

# EMI – TEST REPORT

- FCC Part 15.247, RSS247 -

**Type / Model Name** : TT-BAE2-17-01

**Product Description** : Control and display units 2,7" with BLE gateway

**Applicant** : medica Medizintechnik GmbH

**Address** : Blumenweg 8

88454 HOCHDORF, GERMANY

**Manufacturer** : medica Medizintechnik GmbH

**Address** : Blumenweg 8

88454 HOCHDORF, GERMANY

**Licence holder** : medica Medizintechnik GmbH

**Address** : Blumenweg 8

88454 HOCHDORF, GERMANY

**Test Result** according to the standards  
listed in clause 1 test standards:

**POSITIVE**

**Test Report No. :** **T43063-00-01GK**

20. December 2017

Date of issue



Deutsche  
Akkreditierungsstelle  
D-PL-12030-01-01  
D-PL-12030-01-02

The test report merely corresponds to the test sample.  
It is not permitted to copy extracts of these test results  
without the written permission of the test laboratory.

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Attachment A as separate supplement

## 1 TEST STANDARDS

The tests were performed according to following standards:

## FCC Rules and Regulations Part 15, Subpart A - General (September 2017)

|                                   |                                               |
|-----------------------------------|-----------------------------------------------|
| Part 15, Subpart A, Section 15.31 | Measurement standards                         |
| Part 15, Subpart A, Section 15.33 | Frequency range of radiated measurements      |
| Part 15, Subpart A, Section 15.35 | Measurement detector functions and bandwidths |

## FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September 2017)

|                                    |                                                                                 |
|------------------------------------|---------------------------------------------------------------------------------|
| Part 15, Subpart C, Section 15.203 | Antenna requirement                                                             |
| Part 15, Subpart C, Section 15.204 | External radio frequency power amplifiers and antenna modifications             |
| Part 15, Subpart C, Section 15.205 | Restricted bands of operation                                                   |
| Part 15, Subpart C, Section 15.207 | Conducted limits                                                                |
| Part 15, Subpart C, Section 15.209 | Radiated emission limits, general requirements                                  |
| Part 15, Subpart C, Section 15.247 | Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz |

|                                  |                                                                                                                                                                    |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ANSI C63.10: 2013                | Testing Unlicensed Wireless Devices                                                                                                                                |
| ETSI TR 100 028 V1.3.1: 2001-03, | Electromagnetic Compatibility and Radio Spectrum Matters (ERM);<br>Uncertainties in the Measurement of Mobile Radio Equipment<br>Characteristics—Part 1 and Part 2 |
| KDB 558074 D01 v04               | Guidance for performing compliance measurements on DTS<br>operating under §15.247, April 5, 2017.                                                                  |

## **2 EQUIPMENT UNDER TEST**

### **2.1 Photo documentation of the EUT – Detailed photos see ATTACHMENT A**

### **2.2 Equipment type**

BLE device

### **2.3 Short description of the equipment under test (EUT)**

The EUT is a control and display unit (2.7 inches). The EUT is compatible with the standard 802.15.1. It supports the 2.4 GHz frequency band. A single PCB antenna is used within the system. The EUT must be controlled via terminal program to select the modulation and data rate manually. A personal computer was used to control the settings of the EUT.

|                                   |                                           |
|-----------------------------------|-------------------------------------------|
| Number of tested samples:         | 2 ( 1 radiated and 1 conducted sample)    |
| Serial number (radiated sample):  | pre-production sample                     |
| Serial number )conducted sample): | pre-production sample                     |
| Firmware version:                 | V1.0                                      |
| Bluetooth-Stack:                  | Softdevice V8.0 from Nordic Semiconductor |

#### **EUT configuration:**

(The CDF filled by the applicant can be viewed at the test laboratory.)

### **2.4 Variants of the EUT**

None

## 2.5 Operation frequency and channel plan

The operating frequency is 2400 MHz to 2483.5 MHz.

Channel plan BT-Standard 802.15.1:

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 37      | 2402      | 18      | 2442      |
| 0       | 2404      | 19      | 2444      |
| 1       | 2406      | 20      | 2446      |
| 2       | 2408      | 21      | 2448      |
| 3       | 2410      | 22      | 2450      |
| 4       | 2412      | 23      | 2452      |
| 5       | 2414      | 24      | 2454      |
| 6       | 2416      | 25      | 2456      |
| 7       | 2418      | 26      | 2458      |
| 8       | 2420      | 27      | 2460      |
| 9       | 2422      | 28      | 2462      |
| 10      | 2424      | 29      | 2464      |
| 38      | 2426      | 30      | 2466      |
| 11      | 2428      | 31      | 2468      |
| 12      | 2430      | 32      | 2470      |
| 13      | 2432      | 33      | 2472      |
| 14      | 2434      | 34      | 2474      |
| 15      | 2436      | 35      | 2476      |
| 16      | 2438      | 36      | 2478      |
| 17      | 2440      | 39      | 2480      |

Note: the marked frequencies are determined for final testing.

## 2.6 Transmit operating modes

The EUT uses GFSK modulation and may provide following data rates:

- 1000 kbps

(kbps = kilobits per second)

## 2.7 Antennas

The following antennas shall be used with the EUT:

| Number | Characteristic | Certification name | Plug | Frequency (MHz) | Gain (dBi) |
|--------|----------------|--------------------|------|-----------------|------------|
| 1      | Omni           | PCB antenna        | none | 2402            | 0.6        |
| 1      | Omni           | PCB antenna        | none | 2442            | -2.3       |
| 1      | Omni           | PCB antenna        | none | 2480            | -6.4       |

Note: The antenna gain was measured and calculated in the test report T43063-00-00GK of the test laboratory CSA Group Bayern GmbH.

## 2.8 Power supply system utilised

Power supply voltage,  $V_{nom}$  : 3.3 V DC (powered by Theratrainner mobi or tigo 115 V AC / 60 Hz)

## 2.9 Peripheral devices and interface cables

The following peripheral devices and interface cables are connected during the measurements:

- Laptop \_\_\_\_\_ Model : Fujitsu Siemens E780 \_\_\_\_\_
- \_\_\_\_\_ Model : \_\_\_\_\_
- \_\_\_\_\_ Model : \_\_\_\_\_

Note: The laptop is only connected during the settings but not during the measurements.

## 2.10 Determination of worst case conditions for final measurement

Measurements are made in all three orthogonal axes.

The tests are carried out in the following frequency band:

**2400 MHz – 2483.5 MHz**

For the final test the following channels and test modes are selected:

| Available channels | Tested channels | Power setting | Modulation | Data rate |
|--------------------|-----------------|---------------|------------|-----------|
| 00 to 39           | 37, 18, 39      | (0 dBm)       | GFSK       | 1000 kbps |

- TX continuous mode, 802.15.1

### 2.10.1 Test jig

No special test jig was used.

### 2.10.2 Test software

The test software nRFgo (Direct Test Mode) was used to set the EUT into test mode.

### **3 TEST RESULT SUMMARY**

BLE device using digital modulation:

Operating in the 2400 MHz – 2483.5 MHz:

| FCC Rule Part | RSS Rule Part  | Description                         | Result         |
|---------------|----------------|-------------------------------------|----------------|
| 15.207(a)     | RSS Gen, 8.8   | AC power line conducted emissions   | passed         |
| 15.247(a)(2)  | RSS247, 5.2(a) | -6 dB EBW                           | passed         |
| 15.247(b)(3)  | RSS247, 5.4(d) | Maximum peak conducted output power | passed         |
| 15.247(b)(4)  | RSS247, 5.4(d) | Defacto limit                       | passed         |
| 15.247(d)     | RSS247, 5.5    | Unwanted emission, radiated         | not applicable |
| 15.247(d)     | RSS-Gen, 8.10  | Emissions in restricted bands       | passed         |
| 15.247(e)     | RSS247, 5.2(b) | PSD                                 | passed         |
| 15.35(c)      | RSS-Gen, 6.10  | Pulsed operation                    | passed         |
| 15.247(b)(4)  | -              | Antenna requirement                 | passed         |
|               | RSS-Gen, 6.6   | 99 % Bandwidth                      | passed         |

The mentioned RSS Rule Parts in the above table are related to:

RSS Gen, Issue 4, November 2014

RSS 247, Issue 2, February 2017

#### **3.1 Final assessment**

The equipment under test fulfills the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 16 August 2017

Testing concluded on : 02 November 2017

Checked by:

Tested by:

\_\_\_\_\_  
Klaus Gegenfurtner  
Teamleader Radio

\_\_\_\_\_  
Konrad Graßl  
Radio Team

## **4 TEST ENVIRONMENT**

### **4.1 Address of the test laboratory**

**CSA Group Bayern GmbH  
Ohmstrasse 1-4  
94342 STRASSKIRCHEN  
GERMANY**

### **4.2 Environmental conditions**

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 °C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

### 4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor  $k = 2$ . The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

| Measurement Type                  | Range                  | Confidence Level | Calculated Uncertainty   |
|-----------------------------------|------------------------|------------------|--------------------------|
| AC power line conducted emissions | 0.15 MHz to 30 MHz     | 95%              | $\pm 3.29$ dB            |
| EBW and OBW                       | 2400 MHz to 30000 MHz  | 95%              | $\pm 2.5 \times 10^{-7}$ |
| Output power ERP, radiated        | 1000 MHz to 7000 MHz   | 95%              | $\pm 2.71$ dB            |
| Field strength of the fundamental | 1000 MHz to 7000 MHz   | 95%              | $\pm 2.71$ dB            |
| Power spectral density            | 2400 MHz to 3000 MHz   | 95%              | $\pm 0.62$ dB            |
| Spurious Emissions, conducted     | 9 kHz to 10000 MHz     | 95%              | $\pm 2.15$ dB            |
| Spurious Emissions, conducted     | 10000 MHz to 40000 MHz | 95%              | $\pm 3.47$ dB            |
| Spurious Emissions, radiated      | 9 kHz to 30 MHz        | 95%              | $\pm 3.53$ dB            |
| Spurious Emissions, radiated      | 30 MHz to 1000 MHz     | 95%              | $\pm 4.44$ dB            |
| Spurious Emissions, radiated      | 1000 MHz to 30000 MHz  | 95%              | $\pm 2.34$ dB            |
| Spurious Emissions, radiated      | 30000 MHz to 40000 MHz | 95%              | $\pm 5.13$ dB            |

## 4.4 Measurement protocol for FCC and ISCED

### 4.4.1 General information

The Open Area test site is a listed Open Site under the Canadian Test-Sites File-No:

#### IC 3009A-1

The Anechoic chamber is a listed test site under the Canadian Test-Sites File-No:

#### IC 3009A-2

In compliance with RSS 247 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.10 and applying the CISPR 22 limits.

##### 4.4.1.1 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

##### 4.4.1.2 Details of test procedures

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.10 - "Testing Unlicensed Wireless Devices". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.10 and applying the CISPR 22 limits.

## 5 TEST CONDITIONS AND RESULTS

### 5.1 AC power line conducted emissions

For test instruments and accessories used see section 6 Part A 4.

#### 5.1.1 Description of the test location

Test location: Shielded Room S2

#### 5.1.2 Photo documentation of the test set-up

Please see Attachment B

#### 5.1.3 Applicable standard

According to FCC Part 15, Section 15.207(a):

Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

#### 5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.10 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

#### 5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 1.71 dB at 0.4755 MHz

Limit according to FCC Part 15, Section 15.207(a):

| Frequency of Emission<br>(MHz) | Conducted Limit (dBµV) |            |
|--------------------------------|------------------------|------------|
|                                | Quasi-peak             | Average    |
| 0.15-0.5                       | 66 to 56 *             | 56 to 46 * |
| 0.5-5                          | 56                     | 46         |
| 5-30                           | 60                     | 50         |

\* Decreases with the logarithm of the frequency

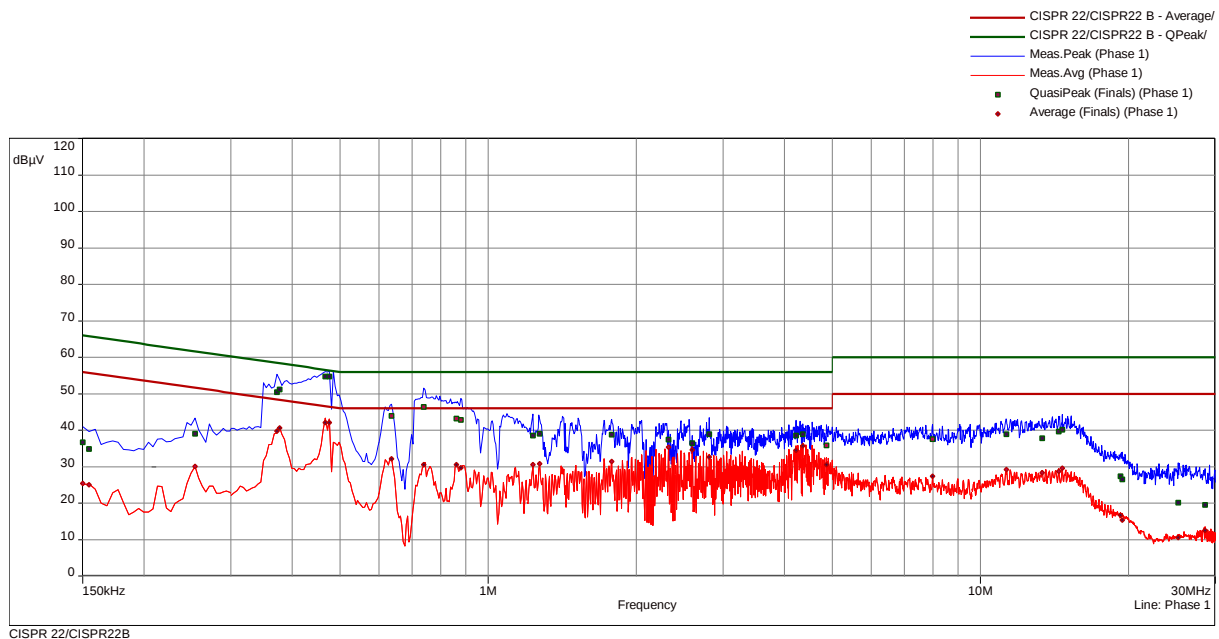
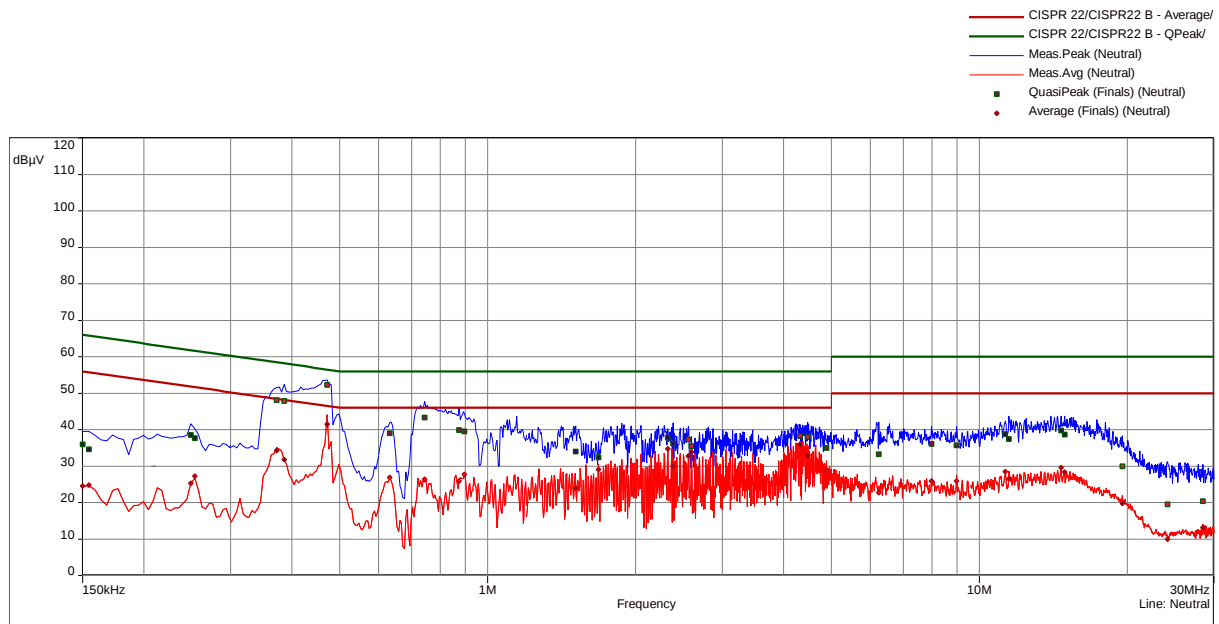
The requirements are **FULFILLED**.

**Remarks:** For detailed test result please see the following test protocols

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Note: The EUT can be powered by Theratrainner mobi and tigo. These devices have an integrated motor which provides a minimal number of revolutions of 10 rpm and a maximal number of 60 rpm.

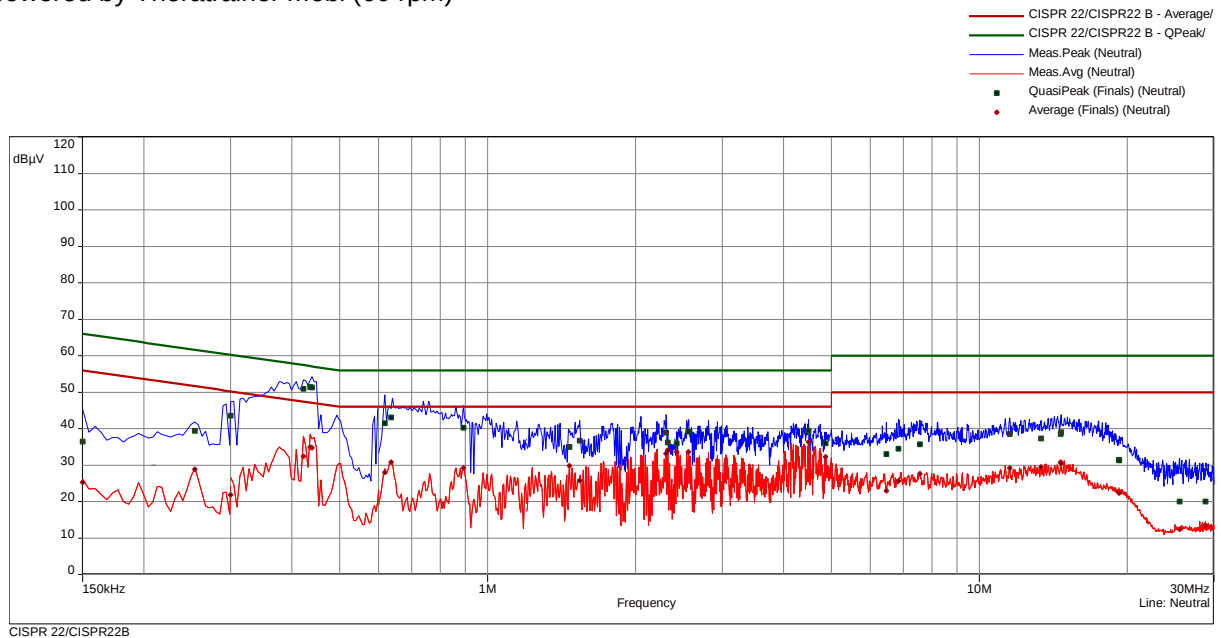
EUT powered by Theratrainner mobi (10 rpm)

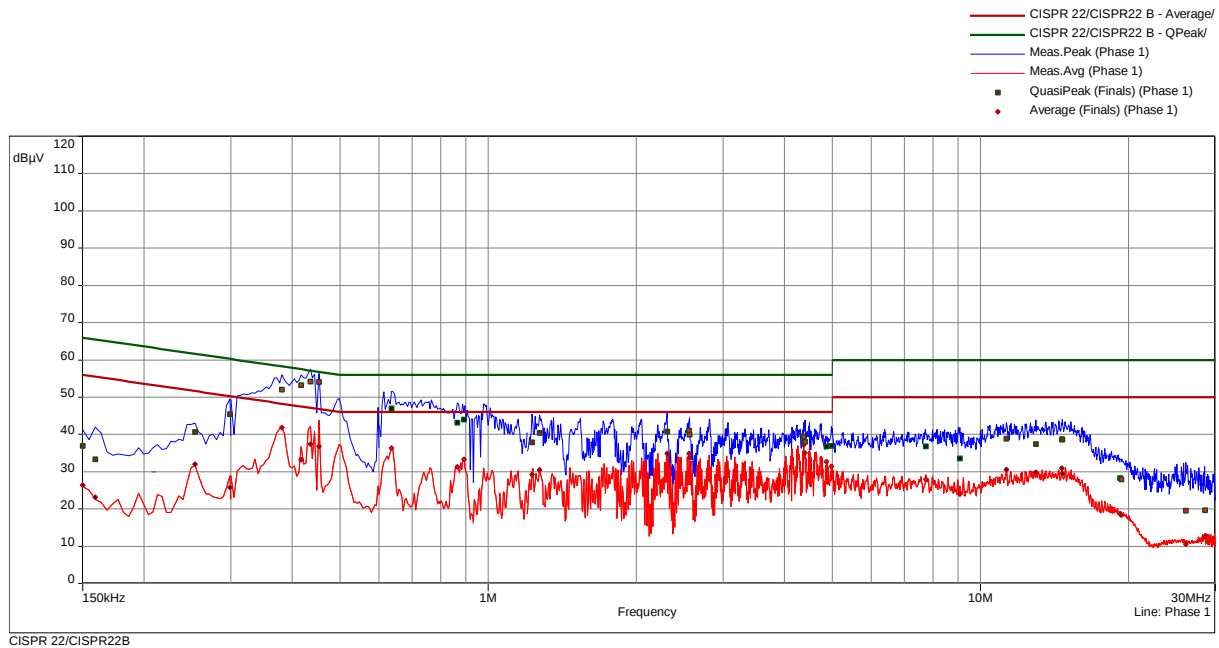


| freq    | SR | QP     | margin | limit | AV     | margin | limit | line    |
|---------|----|--------|--------|-------|--------|--------|-------|---------|
| MHz     |    | dB(μV) | dB     | dB    | dB(μV) | dB     | dB    |         |
| 0.15    | 1  | 36.69  | 29.31  | 66.00 | 25.40  | 30.60  | 56.00 | Phase 1 |
| 0.1545  | 1  | 34.86  | 30.90  | 65.75 | 25.07  | 30.68  | 55.75 | Phase 1 |
| 0.2535  | 1  | 39.08  | 22.56  | 61.64 | 30.11  | 21.54  | 51.64 | Phase 1 |
| 0.372   | 2  | 50.46  | 8.00   | 58.46 | 39.75  | 8.70   | 48.46 | Phase 1 |
| 0.3765  | 2  | 51.20  | 7.15   | 58.36 | 40.61  | 7.75   | 48.36 | Phase 1 |
| 0.4665  | 2  | 54.70  | 1.87   | 56.58 | 42.11  | 4.47   | 46.58 | Phase 1 |
| 0.4755  | 2  | 54.71  | 1.71   | 56.42 | 42.15  | 4.27   | 46.42 | Phase 1 |
| 0.636   | 3  | 43.98  | 12.02  | 56.00 | 32.20  | 13.80  | 46.00 | Phase 1 |
| 0.7395  | 3  | 46.40  | 9.60   | 56.00 | 30.53  | 15.47  | 46.00 | Phase 1 |
| 0.861   | 3  | 43.21  | 12.79  | 56.00 | 30.53  | 15.47  | 46.00 | Phase 1 |
| 0.879   | 3  | 42.84  | 13.16  | 56.00 | 29.74  | 16.26  | 46.00 | Phase 1 |
| 1.2315  | 4  | 38.48  | 17.52  | 56.00 | 30.51  | 15.49  | 46.00 | Phase 1 |
| 1.272   | 4  | 39.04  | 16.96  | 56.00 | 30.75  | 15.25  | 46.00 | Phase 1 |
| 1.7805  | 4  | 38.74  | 17.26  | 56.00 | 31.36  | 14.64  | 46.00 | Phase 1 |
| 2.325   | 4  | 37.42  | 18.58  | 56.00 | 35.40  | 10.60  | 46.00 | Phase 1 |
| 2.598   | 5  | 36.42  | 19.58  | 56.00 | 34.63  | 11.37  | 46.00 | Phase 1 |
| 2.814   | 5  | 38.85  | 17.15  | 56.00 | 32.70  | 13.30  | 46.00 | Phase 1 |
| 4.218   | 5  | 38.56  | 17.44  | 56.00 | 34.53  | 11.47  | 46.00 | Phase 1 |
| 4.3575  | 5  | 38.88  | 17.12  | 56.00 | 35.70  | 10.30  | 46.00 | Phase 1 |
| 4.863   | 6  | 35.89  | 20.11  | 56.00 | 30.60  | 15.40  | 46.00 | Phase 1 |
| 7.9905  | 6  | 37.55  | 22.45  | 60.00 | 27.31  | 22.69  | 50.00 | Phase 1 |
| 11.292  | 7  | 38.85  | 21.15  | 60.00 | 29.20  | 20.80  | 50.00 | Phase 1 |
| 13.3485 | 7  | 37.86  | 22.14  | 60.00 | 28.35  | 21.65  | 50.00 | Phase 1 |
| 14.4105 | 7  | 39.61  | 20.39  | 60.00 | 28.66  | 21.34  | 50.00 | Phase 1 |
| 14.6535 | 7  | 40.08  | 19.92  | 60.00 | 29.63  | 20.37  | 50.00 | Phase 1 |
| 19.236  | 8  | 27.31  | 32.69  | 60.00 | 16.68  | 33.32  | 50.00 | Phase 1 |
| 19.3935 | 8  | 26.53  | 33.47  | 60.00 | 15.37  | 34.63  | 50.00 | Phase 1 |
| 25.1985 | 8  | 20.13  | 39.87  | 60.00 | 10.56  | 39.44  | 50.00 | Phase 1 |
| 28.605  | 8  | 19.50  | 40.50  | 60.00 | 12.48  | 37.52  | 50.00 | Phase 1 |
| 0.15    | 9  | 35.98  | 30.02  | 66.00 | 24.54  | 31.46  | 56.00 | Neutral |
| 0.1545  | 9  | 34.57  | 31.18  | 65.75 | 24.75  | 31.01  | 55.75 | Neutral |
| 0.249   | 9  | 38.49  | 23.31  | 61.79 | 25.26  | 26.53  | 51.79 | Neutral |
| 0.2535  | 9  | 37.72  | 23.93  | 61.64 | 27.29  | 24.35  | 51.64 | Neutral |
| 0.372   | 10 | 48.14  | 10.32  | 58.46 | 34.28  | 14.17  | 48.46 | Neutral |
| 0.3855  | 10 | 47.89  | 10.27  | 58.16 | 31.73  | 16.43  | 48.16 | Neutral |
| 0.471   | 10 | 52.28  | 4.22   | 56.50 | 41.53  | 4.97   | 46.50 | Neutral |
| 0.6315  | 11 | 39.07  | 16.93  | 56.00 | 26.87  | 19.13  | 46.00 | Neutral |
| 0.744   | 11 | 43.29  | 12.71  | 56.00 | 26.40  | 19.60  | 46.00 | Neutral |
| 0.8745  | 11 | 39.86  | 16.14  | 56.00 | 25.86  | 20.14  | 46.00 | Neutral |
| 0.897   | 11 | 39.51  | 16.49  | 56.00 | 27.70  | 18.30  | 46.00 | Neutral |
| 1.5105  | 12 | 33.98  | 22.02  | 56.00 | 23.88  | 22.12  | 46.00 | Neutral |
| 1.6815  | 12 | 32.45  | 23.55  | 56.00 | 29.15  | 16.85  | 46.00 | Neutral |
| 2.325   | 12 | 37.75  | 18.25  | 56.00 | 34.78  | 11.22  | 46.00 | Neutral |
| 2.3835  | 12 | 36.24  | 19.76  | 56.00 | 29.91  | 16.09  | 46.00 | Neutral |
| 2.5575  | 13 | 37.34  | 18.66  | 56.00 | 32.72  | 13.28  | 46.00 | Neutral |

|         |    |       |       |       |       |       |       |         |
|---------|----|-------|-------|-------|-------|-------|-------|---------|
| 2.598   | 13 | 35.50 | 20.50 | 56.00 | 33.85 | 12.15 | 46.00 | Neutral |
| 4.317   | 13 | 38.27 | 17.73 | 56.00 | 35.91 | 10.09 | 46.00 | Neutral |
| 4.4745  | 13 | 38.08 | 17.92 | 56.00 | 32.86 | 13.14 | 46.00 | Neutral |
| 4.8855  | 14 | 35.01 | 20.99 | 56.00 | 28.80 | 17.20 | 46.00 | Neutral |
| 6.2355  | 14 | 33.28 | 26.72 | 60.00 | 22.75 | 27.25 | 50.00 | Neutral |
| 7.986   | 14 | 36.03 | 23.97 | 60.00 | 25.91 | 24.09 | 50.00 | Neutral |
| 8.9895  | 14 | 35.66 | 24.34 | 60.00 | 25.85 | 24.15 | 50.00 | Neutral |
| 11.2875 | 15 | 38.81 | 21.19 | 60.00 | 28.54 | 21.46 | 50.00 | Neutral |
| 11.481  | 15 | 37.38 | 22.62 | 60.00 | 26.47 | 23.53 | 50.00 | Neutral |
| 14.6535 | 15 | 39.79 | 20.21 | 60.00 | 29.57 | 20.43 | 50.00 | Neutral |
| 14.8965 | 15 | 38.63 | 21.37 | 60.00 | 28.37 | 21.63 | 50.00 | Neutral |
| 19.524  | 16 | 29.90 | 30.10 | 60.00 | 19.82 | 30.18 | 50.00 | Neutral |
| 24.132  | 16 | 19.54 | 40.46 | 60.00 | 9.91  | 40.09 | 50.00 | Neutral |
| 28.497  | 16 | 20.42 | 39.58 | 60.00 | 13.14 | 36.86 | 50.00 | Neutral |

EUT powered by Theratrainner mobi (60 rpm)

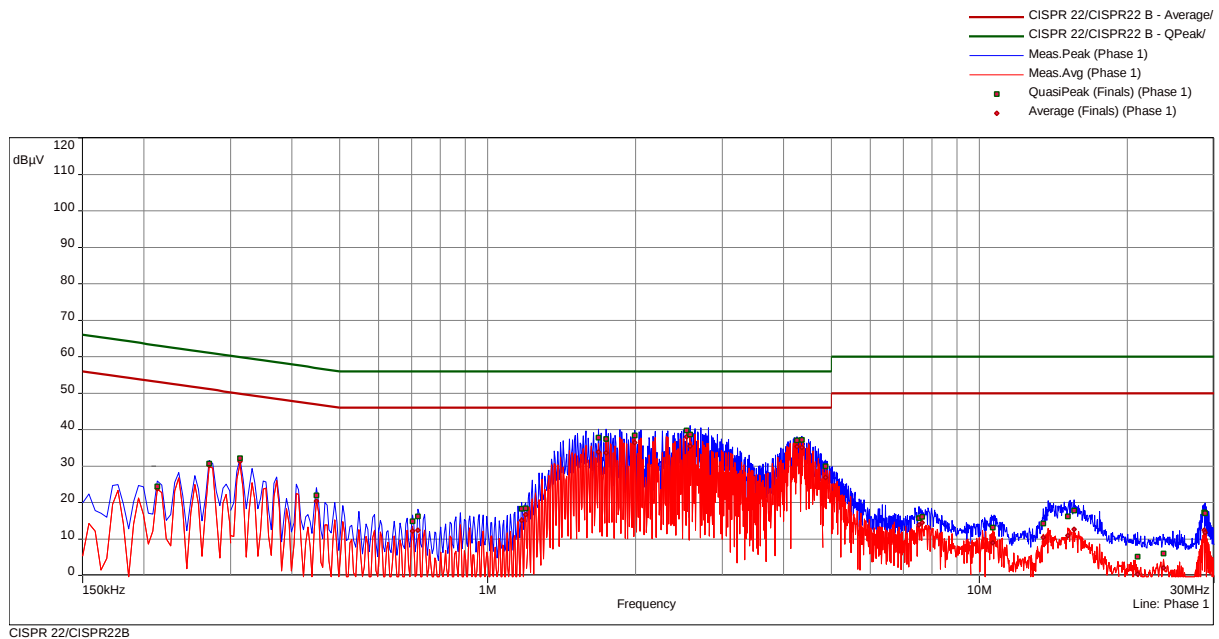




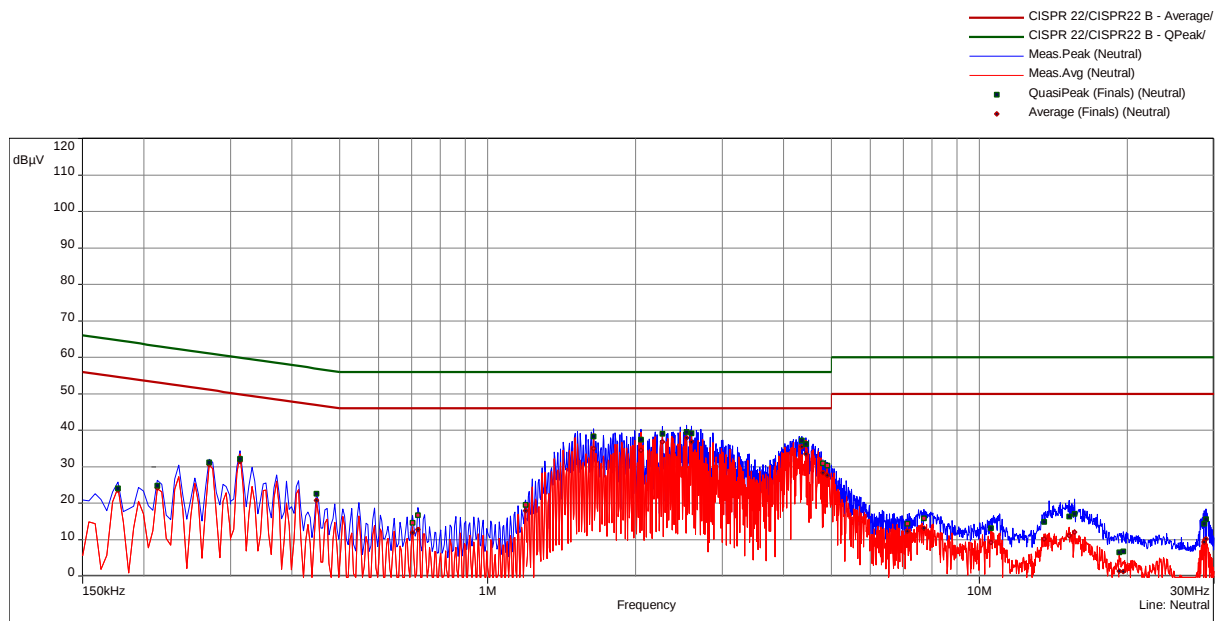
| freq    | SR | QP     | margin | limit | AV     | margin | limit | line    |
|---------|----|--------|--------|-------|--------|--------|-------|---------|
| MHz     |    | dB(μV) | dB     | dB    | dB(μV) | dB     | dB    |         |
| 0.15    | 1  | 36.90  | 29.10  | 66.00 | 26.34  | 29.66  | 56.00 | Phase 1 |
| 0.159   | 1  | 33.34  | 32.17  | 65.52 | 23.09  | 32.42  | 55.52 | Phase 1 |
| 0.2535  | 1  | 40.67  | 20.97  | 61.64 | 31.98  | 19.66  | 51.64 | Phase 1 |
| 0.2985  | 1  | 45.40  | 14.89  | 60.28 | 25.81  | 24.47  | 50.28 | Phase 1 |
| 0.381   | 2  | 52.09  | 6.16   | 58.26 | 41.90  | 6.36   | 48.26 | Phase 1 |
| 0.417   | 2  | 53.20  | 4.31   | 57.51 | 33.26  | 14.25  | 47.51 | Phase 1 |
| 0.435   | 2  | 54.19  | 2.97   | 57.16 | 37.44  | 9.72   | 47.16 | Phase 1 |
| 0.453   | 2  | 54.04  | 2.78   | 56.82 | 36.81  | 10.01  | 46.82 | Phase 1 |
| 0.636   | 3  | 47.04  | 8.96   | 56.00 | 36.38  | 9.62   | 46.00 | Phase 1 |
| 0.8655  | 3  | 43.13  | 12.87  | 56.00 | 31.24  | 14.76  | 46.00 | Phase 1 |
| 0.8925  | 3  | 44.00  | 12.00  | 56.00 | 33.28  | 12.72  | 46.00 | Phase 1 |
| 1.227   | 4  | 37.88  | 18.12  | 56.00 | 29.27  | 16.73  | 46.00 | Phase 1 |
| 1.272   | 4  | 40.45  | 15.55  | 56.00 | 30.52  | 15.48  | 46.00 | Phase 1 |
| 2.307   | 4  | 40.82  | 15.18  | 56.00 | 34.89  | 11.11  | 46.00 | Phase 1 |
| 2.5575  | 5  | 40.97  | 15.03  | 56.00 | 34.95  | 11.05  | 46.00 | Phase 1 |
| 2.562   | 5  | 39.98  | 16.02  | 56.00 | 33.80  | 12.20  | 46.00 | Phase 1 |
| 4.3755  | 5  | 39.43  | 16.57  | 56.00 | 37.20  | 8.80   | 46.00 | Phase 1 |
| 4.398   | 5  | 38.04  | 17.96  | 56.00 | 35.01  | 10.99  | 46.00 | Phase 1 |
| 4.863   | 6  | 36.87  | 19.13  | 56.00 | 32.76  | 13.24  | 46.00 | Phase 1 |
| 4.98    | 6  | 36.90  | 19.10  | 56.00 | 31.47  | 14.53  | 46.00 | Phase 1 |
| 7.743   | 6  | 36.83  | 23.17  | 60.00 | 28.00  | 22.00  | 50.00 | Phase 1 |
| 9.0705  | 6  | 33.58  | 26.42  | 60.00 | 23.96  | 26.04  | 50.00 | Phase 1 |
| 11.292  | 7  | 38.88  | 21.12  | 60.00 | 30.54  | 19.46  | 50.00 | Phase 1 |
| 12.9705 | 7  | 37.47  | 22.53  | 60.00 | 29.81  | 20.19  | 50.00 | Phase 1 |
| 14.6445 | 7  | 38.71  | 21.29  | 60.00 | 30.96  | 19.04  | 50.00 | Phase 1 |
| 14.6715 | 7  | 38.66  | 21.34  | 60.00 | 29.44  | 20.56  | 50.00 | Phase 1 |
| 19.2045 | 8  | 28.24  | 31.76  | 60.00 | 18.74  | 31.26  | 50.00 | Phase 1 |

|         |    |       |       |       |       |       |       |         |
|---------|----|-------|-------|-------|-------|-------|-------|---------|
| 19.344  | 8  | 27.94 | 32.06 | 60.00 | 18.35 | 31.65 | 50.00 | Phase 1 |
| 26.121  | 8  | 19.49 | 40.51 | 60.00 | 10.60 | 39.40 | 50.00 | Phase 1 |
| 28.614  | 8  | 19.65 | 40.35 | 60.00 | 12.63 | 37.37 | 50.00 | Phase 1 |
| 0.15    | 9  | 36.49 | 29.51 | 66.00 | 25.30 | 30.70 | 56.00 | Neutral |
| 0.2535  | 9  | 39.35 | 22.29 | 61.64 | 28.83 | 22.82 | 51.64 | Neutral |
| 0.3     | 9  | 43.58 | 16.67 | 60.24 | 21.82 | 28.42 | 50.24 | Neutral |
| 0.4215  | 10 | 50.92 | 6.49  | 57.42 | 32.38 | 15.03 | 47.42 | Neutral |
| 0.435   | 10 | 51.44 | 5.71  | 57.16 | 35.00 | 12.15 | 47.16 | Neutral |
| 0.4395  | 10 | 51.34 | 5.73  | 57.07 | 34.76 | 12.32 | 47.07 | Neutral |
| 0.618   | 11 | 41.45 | 14.55 | 56.00 | 27.95 | 18.05 | 46.00 | Neutral |
| 0.636   | 11 | 43.09 | 12.91 | 56.00 | 30.85 | 15.15 | 46.00 | Neutral |
| 0.8925  | 11 | 40.30 | 15.70 | 56.00 | 29.25 | 16.75 | 46.00 | Neutral |
| 1.4655  | 12 | 34.95 | 21.05 | 56.00 | 29.78 | 16.22 | 46.00 | Neutral |
| 1.5375  | 12 | 36.64 | 19.36 | 56.00 | 25.75 | 20.25 | 46.00 | Neutral |
| 2.3025  | 12 | 38.89 | 17.11 | 56.00 | 33.18 | 12.82 | 46.00 | Neutral |
| 2.325   | 12 | 36.21 | 19.79 | 56.00 | 33.98 | 12.02 | 46.00 | Neutral |
| 2.4225  | 13 | 35.96 | 20.04 | 56.00 | 33.63 | 12.37 | 46.00 | Neutral |
| 2.5575  | 13 | 39.14 | 16.86 | 56.00 | 33.57 | 12.43 | 46.00 | Neutral |
| 4.4925  | 13 | 39.44 | 16.56 | 56.00 | 36.32 | 9.68  | 46.00 | Neutral |
| 4.863   | 14 | 35.96 | 20.04 | 56.00 | 32.22 | 13.78 | 46.00 | Neutral |
| 6.474   | 14 | 33.03 | 26.97 | 60.00 | 22.94 | 27.06 | 50.00 | Neutral |
| 6.8385  | 14 | 34.45 | 25.55 | 60.00 | 25.63 | 24.37 | 50.00 | Neutral |
| 7.572   | 14 | 35.67 | 24.33 | 60.00 | 27.68 | 22.32 | 50.00 | Neutral |
| 11.526  | 15 | 38.54 | 21.46 | 60.00 | 29.25 | 20.75 | 50.00 | Neutral |
| 13.353  | 15 | 37.29 | 22.71 | 60.00 | 29.47 | 20.53 | 50.00 | Neutral |
| 14.6445 | 15 | 38.48 | 21.52 | 60.00 | 30.76 | 19.24 | 50.00 | Neutral |
| 14.658  | 15 | 38.98 | 21.02 | 60.00 | 30.42 | 19.58 | 50.00 | Neutral |
| 19.2225 | 16 | 31.42 | 28.58 | 60.00 | 22.42 | 27.58 | 50.00 | Neutral |
| 19.2405 | 16 | 31.25 | 28.75 | 60.00 | 22.34 | 27.66 | 50.00 | Neutral |
| 25.518  | 16 | 20.06 | 39.94 | 60.00 | 12.36 | 37.64 | 50.00 | Neutral |
| 28.8435 | 16 | 20.03 | 39.97 | 60.00 | 13.37 | 36.63 | 50.00 | Neutral |

EUT powered by Theratrainertigo (10 rpm)



CISPR 22/CISPR22B

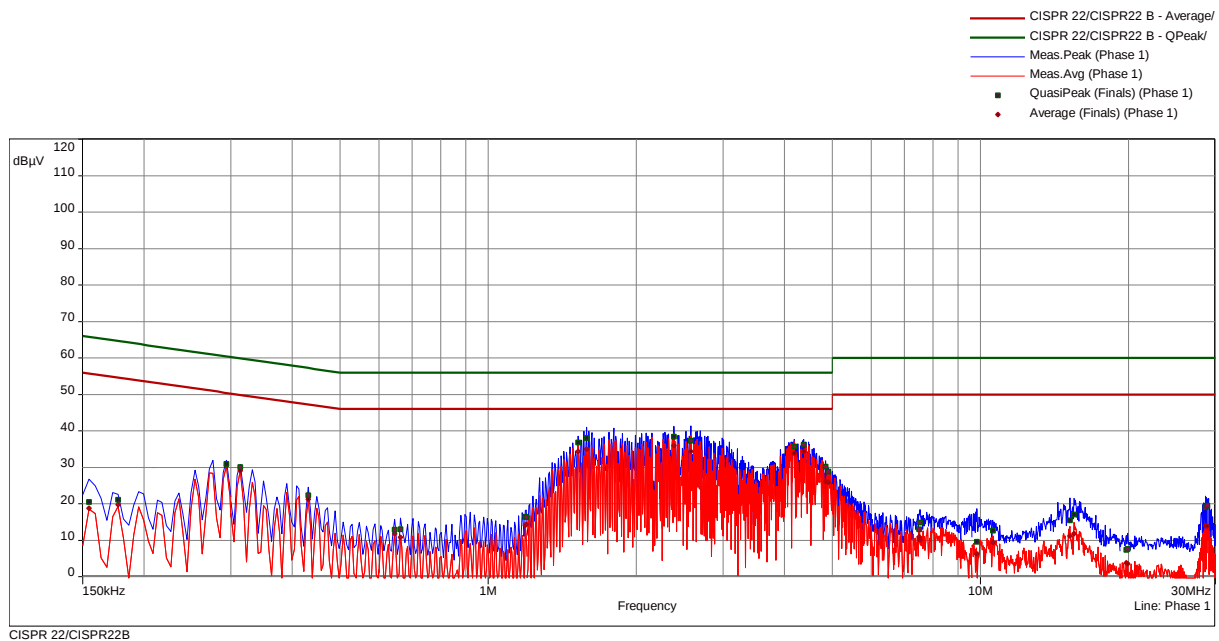
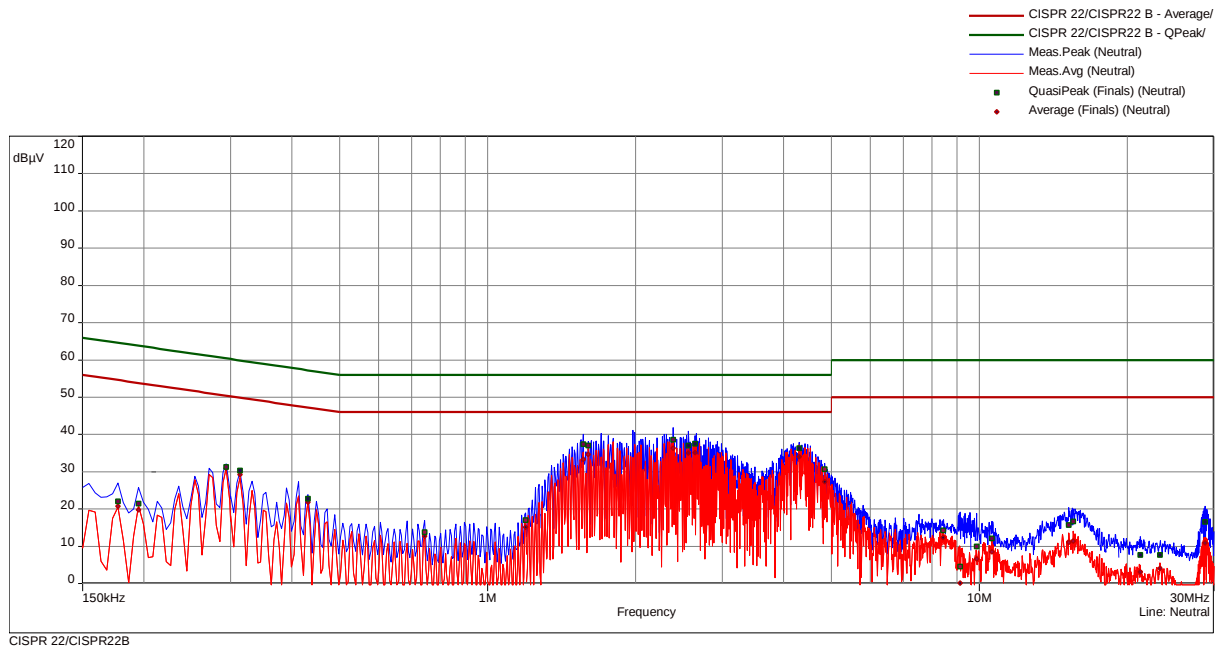


CISPR 22/CISPR22B

| freq   | SR | QP     | margin | limit | AV     | margin | limit | line    |
|--------|----|--------|--------|-------|--------|--------|-------|---------|
| MHz    |    | dB(μV) | dB     | dB    | dB(μV) | dB     | dB    |         |
| 0.213  | 1  | 24.37  | 38.71  | 63.09 | 23.86  | 29.22  | 53.09 | Phase 1 |
| 0.2715 | 1  | 30.68  | 30.39  | 61.07 | 30.24  | 20.83  | 51.07 | Phase 1 |
| 0.3135 | 2  | 32.11  | 27.77  | 59.88 | 31.32  | 18.56  | 49.88 | Phase 1 |
| 0.4485 | 2  | 21.99  | 34.91  | 56.90 | 20.36  | 26.54  | 46.90 | Phase 1 |
| 0.7035 | 3  | 14.91  | 41.09  | 56.00 | 12.18  | 33.82  | 46.00 | Phase 1 |
| 0.7215 | 3  | 16.25  | 39.75  | 56.00 | 12.45  | 33.55  | 46.00 | Phase 1 |
| 1.1715 | 3  | 18.28  | 37.72  | 56.00 | 15.05  | 30.95  | 46.00 | Phase 1 |

|         |    |       |       |       |       |       |       |         |
|---------|----|-------|-------|-------|-------|-------|-------|---------|
| 1.194   | 3  | 18.43 | 37.57 | 56.00 | 16.71 | 29.29 | 46.00 | Phase 1 |
| 1.6815  | 4  | 37.78 | 18.22 | 56.00 | 33.89 | 12.11 | 46.00 | Phase 1 |
| 1.74    | 4  | 37.49 | 18.51 | 56.00 | 33.63 | 12.37 | 46.00 | Phase 1 |
| 1.992   | 4  | 38.45 | 17.55 | 56.00 | 36.45 | 9.55  | 46.00 | Phase 1 |
| 2.5395  | 5  | 39.82 | 16.18 | 56.00 | 38.10 | 7.90  | 46.00 | Phase 1 |
| 2.58    | 5  | 38.72 | 17.28 | 56.00 | 35.47 | 10.53 | 46.00 | Phase 1 |
| 4.2585  | 5  | 37.03 | 18.97 | 56.00 | 35.32 | 10.68 | 46.00 | Phase 1 |
| 4.3575  | 5  | 37.17 | 18.83 | 56.00 | 35.09 | 10.91 | 46.00 | Phase 1 |
| 4.863   | 6  | 29.99 | 26.01 | 56.00 | 26.94 | 19.06 | 46.00 | Phase 1 |
| 7.5405  | 6  | 15.73 | 44.27 | 60.00 | 13.92 | 36.08 | 50.00 | Phase 1 |
| 7.6395  | 6  | 16.09 | 43.91 | 60.00 | 14.46 | 35.54 | 50.00 | Phase 1 |
| 10.6485 | 7  | 13.10 | 46.90 | 60.00 | 8.97  | 41.03 | 50.00 | Phase 1 |
| 13.479  | 7  | 14.19 | 45.81 | 60.00 | 10.40 | 39.60 | 50.00 | Phase 1 |
| 15.1215 | 7  | 16.15 | 43.85 | 60.00 | 10.92 | 39.08 | 50.00 | Phase 1 |
| 15.5895 | 7  | 17.75 | 42.25 | 60.00 | 12.68 | 37.32 | 50.00 | Phase 1 |
| 20.982  | 8  | 5.20  | 54.80 | 60.00 | 0.36  | 49.64 | 50.00 | Phase 1 |
| 23.6595 | 8  | 6.04  | 53.96 | 60.00 | 2.11  | 47.89 | 50.00 | Phase 1 |
| 28.6725 | 8  | 17.36 | 42.64 | 60.00 | 12.37 | 37.63 | 50.00 | Phase 1 |
| 28.785  | 8  | 17.02 | 42.98 | 60.00 | 11.85 | 38.15 | 50.00 | Phase 1 |
| 0.177   | 9  | 24.01 | 40.62 | 64.63 | 23.59 | 31.04 | 54.63 | Neutral |
| 0.213   | 9  | 24.74 | 38.35 | 63.09 | 24.22 | 28.87 | 53.09 | Neutral |
| 0.2715  | 9  | 31.11 | 29.96 | 61.07 | 30.57 | 20.50 | 51.07 | Neutral |
| 0.3135  | 10 | 32.18 | 27.70 | 59.88 | 31.43 | 18.45 | 49.88 | Neutral |
| 0.4485  | 10 | 22.57 | 34.33 | 56.90 | 20.77 | 26.14 | 46.90 | Neutral |
| 0.7035  | 11 | 14.62 | 41.38 | 56.00 | 11.96 | 34.04 | 46.00 | Neutral |
| 0.7215  | 11 | 16.71 | 39.29 | 56.00 | 12.75 | 33.25 | 46.00 | Neutral |
| 1.194   | 11 | 19.55 | 36.45 | 56.00 | 17.98 | 28.02 | 46.00 | Neutral |
| 1.641   | 12 | 38.30 | 17.70 | 56.00 | 34.95 | 11.05 | 46.00 | Neutral |
| 2.0505  | 12 | 37.39 | 18.61 | 56.00 | 34.44 | 11.56 | 46.00 | Neutral |
| 2.2665  | 12 | 39.07 | 16.93 | 56.00 | 36.76 | 9.24  | 46.00 | Neutral |
| 2.5395  | 13 | 39.47 | 16.53 | 56.00 | 37.97 | 8.03  | 46.00 | Neutral |
| 2.598   | 13 | 39.12 | 16.88 | 56.00 | 36.85 | 9.15  | 46.00 | Neutral |
| 4.3575  | 13 | 37.22 | 18.78 | 56.00 | 35.51 | 10.49 | 46.00 | Neutral |
| 4.434   | 13 | 36.18 | 19.82 | 56.00 | 33.52 | 12.48 | 46.00 | Neutral |
| 4.8045  | 14 | 30.89 | 25.11 | 56.00 | 28.37 | 17.63 | 46.00 | Neutral |
| 4.9035  | 14 | 30.33 | 25.67 | 56.00 | 27.59 | 18.41 | 46.00 | Neutral |
| 7.131   | 14 | 14.38 | 45.62 | 60.00 | 12.33 | 37.67 | 50.00 | Neutral |
| 7.716   | 14 | 15.88 | 44.12 | 60.00 | 13.09 | 36.91 | 50.00 | Neutral |
| 10.5495 | 15 | 13.11 | 46.89 | 60.00 | 9.23  | 40.77 | 50.00 | Neutral |
| 13.5375 | 15 | 14.82 | 45.18 | 60.00 | 10.20 | 39.80 | 50.00 | Neutral |
| 15.2205 | 15 | 16.29 | 43.71 | 60.00 | 11.02 | 38.98 | 50.00 | Neutral |
| 15.6075 | 15 | 17.06 | 42.94 | 60.00 | 11.98 | 38.02 | 50.00 | Neutral |
| 19.245  | 16 | 6.50  | 53.50 | 60.00 | 1.38  | 48.62 | 50.00 | Neutral |
| 19.614  | 16 | 6.78  | 53.22 | 60.00 | 1.24  | 48.76 | 50.00 | Neutral |
| 28.659  | 16 | 14.40 | 45.60 | 60.00 | 9.32  | 40.68 | 50.00 | Neutral |
| 28.8795 | 16 | 15.54 | 44.46 | 60.00 | 10.20 | 39.80 | 50.00 | Neutral |

EUT powered by Theratrainertigo (60 rpm)



| freq    | SR | QP     | margin | limit | AV     | margin | limit | line    |
|---------|----|--------|--------|-------|--------|--------|-------|---------|
| MHz     |    | dB(μV) | dB     | dB    | dB(μV) | dB     | dB    |         |
| 0.1545  | 1  | 20.47  | 45.28  | 65.75 | 18.74  | 37.02  | 55.75 | Phase 1 |
| 0.177   | 1  | 21.14  | 43.48  | 64.63 | 19.77  | 34.86  | 54.63 | Phase 1 |
| 0.294   | 1  | 30.92  | 29.49  | 60.41 | 30.44  | 19.97  | 50.41 | Phase 1 |
| 0.3135  | 2  | 30.04  | 29.83  | 59.88 | 29.04  | 20.84  | 49.88 | Phase 1 |
| 0.4305  | 2  | 22.38  | 34.87  | 57.24 | 21.22  | 26.02  | 47.24 | Phase 1 |
| 0.645   | 3  | 12.93  | 43.07  | 56.00 | 11.73  | 34.27  | 46.00 | Phase 1 |
| 0.663   | 3  | 13.05  | 42.95  | 56.00 | 10.84  | 35.16  | 46.00 | Phase 1 |
| 1.1895  | 3  | 16.43  | 39.57  | 56.00 | 14.18  | 31.82  | 46.00 | Phase 1 |
| 1.194   | 3  | 16.27  | 39.73  | 56.00 | 14.38  | 31.62  | 46.00 | Phase 1 |
| 1.524   | 4  | 36.81  | 19.19  | 56.00 | 34.41  | 11.59  | 46.00 | Phase 1 |
| 1.5825  | 4  | 38.02  | 17.98  | 56.00 | 34.96  | 11.04  | 46.00 | Phase 1 |
| 2.3835  | 4  | 38.43  | 17.57  | 56.00 | 35.96  | 10.04  | 46.00 | Phase 1 |
| 2.58    | 5  | 37.33  | 18.67  | 56.00 | 34.37  | 11.63  | 46.00 | Phase 1 |
| 4.182   | 5  | 35.74  | 20.26  | 56.00 | 33.93  | 12.07  | 46.00 | Phase 1 |
| 4.3755  | 5  | 36.25  | 19.75  | 56.00 | 34.41  | 11.59  | 46.00 | Phase 1 |
| 4.845   | 6  | 30.22  | 25.78  | 56.00 | 26.20  | 19.80  | 46.00 | Phase 1 |
| 4.9035  | 6  | 28.89  | 27.11  | 56.00 | 25.84  | 20.16  | 46.00 | Phase 1 |
| 7.5045  | 6  | 13.07  | 46.93  | 60.00 | 10.91  | 39.09  | 50.00 | Phase 1 |
| 7.5405  | 6  | 14.82  | 45.18  | 60.00 | 10.08  | 39.92  | 50.00 | Phase 1 |
| 9.825   | 7  | 9.56   | 50.44  | 60.00 | 6.33   | 43.67  | 50.00 | Phase 1 |
| 10.608  | 7  | 12.69  | 47.31  | 60.00 | 9.47   | 40.53  | 50.00 | Phase 1 |
| 15.2025 | 7  | 15.43  | 44.57  | 60.00 | 11.15  | 38.85  | 50.00 | Phase 1 |
| 15.4725 | 7  | 17.04  | 42.96  | 60.00 | 11.73  | 38.27  | 50.00 | Phase 1 |
| 19.7715 | 8  | 7.32   | 52.68  | 60.00 | 3.85   | 46.15  | 50.00 | Phase 1 |
| 19.8885 | 8  | 7.62   | 52.38  | 60.00 | 3.53   | 46.47  | 50.00 | Phase 1 |
| 28.65   | 8  | 19.06  | 40.94  | 60.00 | 13.95  | 36.05  | 50.00 | Phase 1 |
| 28.8705 | 8  | 19.51  | 40.49  | 60.00 | 13.85  | 36.15  | 50.00 | Phase 1 |
| 0.177   | 9  | 22.12  | 42.51  | 64.63 | 20.72  | 33.90  | 54.63 | Neutral |
| 0.195   | 9  | 21.47  | 42.35  | 63.82 | 19.82  | 34.00  | 53.82 | Neutral |
| 0.294   | 9  | 31.32  | 29.09  | 60.41 | 30.93  | 19.48  | 50.41 | Neutral |
| 0.3135  | 10 | 30.30  | 29.58  | 59.88 | 29.31  | 20.57  | 49.88 | Neutral |
| 0.4305  | 10 | 22.84  | 34.40  | 57.24 | 21.81  | 25.43  | 47.24 | Neutral |
| 0.744   | 11 | 13.80  | 42.20  | 56.00 | 12.73  | 33.27  | 46.00 | Neutral |
| 1.194   | 11 | 17.00  | 39.00  | 56.00 | 15.06  | 30.94  | 46.00 | Neutral |
| 1.5645  | 12 | 37.38  | 18.62  | 56.00 | 33.29  | 12.71  | 46.00 | Neutral |
| 1.6005  | 12 | 37.00  | 19.00  | 56.00 | 34.61  | 11.39  | 46.00 | Neutral |
| 2.3835  | 12 | 38.65  | 17.35  | 56.00 | 36.34  | 9.66   | 46.00 | Neutral |
| 2.5575  | 13 | 37.05  | 18.95  | 56.00 | 34.99  | 11.01  | 46.00 | Neutral |
| 2.6385  | 13 | 37.52  | 18.48  | 56.00 | 35.16  | 10.84  | 46.00 | Neutral |
| 4.299   | 13 | 36.37  | 19.63  | 56.00 | 34.10  | 11.90  | 46.00 | Neutral |
| 4.845   | 14 | 30.72  | 25.28  | 56.00 | 27.30  | 18.70  | 46.00 | Neutral |
| 8.4405  | 14 | 14.25  | 45.75  | 60.00 | 12.34  | 37.66  | 50.00 | Neutral |
| 9.129   | 14 | 4.55   | 55.45  | 60.00 | 0.10   | 49.90  | 50.00 | Neutral |
| 9.8655  | 15 | 10.00  | 50.00  | 60.00 | 6.60   | 43.40  | 50.00 | Neutral |
| 10.59   | 15 | 12.09  | 47.91  | 60.00 | 8.47   | 41.53  | 50.00 | Neutral |

|         |    |       |       |       |       |       |       |         |
|---------|----|-------|-------|-------|-------|-------|-------|---------|
| 15.2025 | 15 | 15.67 | 44.33 | 60.00 | 11.00 | 39.00 | 50.00 | Neutral |
| 15.513  | 15 | 16.61 | 43.39 | 60.00 | 11.43 | 38.57 | 50.00 | Neutral |
| 21.2565 | 16 | 7.71  | 52.29 | 60.00 | 3.10  | 46.90 | 50.00 | Neutral |
| 23.268  | 16 | 7.64  | 52.36 | 60.00 | 4.04  | 45.96 | 50.00 | Neutral |
| 28.7715 | 16 | 16.55 | 43.45 | 60.00 | 10.87 | 39.13 | 50.00 | Neutral |

## 5.2 EBW and OBW

For test instruments and accessories used see section 6 Part **MB**.

### 5.2.1 Description of the test location

Test location:                      Shielded room 6

### 5.2.2 Photo documentation of the test set-up

Please see Attachment B

### 5.2.3 Applicable standard

According to FCC Part 15, Section 15.247(a)(2):

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

### 5.2.4 Description of Measurement

The bandwidth was measured at an amplitude level reduced from the reference level of a modulated channel by a ratio of -6 dB. The reference level is the level of the highest signal amplitude observed at the transmitter at either the fundamental frequency or the first order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. An alternative is to use the bandwidth measurement of the analyser.

Spectrum analyser settings for EBW:

RBW: 100 kHz,    VBW: 300 kHz,    Detector: Max peak,    Span: 1.5 MHz EBW;

Spectrum analyser settings for OBW:

RBW: 30 kHz,    VBW: 100 kHz,    Detector: Max peak,    Span: 2 MHz OBW;

### 5.2.5 Test result

EBW

| Channel | Centre frequency (MHz) | 6 dB bandwidth (kHz) | Minimum limit (MHz) |
|---------|------------------------|----------------------|---------------------|
| 37      | 2402                   | 671.30               | 0.5                 |
| 18      | 2442                   | 681.80               | 0.5                 |
| 39      | 2480                   | 696.80               | 0.5                 |

OBW

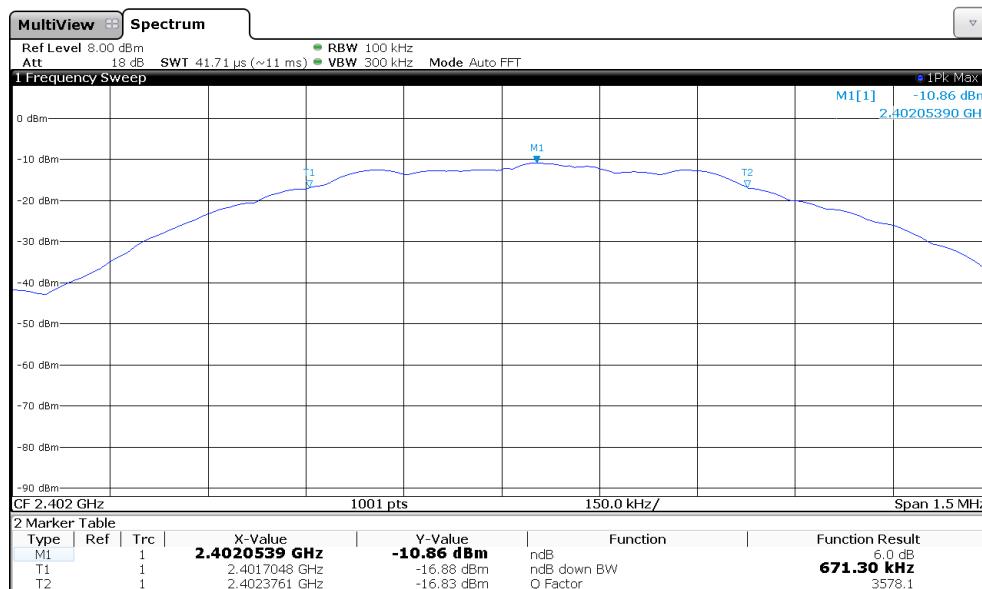
| Channel | Centre frequency (MHz) | 99 % bandwidth (kHz) |
|---------|------------------------|----------------------|
| 37      | 2402                   | 996.07               |
| 18      | 2442                   | 993.78               |
| 39      | 2480                   | 1002.61              |

The requirements are **FULFILLED**.

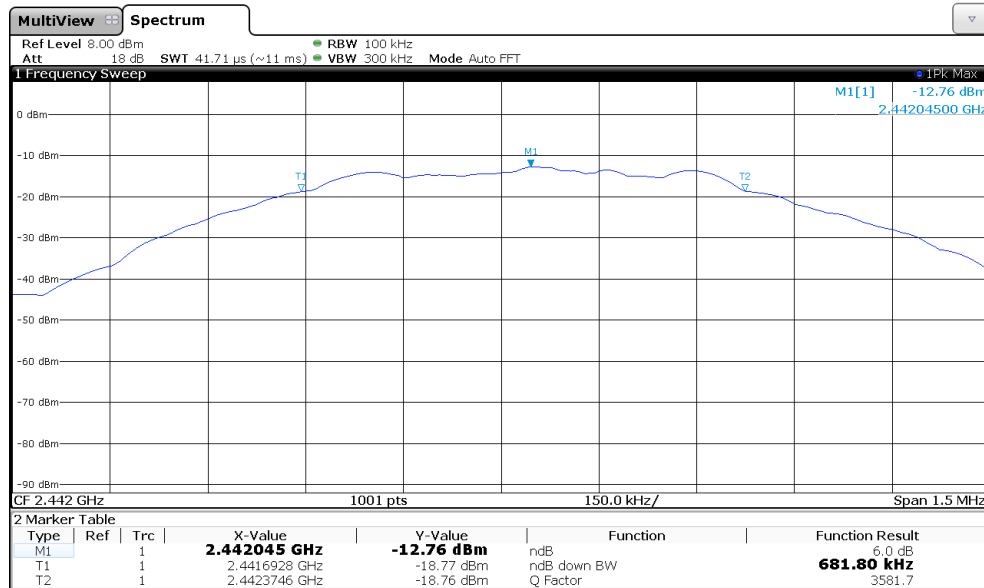
**Remarks:** For detailed test result please see the following test protocols

### 5.2.6 Test protocols EBW

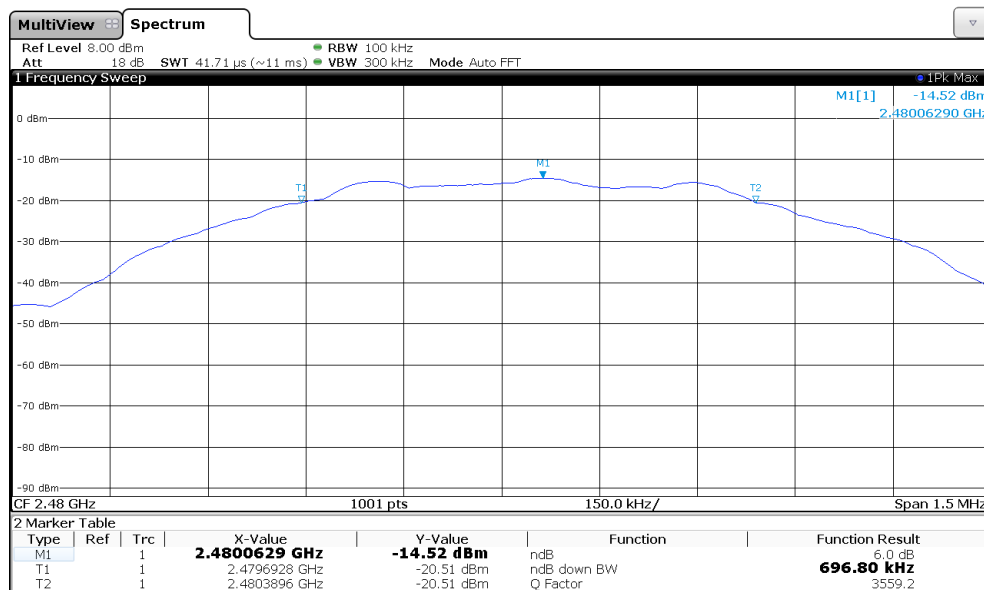
Channel 37 (2402 MHz)



Channel 18 (2442 MHz)

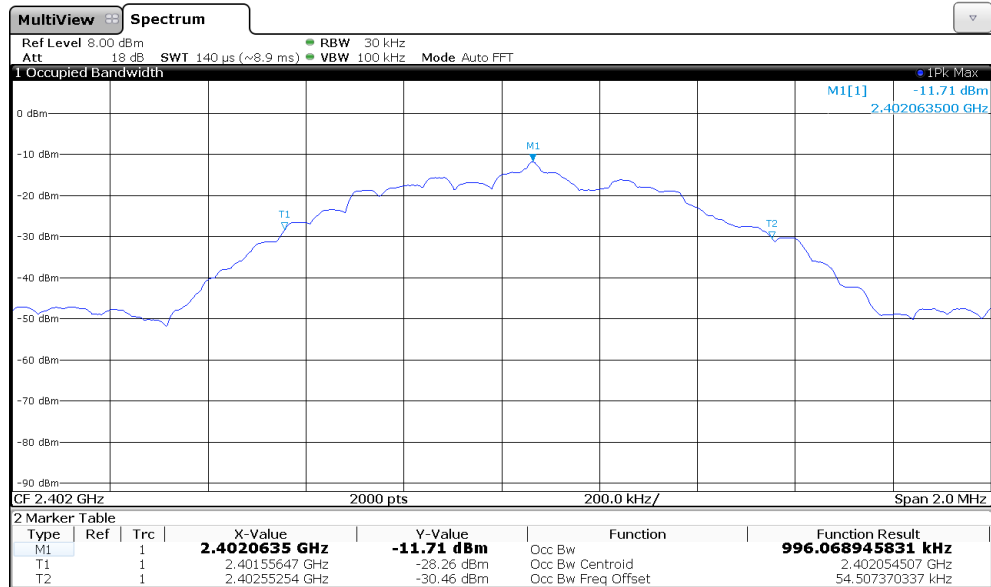


Channel 39 (2480 MHz)

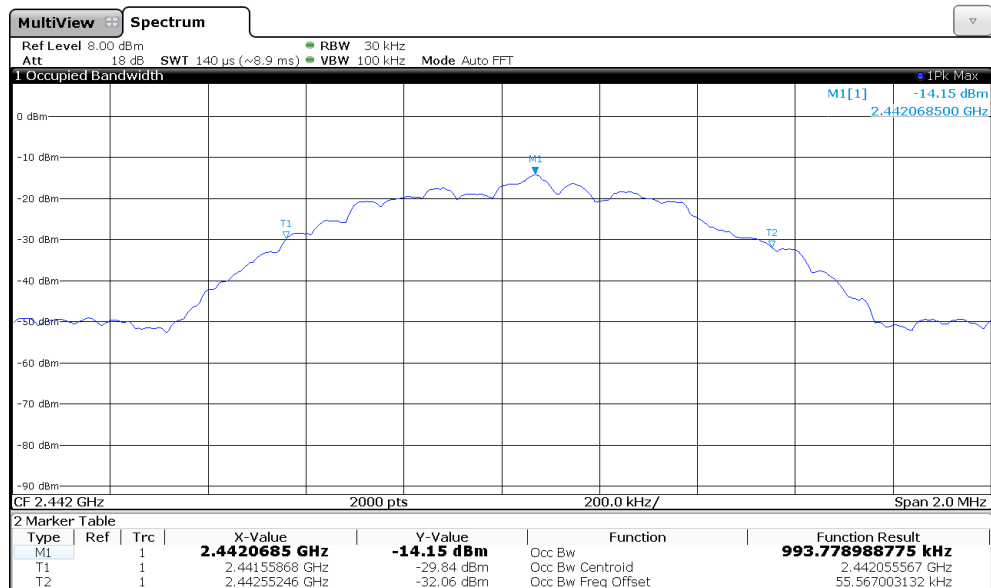


## 5.2.7 Test protocols OBW

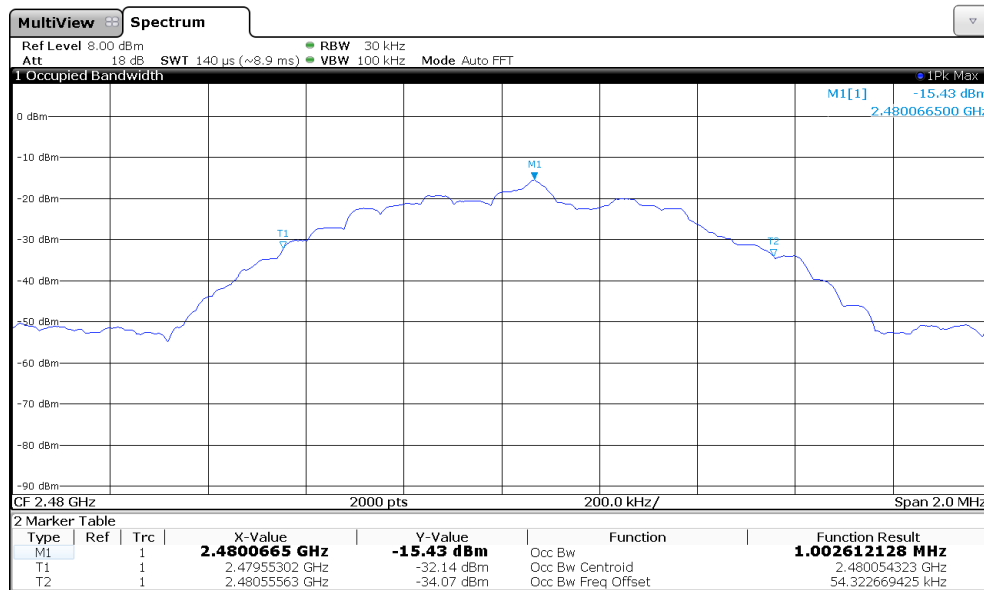
### Channel 37 (2402 MHz)



### Channel 18 (2442 MHz)



Channel 39 (2480 MHz)



### 5.3 Maximum peak conducted output power

For test instruments and accessories used see section 6 Part **CPC 3**.

#### 5.3.1 Description of the test location

Test location: Shielded room 6

#### 5.3.2 Photo documentation of the test set-up

Please see Attachment B

#### 5.3.3 Applicable standard

According to FCC Part 15, Section 15.247(b)(3):

For systems using digital modulation in the 2400 – 2483.5 MHz and 5725 – 5850 MHz bands, the maximum peak output power of the transmitter shall not exceed 1 Watt. The limit is based on transmitting antennas of directional gain that do not exceed 6 dBi.

#### 5.3.4 Description of Measurement

The maximum peak conducted output power is measured using a peak power meter following the procedure set out in KDB 558074, item 9.1.2. The EUT is set in TX continuous mode while measuring.

**5.3.5 Test result**

|                         |           | Test results conducted |                |                |
|-------------------------|-----------|------------------------|----------------|----------------|
|                         |           | A [Pmax]<br>(dBm)      | Limit<br>(dBm) | Margin<br>(dB) |
| Lowest frequency: CH37  |           |                        |                |                |
| $T_{nom}$               | $V_{nom}$ | -4.5                   | 30.0           | -34.5          |
| Middle frequency: CH18  |           |                        |                |                |
| $T_{nom}$               | $V_{nom}$ | -6.4                   | 30.0           | -36.4          |
| Highest frequency: CH39 |           |                        |                |                |
| $T_{nom}$               | $V_{nom}$ | -8.0                   | 30.0           | -38.0          |

Peak Power Limit according to FCC Part 15, Section 15.247(b)(3):

| Frequency<br>(MHz) | Peak Power Limit |            |
|--------------------|------------------|------------|
|                    | (dBm)            | (Watt)     |
| 902-928            | 30               | 1.0        |
| <b>2400-2483.5</b> | <b>30</b>        | <b>1.0</b> |
| 5725-5850          | 30               | 1.0        |

The requirements are **FULFILLED**.

**Remarks:**

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## 5.4 Power spectral density

For test instruments and accessories used see section 6 Part **CPC 3**.

### 5.4.1 Description of the test location

Test location:                      Shielded room 6

### 5.4.2 Photo documentation of the test set-up

Please see Attachment B

### 5.4.3 Applicable standard

According to FCC Part 15, Section 15.247(e):

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

### 5.4.4 Description of Measurement

The measurement is performed using the procedure 10.2 set out in KDB-558074. Therefore the PKPSD is measured conducted. The max peak was located and measured with the spectrum analyser and the marker set to peak. The maximum antenna gain being computed in paragraph 5.9 of this test report is used to calculate the maximum peak power spectral density.

Spectrum analyser settings:

RBW: 3 kHz, VBW: 10 kHz, Detector: Peak, Sweep time: Auto

**5.4.5 Test result**

|                             | Test results conducted  |                     |                |
|-----------------------------|-------------------------|---------------------|----------------|
|                             | PD [Pmax]<br>(dBm/3kHz) | Limit<br>(dBm/3kHz) | Margin<br>(dB) |
| Lowest frequency: 2402 MHz  |                         |                     |                |
|                             | -18.4                   | 8.0                 | -26.4          |
| Middle frequency: 2442 MHz  |                         |                     |                |
|                             | -19.7                   | 8.0                 | -27.7          |
| Highest frequency: 2480 MHz |                         |                     |                |
|                             | -20.9                   | 8.0                 | -28.9          |

Power spectral density limit according to FCC Part 15, Section 15.247(e):

| Frequency<br>(MHz) | Power spectral density limit conducted |
|--------------------|----------------------------------------|
|                    | (dBm/3 kHz)                            |
| 2400 - 2483.5      | 8                                      |

The requirements are **FULFILLED**.

**Remarks:** For detailed test result please see the following test protocols

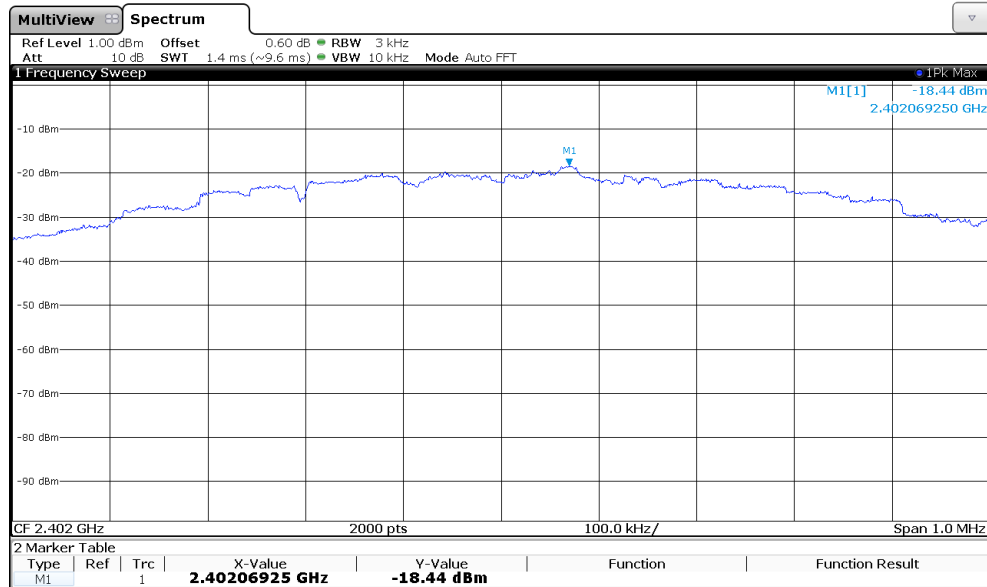
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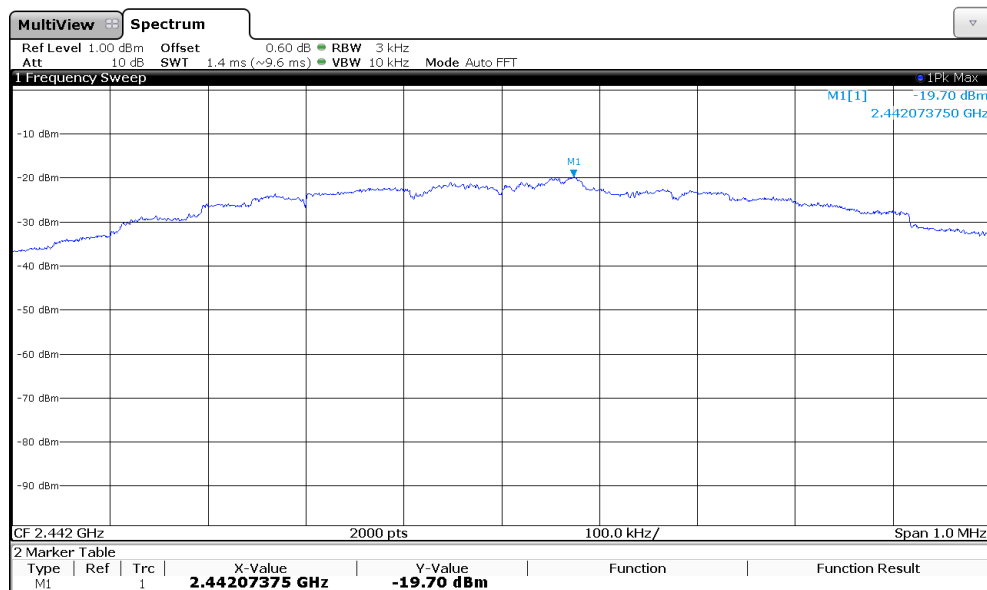
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## 5.4.6 Test protocols

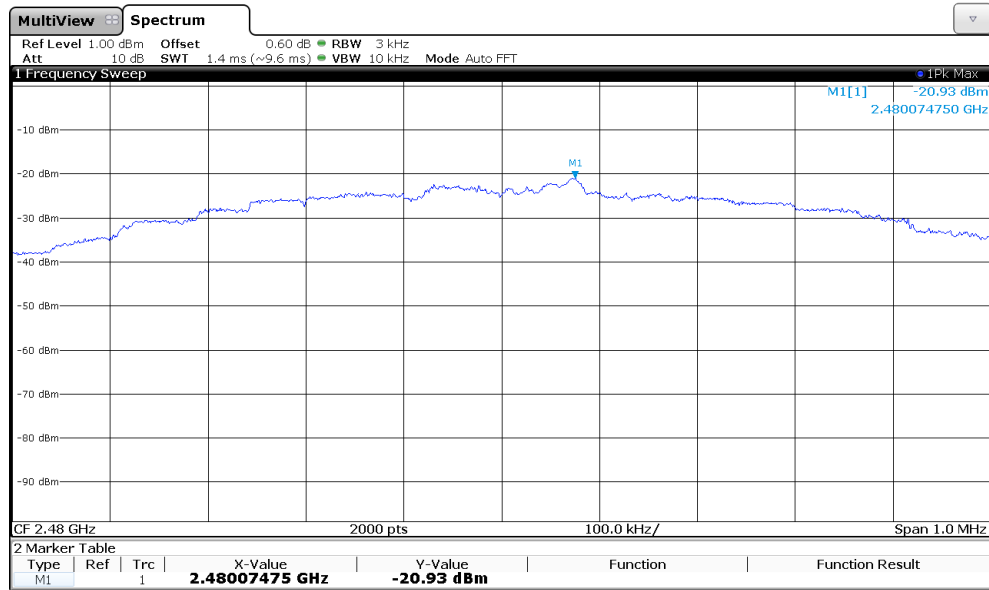
### Channel 37 (2402 MHz)



### Channel 18 (2442 MHz)



Channel 39 (2480 MHz)



## 5.5 Radiated emissions in restricted bands

For test instruments and accessories used see section 6 Part **SER 2, SER 3, DC**.

### 5.5.1 Description of the test location

Test location: OATS 1  
Test location: Anechoic Chamber 1  
Test distance: 3 m

### 5.5.2 Photo documentation of the test set-up

Please see Attachment B

According to FCC Part 15, Section 15.205(a):

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

### 5.5.3 Description of Measurement

The restricted bands are measured radiated. The span of the spectrum analyser is set wide enough to capture the restricted band and measure the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The restricted bands are measured falling emissions into it and the nearest restricted band are checked for emissions also the restricted band for the harmonics of the carrier.

Test receiver settings for SER2:

RBW: 120 MHz, Detector: Quasi peak, Mes. Time: 1 s,

Spectrum analyser settings for SER3:

RBW: 1 MHz, VBW: 3 MHz, Detector: Max. peak, Trace: Max. hold, Sweep: Auto

**5.5.4 Test result**

Frequency range: 9 kHz - 25 GHz

Min. limit margin 11.1 dB at 7326.2 MHz at 3 m (CH 18)

Note: Pre-measurements have shown there are no detectable values below 30 MHz.

Emissions 30 MHz – 1000 MHz

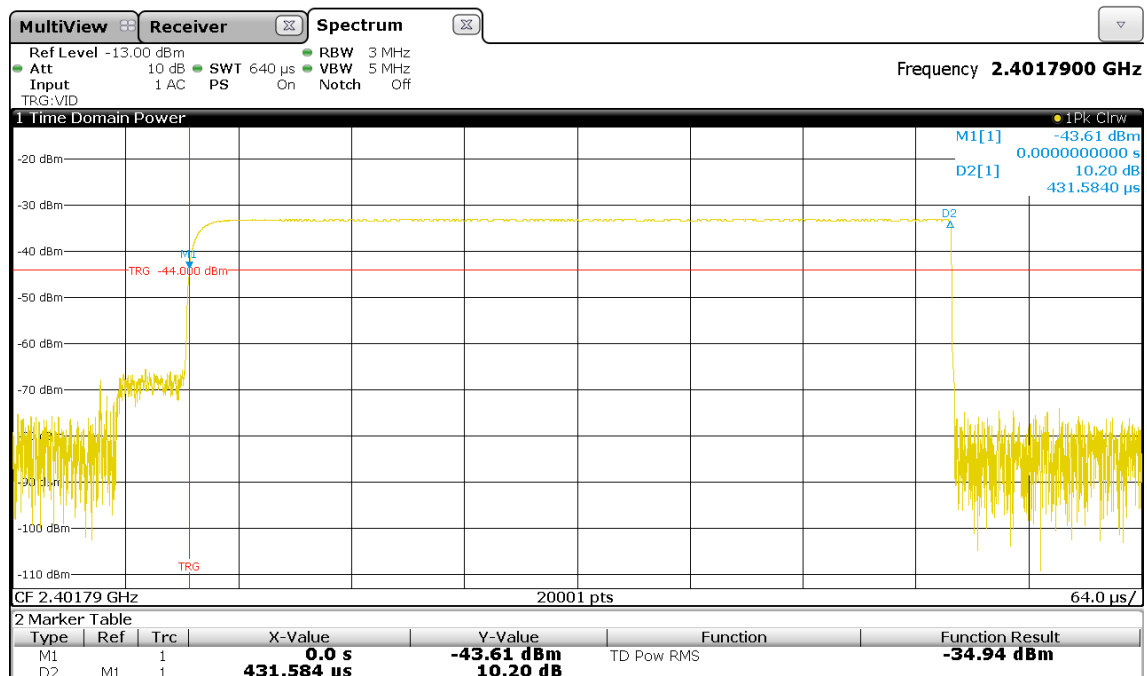
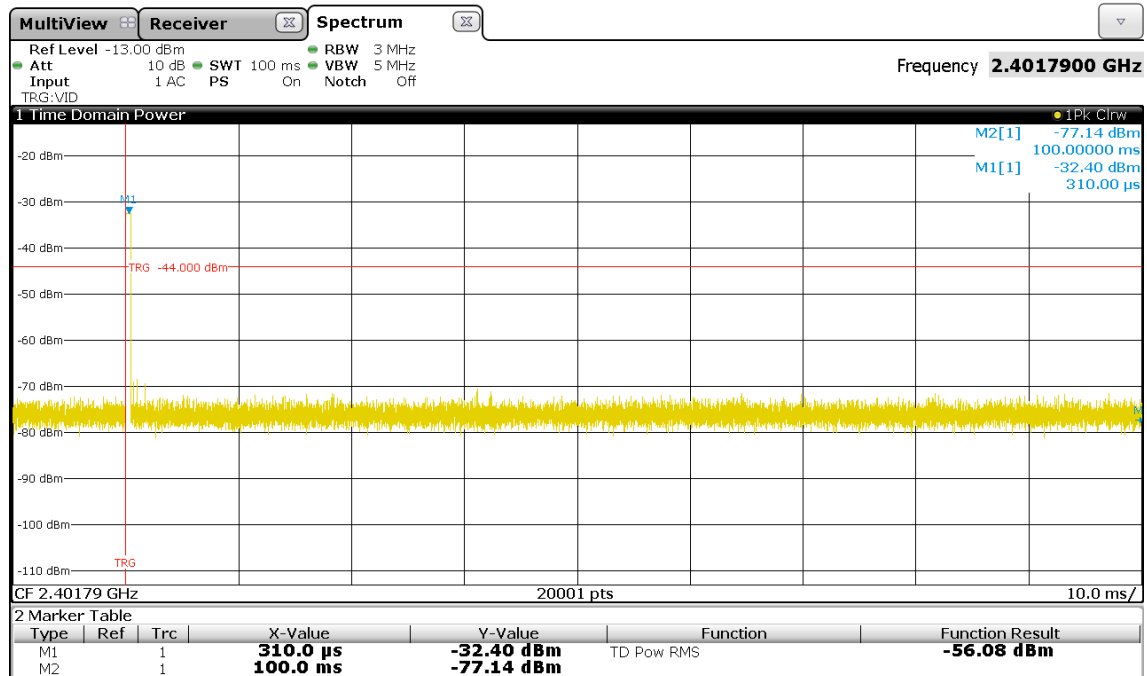
| Frequency<br>(MHz) | Reading<br>Vert.<br>(dBµV) | Reading<br>Hor.<br>(dBµV) | Correct.<br>Vert.<br>(dB) | Correct.<br>Hor.<br>(dB) | Level<br>Vert.<br>(dBµV/m) | Level<br>Hor.<br>(dBµV/m) | Limit<br>(dBµV/m) | Dlimit<br>(dB) |
|--------------------|----------------------------|---------------------------|---------------------------|--------------------------|----------------------------|---------------------------|-------------------|----------------|
| 33.00              | 1.3                        | -2.0                      | 14.0                      | 12.6                     | 15.3                       | 10.6                      | 40.0              | -24.7          |
| 45.00              | 0.9                        | -2.3                      | 15.2                      | 14.0                     | 16.1                       | 11.7                      | 40.0              | -23.9          |
| 54.60              | 2.2                        | -1.7                      | 15.0                      | 14.0                     | 17.2                       | 12.3                      | 40.0              | -22.8          |
| 69.50              | 3.5                        | -1.3                      | 14.0                      | 13.4                     | 17.5                       | 12.1                      | 40.0              | -22.5          |
| 76.30              | 7.0                        | 0.4                       | 12.2                      | 11.7                     | 19.2                       | 12.1                      | 40.0              | -20.8          |
| 128.00             | 0.4                        | -1.5                      | 12.8                      | 13.4                     | 13.2                       | 11.9                      | 43.5              | -30.3          |
| 208.50             | -1.5                       | -1.9                      | 11.7                      | 12.3                     | 10.2                       | 10.4                      | 43.5              | -33.1          |
| 311.70             | -3.8                       | -2.9                      | 17.2                      | 16.8                     | 13.4                       | 13.9                      | 46.0              | -32.1          |
| 413.80             | -4.0                       | -3.9                      | 20.2                      | 19.9                     | 16.2                       | 16.0                      | 46.0              | -29.8          |
| 555.60             | 3.1                        | -1.1                      | 24.2                      | 23.9                     | 27.3                       | 22.8                      | 46.0              | -18.7          |
| 621.60             | -1.6                       | -0.9                      | 25.8                      | 25.5                     | 24.2                       | 24.6                      | 46.0              | -21.4          |
| 700.50             | -1.6                       | -0.3                      | 27.0                      | 26.5                     | 25.4                       | 26.2                      | 46.0              | -19.8          |
| 821.60             | -2.0                       | -1.9                      | 29.8                      | 29.3                     | 27.8                       | 27.4                      | 46.0              | -18.2          |
| 914.50             | -1.9                       | -1.9                      | 31.3                      | 30.9                     | 29.4                       | 29.0                      | 46.0              | -16.6          |

Note: The table shows only values of the noise floor of OATS 1. No values could be detected belonging to the EUT.

Emissions 1 GHz – 25 GHz

Note: If the peak measurement fulfills the peak limit and the average limit than no further RMS measurement or duty cycle correction was performed. The plots show the worst case.

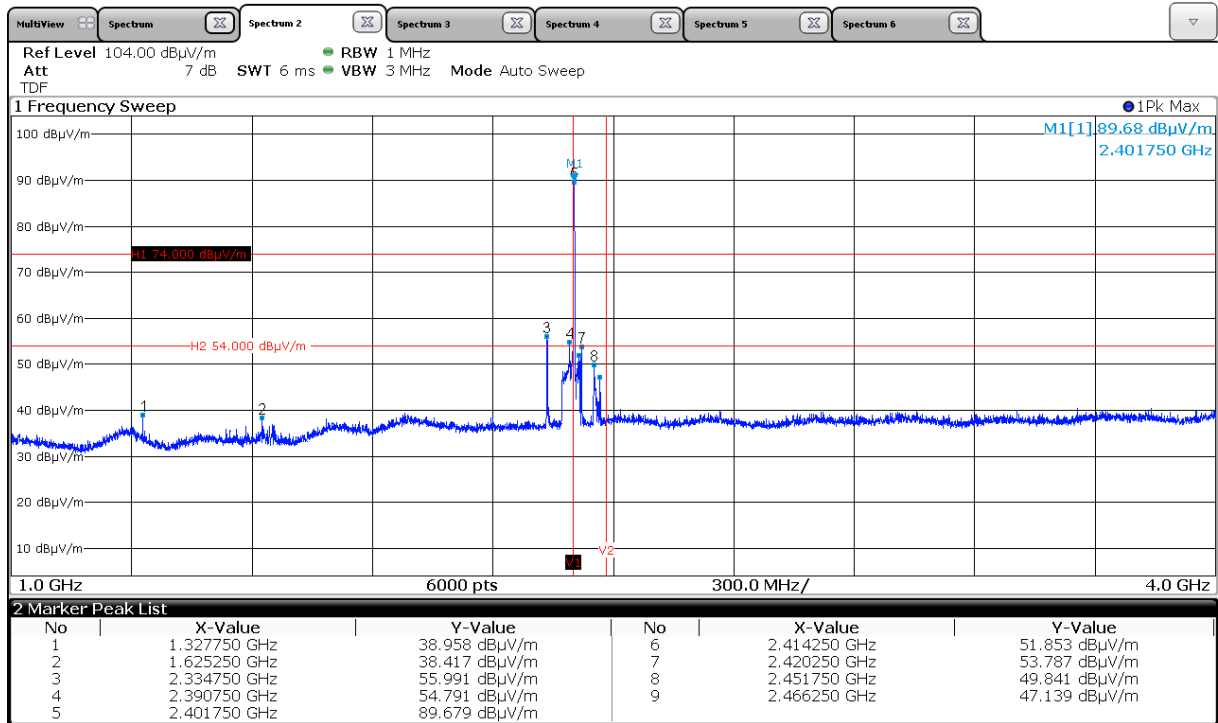
Duty cycle at 2402 MHz (in advertising mode):



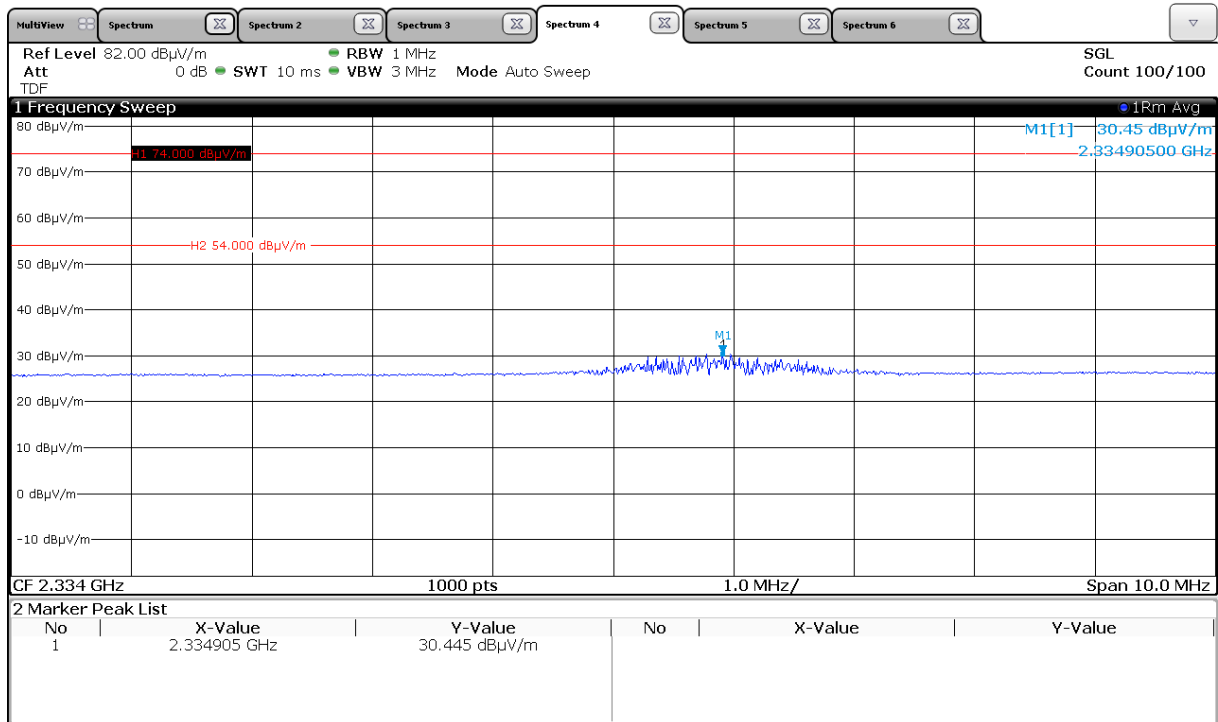
Calculated duty cycle =  $431.584 \mu s / 100 ms = 0.00432 = -47.3 \text{ dB}$

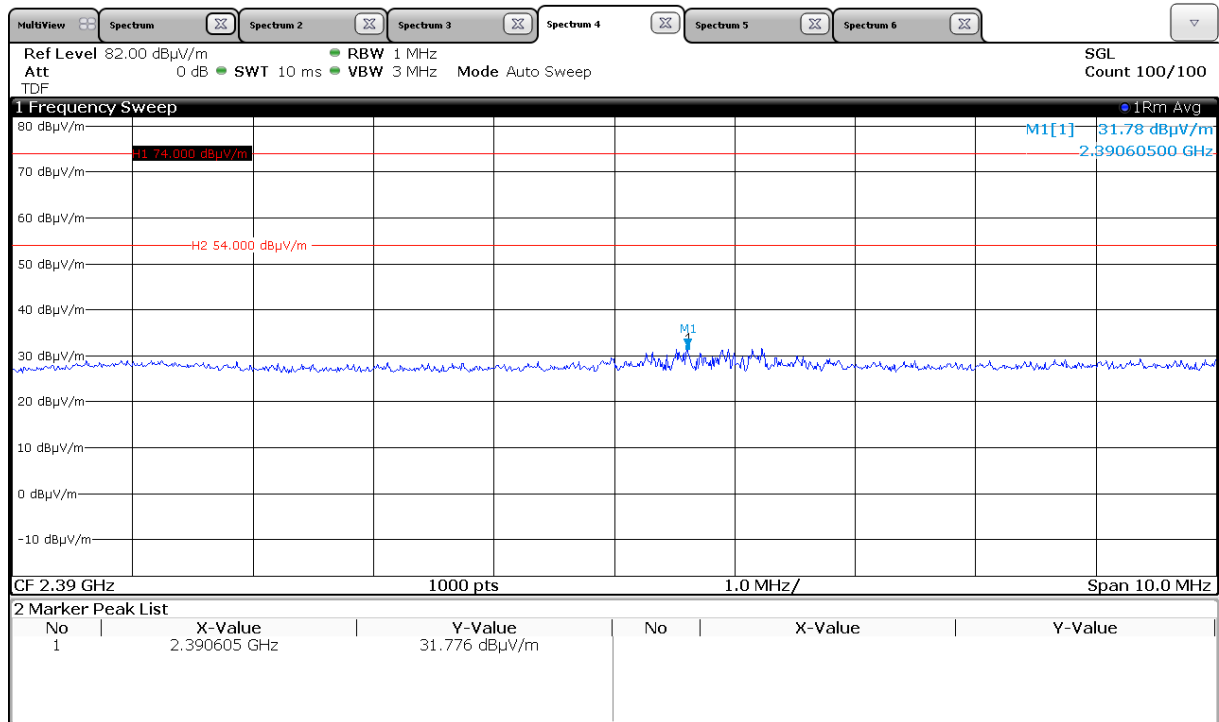
Channel 37

Peak measurement

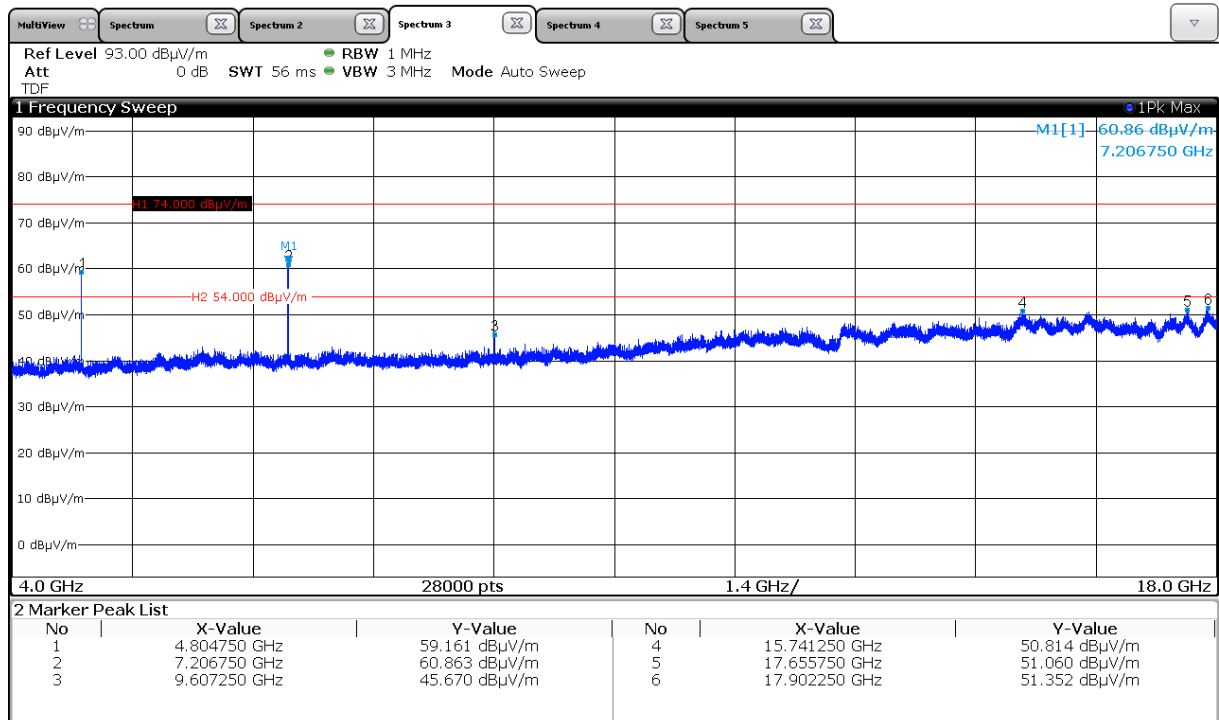


RMS re-measurement





## Peak measurement

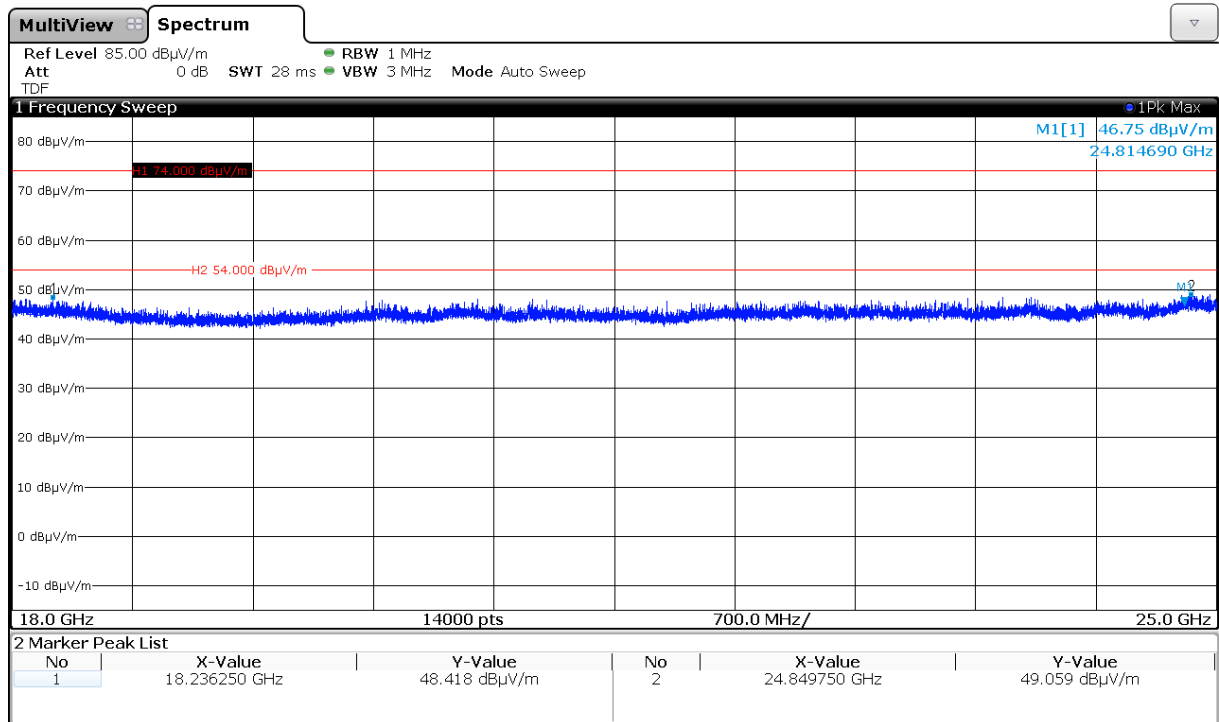


## Average calculation:

At 4804.7 MHz: Peak value – DC = 59.16 dBμV/m – 47.3 dB = 11.86 dBμV/m

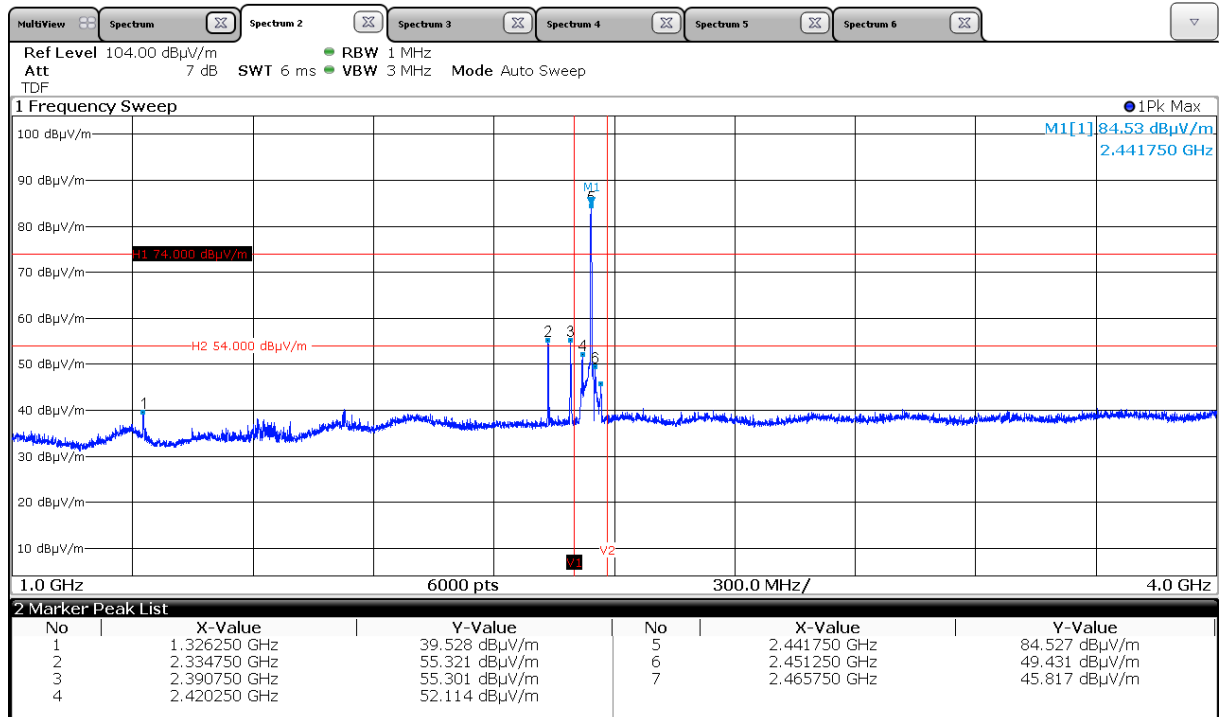
At 7206.7 MHz: Peak value – DC = 60.86 dBμV/m – 47.3 dB = 13.56 dBμV/m

## Peak measurement

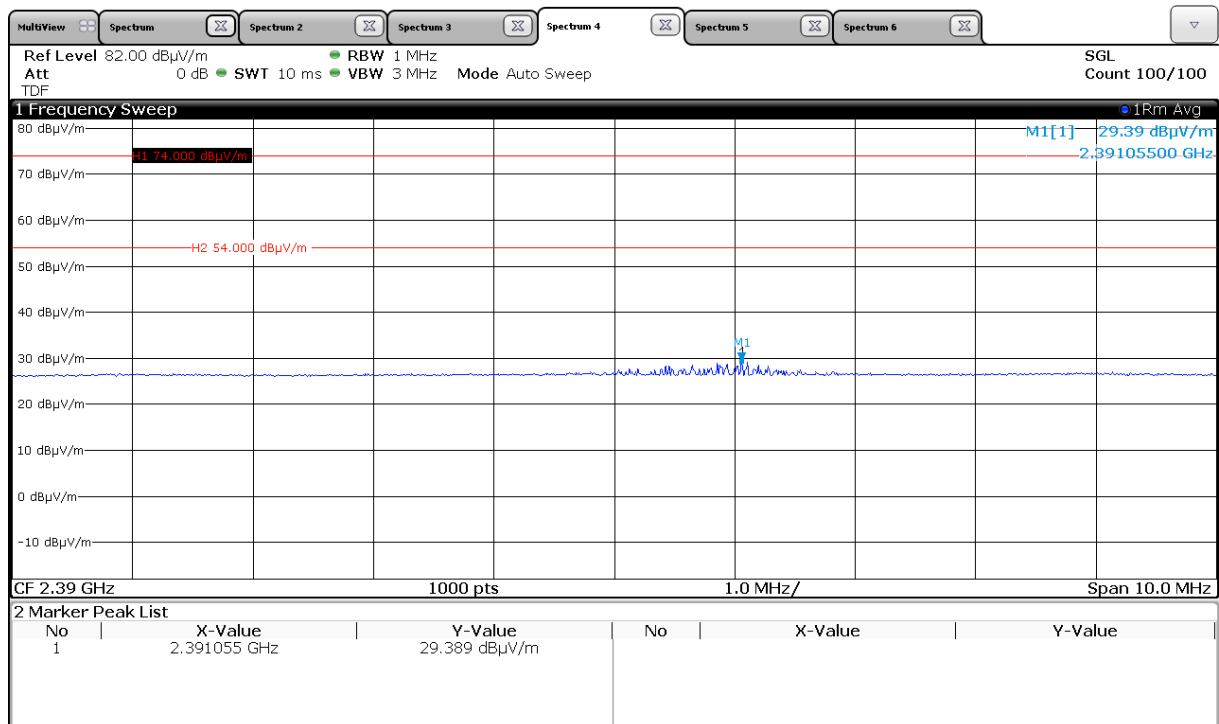
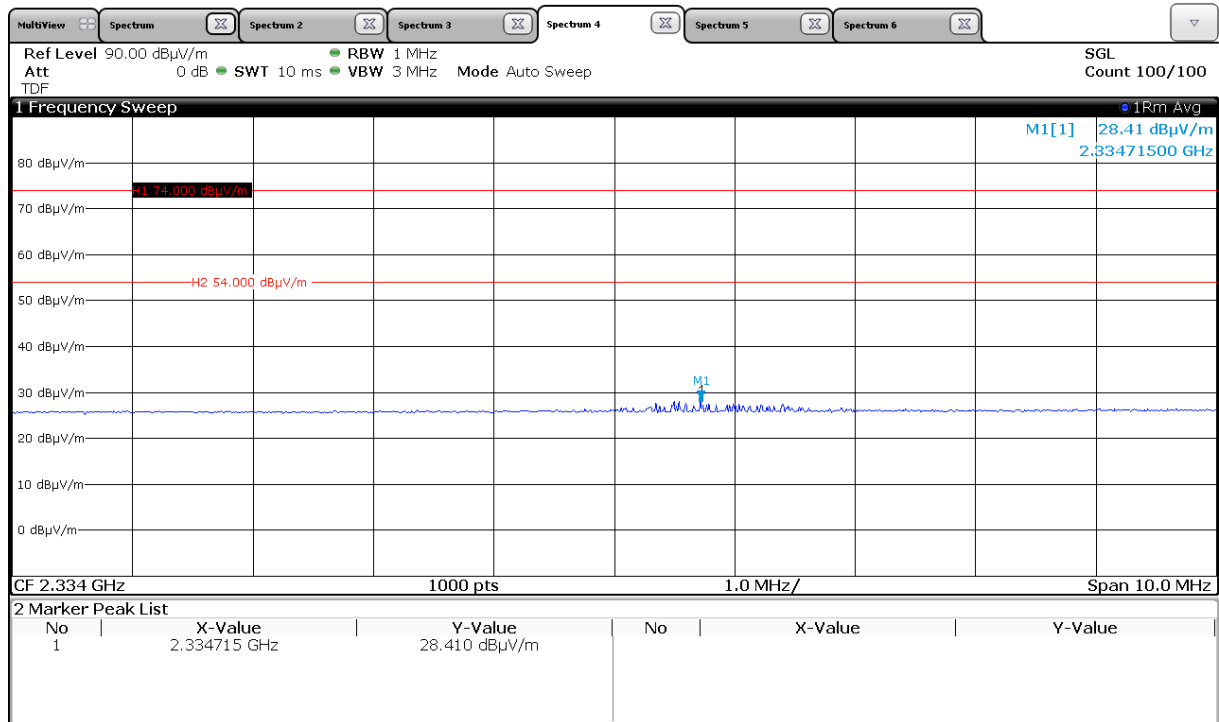


## Channel 18

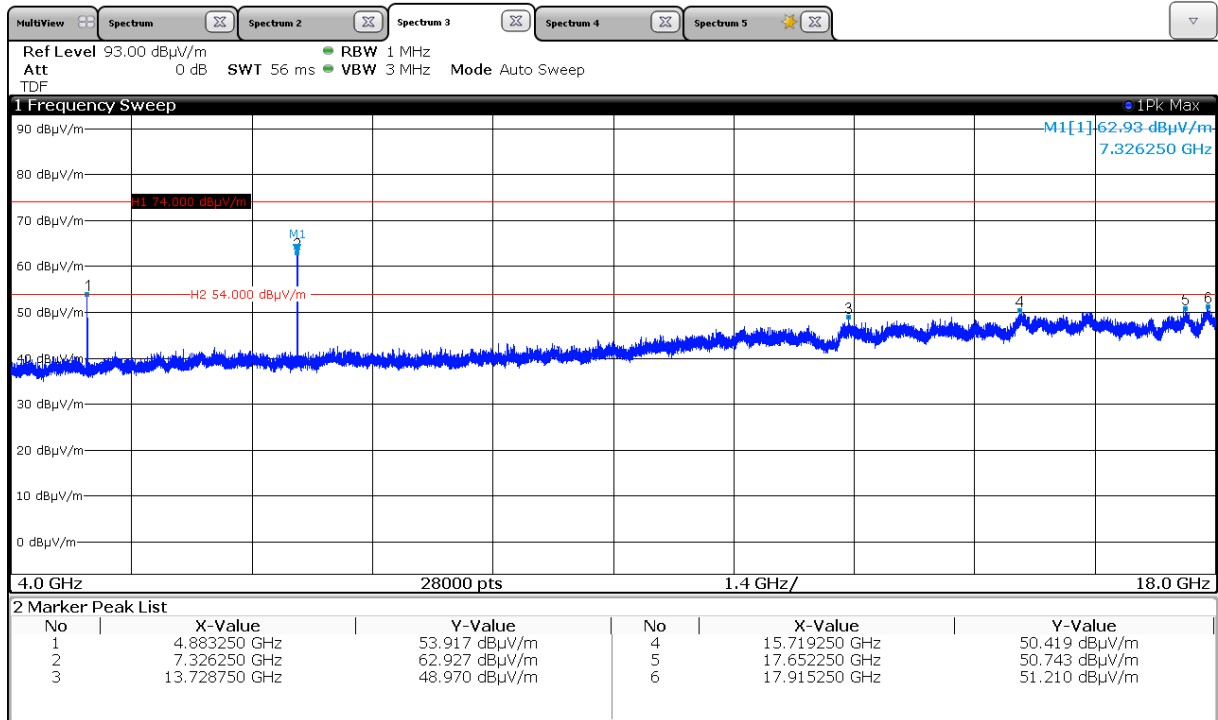
## Peak measurement



RMS re-measurement



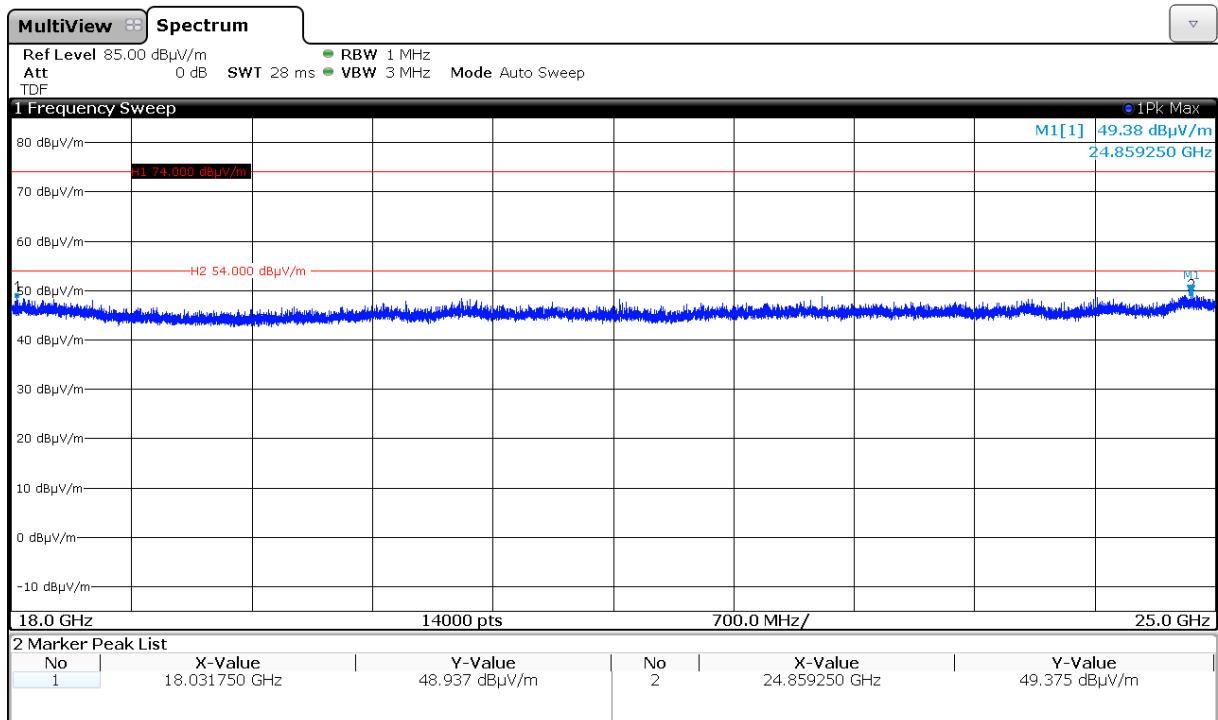
## Peak measurement



## Average calculation:

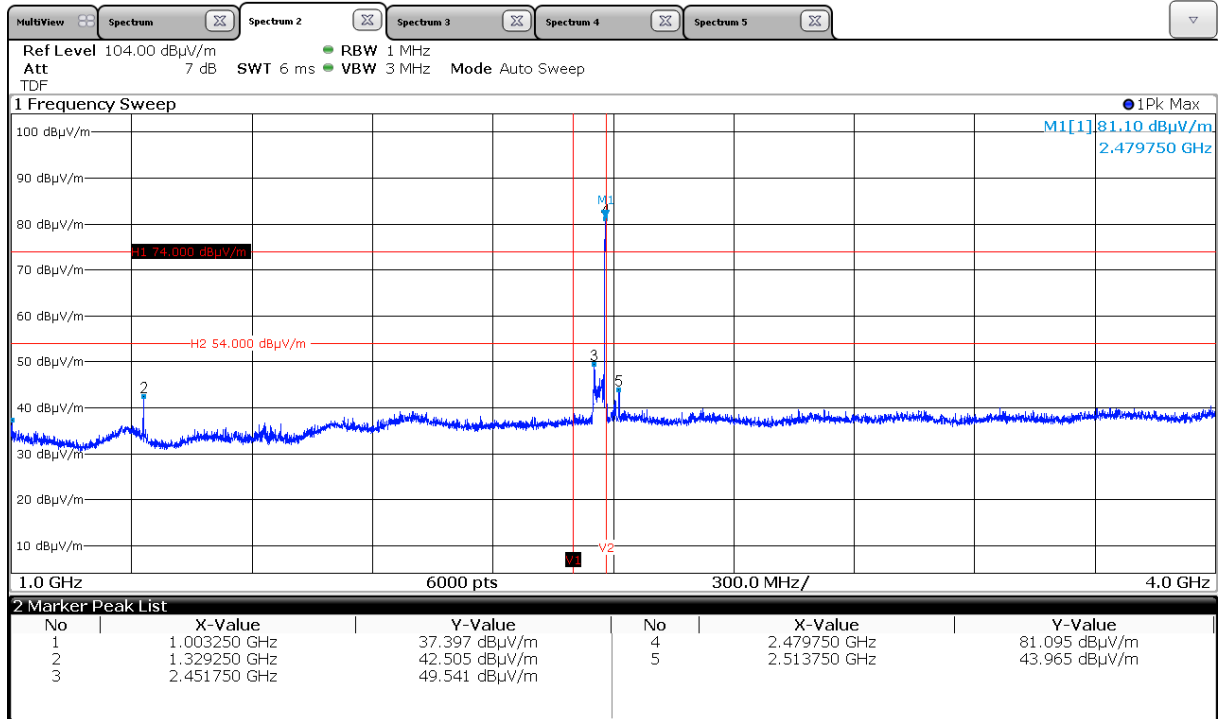
At 7326.2 MHz: Peak value – DC = 62.9 dBμV/m – 47.3 dB = 15.6 dBμV/m

## Peak measurement

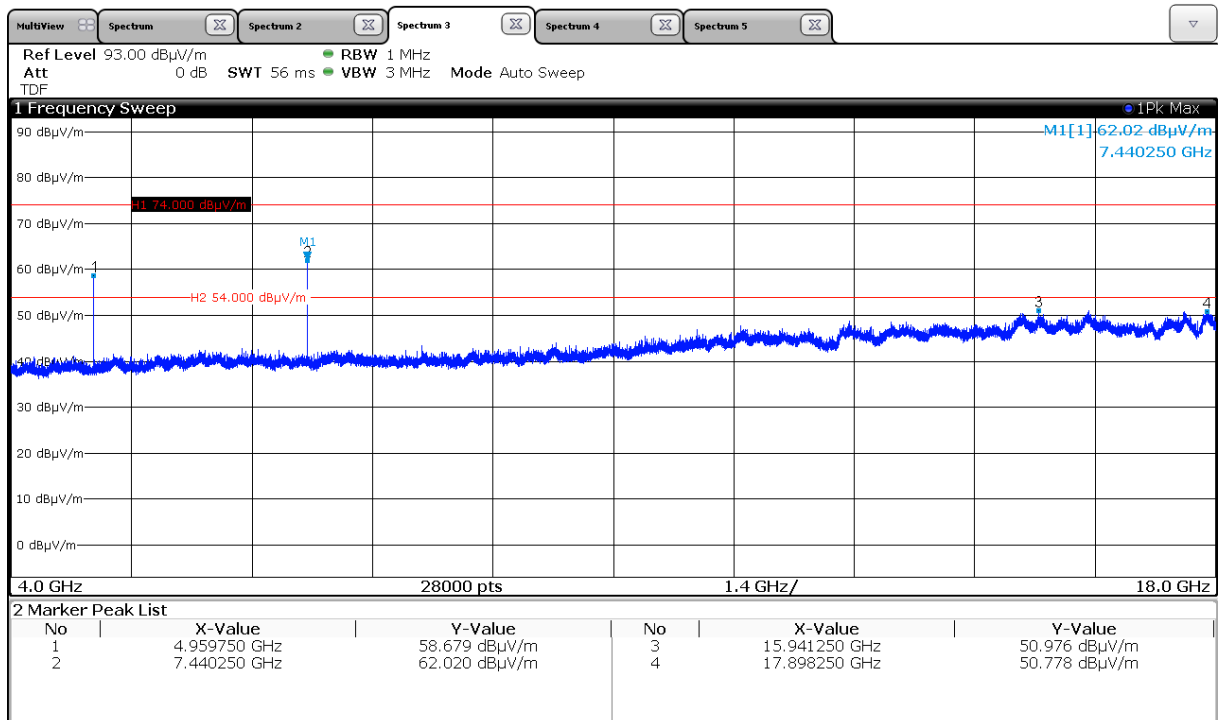


Channel 39

Peak measurement



Peak measurement

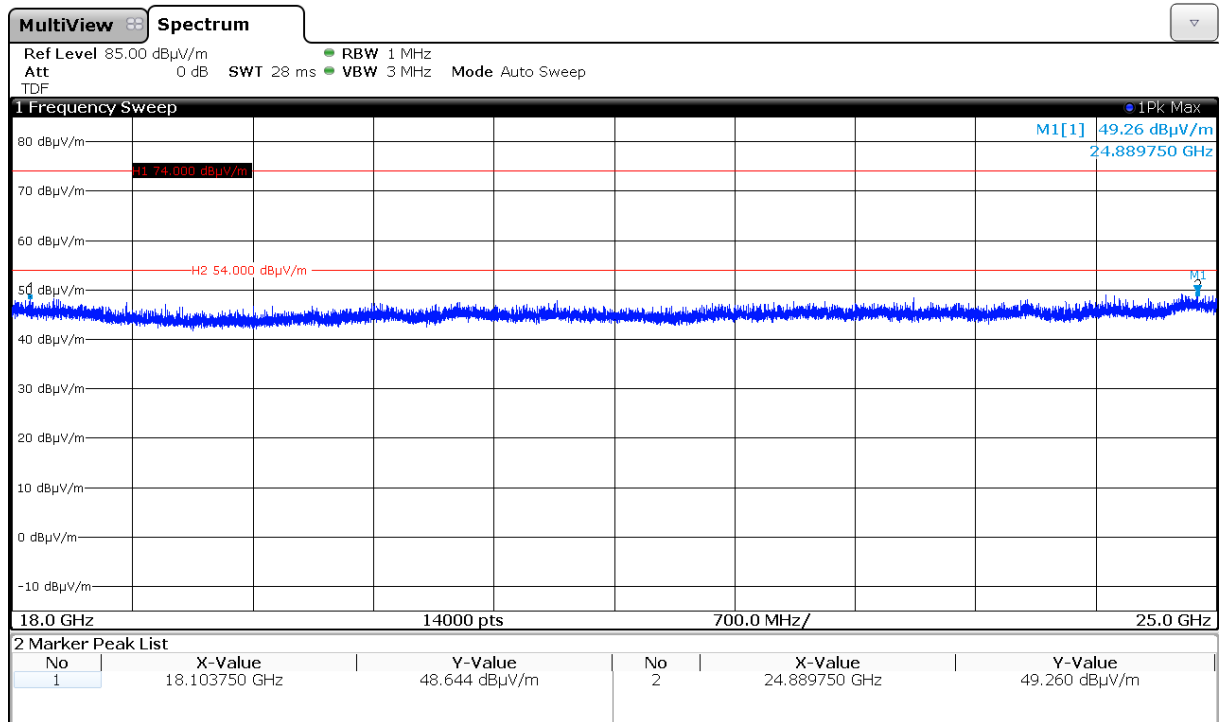


Average calculation:

At 4959.7 MHz: Peak value – DC = 58.7 dBμV/m – 47.3 dB = 11.4 dBμV/m

At 7440.2 MHz: Peak value – DC = 62.0 dBμV/m – 47.3 dB = 14.7 dBμV/m

Peak measurement



Radiated limits according to FCC Part 15 Section 15.209(a) for spurious emissions which fall in restricted bands:

| Frequency<br>(MHz) | Field strength of spurious emissions |                       | Measurement distance |
|--------------------|--------------------------------------|-----------------------|----------------------|
|                    | ( $\mu\text{V/m}$ )                  | dB( $\mu\text{V/m}$ ) | (metres)             |
| 0.009-0.490        | 2400/F (kHz)                         |                       | 300                  |
| 0.490-1.705        | 24000/F (kHz)                        |                       | 30                   |
| 1.705-30           | 30                                   | 29.5                  | 30                   |
| 30-88              | 100                                  | 40                    | 3                    |
| 88-216             | 150                                  | 43.5                  | 3                    |
| 216-960            | 200                                  | 46                    | 3                    |
| Above 960          | 500                                  | 54                    | 3                    |

#### Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209

| MHz                 | MHz                   | MHz             | GHz           |
|---------------------|-----------------------|-----------------|---------------|
| 0.090 – 0.110       | 16.42 – 16.423        | 399.9 – 410     | 4.5 – 5.15    |
| 0.495 – 0.505       | 16.69475 – 16.69525   | 608 – 614       | 5.35 – 5.46   |
| 2.1735 – 2.1905     | 16.80425 – 16.80475   | 960 – 1240      | 7.25 – 7.75   |
| 4.125 – 4.128       | 25.5 – 25.67          | 1300 – 1427     | 8.025 – 8.5   |
| 4.17725 – 4.17775   | 37.5 – 38.25          | 1435 – 1626.5   | 9.0 – 9.2     |
| 4.20725 – 4.20775   | 73 – 74.6             | 1645.5 – 1646.5 | 9.3 – 9.5     |
| 6.215 – 6.218       | 74.8 – 75.2           | 1660 – 1710     | 10.6 – 12.7   |
| 6.26775 – 6.26825   | 108 – 121.94          | 1718.8 – 1722.2 | 13.25 – 13.4  |
| 6.31175 – 6.31225   | 123 – 138             | 2200 – 2300     | 14.47 – 14.5  |
| 8.291 – 8.294       | 149.9 – 150.05        | 2310 – 2390     | 15.35 – 16.2  |
| 8.362 – 8.366       | 156.52475 – 156.52525 | 2483.5 – 2500   | 17.7 – 21.4   |
| 8.37625 – 8.38675   | 156.7 – 156.9         | 2690 – 2900     | 22.01 – 23.12 |
| 8.41425 – 8.41475   | 162.0125 – 167.17     | 3260 – 3267     | 23.6 – 24.0   |
| 12.29 – 12.293      | 167.72 – 173.2        | 3332 – 3339     | 31.2 – 31.8   |
| 12.51975 – 12.52025 | 240 – 285             | 3345.8 – 3358   | 36.43 – 36.5  |
| 12.57675 – 12.57725 | 322 – 335.4           | 3600 – 4400     | Above 38.6    |

The requirements are **FULFILLED**.

**Remarks:** The measurement was performed up to the 10<sup>th</sup> harmonic. The complete frequency range up to .25 GHz was evaluated against the general limit.

## 5.6 Spurious emissions radiated

**Remarks:** Not applicable. All emissions of the EUT are below the general limit (please see clause 5.5),  
Therefore a spurious emissions measurement is not necessary.

## 5.7 Antenna application

### 5.7.1 Applicable standard

According to FCC Part 15C, Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT has an integrated antenna. No other antenna can be used with the device.

The supplied antenna meets the requirements of part 15.203 and 15.204.

### 5.7.2 Antenna requirements

According to FCC Part 15C, Section 15.247(b)(4):

The conducted output power limit specified in paragraph (b) of 15.247 is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2) and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**Defacto EIRP-Limit:**

$$P_{out} = 30 - (G_x - 6);$$

| Antenna | G <sub>x</sub> | Cond. limit | max. G | A [P20] | Limit P <sub>out</sub> | Reduction |
|---------|----------------|-------------|--------|---------|------------------------|-----------|
|         | (dBi)          | (dBm)       | (dBi)  | (dBm)   | (dBm)                  | (dB)      |
| PCB     | 0.6            | 30.0        | 6.0    | -4.5    | 35.4                   | -39.9     |

**Remarks:** No power reduction results from the defacto limit.

## **6 USED TEST EQUIPMENT AND ACCESSORIES**

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

| <b>Test ID</b> | <b>Model Type</b>       | <b>Equipment No.</b>               | <b>Next Calib.</b> | <b>Last Calib.</b> | <b>Next Verif.</b> | <b>Last Verif.</b> |
|----------------|-------------------------|------------------------------------|--------------------|--------------------|--------------------|--------------------|
| A 4            | BAT-EMC 3.16.0.73       | 01-02/68-13-001                    |                    |                    |                    |                    |
|                | ESCI                    | 02-02/03-15-001                    | 31/05/2018         | 31/05/2017         |                    |                    |
|                | ESH 2 - Z 5             | 02-02/20-05-004                    | 26/10/2017         | 26/10/2015         | 18/01/2018         | 18/07/2017         |
|                | N-4000-BNC              | 02-02/50-05-138                    |                    |                    |                    |                    |
|                | N-1500-N                | 02-02/50-05-140                    |                    |                    |                    |                    |
|                | ESH 3 - Z 2<br>6430     | 02-02/50-05-155<br>02-02/50-13-014 | 18/11/2019         | 18/11/2016         | 21/10/2017         | 21/04/2017         |
| CPC 3          | FSW43                   | 02-02/11-15-001                    | 07/04/2018         | 07/04/2017         |                    |                    |
|                | SF104/11SMA/11N/1500MM  | 02-02/50-13-012                    |                    |                    |                    |                    |
| DC             | ESW26                   | 02-02/03-17-002                    | 20/09/2018         | 20/09/2017         |                    |                    |
|                | RF Antenna              | 02-02/24-05-032                    |                    |                    |                    |                    |
| MB             | FSW43                   | 02-02/11-15-001                    | 07/04/2018         | 07/04/2017         |                    |                    |
|                | SF104/11SMA/11N/1500MM  | 02-02/50-13-012                    |                    |                    |                    |                    |
| SER 2          | ESR 3                   | 01-02/03-13-001                    | 29/08/2018         | 29/08/2017         |                    |                    |
|                | VULB 9168               | 02-02/24-05-005                    | 12/04/2018         | 12/04/2017         | 28/03/2018         | 28/09/2017         |
|                | NW-2000-NB              | 02-02/50-05-113                    |                    |                    |                    |                    |
|                | KK-EF393/U-16N-21N20 m  | 02-02/50-12-018                    |                    |                    |                    |                    |
|                | KK-SD_7/8-2X21N-33,0M   | 02-02/50-15-028                    |                    |                    |                    |                    |
| SER 3          | FSW43                   | 02-02/11-15-001                    | 07/04/2018         | 07/04/2017         |                    |                    |
|                | JS4-18004000-30-5A      | 02-02/17-05-017                    |                    |                    |                    |                    |
|                | AMF-6D-01002000-22-10P  | 02-02/17-15-004                    |                    |                    |                    |                    |
|                | 3117                    | 02-02/24-05-009                    | 10/05/2018         | 10/05/2017         |                    |                    |
|                | BBHA 9170               | 02-02/24-05-014                    | 02/06/2018         | 02/06/2015         | 09/12/2017         | 09/12/2016         |
|                | KMS102-0.2 m            | 02-02/50-11-020                    |                    |                    |                    |                    |
|                | SF104/11N/11N/300MM     | 02-02/50-13-008                    |                    |                    |                    |                    |
|                | Ultimate 1000W          | 02-02/50-16-004                    |                    |                    |                    |                    |
|                | 18N-20                  | 02-02/50-17-003                    |                    |                    |                    |                    |
|                | NMS111-GL200SC01-NMS110 | 02-02/50-17-012                    |                    |                    |                    |                    |
|                | Bandpass Filter         | 02-02/50-17-019                    |                    |                    |                    |                    |