

**TEST REPORT CONCERNING THE COMPLIANCE OF A
Low Power Communication Device Transmitter (DXX)
OPERATING IN THE FREQUENCYRANGE
2402 – 2480 MHz,
BRAND MEDTRONIC , MODEL TM90
MODELNAME: Communicator
WITH 47 CFR PART 15 (10-1-16 Edition) and
RSS-Gen (Issue 4, November 2014) and
RSS-210 (Issue 9, August 2016)**

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MEASUREMENT/TECHNICAL REPORT

Brand: Medtronic
Model: TM90
Modelname: Communicator

FCC ID: LF5TM90
IC: 3408D-TM90

This report concerns:	Original grant, certification / Limited Single Modular Approval Class 2 change Verification	
Equipment type:	Low Power Communication Device Transmitter (DXX)	
Report prepared by:	Name	: Richard van der Meer
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The data taken for this test and report herein was done in accordance with 47 CFR Part 15 (10-1-16 Edition), RSS-Gen (Issue 4, November 2014) and RSS-210 (Issue 9, August December 2016) and the measurement procedures of ANSI C63.10-2013. 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: November 16, 2017

Signature:



E. van der Wal
Senior Engineer 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

EUT : Low Power Communication Device Transmitter (DXX)
Manufacturer : Medtronic, Inc.
Brand : Medtronic
Model : TM90
Modelname : Communicator
Serial Number : EUT1 N (Normal Operation- 20:5B:2A:47:09:8B) and EUT2(-)

Applicant information

Applicant's representative : Guillaume Girard
Company : Medtronic, Inc.
Address : 710 Medtronic Parkway NE
Postal code : 55432
City : Minneapolis MN
Country : USA
Telephone number : Office 763.526.0652 | Mobile 612.991.3108
Telefax number : -
Email : g.guillaume@medtronic.com

Test(s) performed

Location : Leek
Test(s) started : May 19, 2017
Test(s) completed : June 27, 2017
Purpose of test(s) : Equipment Authorization (Original grant/certification)

Test specification(s) : 47 CFR Part 15, Subpart C, Section 15.249 (10-1-16 Edition) and
RSS-GEN (ISSUE 4, NOVEMBER 2014) AND
RSS-210 (ISSUE 9, AUGUST 2016).

Test engineer(s) : R. van der Meer



Report written by : R. van der Meer

Report date : November 16, 2017

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The test results relate only to the item(s) tested.

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1 General information.

1.1 Product description.

The brand Medtronic, Model TM90, Modelname Communicator, hereafter referred to as EUT, is a Low Power Communication Device Transmitter (DXX). The EUT is factory configured for the 2402-2480 MHz band (BLE). The EUT also contains a transmitter operating on 175 kHz, although the two transmitters never transmit at the same time. The 175 kHz transmitter is covered in a separate report.

1.1.1 Introduction.

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 grant/certification in equipment authorization files under:
 FCC ID: LF5TM90 and IC: 3408D-TM90.

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	:	Low Power Communication Device Transmitter (DXX)
Manufacturer	:	Medtronic, Inc.
Brand	:	Medtronic
Model(s)	:	TM90
Modelname	:	Communicator
Serial Number	:	EUT1 N (Normal Operation- 20:5B:2A:47:09:8B) and EUT2(-)
Voltage input rating	:	5 Vdc
Voltage output rating	:	--
Current input rating	:	--
Antenna	:	Internal, integrated on the PCB
Antenna Gain	:	+ 1 dBi
Operating frequency	:	2402 MHz-2480 MHz.
Modulation	:	GFSK
Emission bandwidth	:	1 MHz
Remarks	:	n.a.

Auxiliary equipment 1 (AUX1)	:	Notebook computer
Brand	:	Dell
Model	:	Latitude E7240
Serial number	:	1YWqJ12
Remark	:	used for programming the EUT, property applicant

Auxiliary equipment 2 (AUX2)	:	Programming interface
Brand	:	-
Model	:	-
Serial number	:	--
Remarks	:	used for programming the EUT, property applicant

Auxiliary (AUX 3) : Power supply adapter
 Manufacturer : Samsung
 Brand : Samsung
 Model : ETA0U10EBE
 Serial number : n.a.
 Voltage output rating : 5.0 Vdc
 Remark : Used to charge the EUT

Auxiliary (AUX 4) : Mobile phone
 Manufacturer : Samsung
 Brand : Samsung
 Model : Galaxy S3
 Serial number : -
 Remark : Used to communicate with EUT in Normal mode

The test software (as installed on AUX1) is used to program the operating frequency of the EUT. AUX2 were used only to program the operating frequency and once set the auxiliary items were removed from the test-setup and the EUT operates on it's own.

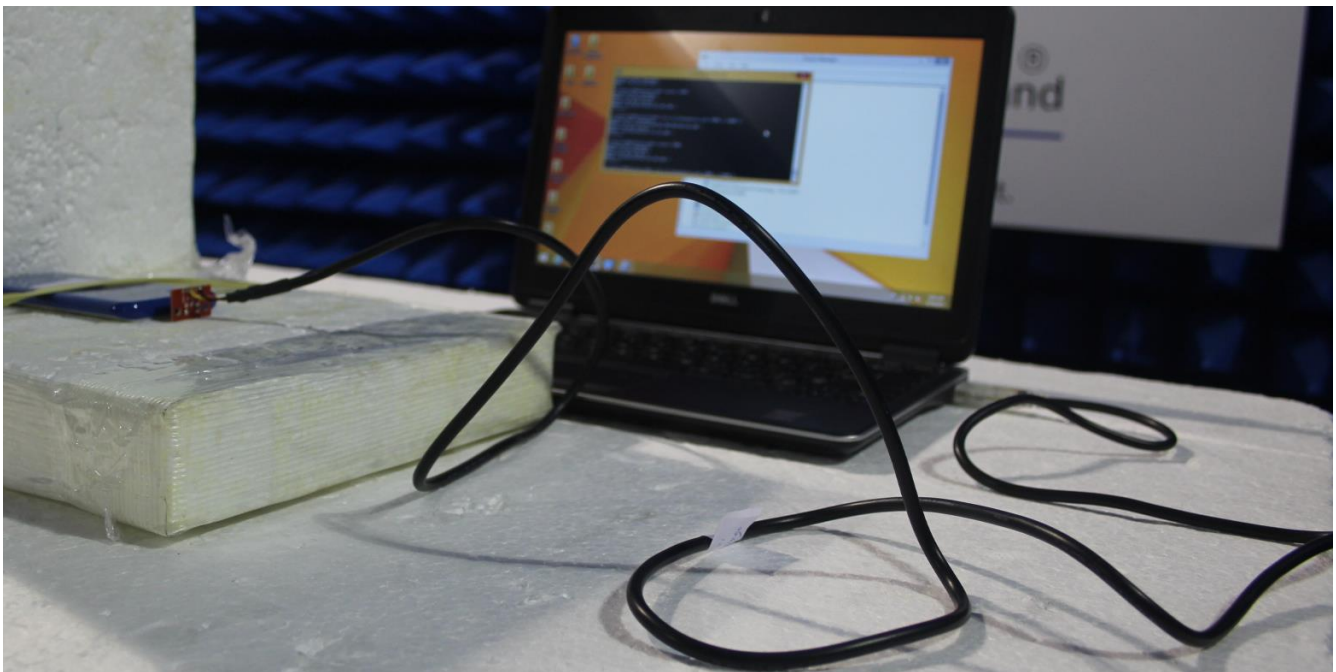


Photo 1: basic setup for frequency programming

1.3.1 Description of input and output ports.

For radiated tests: no input and output connections ports on the EUT during testing, but for programming the following connections were used.

Number	Terminal	From	To	Remarks
1	Mains	Mains	(AUX1)	--
2	Usb	AUX1	AUX2	--
3	datacom	AUX2	EUT	--

For AC power line conducted emissions the EUT’s mini usb port was connected to AUX3 for charging purposes.

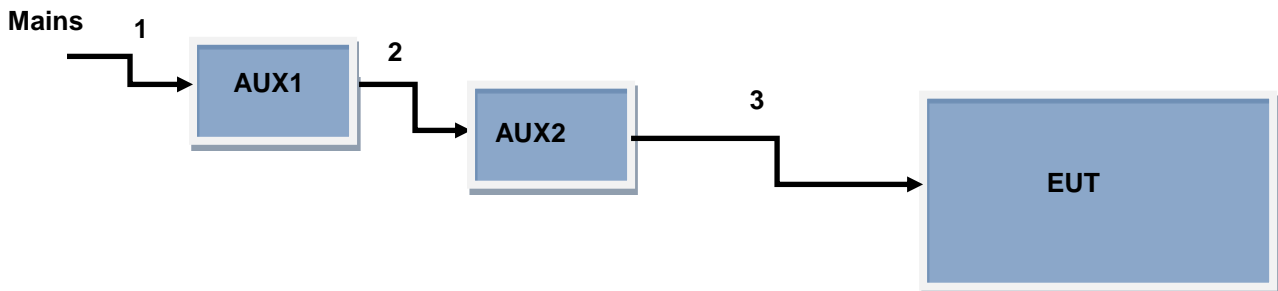


Figure 1. Basic set-up for programming



Photo: AUX4 used to connect to EUT in Normal Mode

1.4 Test results summary

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

Test Standard		Description	Page	Pass / Fail
47 CFR Part 15 (10-1-16 Edition)	RSS-210 Issue 9, August 2016			
15.207(a)	RSS-Gen(8.8)	AC Power Line Conducted Emissions	28 - 31	Pass
15.205 and 15.209	RSS-Gen(8.9, 8.10) RSS-210 section B.10	Radiated Emissions	11 - 27	Pass
15.249(d)	RSS-210 section B.10	Band Edge Emissions	32 - 33	Pass
15.215(c)	RSS-Gen(6.6)	Occupied Bandwidth	34 - 37	Pass

Table : testspecifications

Testmethods: ANSI C63.10-2013 and RSS-Gen Issue 4, November 2014

1.5 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (10-1-16 Edition), sections 15.31, 15.205, 15.207, 15.209 and 15.249, RSS-GEN (ISSUE 4, NOVEMBER 2014) RSS-210 (ISSUE 9, AUGUST 2016).

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

The receivers are switching automatically to the right bandwidth in accordance with CISPR 16. This is implemented in the receiver. The antenna factors are programmed in the test 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 786213. 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. 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 : Battery operated and 5 Vdc through a 100 -240Vac Power Supply Adapter (AUX3) for charging

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 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 continues transmit mode with a modulated carrier in Normal mode (Bluetooth) and the EUT could be set on a single carrier by means of test software. The intentional radiator tests have been performed with a complete functioning EUT.

A continuous transmit mode could be initiated by using a mobile phone (AUX5) in Normal mode or 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 : MBT (Manufacturing Bluetooth test tool)

Batch files programmed by the applicant are used to make the required settings.
This software was running on a laptop computer (AUX1).

2.3 Special accessories.

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

2.4 Equipment modifications.

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

3 Radiated emission data.

RESULT: PASS

Date of testing: 2017-05-19 - 2017-06-14

Frequency range: 30MHz - 25GHz

Requirements:

FCC 15.205, FCC 15.209, FCC 15.249 and IC RSS-Gen(8.9, 8.10) and RSS-210(B.10)

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).

Radiated emissions which fall outside the operation frequency band and outside restricted bands shall either meet the limit specified in FCC 15.209(a)/ RSS-Gen (8.8) 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).

Test procedure:

ANSI C63.10-2013.

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.

3.1 Radiated field strength measurements (30 MHz – 1 GHz, E-field)

3.1.1 Radiated field strength measurements (30 MHz- 1 GHz, E-field)

Frequency [MHz]	EUT orientation	Antenna Orientation	Level QP [dB μ V/m]	Limit QP [dB μ V/m]	Result Pass/Fail
237.16	Horizontal	Horizontal	19.0	46.0	Pass
371.02	Vertical	Vertical	23.0	46.0	Pass
396.24	Vertical	Horizontal	23.4	46.0	Pass
445.16	Horizontal	Horizontal	25.2	46.0	Pass
509.18	Vertical	Horizontal	27.5	46.0	Pass
648.86	Horizontal	Vertical	30.2	46.0	Pass

Table 1 Radiated emissions of the EUT in the frequency range 30 MHz – 1 GHz.

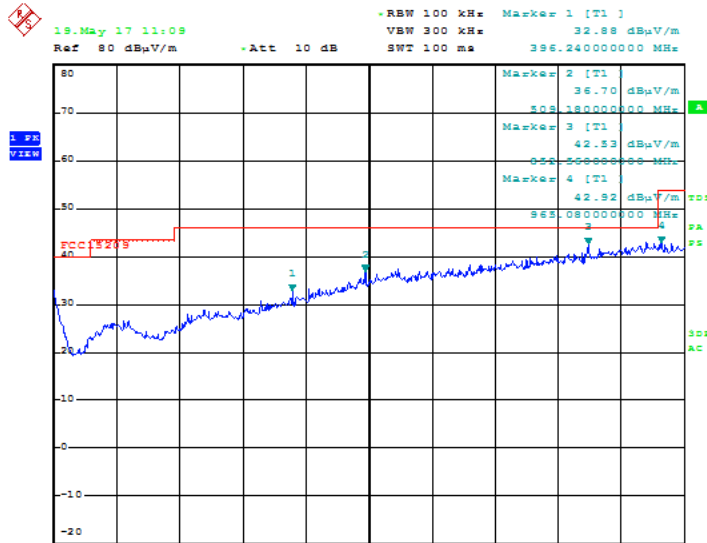
The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209, 15.249 and RSS-210 section B.10 and RSS-Gen section 8.9 with the EUT operating in continues transmit mode are depicted in Table 1.

Notes:

- Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit. The 6 highest values are noted
- Measurement uncertainty is 5.22 dB.
- The reported field strength values are the worst case values at the indicated frequency. The EUT was varied in 2 positions (horizontal and vertical) because of it's physical limitations, the antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
- Preliminary measurements indicated that the radiated emissions from EUT in Normal mode was the worst case.
- A Quasi-peak detector was used with a resolution bandwidth of 120 kHz.
- A selection of plots are provided on the next pages.

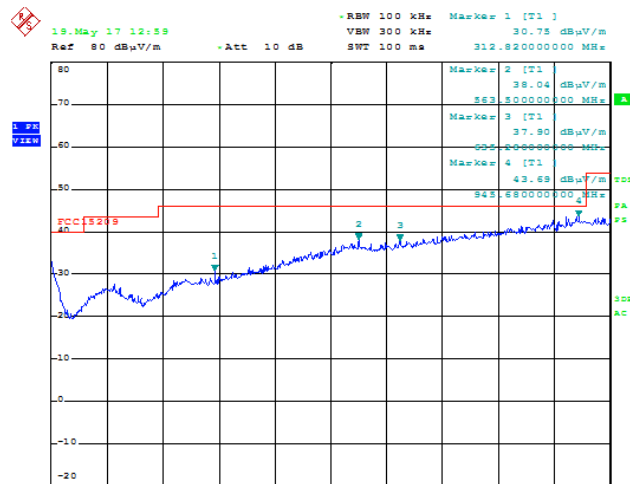
Used test equipment and ancillaries:

A00314	A00447	A00450	A00257	A00235	A00258	A00444	A00466	



ORI
 Date: 19.MAY.2017 11:09:55

Plot 1a Radiated emissions (Peak values) in the frequency range 30 – 1000 MHz of the EUT in Normal mode, EUT Vertical, Antenna Horizontal



ORI
 Date: 19.MAY.2017 12:59:48

Plot 1b Radiated emissions (Peak values) in the frequency range 30 – 1000 MHz of the EUT operating on 2402 MHz, EUT Vertical, Antenna Horizontal

3.2 Radiated field strength measurements (1 - 25 GHz, E-field), Peak values

3.2.1 Radiated field strength measurements (1 - 25 GHz, E-field), EUT's TX Frequency 2402 MHz

Frequency [MHz]	EUT orientation	Antenna Orientation	Detector	Resolution Bandwidth (kHz)	Level Pk [dBm]	Limit [dBm]	Result
2402 (fundamental)	Horizontal	Vertical	Peak	1000	-7.21	-1.2 Av +18.9 Pk	Pass
4804 ^{H-R}	Vertical	Vertical	Peak	1000	-58.8	-21.2 Pk	Pass
7205.3 ^H	Vertical	Vertical	Peak	1000	-52.4	-41.2 Av -21.2 Pk	Pass
9374.3 ^R	Vertical	Vertical	Peak	1000	-53.8	-41.2 Av -21.2 Pk	Pass
12643.5 ^R	Vertical	Vertical	Peak	1000	-49.9	-41.2 Av -21.2 Pk	Pass
17916.5 noise	Vertical	Vertical	Peak	1000	-39.1 Pk / -58.4 Av	-41.2 Av -21.2 Pk	Pass

Table 2

3.2.2 Radiated field strength measurements (1 - 25 GHz, E-field), EUT's TX Frequency 2440 MHz

Frequency [MHz]	EUT Orientation	Antenna Orientation	Detector	Resolution Bandwidth (kHz)	Level Pk [dBm]	Limit [dBm]	Result
2440 (fundamental)	Horizontal	Vertical	Peak	1000	-5.25	-1.2 Av +18.9 Pk	Pass
1195.76 ^R	Vertical	Horizontal	Peak	1000	-61.6	-41.2 Av -21.2 Pk	Pass
4882 ^{H-R}	Vertical	Vertical	Peak	1000	-57.9	-41.2 Av -21.2 Pk	Pass
7318 ^{H-R}	Vertical	Vertical	Peak	1000	-52.7	-41.2 Av -21.2 Pk	Pass
12995 ^R	Vertical	Vertical	Peak	1000	-51.3	-21.2 Pk	Pass
17914.5 noise	Vertical	Vertical	Peak	1000	-39.8 Pk / -55.4 Av	-41.2 Av -21.2 Pk	Pass

Table 3

3.2.3 Radiated field strength measurements (1 - 25 GHz, E-field), EUT's TX Frequency 2480 MHz

Frequency [MHz]	EUT orientation	Antenna Orientation	Detector	Resolution Bandwidth (kHz)	Level [dBm]	Limit [dBm]	Result
2480 (fundamental)	Vertical	Vertical	Peak	1000	-7.48	-1.2 Av +18.9 Pk	Pass
4960 ^{H-R}	Vertical	Vertical	Peak	1000	-58.2	-41.2 Av -21.2 Pk	Pass
6492.8	Horizontal	Horizontal	Peak	1000	-53.3	-41.2 Av -21.2 Pk	Pass
7435 ^{H-R}	Vertical	Horizontal	Peak	1000	-53.7	-41.2 Av -21.2 Pk	Pass
16075.5	Vertical	Vertical	Peak	1000	-49.0	-21.2 Pk	Pass
17714.5 ^{R noise}	Vertical	Vertical	Peak	1000	-38.7 Pk / -55.5 Av	-41.2 Av -21.2 Pk	Pass

Table 4

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

Frequency [MHz]	EUT orientation	Antenna Orientation	Detector	Resolution Bandwidth (kHz)	Level [dBm]	Limit [dBm]	Result
1000.33	Vertical	Vertical	Peak	1000	-55.7	-41.2 Av -21.2 Pk	Pass
4878 ^{H-R}	Vertical	Vertical	Peak	1000	-48.7	-41.2 Av -21.2 Pk	Pass
6687.8	Horizontal	Vertical	Peak	1000	-43.5 Pk / -58.3 Av	-41.2 Av -21.2 Pk	Pass
11025 ^R	Horizontal	Vertical	Peak	1000	-40.8 Pk / -56.6 Av	-41.2 Av -21.2 Pk	Pass
14602.7	Horizontal	Vertical	Peak	1000	-38.4 Pk / -53.2 Av	-41.2 Av -21.2 Pk	Pass
17900 ^{R noise}	Horizontal	Horizontal	Peak	1000	-28.2 Pk / -44.9 Av	-41.2 Av -21.2 Pk	Pass

Table 5

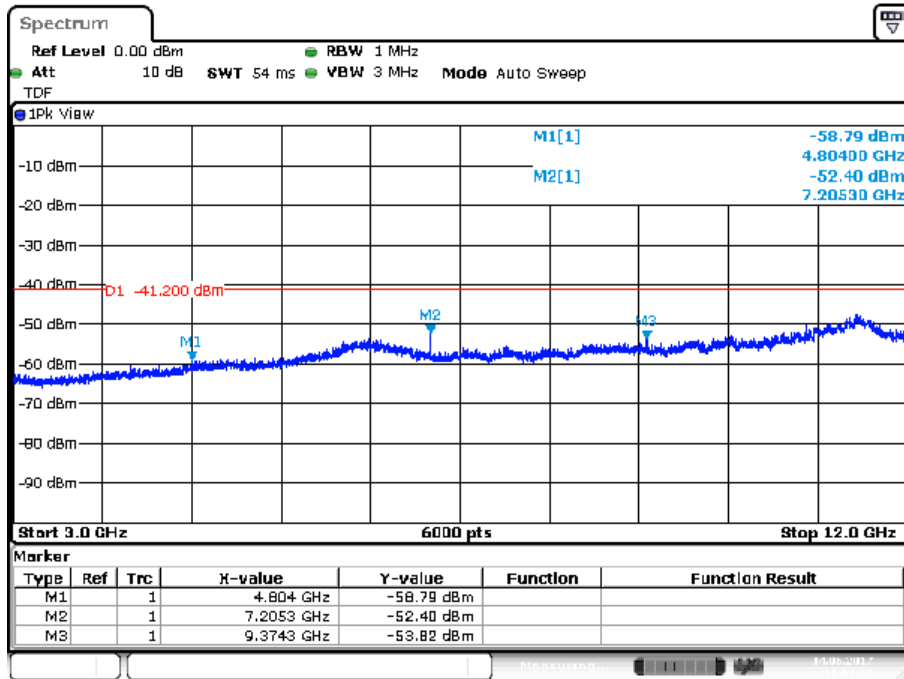
The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209 and 15.249 and RSS-210 section B.10 and RSS-Gen section 8.9 with the EUT operating in continuous transmit mode are depicted in Tables 2 through 5.

Notes:

1. Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit.
2. Measurement uncertainty is 5.22 dB.
3. The reported field strength values are the worst case values at the indicated frequency. The EUT was varied in 2 positions, the antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
4. The EUT was tested in on the lowest frequency (2402 MHz), a middle frequency (2440 MHz) and the highest frequency (2480 MHz) in the 2402 – 2480 MHz band wherein it operates and the normal operation
5. Where Peak values were within Average limits, Average not retested
6. *^H indicates a harmonic frequency, *^R indicates a frequency in the restricted band and *^R indicates a frequency in a restricted band.
7. For a selection of plots see the next pages.

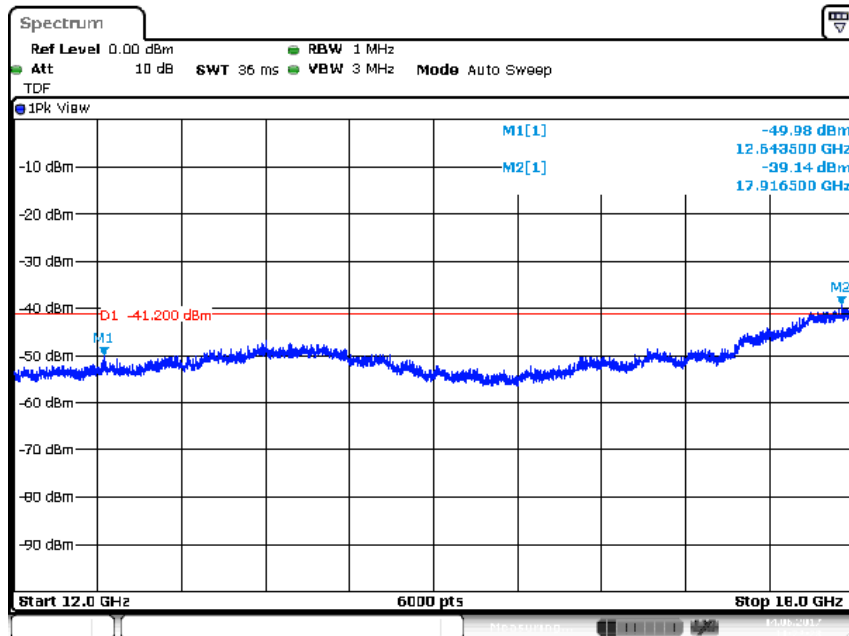
Used test equipment and ancillaries:

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A00151	A00131	A00065						



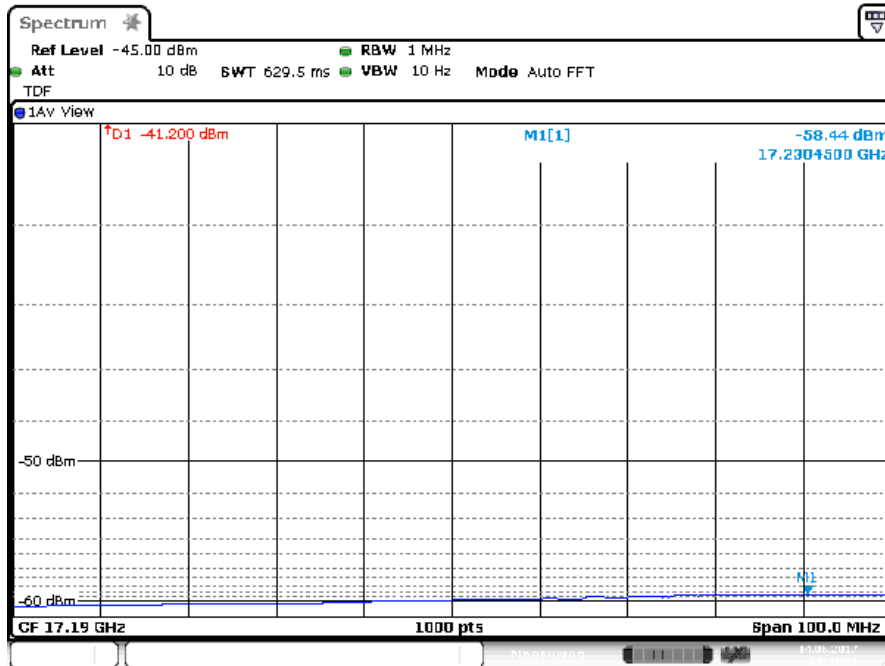
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Plot 2a Radiated unwanted emissions in the range 3 – 12 GHz
 (Peak values, EUT vertical, Antenna Vertical position shown- EUT at 2402 MHz).

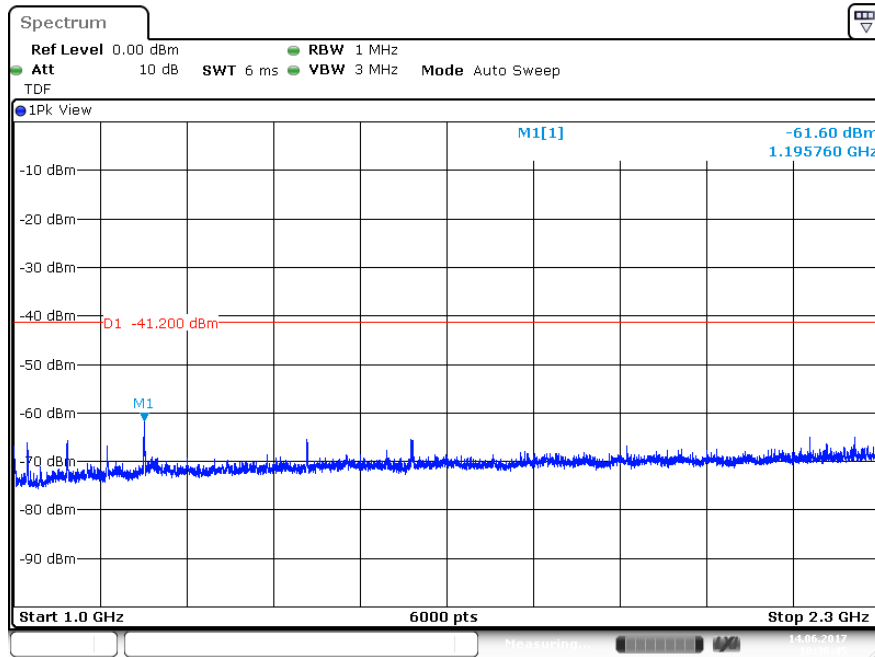


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Plot 2b Radiated unwanted emissions in the range 12 – 18 GHz
 (Peak values, EUT vertical, Antenna Vertical position shown- EUT at 2402 MHz).

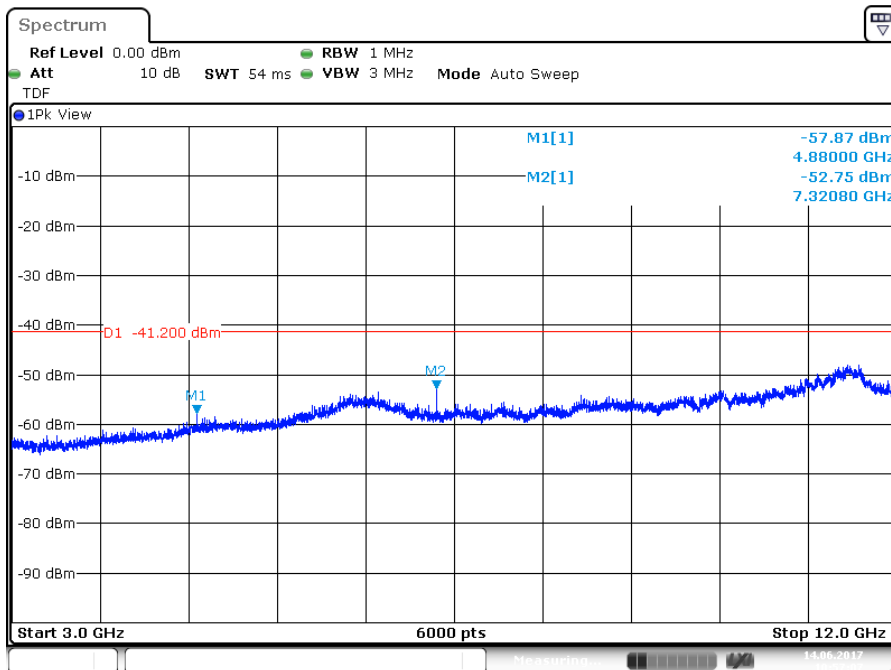


Plot 2c Radiated unwanted emissions at 17 GHz
 (Average value, EUT vertical, Antenna Vertical position shown- EUT at 2402 MHz).



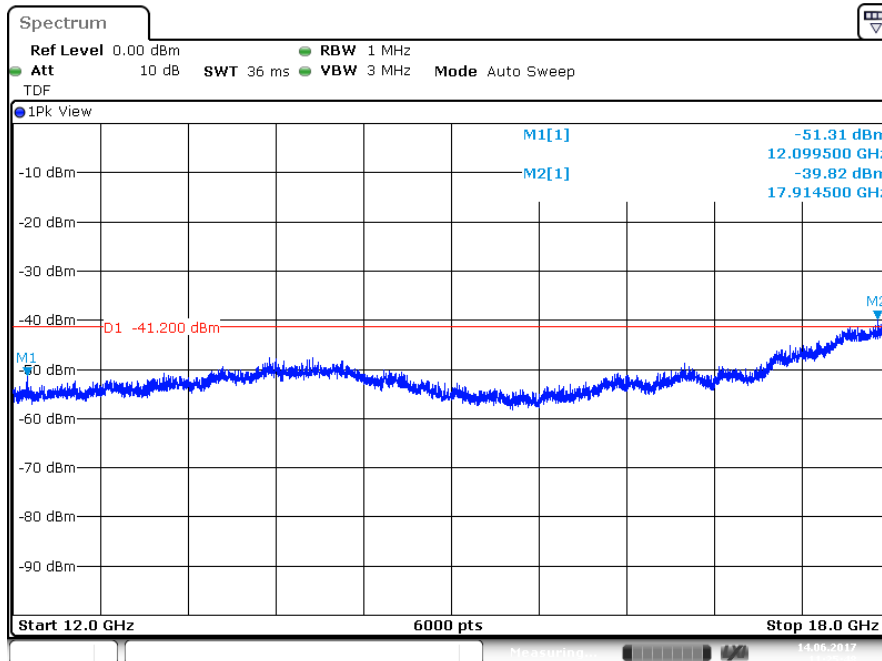
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Plot 3a Radiated unwanted emissions in the range 1 – 2.3 GHz
 (Peak values, EUT vertical, Antenna horizontal position shown- EUT at 2440 MHz).

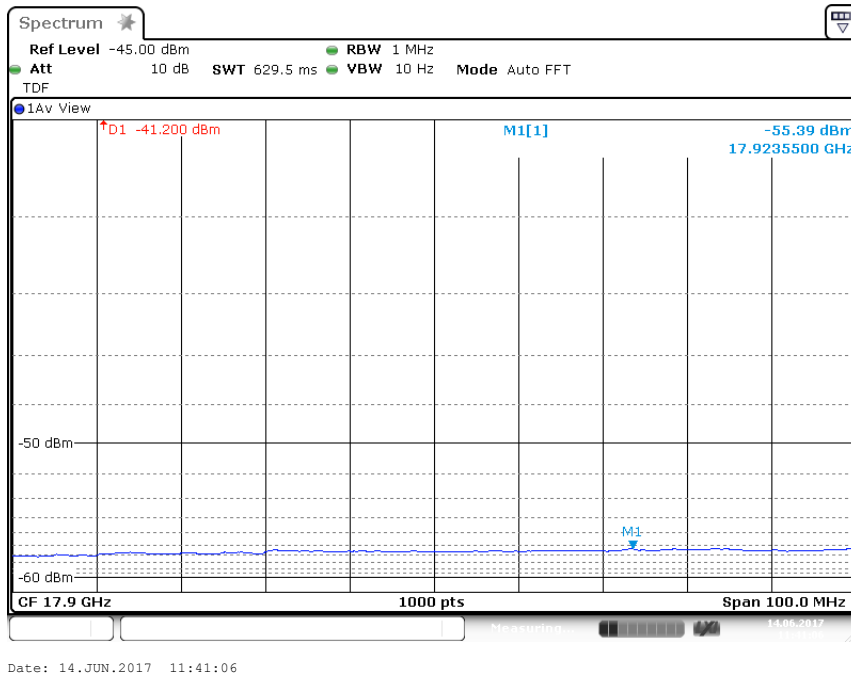


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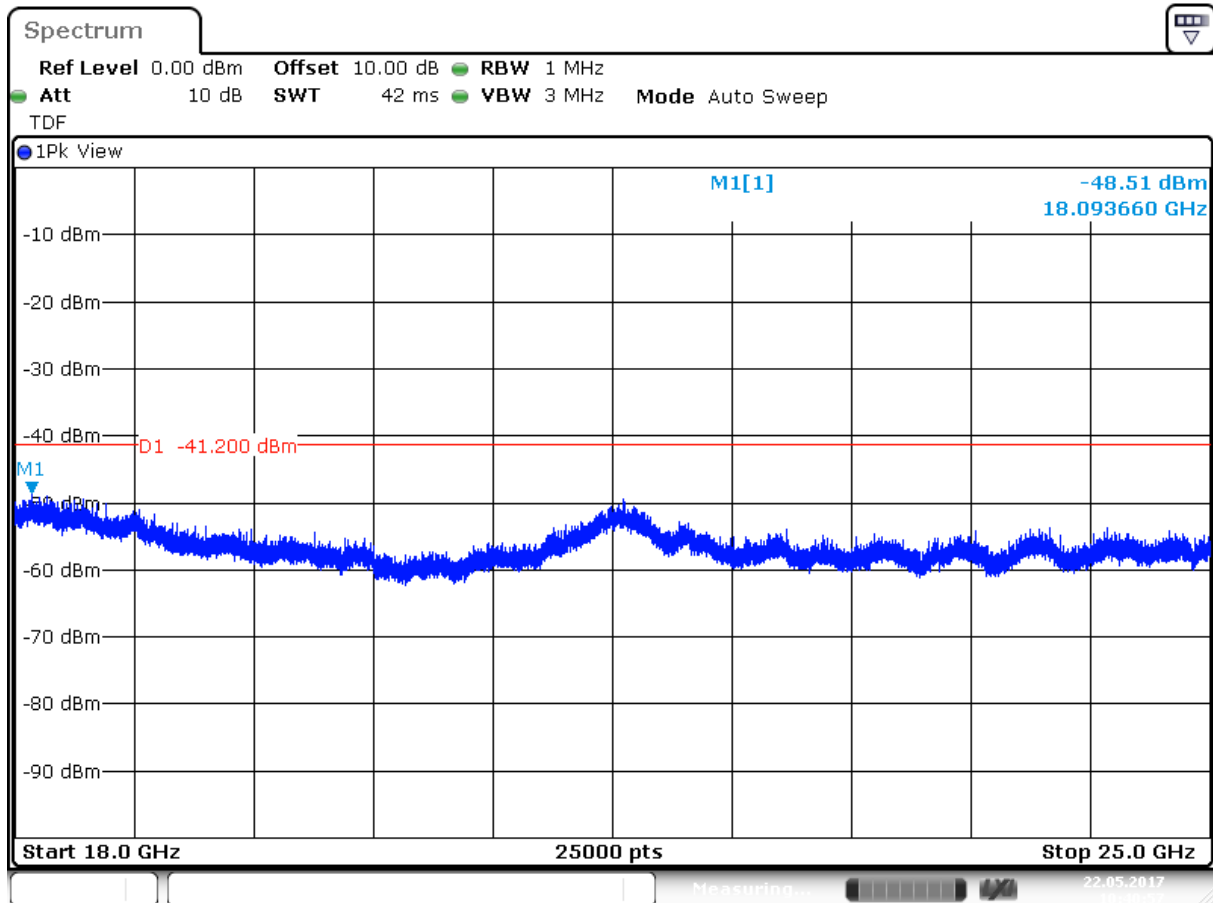
Plot 3b Radiated unwanted emissions in the range 3 – 12 GHz
 (Peak values, EUT vertical, Antenna Vertical position shown- EUT at 2440 MHz).



Plot 3c Radiated unwanted emissions in the range 12 – 18 GHz
 (Peak values, EUT vertical, Antenna Vertical position shown- EUT at 2440 MHz).

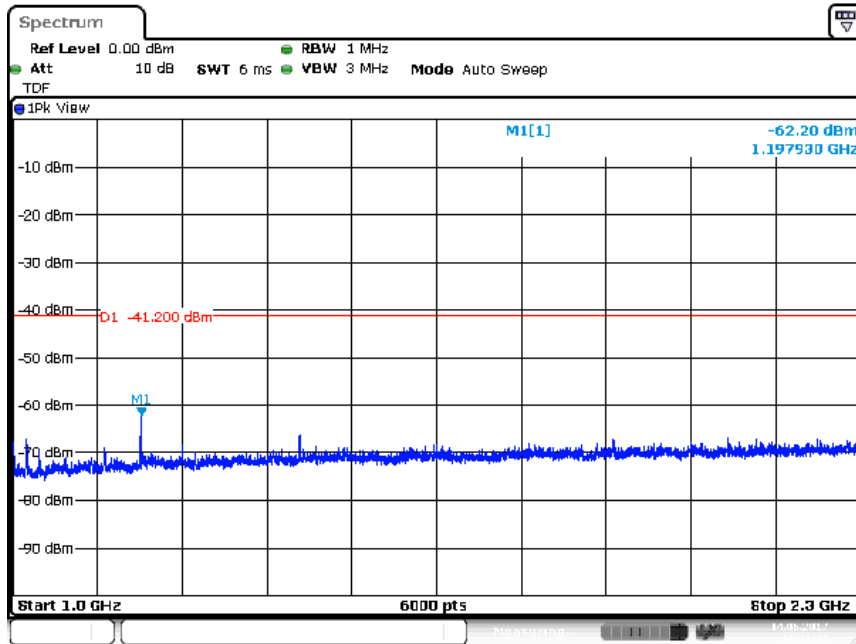


Plot 3d Radiated unwanted emissions at 17.9 GHz
 (Average value, EUT vertical, Antenna Vertical position shown- EUT at 2440 MHz).



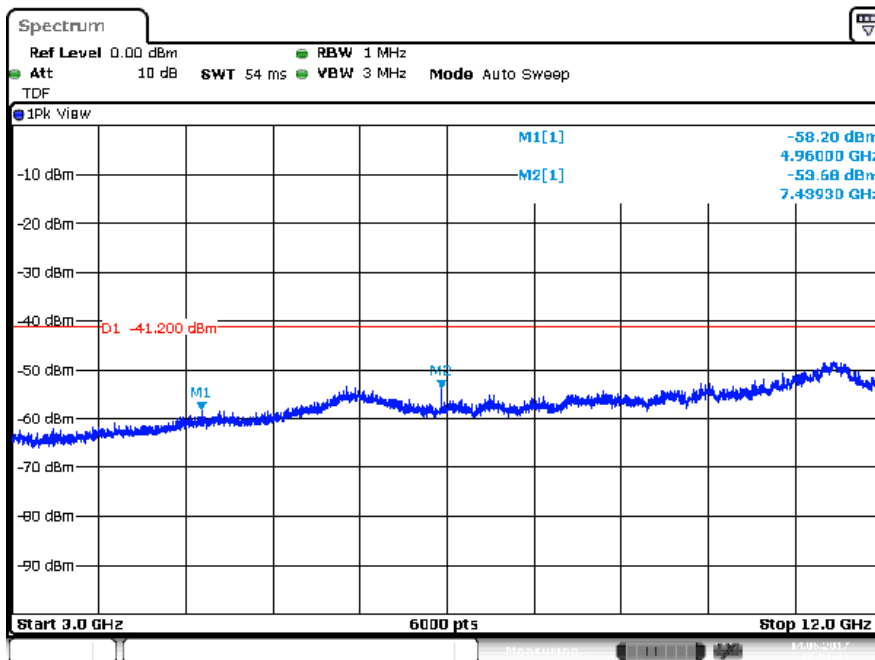
Date: 22.MAY.2017 10:40:58

Plot 3e Radiated unwanted emissions in the range 18 – 25 GHz
 (Peak values, EUT vertical, Antenna horizontal position shown- EUT at 2440 MHz).



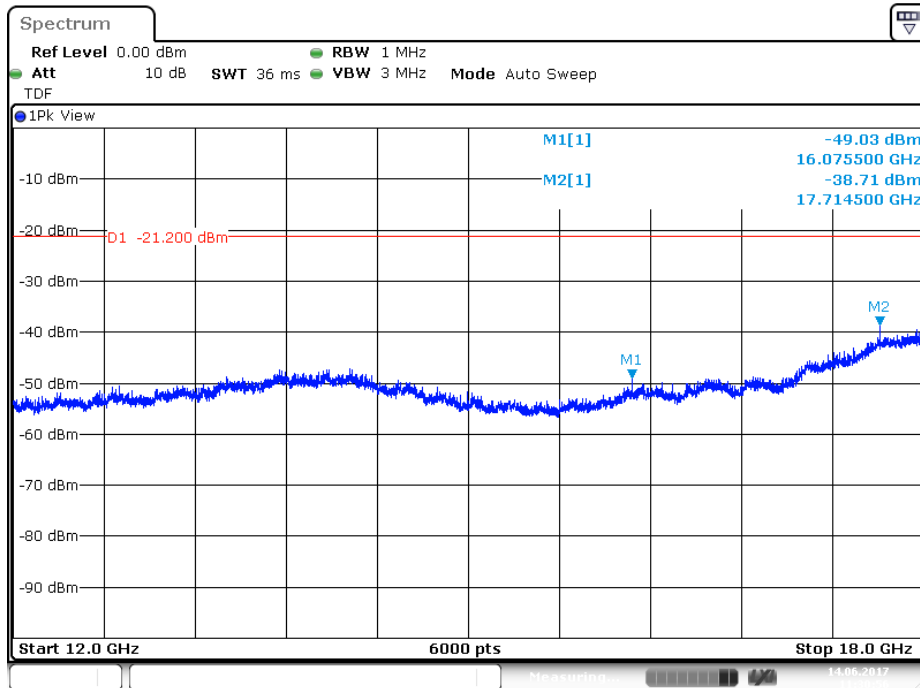
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Plot 4a Radiated unwanted emissions in the range 1 – 2.3 GHz
 (Peak values, EUT vertical, Antenna Vertical position shown- EUT at 2480 MHz).

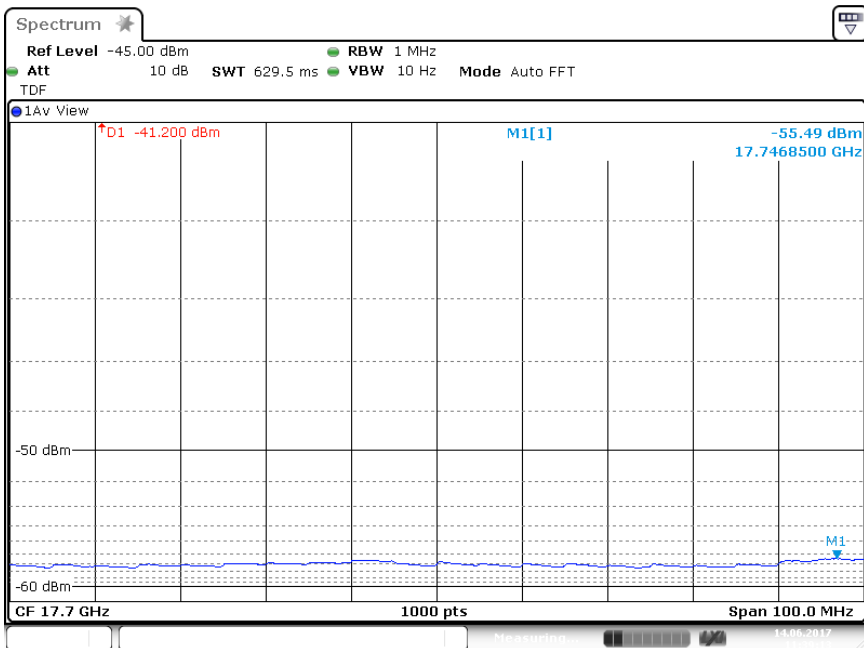


Date: 14.JUN.2017 10:53:02

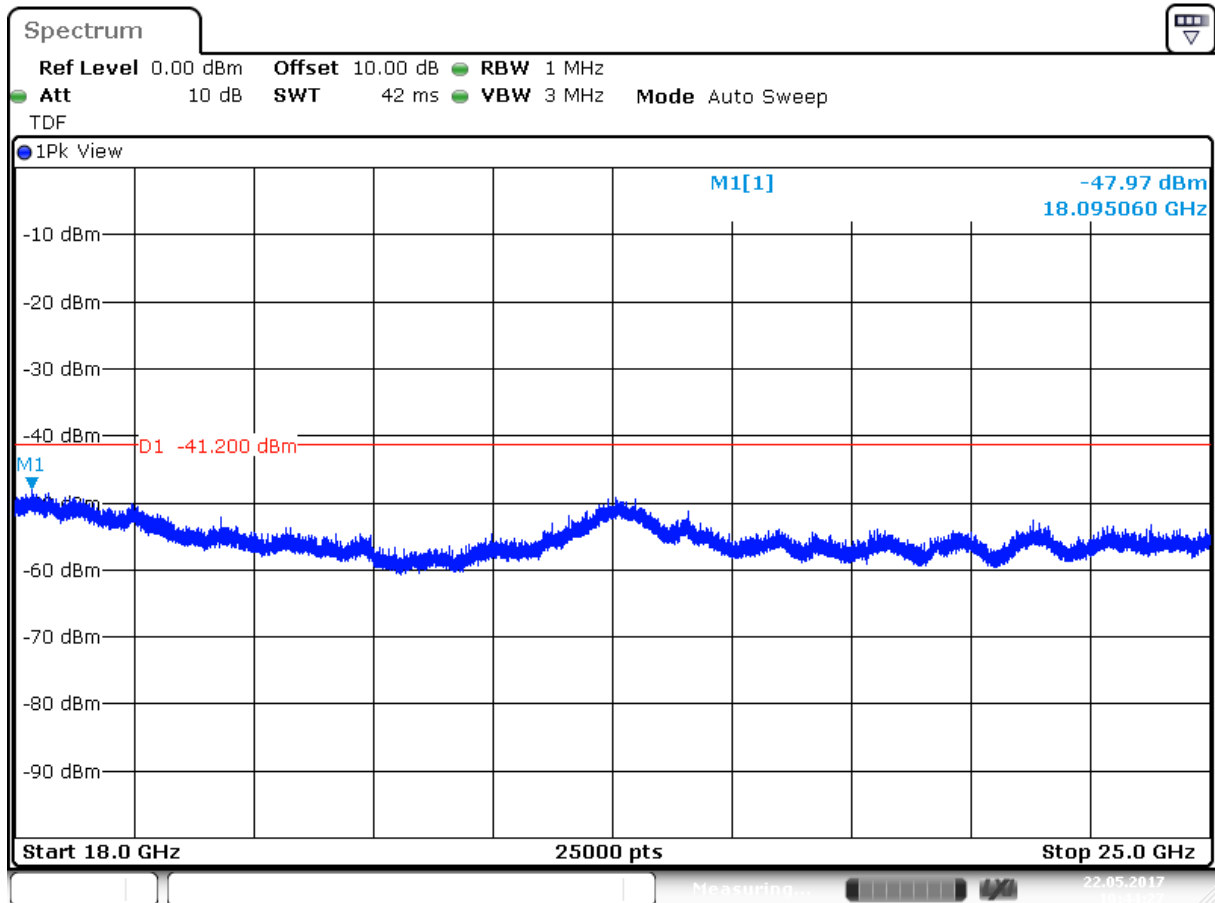
Plot 4b Radiated unwanted emissions in the range 3 – 12 GHz
 (Peak values, EUT vertical, Antenna Vertical position shown- EUT at 2480 MHz).



Plot 4c Radiated unwanted emissions in the range 12 – 18 GHz
 (Peak values, EUT vertical, Antenna Vertical position shown- EUT at 2480 MHz).

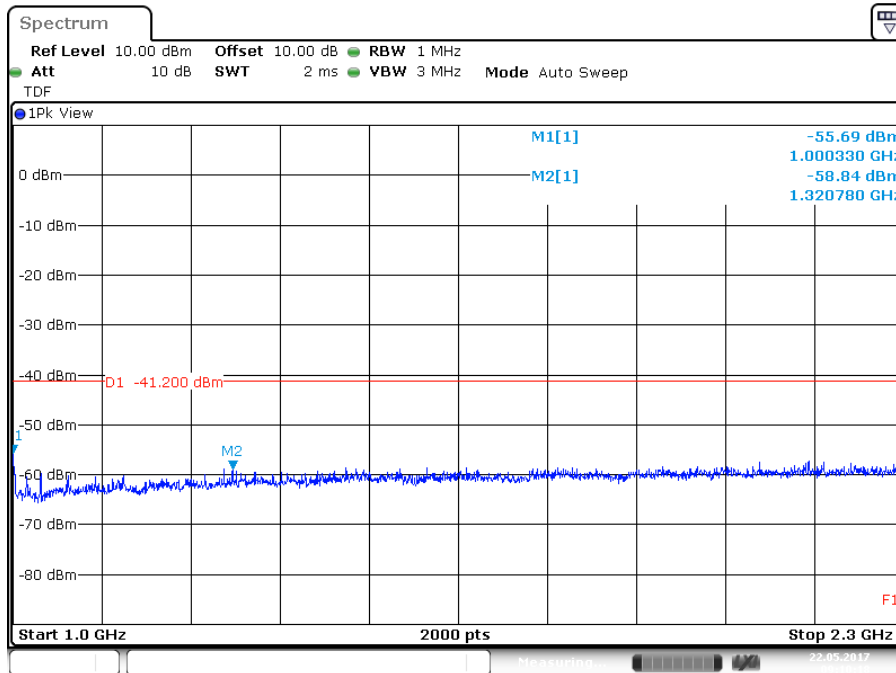


Plot 4d Radiated unwanted emissions at 17 GHz
 (Average value, EUT vertical, Antenna Vertical position shown- EUT at 2480 MHz).

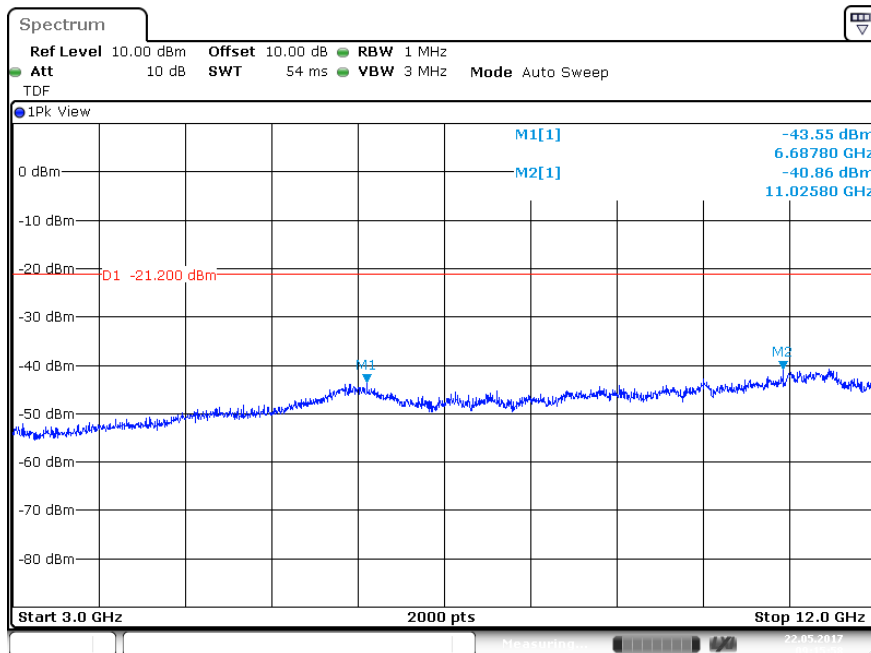


Date: 22.MAY.2017 10:44:27

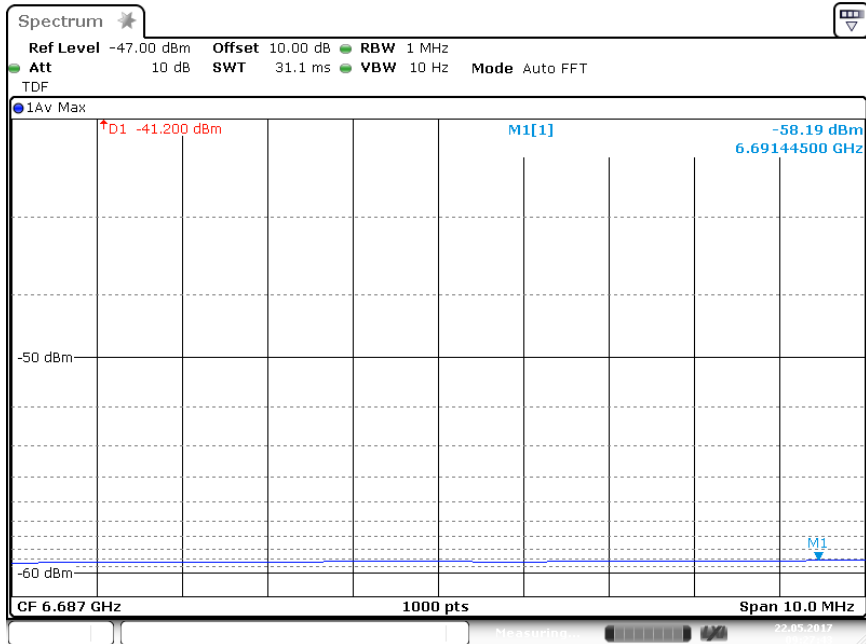
Plot 4e Radiated unwanted emissions in the range 18 – 25 GHz
 (Peak values, EUT horizontal, Antenna horizontal position shown- EUT at 2480 MHz).



Plot 5a Radiated unwanted emissions in the range 1 – 2.3 GHz
 (Peak values, EUT vertical, Antenna Vertical position shown- EUT in Normal mode).

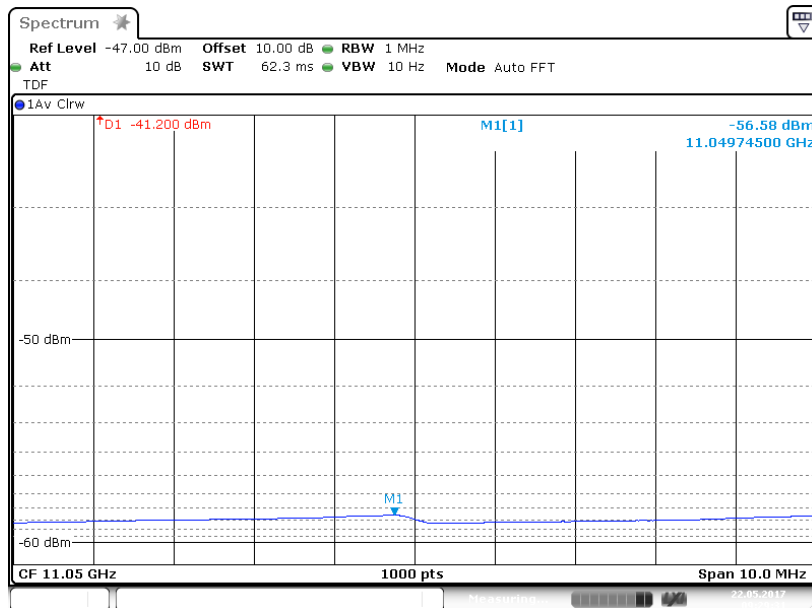


Plot 5b Radiated unwanted emissions in the range 3 – 12 GHz
 (Peak values, EUT vertical, Antenna horizontal position shown- EUT in Normal mode).



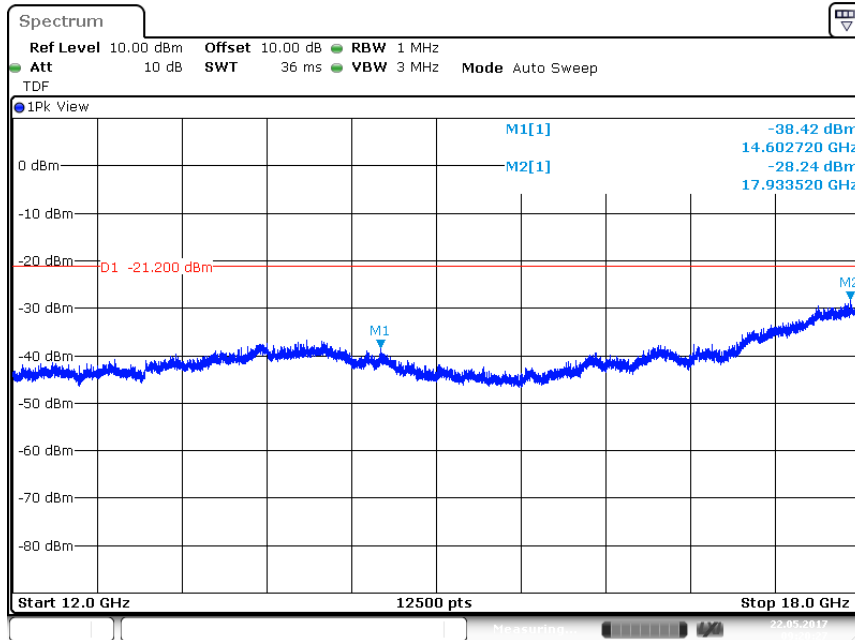
Date: 22.MAY.2017 09:27:43

Plot 5c Radiated unwanted emissions at 6.7 GHz
 (Average value, EUT vertical, Antenna horizontal position shown- EUT in Normal mode).

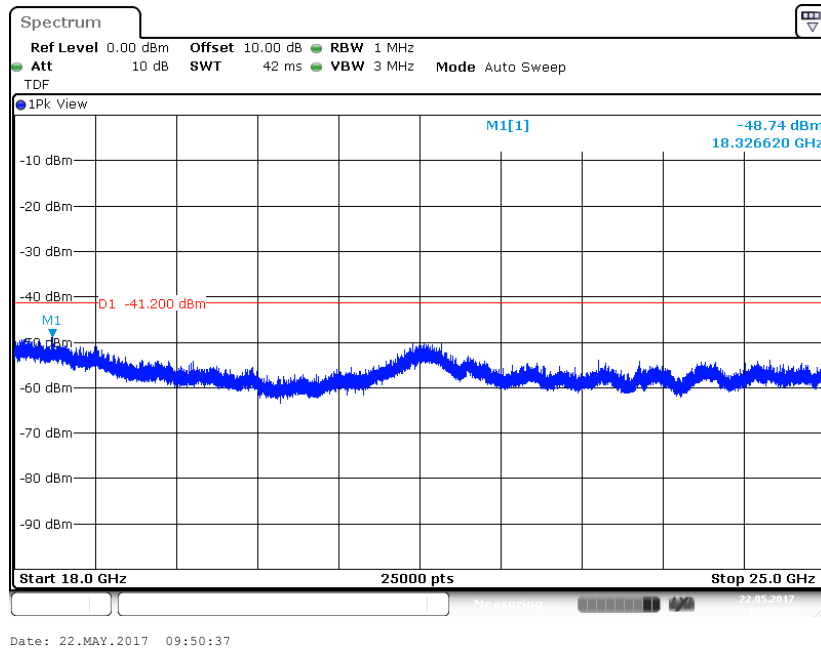


Date: 22.MAY.2017 09:29:31

Plot 5d Radiated unwanted emissions at 11 GHz
 (Average value, EUT vertical, Antenna horizontal position shown- EUT in Normal mode).



Plot 5e Radiated unwanted emissions in the range 12 – 18 GHz
 (Peak values, EUT vertical, Antenna horizontal position shown- EUT in Normal mode).



Plot 5f Radiated unwanted emissions in the range 18 – 25 GHz
 (Peak values, EUT Z- position, Antenna Vertical position shown- EUT in Normal mode).

4 AC Power line Conducted Emission Data.

4.1 AC Power Line Conducted Emission data of the EUT

RESULT: Pass

Date of testing: 2017-06-27

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 was positioned at least 80cm from the LISN. The power cable was routed over the non-conductive plate to the LISN.

4.1.1 AC Power Line Conducted Emissions

Frequency (MHz)	Measurement results (dB μ V) L1		Measurement results (dB μ V) L2/Neutral		Limits (dB μ V)		Verdict (Pass/Fail)
	QP	AV	QP	AV	QP	AV	
0.16172	38.9	*2	30.6	*2	65.5	55.5	Pass
0.19297	28.8	*2	20.3	*2	63.6	53.6	Pass
6.48594	27.9	*2	24.2	*2	60.0	50.0	Pass
9.45469	27.3	*2	26.2	*2	60.0	50.0	Pass
21.97422	27.7	*2	25.0	*2	60.0	50.0	Pass
22.41172	24.0	*2	24.7	*2	60.0	50.0	Pass

Table 6 AC Power Line Conducted Emissions results

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 AC mains connection terminals of the AUX3 that connects to the EUT, are depicted in the table above.

Notes:

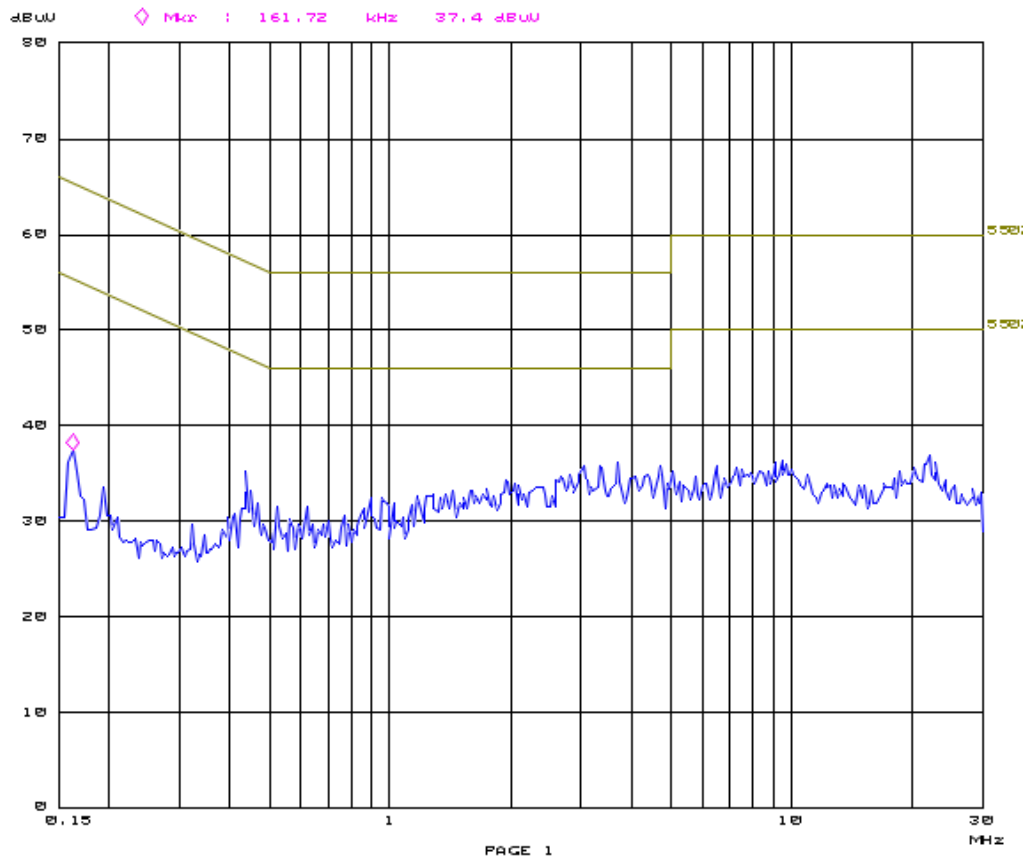
1. The resolution bandwidth used was 9 kHz.
2. Qp values were already within Av limits, therefor Av not tested.
3. Plots are provided on the next pages.

4.1.2 Plots of the AC Power Line Conducted Emissions

27. Jun 17 13:08

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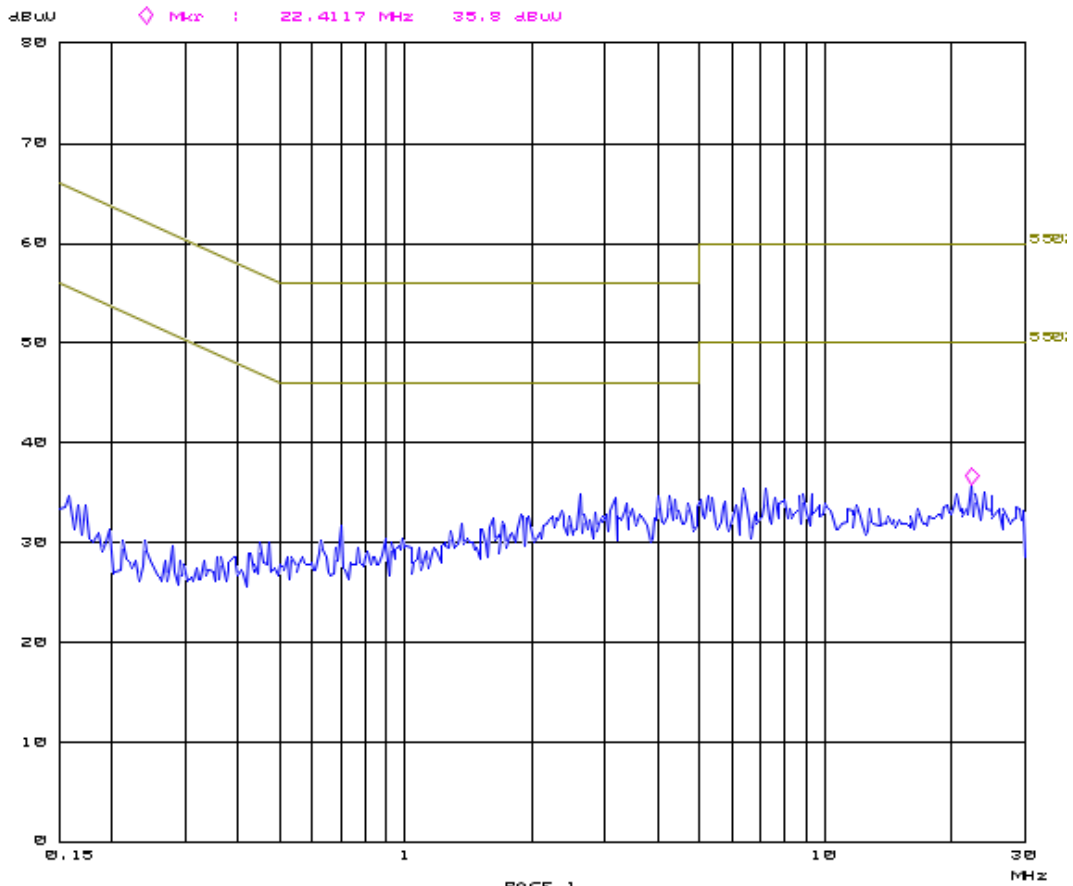
Overview Scan Settings (1 Range)
----- Frequencies ----- Receiver Settings -----
Start      Stop      Step      IF BW  Detector  M-Time  Atten  Preamp
150k       30M       3.9k      9k     PK        0.10ms 20dBLN OFF
    
```



Plot 7a of the AC Power Line Conducted Emissions on L1

27. Jun 17 13:16

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 20dB LN OFF



Plot 7b of the AC Power Line Conducted Emissions on L2

5 Emissions at the band edges

RESULT: Pass

Date of testing: 2017-05-19

The tables below show compliance with the 47 CFR Part 15 section 15.249(d) and RSS-210 section B.10, this section requires the emissions outside the 2400 and 2483.5 MHz frequency band to be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in section 15.209 and RSS-Gen section 8.9, whichever is the lower attenuation.

Table 8 below show the levels at the band edges in respect to the general radiated emission limits.

EUT Frequency [MHz]	Band Edge Frequency [MHz]	Antenna Orientation	Level Pk [dBm]	Limit Pk /Av [dBm]	Result Pass/Fail	Plot number
2402	2326.65	Horizontal	-57.2	-21.2 / -41.2	Pass	1a
2480	2490.43	Horizontal	-57.4	-21.2 / -41.2	Pass	1b

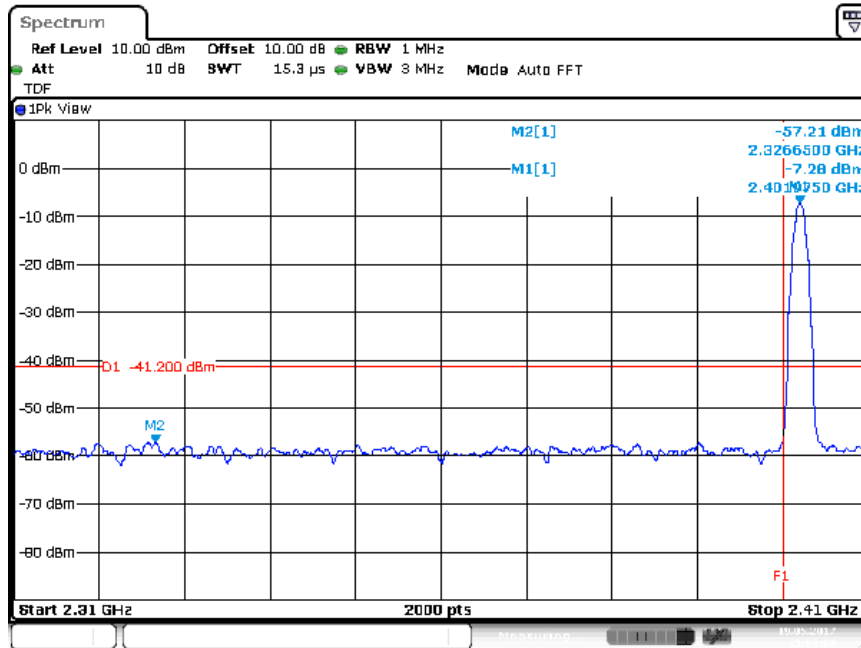
Table 8 level of the band edge emissions, Peak values

Notes:

1. Measurement uncertainty is 5.22 dB
2. The reported field strength values are the worst case values at the indicated frequency. The antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
3. The EUT was tested in on the lowest frequency (2402 MHz) and the highest frequency (2480 MHz) in the 2402 – 2480 MHz band wherein it operates.
4. Peak (Pk) values were already within Average (Av) limits, Av therefor not tested.
5. See plots on pages 33-24.

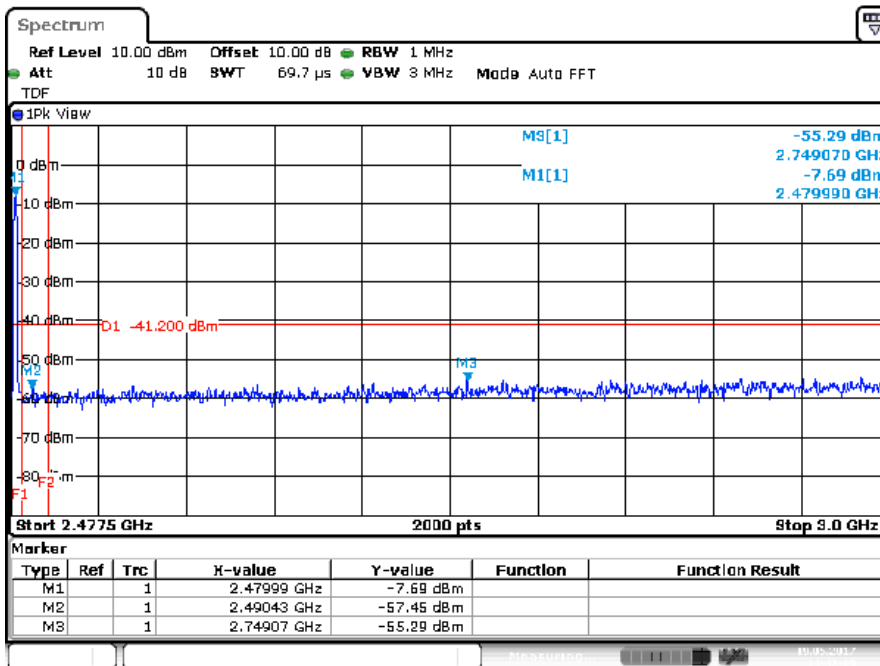
Used test equipment and ancillaries:

A00450	A00235	A00337	A00258	A00444	A00009	A00012	A00255	A00247



Date: 19.MAY.2017 15:03:09

Plot 1a Band Edge (Low), Peak value, Spectral Diagram, 2402 MHz
 F1 shows the band edge frequency of 2400 MHz.



Date: 19.MAY.2017 14:47:05

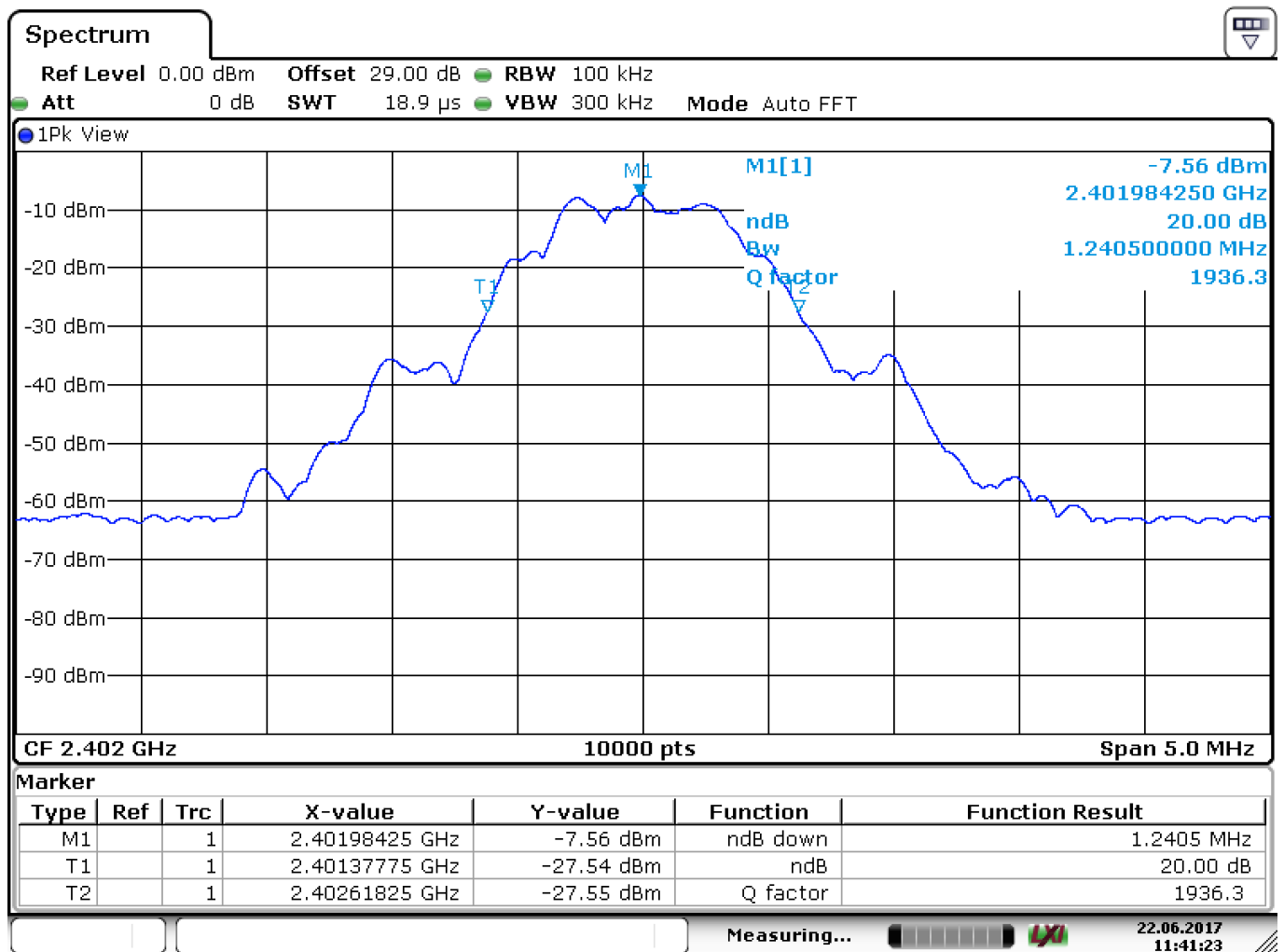
Plot 2a Band Edge (High), Peak value, Spectral Diagram, 2480 MHz.
 F1 shows the band edge frequency of 2483.5 MHz

6 Bandwidth of the emission

RESULT: PASS

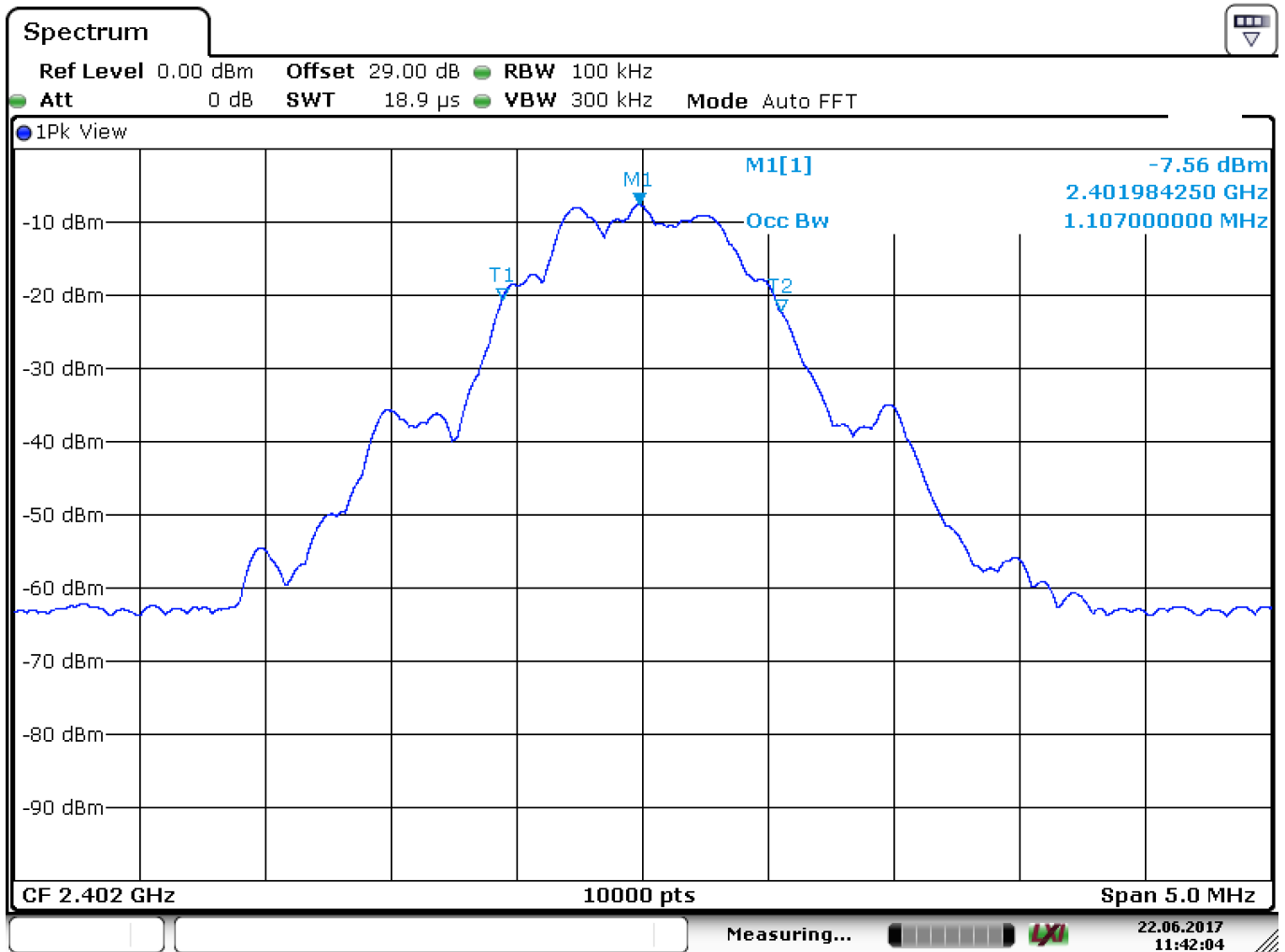
Date of testing: 2017-06-22

The plots below show compliance with the 47 CFR Part 15 section 15.215(c), this section requires the 20 dB emission bandwidth is within the frequencyband designated in section 15.249.



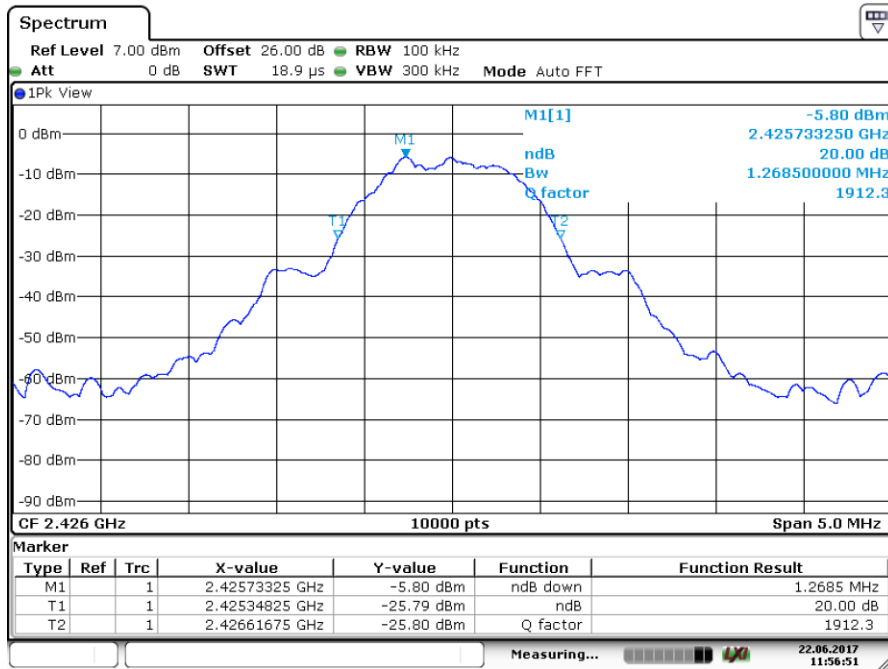
Date: 22.JUN.2017 11:41:24

Plot lowest channel 2402 MHz, Occupied bandwidth is 1240.5 kHz as measured on a spectrum analyzer.



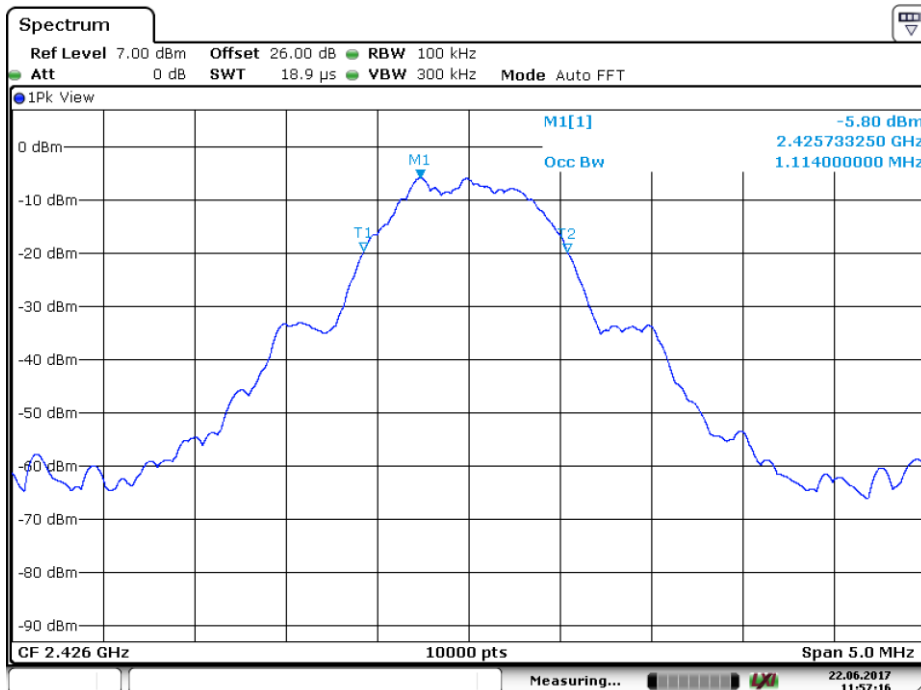
Date: 22.JUN.2017 11:42:04

Plot lowest channel 2402 MHz, 99% bandwidth is 1107 kHz as measured on a spectrum analyzer.



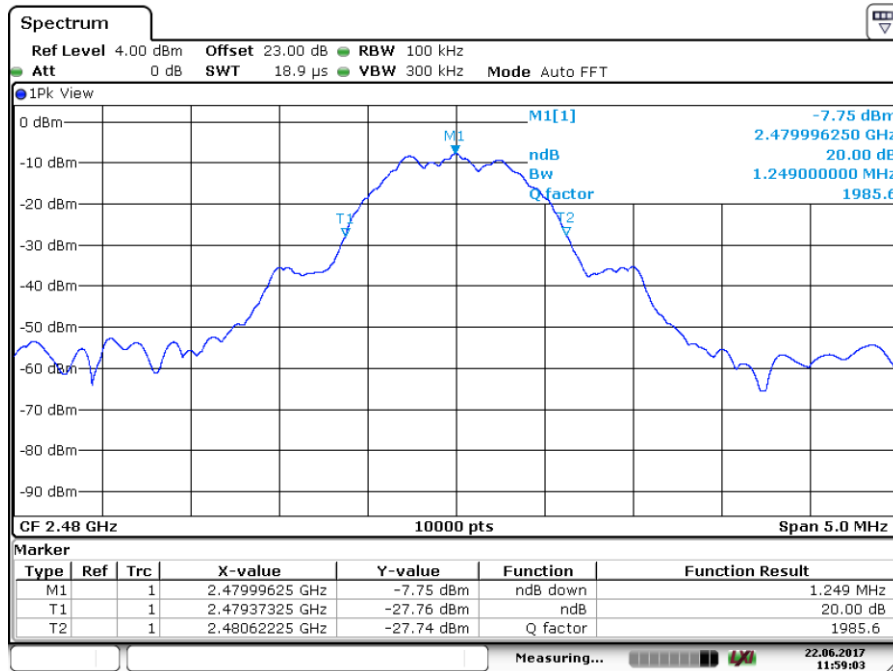
Date: 22 JUN 2017 11:56:51

Plot middle channel 2426 MHz, Occupied bandwidth is 1268.5 kHz as measured on a spectrum analyzer.



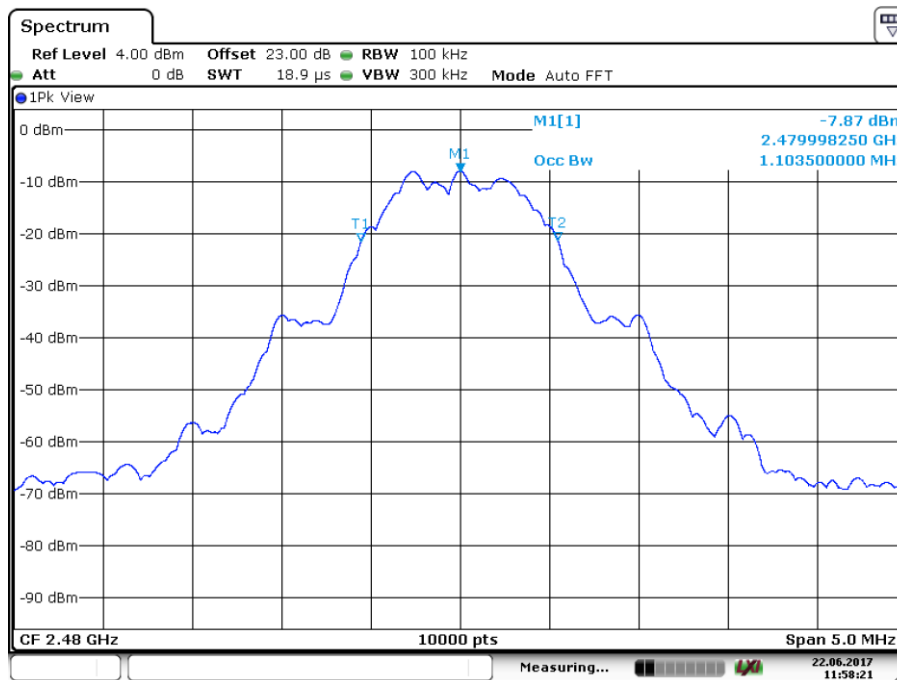
Date: 22 JUN 2017 11:57:17

Plot lowest channel 2426 MHz, 99% bandwidth is 1114 kHz as measured on a spectrum analyzer



Date: 22.JUN.2017 11:59:03

Plot highest channel 2480 MHz, Occupied bandwidth is 1249 kHz as measured on a spectrum analyzer.



Date: 22.JUN.2017 11:58:22

Plot highest channel 2480 MHz, 99% bandwidth is 1103.5 kHz as measured on a spectrum analyzer

7 List of utilized test equipment.

Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (mm/yyyy)	Calibration due date (mm/yyyy)
For Radiated Emissions					
Measurement Receiver	Rohde & Schwarz	ESCI	A00314	03/2017	03/2018
RF Cable S-AR	Gigalink	APG0500	A00447	01/2017	01/2018
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	08/2014	08/2018
Spectrum Analyzer	Rohde & Schwarz	FSV	A01740	05/2016	05/2018
Antenna mast	EMCS	AP-4702C	A00258	N/A	N/A
Temperature-Humiditymeter	Extech	SD500	A00444	04/2017	04/2018
Guidehorn 1-18 GHz	EMCO	3115	A00009	N/A	N/A
Guidehorn 18-40 GHz	EMCO	RA42-K-F-4B-C	A00012	N/A	N/A
Biconilog Testantenna	Teseq	CBL 6111D	A00466	06/2016	06/2018
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	08/2016	08/2017

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	01/2017	01/2018
Variac	RFT	LSS020	A00171	NA	NA
LISN	EMCO	3625/2	A00022	01/2016	01/2018
Measurement Receiver	Rohde & Schwarz	ESCS30	A00726	09/2016	09/2017
Shielded room for Conducted emissions	--	--	A00437	NA	NA
Temperature-Humiditymeter	Extech	SD500	A00444/	04/2017	04/2018

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

Test specification(s): 47 CFR Part 15 and RSS
Description of EUT: Low Power Communication Device Transmitter (DXX)
Manufacturer: Medtronic, Inc.
Brand mark: Medtronic
Model: TM90
Modelname: Communicator
FCC ID: LF5TM90
IC: 3408D-TM90

<< End of report >>