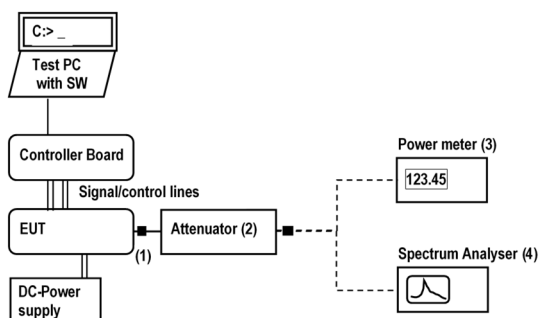
| Duty-Cycle [%] | Duty-Cycle correction Power [dB] | Duty-Cycle correction Field Strength [dB] |
|----------------|----------------------------------|-------------------------------------------|
| --             | --                               | --                                        |

## 4.2 Peak output power (Sweep)

### 4.2.1 Description of the general test setup and methodology, see below example:

The EUT's RF-signal is coupled out by a suitable antenna coupling connector (1). The signal is first attenuated (2) then connected to power meter (3) or spectrum-analyzer (4) for RF-conducted measurements. The specific attenuation loss is determined prior to the measurement within a set-up attenuation measurement. These are then taken into account by correcting the measurement readings.

#### Schematic:



#### Testing method:

The measurement is made according to relevant reference clauses:

(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Measurement is made using Rohde & Schwarz TS8997 test system.

| Test method | PKPM1 Peak reading power meter (broadband PK RF-power meter) |
|-------------|--------------------------------------------------------------|
| Remarks     | --                                                           |

The measurement was performed in non-hopping transmission mode with the carrier set to lowest/middle and highest channel.

#### EUT settings

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

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

### 4.2.2 Measurement Location

| Test site | 120910 - Radio Laboratory 1 (TS 8997) |
|-----------|---------------------------------------|
|-----------|---------------------------------------|

### 4.2.3 Limit

| Frequency Range [MHz] | Limit [W] | Limit [dBm] | Detector | RBW / VBW [MHz] |
|-----------------------|-----------|-------------|----------|-----------------|
| 2400 - 2483.5         | 1         | 30          | MaxPeak  | 3 / 10          |

#### 4.2.4 Result

| Mode           | Channel | Frequency [MHz] | Max Peak Power [dBm] | Result |
|----------------|---------|-----------------|----------------------|--------|
| BLE GFSK 1Mbps | 0       | 2402            | -1.61                | Passed |
| BLE GFSK 1Mbps | 17      | 2440            | -1.93                | Passed |
| BLE GFSK 1Mbps | 39      | 2480            | -2.32                | Passed |
| BLE GFSK 2Mbps | 1       | 2404            | -1.64                | Passed |
| BLE GFSK 2Mbps | 17      | 2440            | -1.91                | Passed |
| BLE GFSK 2Mbps | 38      | 2478            | -2.29                | Passed |

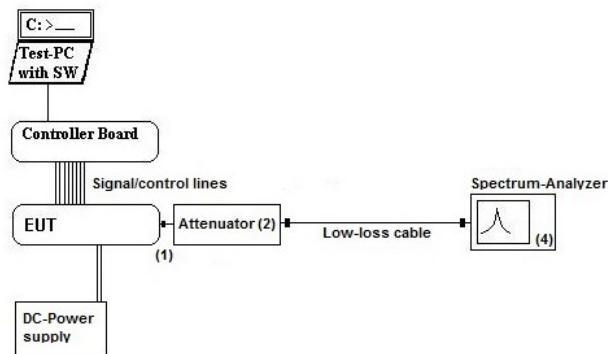
Remark1: for more information and graphical plot see annex A1 **1-8898-24-01-05\_TR1-A201-R01**

## 4.3 Power spectral density

### 4.3.1 Description of the general test setup and methodology, see below example:

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

#### Schematic:



#### Testing method:

The measurement is made according to relevant reference clauses:  
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Measurement is made using Rohde & Schwarz TS8997 test system.

| Test method | PKPSD-Method |
|-------------|--------------|
| Remarks     | --           |

#### EUT settings

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

### 4.3.2 Measurement Location

| Test site | 120910 - Radio Laboratory 1 (TS 8997) |
|-----------|---------------------------------------|
|-----------|---------------------------------------|

### 4.3.3 Limit

| Limit [dBm] @ 3 kHz | Detector [MaxHold] | RBW / VBW [kHz] |
|---------------------|--------------------|-----------------|
| ≤ 8                 | Peak               | 3 / 10          |

### 4.3.4 Result

| Mode           | Channel | Frequency [MHz] | PSD [dBm] | Result |
|----------------|---------|-----------------|-----------|--------|
| BLE GFSK 1Mbps | 0       | 2402            | -14.62    | Passed |
| BLE GFSK 1Mbps | 17      | 2440            | -14.77    | Passed |
| BLE GFSK 1Mbps | 39      | 2480            | -15.25    | Passed |
| BLE GFSK 2Mbps | 1       | 2404            | -17.34    | Passed |
| BLE GFSK 2Mbps | 17      | 2440            | -18.54    | Passed |
| BLE GFSK 2Mbps | 38      | 2478            | -19.10    | Passed |

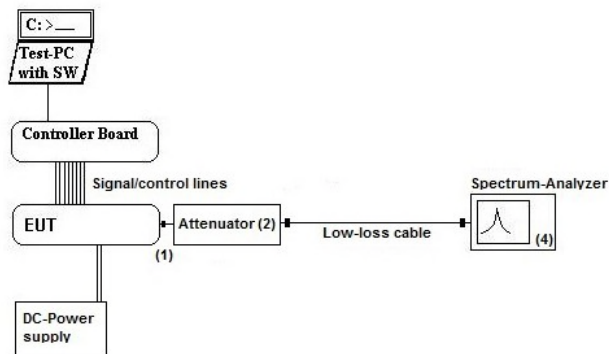
Remark: for more information and graphical plot see annex A1 1-8898-24-01-05\_TR1-A201-R01

## 4.4 Minimum Emission Bandwidth 6 dB

### 4.4.1 Description of the general test setup and methodology, see below example:

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

#### Schematic:



#### Testing method:

The measurement is made according to relevant reference clauses:

(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Measurement is made using Rohde & Schwarz TS8997 test system.

### 4.4.2 Measurement Location

|           |                                       |
|-----------|---------------------------------------|
| Test site | 120910 - Radio Laboratory 1 (TS 8997) |
|-----------|---------------------------------------|

### 4.4.3 Limit

| Limit [kHz] | Detector [MaxHold] | RBW / VBW [kHz] |
|-------------|--------------------|-----------------|
| ≥ 500       | MaxPeak            | 100 / 300       |

### 4.4.4 Result

| Mode           | Channel | Frequency [MHz] | 6 dB bandwidth [MHz] | Result |
|----------------|---------|-----------------|----------------------|--------|
| BLE GFSK 1Mbps | 0       | 2402            | 0.719                | Passed |
| BLE GFSK 1Mbps | 17      | 2440            | 0.755                | Passed |
| BLE GFSK 1Mbps | 39      | 2480            | 0.720                | Passed |
| BLE GFSK 2Mbps | 1       | 2404            | 1.300                | Passed |
| BLE GFSK 2Mbps | 17      | 2440            | 1.259                | Passed |
| BLE GFSK 2Mbps | 38      | 2478            | 1.409                | Passed |

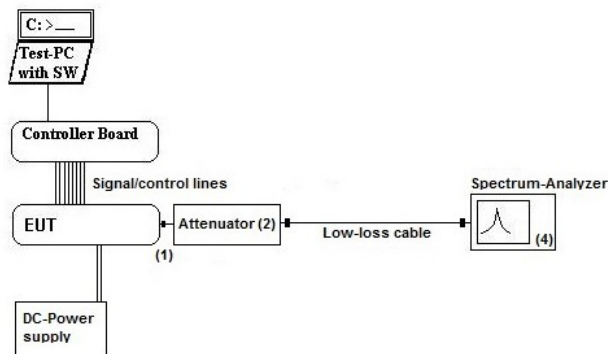
Remark: for more information and graphical plot see annex A1 1-8898-24-01-05\_TR1-A201-R01

## 4.5 Occupied Channel Bandwidth 99%

### 4.5.1 Description of the general test setup and methodology, see below example:

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

#### Schematic:



#### Testing method:

The measurement is made according to relevant reference clauses:  
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Measurement is made using Rohde & Schwarz TS8997 test system.

### 4.5.2 Measurement Location

|           |                                       |
|-----------|---------------------------------------|
| Test site | 120910 - Radio Laboratory 1 (TS 8997) |
|-----------|---------------------------------------|

### 4.5.3 Limit

When the occupied bandwidth limit is not stated in the applicable reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

### 4.5.4 Result

| Mode           | Channel | Frequency [MHz] | 99% Occupied bandwidth [MHz] | Result |
|----------------|---------|-----------------|------------------------------|--------|
| BLE GFSK 1Mbps | 0       | 2402            | 1.066                        | Passed |
| BLE GFSK 1Mbps | 17      | 2440            | 1.080                        | Passed |
| BLE GFSK 1Mbps | 39      | 2480            | 1.061                        | Passed |
| BLE GFSK 2Mbps | 1       | 2404            | 2.105                        | Passed |
| BLE GFSK 2Mbps | 17      | 2440            | 2.108                        | Passed |
| BLE GFSK 2Mbps | 38      | 2478            | 2.117                        | Passed |

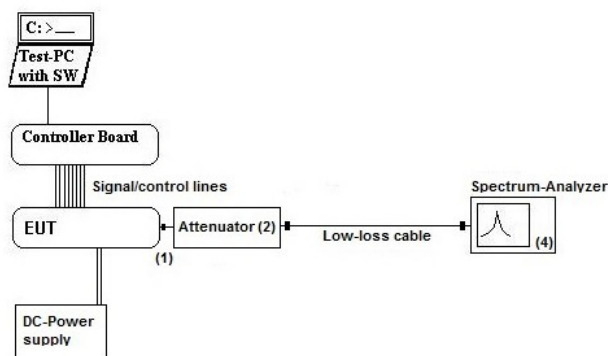
Remark: for more information and graphical plot see annex A1 1-8898-24-01-05\_TR1-A201-R01

## 4.6 Emissions in non-restricted frequency bands

### 4.6.1 Description of the general conducted test setup and methodology, see below example:

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

#### Schematic:



#### Testing method:

The measurement is made according to relevant reference clauses:  
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Measurement is made using Rohde & Schwarz TS8997 test system.

The measurements were performed with the RBW set to 100 kHz & maximum carrier level was indicated with MAX-Hold positive peak detector using markers. Then a frequency line was set 20 or 30 dB below this measured maximum carrier level.

Then using RBW 100 kHz & spectrum analyzer span from 150 kHz to 25 GHz in three steps spurious emissions were measured with MAX-Hold positive peak detector.

The sweep time set as long as necessary to capture the full signal burst per hopping channel. The burst on-period is captured by setting appropriate markers in the rising and falling edges.

#### EUT settings

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

### 4.6.2 Measurement Location

|           |                                       |
|-----------|---------------------------------------|
| Test site | 120910 - Radio Laboratory 1 (TS 8997) |
|-----------|---------------------------------------|

#### 4.6.3 Limit

| Frequency Range [MHz] | Limit [dBc] |
|-----------------------|-------------|
| 0.15 – 25000          | -20 / -30   |

#### 4.6.4 Result

Maximum Level Peak [dBc]

| Mode           | Channel | Frequency [MHz] | Result |
|----------------|---------|-----------------|--------|
| BLE GFSK 1Mbps | 0       | 2402            | Passed |
| BLE GFSK 1Mbps | 17      | 2440            | Passed |
| BLE GFSK 1Mbps | 39      | 2480            | Passed |
| BLE GFSK 2Mbps | 1       | 2404            | Passed |
| BLE GFSK 2Mbps | 17      | 2440            | Passed |
| BLE GFSK 2Mbps | 38      | 2478            | Passed |

Remark: for more information and graphical plot see annex A1 1-8898-24-01-05\_TR1-A201-R01

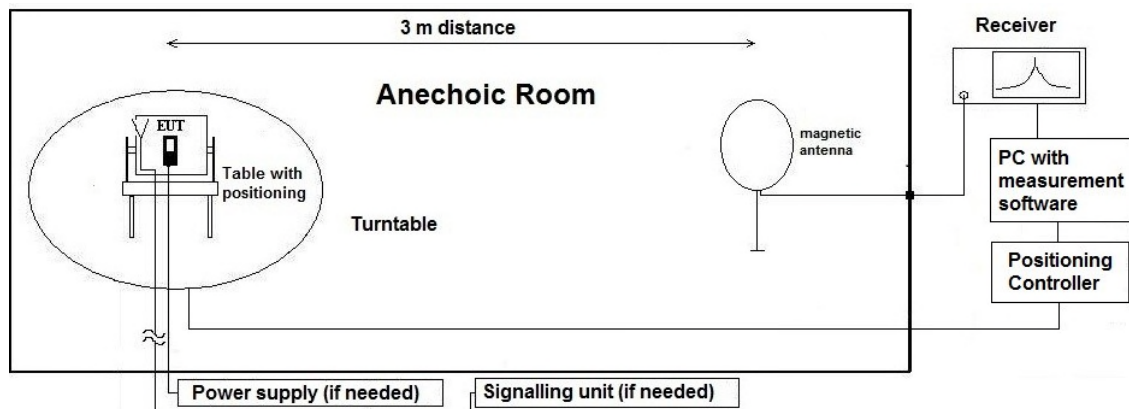
## 4.7 Radiated field strength emissions below 30 MHz

### 4.7.1 Description of the general test setup and methodology, see below example:

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

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

#### Schematic:



#### Testing method:

The measurement is made according to relevant reference clauses:

(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

#### 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 (step 90°, range 0° to 360°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT), the emission spectrum was recorded.

The loop antenna was moved at least to 2-perpendicular axes (antenna vector in direction of EUT and parallel to EUT) in order to maximize the emissions. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a data reduction table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

#### Final measurement on critical frequencies

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

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

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

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

**Remark:** A pre-scan was performed for both 1Mbps and 2Mbps to identify the worst-case operating mode. Based on the pre-scan results, **1 Mbps** was identified as the worst case; therefore, the final radiated measurements were performed only at **1 Mbps**

#### Formula:

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

$$M = L_T - E_C$$

AF = Antenna factor

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

D<sub>F</sub> = Distance correction factor (if used)

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

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

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

L<sub>T</sub> = Limit

M = Margin

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

#### 4.7.2 Sample calculation

| Raw-Value<br>[dBuV/m] | Antenna<br>factor | Distance<br>Correction<br>[dB] | Cable<br>Loss | Preamplifier | Resulting<br>correction value<br>[dB] | Final result<br>[dBuV/m] | Remarks                                                       |
|-----------------------|-------------------|--------------------------------|---------------|--------------|---------------------------------------|--------------------------|---------------------------------------------------------------|
| 19.83                 | 18.9              | -70.75                         | 0.18          | --           | -51.67                                | -31.83                   | 30 to 3 m<br>correction used<br>according<br>ANSI C63.10-2013 |

Remark: This calculation is based on an example value at 458 kHz

#### 4.7.3 Measurement Location

|           |                                             |
|-----------|---------------------------------------------|
| Test site | 120901 - ESS SAC3 - Radiated Emission <1GHz |
|-----------|---------------------------------------------|

#### 4.7.4 Correction factors due to reduced meas. distance ( $f < 30$ MHz):

The used correction factors when the measurement distance is reduced compared to regulatory measurement distance, are calculated according Extrapolation formulas valid for EUT's with maximum dimension of  $0.625 \times \text{Lambda}$ . Formula 2+3+4 as presented in ANSI C63.10, Chapter 6.4.4 are used for the calculations of proper extrapolation factors

| Frequency Range | f [kHz/MHz] | Lambda [m] | Far-Field Point [m] | Distance Limit accord. 15.209 [m] | 1st Condition (dmeas < Dnear-field) | 2nd Condition (Limit distance bigger dnear-field) | Distance Correction accord. Formula |
|-----------------|-------------|------------|---------------------|-----------------------------------|-------------------------------------|---------------------------------------------------|-------------------------------------|
| kHz             | 9           | 33333.33   | 5305.17             | 300                               | fulfilled                           | not fulfilled                                     | -80.00                              |
|                 | 10          | 30000.00   | 4774.65             |                                   | fulfilled                           | not fulfilled                                     | -80.00                              |
|                 | 20          | 15000.00   | 2387.33             |                                   | fulfilled                           | not fulfilled                                     | -80.00                              |
|                 | 30          | 10000.00   | 1591.55             |                                   | fulfilled                           | not fulfilled                                     | -80.00                              |
|                 | 40          | 7500.00    | 1193.66             |                                   | fulfilled                           | not fulfilled                                     | -80.00                              |
|                 | 50          | 6000.00    | 954.93              |                                   | fulfilled                           | not fulfilled                                     | -80.00                              |
|                 | 60          | 5000.00    | 795.78              |                                   | fulfilled                           | not fulfilled                                     | -80.00                              |
|                 | 70          | 4285.71    | 682.09              |                                   | fulfilled                           | not fulfilled                                     | -80.00                              |
|                 | 80          | 3750.00    | 596.83              |                                   | fulfilled                           | not fulfilled                                     | -80.00                              |
|                 | 90          | 3333.33    | 530.52              |                                   | fulfilled                           | not fulfilled                                     | -80.00                              |
|                 | 100         | 3000.00    | 477.47              |                                   | fulfilled                           | not fulfilled                                     | -80.00                              |
|                 | 125         | 2400.00    | 381.97              |                                   | fulfilled                           | not fulfilled                                     | -80.00                              |
|                 | 200         | 1500.00    | 238.73              |                                   | fulfilled                           | fulfilled                                         | -78.02                              |
|                 | 300         | 1000.00    | 159.16              |                                   | fulfilled                           | fulfilled                                         | -74.49                              |
|                 | 400         | 750.00     | 119.37              |                                   | fulfilled                           | fulfilled                                         | -72.00                              |
|                 | 490         | 612.24     | 97.44               |                                   | fulfilled                           | fulfilled                                         | -70.23                              |
|                 | 500         | 600.00     | 95.49               | 30                                | fulfilled                           | not fulfilled                                     | -40.00                              |
|                 | 600         | 500.00     | 79.58               |                                   | fulfilled                           | not fulfilled                                     | -40.00                              |
|                 | 700         | 428.57     | 68.21               |                                   | fulfilled                           | not fulfilled                                     | -40.00                              |
|                 | 800         | 375.00     | 59.68               |                                   | fulfilled                           | not fulfilled                                     | -40.00                              |
|                 | 900         | 333.33     | 53.05               |                                   | fulfilled                           | not fulfilled                                     | -40.00                              |
| MHz             | 1.00        | 300.00     | 47.75               |                                   | fulfilled                           | not fulfilled                                     | -40.00                              |
|                 | 1.59        | 188.50     | 30.00               |                                   | fulfilled                           | not fulfilled                                     | -40.00                              |
|                 | 2.00        | 150.00     | 23.87               |                                   | fulfilled                           | fulfilled                                         | -38.02                              |
|                 | 3.00        | 100.00     | 15.92               |                                   | fulfilled                           | fulfilled                                         | -34.49                              |
|                 | 4.00        | 75.00      | 11.94               |                                   | fulfilled                           | fulfilled                                         | -32.00                              |
|                 | 5.00        | 60.00      | 9.55                |                                   | fulfilled                           | fulfilled                                         | -30.06                              |
|                 | 6.00        | 50.00      | 7.96                |                                   | fulfilled                           | fulfilled                                         | -28.47                              |
|                 | 7.00        | 42.86      | 6.82                |                                   | fulfilled                           | fulfilled                                         | -27.13                              |
|                 | 8.00        | 37.50      | 5.97                |                                   | fulfilled                           | fulfilled                                         | -25.97                              |
|                 | 9.00        | 33.33      | 5.31                |                                   | fulfilled                           | fulfilled                                         | -24.95                              |
|                 | 10.00       | 30.00      | 4.77                |                                   | fulfilled                           | fulfilled                                         | -24.04                              |
|                 | 10.60       | 28.30      | 4.50                |                                   | fulfilled                           | fulfilled                                         | -23.53                              |
|                 | 11.00       | 27.27      | 4.34                |                                   | fulfilled                           | fulfilled                                         | -23.21                              |
|                 | 12.00       | 25.00      | 3.98                |                                   | fulfilled                           | fulfilled                                         | -22.45                              |
|                 | 13.56       | 22.12      | 3.52                |                                   | fulfilled                           | fulfilled                                         | -21.39                              |
|                 | 15.00       | 20.00      | 3.18                |                                   | fulfilled                           | fulfilled                                         | -20.51                              |
|                 | 15.92       | 18.85      | 3.00                |                                   | fulfilled                           | fulfilled                                         | -20.00                              |
|                 | 17.00       | 17.65      | 2.81                |                                   | not fulfilled                       | fulfilled                                         | -20.00                              |
|                 | 18.00       | 16.67      | 2.65                |                                   | not fulfilled                       | fulfilled                                         | -20.00                              |
|                 | 20.00       | 15.00      | 2.39                |                                   | not fulfilled                       | fulfilled                                         | -20.00                              |
|                 | 21.00       | 14.29      | 2.27                |                                   | not fulfilled                       | fulfilled                                         | -20.00                              |
|                 | 23.00       | 13.04      | 2.08                |                                   | not fulfilled                       | fulfilled                                         | -20.00                              |
|                 | 25.00       | 12.00      | 1.91                |                                   | not fulfilled                       | fulfilled                                         | -20.00                              |
|                 | 27.00       | 11.11      | 1.77                |                                   | not fulfilled                       | fulfilled                                         | -20.00                              |
|                 | 29.00       | 10.34      | 1.65                |                                   | not fulfilled                       | fulfilled                                         | -20.00                              |
|                 | 30.00       | 10.00      | 1.59                |                                   | not fulfilled                       | fulfilled                                         | -20.00                              |

#### 4.7.5 Limit

| Radiated emissions limits, (3 meters) |                                  |                                             |              |            |           |
|---------------------------------------|----------------------------------|---------------------------------------------|--------------|------------|-----------|
| Frequency Range [MHz]                 | Limit [ $\mu\text{V}/\text{m}$ ] | Limit [ $\text{dB}\mu\text{V}/\text{m}$ ] * | Distance [m] | Detector   | RBW [kHz] |
| 0.009 – 0.09                          | 2400 / f [kHz]                   | 67.6 – 20Log(f) (kHz)                       | 300          | Pk & Avg   | 0.2       |
| 0.09 – 0.11                           | 2400 / f [kHz]                   | 67.6 – 20Log(f) (kHz)                       | 300          | Quasi peak | 0.2       |
| 0.11 – 0.15                           | 2400 / f [kHz]                   | 67.6 – 20Log(f) (kHz)                       | 300          | Pk & Avg   | 0.2       |
| 0.15 – 0.49                           | 2400 / f [kHz]                   | 67.6 – 20Log(f) (kHz)                       | 300          | Pk & Avg   | 9         |
| 0.49 – 1.705                          | 24000 / f [kHz]                  | 87.6 – 20Log(f) (kHz)                       | 30           | Quasi peak | 9         |
| 1.705 - 30                            | 30                               | 29.5                                        | 30           | Quasi peak | 9         |

\*Remark: In Canada same limits apply, just unit reference is different

#### 4.7.6 Result

| Diagram | Channel | Mode                                                | Maximum Level [ $\text{dB}\mu\text{V}/\text{m}$ ] Frequency Range 0.009 – 30 MHz | Result |
|---------|---------|-----------------------------------------------------|----------------------------------------------------------------------------------|--------|
| 2.01    | Low     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @25.61 MHz, 20.27                                                                | Passed |
| 2.02    | Low     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @25.07 MHz, 20.69                                                                | Passed |
| 2.03    | Mid     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @25.28 MHz, 19.94                                                                | Passed |
| 2.04    | Mid     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @23.18 MHz, 19.52                                                                | Passed |
| 2.05    | High    | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @24.13 MHz, 19.77                                                                | Passed |
| 2.06    | High    | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @24.39 MHz, 20.18                                                                | Passed |

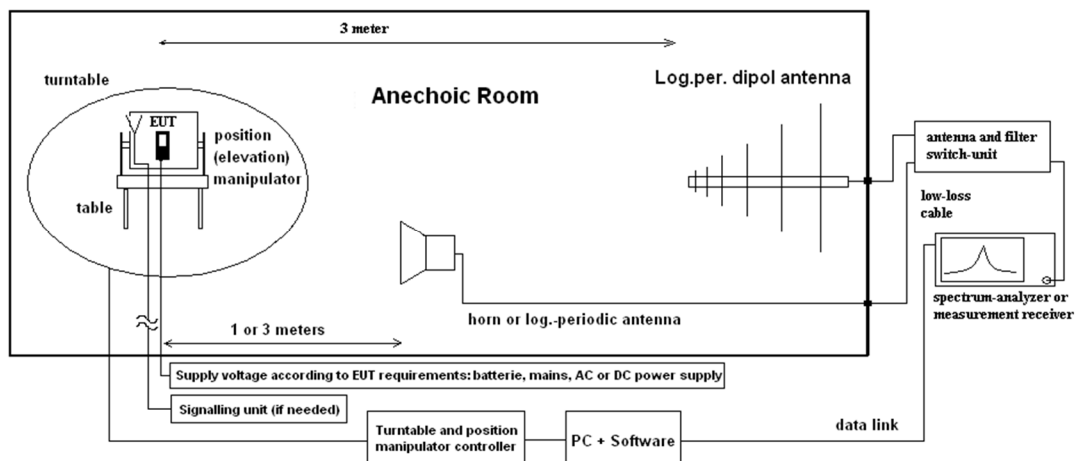
Remark: for more information and graphical plot see annex A1 1-8898-24-01-05\_TR1-A202-R04

## 4.8 Radiated field strength emissions 30 MHz – 1 GHz

### 4.8.1 Description of the general test setup and methodology, see below example:

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 semi anechoic room (SAR) and 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:

The measurement is made according to relevant reference clauses:

(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

#### 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 main-taining 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

**Remark:** A pre-scan was performed for both 1Mbps and 2Mbps to identify the worst-case operating mode. Based on the pre-scan results, **1 Mbps** was identified as the worst case; therefore, the final radiated measurements were performed only at **1 Mbps**

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

D<sub>F</sub> = Distance correction factor (if used)

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

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

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

L<sub>T</sub> = Limit

M = Margin

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

#### 4.8.2 Sample calculation

| Raw-Value<br>[dBuV/m] | Antenna factor | Distance Correction<br>[dB] | Cable Loss | Preamplifier | Resulting correction value<br>[dB] | Final result<br>[dBuV/m] | Remarks |
|-----------------------|----------------|-----------------------------|------------|--------------|------------------------------------|--------------------------|---------|
| 32.7                  | 22.25          | --                          | 3.1        | --           | 25.35                              | 58.05                    | --      |

Remark: This calculation is based on an example value at 800.4 MHz

#### 4.8.3 Measurement Location

|           |                                             |
|-----------|---------------------------------------------|
| Test site | 120901 - ESS SAC3 - Radiated Emission <1GHz |
|-----------|---------------------------------------------|

#### 4.8.4 Limit

| Radiated emissions limits, (3 meters) |                 |                   |            |                    |
|---------------------------------------|-----------------|-------------------|------------|--------------------|
| Frequency Range<br>[MHz]              | Limit<br>[μV/m] | Limit<br>[dBμV/m] | Detector   | RBW / VBW<br>[kHz] |
| 30 - 88                               | 100             | 40.0              | Quasi peak | 100 / 300          |
| 88 - 216                              | 150             | 43.5              | Quasi peak | 100 / 300          |
| 216 - 960                             | 200             | 46.0              | Quasi peak | 100 / 300          |
| 960 - 1000                            | 500             | 54.0              | Quasi peak | 100 / 300          |

#### 4.8.5 Result

| Diagram | Channel | Mode                                                | Maximum Level [dB $\mu$ V/m]<br>Frequency Range 30 – 1000 MHz | Result |
|---------|---------|-----------------------------------------------------|---------------------------------------------------------------|--------|
| 3.01    | Low     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | No critical peaks found                                       | Passed |
| 3.02    | Low     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | No critical peaks found                                       | Passed |
| 3.03    | Mid     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | No critical peaks found                                       | Passed |
| 3.04    | Mid     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | No critical peaks found                                       | Passed |
| 3.05    | High    | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | No critical peaks found                                       | Passed |
| 3.06    | High    | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | No critical peaks found                                       | Passed |

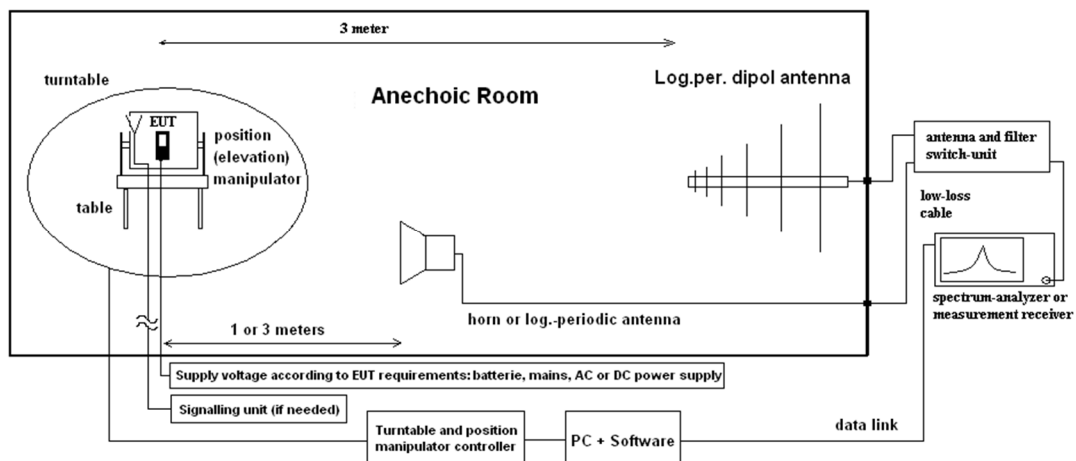
Remark: for more information and graphical plot see annex A1 **1-8898-24-01-05\_TR1-A202-R04**

## 4.9 Radiated field strength emissions above 1 GHz

### 4.9.1 Description of the general test setup and methodology, see below example:

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 18-1-4:2010 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:

The measurement is made according to relevant reference clauses:  
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

#### 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 or three axis scan for portable/small equipment.

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

**Remark:** A pre-scan was performed for both 1Mbps and 2Mbps to identify the worst-case operating mode. Based on the pre-scan results, **1 Mbps** was identified as the worst case; therefore, the final radiated measurements were performed only at **1 Mbps**

#### Formula:

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

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

$E_C$  = Electrical field – corrected value

$E_R$  = Receiver reading

$M$  = Margin

$L_T$  = Limit

$A_F$  = Antenna factor

$C_L$  = Cable loss

$D_F$  = Distance correction factor (if used)

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

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

#### 4.9.2 Sample calculation

| Raw-Value<br>[dBuV/m] | Antenna factor | Distance Correction<br>[dB] | Cable Loss +<br>Preamplifier | Resulting correction value<br>[dB] | Final result<br>[dBuV/m] | Remarks                                               |
|-----------------------|----------------|-----------------------------|------------------------------|------------------------------------|--------------------------|-------------------------------------------------------|
| 29.37                 | 41.20          | --                          | 24.28                        | 16.92                              | 46.3                     | CableLoss and PreAmp data in one data correction file |

Remark: This calculation is based on an example value at 10 GHz

#### 4.9.3 Measurement Location

|                         |                                    |
|-------------------------|------------------------------------|
| Test site 1 – 18 GHz    | 120904 - FAC1 - Radiated Emissions |
| Test site 18 – 26.5 GHz | 120907 - FAC2 - Radiated Emissions |

#### 4.9.4 Limit

| Radiated emissions limits, (3 meters) |                 |                   |          |                    |
|---------------------------------------|-----------------|-------------------|----------|--------------------|
| Frequency Range<br>[MHz]              | Limit<br>[μV/m] | Limit<br>[dBμV/m] | Detector | RBW / VBW<br>[kHz] |
| Above 1000                            | 500             | 54                | Average  | 1000 / 3000        |
| Above 1000                            | 5000            | 74                | Peak     | 1000 / 3000        |

#### 4.9.5 Result

| Diagram | Channel | Mode                                                | Maximum Level [dBμV/m]<br>Frequency Range 1 – 18 GHz | Result |
|---------|---------|-----------------------------------------------------|------------------------------------------------------|--------|
| 4.01    | Low     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @4.803 GHz, 40.73                                    | Passed |
| 4.02    | Mid     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @7.321 GHz, 53.40                                    | Passed |
| 4.03    | High    | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @7.441 GHz, 52.93                                    | Passed |

Remark1: for more information and graphical plot see annex A1 **1-8898-24-01-05\_TR1-A202-R04**

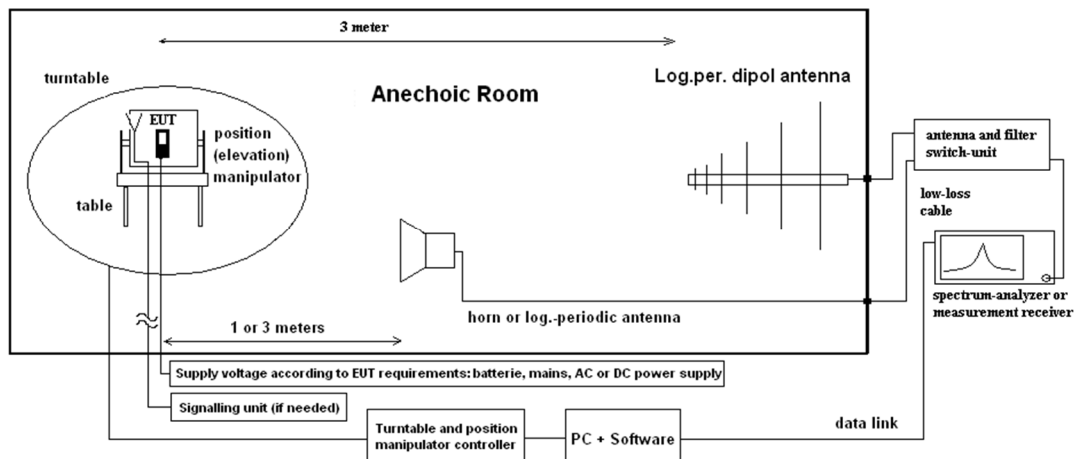
| Diagram | Channel | Mode                                                | Maximum Level [dBμV/m]<br>Frequency Range 18 – 26.5 GHz | Result |
|---------|---------|-----------------------------------------------------|---------------------------------------------------------|--------|
| 4.04    | Low     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @23.69 GHz, 47.67                                       | Passed |
| 4.05    | Low     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @23.96 GHz, 47.09                                       | Passed |
| 4.06    | Mid     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @23.66 GHz, 47.23                                       | Passed |
| 4.07    | Mid     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @22.16 GHz, 47.08                                       | Passed |
| 4.08    | High    | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @19.55 GHz, 46.79                                       | Passed |
| 4.09    | High    | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | @23.78 GHz, 47.18                                       | Passed |

Remark: for more information and graphical plot see annex A1 **1-8898-24-01-05\_TR1-A202-R04**

## 4.10 Radiated Band-Edge emissions

### 4.10.1 Description of the general test setup and methodology, see below example:

#### Schematic:



#### Testing method:

The measurement is made according to relevant reference clauses:

(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

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

For critical results a Marker-Delta marker method was used for showing compliance to restricted bands.

The method consists of three independent steps:

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

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

### 4.10.2 Measurement Location

|           |                                    |
|-----------|------------------------------------|
| Test site | 120904 - FAC1 - Radiated Emissions |
|-----------|------------------------------------|

#### 4.10.3 Limit

| Frequency Range [MHz] | Pk Limit [dBc] | Avg Limit [dBc] | Avg Limit [dBμV/m] | Pk Limit [dBμV/m] | Detector       | RBW / VBW [kHz] |
|-----------------------|----------------|-----------------|--------------------|-------------------|----------------|-----------------|
| Below 2390            | -              | -               | 54                 | 74                | Average / Peak | 1000 / 3000     |
| Above 2483.5          | -              | -               | 54                 | 74                | Average / Peak | 1000 / 3000     |
| 2390 - 2400           | -20            | -               | -                  | -                 | Peak           | 100 / 300       |
| 2390 - 2400           | -              | -30             | -                  | -                 | Average        | 100 / 300       |

#### 4.10.4 Result

Non-restricted bands near-by

| Diagram | Channel | Mode                                                | Peak [dBc] | Average [dBc] | Result |
|---------|---------|-----------------------------------------------------|------------|---------------|--------|
| 9.01    | Low     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | 32.21      | 43.14         | Passed |
| 9.03    | Low     | BLE Mode / Modulation Type: GFSK / Data rate: 2Mbps | 33.44      | 43.41         | Passed |

Remark: for more information and graphical plot see annex A1 **1-8898-24-01-05\_TR1-A202-R04**

Restricted bands near-by

| Diagram | Channel | Mode                                                | Peak [dBμV/m] | Average [dBμV/m] | Result |
|---------|---------|-----------------------------------------------------|---------------|------------------|--------|
| 9.01    | Low     | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | 57.95         | 45.71            | Passed |
| 9.02    | High    | BLE Mode / Modulation Type: GFSK / Data rate: 1Mbps | 58.50         | 46.39            | Passed |
| 9.03    | Low     | BLE Mode / Modulation Type: GFSK / Data rate: 2Mbps | 57.86         | 45.62            | Passed |
| 9.04    | High    | BLE Mode / Modulation Type: GFSK / Data rate: 2Mbps | 58.12         | 46.37            | Passed |

Remark: for more information and graphical plot see annex A1 **1-8898-24-01-05\_TR1-A202-R04**

## 4.11 Equipment lists

| ID    | Description                                           | Manufacturer                                      | SerNo             | CheckType | Last Check                           | Interval             | Next Check       |
|-------|-------------------------------------------------------|---------------------------------------------------|-------------------|-----------|--------------------------------------|----------------------|------------------|
|       | 120901 - ESS SAC3 - Radiated Emission <1GHz           |                                                   |                   | chk       | chk: 2025-Mar-29                     | chk: 12M             | chk: 2026-Mar-29 |
| 20442 | Semi Anechoic Chamber SAC3                            | ETS-Lindgren GmbH / Taufkirchen                   | without           | chk       | chk: 2025-Sep-05                     | chk: 12M             | chk: 2026-Sep-05 |
| 20482 | Filter Matrix SAC3                                    | cetecom advanced GmbH / Essen                     | without           | cnn       | cal: -<br>chk: -                     | cal: -<br>chk: -     | cal: -<br>chk: - |
| 20574 | Biconilog Hybrid Antenna BTA-L                        | Frankonia GmbH / Heideck                          | 980026L           | cal       | cal: 2025-Jun-06                     | cal: 36M             | cal: 2028-Jun-06 |
| 20620 | EMI Test Receiver ESU26                               | Rohde & Schwarz Messgerätebau GmbH / Memmingen    | 100362            | cal       | cal: 2025-May-06                     | cal: 12M             | cal: 2026-May-06 |
| 20885 | Power Supply EA3632A                                  | Agilent Technologies Deutschland GmbH / Böblingen | 75305850          | cnn       | cal: -<br>chk: -                     | cal: -<br>chk: -     | cal: -<br>chk: - |
| 20979 | Loop Antenna HFH2-Z2                                  | Rohde & Schwarz Messgerätebau GmbH / Memmingen    | 872096/61         | cal       | cal: 2024-Sep-16                     | cal: 36M             | cal: 2027-Sep-16 |
|       | 120904 - FAC1 - Radiated Emissions                    |                                                   |                   | chk       | chk: 2025-Mar-25                     | chk: 12M             | chk: 2026-Mar-25 |
| 20020 | Double-Ridged Waveguide Horn Antenna 3115 (Subst 1)   | EMCO Elektronik GmbH / Gilching                   | 9107-3699         | calchk    | cal: 2024-Sep-11<br>chk: 2013-Apr-20 | cal: 36M<br>chk: 12M | cal: 2027-Sep-11 |
| 20066 | Notch Filter WRCT 1900/2200-5/40-10EEK                | Wainwright Instruments GmbH / Andechs             | 5                 | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20121 | Notch Filter WRCB 1879,5/1880,5EE                     | Wainwright Instruments GmbH / Andechs             | 15                | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20122 | Notch Filter WRCB 1747/1748                           | Wainwright Instruments GmbH / Andechs             | 12                | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20254 | High Pass Filter SHC 2600/12750-1.5KK                 | Trilithic                                         | 23042             | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20287 | Pre-Amplifier 25MHz - 4GHz AMF-2D-100M4G-35-10P       | Miteq Inc.                                        | 379418            | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20290 | Notch Filter WRCA 901,9/903,15S                       | Wainwright Instruments GmbH / Andechs             | 3RR               | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20291 | High Pass Filter WHJ 2200-4EE                         | Wainwright Instruments GmbH / Andechs             | 14                | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20338 | Pre-Amplifier JS4-00102600-38-5P                      | Miteq Inc.                                        | 838697            | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20341 | Digital Multimeter Fluke 112                          | Fluke Deutschland GmbH / Glotttetal               | 81650455          | cal       | cal: 2024-May-13                     | cal: 24M             | cal: 2026-May-13 |
| 20448 | Notch Filter WRCT 1850,0/2170,0-5/40-10SSK            | Wainwright Instruments GmbH / Andechs             | 5                 | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20449 | Notch Filter WRCT 824,0/894,0-5/40-8SSK               | Wainwright Instruments GmbH / Andechs             | 1                 | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20484 | Pre-Amplifier 2,5GHz - 18GHz AMF-5D-02501800-25-10P   | Miteq Inc.                                        | 1244554           | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20489 | EMI Test Receiver ESU40                               | Rohde & Schwarz Messgerätebau GmbH / Memmingen    | 100030            | cal       | cal: 2025-May-08                     | cal: 12M             | cal: 2026-May-08 |
| 20512 | Notch Filter WRCA 800/960-02/40-6EEK (GSM 850)        | Wainwright Instruments GmbH / Andechs             | 24                | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20549 | Log. Per. Antenna HL025                               | Rohde & Schwarz Messgerätebau GmbH / Memmingen    | 1000060           | calchk    | cal: 2024-Oct-08                     | cal: 36M<br>chk: 12M | cal: 2027-Oct-08 |
| 20558 | Fully Anechoic Chamber 1                              | ETS-Lindgren GmbH / Taufkirchen                   | without           | chk       | chk: 2025-Mar-28                     | chk: 24M             | chk: 2027-Mar-28 |
| 20608 | Ultrabroadband-Antenna HL562                          | Rohde & Schwarz Messgerätebau GmbH / Memmingen    | 830547/009        | cal       | cal: 2023-Jul-04                     | cal: 36M             | cal: 2026-Jul-04 |
| 20611 | Power Supply E3632A                                   | Agilent Technologies Deutschland GmbH             | KR 75305854       | cpu       |                                      |                      |                  |
| 20690 | Spectrum Analyzer FSU26                               | Rohde & Schwarz Messgerätebau GmbH / Memmingen    | 100302/026        | cal       | cal: 2025-May-07                     | cal: 24M             | cal: 2027-May-07 |
| 20720 | Measurement Software EMC32 [FAC]                      | Rohde & Schwarz Messgerätebau GmbH                | V10.xx            | cnn       | cal: -<br>chk: -                     | cal: -<br>chk: -     | cal: -<br>chk: - |
| 20868 | High Pass Filter AFH-07000                            | AtlanTecRF / Braintree, Essex                     | 16071300004       | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20883 | Open Switch and control Platform OSP-B200S2 Satellite | Rohde & Schwarz Messgerätebau GmbH / Memmingen    | 101432            | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
| 20884 | Open Switch and control Platform OSP320               | Rohde & Schwarz Messgerätebau GmbH / Memmingen    | 101391            | chk       | chk: 2025-Mar-21                     | chk: 12M             | chk: 2026-Mar-21 |
|       | 120907 - FAC2 - Radiated Emissions                    |                                                   |                   | chk       | chk: 2024-Oct-31                     | chk: 24M             | chk: 2026-Oct-31 |
| 20133 | Double-Ridged Waveguide Horn Antenna 3115 (Meas 1)    | EMCO Elektronik GmbH / Gilching                   | 9012-3629         | cal       | cal: 2023-May-22                     | cal: 36M             | cal: 2026-May-22 |
| 20302 | Horn Antenna BBHA9170 (Meas 1)                        | Schwarzbeck Mess-Elektronik OHG / Schönaun        | 155               | cpu       | chk: 2020-Apr-15                     | chk: 12M             |                  |
| 20412 | Fully Anechoic Chamber 2                              | ETS-Lindgren GmbH / Taufkirchen                   | without           | chk       | chk: 2024-Mar-15                     | chk: 12M             | chk: 2025-Mar-15 |
| 20811 | Horn Antenna ASY-SGH-124-SMA                          | Antenna Systems Solutions S.L / Santander         | 29F14182337       | cal       | cal: 2024-Oct-08                     | cal: 36M             | cal: 2027-Oct-08 |
| 20816 | SGH Antenna SGH-26-WR10                               | Anteral S.L. / Pamplona, Navarra                  | 1144              | cpu       | chk: 2024-Mar-22                     |                      |                  |
| 20817 | Waveguide Rectangular Horn Antenna SAR-2309-22-S2     | ERAVANT / Torrance                                | 13254-01          | chk       | chk: 2024-Oct-16                     | chk: 24M             | chk: 2026-Oct-16 |
| 20832 | Horn Antenna WR90, 90-HA20                            | TACTRON ELEKTRONIK GmbH & Co. KG / Martinsried    | J202064946        | chk       | chk: 2024-Nov-16                     | chk: 12M             | chk: 2025-Nov-16 |
| 20836 | 1-18 GHz Amplifier                                    | Wright Technologies, Inc. / Roseville             | 0001              | chk       | chk: 2024-Oct-18                     | chk: 24M             | chk: 2026-Oct-18 |
| 20877 | JS42-08001800-16-8P Verstärker                        | Miteq Inc.                                        | 2079991 / 2079992 | chk       | chk: 2024-Oct-18                     | chk: 24M             | chk: 2026-Oct-18 |
| 20879 | JS44-18004000-40-8P Verstärker                        | Miteq Inc.                                        | 1750117           | chk       | chk: 2024-Oct-18                     | chk: 24M             | chk: 2026-Oct-18 |
| 20907 | Waveguide WR-15 attenuator STA-30-15-M2               | ERAVANT / Torrance                                | 13256-01          | cpu       | chk: 2024-Mar-19                     |                      |                  |
| 20908 | Waveguide WR 10 attenuator STA-30-10-M2               | ERAVANT / Torrance                                | 13256-01          | cpu       | chk: 2024-Mar-22                     |                      |                  |
| 20909 | Waveguide Horn Antenna PE9881-24                      | Pasternack Enterprises, Inc. / Irvine             | 37/2016           | cpu       |                                      |                      |                  |

| ID    | Description                                          | Manufacturer                                            | SerNo          | CheckType | Last Check       | Interval         | Next Check       |
|-------|------------------------------------------------------|---------------------------------------------------------|----------------|-----------|------------------|------------------|------------------|
| 20910 | Frequency Multiplier 936VF-10/385                    | MI-Wave, Millimeter Wave Products Inc. / St. Petersburg | 142            | cpu       | chk: 2024-Mar-19 |                  |                  |
| 20911 | Frequency Multiplier 938WF-10/387                    | MI-Wave, Millimeter Wave Products Inc. / St. Petersburg | 141            | cpu       | chk: 2024-Mar-19 |                  |                  |
| 20913 | Phase Amplitude Stable Cable Assembly DC-40GHz       | RF-Lambda Europe GmbH                                   | AC19040001     | cnn       | cal: -<br>chk: - | cal: -<br>chk: - | cal: -<br>chk: - |
| 20972 | Signal- and Spectrum Analyzer FSW50                  | Rohde & Schwarz Messgerätebau GmbH / Memmingen          | 101929         | cal       | cal: 2025-Mar-19 | cal: 12M         | cal: 2026-Mar-19 |
| 25458 | DRG Horn Antenna 19 dB                               | A.H. Systems, Inc. / Chatsworth                         | 183            | cal       | cal: 2025-Jun-03 | cal: 36M         | cal: 2028-Jun-03 |
|       | 120910 - Radio Laboratory 1 (TS 8997)                |                                                         |                | chk       | chk: 2025-Jul-14 | chk: 12M         | chk: 2026-Jul-14 |
| 20559 | Vector Signal Generator SMU200A                      | Rohde & Schwarz Messgerätebau GmbH / Memmingen          | 103736         | cal       | cal: 2025-May-07 | cal: 24M         | cal: 2027-May-07 |
| 20691 | Open Switch and control Platform OSP157W 8 Port Plus | Rohde & Schwarz Messgerätebau GmbH / Memmingen          | 100950         | cal       | cal: 2023-Jun-30 | cal: 36M         | cal: 2026-Jun-30 |
| 20866 | Signal Analyzer FSV3030                              | Rohde & Schwarz Messgerätebau GmbH / Memmingen          | 101247         | cal       | cal: 2025-Jun-10 | cal: 12M         | cal: 2026-Jun-10 |
| 20904 | Climatic Chamber ClimeEvent C/1000/70a/5             | Weiss Umwelttechnik GmbH / Reiskirchen-Lindenstruth     | 58226223240010 | cal       | cal: 2025-Jan-23 | cal: 24M         | cal: 2027-Jan-23 |
| 20927 | Signal Generator SMF 100A                            | Rohde & Schwarz Messgerätebau GmbH / Memmingen          | 102109         | cal       | cal: 2025-May-08 | cal: 36M         | cal: 2028-May-08 |
| 20978 | HMP2020 2-CH power Supply 188W                       | Rohde & Schwarz Messgerätebau GmbH / Memmingen          | 121649         | cal       | cal: 2024-Aug-06 | cal: 24M         | cal: 2026-Aug-06 |
| 20980 | USB Wideband power Sensor U2021XA                    | Keysight Technologies Deutschland GmbH / Böblingen      | MY64330007     | cal       | cal: 2025-Jul-02 | cal: 12M         | cal: 2026-Jul-02 |
| 80682 | Switch Matrix USM                                    | cetekom advanced GmbH / Saarbrücken                     | D001           | cnn       | cal: -<br>chk: - | cal: -<br>chk: - | cal: -<br>chk: - |

Tools used in 'P1M6'

#### 4.11.1 Legend

| Note / remarks | Interval of calibration & Verification |
|----------------|----------------------------------------|
| 12M            | 12 months                              |
| 24M            | 24 months                              |
| 36M            | 36 months                              |
| 10Y            | 10 Years                               |

| Abbreviation Check Type | Description                                |
|-------------------------|--------------------------------------------|
| cnn                     | Calibration and verification not necessary |
| cal                     | Calibration                                |
| calchk                  | Calibration plus intermediate Verification |
| chk                     | Verification                               |
| cpu                     | Verification before usage                  |

## 5 Results from external laboratory

None

-

## 6 Opinions and interpretations

None

-

## 7 List of abbreviations

None

-

## 8 Measurement Uncertainty valid for conducted/radiated measurements

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 its statistical distribution calculated.

| Issue No. | Measurement type                                         | Reference         | Frequency range of measurement |            | Calculated Uncertainty based on confidence level of 95.54% | Remarks                                                                         |
|-----------|----------------------------------------------------------|-------------------|--------------------------------|------------|------------------------------------------------------------|---------------------------------------------------------------------------------|
|           |                                                          |                   | Start [MHz]                    | Stop [MHz] |                                                            |                                                                                 |
| 1         | Magnetic Field Strength                                  | EN, FCC, JP, IC   | 0.009                          | 30         | 4.86                                                       | Magnetic loop antenna, Pre-Amp on                                               |
| 2         | RF-Output Power (EIRP)<br>Unwanted emissions (EIRP) [dB] | EN, FCC, JP, IC   | 30                             | 100        | 4.57                                                       | without Pre-Amp                                                                 |
|           |                                                          |                   | 30                             | 100        | 4.91                                                       | with Pre-Amp                                                                    |
|           |                                                          |                   | 100                            | 1000       | 4.02                                                       | without Pre-Amp                                                                 |
|           |                                                          |                   | 100                            | 1000       | 4.26                                                       | with Pre-Amp                                                                    |
|           |                                                          |                   | 1000                           | 18000      | 4.36                                                       | without Pre-Amp                                                                 |
|           |                                                          |                   | 1000                           | 18000      | 5.23                                                       | with Pre-Amp                                                                    |
|           |                                                          |                   | 18000                          | 33000      | 4.92                                                       | Schwarzbeck BBHA9170 (#20302) Antenna set-up non-waveguide antenna)             |
|           |                                                          |                   | 33000                          | 50000      | 4.17                                                       | Set-up for Q-Band (WR-22), non-wave guide antenna                               |
|           |                                                          |                   | 40000                          | 60000      | 4.69                                                       | Set-up U-Band (WR-19), non-waveguide antenna                                    |
|           |                                                          |                   | 50000                          | 75000      | 4.06                                                       | External Mixer set-up V-Band (WR-15)                                            |
|           |                                                          |                   | 75000                          | 110000     | 4.17                                                       | External Mixer set-up W-Band (WR-6)                                             |
|           |                                                          |                   | 90000                          | 140000     | 5.49                                                       | External Mixer set-up F-Band (WR-8)                                             |
|           |                                                          |                   | 140000                         | 225000     | 6.22                                                       | External Mixer set-up G-Band (WR-5)                                             |
|           |                                                          |                   | 225000                         | 325000     | 7.04                                                       | External Mixer set-up (WR-3)                                                    |
|           |                                                          |                   | 325000                         | 500000     | 8.84                                                       | External Mixer set-up (WR-2.2)                                                  |
| 3         | Radiated Blocking [dB]                                   | EN                | 1000                           | 18000      | 2.85                                                       | Typical set-up with microwave generator and antenna, value for 7 GHz calculated |
|           |                                                          |                   | 18000                          | 33000      | 4.66                                                       | Typical set-up with microwave generator and antenna                             |
|           |                                                          |                   | 33000                          | 50000      | 3.48                                                       | WR-22 set-up                                                                    |
|           |                                                          |                   | 50000                          | 75000      | 3.73                                                       | WR-15 set-up                                                                    |
|           |                                                          |                   | 75000                          | 110000     | 4.26                                                       | WR-6 set-up                                                                     |
| 4         | Frequency Error / UWB+FMCW [kHz]                         | EN, FCC, JP, ISED | 40000                          | 77000      | 276.19                                                     | calculated for 77 GHz (FMCW) carrier                                            |
|           | Frequency Error / NFC [Hz]                               | EN, FCC, JP, ISED | 6000                           | 7000       | 33.92                                                      | calculated for 6.5 GHz UWB Ch.5                                                 |
|           |                                                          |                   | 11.00                          | 14.00      | 20.76                                                      | calculated for 13.56 MHz NFC carrier                                            |
| 5         | TS 8997<br>Conducted Parameters                          | FCC15/18 / ISED   | 30                             | 6000       | 1.11                                                       | 1. Power measurement with Fast-sampling-detector                                |
|           |                                                          |                   | 30                             | 6000       | 1.20                                                       | 2. Power measurement with Spectrum-Analyzer                                     |
|           |                                                          |                   | 30                             | 6000       | 1.20                                                       | 3. Power Spectrum-Density measurement                                           |
|           |                                                          |                   | 30                             | 7500       | 1.20                                                       | 4. Conducted Spurious emissions                                                 |
|           |                                                          |                   | 0.009                          | 30         | 2.56                                                       | 5. Conducted Spurious emissions                                                 |
|           |                                                          |                   | 2.4                            | 2.48       | 1.95 ppm                                                   | 6a. Bandwidth / 2-Marker Method for 2.4 GHz ISM                                 |
|           |                                                          |                   | 5.18                           | 5.825      | 7.180 ppm                                                  | 6b. Bandwidth / 2-Marker Method for 5 GHz WLAN                                  |
|           |                                                          |                   | 5.18                           | 5.825      | 1.099 ppm                                                  | 7. Frequency (Marker method) for 5 GHz WLAN                                     |
|           |                                                          |                   | 30                             | 6000       | 0.11561 µs                                                 | 8. Medium-Utilization factor / Timing                                           |
|           |                                                          |                   | 30                             | 6000       | 1.85                                                       | 9a. Blocking-Level of companion device                                          |
|           |                                                          |                   | 30                             | 6000       | 1.62                                                       | 9b. Blocking Generator level                                                    |
|           |                                                          |                   |                                |            |                                                            |                                                                                 |
| 6         | Conducted Emissions                                      | EN, FCC           | 0.009                          | 30         | 3.57                                                       | general EMI-measurements on AC/DC ports                                         |

## 9 Versions of test reports (change history)

| Version | Applied changes                                                                                            | Date of release |
|---------|------------------------------------------------------------------------------------------------------------|-----------------|
| R01     | Initial release                                                                                            | 2026-Mar-31     |
| R02     | @Page1 Product Type + Model Name updated, FCC ID and IC ID added<br>@2.7 Product Type + Model Name updated | 2026-May-05     |
| R03     | @Page1 PMN changed 456BT to Blucon ,FVIN added                                                             | 2026-Jul-03     |
| R04     | @Page1 PMN changed Blucon to 465BT                                                                         | 2026-Jul-21     |
| R05     | @4.7.1 worst case remark added<br>@4.8.1 worst case remark added<br>@4.9.1 worst case remark added         | 2026-Jul-22     |

**End Of Test Report**