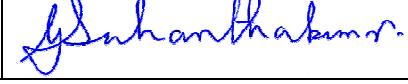




Report No. 312072-4

## Test Report

<b>Product</b>	Digital Video Conference System with WLAN and BT
<b>Name and address of the applicant</b>	Cisco Systems, Inc. 170 West Tasman Drive San Jose, CA 95134, USA
<b>Name and address of the manufacturer</b>	Cisco Systems, Inc. 170 West Tasman Drive 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> Frequency Hopping Transmitters / Digital Transmission Systems <b>Industry Canada RSS-247, Issue 2</b> 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>	 Instituttveien 6 Kjeller, Norway
	FCC No: 994405 IC OATS: 2040D-1 TEL: +47 22 96 03 30 FAX: +47 22 96 05 50
	 
	Prepared by [Frode Sveinsen] Approved by [G. Suhanthakumar]
This report shall not be reproduced except in full without the written approval of Nemko. Opinions and interpretations expressed within this report are not part of the current accreditation. This report was originally distributed electronically with digital signatures. For more information contact Nemko.	

Template version: C

### Nemko Norway

Nemko AS, Instituttveien 6, P.O. Box 96 Kjeller, 2027 Kjeller, Norway  
TEL +47 22 96 03 30 FAX +47 22 96 05 50 EMAIL info@nemko.com  
ENTERPRISE NUMBER NO974404532

[nemko.com/no](http://nemko.com/no)

## CONTENTS

<b>1</b>	<b>INFORMATION</b>	<b>3</b>
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
<b>2</b>	<b>TEST REPORT SUMMARY</b>	<b>5</b>
2.1	General .....	5
2.2	Test Summary .....	6
<b>3</b>	<b>TEST RESULTS</b>	<b>7</b>
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
<b>4</b>	<b>Measurement Uncertainty</b> .....	<b>24</b>
<b>5</b>	<b>LIST OF TEST EQUIPMENT</b> .....	<b>25</b>
<b>6</b>	<b>BLOCK DIAGRAM</b> .....	<b>26</b>
6.1	Power Line Conducted Emission .....	26
6.2	Test Site Radiated Emission .....	26

## 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 Bluetooth: 79
<b>Operating Modes :</b>	Bluetooth and Bluetooth Low Energy
<b>Type of Modulation :</b>	GFSK, π/4-DQPSK, 8DPSK
<b>Output Power :</b>	GFSK: 11.56 mW 8PSK: 9.93 mW 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.

<input checked="" type="checkbox"/> New Submission	<input checked="" type="checkbox"/> Production Unit
<input type="checkbox"/> Class II Permissive Change	<input type="checkbox"/> Pre-production Unit
<b>DSS</b> Equipment Code	<input type="checkbox"/> 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".

Nemko Group authorizes the above named company to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any reproduction of parts of this report requires approval in writing from Nemko Group.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Group accepts no responsibility for damages suffered by any third party as a result of decisions made or actions based on this report.

## 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) 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) 15.109(a) 15.209(a)	5.5 (RSS-247) 6.13 (RSS-GEN) 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.

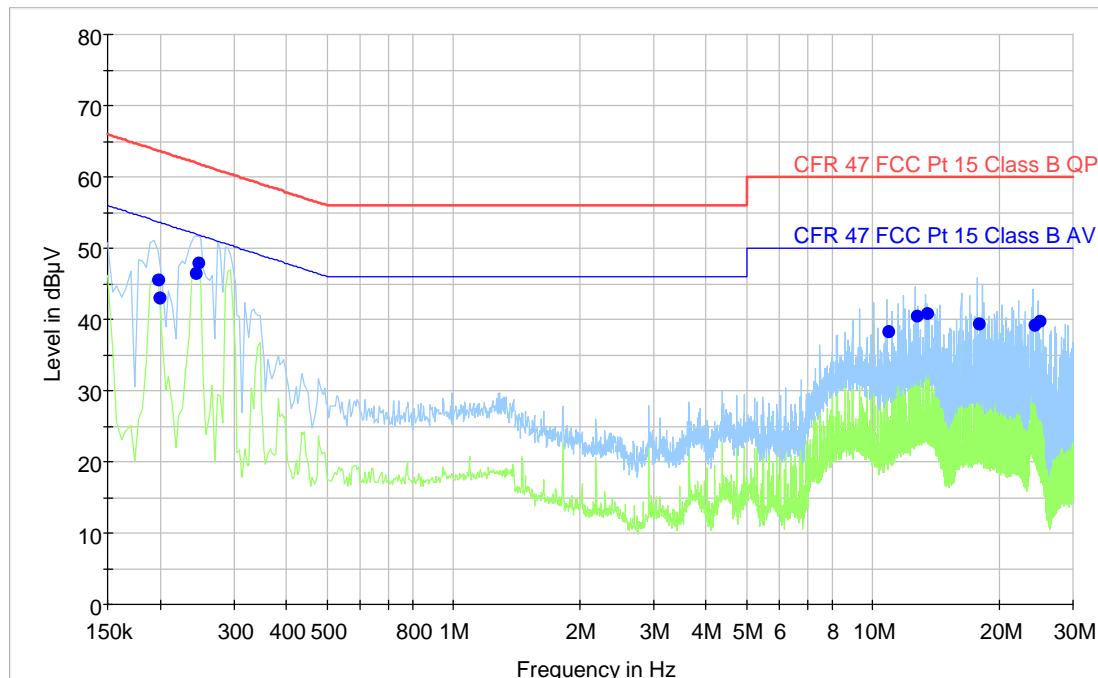
Test Results: Complies.

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 (dB $\mu$ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz		dB $\mu$ V/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:

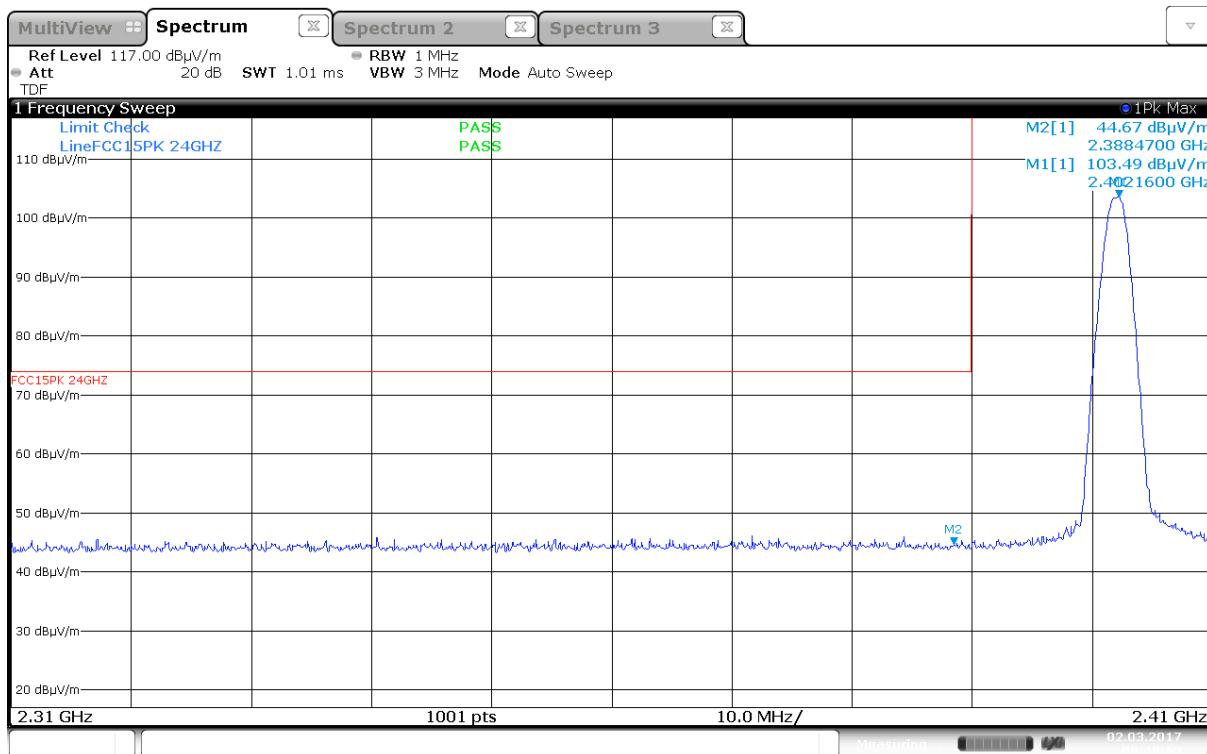
Calculated from values in UL report no. 15U21878-E1V2.

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

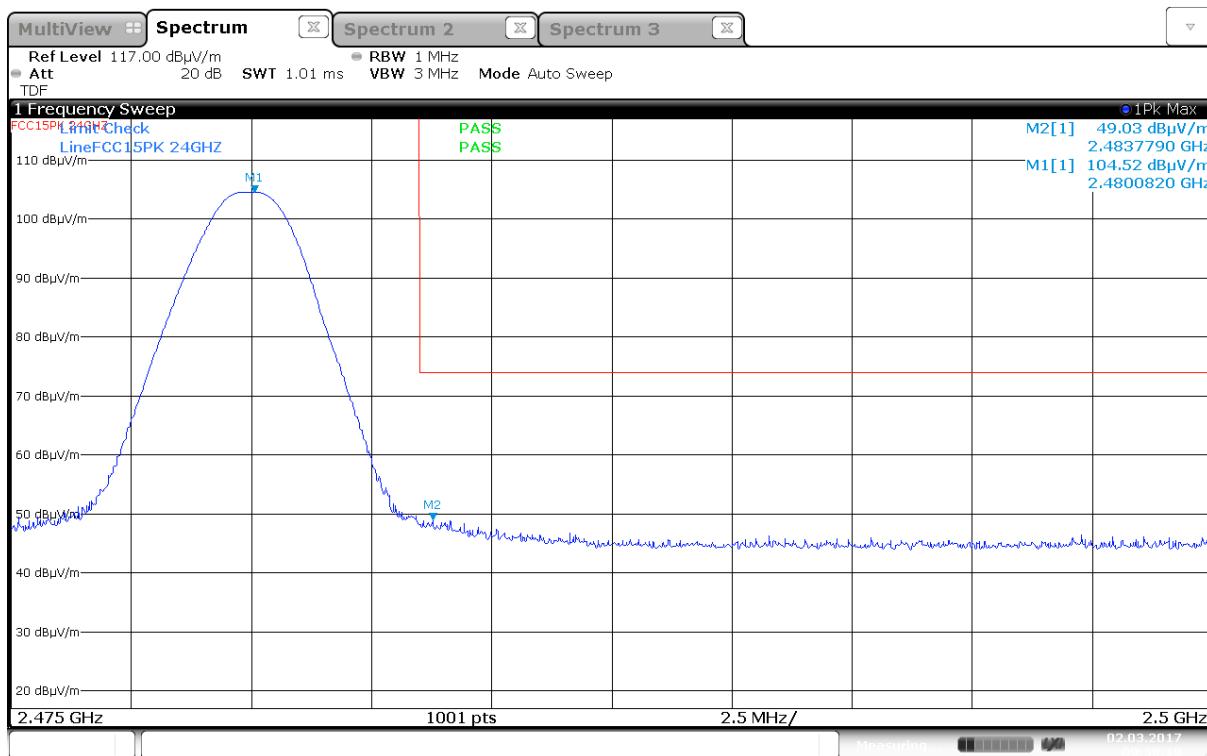
Duty Cycle Correction factor =  $-20 \times \log(\text{Duty Cycle}/\text{Number of Hopping Channels})$

**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

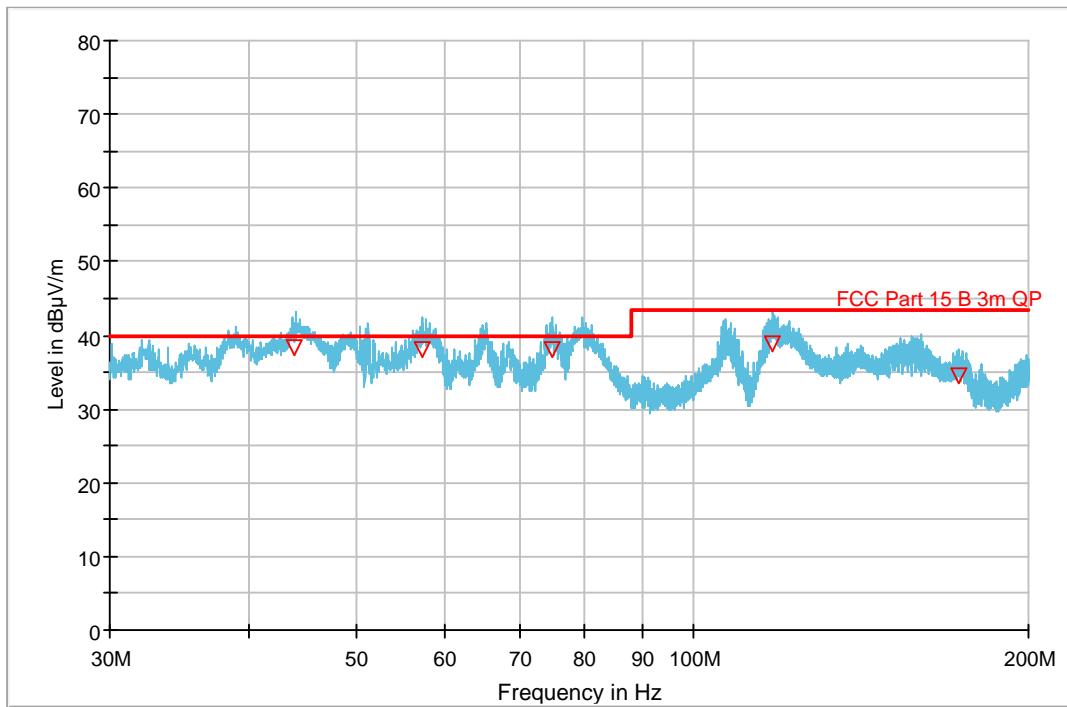
Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
43.831	38.40	40.00	1.60	1000.0	120.000	110.0	V	208	-27.1
57.103	37.98	40.00	2.02	1000.0	120.000	100.0	V	216	-28.7
74.853	38.14	40.00	1.86	1000.0	120.000	110.0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

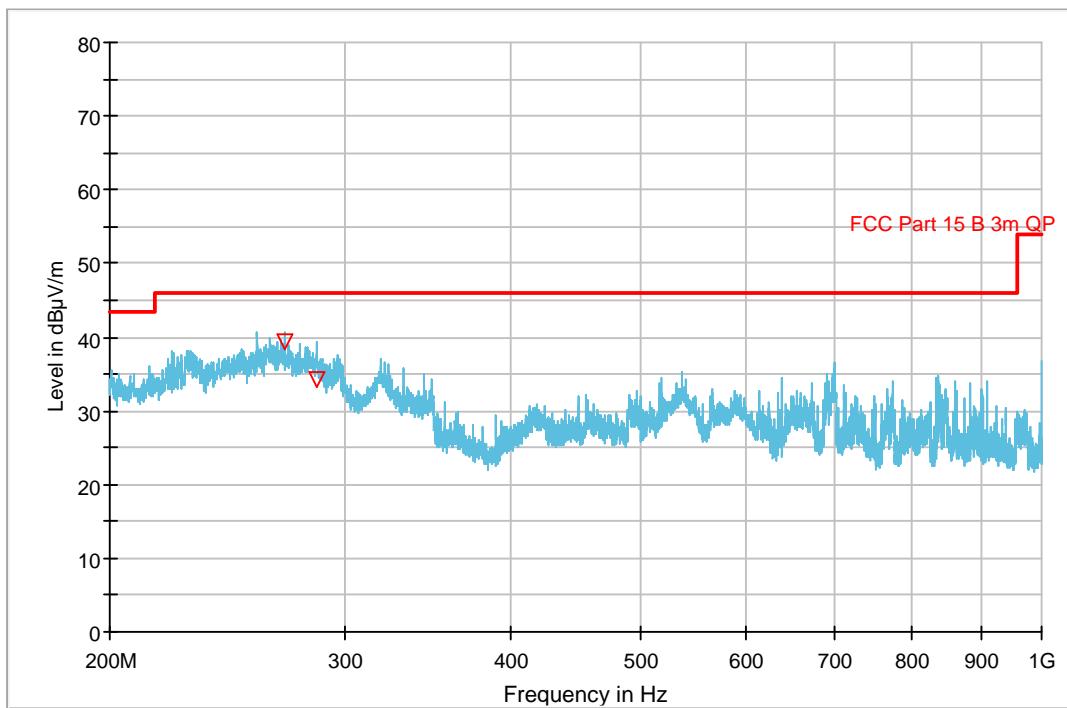
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 4, clause 8.9 @ frequencies defined in clause 8.10	
Radiated emission limit @3 meters		
Frequency (MHz)	Quasi Peak ( $\mu$ V/m)	Quasi Peak (dB $\mu$ V/m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

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 dB $\mu$ V/m @3m	Measured value AV dB $\mu$ V/m @3m	Limit (dB $\mu$ V/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

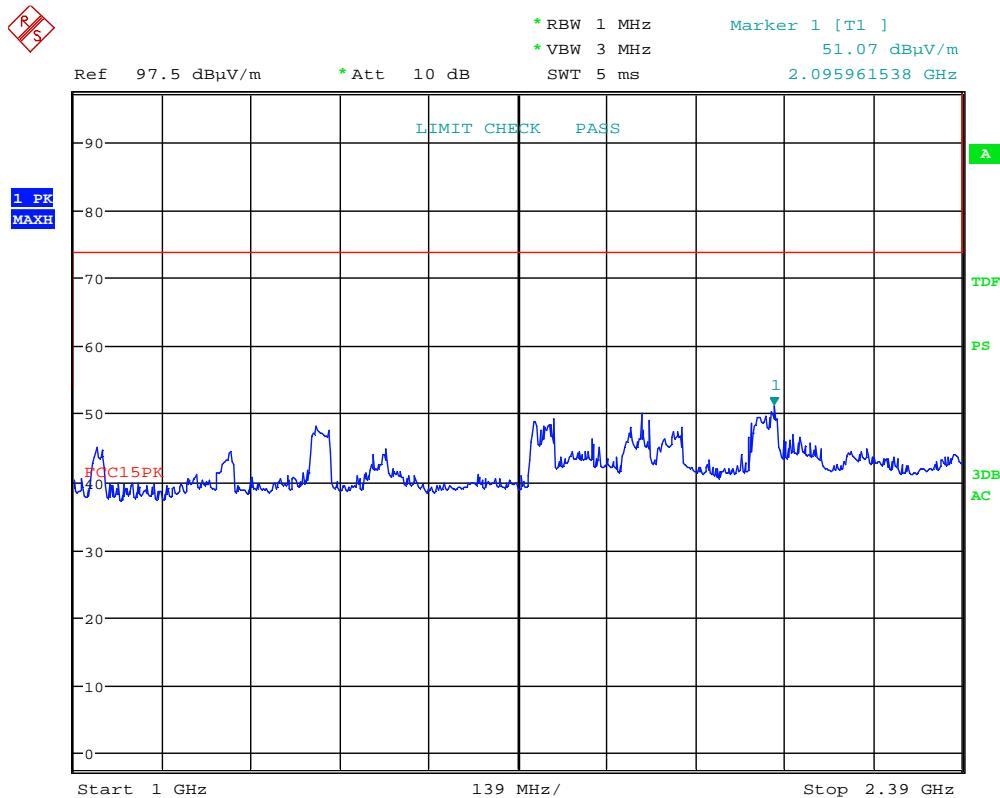
Only harmonics that fall in the restricted bands (ref. §15.205) have been checked.

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 (dB $\mu$ V/m)	Peak (dB $\mu$ V/m)
Above 1 GHz	54.0	74.0



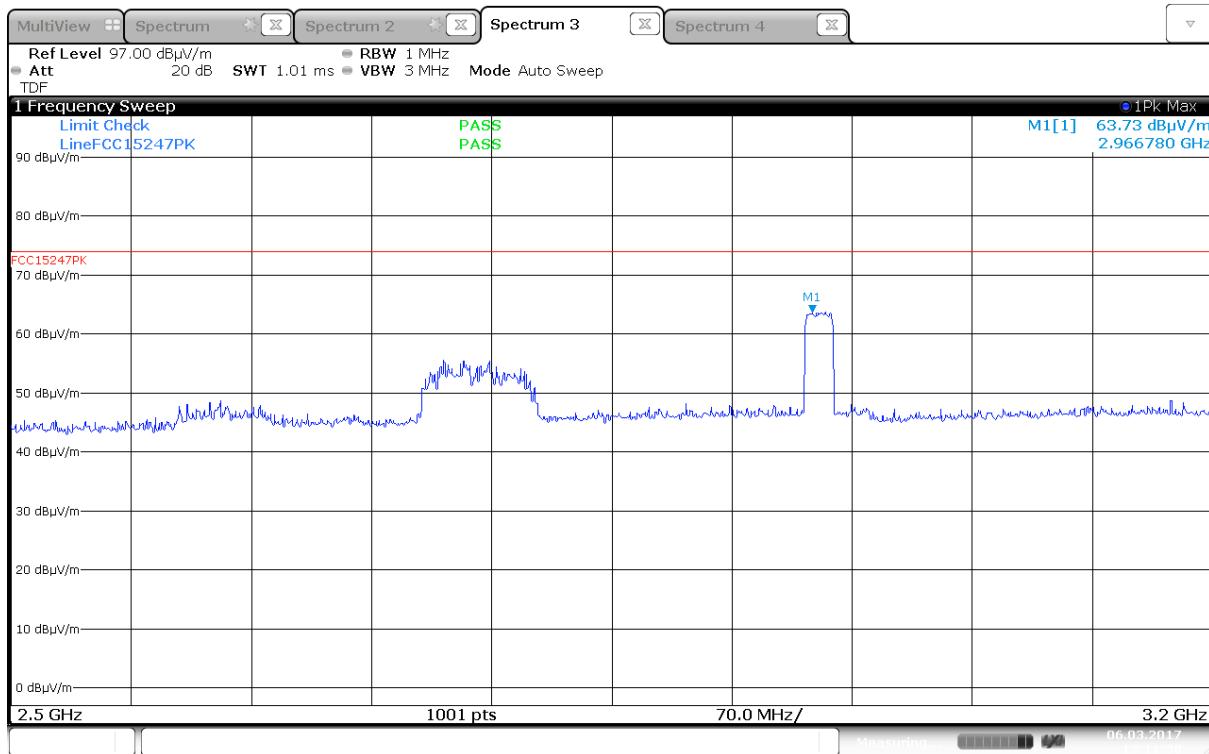
Date: 6.MAR.2017 09:16:38

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

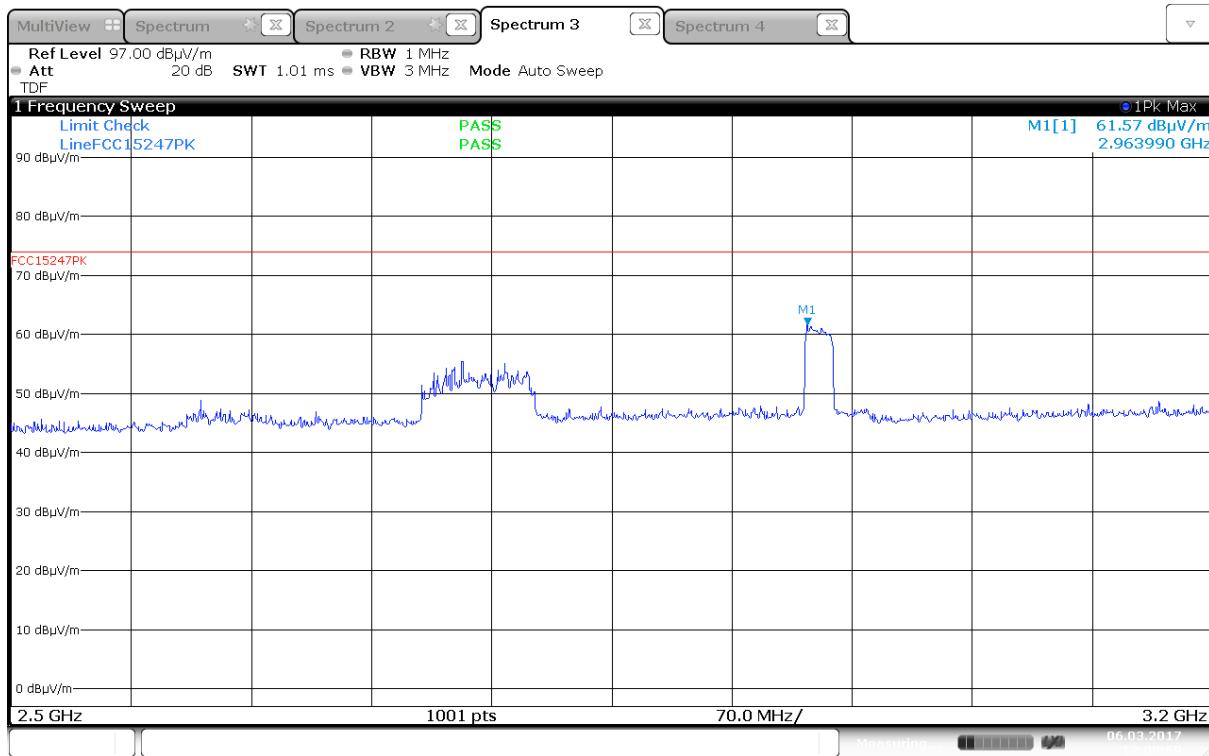


Date: 6.MAR.2017 09:14:47

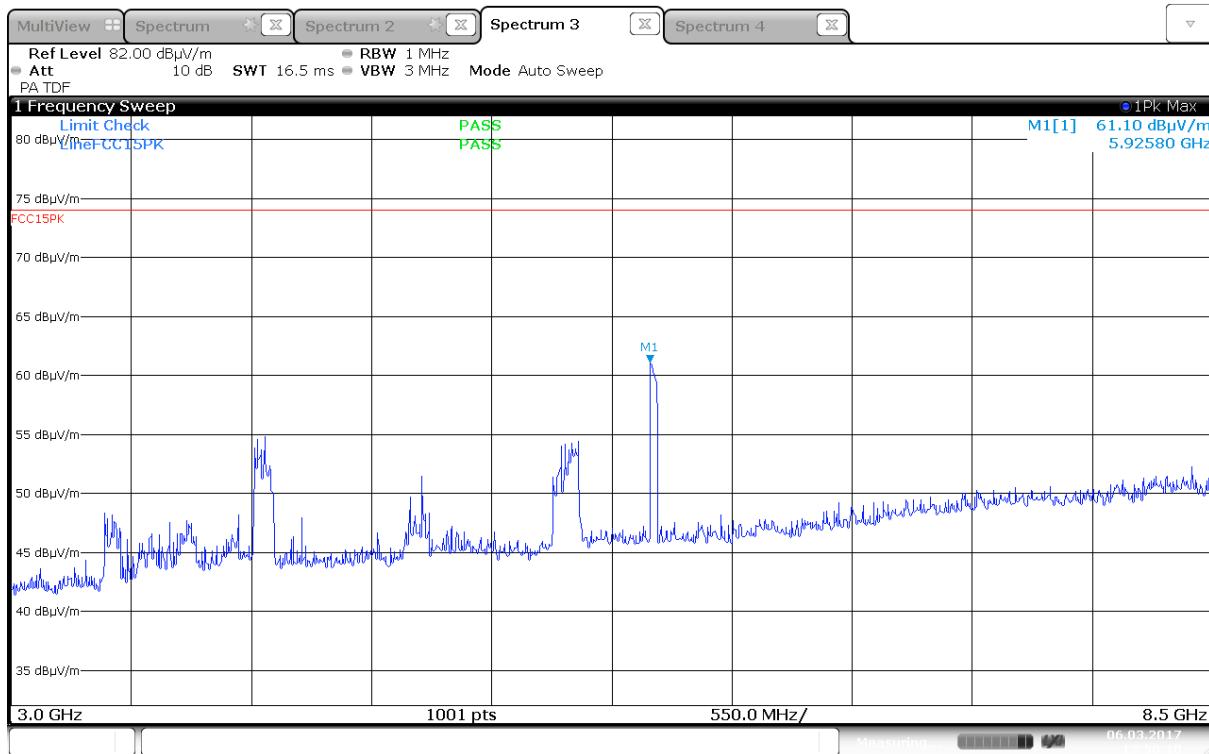
### Radiated Emissions, 1000 -2390MHz, 2402MHz, VP



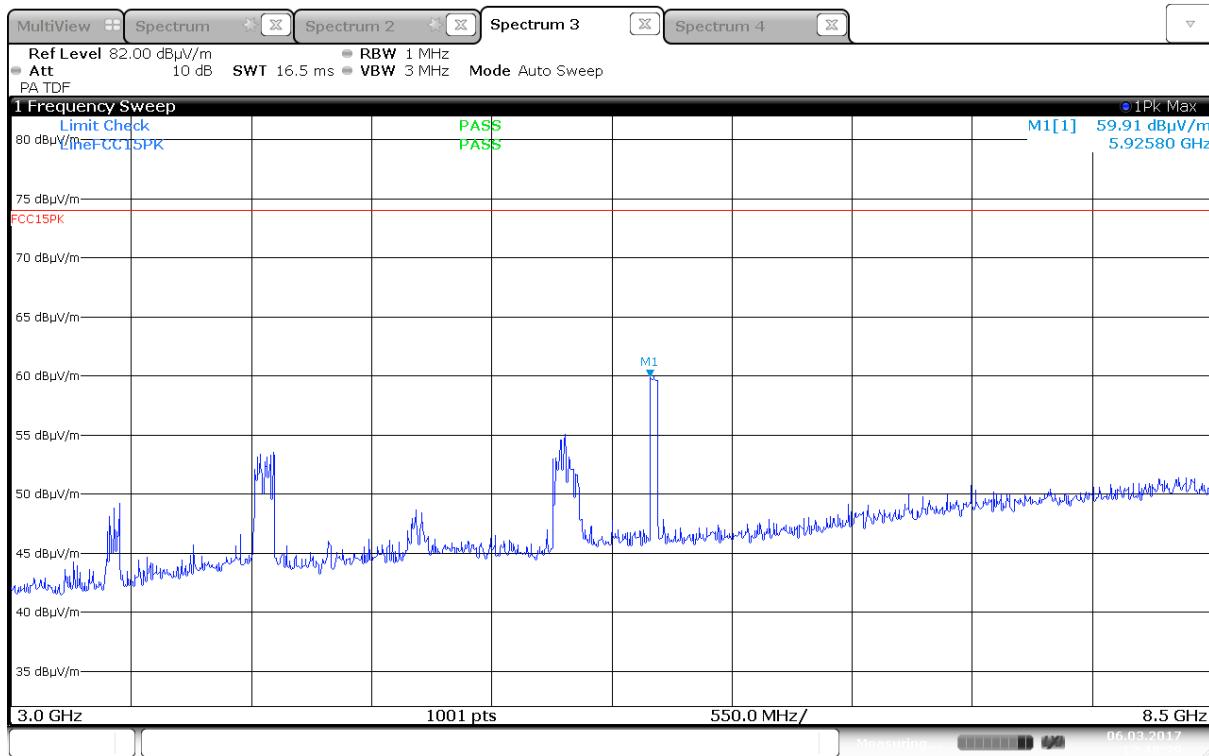
### Radiated Emissions, 2500 -3200MHz, 2480MHz, HP



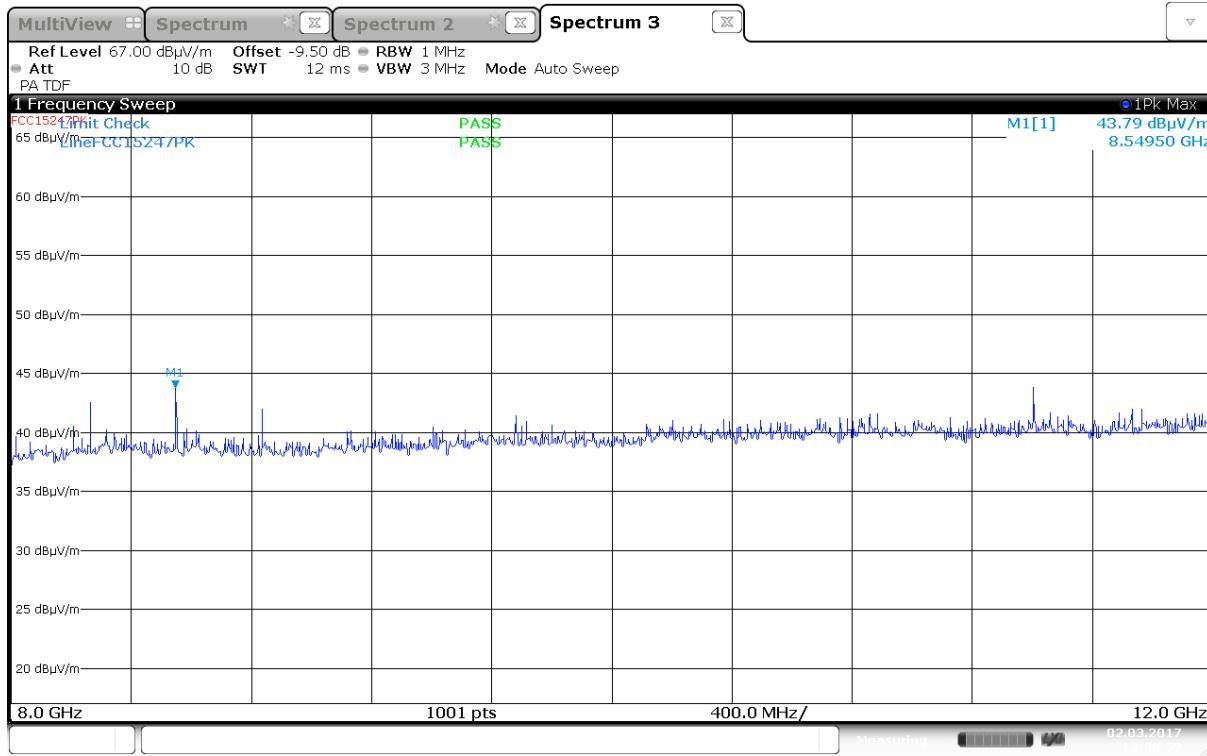
### Radiated Emissions, 2500 -3200MHz, 2480MHz, VP



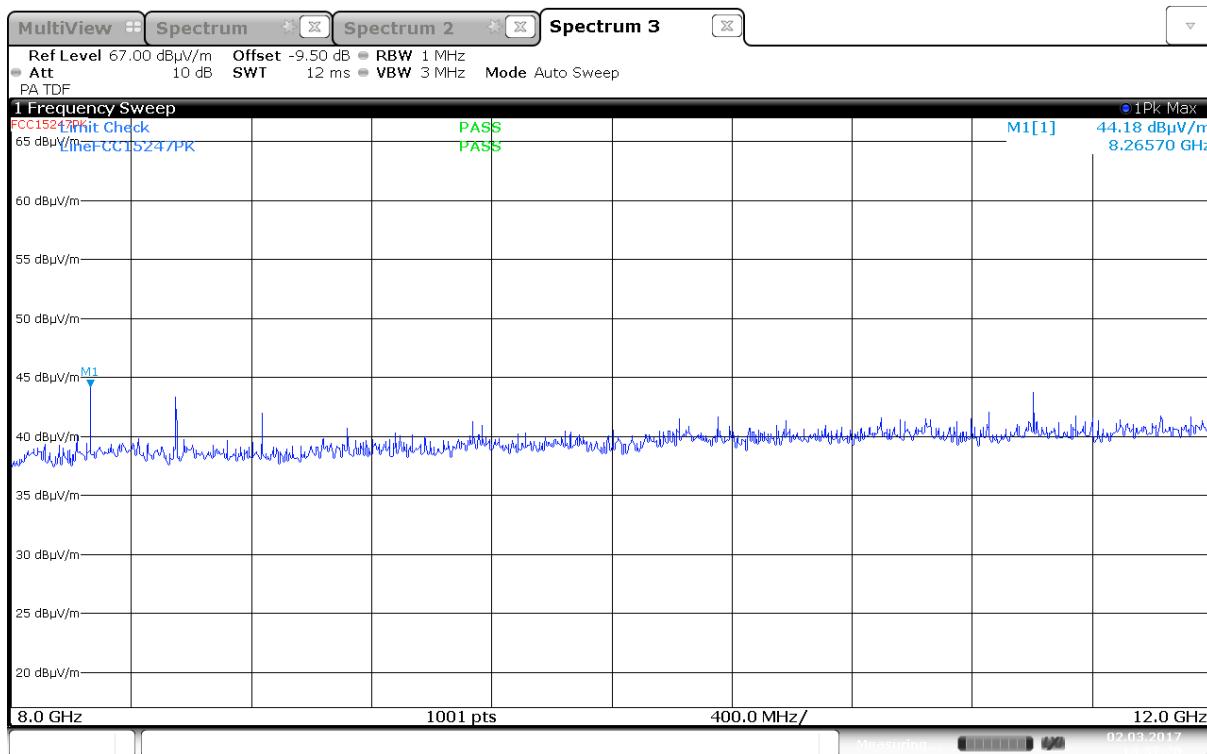
### Radiated Emissions, 3000 -8500MHz, 2440MHz, HP



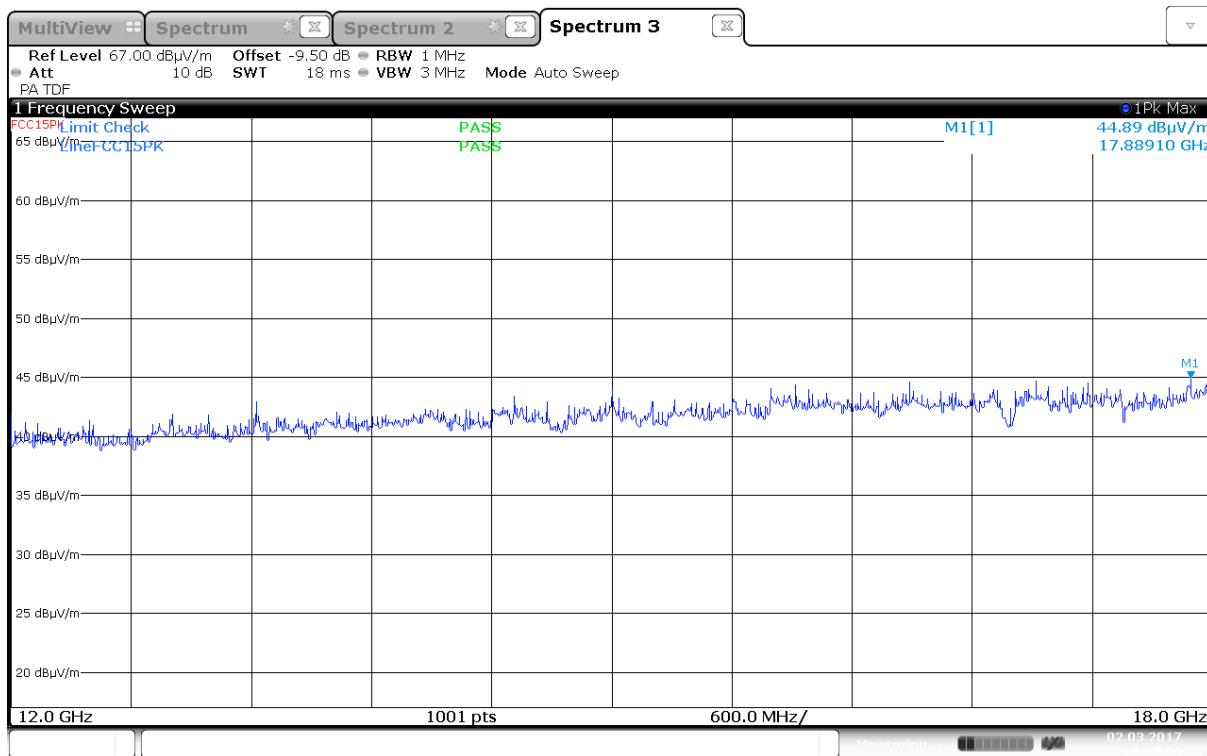
### Radiated Emissions, 3000 -8500MHz, 2440MHz, VP



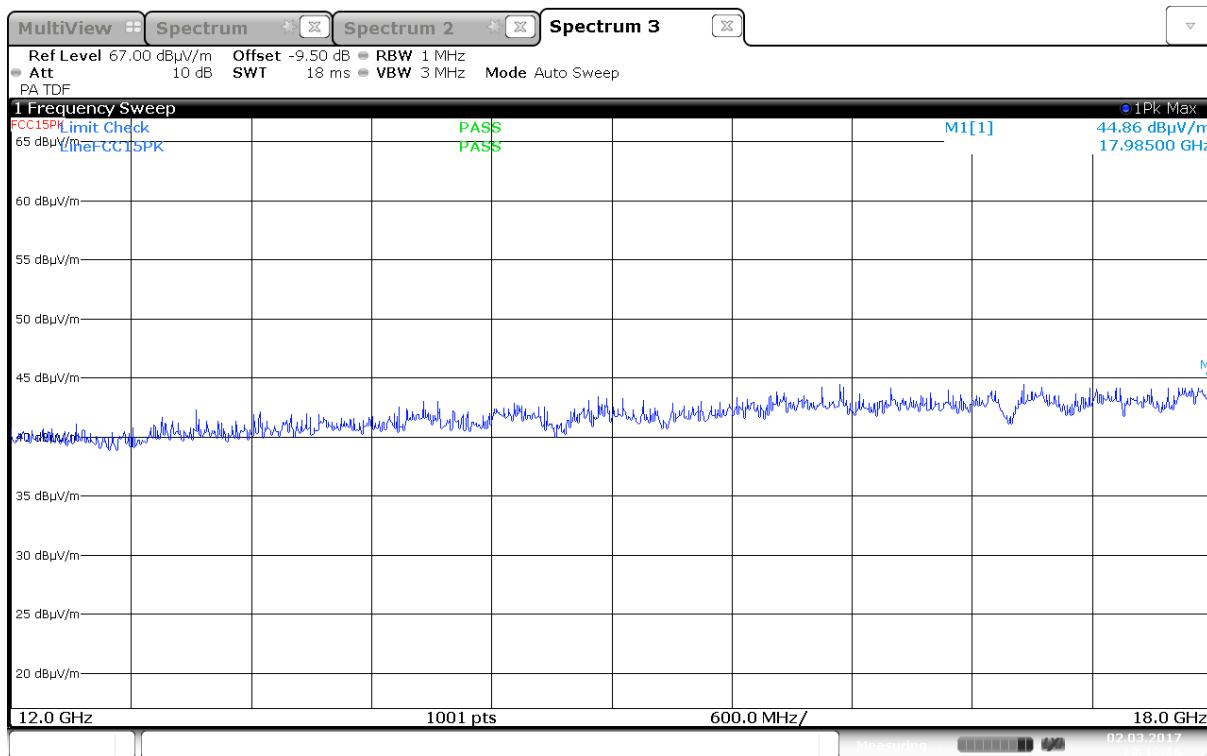
**Radiated Emissions, 8000 -12000MHz, 2440MHz, HP, @1m**



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



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



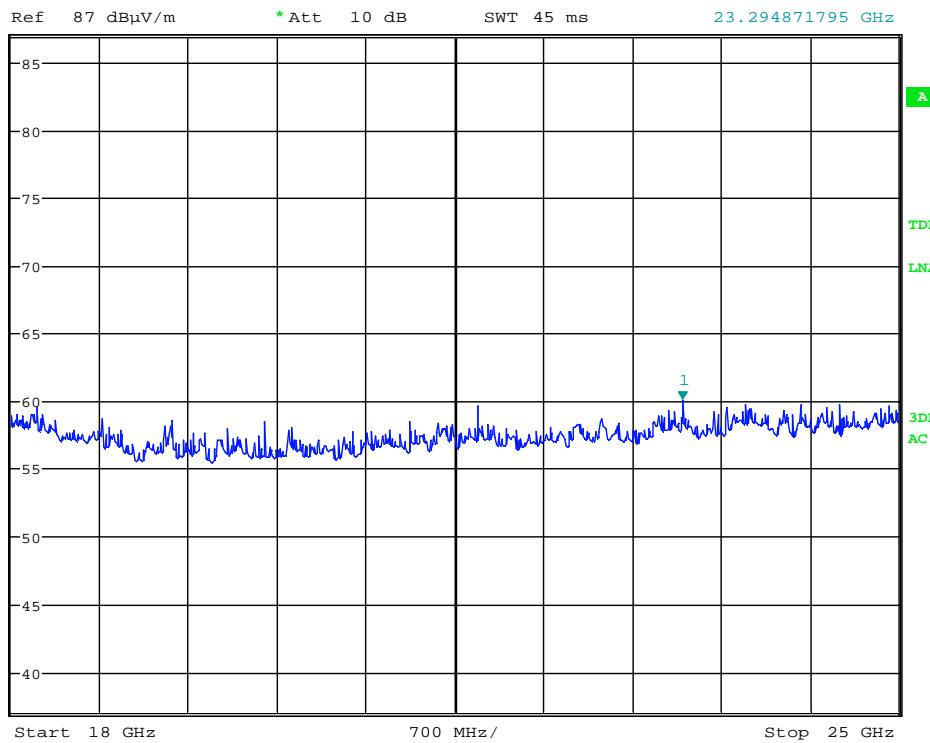
**Radiated Emissions, 12000 -18000MHz, 2440MHz, VP, @1m**

85

1 PK  
MAXH

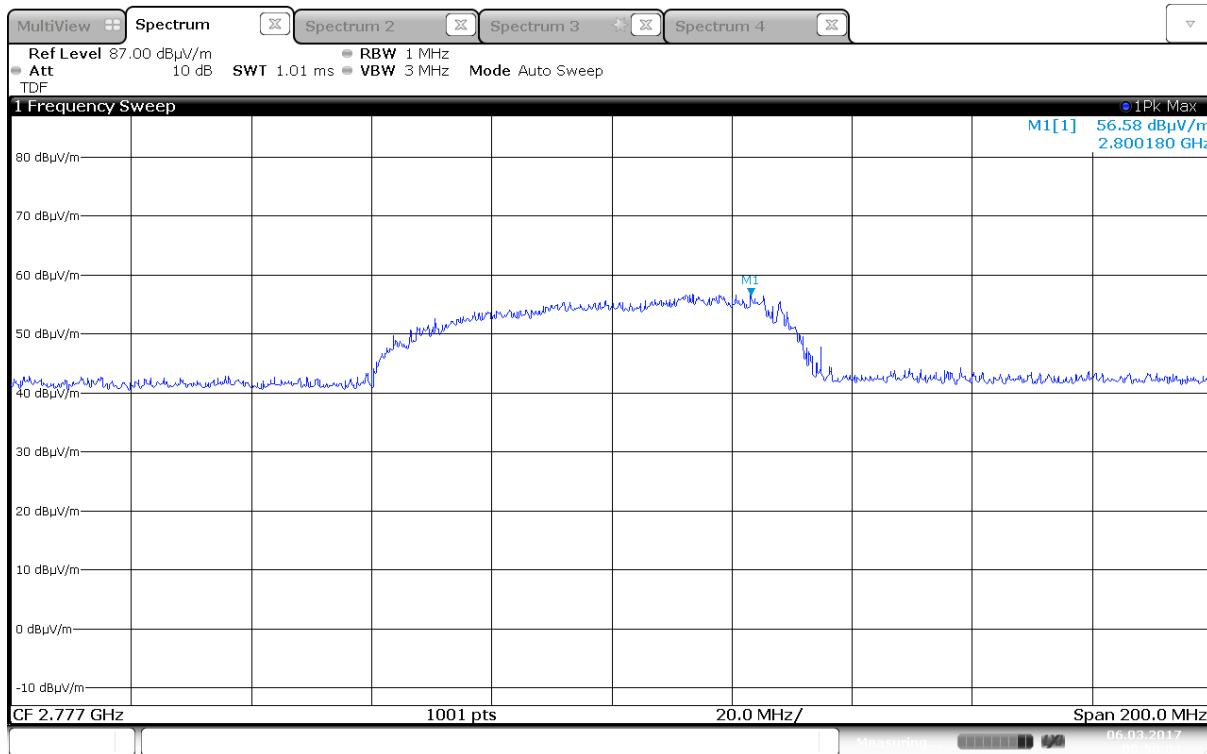
\* RBW 1 MHz  
 VBW 3 MHz  
 SWT 45 ms

Marker 1 [T1 ]  
 60.05 dB $\mu$ V/m  
 23.294871795 GHz

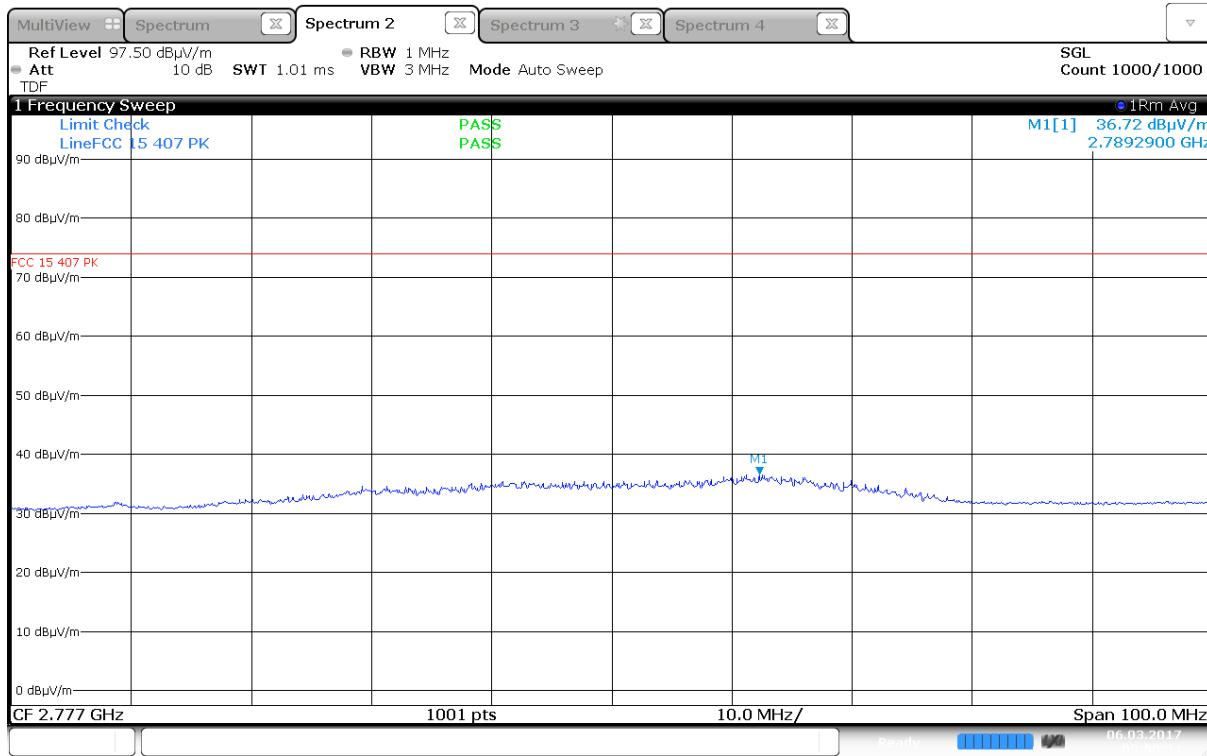


Date: 2.MAR.2017 15:47:15

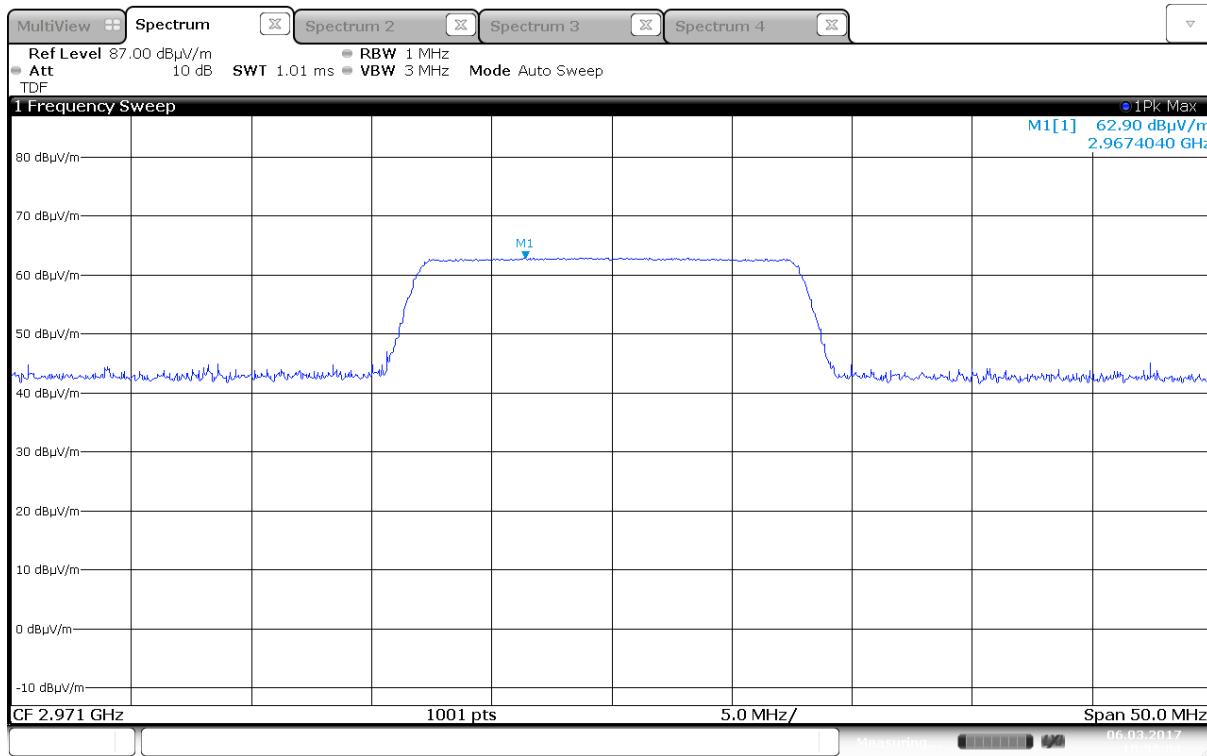
Pre-scan, 18000 -25000MHz, 2440MHz, HP, @10cm



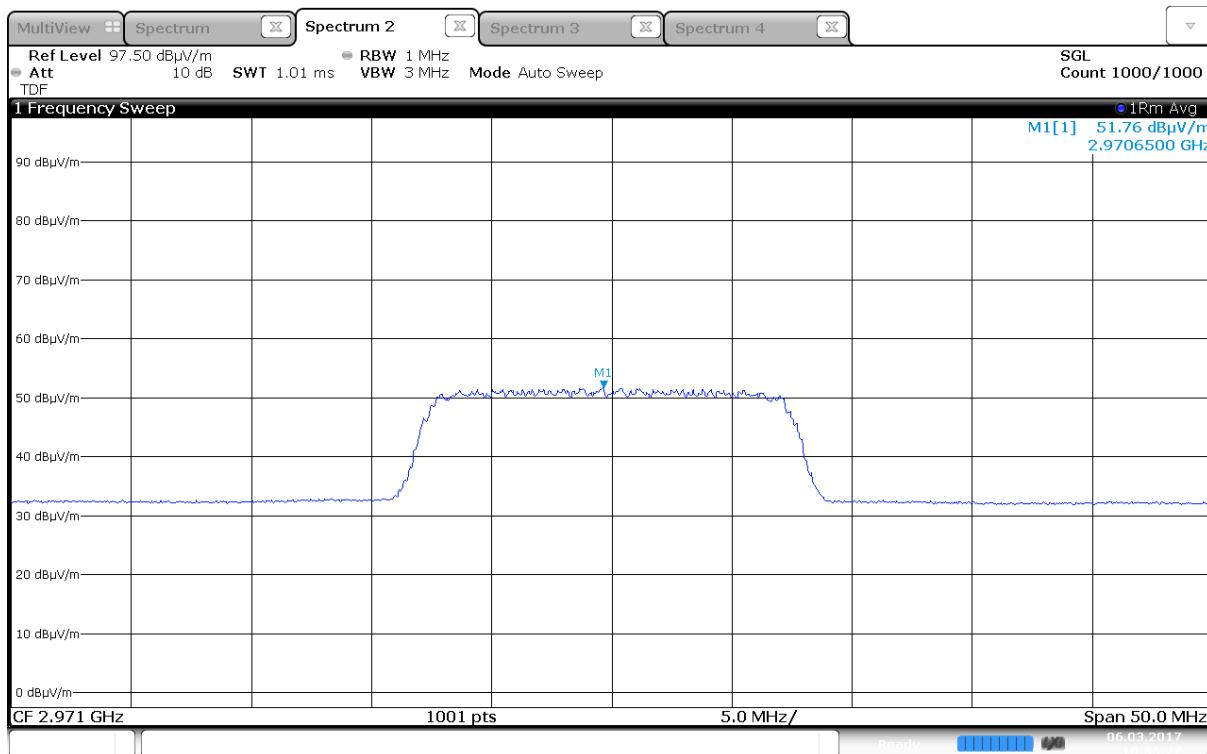
### Radiated Emissions, 2777MHz Peak, 2440MHz (Max: VP)



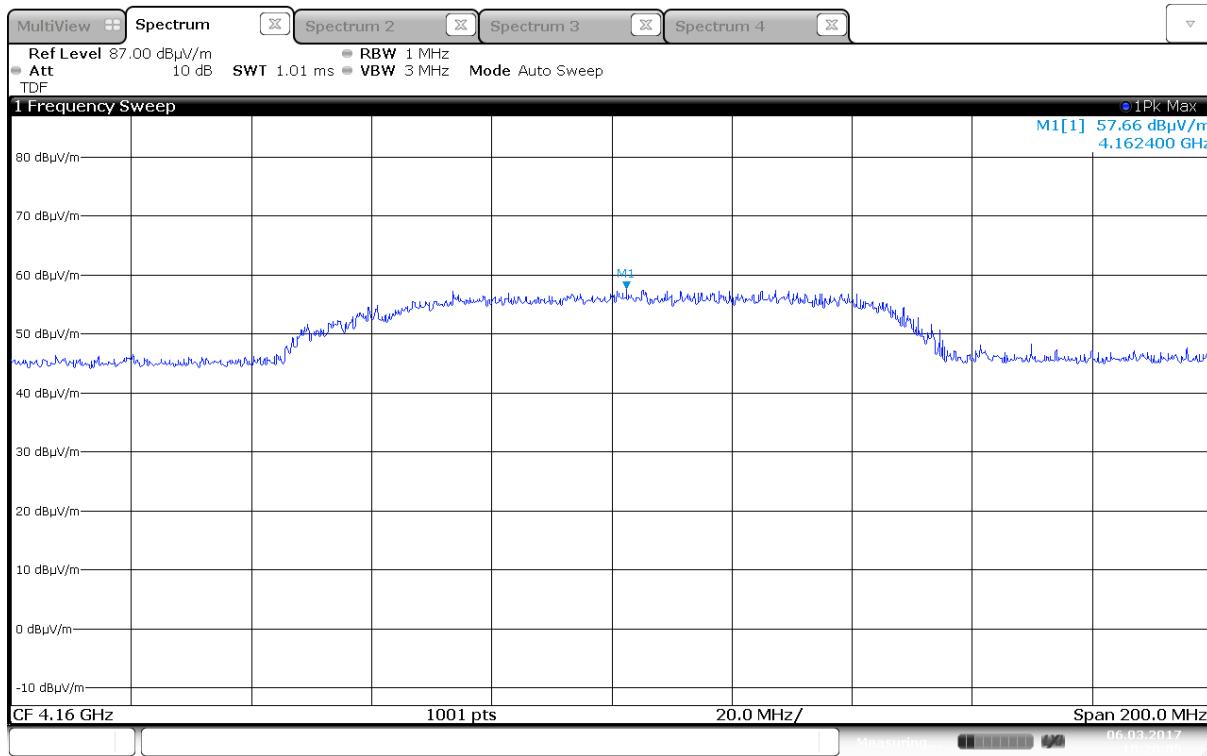
### Radiated Emissions, 2777MHz RMS, 2440MHz (Max: VP)



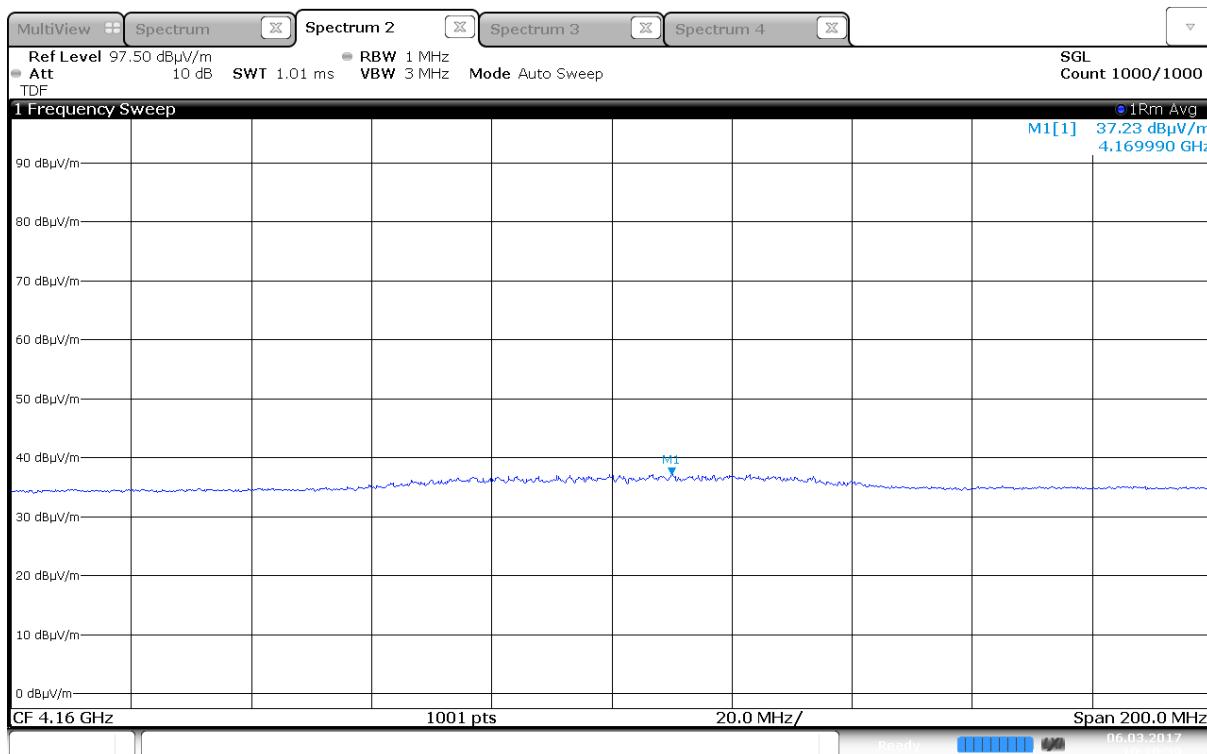
### Radiated Emissions, 2971MHz Peak, 2440MHz (Max: VP)



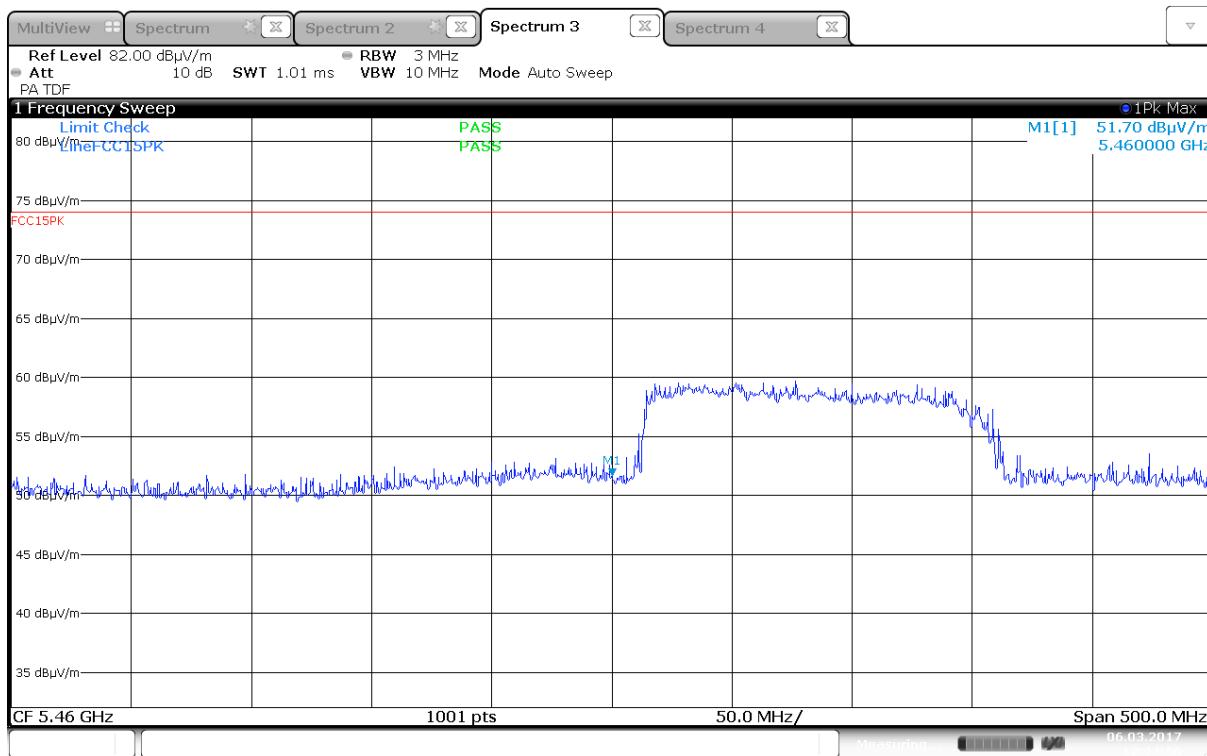
### Radiated Emissions, 2971MHz RMS, 2440MHz (Max: VP)



### 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

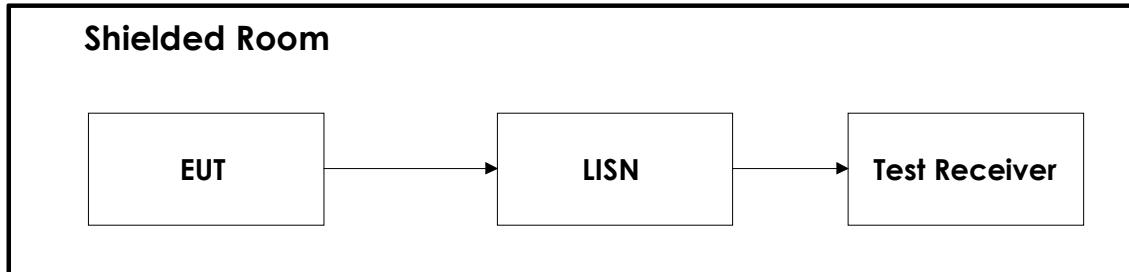
To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

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

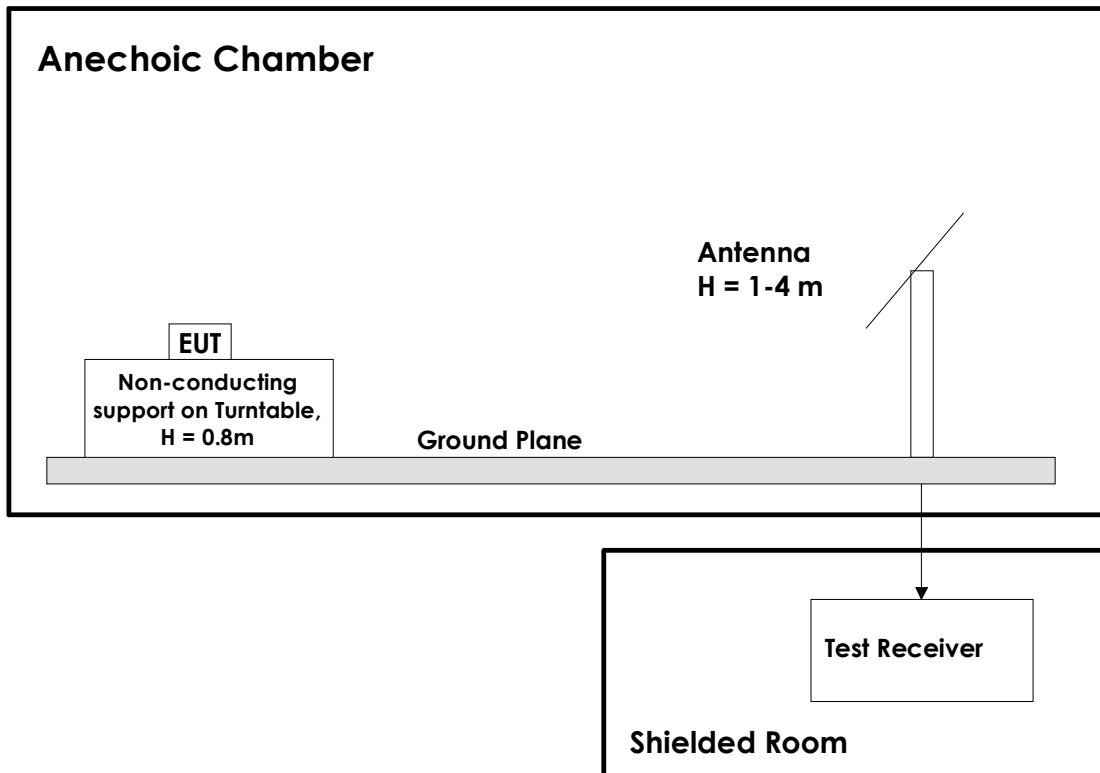
Test Software List			
Description	Manufacturer	Model	Version
EMC Software for Conducted tests	Rohde & Schwarz	EMC32	9.26.00

## 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