
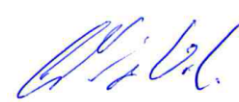


<b>Test Report No.:</b>		<b>18052903.r01</b>		Page 1 of 42	
<i>Client:</i>	<b>Tacx b.v.</b> Rijksstraatweg 52, 2241BW Wassenaar, Netherlands				
<i>Test Item:</i>	<b>Digital Transmission System (DTS)</b> <b>BLE</b>				
<i>Identification:</i>	<b>T2850</b>	<i>Serial Number:</i>	<b>P170631-1800022</b> <b>(conducted tests) and</b> <b>(radiated tests)</b>		
<i>Project No.:</i>	<b>18052903</b>	<i>Date of Receipt:</i>	<b>August 02, 2018</b>		
<i>Testing Location:</i>	<b>TÜV Rheinland Nederland B.V.</b> Eiberkamp 10 9351VT Leek				
<i>Test Specification:</i>	FCC 47 CFR Part 15, Subpart C, Section 15.247 (10-1-17 Edition) RSS-Gen (Issue 5, April 2018) and RSS-247 (Issue 2, February 2017) ANSI C63.10-2013				
<i>Test Result:</i>	The test item <b>passed</b> the test specification(s).				
<i>Testing Laboratory:</i>	<b>TÜV Rheinland Nederland B.V.</b> Eiberkamp 10 9351 VT Leek				
<i>Tested by:</i>			<i>Reviewed by:</i>		
2019-03-15	R. van der Meer / Inspector	2019-03-15	E. van der Wal / 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					
<p><b>This report shall not be reproduced, except in full, without the written permission of</b> <b>TÜV Rheinland Nederland B.V.</b> <b>The test results relate only to the item(s) tested.</b></p>					

Test Report No.:

**18052903.r01**

Page 2 of 42

## 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*

### **5.2.1 AC POWER LINE CONDUCTED EMISSION OF TRANSMITTER**

*RESULT: Pass*

## Contents

<b>1.</b>	<b>GENERAL REMARKS .....</b>	<b>4</b>
<b>1.1</b>	<b>COMPLEMENTARY MATERIALS .....</b>	<b>4</b>
<b>2.</b>	<b>TEST SITES .....</b>	<b>4</b>
<b>2.1</b>	<b>TEST FACILITIES .....</b>	<b>4</b>
<b>2.2</b>	<b>LIST OF TEST AND MEASUREMENT INSTRUMENTS TABLE 1: LIST OF TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>5</b>
<b>2.3</b>	<b>MEASUREMENT UNCERTAINTY .....</b>	<b>6</b>
<b>3.</b>	<b>GENERAL PRODUCT INFORMATION.....</b>	<b>7</b>
<b>3.1</b>	<b>PRODUCT FUNCTION AND INTENDED USE .....</b>	<b>7</b>
<b>3.2</b>	<b>SYSTEM DETAILS .....</b>	<b>7</b>
<b>3.3</b>	<b>COUNTERMEASURES TO ACHIEVE COMPLIANCE .....</b>	<b>8</b>
<b>4.</b>	<b>TEST SET-UP AND OPERATION MODES.....</b>	<b>9</b>
<b>4.1</b>	<b>TEST METHODOLOGY.....</b>	<b>9</b>
<b>4.2</b>	<b>OPERATION MODES .....</b>	<b>9</b>
<b>4.3</b>	<b>PHYSICAL CONFIGURATION FOR TESTING.....</b>	<b>10</b>
<b>4.4</b>	<b>TEST SOFTWARE .....</b>	<b>12</b>
<b>4.5</b>	<b>SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT .....</b>	<b>13</b>
<b>5.</b>	<b>TEST RESULTS.....</b>	<b>14</b>
<b>5.1</b>	<b>CONDUCTED MEASUREMENTS AT ANTENNA PORT.....</b>	<b>14</b>
5.1.1	<i>Conducted Output Power.....</i>	<i>14</i>
5.1.2	<i>6dB and 99% Bandwidth.....</i>	<i>17</i>
5.1.3	<i>Peak Power Spectral Density.....</i>	<i>22</i>
5.1.4	<i>Band Edge Conducted Emissions.....</i>	<i>25</i>
5.1.5	<i>Radiated Spurious Emissions of Transmitter.....</i>	<i>28</i>
<b>5.2</b>	<b>AC POWER LINE CONDUCTED MEASUREMENTS.....</b>	<b>36</b>
5.2.1	<i>AC Power Line Conducted Emission of Transmitter.....</i>	<i>37</i>
5.2.2	<i>Plots of the AC Power-line Conducted Emissions.....</i>	<i>38</i>

Test Report No.:

**18052903.r01**

Page 4 of 42

## **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 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-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 : 120 VAC.

*(\*)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.*

Test Report No.:

**18052903.r01**

Page 5 of 42

## 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)
<b>For Antenna Port Conducted Emissions</b>					
Temperature-Humiditymeter	Extech	SD500	A00446	06/2018	06/2019
Spectrum Analyzer	Rohde & Schwarz	FSV	A01744	07/2018	07/2020
RF Cable	Huber + Suhner	Sucoflex 102	A00347	06/2018	06/2019
<b>For Radiated Emissions</b>					
Measurement Receiver	Rohde & Schwarz	ESCI	A00314	03/2018	03/2019
RF Cable S-AR	Gigalink	APG0500	A00447	03/2018	03/2019
Controller	Maturo	SCU/088/ 8090811	A00450	N/A	N/A
Controller	EMCS	DOC202	A00257	N/A	N/A
Test facility	Comtest	FCC listed: 786213 IC: 2932G-2	A00235	10/2017	10/2020
Spectrum Analyzer	Rohde & Schwarz	FSV	A00337	07/2018	07/2019
Antenna mast	EMCS	AP-4702C	A00258	N/A	N/A
Temperature-Humiditymeter	Extech	SD500	A00444	06/2018	06/2019
Guidehorn 1-18 GHz	EMCO	3115	A00008	12/2017	12/2020
Guidehorn 18-40 GHz	EMCO	RA42-K-F-4B-C	A00012	01/2018	01/2021
Biconilog Testantenna	Teseq	CBL 6111D	A00466	03/2018	03/2019
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	04/2018	04/2019

Test Report No.:

**18052903.r01**

Page 6 of 42

Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (mm/yyyy)	Calibration due date (mm/yyyy)
<b>For AC Powerline Conducted Emissions</b>					
Pulse limiter	R&S	ESH3-Z2	A00051	01/2017	01/2019
Variac	RFT	LSS020	A00171	NA	NA
LISN	EMCO	3625/2	A00022	01/2018	01/2020
Measurement Receiver	Rohde & Schwarz	ESCS30	A00726	06/2018	06/2019
RF Cable	-	-	A01844	NA	NA
Shielded room for Conducted emissions	--	--	A00437	NA	NA
Temperature-Humidity meter	Extech	SD500	A00441	06/2018	06/2019

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	< 1.3GHz	1.7dB
	1.3 - 40GHz	2.9 – 3.4dB
Radiated Emission	150kHz - 30MHz	±5.0dB
	30MHz - 1GHz	±5.22dB
	> 1GHz	±5.22dB
AC Power Line Conducted Emissions	150kHz - 30MHz	±3.6dB

Test Report No.:

**18052903.r01**

Page 7 of 42

### **3. General Product Information**

#### **3.1 Product Function and Intended Use**

The brand Tacx model T2850, hereafter referred to as EUT, is a Bluetooth Low Energy (BLE) 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 2 Mbps is used. The EUT also contains a Digital Transmission System (DTS) operating in the frequencyband 2403-2480 MHz, based on ANT technology. The ANT+ transceiver is covered in a separate test report.

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, BLE
Manufacturer	:	Tacx b.v.
Brand	:	Tacx
Model(s)	:	T2850
Serial Number	:	P170631-1800022 (conducted tests) and (radiated tests)
Voltage input rating	:	48 Vdc (through AUX2)
Voltage output rating	:	--
Current input rating	:	--
Antenna	:	Internal, integrated on the PCB
Antenna Gain	:	+ 2.0 dBi
Operating frequency	:	2402 MHz-2480 MHz.
Modulation	:	GFSK
Data-rate	:	2 Mbps
Remarks	:	n.a.

*Test Report No.:*

**18052903.r01**

*Page 8 of 42*

**Table 3: Interfaces present on the EUT**

There are no interface ports present on the EUT.

**3.3 Countermeasures to achieve 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.

### 4.2 Operation Modes

Testing was performed at the lowest operating frequency (2402 MHz), at the operating frequency in the middle of the specified frequency band (2440 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 control setting
Transmit (Tx)	On	2402	3
Transmit (Tx)	On	2440	3
Transmit (Tx)	On	2480	3

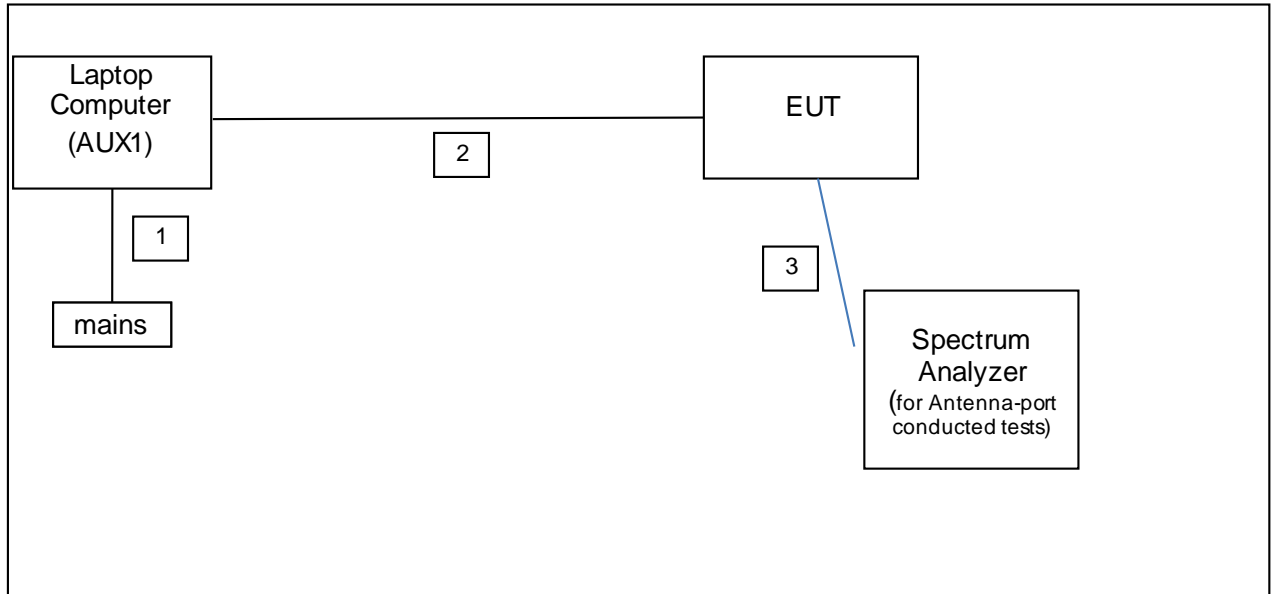
### 4.3 Physical Configuration for Testing

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 test data. 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 power supply
2.	Data com.	Laptop USB	EUT	--
3.	Antenna port	EUT	Spectrum analyzer	Conducted tests

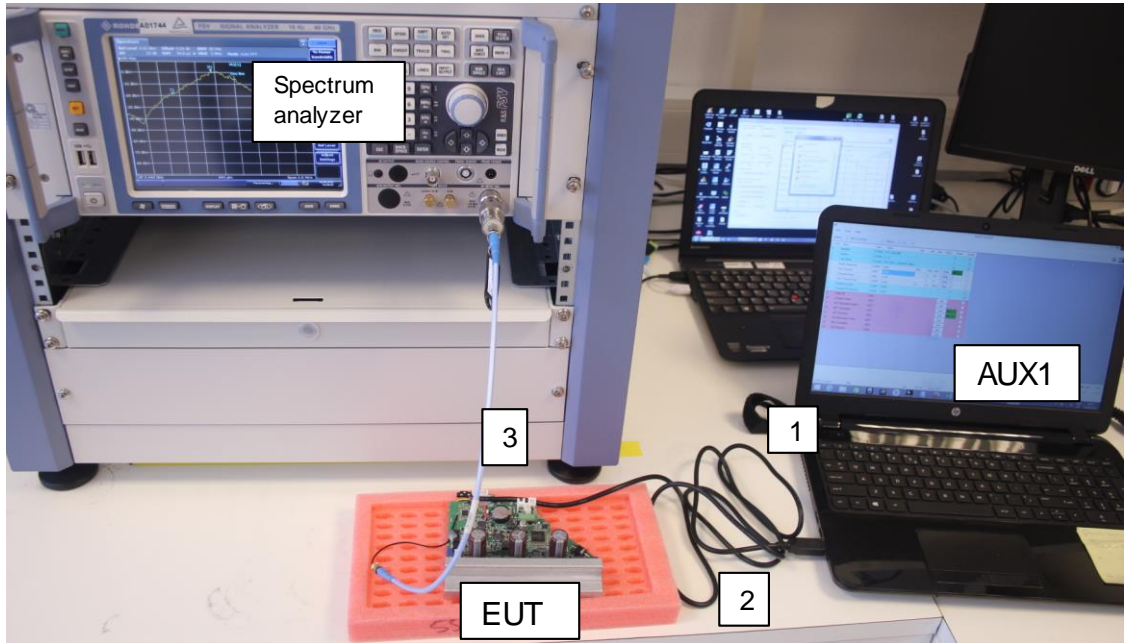


Figure 2b: Test Setup Photos – conducted tests and programming



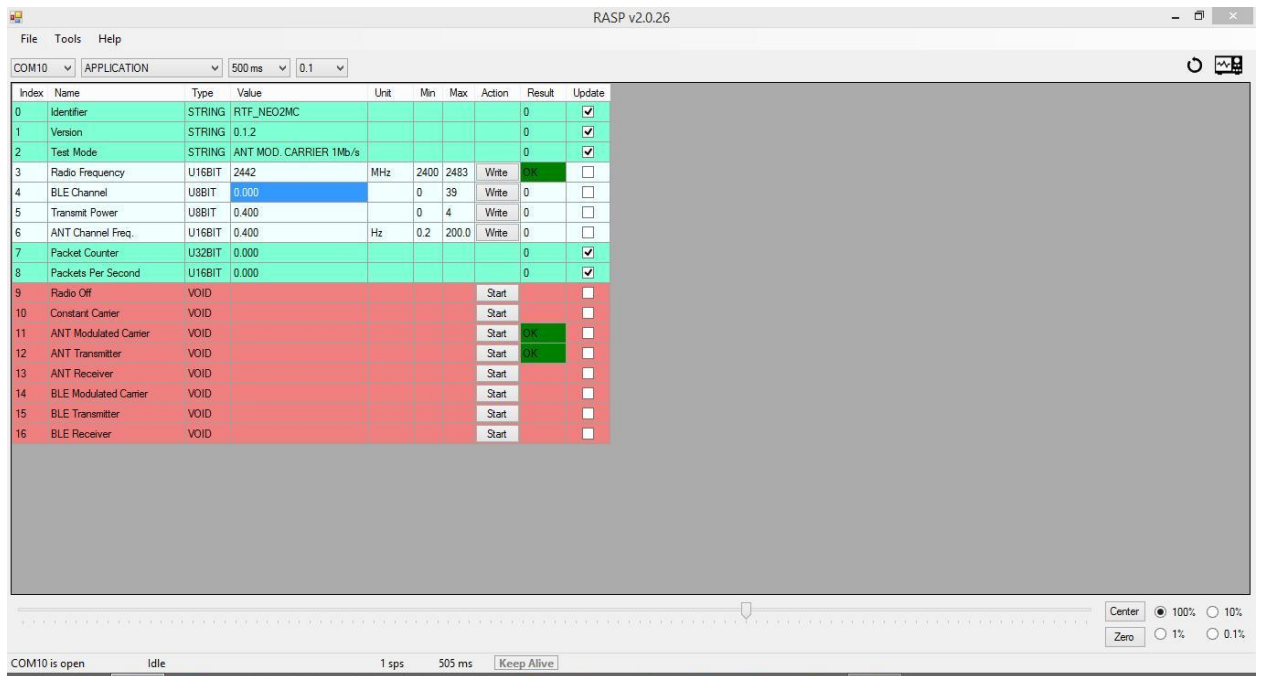
Figure 3c: Test Setup Photos – radiated tests and programming

### 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 : RASP v2.0.26

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.



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

## 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: J3T34EA#ABH  
Serial Number: CND424BVDG  
Remark: host for test software, property applicant



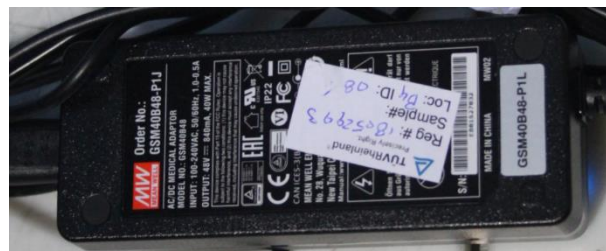
2. AUX2a

Product: Power supply  
Brand: Mean Well  
Model: GST40A48P1LTE  
Serial Number: EB78290647  
Remark: property applicant



3. AUX2b

Product: Power supply  
Brand: Mean Well  
Model: GSM40848-P1J  
Serial Number: EB81527832  
Remark: property applicant



Test Report No.:

**18052903.r01**

Page 14 of 42

## 5. Test Results

### 5.1 Conducted Measurements at Antenna Port

#### 5.1.1 Conducted Output Power

**RESULT: Pass**

Date of testing: 2019-01-17

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.

Measurement uncertainty is +/- 2.5 dB.

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 (= 0.8dB Cableloss) included in the reading.

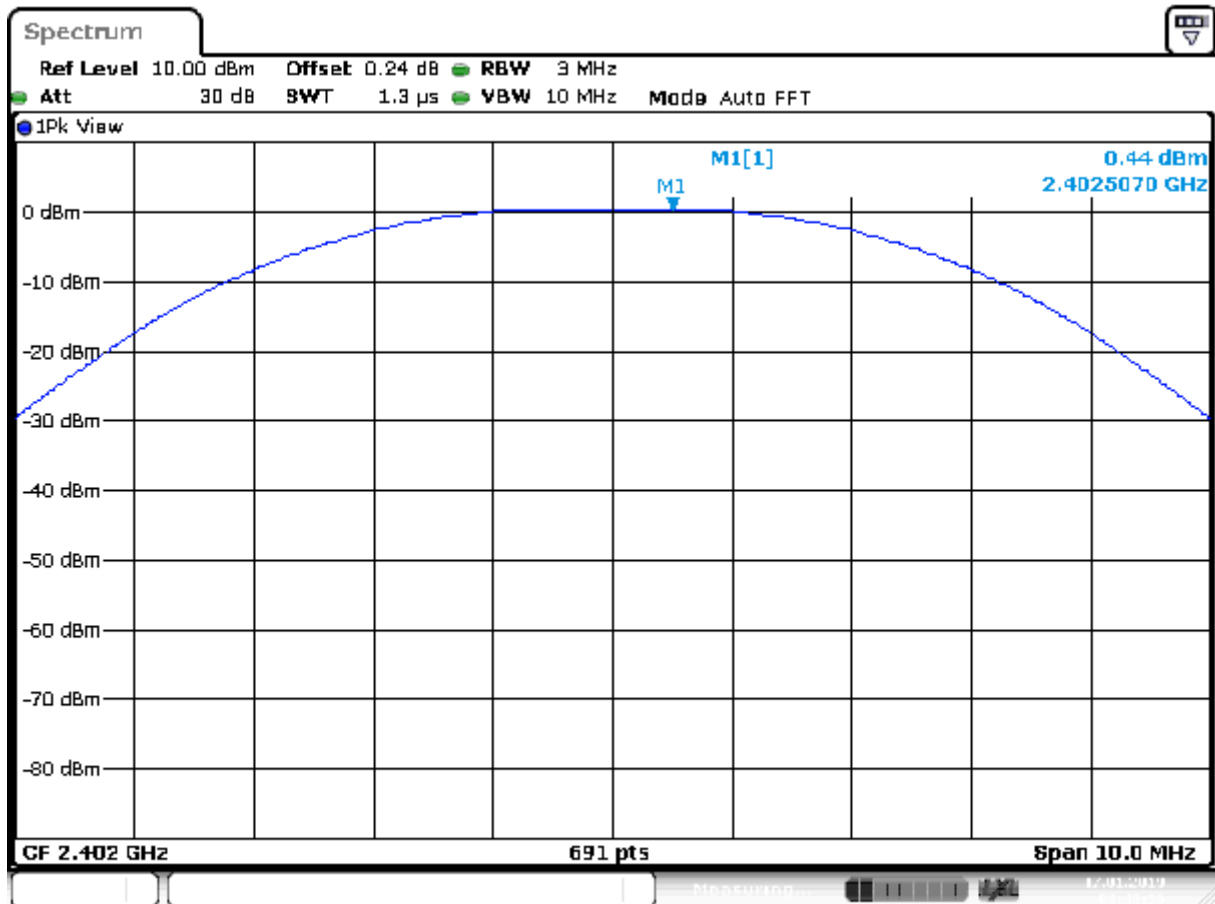
Test Report No.:

**18052903.r01**

Page 15 of 42

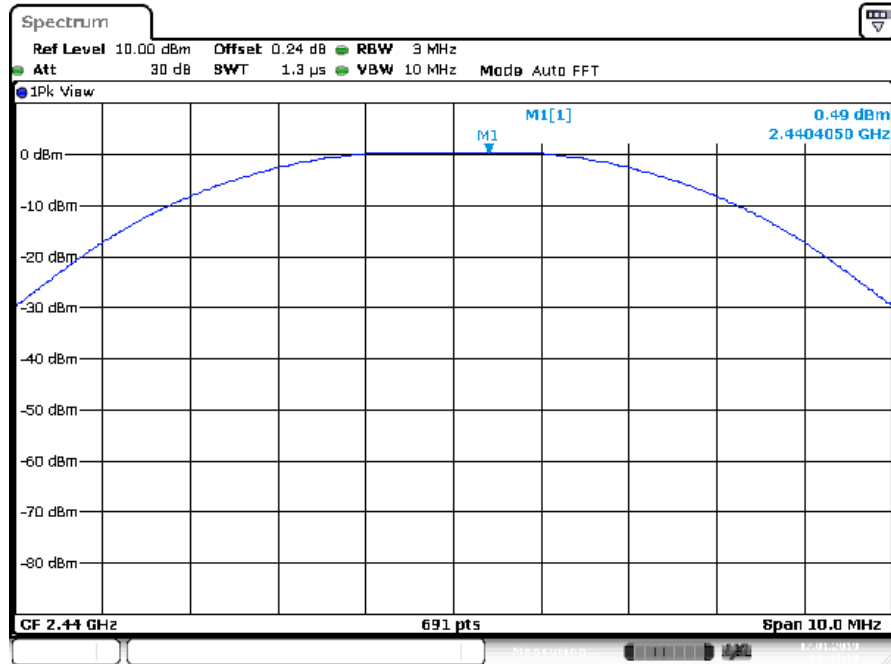
**Conducted Output Power**

Frequency [MHz]	Output Power [dBm] (mW)	Limit [dBm]	Verdict [Pass/Fail]	Antenna Gain [dBi]	EIRP [dBm]	EIRP [mW]	Plot number
2402	0.44 (1.11 mW)	+30	Pass	+2.0	2.44	1.75	1A
2440	0.49 (1.12 mW)	+30	Pass	+2.0	2.49	1.77	1B
2480	0.36 (1.09 mW)	+30	Pass	+2.0	2.36	1.72	1C

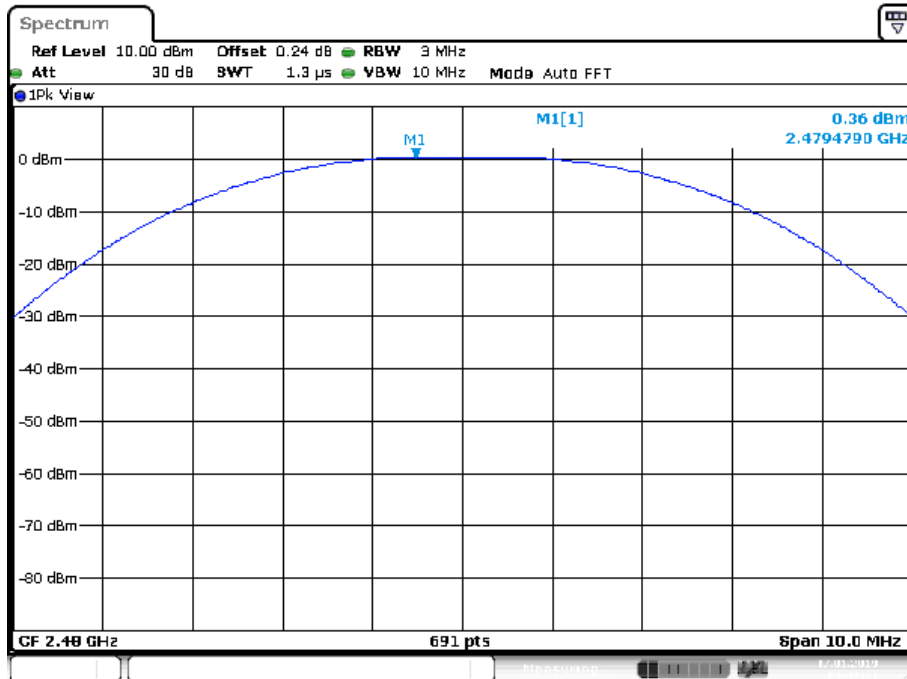


Date: 17.JAN.2019 08:48:55

Plot A



Plot B



Plot C



Test Report No.:

**18052903.r01**

Page 17 of 42

## 5.1.2 6dB and 99% Bandwidth

### RESULT: PASS

Date of testing: 2019-01-17

#### 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 sideskirts. 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.

Measurement uncertainty is +/- 26kHz.

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

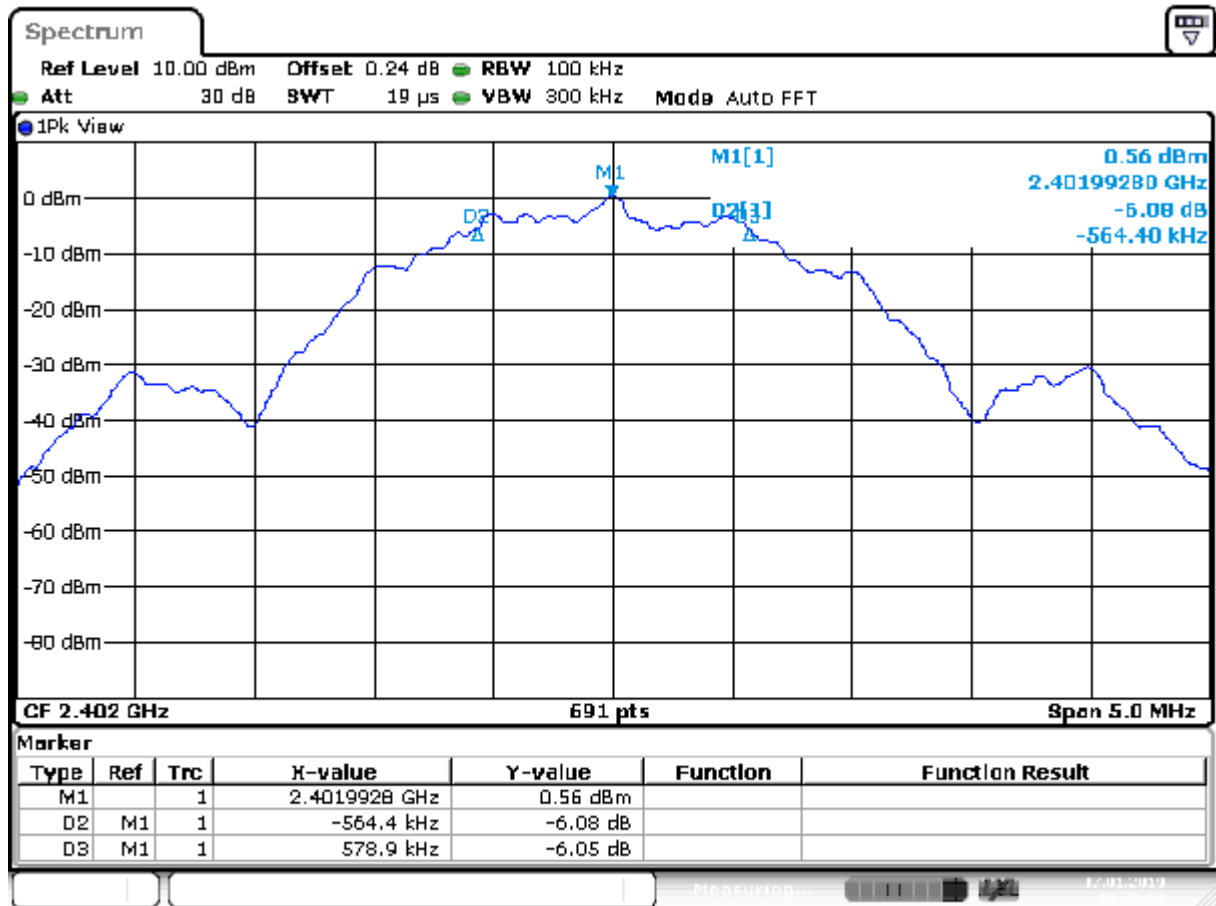
Test Report No.:

**18052903.r01**

Page 18 of 42

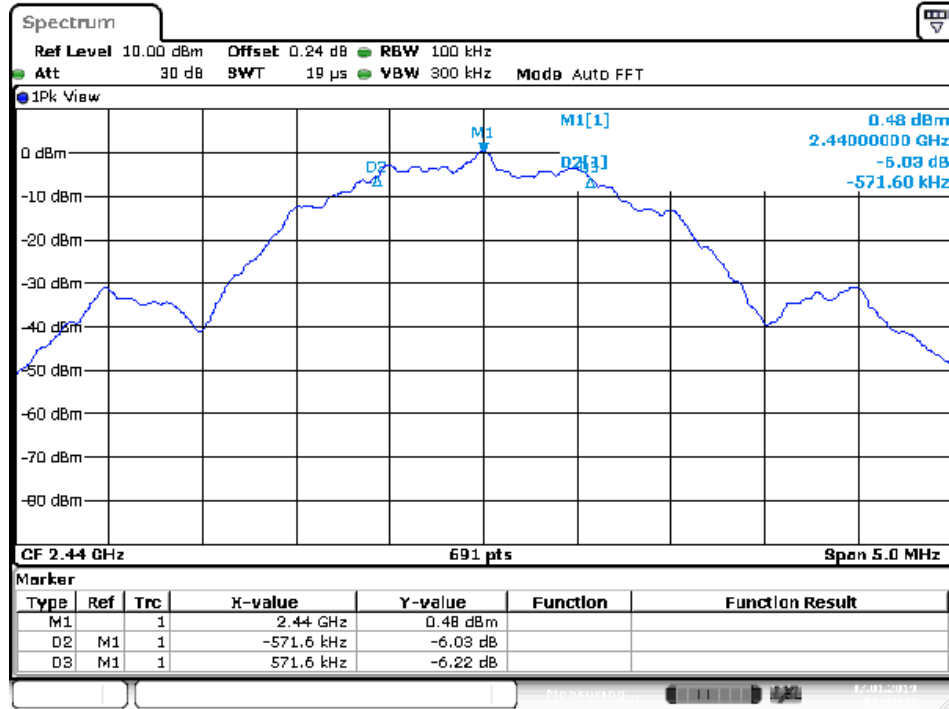
**6dB Bandwidth**

Operating Frequency [MHz]	99% Bandwidth [kHz]	6dB Bandwidth [kHz]	Limit 6dB BW [kHz]	Verdict [Pass/Fail]	Plot number
2402	2076.7	1143.3	>500	Pass	A1/A2
2440	2076.7	1143.2	>500	Pass	B1/B2
2480	2083.9	1150.5	>500	Pass	C1/C2

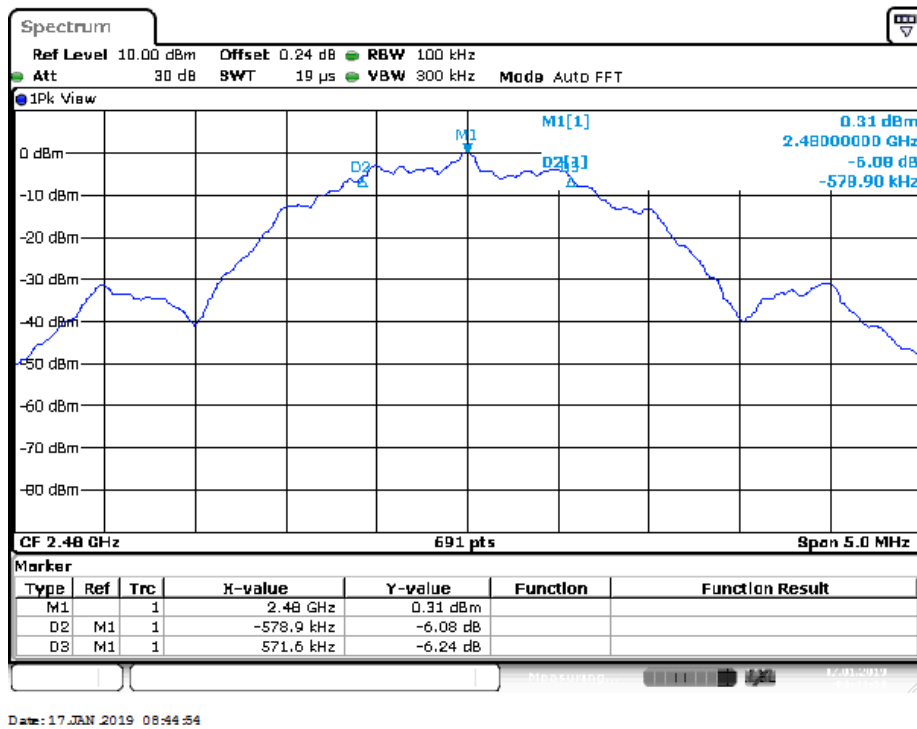


Date: 17 JAN 2019 08:40:51

Plot A1



Plot B1

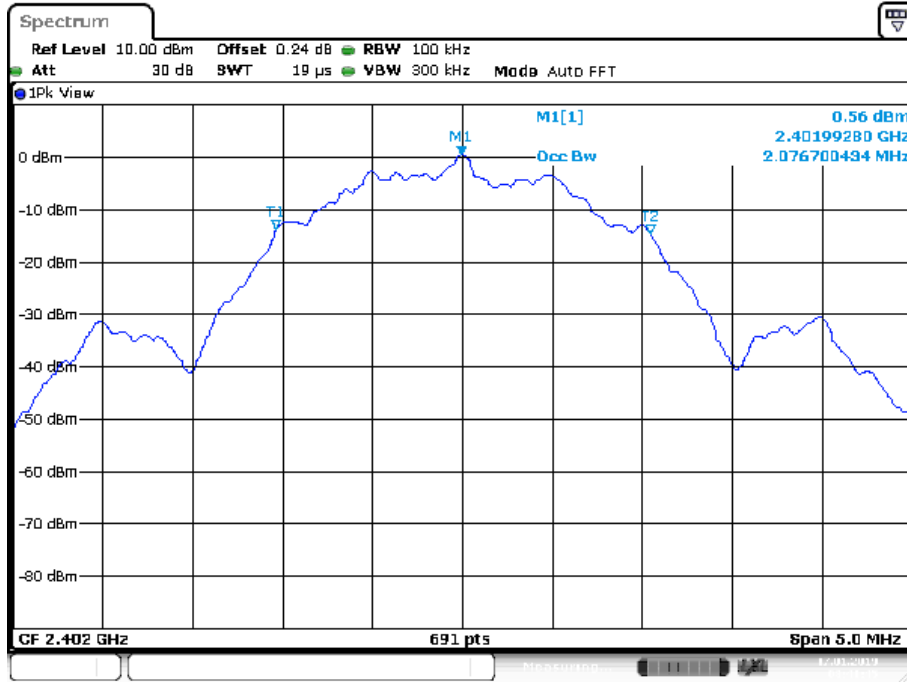


Plot C1

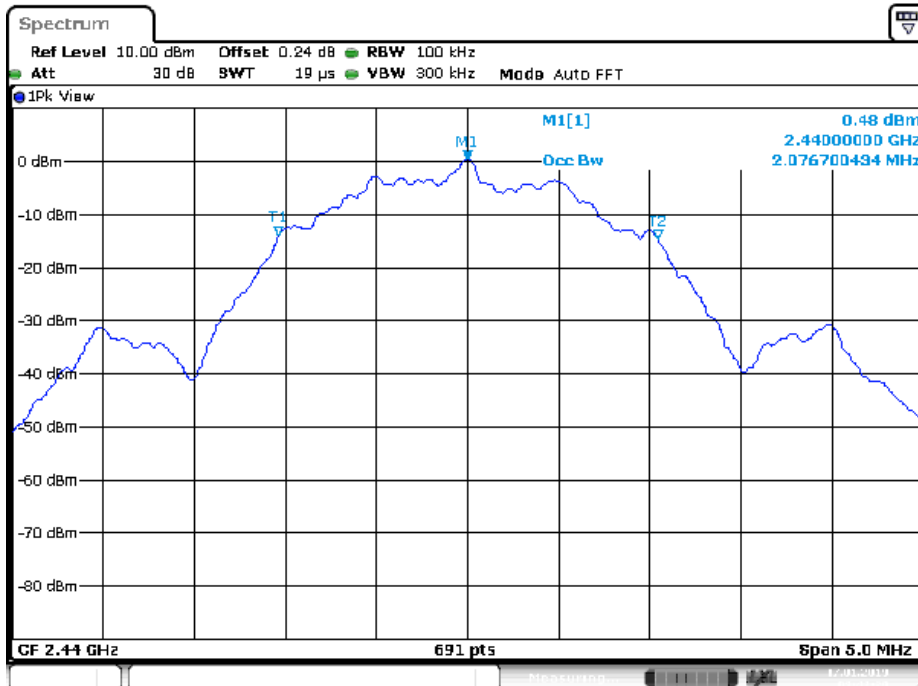
Test Report No.:

18052903.r01

Page 20 of 42



Plot A2

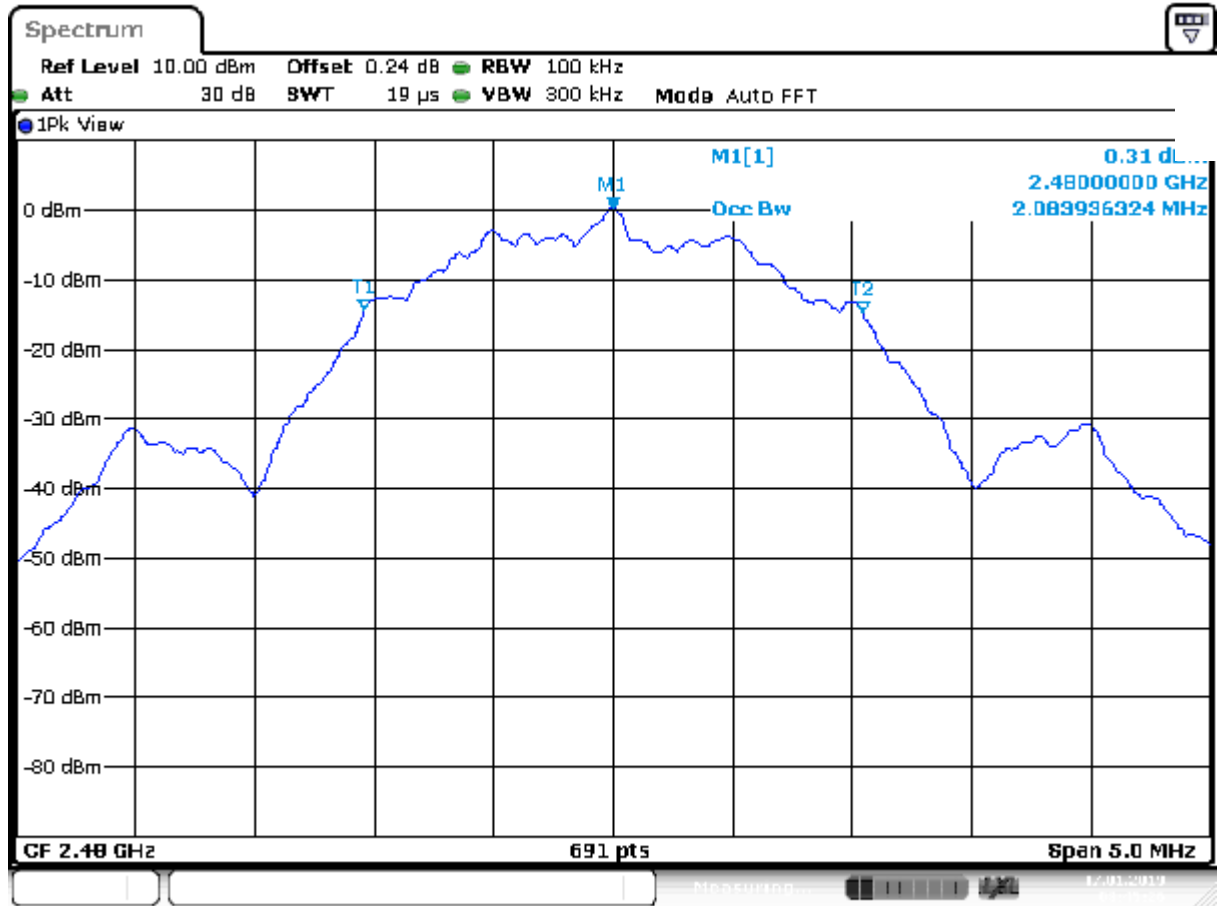


Plot B2

Test Report No.:

18052903.r01

Page 21 of 42



Date: 17 JAN 2019 08:45:26

Plot C2

Test Report No.:

**18052903.r01**

Page 22 of 42

### 5.1.3 Peak Power Spectral Density

#### RESULT: Pass

Date of testing: 2019-01-17

#### 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 (0.24 dB).

Measurement uncertainty is +/- 1.1 dB.

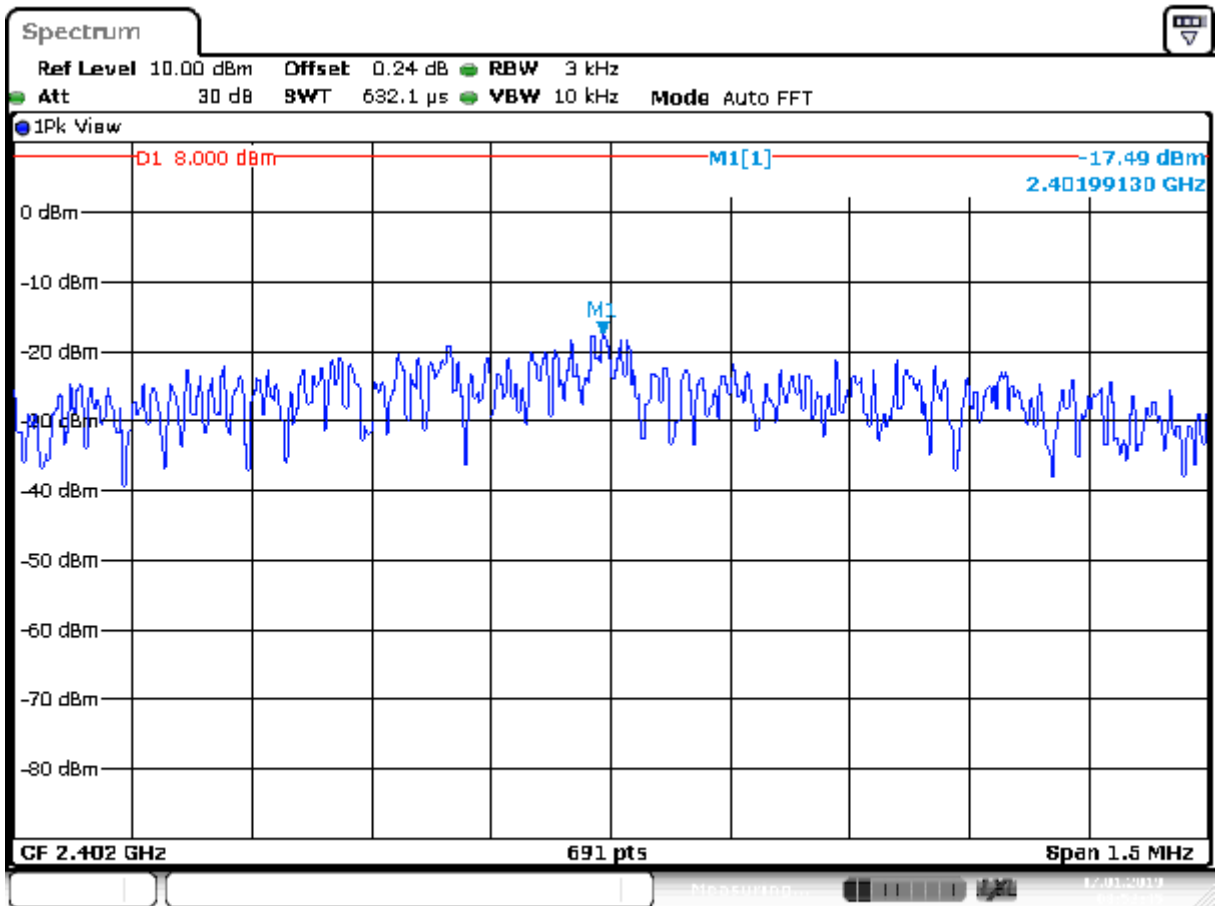
Test Report No.:

**18052903.r01**

Page 23 of 42

**Peak Power Spectral Density**

Operating Frequency [MHz]	Max PSD [dBm]	Limit [dBm]	Verdict [Pass/Fail]	Plot
2402	-17.49	8	Pass	A
2440	-17.57	8	Pass	B
2480	-17.75	8	Pass	C



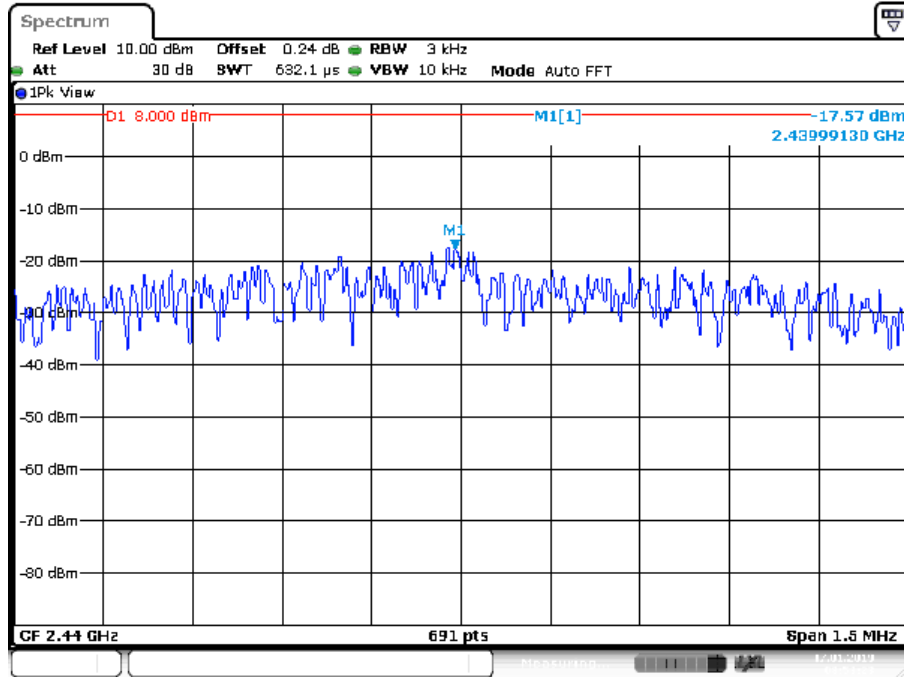
Date: 17.JAN.2019 08:52:45

Plot A

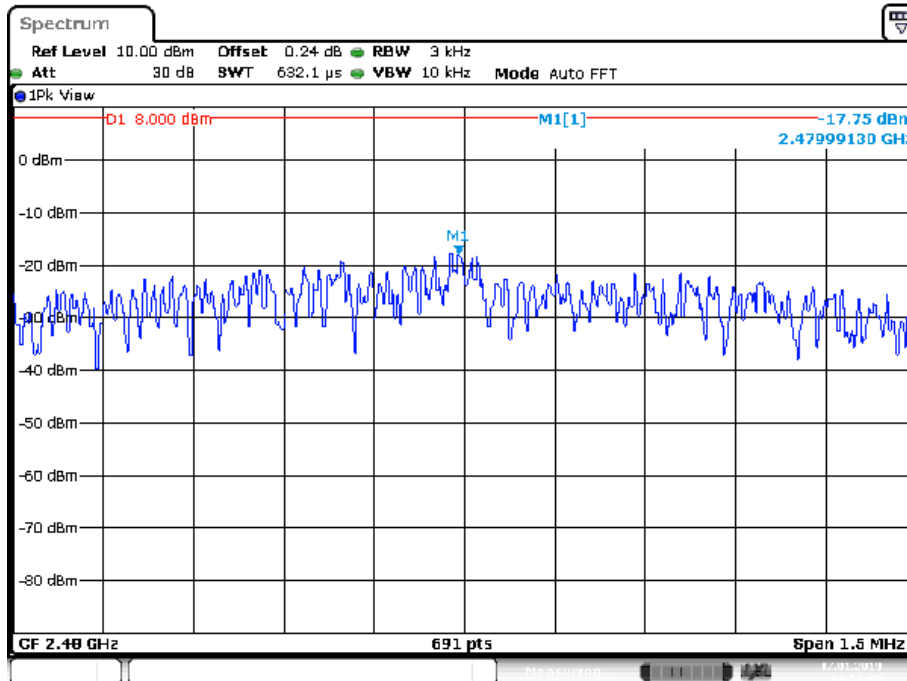
Test Report No.:

18052903.r01

Page 24 of 42



Plot B



Plot C



Test Report No.:

**18052903.r01**

Page 25 of 42

## 5.1.4 Band Edge Conducted Emissions

**RESULT: Pass**

Date of testing: 2019-01-17

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

An RF conducted measurement was done using the marker-delta method, as described in ANSI C63.10.

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.

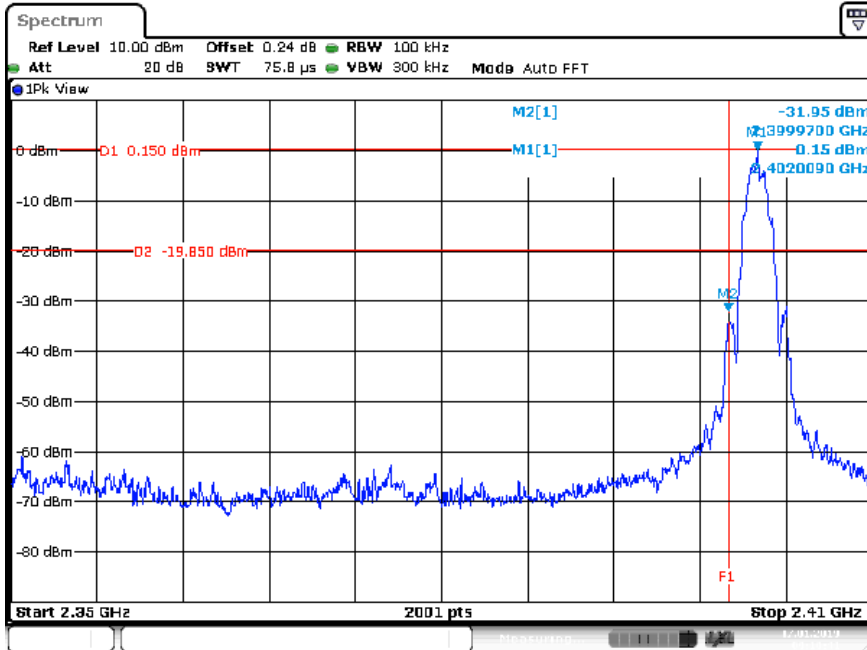
Measurement uncertainty is +/- 2.5 dB.

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

Test Report No.:

18052903.r01

Page 26 of 42

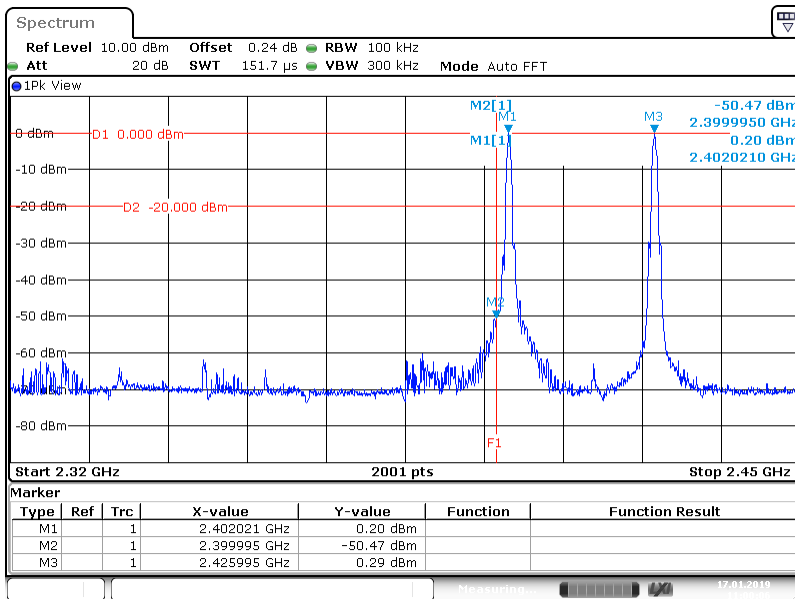


Date: 17 JAN 2019 09:10:41

Plot: Band Edge Conducted Emission, Spectral Diagram, 2402 MHz

Plot showing more than 20 dB band edge attenuation.

F1 shows the band edge frequency of 2400 MHz.

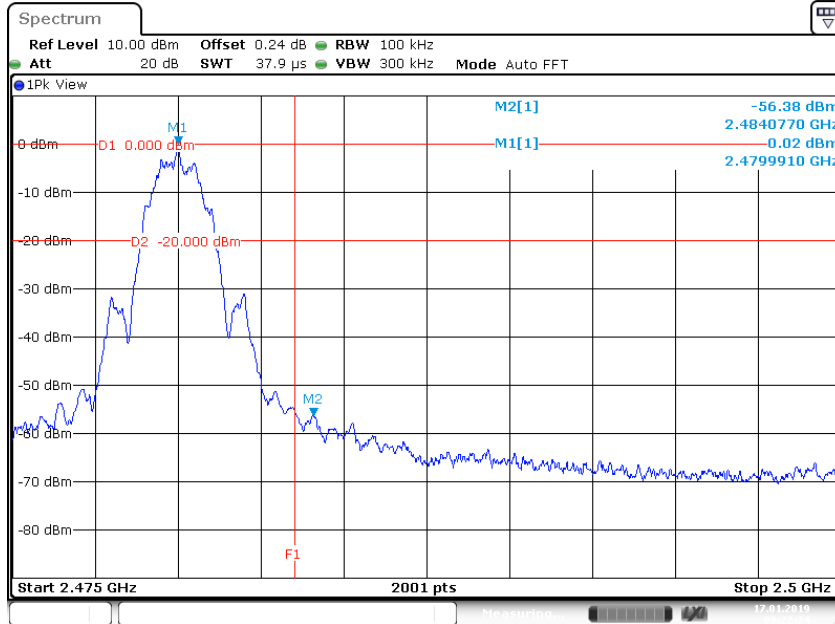


Date: 17 JAN 2019 11:00:07

Plot: Band Edge Conducted Emission, Spectral Diagram, Normal Mode

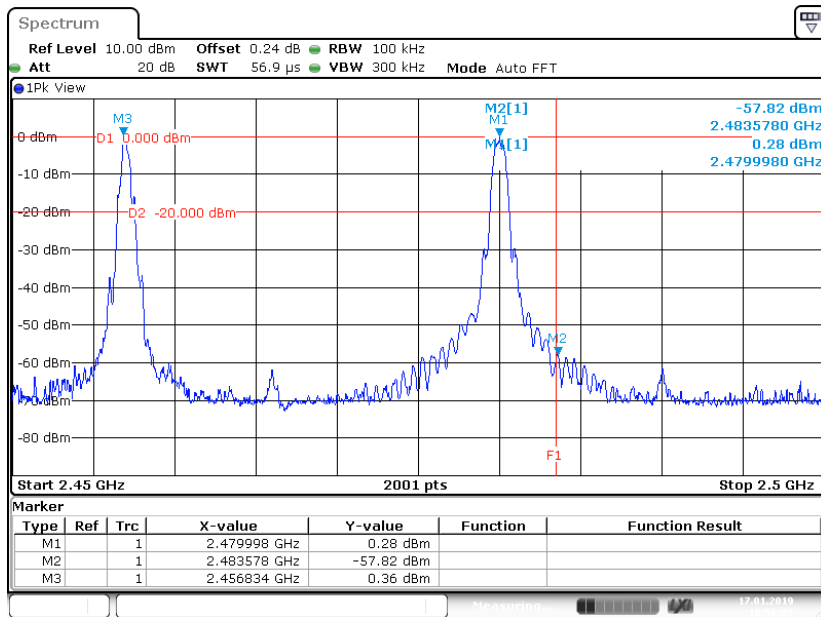
Plot showing more than 20 dB band edge attenuation.

F1 shows the band edge frequency of 2400 MHz



Date: 17.JAN.2019 09:22:24

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.



Date: 17.JAN.2019 10:56:07

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

Test Report No.:

**18052903.r01**

Page 28 of 42

## 5.1.5 Radiated Spurious Emissions of Transmitter

### RESULT: Pass

Date of testing: 2018-12-11 & 2019-01-15

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 10mm 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 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.

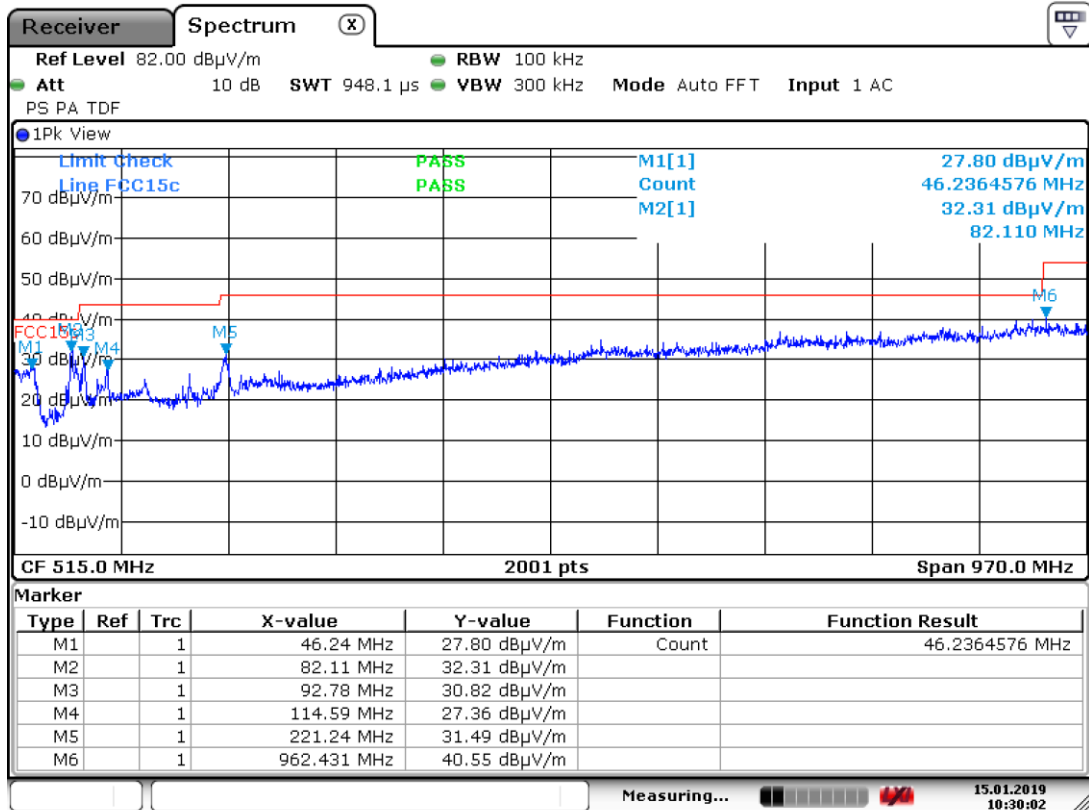
At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

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. 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.

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

Frequency [MHz]	Antenna Orientation	Level QP [dBµV/m]	Limit QP [dBµV/m]	Verdict [Pass/Fail]
81.35	Vertical	28.3	40.0	Pass
81.43	Vertical	29.3	40.0	Pass
114.02	Vertical	24.5	40.0	Pass
220.59	Vertical	24.3	46.0	Pass
249.46	Vertical	14.1	46.0	Pass
800-960 noise	Vertical	28.2	46.0	Pass

- Notes:
- 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.
  - Preliminary measurements indicated that the radiated emissions from EUT were not affected by the power supplies (AUX2a / AUX2b) used, worst case (AUX2a) shown.
  - \*R refers to a frequency in a restricted band
  - Quasi Peak detector used with a bandwidth of 120 kHz.
  - Measurement uncertainty is +/- 5.22 dB.



Date: 15.JAN.2019 10:30:02

Plot of the emissions (Peak detector values shown)

Test Report No.:

**18052903.r01**

Page 30 of 42

**Radiated Emissions, 1 - 25GHz, 2402 MHz.**

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Result
2666	Vertical	Pk	1	46.0	54 (Av) 74 (Pk)	Pass
3120	Vertical	Pk	1	46.9	54 (Av) 74 (Pk)	Pass
4804 <sup>H</sup>	Vertical	Pk	1	54.8 Pk 50.8 Av	54 (Av) 74 (Pk)	Pass
9606 <sup>H</sup>	Vertical	Pk	1	54.2 Pk 50.9 Av	54 (Av) 74 (Pk)	Pass

**Radiated Emissions, 1 - 25GHz, 2440 MHz.**

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Result
2568	Vertical	Pk	1	50.3 Pk 47.2 Av	54 (Av) 74 (Pk)	Pass
4882 <sup>H</sup>	Horizontal	Pk	1	53.1 Pk 51.7 Av	54 (Av) 74 (Pk)	Pass
6000	Horizontal	Pk	1	50.7 Pk 44.9 Av	54 (Av) 74 (Pk)	Pass
7526	Horizontal	Av	1	53.0 Pk 45.9 Av	54 (Av) 74 (Pk)	Pass

Test Report No.:

**18052903.r01**

Page 31 of 42

**Radiated Emissions, 1 - 25GHz, 2480 MHz.**

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Result
2608	Vertical	Pk	1	49.1	54 (Av) 74 (Pk)	Pass
4666	Vertical	Pk	1	48.9	54 (Av) 74 (Pk)	Pass
4929	Horizontal	Pk	1	50.6 Pk 38.3 Av	54 (Av) 74 (Pk)	Pass
4960*H	Horizontal	Pk	1	52.9 Pk 52.5 Av	54 (Av) 74 (Pk)	Pass

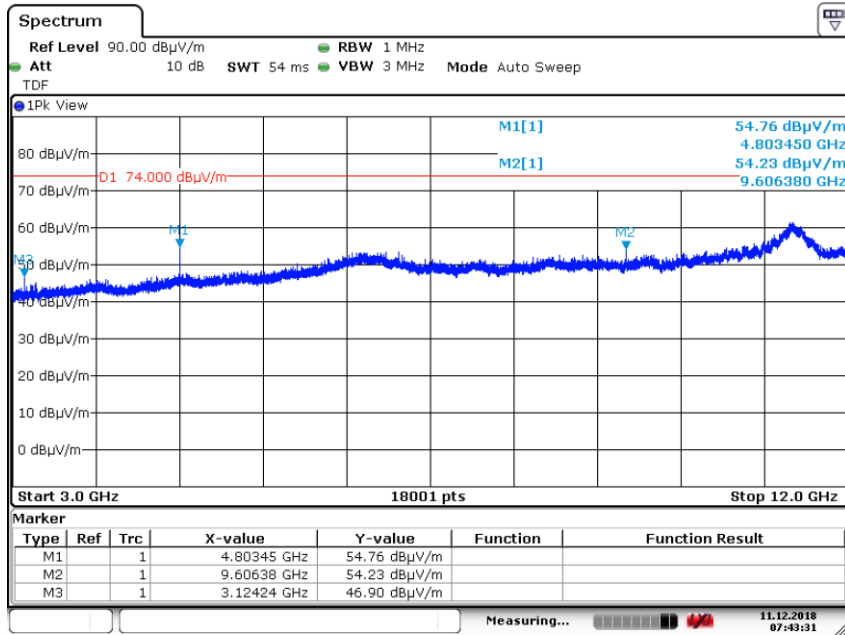
- Notes:
- \*R refers to a frequency in a restricted band,
  - \*H refers to a frequency which is a harmonic of the fundamental.
  - Field strength values of radiated emissions not listed in the tables above are more than 20 dB below the applicable limit.
  - Measurement uncertainty is +/- 5.5 dB.
  - a selection of plots is provided on the next pages

Test Report No.:

18052903.r01

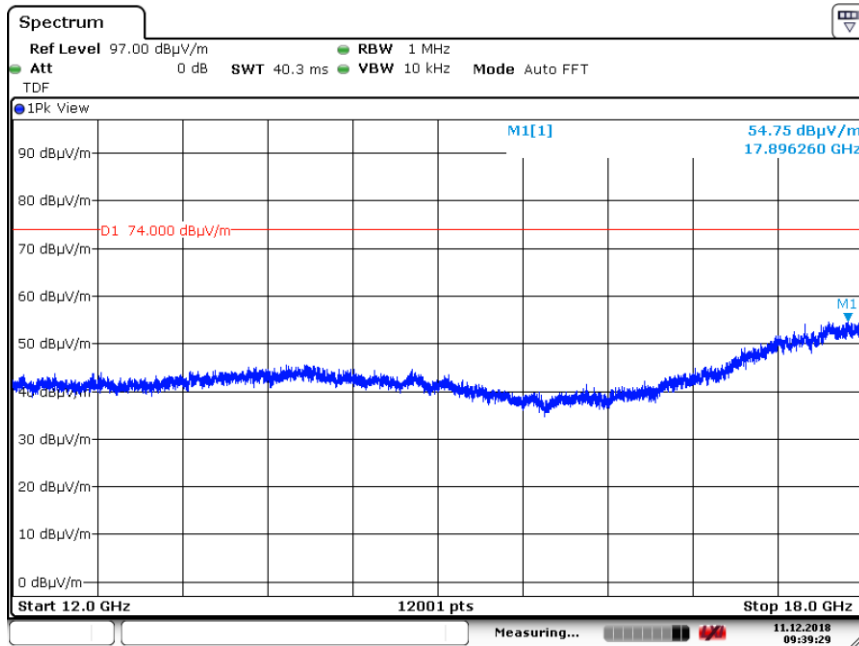
Page 32 of 42

### Plots of the radiated emissions



Date: 11.DEC.2018 07:43:31

Plot of the emissions at 2402 MHz, Vertical polarization, Peak values shown



Date: 11.DEC.2018 09:39:29

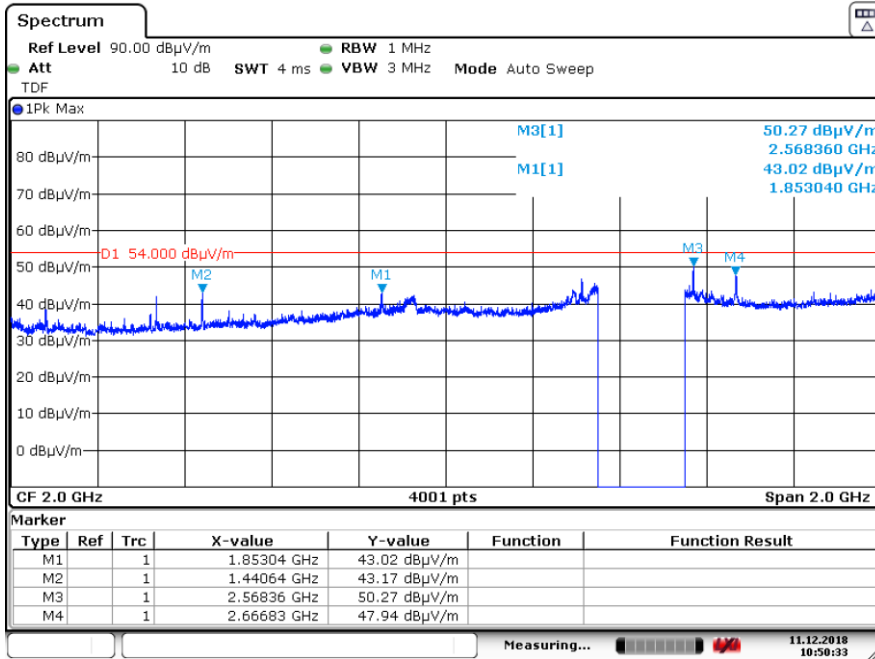
Plot of the emissions at 2402 MHz, Vertical polarization, Peak values shown



Test Report No.:

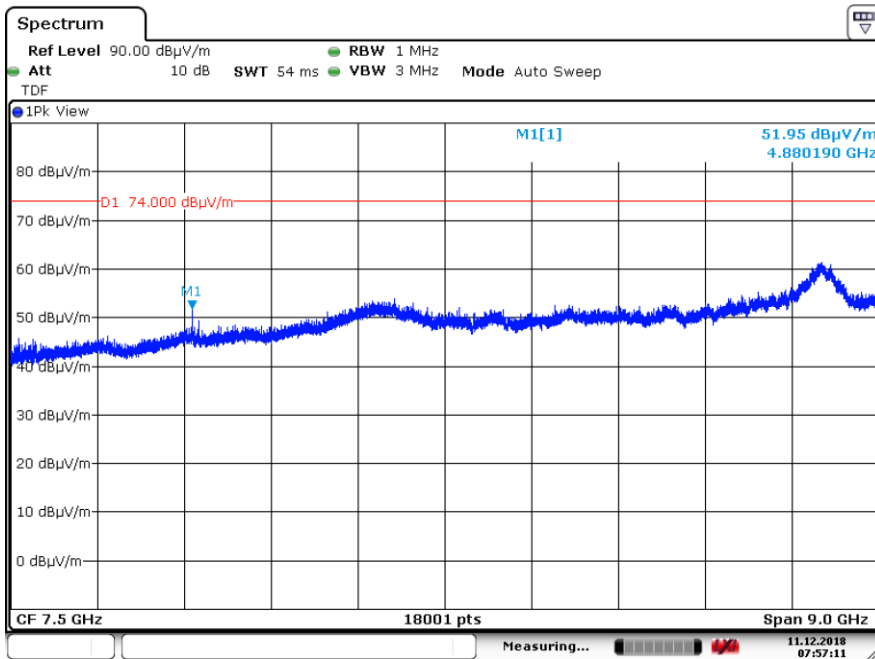
**18052903.r01**

Page 33 of 42



Date: 11.DEC.2018 10:50:33

Plot of the emissions at 2440 MHz, Vertical polarization, Peak values shown, gap in the plot is of the used Notch filter



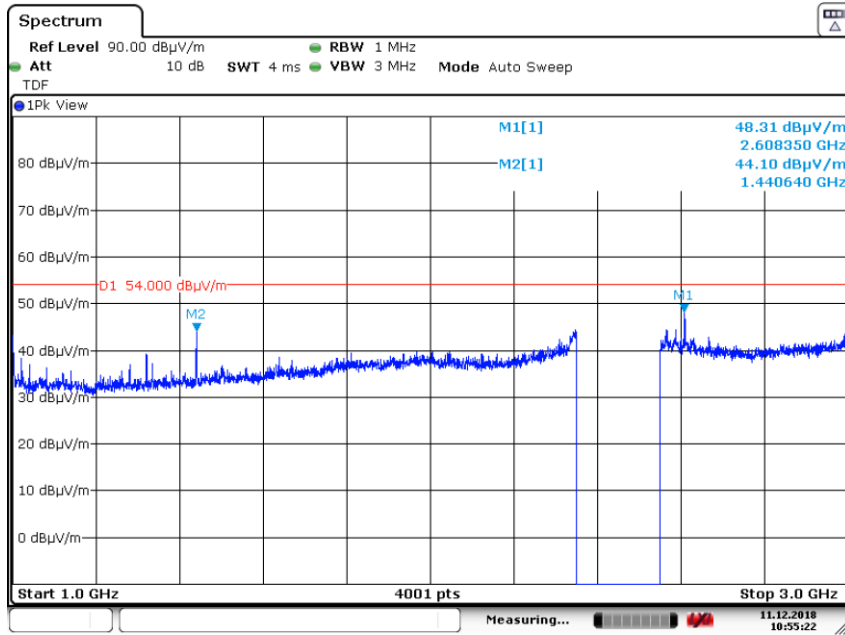
Date: 11.DEC.2018 07:57:11

Plot of the emissions at 2440 MHz, Vertical polarization, Peak values shown

Test Report No.:

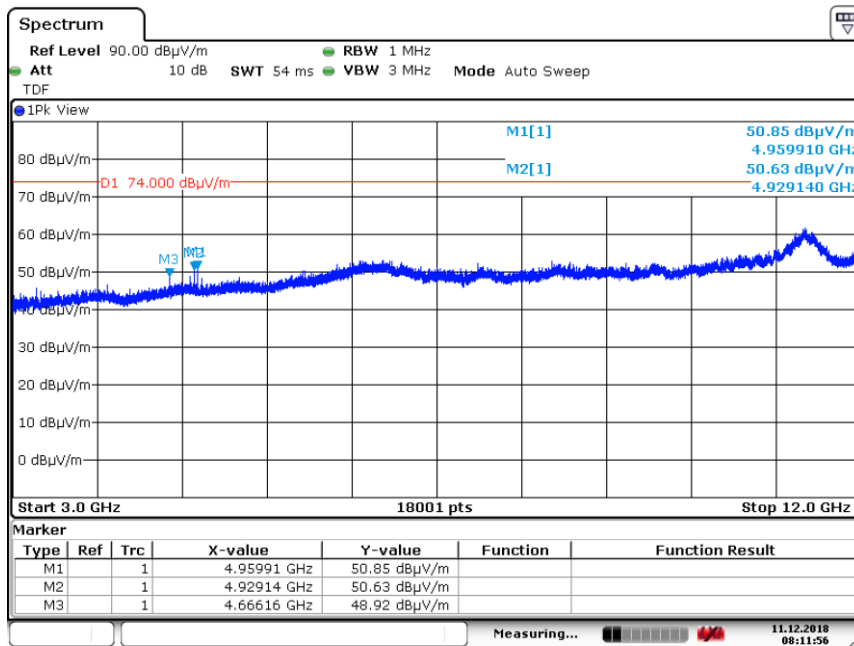
18052903.r01

Page 34 of 42



Date: 11.DEC.2018 10:55:22

Plot of the emissions at 2480 MHz, horizontal polarization, Peak values shown, gap in the plot is of the used Notch filter



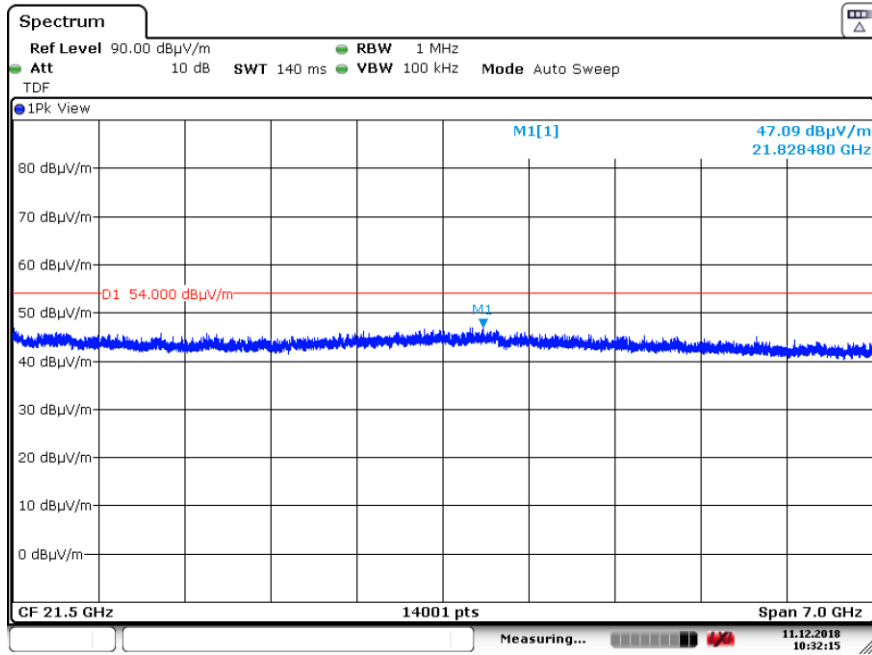
Date: 11.DEC.2018 08:11:56

Plot of the emissions at 2480 MHz, Vertical polarization, Peak values shown

Test Report No.:

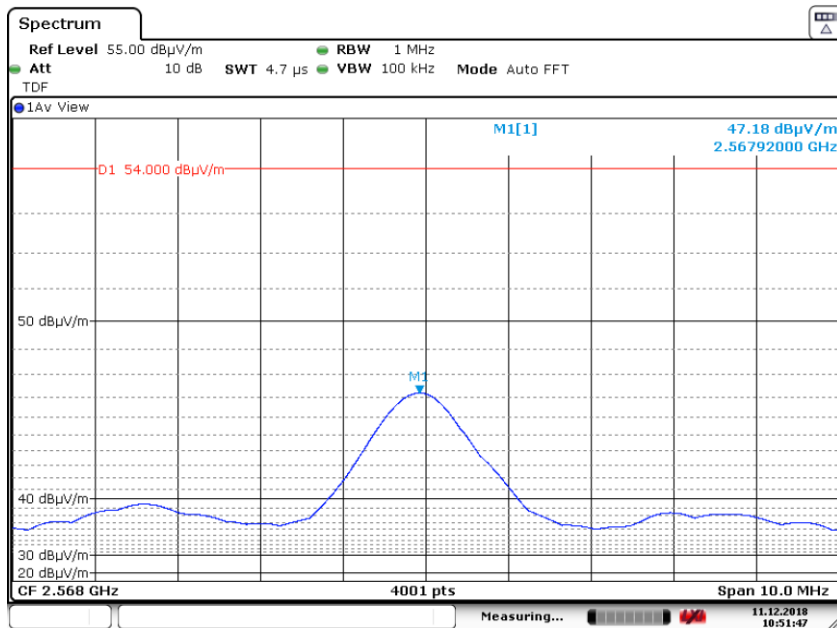
18052903.r01

Page 35 of 42



Date: 11.DEC.2018 10:32:15

Plot Radiated unwanted emissions in the range 18 – 25 GHz at 2480 MHz, reduced Video BW (Peak values, Antenna Vertical position show n).



Date: 11.DEC.2018 10:51:47

Plot Radiated unwanted emissions at 2440 MHz, (Average values, Antenna Vertical position show n).

## 5.2 AC Power Line Conducted Measurements

**RESULT: Pass.**

Date of testing: 2018-12-21

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  $\mu$ 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 $\mu$ V) Quasi-Peak	Conducted Limit (dB $\mu$ 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  $\mu$ H / 50  $\Omega$  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 10mm 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.

Test Report No.:

**18052903.r01**

Page 37 of 42

**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	
0.1734	41.8	*3	41.8	*3	65.4	55.4	Pass
0.2555	43.2	*3	43.1	*3	61.4	51.4	Pass
1.896	39.0	*3	38.5	*3	56.0	46.0	Pass
2.283	41.0	*3	40.3	*3	56.0	46.0	Pass
2.705	39.5	*3	39.3	*3	56.0	46.0	Pass
4.263	40.3	*3	40.0	*3	56.0	46.0	Pass
6.150	50.0	*3	47.1	*3	60.0	50.0	Pass
6.497	47.9	*3	45.0	*3	60.0	50.0	Pass
8.052	42.4	*3	47.6	*3	60.0	50.0	Pass

Power supply AUX2a

Frequency (MHz)	Measurement results (dBµV) L1		Measurement results (dBµV) L2/Neutral		Limits (dBµV)		Verdict (Pass/Fail)
	QP	AV	QP	AV	QP	AV	
0.1500	48.4	*3	45.0	*3	66.0	56.0	Pass
0.1578	45.0	*3	48.1	*3	65.5	55.5	Pass
0.1773	45.2	*3	44.6	*3	64.5	54.5	Pass
0.2320	41.8	*3	41.7	*3	62.4	52.4	Pass
0.3922	47.8	*3	47.9	*3	58.1	48.1	Pass
3.236	35.9	*3	34.3	*3	56.0	46.0	Pass
9.904	40.5	*3	40.6	*3	60.0	50.0	Pass

Power supply AUX2b

The results of the AC power line 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 AUX2a , AUX2b respectively that connects to 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 but not transmitting simultaneously. Worst case values noted.
3. Qp values already within Av limits, therefor Av not tested.
4. Measurement uncertainty is +/- 3.5 dB.
5. Plots are provided on the next pages.

Test Report No.:

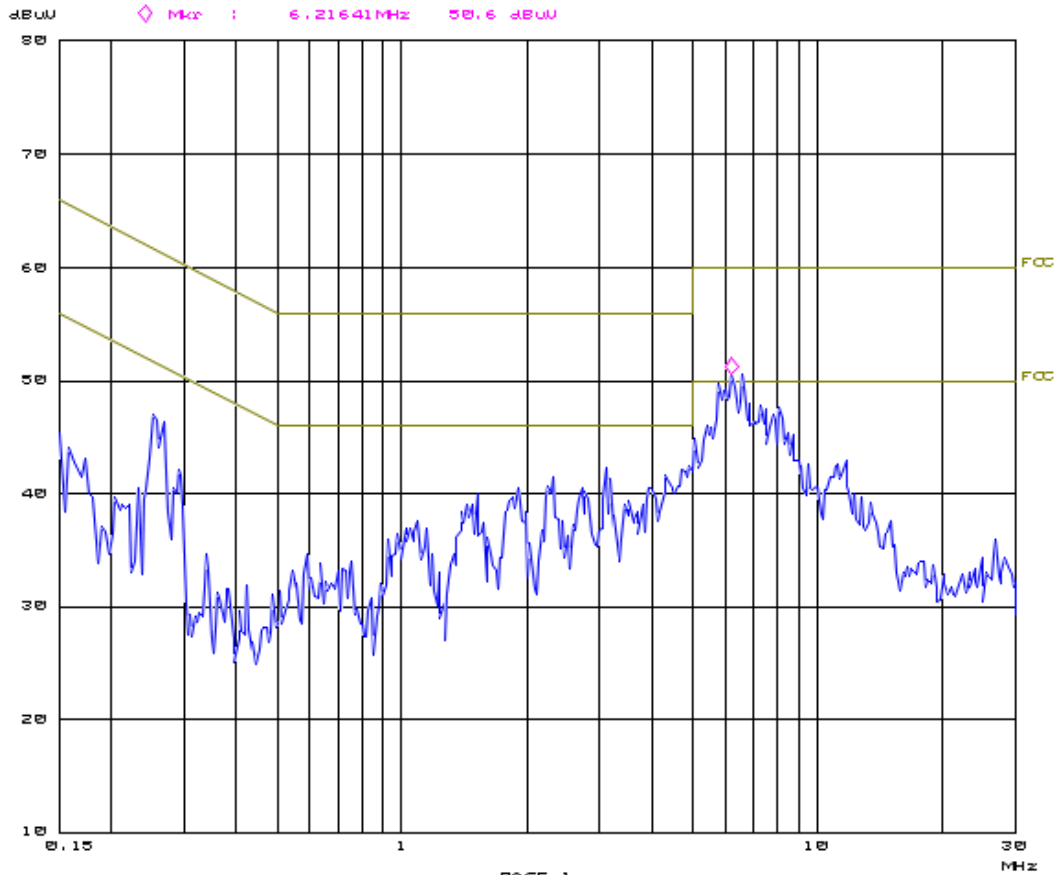
**18052903.r01**

Page 38 of 42

### 5.2.2 Plots of the AC Power-line Conducted Emissions

21. Dec 18 10:16

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 of the AC Power-line Conducted emissions with AUX2a on L1

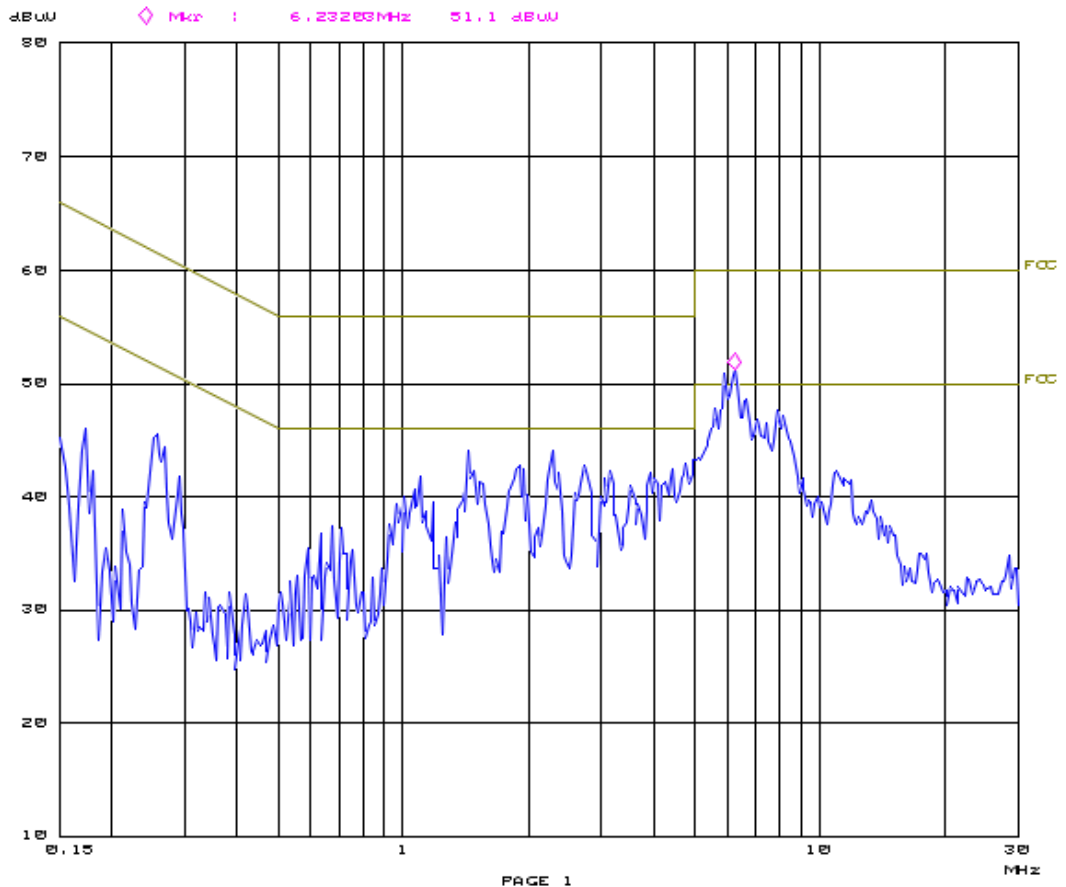
Test Report No.:

**18052903.r01**

Page 39 of 42

21. Dec 18 10:24

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 of the AC Power-line Conducted emissions with AUX2a on L2

Test Report No.:

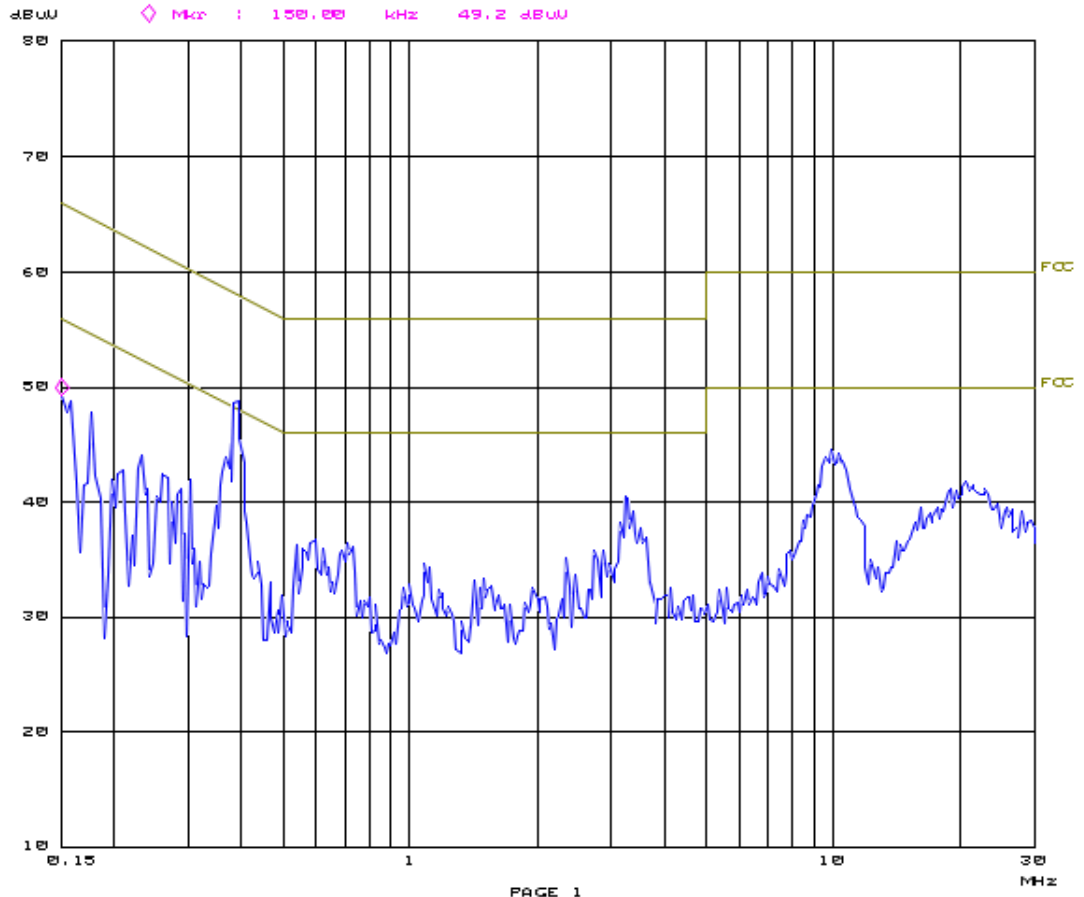
**18052903.r01**

Page 40 of 42

21. Dec 18 11:57

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 of the AC Power-line Conducted emissions with AUX2b on L1



Test Report No.:

**18052903.r01**

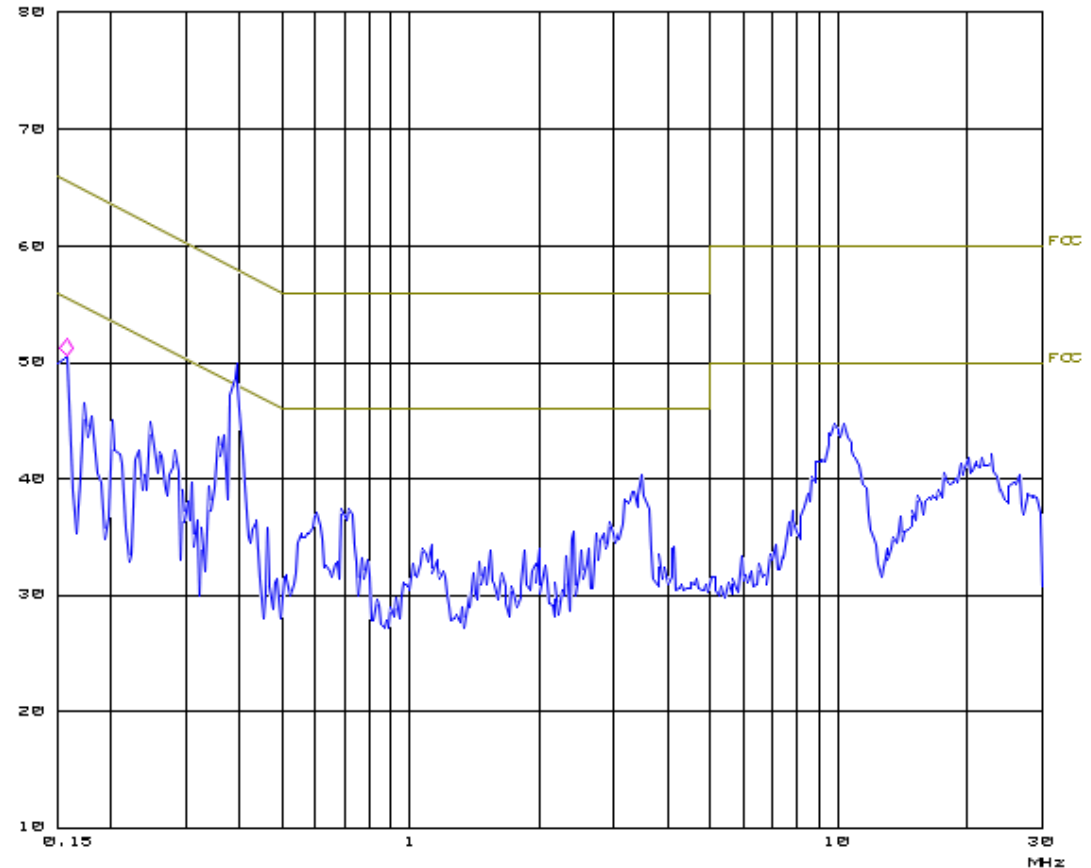
Page 41 of 42

21. Dec 18 12:00

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

dBu ◇ Max : 157.81 kHz 50.6 dBu



Plot of the AC Power-line Conducted emissions with AUX2a on N



*Test Report No.:*

**18052903.r01**

*Page 42 of 42*

**End of report**