Report No. 290009-1

# Test Report

| | |
|---|---|
| **Product** | Wireless Microphone |
| **Name and address of the applicant** | Phonak Communications AG<br>Laenggasse 17, CH-3280 Murten<br>Switzerland |
| **Name and address of the manufacturer** | Same as above |
| **Model** | Roger Table Mic |
| **Rating** | 3.7V DC (Secondary Battery) and 5.0V DC (Power Adaptor) |
| **Trademark** | Phonak |
| **Serial number** | / |
| **Additional information** | USB charging, Frequency Hopping |
| **Tested according to** | **FCC Part 15.247**<br>Frequency Hopping Transmitters / Digital Transmission Systems<br>**Industry Canada RSS-247, Issue 1**<br>Low Power Licence-Exempt Radiocommunications Devices |
| **Order number** | 290009 |
| **Tested in period** | 2015.09.10 to 2015.09.11 and 2016.01.13 |
| **Issue date** | 2016.03.04 |
| **Name and address of the testing laboratory** | Nemko<br>Instituttveien 6<br>Kjeller, Norway<br><br>FCC No: 994405<br>IC OATS: 2040D-1<br><br>TEL: +47 22 96 03 30<br>FAX: +47 22 96 05 50 |

| Prepared by [Frode Sveinsen] | Approved by [G.Suhanthakumar] |
|---|---|

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# 1 INFORMATION

## 1.1 Test Item

| | |
|---|---|
| **Name :** | Phonak |
| **FCC ID :** | KWC-TX23V1 |
| **Industry Canada ID :** | 2262A-TX23V1 |
| **Model/version :** | Roger Table Mic |
| **Serial number :** | - |
| **Hardware identity and/or version:** | V3 |
| **Software identity and/or version :** | W1509 |
| **Frequency Range :** | FHSS: 2402 – 2476 MHz<br>Control Carrier: 2402 - 2480 MHz |
| **Number of Channels :** | FHSS: Minimum 20 and Maximum 38<br>Control Carrier: 3 (2402, 2450 and 2480 MHz) |
| **Operating Modes :** | Adaptive Frequency Hopping with Control Carrier |
| **Type of Modulation :** | Digital (GFSK) |
| **User Frequency Adjustment :** | None |
| **Rated Output Power :** | 44 mW (Peak, Conducted) |
| **Type of Power Supply :** | Internal Battery and External Power Adaptor for charging and operation.<br>3.7V (Secondary Battery, Li-Ion) and 5.0V DC (AC Adaptor) |
| **Antenna Connector :** | None |
| **Number of Antennas :** | 2 |
| **Antenna Diversity Supported :** | Yes |
| **Power Adaptors :** | GPE125-050200-Z (5.0V, 2000mA)<br>GPE053A-075065-Z (7.5V, 650mA)<br>GPE053B-050100-Z (5.0V, 1000mA, USB Interface) |

### Description of Test Item

The EUT is a Wireless Desktop Microphone with Frequency Hopping and a fixed Control Carrier.
Several Wireless Microphones may be synchronized, for this the system uses a Control Carrier at 2402, 2450 or 2480 MHz. The Control Carrier uses Dynamic Frequency Selection.

Because of the control carriers this is considered a Hybrid System and it has been tested that the control carrier fiuilfills the 6dB Bandwidth and Power Spectral Density requirements for DTS systems. The Output Power and Band Edge Radiations have also been tested separately on the Control Carrier since the Control Carrier operates closer to the upper band edge than the FHSS system.

### Exposure Evaluation

The EUT is designed for tabletop use and the user manual contains text that it shall be positioned with a separation distance of at least 20 cm from any humans. For the purposes of exposure evaluation this EUT is a mobile device. MPE Calculation at 20 cm satisfying FCC requirements is submitted as a separate document.

The EUT is exempted from RF Exposure Evaluation to Industry Canada requirements since the output power complies with the power levels of section 2.5.2 of RSS-102 Issue 5.

## 1.2 Test Environment

### *1.2.1 Normal test condition*

| | |
|---|---|
| Temperature: | 20.0 – 22.1 °C |
| Relative humidity: | 39 - 54 % |
| Normal test voltage: | 3.7 V DC (Nominal battery voltage) |

All tests were performed with the EUT powered from a fully charged battery.

For radiated emissions tests the EUT was also powered from a USB charger supplied by the manufacturer.

Power Line Conducted emissions Tests were performed with the two supplied power adaptors.

The values are the limit registered during the test period.

## 1.3 Test Engineer(s)

Frode Sveinsen / Thomas Danglé

## 1.4 Test Equipment

See list of test equipment in clause 5.

# 2 TEST REPORT SUMMARY

## 2.1 General

All measurements are tracable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and Industry Canada RSS-247 Issue 1.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were made in a semi-anechoic chamber at measuring distances of 1m, 3m and 10m.

A description of the test facility is on file with the FCC and Industry Canada.

☒ New Submission ☐ Production Unit

☐ Class II Permissive Change ☒ Pre-production Unit

**DSS** Equipment Code ☐ Family Listing

**THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.**

Deviations from, additions to, or exclusions from the test specifications are described in “Summary of Test Data”.

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## 2.2 Test Summary

| Name of test | FCC Part 15 reference | RSS-247 Issue 1, RSS-GEN Issue 4 reference | Result |
|---|---|---|---|
| Supply Voltage Variations | 15.31(e) | 6.11 (RSS-GEN) | Complies |
| Number of Operating Frequencies | 15.31(m) | 5.1 (6) | Complies |
| Antenna Requirement | 15.203 | 8.3 (RSS-GEN) | Complies |
| Power Line Conducted Emission | 15.107(a)<br>15.207(a) | 8.8 (RSS-GEN) | Complies |
| Channel Separation | 15.247(a)(1) | 5.1 (4) | Complies |
| Pseudorandom Hopping Algorithm | 15.247(a)(1) | 5.1 (3) | Complies |
| Time of Occupancy | 15.247(a)(1)(iii) | 5.1 (5) | Complies |
| Occupied Bandwidth | 15.247(a)(1) | 5.1 (7) | Complies |
| Minimum 6 dB Bandwidth | 15.247(a)(2) | 5.2 (1) | Complies[1] |
| Peak Power Output | 15.247(b) | 5.4 (5) | Complies |
| Power Spectral Density | 15.247(d) | 5.2 (2) | Complies[1] |
| Spurious Emissions (Antenna Conducted) | 15.247(c) | 5.5 | Complies |
| Spurious Emissions (Radiated) | 15.247(c)<br>15.109(a)<br>15.209(a) | 6.13 (RSS-GEN)<br>8.9 (RSS-GEN) | Complies |

[1] Only applicable for Control Carriers.

## 2.3 Description of modification for Modification Filing

Not applicable.

## 2.4 Comments

The EUT uses frequency hopping with 38 hopping channels from 2402 to 2476 MHz. Additionally the EUT transmit a control signal on alternatingly on 2402, 2450 and 2480 MHz. The control signal is transmitted with the same modulation and bandwidth but with reduced Output Power.

Radiated measurements were done with the EUT powered by a fully charged battery. Measurements below 1 GHz was performed with the EUT charging from a USB power adaptor.

Antenna Conducted tests were performed with the EUT powered from a regulated power supply. It was also checked that power variations of ±15 % did not have any influence on Output Power.

## 2.5 Family List Rational

Not Applicable.

# 3 TEST RESULTS

## 3.1 Power Line Conducted Emissions

**Para. No.: 15.207 (a)**

| **Test Performed By: Thomas Danglé** | **Date of Test: 1-Oct-2015** |
|---|---|

**Measurement procedure:** **ANSI C63.4-2014 using 50 µH/50 ohms LISN.**

**Test Results:** **Complies.**

**Measurement Data:** **See attached graph, (Peak detector).**

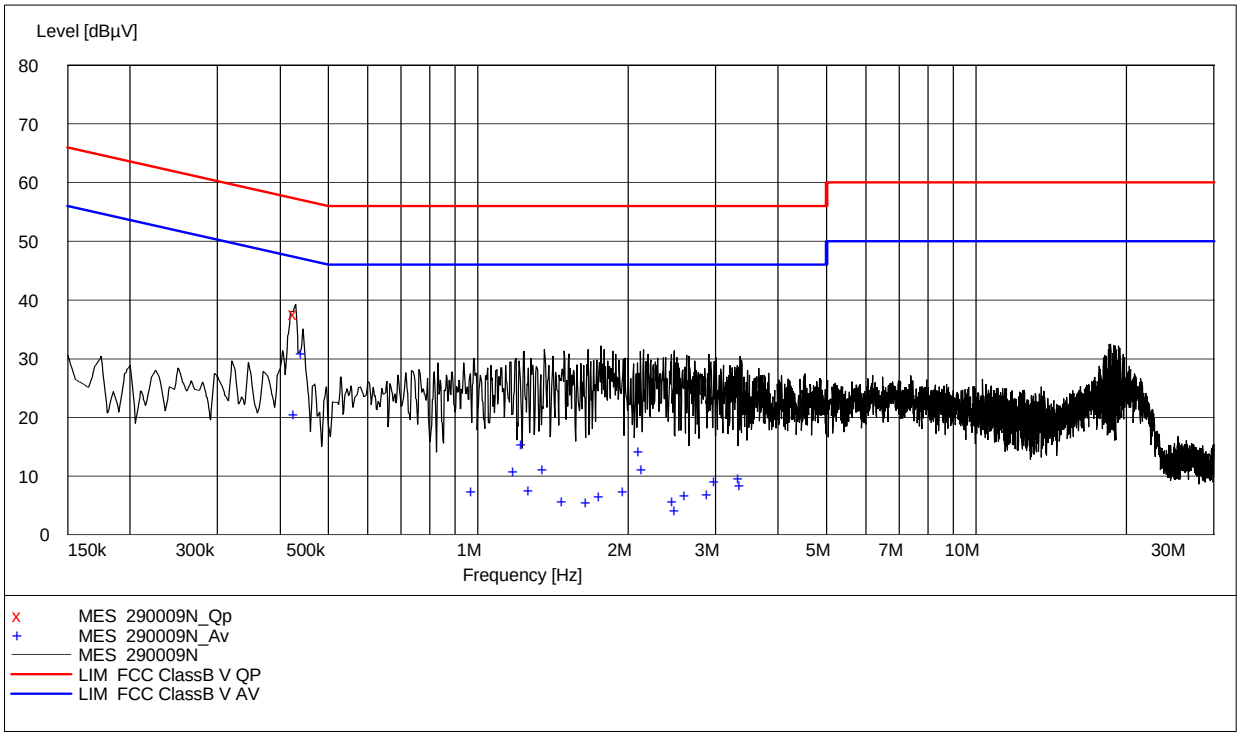
**Highest measured value (L1 and N):**

**Single Adaptor (120V 60Hz):**

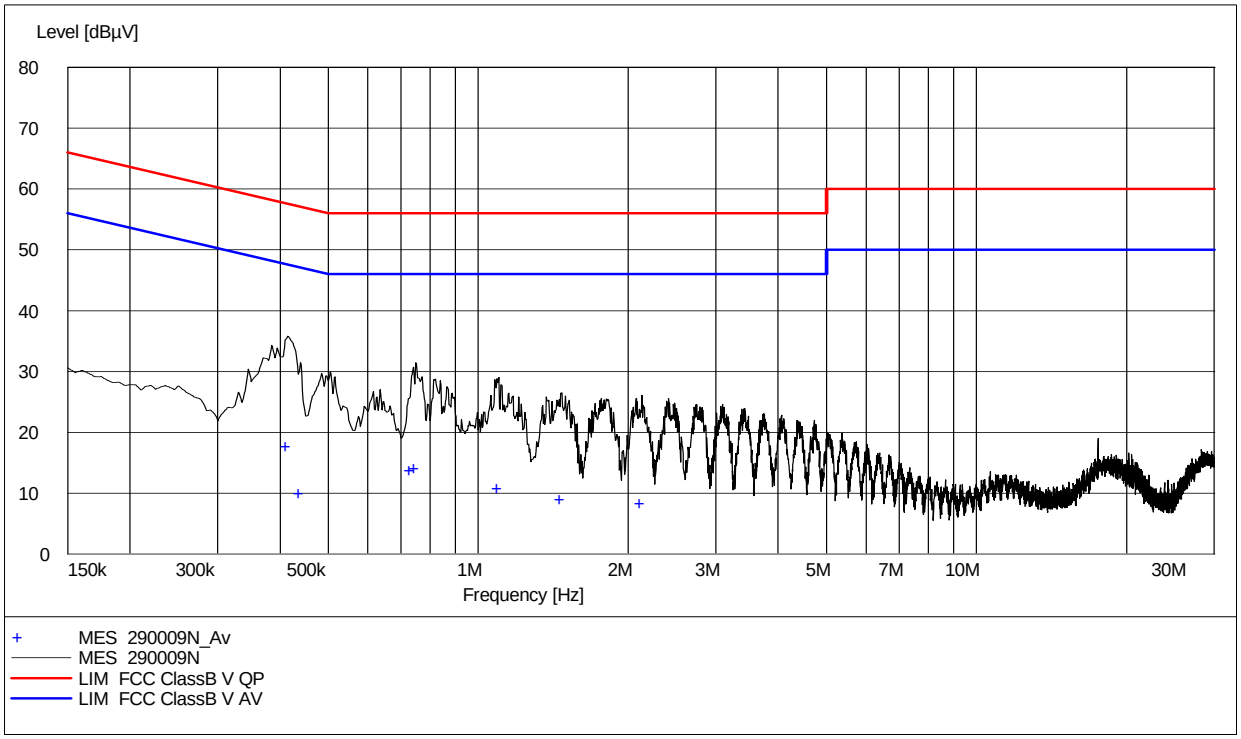
| Frequency [MHz] | Level [dBuV] | Af [dB] | Limit [dBuV] | Margin [dB] | Det | Position | Verdict [Pass/Fail] |
|---|---|---|---|---|---|---|---|
| 0.430000 | 37.70 | 10.30 | 57.30 | 19.60 | QP | L1 | Pass |
| 0.430000 | 20.50 | 10.30 | 47.30 | 26.80 | AV | L1 | Pass |
| 0.445000 | 30.90 | 10.30 | 47.00 | 16.10 | AV | L1 | Pass |
| 0.980000 | 7.40 | 10.40 | 46.00 | 38.60 | AV | N | Pass |
| 1.190000 | 10.70 | 10.40 | 46.00 | 35.30 | AV | N | Pass |
| 1.235000 | 15.40 | 10.40 | 46.00 | 30.60 | AV | N | Pass |
| 1.275000 | 7.50 | 10.40 | 46.00 | 38.50 | AV | L1 | Pass |
| 1.360000 | 11.10 | 10.40 | 46.00 | 34.90 | AV | N | Pass |
| 1.490000 | 5.60 | 10.40 | 46.00 | 40.40 | AV | N | Pass |
| 1.665000 | 5.50 | 10.40 | 46.00 | 40.50 | AV | N | Pass |
| 1.765000 | 6.60 | 10.40 | 46.00 | 39.40 | AV | N | Pass |
| 1.970000 | 7.40 | 10.40 | 46.00 | 38.60 | AV | N | Pass |
| 2.120000 | 14.30 | 10.40 | 46.00 | 31.70 | AV | N | Pass |
| 2.150000 | 11.10 | 10.40 | 46.00 | 34.90 | AV | N | Pass |
| 2.475000 | 5.70 | 10.40 | 46.00 | 40.30 | AV | N | Pass |
| 2.505000 | 4.20 | 10.40 | 46.00 | 41.80 | AV | N | Pass |
| 2.620000 | 6.80 | 10.40 | 46.00 | 39.20 | AV | N | Pass |
| 2.905000 | 6.90 | 10.40 | 46.00 | 39.10 | AV | N | Pass |
| 3.010000 | 9.20 | 10.40 | 46.00 | 36.80 | AV | N | Pass |
| 3.355000 | 9.60 | 10.40 | 46.00 | 36.40 | AV | N | Pass |
| 3.380000 | 8.40 | 10.40 | 46.00 | 37.60 | AV | N | Pass |

**Dual Adaptor (120V 60Hz):**

| Frequency [MHz] | Level [dBuV] | Af [dB] | Limit [dBuV] | Margin [dB] | Det | Position | Verdict [Pass/Fail] |
|---|---|---|---|---|---|---|---|
| 0.415000 | 17.80 | 10.30 | 47.50 | 29.70 | AV | N | Pass |
| 0.440000 | 10.00 | 10.30 | 47.10 | 37.10 | AV | N | Pass |
| 0.735000 | 13.70 | 10.20 | 46.00 | 32.30 | AV | N | Pass |
| 0.750000 | 14.00 | 10.20 | 46.00 | 32.00 | AV | N | Pass |
| 1.100000 | 10.70 | 10.40 | 46.00 | 35.30 | AV | N | Pass |
| 1.470000 | 8.90 | 10.40 | 46.00 | 37.10 | AV | N | Pass |
| 2.130000 | 8.30 | 10.40 | 46.00 | 37.70 | AV | N | Pass |




**Single Adaptor (120V 60Hz)**




**Dual Adaptor (120V 60Hz)**

## 3.2 Channel Separation

**Para. No.: 15.247 (a)(1)**

**Test Results:** **Complies**

**Measurement Data:**

| | |
|---|---|
| Channel Separation: | 2.0 MHz |
| 20 dB Bandwidth of hopping channel: | 2.44 MHz |
| Nominal value for Channel Separation | 2.0 MHz |

Only maximum 20dB BW is reported above

**See attached plots**

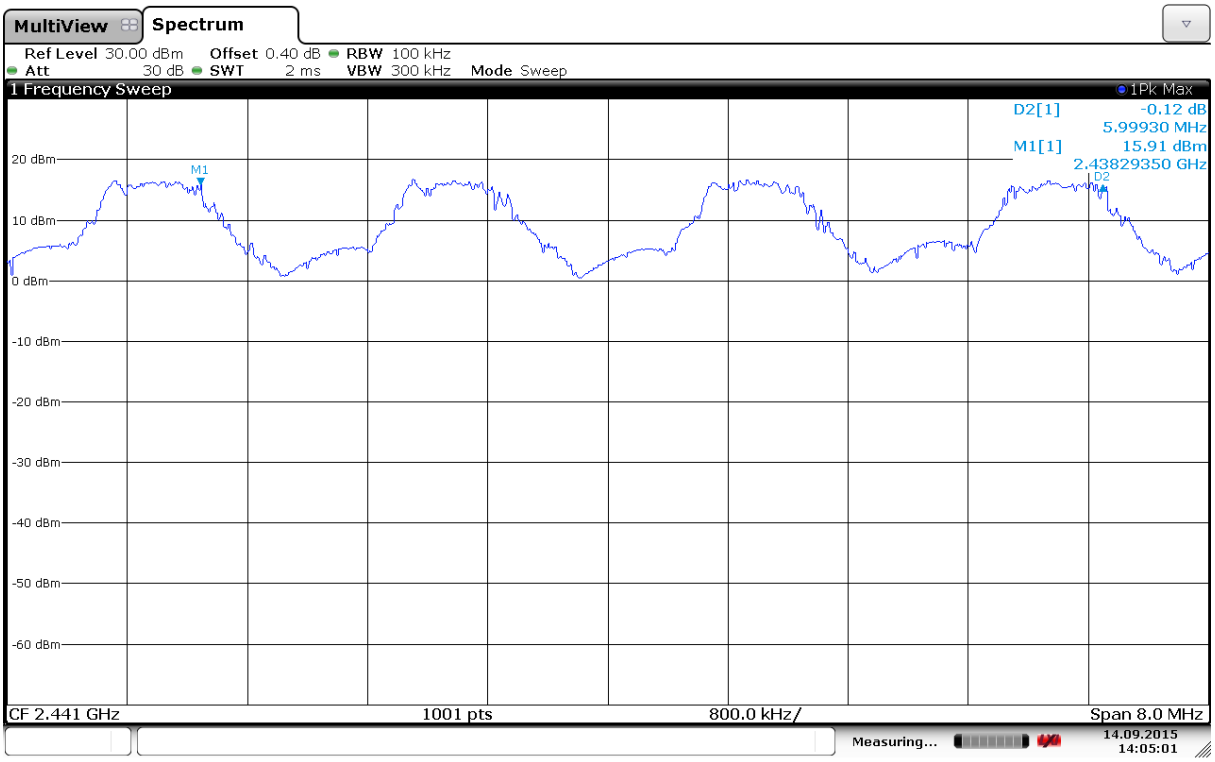
**Requirement:**

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

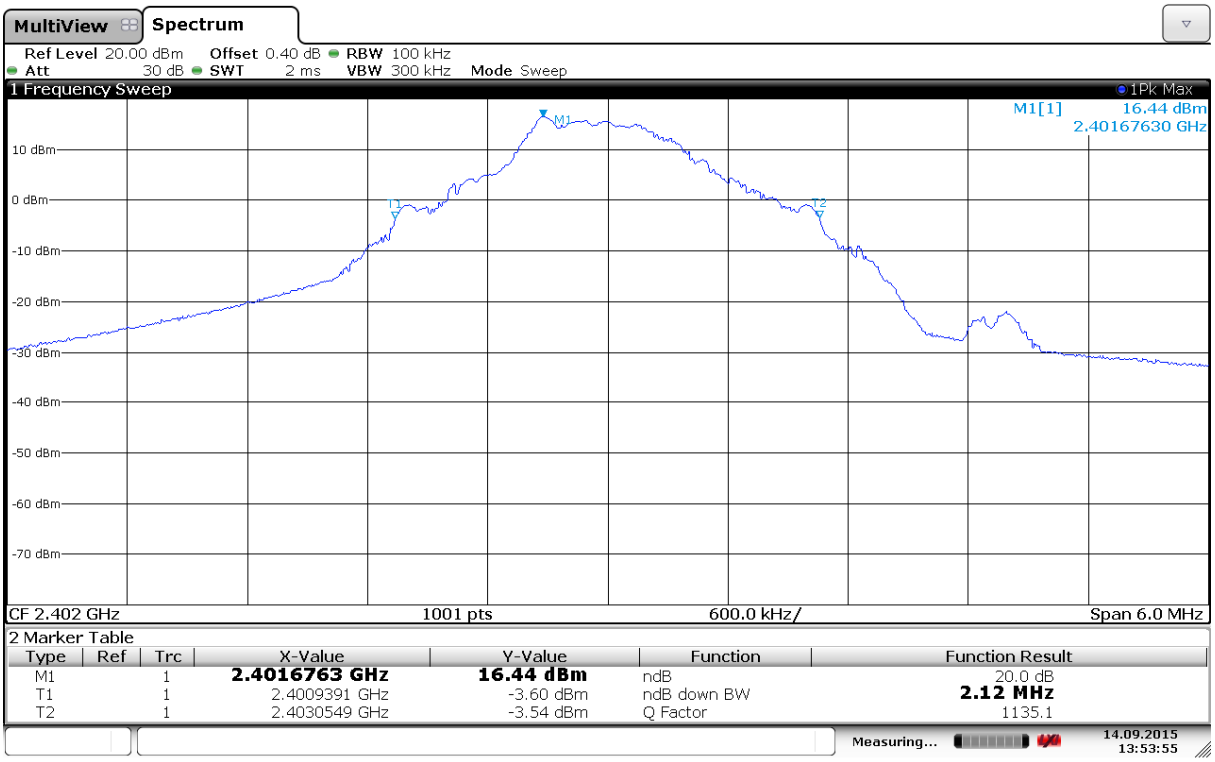
or:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the system operates with an output power no greater than 125 mW.

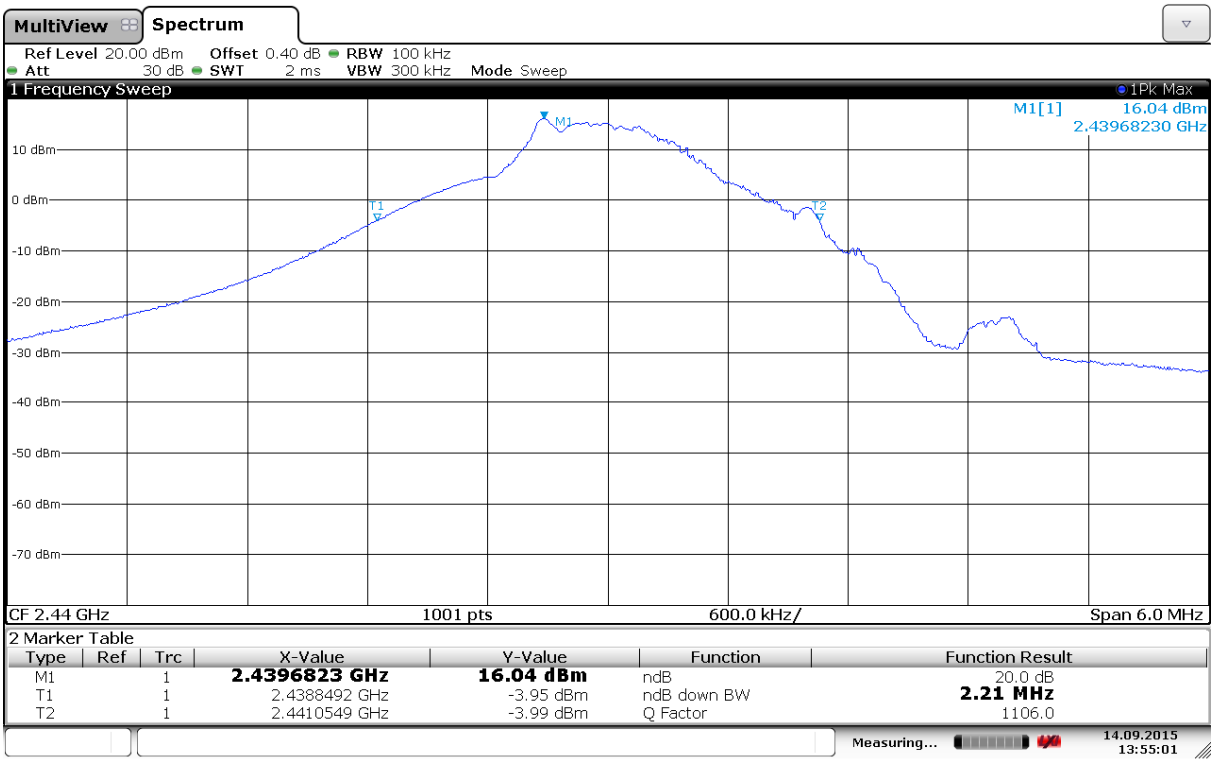
No requirements for Digital Transmission Systems.



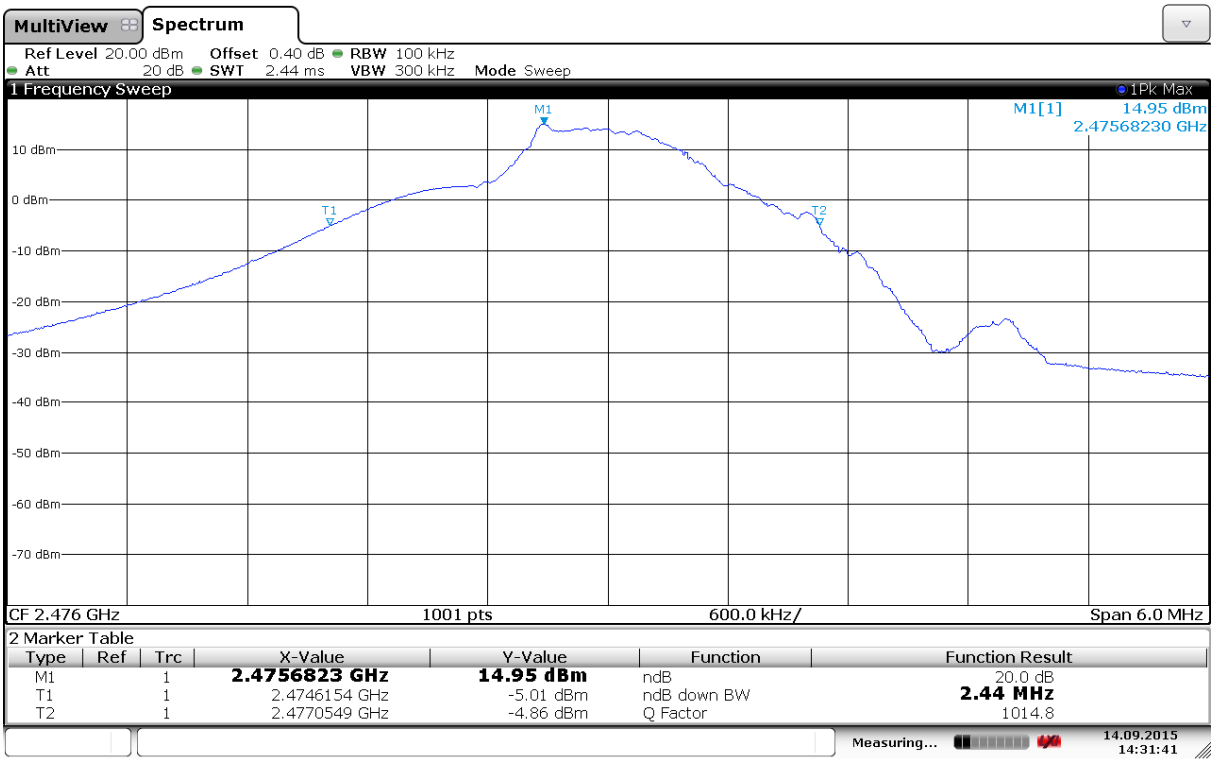

## Channel Separation



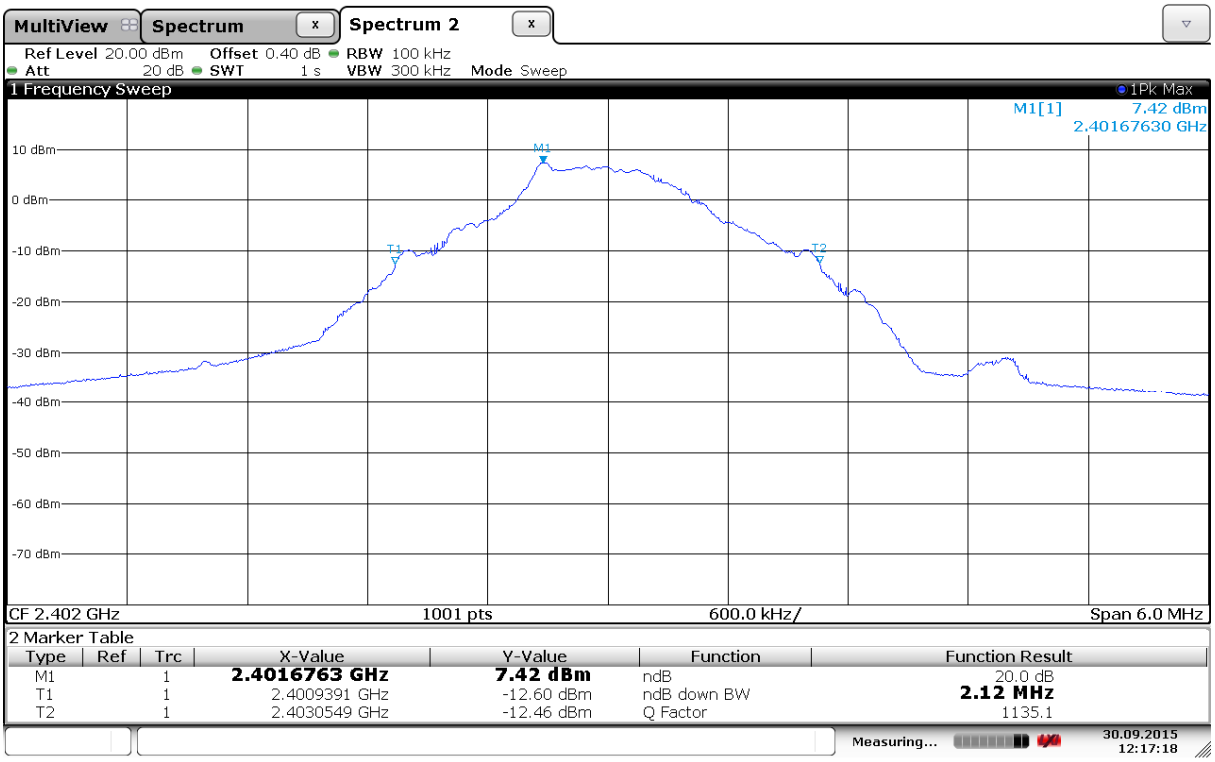

**20dB Bandwidth, 2402 MHz**



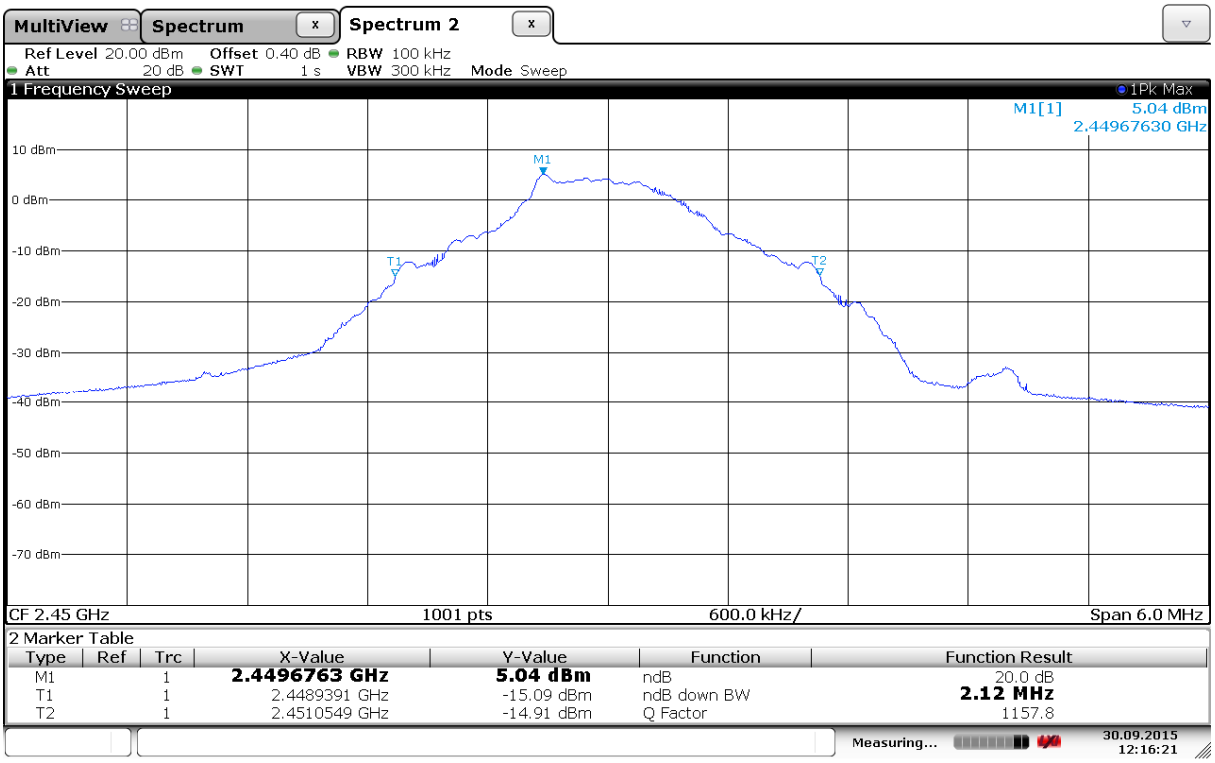

**20dB Bandwidth, 2440 MHz**



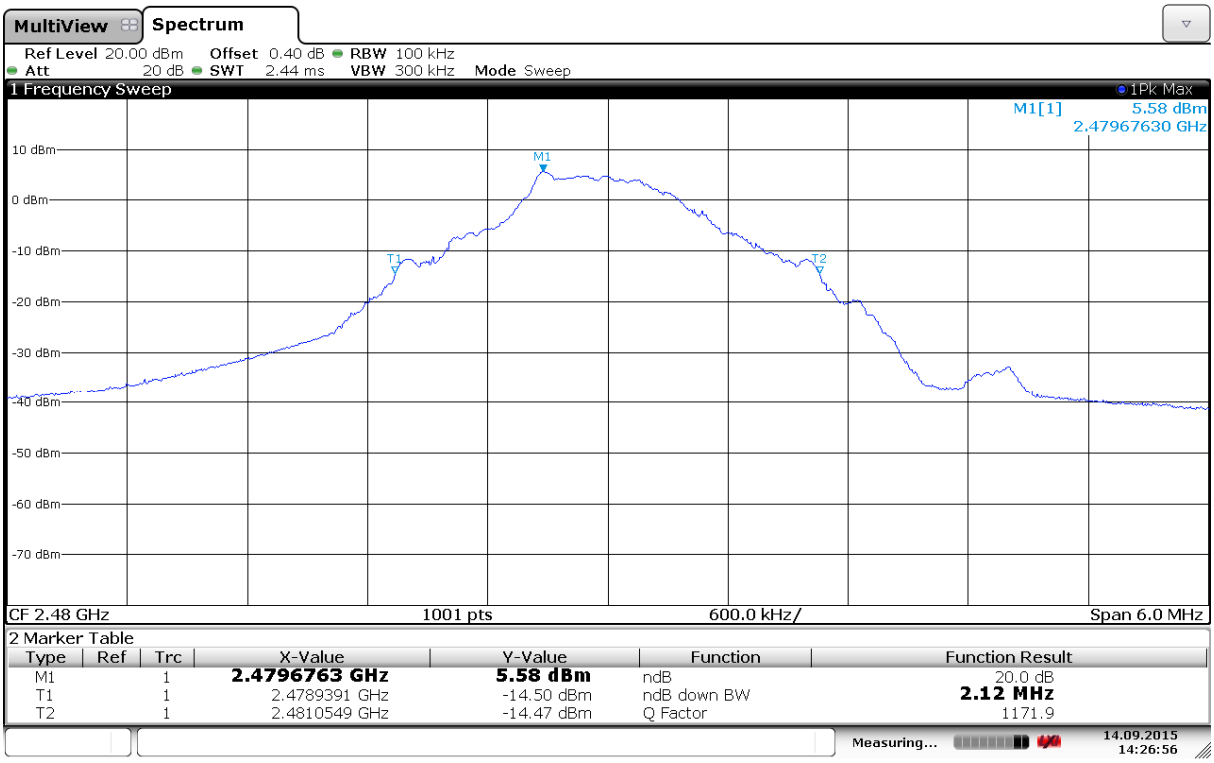

**20dB Bandwidth, 2476 MHz**




**20dB Bandwidth, 2402 MHz, Control Channel**




**20dB Bandwidth, 2450 MHz, Control Channel**




**20dB Bandwidth, 2480 MHz, Control Channel**

## 3.3 Minimum 6 dB Bandwidth

**Para. No.: 15.247 (a)(2)**

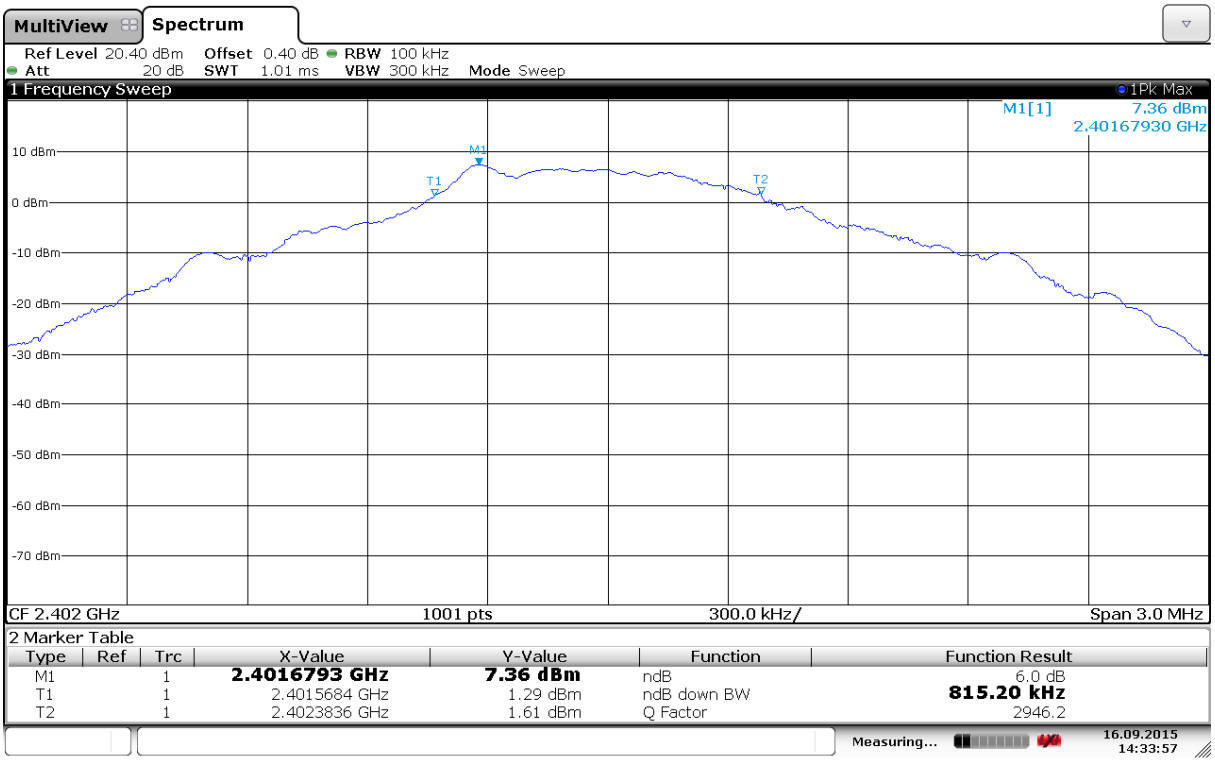
**Test Results: Complies**

**Measurement Data:**

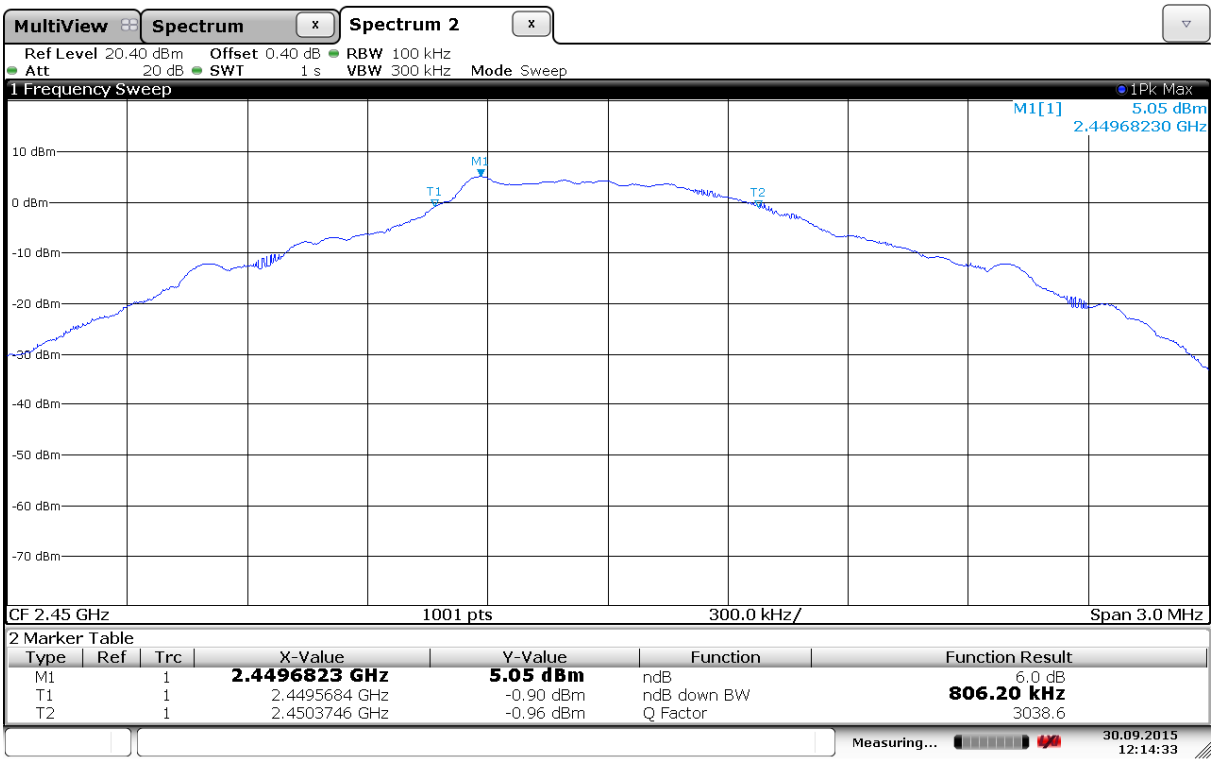
| Modulation type and bitrate | Measured 6 dB Bandwidth (kHz) |
|---|---|
| 2402 MHz | 815 |
| 2450 MHz | 806 |
| 2480 MHz | 788 |

**Requirements:**

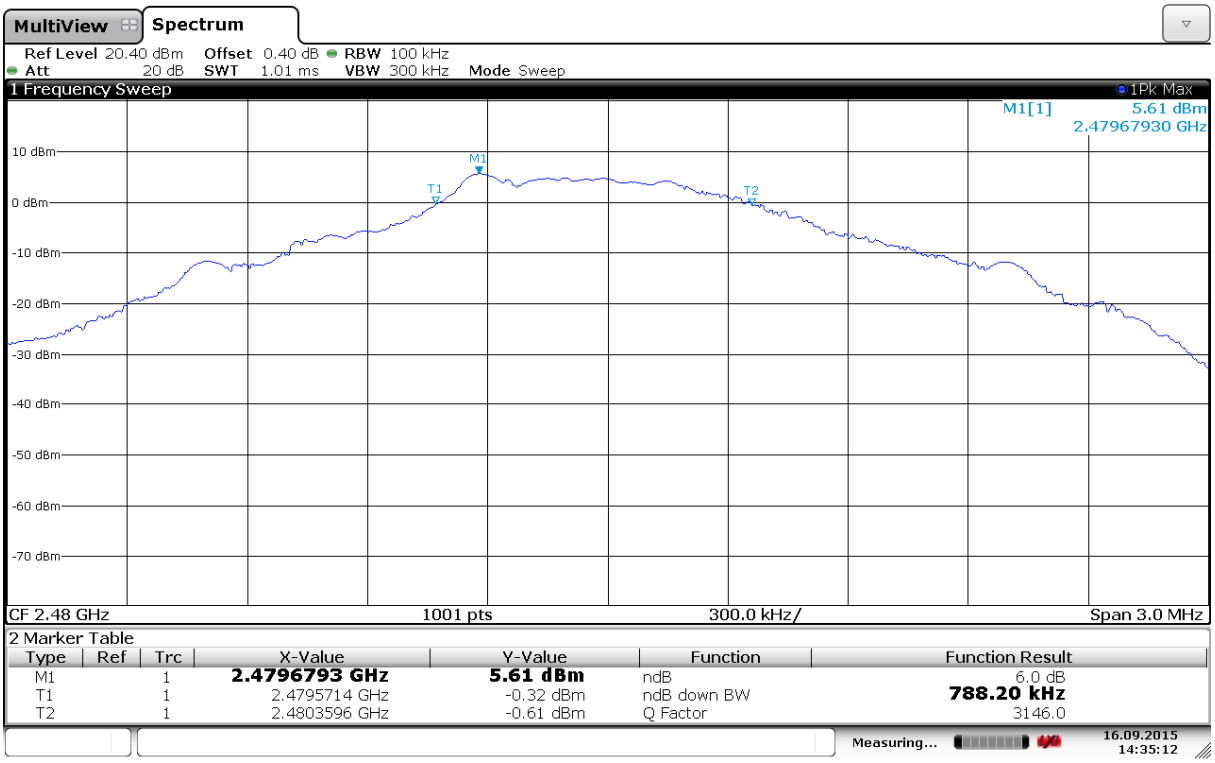
For Digital Transmission Systems in the 2400-2483.5 MHz band the minimum 6 dB bandwidth shall be at least 500 KHz.




**DTS Bandwidth, 2402 MHz, Control Channel**




**DTS Bandwidth, 2450 MHz, Control Channel**




**DTS Bandwidth, 2480 MHz, Control Channel**

## 3.4 Pseudorandom Hopping Algorithm

**Para. No.: 15.247 (a)(1)**

**Test Results: Complies**

**Measurement Data:** The EUT uses a proprietary hopping scheme.

**Requirements:**

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally by the transmitter.

No requirements for Digital Transmission Systems.

## 3.5 Occupancy Time

**Para. No.: 15.247 (a)(1)(iii)**

**Test Results: Complies**

**Measurement Data:**

| | |
|---|---|
| **Number of RF Channels:** | From 20 to 36 |
| **Maximum Length of RF Burst pr. channel (ms)** | 2*185µs = 370 µs |
| **Slot length (ms)** | 2*400µs = 800µs |
| **Time between RF Burst on same RF Channel (ms)** | 16.0 ms |
| **Time of Occupancy** | 185 ms |

Time between RF burst on same channel: 0.800 x 20 ms = 16.0 ms

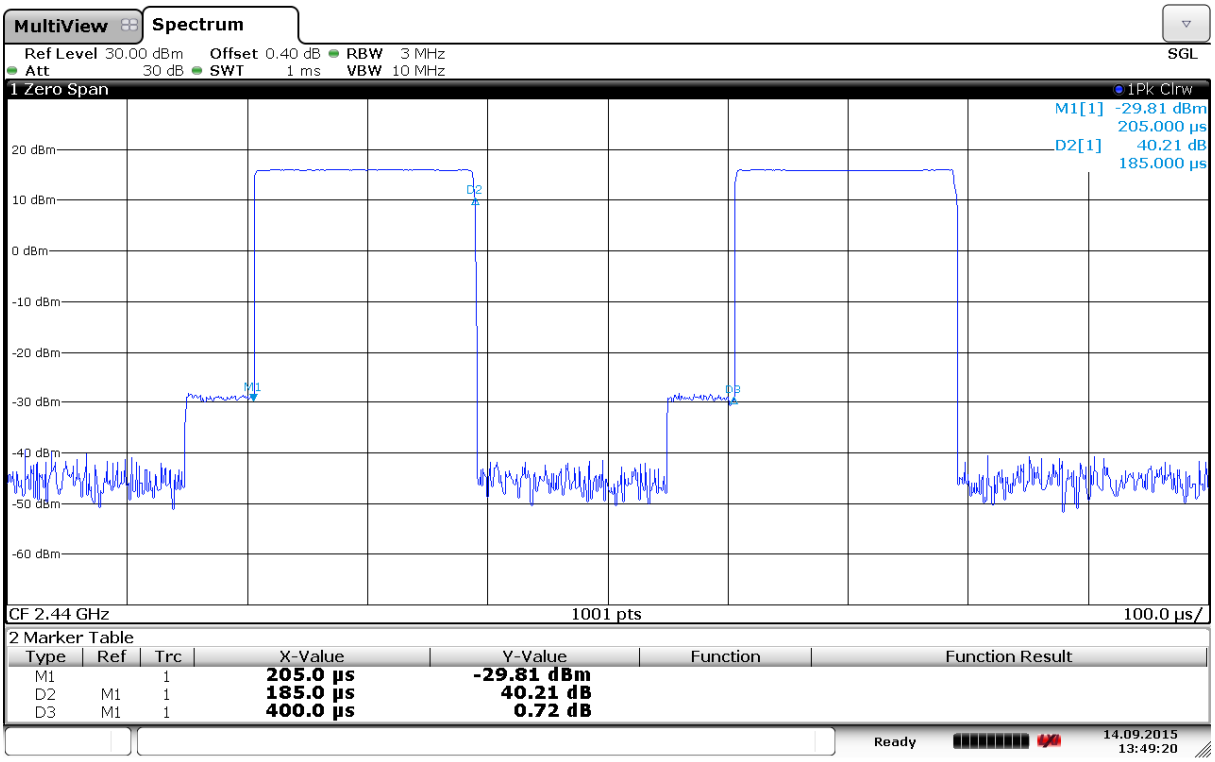
Time of occupancy: (0.370 x 400 x 20) / 16.0 = 185 ms

**See attached graph.**

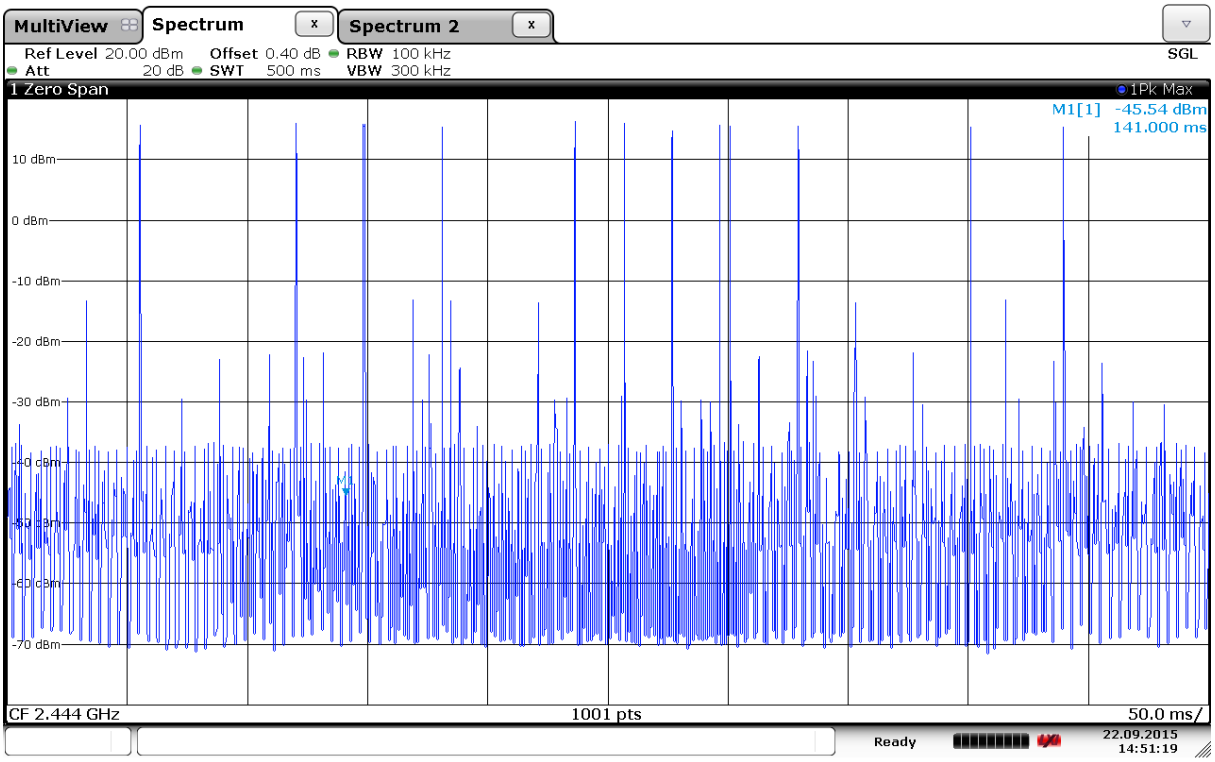
**Requirements:**

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

No requirements for Digital Transmission Systems.




**Burst Length, Hopping Channel**




**Occupancy Time**

## 3.6 Occupied Bandwidth

**Para. No.: 15.247 (a)(1)(iii)**

**Test Results: Complies**

**Measurement Data:**

| | |
|---|---|
| Number of Hopping Channels in use: | 20 to 36 |
| Hopping Channel Centre Frequencies: | 2402 to 2476 MHz |
| Control Channels | 2402, 2450 and 2480 MHz |
| 99% BW, Lower Hopping Channel (2402 MHz) | 1.88 MHz |
| 99% BW, Centre Hopping Channel (2440 MHz) | 2.03 MHz |
| 99% BW, Upper Hopping Channel (2476 MHz) | 2.25 MHz |
| 99% BW, Lower Control Channel (2402 MHz) | 1.87 MHz |
| 99% BW, Centre Control Channel (2450 MHz) | 1.88 MHz |
| 99% BW, Upper Control Channel (2480 MHz) | 1.88 MHz |

Modulation for Control Channels is the same as for Hopping Channels, the only difference is that Control Channels have lower Output Power.

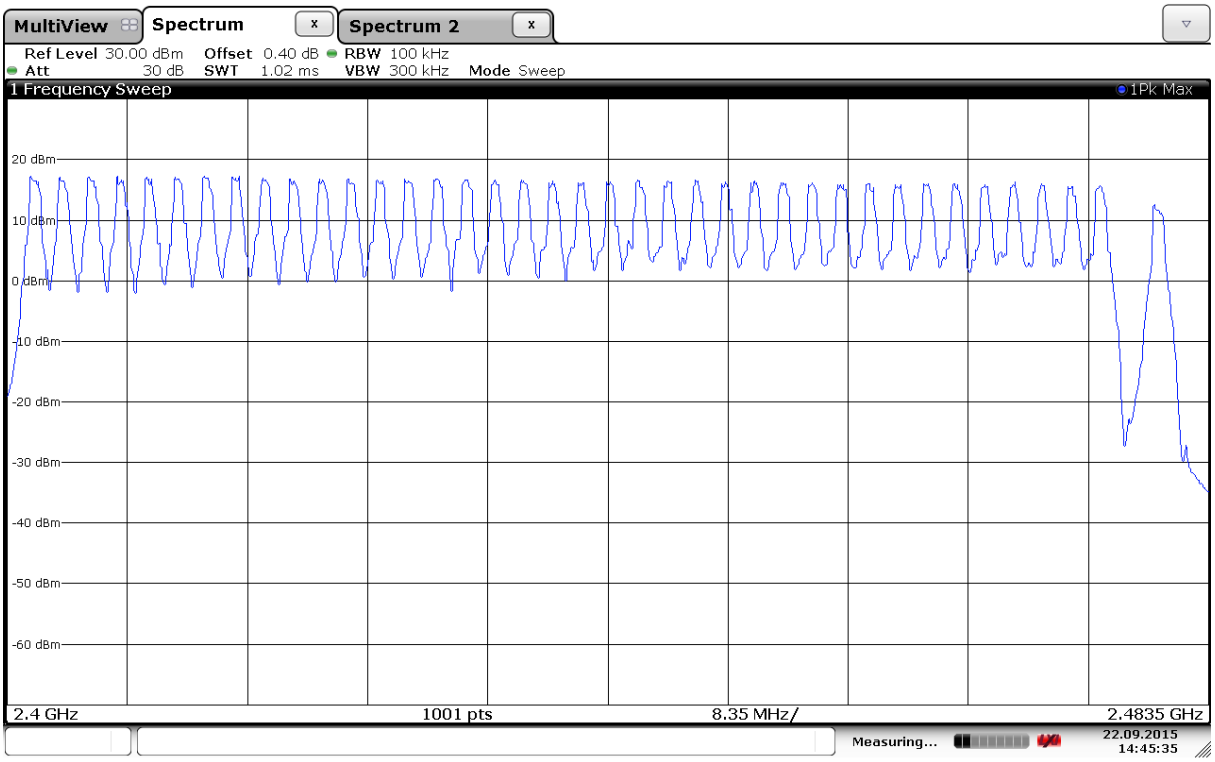
See attached plots.

**Requirements:**

Frequency hopping systems in the 2400 - 2483.5 MHz band shall use at least 15 non-overlapping channels. No requirements for bandwidth for this frequency band.

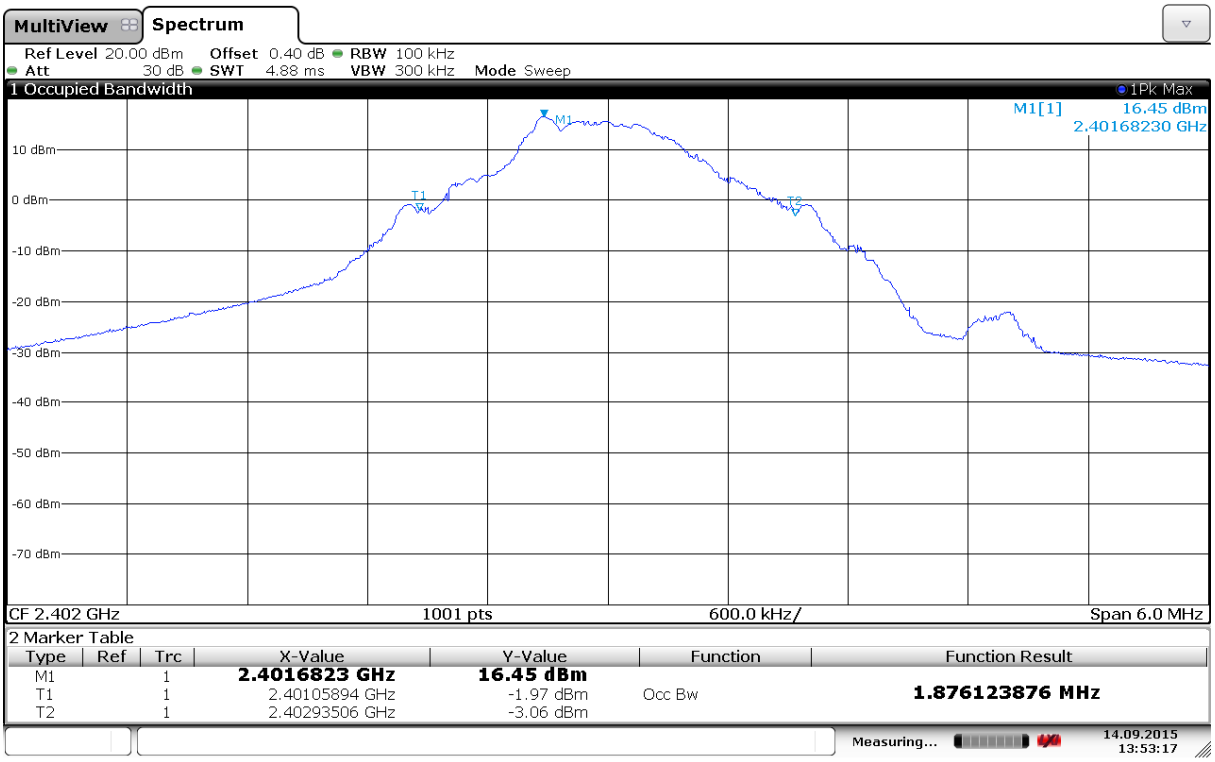
No requirements for Digital Transmission Systems.

No requirement for 99% BW, reported for information only.

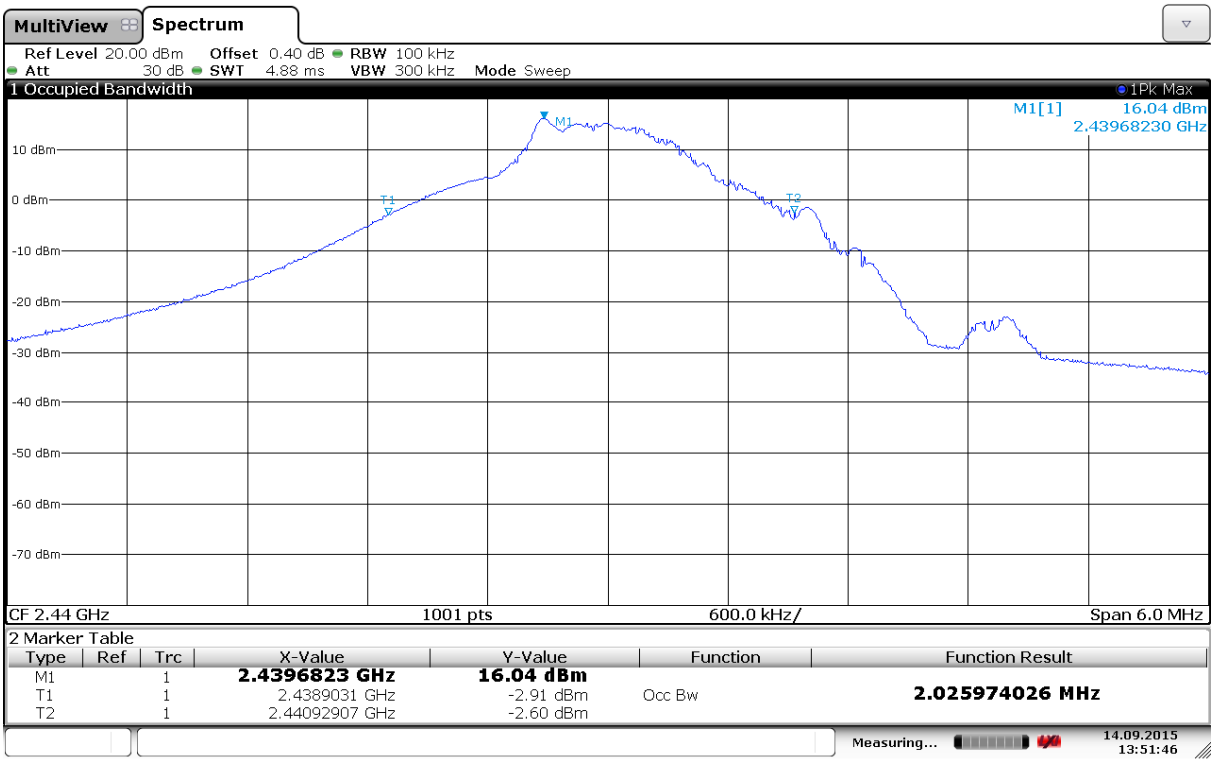



## RF Channels in Use, 38 Ch

The signal at 2480MHz is a Control Channel

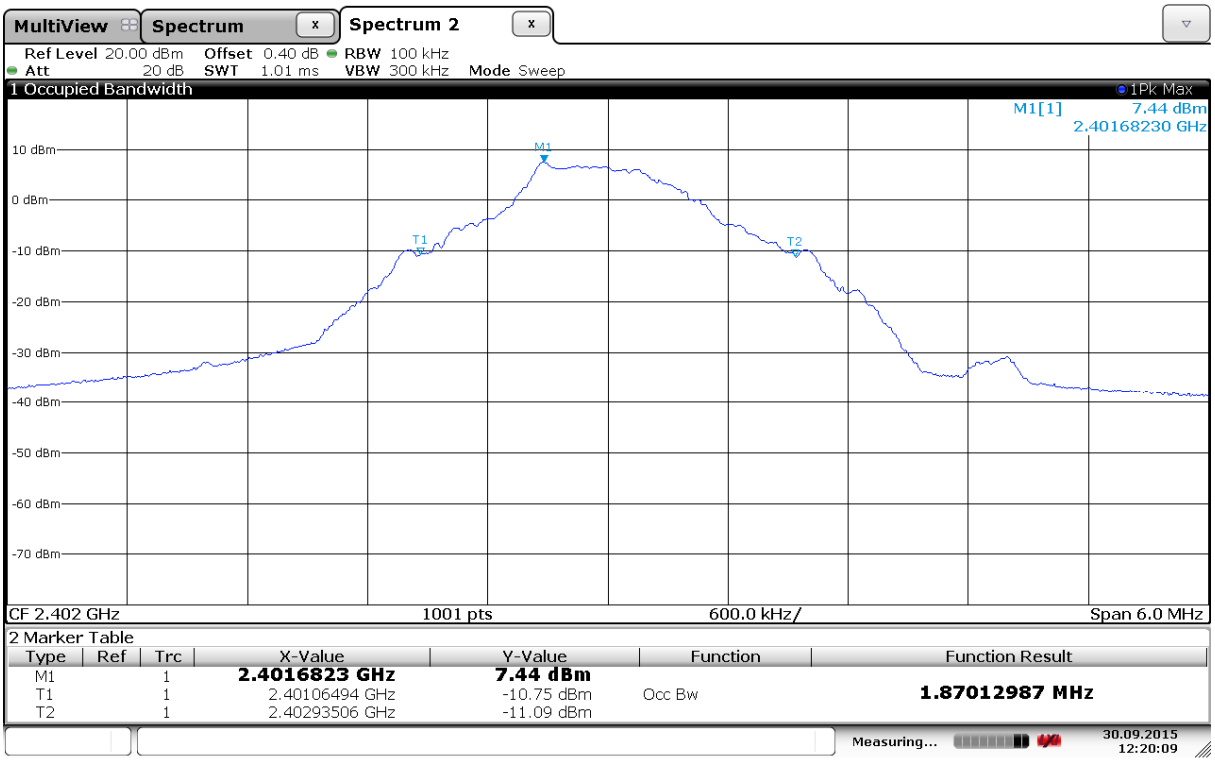



**Occupied Bandwidth, 99%, 2402 MHz**

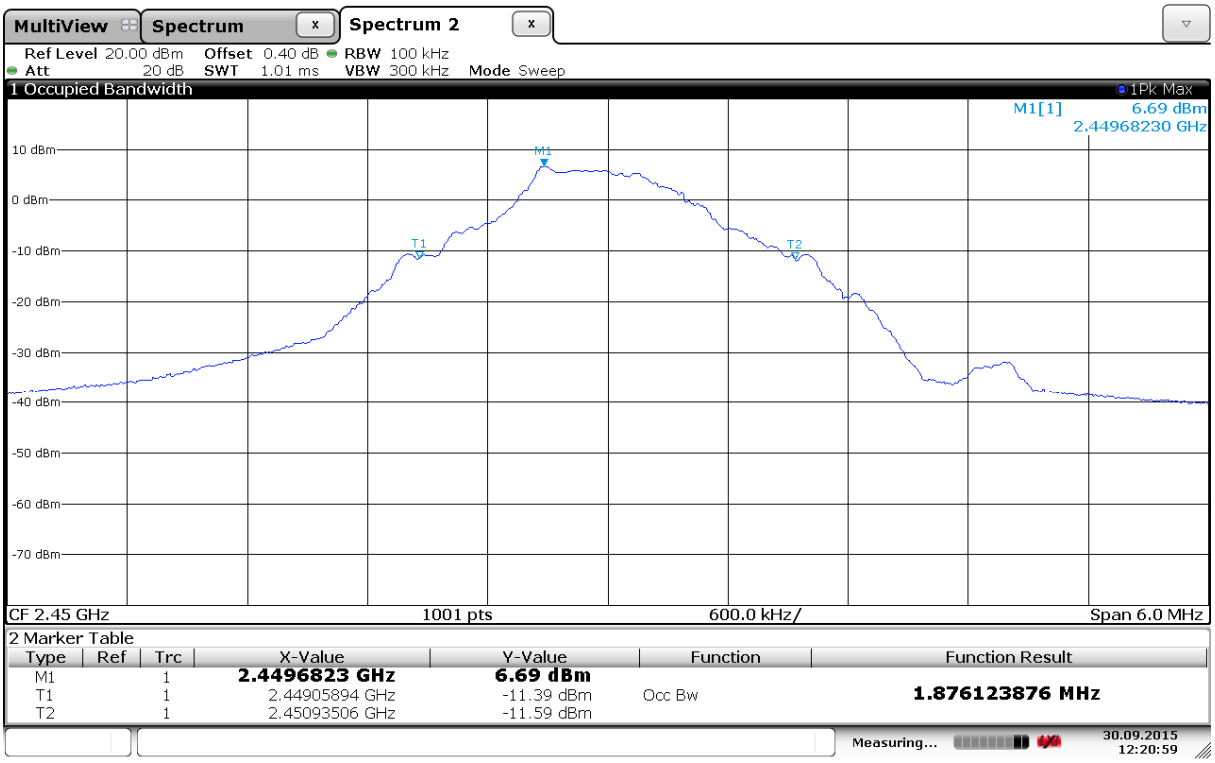



**Occupied Bandwidth, 99%, 2440 MHz**

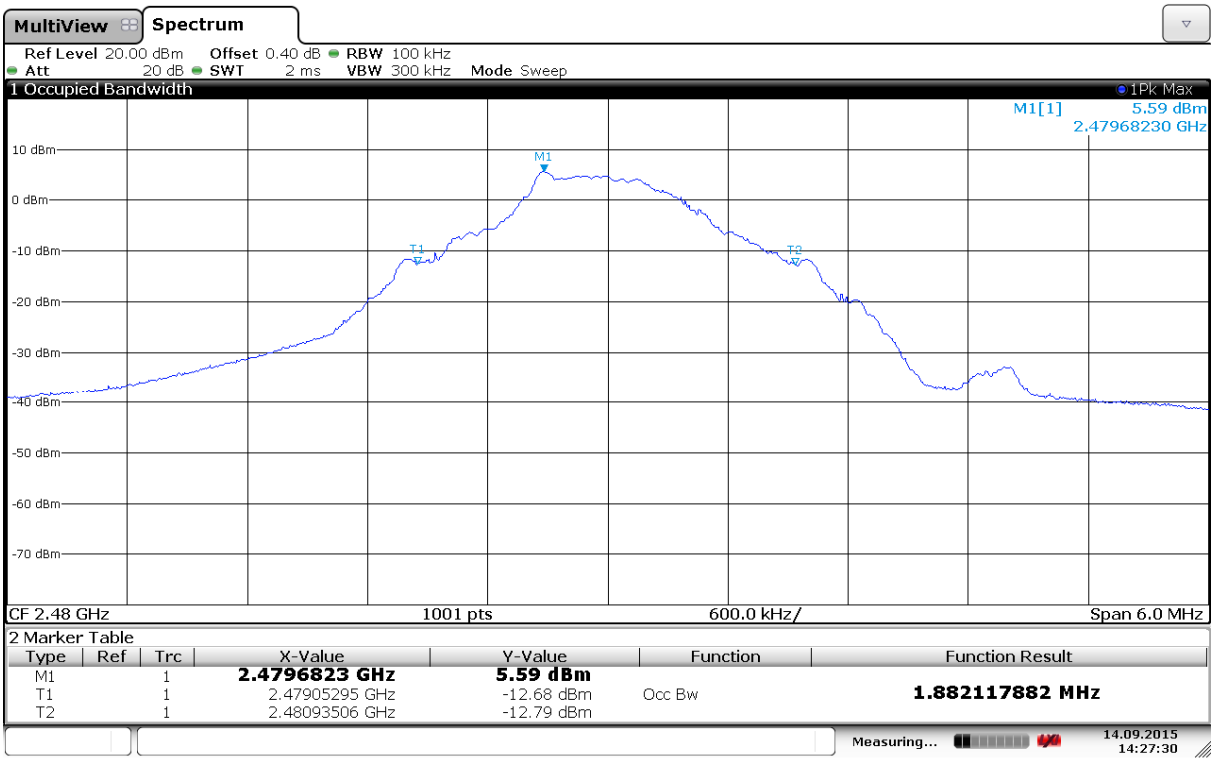

**Occupied Bandwidth, 99%, 2476 MHz**



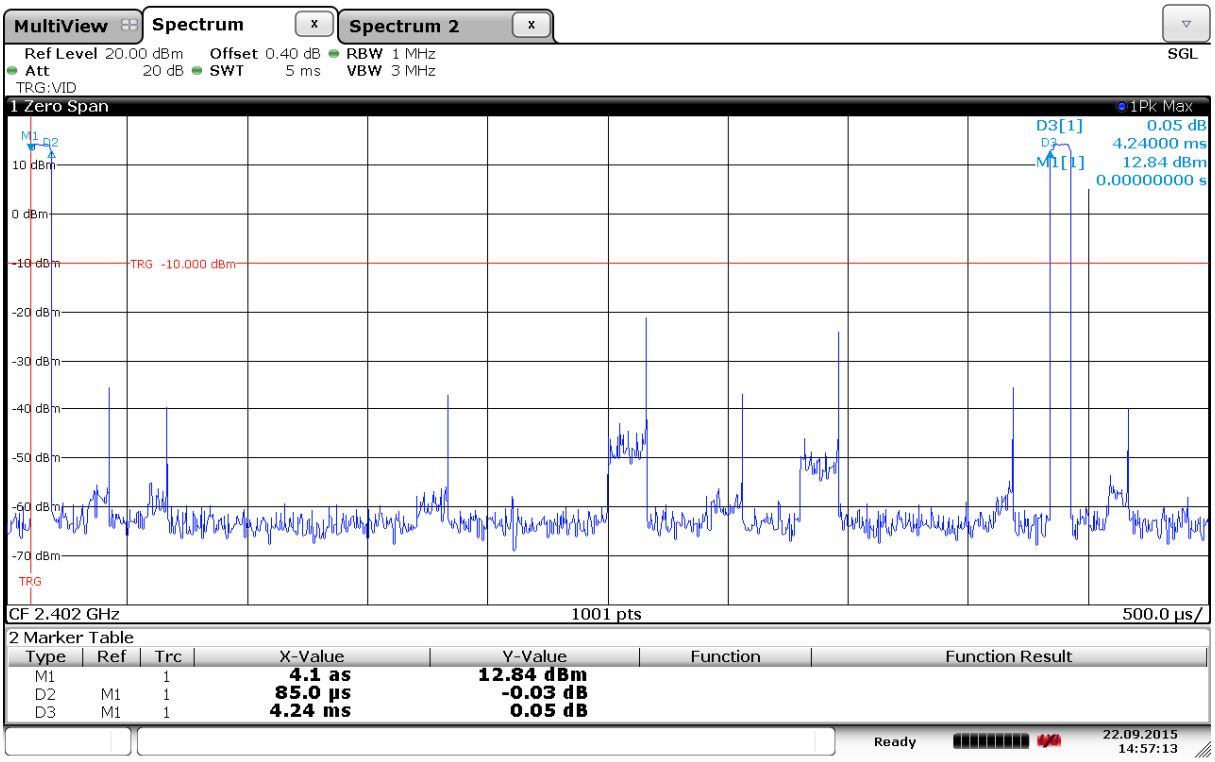

**Occupied Bandwidth, 99%, 2402 MHz, Control Channel**



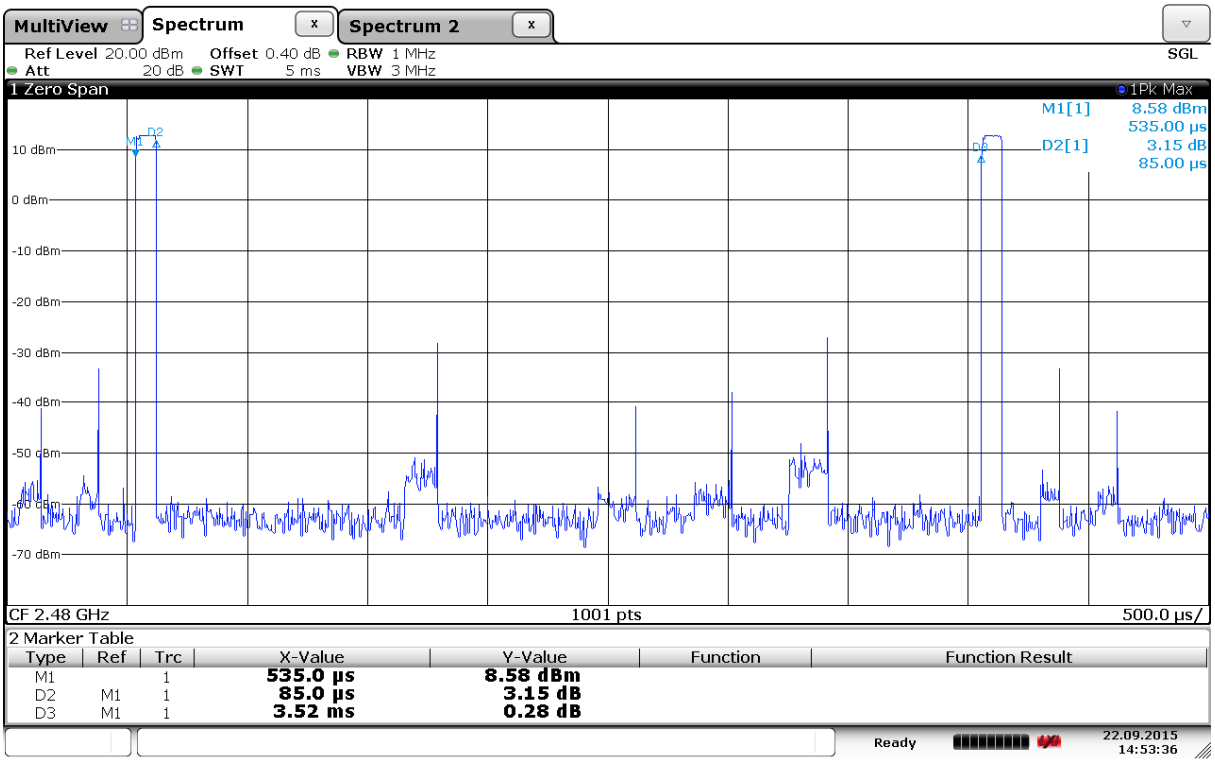

**Occupied Bandwidth, 99%, 2450 MHz, Control Channel**




**Occupied Bandwidth, 99%, 2480 MHz, Control Channel**




**Control Carrier, 2402MHz**




**Control Carrier, 2480MHz**

## 3.7 Peak Power Output

**Para. No.: 15.247 (b)**

**Test Results: Complies**

**Measurement Data:**

**Hopping Channels**

| | 2402 MHz | 2440 MHz | 2476 MHz |
|---|---|---|---|
| **Operating Mode** | **FHSS** | **FHSS** | **FHSS** |
| **Conducted Power (dBm)** | 16.4 | 16.0 | 14.9 |
| **Conducted Power (mW)** | 44.1 | 39.7 | 31.2 |
| **Field Strength (dBµV/m)** | 110.4 | 112.0 | 110.7 |
| **EIRP, Calculated (mW)** | 32.9 | 47.3 | 34.9 |
| **Antenna gain (dBi)** | -1.3 | 0.8 | 0.5 |

**Control Channels**

| | 2402 MHz | 2450 MHz | 2480 MHz |
|---|---|---|---|
| **Operating Mode** | **DM** | **DM** | **DM** |
| **Conducted Power (dBm)** | 7.4 | 5.1 | 5.7 |
| **Conducted Power (mW)** | 5.5 | 3.2 | 3.7 |

Antenna gain = 10*log(EIRP/Conducted power) dBi

EIRP is calculated from measured field strength by the formulas in KDB 412172 D01 Determining ERP and EIRP v02.

See attached plots

Detachable antenna? ☐ Yes ☒ No

If detachable, is the antenna connector non-standard? ☐ Yes ☐ No

Type of antenna connector: N/A

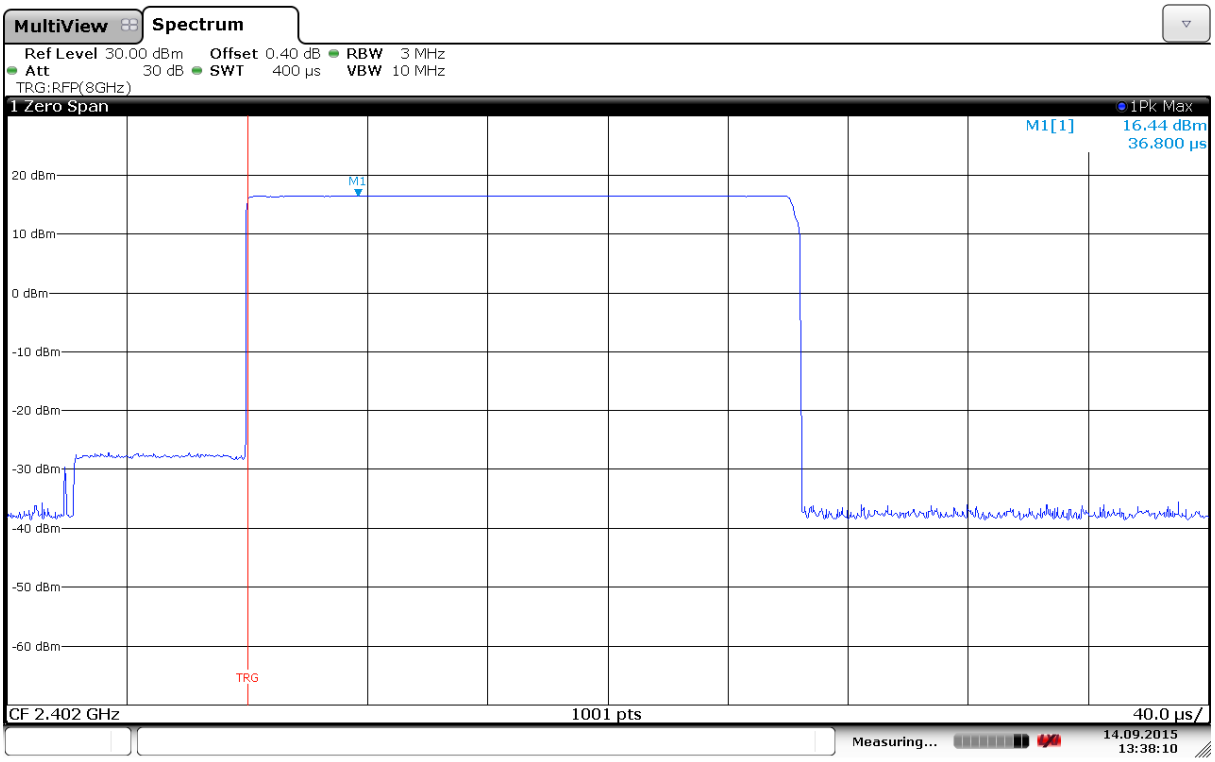
**Requirements:**

The maximum peak output power shall not exceed the following limits:

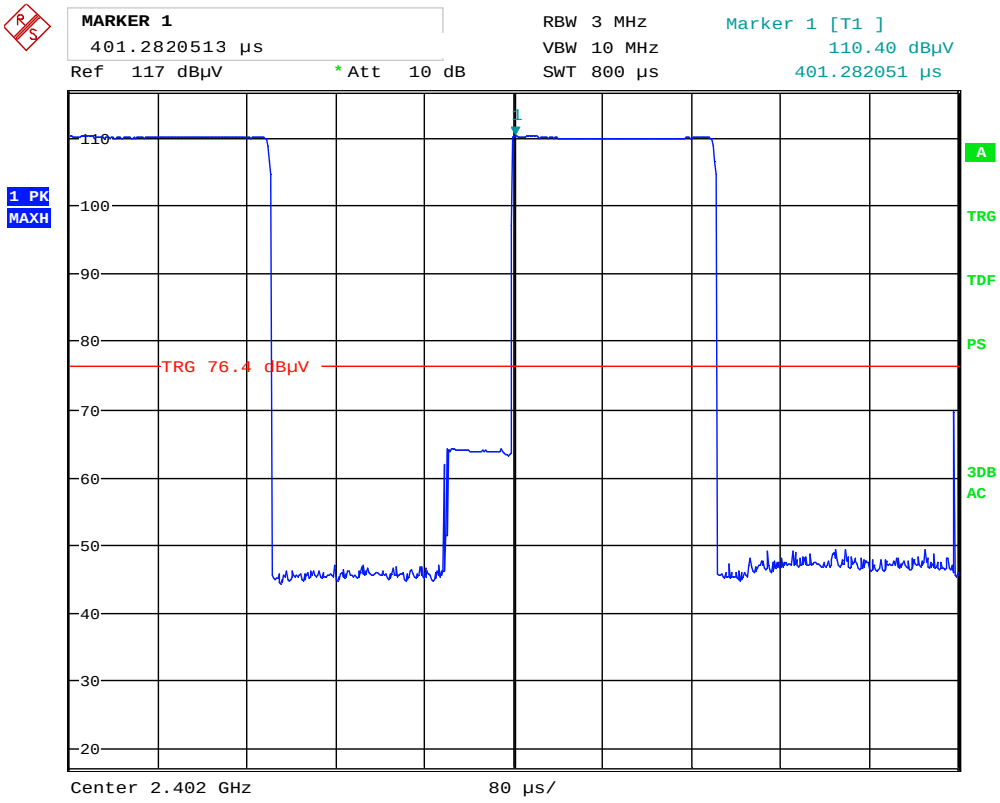
FHSS systems in the 2400 - 2483.5 MHz band with less than 75 channels: 0.125 Watts

Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

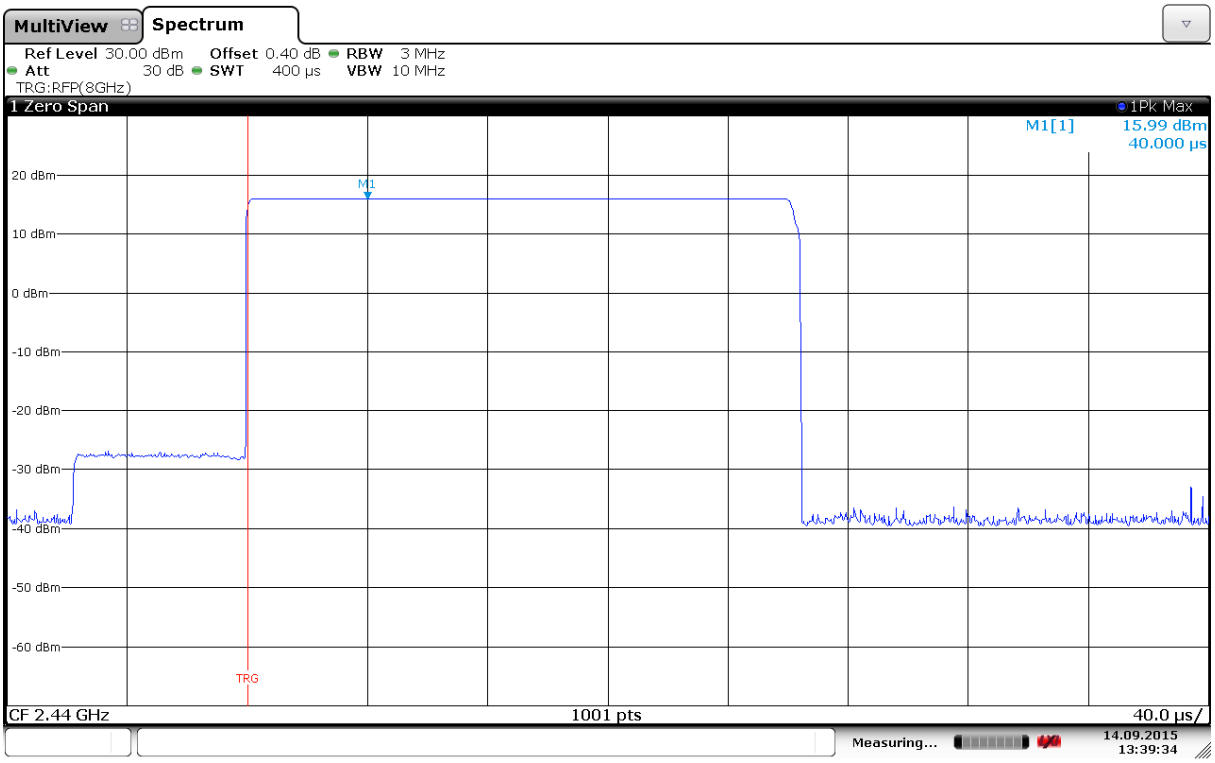



**Conducted Power, 2402 MHz, Hopping**

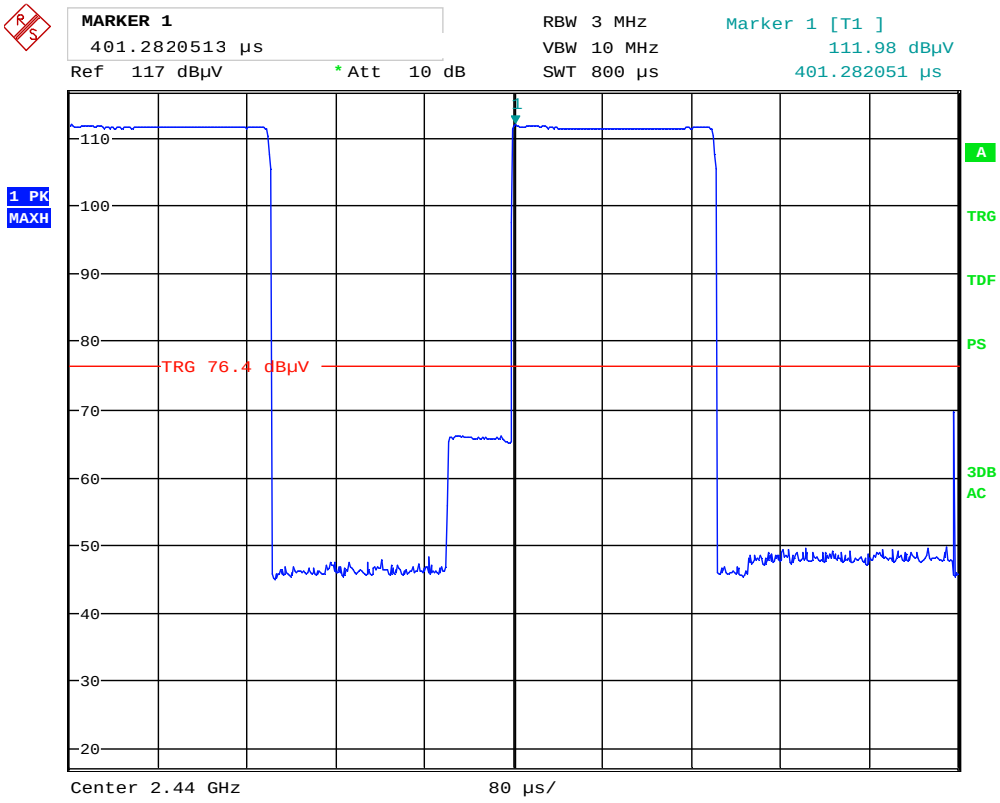



Date: 10.SEP.2015 15:00:50

**Radiated Power, 2402 MHz, Hopping (VP)**

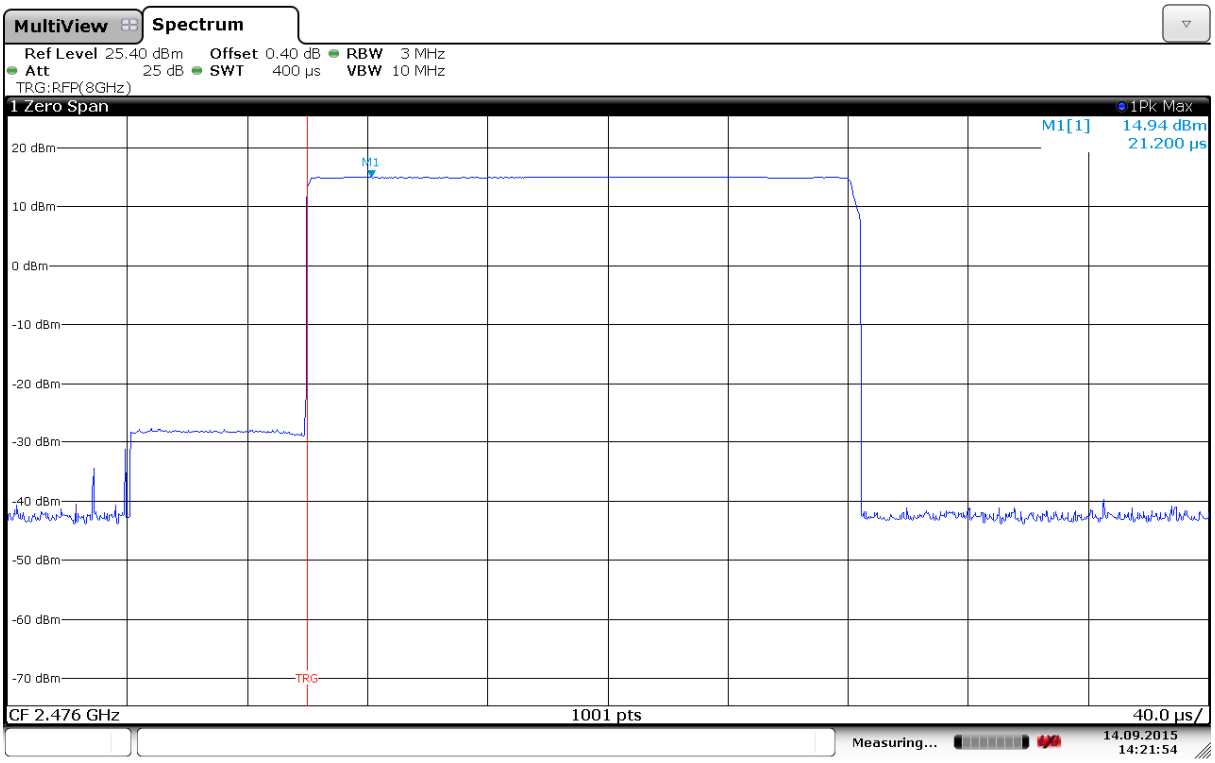



**Conducted Power, 2440 MHz, Hopping**

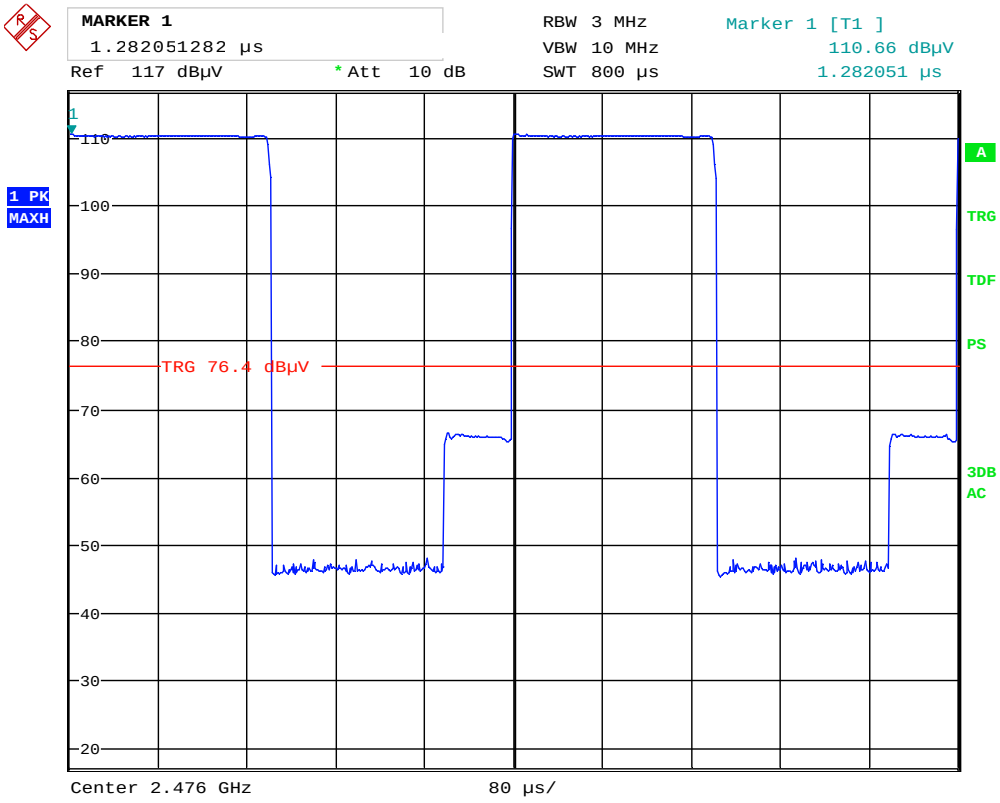



Date: 10.SEP.2015 15:00:29

**Radiated Power, 2440 MHz, Hopping (VP)**

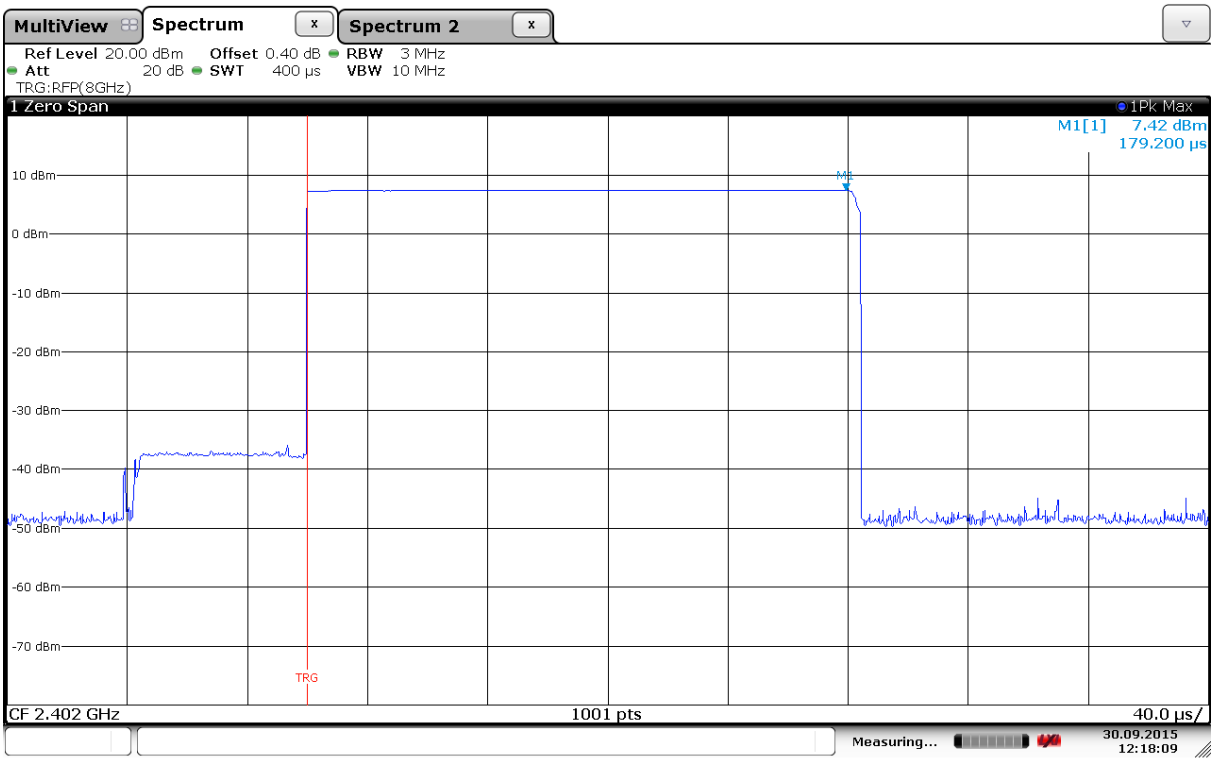



**Conducted Power, 2476, Hopping MHz**

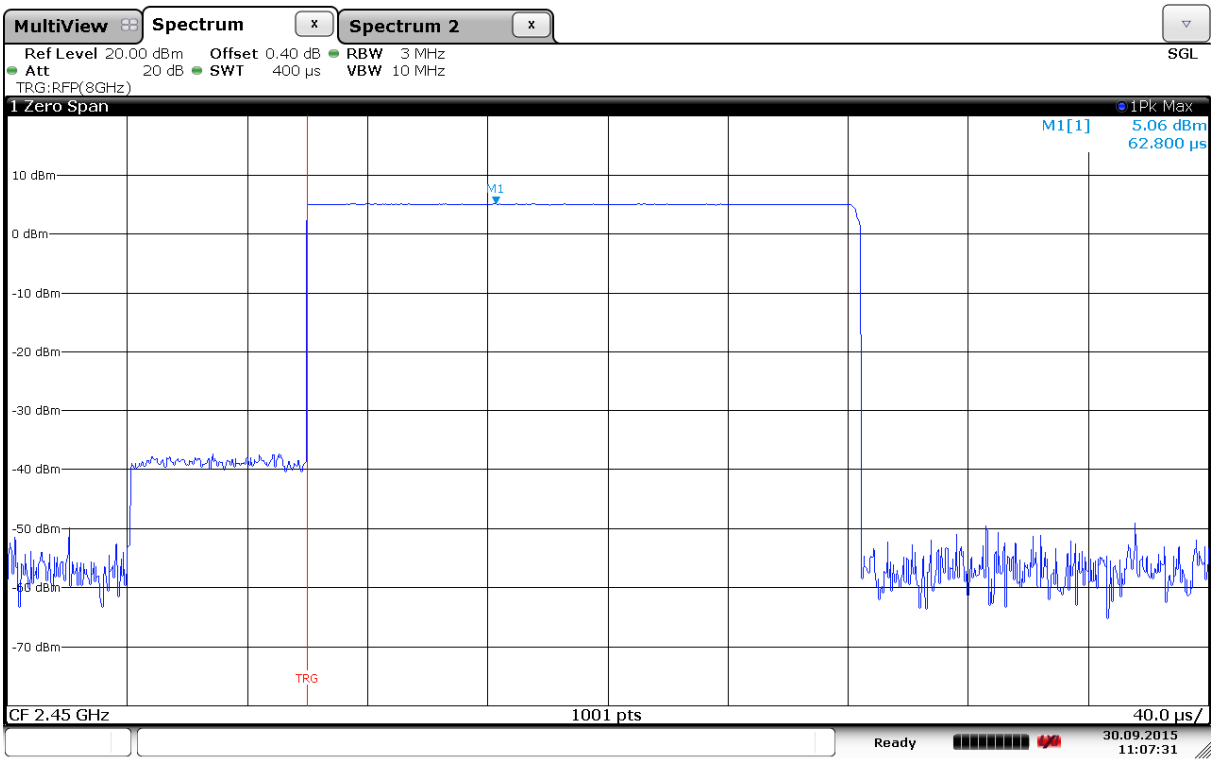



Date: 10.SEP.2015 14:53:24

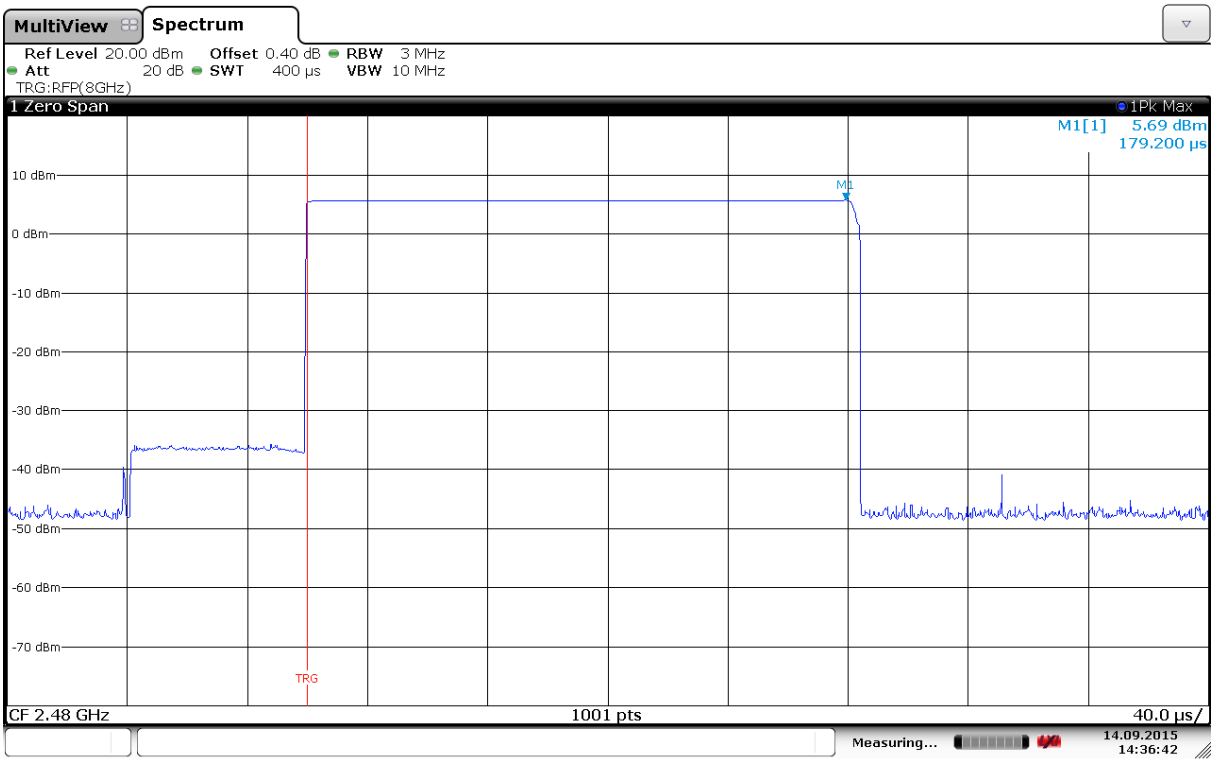
**Radiated Power, 2476 MHz, Hopping (VP)**




**Conducted Power, 2402 MHz, Control Carrier**




**Conducted Power, 2450 MHz, Control Carrier**




**Conducted Power, 2480 MHz, Control Carrier**

## 3.8 Power Spectral Density (PSD)

**Para. No.: 15.247 (d)**

**Test Results: Passed**

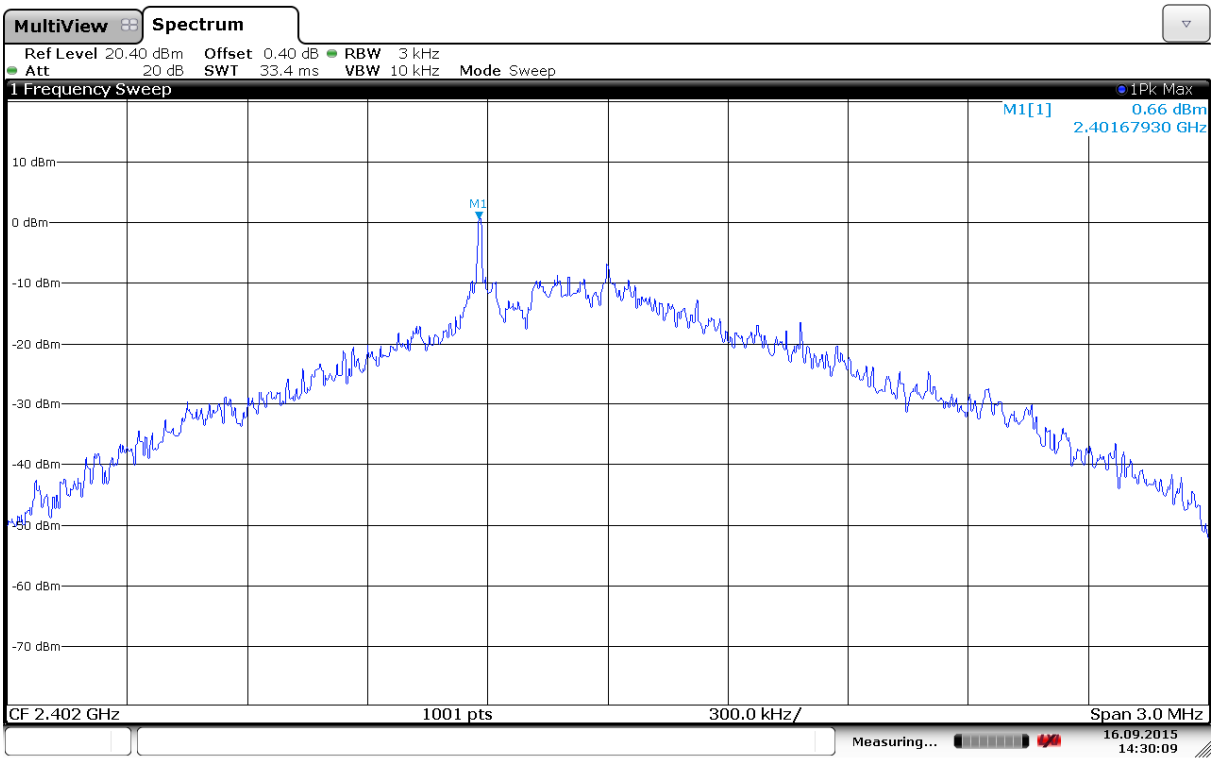
**Measured and Calculated Data:**

The measurement procedures PKPSD described in ANSI C63.10-2013 was used.

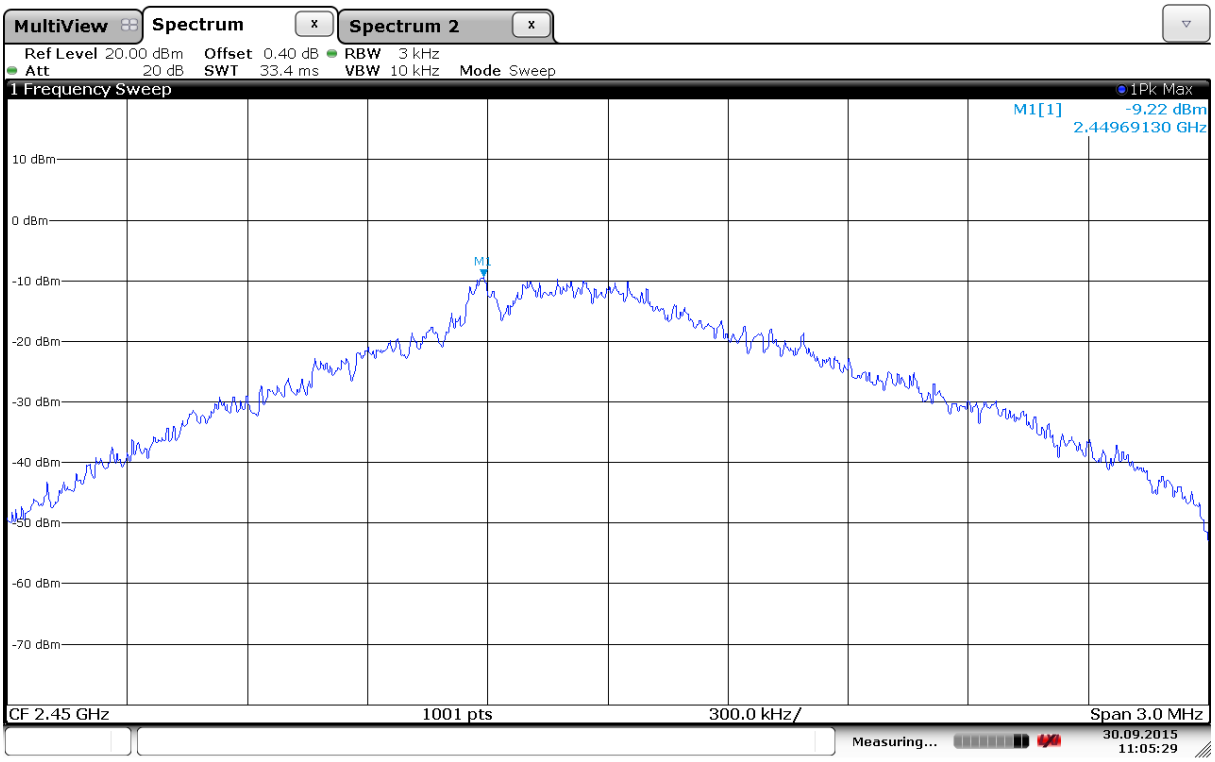
| Carrier Frequency (MHz) | Power Spectral Density (dBm) |
|---|---|
| **2402** | 0.66 |
| **2450** | -9.22 |
| **2480** | -0.93 |

**Requirements:**

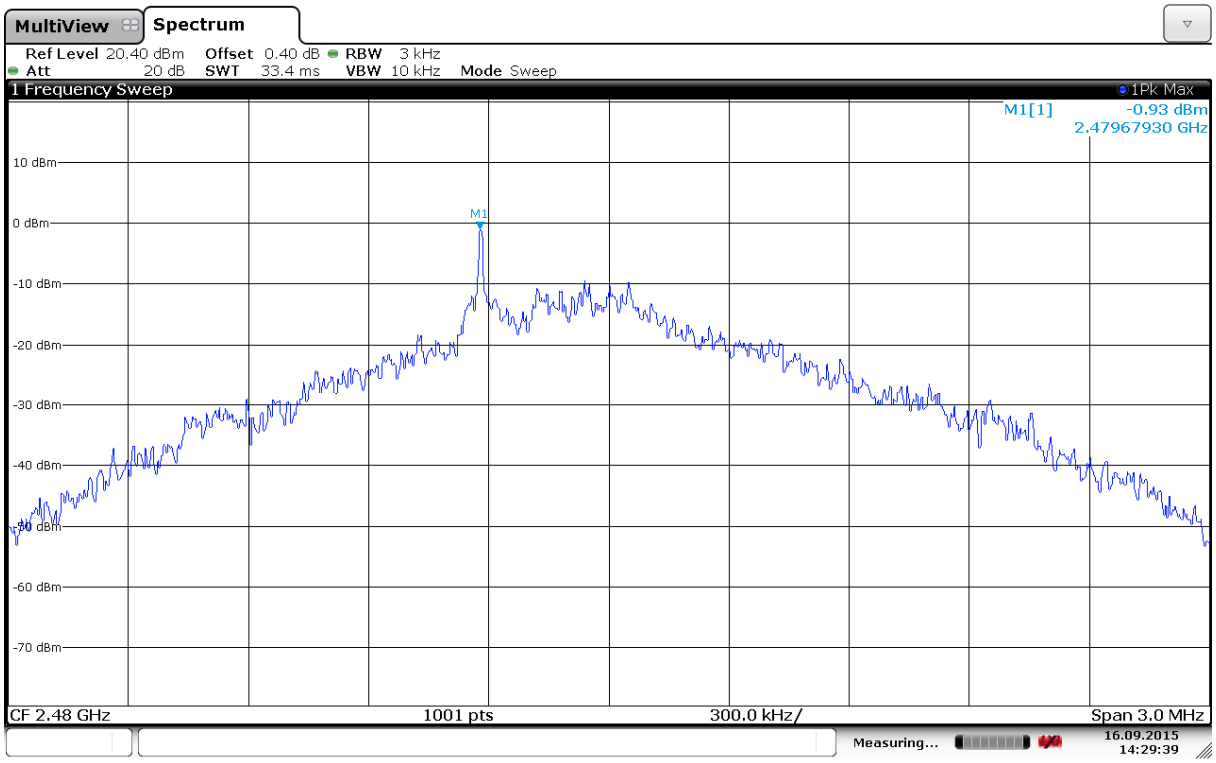
The Power Spectral Density of a Digital Transmission System shall be no greater than +8 dBm in any 3 kHz band




**PSD, 2402 MHz, Control Channel**




**PSD, 2450 MHz, Control Channel**




**PSD, 2480 MHz, Control Channel**

## 3.9 Spurious Emissions (Radiated)

**Para. No.: 15.247 (c)**

**Test Results: Complies**

**Measurement Data:**

**Band-Edge Spurious Emissions, Hopping 2402 – 2476 MHz**

| | Measured field strength (dBµV/m) | | Limit | Margin | |
|---|---|---|---|---|---|
| | 2390 MHz | 2483.5 MHz | dBµV/m | dB | |
| **Peak Detector** | 70.7 | 73.1 | 74 | 3.3 | 0.9 |
| **Average Detector** | 50.7 | 53.1 | 54 | 3.3 | 0.9 |

**Band-Edge Spurious Emissions, Control Carrier 2480 MHz**

| | Measured field strength (dBµV/m) | Limit | Margin |
|---|---|---|---|
| | 2483.5 MHz | dBµV/m | dB |
| **Peak Detector** | 72.8 | 74 | 1.2 |
| **Average Detector** | 52.8 | 54 | 1.2 |

Average Detector values are measured with Peak Detector and corrected for Duty Cycle.

See attatched plots.

**Duty Cycle Correction Factor Calculation, Hopping Channels:**

Duty Cycle = slot length / (frame length * number of hopping channels) = 0.370 / (0.800 * 20) = 0.0231

Duty Cycle Correction factor = -20 * log(0.0231) = 32.7 > 20 dB

***Maximum Duty Cycle Correction Factor according to Para 15.35 (b): 20 dB***

**Duty Cycle Correction Factor Calculation, Control Channels:**

Duty Cycle = slot length / frame length = 0.085 / 3.5 = 0.0243

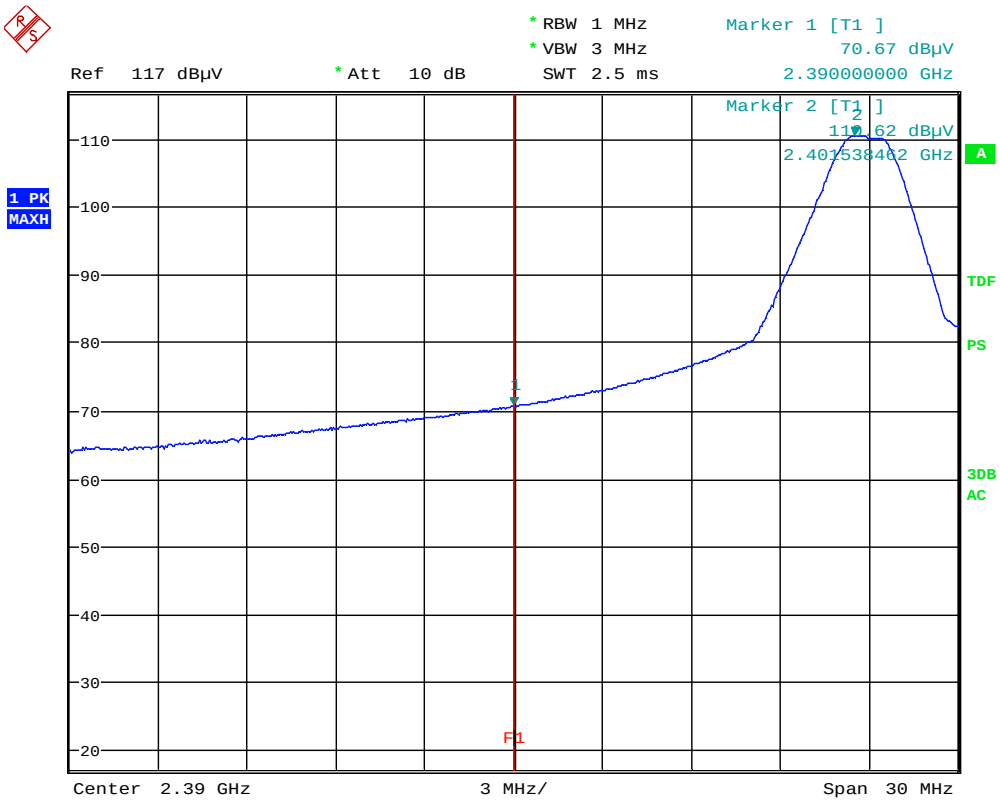
Duty Cycle Correction factor = -20 * log(0.0243) = 30.9 > 20 dB

***Maximum Duty Cycle Correction Factor according to Para 15.35 (b): 20 dB***

**RF conducted power** to 25 GHz see attached plots.

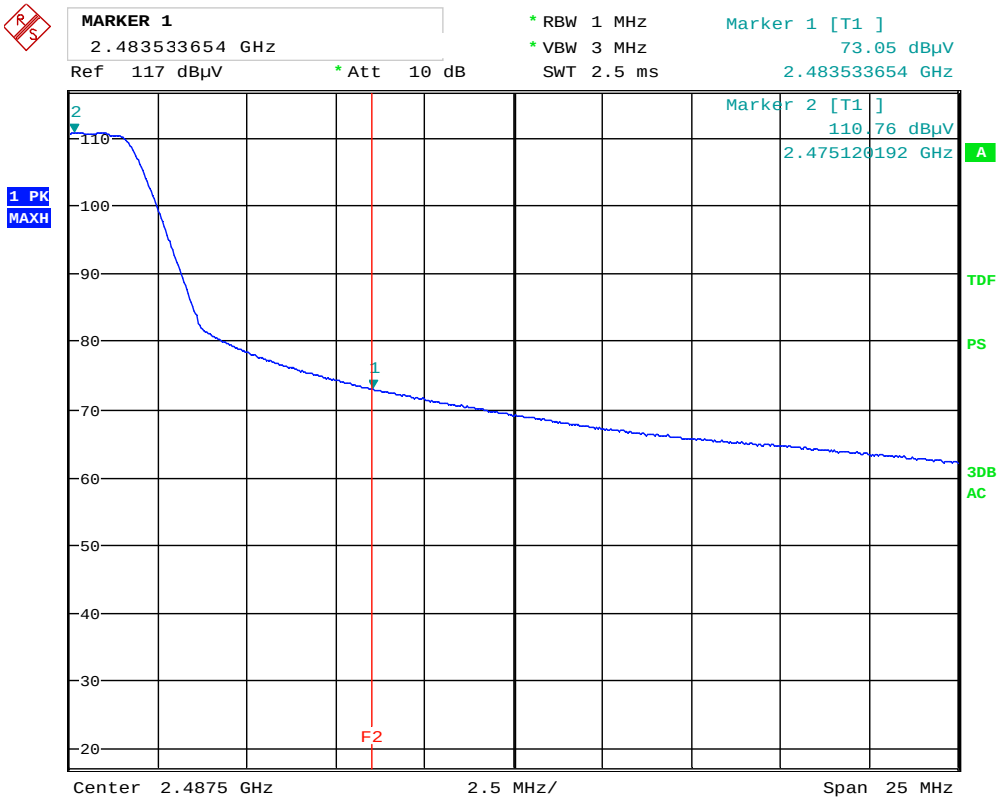
Maximum RF level outside operating band:

Hopping Active : >40 dB/C, margin >40 dB



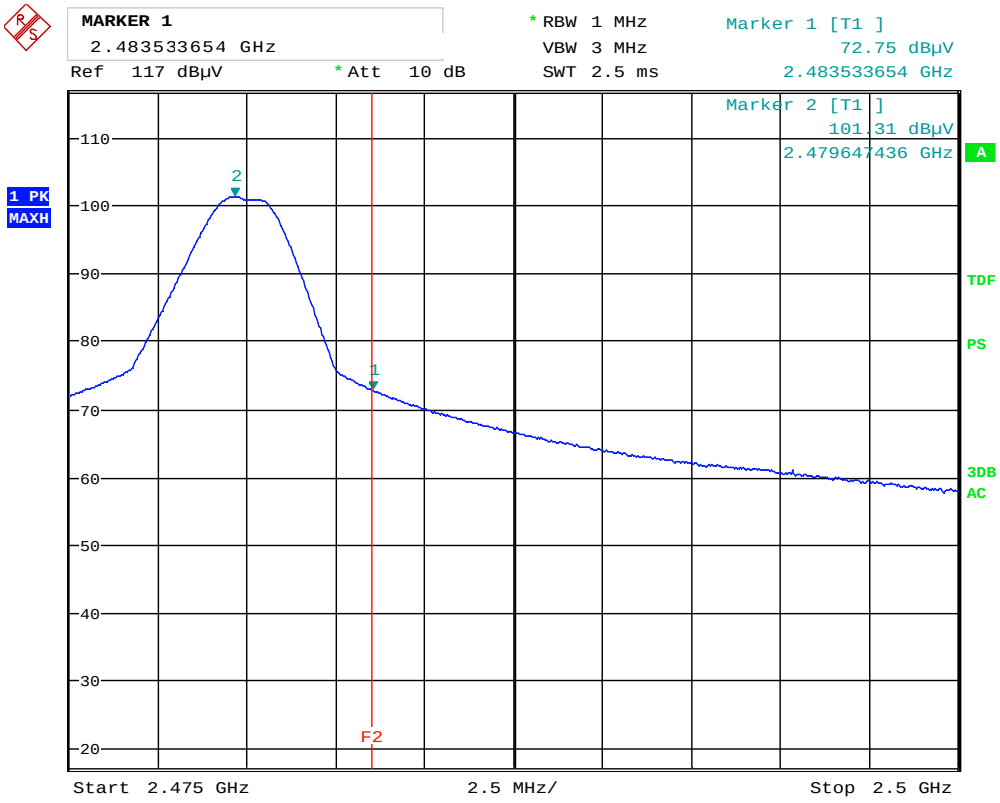

Date: 10.SEP.2015 15:34:26

**Lower Band Edge, Radiated, Hopping**



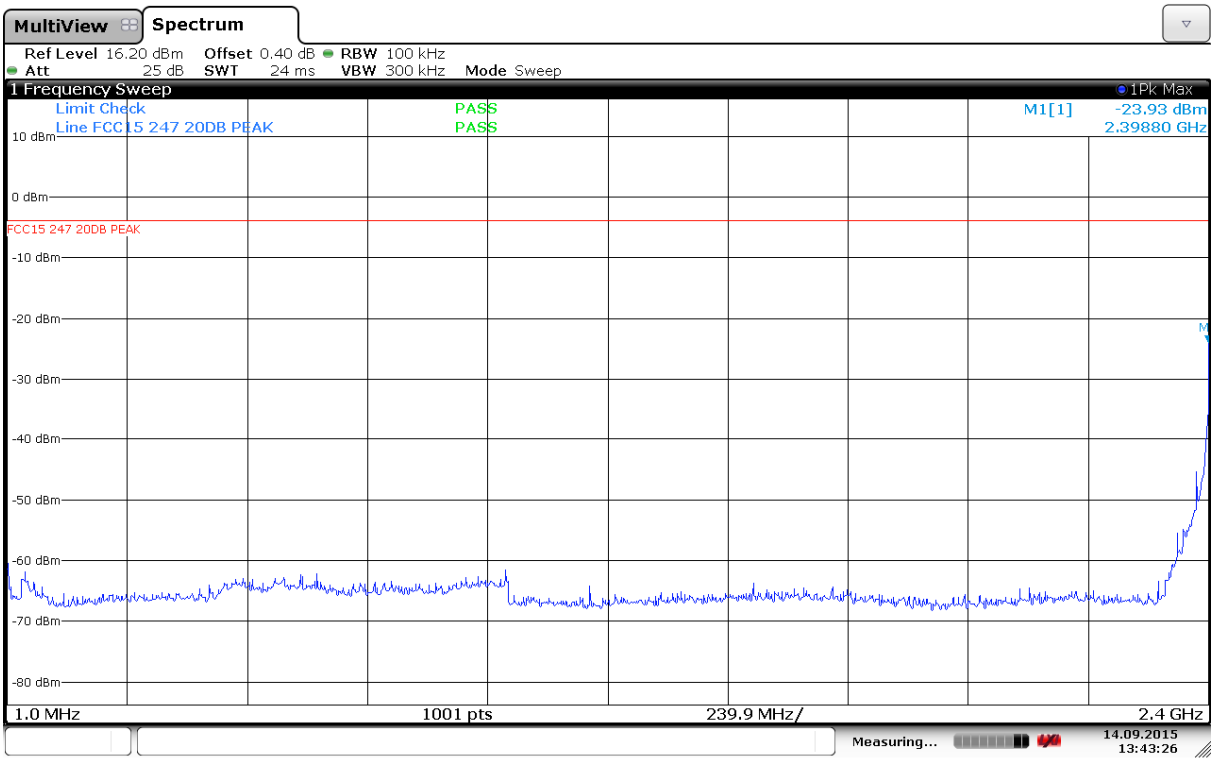

Date: 10.SEP.2015 15:38:27

**Upper Band Edge, Radiated, Hopping (Upper Hopping Freq 2476 MHz)**

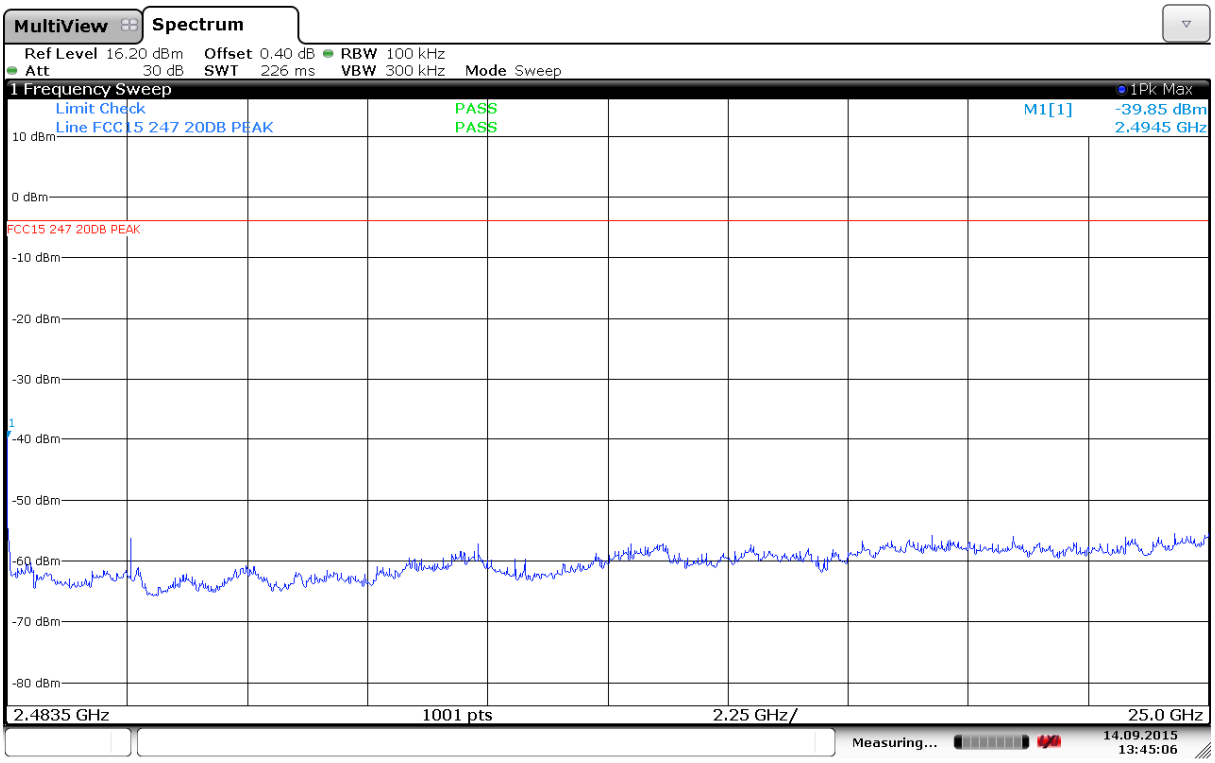



Date: 11.SEP.2015 14:53:15

**Upper Band Edge, Radiated, 2480 MHz (Control Carrier)**




**Conducted Emissions, 1 -2400 MHz, Hopping On**



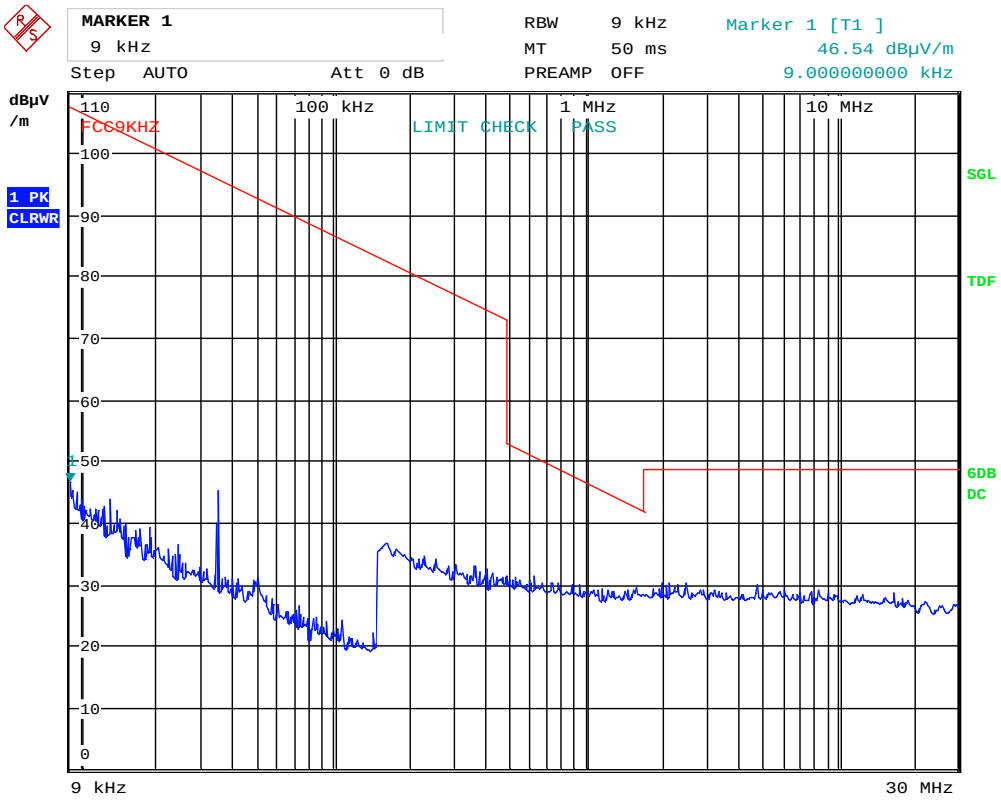

**Conducted Emissions, 2483.5 -25000 MHz, Hopping On**

**Radiated emissions 9 kHz-30 MHz.**

Measuring distance 10 m, measured with Peak detector.

No component detected, see attached plot.

Limit is converted to 10 m using 40 dB/decade according to 15.31 (f) (2).




Date: 11.SEP.2015 16:56:32

**Radiated emission 30 – 1000 MHz.**

Detector: Quasi-Peak

Measuring distance 3m according to FCC 15.209.

Tested in speech mode with active connection.

| Frequency | Operational condition | Polarization | Field strength | Measuring distance | Limit FCC15.209 | Margin |
|---|---|---|---|---|---|---|
| MHz | | | dBµV/m | metres | dBµV/m | dB |
| 37.36 | TX on | VP | 36.3 | 3 | 40 | 3.7 |
| Other freqs | TX on | VP / HP | / | 3 | / | >10 |

Value above is measured with Peak detector.

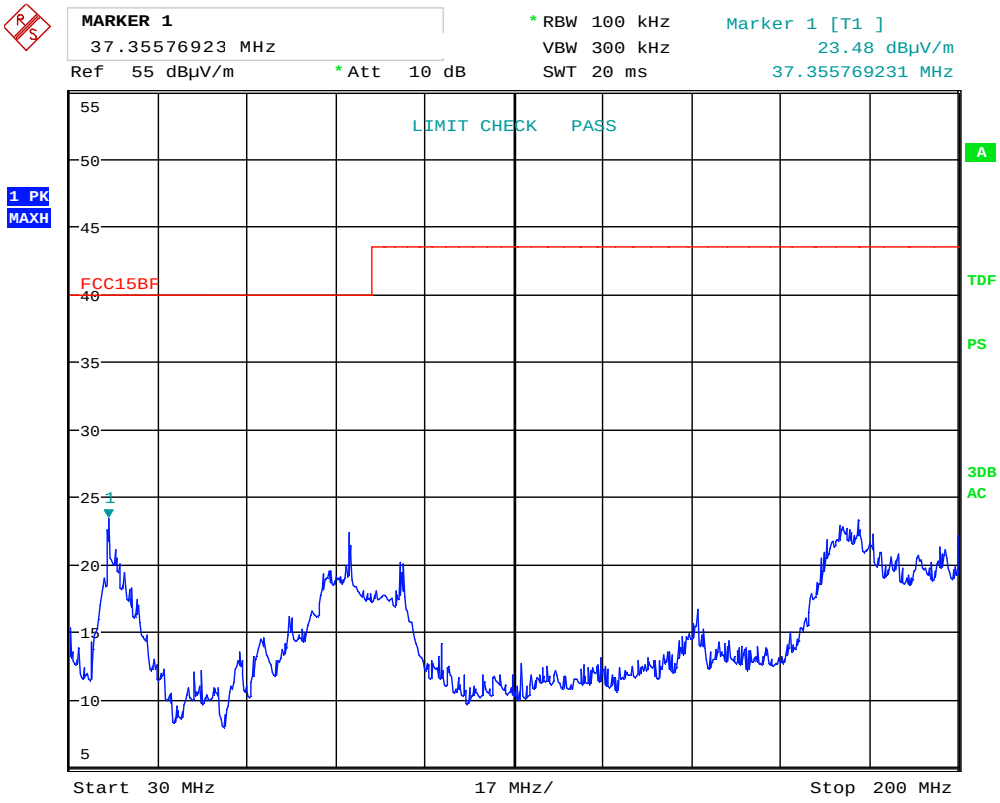
See attached plots.

**Limits:**

| **Spurious Frequency MHz** | **Field Strength dBµV/m @3m** |
|---|---|
| 30-88 | 40 |
| 88-216 | 43.5 |
| 216-960 | 46 |
| Above 960 | 54[1] |

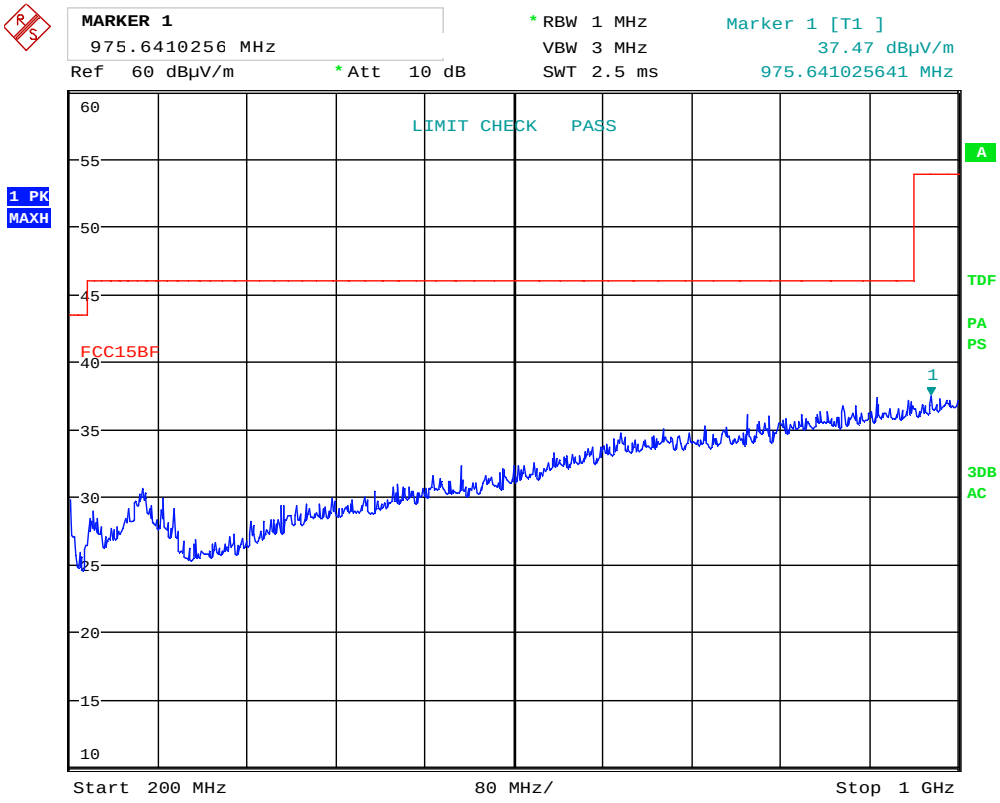

Date: 13.JAN.2016 14:58:12

**Radiated Emissions, 30 -200MHz, Single Power Supply, VP**



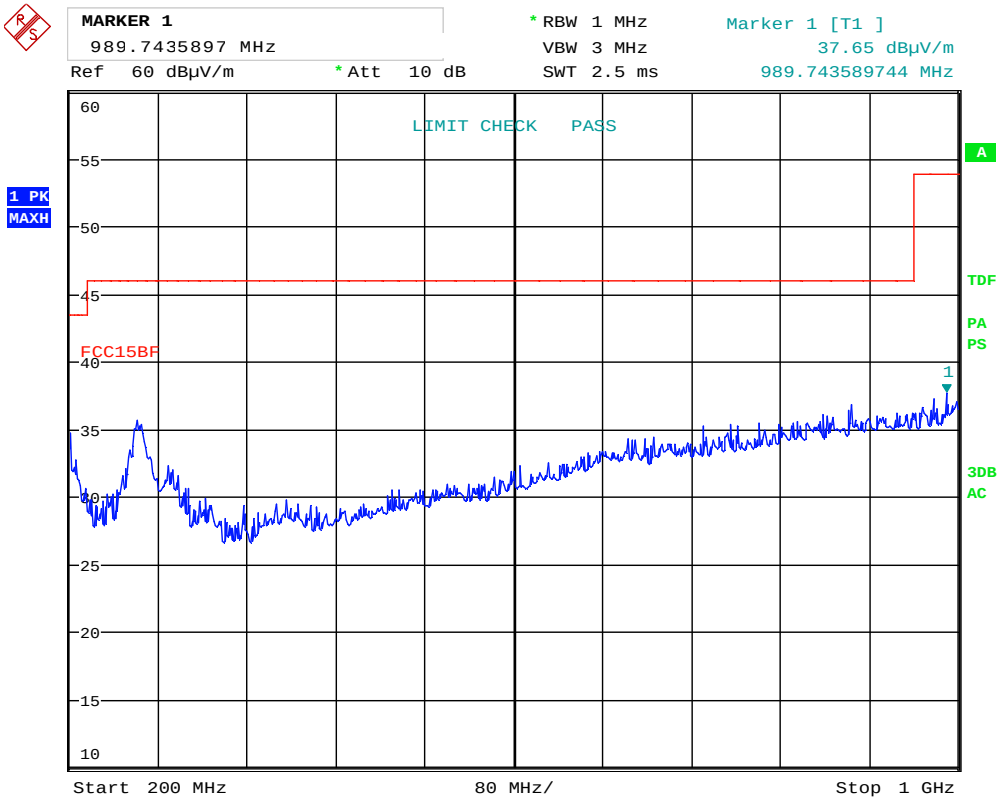

Date: 13.JAN.2016 14:52:40

**Radiated Emissions, 30 -200MHz, Single Power Supply, HP**



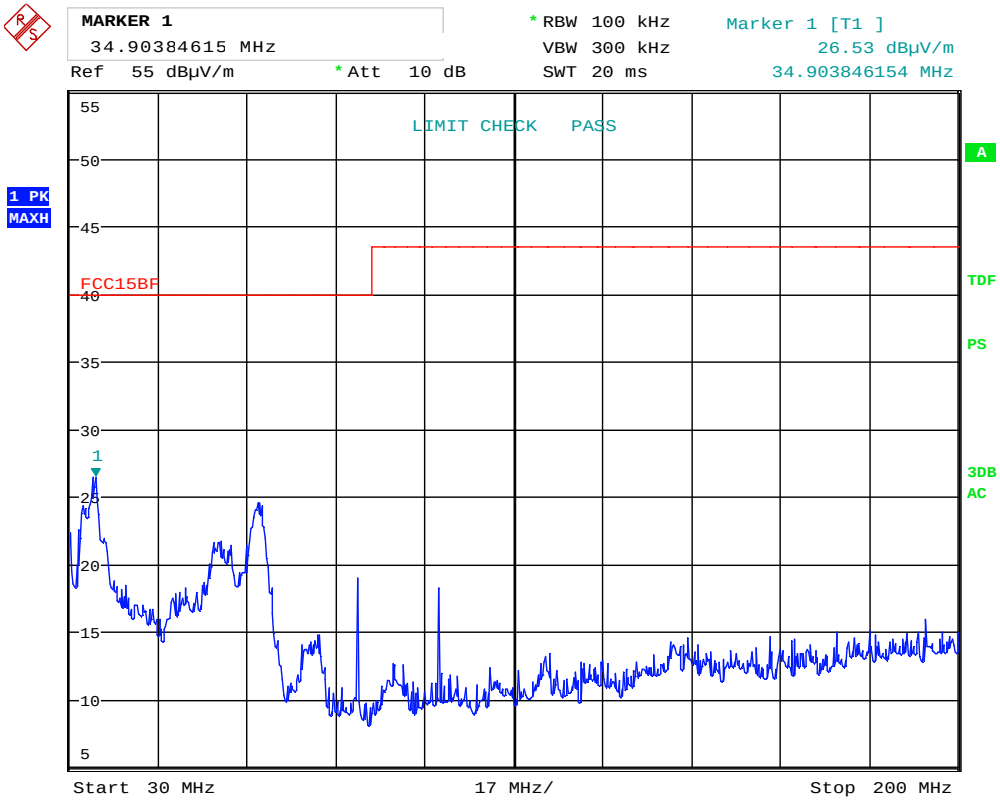

Date: 13.JAN.2016 14:25:45

**Radiated Emissions. 200 -1000MHz, Single Power Supply, VP**



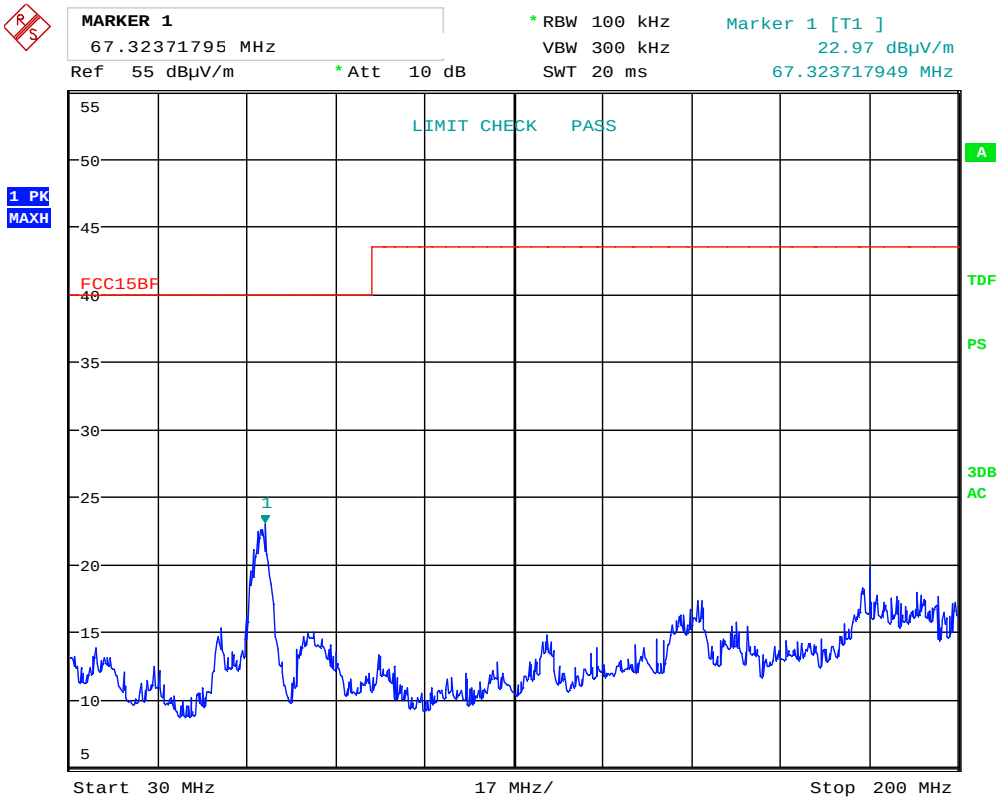

Date: 13.JAN.2016 14:28:53

**Radiated Emissions. 200 -1000MHz, Single Power Supply, HP**



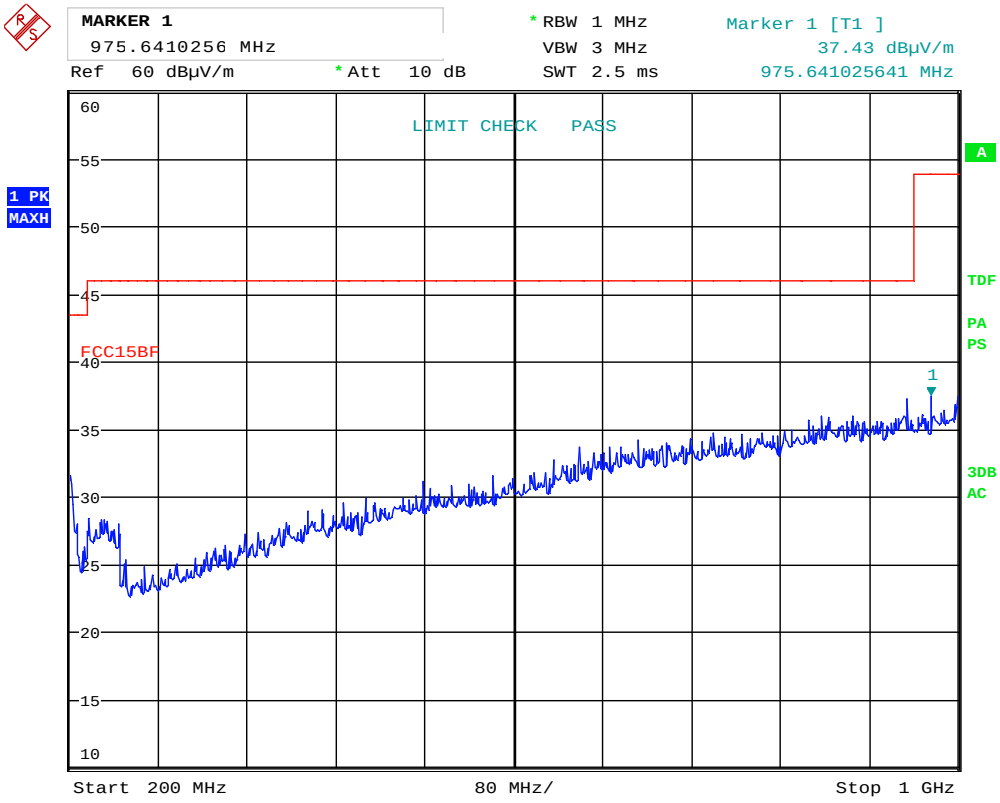

Date: 13.JAN.2016 14:47:46

**Radiated Emissions, 30 -200MHz, Dual Power Supply, VP**



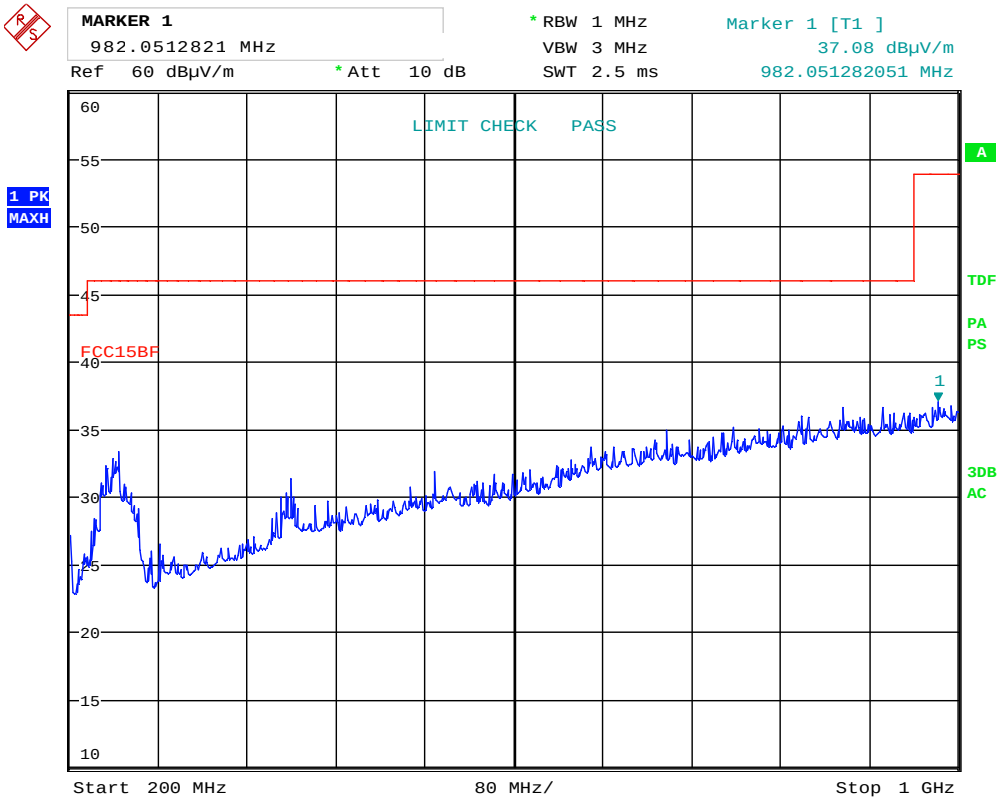

Date: 13.JAN.2016 14:50:31

**Radiated Emissions, 30 -200MHz, Dual Power Supply, HP**




Date: 13.JAN.2016 14:35:18

**Radiated Emissions. 200 -1000MHz, Dual Power Supply, VP**




Date: 13.JAN.2016 14:33:10

**Radiated Emissions. 200 -1000MHz, Dual Power Supply, HP**

**Radiated Emissions, 1 -25 GHz**

Measuring distance: 3m (1 – 8.5 GHz)
1m (5.5 – 25 GHz)
(5.5 to 8.5 GHz was also measured @1m with a standard gain horm antenna)

**Peak Detector:**

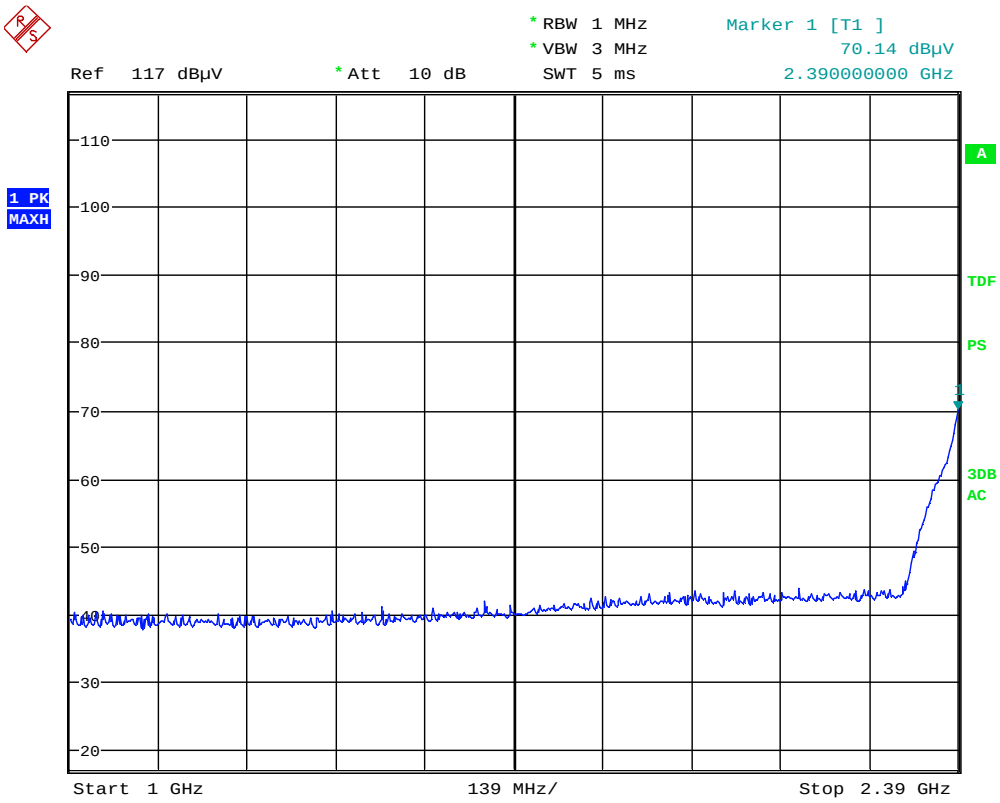
| Frequency | RF channel | Dist. corr. factor | Field strength, Peak Detector | Duty cycle corr. factor | Limit | Margin |
|---|---|---|---|---|---|---|
| GHz | L,M,H | dB | dBµV/m | dB | dBµV/m | dB |
| All freqs | L,M,H | N/A | None detected | 20 | 74 | >20 |

Average Detector values are calculated from Peak values by Duty Cycle Correction Factor.

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer “Transducer factor”.

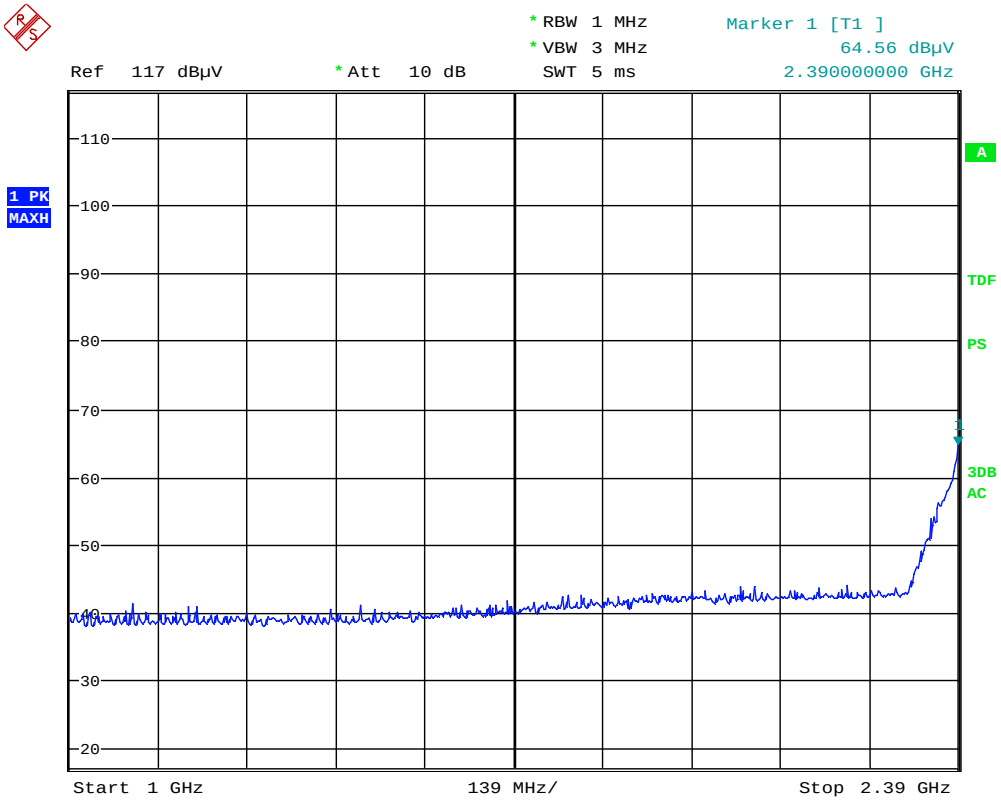
Distance correction factor is included on the plots when the measurement is performed @1m.

See plots.



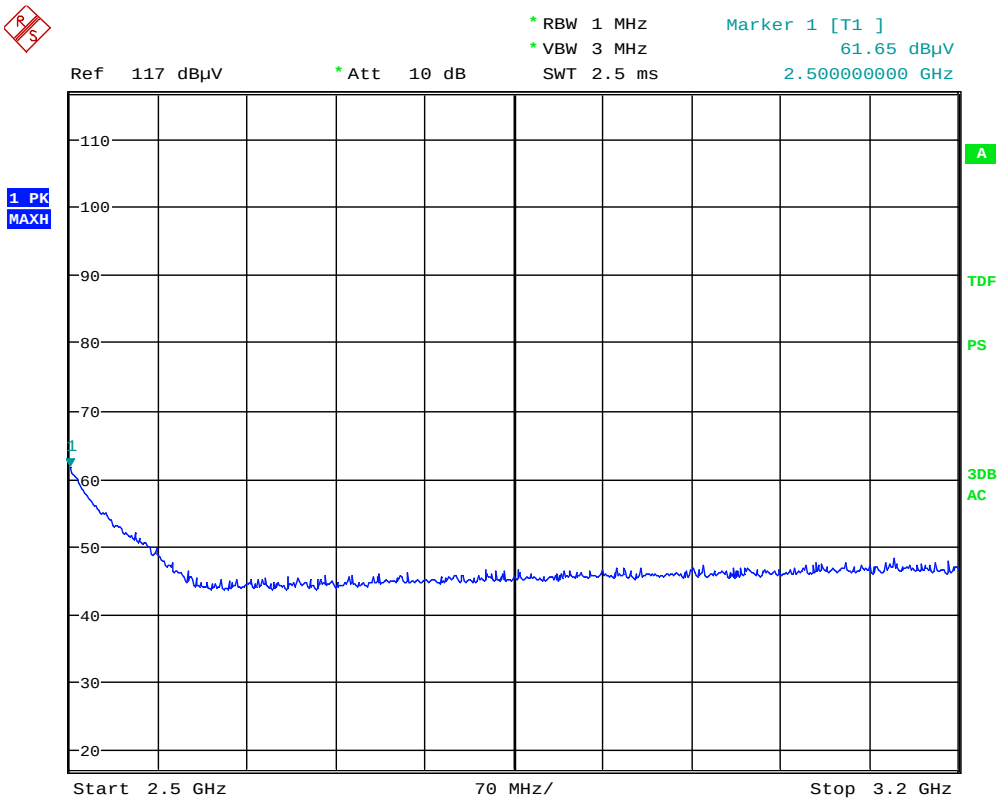

Date: 10.SEP.2015 15:04:19

**Radiated Emissions, 1000 -2390MHz, Hopping On, VP**



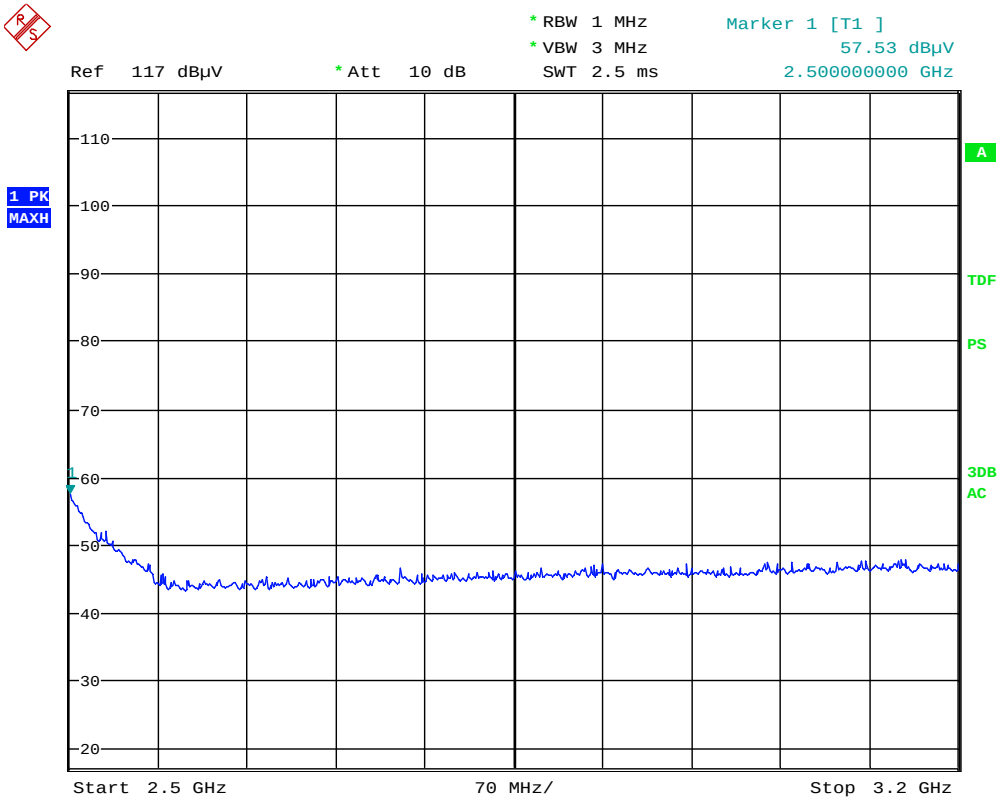

Date: 10.SEP.2015 15:06:10

**Radiated Emissions, 1000 -2390MHz, Hopping On, HP**



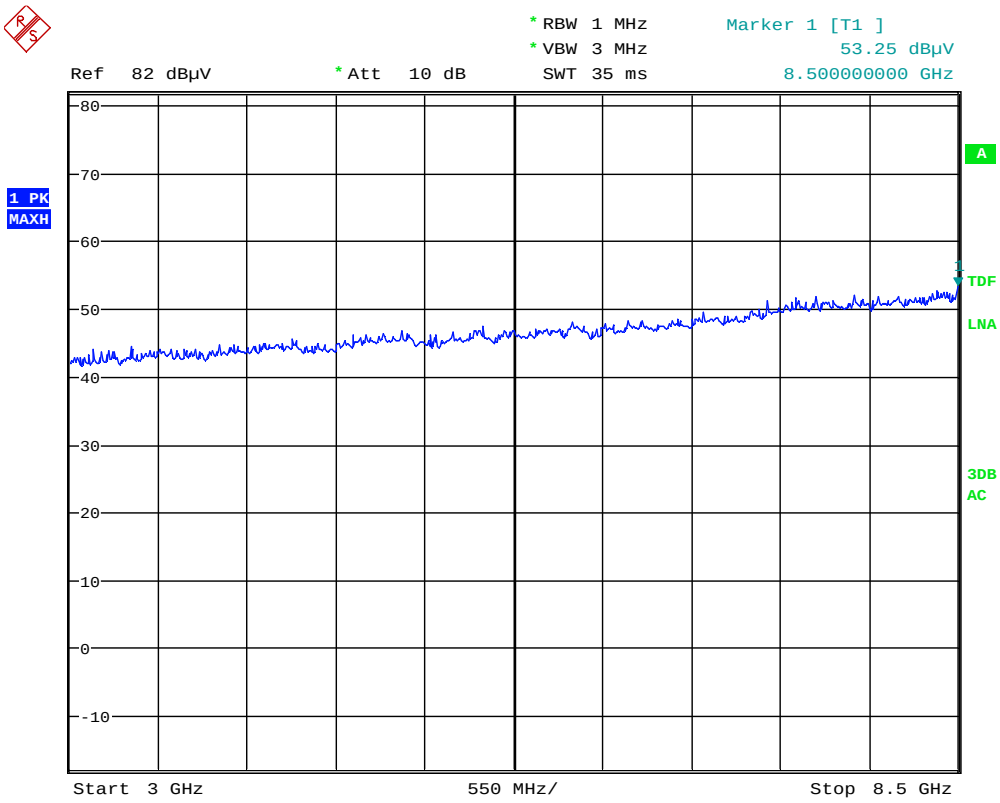

Date: 10.SEP.2015 15:41:40

**Radiated Emissions, 2500 -3200MHz, 2476MHz, VP**



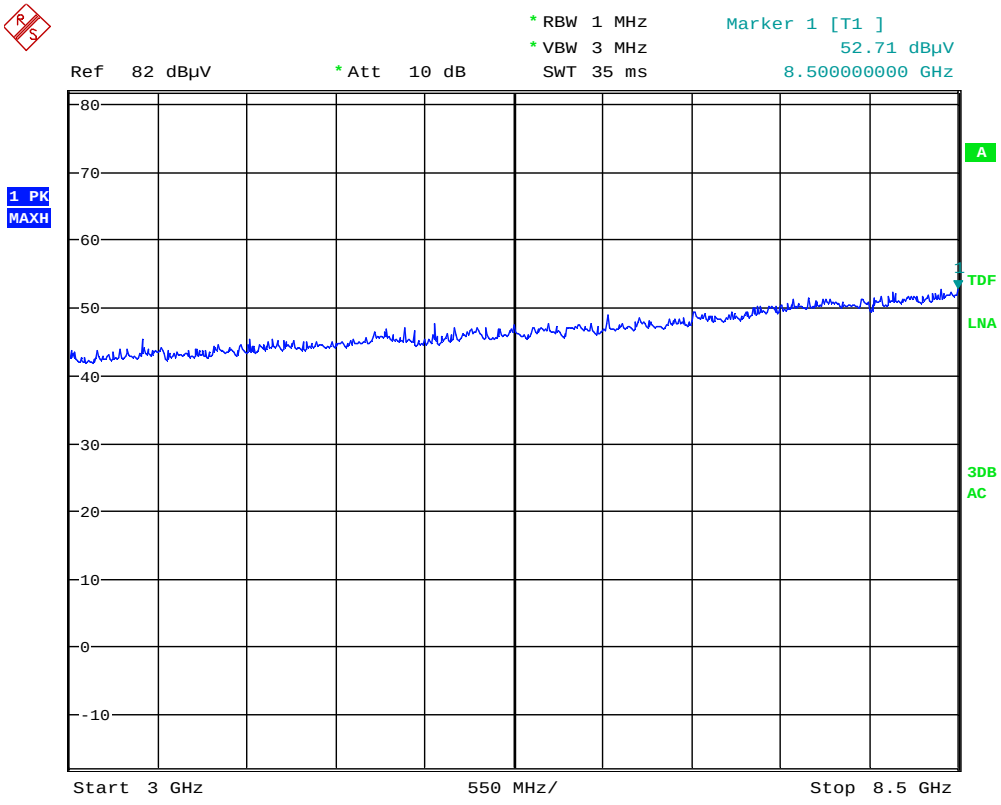

Date: 10.SEP.2015 15:43:34

**Radiated Emissions, 2500 -3200MHz, 2476MHz, HP**



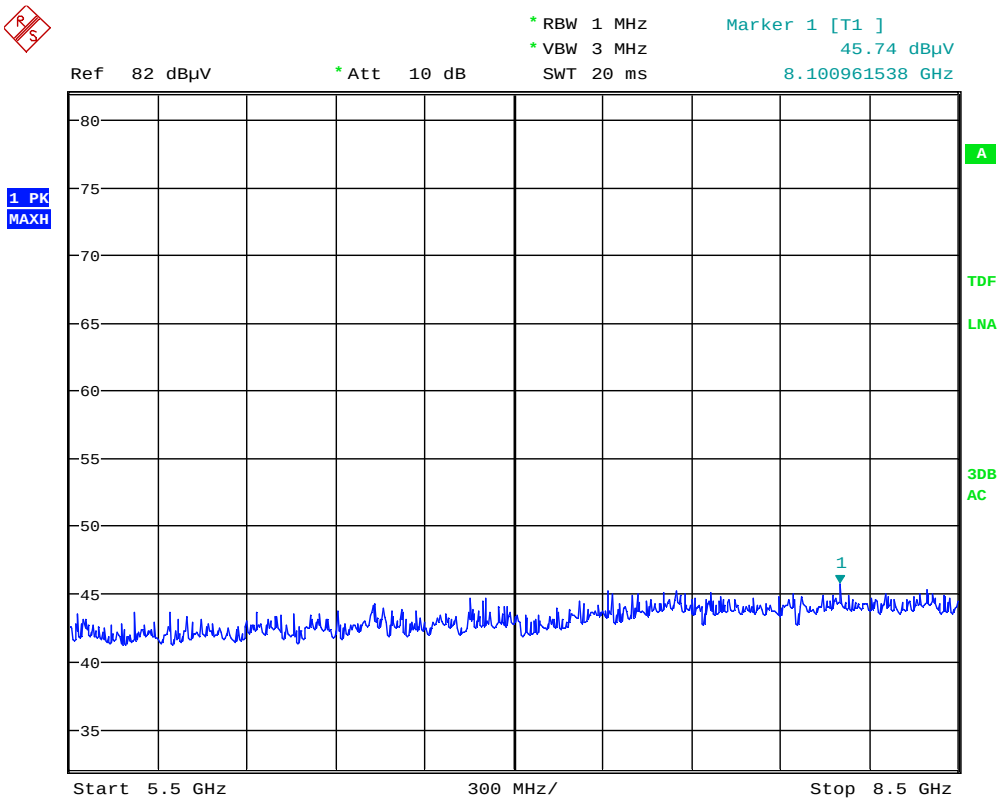

Date: 10.SEP.2015 15:16:41

**Radiated Emissions, 3000 -8500MHz, Hopping, VP**



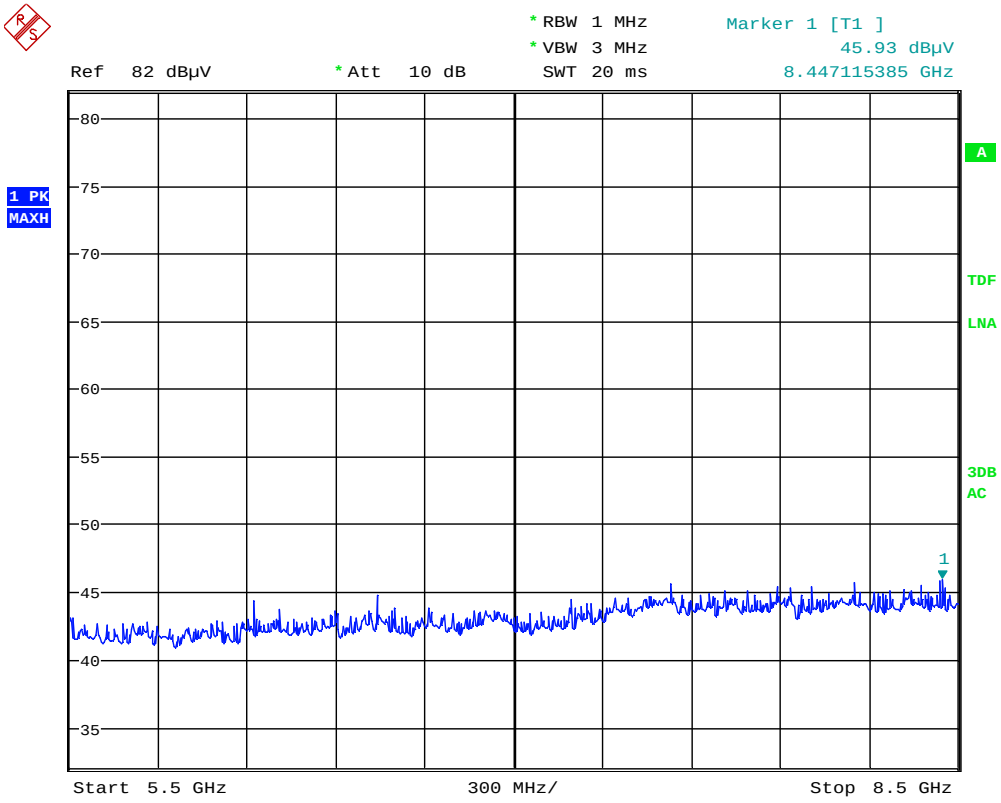

Date: 10.SEP.2015 15:18:34

**Radiated Emissions, 3000 -8500MHz, Hopping, HP**



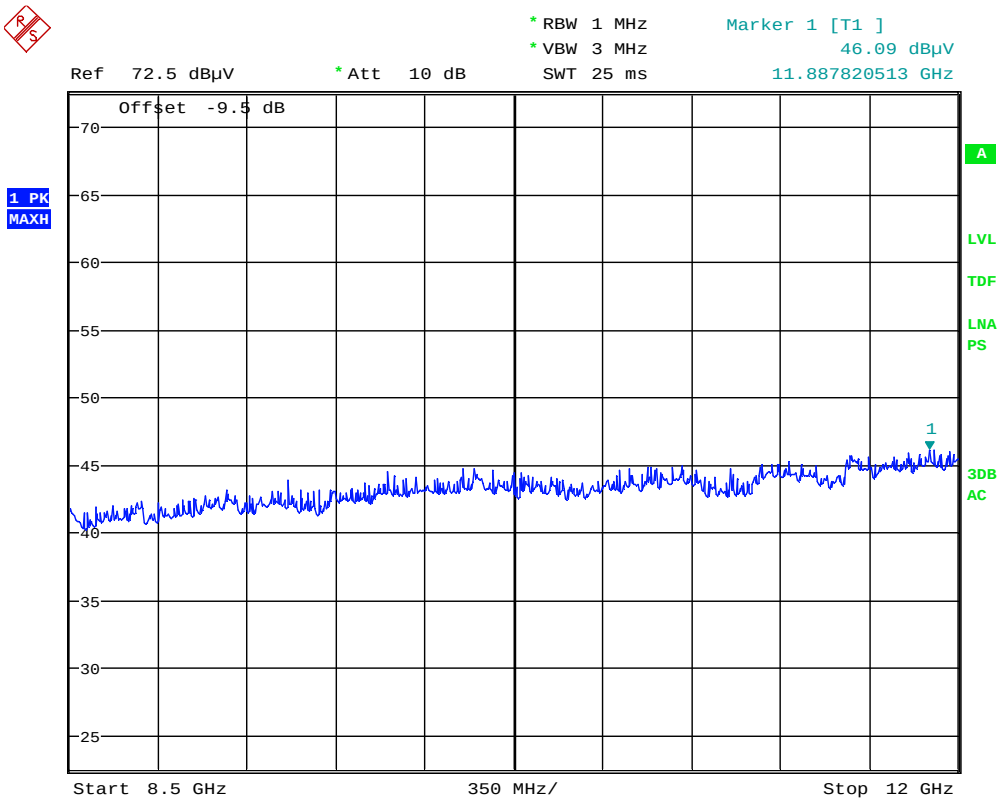

Date: 10.SEP.2015 15:27:00

**Radiated Emissions, 5500 -8500MHz, Hopping, VP, 1m**



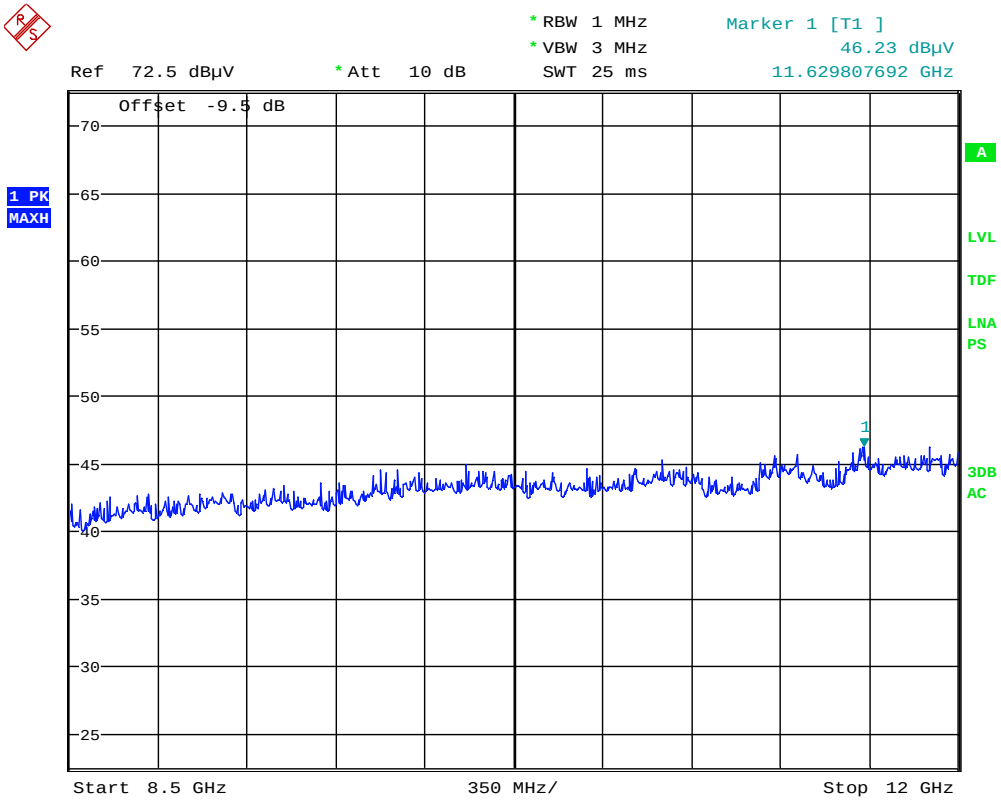

Date: 10.SEP.2015 15:28:51

**Radiated Emissions, 5500 -8500MHz, Hopping, HP, 1m**



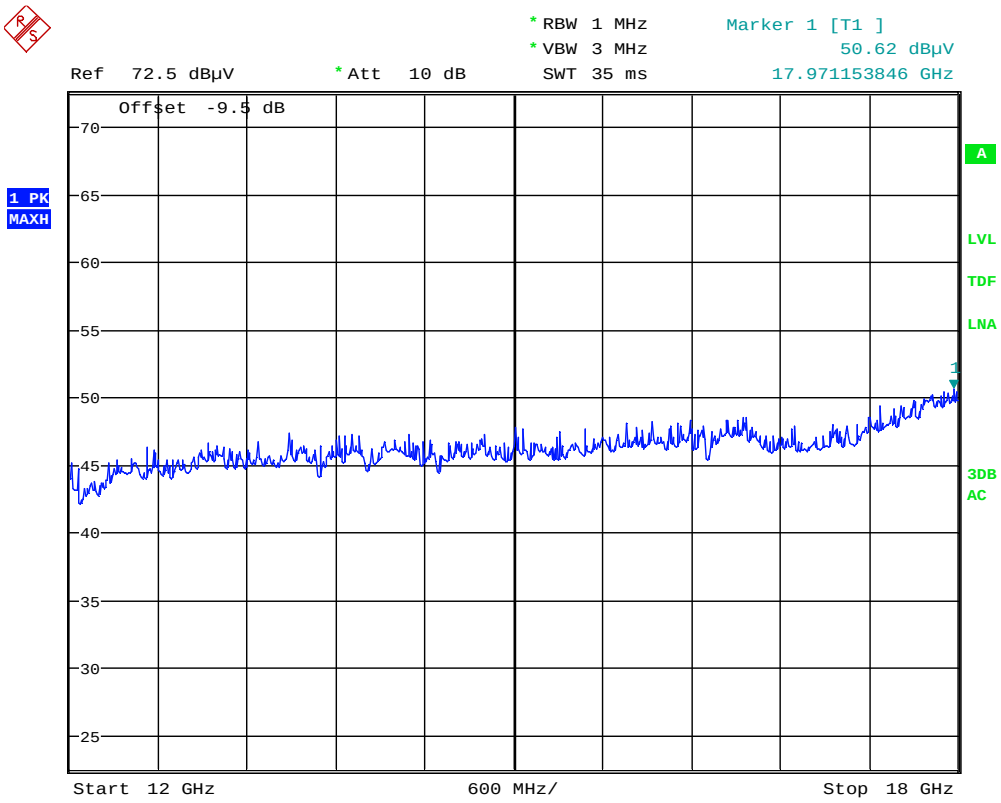

Date: 10.SEP.2015 13:45:07

**Radiated Emissions, 8500 -12000MHz, Hopping, VP, 1m**



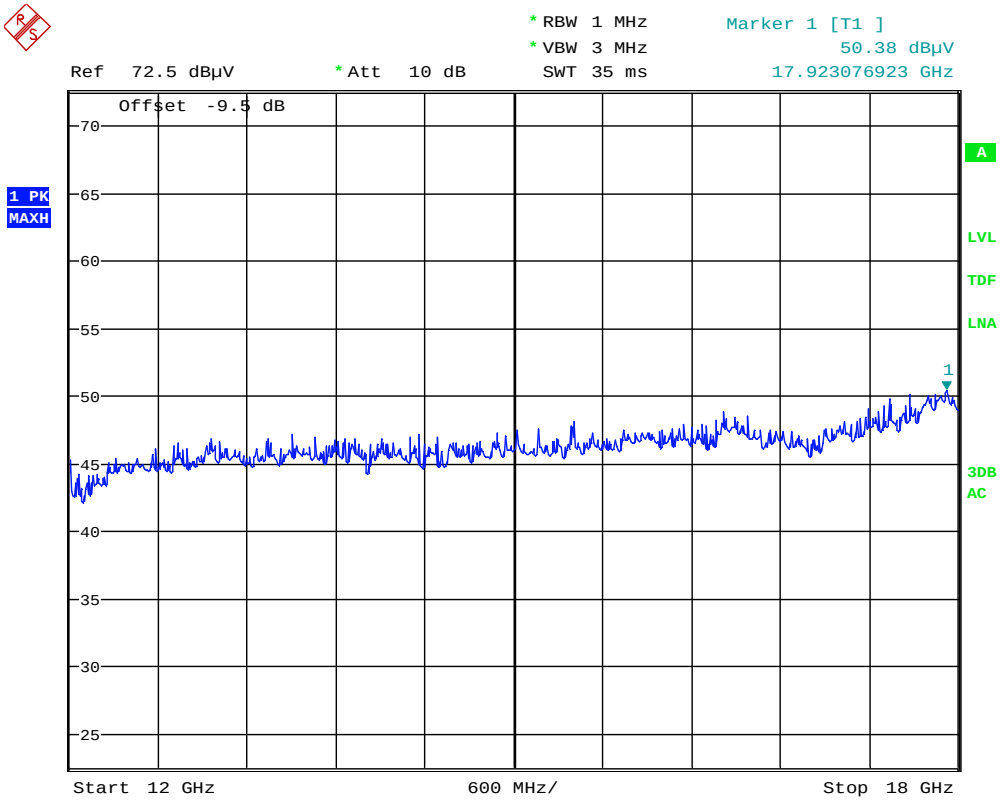

Date: 10.SEP.2015 13:47:00

**Radiated Emissions, 8500 -12000MHz, Hopping, HP, 1m**



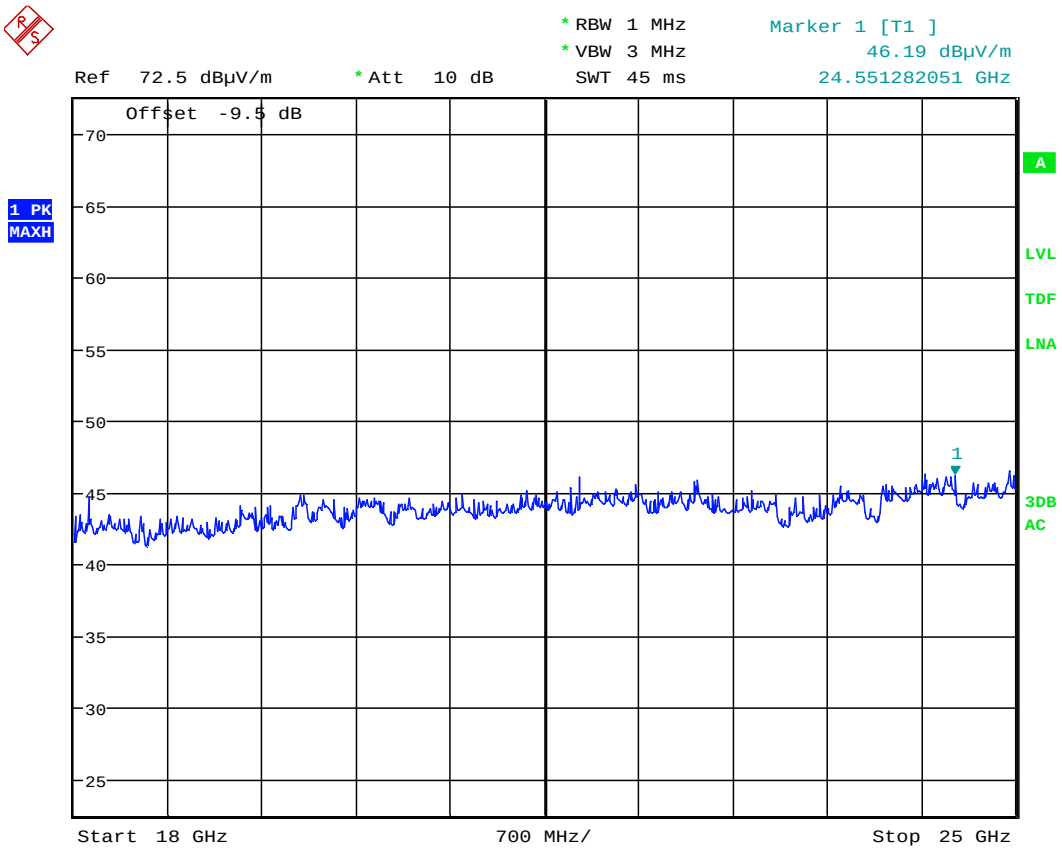

Date: 10.SEP.2015 15:57:47

**Radiated Emissions, 12000 -18000MHz, Hopping, VP, 1m**



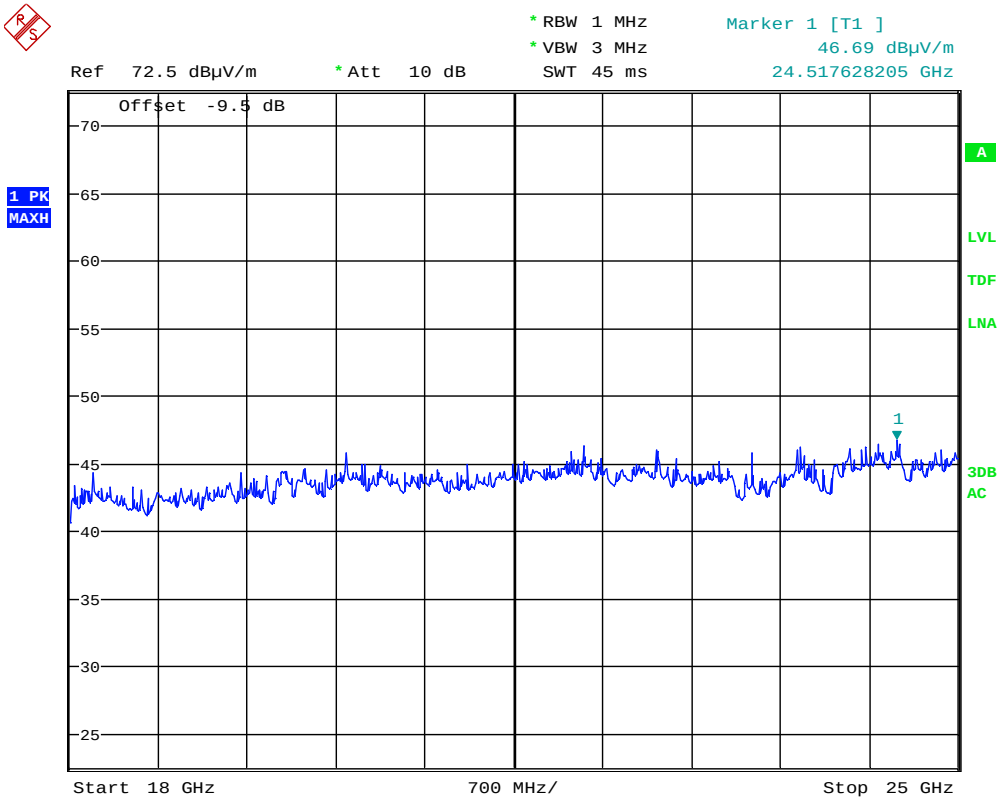

Date: 10.SEP.2015 15:59:40

**Radiated Emissions, 12000 -18000MHz, Hopping, HP, 1m**




Date: 10.SEP.2015 16:28:13

**Radiated Emissions, 18000 -25000MHz, Hopping, VP, 1m**




Date: 10.SEP.2015 16:33:11

**Radiated Emissions, 18000 -25000MHz, Hopping, HP, 1m**

# 4 Measurement Uncertainty

| Measurement Uncertainty Values | | |
|---|---|---|
| **Test Item** | | **Uncertainty** |
| **Output Power** | | ±0.5 dB |
| **Power Spectral Density** | | ±0.5 dB |
| **Out of Band Emissions, Conducted** | **< 3.6 GHz** | ±0.6 dB |
| | **> 3.6 GHz** | ±0.9 dB |
| **Spurious Emissions, Radiated** | **< 1 GHz** | ±2.5 dB |
| | **> 1 GHz** | ±2.2 dB |
| **Emission Bandwidth** | | ±4 % |
| **Power Line Conducted Emissions** | | +2.9 / -4.1 dB |
| **Spectrum Mask Measurements** | **Frequency** | ±5 % |
| | **Amplitude** | ±1.0 dB |
| **Frequency Error** | | ±0.6 ppm |
| **Temperature Uncertainty** | | ±1 °C |

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

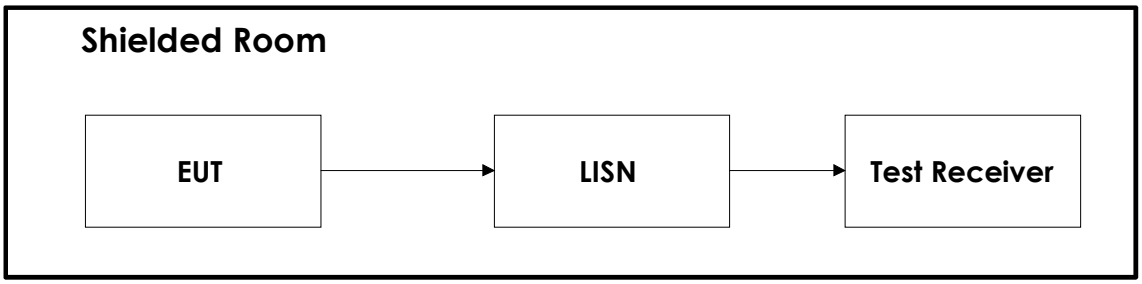
# 5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

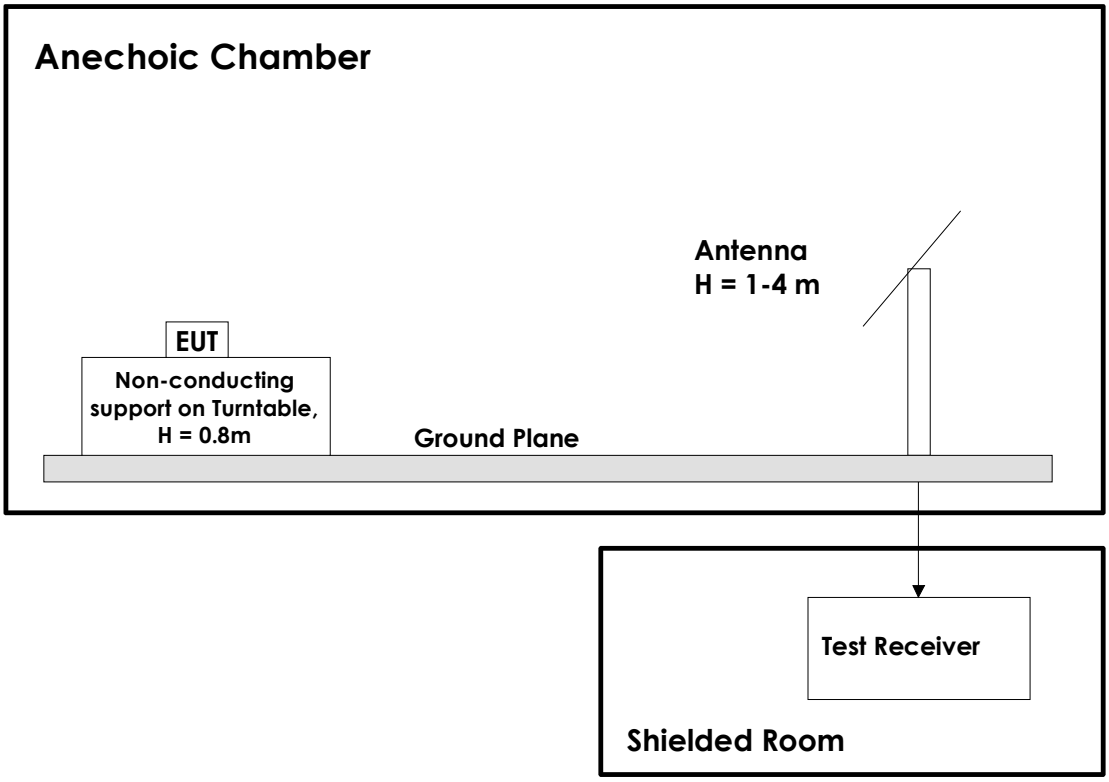
| No. | Model number | Description | Manufacturer | Ref. no. | Cal. date | Cal. Due |
|---|---|---|---|---|---|---|
| 1 | FSW26 | Spectrum Analyzer | Rohde & Schwarz | LR 1640 | 2014.09<br>2015.10 | 2015.09<br>2016.10 |
| 2 | ESU40 | Measuring Receiver | Rohde & Schwarz | LR 1639 | 2014.11<br>2015.11 | 2015.11<br>2016.11 |
| 3 | 6HC3000/18000 | Highpass Filter | Trilithic | LR 1614 | Cal b4 use | |
| 4 | HK116 | Biconical Antenna | Rohde & Schwarz | LR 1260 | 2013.12 | 2017.12 |
| 5 | HL223 | LPDA antenna | Rohde & Schwarz | LR 1261 | 2013.12 | 2017.12 |
| 6 | 3115 | Horn Antenna | EMCO | LR 1226 | 2013.12 | 2018.12 |
| 7 | 8449A | Pre-amplifier | Hewlett Packard | LR 1322 | 2014.11<br>2015.10 | 2015.11<br>2016.10 |
| 8 | 642 | Antenna Horn | Narda | LR 220 | 2009.01.26 | 2017.01.26 |
| 9 | PM7320X | Antenna horn | Siverts lab | LR 103 | 2009.01.26 | 2017.01.26 |
| 10 | DBF-520-20 | Antenna horn | Systron Donner | LR 101 | 2009.01.26 | 2017.01.26 |
| 11 | 638 | Antenna Horn | Narda | LR 1480 | 2010.06 | 2020.06 |
| 12 | HFH2-Z2 | Loop Antenna | Rohde & Schwarz | LR 1660 | 2014.10 | 2016.10 |
| 13 | Model 87V | Multimeter | Fluke | N-4669 | 2015.10 | 2016.10 |
| 14 | ESHS10 | EMI | Rohde & Schwarz | N 3528 | 2015.08 | 2016.08 |
| 15 | ESH3-Z5 | Two-line V-Network | Rohde & Schwarz | LR 1076 | 2014.04.23 | 2016.04.23 |
| 16 | ESH3-Z2 | Pulse limiter | Rohde & Schwarz | LR 1074 | 2015.03.05 | 2017.03.05 |
| 17 | 6812B | AC power Source | Agilent | LR 1515 | 2015.12 | 2016.12 |
| 18 | HP 10855A | Pre-amplifier | Hewlett Packard | LR 1445 | 2015.10 | 2016.10 |
| 19 | 6810.17B | Attenuator | Suhner | LR 1669 | Cal b4 use | |

# 6 BLOCK DIAGRAM

## 6.1 Power Line Conducted Emission




## 6.2 Test Site Radiated Emission



## Revision history

| Version | Date | Comment | Sign |
|---|---|---|---|
| 1.0 | 2016.01.26 | First Edition | FS |
| 2.0 | 2016.03.04 | Addd duty cycle for control channels | FS |