

Test Report

Product	Digital Video Conference System with WLAN and BT
Name and address of the applicant	Cisco Systems, Inc. 170 West Tasman Drive San Jose, CA 95134, USA
Name and address of the manufacturer	Cisco Systems, Inc. 170 West Tasman Drive San Jose, CA 95134, USA
Model	TTC60-21
Rating	Mains (100-240V 50/60 Hz, 1.8A – 0.8A)
Trademark	Cisco
Serial number	/
Additional information	Bluetooth, 802.11a/b/g/n/ac
Tested according to	FCC Part 15.247 Frequency Hopping Transmitters / Digital Transmission Systems Industry Canada RSS-247, Issue 2 Low Power Licence-Exempt Radiocommunications Devices
Order number	312072
Tested in period	2017.03.01 to 2017.03.06 and 2017.03.20
Issue date	2017.04.26
Name and address of the testing laboratory	 <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> Instituttveien 6 Kjeller, Norway </div> <div> FCC No: 994405 IC OATS: 2040D-1 TEL: +47 22 96 03 30 FAX: +47 22 96 05 50 </div> </div>
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  Prepared by [Frode Sveinsen] </div> <div style="text-align: center;">  Approved by [G.Suwanthakumar] </div> </div>	
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CONTENTS

1	INFORMATION	3
1.1	Test Item	3
1.2	Normal test conditions	4
1.3	Test Engineer(s)	4
1.4	Description of modification for Modification Filing	4
1.5	Family List Rationale	4
1.6	Antenna Requirement	4
1.7	Comments	4
2	TEST REPORT SUMMARY	5
2.1	General	5
2.2	Test Summary	6
3	TEST RESULTS	7
3.1	Power Line Conducted Emissions	7
3.2	Spurious Emissions Band Edge (Radiated)	8
3.3	Radiated Emissions, below 1GHz	10
3.4	Radiated Emissions, above 1GHz	12
4	Measurement Uncertainty	24
5	LIST OF TEST EQUIPMENT	25
6	BLOCK DIAGRAM	26
6.1	Power Line Conducted Emission	26
6.2	Test Site Radiated Emission	26

1 INFORMATION

1.1 Test Item

Name :	Cisco
Model/version :	TTC60-21
FCC ID :	LDK60211476
Industry Canada ID :	2461N-60211476
Serial number :	/
Hardware identity and/or version:	Rev. D
Software identity and/or version :	S01828-1.1.0 574512d, CE9.1.x
Frequency Range :	2402 – 2480 MHz
Number of Channels :	Bluetooth Low energy: 39 Bluetooth: 79
Operating Modes :	Bluetooth and Bluetooth Low Energy
Type of Modulation :	GFSK, $\pi/4$ -DQPSK, 8DPSK
Output Power :	GFSK: 11.56 mW 8PSK: 9.93 mW BLE: 6.46 mW
Antenna Connector :	Internal Antenna connected to PCB with U-FL connector
Number of antennas :	1
Antenna Diversity Supported :	No
Power Supply :	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 ¹
Number of Operating Frequencies	15.31(m)	5.1 (6) (RSS-247)	Complies ¹
Antenna Requirement	15.203	8.3 (RSS-GEN)	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	8.8 (RSS-GEN)	Complies
Channel Separation	15.247(a)(1)	5.1 (4) (RSS-247)	Complies ¹
Pseudorandom Hopping Algorithm	15.247(a)(1)	5.1 (3) (RSS-247)	Complies ¹
Time of Occupancy	15.247(a)(1)(iii)	5.1 (5) (RSS-247)	Complies ¹
Occupied Bandwidth	15.247(a)(1)	5.1 (7) (RSS-247)	Complies ¹
Peak Power Output	15.247(b)	5.4 (RSS-247)	Complies ¹
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	Complies ¹
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5 (RSS-247) 6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

¹ 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 μ H/50 ohms LISN.

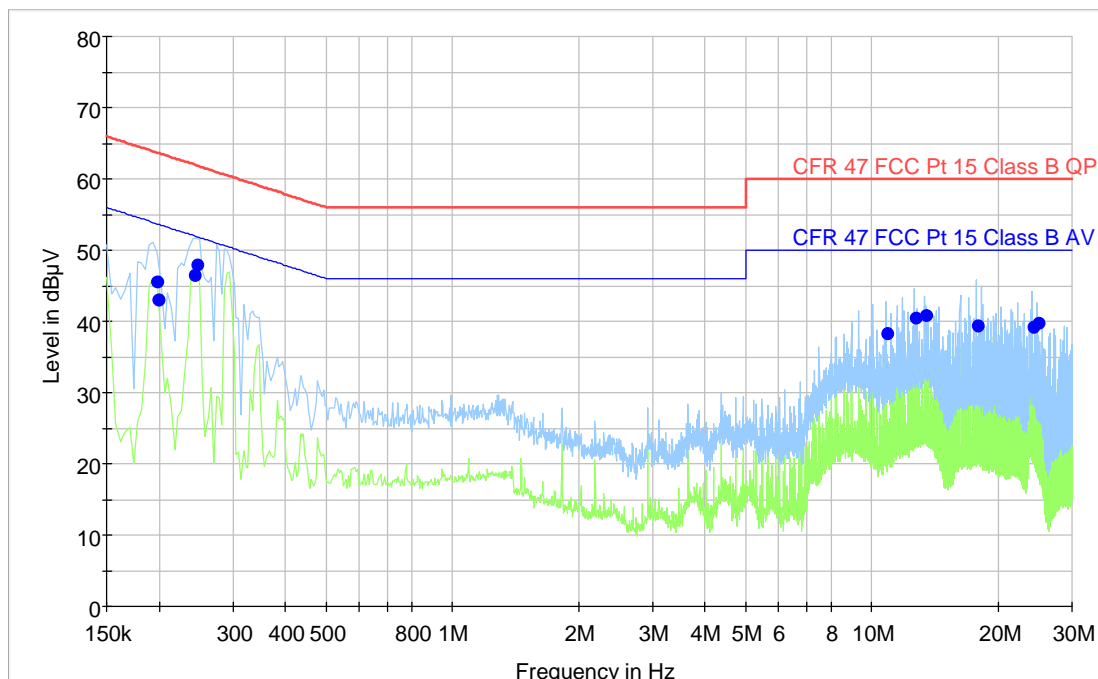
Test Results: Complies.

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

Highest measured value (L1 and N):

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ 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:

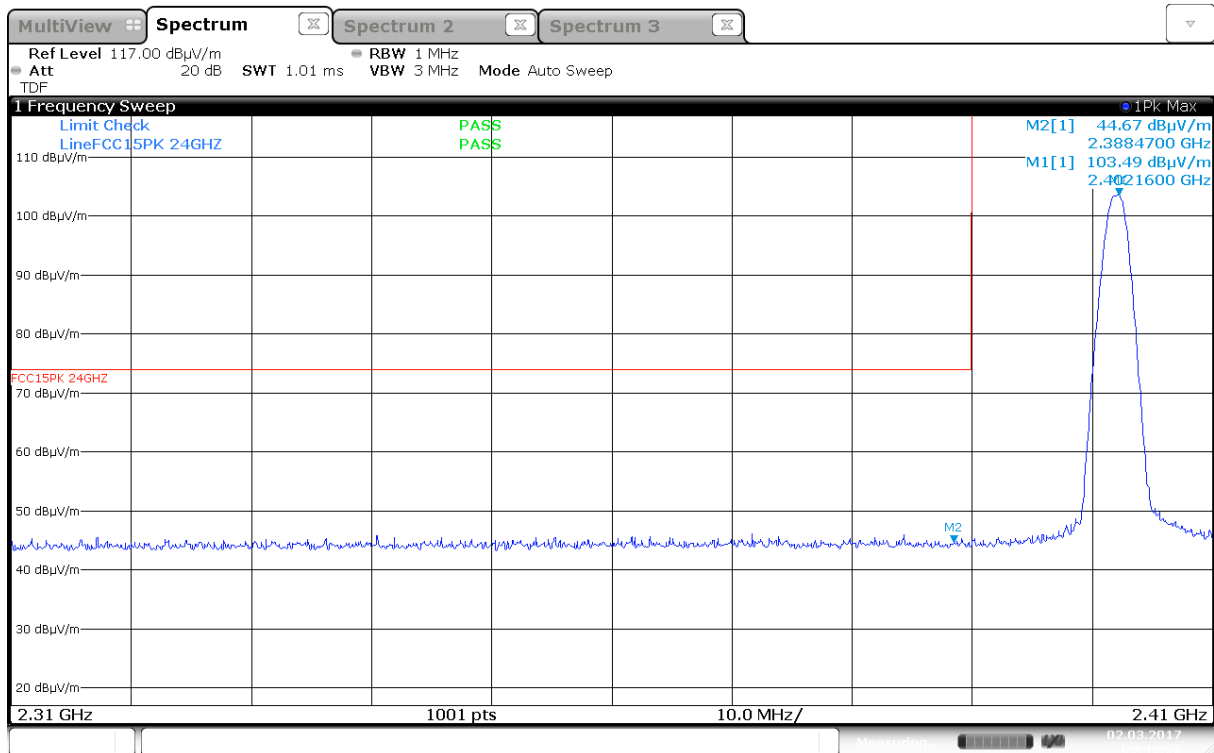
Calculated from values in UL report no. 15U21878-E1V2.

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

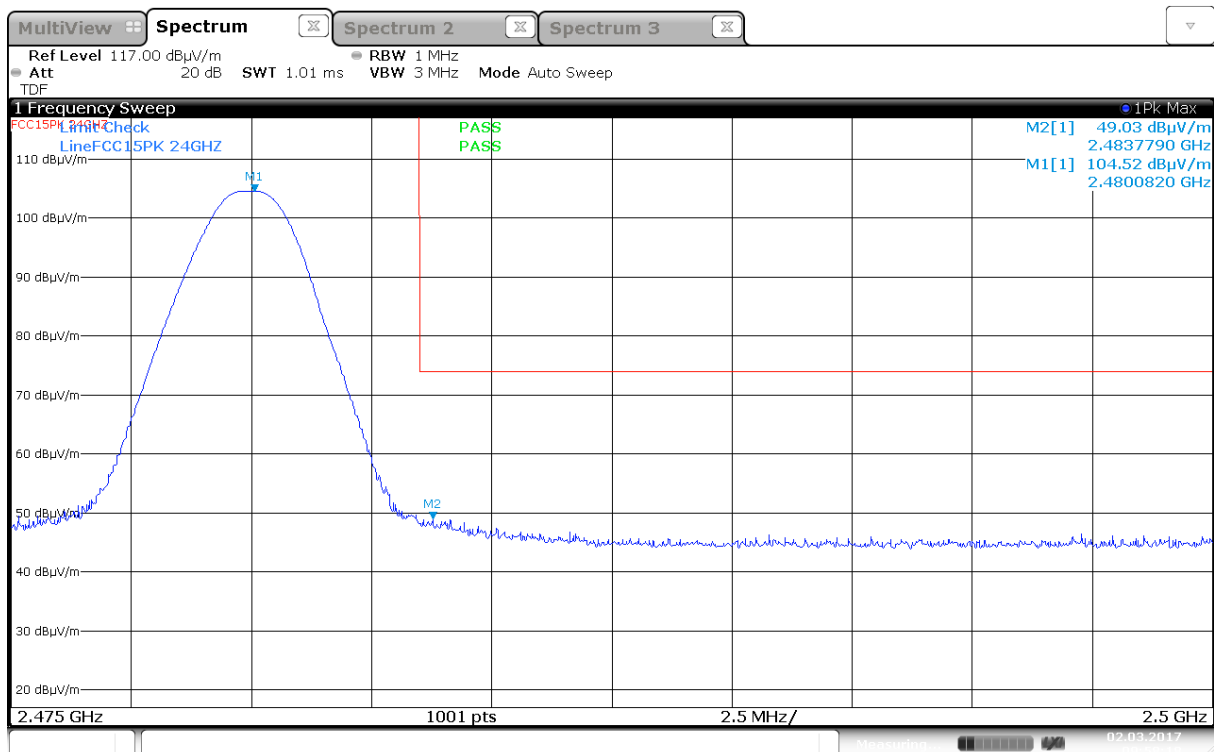
Duty Cycle Correction factor = $-20 \times \log(\text{Duty Cycle} / \text{Number of Hopping Channels})$

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

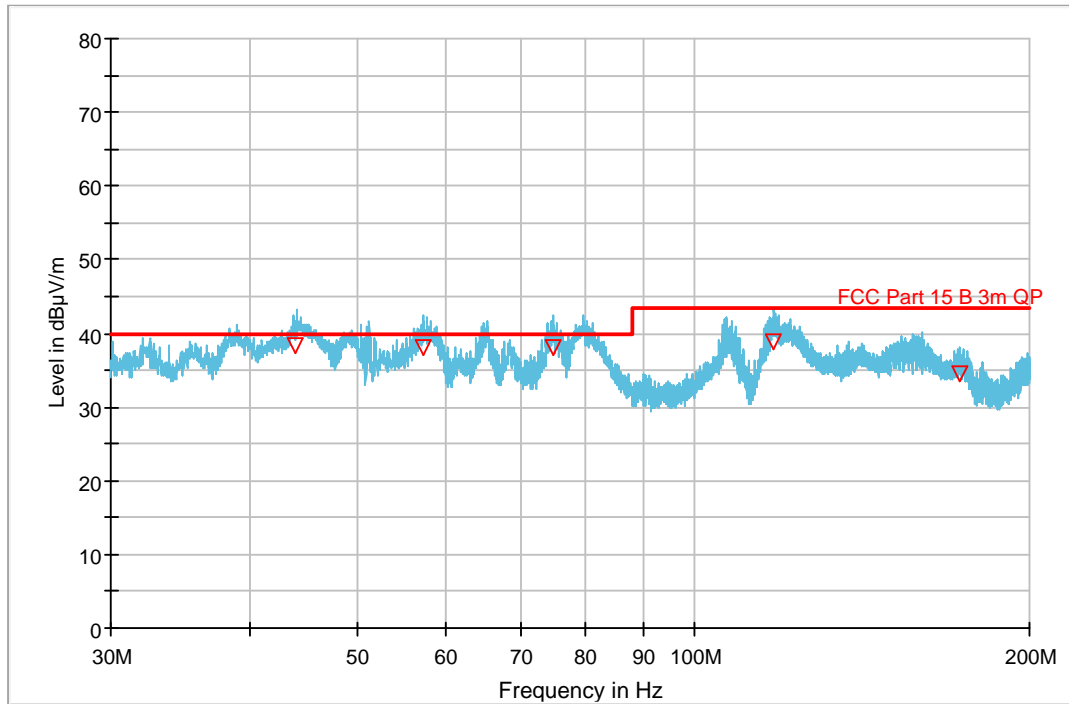
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
43.831	38.40	40.00	1.60	1000.0	120.000	110.0	V	208	-27.1
57.103	37.98	40.00	2.02	1000.0	120.000	100.0	V	216	-28.7
74.853	38.14	40.00	1.86	1000.0	120.000	110.0	V	182	-28.3
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

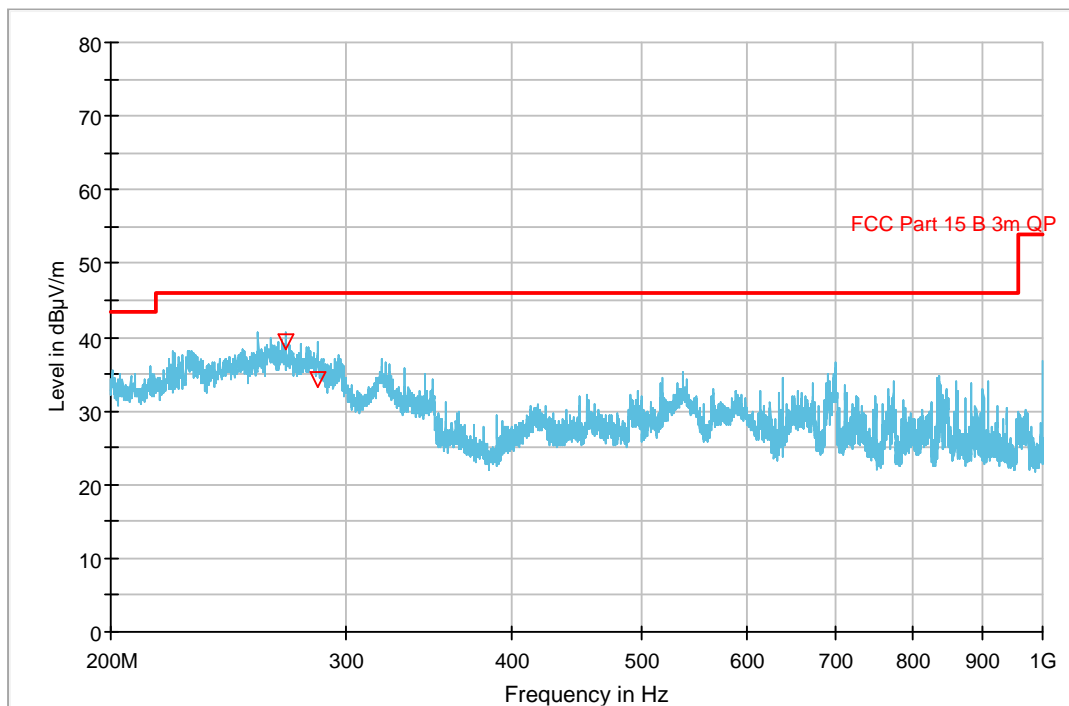
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 4, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	Quasi Peak (µV/m)	Quasi Peak (dBµV/m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

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

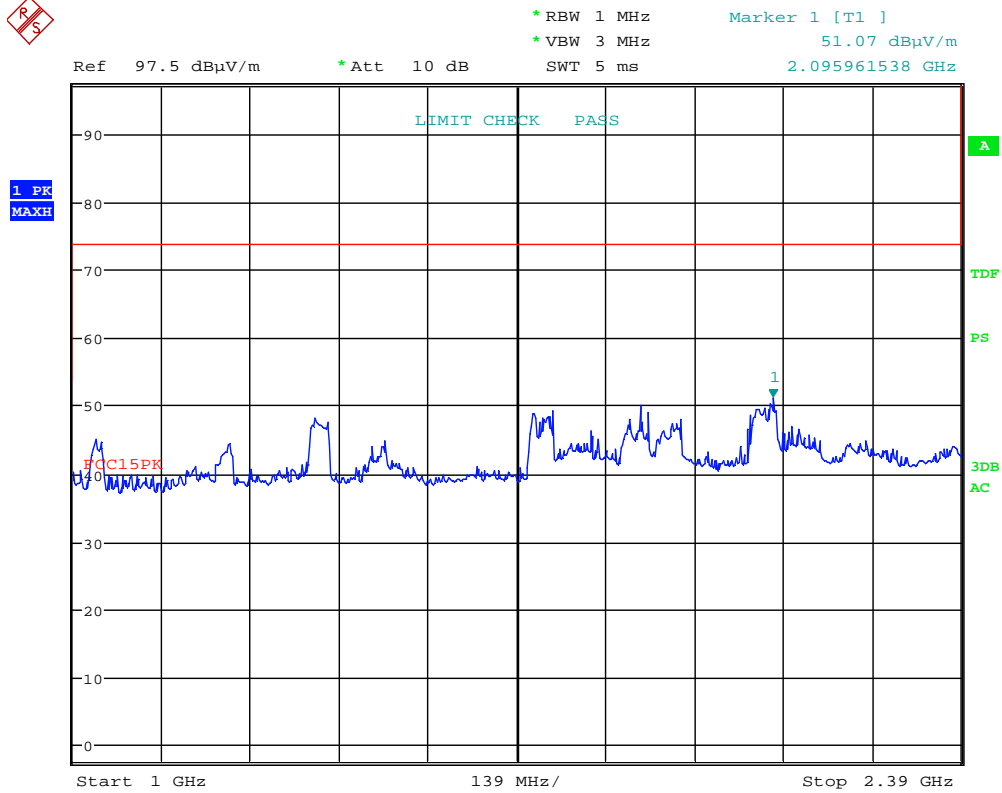
Only harmonics that fall in the restricted bands (ref. §15.205) have been checked.

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



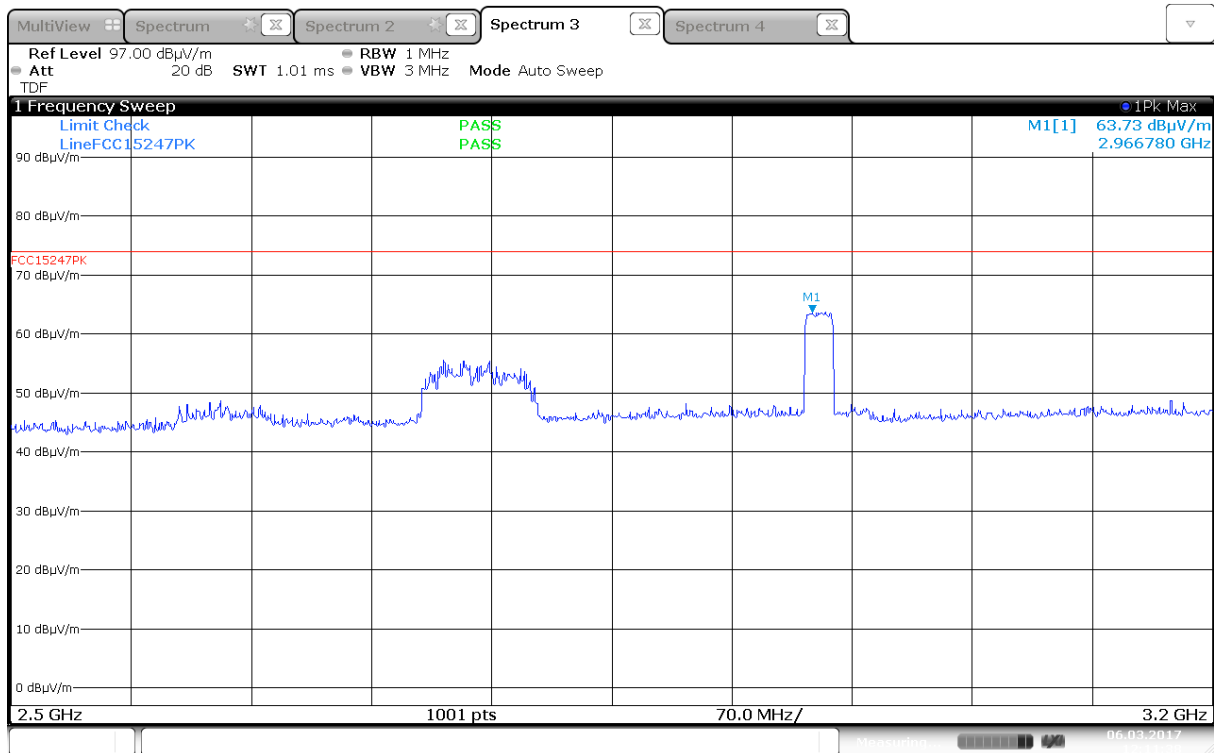
Date: 6.MAR.2017 09:16:38

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

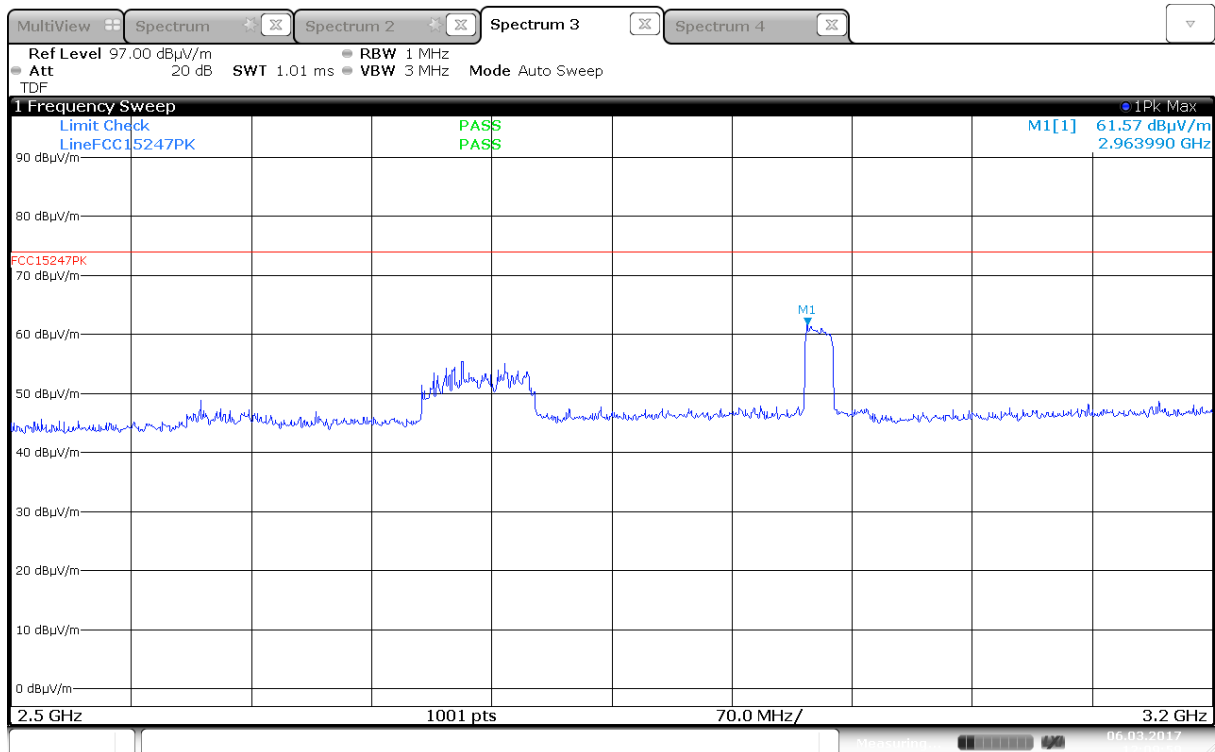


Date: 6.MAR.2017 09:14:47

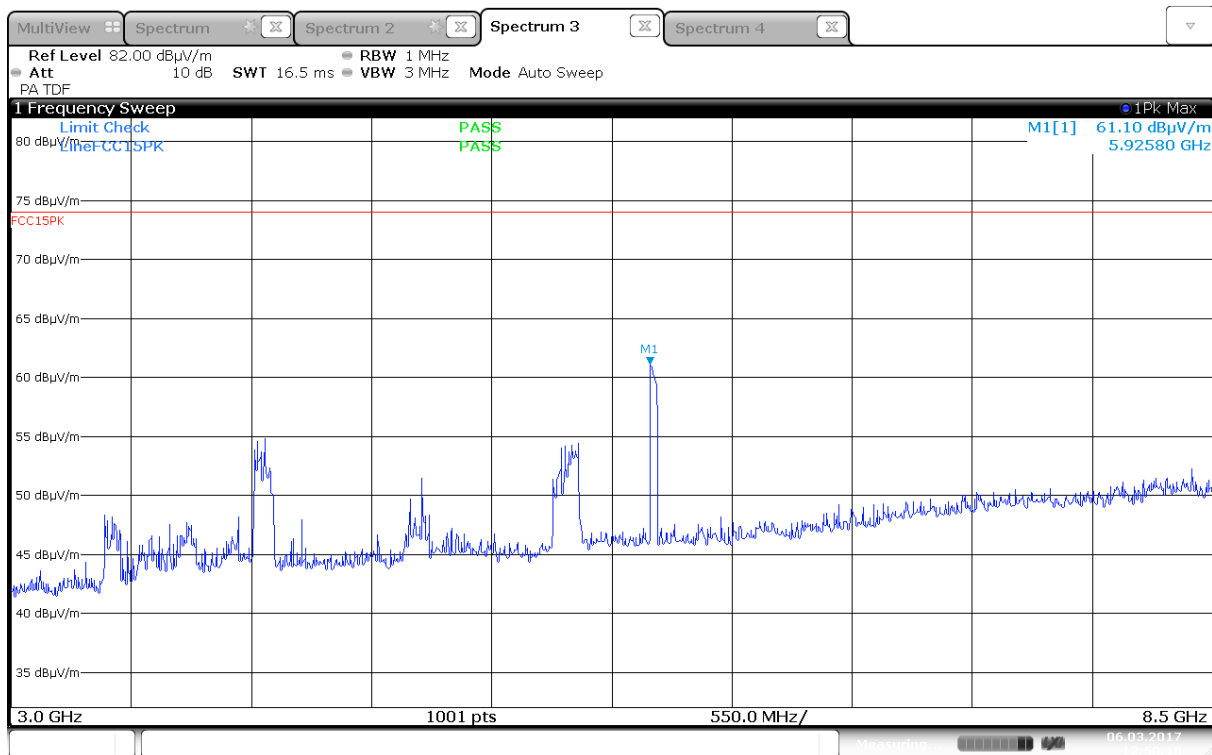
Radiated Emissions, 1000 -2390MHz, 2402MHz, VP



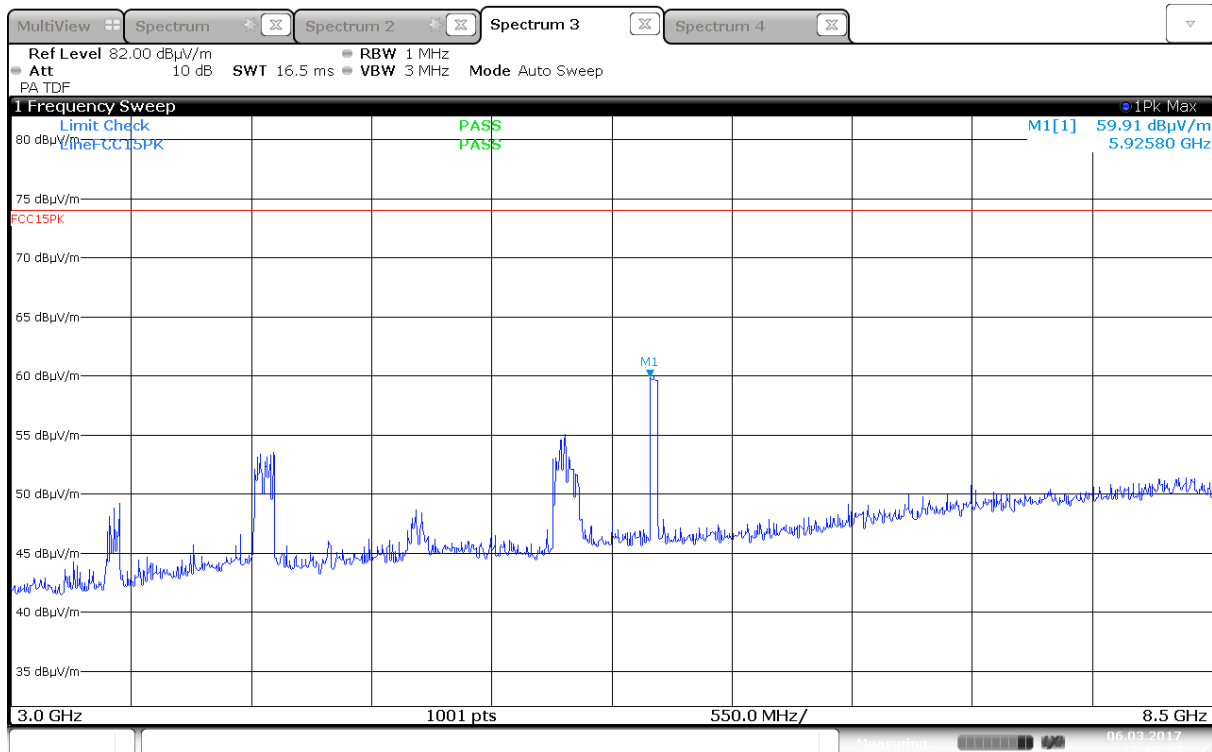
Radiated Emissions, 2500 -3200MHz, 2480MHz, HP



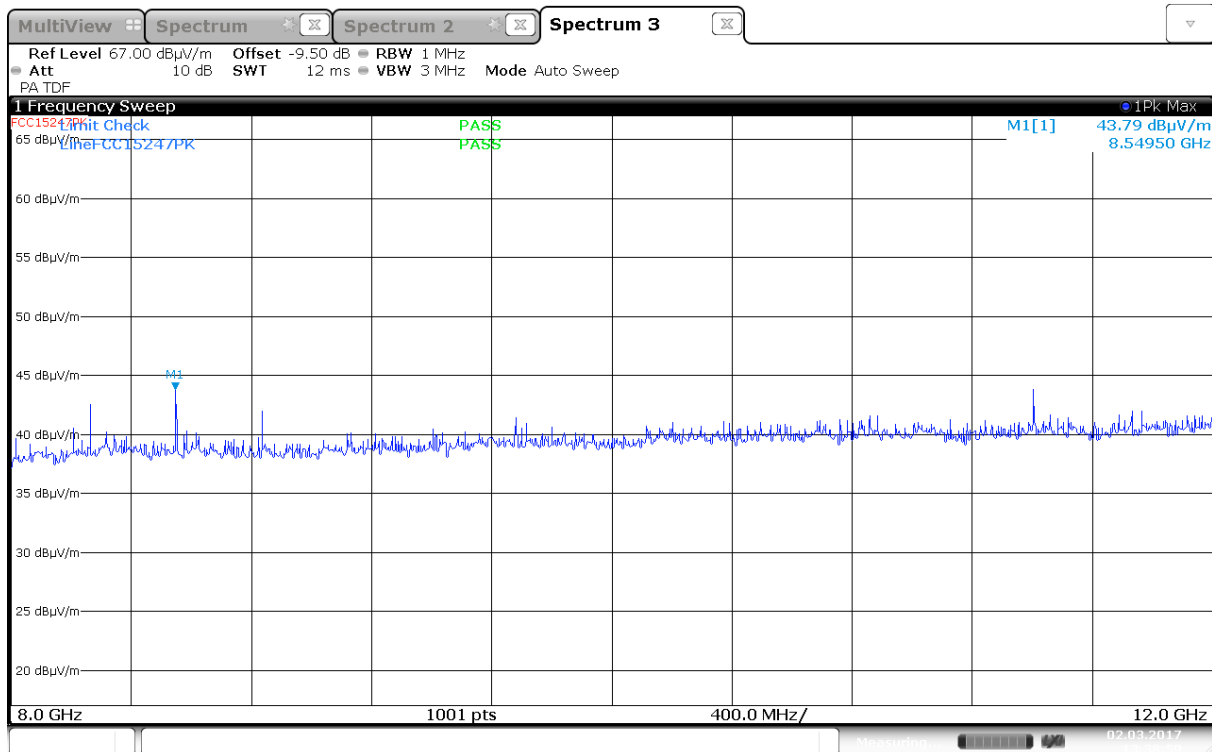
Radiated Emissions, 2500 -3200MHz, 2480MHz, VP



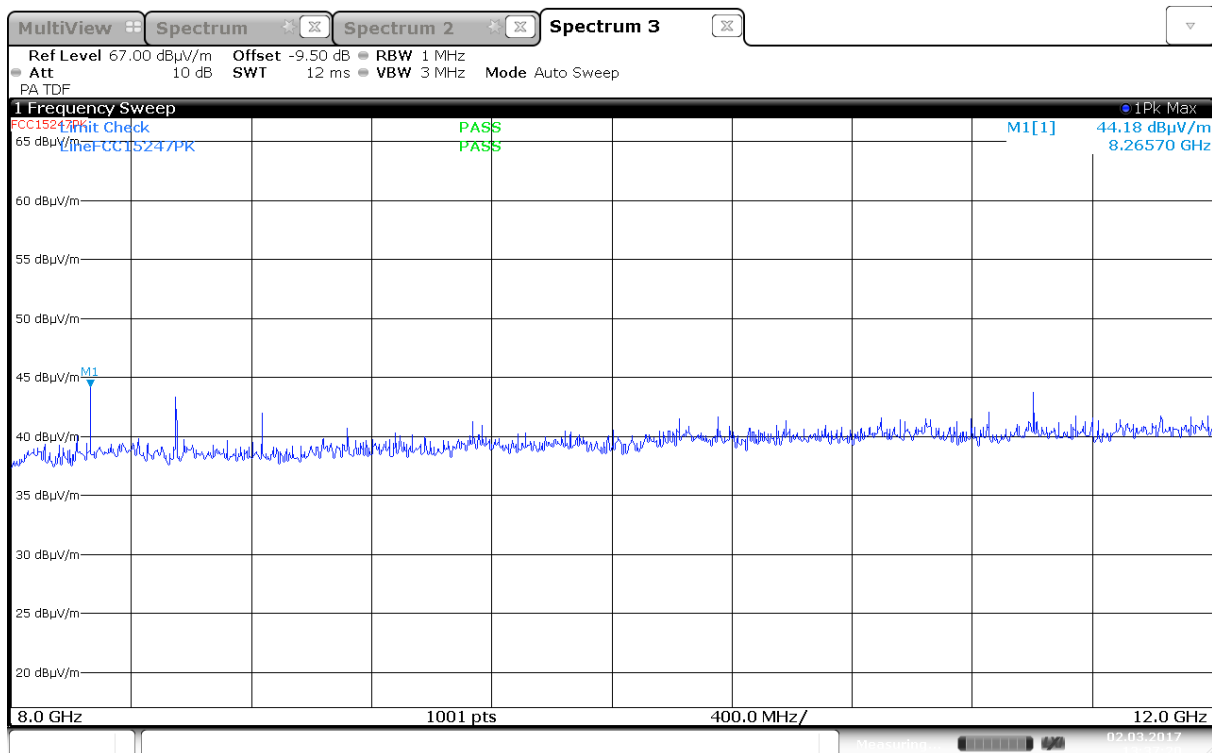
Radiated Emissions, 3000 -8500MHz, 2440MHz, HP



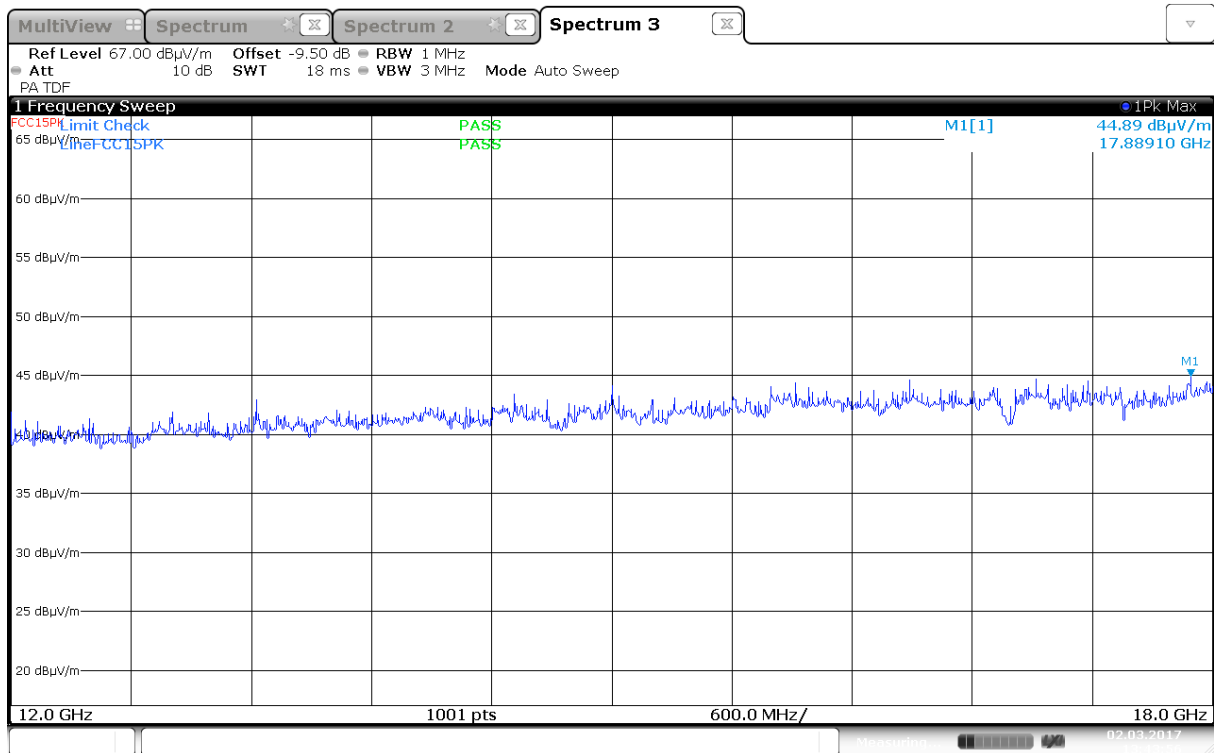
Radiated Emissions, 3000 -8500MHz, 2440MHz, VP



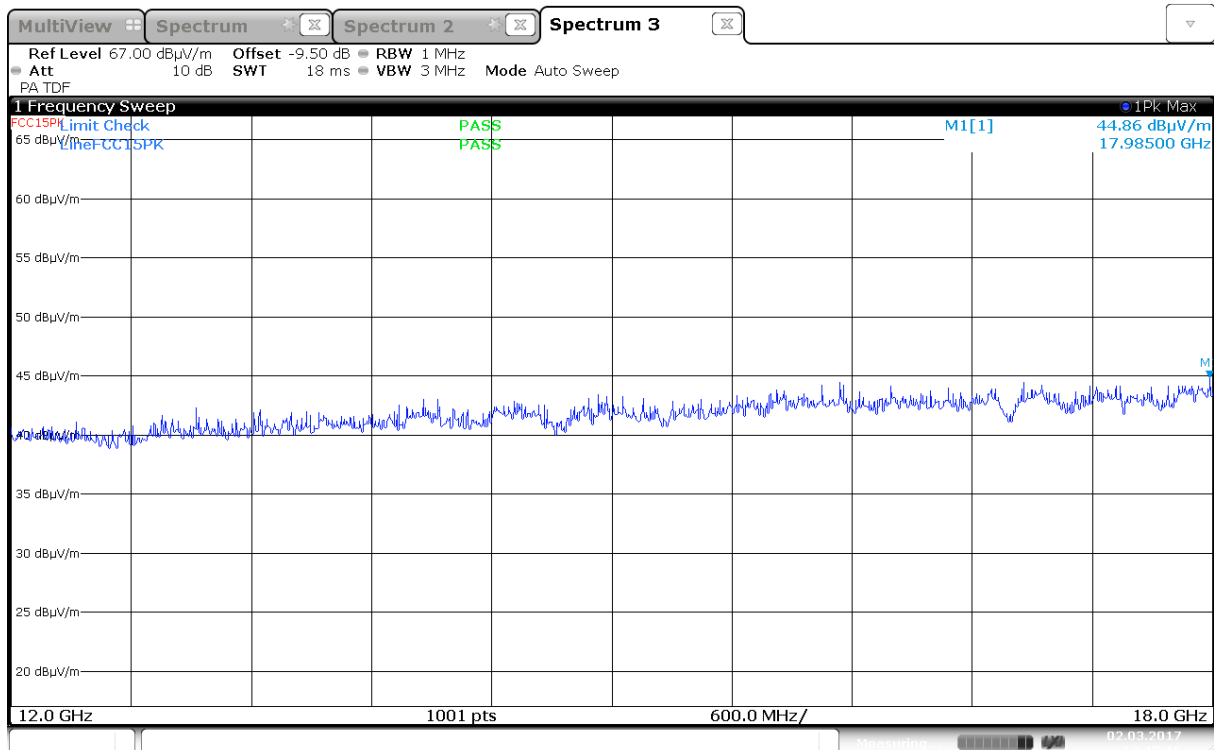
Radiated Emissions, 8000 -12000MHz, 2440MHz, HP, @1m



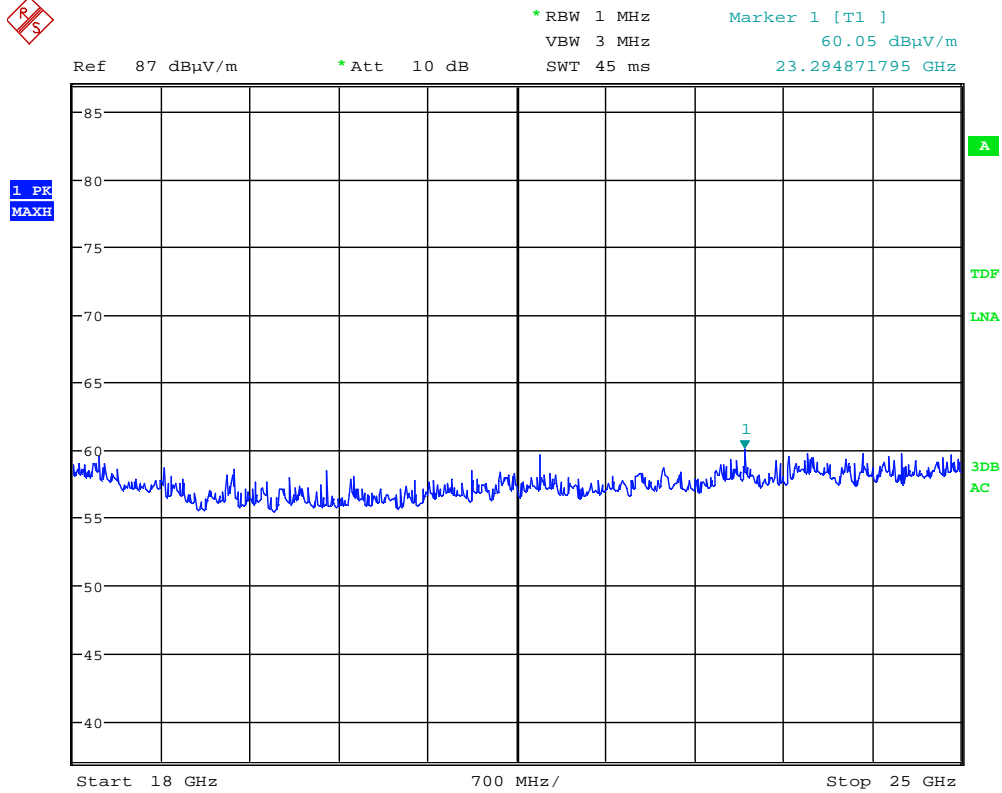
Radiated Emissions, 8000 -12000MHz, 2440MHz, VP, @1m



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

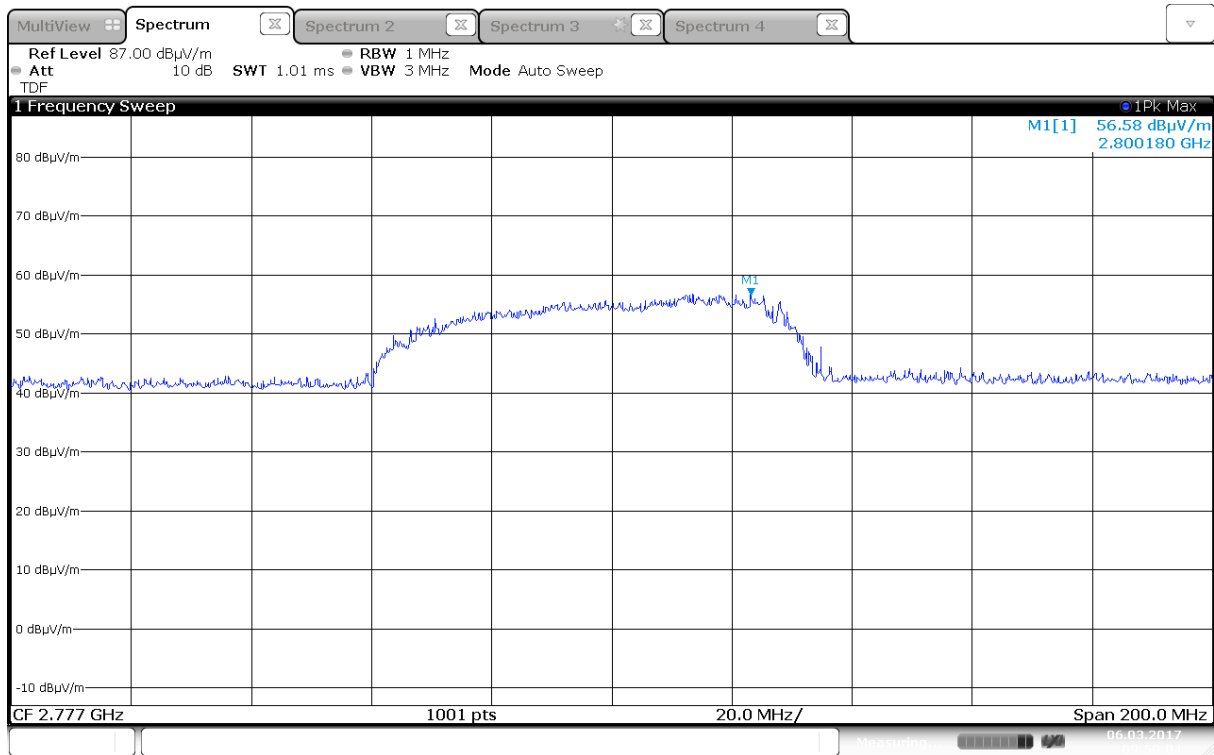


Radiated Emissions, 12000 -18000MHz, 2440MHz, VP, @1m

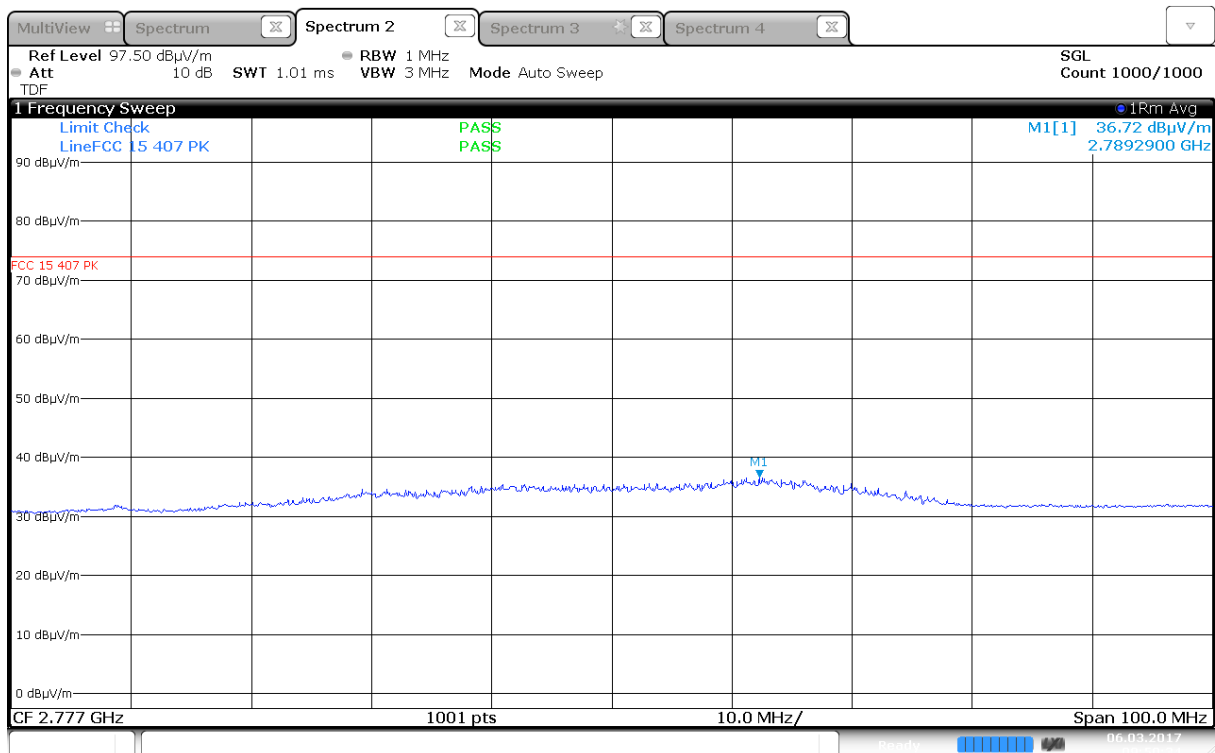


Date: 2.MAR.2017 15:47:15

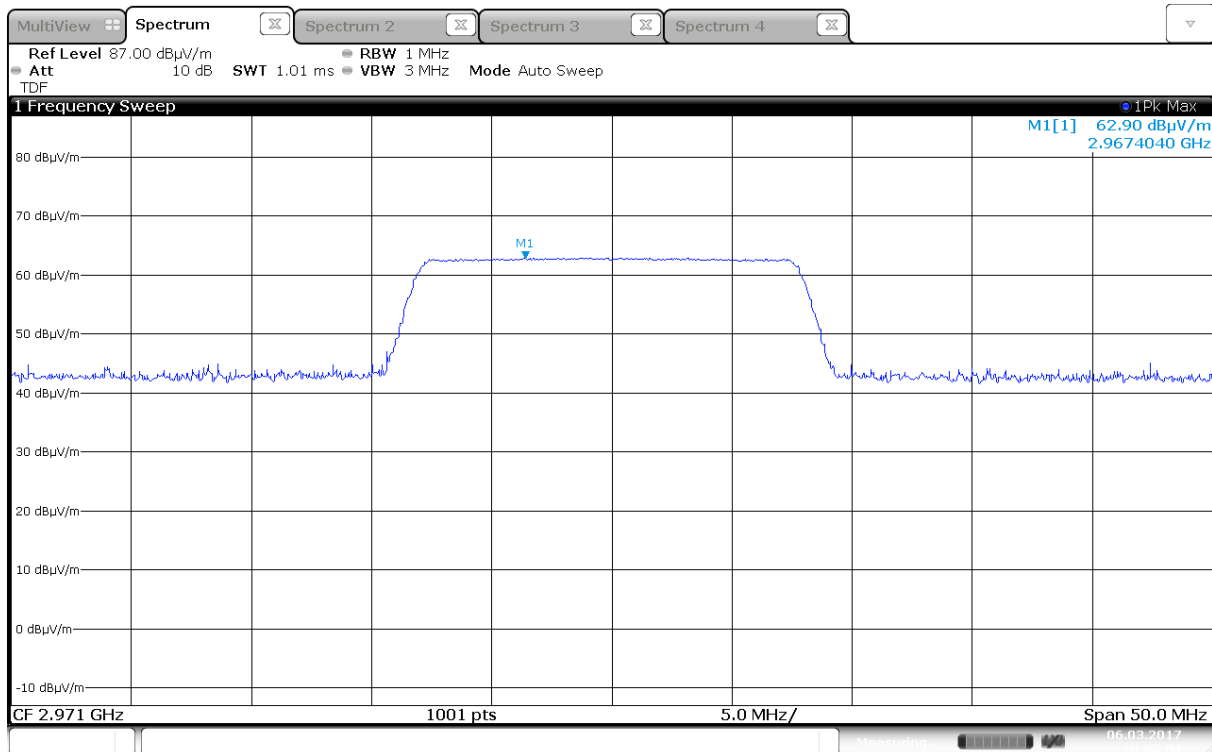
Pre-scan, 18000 -25000MHz, 2440MHz, HP, @10cm



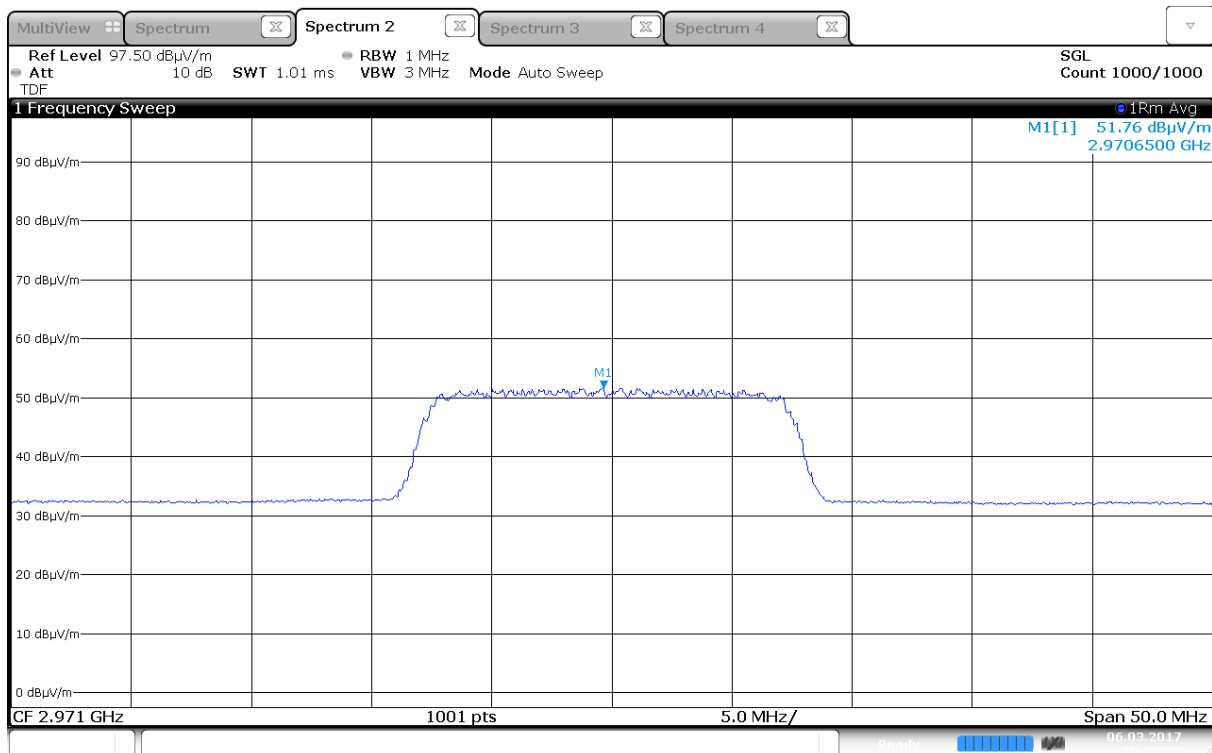
Radiated Emissions, 2777MHz Peak, 2440MHz (Max: VP)



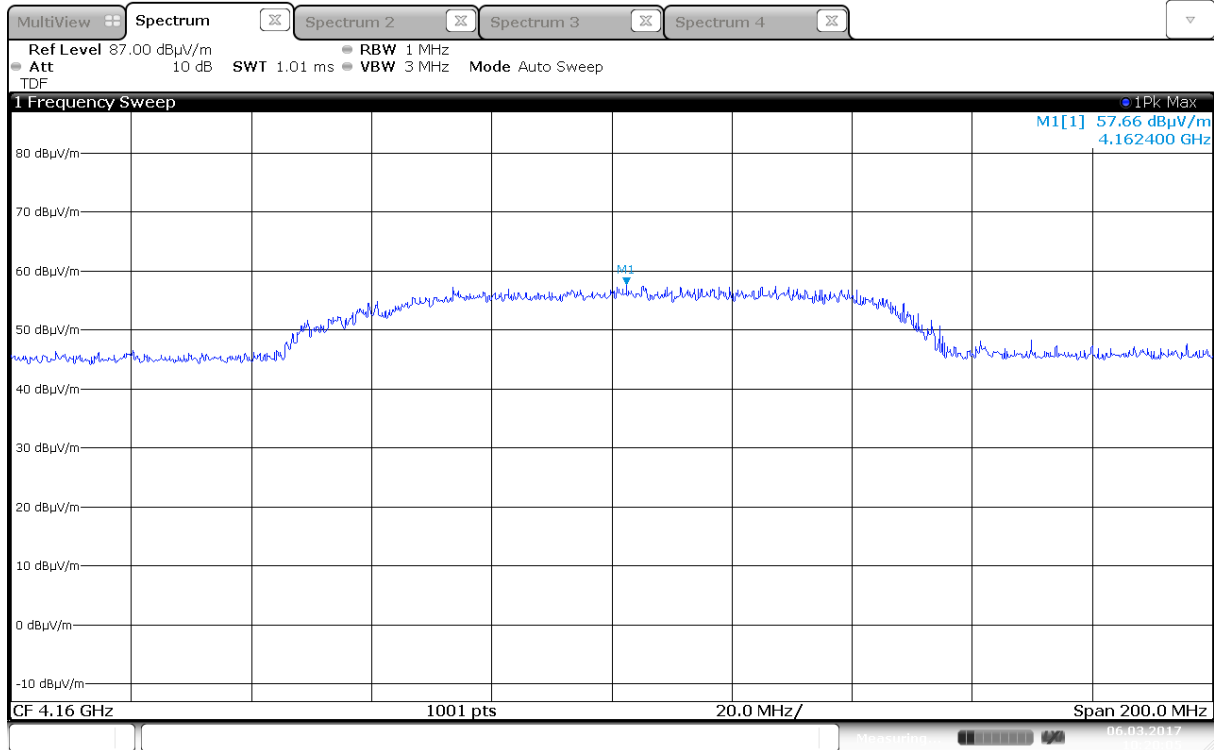
Radiated Emissions, 2777MHz RMS, 2440MHz (Max: VP)



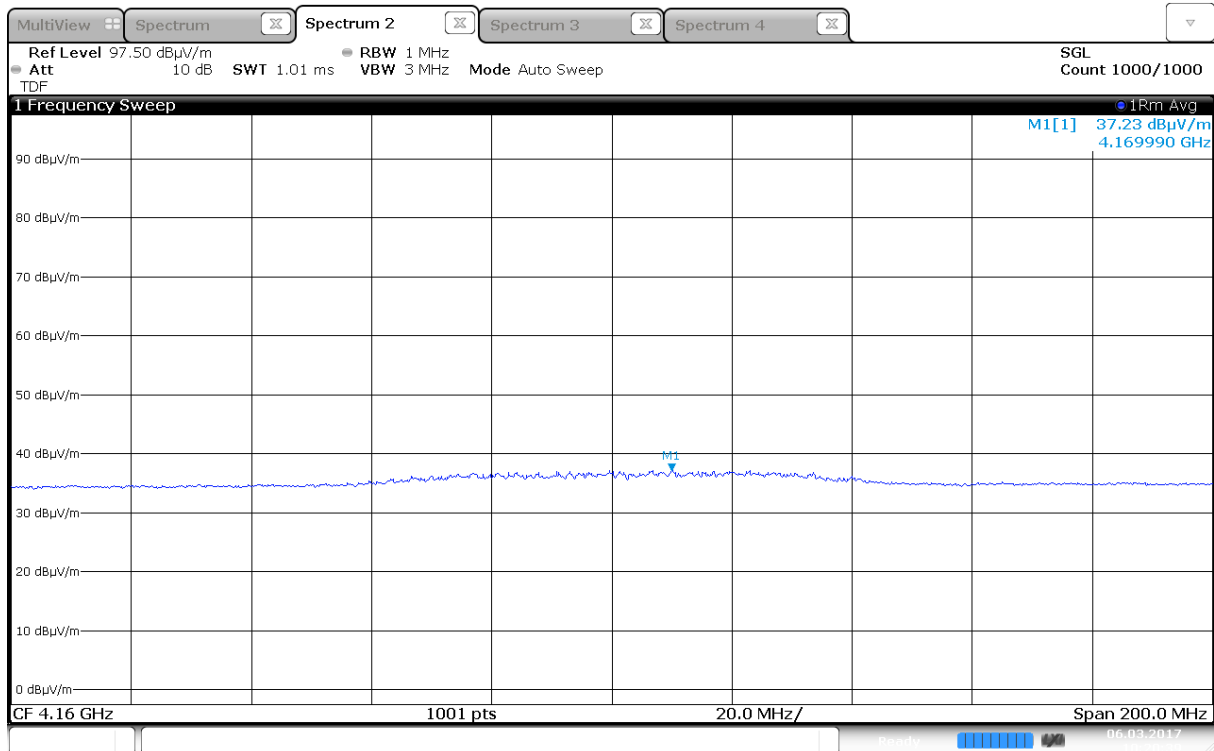
Radiated Emissions, 2971MHz Peak, 2440MHz (Max: VP)



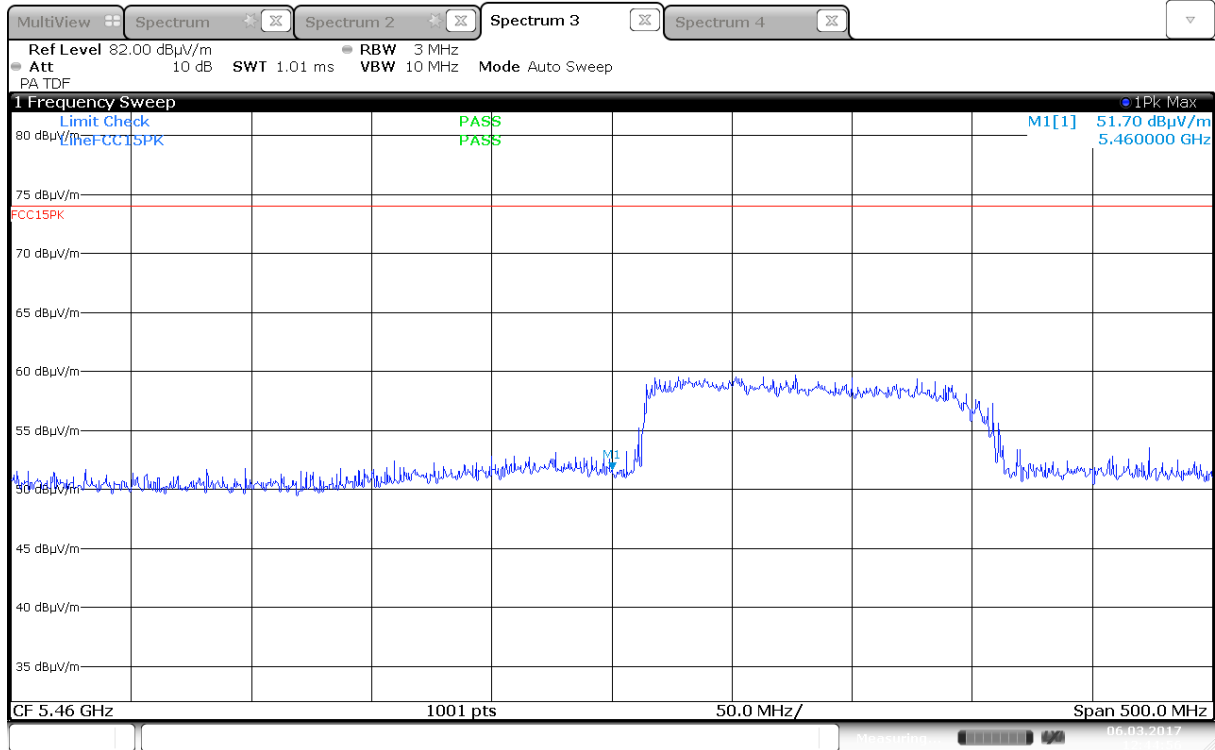
Radiated Emissions, 2971MHz RMS, 2440MHz (Max: VP)



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

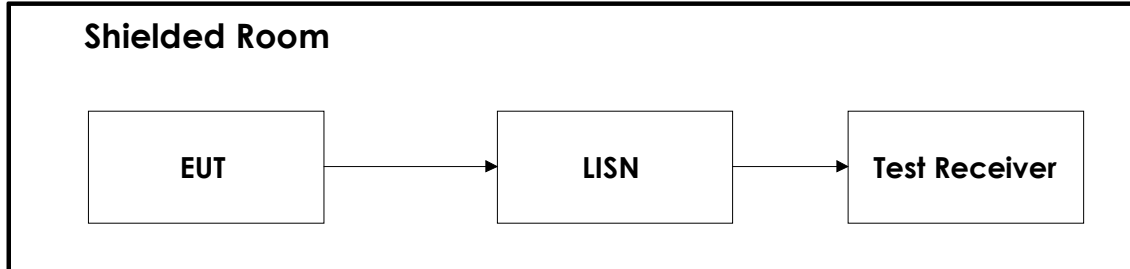
To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

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	ESCI3	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

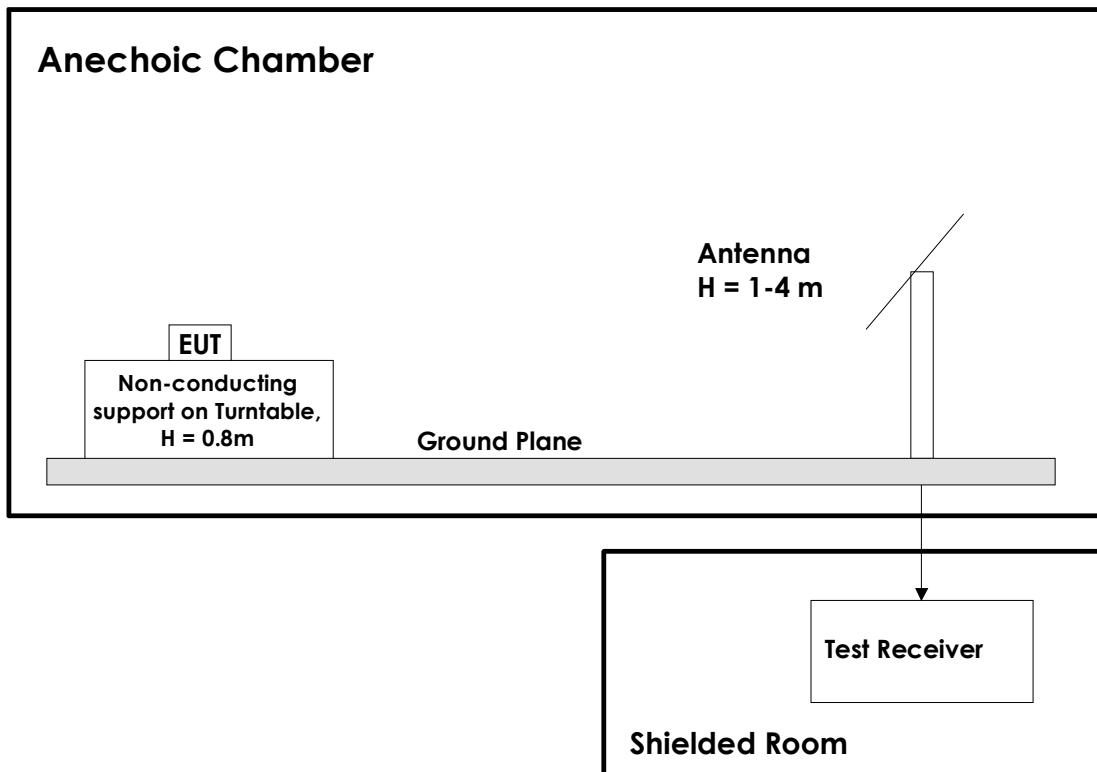
Test Software List			
Description	Manufacturer	Model	Version
EMC Software for Conducted tests	Rohde & Schwarz	EMC32	9.26.00

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