



Test Report No.:		15050601.fcc01	Page 1 of 40
<i>Client:</i>	Tacx b.v. Rijksstraatweg 52, 2241BW Wassenaar, Netherlands		
<i>Test Item:</i>	Digital Transmission System (DTS) ANT		
<i>Identification:</i>	T2800 Neo	<i>Serial Number:</i>	P140103-1500001 (conducted tests) and an unlabeled engineering sample (radiated tests)
<i>Project No.:</i>	15050601	<i>Date of Receipt:</i>	July 07, 2015
<i>Testing Location:</i>	TÜV Rheinland Nederland B.V. Eiberkamp 10 9351VT Leek		
<i>Test Specification:</i>	FCC 47 CFR Part 15, Subpart C, Section 15.247 (10-1-14 Edition) RSS-Gen (Issue 4, November 2014) an RSS-247 (Issue 1, May 2015) ANSI C63.10-2013		
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<i>Test Result:</i>	The test item passed the test specification(s).		
<i>Testing Laboratory:</i>	TÜV Rheinland Nederland B.V. Eiberkamp 10 9351 VT Leek		
<i>Tested by:</i>		<i>Reviewed by:</i>	
2015-08-13	R. van der Meer / Inspector	2015-08-13	P. de Beer / Reviewer
<i>Date</i>	<i>Name/Position</i>	<i>Signature</i>	<i>Date</i>
			<i>Name/Position</i>
			<i>Signature</i>
<i>Other Aspects:-.</i>			
<i>Abbreviations:</i> P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested			

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TEST SUMMARY

5.1.1 CONDUCTED MEASUREMENTS AT ANTENNA PORT

RESULT: Pass

5.1.2 6dB AND 99% BANDWIDTH

RESULT: Pass

5.1.3 PEAK POWER SPECTRAL DENSITY

RESULT: Pass

5.1.4 BAND EDGE CONDUCTED EMISSIONS

RESULT: Pass

5.1.5 RADIATED SPURIOUS EMISSIONS OF TRANSMITTER

RESULT: Pass

5.1.6 RADIATED SPURIOUS EMISSIONS OF TRANSMITTER IN RESTRICTED BANDS

RESULT: Pass

5.2.1 AC POWER LINE CONDUCTED EMISSION OF TRANSMITTER

RESULT: Pass

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1. General Remarks

1.1 Complementary Materials

There is no attachment to this test report.

2. Test Sites

2.1 Test Facilities

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.

Normal test conditions:

Temperature (*) : +15°C to +35°C
Relative humidity(*) : 20 % to 75 %
Supply voltage : Not Applicable, EUT is not operable on AC mains voltage.

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.

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2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement 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	FSP	A00337	11/2015	11/2016
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	01/2015	01/2016
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	08/2014	08/2015
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
Guidehorn 18-40 GHz	EMCO	RA42-K-F-4B-C	A00012	04/2015	04/2016
Biconilog Testantenna	Teseq	CBL 6111D	A00466	06/2015	06/2016
2.4 GHz bandreject filter	BSC	XN-1783	A00065	N/A	N/A
Bandpass filter 4-10 GHz	Reactel	7AS-7G-6G-511	A00131	N/A	N/A
Bandpass filter 10-26 GHz	Reactel	9HS-10G/26.5G-S11	A00151	N/A	N/A
Preamplifier 0.5 - 18 GHz	Miteq	AMF-5D-005180-28-13p	A00247	N/A	N/A
Filterbox	EMCS	RFS06S	A00255	08/2014	08/2015

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Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (mm/yyyy)	Calibration due date (mm/yyyy)
For AC Powerline Conducted Emissions					
Pulse limiter	R&S	ESH3-Z2	A00051	01/2015	01/2016
Variac	RFT	LSS020	A00171	NA	NA
LISN	EMCO	3625/2	A00022	01/2014	01/2016
Measurement Receiver	Rohde & Schwarz	ESCS30	A00726	09/2014	09/2015
Shielded room for Conducted emissions	--	--	A00437	NA	NA
Temperature-Humiditymeter	Extech	SD500	A00444/	03/2015	03/2016

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing. NA= Not Applicable

2.3 Measurement Uncertainty

Table 2: Emission Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	±0.5dB
	> 1GHz	±0.7dB
Radiated Emission	150kHz - 30MHz	±5.0dB
	30MHz - 1GHz	±5.0dB
	> 1GHz	±5.5dB
AC Power Line Conducted Emissions	150kHz - 30MHz	±3.5dB

3. General Product Information

3.1 Product Function and Intended Use

The brand Tacx model T2800 Neo, hereafter referred to as EUT, is a transmitter used in an Interactive Smart Trainer with Electric Motor Brake for bicycles to transmit performance data to PC, Tablet or smartphone. The transmitter will support and utilizes GFSK modulation techniques. Although the chip used is capable of multiple data-rates only 1 Mbps is used. The system also incorporates a BLE transceiver but both transmitters never transmit at the same time. The BLE transceiver is covered in a separate testreport.

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

3.2 System Details

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

EUT	:	Digital Transmission System, ANT
Manufacturer	:	Tacx b.v.
Brand	:	Tacx
Model(s)	:	T2800 Neo
Serial Number	:	P140103-1500001 (PCB serial nr-conducted tests) and Unlabeled engineering sample (radiated tests)
Voltage input rating	:	48 Vdc (through AUX3)
Voltage output rating	:	--
Current input rating	:	--
Antenna	:	Internal, integrated on the PCB
Antenna Gain	:	+ 3.3dBi
Operating frequency	:	2403 MHz-2480 MHz.
Modulation	:	GFSK
Data-rate	:	1 Mbps
Remarks	:	n.a.

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Table 3: Interfaces present on the EUT

There are no interface ports present on the EUT.

3.3 Countermeasures to achieve EMC Compliance

No additional measures were employed to achieve compliance.

4. Test Set-up and Operation Modes

4.1 Test Methodology

The test methodology used is based on the requirements of RSS-GEN, RSS-247, 47 CFR Part 15, Sections 15.31, 15.33, 15.35, 15.205, 15.207, 15.209, 15.247.

The test methods, which have been used, are based on ANSI C63.10-2013.

For details, see under each test item.

4.2 Operation Modes

Testing was performed at the lowest operating frequency (2403 MHz), at the operating frequency in the middle of the specified frequency band (2442 MHz) and at the highest operating frequency (2480 MHz). These operation modes were selected after review of the capabilities and characteristics of the EUT. The test software as mentioned in section 4.4 enabled the settings of these modes.

The EUT has been tested in the modes as described in table below

Operation Mode	EUT Status	Frequency (MHz)	TX power
Transmit (Tx)	On	2403	4
Transmit (Tx)	On	2442	4
Transmit (Tx)	On	2480	4

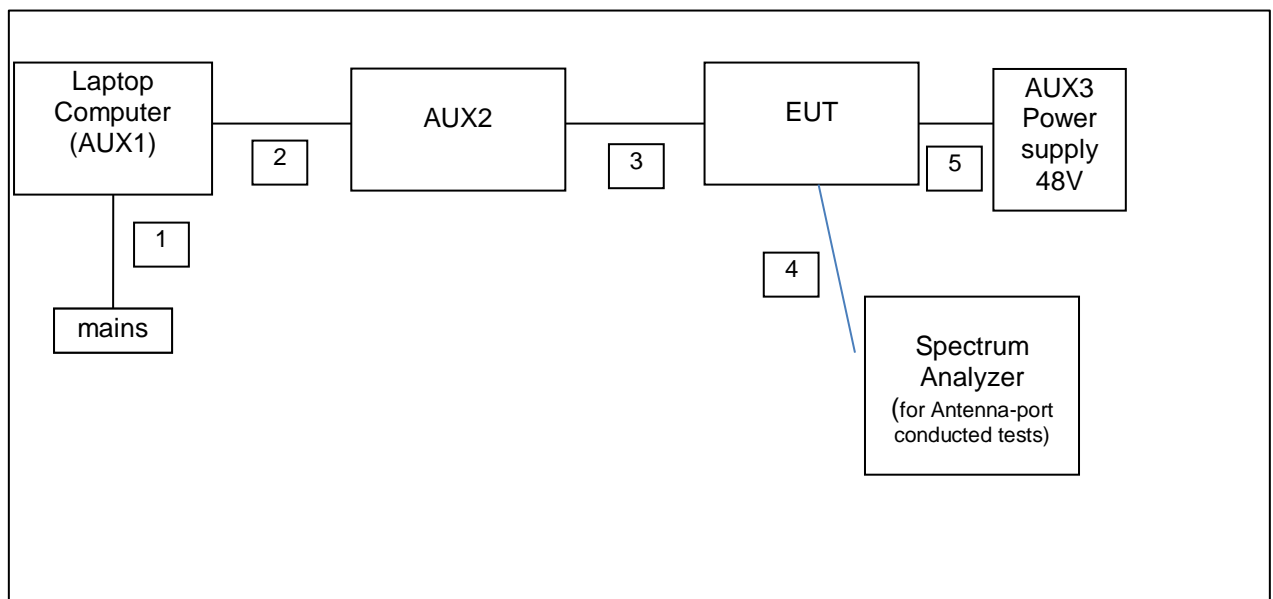
4.3 Physical Configuration for Testing

For programming purposes only the EUT was connected to the usb port of a laptop computer. The laptop computer was used to configure the EUT to continuously transmit at a specified output power and channel as specified in the testdata. See section 4.5 for Auxiliary details.

The EUT was tested on a stand-alone basis and the test system was configured in a way that a load condition was emulated by a bicycle wheel that was spun by a controllable speed.

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.

Figure 1a: Test Setup Diagram – antenna port conducted tests and programming.



No.	Port	From	To	Remarks
1.	Mains	Mains	Laptop (AUX1)	Through a AC/DC power supply
2.	Data com.	Laptop USB	AUX2	--
3.	Data com.	AUX2	EUT	--
4.	Antenna port	EUT	Spectrum analyzer	Conducted tests
5.	Power supply	AUX3	EUT	48 Vdc

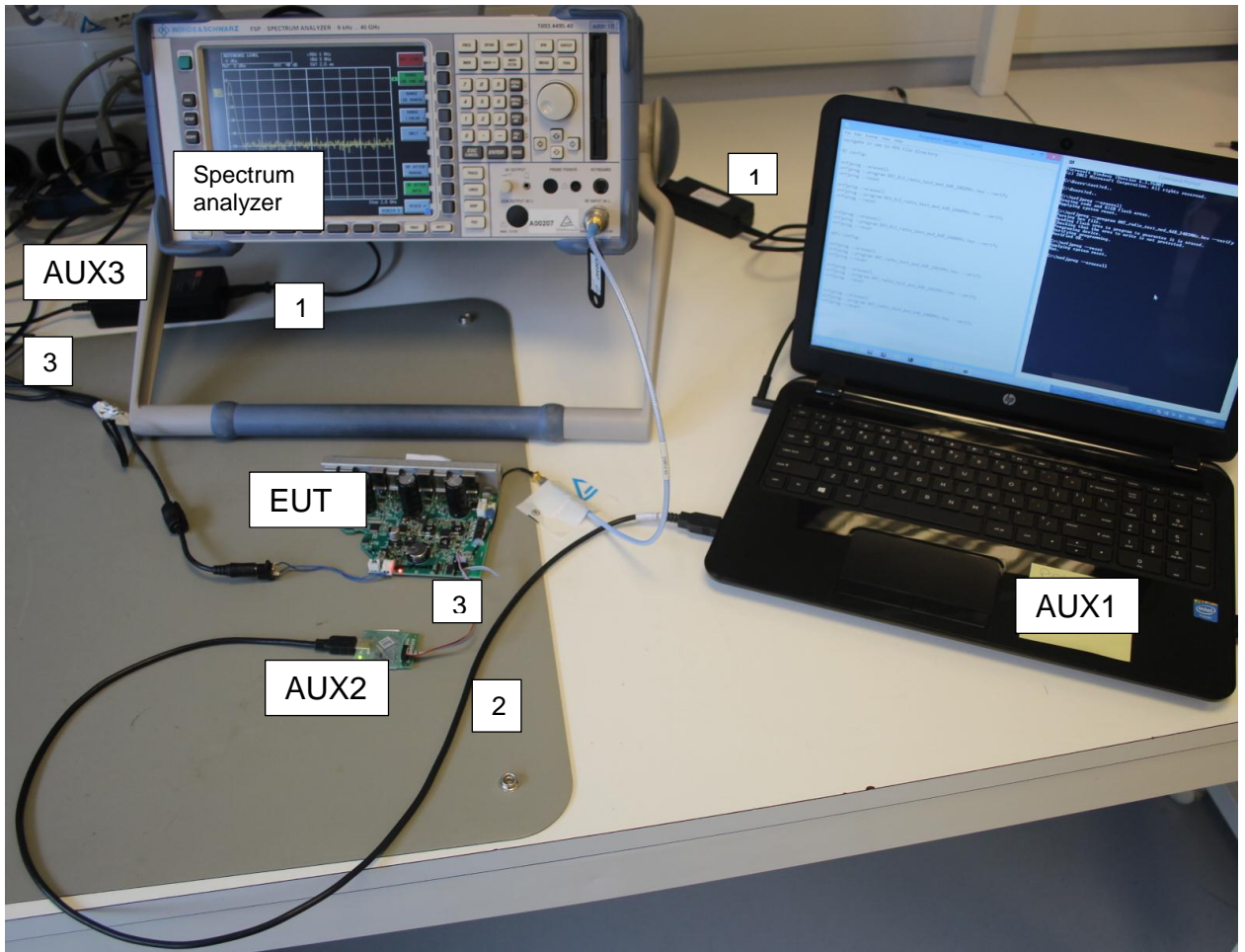
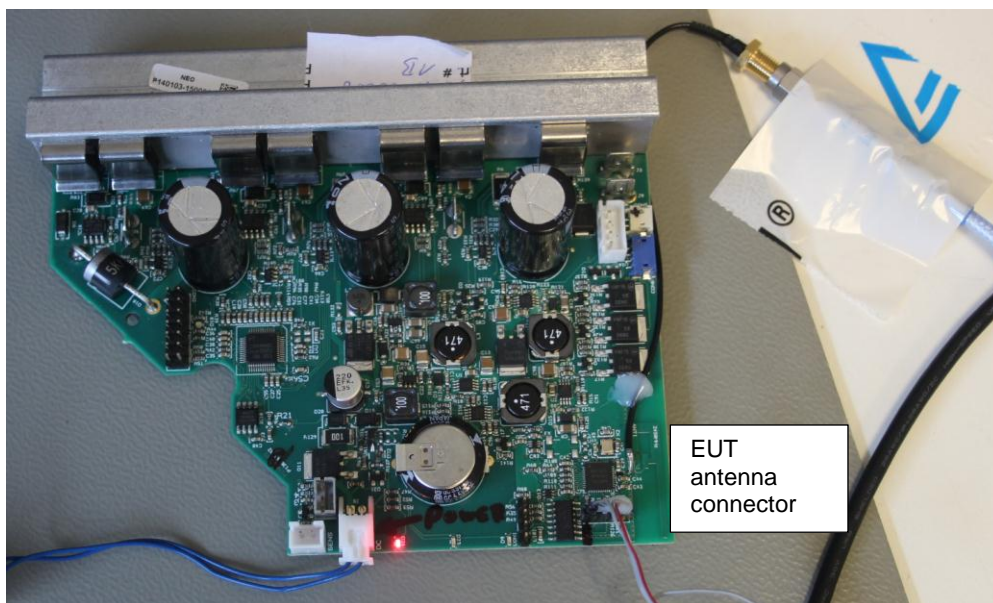


Figure 2b: Test Setup Photos – conducted tests and programming.



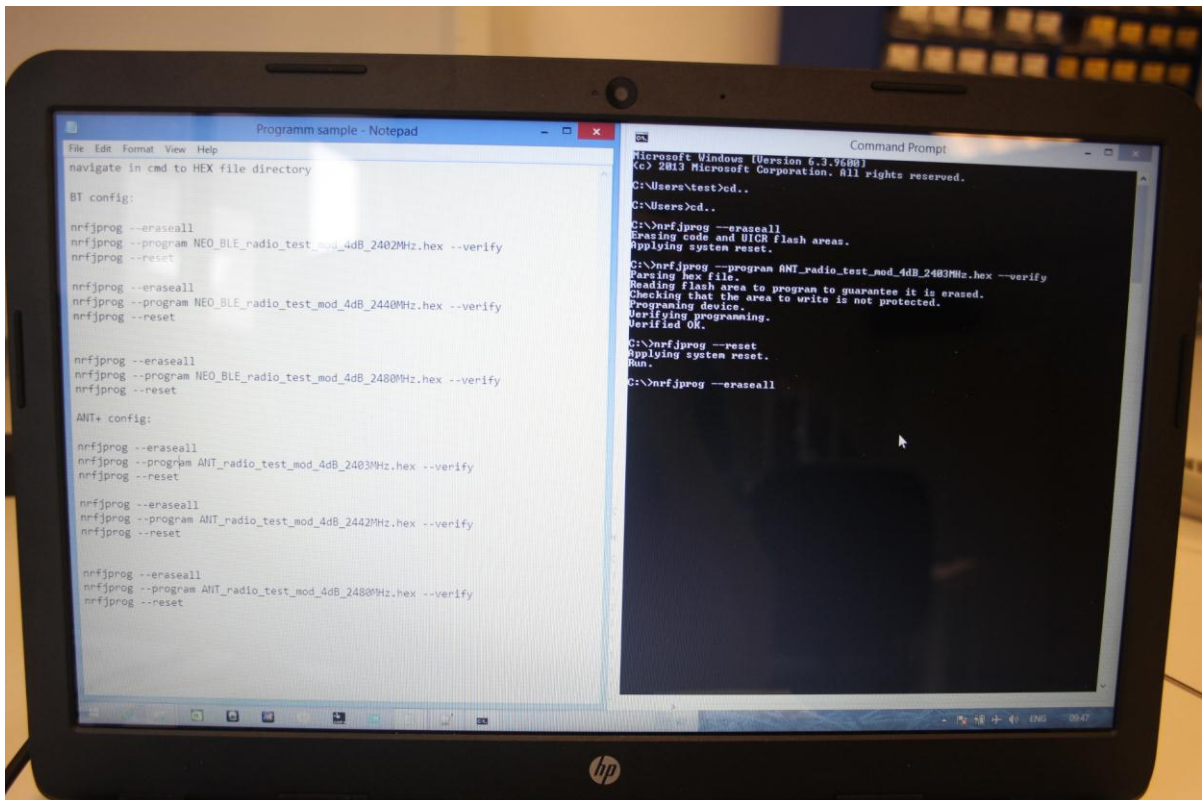
4.4 Test Software

A continuous transmit mode could be initiated by using test software as supplied by the applicant. The test software was used to define various different operational modes of the EUT for the purpose of compliance testing. The version of the test software, as supplied by the applicant and used during all tests is:

Test software : nRFTools v 7.5.1

Batch files programmed by the applicant are used to make the required settings.

This software was running on a laptop computer (AUX1). It was used to enable the test operation modes listed in section 4.2 as appropriate.



Photograph of the software (and settings) as used on AUX1

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4.5 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

The auxiliary items were not used during testing, but instead are only used to make the required settings for testing. For setting the transmit frequency, enable modulation etc.

1. AUX1
Product: Laptop Computer
Brand: HP
Model: 15-r085nd Rev: 2213-100
Serial Number: CND424BVDG
Remark: host for testsoftware, property applicant

2. AUX2
Product: Programming interface
Brand: Segger
Model: J-Link Lite CortexM
Serial Number: --
Remark: property applicant

3. AUX3
Product: Power Supply Adapter
Brand: Mean Well
Model: GSM40B48
Serial Number: EB54F36088
Input voltage: 100 – 240 Vac 50/60 Hz
Output voltage: 48 Vdc
Remark: property applicant

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5. Test Results

5.1 Conducted Measurements at Antenna Port

5.1.1 Conducted Output Power

RESULT: PASS

Date of testing: 2015-07-15

Requirements:

FCC 15.247(b)(3)

For systems using digital modulation in the 2400-2483.5 MHz band, the maximum peak output power is 1W (+30dBm).

RSS-247 section 5.4(4): the e.i.r.p. shall not exceed 4 W (+36 dBm).

Test procedure:

The Peak Conducted Output Power was measured using the method according to section 11.9.1.1 in ANSI C63.10-2013.

The maximum peak output power (conducted) was measured at the antenna connector with a spectrum analyzer. The final measurement takes into account the loss generated by all the involved cables.

Notes: $mW = 10^{(dBm/10)}$
 $dBm = 10 \times \log(mW)$

plots : Peak power plots,

Figures 1a, 1b and 1c show plots of the Peak Power outputs, correction factors (= 0.3dB Cableloss) included in the reading.

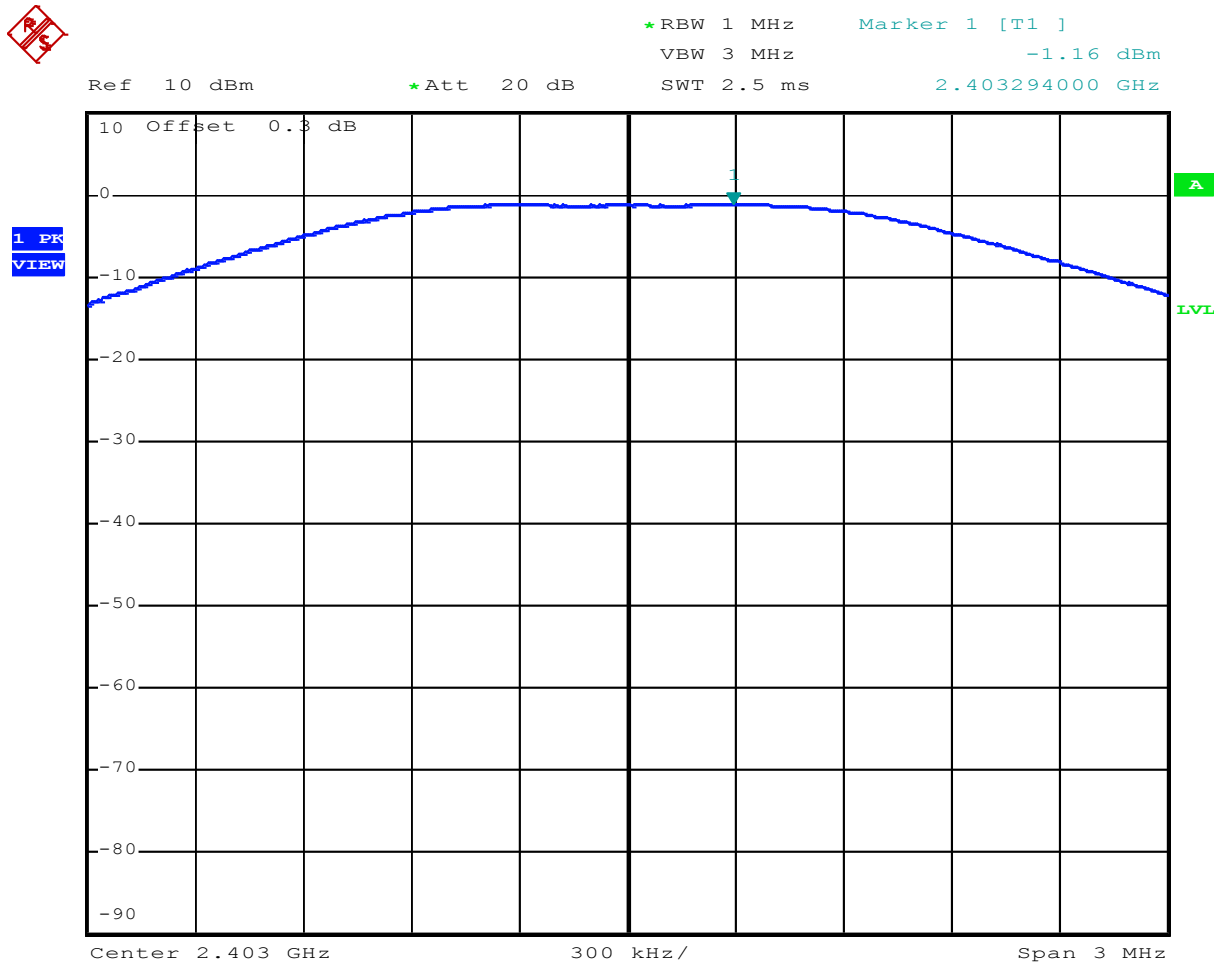
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Conducted Output Power

Frequency [MHz]	Output Power [dBm] (mW)	Limit [dBm]	Verdict [Pass/Fail]	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)	Plot number
2403	-1.16 (0.77mW)	+30	Pass	+3.3	2.14	1.64	1A
2442	-1.17 (0.76 mW)	+30	Pass	+3.3	2.13	1.63	1B
2480	-1.63 (0.69 mW)	+30	Pass	+3.3	1.67	1.47	1C



Date: 15.JUL.2015 11:32:54

Plot A

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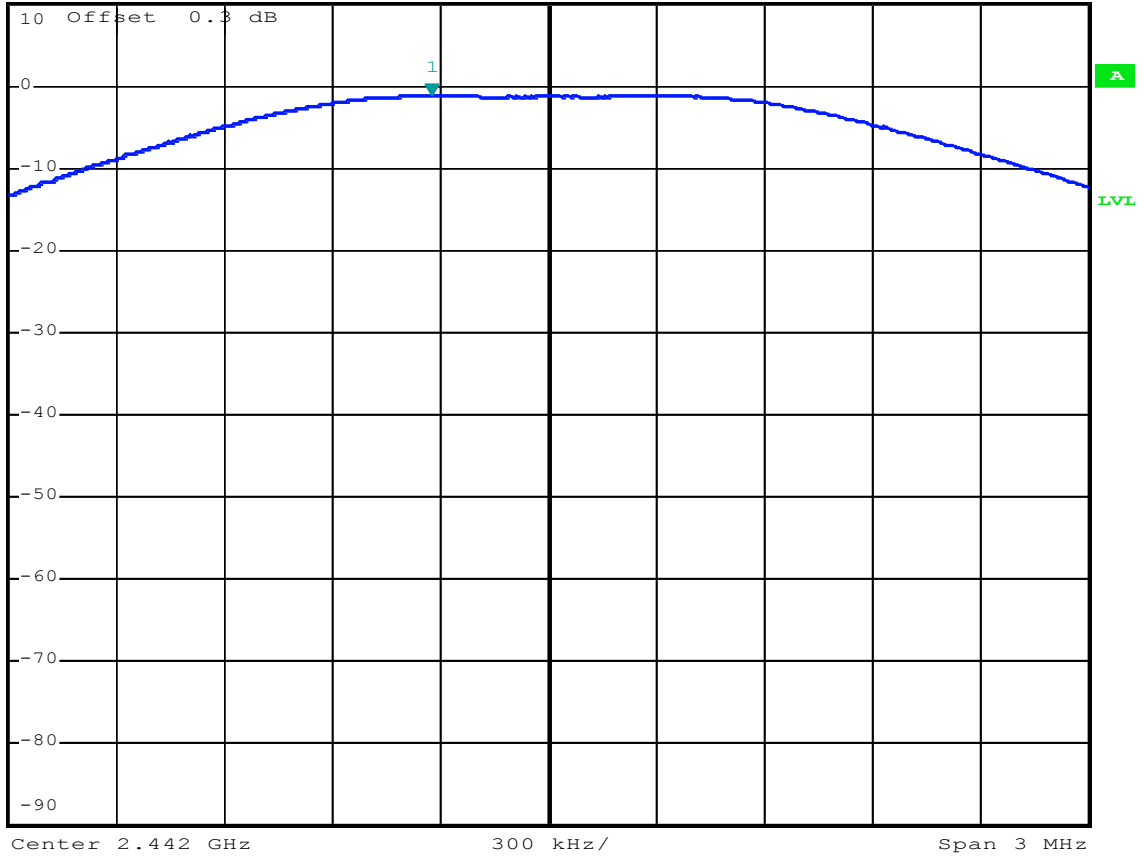


*RBW 1 MHz Marker 1 [T1]
VBW 3 MHz -1.17 dBm
SWT 2.5 ms 2.441676000 GHz

Ref 10 dBm

*Att 20 dB

1 PK
VIEW



Date: 15.JUL.2015 11:31:37

Plot B

Test Report No.:

15050601.fcc01

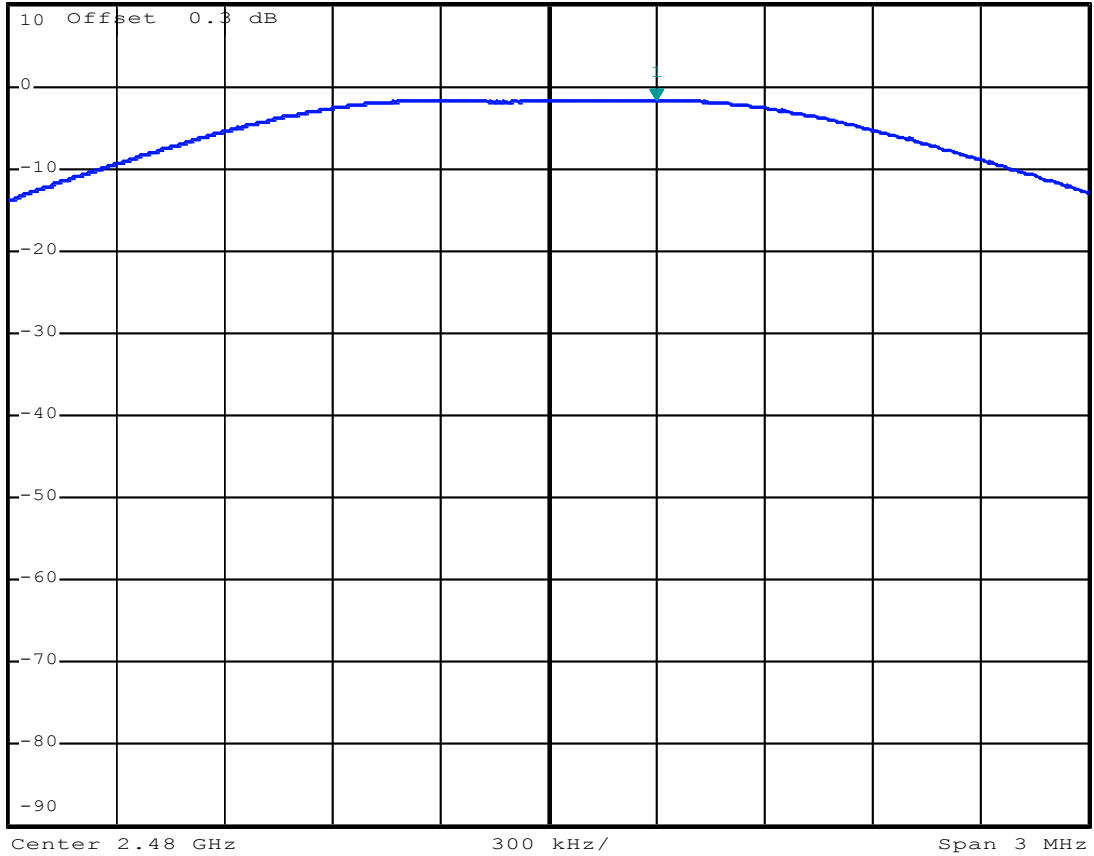
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*RBW 1 MHz Marker 1 [T1]
VBW 3 MHz -1.63 dBm
SWT 2.5 ms 2.480300000 GHz

Ref 10 dBm

*Att 20 dB



Date: 15.JUL.2015 11:30:09

Plot C

Test Report No.:

15050601.fcc01

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5.1.2 6dB and 99% Bandwidth

RESULT: PASS

Date of testing: 2015-07-15

Requirements:

FCC 15.247(a)(2) and RSS-247 Section 5.2(1)

For systems using digital modulation in the 2400-2483.5MHz band, the 6dB bandwidth shall be at least 500kHz.

For 99% Bandwidth: RSS-Gen Section 4.6.1: No requirement is given.

Test procedure 6dB bandwidth:

ANSI C63.10-2013 section 11.8.1 Option 1

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 100kHz, video bandwidth to 300kHz and the span wide enough to capture the modulated carrier.

For 99% Bandwidth:

RSS-Gen.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 1% of the selected span, Video bandwidth was set to 3 times the resolution bandwidth. The span was set to capture the whole modulation process. The Spectrum analyzers automated function for 99% BW was used.

Plots A1,B1 and C1 shown on the next pages are of the 6 dB bandwidth.

Plots A2,B2 and C2 shown on the next pages are of the 99% bandwidth

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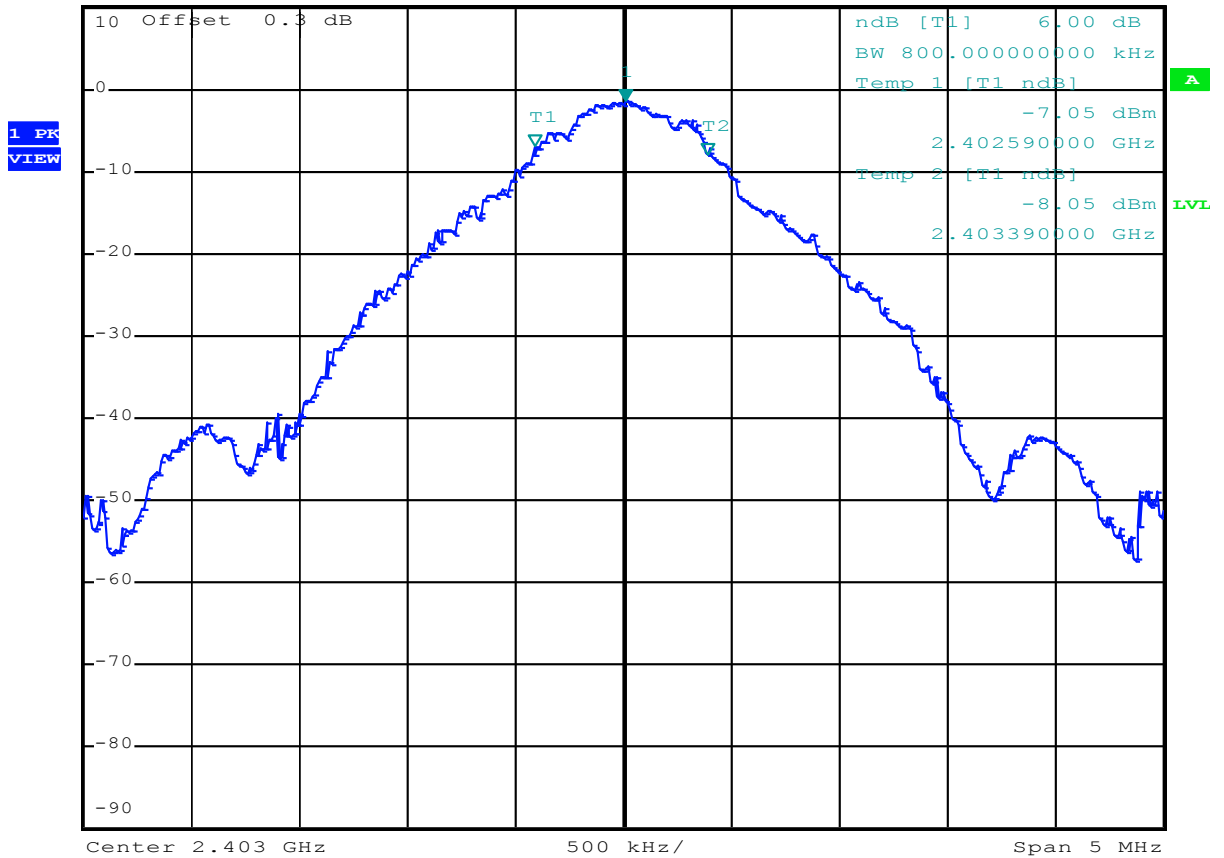
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6dB Bandwidth

Operating Frequency [MHz]	99% Bandwidth [kHz]	6dB Bandwidth [kHz]	Limit [kHz]	Verdict [Pass/Fail]	Plot number
2403	1770.0	800.0	>500	Pass	A1/A2
2442	1780.0	780.0	>500	Pass	B1/B2
2480	1830.0	790.0	>500	Pass	C1/C2



*RBW 100 kHz Marker 1 [T1]
 VBW 300 kHz -1.47 dBm
 Ref 10 dBm *Att 20 dB SWT 2.5 ms 2.403010000 GHz



Date: 15.JUL.2015 11:20:04

Plot A1

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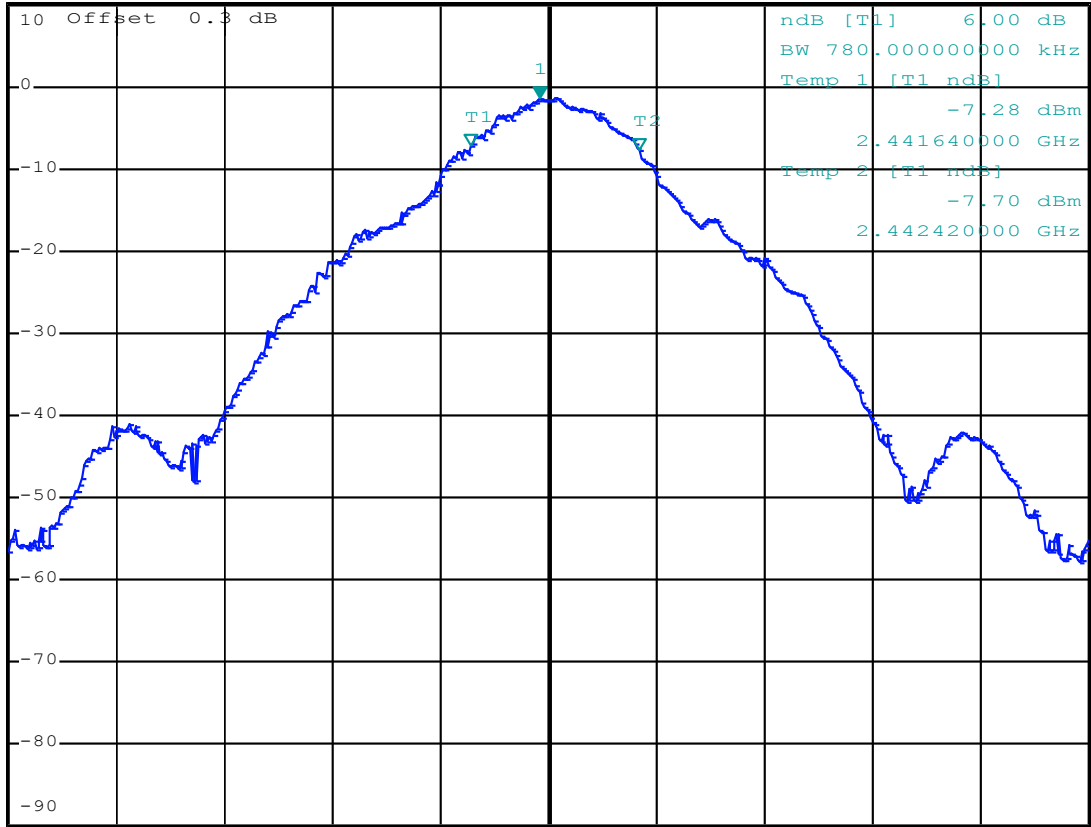
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*RBW 100 kHz Marker 1 [T1] -1.43 dBm
VBW 300 kHz
SWT 2.5 ms 2.441960000 GHz

Ref 10 dBm *Att 20 dB

1 PK
VIEW



Center 2.442 GHz

500 kHz/

Span 5 MHz

Date: 15.JUL.2015 11:23:52

Plot B1

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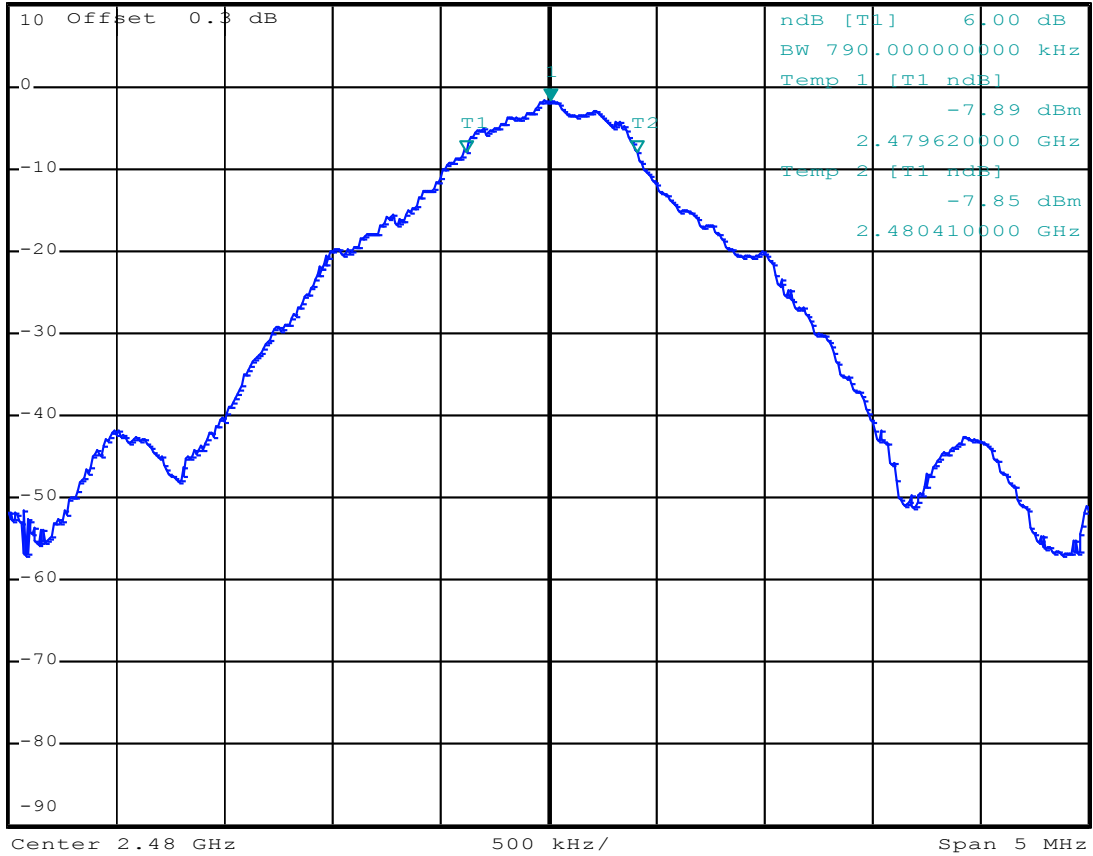


*RBW 100 kHz Marker 1 [T1]
 VBW 300 kHz -1.78 dBm
 SWT 2.5 ms 2.480010000 GHz

Ref 10 dBm

*Att 20 dB

1 PK
 VIEW



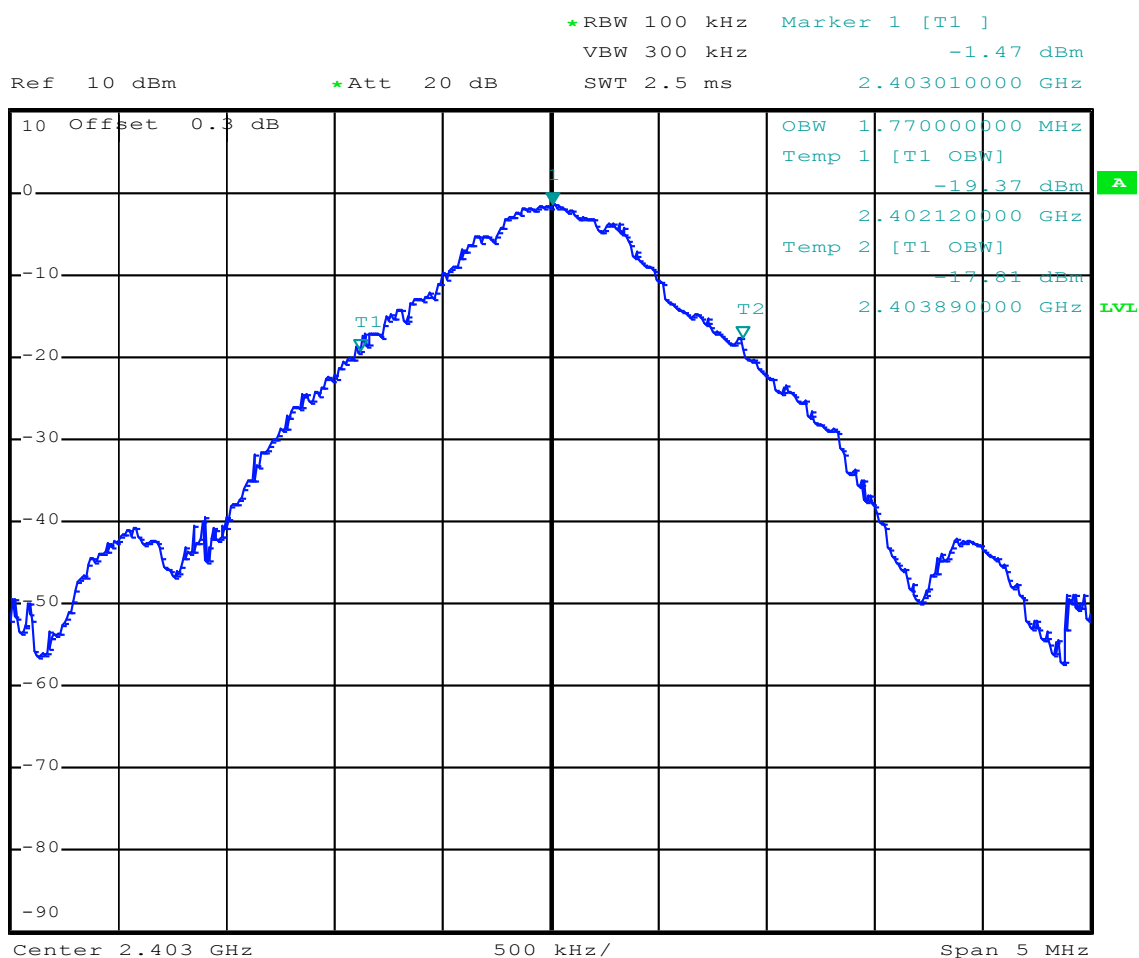
Date: 15.JUL.2015 11:26:50

Plot C1

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Date: 15.JUL.2015 11:21:22

Plot A2

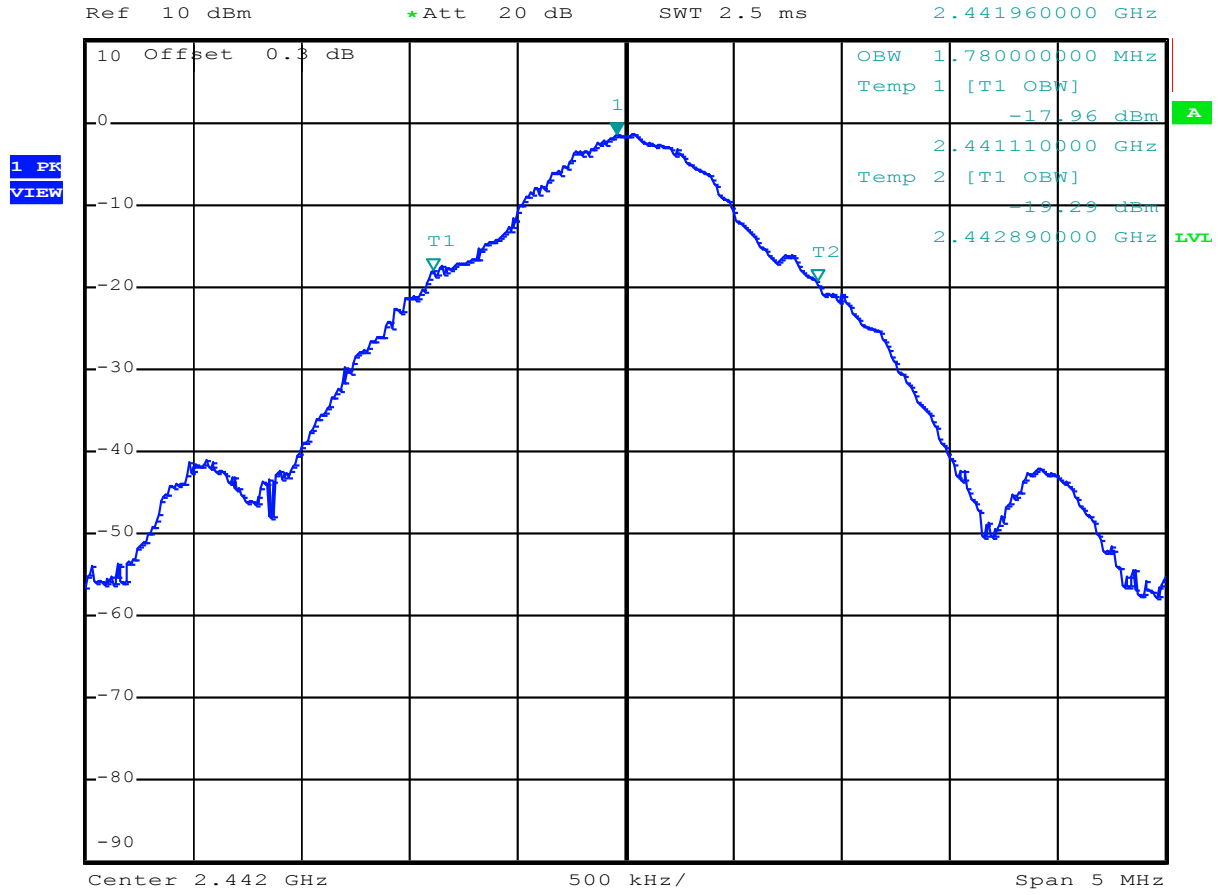
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*RBW 100 kHz Marker 1 [T1]
 VBW 300 kHz -1.43 dBm
 SWT 2.5 ms 2.441960000 GHz



Date: 15.JUL.2015 11:24:42

Plot B2

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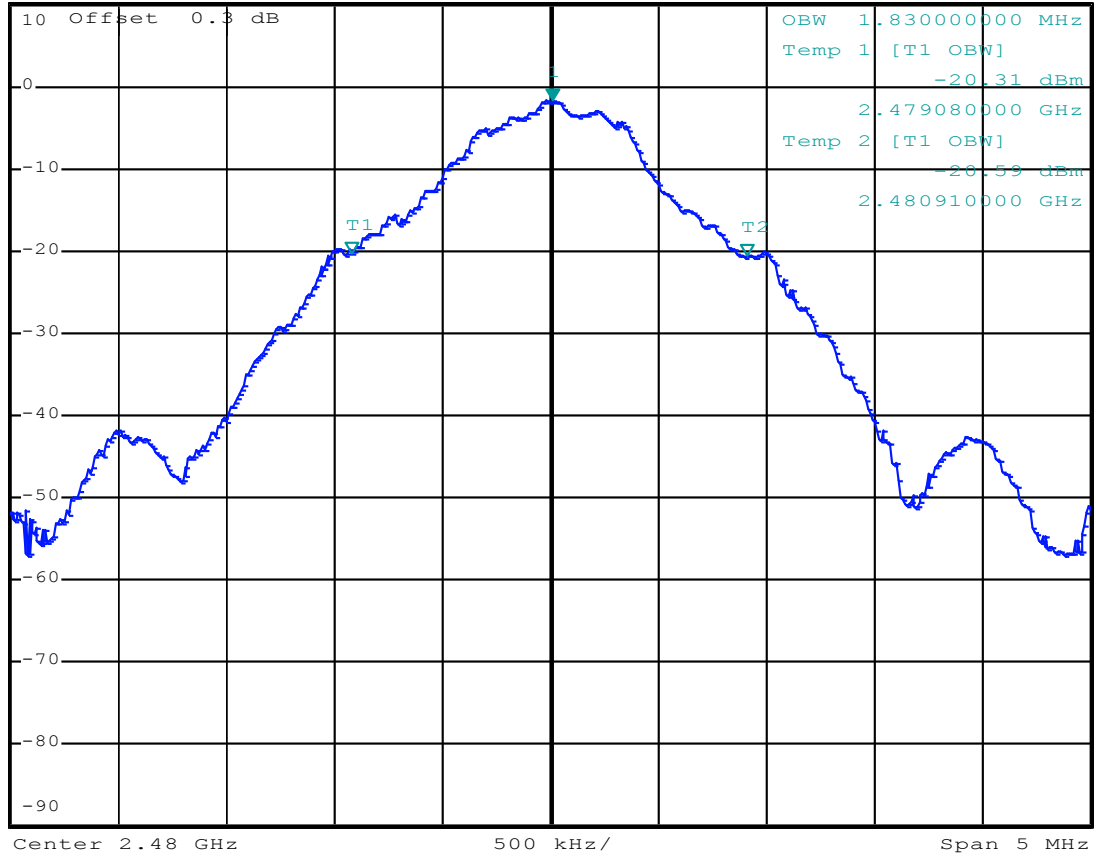


*RBW 100 kHz Marker 1 [T1]
VBW 300 kHz -1.78 dBm
SWT 2.5 ms 2.480010000 GHz

Ref 10 dBm

*Att 20 dB

1 PK
VIEW



Date: 15.JUL.2015 11:27:42

Plot C2

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5.1.3 Peak Power Spectral Density

RESULT: PASS

Date of testing: 2015-07-15

Requirements:

FCC 15.247(e) and RSS-247 section 5.2(2)

For digitally modulated systems, the power spectral density (PSD) conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

Test procedure:

ANSI C63.10-2013

The section 11.10.2 PKPSD peak PSD procedure was used. A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth was set to 3kHz and the video bandwidth was set to 10kHz. The sweep time was set to auto couple and the trace was allowed to stabilize before making the final measurement. By using the Peak marker function the maximum amplitude was determined. The final measurement takes into account the loss generated by all the involved cables (0.3 dB).

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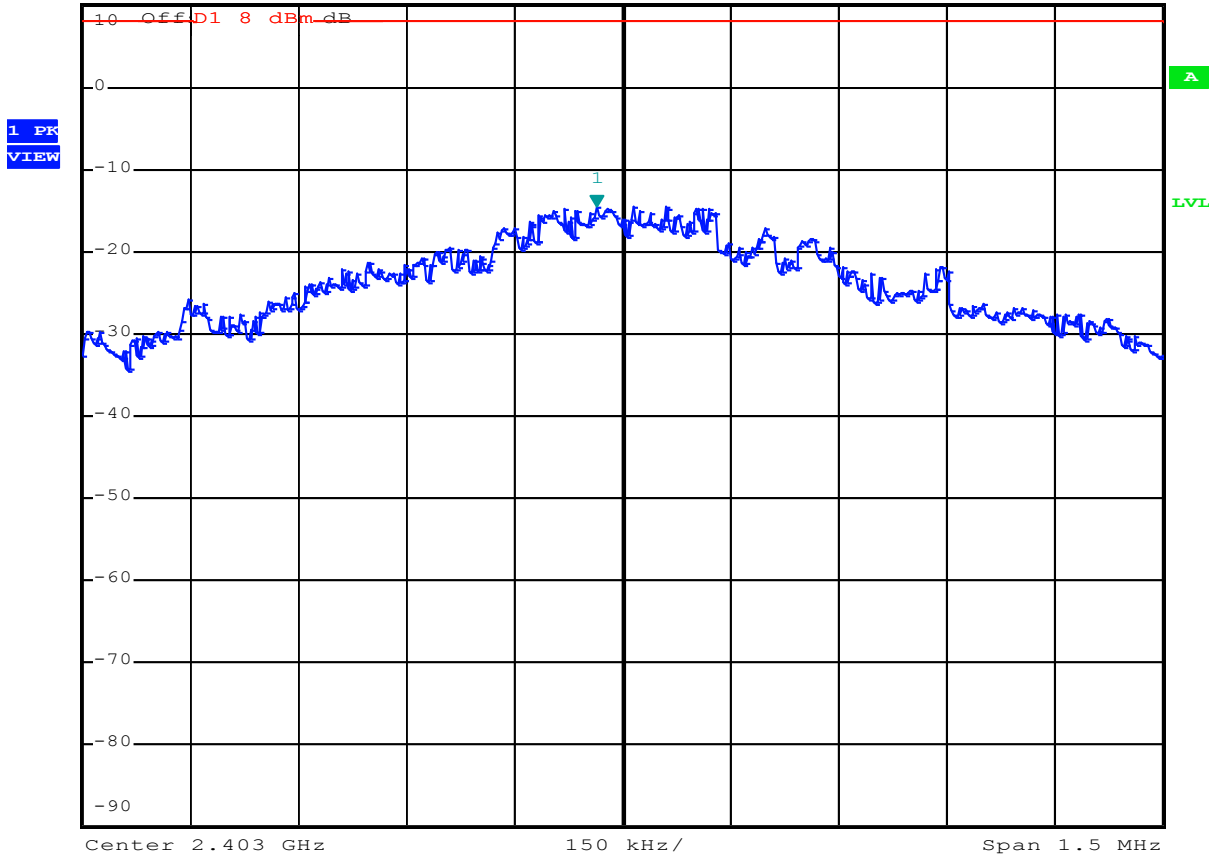
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Peak Power Spectral Density

Operating Frequency [MHz]	Max PSD [dBm]	Limit [dBm]	Verdict [Pass/Fail]	Plot
2403	-14.54	8	Pass	A
2442	-12.37	8	Pass	B
2480	-13.39	8	Pass	C



*RBW 3 kHz Marker 1 [T1]
 VBW 10 kHz -14.54 dBm
 Ref 10 dBm *Att 20 dB SWT 170 ms 2.402964000 GHz



Date: 15.JUL.2015 11:40:14

Plot A

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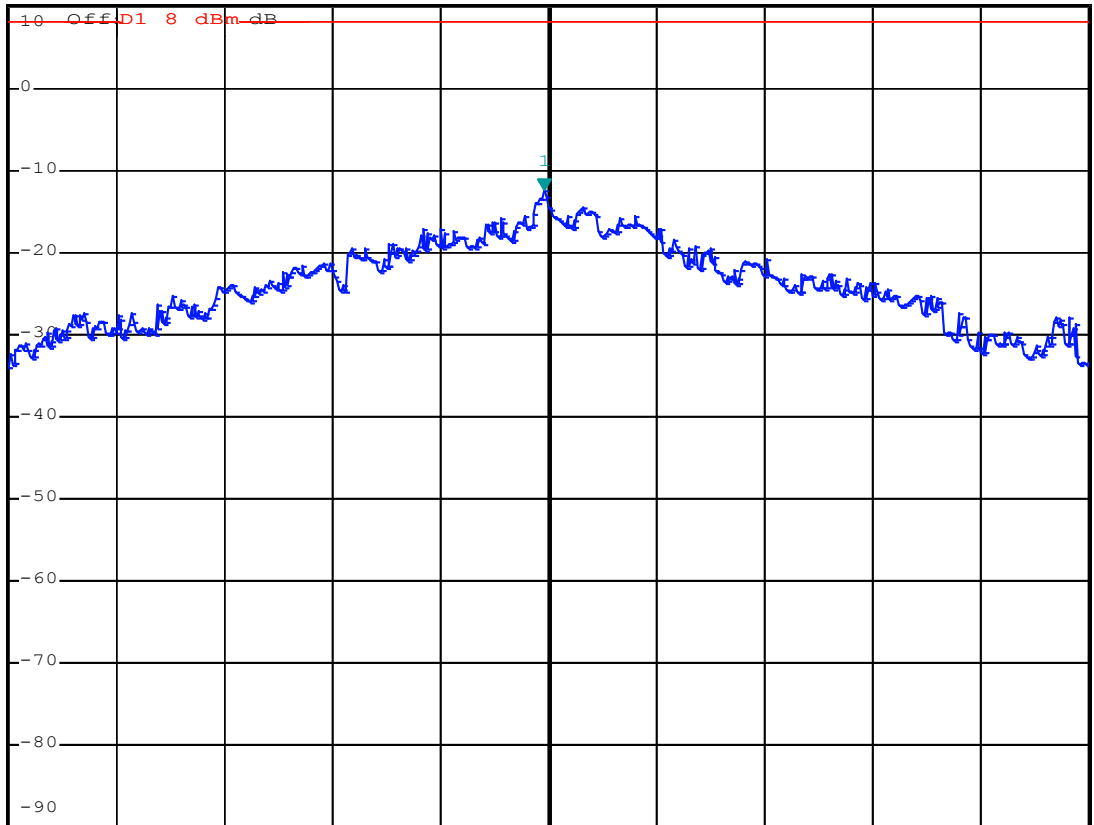


*RBW 3 kHz Marker 1 [T1]
VBW 10 kHz -12.37 dBm
SWT 170 ms 2.441994000 GHz

Ref 10 dBm

*Att 20 dB

1 PK
VIEW



Center 2.442 GHz 150 kHz/ Span 1.5 MHz

Date: 15.JUL.2015 11:41:33

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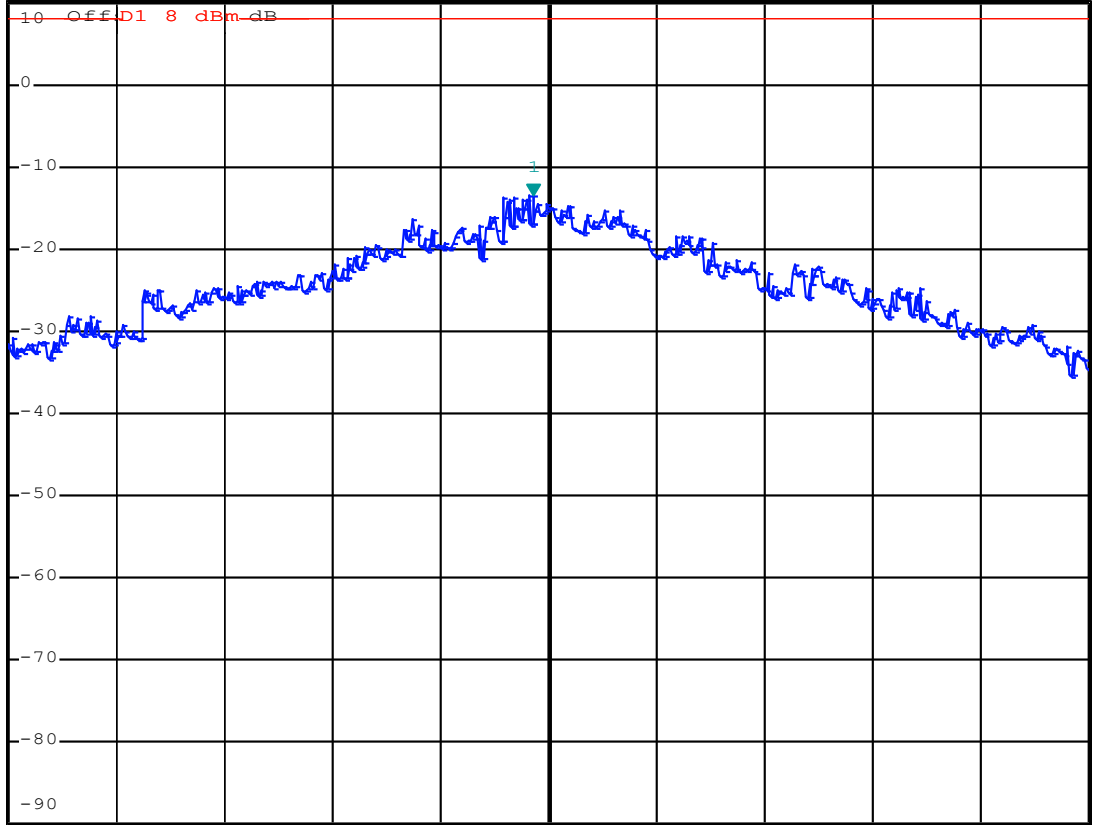


*RBW 3 kHz Marker 1 [T1]
VBW 10 kHz -13.39 dBm
SWT 170 ms 2.479979000 GHz

Ref 10 dBm

*Att 20 dB

1 PK
VIEW



Center 2.48 GHz

150 kHz/

Span 1.5 MHz

Date: 15.JUL.2015 11:42:49

Plot C

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5.1.4 Band Edge Conducted Emissions

RESULT: Pass

Date of testing: 2015-07-15

Requirements:

FCC 15.205, FCC 15.209, 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
Section 11.13

The marker-delta method, as described in ANSI C63.10 was used.

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 the figures on the following pages.

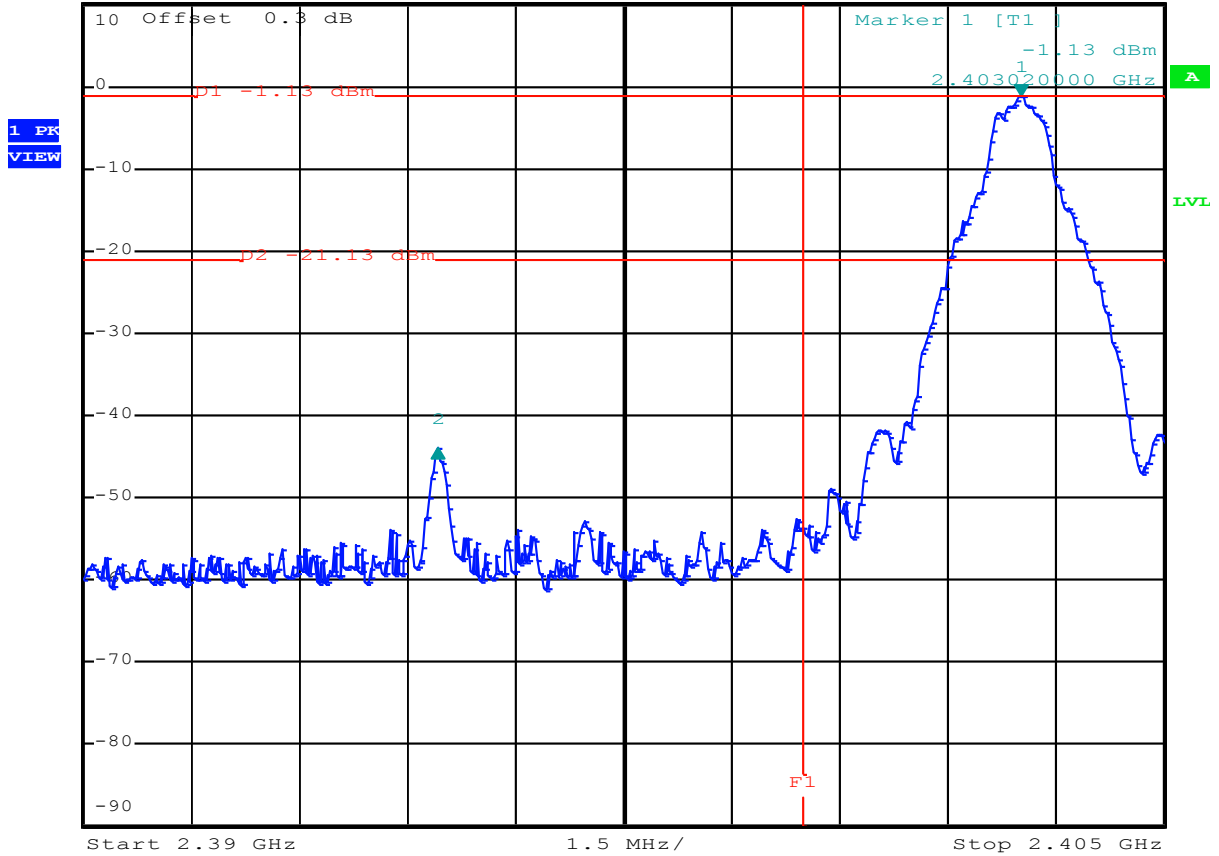
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Ref 10 dBm *Att 20 dB *RBW 100 kHz Delta 2 [T1]
VBW 300 kHz -42.69 dB
SWT 2.5 ms -8.100000000 MHz



Date: 15.JUL.2015 11:48:29

Plot: Band Edge Conducted Emission, Spectral Diagram, 2403 MHz

Plot showing more than 20 dB band edge attenuation.

F1 shows the band edge frequency of 2400 MHz.

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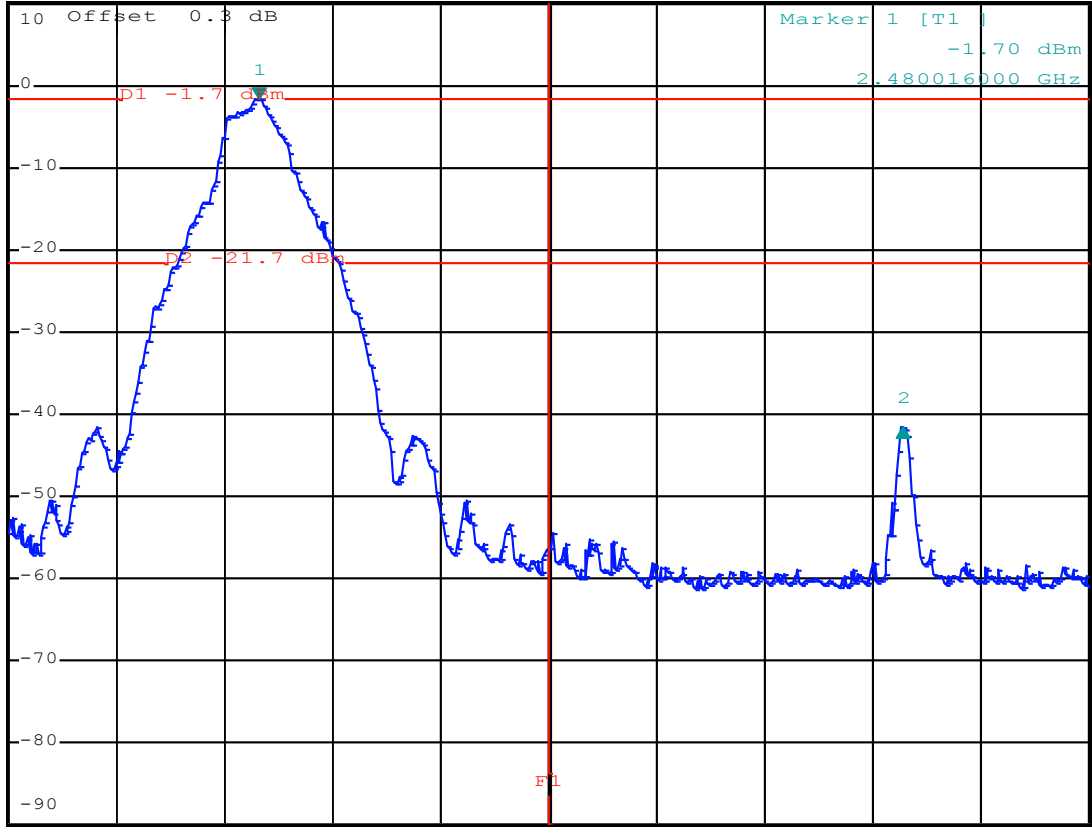


*RBW 100 kHz Delta 2 [T1]
VBW 300 kHz -39.88 dB
SWT 2.5 ms 7.748000000 MHz

Ref 10 dBm

*Att 20 dB

1 PK
VIEW



Start 2.477 GHz

1.3 MHz/

Stop 2.49 GHz

Date: 15.JUL.2015 11:51:27

Plot: Band Edge Conducted Emission, Spectral Diagram, 2480 MHz.
Plot showing more than 20 dB band edge attenuation.
F1 shows the band edge frequency of 2483.5 MHz.

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5.1.5 Radiated Spurious Emissions of Transmitter

RESULT: Pass

Date of testing: 2015-07-23

Frequency range: 30MHz - 25GHz

Requirements:

FCC 15.209 and FCC 15.247(d) and RSS-Gen

Radiated emissions which fall outside the operation frequency band and outside restricted bands shall either meet the limit specified in FCC 15.209(a) or be attenuated at least 20dB below the power level in the 100kHz bandwidth within the band that contains the highest level of the desired power (the less severe limit applies).

Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and RSS-Gen Table 6, must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen Table 4.

Test procedure:

ANSI C63.10-2013

The EUT is considered as floor-standing equipment not typically installed with its base in direct electrical contact with, or connected to, a metal floor or grid. The EUT was placed on the test site turntable with insulation material in-between of 4mm thickness to prevent electric contact.

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 levels are expressed in dBm which are derived from $\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}$. Where Peak (Pk) values were at least 6 dB under the Average (Av) limits, Av value was not tested. Where Average values were tested, Average values were measured using a 10Hz Video Bandwidth.

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Radiated Emissions, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations

Frequency [MHz]	Antenna Orientation	Level QP [dB μ V/m]	Limit QP [dB μ V/m]	Verdict [Pass/Fail]
50.000	Horizontal	22.0	40.0	Pass
204.00	Vertical	24.0	40.0	Pass
381.14	Horizontal	30.4	43.5	Pass
608.12	Horizontal	36.1	43.5	Pass
887.68	Vertical	43.0	46.0	Pass
965.08 (noise)	Vertical	43.0	46.0	Pass

Note: - Level QP = Reading QP + Factor
- Tested in modes as described in section 4.2, the 6 highest values noted.
Preliminary measurements indicated that the radiated emissions from EUT were not affected by the EUT's operating mode or frequency.
- Quasi Peak detector used with a bandwidth of 120 kHz.

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Radiated Emissions, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, 2403 MHz.

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBm]	Limit [dBm]	Result
1440.8 ^{*R}	Vertical	Pk	1	-58.5	-41.2 (Av) -21.2 (Pk)	Pass
2316.2 ^{*R}	Vertical	Pk	1	-50.4	-41.2 (Av) -21.2 (Pk)	Pass
4806.0 ^{*H^R}	Vertical	Pk	1	-57.6	-41.2 (Av) -21.2 (Pk)	Pass
7210.0 ^{*H}	Vertical	Pk	1	-56.8	-41.2 (Av) -21.2 (Pk)	Pass
9612.0 ^{*H}	Vertical	Pk	1	-51.7	-41.2 (Av) -21.2 (Pk)	Pass
9753.0	Vertical	Pk	1	-51.7	-41.2 (Av) -21.2 (Pk)	Pass

Radiated Emissions, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, 2442 MHz.

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBm]	Limit [dBm]	Result
1441.8 ^{*R}	Horizontal	Pk	1	-59.7	-41.2 (Av) -21.2 (Pk)	Pass
4884.0 ^{*H^R}	Vertical	Pk	1	-58.8	-41.2 (Av) -21.2 (Pk)	Pass
7826	Vertical	Pk	1	-55.8	-41.2 (Av) -21.2 (Pk)	Pass
9727	Vertical	Pk	1	-54.0	-41.2 (Av) -21.2 (Pk)	Pass
11603 ^{*R}	Vertical	Pk	1	-49.2	-41.2 (Av) -21.2 (Pk)	Pass

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Radiated Emissions, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, 2480 MHz.

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBm]	Limit [dBm]	Result
1439.6 ^{*R}	Horizontal	Pk	1	-59.5	-41.2 (Av) -21.2 (Pk)	Pass
3710 ^{*R}	Horizontal	Pk	1	-62.2	-41.2 (Av) -21.2 (Pk)	Pass
4960 ^{*H+R}	Vertical	Pk	1	-59.4	-41.2 (Av) -21.2 (Pk)	Pass
7452.0 ^{*H+R}	Vertical	Pk	1	-57.8	-41.2 (Av) -21.2 (Pk)	Pass
9920.2 ^{*H}	Vertical	Pk	1	-54.9	-41.2 (Av) -21.2 (Pk)	Pass
11654.8 ^{*R}	Vertical	Pk	1	-48.7	-41.2 (Av) -21.2 (Pk)	Pass

Radiated field strength measurements (1 - 25 GHz, E-field), EUT normal operation

Frequency [MHz]	Antenna Orientation	Detector	Resolution Bandwidth (MHz)	Level [dBm]	Limit [dBm]	Result
4810 ^{*R}	Horizontal	Peak	1	-56.4	-41.2 Av -21.2 Pk	Pass
4884 ^{*R}	Horizontal	Peak	1	-56.2	-41.2 Av -21.2 Pk	Pass
4921 ^{*H+R}	Vertical	Peak	1	-57.1	-41.2 Av -21.2 Pk	Pass
4960 ^{*H+R}	Vertical	Peak	1	-58.4	-41.2 Av -21.2 Pk	Pass
9612	Vertical	Peak	1	-52.0	-41.2 Av -21.2 Pk	Pass
14731 ^{*H}	Vertical	Peak	1	-47.0	-41.2 Av -21.2 Pk	Pass

- Notes:
- *R refers to a frequency in a restricted band,
 - *H refers to a frequency which is a harmonic of the fundamental.
 - Both transmitters were transmitting at the same time.
 - Field strength values of radiated emissions not listed in the tables above are more than 20 dB below the applicable limit.

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5.2 AC Power Line Conducted Measurements

RESULT: Pass.

Date of testing: 2015-08-12

Requirements: for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency of Emission (MHz)	Conducted Limit (dB μ V) Quasi-Peak	Conducted Limit (dB μ V) 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 μ H / 50 Ω LISN. The frequency range from 150kHz to 30MHz was searched. The six highest EUT emissions relative to the limit were noted. The EUT is considered a floor-standing device. The EUT is placed on a non-conductive plate of 5mm thick above the ground plane, so to isolate it from the ground plane because the EUT normally does not make electrical contact with a ground plane. The EUT was positioned at least 80cm from the LISN. The power cable was routed over the non-conductive plate to the LISN.

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5.2.1 AC Power Line Conducted Emission of Transmitter

Frequency (MHz)	Measurement results (dBµV) L1		Measurement results (dBµV) L2/Neutral		Limits (dBµV)		Verdict (Pass/Fail)
	QP	AV	QP	AV	QP	AV	
0.15000	43.8	30.0	42.0	30.0	66.0	56.0	Pass
0.21000	40.0	30.0	41.1	34.2	63.2	53.2	Pass
0.35000	46.3	38.5	45.3	34.4	59.0	49.0	Pass
0.78500	39.4	30.3	33.6	28.9	56.0	46.0	Pass
1.03000	36.4	31.0	35.1	30.3	56.0	46.0	Pass
2.80500	30.0	25.0	33.6	28.8	56.0	46.0	Pass
9.86000	36.2	31.8	38.8	34.1	60.0	50.0	Pass

The results of the AC power line conducted emission tests, carried out in accordance with 47 CFR Part 15 section 15.207(a) and RS-Gen section 8.8, at the 120 Volts/ 60 Hz AC mains connection terminals of the EUT, are depicted in the table above.

Notes:

1. The resolution bandwidth used was 9 kHz.
2. From pre-test the worst case configuration proved to be the normal operation mode wherein both DTS transmitter and Bluetooth were operational. Worst case values noted.
3. Plots are provided on the next pages.

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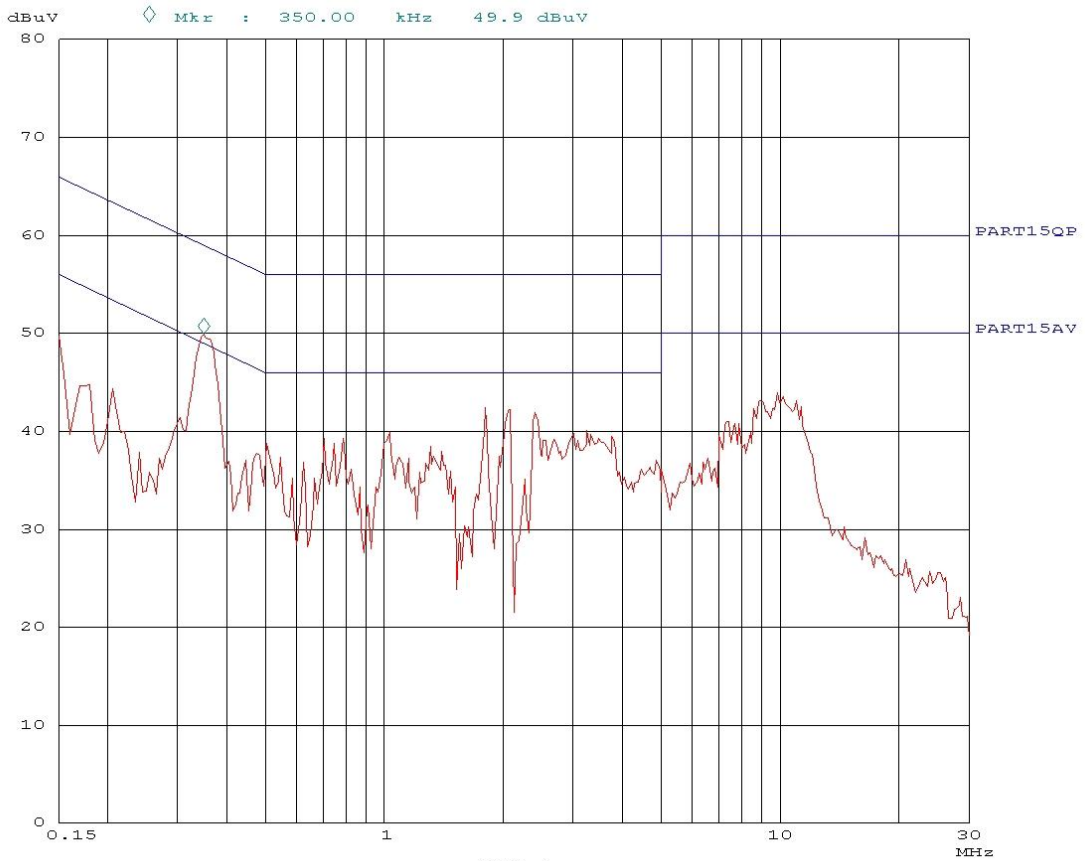
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5.2.2 Plots of the AC Power-line Conducted Emissions

12. Aug 15 15:50

```
Scan Settings (1 Range)
|----- Frequencies -----|----- Receiver Settings -----|
Start      Stop      Step      IF BW  Detector  M-Time  Atten  Preamp
150k       30M       5k        9k     PK        20ms   OdBLN  OFF

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



Plot of the AC Power-line Conducted emissions on L1

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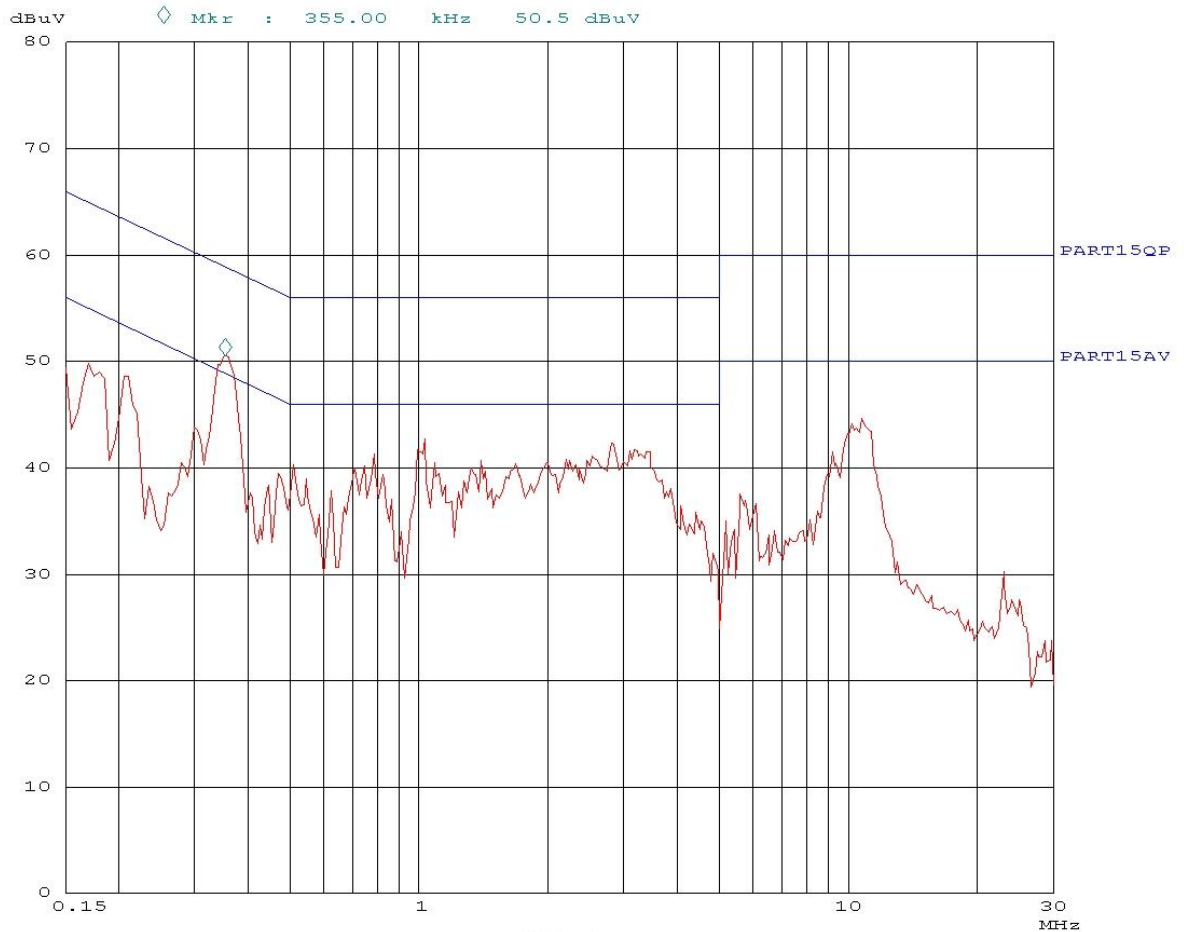
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12. Aug 15 15:59

```
Scan Settings (1 Range)
|----- Frequencies -----|----- Receiver Settings -----|
  Start      Stop      Step      IF BW  Detector  M-Time  Atten  Preamp
  150k       30M       5k       9k     PK        20ms   OdBLN  OFF

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



Plot of the AC Power-line Conducted emissions on L2

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End of report