TEST REPORT CONCERNING THE COMPLIANCE OF A SPREAD SPECTRUM TRANSMITTER FOR A ANIMAL BIOMETRICS MONITORING DEVICE BRAND HEYREX, MODEL R4 WITH 47 CFR PART 15 (10-1-14 Edition) AND RSS-GEN (ISSUE 4, NOVEMBER 2014) AND RSS-247 (ISSUE 1, MAY 2015)

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February 18, 2016

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

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MEASUREMENT/TECHNICAL REPORT

Brand: Heyrex
Model: R4

FCC ID: RGZ-R4
IC: 12380A-R4

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), RSS-Gen (Issue 4, November 2014) and RSS-247 (Issue 1, May 2015). 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 18, 2016

Signature: 

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

Test 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

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

Test Standard		Description	Page	Pass / Fail
47 CFR Part 15 (10-1-14 Edition)	**RSS-247 Issue 1, May 15**			
15.207(a)	RSS-Gen(7.2.4)	AC power-line conducted emissions	37 - 40	Pass
15.205 and 15.223	RSS-Gen(7.2.2)	Radiated emissions in restricted bands	34 - 36	Pass
15.215(c) and 15.223(a)	RSS-Gen(4.6.1) and RSS-Gen (4.6.2) RSS-247 5.1(3)	Occupied bandwidth and Bandwidth of the emission	15 - 18	Pass
15.247(b)(1)	RSS-247 5.4(1)	Peak Output Power	11 - 14	Pass
15.247(a)	RSS-247 5.1(3)	Hopping characteristics	19 – 23	Pass
15.247(d)	RSS-247 5.5	Conducted Spurious Emissions	34 - 36	Pass

Table : testspecifications

Description of test item

Test item	:	Spread Spectrum Transmitter (DSS)
Manufacturer	:	Heyrex
Brand	:	Heyrex
Model	:	R4
Serial number	:	Unindentified test sample
Revision	:	--
Firmware version		Rexnet version 5.0:53NZ, except RF On Time (plot 8b) where the Rexnet version 5.0:55NZ was used.

Applicant information

Applicant's representative	:	Mr. M. Koop
Company	:	Teleconformity
Address	:	Constructieweg 1
Postal code	:	7451PS
City	:	Holten
Country	:	The Netherlands
Telephone number	:	+31 53 4785267
Telefax number	:	+31 84 8362566

Test(s) performed

Location	:	Leek
Test(s) started	:	January 19, 2016
Test(s) completed	:	February 18, 2016
Purpose of test(s)	:	Equipment Authorization (Original grant/certification)
Test specification(s)	:	FCC 47 CFR Part 15, Subpart C, Section 15.247 (10-1-14 Edition) and RSS-Gen (Issue 4, November 2014) and RSS-247 (Issue 1, May 2015)

Test engineer(s) : R. van der Meer 

Report written by : R. van der Meer 

Report date : February 18, 2016

Table of contents

1 General information.

1.1 Product description.

1.1.1 Introduction.

The brand Heyrex model R4, hereafter referred to as EUT, is a Spread Spectrum Transmitter (DSS) and is part of an animal activity and health monitoring system. The EUT is factory configured for the 2402-2462 MHz band.

Photographs of the EUT, top (left) and bottom (right)

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: RGZ-R4 and IC: 12380A-R4.

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	:	Heyrex
Brand	:	Heyrex
Model	:	R4
Serial number	:	unindentified test sample
Voltage input rating	:	5 Vdc
Voltage output rating	:	n.a.
Current input rating	:	--
Antenna	:	external, reversed sma connector
Operation frequency	:	2402 – 2462 MHz
Modulation	:	GFSK (2Mbps)
Spreading technique	:	FHSS
Remarks	:	21 channels
Firmware version		Rexnet version 5.0:53NZ, except RF On Time (plot 8b) where the Rexnet version 5.0:55NZ was used.

AUX1	:	Mains Power Supply Adapter
Brand	:	V-INFINITY
Model	:	EMSA050100
Serial number	:	--
Voltage input rating	:	100-240V, 50-60Hz
Voltage output rating	:	5 Vdc 1.0A
Remark	:	power supply for EUT

AUX2	:	Laptop Computer
Brand	:	Dell
Model	:	Latitude E6410
Serial number	:	BY93ZN1
Remark	:	Contains software for programming the EUT

1.3.1 Description of input and output ports.

Number	Terminal	From	To	Remarks
1	Mains	AUX1	EUT	--
2	Mains	Mains	AUX2	--
3	LAN (RJ45)	LAN	EUT	shielded cable

Table 1: Interconnection between EUT and auxiliary equipment

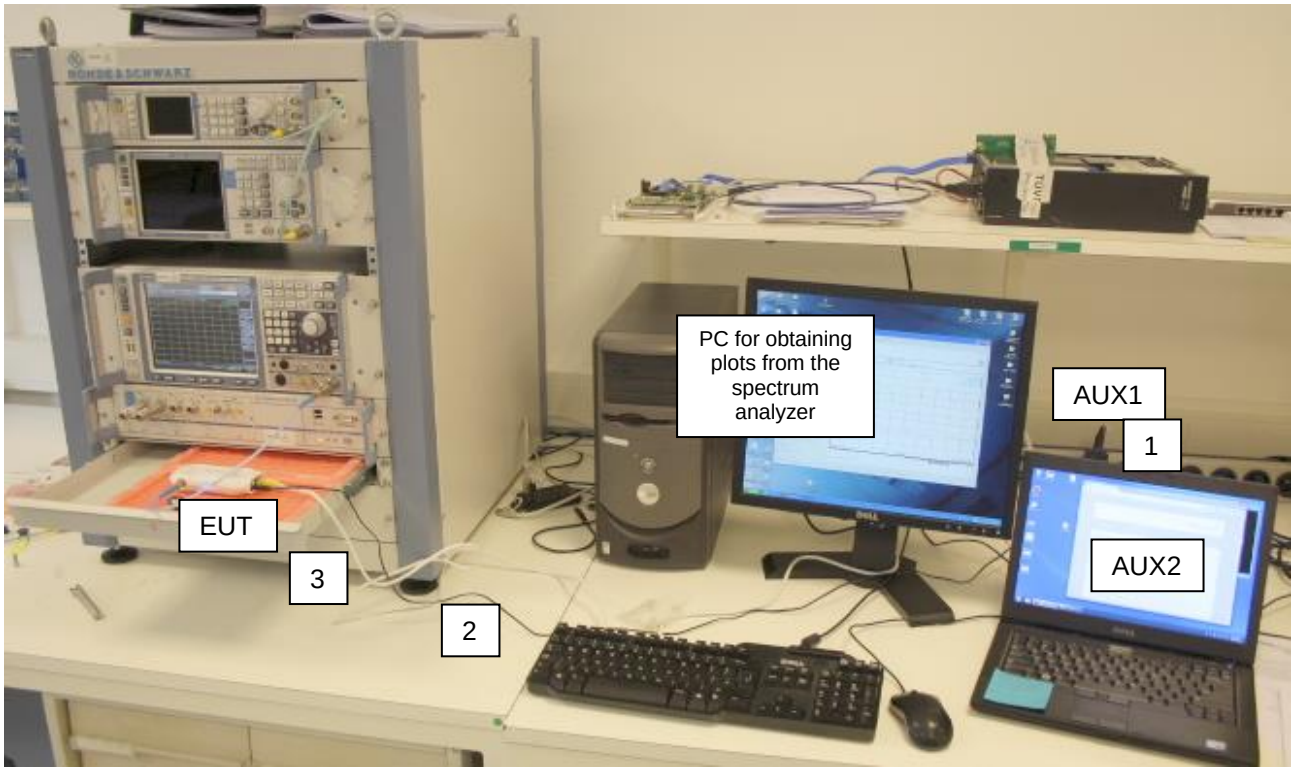


Photo 1: Basic test setup and connections

1.4 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, RSS-Gen (Issue 4, November 2014) and RSS-247 (Issue 1, May 2015) .

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.

1.5 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.

1.6 Test conditions.

Normal test conditions:

Temperature (*)	: +15°C to +35°C
Relative humidity(*)	: 20 % to 75 %
Supply voltage	: 120VAC/60Hz to the AC/DC Power Supply (AUX1)
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 system was configured for testing in a typical situation as a customer would normally use it.
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 C63.10-2013.

2.2 EUT mode of operation.

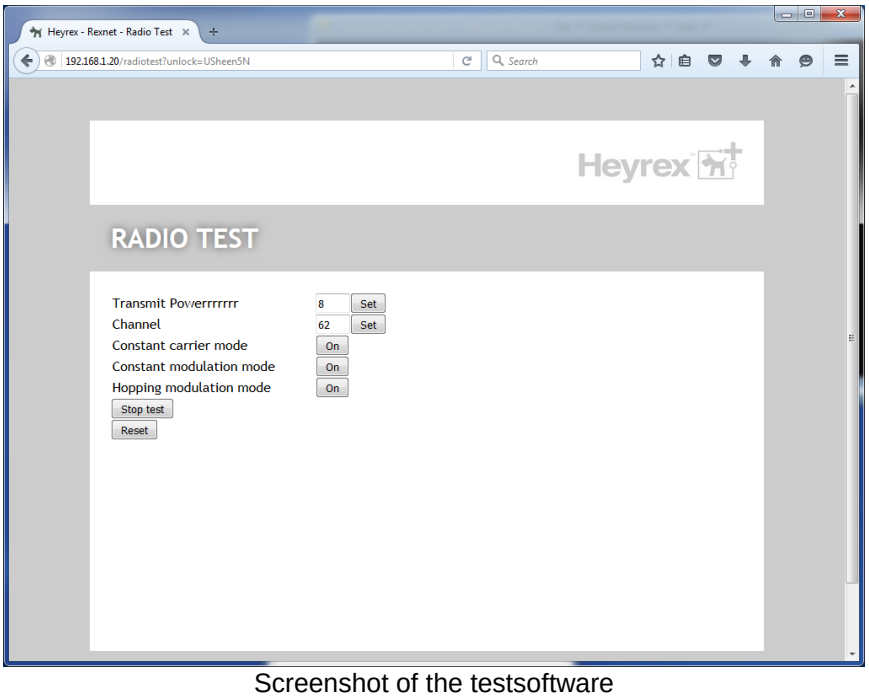
The EUT has been tested in continuous transmit mode. Testing was performed at the lowest operating frequency (2402 MHz), at the operating frequency in the middle of the specified frequency band (2432 MHz) and at the highest operating frequency (2462 MHz).

2.3 Special accessories.

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

2.4 Test software.

The EUT was provided by the manufacturer with suitable software to allow operation in all the required modes.
Software used for testing: discover.
This software was running on a laptop computer (AUX2). It was used to enable the test operation modes listed in section 2.2 as appropriate.



Screenshot of the testsoftware

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 Heyrex.

2.7 Schematics of the EUT.

The schematics are available at Heyrex.

2.8 Part list of the EUT.

The part list is available at Heyrex.

3 Peak output power

Results: Pass

Date of testing: 2016-01-21

Requirements:

FCC 15.247(b)(3), RSS-247 Section 5.4(2)

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:

ANSI C63.10-2013

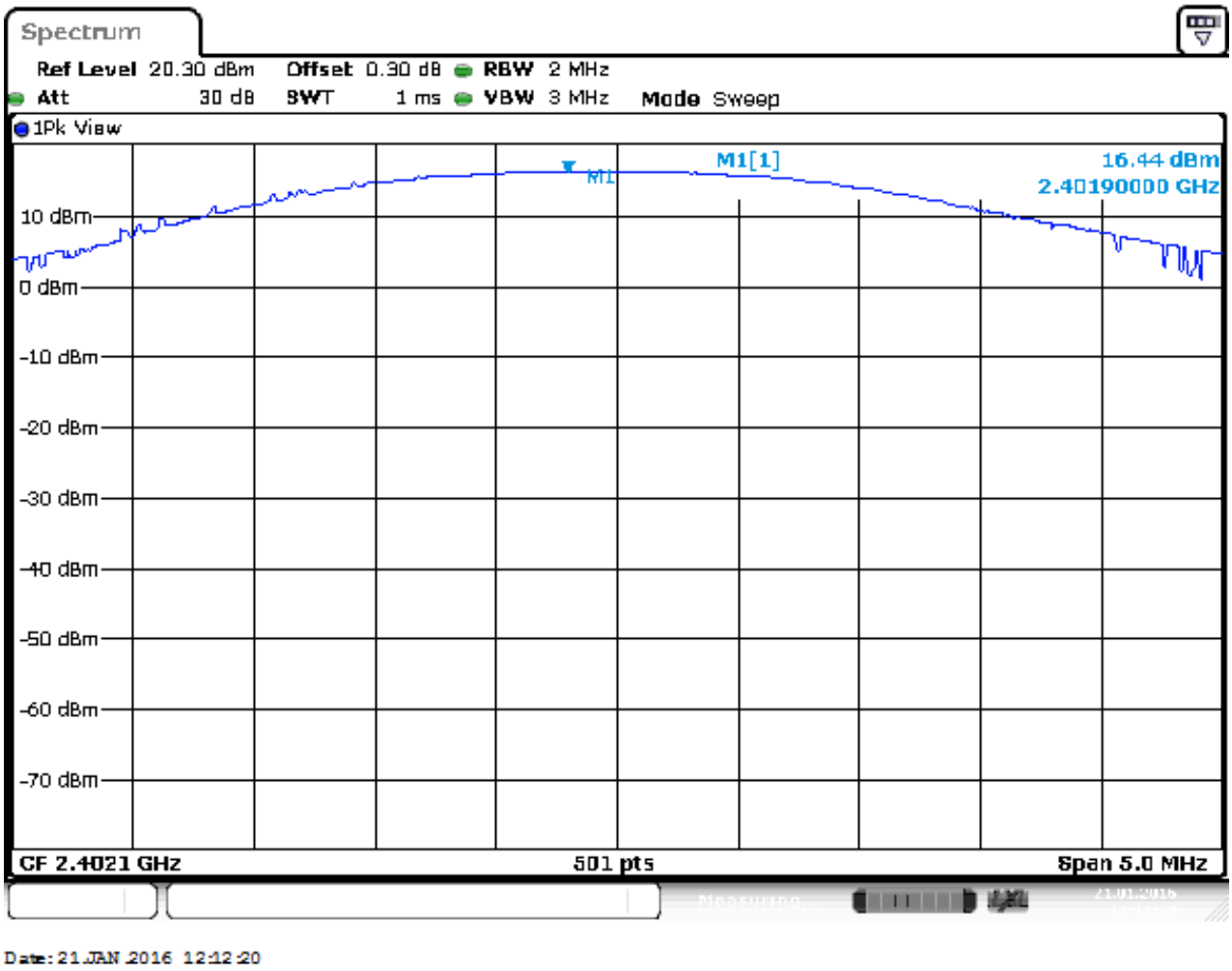
The EUT has an antenna port for conducted tests, the test results are obtained by conducted power measurements using a spectrum analyzer with a Peak detector with a resolution bandwidth of 1 MHz.

Frequency (MHz)	Measured Peak Output Power (dBm)	Limit (dBm)
2402	16.44	21
2432	15.02	21
2462	14.05	21

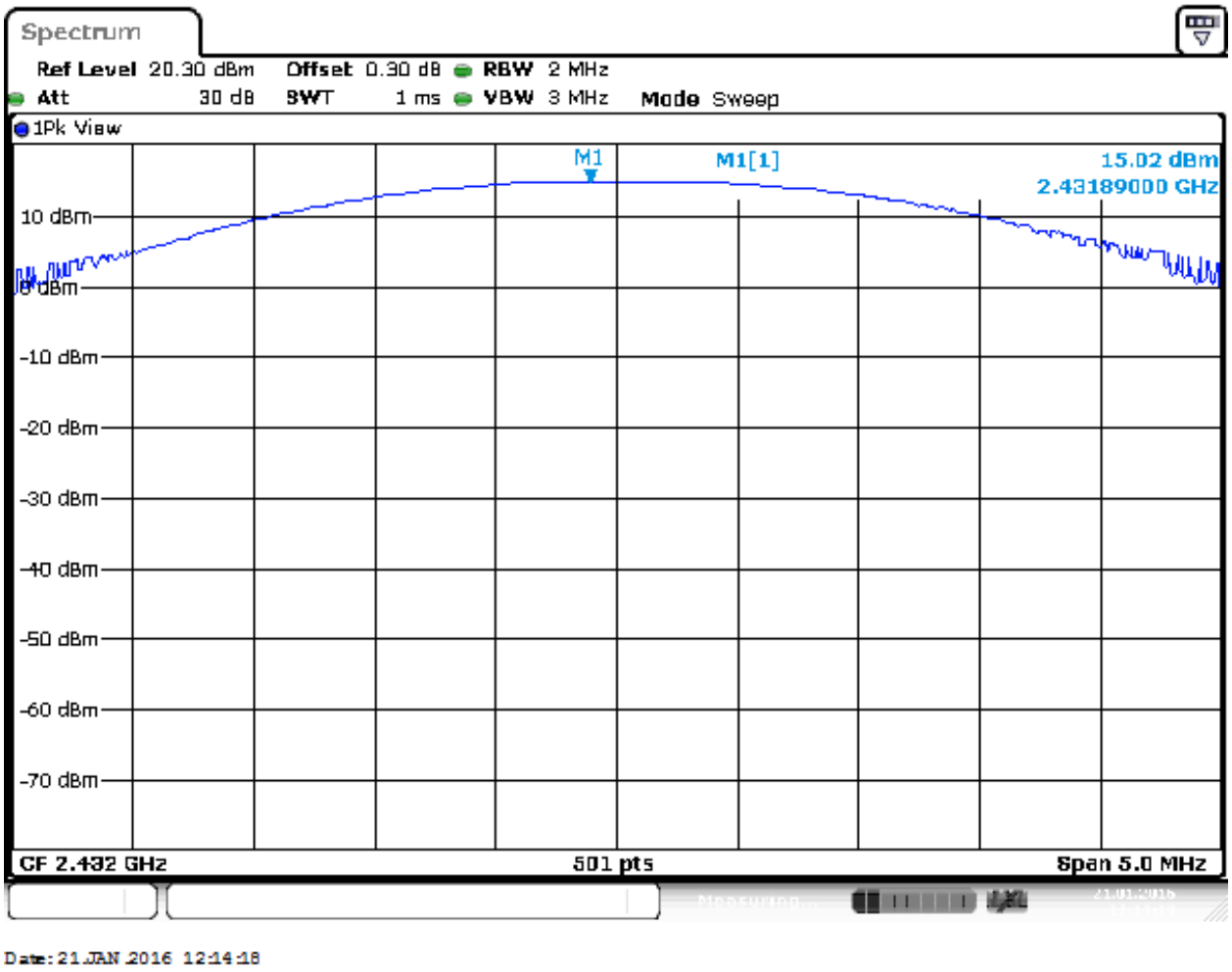
Table 2 Peak output power

Notes:

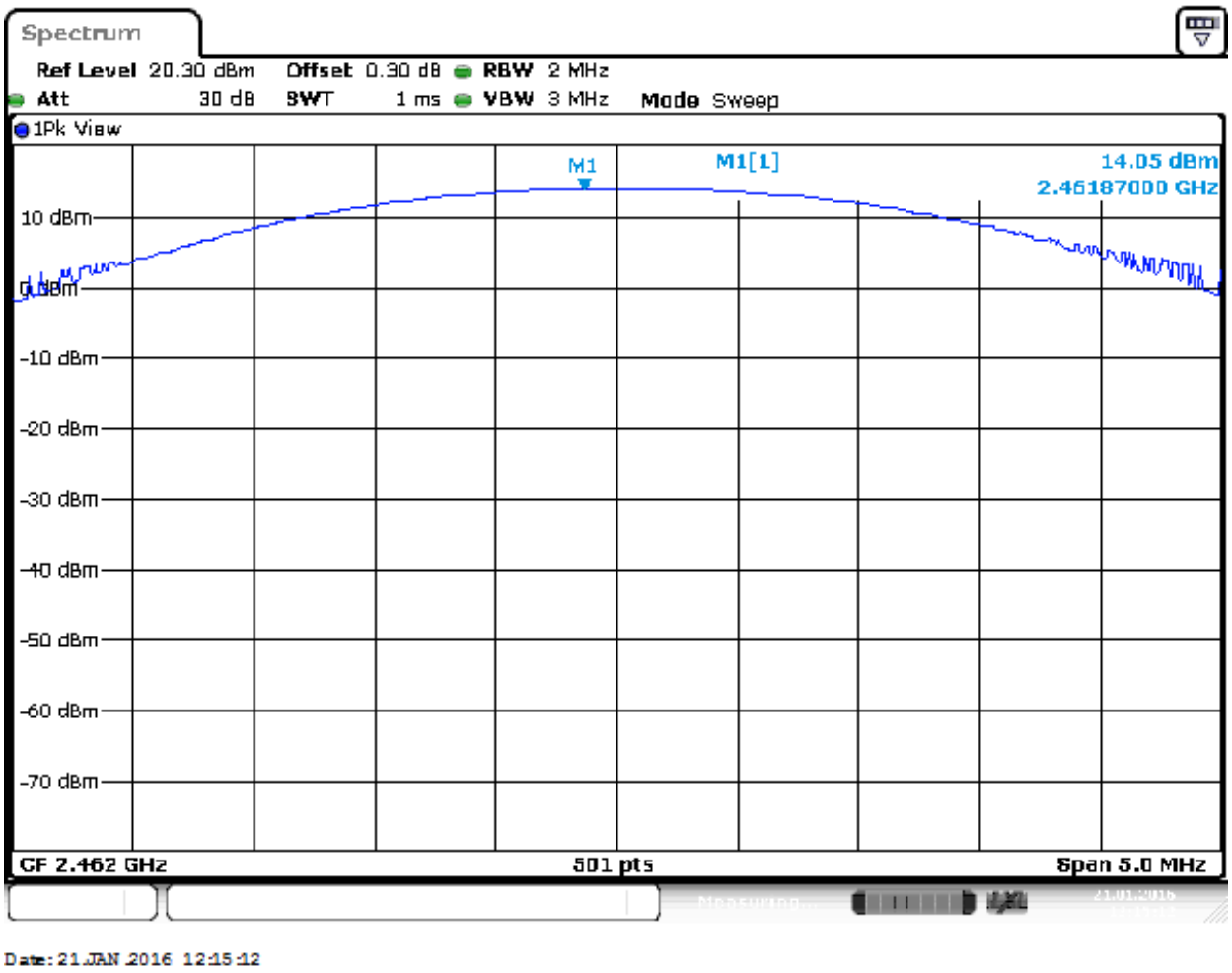
1. Measured value includes correction factor for cable loss.
2. Measurement uncertainty is ±2.5 dB.
3. See plots on the next pages.



Plot 1: Peak Output Power (2402 MHz)



Plot 2: Peak Output Power (2432 MHz)



Plot 3: Peak Output Power (2462 MHz)

4 Emission bandwidth

Results: Pass

Date of testing: 2016-01-21

Requirements:

FCC 15.247(a)(2), RSS-247 Section 5.1

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

Test procedure:

ANSI C63.10-2013

The Occupied bandwidth/99 % bandwidth was measured with the conducted test setup (see Photo.1).
The spectrum analyzer settings were as follows:

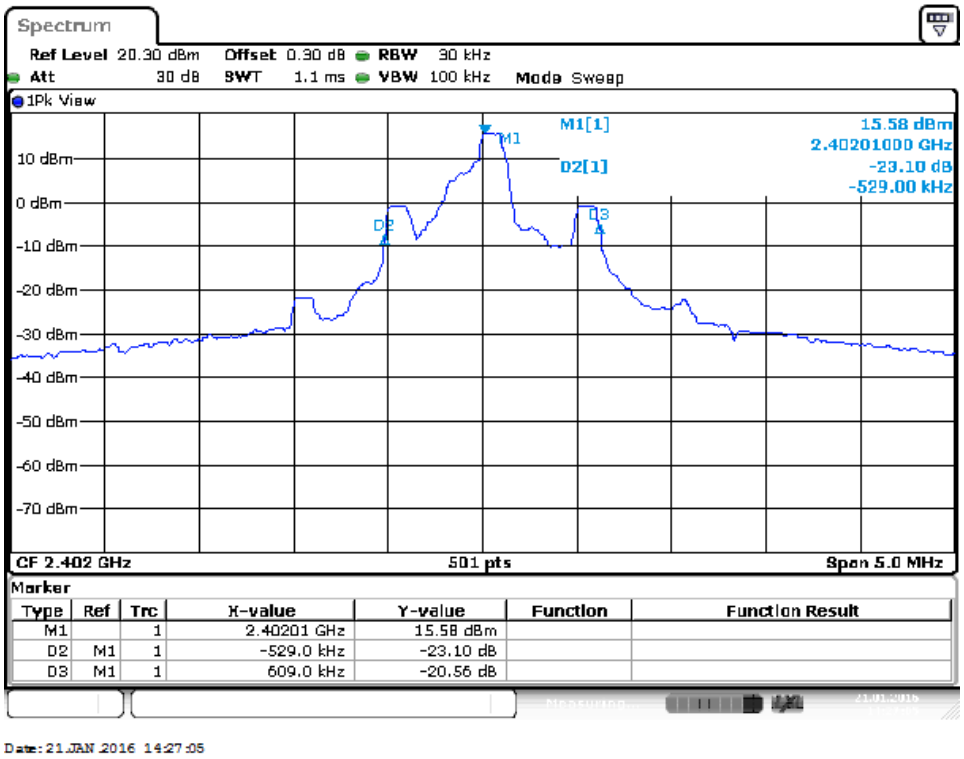
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥ 1% of the 20 dB bandwidth
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

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

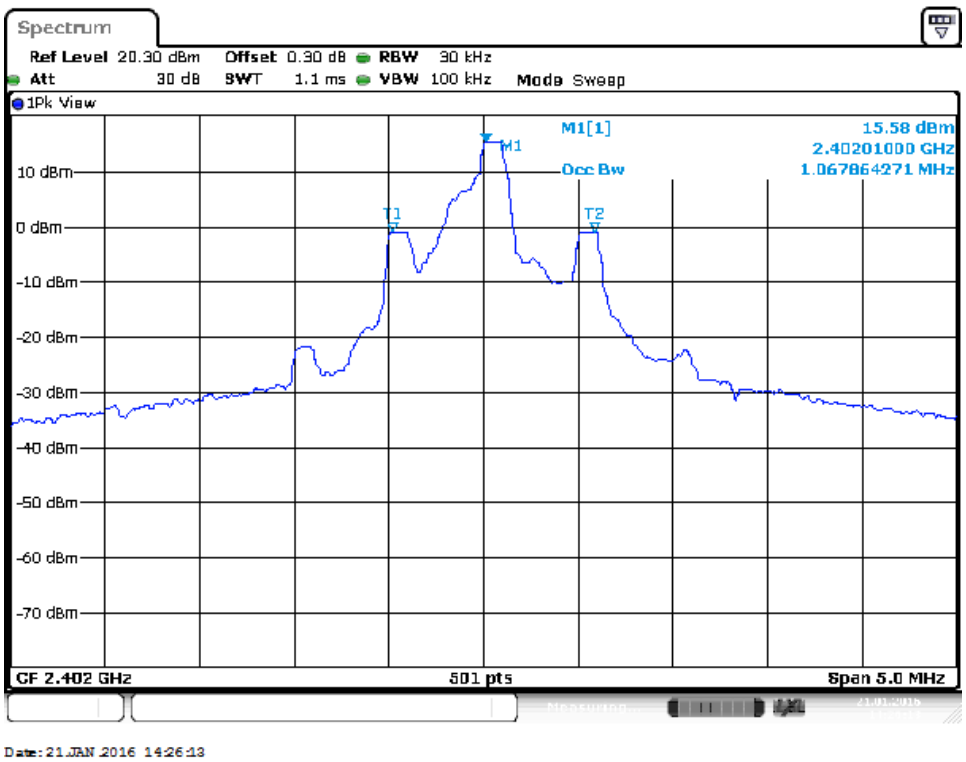
For 99% bandwidth the automated function of the spectrum analyzer was used.

Measurement uncertainty is ±14.2%

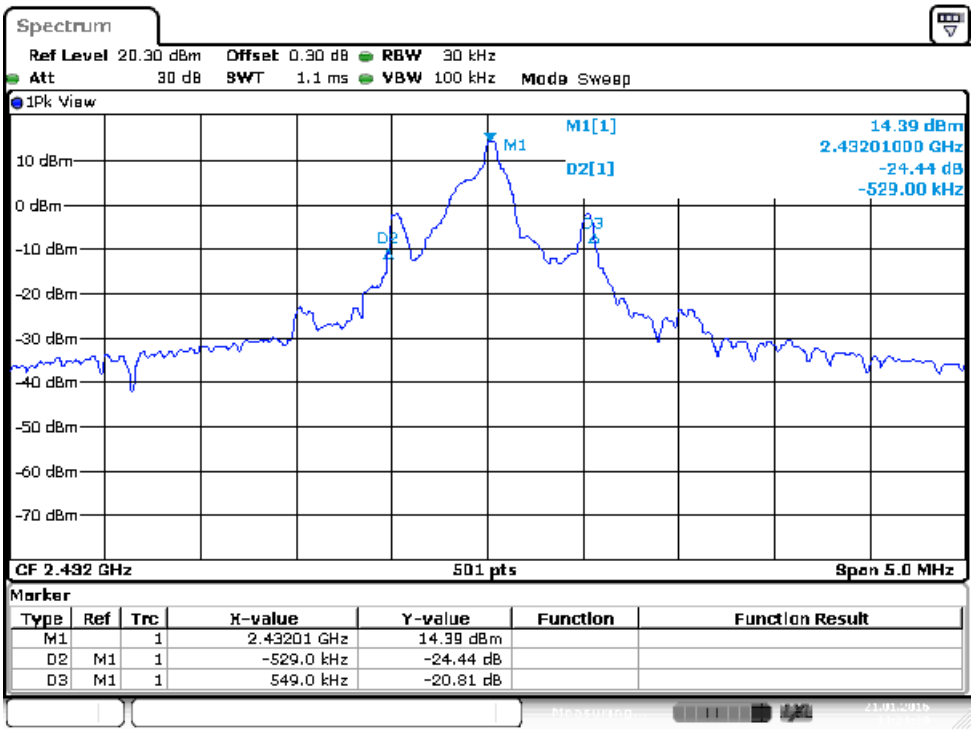
See plots on the next pages.



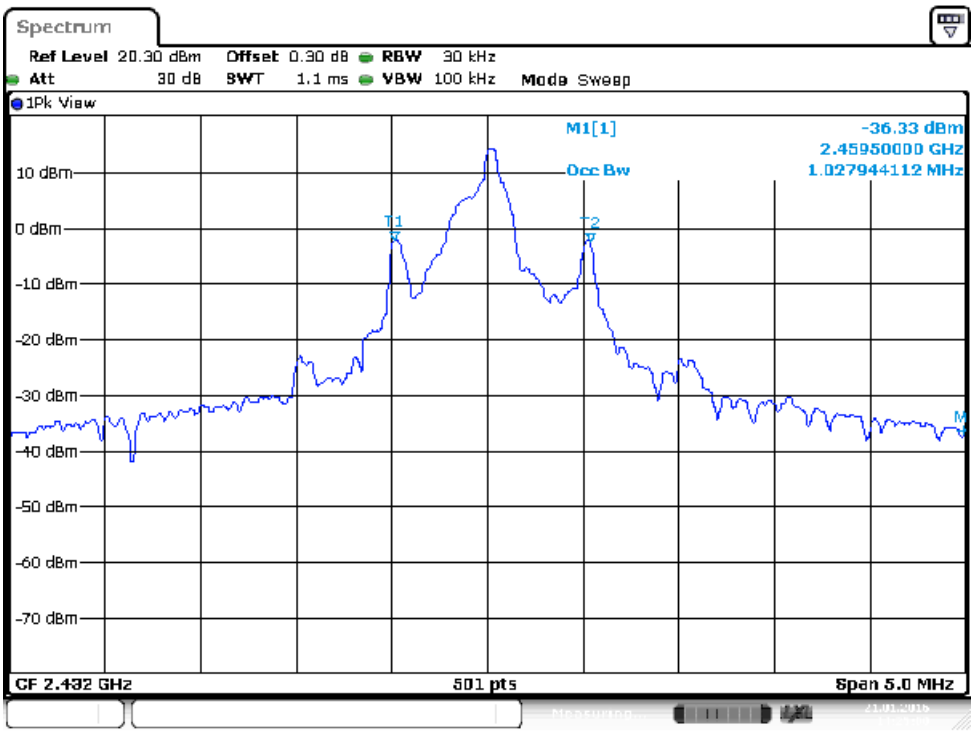
Plot 4a: Emission 20dB Bandwidth (= 1.138 MHz) of the EUT transmitting at 2402 MHz



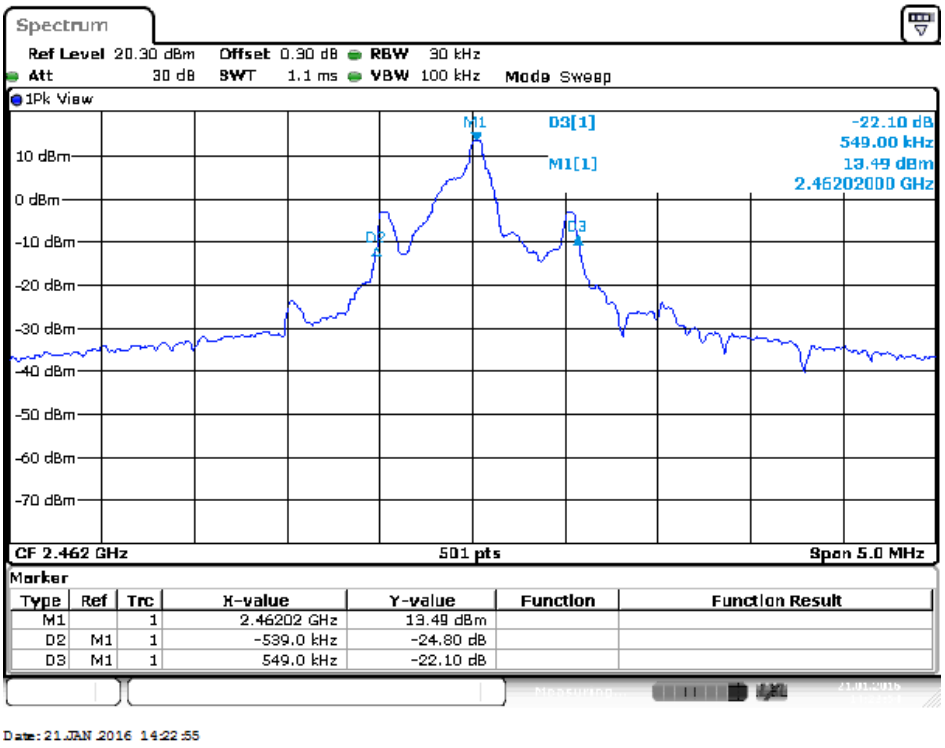
Plot 4b: Emission 99% Bandwidth (= 1.068 MHz) of the EUT transmitting at 2402 MHz



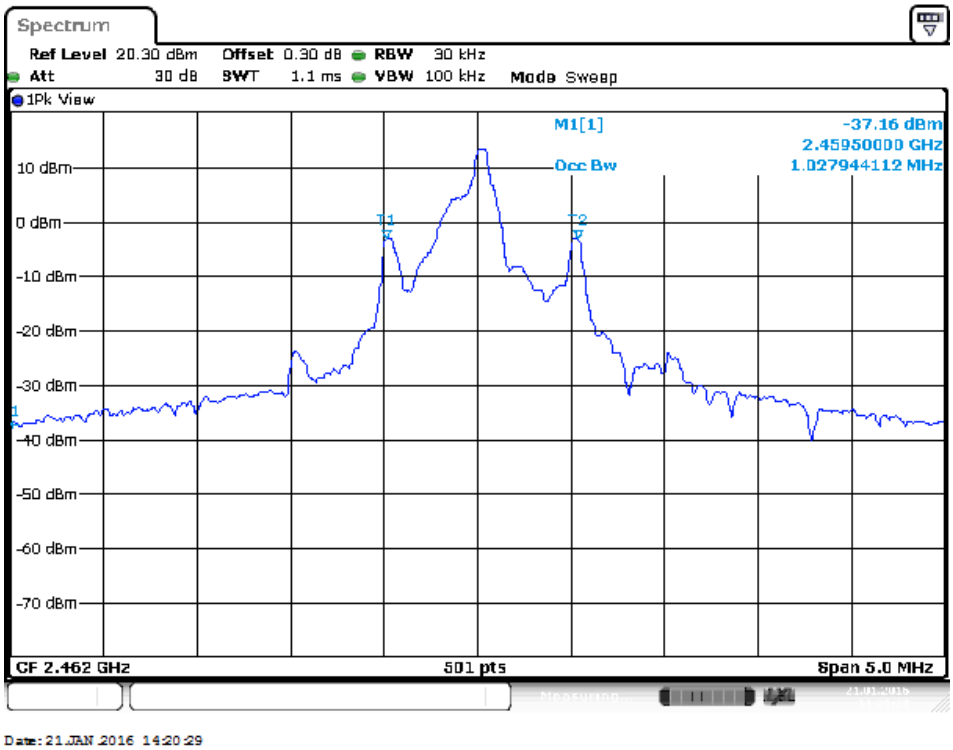
Plot 5a: Emission 20dB Bandwidth (= 1.078 MHz) of the EUT transmitting at 2432 MHz



Plot 5b: Emission 99% Bandwidth (= 1.028 MHz) of the EUT transmitting at 2432 MHz



Plot 6a: Emission 20dB Bandwidth (= 1.088 MHz) of the EUT transmitting at 2462 MHz



Plot 6b: Emission 99% Bandwidth (= 1.028 MHz) of the EUT transmitting at 2462 MHz

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

RESULT: PASS

Date of testing: 2016-01-21

Requirements:

FCC 15.247(a)(1)(iii), RSS-247 Section 5.1.

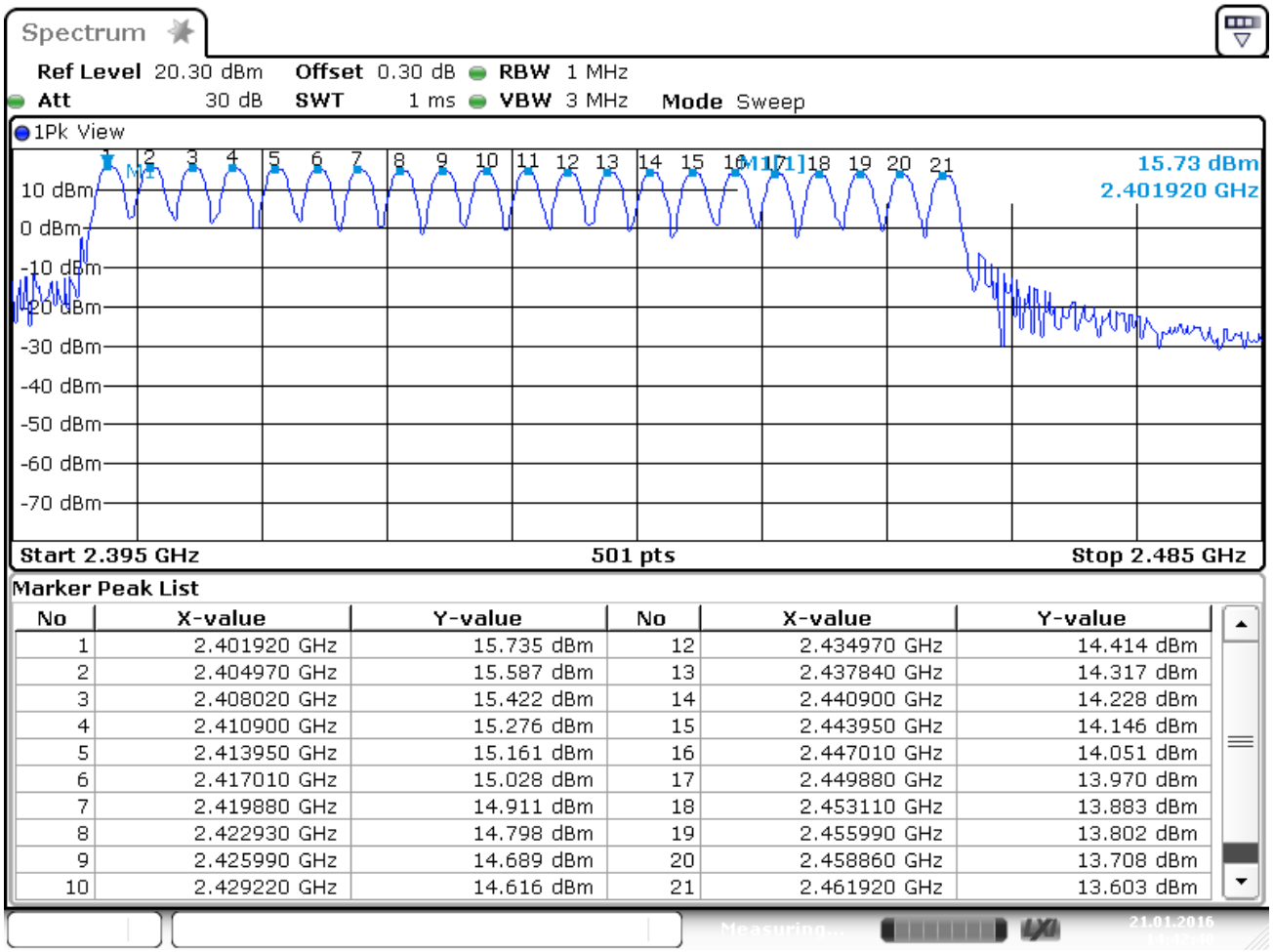
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress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

Test procedure:

ANSI C63.10-2013.

The EUT's hopping function was enabled.

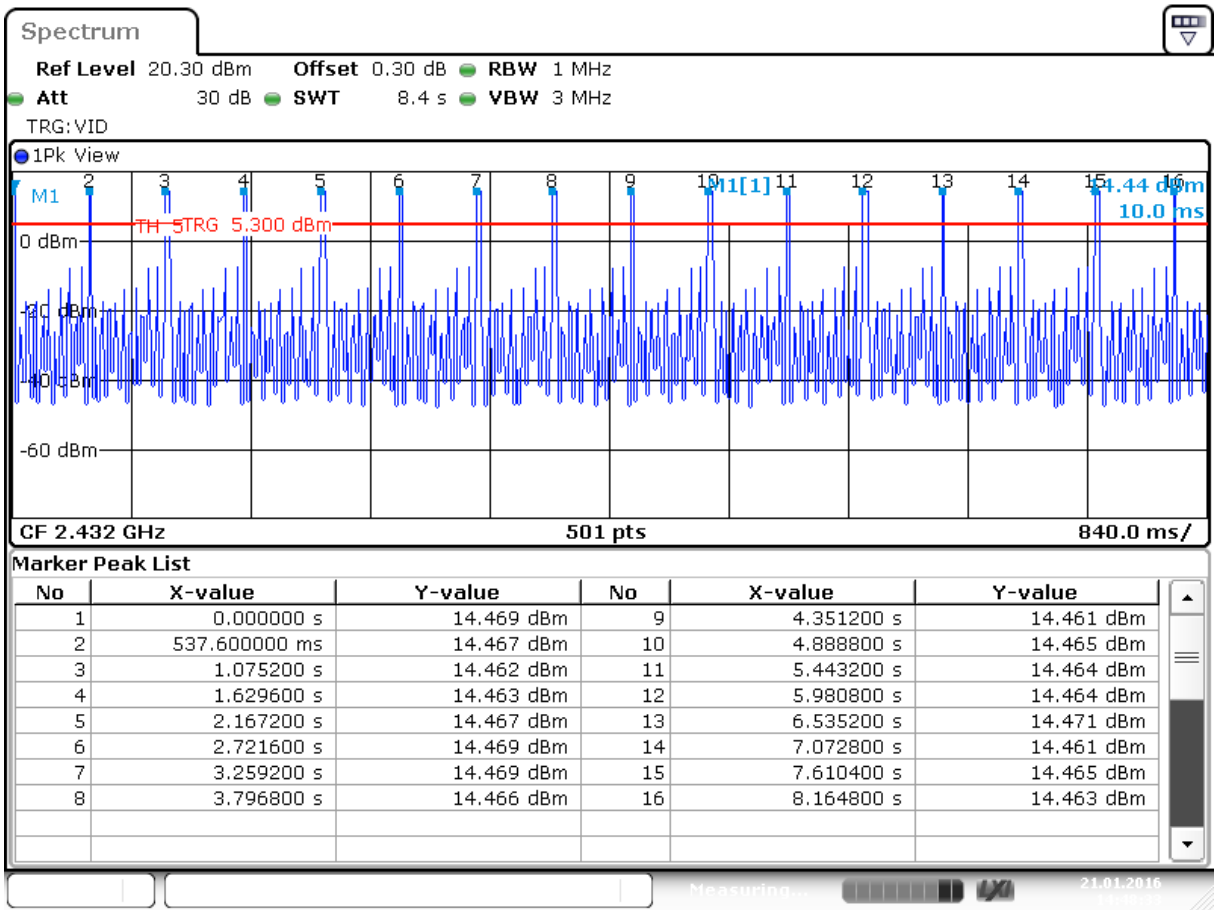
The tests were done with the conducted test setup (spectrum analyzer). See plots on the next pages.



No	X-value	Y-value	No	X-value	Y-value
1	2.401920 GHz	15.735 dBm	12	2.434970 GHz	14.414 dBm
2	2.404970 GHz	15.587 dBm	13	2.437840 GHz	14.317 dBm
3	2.408020 GHz	15.422 dBm	14	2.440900 GHz	14.228 dBm
4	2.410900 GHz	15.276 dBm	15	2.443950 GHz	14.146 dBm
5	2.413950 GHz	15.161 dBm	16	2.447010 GHz	14.051 dBm
6	2.417010 GHz	15.028 dBm	17	2.449880 GHz	13.970 dBm
7	2.419880 GHz	14.911 dBm	18	2.453110 GHz	13.883 dBm
8	2.422930 GHz	14.798 dBm	19	2.455990 GHz	13.802 dBm
9	2.425990 GHz	14.689 dBm	20	2.458860 GHz	13.708 dBm
10	2.429220 GHz	14.616 dBm	21	2.461920 GHz	13.603 dBm

Date: 21.JAN.2016 14:42:40

Plot 7: at least 15 (actual = 21) hopping frequencies, as measured on a spectrum analyzer



No	X-value	Y-value	No	X-value	Y-value
1	0.000000 s	14.469 dBm	9	4.351200 s	14.461 dBm
2	537.600000 ms	14.467 dBm	10	4.888800 s	14.465 dBm
3	1.075200 s	14.462 dBm	11	5.443200 s	14.464 dBm
4	1.629600 s	14.463 dBm	12	5.980800 s	14.464 dBm
5	2.167200 s	14.467 dBm	13	6.535200 s	14.471 dBm
6	2.721600 s	14.469 dBm	14	7.072800 s	14.461 dBm
7	3.259200 s	14.469 dBm	15	7.610400 s	14.465 dBm
8	3.796800 s	14.466 dBm	16	8.164800 s	14.463 dBm

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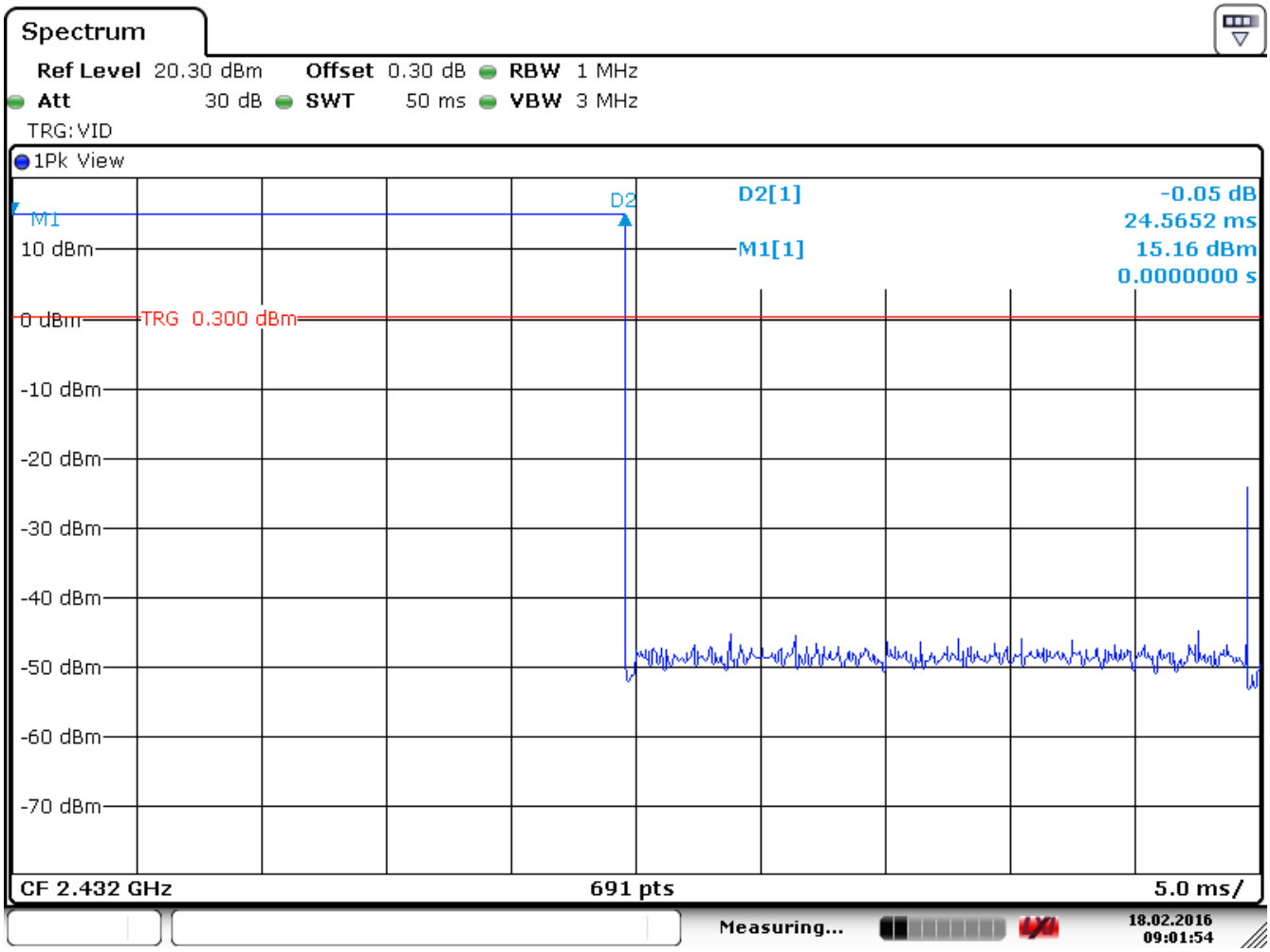
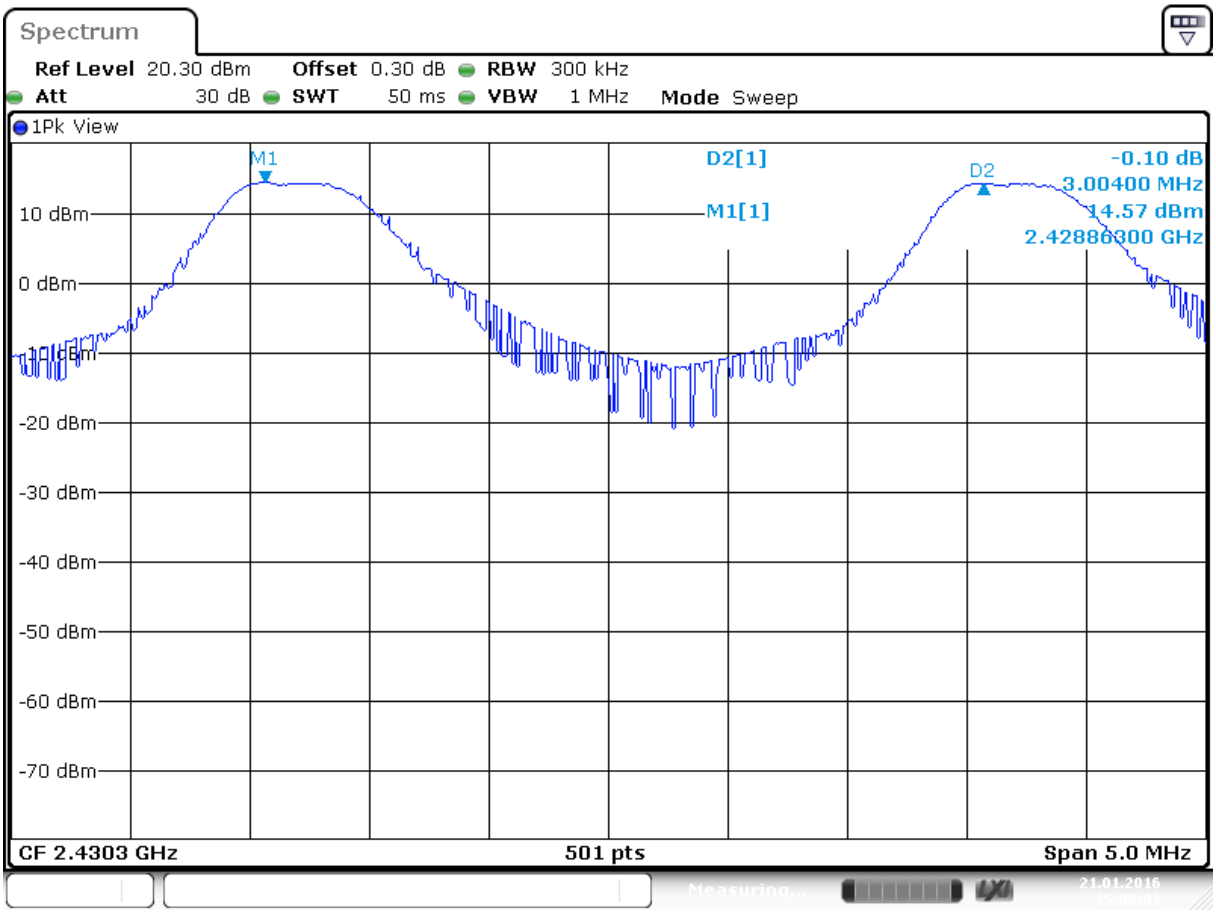
Plot 8a: showing Average time of occupancy <0.4 s within a 8.4 sec period.



Date: 18.FEB.2016 09:01:54

Plot 8b: showing the RF on time of 24.565 ms for one emission

In a period of 8.4 seconds (0.4s * 21 channels) the transmitter was observed to transmit 16 times (see plot 8a). 16 emission * 24.565 ms results in an average time of occupancy of 0.393s (393.0 ms), which is well within the limit of 0.4s. Tested with firmware version Rexnet version 5.0:55NZ.



Date: 21.JAN.2016 15:08:01

Plot 9: showing approximately 3 MHz spacing between channels as measured on a spectrum analyzer.

6 Band edge compliance

RESULT: Pass

Date of testing: 2016-01-21

Requirements:

FCC 15.205, FCC 15.209, FCC 15.247 Section 5.5

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.

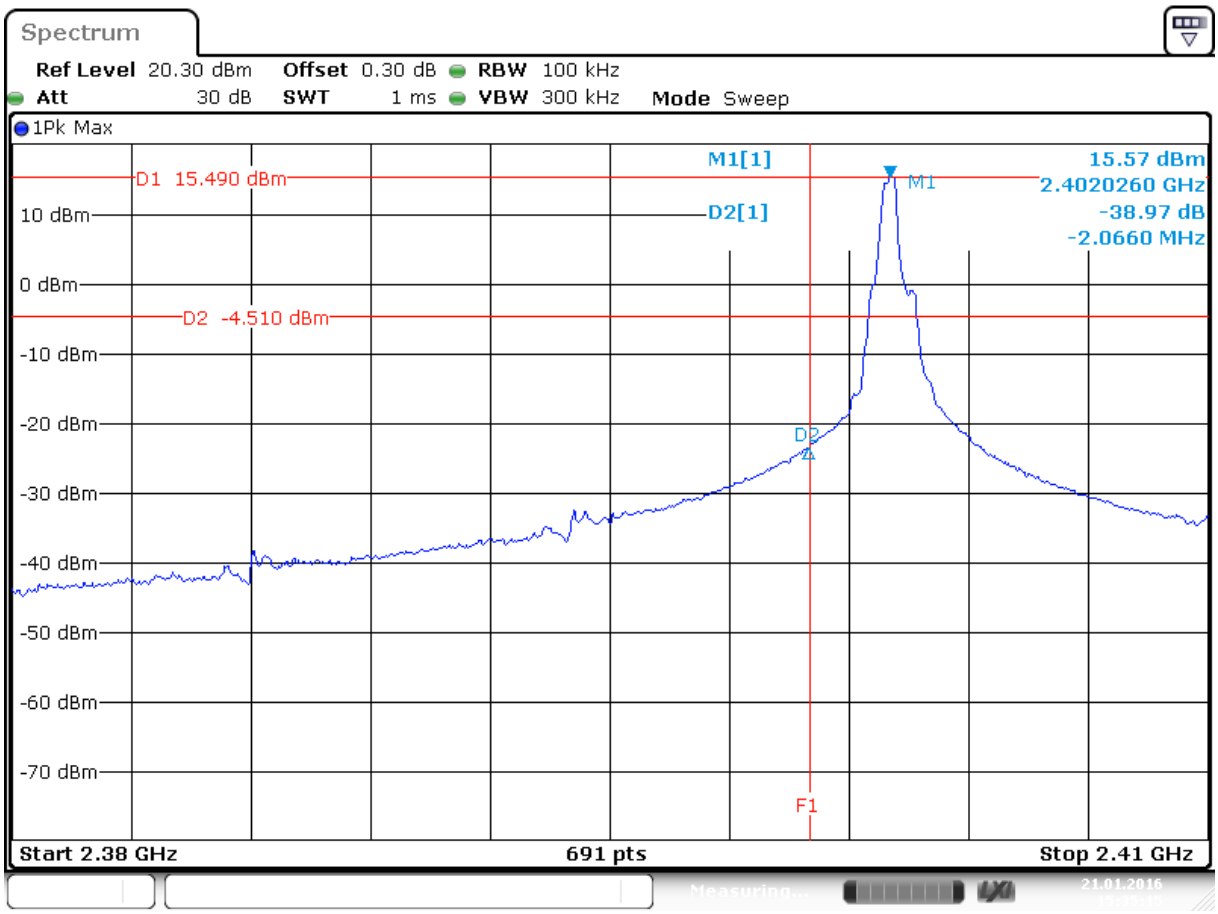
Test procedure:

ANSI C63.10-2013

The tests were performed with the conducted test setup (see photo 1). 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.



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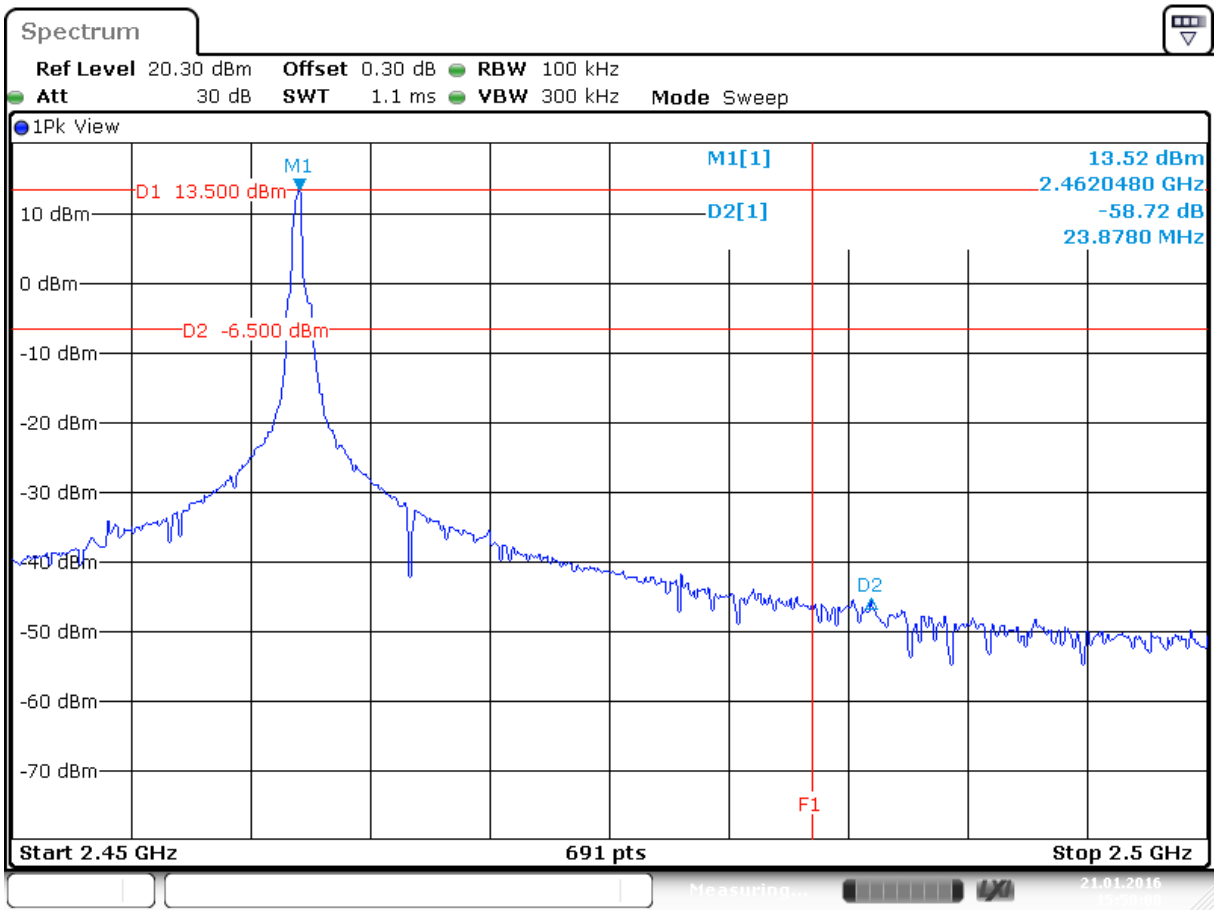
Plot 10. showing more than 20 dB band edge attenuation, EUT continues modulated carrier at 2402 MHz F1 shows the band edge frequency of 2400 MHz.



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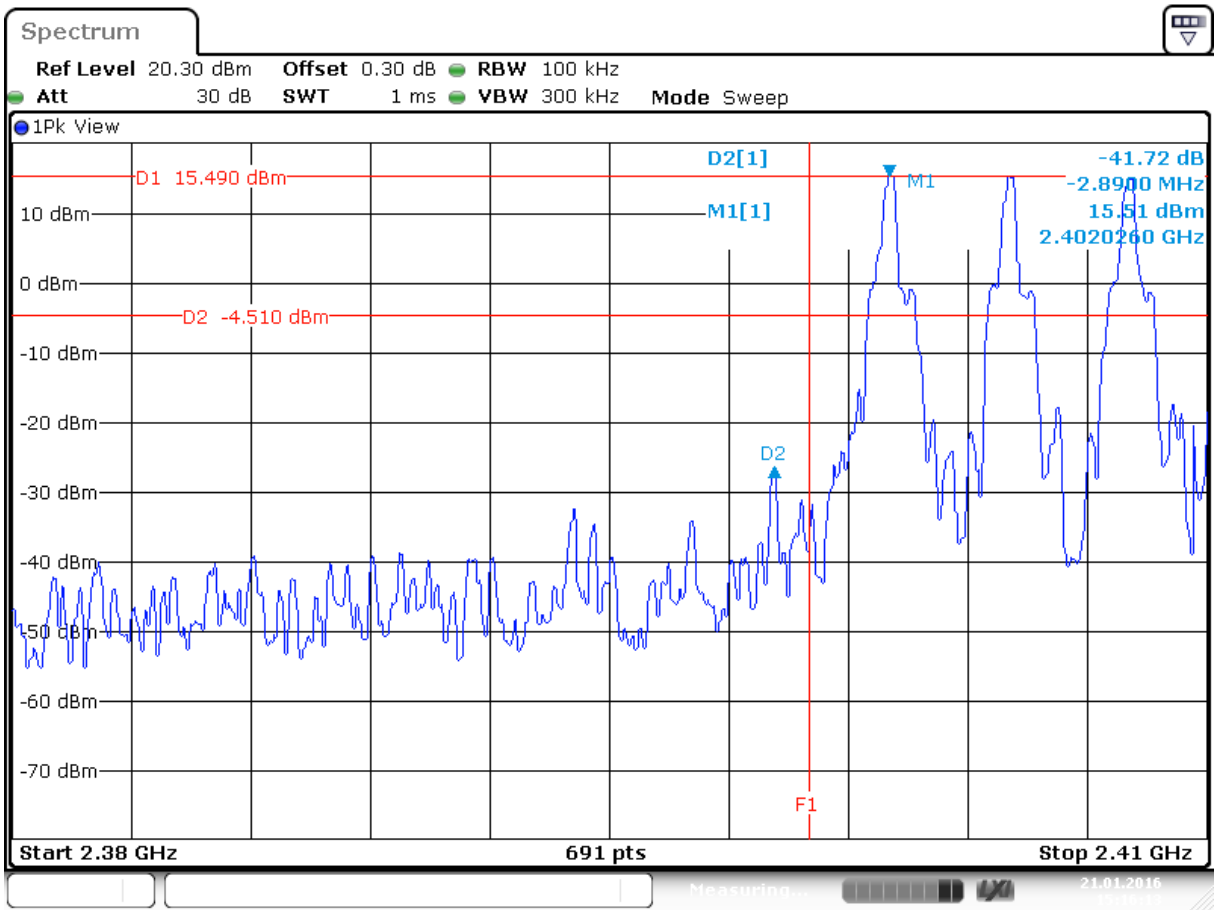
Plot 11. showing more than 20 dB band edge attenuation, EUT continues modulated carrier at 2462 MHz
F1 shows the band edge frequency of 2483.5 MHz.



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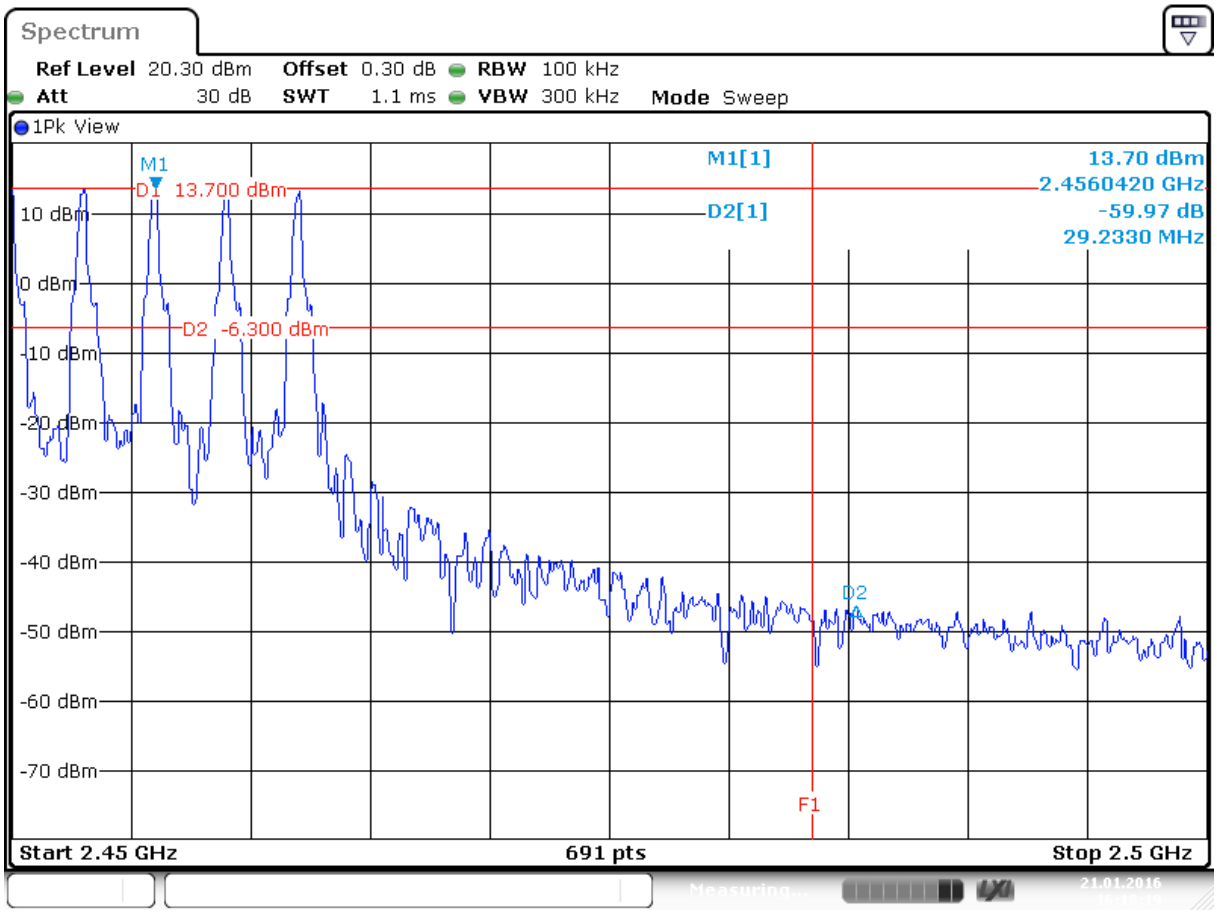
Plot 12. showing more than 20 dB band edge attenuation, EUT in Hopping mode
F1 shows the band edge frequency of 2400 MHz.



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Plot 13. 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: 2016-01-21

Requirements:

FCC 15.247(d) and RSS-247 Section 5.5.

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:

ANSI C63.10-2013.

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

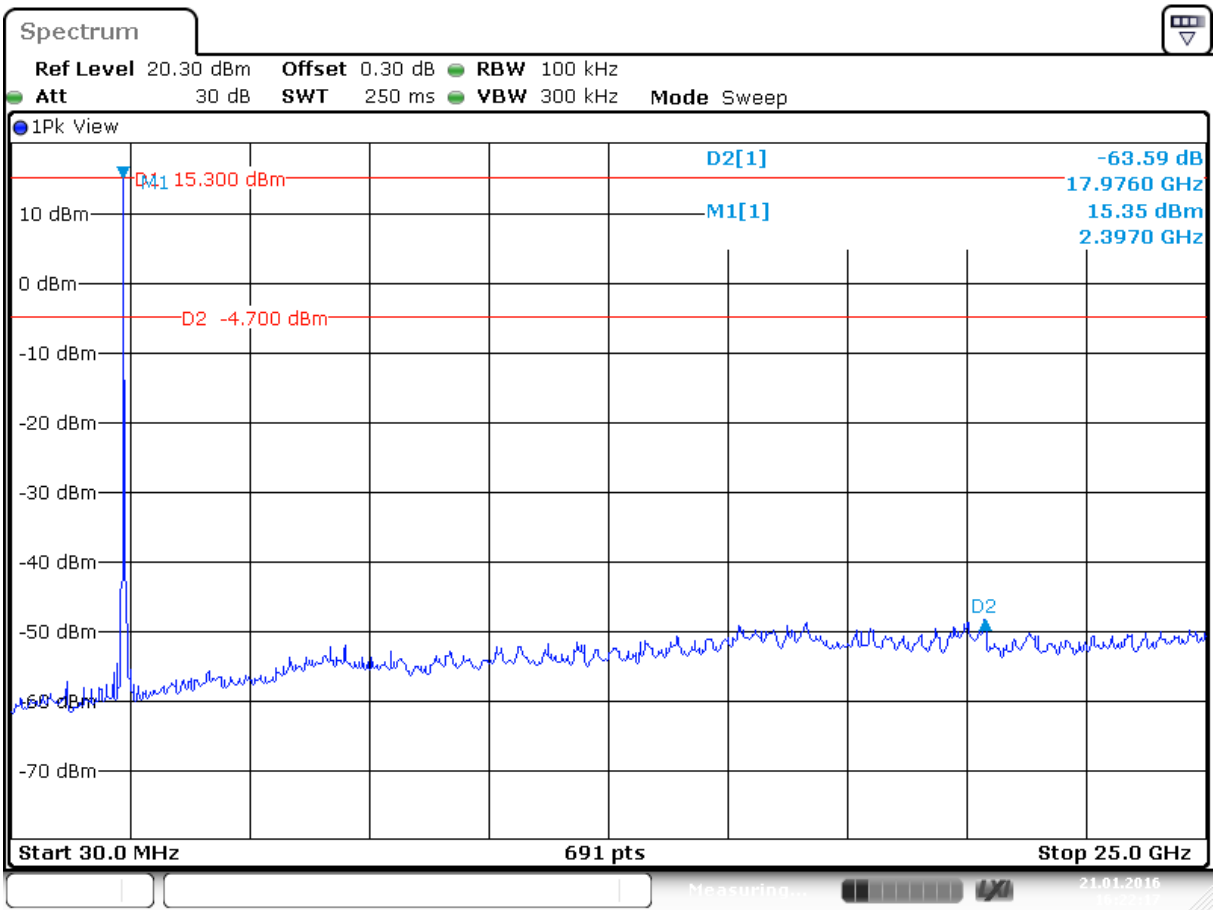
Use the following spectrum analyzer settings:

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 10^{th} harmonic.

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

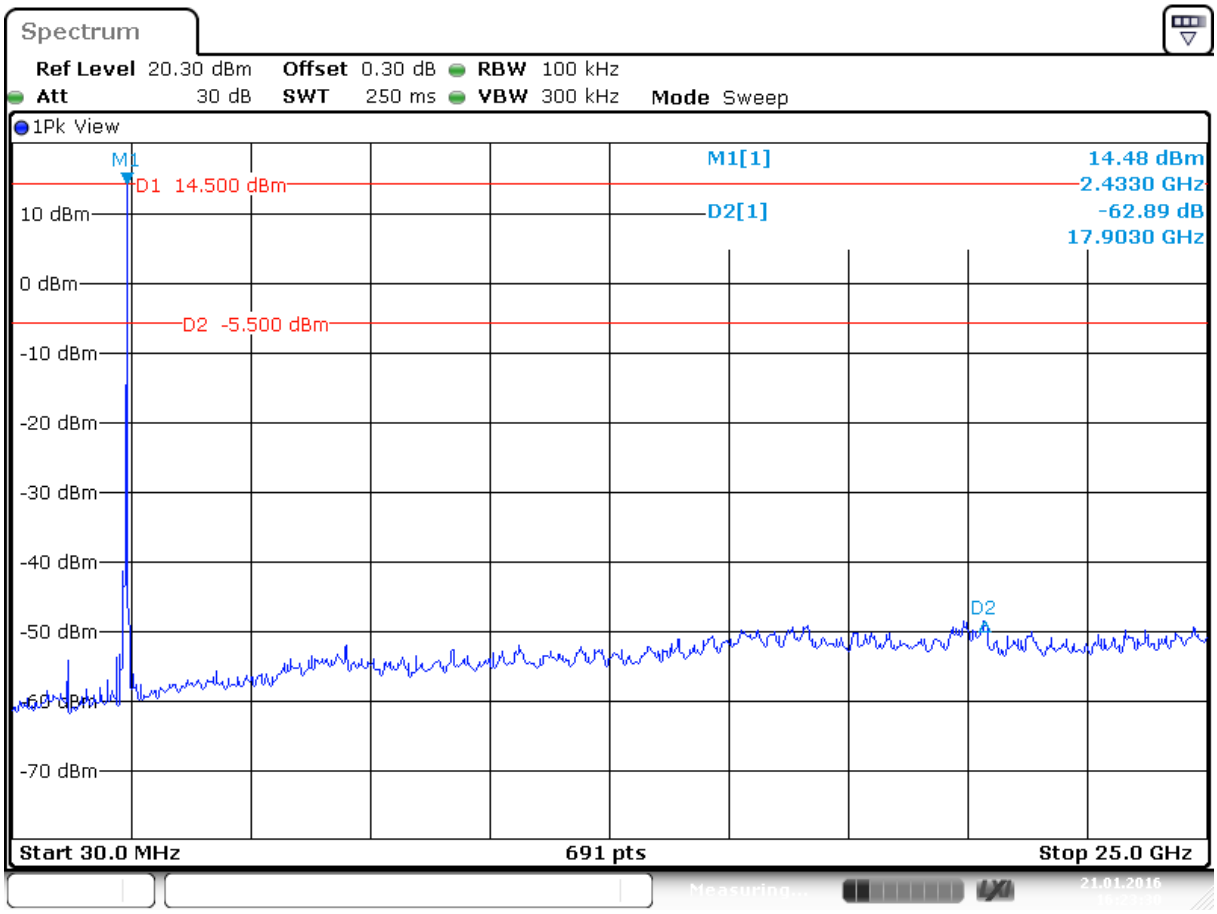
Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section. See the plots on the next pages.

Tested up to 25 GHz.



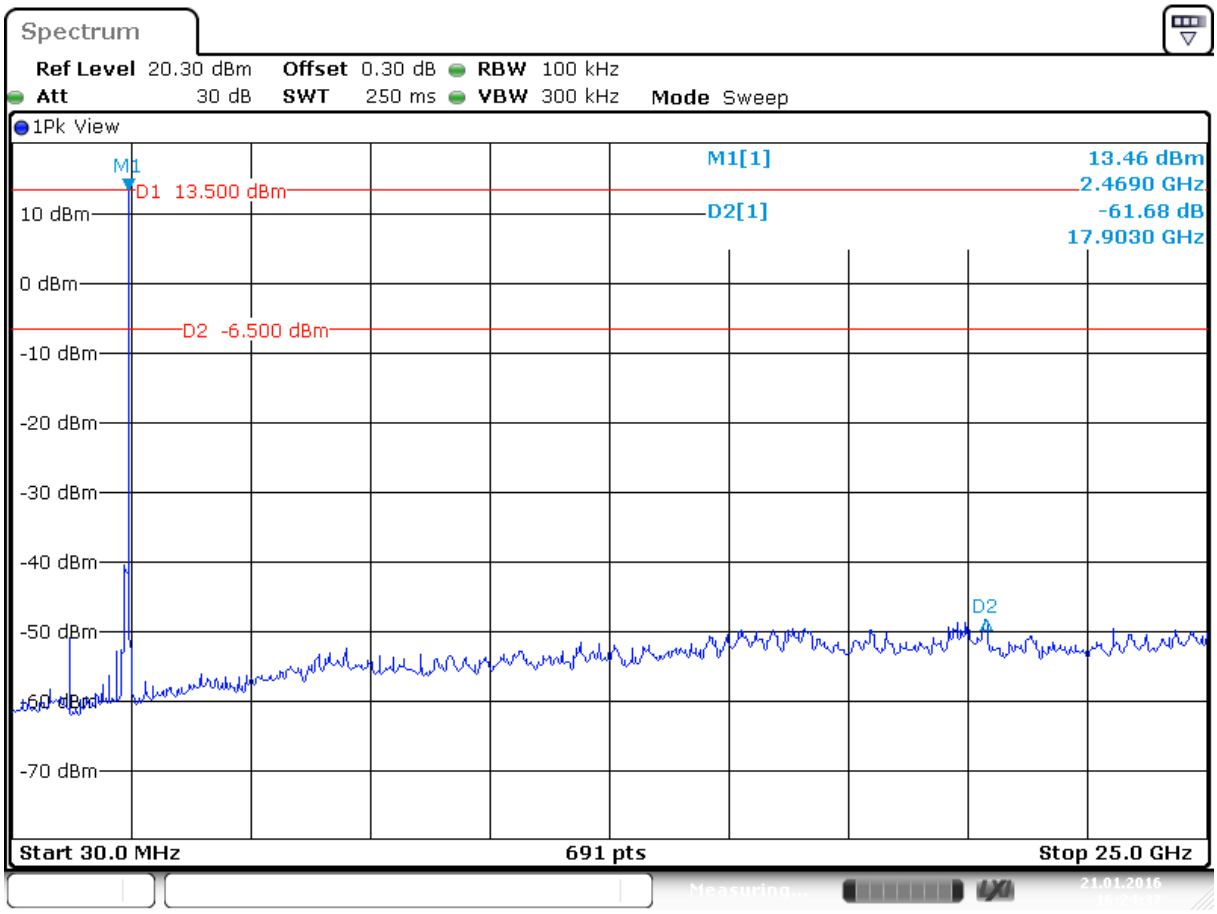
Date: 21.JAN.2016 16:22:18

Plot 14 of the radiated spurious emission, EUT frequency 2402 MHz Constant modulated carrier.



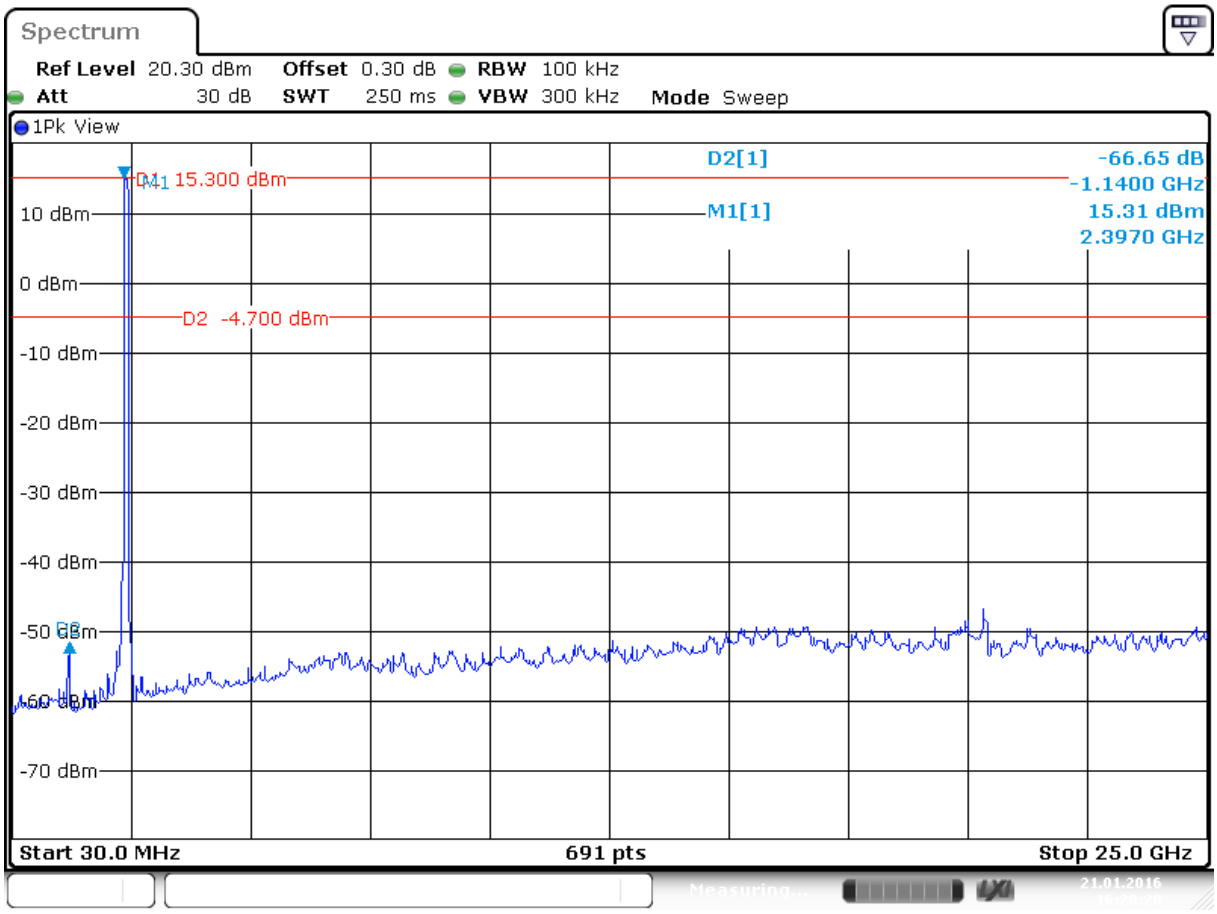
Date: 21.JAN.2016 16:23:31

Plot 15 of the radiated spurious emission, EUT frequency 2432 MHz Constant modulated carrier.



Date: 21.JAN.2016 16:24:38

Plot 16 of the radiated spurious emission, EUT frequency 2462 MHz Constant modulated carrier.



Date: 21.JAN.2016 16:20:20

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

8 Radiated Spurious Emissions of the Transmitter out of band and in restricted bands.

RESULT: PASS

Date of testing: 2016-01-22

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) and RSS-Gen.

Test procedure:

ANSI C63.10-2013.

The EUT was tested against the limit specified in FCC 15.209(a) and RSS-Gen.

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 1.5m 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.

Frequency [MHz]	Antenna Orientation	Detector	Level [dBµV/m]	Limit [dBµV/m]
50.00	Vertical	Qp	32.7	40.0
111.48	Vertical	Qp	23.5	43.5
450.98	Vertical	Qp	15.4	46.0
Frequency [MHz]	**Antenna Orientation**	**Detector**	**Level [dBm]**	**Limit Av / Pk [dBm]**
2483.5-2500*[R]	Vertical	Pk	<-60.0	-21.2 / -41.2
4804*[H*R]	Vertical	Pk	-45.1	-21.2 / -41.2
7206*[H]	Vertical	Pk	-46.3	-21.2 / -41.2
9608*[H]	Vertical	Pk	-46.0	-21.2 / -41.2

Table 1a Radiated spurious emissions of the EUT at 2402 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBµV/m]	Limit [dBµV/m]
50.00	Vertical	Qp	32.5	40.0
111.48	Vertical	Qp	23.5	43.5
450.98	Vertical	Qp	15.5	46.0
Frequency [MHz]	**Antenna Orientation**	**Detector**	**Level [dBm]**	**Limit Av / Pk [dBm]**
2483.5-2500*[R]	Vertical	Pk	<-60.0	-21.2 / -41.2
4864*[H*R]	Vertical	Pk	-45.4	-21.2 / -41.2
7296*[H]	Vertical	Pk	-46.2	-21.2 / -41.2

Table 1b Radiated spurious emissions of the EUT at 2432 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBµV/m]	Limit [dBµV/m]
50.00	Vertical	Qp	32.5	40.0
111.48	Vertical	Qp	23.5	43.5
450.98	Vertical	Qp	15.4	46.0
Frequency [MHz]	**Antenna Orientation**	**Detector**	**Level [dBm]**	**Limit Av / Pk [dBm]**
2483.5-2500*[R]	Vertical	Pk	<-60.0	-21.2 / -41.2
4925*[H]	Vertical	Pk	-46.2	-21.2 / -41.2
7386*[H]	Vertical	Pk	-47.5	-21.2 / -41.2

Table 1c Radiated spurious emissions of the EUT at 2462 MHz

Freq. [MHz]	Antenna Orientation	Detector	Level [dBµV/m]	Limit [dBµV/m]
48.10	Vertical	Qp	30.6	40.0
450.98	Vertical	Qp	15.7	43.5
549.92	Vertical	Qp	21.1	46.0
Frequency [MHz]	**Antenna Orientation**	**Detector**	**Level [dBm]**	**Limit Av / Pk [dBm]**
4804*H*R	Vertical	Pk	-45.4	-21.2 / -41.2
7206*H	Vertical	Pk	-46.0	-21.2 / -41.2
9608*H	Vertical	Pk	-45.8	-21.2 / -41.2

Table 1d 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 1d.

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. Where Peak (Pk) value was within Average (Av) limit, Average not tested.
3. Measurement uncertainty is ±5.0dB
4. 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).
5. *h = harmonic of the fundamental frequency, *R = an emission in a restricted frequencyband.

9 AC Power Line Conducted Emission Data.

9.1 AC Power Line Conducted Emission data of the EUT

RESULT: Pass

Date of testing: 2016-01-26

Requirements: FCC 15.207(a) and RSS-Gen section 8.8.

Except when the requirements applicable to a given device state otherwise, for any license-exempt radio communication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the following table. The tighter limit applies at the frequency range boundaries.

Frequency of Emission (MHz)	Conducted Limit (dBµV) Quasi-Peak	Conducted Limit (dBµV) Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 - 30	46	50

*Decreases with the logarithm of the frequency.

Test procedure:

ANSI C63.10-2013.

Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a 50 µH / 50 Ω LISN. The frequency range from 150kHz to 30MHz was searched. The EUT was positioned at least 80cm from the LISN.

9.1.1 Testresults, AC power line conducted emissions.

Frequency (MHz)	Measurement results (dBµV) L1		Measurement results (dBµV) L2/Neutral		Limits (dBµV)		Verdict (Pass/Fail)
	QP	AV	QP	AV	QP	AV	
0.15000	40.0	Note 3	45.7	Note 3	66.0	56.0	Pass
0.29844	42.7	Note 3	42.1	Note 3	60.2	50.2	Pass
0.40000	43.1	Note 3	44.1	Note 3	57.9	47.9	Pass
0.41953	39.7	Note 3	38.0	Note 3	57.4	47.4	Pass
0.50156	37.9	Note 3	35.8	Note 3	56.0	46.0	Pass
0.59531	33.8	Note 3	35.3	Note 3	56.0	46.0	Pass
0.69297	43.0	Note 3	38.9	Note 3	56.0	46.0	Pass
0.72031	42.8	Note 3	38.9	Note 3	56.0	46.0	Pass

Table 4 AC Power Line Conducted Emissions of the EUT

The results of the conducted emission tests, carried out in accordance with 47 CFR Part 15 section 15.207(a) and RSS-Gen section 8.8, at the 120 Volts/ 60 Hz AC mains connection terminals of the power supply (AUX1) that connects to the EUT, are depicted in the Table 4 above.

Notes:

1. The resolution bandwidth used was 9 kHz.
2. Tested in the normal operation mode. Worst case values noted.
3. Qp values already within Av limits, therefor Av not tested.
4. emissions not listed in the table above are more than 20 dB below the applicable limit
5. Measurement uncertainty is ±3.5 dB.
6. Plots are provided on the next pages.

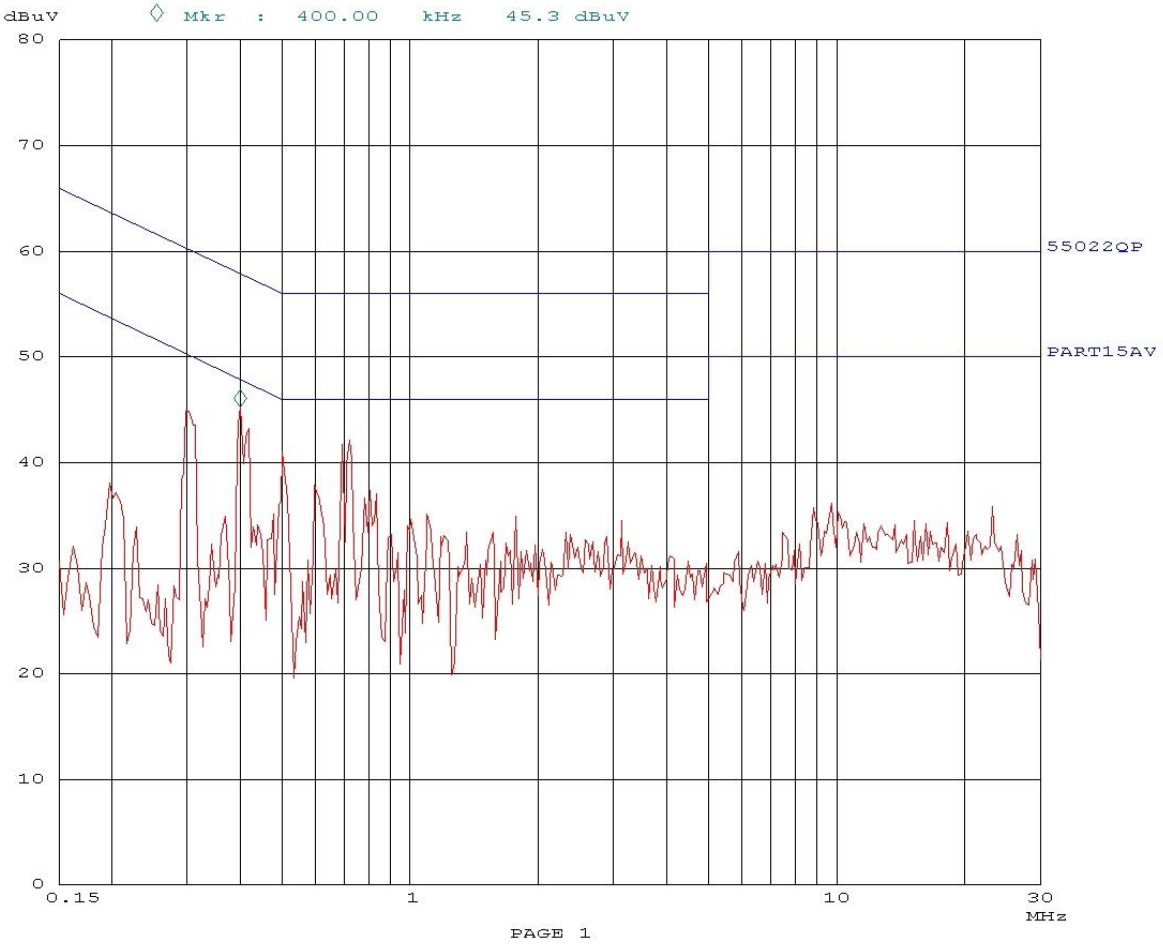
Used test equipment and ancillaries:

A00022	A00051	A00171	A00437	A00444	A00726	A01844
A00040						

26. Jan 16 12:25

```
Overview Scan Settings (1 Range)
|--------- Frequencies -----------||--------- Receiver Settings ---------|
   Start        Stop         Step      IF BW   Detector  M-Time   Atten Preamp
 150k          30M          3.9k        9k       PK      0.10ms    0dBLN   OFF

Final Measurement: x QP
                   Meas Time:     1 s
                   Subranges:    25
                   Acc Margin:   6dB
```



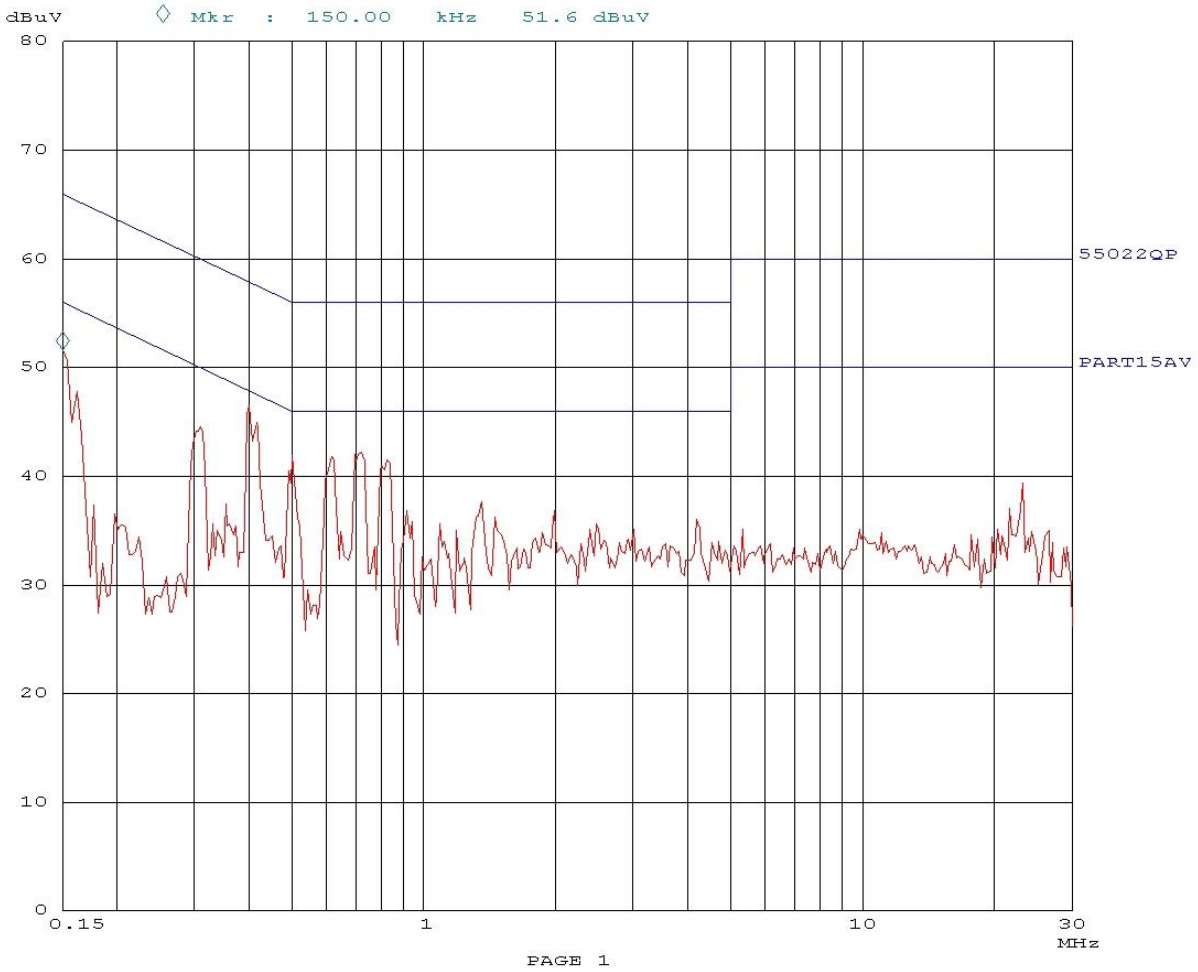
Plot 18 AC Power Line Conducted Emissions on L1

26. Jan 16 12:52

Overview Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	30M	3.9k	9k	PK	0.10ms	0dBLN	OFF

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



Plot 19 AC Power Line Conducted Emissions on L2

10 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 Emissions					
Temperature-Humiditymeter	Extech	SD500	A00446	03/2015	03/2016
Spectrum Analyzer	Rohde & Schwarz	FSV	A00337	05/2015	05/2016
RF Cable	H+S	Secuflex	A00347	04/2015	04/2016
For Radiated Emissions					
Measurement Receiver	Rohde & Schwarz	ESCI	A00314	03/2015	03/2016
RF Cable S-AR	Gigalink	APG0500	A00447	01-30/2015	01-30/2016
Controller	Maturo	SCU/088/ 8090811	A00450	N/A	N/A
Controller	EMCS	DOC202	A00257	N/A	N/A
Test facility	Comtest	FCC listed: 90828 IC: 2932G-2	A00235	04/2014	04/2017
Spectrum Analyzer	Rohde & Schwarz	FSV	A00337	05/2015	05/2016
Antenna mast	EMCS	AP-4702C	A00258	N/A	N/A
Temperature-Humiditymeter	Extech	SD500	A00444	03/2015	03/2016
Guidehorn 1-18 GHz	EMCO	3115	A00009	04/2015	04/2016
Biconilog Testantenna	Teseq	CBL 6111D	A00466	06/2015	06/2016
Guidehorn 18-26 GHz	EMCO	3160-09	A00012	04/2015	04/2016
Preamplifier 0.5 - 18 GHz	Miteq	AMF-5D-005180-28-13p	A00247	N/A	N/A
Filterbox	EMCS	RFS06S	A00255	11/2015	11/2016
For AC Power Line	**Conducted**	**Emissions**			
Pulse limiter	R&S	ESH3-Z2	A00051	01-05/2016	01-05/2017
Variac	RFT	LSS020	A00171	NA	NA
LISN	EMCO	3625/2	A00022	01-18/2014	01-18/2016
RF cable	-	-	A01844	NA	NA
DC Power supply	Delta Elektronica	SM6020	A00040	04/2015	04/2016
Measurement Receiver	Rohde & Schwarz	ESCS30	A00726	09/2015	09/2016
Shielded room for Conducted emissions	--	--	A00437	NA	NA
Temperature-Humiditymeter	Extech	SD500	A00444	03/2015	03/2016

NA= Not Applicable

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

END OF REPORT