



Report No. 281941-1

Test Report

Product	Wireless Gas Detector
Name and address of the applicant	GasSecure AS Hoffsveien 70C, 0377 Oslo Norway
Name and address of the manufacturer	Same as above
Model	GS01
Rating	7.2 V DC (Primary Batteries)
Trademark	GasSecure
Serial number	N/A
Additional information	/
Tested according to	FCC Part 15.247 Frequency Hopping Transmitters / Digital Transmission Systems Industry Canada RSS-210, Issue 8 Low Power Licence-Exempt Radiocommunications Devices
Order number	281941
Tested in period	2015.04.08
Issue date	2015.05.28
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway FCC No: 994405 IC OATS: 2040D-1 TEL: (+47) 22 96 03 30 FAX: (+47) 22 96 05 50
	
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1 INFORMATION

1.1 Test Item

Name :	GasSecure
FCC ID :	2AEJXGS01AA
Industry Canada ID :	/
Model/version :	GS01
Serial number :	/
Hardware identity and/or version:	/
Software identity and/or version :	/
Frequency Range :	2405 – 2475 MHz
Number of Channels :	15
Type of Modulation :	Digital (O-QPSK)
User Frequency Adjustment :	None
Rated Output Power :	11.8 mW
Type of Power Supply :	Primary Batteries (2x D-size Lithium Thionyl Chloride cells)
Antenna Connector :	None
Number of antennas :	1
Antenna Diversity Supported :	No
Desktop Charger :	N/A

Description of Test Item

The EUT is a 2.4GHz Transceiver in a Gas Leakage Detector.

The EUT contains the Nivis LLC, VN210 Module (FCC ID: SQB-NIVISMOD0003), but with a different antenna.

Exposure Evaluation

The EUT is designed to be fixed to a wall etc. and the user manual contains text that it shall be mounted with a separation distance of at least 20 cm from any persons. For the purposes of exposure evaluation this EUT is a fixed 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 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	7.2 V DC (2x Primary Batteries)

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen

1.4 Test Equipment

See list of test equipment in clause 5.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable 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-210 Issue 8.

Tests were performed in accordance with ANSI C63.4-2009/2014 and KDB 55074 D01 DTS Measurement Guidance v02.

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
DTS 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".

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2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-210 Issue 8, RSS-GEN Issue 4 reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	N/A ¹
Antenna Requirement	15.203	8.3 (RSS-GEN)	Passed
Power Line Conducted Emission	15.107(a) 15.207(a)	8.8 (RSS-GEN)	N/A ¹
Occupied Bandwidth	15.247(a)(1)	A8.1	N/T ⁴
Minimum 6 dB Bandwidth	15.247(a)(2)	A8.2	N/T ⁴
Peak Power Output	15.247(b)	A8.4	Passed ²
Power Spectral Density	15.247(d)	A8.2	N/T ⁴
Spurious Emissions (Antenna Conducted)	15.247(c)	A8.5	N/A ³
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	A8.5	Passed

¹ The EUT is battery operated

² This report cover only Radiated Output Power

³ The tested equipment has integrated antennas only

⁴ Covered by Nivis LLC, VN210 Module Test Report (FCC ID: SQB-NIVISMOD0003)

2.3 Description of modification for Modification Filing

Not applicable.

2.4 Comments

All tests except Radiated Power and Radiated Emissions are covered by US Tech Report No. 09-0058 for Nivis LLC, VN210 Module (FCC ID: SQB-NIVISMOD0003).

2.5 Family List Rational

Not Applicable.

3 TEST RESULTS

3.1 Peak Power Output

Para. No.: 15.247 (b)

Test Results: Complies

Measurement Data:

	Ch00 2405 MHz	Ch07 2440 MHz	Ch14 2475 MHz
Conducted Power (dBm)	10.7	10.0	9.2
Conducted Power (mW)	11.8	9.91	8.36
Field Strength (dB μ V/m)	104.3	103.0	101.5
EIRP, Calculated (mW)	8.15	6.01	4.26
Antenna gain (dBi)	-1.6	-2.2	-2.9

Antenna gain = $10 \times \log(EIRP/Conducted\ power)$ dBi

EIRP is calculated from measured field strength by the formulas in KDB 412172 D01 Determining ERP and EIRP v01.

See attached graph.

Detachable antenna?

Yes No

If detachable, is the antenna connector non-standard?

Yes No

Type of antenna connector: None.

Requirements:

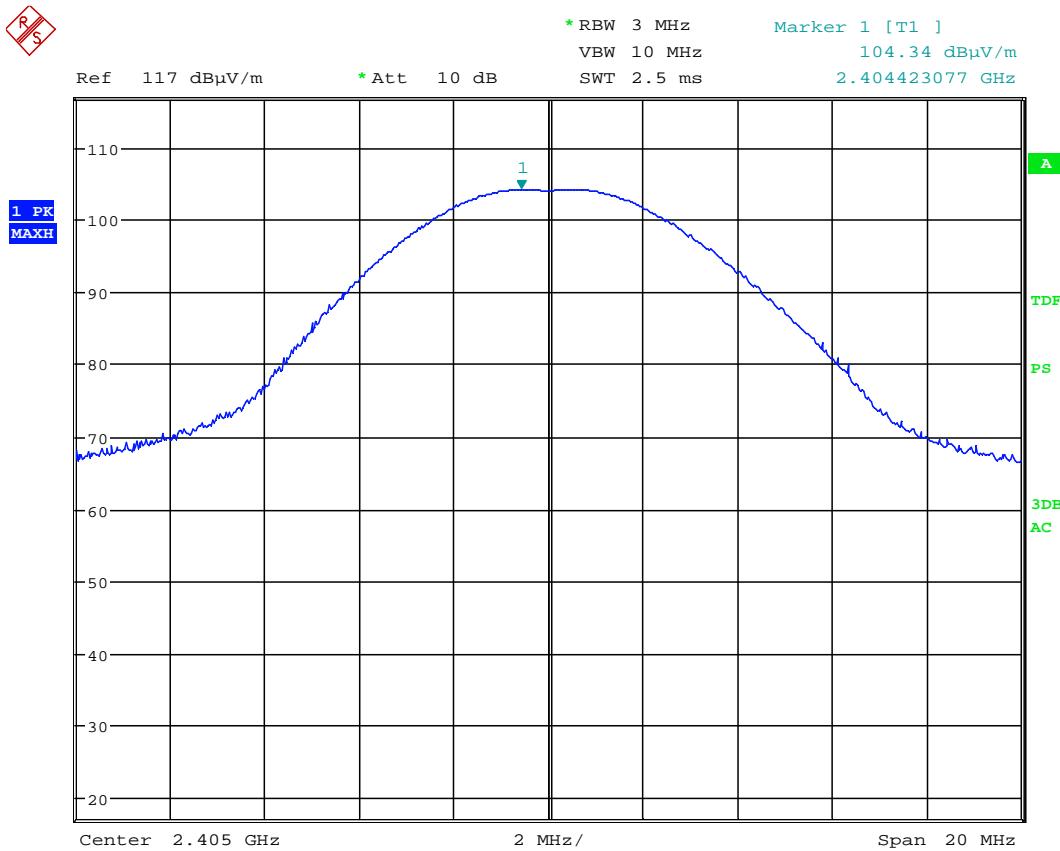
The maximum peak output power shall not exceed the following limits:

For frequency hopping systems employing at least 75 hopping channels: 1 Watt

For all other frequency hopping systems in the 2400 - 2483.5 MHz band: 0.125 Watts

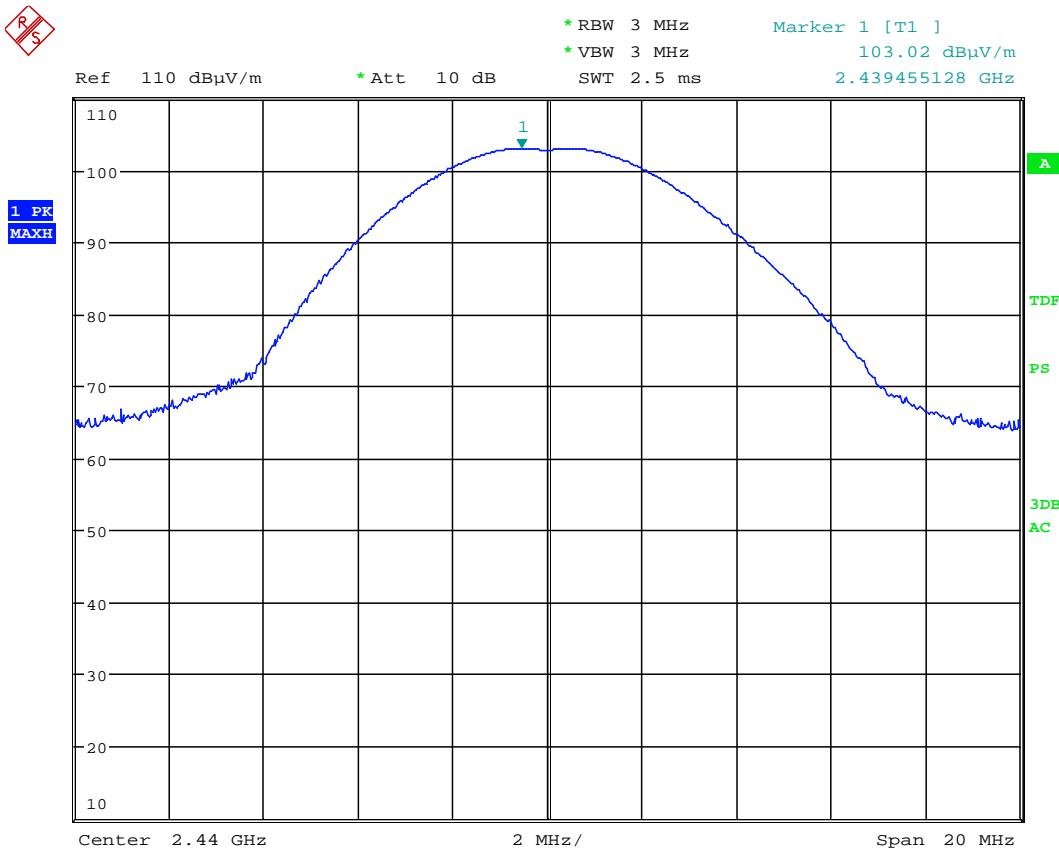
For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

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.



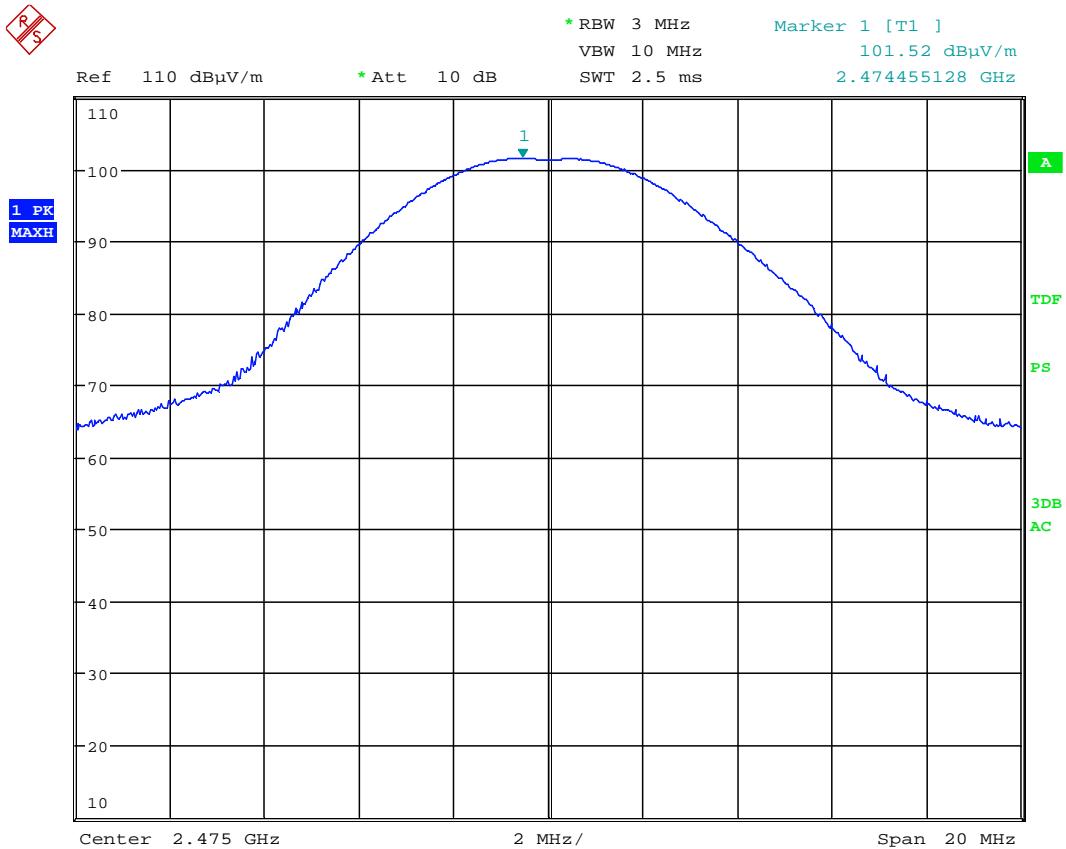
Date: 8.APR.2015 10:37:12

Maximum Field Strength, 2405 MHz (VP)



Date: 8.APR.2015 11:41:23

Maximum Field Strength, 2440 MHz (VP)



Date: 8.APR.2015 11:25:35

Maximum Field Strength, 2475 MHz (VP)

3.2 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Results: Complies

Measurement Data:

Band-edge conducted power

	Measured field strength (dB μ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz		dB μ V/m	dB
Peak Detector	58.6	60.2	74	15.4	13.8
Average Detector	51.4	47.9	54	2.6	6.1

Average Detector value at lower band edge was measured with Peak Detector and corrected for Duty Cycle. Average Detector value at upper band edge was measured with Average Detector and 100% Duty Cycle and corrected for Duty Cycle.

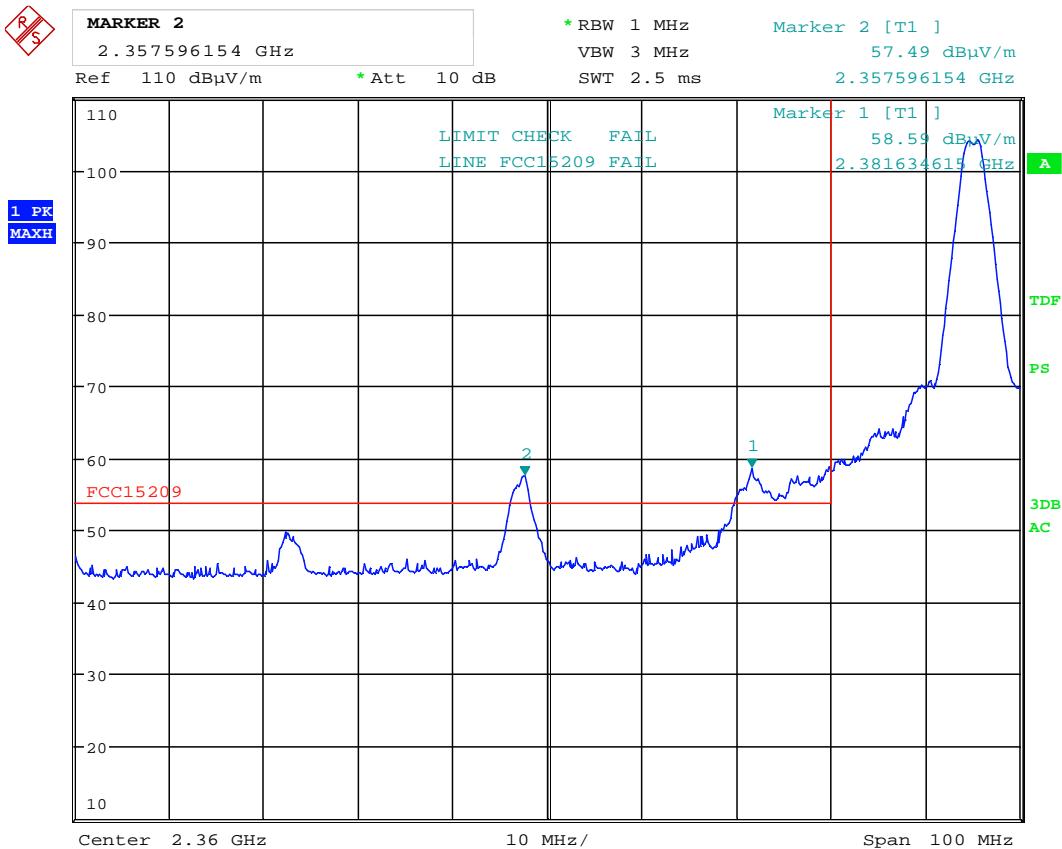
See attached plots.

Duty Cycle Correction Factor Calculation:

Duty Cycle = slot length / frame length = 4.352 ms / 10 ms = 0.4352

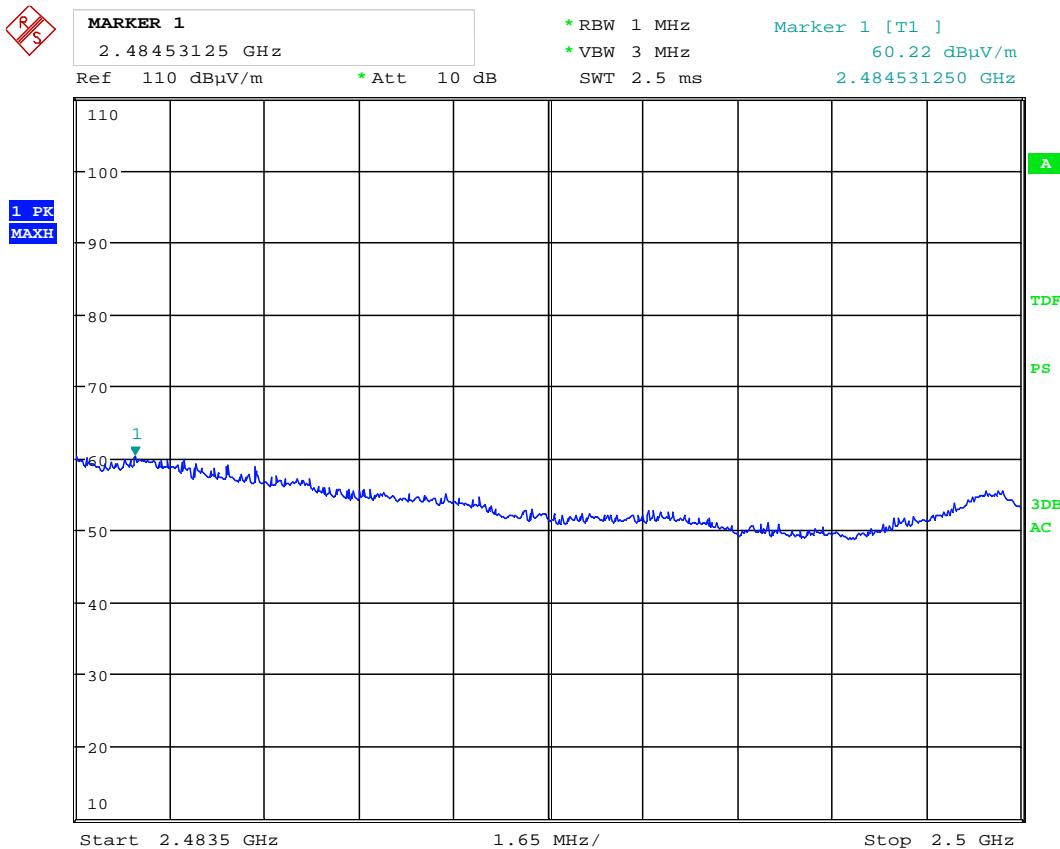
Duty Cycle Correction factor = $-20 \times \log(0.4352) = 7.2 \text{ dB}$

All values above are from the Nivis LLC, VN210 test report.



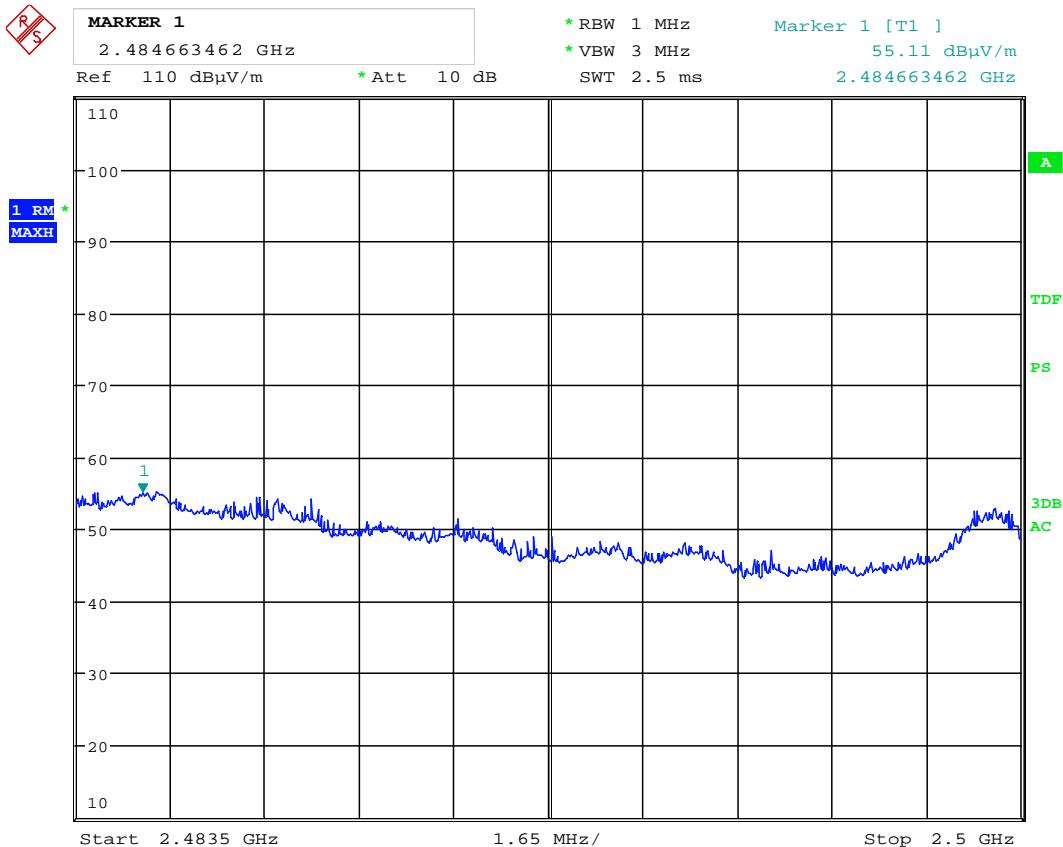
Date: 8.APR.2015 10:54:25

Lower Band Edge, Peak Det, 2405 MHz



Date: 8.APR.2015 11:24:02

Upper Band Edge, Peak Det, 2475 MHz



Date: 8.APR.2015 11:24:37

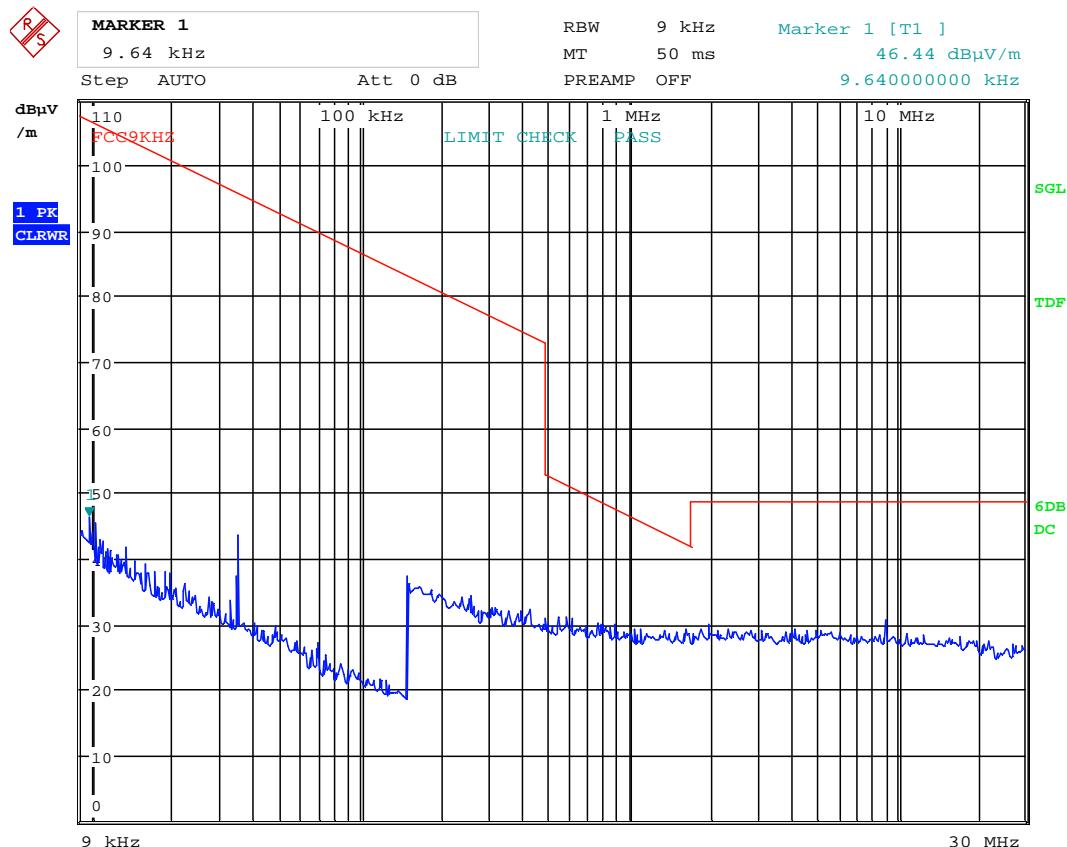
Upper Band Edge, Average Det, 2475 MHz

Radiated emissions 10 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: 8.APR.2015 14:10:06

Radiated emission 30 – 1000 MHz.

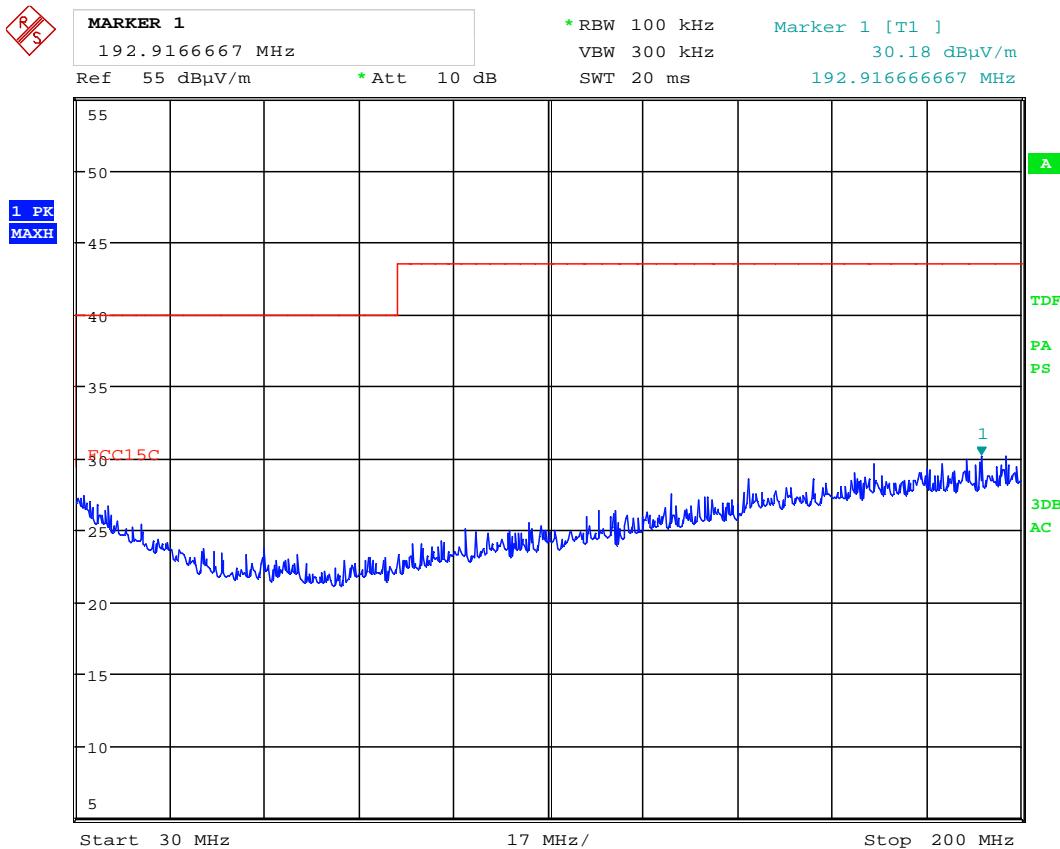
Detector: Peak

Measuring distance 3m

Tested with EUT transmitting at 100% duty cycle.

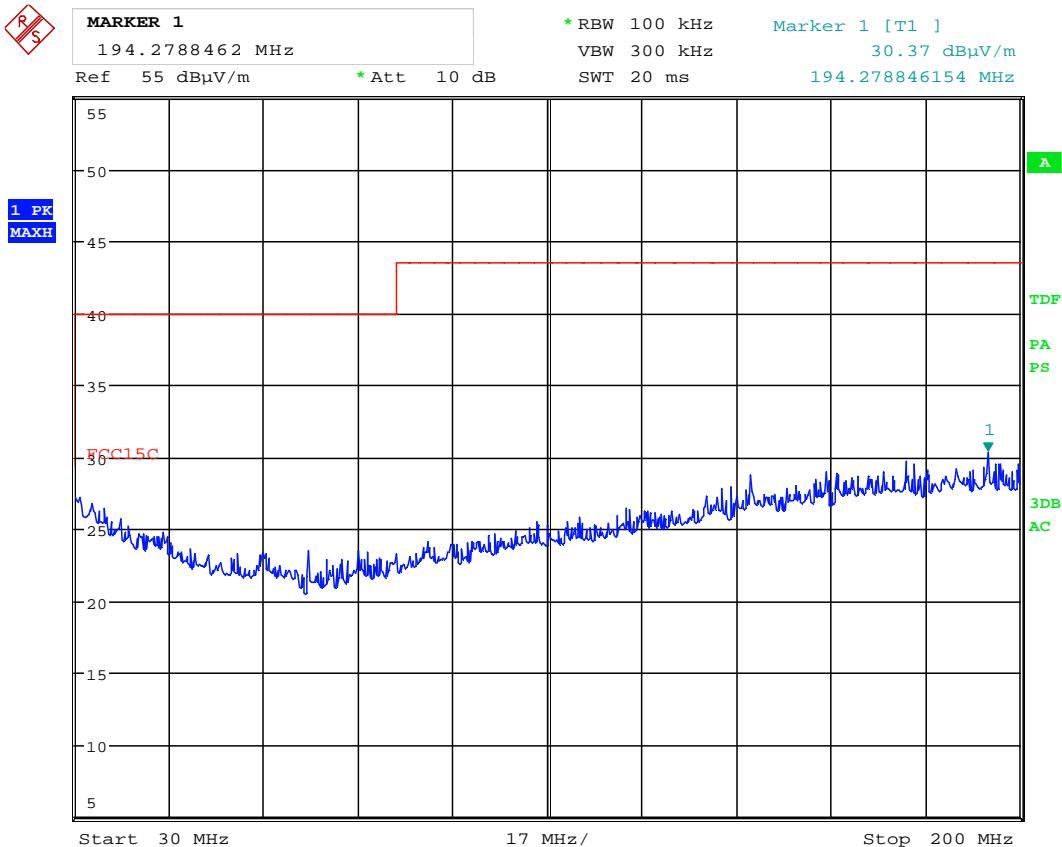
All values are at least 10dB below the limit when measured with Peak Detector.

See attached plots.



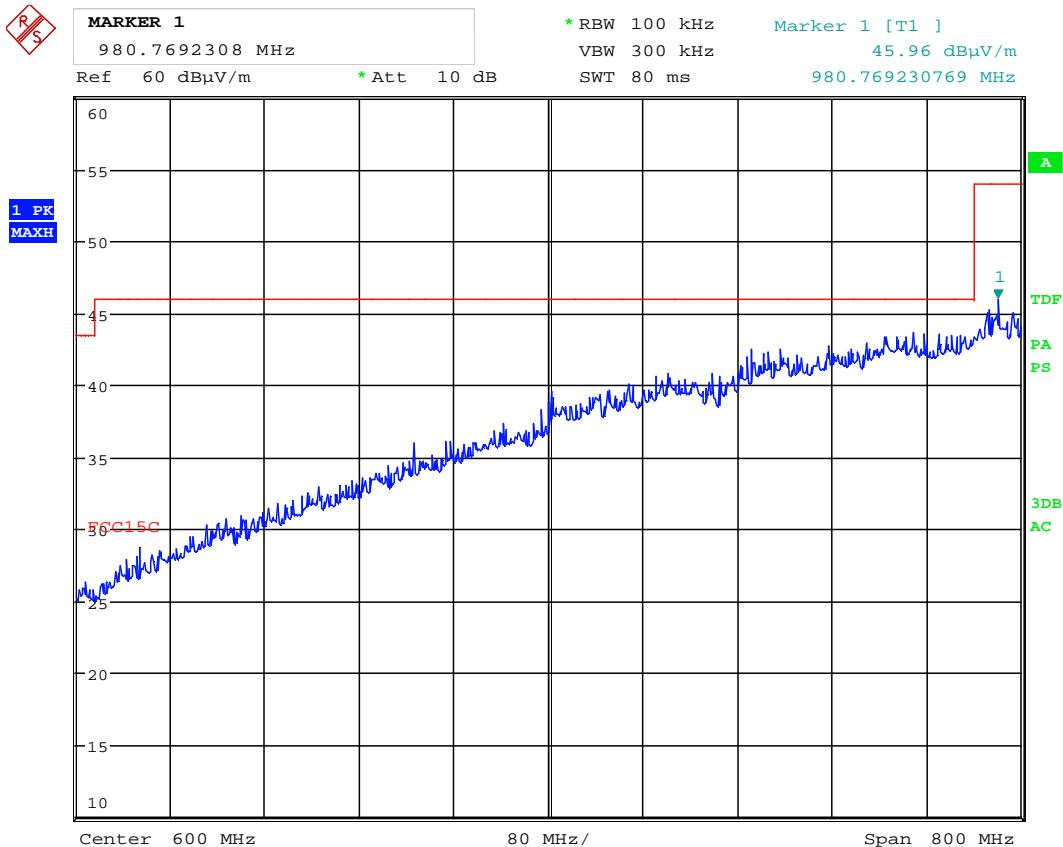
Date: 8.APR.2015 13:49:11

Radiated Emissions, 30 -200 MHz, HP



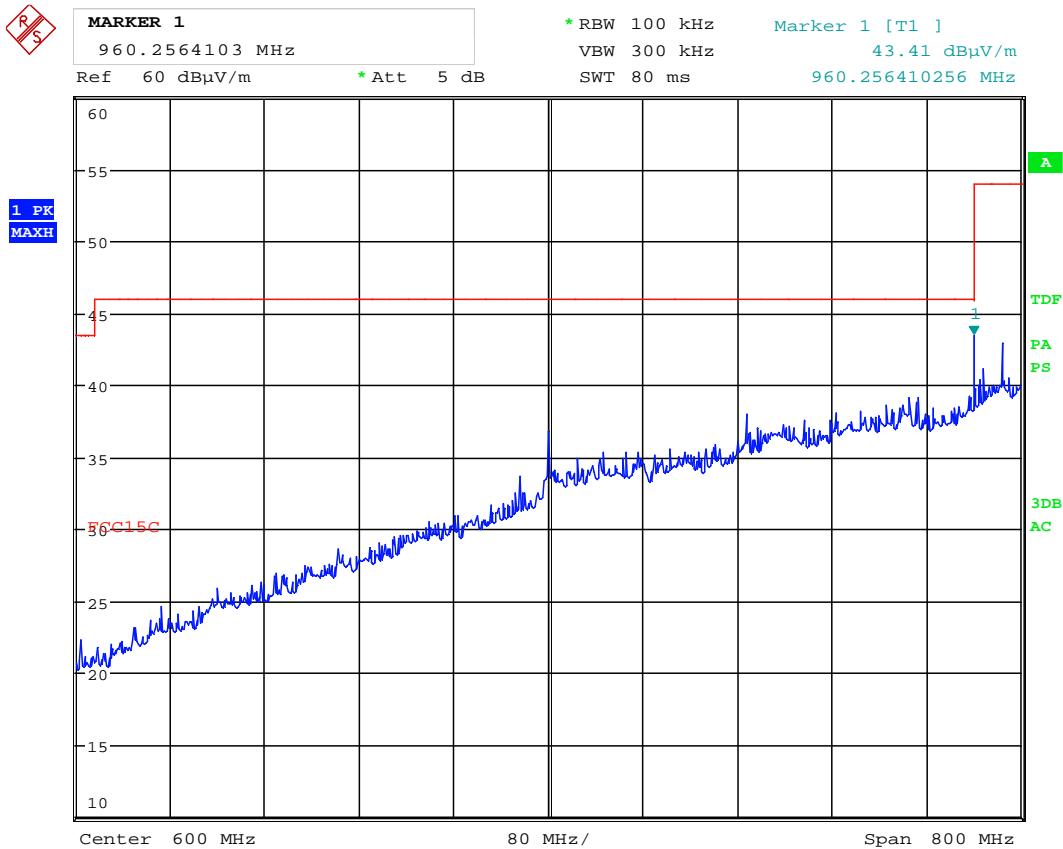
Date: 8.APR.2015 13:46:38

Radiated Emissions, 30 -200 MHz, VP



Date: 8.APR.2015 13:36:44

Radiated Emissions, 200 -1000 MHz, HP



Date: 8.APR.2015 13:38:53

Radiated Emissions, 200 -1000 MHz, VP

Radiated Emissions, 1-25 GHz

Measuring distance: 3m (1 – 8.5 GHz)
 1m (8.5 – 18 GHz)

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

Peak Detector:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
GHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
1.653	L	0	58.7	7.2	74	15.3
Other freqs	L,M,H	0	None detected	7.2	74	>20

Average Detector:

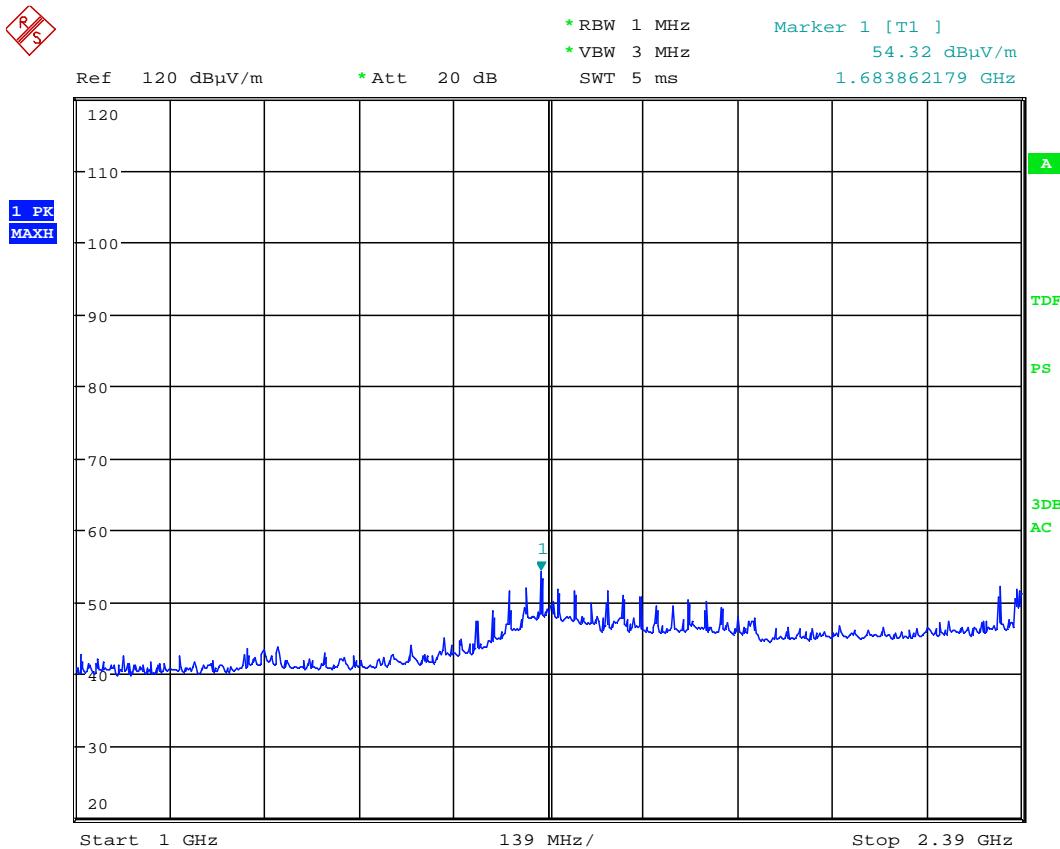
Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
GHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
1.653	L	0	51.5	7.2	54	2.5
Other freqs	L,M,H	/	None detected	7.2	54	>20

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".

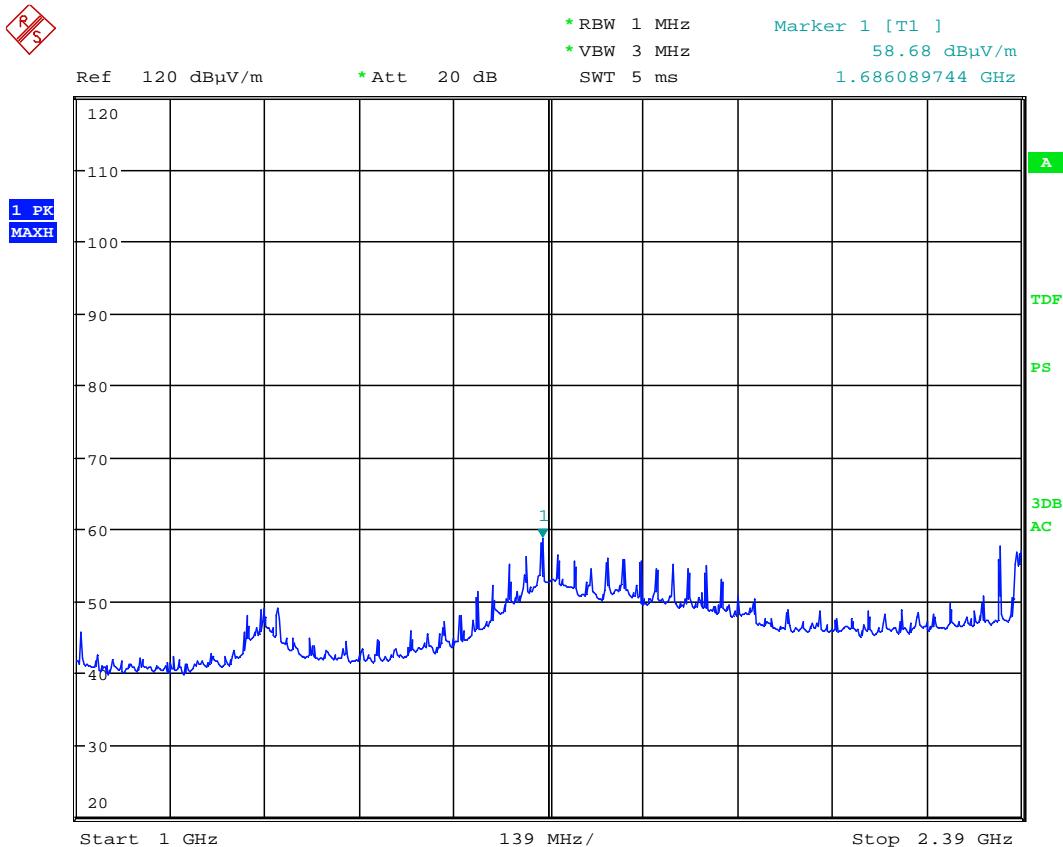
The ground plane was covered with absorbers during this test.

See plots.



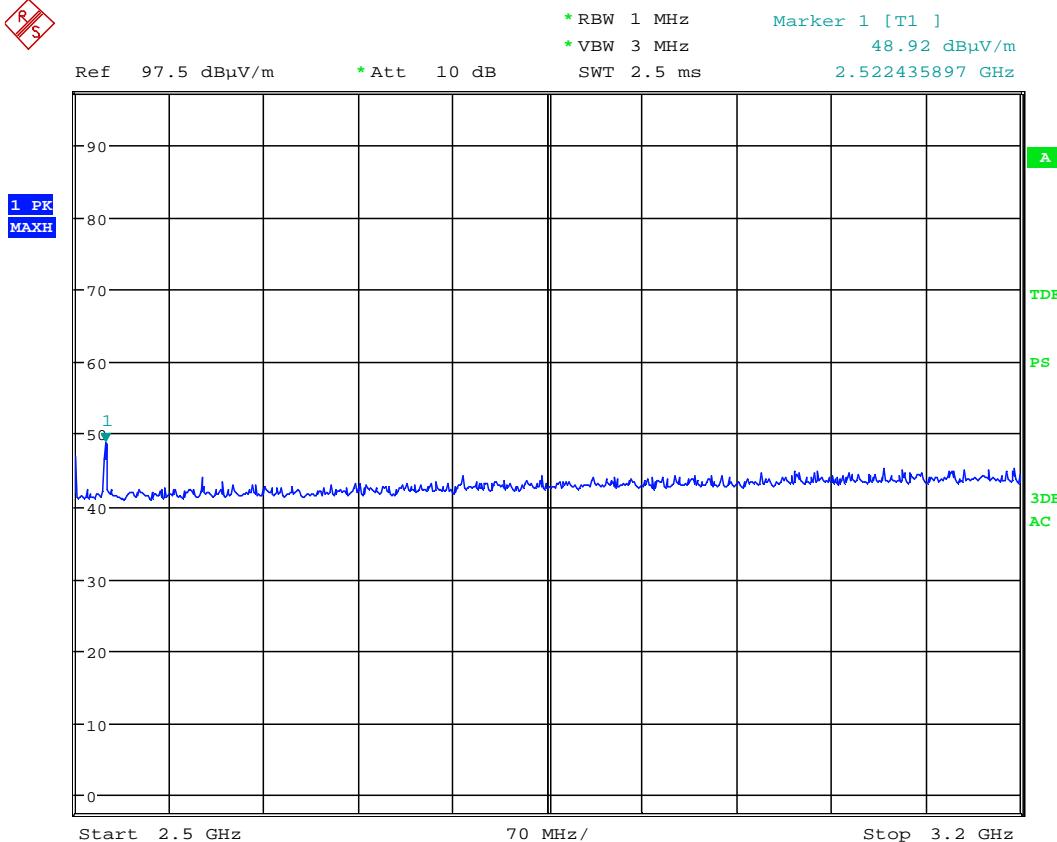
Date: 8.APR.2015 11:00:57

Radiated Emissions, 1000 -2390 MHz, 2405 MHz, HP



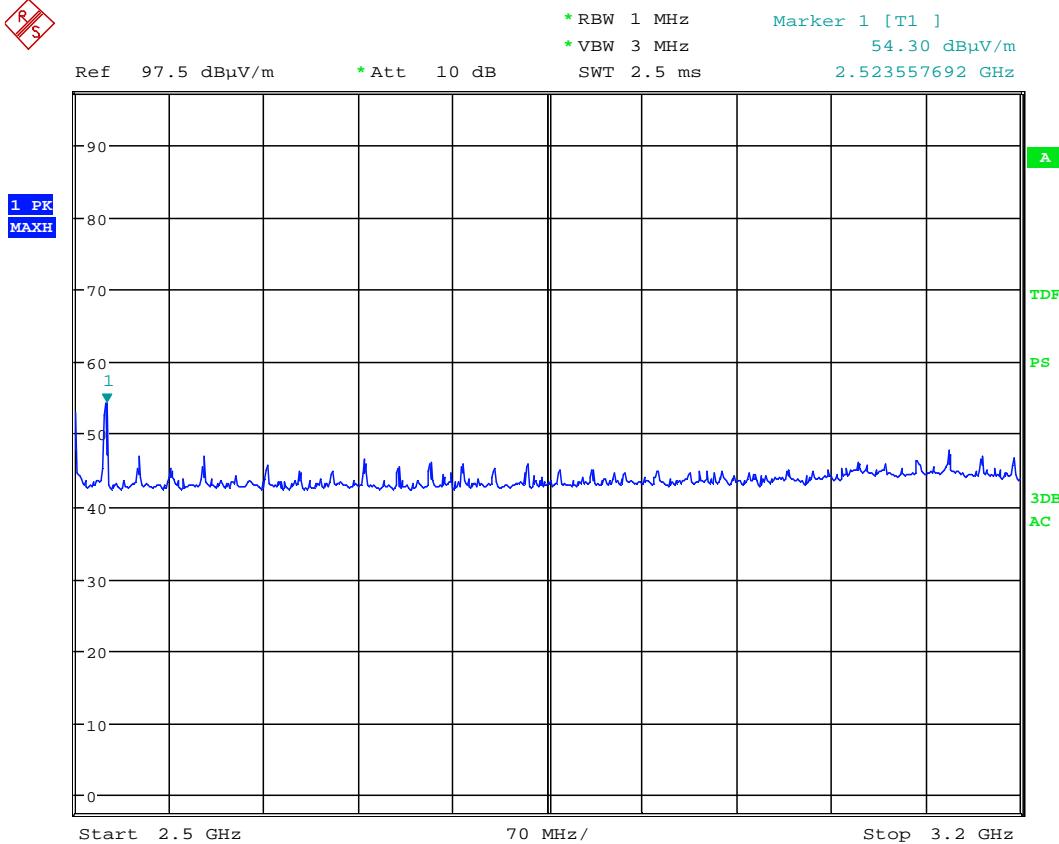
Date: 8.APR.2015 10:56:57

Radiated Emissions, 1000 -2390 MHz, 2405 MHz, VP

R
S

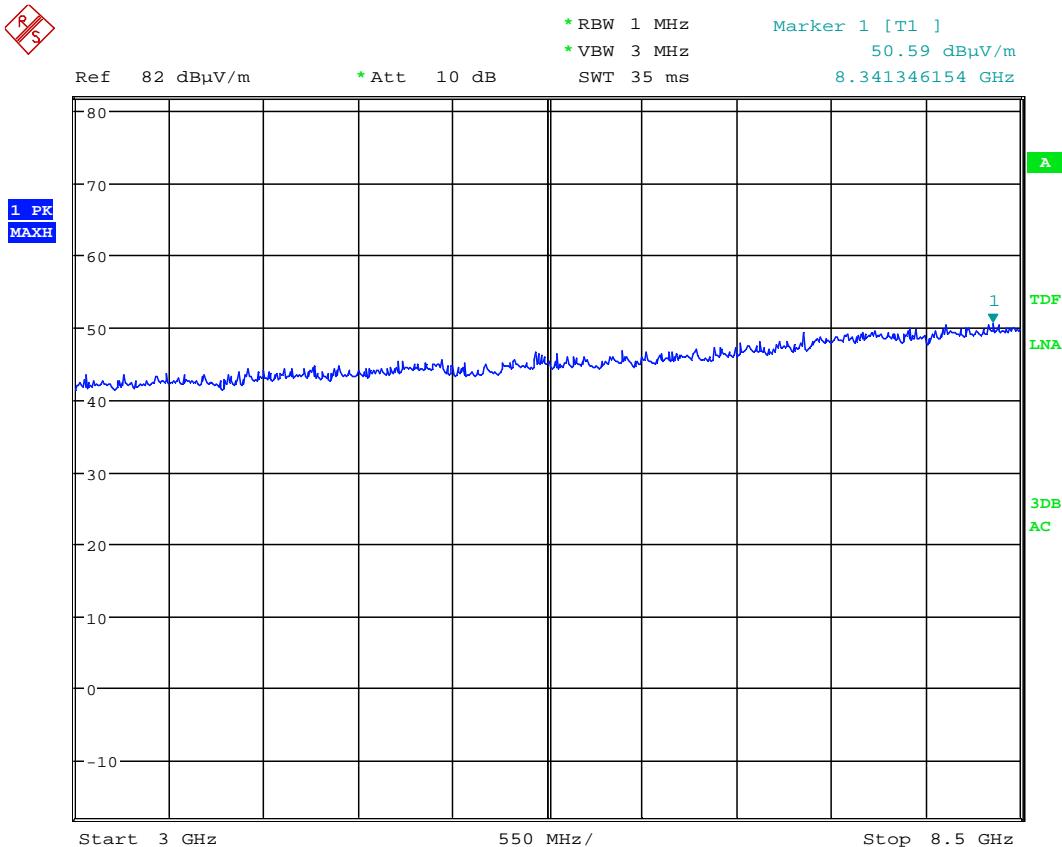
Date: 8.APR.2015 12:13:18

Radiated Emissions, 2500 -3200 MHz, 2475 MHz, HP

R
S

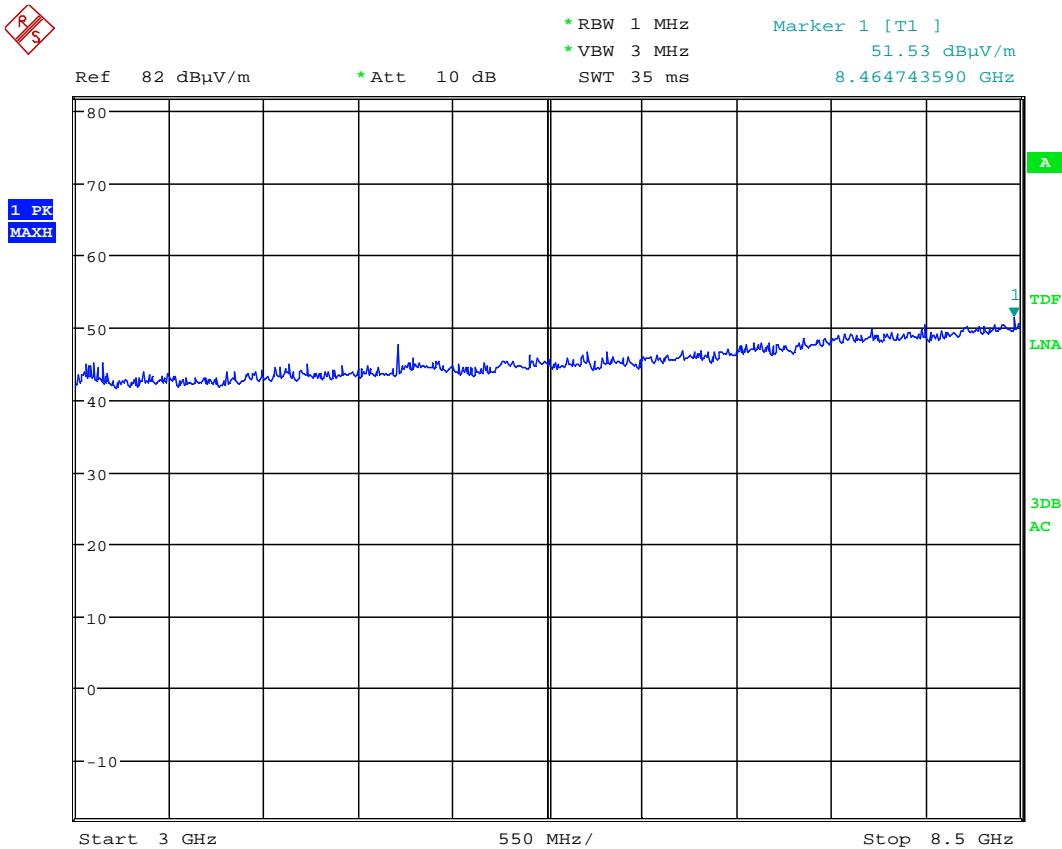
Date: 8.APR.2015 12:11:24

Radiated Emissions, 2500 -3200 MHz, 2475 MHz, VP



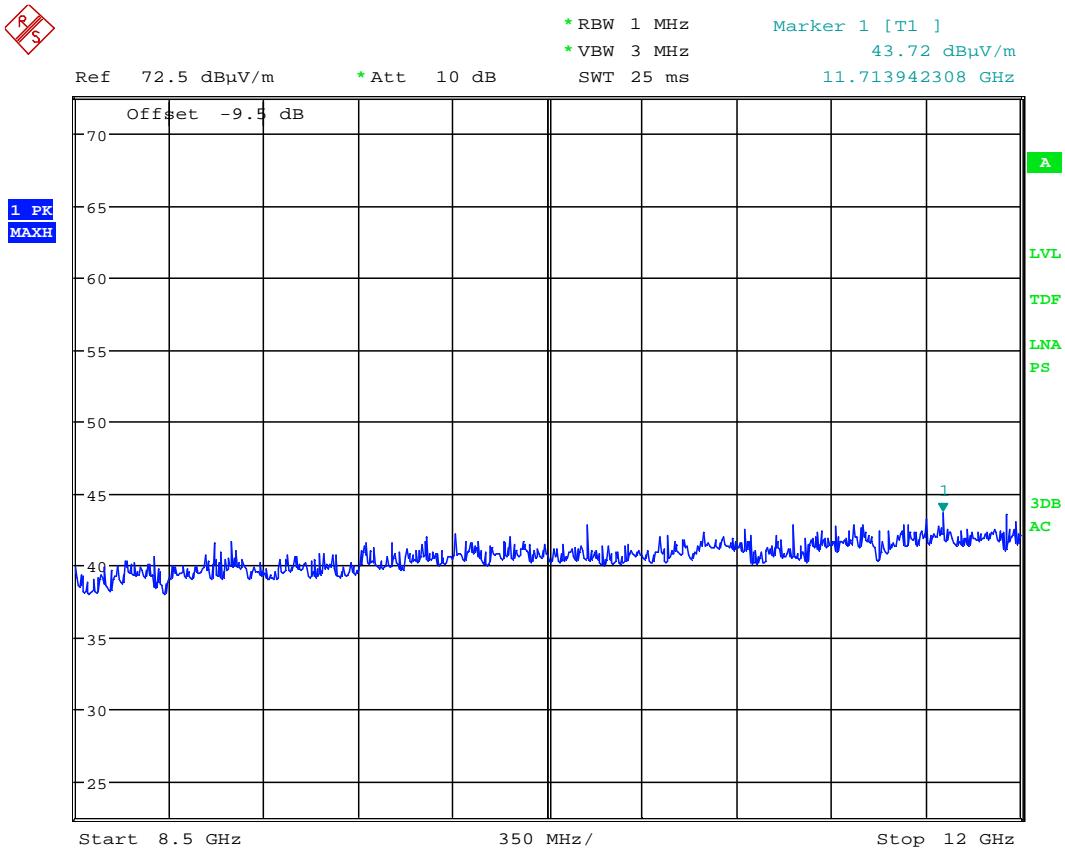
Date: 8.APR.2015 12:47:11

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



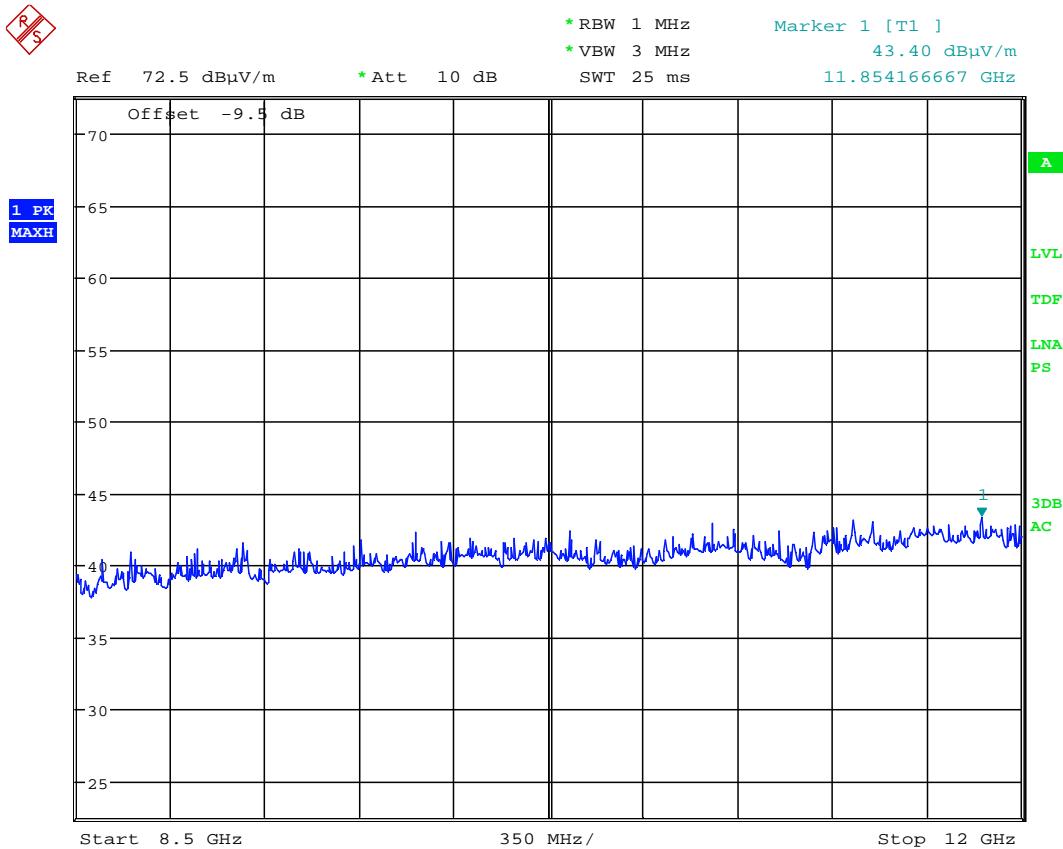
Date: 8.APR.2015 12:45:19

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



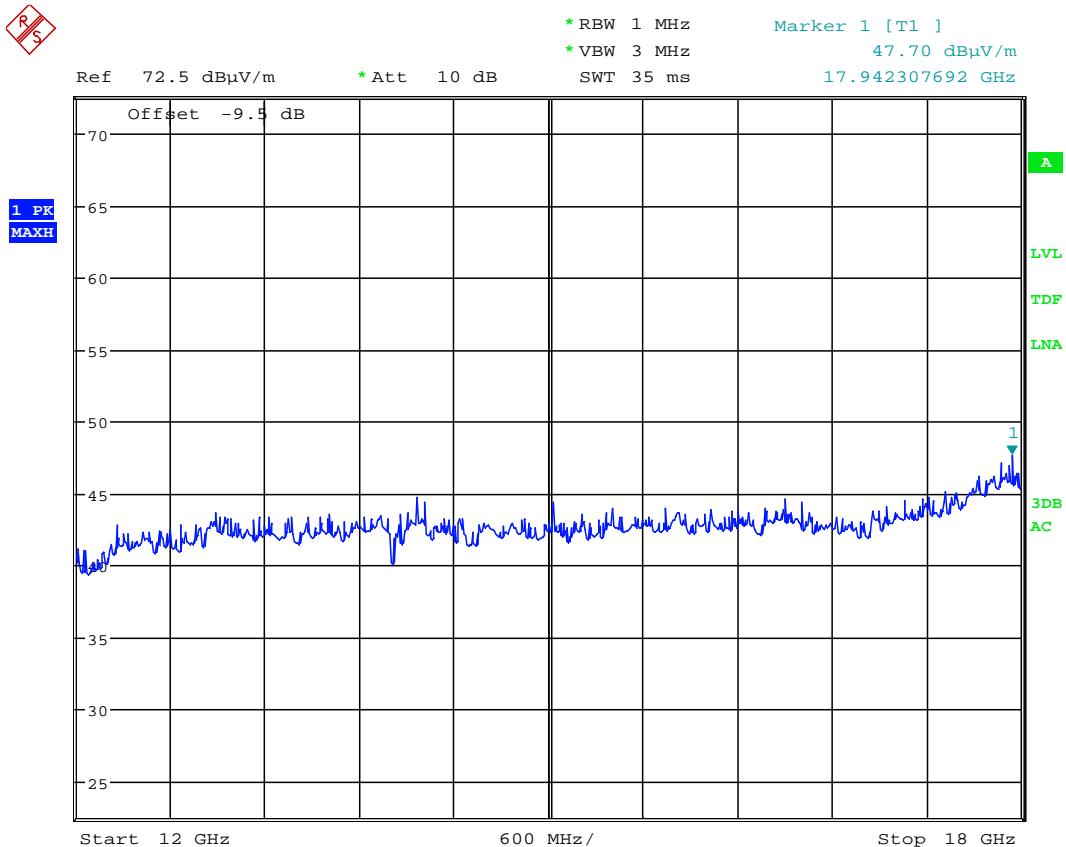
Date: 8.APR.2015 13:06:35

Radiated Emissions, 8500 -12000 MHz, 2440 MHz, HP, d=1m



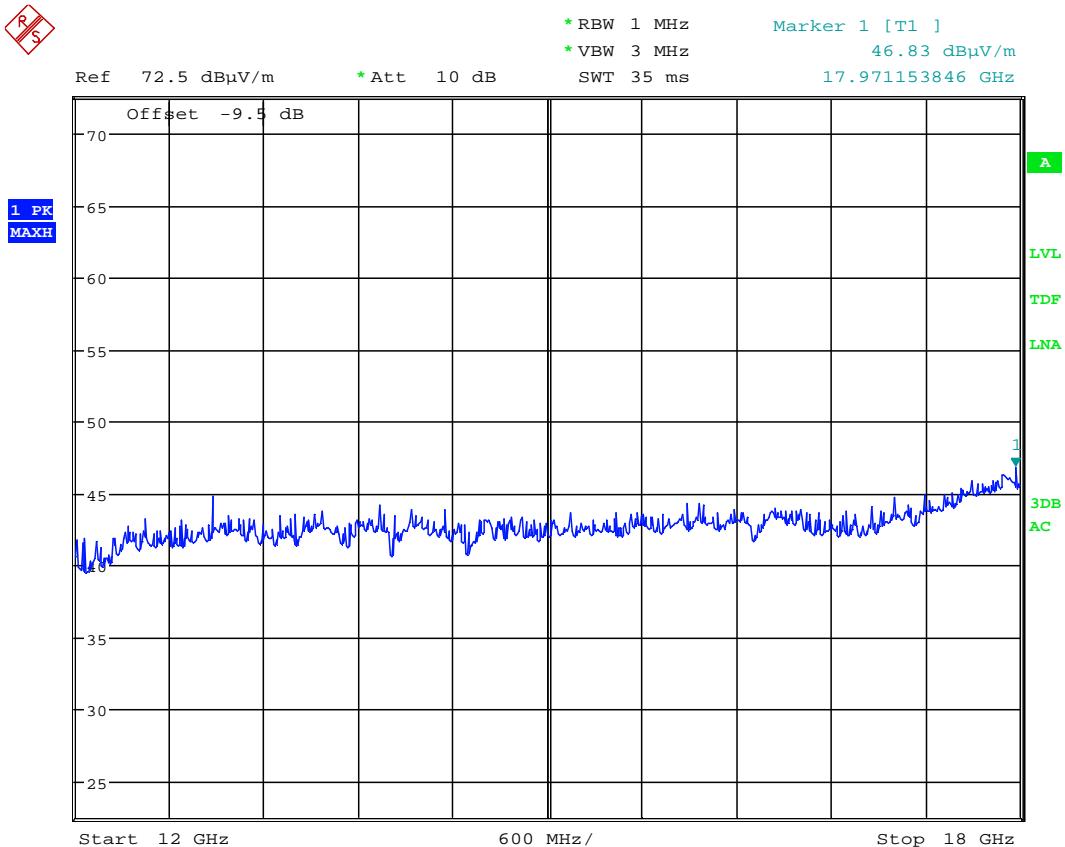
Date: 8.APR.2015 13:04:43

Radiated Emissions, 8500 -12000 MHz, 2440 MHz, VP, d=1m



Date: 8.APR.2015 13:16:17

Radiated Emissions, 12000 -18000 MHz, 2440 MHz, HP, d=1m



Date: 8.APR.2015 13:14:25

Radiated Emissions, 12000 -18000 MHz, 2440 MHz, VP, d=1m

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 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
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2014.11	2015.11
4	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	Cal b4 use	
7	3115	Horn Antenna	EMCO	LR 1226	2013.12	2018.12
8	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2014.11	2015-11
9	643	Antenna Horn	Narda	LR 093	2009.01.26	2019.01.26
10	PM7320X	Antenna Horn	Sivers Lab	LR 102	2009.01.26	2019.01.26
11	DBF-520-20	Antenna Horn	Systron Donner	LR 100	2009.01.26	2019.01.26
12	638	Antenna Horn	Narda	LR 1480	2010.06.17	2019.06.17
14	HFH2-Z2	Loop Antenna	Rohde & Schwarz	LR 1660	2014.10	2017.10
15	HK116	Biconical Antenna	Rohde & Schwarz	LR 1260	2013.12	2016.12
16	HL223	Log-Period Antenna	Rohde & Schwarz	LR 1261	2013.12	2016.12
17	10855A	Pre-amplifier	Hewlett Packard	LR 1445	2014.11	2015.11

6 BLOCK DIAGRAM

6.1 Test Site Radiated Emission

