TEST REPORT CONCERNING THE COMPLIANCE OF A SPREAD SPECTRUM TRANSMITTER BRAND SIEMENS, MODEL 1218RF WITH 47 CFR PART 15 (10-1-14 Edition)

15050802.fcc01_Rev01
February 10, 2016

FCC listed : 90828
Industry Canada : 2932G-2
R&TTE and EMC Notified Body : 1856

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MEASUREMENT/TECHNICAL REPORT

Brand: Siemens
Model: 1218RF

FCC ID: 2AF88-1218RF
IC: Not applicable

This report concerns: Original grant/certification ~~Class 1 permissive change~~ ~~Verification~~

Equipment type: Spread Spectrum Transmitter (DSS)

Report prepared by:

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Company name	: TÜV Rheinland Nederland B.V.
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The data taken for this test and report herein was done in accordance with 47 CFR Part 15 (10-1-14 Edition) and the measurement procedures of ANSI C63.4-2014. TÜV Rheinland Nederland B.V. at Leek, The Netherlands, certifies that the data is accurate and contains a true representation of the emission profile of the Equipment Under Test (EUT) on the date of the test as noted in the test report. I have reviewed the test report and find it to be an accurate description of the test(s) performed and the EUT so tested.

Date: February 10, 2016

Signature:

P. de Beer
Technical Manager TÜV Rheinland Nederland B.V.

Summary

The device under test does:

- ● fulfill the general approval requirements as identified in this test report
- ○ not fulfill the general approval requirements as identified in this test report

Description of test item

Test item	:	Spread Spectrum Transmitter (DSS)
Manufacturer	:	Siemens Industry Software B.V.
Brand	:	Siemens
Model	:	1218RF
Serial number	:	Unindentified test sample
Revision	:	--

Applicant information

Applicant's representative	:	Mr. Jos op ' Hoog
Company	:	Siemens Industry Software B.V.
Address	:	Druivenstraat 47
Postal code	:	4816KB
City	:	Breda
Country	:	The Netherlands
Telephone number	:	+31765736363
Telefax number	:	+31765736373

Test(s) performed

Location	:	Leek
Test(s) started	:	September 26, 2014
Test(s) completed	:	February 09, 2015
Purpose of test(s)	:	Equipment Authorization (Original grant/certification) for a Limited Single Modular Approval.
Test specification(s)	:	FCC 47 CFR Part 15, Subpart C, Section 15.247 (10-1-14 Edition) FCC Public Notice DA 00-705 ANSI C63.4-2014
Test engineer(s)	:	R. van der Meer 
Report written by	:	R. van der Meer 
Report date	:	February 10, 2016

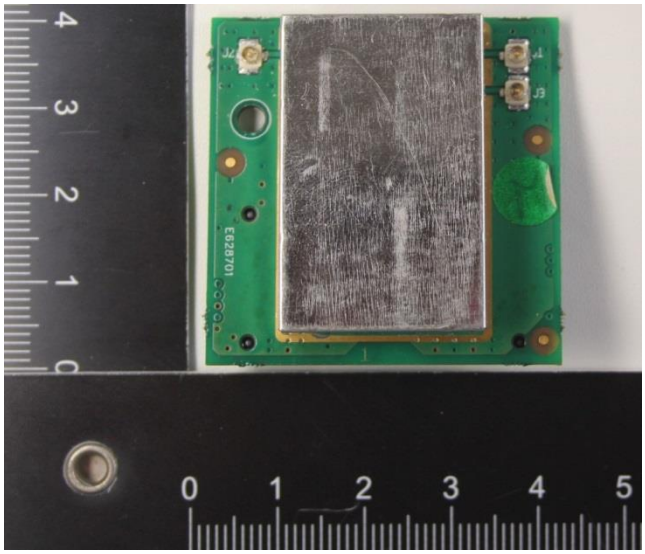
Table of contents

1 General information.

1.1 Product description.

1.1.1 Introduction.

The brand SIEMENS model 1218RF, hereafter referred to as EUT, is a Spread Spectrum Transmitter (DSS) and is part of the LMS SCADAS Pass-By Noise system. The EUT is factory configured for the 2407-2474 MHz band.
The EUT has 3 RF output connectors designated as J1, J2 and J3



Photographs of the EUT

The content of this report and measurement results have not been changed other than the way of presenting the data.

1.2 Related submittal(s) and/or Grant(s).

1.2.1 General.

This test report supports the original certification in equipment authorization files under FCC ID: 2AF88-1218RF.

1.3 Tested system details.

Details and an overview of the system and all of its components, as it has been tested, may be found below.

EUT	:	Spread Spectrum Transmitter (DSS)
Manufacturer	:	Siemens Industry Software B.V.
Brand	:	Siemens
Model	:	1218RF
Serial number	:	unindentified test sample
Voltage input rating	:	3.3 Vdc
Voltage output rating	:	n.a.
Current input rating	:	--
Antenna	:	External
Operation frequency	:	2407 – 2474 MHz
Modulation/ data rate	:	8FSK / 5Mbps
Spreading technique	:	FHSS
Remarks	:	--

AUX1	:	Notebook computer
Manufacturer	:	Dell
Brand	:	Dell
Model	:	Latitude
Serial number	:	7ZJKNX1
Remarks	:	Property applicant

AUX2	:	Test board
Manufacturer	:	Texas Instruments
Brand	:	Texas Instruments
Model	:	Pure Path Wireless Audio EB 1.2
Serial number	:	--
Remarks	:	Host for EUT

AUX3	:	Programming interface
Manufacturer	:	Texas Instruments
Brand	:	Texas Instruments
Model	:	CC Debugger Rev 01
Serial number	:	Z__100001C02192
Remarks	:	Host for EUT

AUX4	:	4 port USB Hub
Manufacturer	:	Sitecom
Brand	:	Sitecom
Model	:	CN-060
Serial number	:	--
Remarks	:	powers AUX2

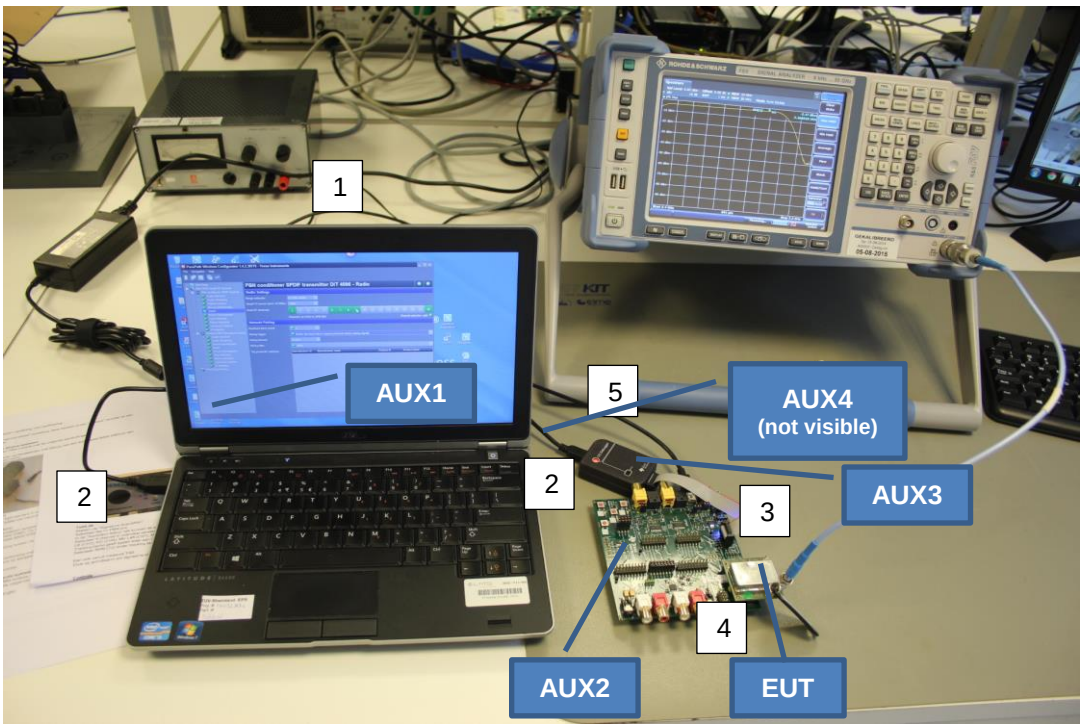


Photo 1: Photograph of the testsetup

1.3.1 Description of input and output ports.

Number	Terminal	From	To	Remarks
1	Mains	Mains	AUX1	--
2	USB connection	AUX1	AUX2	shielded cable
3	Data	AUX3	AUX2	unshielded cable
4	Data, power	AUX3	AUX2	--
5	Power for AUX2	mains	AUX4	shielded cable

Table 1a: Interconnection between EUT and auxiliary equipment

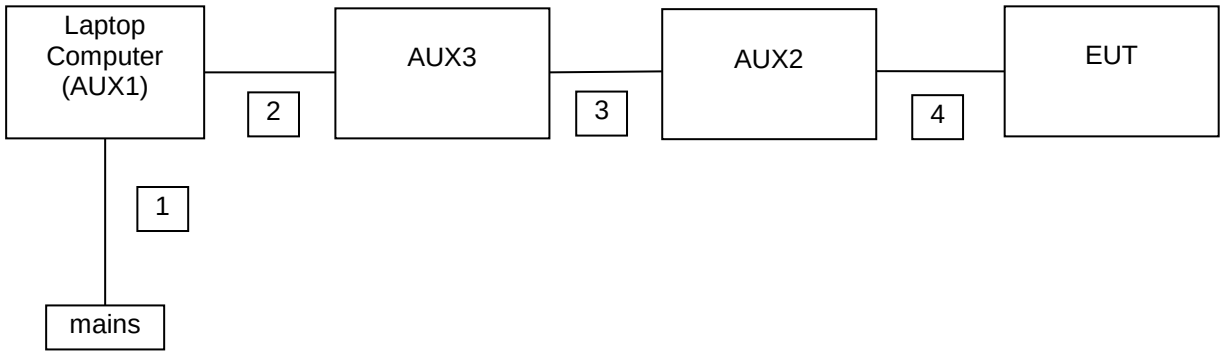


Figure 1. Blockdiagram of the basic test setup and connections

1.4 Test Summary

The EUT was tested in accordance with the specifications given in the table below.

Test Standard	Description		
47 CFR Part 15 Subpart C (10-1-14 Edition)		**Page**	**Pass / Fail**
15.207(a)	AC Power Line Conducted Emissions	-	Not Applicable
15.209(a)	Radiated Emissions	55 - 61	Pass
FCC 15.247(b)(3)	Peak Output Power	11 - 17	Pass
FCC 15.247(a)(2)	Emission bandwitdh	18 - 25	Pass
FCC 15.247(a)(1)(iii)	Hopping Frequencies, Average time of occupancy, Channel separation	26 - 34	Pass
FCC 15.205, FCC 15.209 and FCC 15.247(d)	Band edge compliance	35 - 41	Pass
FCC 15.247(d)	Out of band spurious emissions of the transmitter	42 - 54	Pass

Table 1b: Testspecifications

Testmethods: ANSI C63.4-2014

1.5 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (10-1-14 Edition), sections 15.31, 15.209 and 15.247. The test methods, which have been used, are based on FCC Public Notice DA 00-705, for radiated tests ANSI C63.4-2014.

Radiated emission tests were performed at a measurement distance of 3 meters.

The measurement receiver is switching automatically to the right bandwidth in accordance with CISPR 16. This is implemented in the receiver. The antenna factors are programmed in the measurement receiver. The receiver automatically calculates the appropriate correction factor for the utilized antenna and also the appropriate antenna factor for the cable loss. The total correction is automatically added to the measured value.

1.6 Test facility.

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland Nederland B.V., located in Leek, 9351VT Eiberkamp 10, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948.

The description of the test facilities has been filed at the Office of the Federal Communications Commission under registration number 90828. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The description of the test facilities has been filed to Industry Canada under registration number 2932G-2. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

1.7 Test conditions.

Normal test conditions:

Temperature (*)	: +15°C to +35°C
Relative humidity(*)	: 20 % to 75 %
Supply voltage	: 120Vac / 60 Hz
Air pressure	: 950 – 1050 hPa

*When it was impracticable to carry out the tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests are stated separately.

2 System test configuration.

2.1 Justification.

The EUT was placed on a test board. The EUT was provided with software that enabled selection of various test modes.
For radiated test the rooftop antenna was used (which has the higher gain over the Microphone antenna.

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.4-2014.

2.2 EUT mode of operation.

The EUT has been tested in continuous transmit mode. Testing was performed at the lowest operating frequency (2407 MHz), at the operating frequency in the middle of the specified frequency band (2438 or 2439 MHz) and at the highest operating frequency (2474 MHz).

2.3 Special accessories.

No special accessories are used and/or needed to achieve compliance.

2.4 Test software.

Test software used for testing was :

Texas Instruments Pure Path Wireless Configurator version 1.4.2.38775..

2.5 Equipment modifications.

No modifications have been made to the equipment in order to achieve compliance.

2.6 Product Labeling

The product labeling information is available at the applicant.

2.7 Schematics of the EUT.

The schematics are available at the applicant.

2.8 Part list of the EUT.

The part list is available at the applicant.

3 Peak output power

Results: Pass

Date of testing: 2014-09-26 and 2015-02-09

Requirements:

FCC 15.247(b)(3)

For systems using frequency hopping using less than 75 channels in the 2400-2483.5MHz band, the maximum peak output power is 0.125W (+21dBm).

Test procedure:

FCC Public notice DA 00-705 March 30, 2000 Alternative Test Procedure.

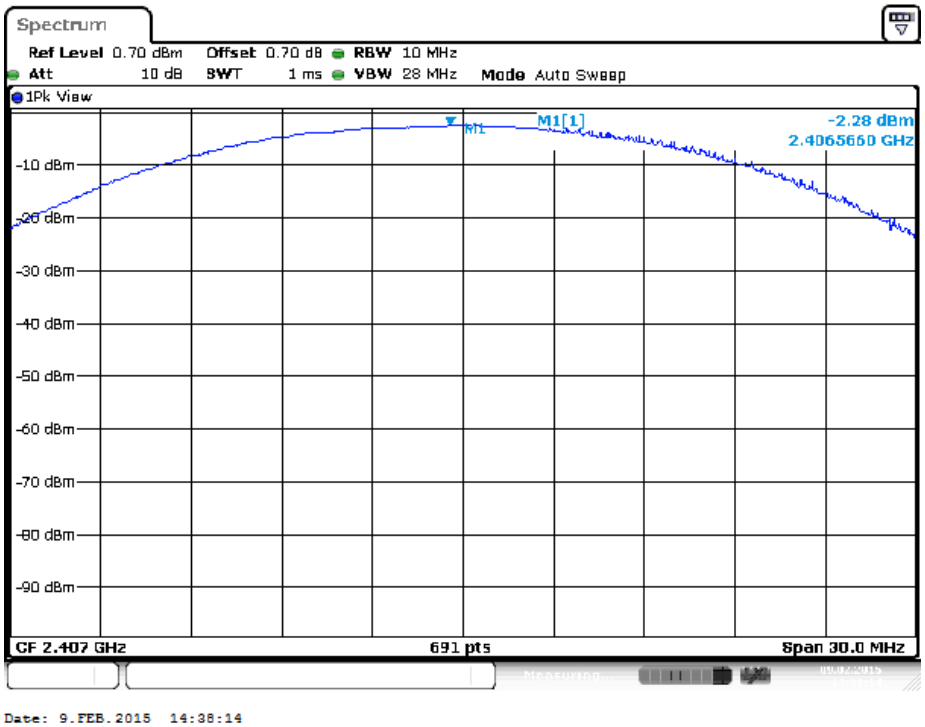
The testresults are obtained by conducted power measurements using a spectrum analyzer with a Peak detector with a resolution bandwidth of 10 MHz.

Frequency (MHz)	Measured Peak Output Power J1 (dBm)	Measured Peak Output Power J2 (dBm)	Measured Peak Output Power J3 (dBm)	Limit (dBm)
2407	-2.28	12.82	12.76	21
2439	-4.08	12.63	12.72	21
2474	-3.56	12.09	12.80	21

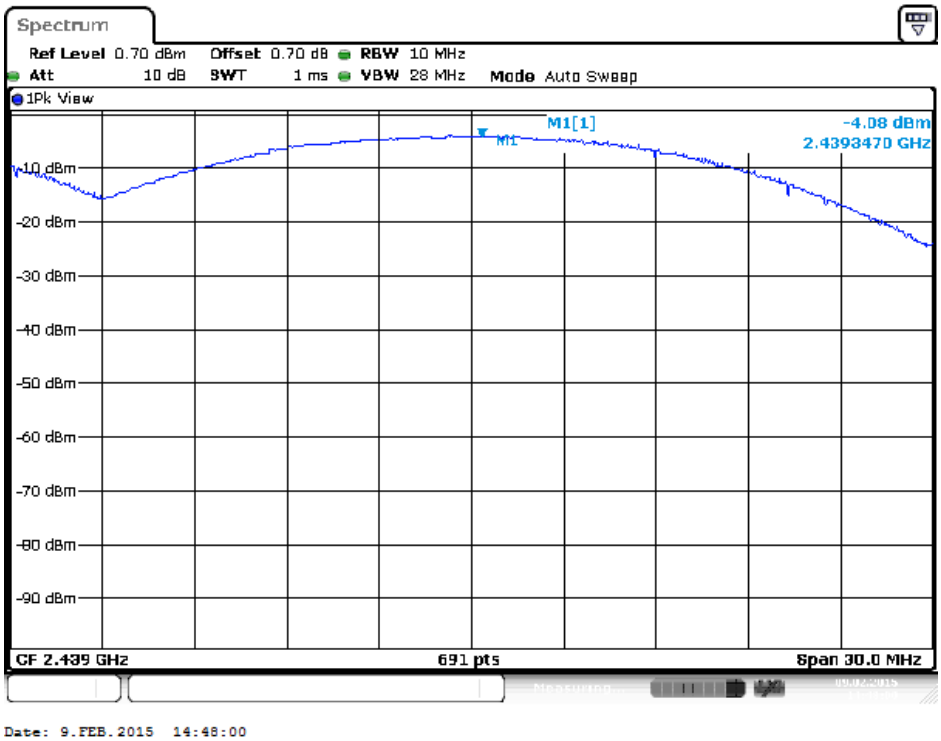
Table 2 Peak output power

Notes:

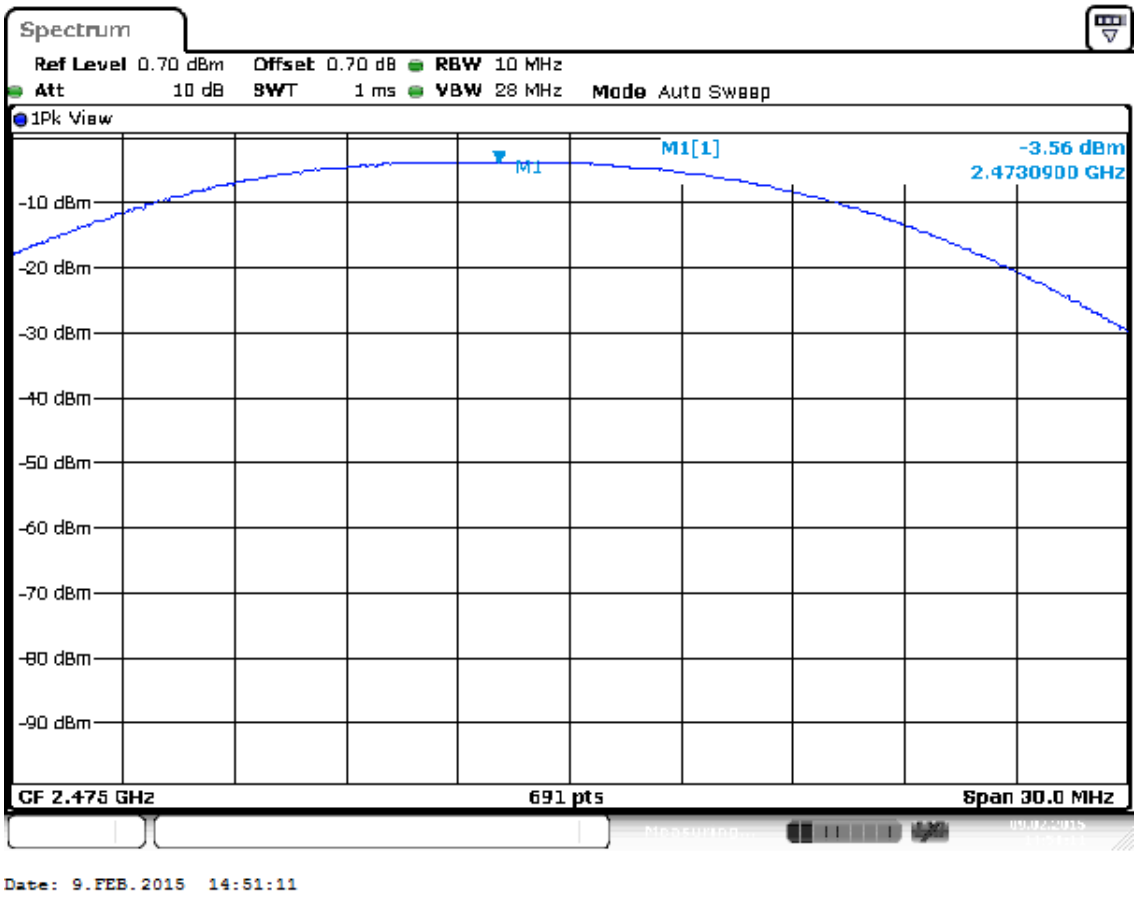
1. Measured value includes correction factor for cable loss.
2. See plots on the next pages.



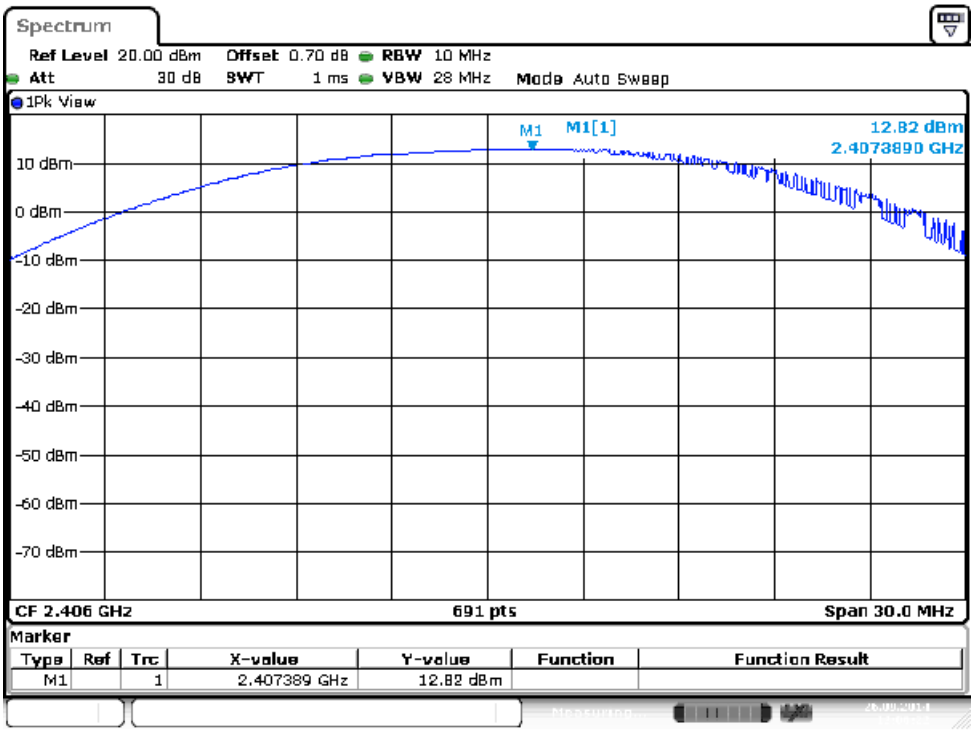
Plot 1a: J1-Peak Output Power (2407 MHz)



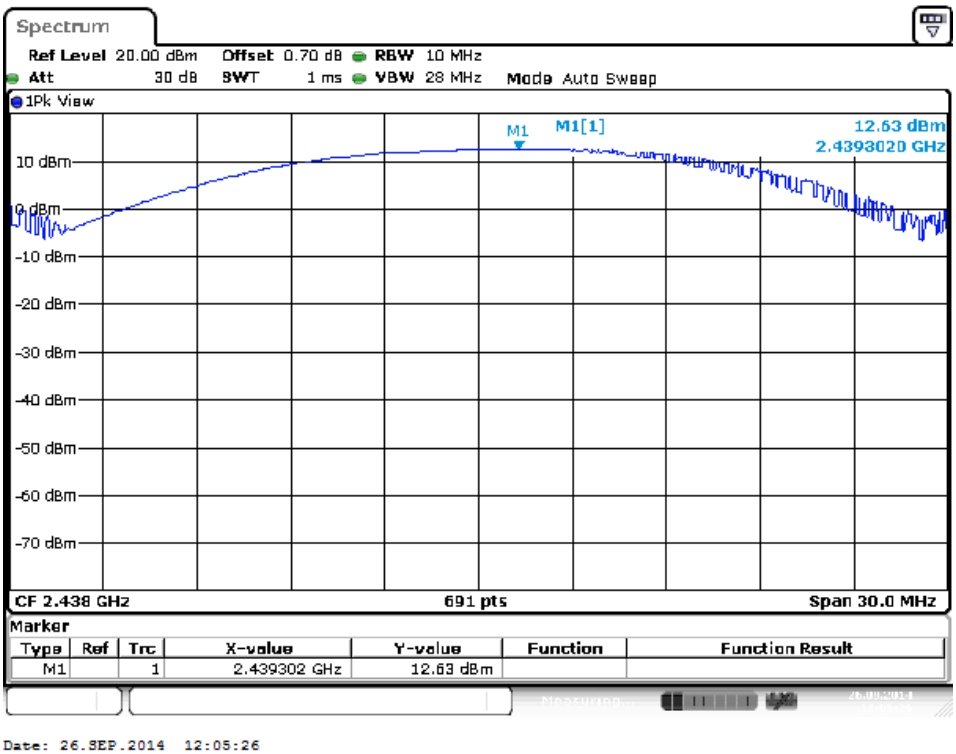
Plot 2a: J1- Peak Output Power (2439 MHz)



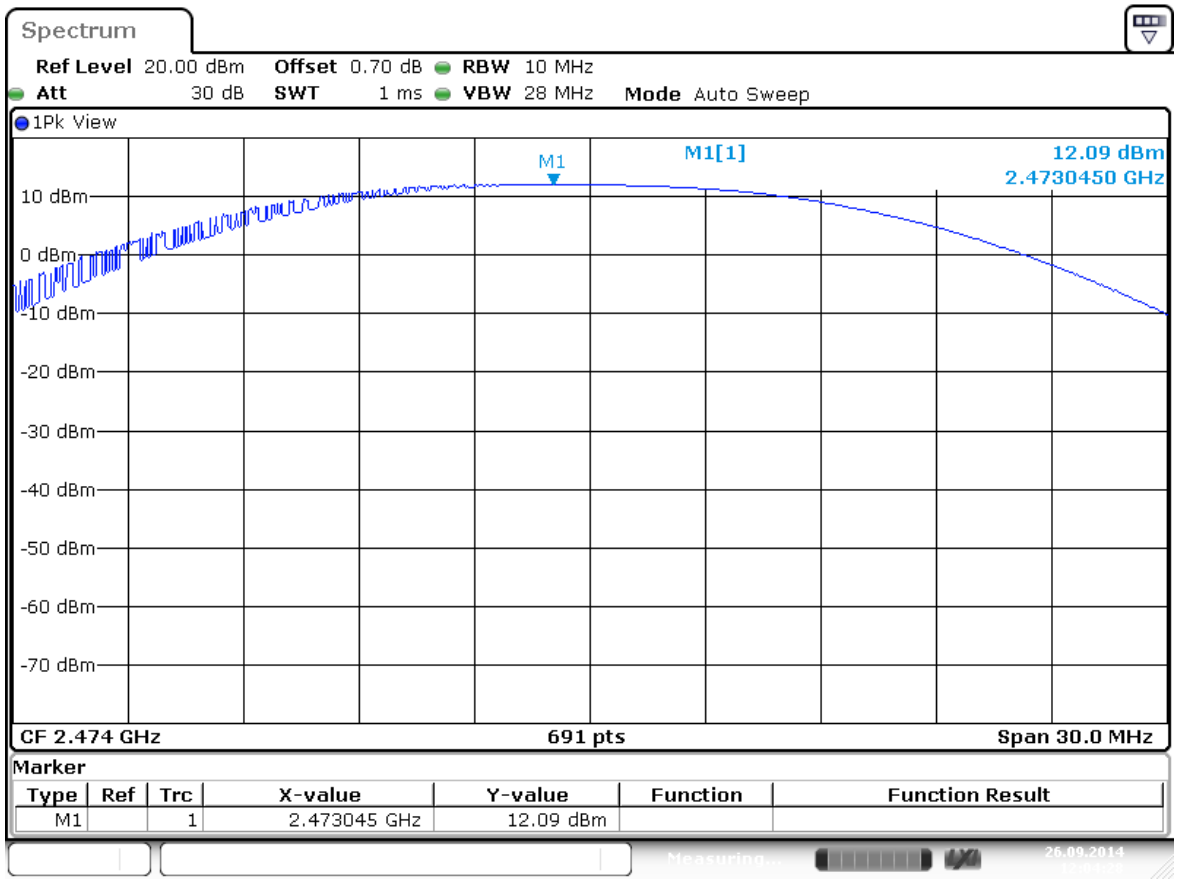
Plot 3a: J1-Peak Output Power (2474 MHz)



Plot 1b: J2- Peak Output Power (2407 MHz)



Plot 2b: J2- Peak Output Power (2439 MHz)



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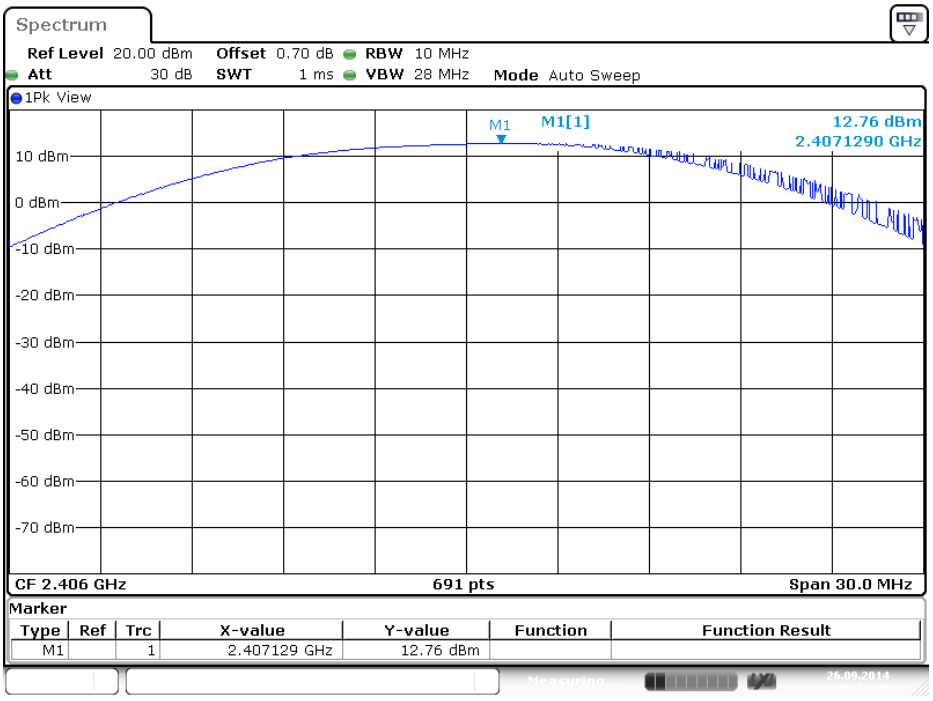
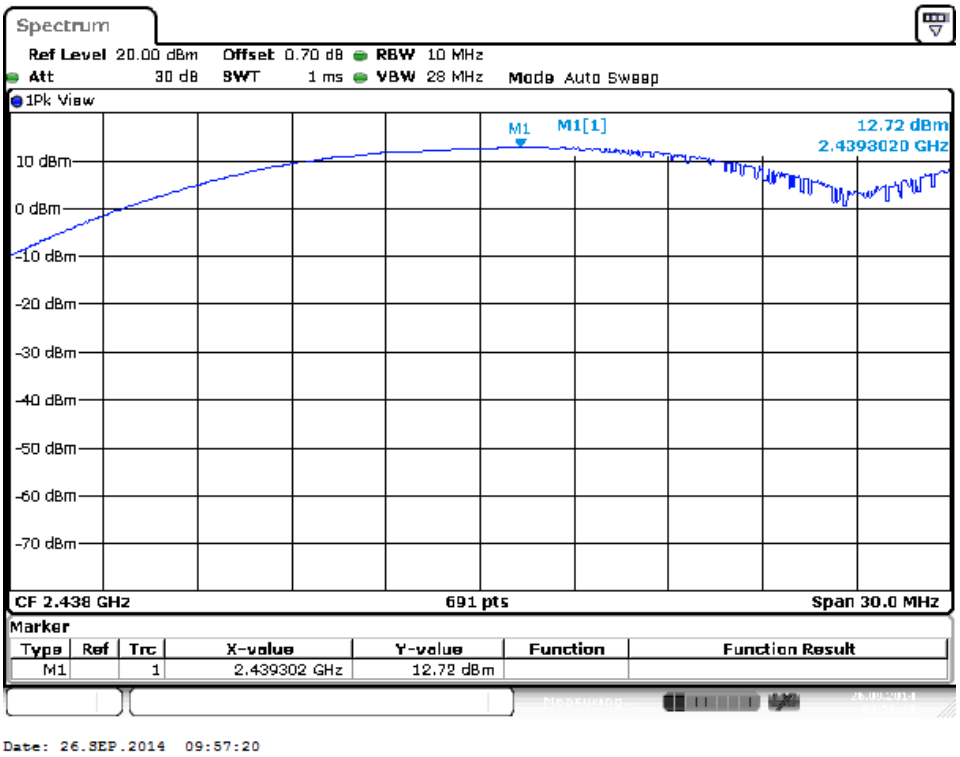
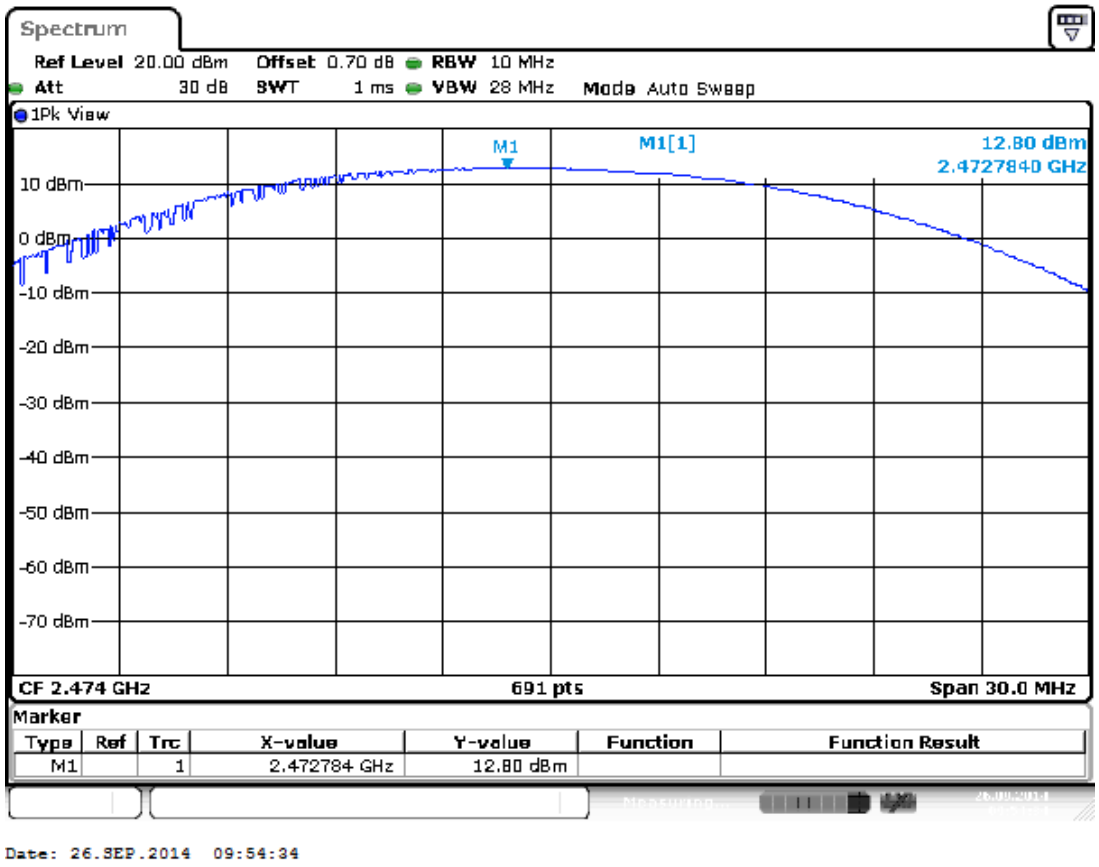
Plot 3b: J2- Peak Output Power (2474 MHz)



Plot 1c: J3- Peak Output Power (2407 MHz)



Plot 2c: J3- Peak Output Power (2439 MHz)



Plot 3c: J3- Peak Output Power (2474 MHz)

4 Emission bandwidth

Results: Pass

Date of testing: 2014-09-26 and 2015-02-09

Requirements:

FCC 15.247(a)(2)

For systems using hopping technology in the 2400-2483.5MHz band, the 20dB bandwidth is not limited.

Test procedure:

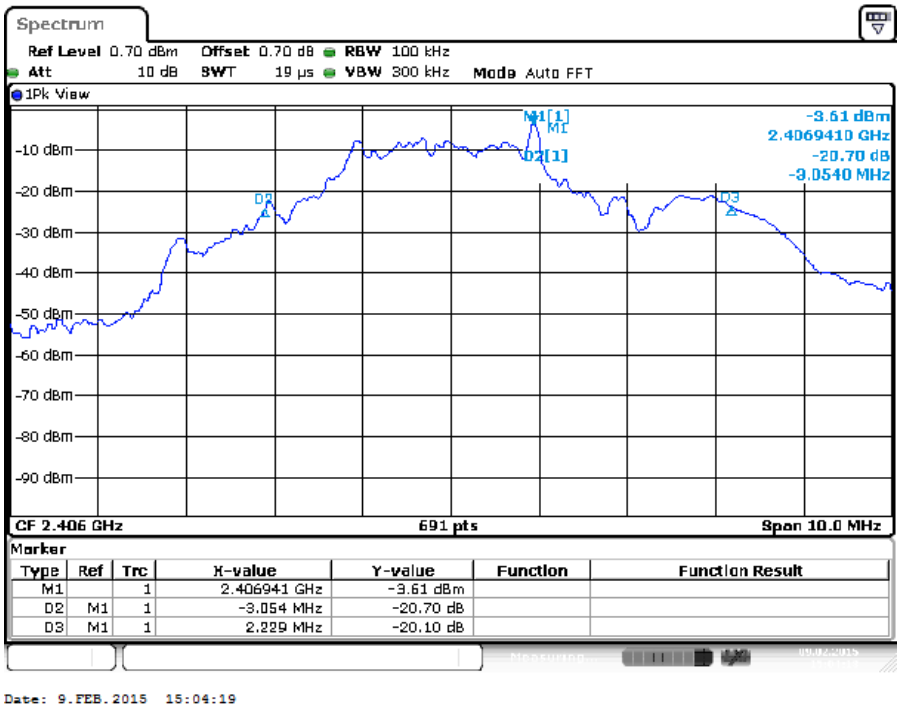
Public notice DA 00-705 March 30, 2000

The Occupied bandwidth was measured conducted. The spectrum analyzer settings were as follows:

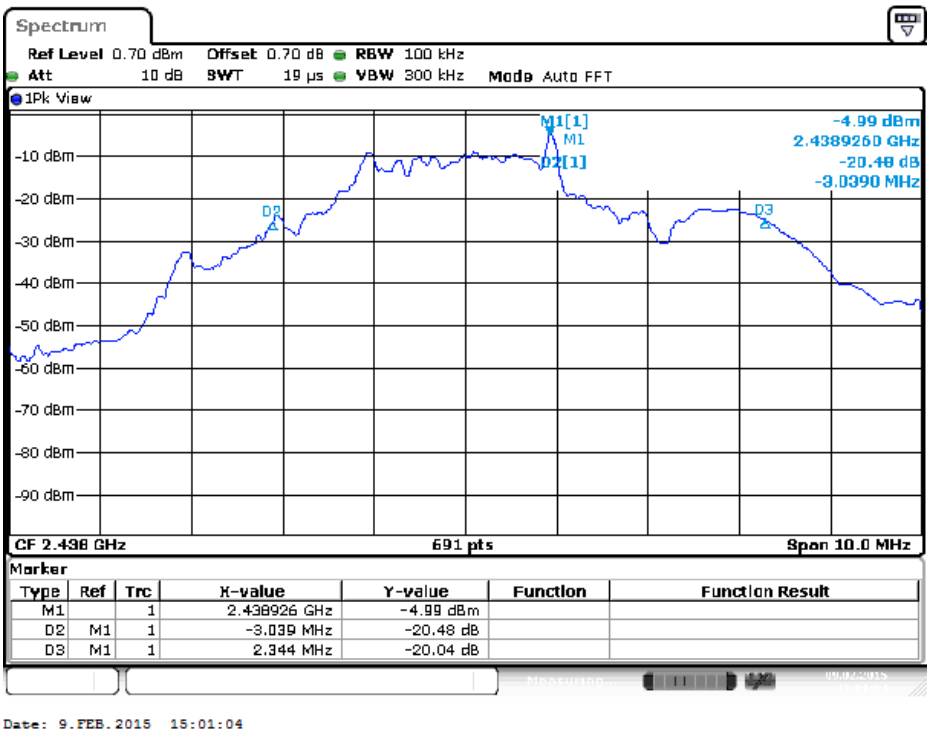
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥ 1% of the 20 dB bandwidth
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

The marker-delta function was used to determine the -20 dB points.

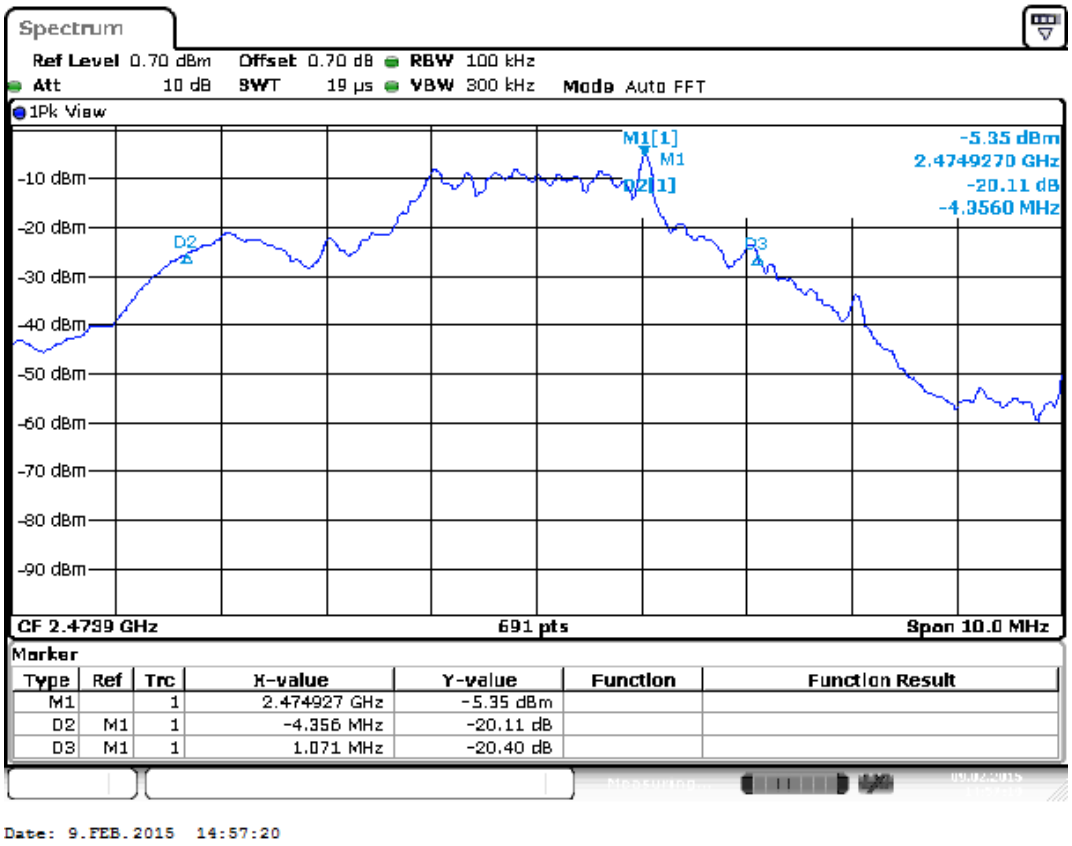
See plots on the next pages.



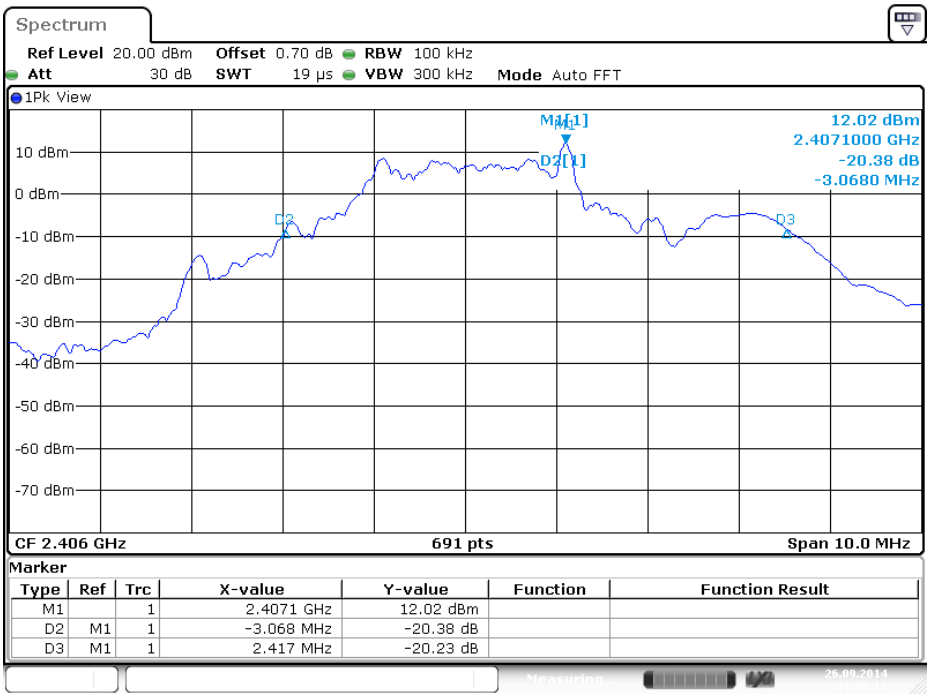
Plot 4a: Emission 20dB Bandwidth (= 5.28 MHz) of the EUT transmitting on J1 at 2407 MHz



Plot 5a: Emission 20dB Bandwidth (= 5.38 MHz) of the EUT transmitting on J1 at 2438 MHz



Plot 6ba: Emission 20dB Bandwidth (= 5.42 MHz) of the EUT transmitting on J1 at 2474 MHz



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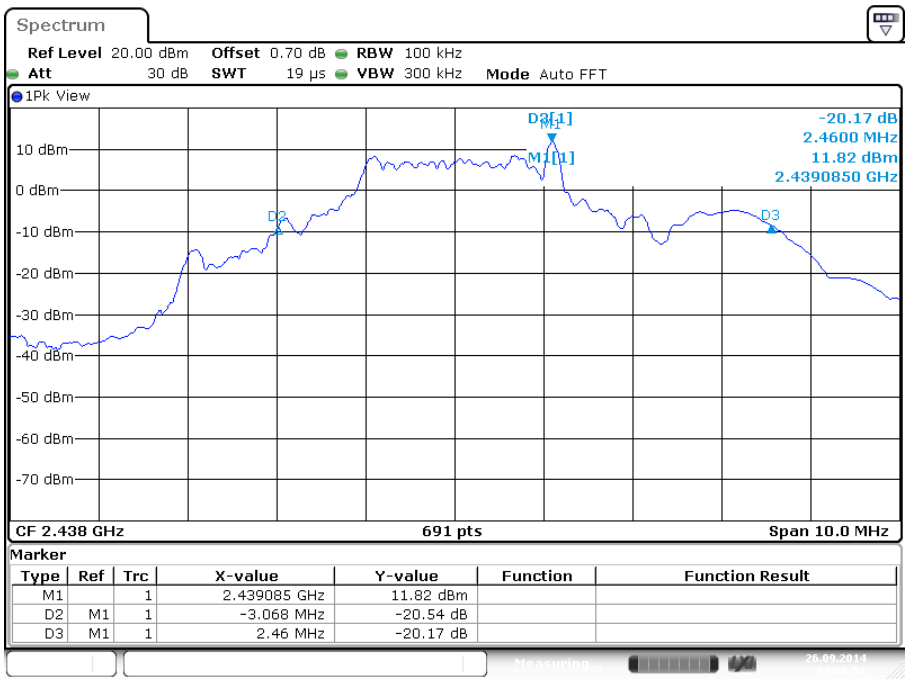
Plot 4b: Emission 20dB Bandwidth (= 5.48 MHz) of the EUT transmitting on J2 at 2407 MHz



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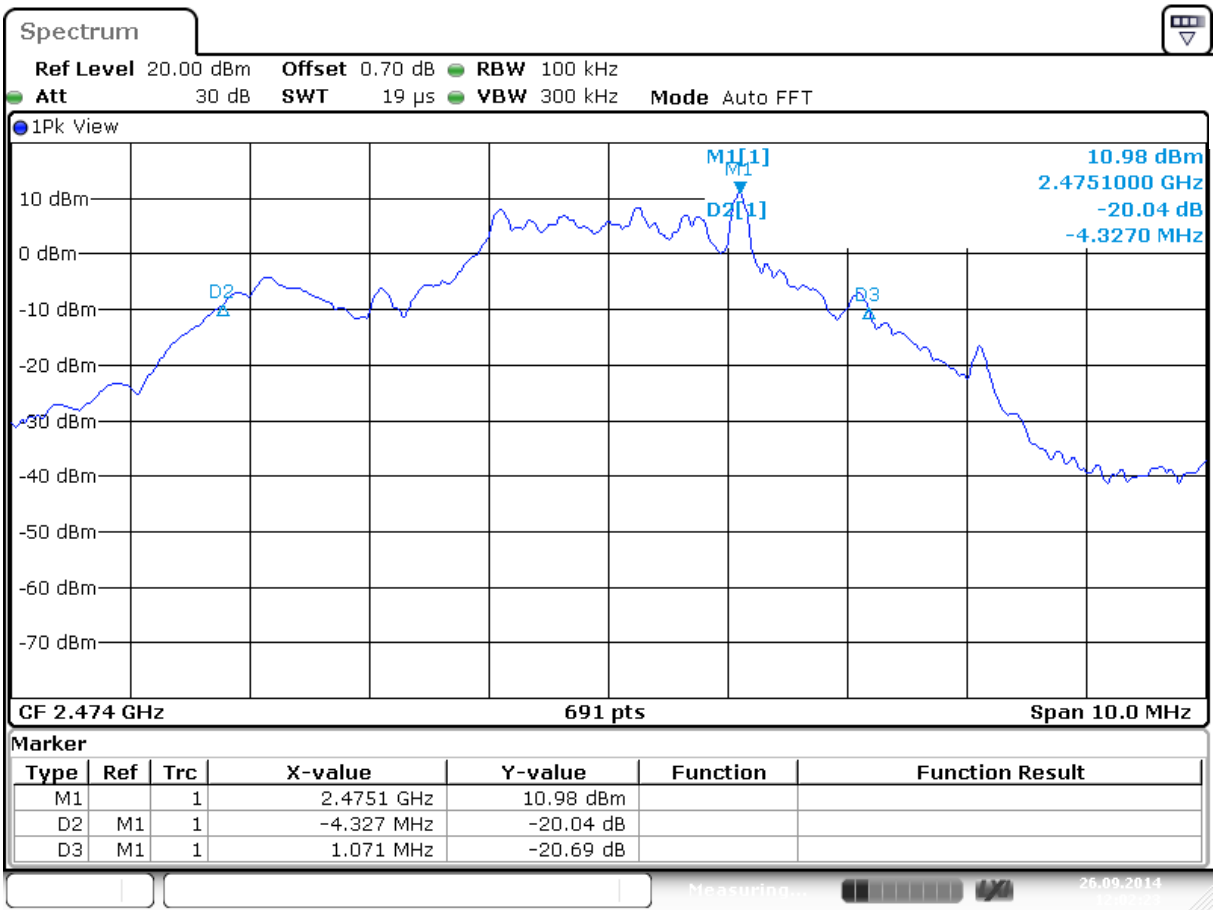
Plot 5b: Emission 20dB Bandwidth (= 5.53 MHz) of the EUT transmitting on J2 at 2438 MHz



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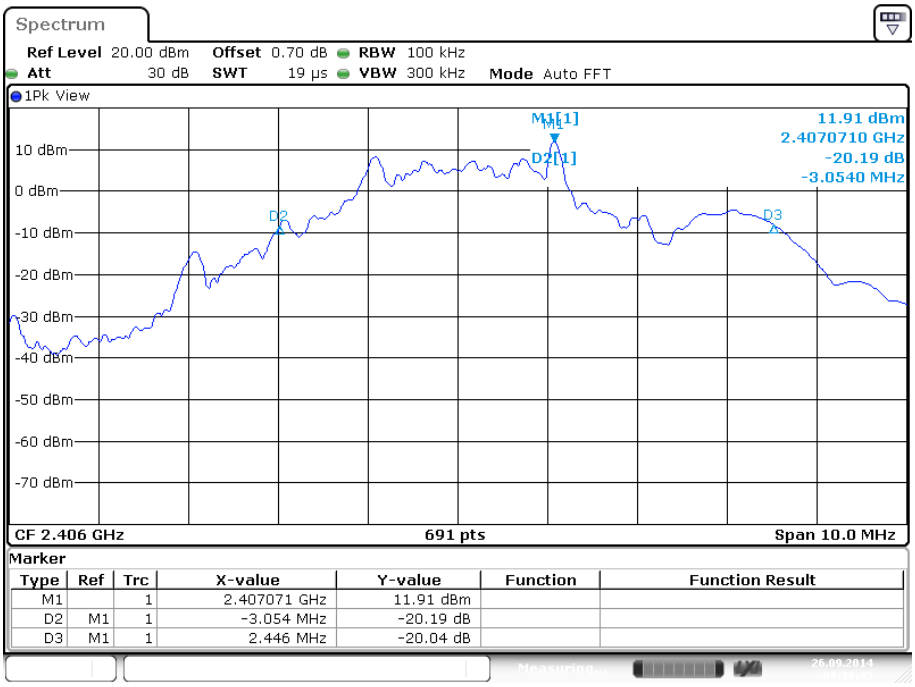
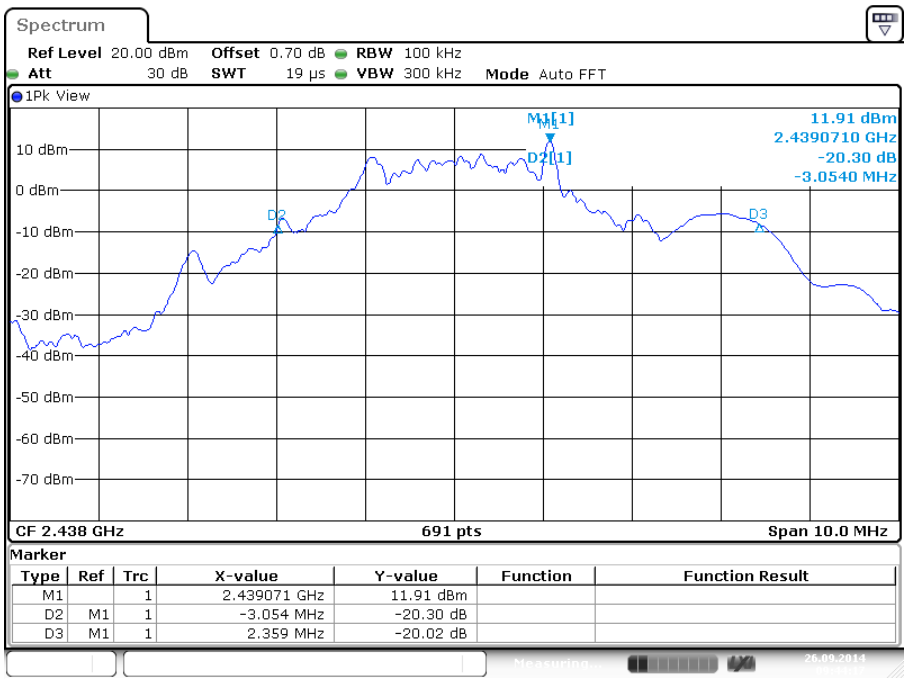
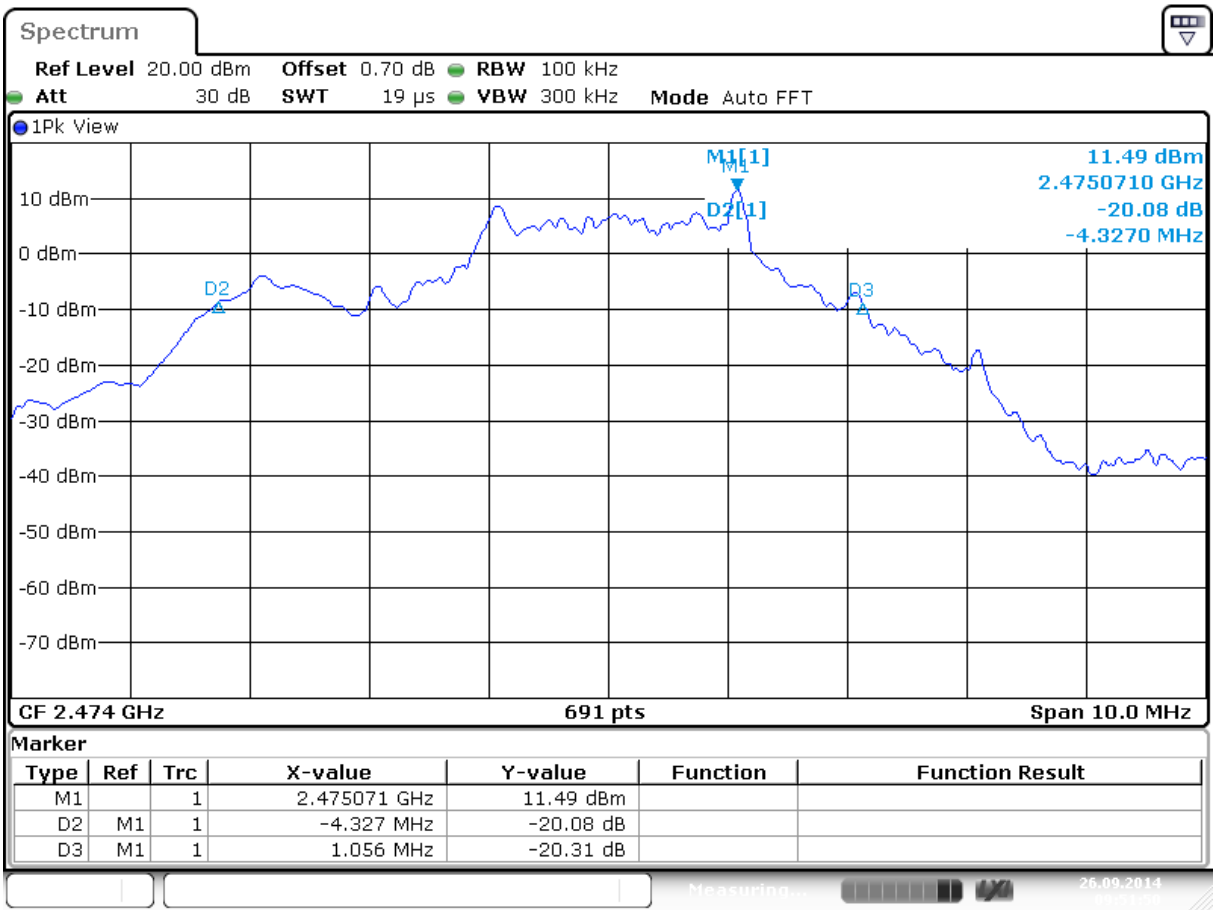
Plot 6b: Emission 20dB Bandwidth (=5.40 MHz) of the EUT transmitting on J2 at 2474 MHz



Plot 4c: Emission 20dB Bandwidth (= 5.50 MHz) of the EUT transmitting on J3 at 2407 MHz



Plot 5c: Emission 20dB Bandwidth (= 5.41 MHz) of the EUT transmitting on J3 at 2438 MHz



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Plot 6c: Emission 20dB Bandwidth (= 5.38 MHz) of the EUT transmitting on J3 at 2474 MHz

5 Hopping frequencies, Average time of occupancy and Channel spacing.

RESULT: PASS

Date of testing: 2014-09-26 and 2015-02-10 + 11

Requirements:

FCC 15.247(a)(1)(iii)

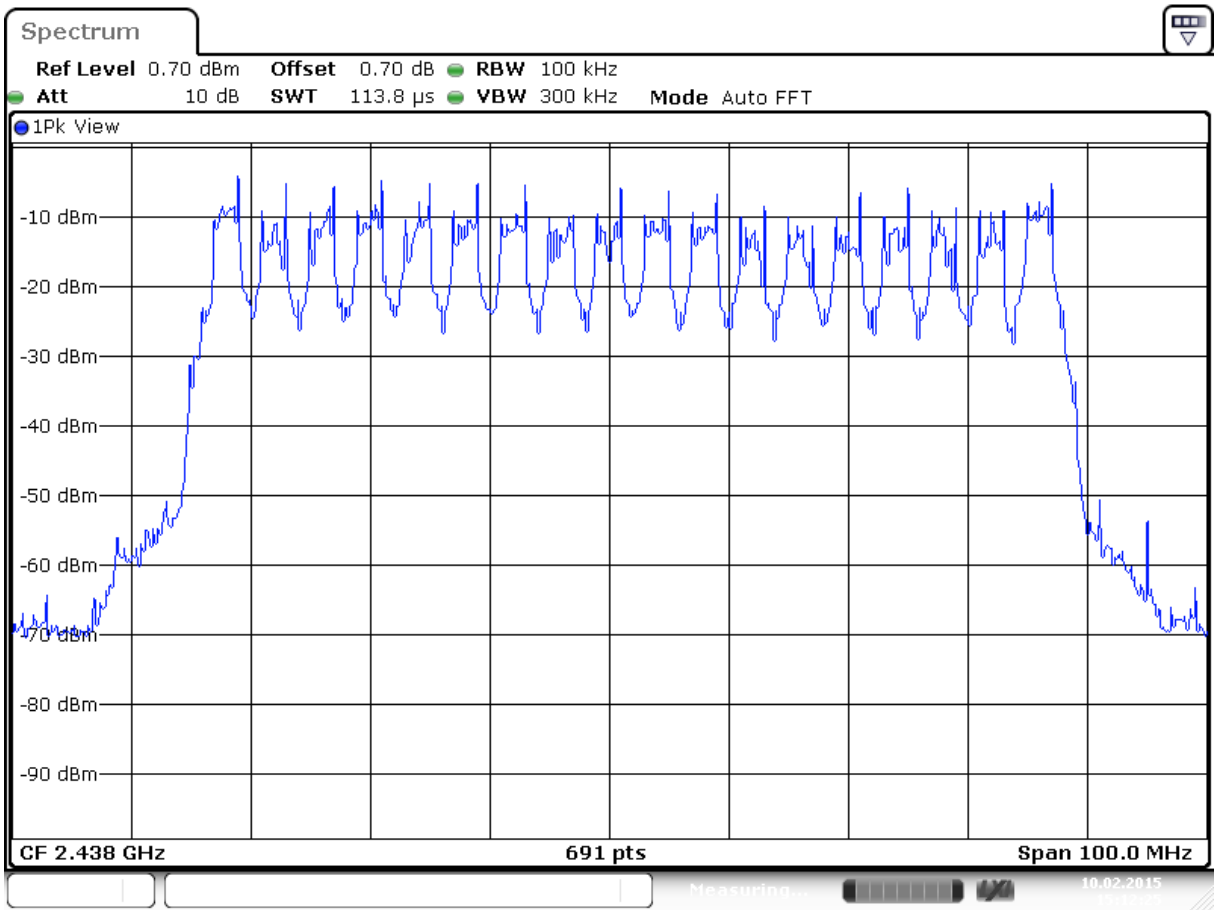
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test procedure:

FCC Public notice DA 00-705 March 30, 2000.

The EUT's hopping function was enabled.

The tests were done with the conducted test setup (spectrum analyzer). See plots on the next pages.



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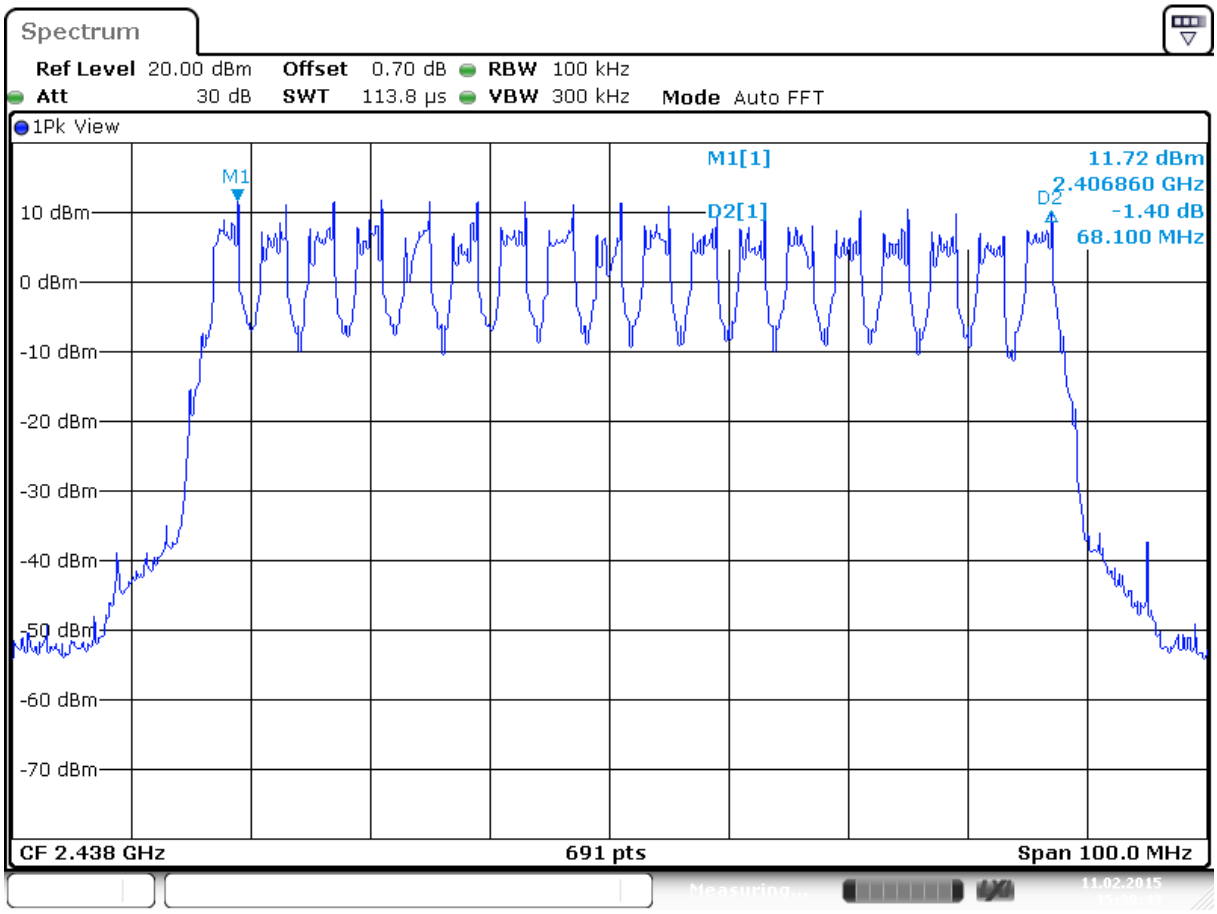
Plot 7a J1: at least 15 (actual = 18) hopping frequencies, as measured on a spectrum analyzer



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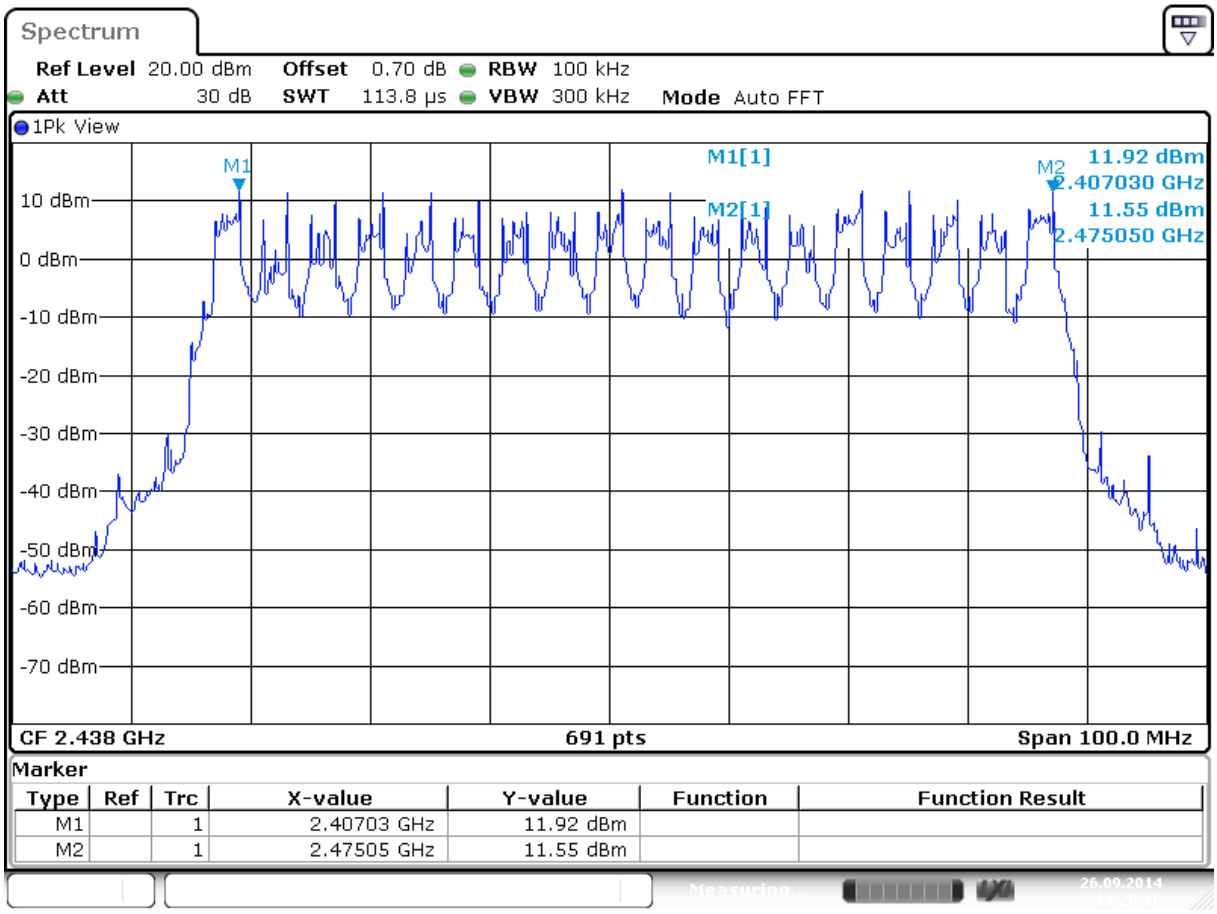
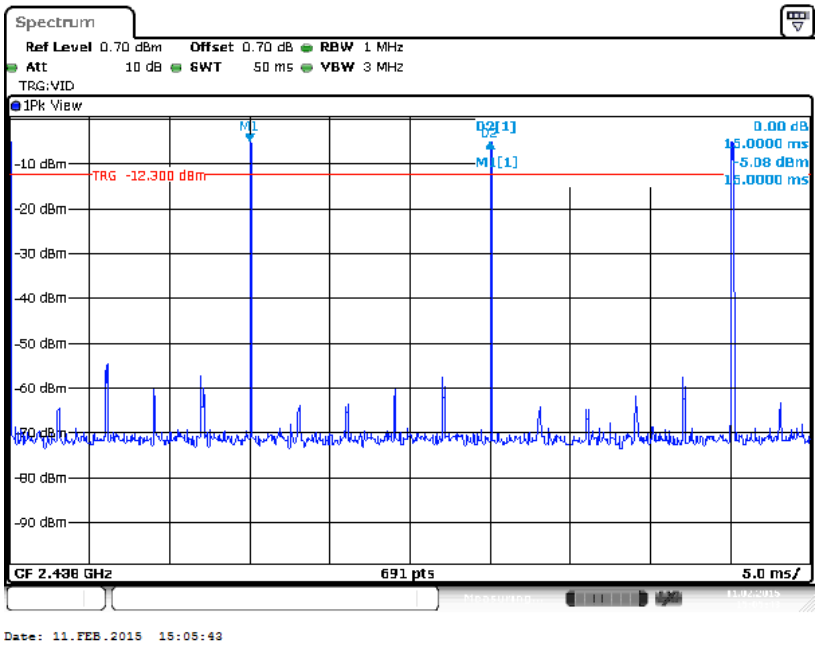
Plot 7b J2: at least 15 (actual = 18) hopping frequencies, as measured on a spectrum analyzer



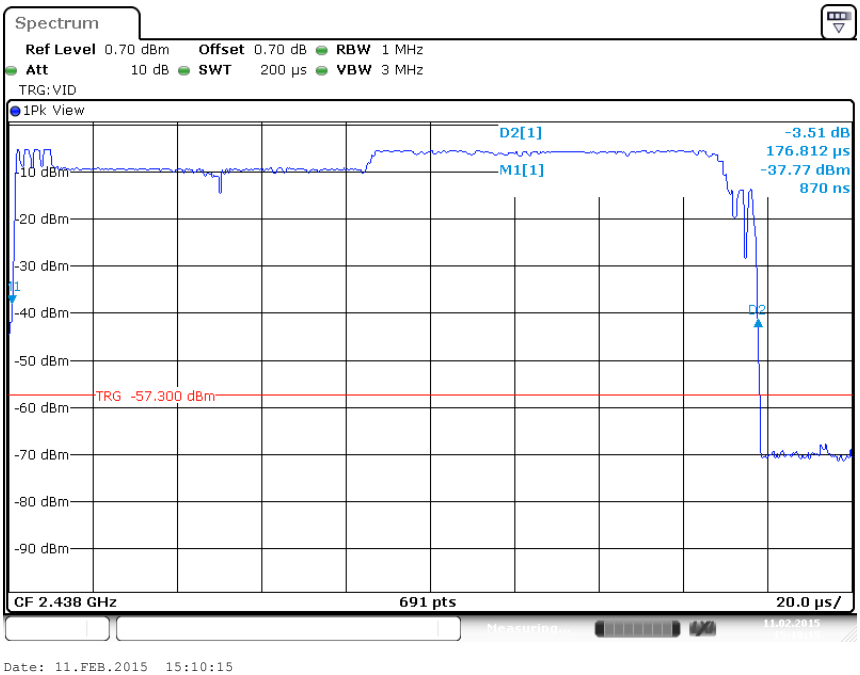
Date: 26.SEP.2014 11:26:16

Plot 7c J3: at least 15 (actual = 18) hopping frequencies, as measured on a spectrum analyzer

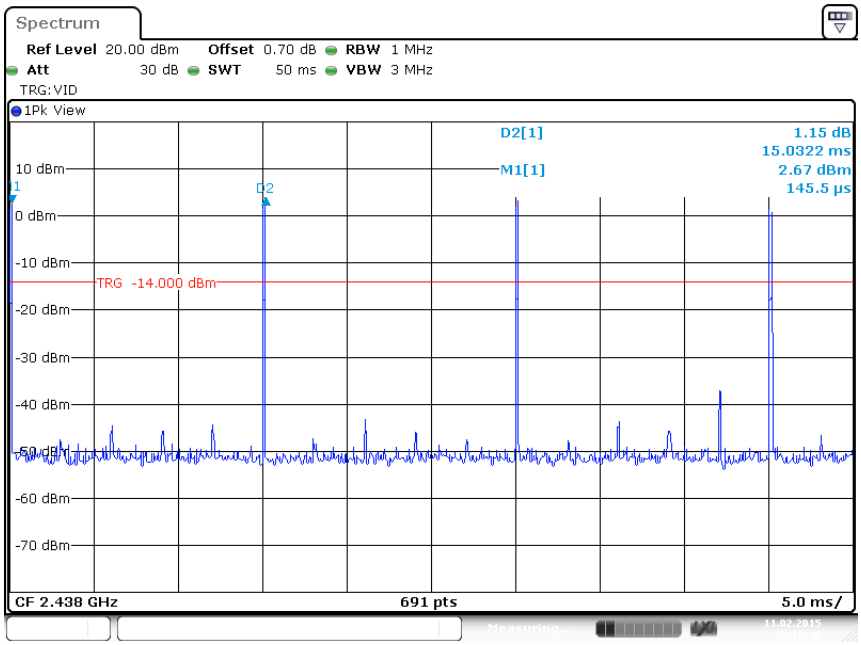


Plot 8a J1: showing Pulse Repetition Rate of 15ms.

Plot 8a shows that every 15ms a hop occurs. In a 0.4s period there for a maximum of 26 hops would be possible
Plot 8b shows a hoplenght of 0.177 ms for 1 channel.
26 hops times the hoplength of 0.177 ms would make average time of occupancy of 4.6 ms which is below the 0.4 seconds limit.

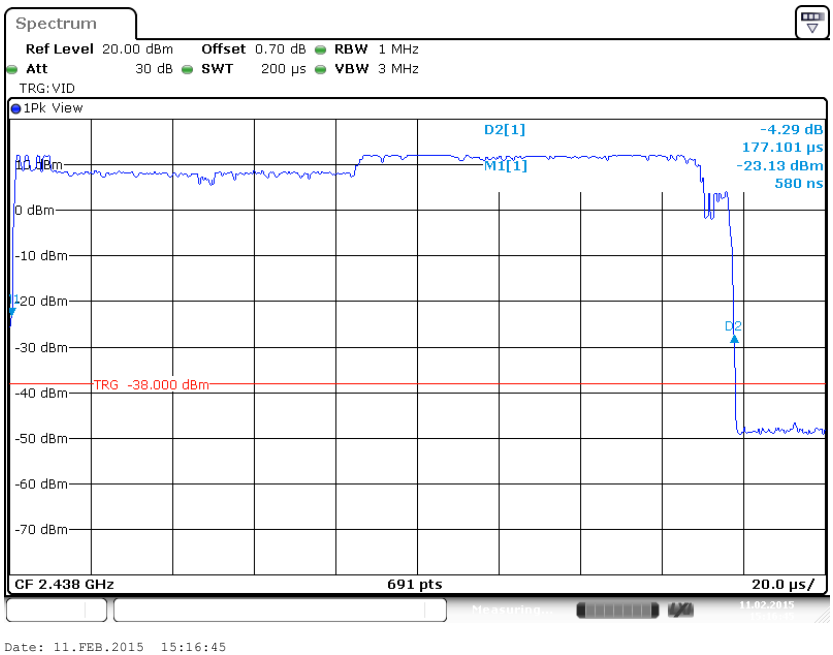


Plot 8b J1: showing the RF on time of 0.177 ms for one emission

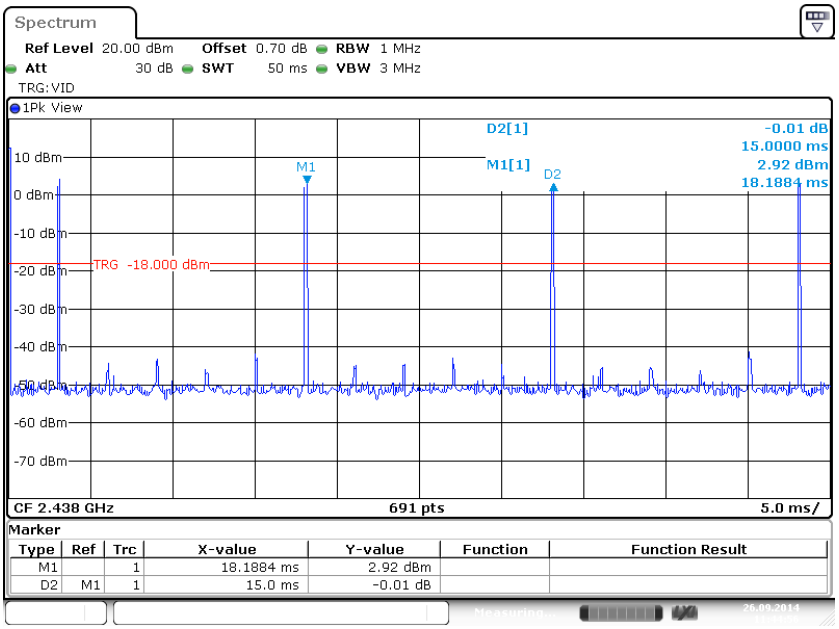


Plot 8c J2: showing Pulse Repetition Rate of 15ms.

Plot 8c shows that every 15 ms a hop occurs. In a 0.4s period there for a maximum of 26 hops would be possible
Plot 8d shows a hoplenght of 0.177 ms for 1 channel.
26 hops times the hoplength of 0.177 ms would make average time of occupancy of 4.6 ms which is below the 0.4 seconds limit.

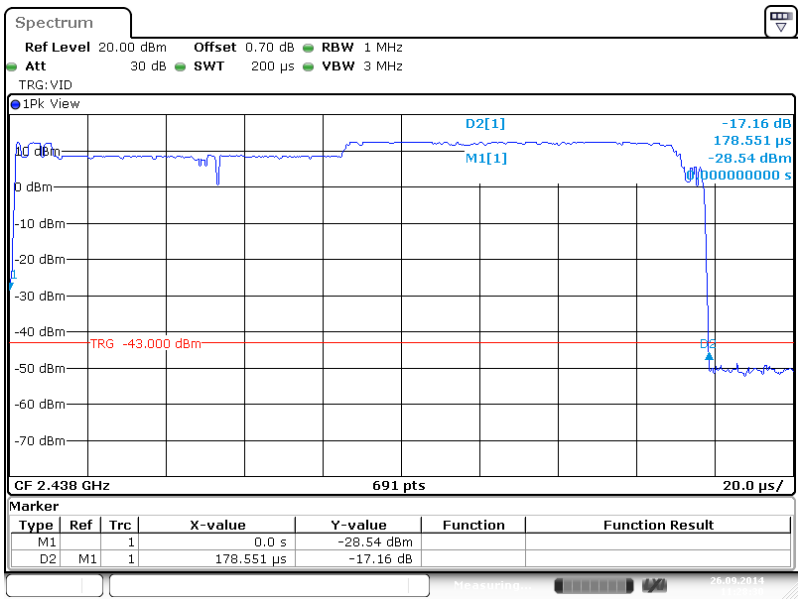


Plot 8d J2: showing the RF on time of 0.177 ms for one emission

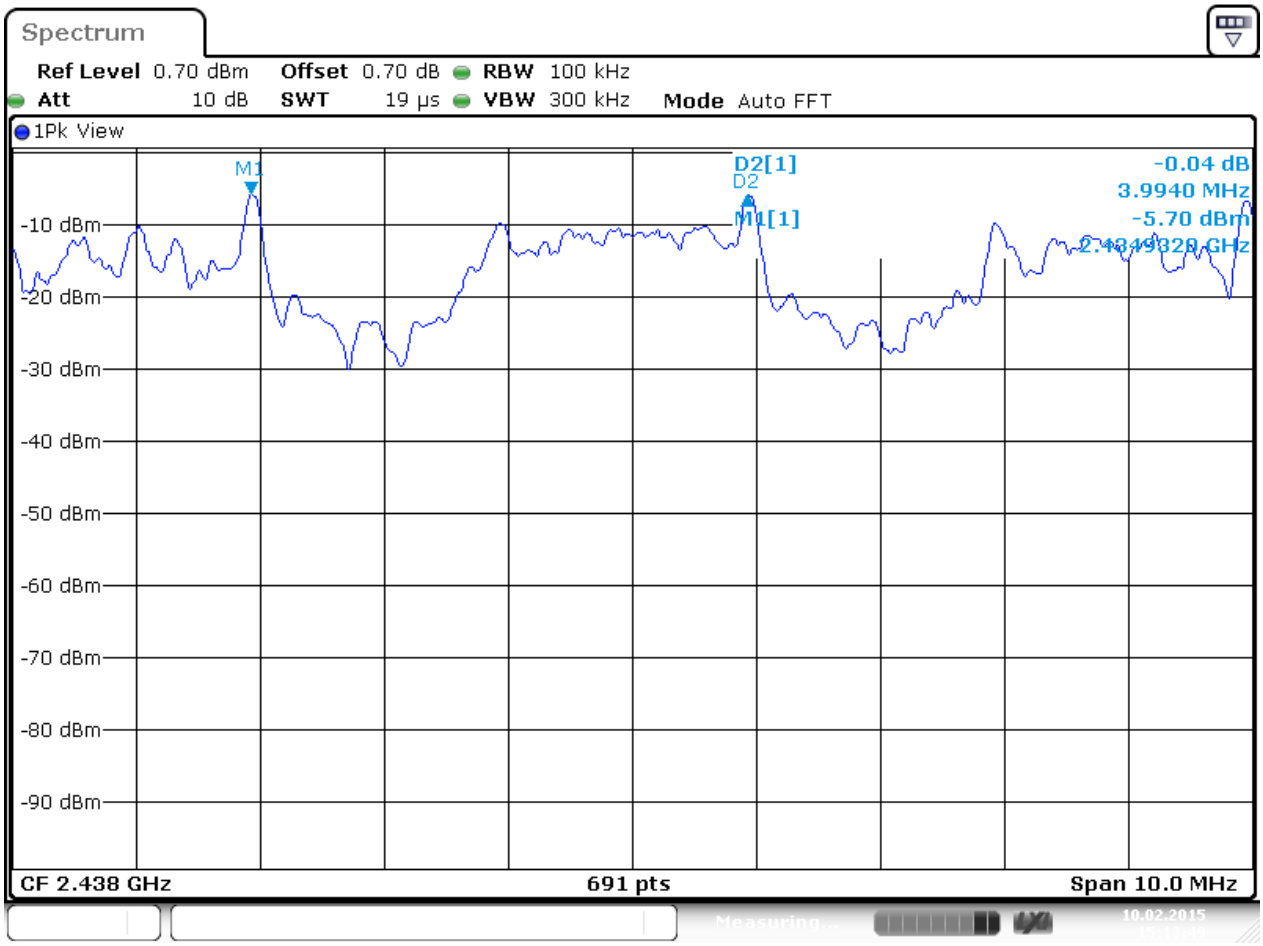


Plot 8e J3: showing Pulse Repetition Rate of 15ms.

Plot 8e shows that every 15 ms a hop occurs. In a 0.4s period there for a maximum of 26 hops would be possible
Plot 8f shows a hoplenght of 0.1786 ms for 1 channel.
26 hops times the hoplength of 0.1786 ms would make average time of occupancy of 4.64 ms which is below the 0.4 seconds limit

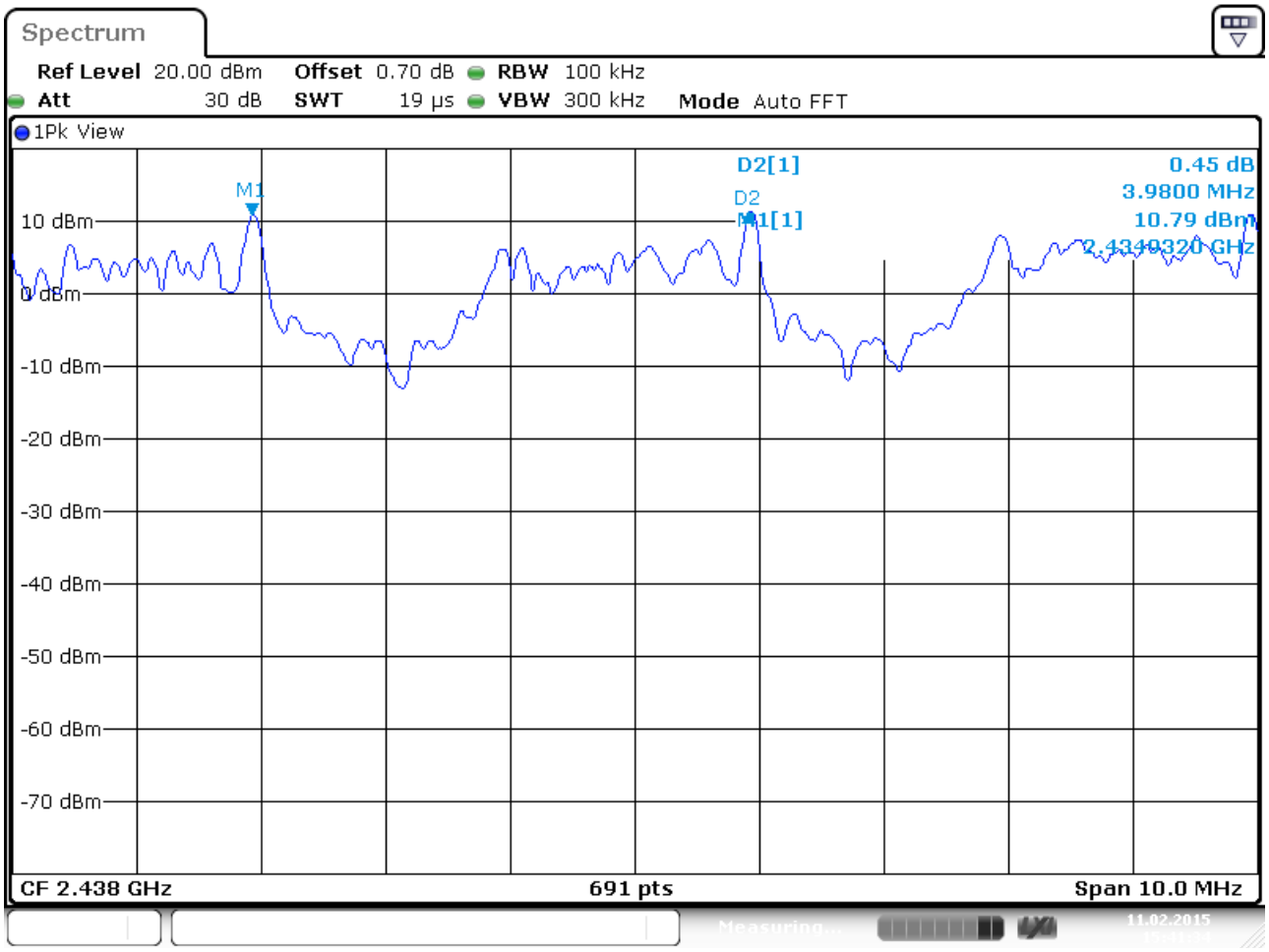


Plot 8f J3: showing the RF on time of 0.1786 ms for one emission



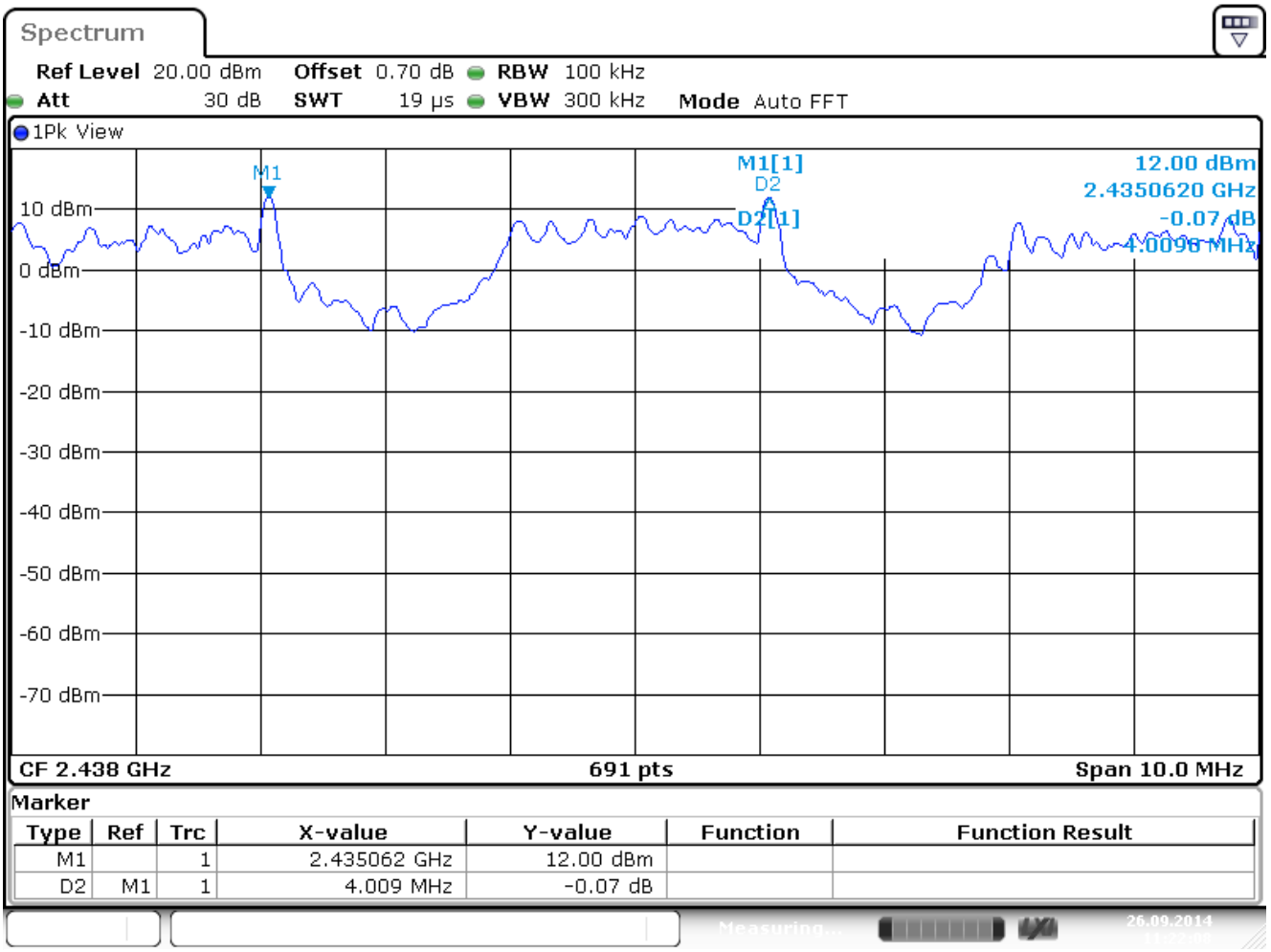
Date: 10.FEB.2015 15:13:49

Plot 9a J1: showing approximately 3.99 MHz spacing between channels as measured on a spectrum analyzer.



Date: 11.FEB.2015 15:41:34

Plot 9b J2: showing approximately 3.98 MHz spacing between channels as measured on a spectrum analyzer.



Date: 26.SEP.2014 11:22:08

Plot 9c J3: showing approximately 4.00 MHz spacing between channels as measured on a spectrum analyzer.

6 Band edge compliance

RESULT: Pass

Date of testing: 2014-09-26 and 2015-02-09

Requirements:

FCC 15.205, FCC 15.209 and FCC 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test procedure:

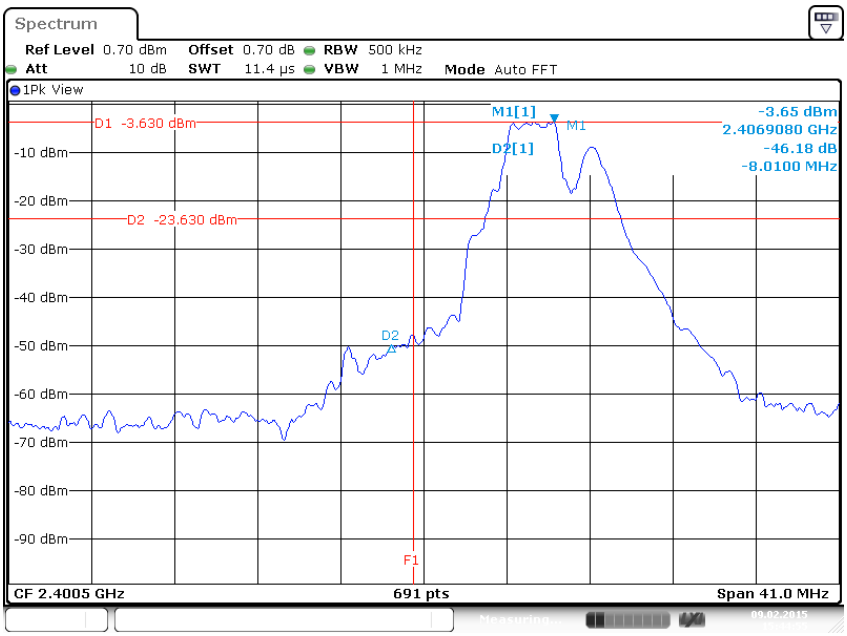
FCC Public notice DA 00-705 March 30, 2000.

Conducted measurements were performed using a spectrum analyzer with a suitable span to encompass the peak of the fundamental and using the following settings:
RBW = 100kHz, VBW = 300kHz.

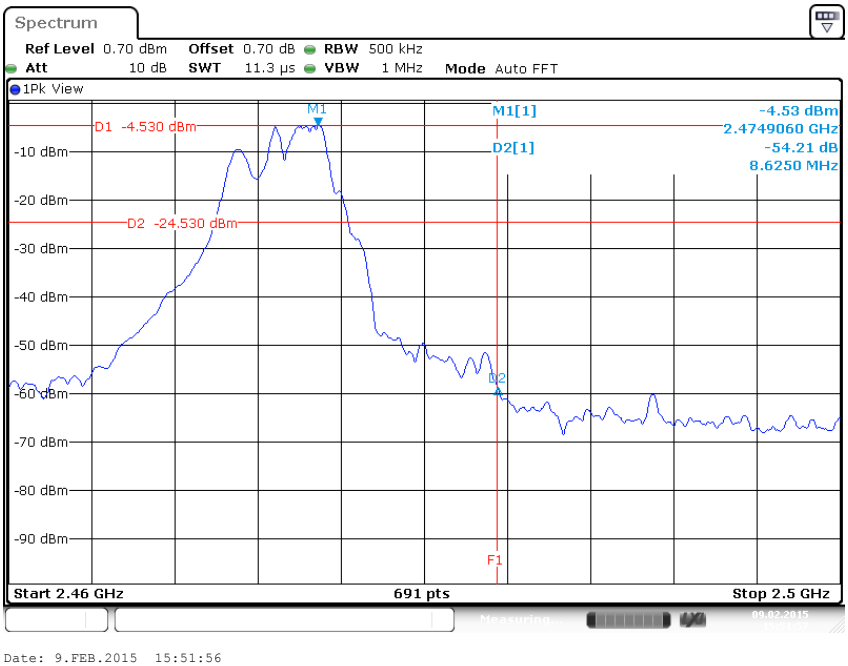
The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Results: All out of band spurious emissions are more than 20 dB below the fundamental.
See plots on the following pages.

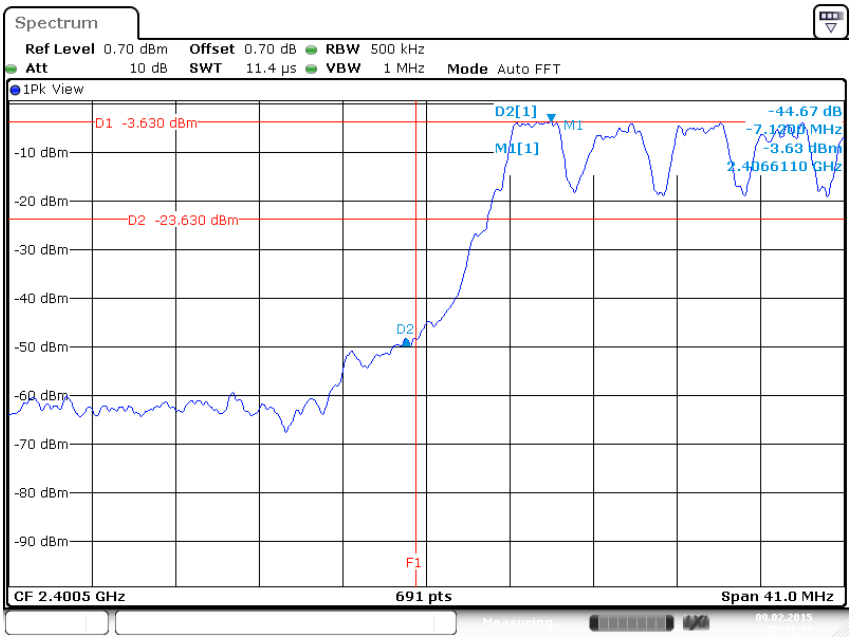
6.1 Plots Band edge compliance output J1



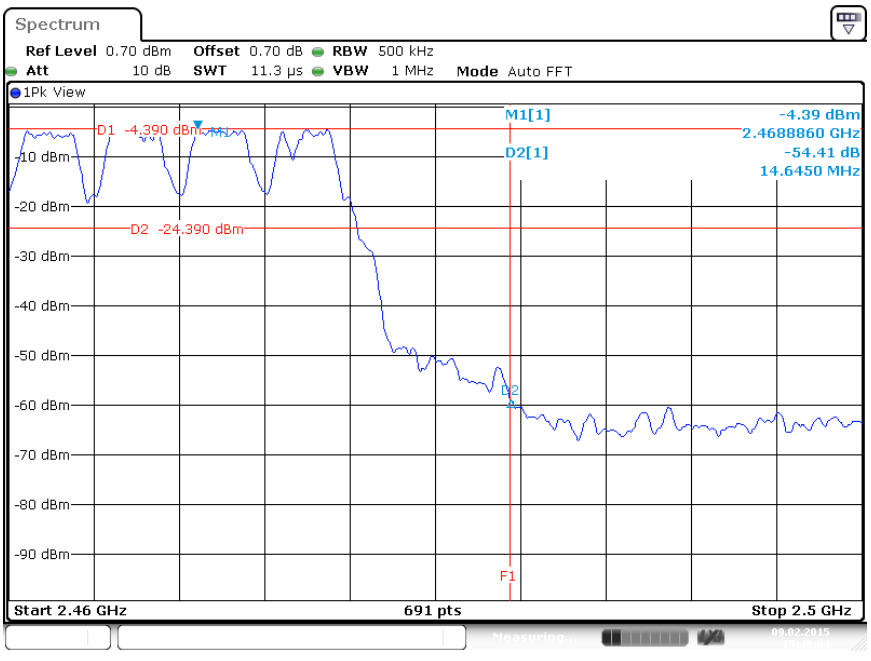
Plot 10a. showing more than 20 dB band edge attenuation, EUT continues modulated carrier at 2407 MHz
F1 shows the band edge frequency of 2400 MHz.



Plot 11a. showing more than 20 dB band edge attenuation, EUT continues modulated carrier at 2474 MHz
F1 shows the band edge frequency of 2483.5 MHz.

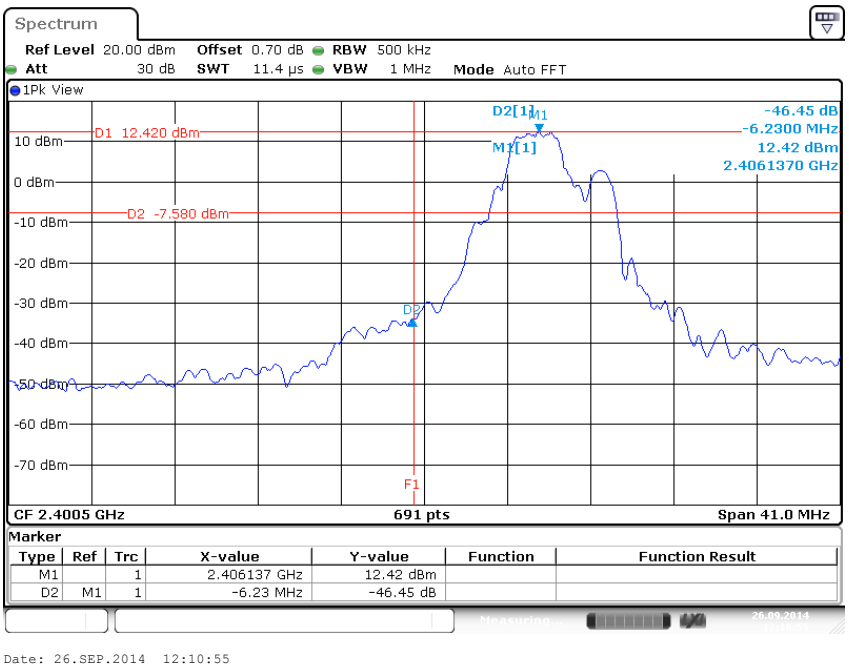


Plot 12a. showing more than 20 dB band edge attenuation, EUT in Hopping mode
F1 shows the band edge frequency of 2400 MHz.

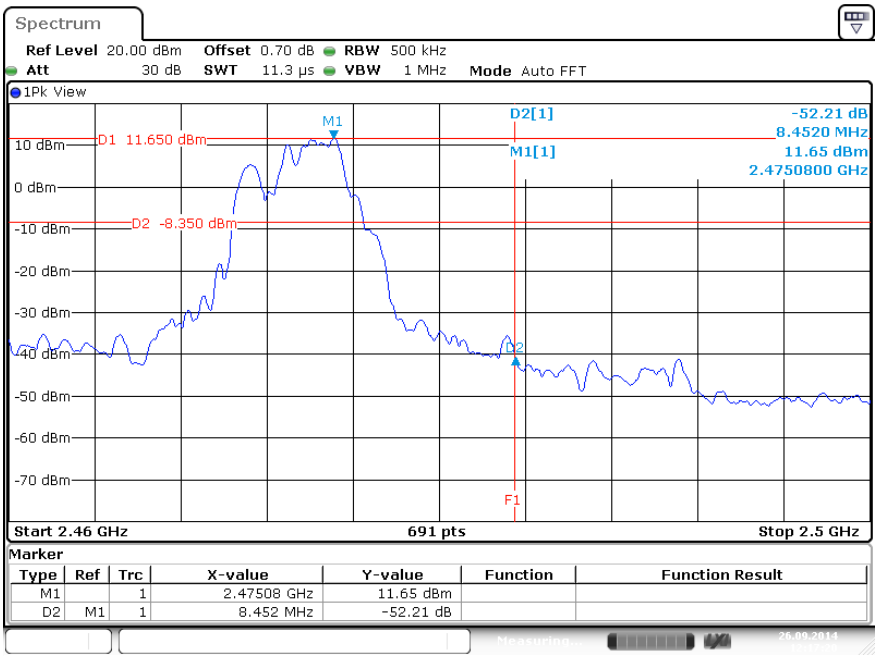


Plot 13a. showing more than 20 dB band edge attenuation, EUT in Hopping mode
F1 shows the band edge frequency of 2483.5 MHz.

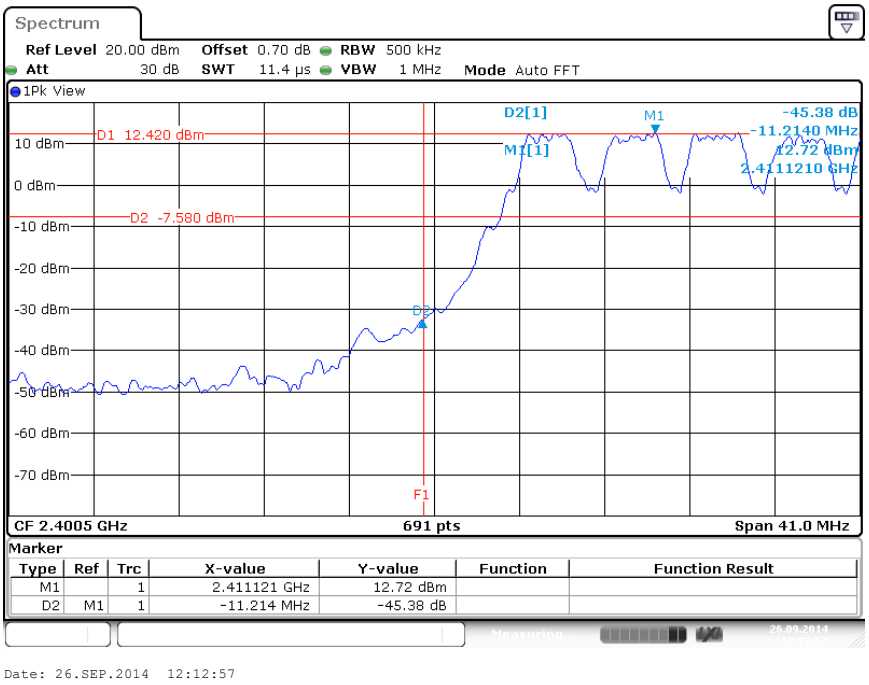
6.2 Plots Band edge compliance output J2



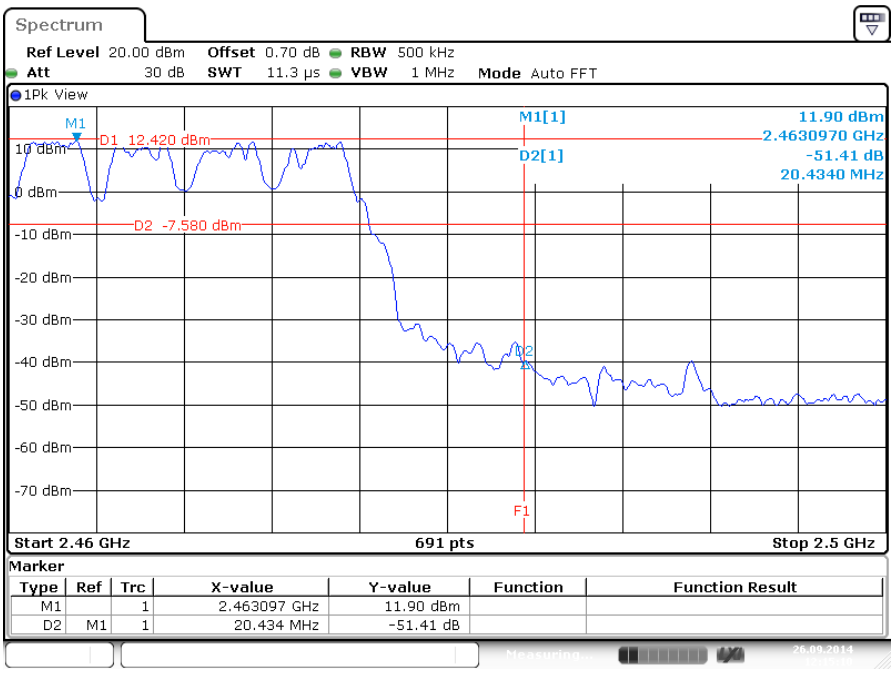
Plot 10b. showing more than 20 dB band edge attenuation, EUT continues modulated carrier at 2407 MHz
F1 shows the band edge frequency of 2400 MHz.



Plot 11b. showing more than 20 dB band edge attenuation, EUT continues modulated carrier at 2474 MHz
F1 shows the band edge frequency of 2483.5 MHz.

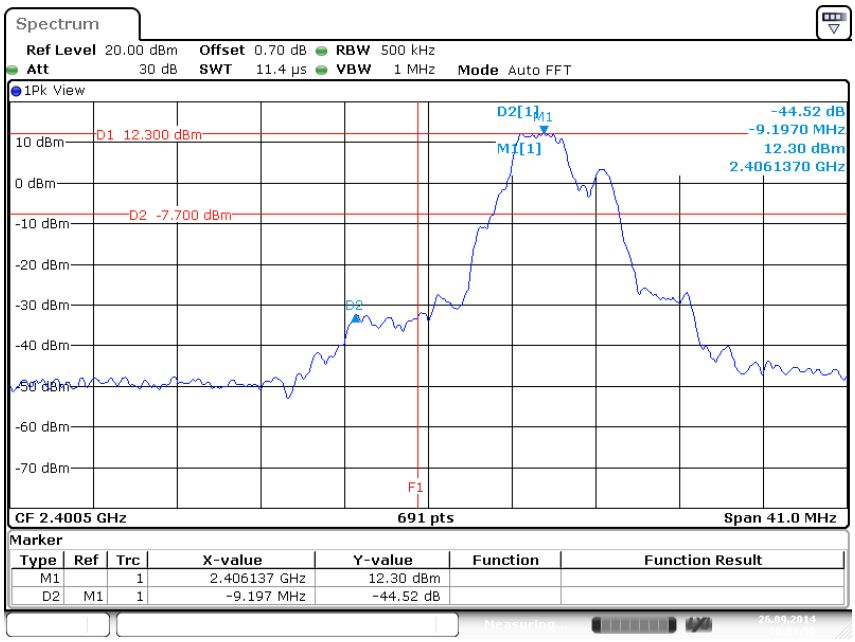


Plot 12b. showing more than 20 dB band edge attenuation, EUT in Hopping mode
F1 shows the band edge frequency of 2400 MHz.

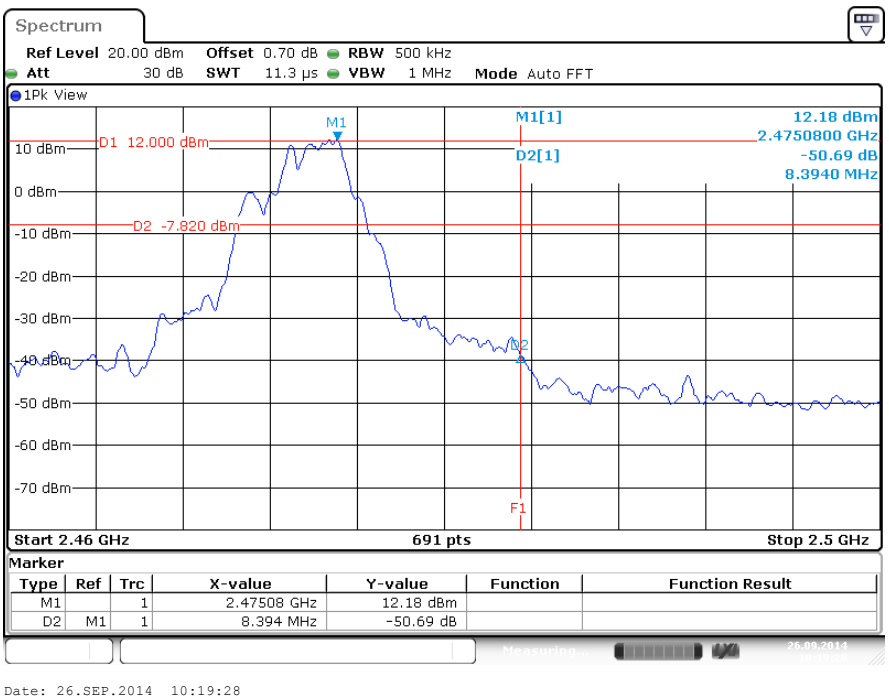


Plot 13b. showing more than 20 dB band edge attenuation, EUT in Hopping mode
F1 shows the band edge frequency of 2483.5 MHz.

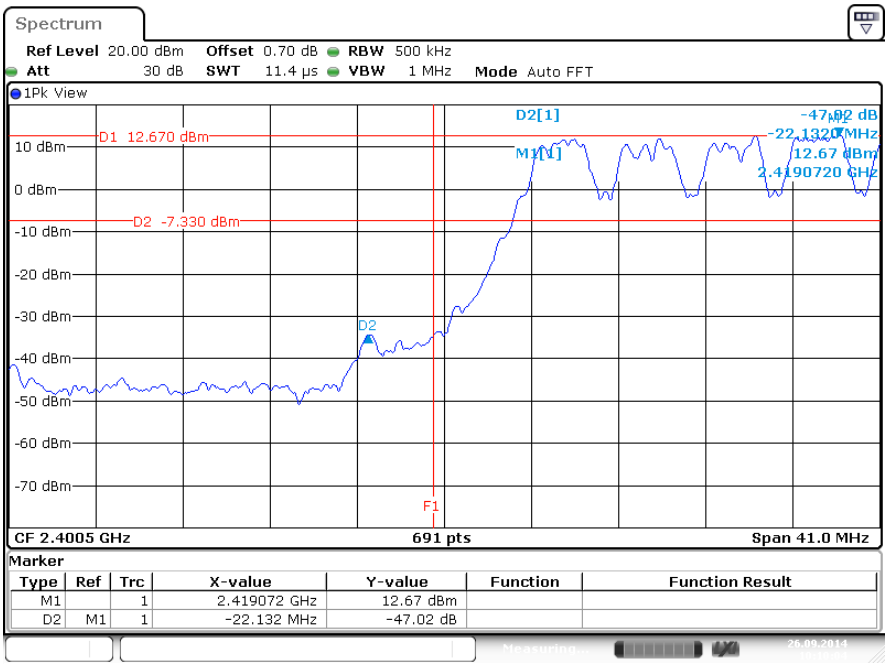
6.3 Plots Band edge compliance output J3



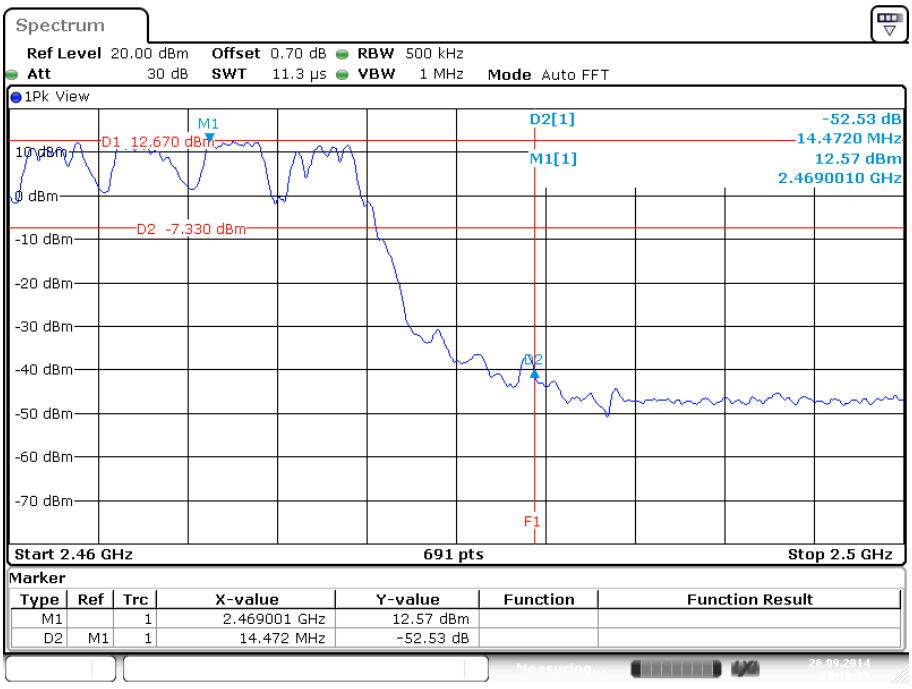
Plot 10c. showing more than 20 dB band edge attenuation, EUT continues modulated carrier at 2407 MHz
F1 shows the band edge frequency of 2400 MHz.



Plot 11c. showing more than 20 dB band edge attenuation, EUT continues modulated carrier at 2474 MHz
F1 shows the band edge frequency of 2483.5 MHz.



Plot 12c. showing more than 20 dB band edge attenuation, EUT in Hopping mode
F1 shows the band edge frequency of 2400 MHz.



Plot 13c. showing more than 20 dB band edge attenuation, EUT in Hopping mode
F1 shows the band edge frequency of 2483.5 MHz.

7 Out of band Spurious Emissions of the Transmitter.

RESULT: PASS

Date of testing: 2014-09-26 and 2015-02-09

Requirements:

FCC 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test procedure:

Public Notice DA 00-705 March 30, 2000 Alternative test procedures.

The tests were performed by conducted measurement using a spectrum analyzer.

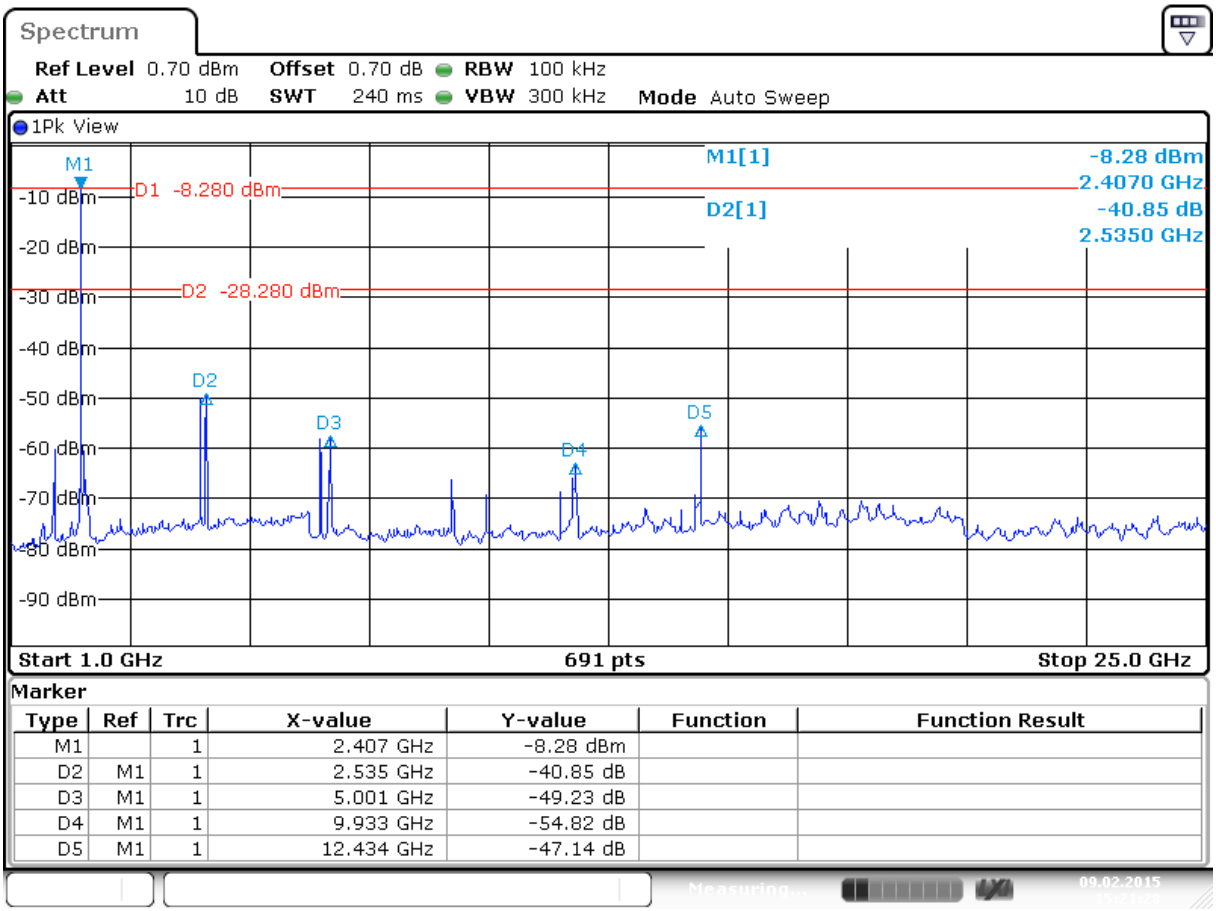
Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.

RBW = 100 kHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

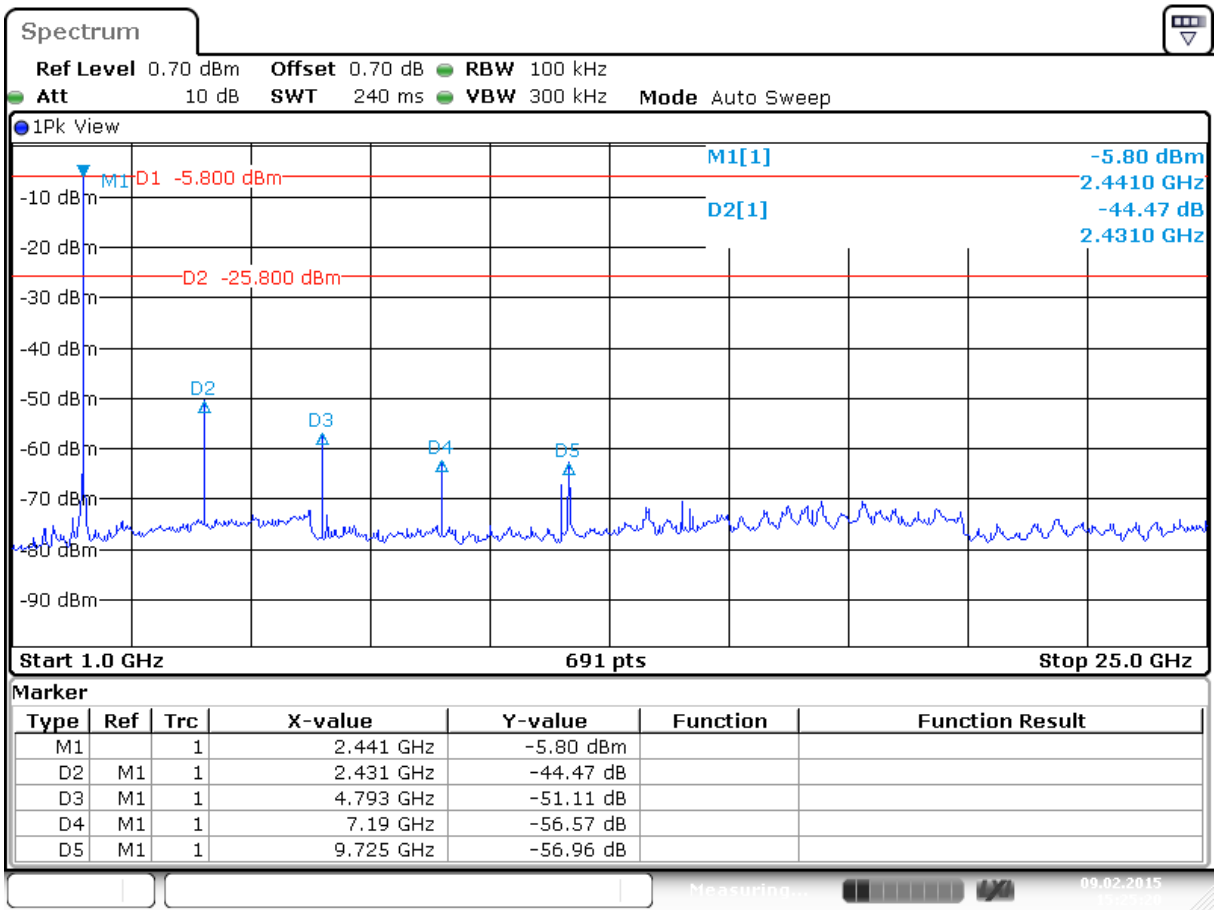
Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section. See the plots on the next pages.

7.1 Out of band emissions on J1



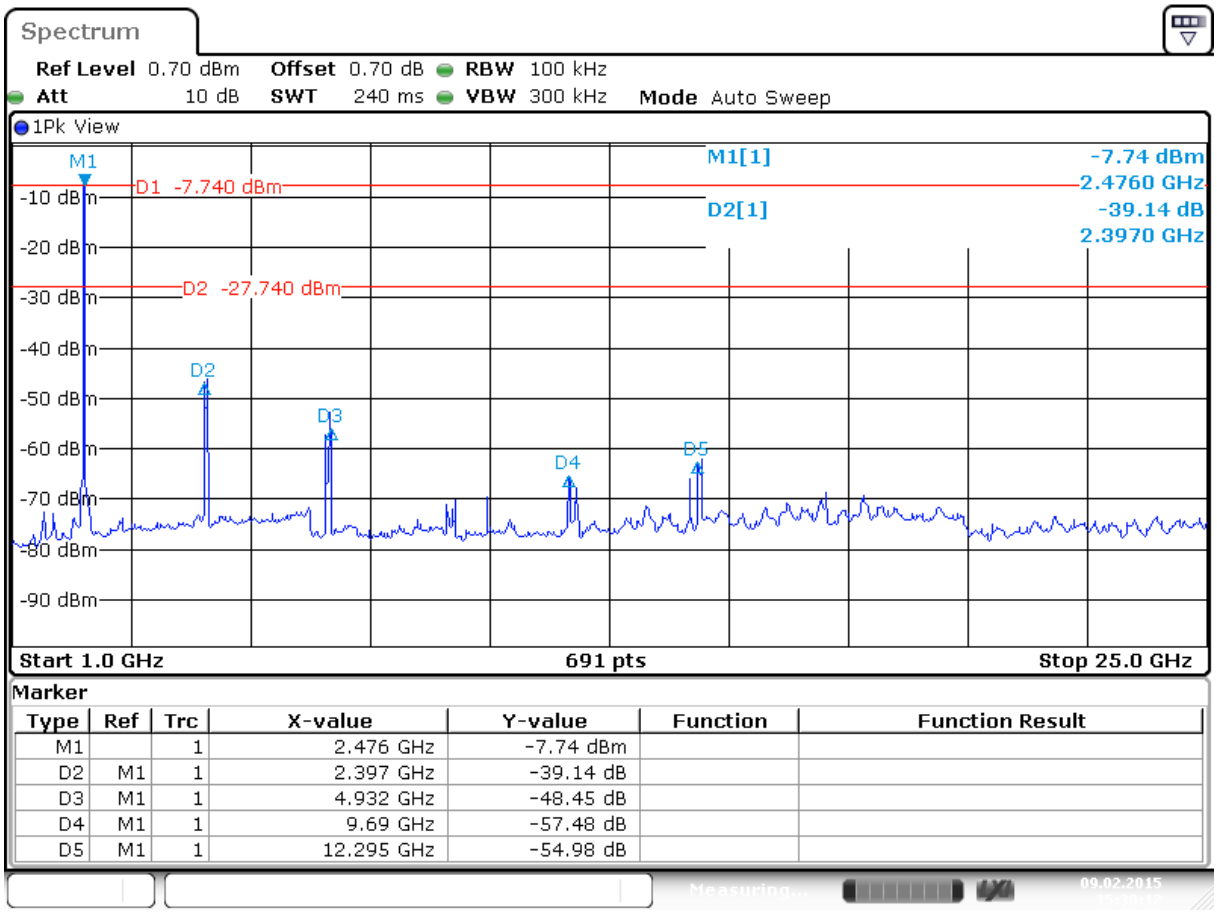
Date: 9.FEB.2015 15:21:27

Plot 14a of the spurious emission, EUT frequency 2407 MHz Constant modulated carrier.



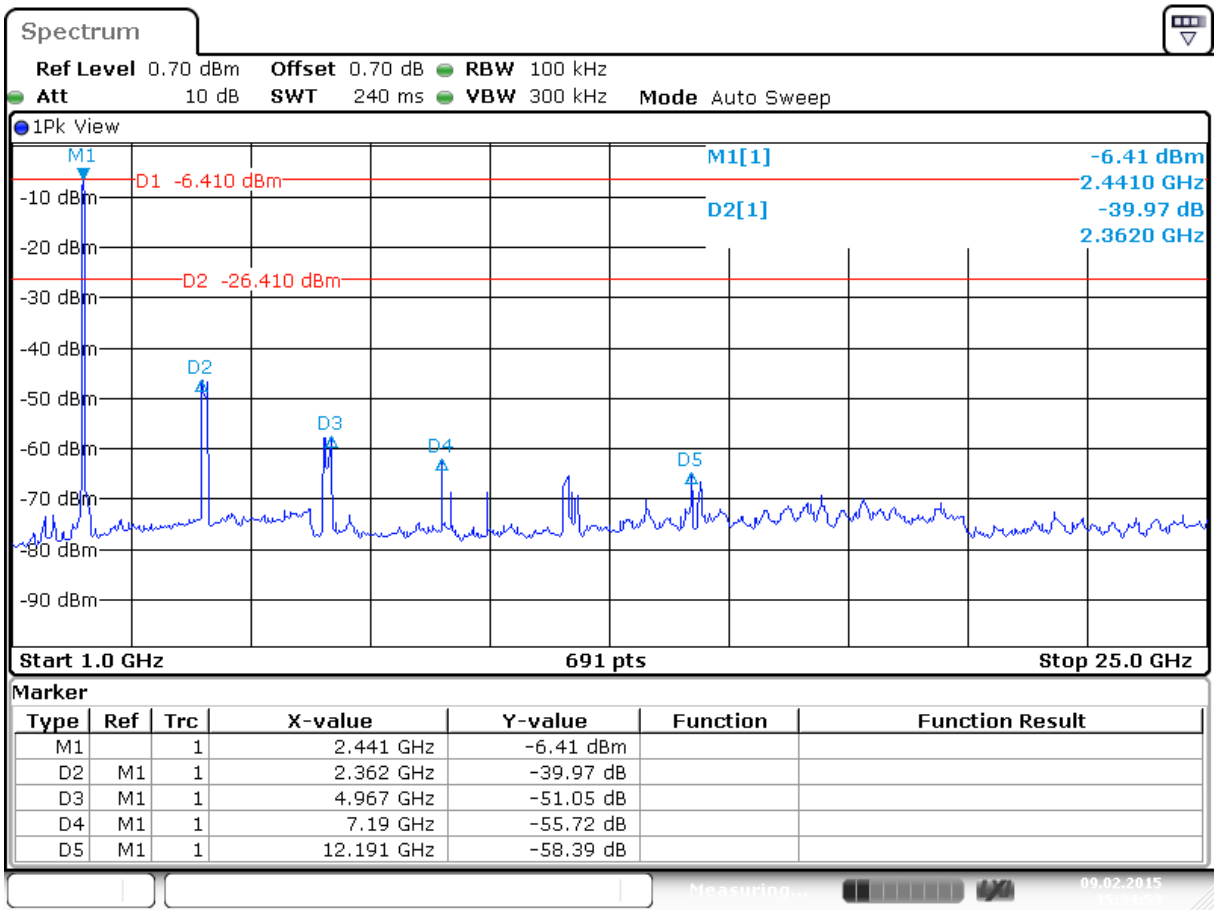
Date: 9.FEB.2015 15:25:19

Plot 15a of the spurious emission, EUT frequency 2438 MHz Constant modulated carrier.



Date: 9.FEB.2015 15:30:11

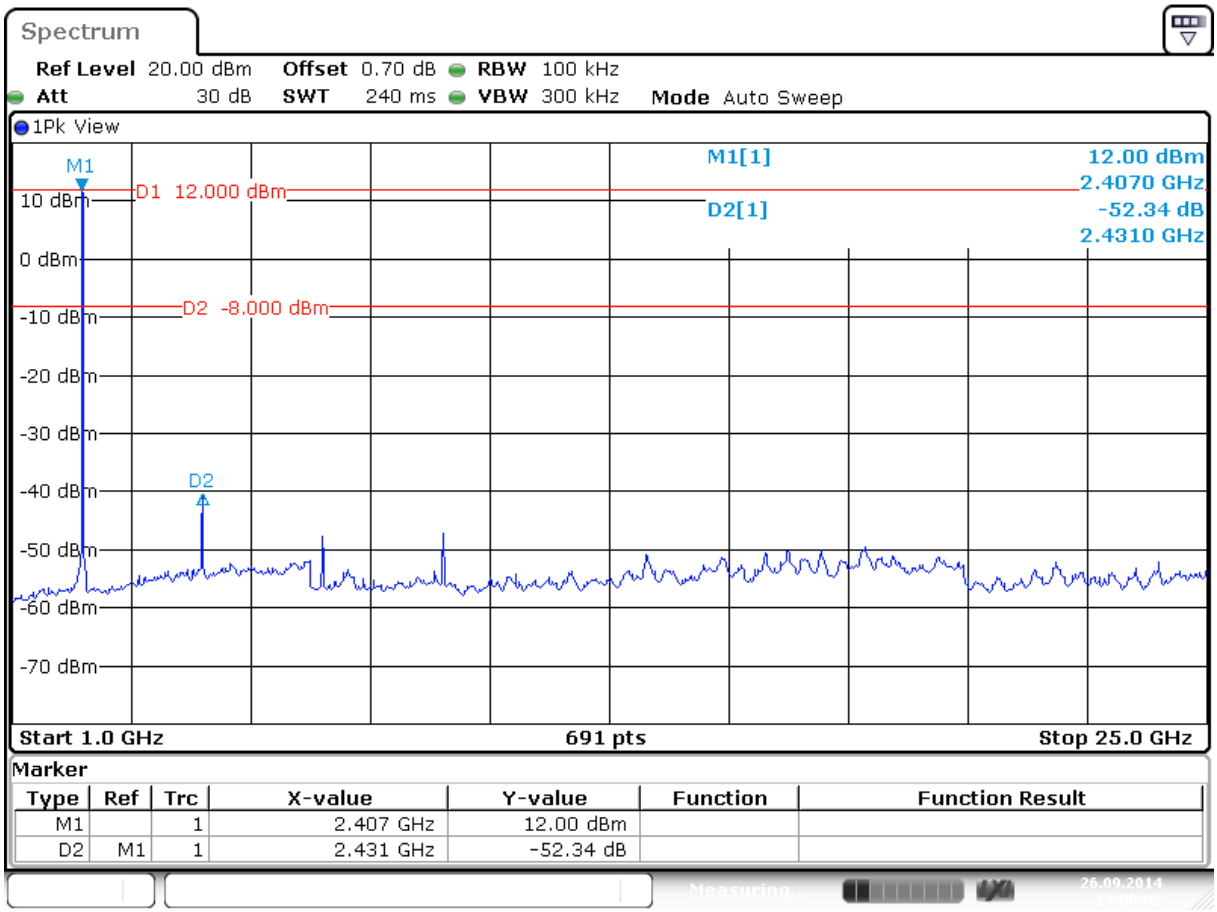
Plot 16a of the spurious emission, EUT frequency 2474 MHz Constant modulated carrier.



Date: 9.FEB.2015 15:34:52

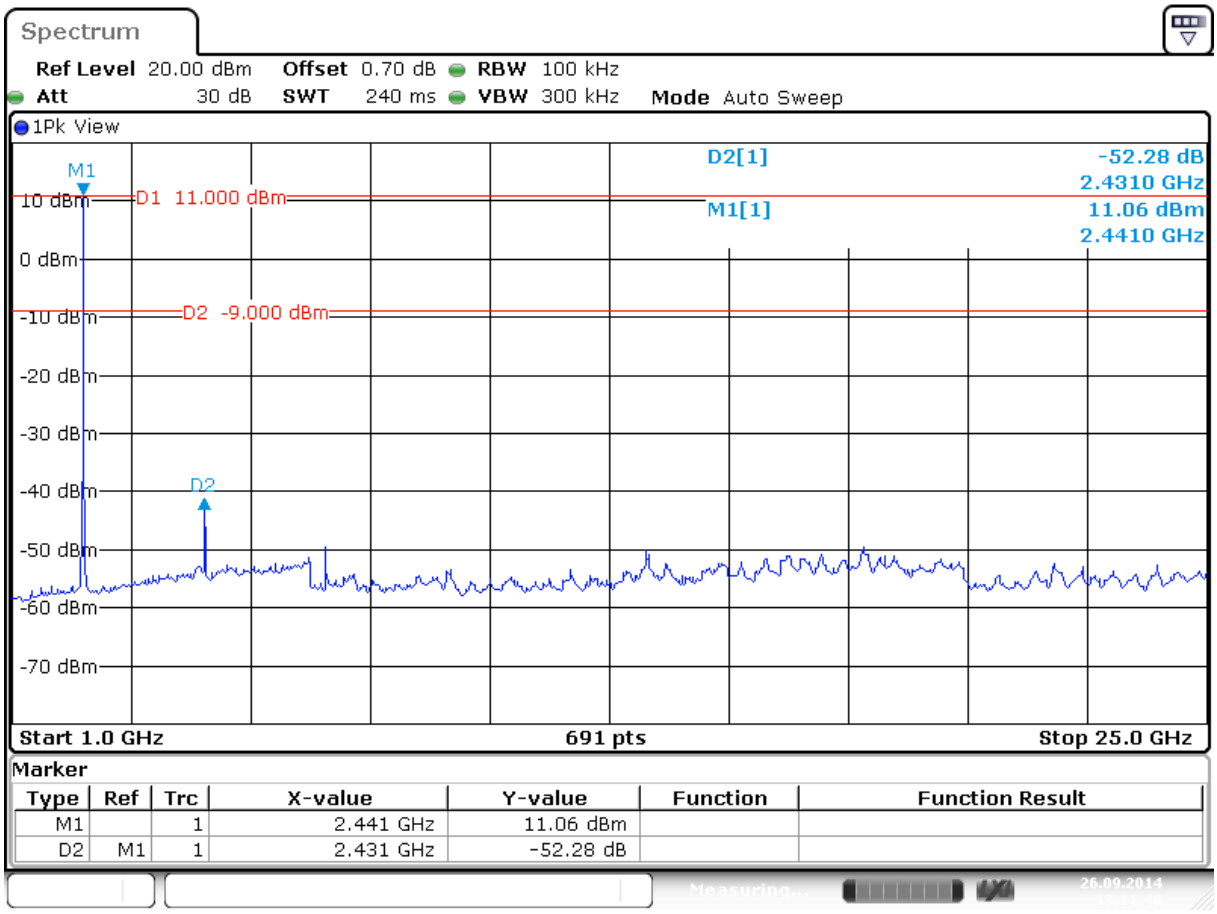
Plot 17a of the spurious emission, EUT in Hopping mode.

7.2 Out of band emissions on J2



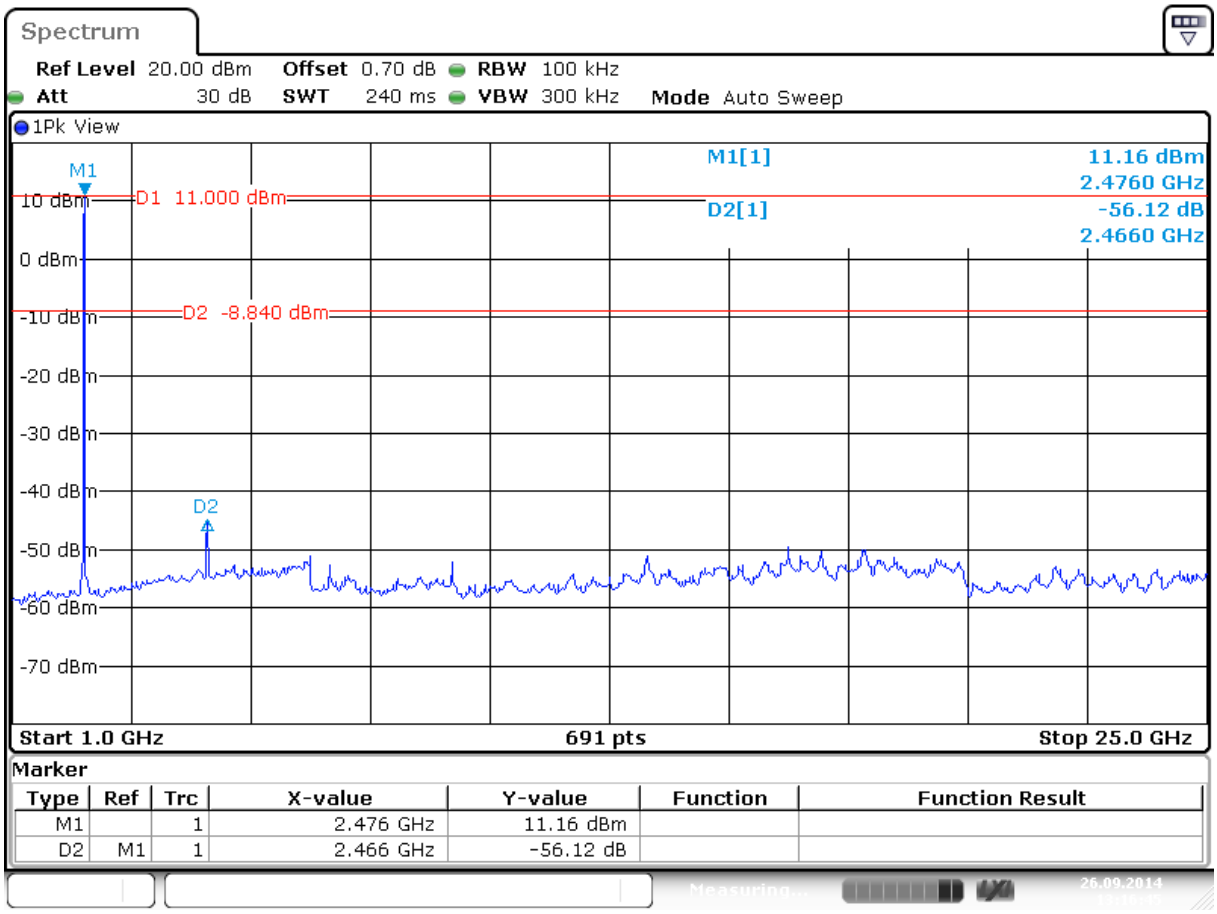
Date: 26.SEP.2014 13:00:02

Plot 14b of the spurious emission, EUT frequency 2407 MHz Constant modulated carrier.



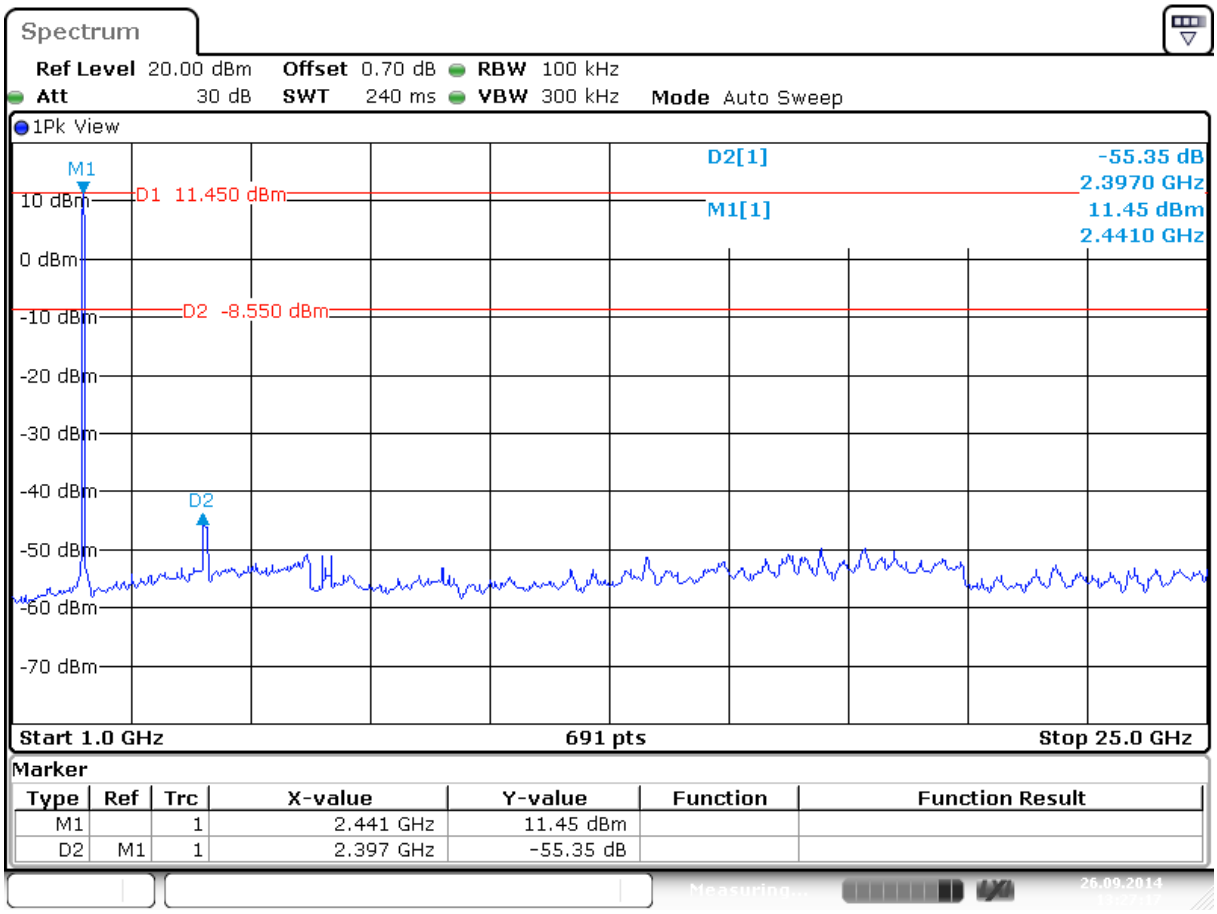
Date: 26.SEP.2014 13:11:41

Plot 15b of the spurious emission, EUT frequency 2438 MHz Constant modulated carrier.



Date: 26.SEP.2014 13:16:46

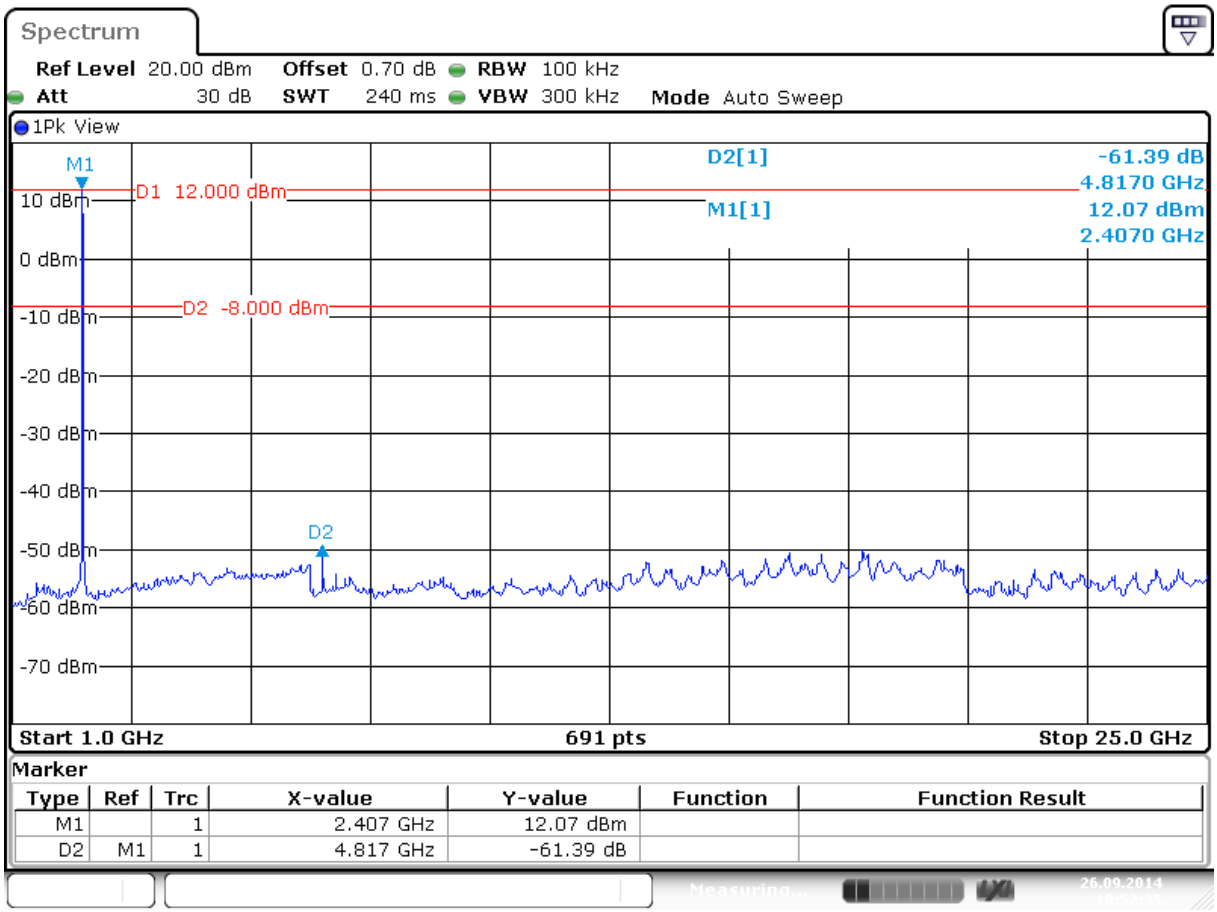
Plot 16b of the spurious emission, EUT frequency 2474 MHz Constant modulated carrier.



Date: 26.SEP.2014 13:27:18

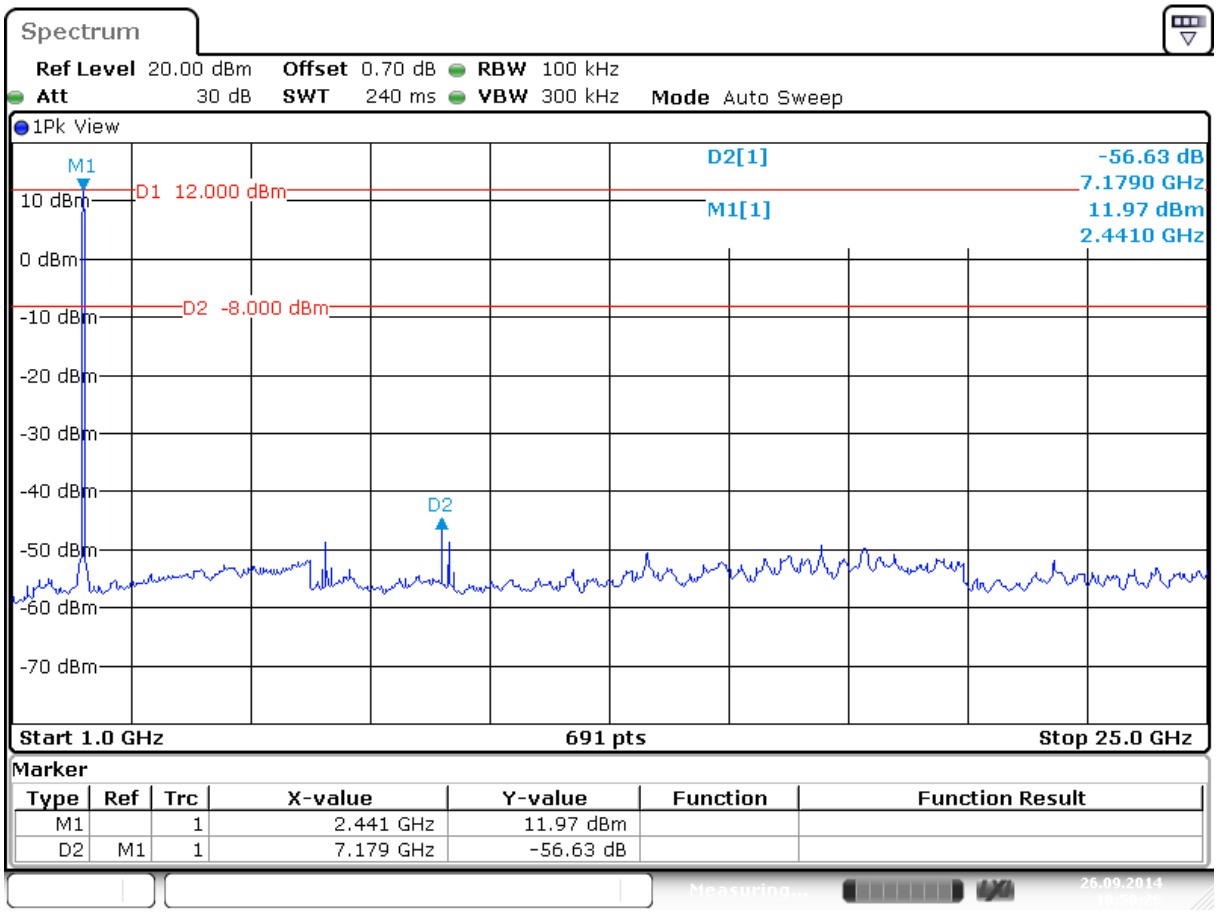
Plot 17b of the spurious emission, EUT in Hopping mode.

7.3 Out of band emissions on J3



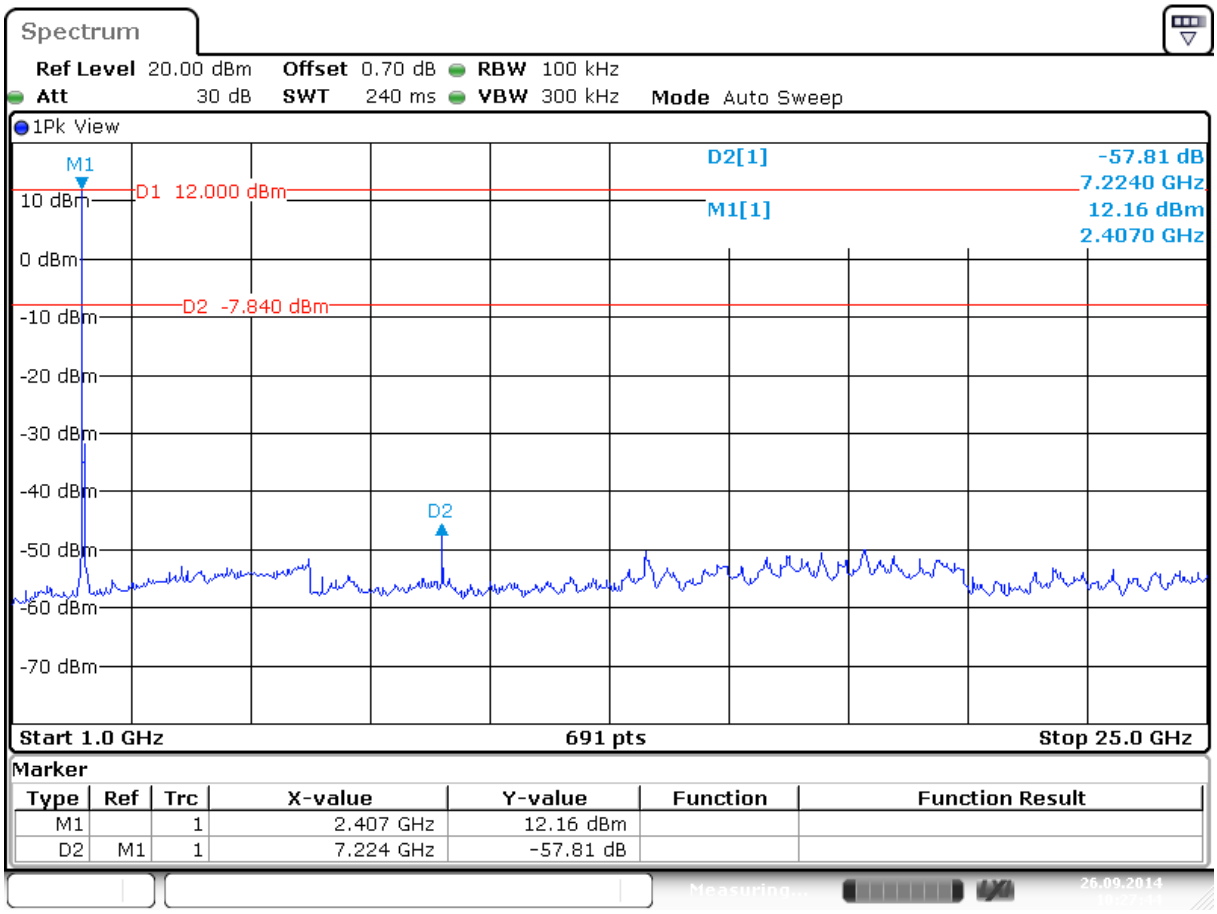
Date: 26.SEP.2014 10:52:35

Plot 14c of the spurious emission, EUT frequency 2407 MHz Constant modulated carrier.



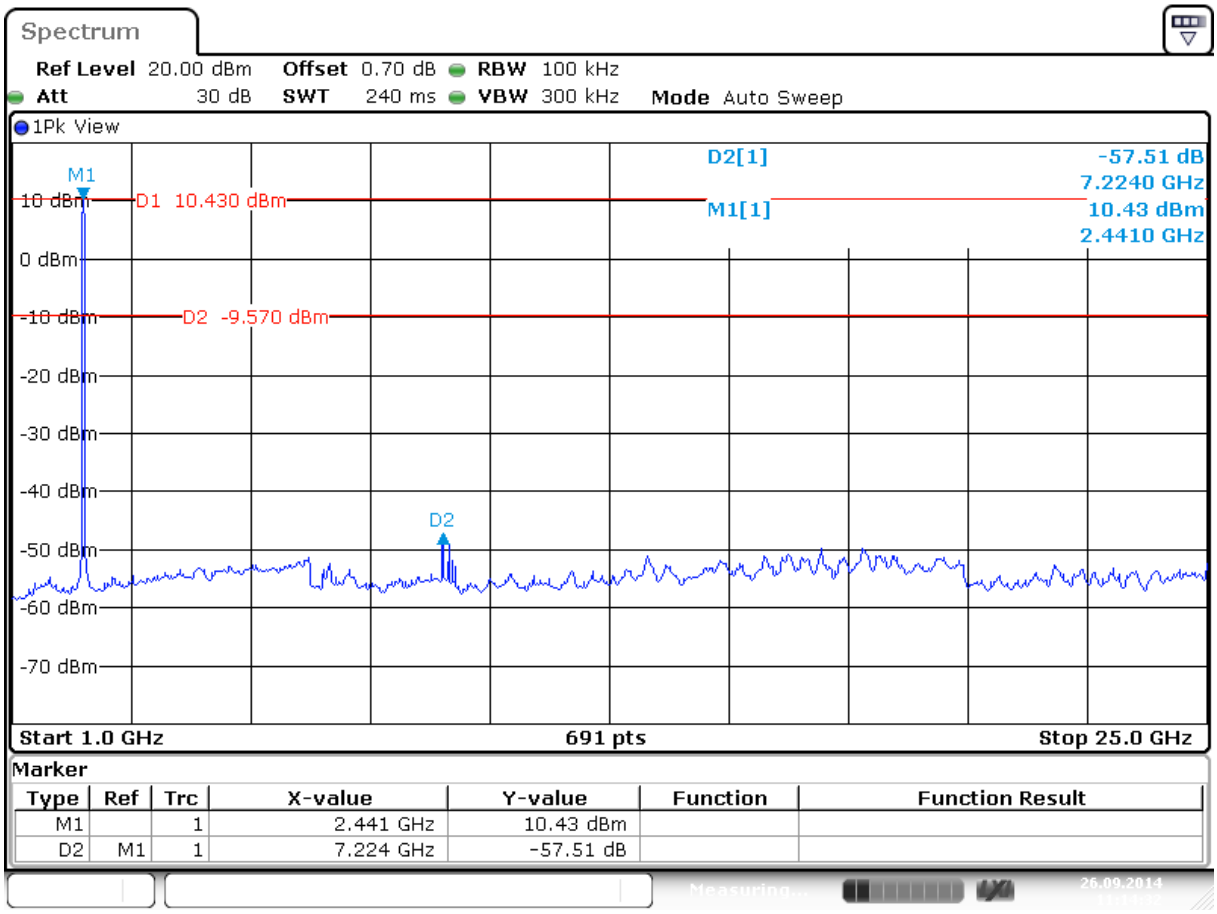
Date: 26.SEP.2014 10:50:26

Plot 15c of the spurious emission, EUT frequency 2438 MHz Constant modulated carrier.



Date: 26.SEP.2014 10:27:44

Plot 16c of the spurious emission, EUT frequency 2474 MHz Constant modulated carrier.



Date: 26.SEP.2014 11:14:33

Plot 17c of the spurious emission, EUT in Hopping mode.

8 Radiated Spurious Emissions of the Transmitter in restricted bands.

RESULT: PASS

Date of testing: 2014-09-27

Requirements:

Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) must comply with the radiated emission limits specified in FCC 15.209(a)

Test procedure:

Public Notice DA 00-705 March 30, 2000 Alternative test procedures.

The EUT in combination with the rooftop antenna was tested against the limit specified in FCC 15.209(a)

This test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y, Z) were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 30MHz to the 10th harmonic of the highest fundamental transmitter frequency (25GHz). Final radiated emission measurements were made at 3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Field strength values of radiated emissions at frequencies not listed in the tables are more than 20 dB below the applicable limit. The final measurement takes into account the loss generated by all the involved cables and filters. The levels are expressed in dBm which are derived from dBm = E(dBµV/m) – 95.2dB.

Peak values were already within Av limits, therefor Av not tested.

8.1 Radiated spurious emissions results on J1

Frequency [MHz]	Antenna Orientation	Detector	Level [dBm]	Limit Av / Pk [dBm]
1100	Vertical	Pk	-58.0	-21.2 / -41.2
2483.5-2500	Vertical	Pk	<-60.0	-21.2 / -41.2
4815*h	Vertical	Pk	-47.5	-21.2 / -41.2
9920	Vertical	Pk	-50.0	-21.2 / -41.2
12430	Vertical	Pk	-46.4	-21.2 / -41.2
13560	Vertical	Pk	-47.0	-21.2 / -41.2

Table 1a Radiated spurious emissions in restricted bands of the EUT at 2407 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBm]	Limit Av / Pk [dBm]
1100	Vertical	Pk	-57.2	-21.2 / -41.2
2431	Vertical	Pk	-44.2	-21.2 / -41.2
2483.5-2500	Vertical	Pk	<-60.0	-21.2 / -41.2
4875*h	Vertical	Pk	-51.5	-21.2 / -41.2
7190	Vertical	Pk	-55.5	-21.2 / -41.2
9725	Vertical	Pk	-55.0	-21.2 / -41.2

Table 1b Radiated spurious emissions in restricted bands of the EUT at 2438 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBm]	Limit Av / Pk [dBm]
1105	Vertical	Pk	-56.5	-21.2 / -41.2
2483.5-2500	Vertical	Pk	<-60.0	-21.2 / -41.2
4530*h	Horizontal	Pk	-48.5	-21.2 / -41.2
6650	Horizontal	Pk	-50.0	-21.2 / -41.2
9700	Vertical	Pk	-55.2	-21.2 / -41.2
12250	Horizontal	Pk	-55.0	-21.2 / -41.2

Table 1c Radiated spurious emissions in restricted bands of the EUT at 2474 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBm]	Limit Av / Pk [dBm]
1100	Vertical	Pk	-57.5	-21.2 / -41.2
2483.5-2500	Vertical	Pk	<-60.0	-21.2 / -41.2
4820[*h]	Vertical	Pk	-45.4	-21.2 / -41.2
7300[*h]	Vertical	Pk	-47.5	-21.2 / -41.2
7500-12400	Vertical	Pk	<-48.0	-21.2 / -41.2
12400-18000	Vertical	Pk	<-48.0	-21.2 / -41.2

Table 1d Radiated spurious emissions of the EUT in normal mode (hopping)

8.2 Radiated spurious emissions results on J2

Frequency [MHz]	Antenna Orientation	Detector	Level [dBm]	Limit Av / Pk [dBm]
1100	Vertical	Pk	-60.0	-21.2 / -41.2
2483.5-2500	Vertical	Pk	<-60.0	-21.2 / -41.2
4815*h	Vertical	Pk	<-60.0	-21.2 / -41.2
9920	Vertical	Pk	<-50.0	-21.2 / -41.2
12430	Vertical	Pk	<-50.0	-21.2 / -41.2
13000 -18000	Vertical	Pk	<-47.0	-21.2 / -41.2

Table 2e Radiated spurious emissions in restricted bands of the EUT at 2407 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBm]	Limit Av / Pk [dBm]
1100	Vertical	Pk	-59.5	-21.2 / -41.2
2483.5-2500	Vertical	Pk	<-60.0	-21.2 / -41.2
4875*h	Vertical	Pk	<-50.0	-21.2 / -41.2
7310*h	Vertical	Pk	<-50.0	-21.2 / -41.2
10000 - 13000	Vertical	Pk	<-48.0	-21.2 / -41.2
13000 -18000	Vertical	Pk	<-47.0	-21.2 / -41.2

Table 1f Radiated spurious emissions in restricted bands of the EUT at 2438 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBm]	Limit Av / Pk [dBm]
1110	Horizontal	Pk	-58.9	-21.2 / -41.2
2483.5-2500	Vertical	Pk	<-60.0	-21.2 / -41.2
4950*h	Horizontal	Pk	<-50.0	-21.2 / -41.2
7425*h	Horizontal	Pk	<-50.0	-21.2 / -41.2
10000 - 13000	Vertical	Pk	<-48.0	-21.2 / -41.2
13000 -18000	Vertical	Pk	<-47.0	-21.2 / -41.2

Table 1g Radiated spurious emissions in restricted bands of the EUT at 2474 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBm]	Limit Av / Pk [dBm]
1110	Vertical	Pk	-50.5	-21.2 / -41.2
2483.5-2500	Vertical	Pk	<-60.0	-21.2 / -41.2
4820[*h]	Vertical	Pk	-45.8	-21.2 / -41.2
7330[*h]	Vertical	Pk	-46.8	-21.2 / -41.2
7500-12400	Vertical	Pk	<-48.0	-21.2 / -41.2
12400-18000	Vertical	Pk	<-48.0	-21.2 / -41.2

Table 1h Radiated spurious emissions of the EUT in normal mode (hopping)

8.3 Radiated spurious emissions results on J3

Frequency [MHz]	Antenna Orientation	Detector	Level [dBm]	Limit Av / Pk [dBm]
1100	Vertical	Pk	-58.7	-21.2 / -41.2
2483.5-2500	Vertical	Pk	<-60.0	-21.2 / -41.2
4815[*h]	Vertical	Pk	<-50.0	-21.2 / -41.2
9920	Vertical	Pk	-49.4	-21.2 / -41.2
10000 - 13000	Vertical	Pk	<-48.0	-21.2 / -41.2
13000 -18000	Vertical	Pk	<-47.0	-21.2 / -41.2

Table 3i Radiated spurious emissions in restricted bands of the EUT at 2407 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBm]	Limit Av / Pk [dBm]
1100	Vertical	Pk	-58.2	-21.2 / -41.2
2483.5-2500	Vertical	Pk	<-60.0	-21.2 / -41.2
4875[*h]	Vertical	Pk	<-50.0	-21.2 / -41.2
7310[*h]	Vertical	Pk	<-50.0	-21.2 / -41.2
10000 - 13000	Vertical	Pk	<-48.0	-21.2 / -41.2
13000 -18000	Vertical	Pk	<-47.0	-21.2 / -41.2

Table 1j Radiated spurious emissions in restricted bands of the EUT at 2438 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBm]	Limit Av / Pk [dBm]
1110	Horizontal	Pk	-58.4	-21.2 / -41.2
2483.5-2500	Vertical	Pk	<-60.0	-21.2 / -41.2
4950[*h]	Horizontal	Pk	<-50.0	-21.2 / -41.2
7425[*h]	Horizontal	Pk	<-50.0	-21.2 / -41.2
10000 - 13000	Vertical	Pk	<-48.0	-21.2 / -41.2
13000 -18000	Vertical	Pk	<-47.0	-21.2 / -41.2

Table 1k Radiated spurious emissions in restricted bands of the EUT at 2474 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBm]	Limit Av / Pk [dBm]
1110	Vertical	Pk	-50.0	-21.2 / -41.2
2483.5-2500	Vertical	Pk	<-60.0	-21.2 / -41.2
4880*h	Vertical	Pk	-45.7	-21.2 / -41.2
7350*h	Vertical	Pk	-46.2	-21.2 / -41.2
7500-12400	Vertical	Pk	<-48.0	-21.2 / -41.2
12400-18000	Vertical	Pk	<-48.0	-21.2 / -41.2

Table 1l Radiated spurious emissions of the EUT in normal mode (hopping)

The results of the radiated emission tests in the range 30 MHz – 25 GHz, carried out in accordance with 47 CFR Part 15 section 15.209 and 15.205 with the system operating in transmit mode are depicted in Table 1a through 1l.

Notes:

1. Field strength values of radiated emissions at frequencies in the range 30 MHz – 25 GHz not listed in the table above are more than 20 dB below the applicable limit.
2. Measurement uncertainty is ±5.0dB
3. The reported field strength values are the worst case values at the indicated frequency. The receiving antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
4. *h = harmonic of the fundamental frequency.

9 List of utilized test equipment.

Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (mm/yyyy)	Calibration due date (mm/yyyy)
For Antenna Port Conducted Tests					
Spectrum Analyzer	Rohde & Schwarz	FSV	A00337	08/2014	08/2015
Temperature-Humiditymeter	Extech	SD500	A00446	03/2014	03/2015
RF Cable	H&S	--	A00342	04/2014	04/2015
For Radiated Emission					
Measurement Receiver	Rohde & Schwarz	ESCI	A00314	03/2014	03/2015
RF Cable S-AR	Gigalink	APG0500	A00447	02/2014	02/2015
Controller	Heinrich Deisel	4630-100	A00450	N/A	N/A
Test fascility	Comtest	FCC listed: 90828 IC: 2932G-2	A00235	02/2012	02/2015
Spectrum Analyzer	Rohde & Schwarz	FSV	A00337	08/2014	08/2015
Controller	EMCS	DOC202	A00257	N/A	N/A
Antenna mast	EMCS	AP-4702C	A00258	N/A	N/A
Temperature-Humiditymeter	Extech	SD500	A00444	02/2014	02/2015
Guidehorn 1-18 GHz	EMCO	3115	A00009	04/2014	04/2015
Guidehorn 18-40 GHz	EMCO	RA42-K-F-4B-C	A00012	04/2014	04/2015
Filter section	Reactel	--	A00255	10/2013	10/2014
Biconilog Testantenna	Teseq	CBL 6111D	A00466	06/2014	06/2015

NA= Not Applicable

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing.