TÜVRheinland®
Precisely Right.

Test Report No.:	**19052404.r02**		*Page 1 of 48*
Client:	**Tacx b.v.** Rijksstraatweg 52, 2241BW Wassenaar, Netherlands		
Test Item:	**Digital Transmission System (DTS)** **ANT**		
Identification:	**T2875**	*Serial Number:*	**- (conducted tests) and 800049670 (radiated tests)**
Project No.:	**19052404**	*Date of Receipt:*	**July 25, 2019**
Testing Location:	**TÜV Rheinland Nederland B.V.** Eiberkamp 10 9351VT Leek		
Test Specification:	FCC 47 CFR Part 15, Subpart C, Section 15.247 (10-1-18 Edition) KDB 558074 D01 15.247 Meas Guidance v05r02 RSS-Gen (Issue 5, April 2018) and RSS-247 (Issue 2, February 2017) ANSI C63.10-2013		
Test Result:	*The test item **passed** the test specification(s).*		
Testing Laboratory:	**TÜV Rheinland Nederland B.V.** Eiberkamp 10 9351 VT Leek		

Tested by:			*Reviewed by:*		
2019-09-20	R. van der Meer / Inspector		2019-09-20	E. van der Wal / Reviewer	
Date	*Name/Position*	*Signature*	*Date*	*Name/Position*	*Signature*

Other Aspects:-.

Abbreviations:

P(ass)	=	***passed***
F(ail)	=	***failed***
N/A	=	***not applicable***
N/T	=	***not tested***

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 CONDUCTED OUT OF BAND 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

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.

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	06/2019	06/2020
Spectrum Analyzer	Rohde & Schwarz	FSV	A01744	07/2018	07/2020
RF Cable	Huber + Suhner	Sucoflex 102	A00347	07/2019	07/2020
For Radiated Emissions					
Measurement Receiver	Rohde & Schwarz	ESCI	2789083 (A00317)	03/2019	03/2020
RF Cable S-AR	Gigalink	APG0500	A00447	03/2019	03/2020
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	07/2020
Antenna mast	EMCS	AP-4702C	A00258	N/A	N/A
Temperature-Humiditymeter	Extech	SD500	A00444	06/2018	06/2020
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	03/2019	03/2020
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	04/2020

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	2788823 (A00051)	11/2018	11/2019
Variac	RFT	LSS020	A00171	NA	NA
LISN	R&S	ESH-2	2788791 (A00019)	06/2019	06/2020
Measurement Receiver	Rohde & Schwarz	ESCS30	2789421 (A00726)	07/2019	07/2020
RF Cable	-	-	A01844	06/2019	06/2020
Shielded room for Conducted emissions	--	--	A00437	NA	NA
Temperature-Humidity meter	Extech	SD500	2789211 (A00441)	06/2019	06/2020

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

3. General Product Information

3.1 Product Function and Intended Use

The brand Tacx model T2875, hereafter referred to as EUT, is an ANT+ 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 EUT also contains a Digital Transmission System (DTS) operating in the frequencyband 2403-2480 MHz, based on BLE technology. The BLE 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, ANT+
Manufacturer	:	Tacx b.v.
Brand	:	Tacx
Model(s)	:	T2875
Serial Number	:	N/A (conducted tests) and 800049670 (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	:	2403 MHz-2480 MHz.
Modulation	:	GFSK
Data-rate	:	1 Mbps
Remarks	:	n.a.

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

The EUT has 2 operating modes: a) ‘’at rest’’ – no person is operating the EUT and b) ‘spinning’’ – in this mode a person is on the bike doing training. The EUT was tested in ‘’at rest’’ mode. 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 control setting
Transmit (Tx)	On – at rest	2403	3
Transmit (Tx)	On – at rest	2442	3
Transmit (Tx)	On – at rest	2480	3

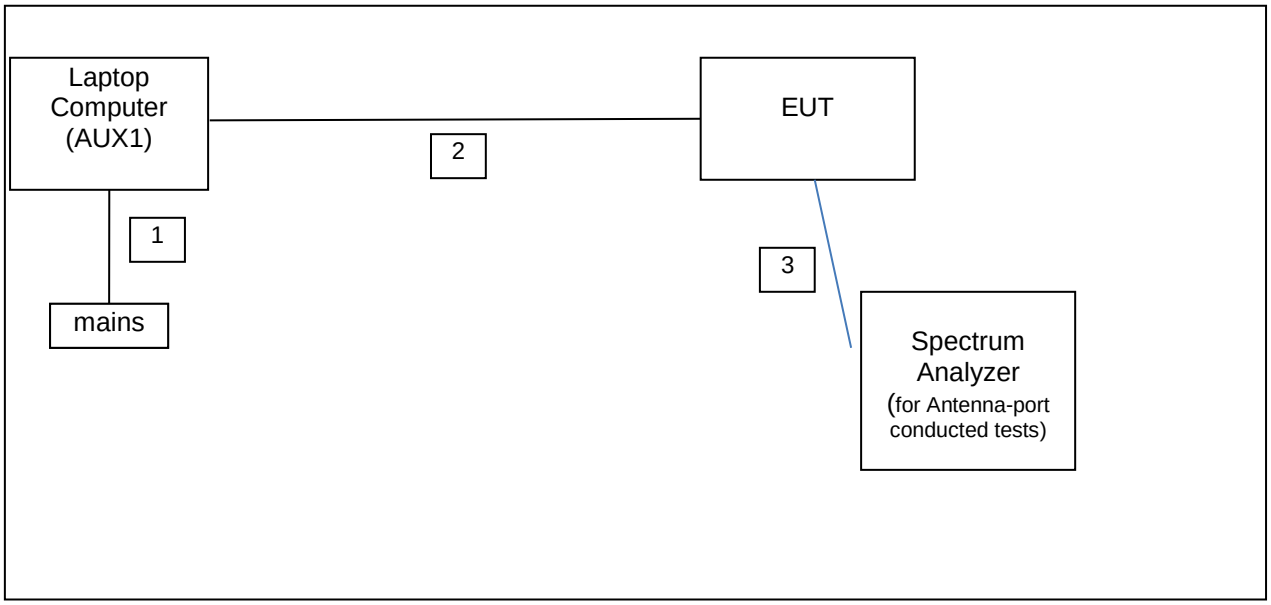
4.3 Physical Configuration for Testing

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

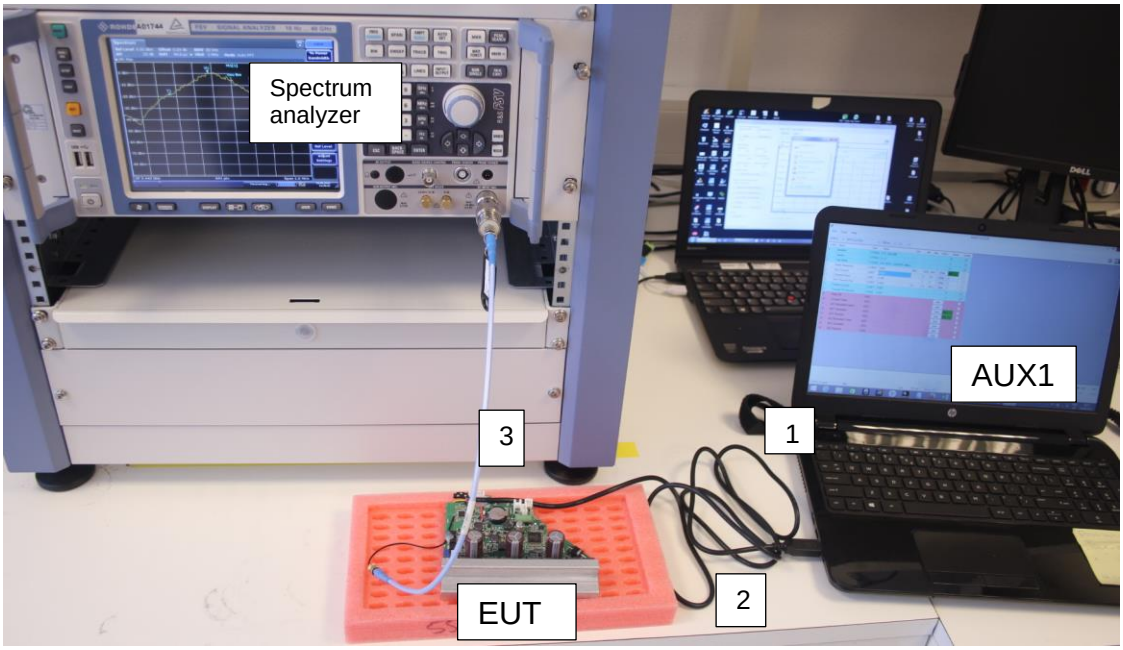


Figure 2: Test Setup Photos – conducted tests and programming

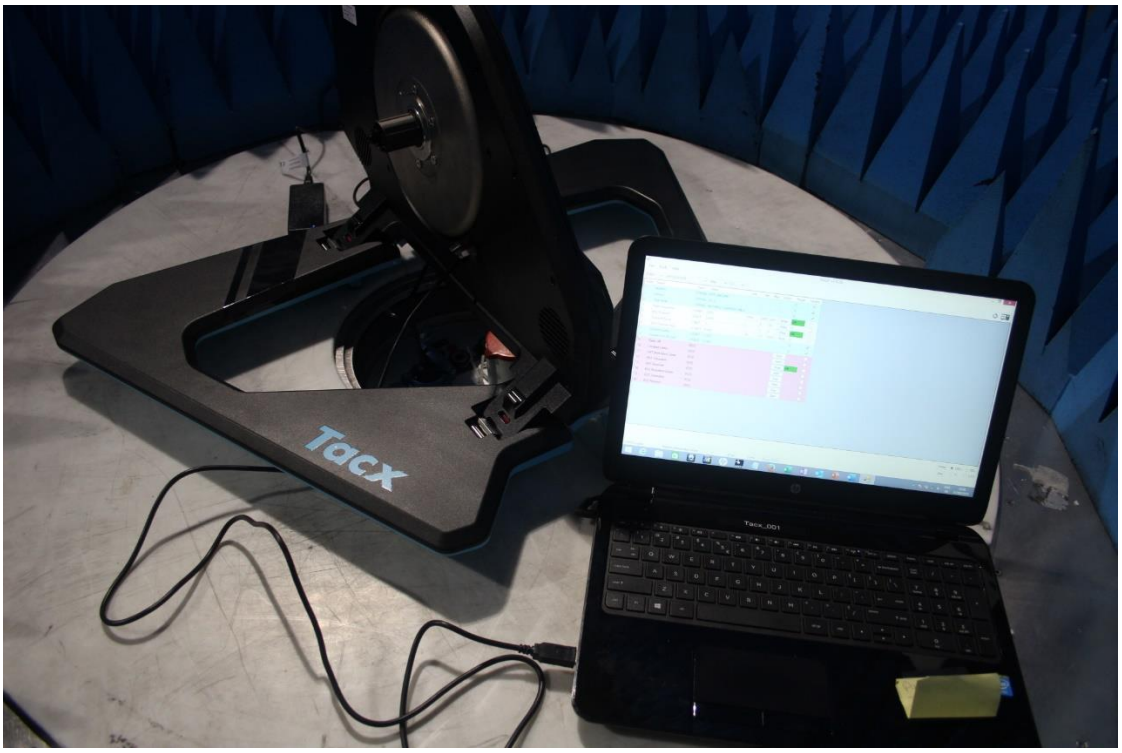


Figure 3: Test Setup Photos – radiated tests and programming

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. AUX2
   Product: Power supply
   Brand: Mean Well
   Model: GSM40B48-P1L
   Serial Number: EB93G85008
   Remark: property applicant

5. Test Results

5.1 Conducted Measurements at Antenna Port

5.1.1 Conducted Output Power

RESULT: PASS

Date of testing: 2019-08-19

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.

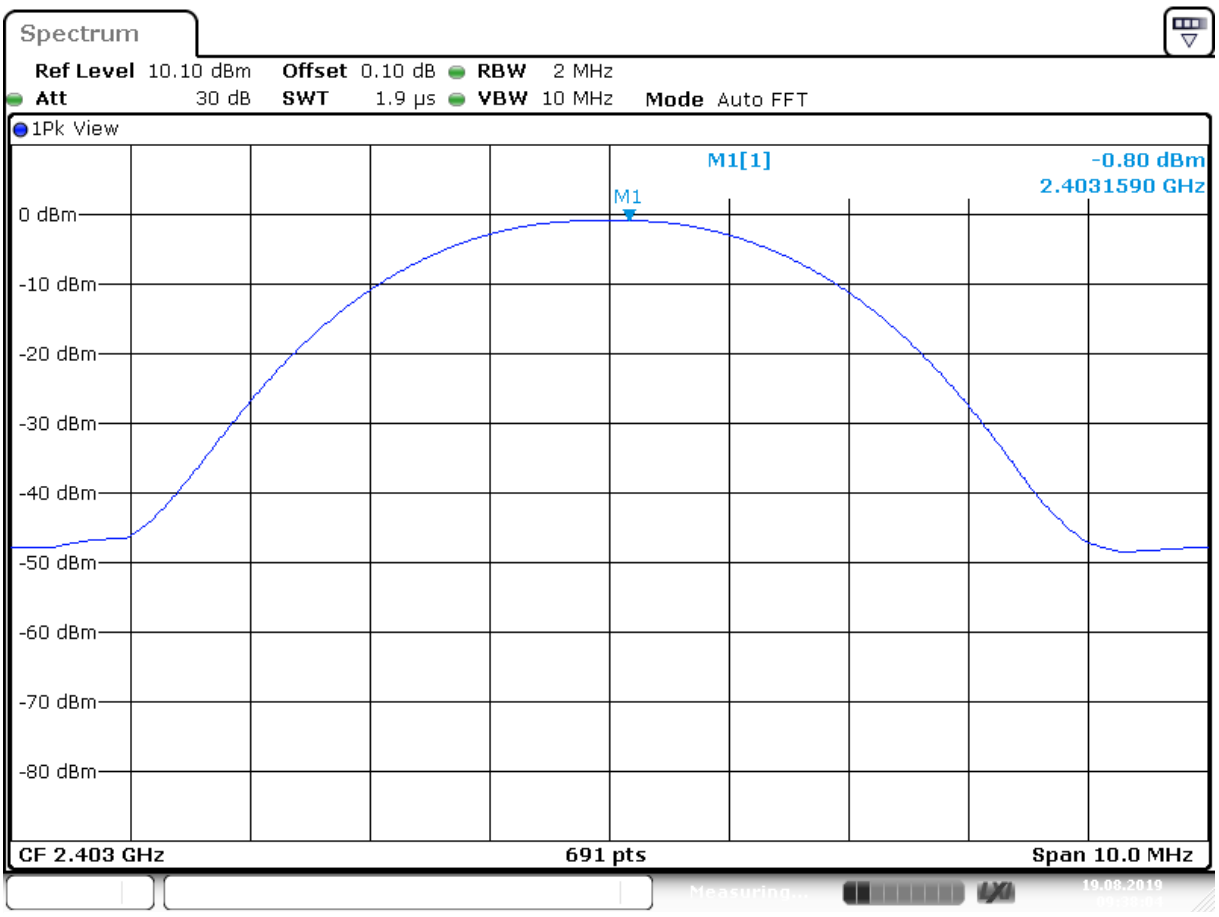
Measurement uncertainty is +/- 2.5 dB.

Notes: mW = 10 ^ (dBm/10)
dBm = 10 x log(mW)

plots : Peak power plots,
Figures 1a, 1b and 1c show plots of the Peak Power outputs, correction factors (= 0.1dB Cableloss) included in the reading.

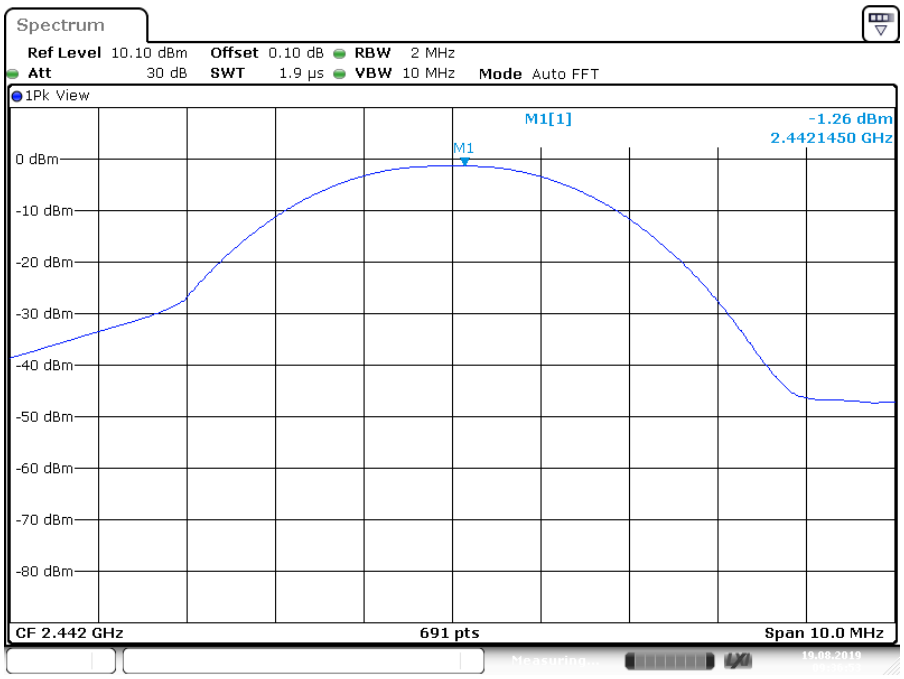
Conducted Output Power

Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Verdict [Pass/Fail]	Plot number
2403	-0.80 (0.83 mW)	+30 (1W)	Pass	1A
2442	-1.26 (0.75 mW)	+30 (1W)	Pass	1B
2480	-1.50 (0.71 mW)	+30 (1W)	Pass	1C

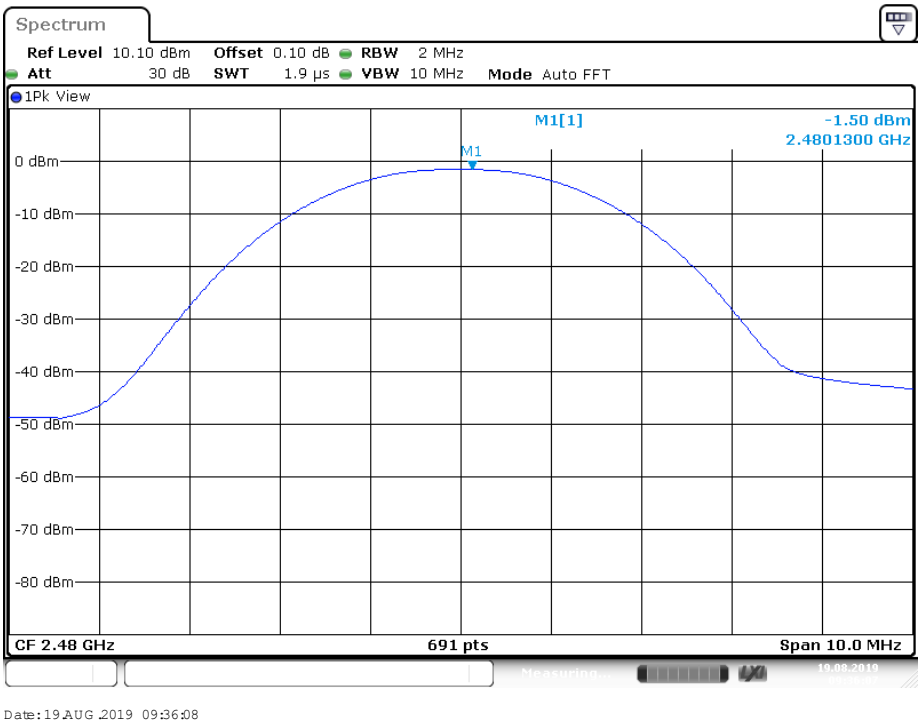


Date: 19.AUG.2019 09:38:04

Plot A


Spectrum
Ref Level 10.10 dBm Offset 0.10 dB RBW 2 MHz
Att 30 dB SWT 1.9 µs VBW 10 MHz Mode Auto FFT
1Pk View
M1[1] -1.26 dBm
2.4421450 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.442 GHz 691 pts Span 10.0 MHz
Measuring...
19.08.2019
Date: 19.AUG.2019 09:36:53

Plot B


Spectrum
Ref Level 10.10 dBm Offset 0.10 dB RBW 2 MHz
Att 30 dB SWT 1.9 µs VBW 10 MHz Mode Auto FFT
1Pk View
M1[1] -1.50 dBm
2.4801300 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz 691 pts Span 10.0 MHz
Measuring...
19.08.2019
Date: 19.AUG.2019 09:36:08

Plot C

5.1.2 6dB and 99% Bandwidth

RESULT: PASS

Date of testing: 2019-08-19

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.

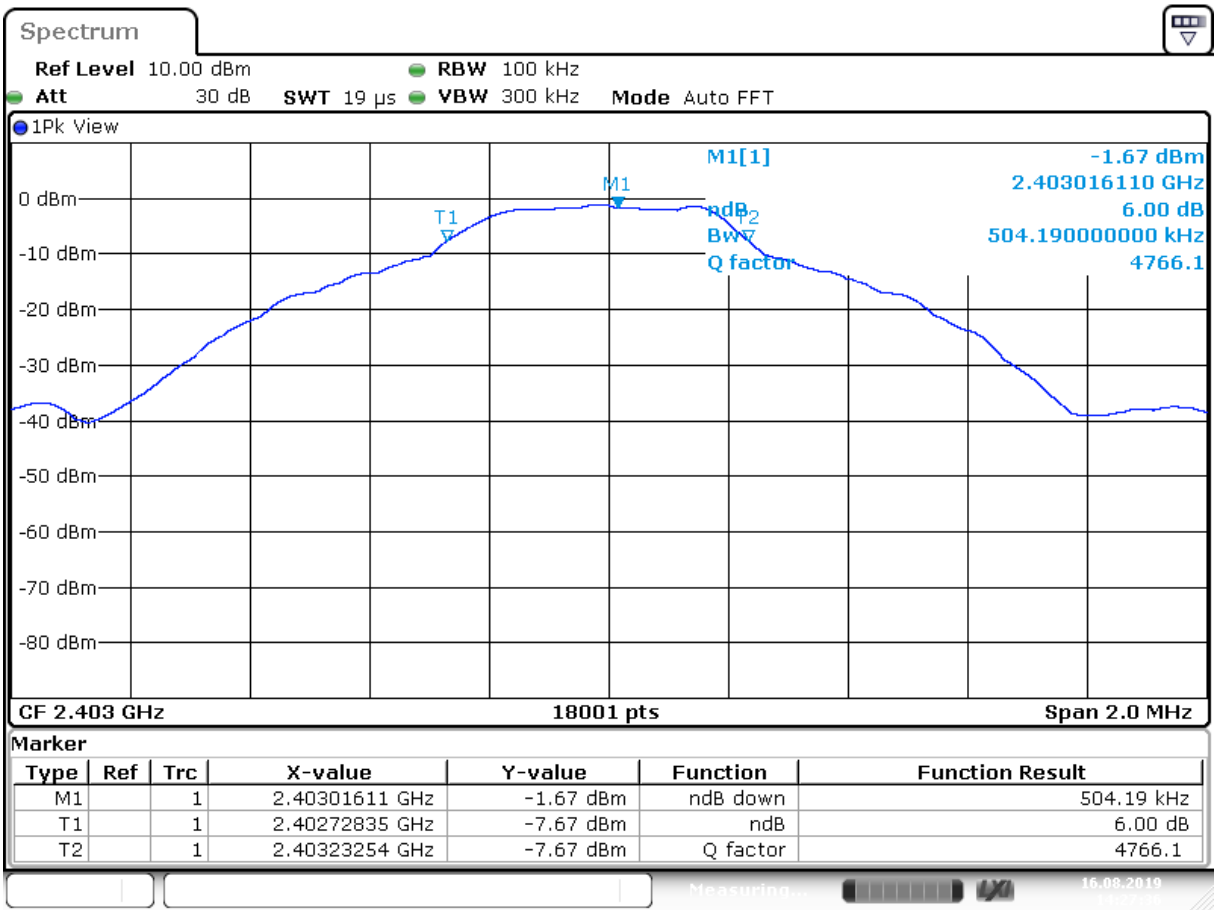
The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission sideskirts. The resolution bandwidth shall be set as close to 1% of the selected span as 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

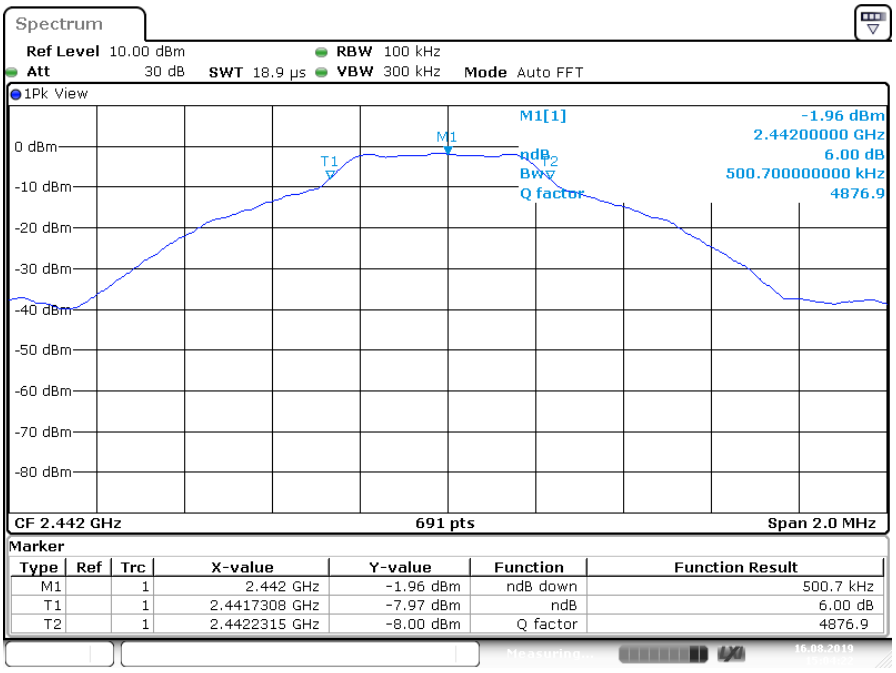
6dB Bandwidth

Operating Frequency [MHz]	99% Bandwidth [kHz]	6dB Bandwidth [kHz]	Limit 6dB BW [kHz]	Verdict [Pass/Fail]	Plot number
2403	934.35	504.19	>500	Pass	A1/A2
2442	913.78	500.70	>500	Pass	B1/B2
2480	917.78	500.70	>500	Pass	C1/C2

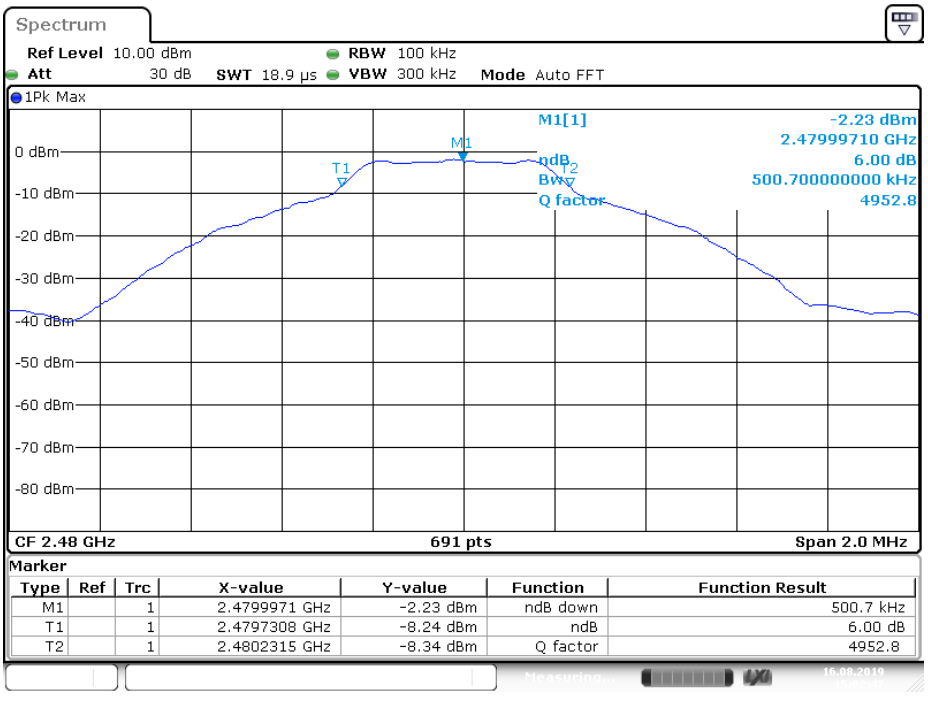


Date: 16.AUG.2019 14:27:36

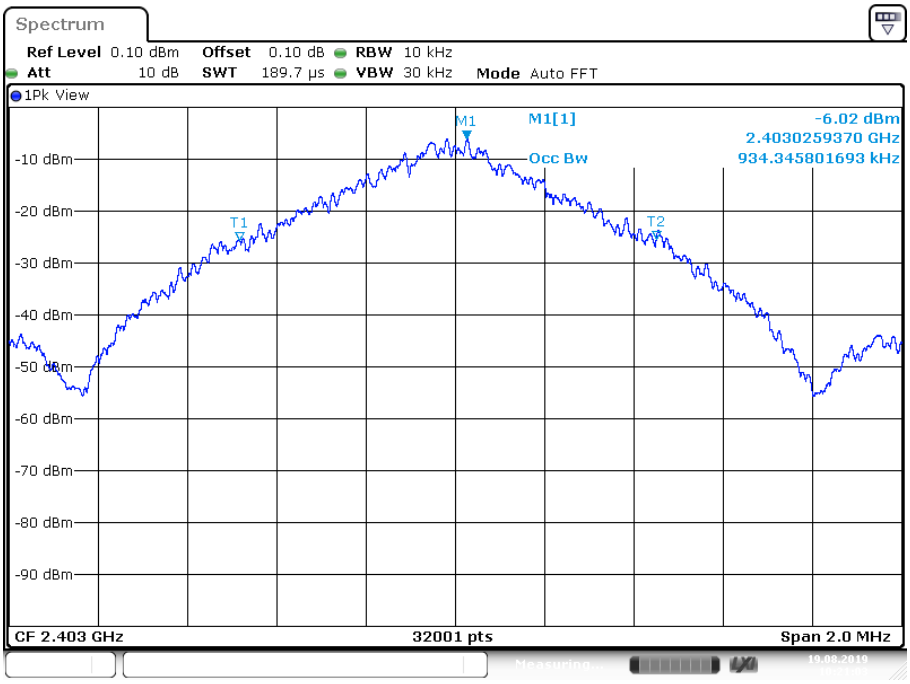
Plot A1



Plot B1

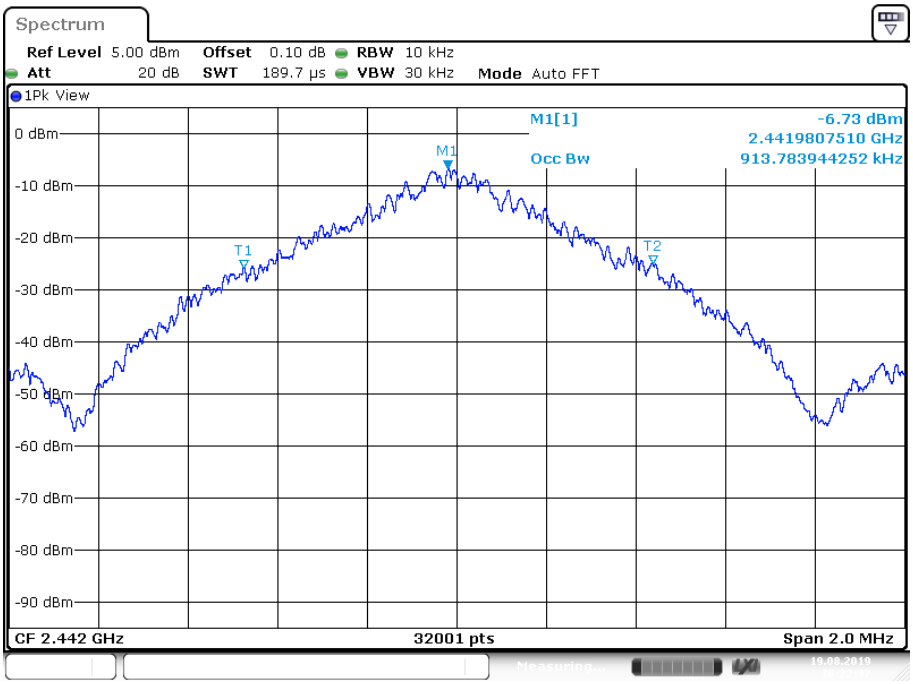


Plot C1



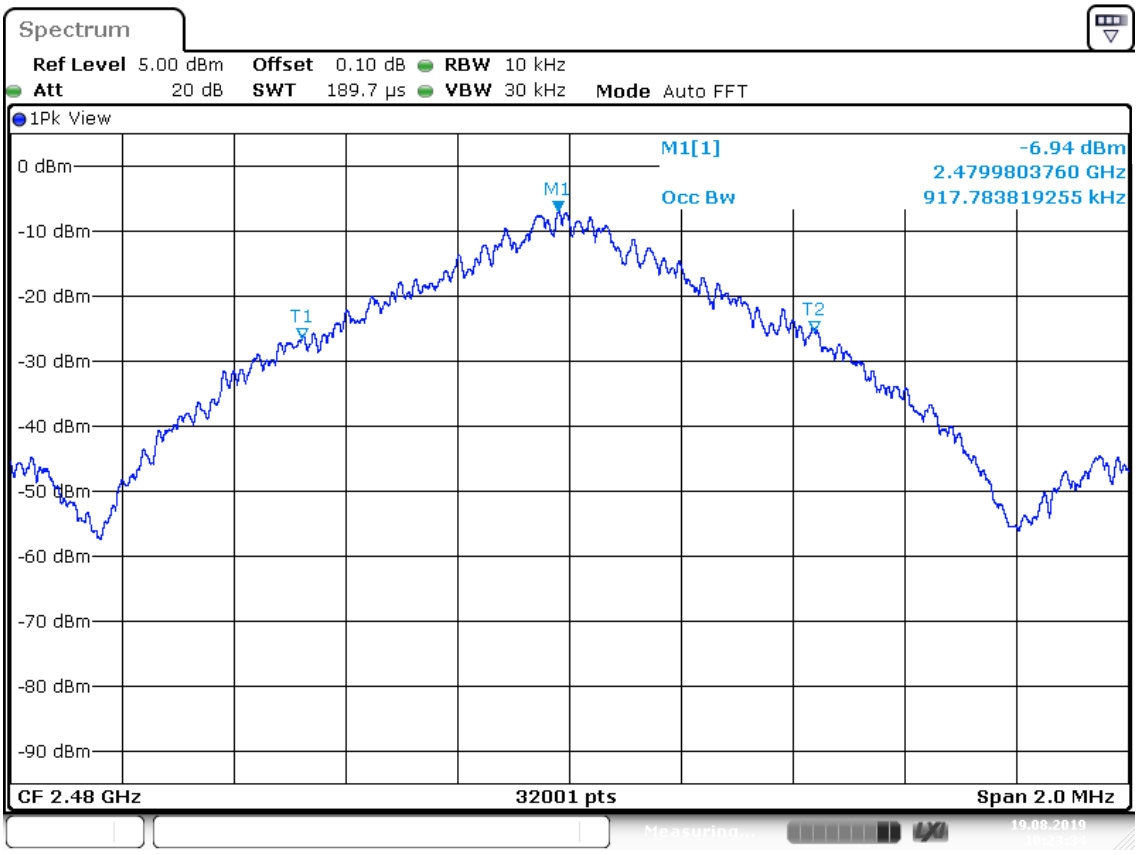
Date: 19.AUG.2019 10:21:04

Plot A2



Date: 19.AUG.2019 10:22:36

Plot B2



Date: 19.AUG.2019 10:23:34

Plot C2

5.1.3 Peak Power Spectral Density

RESULT: PASS

Date of testing: 2019-08-19

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:

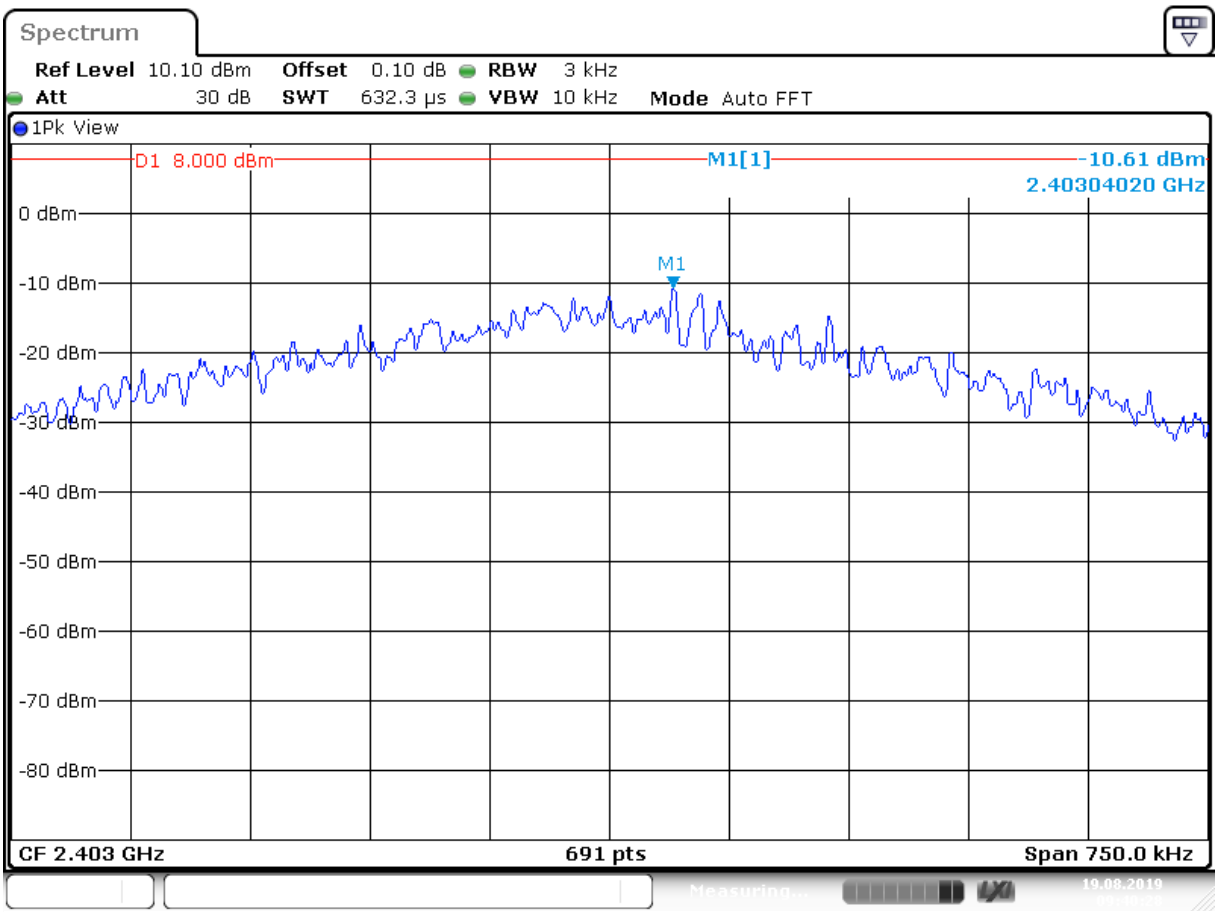
ANSI C63.10-2013

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.

Measurement uncertainty is +/- 1.1 dB.

Peak Power Spectral Density

Operating Frequency [MHz]	Max PSD [dBm]	Limit [dBm]	Verdict [Pass/Fail]	Plot
2403	-10.61	8	Pass	A
2442	-11.07	8	Pass	B
2480	-11.28	8	Pass	C



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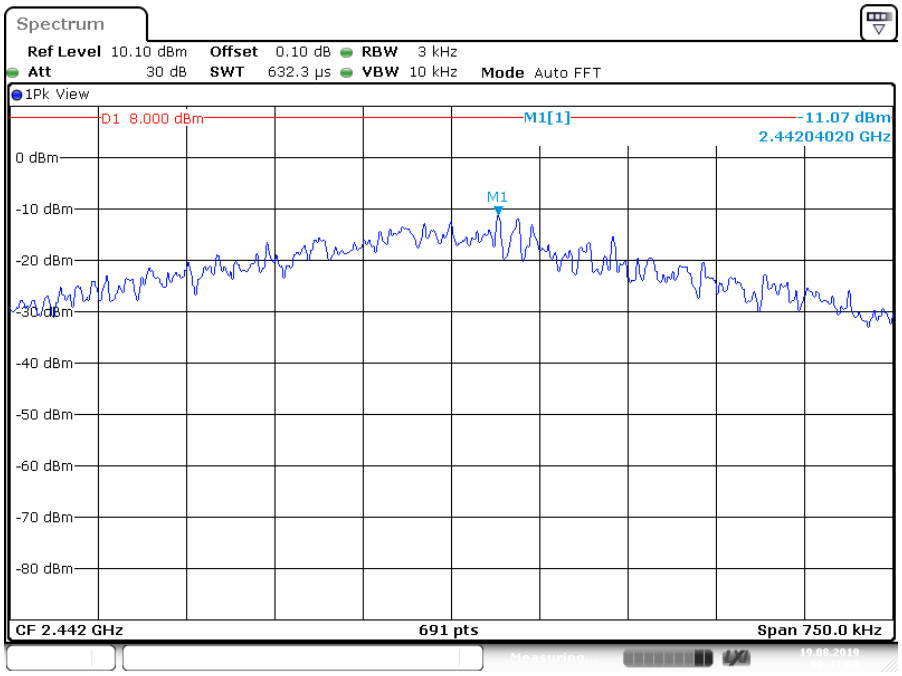
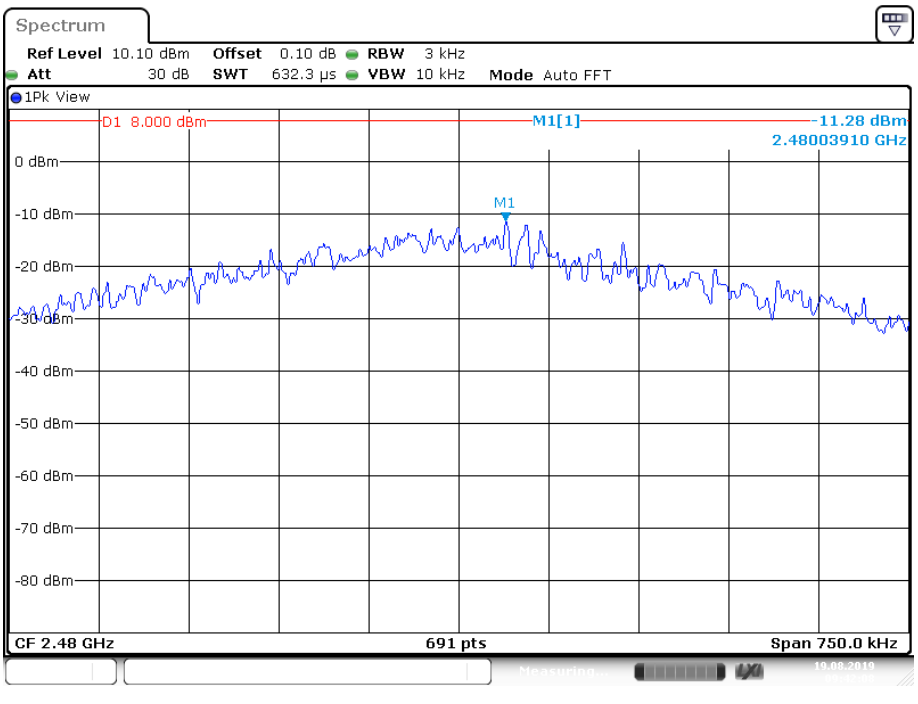
Plot A


Spectrum
Ref Level 10.10 dBm Offset 0.10 dB RBW 3 kHz
Att 30 dB SWT 632.3 µs VBW 10 kHz Mode Auto FFT
1Pk View
D1 8.000 dBm
M1[1] -11.07 dBm
2.44204020 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
CF 2.442 GHz
691 pts
Span 750.0 kHz
Measuring...
19.08.2019
Date: 19.AUG.2019 09:41:09

Plot B


Spectrum
Ref Level 10.10 dBm Offset 0.10 dB RBW 3 kHz
Att 30 dB SWT 632.3 µs VBW 10 kHz Mode Auto FFT
1Pk View
D1 8.000 dBm
M1[1] -11.28 dBm
2.48003910 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
CF 2.48 GHz
691 pts
Span 750.0 kHz
Measuring...
19.08.2019
Date: 19.AUG.2019 09:42:09

Plot C

5.1.4 Conducted Out Of Band Spurious Emissions

RESULT: Pass

Date of testing: 2019-08-19

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:

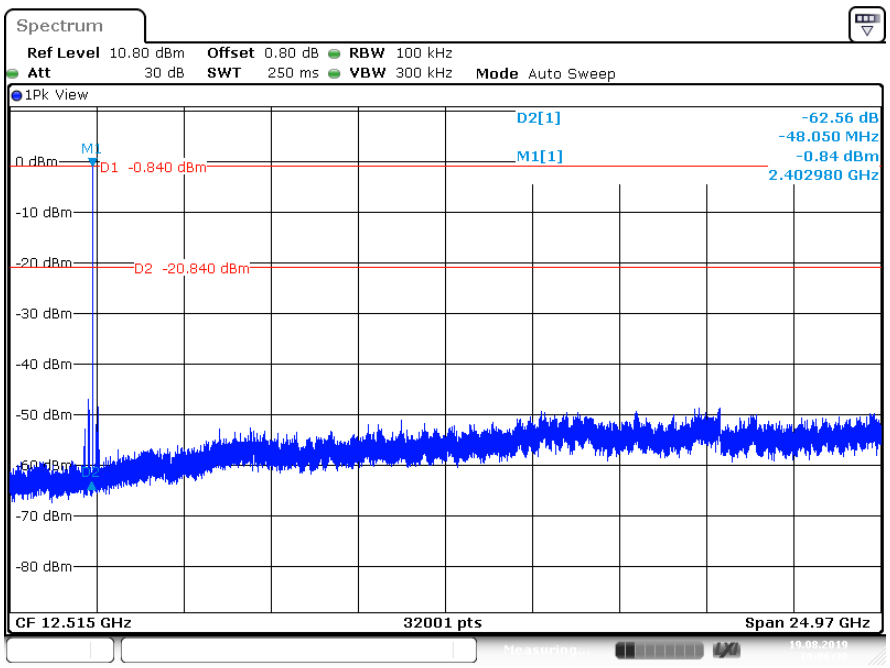
ANSI C63.10-2013
Section 11.13

An RF conducted measurement was used with 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.

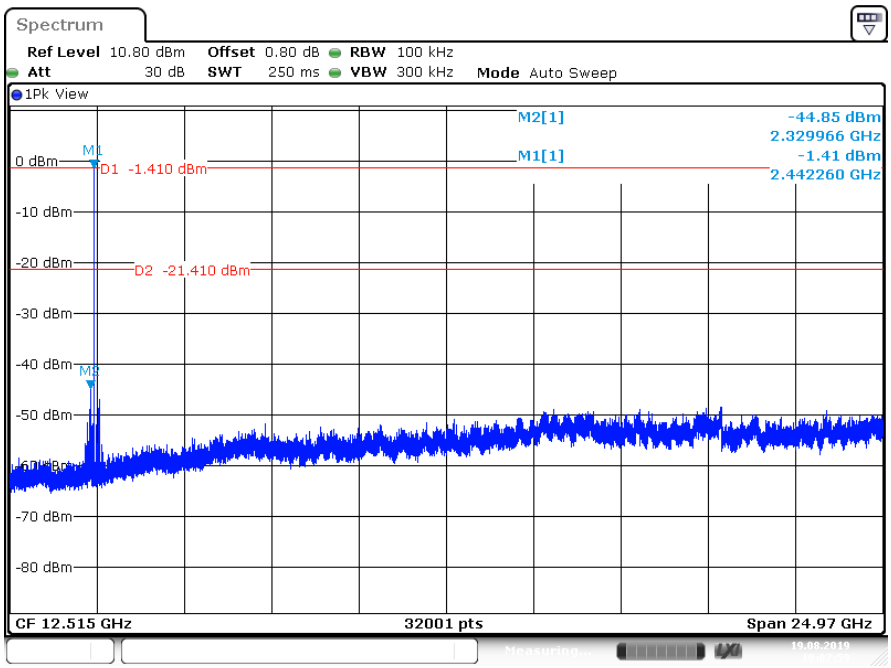
The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.
Measurement uncertainty is +/- 2.5 dB.

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



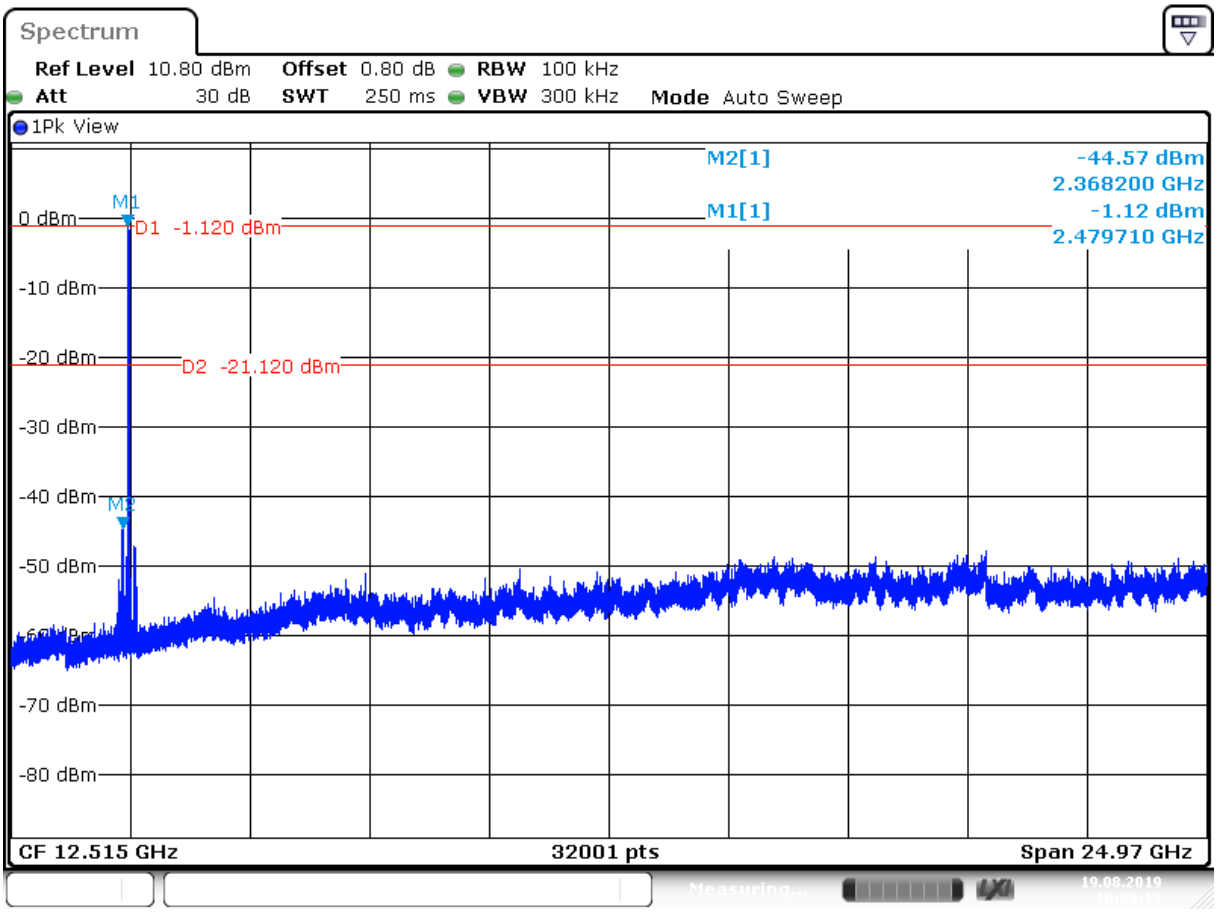
Date: 19.AUG.2019 10:06:31

Plot: Conducted Emission @2403 MHz



Date: 19.AUG.2019 10:08:00

Plot: Conducted Emission @2442 MHz



Date: 19.AUG.2019 10:09:16

Plot: Conducted Emission, @2480 MHz.

5.1.5 Radiated Spurious Emissions of Transmitter

RESULT: PASS

Date of testing: 2019-08-07 & 13

Frequency range: 30MHz - 25GHz

Requirements:

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

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.

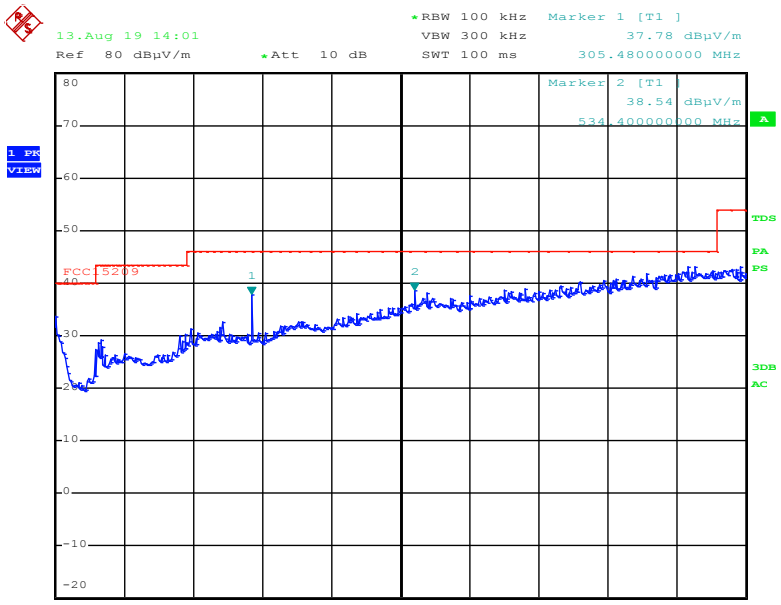
At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

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 where at least 6 dB under the Average (Av) limits, Av value was not tested. Were Average values were tested, Average values were measured using at least 10kHz Video Bandwidth.

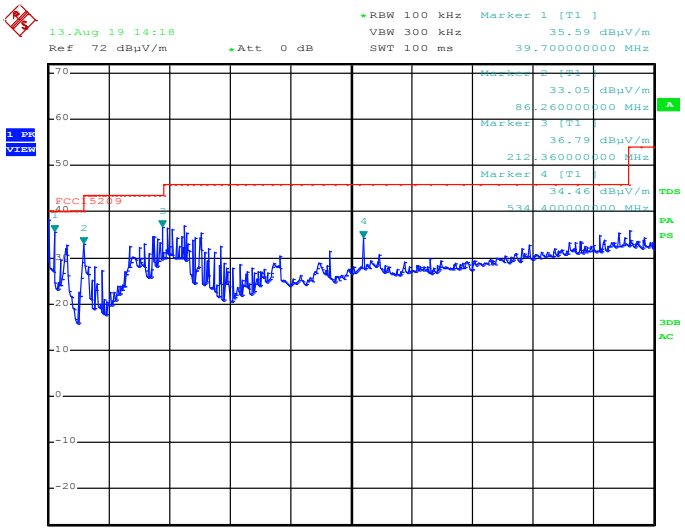
Radiated Emissions, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations

Frequency [MHz]	EUT frequency (MHz)	Antenna Orientation	Level QP [dBµV/m]	Limit QP [dBµV/m]	Verdict [Pass/Fail]
534.4	2403	Horizontal	23.9	46.0	Pass
212.4	2403	Vertical	26.0	43.5	Pass
220.9	2442	Vertical	34.8	46.0	Pass
227.9	2442	Vertical	34.8	46.0	Pass
247.3	2442	Vertical	30.7	46.0	Pass
800-960 noise	2480	Vertical	32.0	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.
- *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.



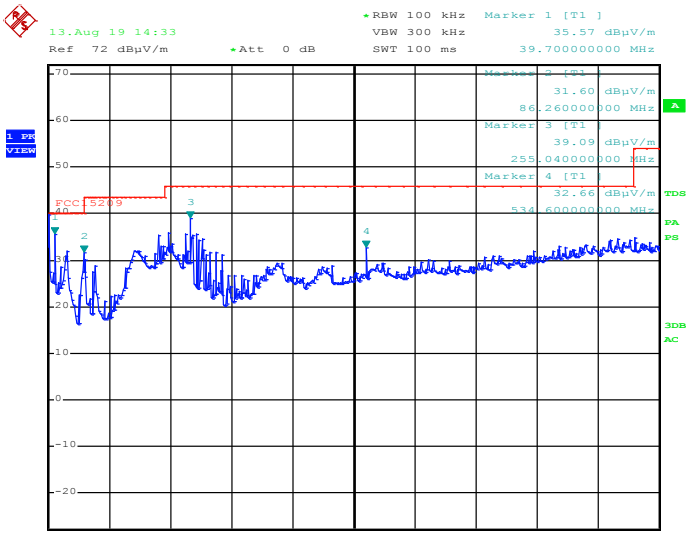
Plot of the emissions (@2403 MHz, Antenna Horizontal)
(Peak detector values shown)



ORI

Date: 13.AUG.2019 14:18:11

Plot of the emissions (@2442 MHz, Antenna Vertical)
(Peak detector values shown)



ORI

Date: 13.AUG.2019 14:33:21

Plot of the emissions (@2480 MHz, Antenna Vertical)
(Peak detector values shown)

Radiated Emissions, 1 - 25GHz, 2403 MHz.

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Result
2259*R	Horizontal	Pk	1	54.0 Pk 48.9 Av	54 (Av) 74 (Pk)	Pass
2275*R	Horizontal	Pk	1	55.7 Pk 50.7 Av	54 (Av) 74 (Pk)	Pass
4806*H*R	Horizontal	Pk	1	58.3 Pk 50.3 Av	54 (Av) 74 (Pk)	Pass
7209*H	Horizontal	Pk	1	54.7 Pk 46.0 Av	54 (Av) 74 (Pk)	Pass
14026	Horizontal	Pk	1	58.6 Pk 45.8 Av	54 (Av) 74 (Pk)	Pass
17718*R noise	Horizontal	Pk	1	68.7 Pk 53.8 Av	54 (Av) 74 (Pk)	Pass

Radiated Emissions, 1 - 25GHz, 2442 MHz.

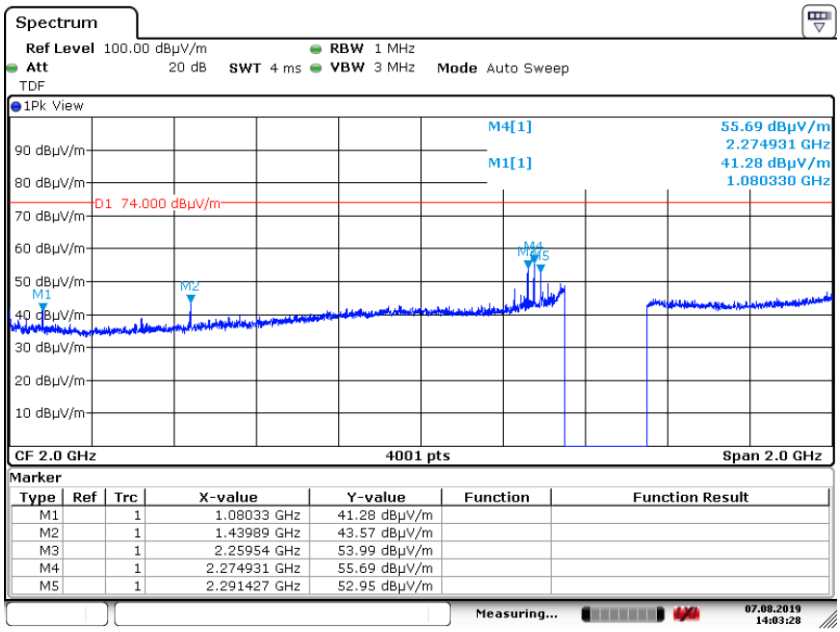
Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Result
2314*R	Vertical	Pk	1	52.5	54 (Av) 74 (Pk)	Pass
2570	Vertical	Pk	1	53.1	54 (Av) 74 (Pk)	Pass
4883*H*R	Vertical	Pk	1	50.0	54 (Av) 74 (Pk)	Pass
7326*H*R	Vertical	Pk	1	55.6 Pk 47.3 Av	54 (Av) 74 (Pk)	Pass
12075*R noise	Vertical	Pk	1	55.2 Pk 47.0 Av	54 (Av) 74 (Pk)	Pass
17718*R noise	Horizontal	Pk	1	68.7 Pk 53.8 Av	54 (Av) 74 (Pk)	Pass

Radiated Emissions, 1 - 25GHz, 2480 MHz.

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Result
2640	Horizontal	Pk	1	51.2	54 (Av) 74 (Pk)	Pass
4960*H*R	Vertical	Pk	1	56.1 Pk 53.1 Av	54 (Av) 74 (Pk)	Pass
7440*H*R	Vertical	Pk	1	57.0 Pk 53.6 Av	54 (Av) 74 (Pk)	Pass
13805 noise	Vertical	Pk	1	59.1 Pk 47.0 Av	54 (Av) 74 (Pk)	Pass
17718*R noise	Horizontal	Pk	1	68.7 Pk 53.8 Av	54 (Av) 74 (Pk)	Pass

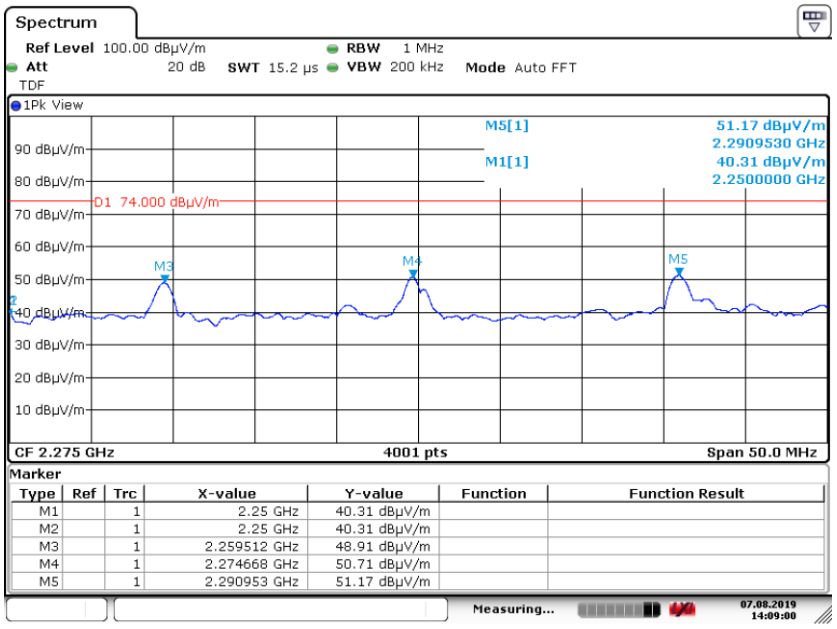
Notes:
- *R refers to a frequency in a restricted band,
- *H refers to a frequency which is a harmonic of the fundamental.
- Field strength values of radiated emissions not listed in the tables above are more than 20 dB below the applicable limit.
- Measurement uncertainty is +/- 5.5 dB.
- a selection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

Plots of the radiated emissions



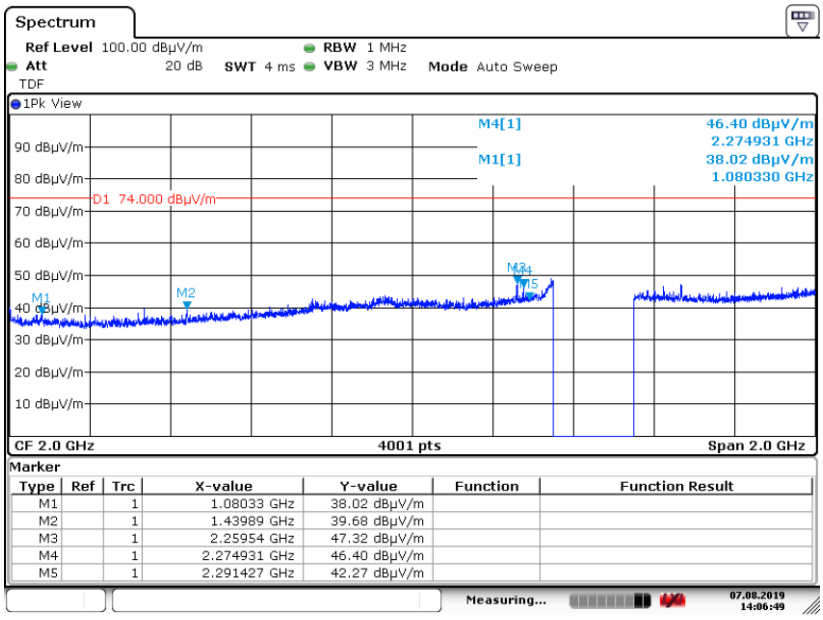
Date: 7.AUG.2019 14:03:28

Plot of the emissions at 2403 MHz, Horizontal polarization, Peak values shown



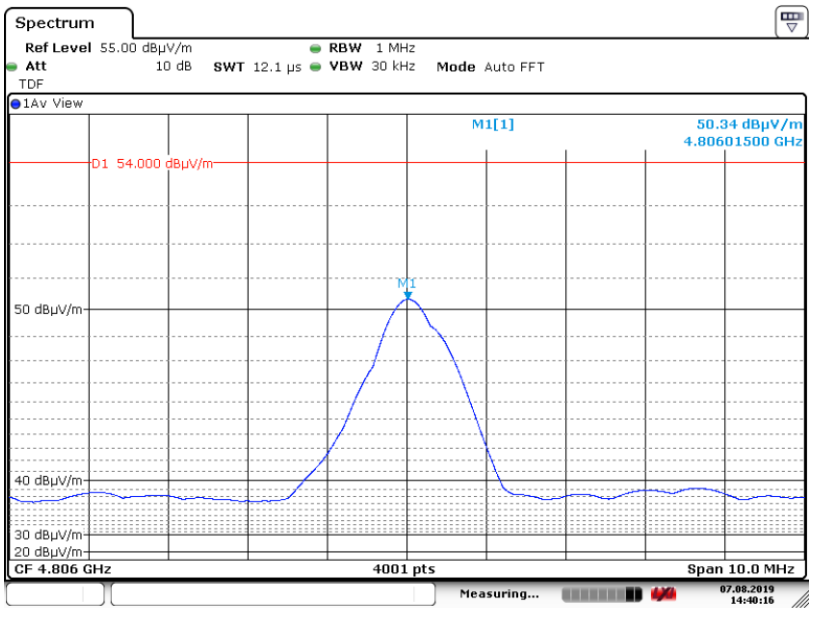
Date: 7.AUG.2019 14:09:00

Plot of the emissions at 2403 MHz, Horizontal polarization, 2.25 and 2.27 GHz, shown (reduced VBW)



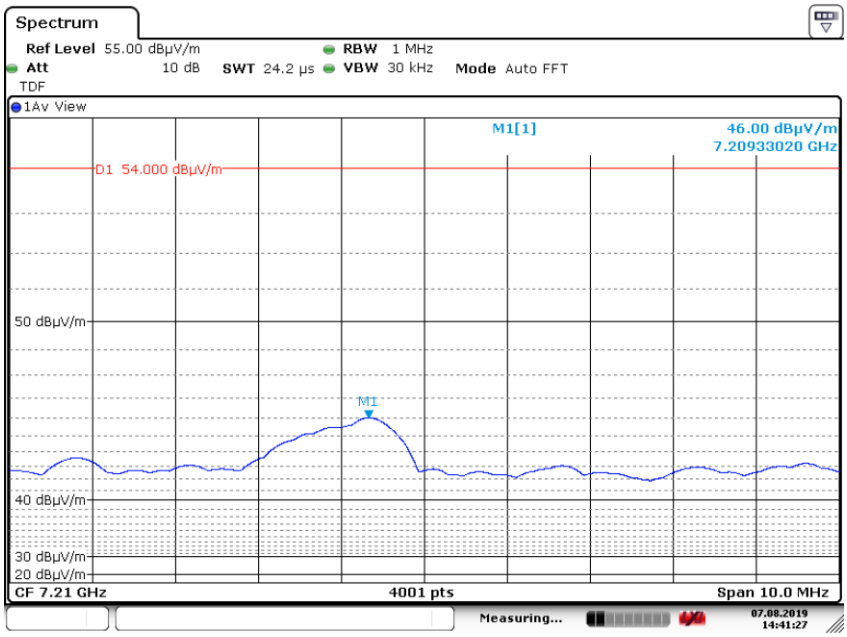
Date: 7.AUG.2019 14:06:48

Plot of the emissions at 2403 MHz in the range 1 – 3 GHz, Vertical polarization, Peak values shown. (gap in the plot is of the used 2.4 GHz Notch filter).



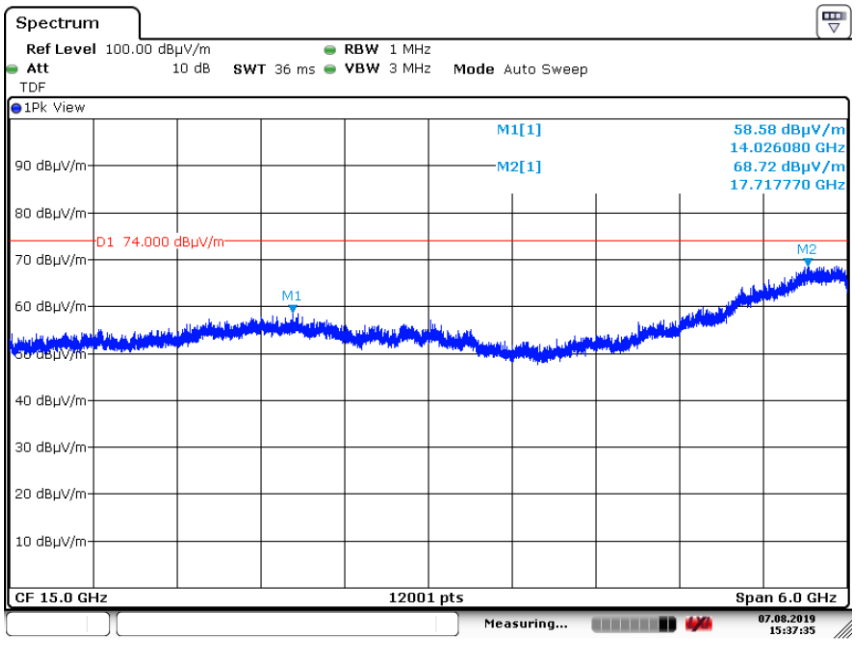
Date: 7.AUG.2019 14:40:15

Plot of the emissions at 2403 MHz, Horizontal polarization, Average value at 4.8 GHz shown



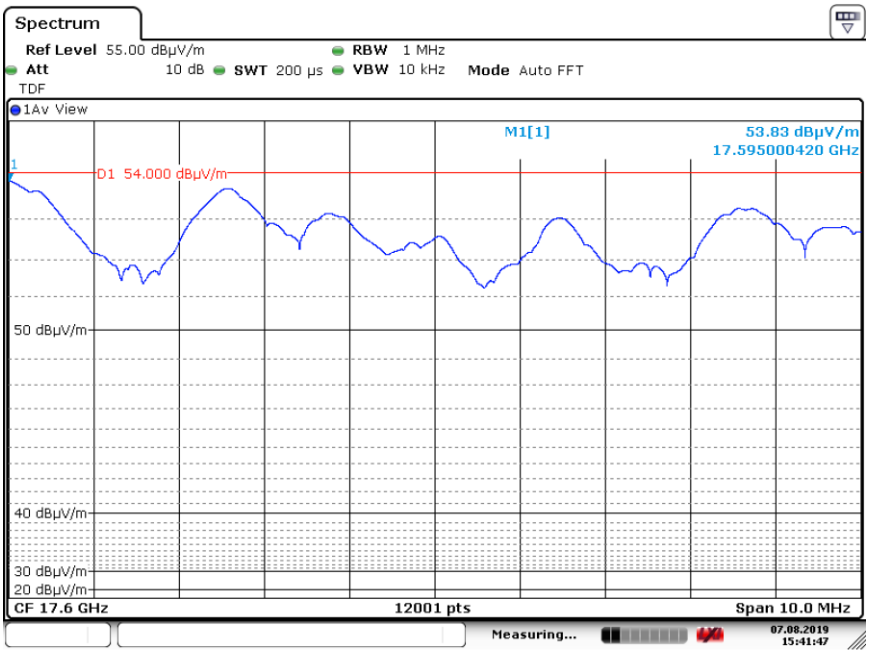
Date: 7.AUG.2019 14:41:26

Plot of the emissions at 2403 MHz, Horizontal polarization, Average value at 7.2 GHz shown



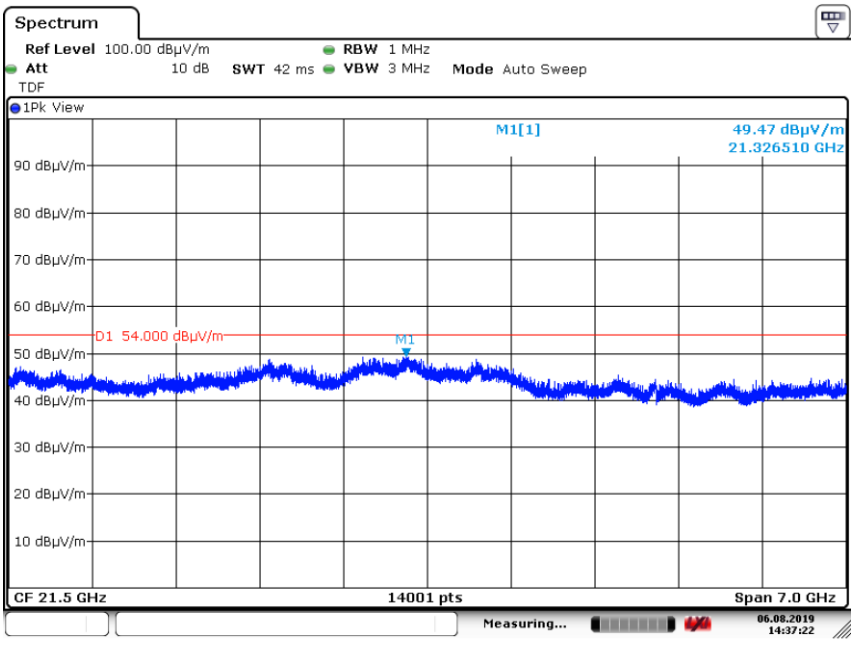
Date: 7.AUG.2019 15:37:34

Plot of the emissions at 2403 MHz in the range 12 – 18 GHz, vertical polarization, Peak values shown.



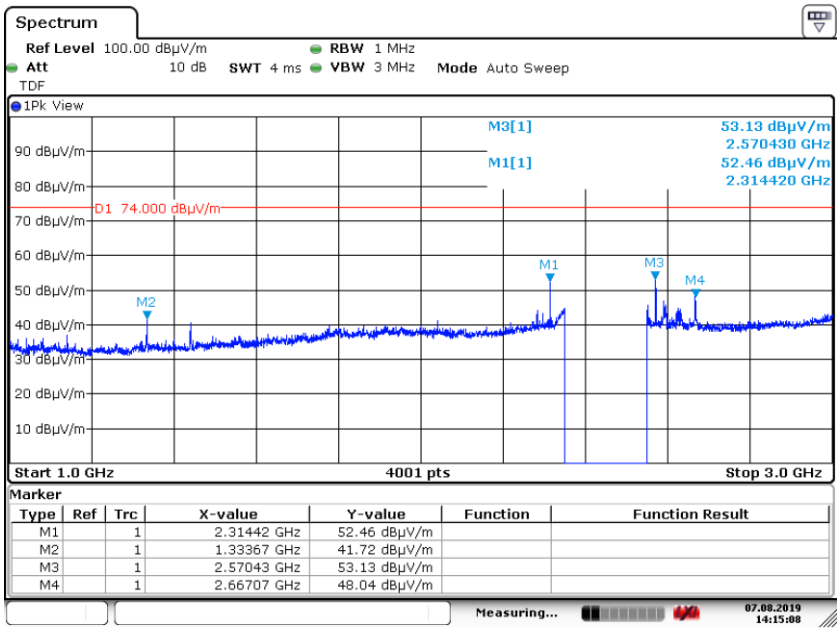
Date: 7.AUG.2019 15:41:46

Plot of the emissions in the range 12 – 18 GHz, vertical polarization, general noise level. Peak values shown-Reduced VBW.



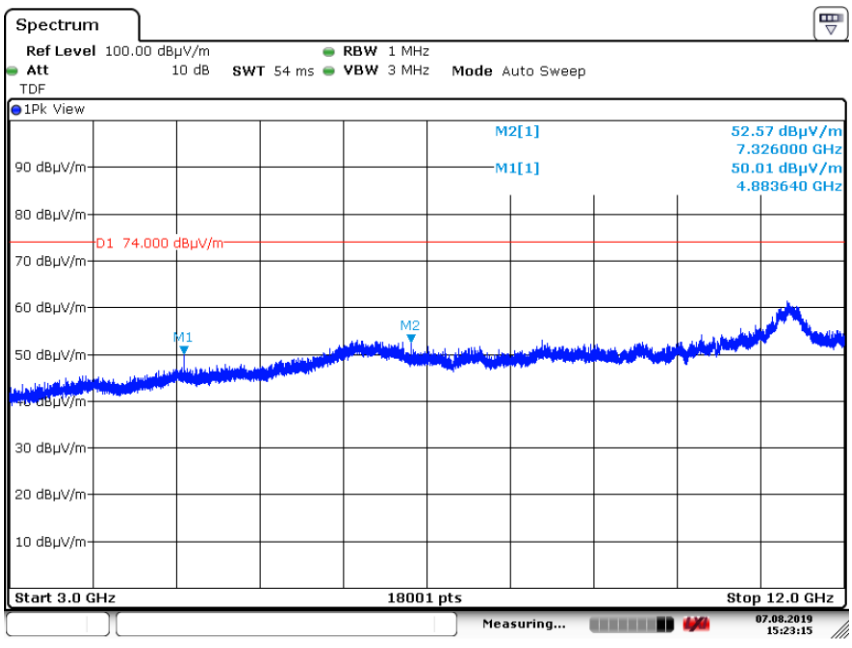
Date: 6.AUG.2019 14:37:22

Plot of the emissions at 2403 MHz in the range 18 – 25 GHz, vertical polarization, Peak values shown.



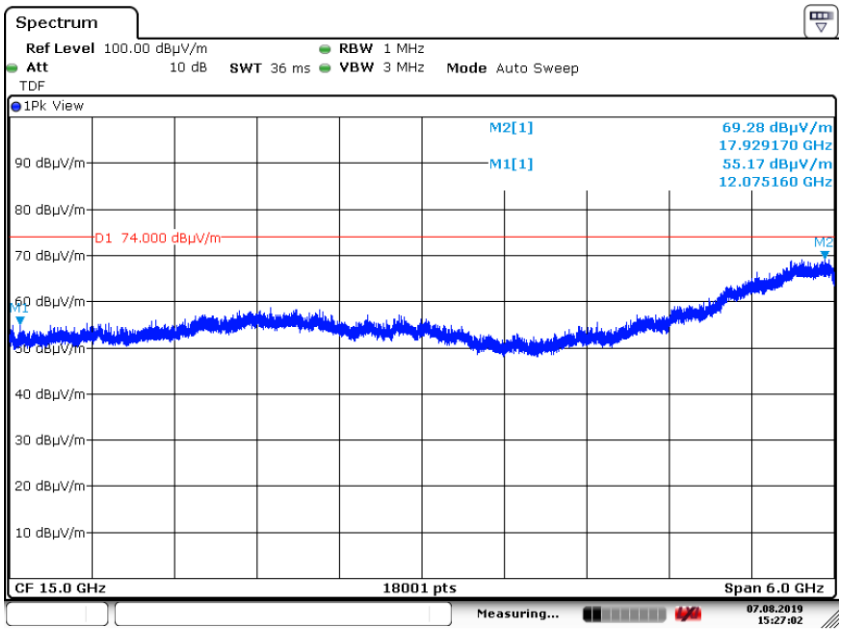
Date: 7.AUG.2019 14:15:07

Plot of the emissions at 2442 MHz in the range 1 – 3 GHz, Vertical polarization, Peak values shown. (gap in the plot is of the used 2.4 GHz Notch filter).



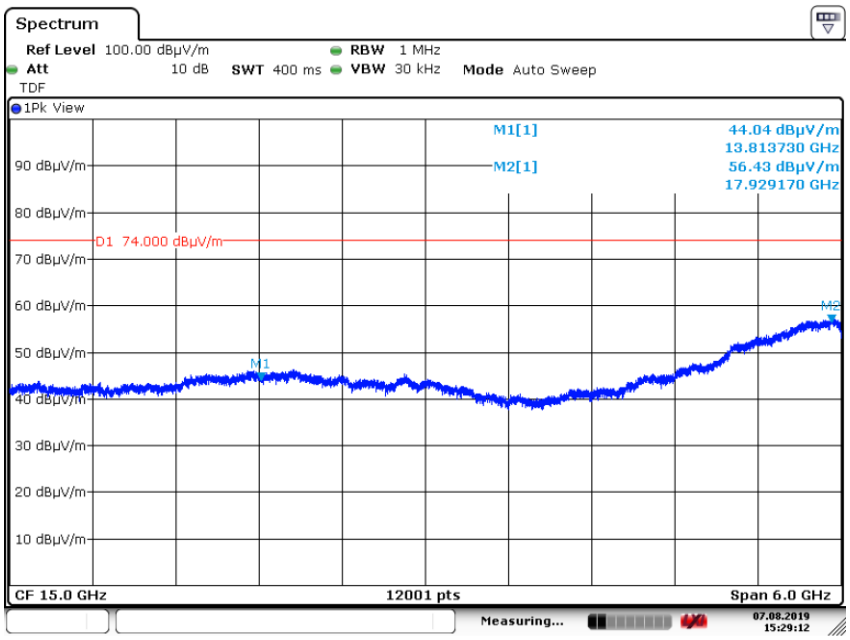
Date: 7.AUG.2019 15:23:14

Plot of the emissions at 2442 MHz in the range 3 – 12 GHz, Vertical polarization, Peak values shown



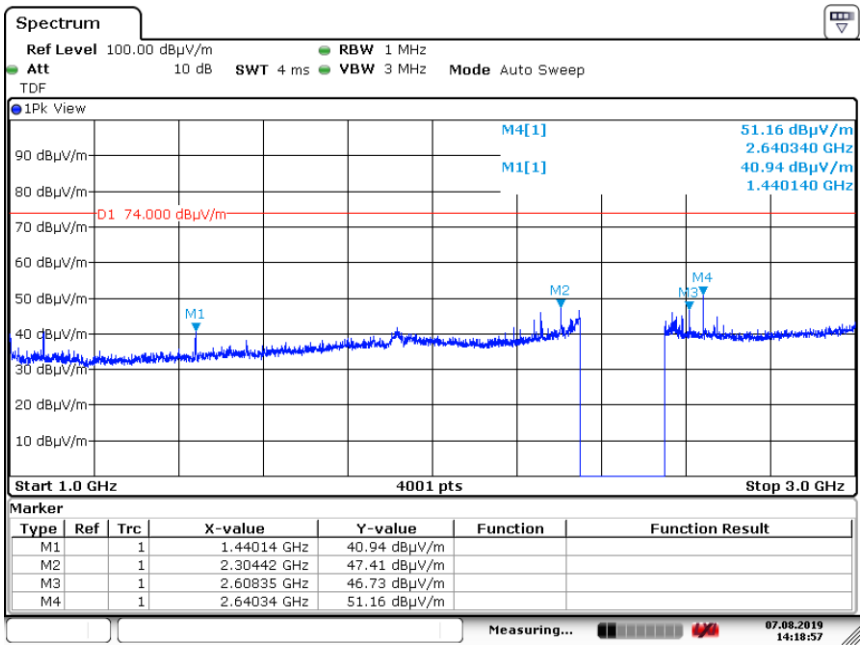
Date: 7.AUG.2019 15:27:02

Plot of the emissions at 2442 MHz in the range 12 – 18 GHz, vertical polarization, Peak values shown.



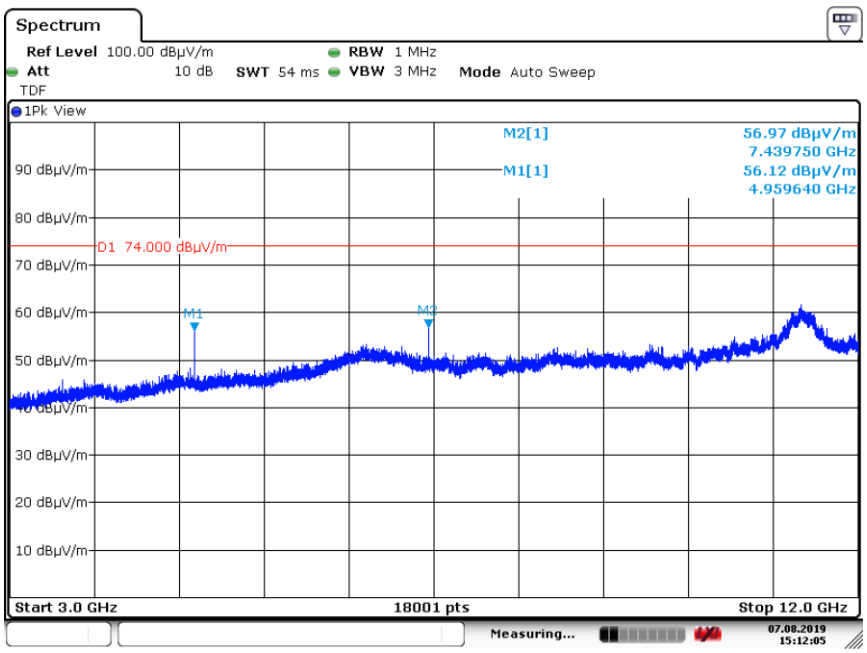
Date: 7.AUG.2019 15:29:11

Plot of the emissions at 2442 MHz in the range 12 – 18 GHz, vertical polarization, Peak values shown. (Reduced Video Bandwidth used)



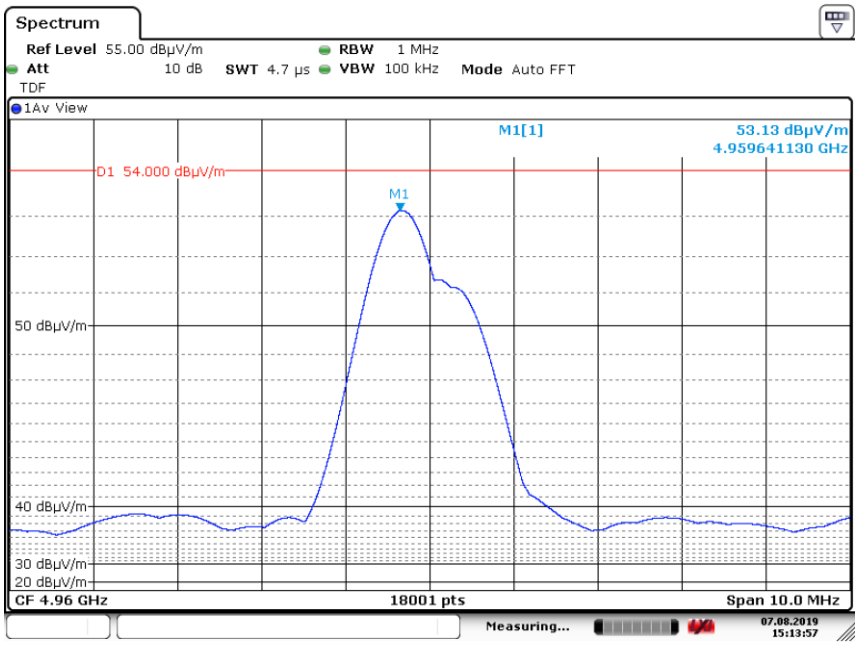
Date: 7.AUG.2019 14:18:56

Plot of the emissions at 2480 MHz in the range 1 – 3 GHz, Horizontal polarization, Peak values shown. (gap in the plot is of the used 2.4 GHz Notch filter).



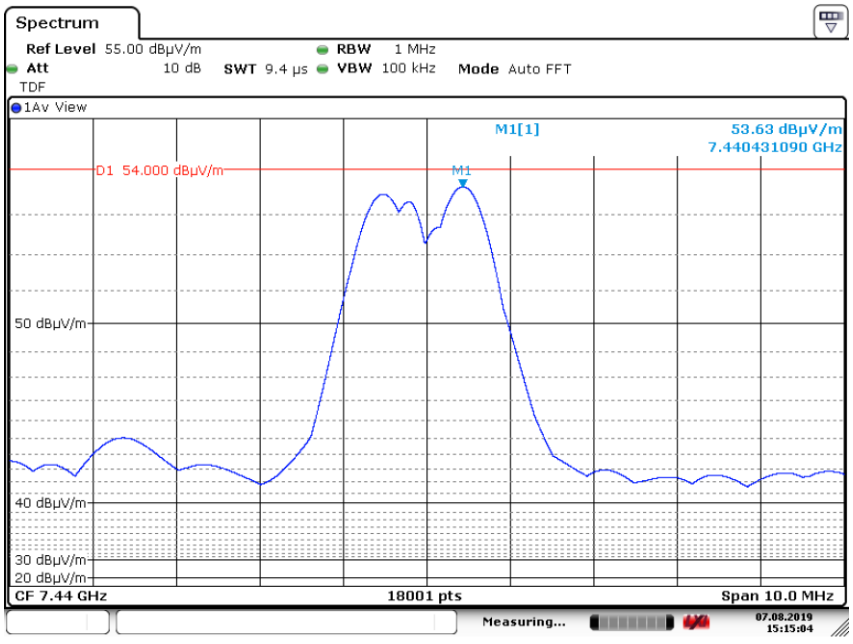
Date: 7.AUG.2019 15:12:04

Plot of the emissions at 2480 MHz in the range 3 – 12 GHz, Vertical polarization, Peak values shown



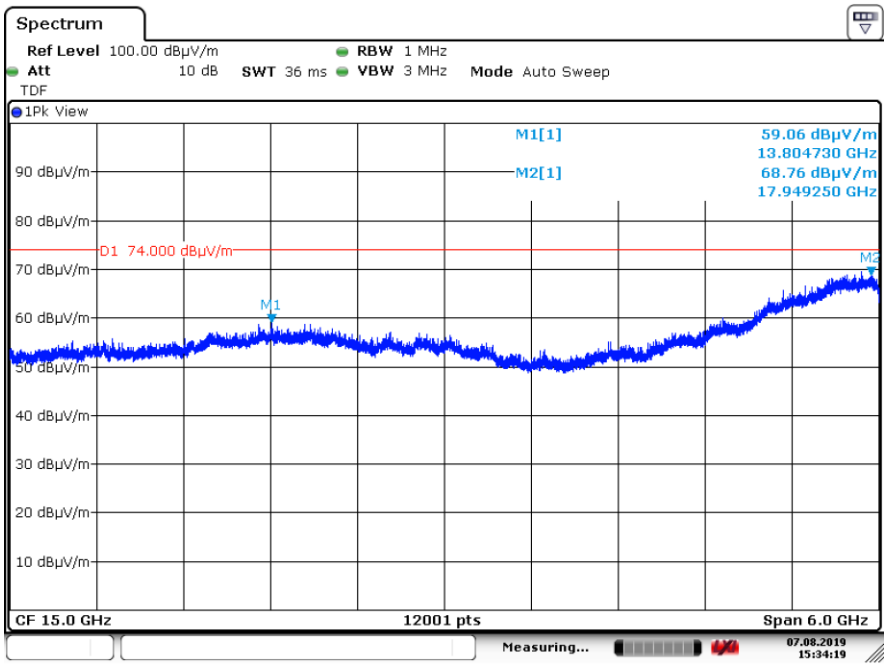
Date: 7.AUG.2019 15:13:57

Plot of the emissions at 2480 MHz in the range 3 – 12 GHz, Vertical polarization, Average value at 4.96 GHz shown.



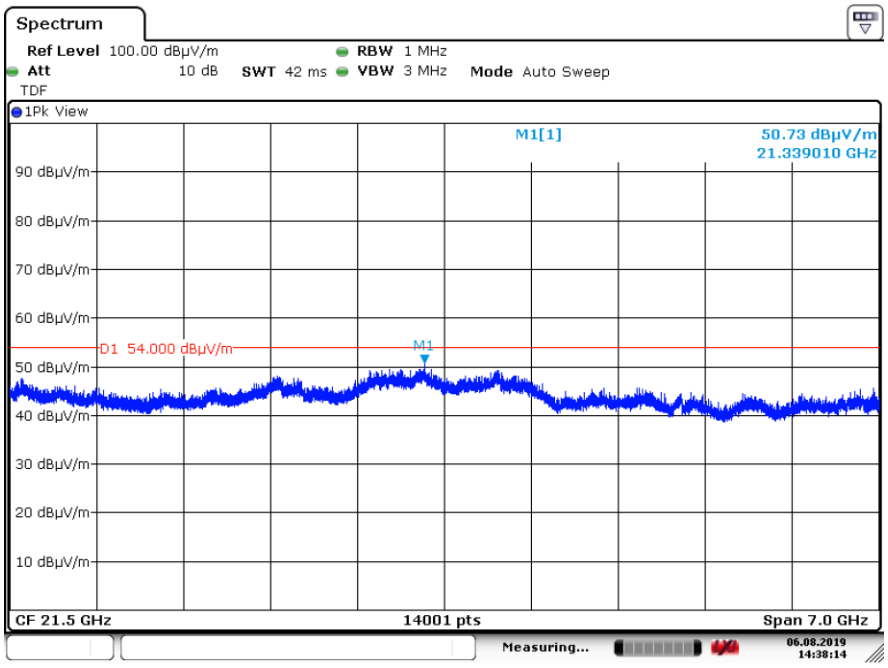
Date: 7.AUG.2019 15:15:03

Plot of the emissions at 2480 MHz in the range 3 – 12 GHz, Vertical polarization, Average value at 7.44 GHz shown.



Date: 7.AUG.2019 15:34:18

Plot of the emissions at 2480 MHz in the range 12 – 18 GHz, vertical polarization, Peak values shown. (Reduced Video Bandwidth used)



Date: 6.AUG.2019 14:38:13

Plot of the emissions at 2480 MHz in the range 18 – 25 GHz, vertical polarization, Peak values shown.

5.2 AC Power Line Conducted Measurements

RESULT: Pass.

Date of testing: 2019-08-15

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 μH/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 (dBμV) Quasi-Peak	Conducted Limit (dBμV) Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 - 30	46	50

*Decreases with the logarithm of the frequency.

Test procedure:

ANSI C63.10-2013.

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

5.2.1 AC Power Line Conducted Emission of Transmitter

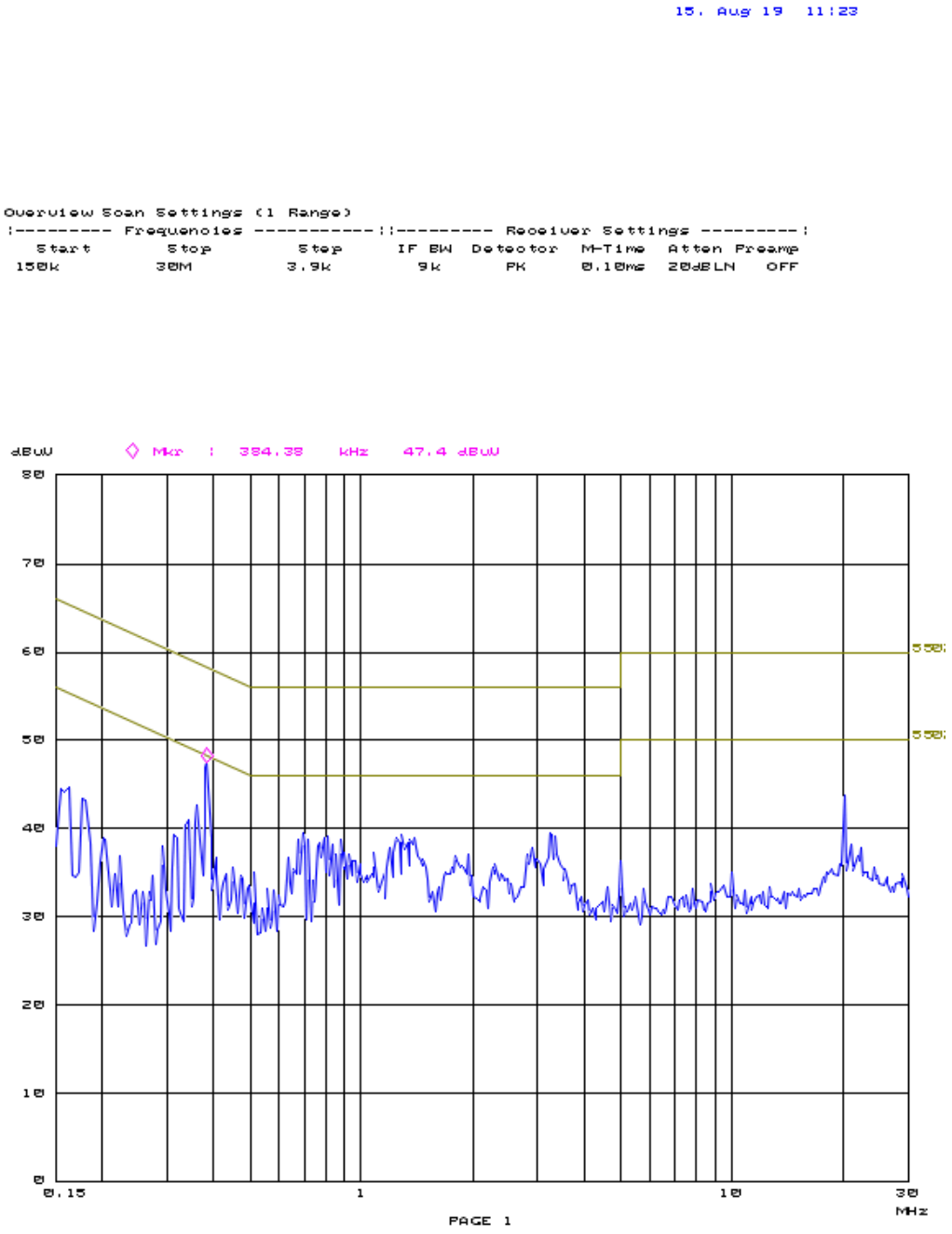
Frequency (MHz)	Measurement results (dBµV) L1		Measurement results (dBµV) L2/Neutral		Limits (dBµV)		Verdict (Pass/Fail)
	QP	AV	QP	AV	QP	AV	
0.1578	35.0	*3	45.4	*3	65.5	55.5	Pass
0.1773	41.0	*3	42.4	*3	64.5	54.5	Pass
0.3609	41.4	*3	41.4	*3	58.7	48.7	Pass
0.3844	46.0	*3	45.7	*3	58.3	48.3	Pass
0.6969	38.2	*3	38.0	*3	56.0	46.0	Pass
3.3224	35.4	*3	35.8	*3	56.0	46.0	Pass
20.040	40.4	*3	40.5	*3	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 RSS-Gen section 8.8, at the 120 Volts/ 60 Hz AC mains connection terminals of the AUX2 that connects to the EUT, are depicted in the table above.

Notes:

1. The resolution bandwidth used was 9 kHz.
2. Measurement uncertainty is +/- 3.5 dB.
3. Plots are provided on the next pages.

5.2.2 Plots of the AC Power-line Conducted Emissions

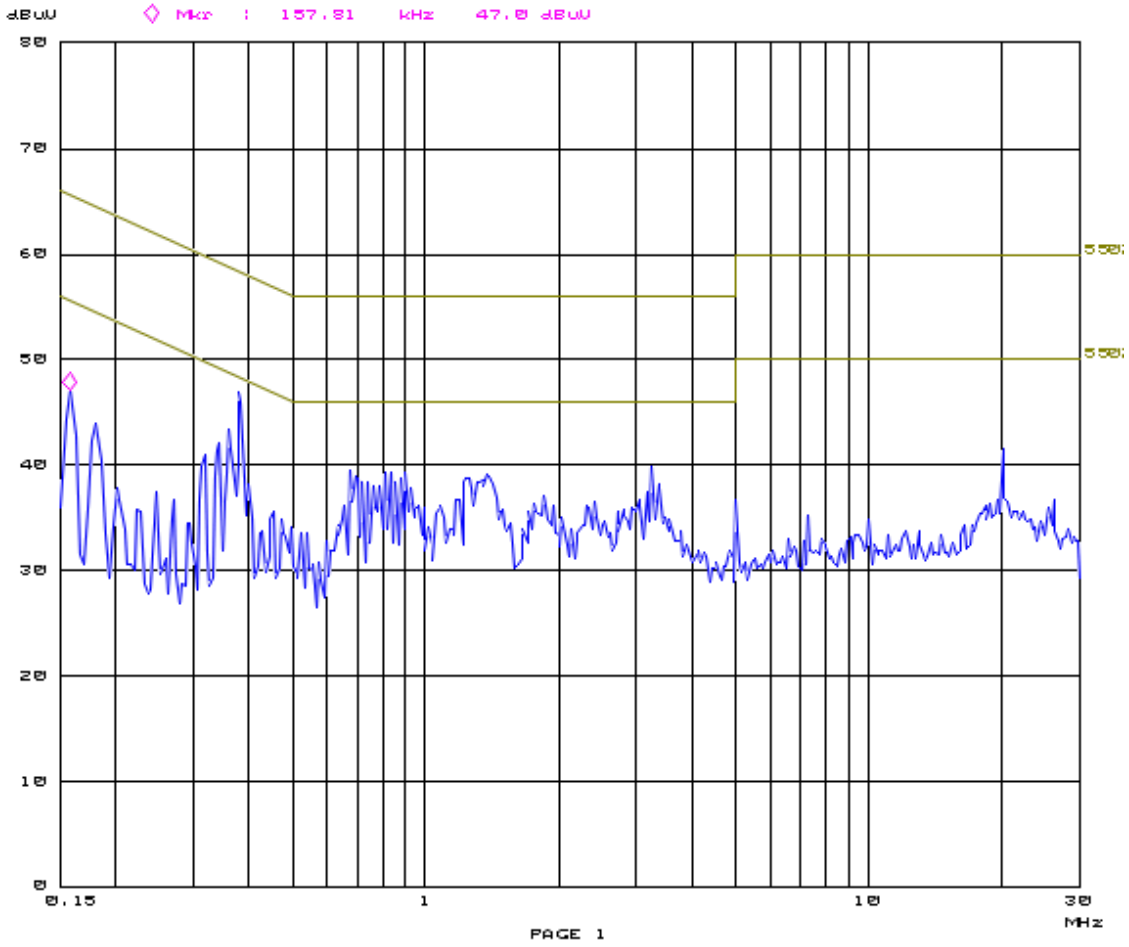


Plot of the AC Power-line Conducted emissions on L1, @2403

15. Aug 19 11:27

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

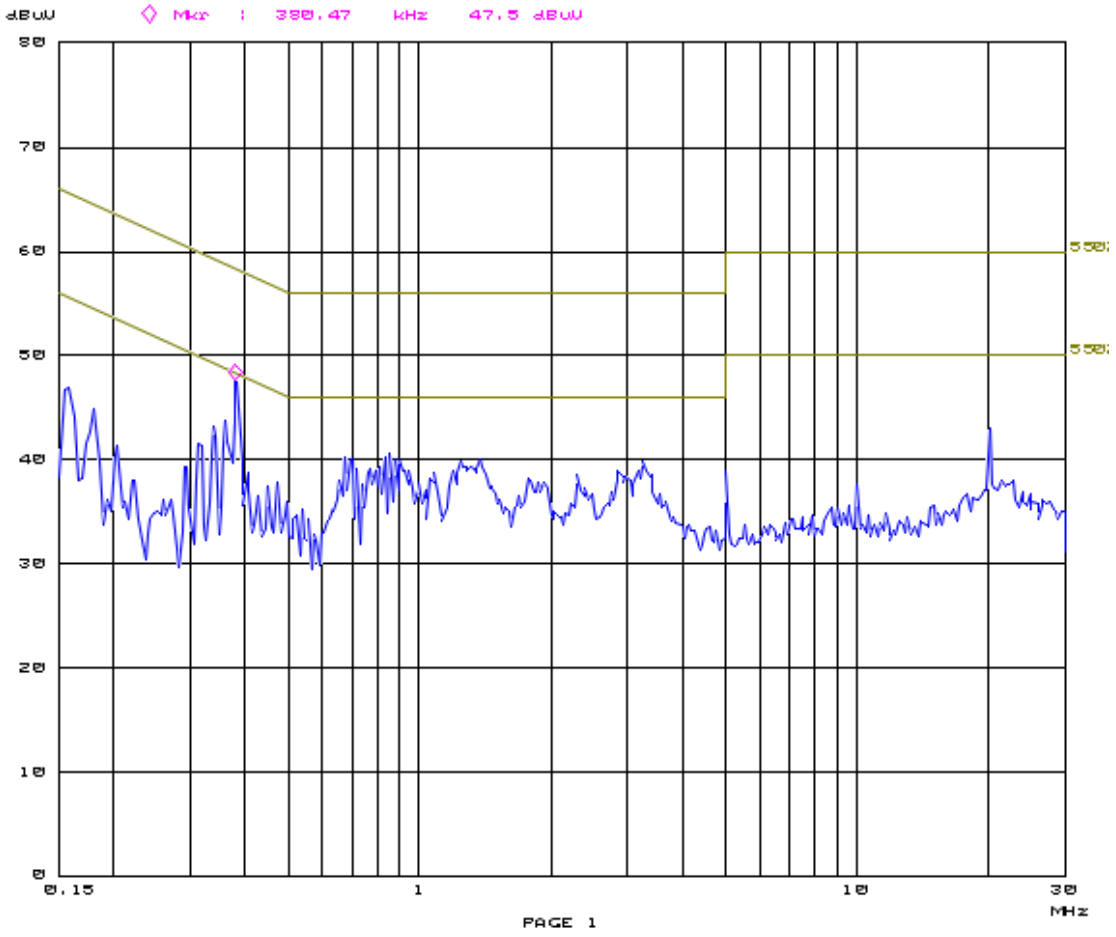


Plot of the AC Power-line Conducted emissions on L2, @2403 MHz

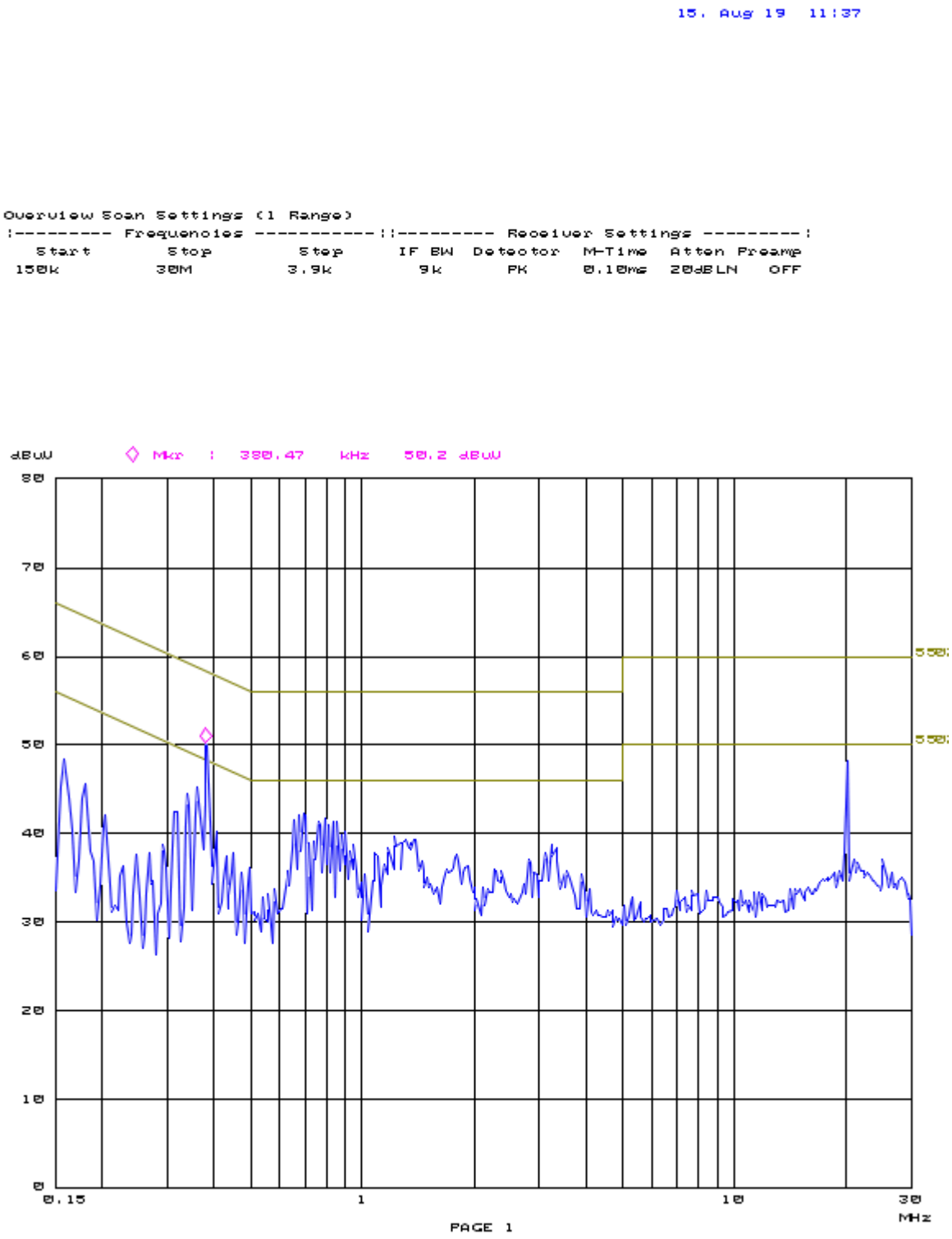
15. Aug 19 11:31

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 on L2, @2442 MHz



Plot of the AC Power-line Conducted emissions on L2, @2480 MHz

End of report