FCC- TEST REPORT

Report Number	:	**64.912.16.04711.01**	Date of Issue:	November 25, 2018

Model	:	SPG-US-01
Product Type	:	Adaptors (Smart Plug)
Applicant	:	Smart iBlue Technology Limited
Manufacturer	:	Smart iBlue Technology Limited.
Address	:	Unit 12, 10/F., Hong Man Industrial Centre, 2 Hong Man Street, Chai Wan, HONG KONG

Test Result	:	■ **Positive**	☐ **Negative**
Total pages including Appendices	:	29	

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2 Details about the Test Laboratory

Details about the Test Laboratory
Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District, Shenzhen City, 518052, P. R. China
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3 Description of the Equipment under Test

Product: Adaptors (Smart Plug)

Model no.: SPG-US-01

FCC ID: 2AKSESPGUS-01

Input: 100-240V AC, 50/60Hz

RF Transmission Frequency: 2402MHz to 2480MHz

Modulation: GFSK

Antenna Type: Integrated Antenna

Antenna Gain: 0 dBi

Description of the EUT: The EUT is a Smart Plug which can be controlled by connecting Bluetooth.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2017 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB558074 D01 v05 and ANSI C63.10 (2013).

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5 Summary of Test Results

Technical Requirements				
FCC Part 15 Subpart C				
Test Condition		Pages	Test Result	Test Site
§15.207	Conducted emission AC power port	10-12	Pass	Site 1
§15.247(b)(1)	Conducted peak output power	13-14	Pass	Site 1
§15.247(e)	Power spectral density	15-16	Pass	Site 1
§15.247(a)(2)	6dB bandwidth	17-18	Pass	Site 1
§15.247(d)	Spurious RF conducted emissions	19-22	Pass	Site 1
§15.247(d)	Band edge	23-24	Pass	Site 1
§15.247(d) & §15.209 &	Spurious radiated emissions for transmitter and receiver	25-27	Pass	Site 1
§15.203	Antenna requirement	See note 1	Pass	--

Note 1: The EUT uses an PCB Antenna, which gain is 0dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2AKSESPGUS-01 complies with Section 15.207, 15.247 of the FCC Part 15, Subpart C.
This report is for the BLE part.

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

☐ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

Sample Received Date: October 8, 2016

Testing Start Date: January 4, 2017

Testing End Date: June 29, 2018

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Reviewed by:	Prepared by:	Tested by:
Peter Jia	Matt Zhang	Joe Gu

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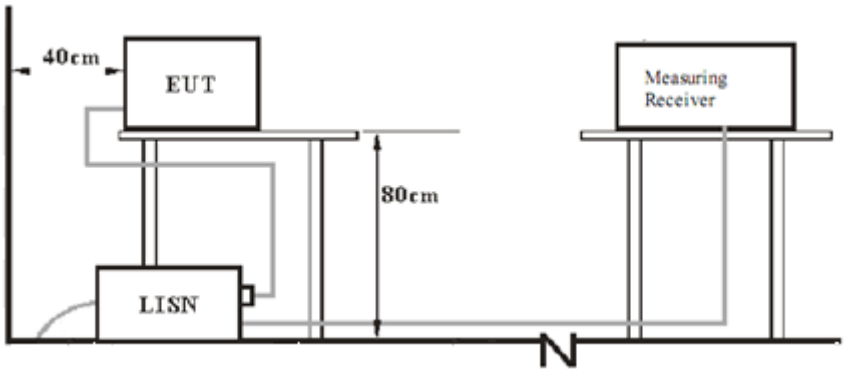
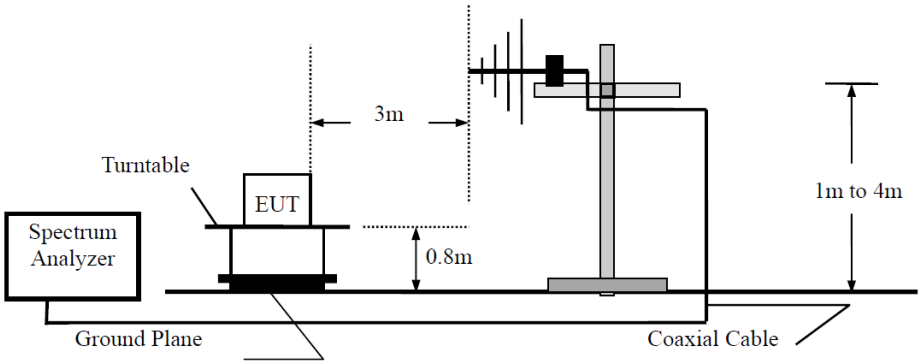
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

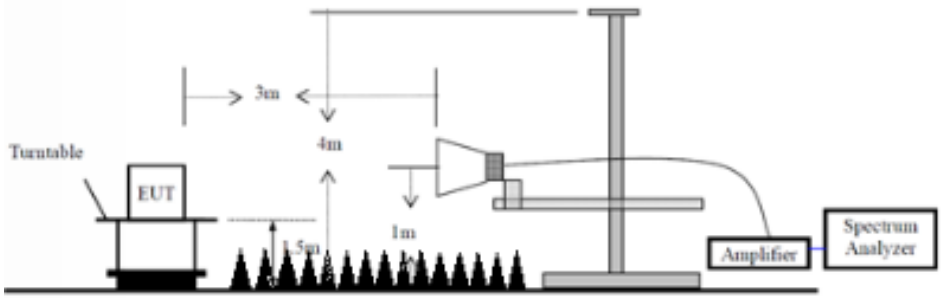


7.2 Radiated test setups

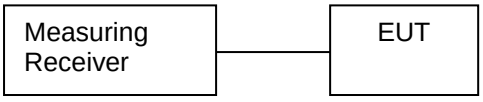
Below 1GHz



Above 1GHz



7.3 Conducted RF test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Mobile Phone	SAMSUNG	SAMSUNG Note2	---

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9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

* Decreasing linear

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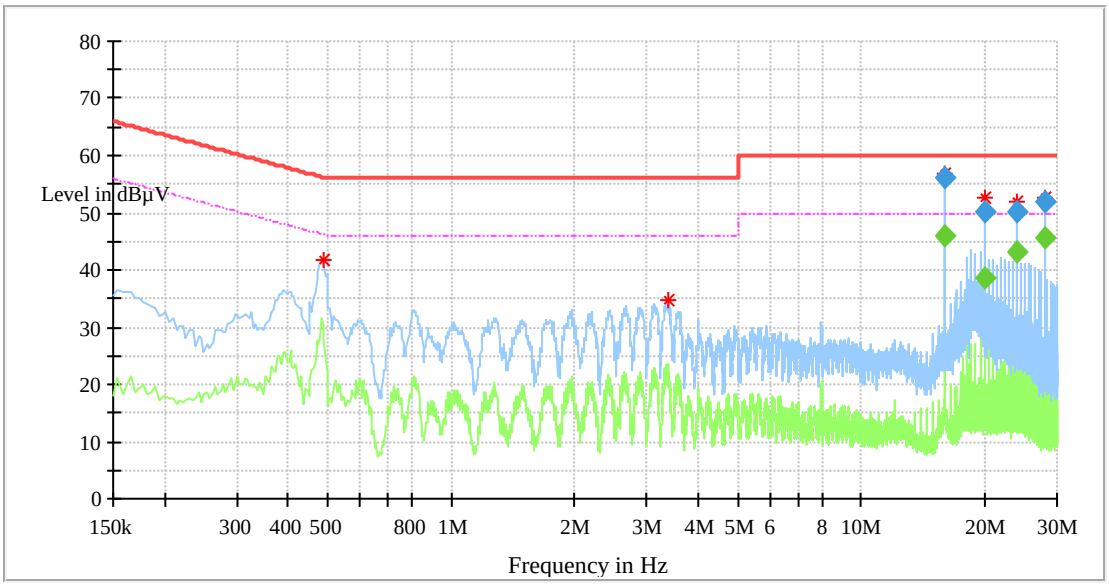
Conducted Emission

Product Type : Smart Plug
M/N : SPG-US-01
Operating Condition : ON with a functional load and communicating
Conduct Line : L



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
16.001500	---	46.02	50.00	3.98	L1	10.8
16.001500	56.01	---	60.00	3.99	L1	10.8
19.997500	---	38.63	50.00	11.37	L1	11.0
19.997500	50.35	---	60.00	9.65	L1	11.0
23.997500	---	43.07	50.00	6.93	L1	11.0
23.997500	50.08	---	60.00	9.92	L1	11.0
28.001500	---	45.50	50.00	4.50	L1	11.1
28.001500	51.97	---	60.00	8.03	L1	11.1

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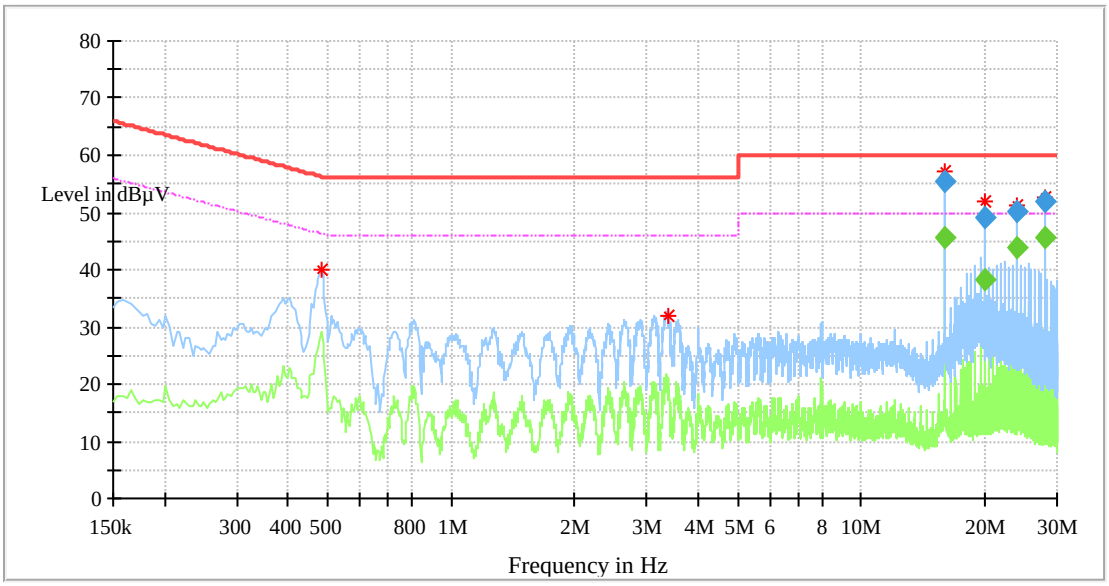
Product Type : Smart Plug
M/N : SPG-US-01
Operating Condition : ON with a functional load and communicating
Conduct Line : N



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
15.997500	---	45.61	50.00	4.39	N	10.9
15.997500	55.28	---	60.00	4.72	N	10.9
19.997500	---	38.22	50.00	11.78	N	11.2
19.997500	49.28	---	60.00	10.72	N	11.2
24.001500	---	43.71	50.00	6.29	N	11.2
24.001500	50.21	---	60.00	9.79	N	11.2
28.001500	---	45.72	50.00	4.28	N	11.1
28.001500	51.87	---	60.00	8.13	N	11.1

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9.2 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
   RBW > the 6 dB bandwidth of the emission being measured, VBW≥3RBW, Span≥3RBW
   Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

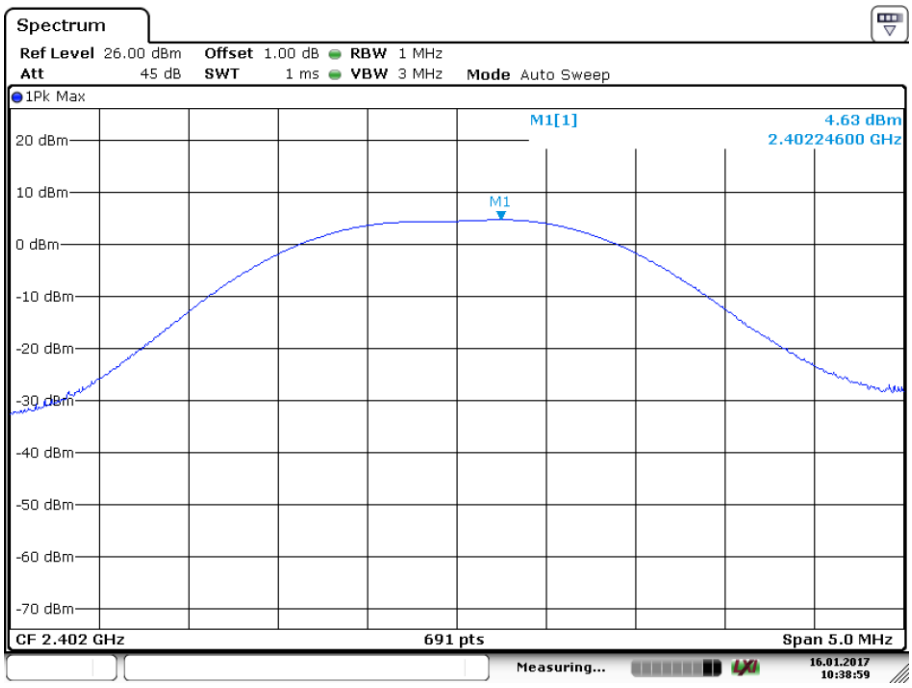
Limits

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

Test result as below table

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	4.63	Pass
Middle channel 2440MHz	5.10	Pass
High channel 2480MHz	4.83	Pass

2402MHz



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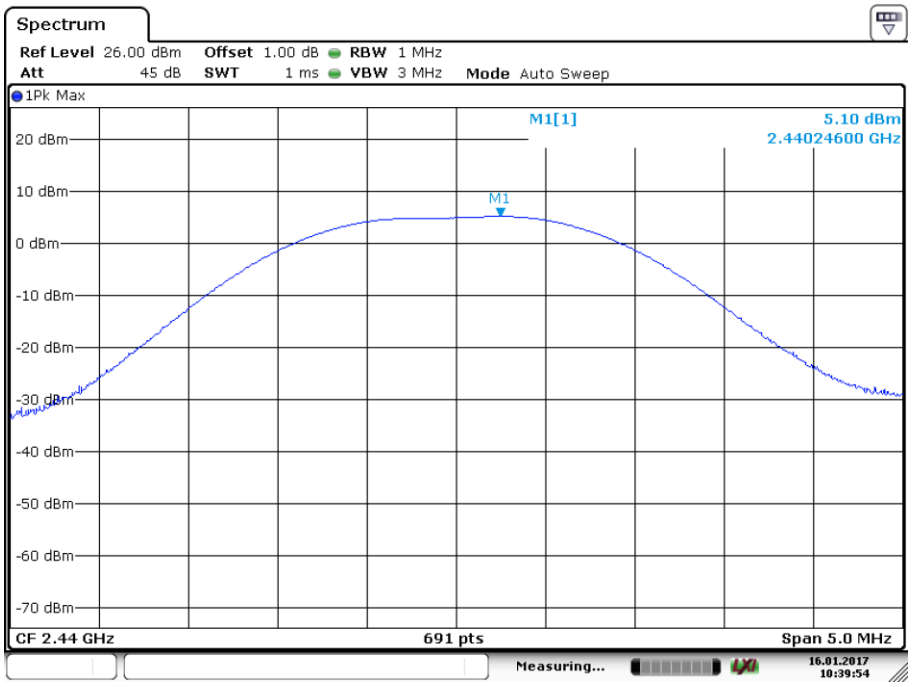
2440MHz



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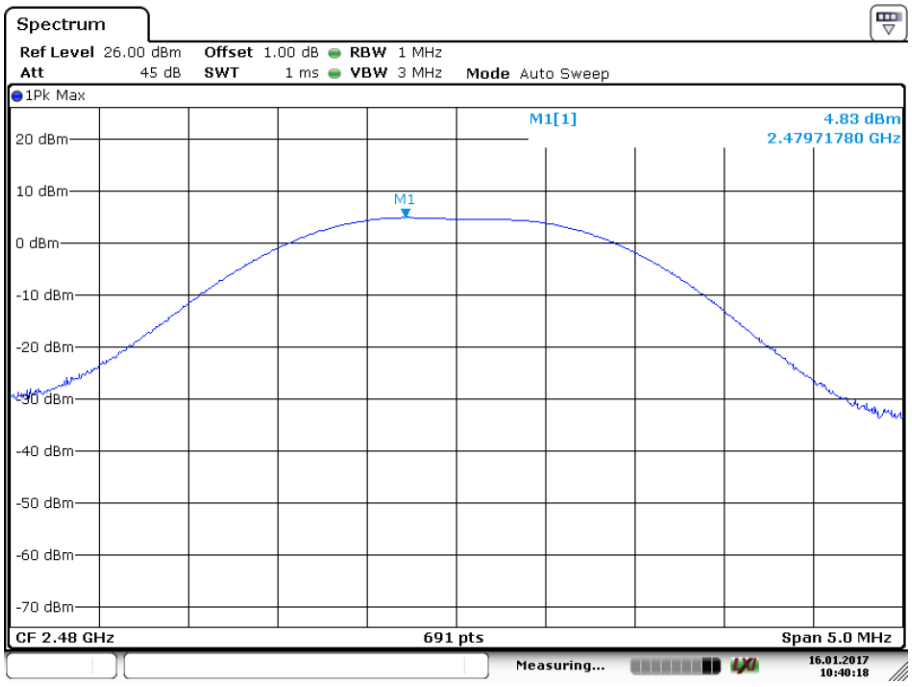
2480MHz



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9.3 6dB bandwidth and 99% Occupied Bandwidth

Test Method

1. Use the following spectrum analyzer settings:
   RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

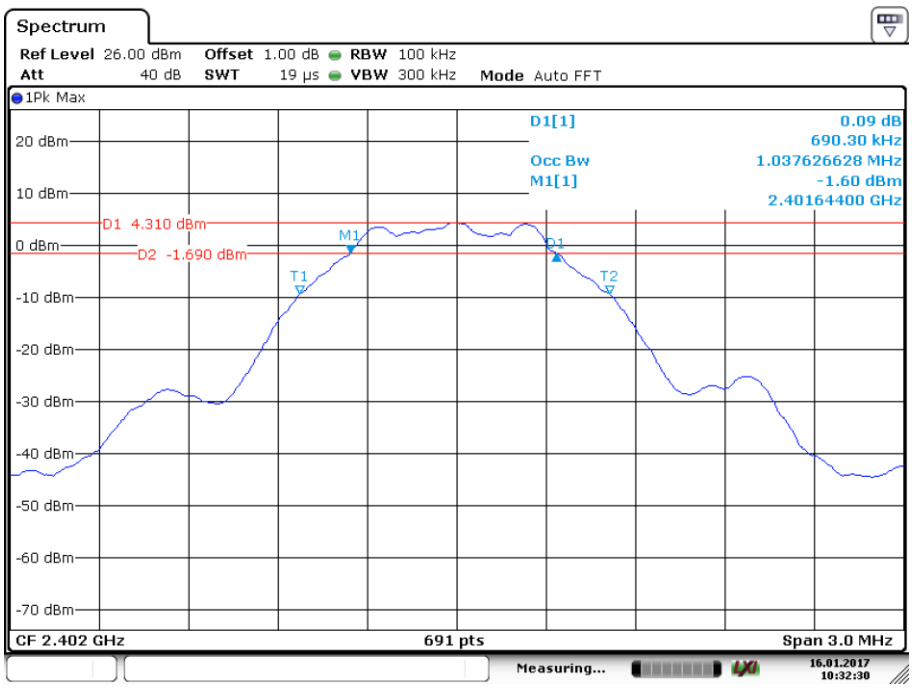
Limit

Limit [kHz]
⩾500

Test result

Frequency MHz	6dB bandwidth kHz	**99% Bandwidth kHz**	Result
Top channel 2402MHz	690.3	1037.626	Pass
Middle channel 2440MHz	664.3	1041.968	Pass
Bottom channel 2480MHz	707.7	1041.968	Pass

2402MHz



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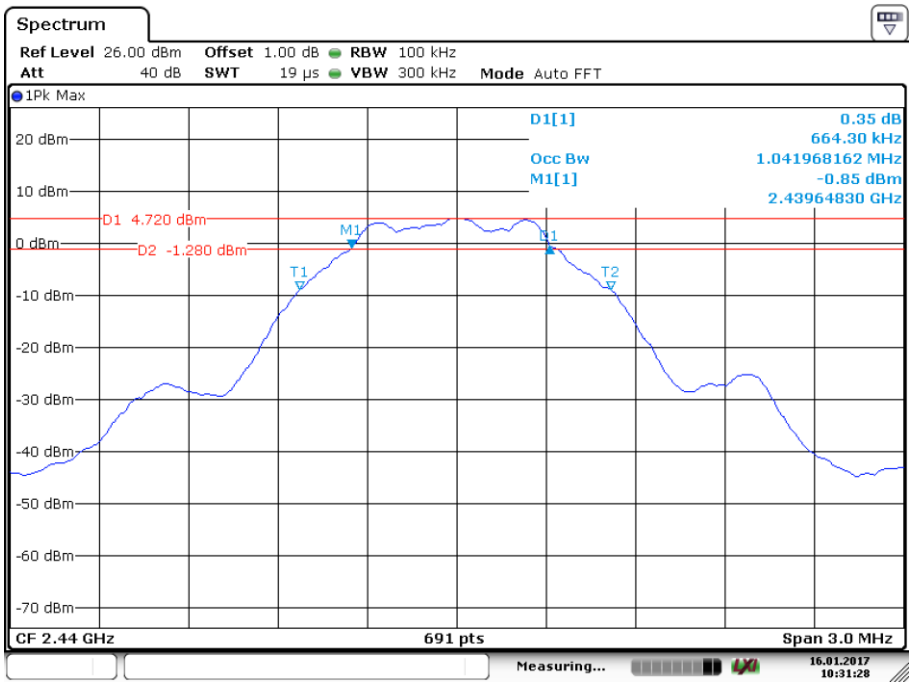
2440MHz



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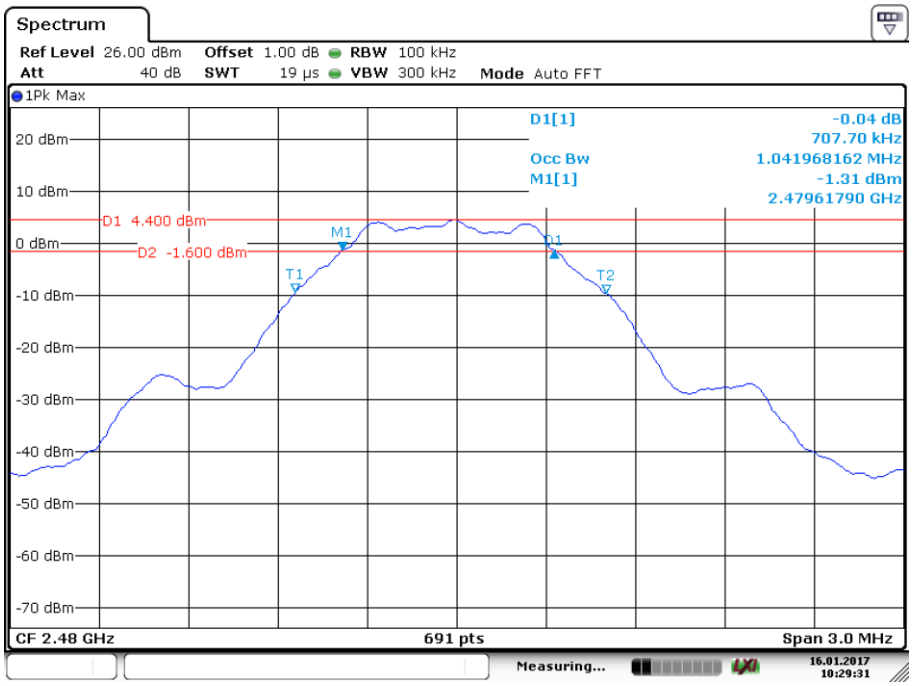
2480MHz



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9.4 Power spectral density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz,VBW≥3RBW,Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
3. Repeat above procedures until other frequencies measured were completed.

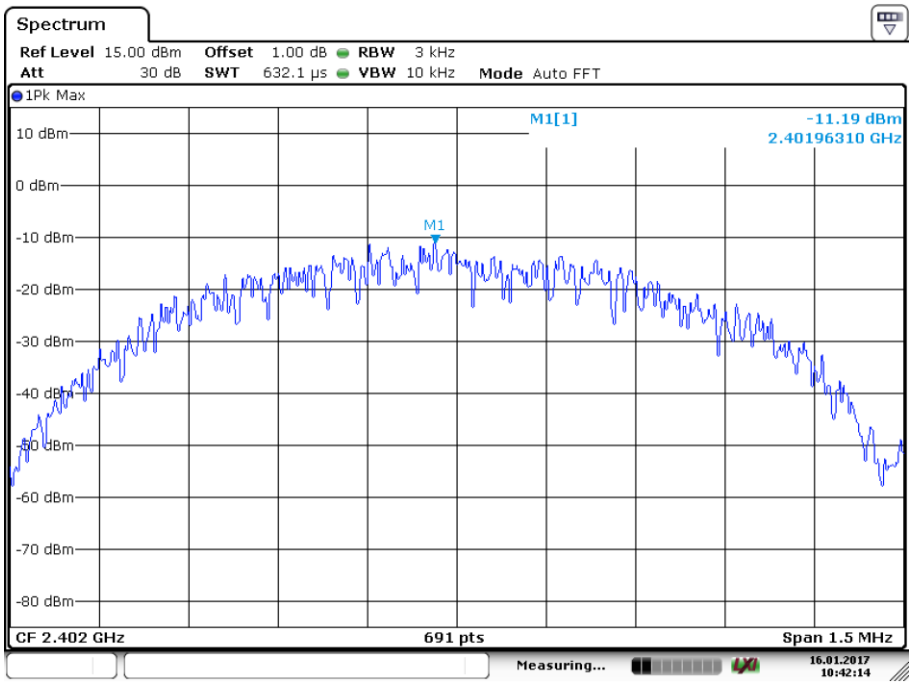
Limit

Limit [dBm]
≤8

Test result

Frequency MHz	Power spectral density dBm	Result
Top channel 2402MHz	-11.19	Pass
Middle channel 2440MHz	-10.77	Pass
Bottom channel 2480MHz	-10.62	Pass

2402MHz



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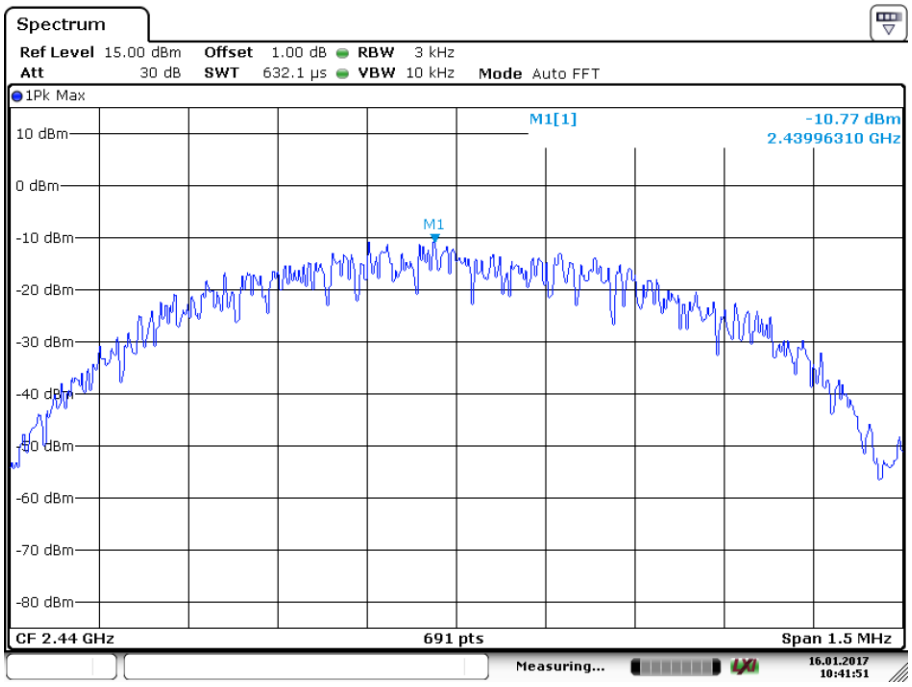
2440MHz



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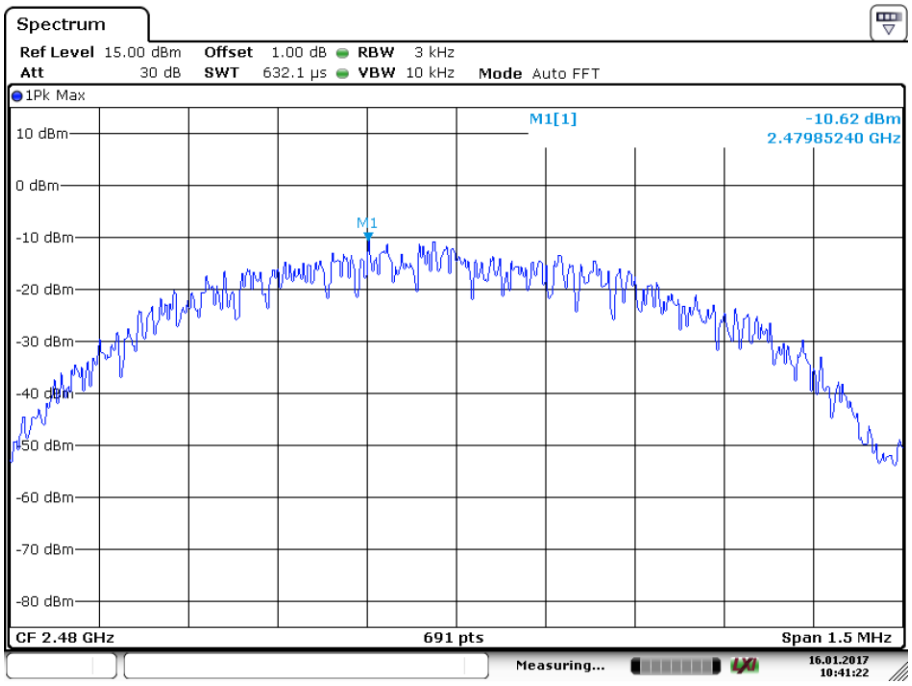
2480MHz



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9.5 Spurious RF conducted emissions

Test Method

1. Establish a reference level by using the following procedure:
   a. Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
   b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
2. Use the maximum PSD level to establish the reference level.
   a. Set the center frequency and span to encompass frequency range to be measured.
   b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
3. Repeat above procedures until other frequencies measured were completed.

Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

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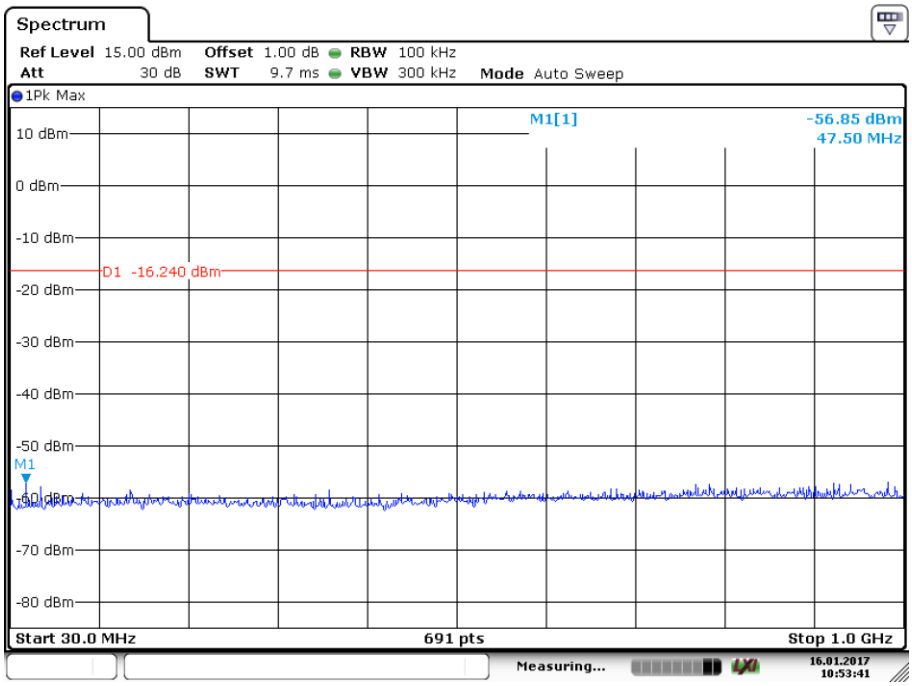
Spurious RF conducted emissions

2402MHz



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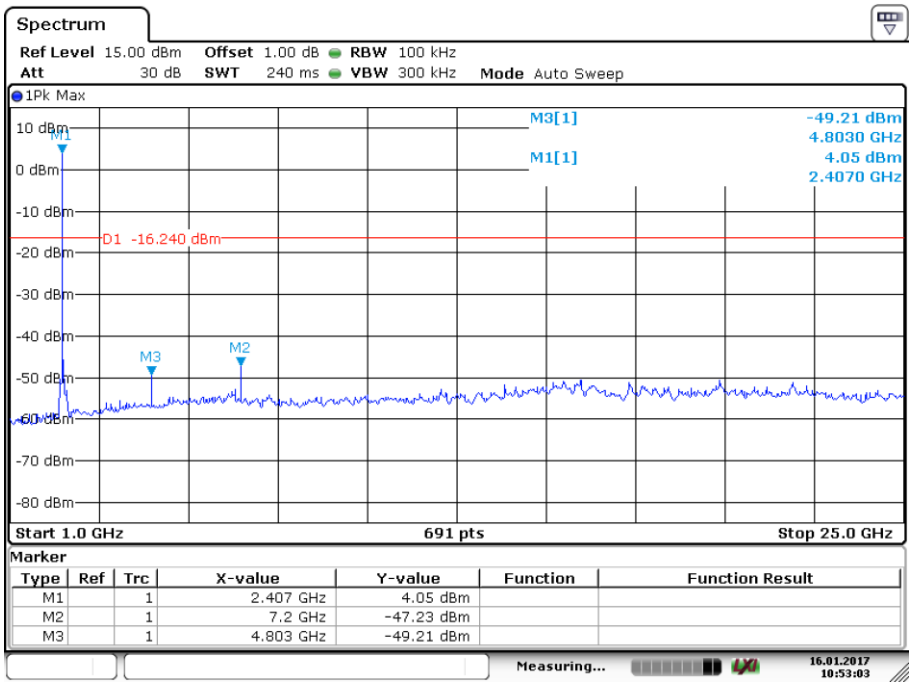

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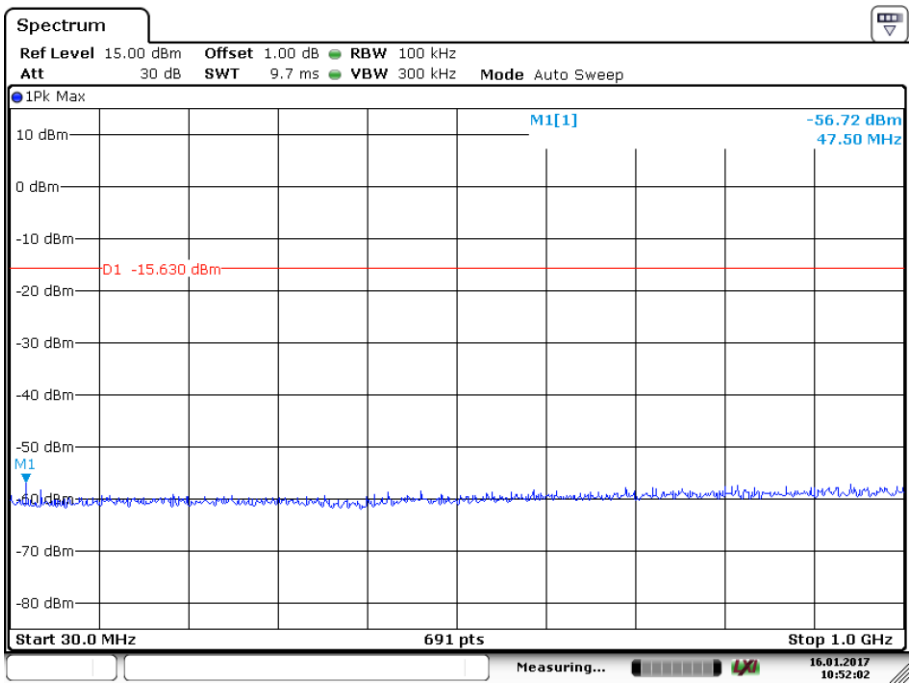
2440MHz



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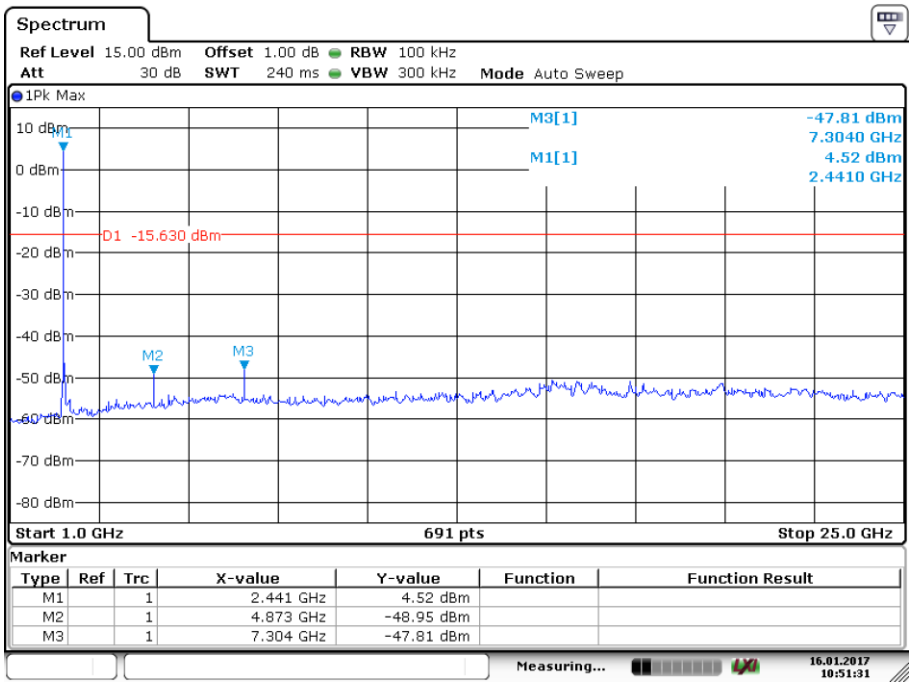

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.441 GHz	4.52 dBm		
M2		1	4.873 GHz	-48.95 dBm		
M3		1	7.304 GHz	-47.81 dBm		

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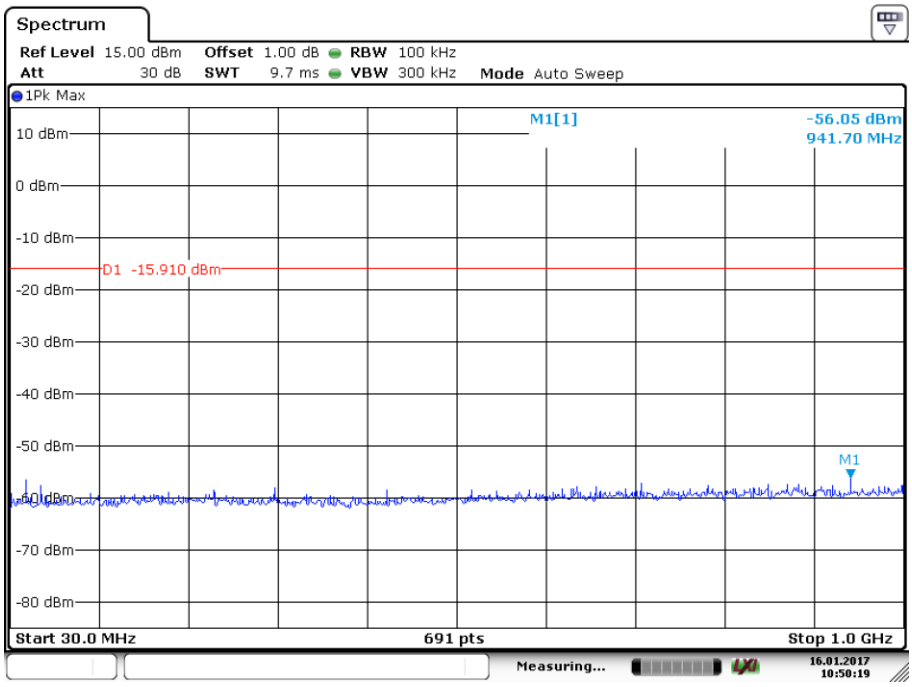
2480MHz



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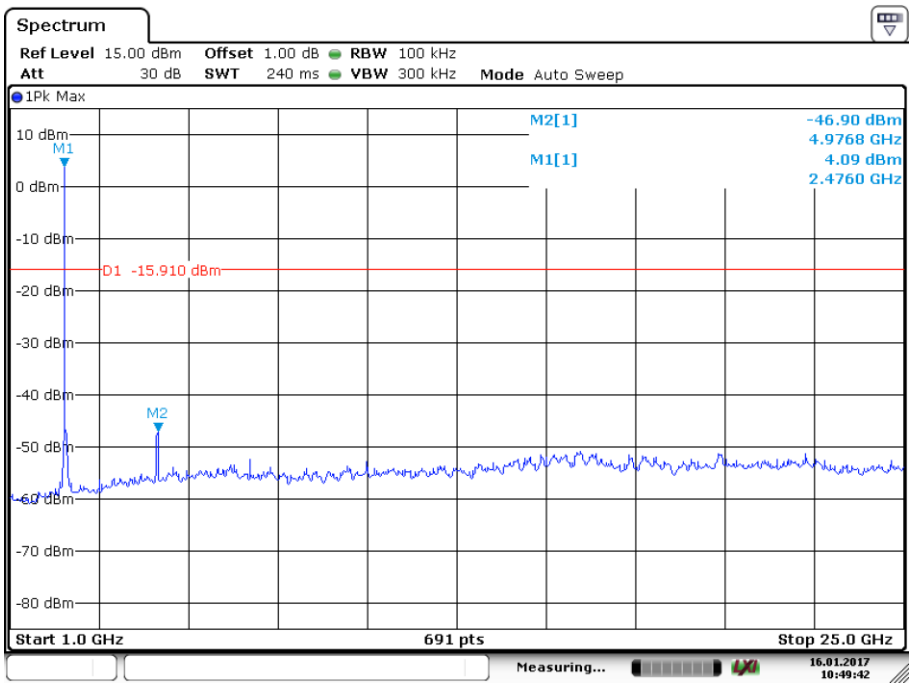

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9.6 Band edge

Test Method

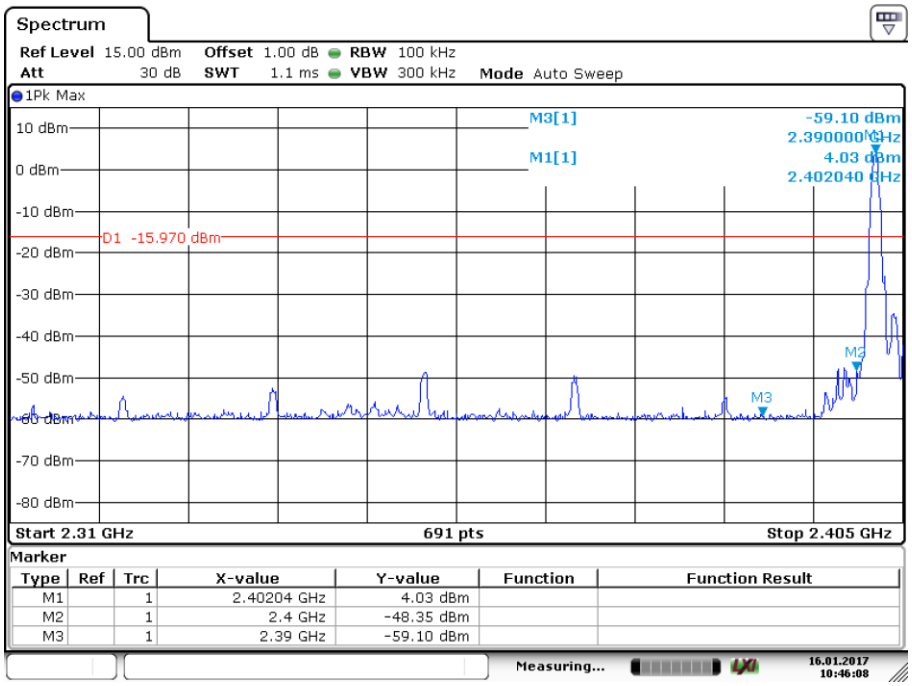
1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW⩾RBW, Sweep = auto, Detector function = peak, Trace = max hold.
2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
3 The level displayed must comply with the limit specified in this Section.

Limit

In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

Test result

2402MHz



Date: 16.JAN.2017 10:46:08

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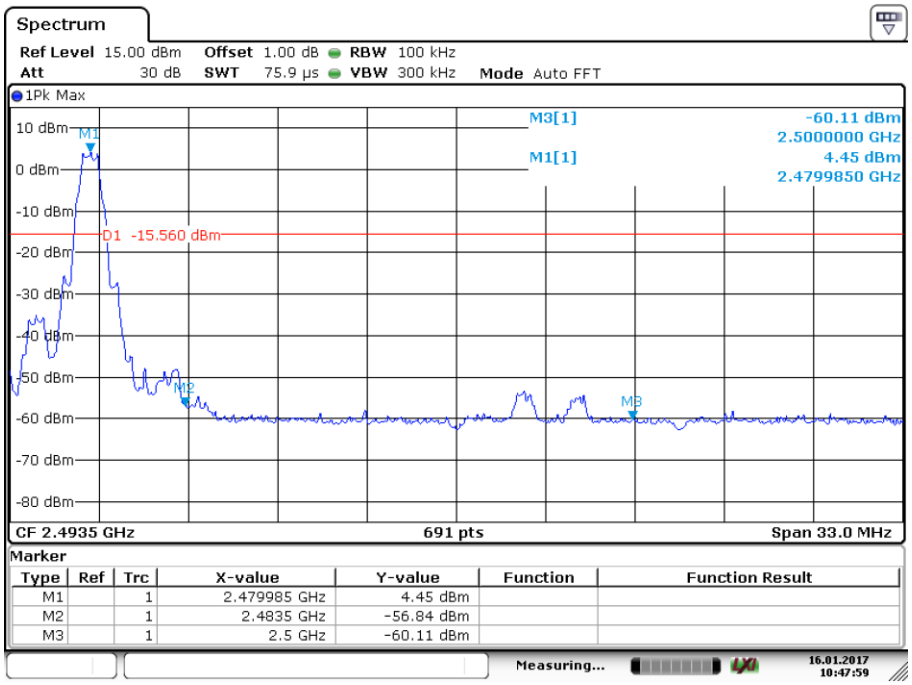
Band edge

2480MHz



Date: 16.JAN.2017 10:47:59

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9.7 Spurious radiated emissions for transmitter

Test Method

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3-meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.

3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

5: Use the following spectrum analyzer settings According to C63.10:

For Above 1GHz

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW≥RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:

1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.

2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.

3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).

4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.

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Limit

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

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Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Transmitting spurious emission test result as below:

2402MHz (30MHz – 1GHz)

Frequency MHz	Emission Level dBuV/m	Polarization	Limit dBµV/m	Detector	Result
576.05	33.71	Horizontal	46.00	QP	Pass
944.92	31.64	Vertical	46.00	QP	Pass

2402MHz (Above 1GHz)

Frequency MHz	Emission Level dBuV/m	Polarization	Limit dBµV/m	Detector	Result
4803.28*	41.86	Horizontal	74.00	PK	Pass
4803.28*	36.44	Vertical	74.00	PK	Pass

2440MHz (Above 1GHz)

Frequency MHz	Emission Level dBuV/m	Polarization	Limit dBµV/m	Detector	Result
4879.21*	38.14	Horizontal	74	PK	Pass
4880.15*	40.49	Vertical	74	PK	Pass

2480MHz (Above 1GHz)

Frequency MHz	Emission Level dBuV/m	Polarization	Limit dBµV/m	Detector	Result
4959.37*	38.89	Horizontal	74.00	PK	Pass
4859.37*	42.08	Vertical	74.00	PK	Pass

Remark:

(1) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(2) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 10dB below the permissible limits or the field strength is too small to be measured.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

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10 Test Equipment List

List of Test Instruments

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
CE	EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2018-7-14
	LISN	Rohde & Schwarz	ENV4200	100249	2018-7-17
	LISN	Rohde & Schwarz	ENV216	100326	2018-7-14
	ISN	Rohde & Schwarz	ENY81	100177	2018-7-14
	ISN	Rohde & Schwarz	ENY81-CAT6	101664	2018-7-14
	High Voltage Proble	Rohde & Schwarz	TK9420(VT9420)	9420-58	2018-7-14
	RF Current probe	Rohde & Schwarz	EZ-17	100816	2018-7-14
C	Signal Generator	Rohde & Schwarz	SMB100A	108272	2018-7-7
	Signal Analyzer	Rohde & Schwarz	FSV40	101030	2018-7-7
	Vector Signal Generator	Rohde & Schwarz	SMU 200A	105324	2018-7-7
	RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2018-7-7
RE	EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2018-7-14
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2018-7-14
	Horn Antenna	Rohde & Schwarz	HF907	102294	2018-7-14
	Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2018-7-14
	3m Semi-anechoic chamber	TDK	9X6X6	----	2019-5-29

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth
- Power spectral density*
- Spurious RF conducted emissions
- Band edge
- Conducted emission AC power port

RE - Radiated RF tests

- Spurious radiated emissions for transmitter

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11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz	Horizontal: 4.91dB; Vertical: 4.89dB;
Uncertainty for Radiated Emission in 3m chamber 1000MHz-18000MHz	Horizontal: 4.80dB; Vertical: 4.79dB;
Uncertainty for Conducted Emission 150KHz-30MHz	U=3.21dB
RF Power Conducted:	1.16dB
Frequency test involved:	0.6×10^{-7} or 1%
Power Spectral Density Conducted measurement	1.17dB
Spurious emissions Conducted measurement	1.43dB

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