

# Test Report

|                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product</b>                                                                                                                                                                                                                                                                                                                                                                                                             | Digital Video Conference System with WLAN and BT                                                                                                                                                                                                                                                                                                                                                |
| <b>Name and address of the applicant</b>                                                                                                                                                                                                                                                                                                                                                                                   | Cisco Systems, Inc.<br>170 West Tasman Drive<br>San Jose, CA 95134, USA                                                                                                                                                                                                                                                                                                                         |
| <b>Name and address of the manufacturer</b>                                                                                                                                                                                                                                                                                                                                                                                | Cisco Systems, Inc.<br>170 West Tasman Drive<br>San Jose, CA 95134, USA                                                                                                                                                                                                                                                                                                                         |
| <b>Model</b>                                                                                                                                                                                                                                                                                                                                                                                                               | TTC60-21                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Rating</b>                                                                                                                                                                                                                                                                                                                                                                                                              | Mains (100-240V 50/60 Hz, 1.8A – 0.8A)                                                                                                                                                                                                                                                                                                                                                          |
| <b>Trademark</b>                                                                                                                                                                                                                                                                                                                                                                                                           | Cisco                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Serial number</b>                                                                                                                                                                                                                                                                                                                                                                                                       | /                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Additional information</b>                                                                                                                                                                                                                                                                                                                                                                                              | Bluetooth, 802.11a/b/g/n/ac                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Tested according to</b>                                                                                                                                                                                                                                                                                                                                                                                                 | <b>FCC Part 15.247</b><br>Frequency Hopping Transmitters / Digital Transmission Systems<br><b>Industry Canada RSS-247, Issue 2</b><br>Low Power Licence-Exempt Radiocommunications Devices                                                                                                                                                                                                      |
| <b>Order number</b>                                                                                                                                                                                                                                                                                                                                                                                                        | 312072                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Tested in period</b>                                                                                                                                                                                                                                                                                                                                                                                                    | 2017.03.01 to 2017.03.06 and 2017.03.20                                                                                                                                                                                                                                                                                                                                                         |
| <b>Issue date</b>                                                                                                                                                                                                                                                                                                                                                                                                          | 2017.04.26                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Name and address of the testing laboratory</b>                                                                                                                                                                                                                                                                                                                                                                          |  <div style="display: inline-block; vertical-align: top; margin-left: 20px;"> FCC No: 994405<br/> IC OATS: 2040D-1<br/><br/> TEL: +47 22 96 03 30<br/> FAX: +47 22 96 05 50 </div> <div style="display: inline-block; vertical-align: top; margin-left: 20px;"> Instituttveien 6<br/> Kjeller, Norway </div> |
| <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <br/> Prepared by [Frode Sveinsen] </div> <div style="text-align: center;"> <br/> Approved by [G. Suhanthakumar] </div> </div> |                                                                                                                                                                                                                                                                                                                                                                                                 |
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## 1 INFORMATION

### 1.1 Test Item

|                                           |                                                       |
|-------------------------------------------|-------------------------------------------------------|
| <b>Name :</b>                             | Cisco                                                 |
| <b>Model/version :</b>                    | TTC60-21                                              |
| <b>FCC ID :</b>                           | LDK60211476                                           |
| <b>Industry Canada ID :</b>               | 2461N-60211476                                        |
| <b>Serial number :</b>                    | /                                                     |
| <b>Hardware identity and/or version:</b>  | Rev. D                                                |
| <b>Software identity and/or version :</b> | S01828-1.1.0 574512d, CE9.1.x                         |
| <b>Frequency Range :</b>                  | 2402 – 2480 MHz                                       |
| <b>Number of Channels :</b>               | Bluetooth Low energy: 39<br>Bluetooth: 79             |
| <b>Operating Modes :</b>                  | Bluetooth and Bluetooth Low Energy                    |
| <b>Type of Modulation :</b>               | GFSK, $\pi/4$ -DQPSK, 8DPSK                           |
| <b>Output Power :</b>                     | GFSK: 11.56 mW<br>8PSK: 9.93 mW<br>BLE: 6.46 mW       |
| <b>Antenna Connector :</b>                | Internal Antenna connected to PCB with U-FL connector |
| <b>Number of antennas :</b>               | 1                                                     |
| <b>Antenna Diversity Supported :</b>      | No                                                    |
| <b>Power Supply :</b>                     | Mains (Integrated Power Supply)                       |

### Description of Test Item

The EUT is a digital video encoder/decoder with WiFi and Bluetooth transceivers. The WiFi and Bluetooth transceivers are contained in a module from NVIDIA with single modular certification (FCC ID: VOB-P2180), however the antennas used in this EUT are not certified.

## 1.2 Normal test conditions

Temperature: 21.4 – 23.6 °C  
Relative humidity: 20 - 42 %  
Normal test voltage: 120V 60Hz

The values are the limit registered during the test period.

## 1.3 Test Engineer(s)

Frode Sveinsen  
Kristian Osvoll (Power Line Conducted Test)

## 1.4 Description of modification for Modification Filing

Not applicable.

## 1.5 Family List Rationale

Not Applicable.

## 1.6 Antenna Requirement

Is the antenna detachable? ☒ Yes ☐ No

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

Type of antenna connector: U-FL (The antennas are internal with connector on the PCB)

Ref. FCC §15.203

## 1.7 Comments

This report covers only limited radiated tests to show compliance with the new antenna in this EUT. All other radio tests for DSS are covered by UL reports no. 15U21878-E1V2.

Radio tests for BLE are covered by UL report no. 15U21878-E2V1. Output Power when operating in BLE mode is lower than in normal BT mode, therefore spurious emissions are only measured in BT mode.

The measurements were done with the EUT powered by 120 V AC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

All ports were populated during spurious emission measurements.

## 2 TEST REPORT SUMMARY

### 2.1 General

All measurements are traceable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and Industry Canada RSS-247 Issue 2.

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 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 <sup>1</sup> |
| Number of Operating Frequencies        | 15.31(m)                            | 5.1 (6) (RSS-247)                                | Complies <sup>1</sup> |
| 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) (RSS-247)                                | Complies <sup>1</sup> |
| Pseudorandom Hopping Algorithm         | 15.247(a)(1)                        | 5.1 (3) (RSS-247)                                | Complies <sup>1</sup> |
| Time of Occupancy                      | 15.247(a)(1)(iii)                   | 5.1 (5) (RSS-247)                                | Complies <sup>1</sup> |
| Occupied Bandwidth                     | 15.247(a)(1)                        | 5.1 (7) (RSS-247)                                | Complies <sup>1</sup> |
| Peak Power Output                      | 15.247(b)                           | 5.4 (RSS-247)                                    | Complies <sup>1</sup> |
| Spurious Emissions (Antenna Conducted) | 15.247(c)                           | 5.5 (RSS-247)                                    | Complies <sup>1</sup> |
| Spurious Emissions (Radiated)          | 15.247(c)<br>15.109(a)<br>15.209(a) | 5.5 (RSS-247)<br>6.13 (RSS-GEN)<br>8.9 (RSS-GEN) | Complies              |

<sup>1</sup> Covered by UL Report No. 15U21878-E1V2 (FCC ID: VOB-P2180)

### 3 TEST RESULTS

#### 3.1 Power Line Conducted Emissions

FCC Part 15.207 (a)

ISED RSS-GEN Issue 4, Clause 8.8

Test Performed By: Kristian Osvoll

Date of Test: 20-Mar-2017

Measurement procedure: ANSI C63.4-2014 using 50  $\mu$ H/50 ohms LISN.

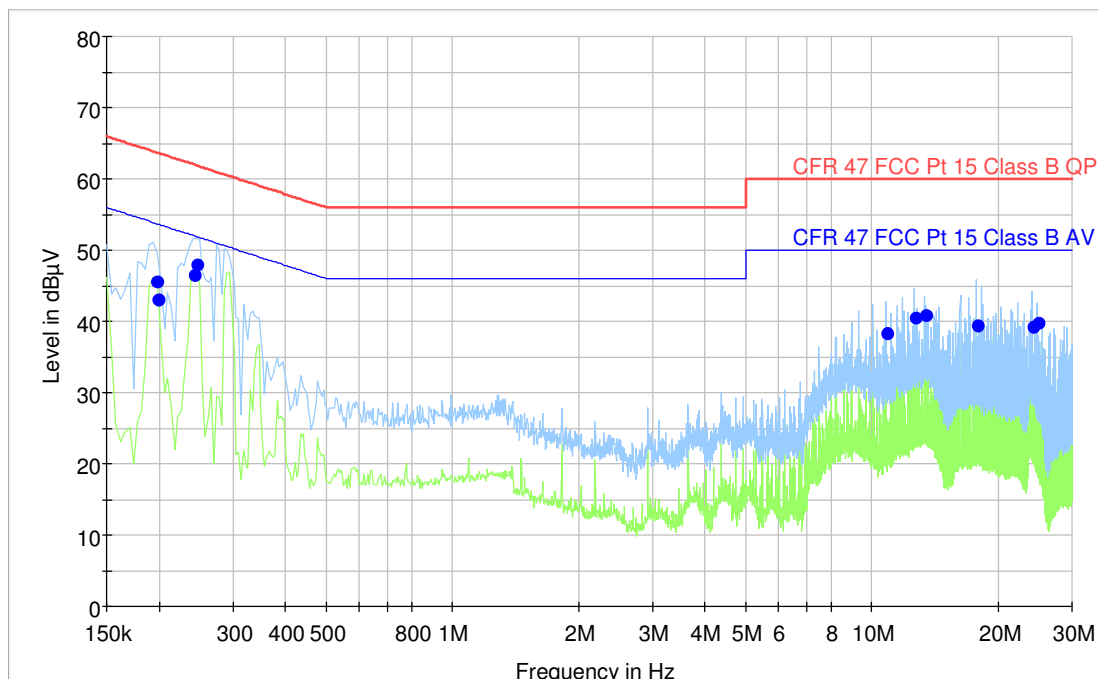
Test Results: Complies.

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

Highest measured value (L1 and N):

| Frequency (MHz) | QuasiPeak (dB $\mu$ V) | Average (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | PE  | Corr. (dB) |
|-----------------|------------------------|----------------------|--------------------|-------------|-----------------|-----------------|------|-----|------------|
| 0.196           | ---                    | 45.75                | 53.78              | 8.03        | 1000.0          | 9.000           | L1   | GND | 10.1       |
| 0.198           | ---                    | 43.35                | 53.69              | 10.34       | 1000.0          | 9.000           | N    | GND | 10.1       |
| 0.242           | ---                    | 46.78                | 52.03              | 5.24        | 1000.0          | 9.000           | L1   | GND | 10.1       |
| 0.244           | ---                    | 48.10                | 51.96              | 3.86        | 1000.0          | 9.000           | N    | GND | 10.1       |
| 10.764          | ---                    | 38.62                | 50.00              | 11.38       | 1000.0          | 9.000           | N    | GND | 10.3       |
| 12.588          | ---                    | 40.80                | 50.00              | 9.20        | 1000.0          | 9.000           | N    | GND | 10.3       |
| 13.316          | ---                    | 41.06                | 50.00              | 8.94        | 1000.0          | 9.000           | N    | GND | 10.3       |
| 17.692          | ---                    | 39.70                | 50.00              | 10.30       | 1000.0          | 9.000           | N    | GND | 10.5       |
| 24.080          | ---                    | 39.40                | 50.00              | 10.60       | 1000.0          | 9.000           | N    | GND | 10.6       |
| 24.808          | ---                    | 39.97                | 50.00              | 10.03       | 1000.0          | 9.000           | L1   | GND | 10.7       |

Full Spectrum



### 3.2 Spurious Emissions Band Edge (Radiated)

FCC 15.205, 15.209

ISED RSS-GEN, Issue 4, Clause 8.9

Test Results: Complies

Measurement Data:

|                  | Measured field strength (dBμV/m) |            | Limit  | Margin |      |
|------------------|----------------------------------|------------|--------|--------|------|
|                  | 2390 MHz                         | 2483.5 MHz | dBμV/m | dB     |      |
| Peak Detector    | 44.7                             | 49.0       | 74     | 29.3   | 25.0 |
| Average Detector | 24.7                             | 29.0       | 54     | 29.3   | 25.0 |

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

See attached plots.

#### Duty Cycle Correction Factor Calculation:

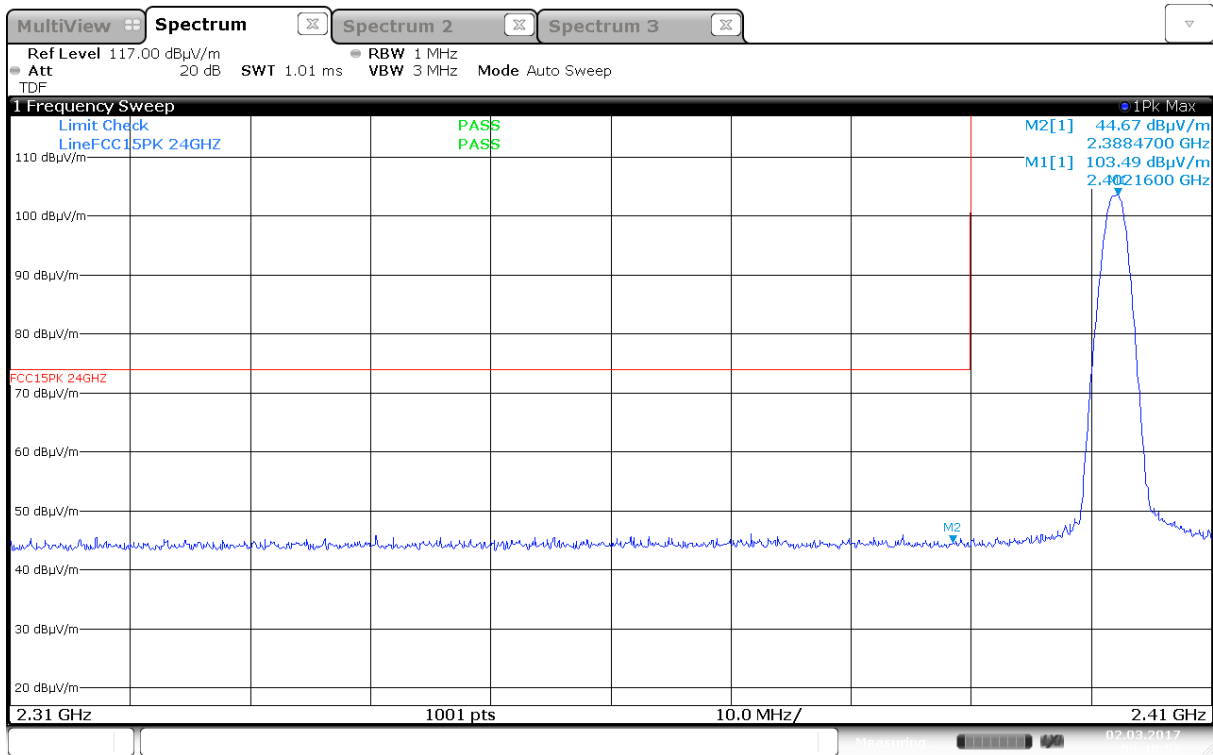
Calculated from values in UL report no. 15U21878-E1V2.

| Mode | On Time (ms) | Period (ms) | Duty Cycle (linear) | Number of Hopping Channels | Calculated Duty Cycle Correction Factor (dB) | Duty Cycle Correction Factor (dB) |
|------|--------------|-------------|---------------------|----------------------------|----------------------------------------------|-----------------------------------|
| GFSK | 2.884        | 3.738       | 0.772               | 79                         | 40.2                                         | 20                                |
| 8PSK | 1.044        | 3.750       | 0.278               | 79                         | 49.1                                         | 20                                |

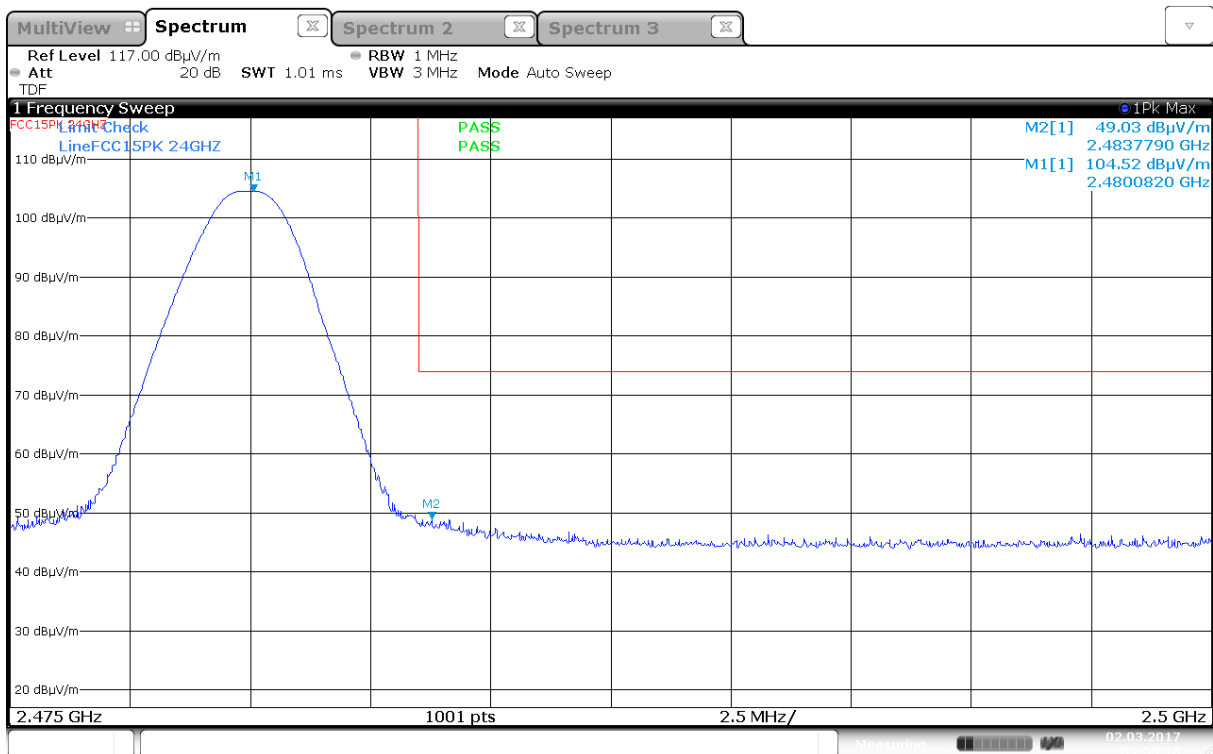
Duty Cycle Correction factor =  $-20 \times \log(\text{Duty Cycle} / \text{Number of Hopping Channels})$

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

Correction Factors above are used with field strength values and are valid when EUT is operating in hopping mode with 79 hopping channels..



Lower Band Edge, 2402MHz, Peak, @3m



Upper Band Edge, 2480MHz, Peak, @3m

### 3.3 Radiated Emissions, below 1GHz

FCC 15.205, 15.209

ISED RSS-GEN, Issue 4, Clause 8.9

Test Results: Complies

Measurement Data:

**Radiated emission 30 – 1000 MHz.**

Detector: Quasi-Peak

Measuring distance 3m

Tested with all all connections active and LCD on

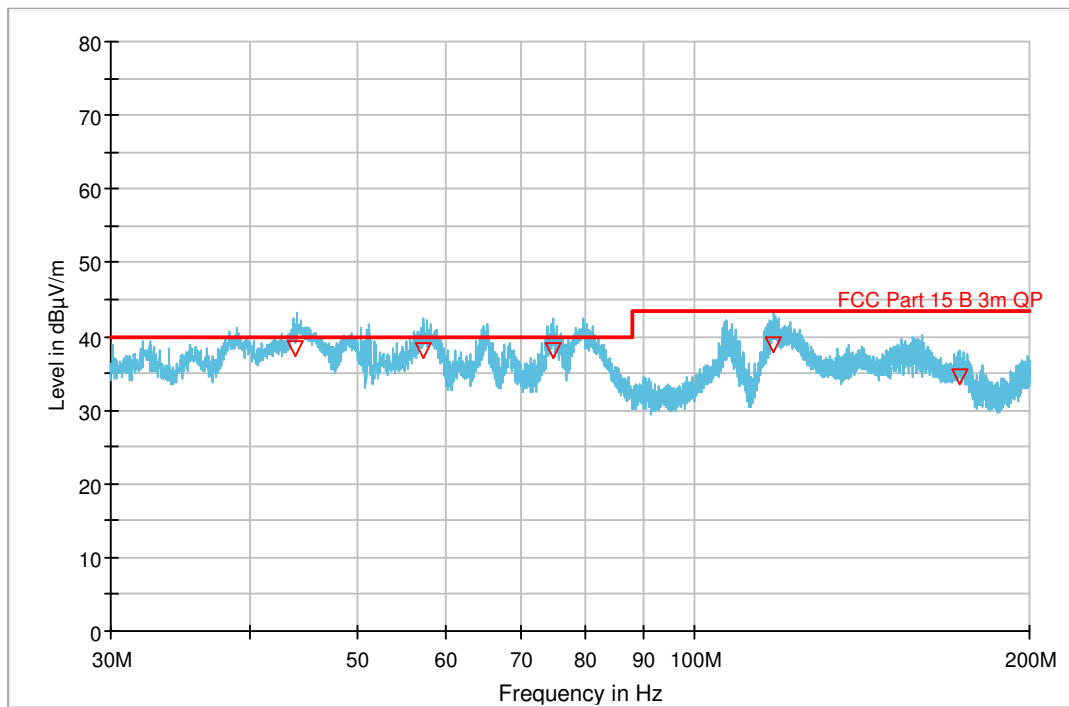
| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 43.831          | 38.40              | 40.00          | 1.60        | 1000.0          | 120.000         | 110.0       | V   | 208           | -27.1      |
| 57.103          | 37.98              | 40.00          | 2.02        | 1000.0          | 120.000         | 100.0       | V   | 216           | -28.7      |
| 74.853          | 38.14              | 40.00          | 1.86        | 1000.0          | 120.000         | 110.0       | V   | 182           | -28.3      |
| 118.001         | 38.83              | 43.50          | 4.67        | 1000.0          | 120.000         | 100.0       | V   | 147           | -26.0      |
| 173.248         | 34.44              | 43.50          | 9.06        | 1000.0          | 120.000         | 113.0       | H   | 242           | -23.2      |
| 270.336         | 39.27              | 46.00          | 6.73        | 1000.0          | 120.000         | 100.0       | H   | 318           | -23.5      |
| 285.840         | 34.31              | 46.00          | 11.69       | 1000.0          | 120.000         | 100.0       | H   | 230           | -22.9      |

See attached plots.

#### Requirements/Limit

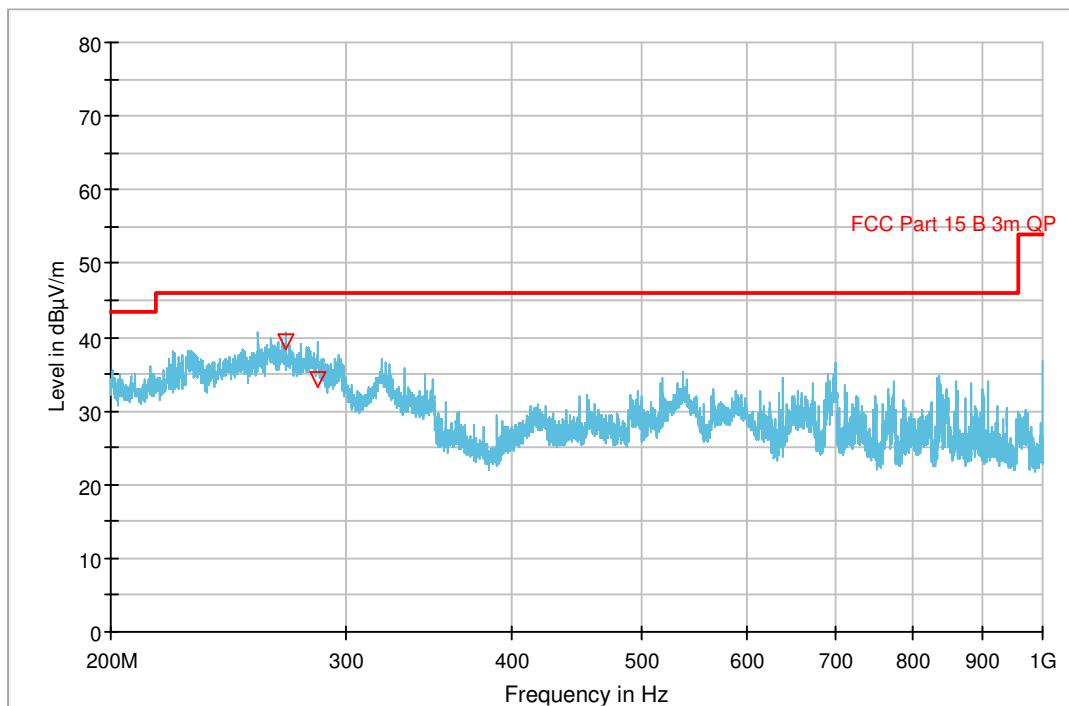
|                 |                                                                  |                     |
|-----------------|------------------------------------------------------------------|---------------------|
| FCC             | Part 15.209 @ frequencies defined in §15.205                     |                     |
| ISED            | RSS-GEN Issue 4, clause 8.9 @ frequencies defined in clause 8.10 |                     |
|                 | Radiated emission limit @3 meters                                |                     |
| Frequency (MHz) | Quasi Peak (µV/m)                                                | Quasi Peak (dBµV/m) |
| 30 – 88         | 100                                                              | 40.0                |
| 88 – 216        | 150                                                              | 43.5                |
| 216 – 960       | 200                                                              | 46.0                |
| Above 960       | 500                                                              | 54.0                |

Full Spectrum



### Radiated Emissions, 30 -200MHz

Full Spectrum



### Radiated Emissions, 200 -1000MHz

### 3.4 Radiated Emissions, above 1GHz

FCC 15.205, 15.209

ISED RSS-GEN, Issue 4, Clause 8.9

Test Results: Complies

Measurement Data:

Radiated Emissions, 1-25 GHz

Measuring distance: 3m (1 – 8.5 GHz)  
1m (8 – 25 GHz)

A pre-scan was performed above 18 GHz and no spurious emissions were detected.

| Radiated Emissions in Restricted Bands |                  |                   |                                |                              |                |          |
|----------------------------------------|------------------|-------------------|--------------------------------|------------------------------|----------------|----------|
| Carrier Modulation                     | Carrier Freq MHz | Measured Freq MHz | Measured value Peak dBμV/m @3m | Measured value AV dBμV/m @3m | Limit (dBμV/m) | Verdict  |
| Any*                                   | Any              | 2777              | 57.0                           | 36.1                         | 74/54          | Complies |
| Any*                                   | Any              | 4160              | 57.7                           | 37.2                         | 74/54          | Complies |

\* Not an emission from the radio

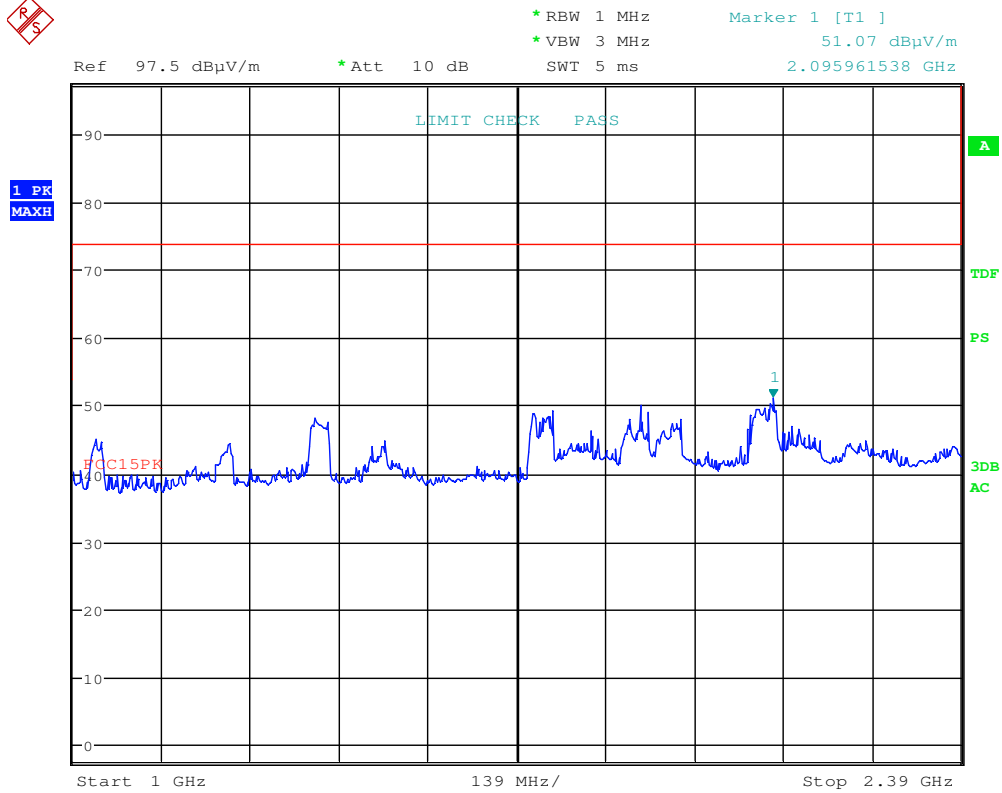
Only harmonics that fall in the restricted bands (ref. §15.205) have been checked.

Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer "Transducer factor".

See attached plots.

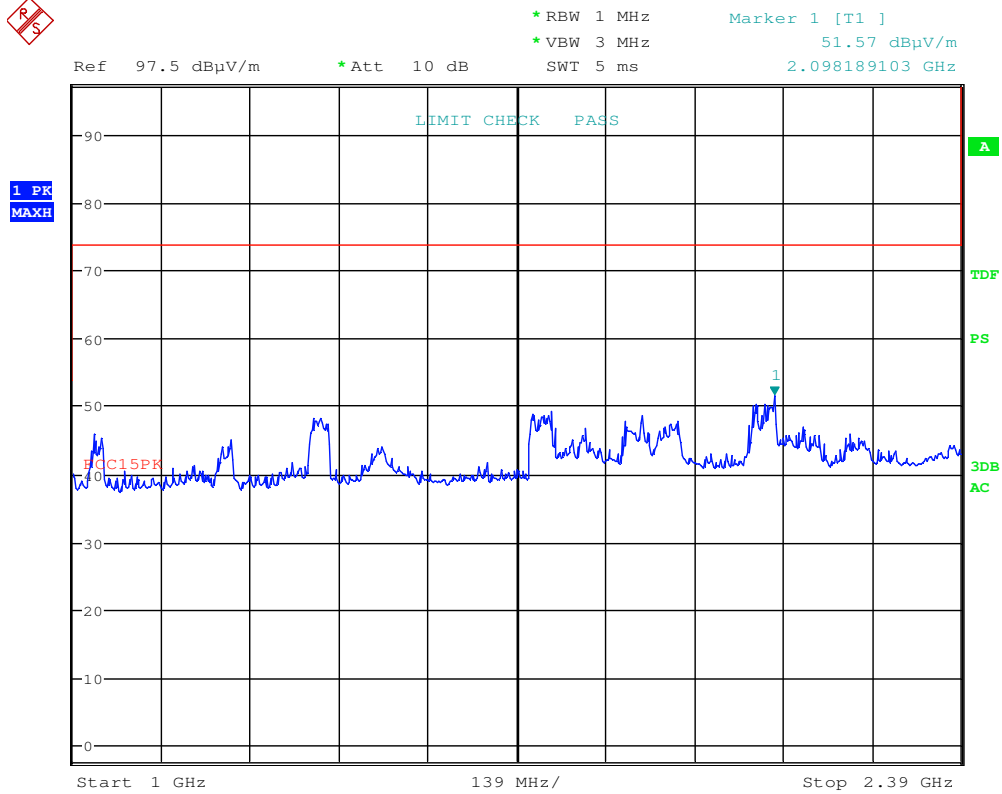
#### Requirements/Limit

|                 |                                                                  |               |
|-----------------|------------------------------------------------------------------|---------------|
| FCC             | Part 15.209 @ frequencies defined in §15.205                     |               |
| ISED            | RSS-GEN Issue 4, clause 8.9 @ frequencies defined in clause 8.10 |               |
|                 | Radiated emission limit @3 meters                                |               |
| Frequency (MHz) | AV (dBμV/m)                                                      | Peak (dBμV/m) |
| Above 1 GHz     | 54.0                                                             | 74.0          |



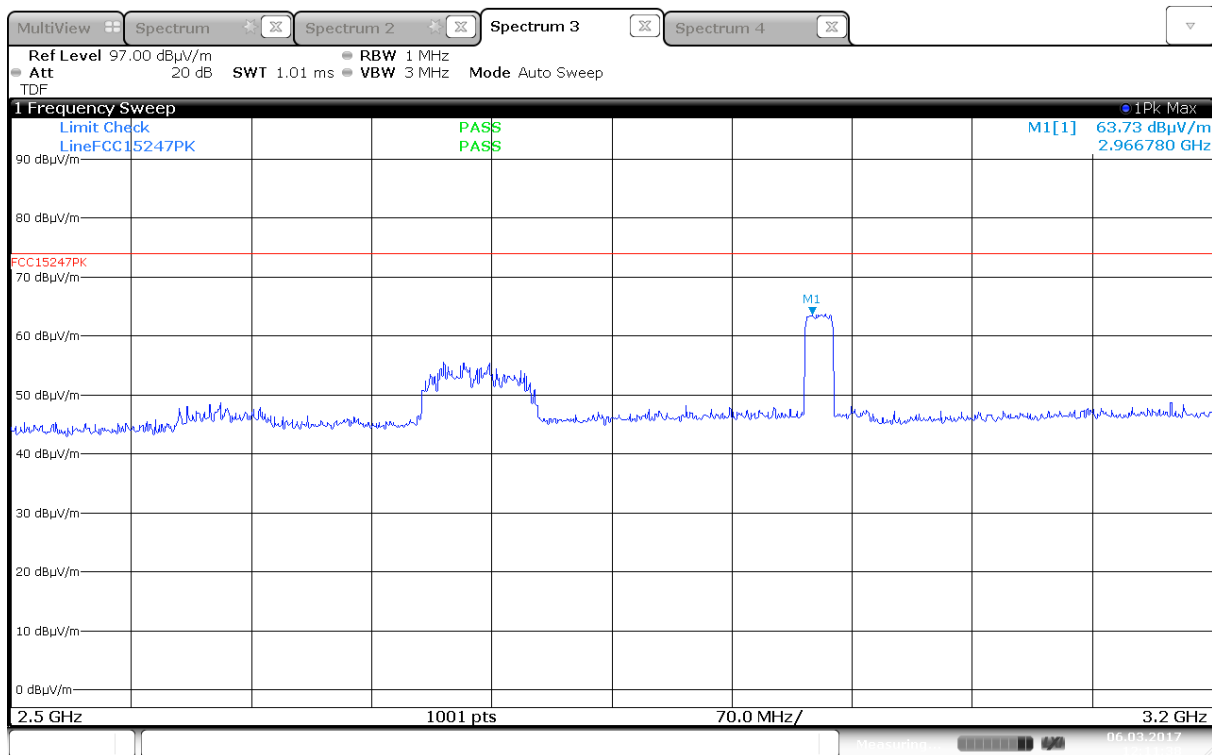
Date: 6.MAR.2017 09:16:38

**Radiated Emissions, 1000 -2390MHz, 2402MHz, HP**

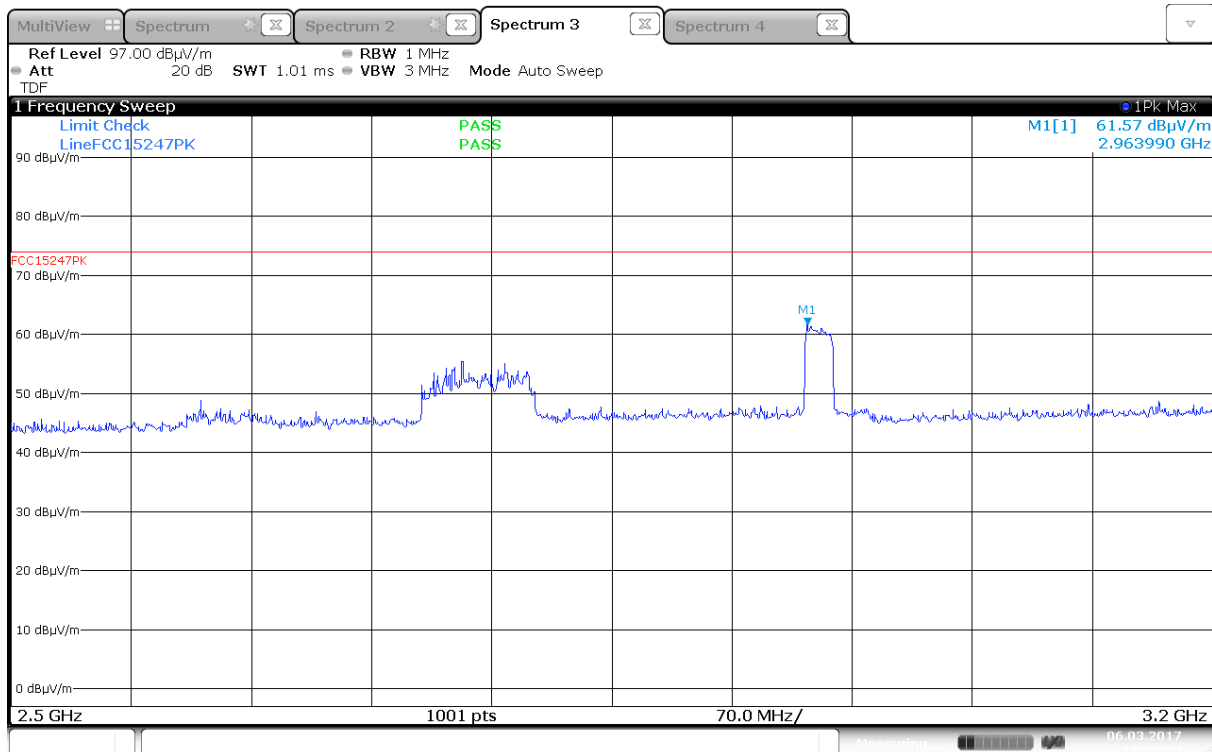


Date: 6.MAR.2017 09:14:47

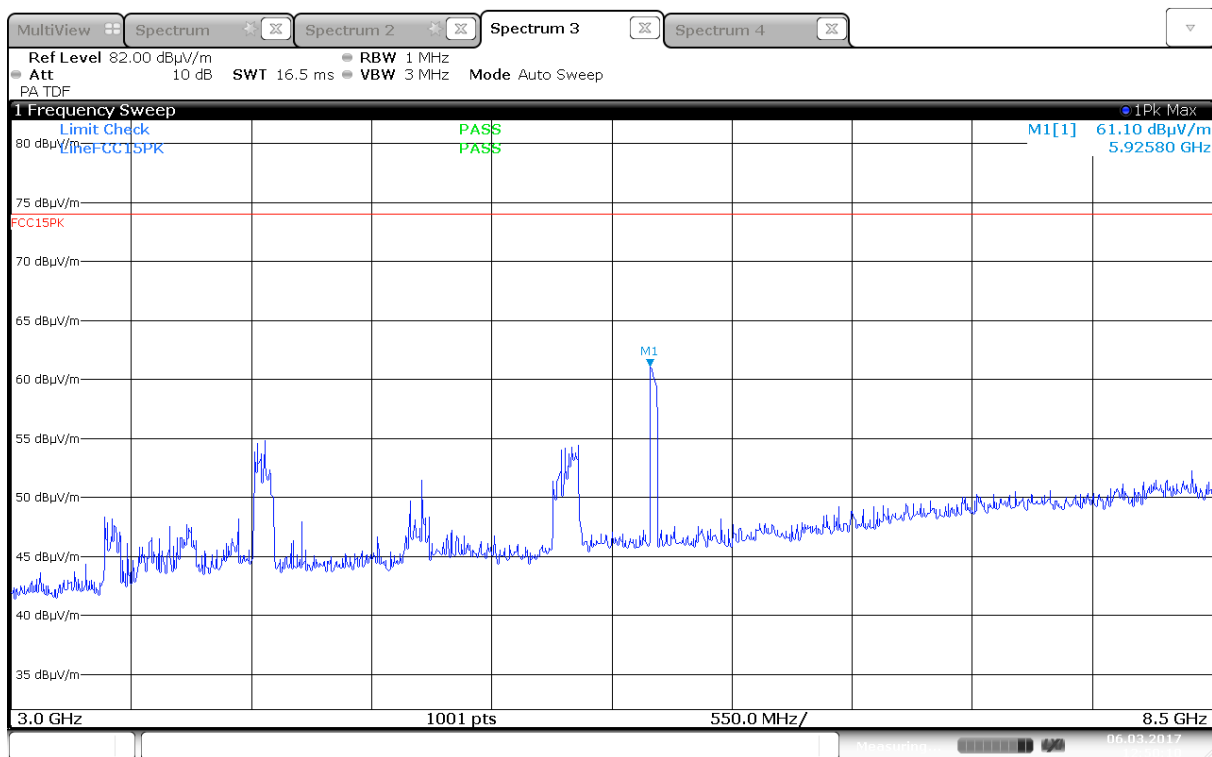
### Radiated Emissions, 1000 -2390MHz, 2402MHz, VP



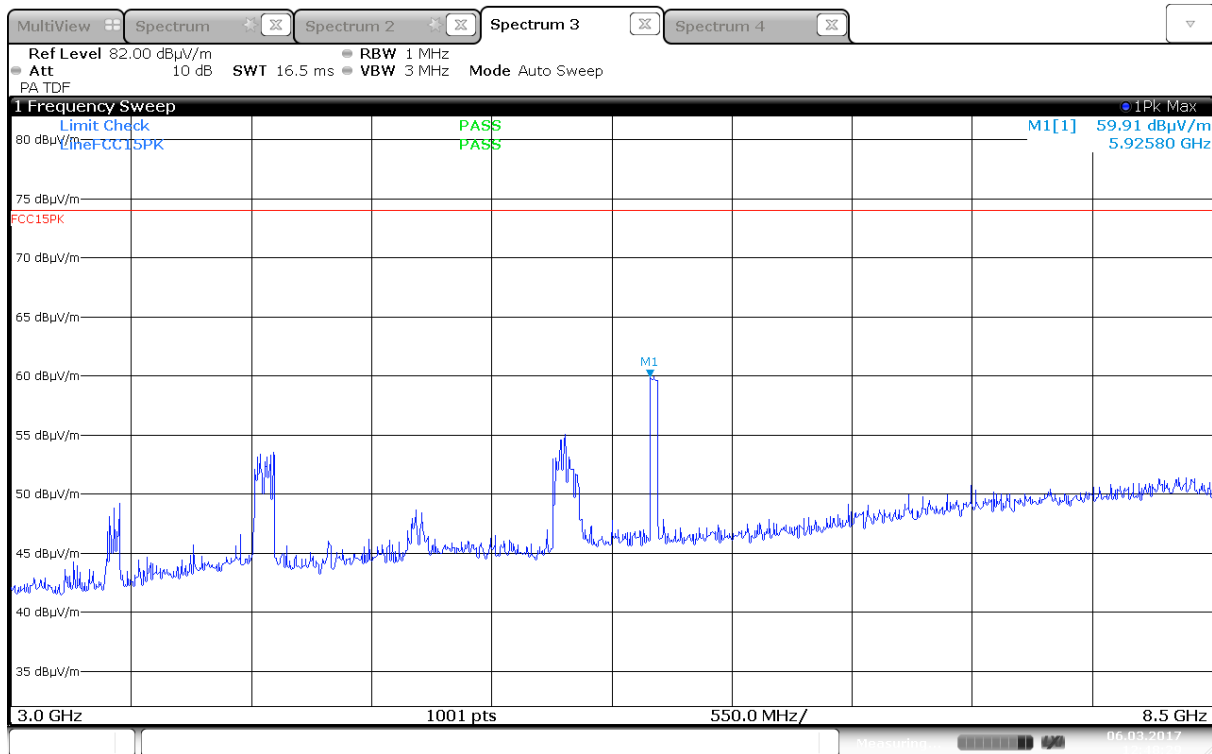
Radiated Emissions, 2500 -3200MHz, 2480MHz, HP



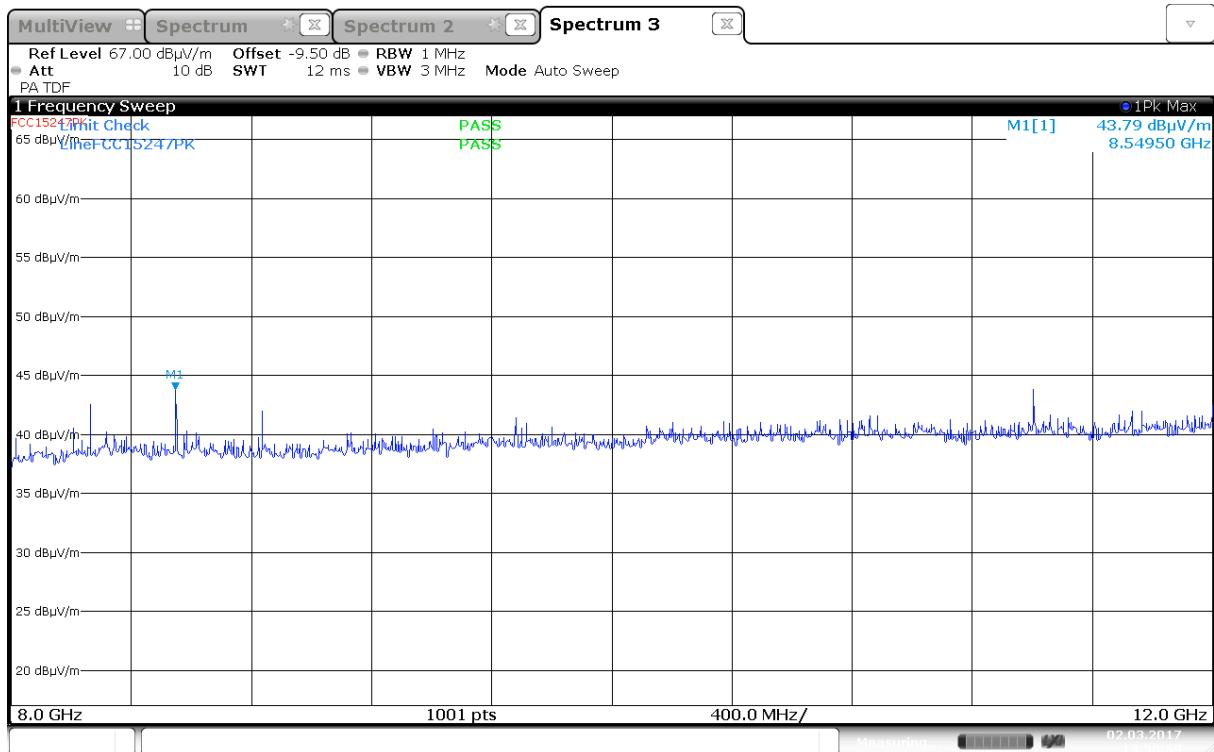
Radiated Emissions, 2500 -3200MHz, 2480MHz, VP



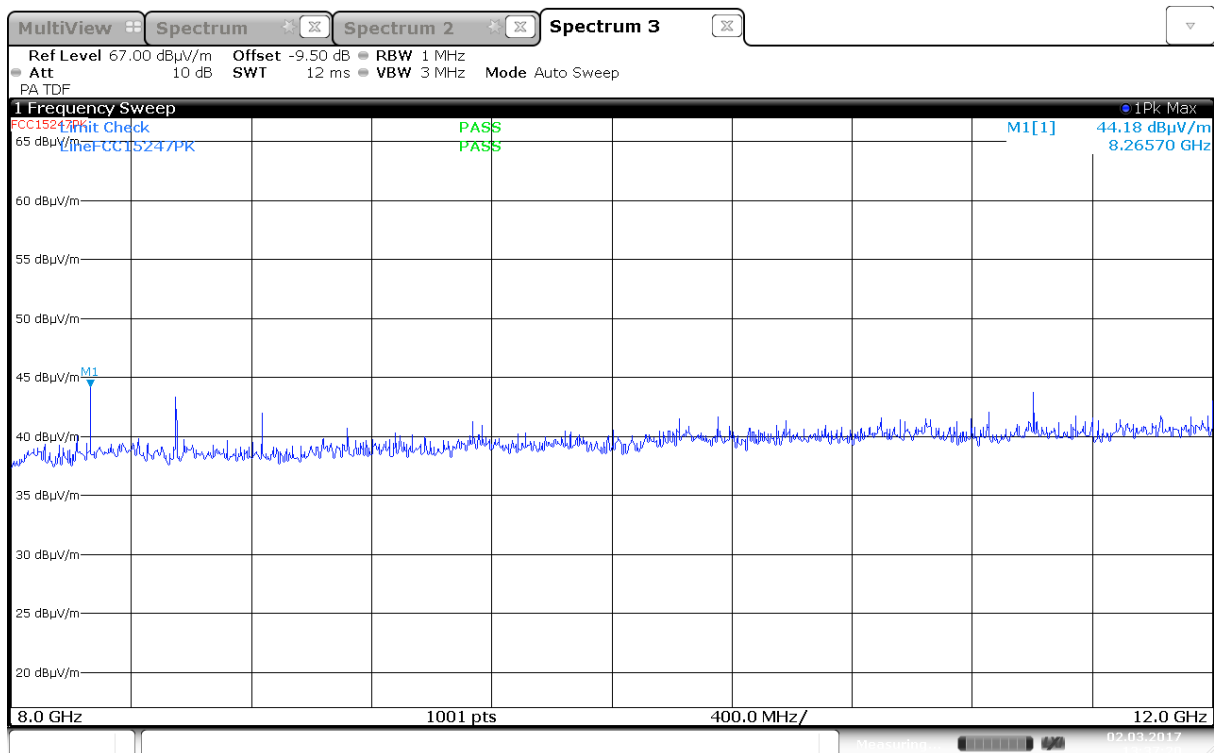
Radiated Emissions, 3000 -8500MHz, 2440MHz, HP



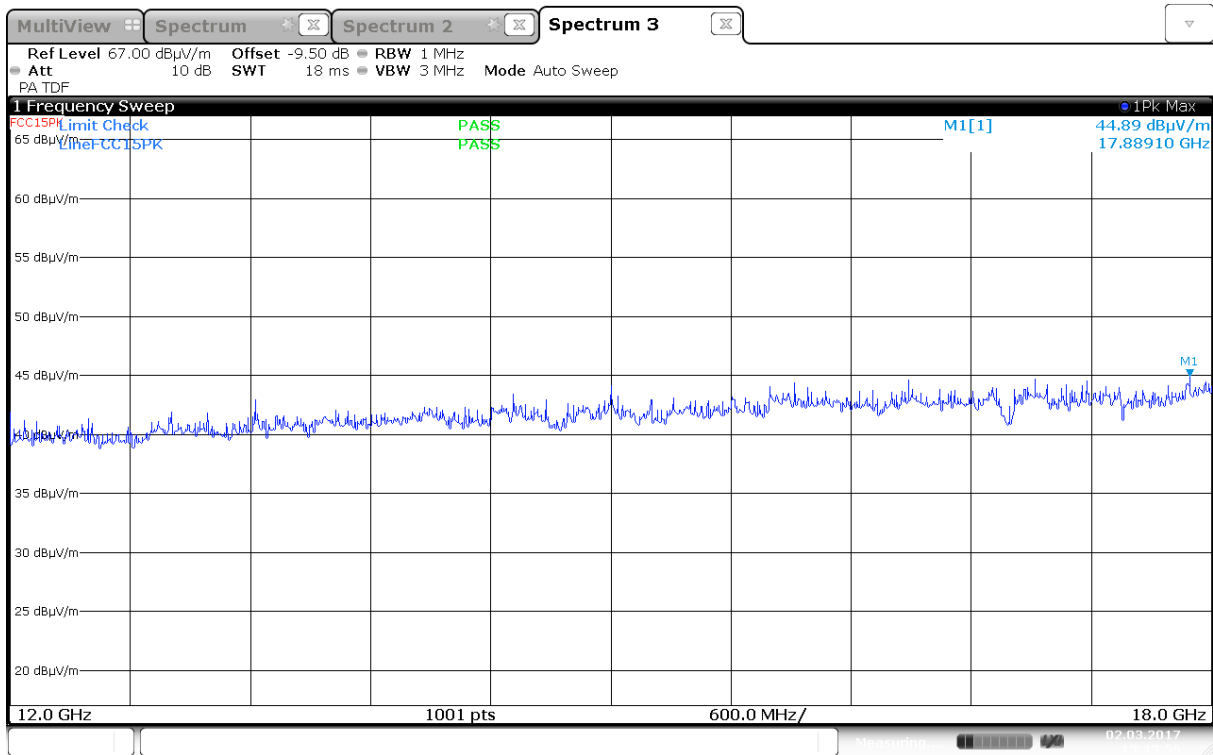
Radiated Emissions, 3000 -8500MHz, 2440MHz, VP



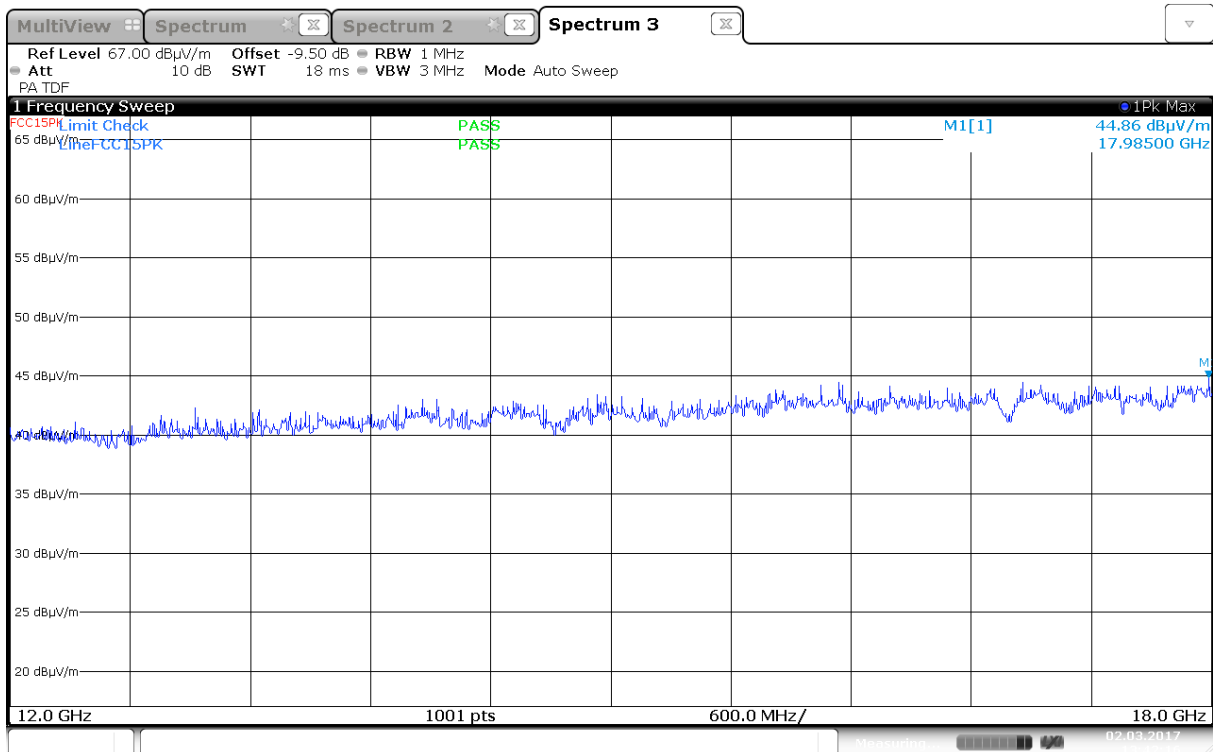
Radiated Emissions, 8000 -12000MHz, 2440MHz, HP, @1m



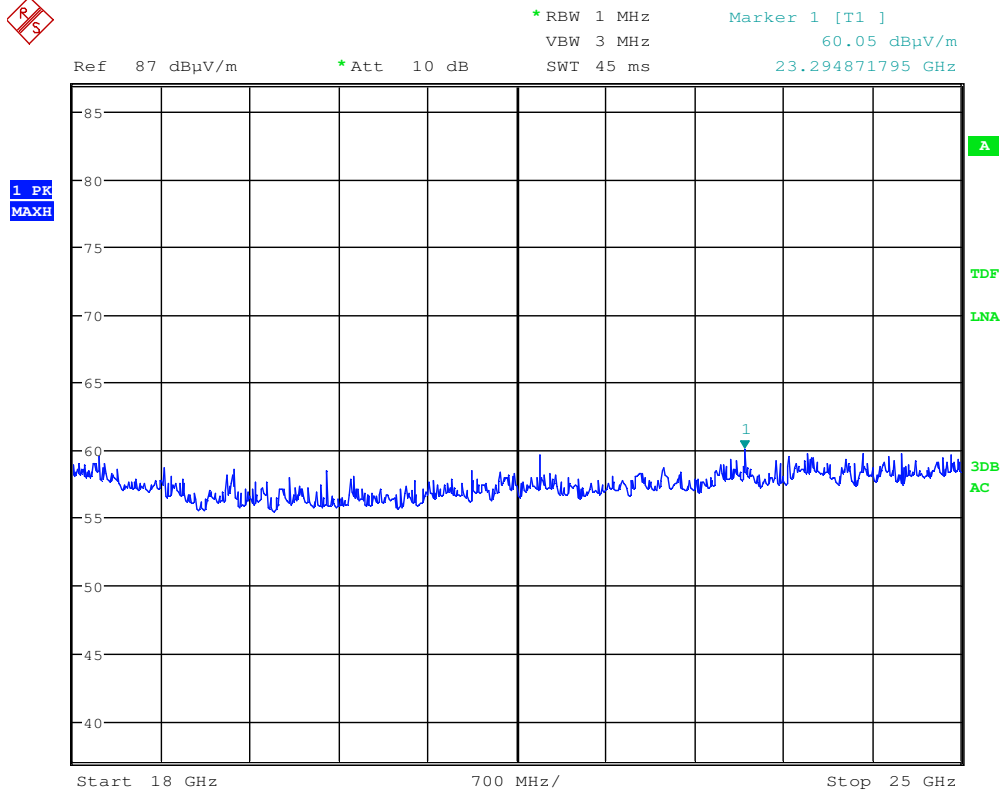
Radiated Emissions, 8000 -12000MHz, 2440MHz, VP, @1m



Radiated Emissions, 12000 -18000MHz, 2440MHz, HP, @1m

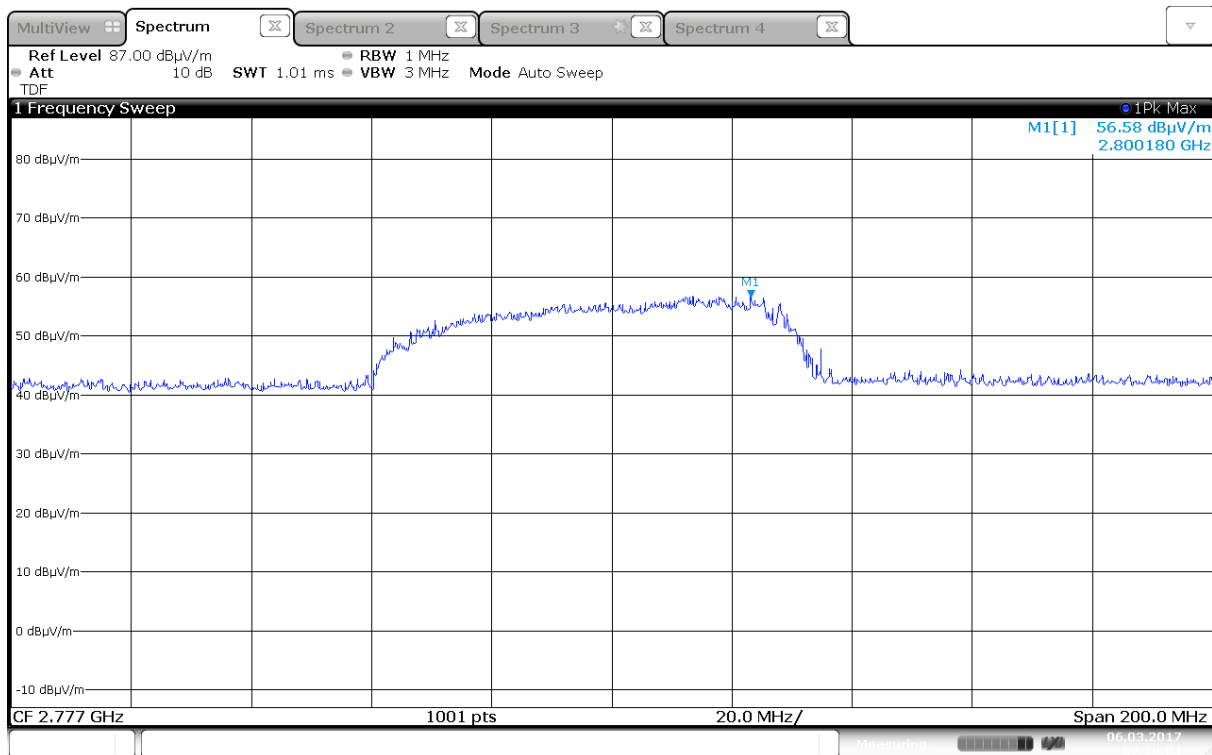


Radiated Emissions, 12000 -18000MHz, 2440MHz, VP, @1m

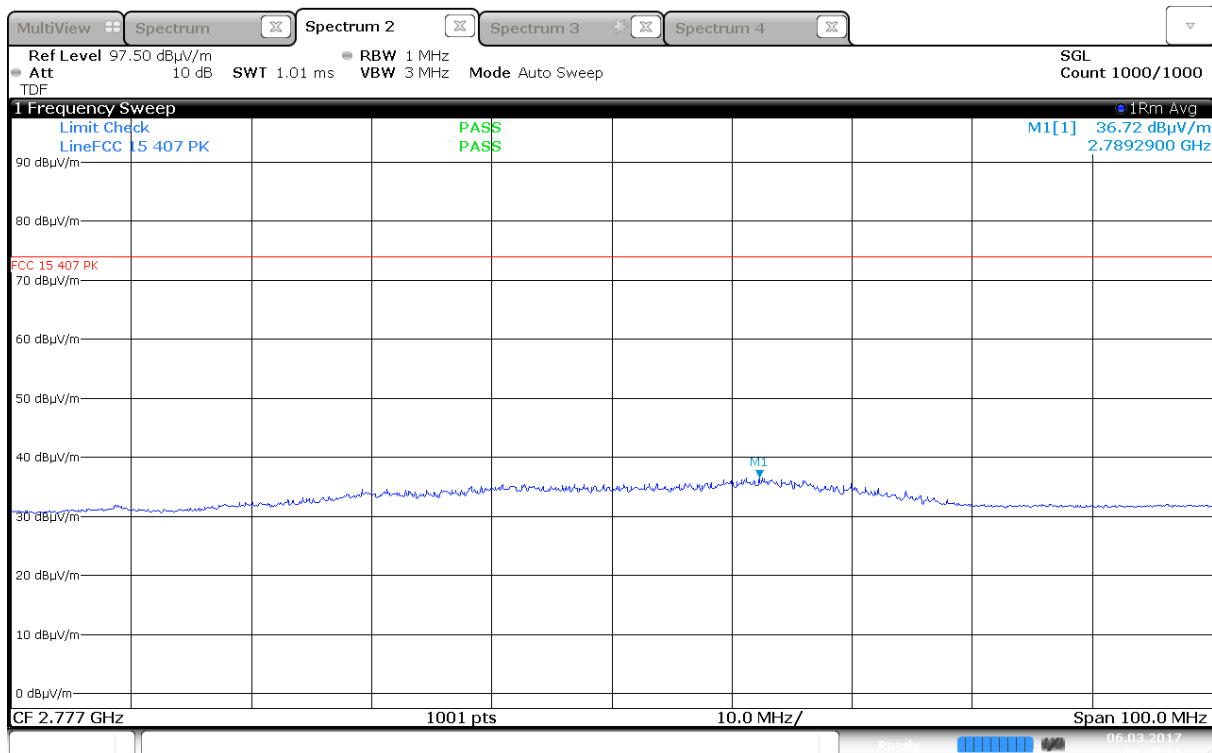


Date: 2.MAR.2017 15:47:15

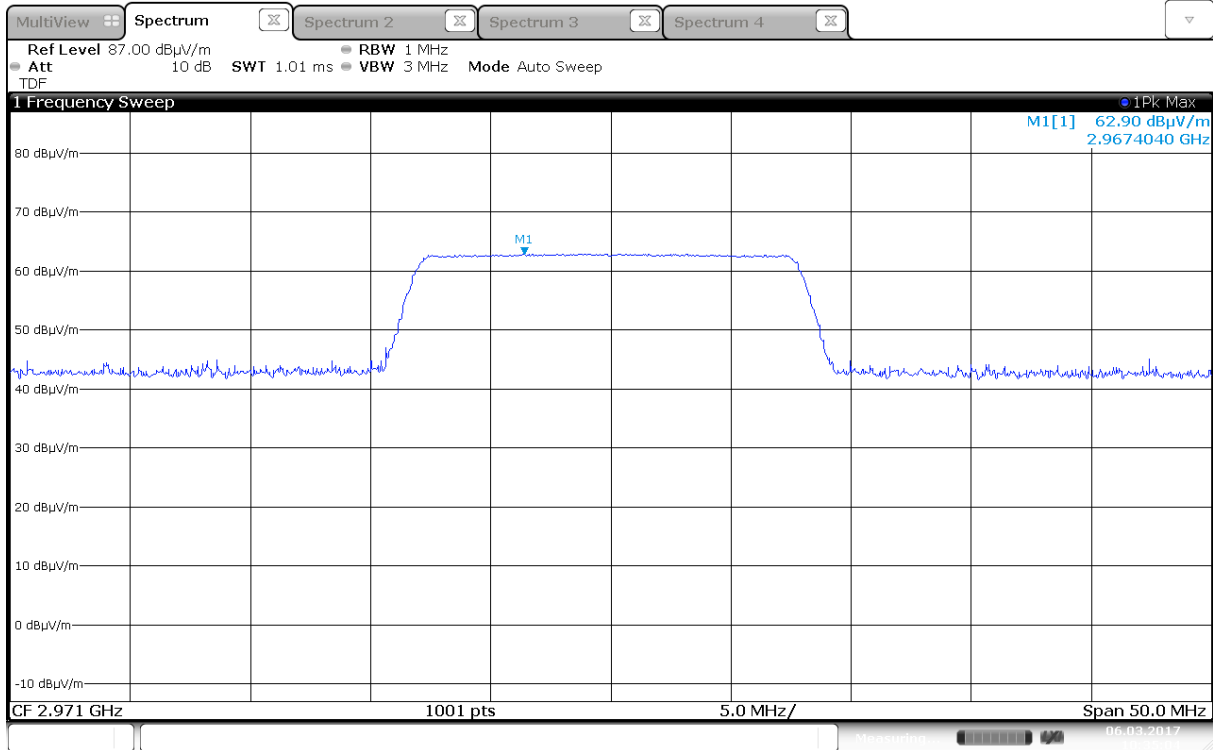
**Pre-scan, 18000 -25000MHz, 2440MHz, HP, @10cm**



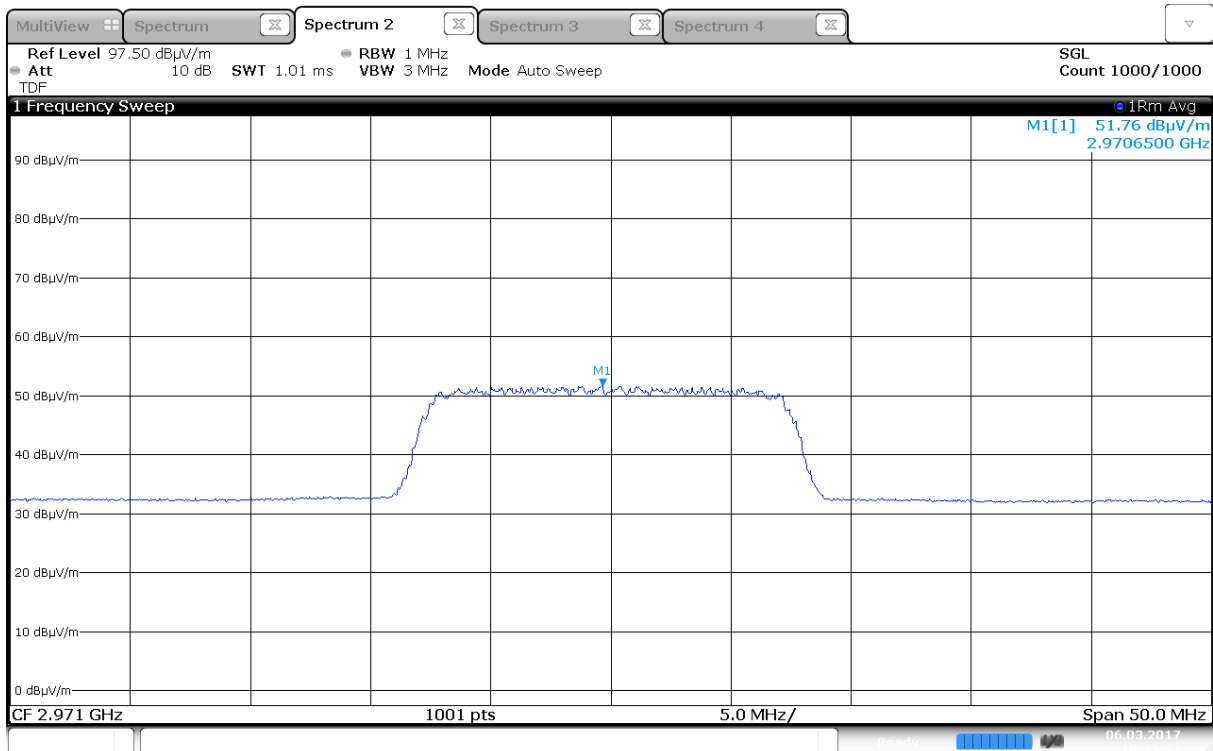
Radiated Emissions, 2777MHz Peak, 2440MHz (Max: VP)



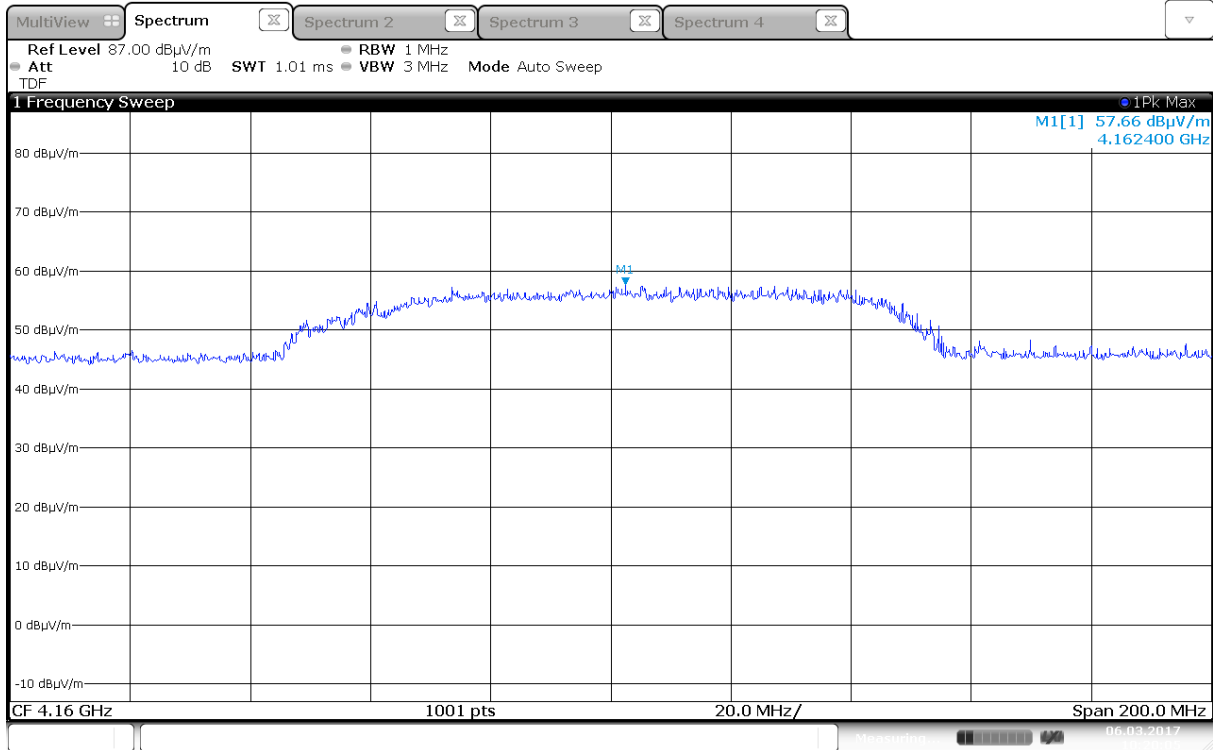
Radiated Emissions, 2777MHz RMS, 2440MHz (Max: VP)



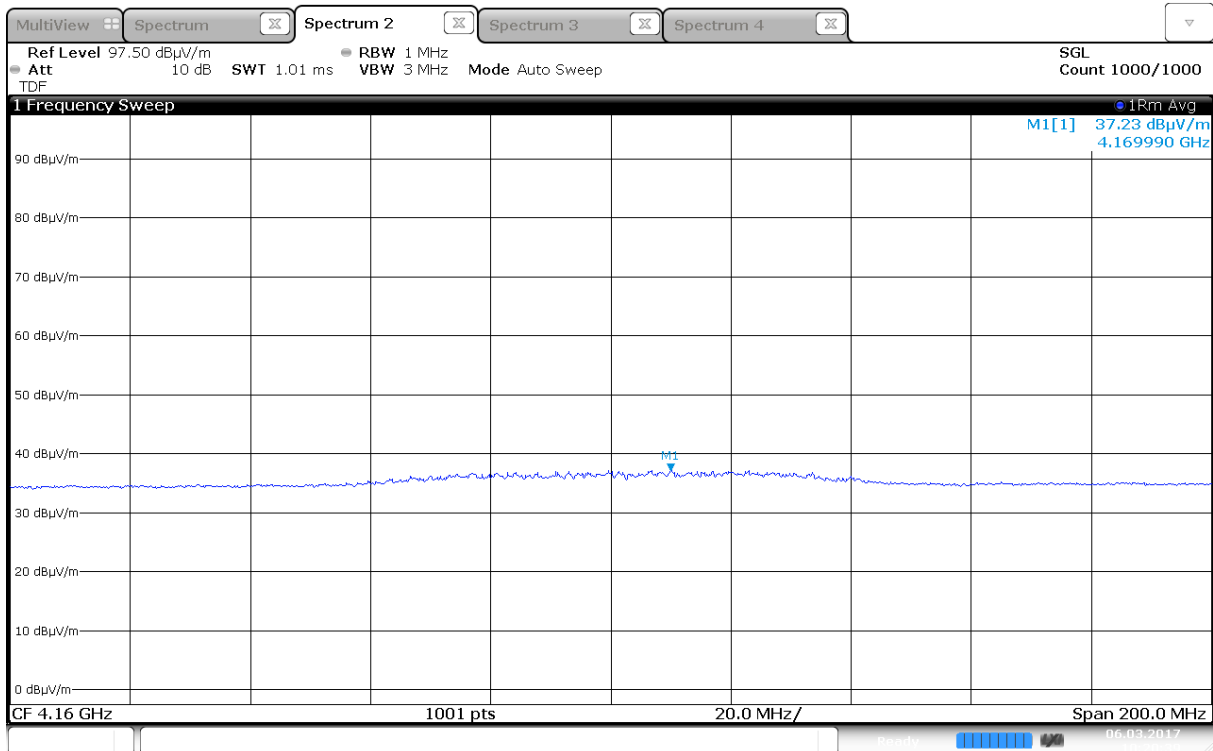
**Radiated Emissions, 2971MHz Peak, 2440MHz (Max: VP)**



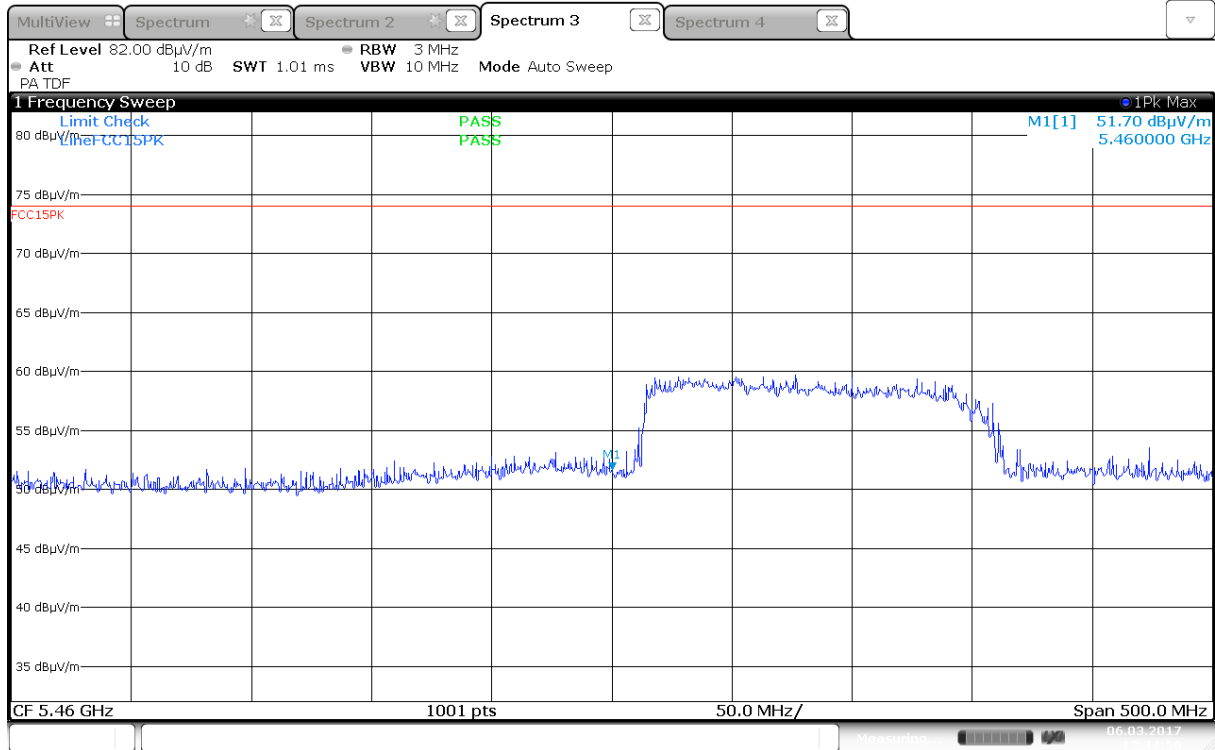
**Radiated Emissions, 2971MHz RMS, 2440MHz (Max: VP)**



**Radiated Emissions, 4160MHz Peak, 2440MHz (Max: VP)**



**Radiated Emissions, 4160MHz RMS, 2440MHz (Max: VP)**



**Radiated Emissions, 5460MHz Peak, 2440MHz (Max: VP)**

## 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

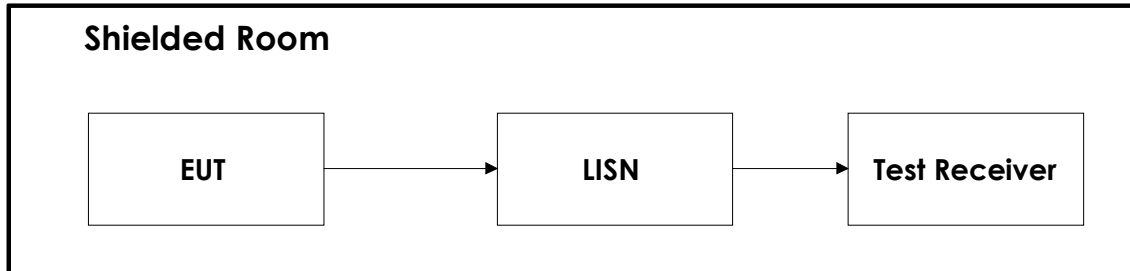
To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

| No. | Model         | Description        | Manufacturer      | Asset no. | Cal. date  | Cal. Due |
|-----|---------------|--------------------|-------------------|-----------|------------|----------|
| 1   | FSW26         | Spectrum Analyzer  | Rohde & Schwarz   | LR 1640   | 2017.01    | 2018.01  |
| 2   | ESU40         | Measuring Receiver | Rohde & Schwarz   | LR 1639   | 2016.12    | 2017.12  |
| 3   | 6HC3000/18000 | Highpass Filter    | Trilithic         | LR 1614   | Cal b4 use |          |
| 4   | 317           | Preamplifier       | Sonoma Instrument | LR 1687   | 2016.05    | 2017.05  |
| 5   | 8449A         | Pre-amplifier      | Hewlett Packard   | LR 1322   | 2016.10    | 2017.10  |
| 6   | 6812B         | AC Power Source    | Agilent           | LR 1515   | Cal b4 use |          |
| 7   | 3115          | Horn Antenna       | EMCO              | LR 1330   | 2016.10    | 2021.10  |
| 8   | PM7320X       | Antenna Horn       | Sivers Lab        | LR 102    | 2009.01    | 2019.01  |
| 9   | DBF-520-20    | Antenna Horn       | Systron Donner    | LR 100    | 2009.01    | 2019.01  |
| 10  | 638           | Antenna Horn       | Narda             | LR 098    | 2010.06    | 2020.06  |
| 11  | HK116         | Biconical Antenna  | Rohde & Schwarz   | LR 1260   | 2013.12    | 2018.12  |
| 12  | HL223         | LogPeriod Antenna  | Rohde & Schwarz   | LR 1261   | 2013.12    | 2018.12  |
| 13  | Model 87 V    | Multimeter         | Fluke             | LR 1597   | 2016.10    | 2017.10  |
| 14  | ESC13         | Measuring receiver | Rohde & Schwarz   | N-4259    | 2015.08    | 2017.08  |
| 15  | ESH3-Z2       | Pulse Limiter      | Rohde & Schwarz   | LR 1074   | 2016.05    | 2017.05  |
| 16  | ESH3-Z5       | Two-Line V-Network | Rohde & Schwarz   | N-3403    | 2015.07    | 2017.07  |

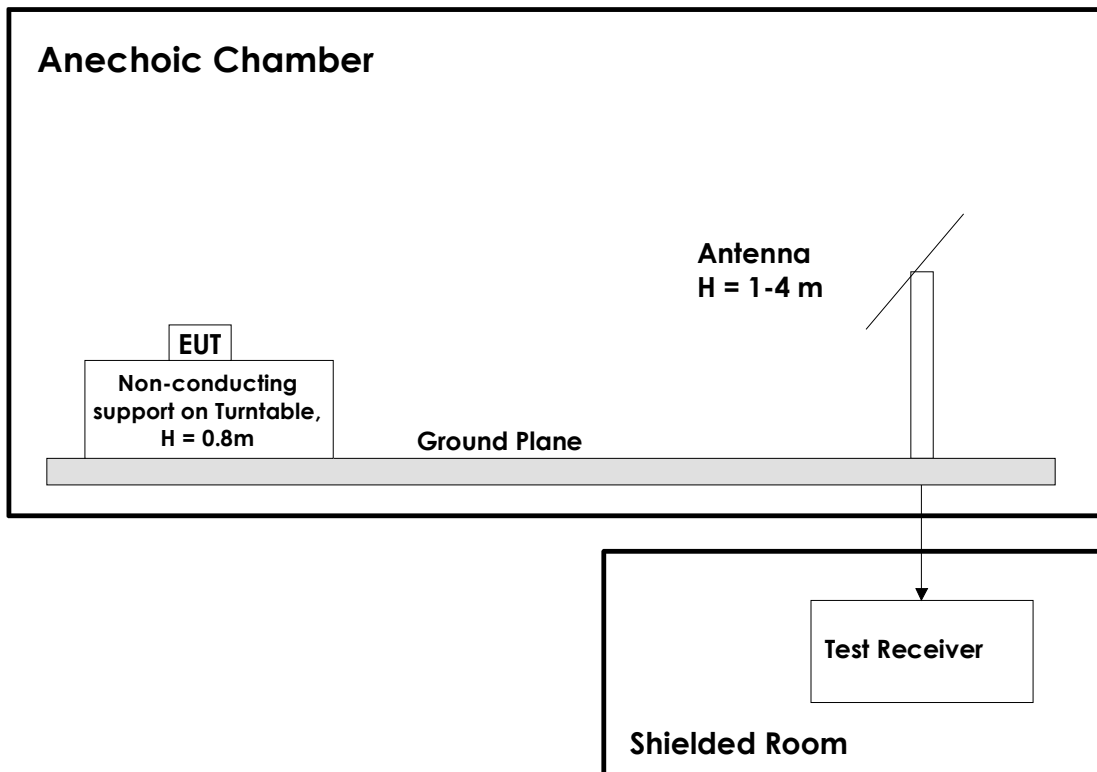
| Test Software List               |                 |       |         |
|----------------------------------|-----------------|-------|---------|
| Description                      | Manufacturer    | Model | Version |
| EMC Software for Conducted tests | Rohde & Schwarz | EMC32 | 9.26.00 |
|                                  |                 |       |         |

## 6 BLOCK DIAGRAM

### 6.1 Power Line Conducted Emission



### 6.2 Test Site Radiated Emission



The EUT is supplied with a stand for floor standing use, all tests were performed with the EUT mounted on this stand. No turntable was used for any of the tests.

For frequencies above 1 GHz the ground plane between the EUT and the measuring antenna was covered by absorbers.

### Revision history

| Version | Date       | Comment       | Sign |
|---------|------------|---------------|------|
| 1.0     | 2017.04.26 | First edition | FS   |
|         |            |               |      |