

FCC/IC - TEST REPORT

Report Number	:	68.950.18.0060.01	Date of Issue:	<u>April 08, 2018</u>
Model	:	WOO 3.0		
Product Type	:	Motion sensor with Bluetooth data transmission		
Applicant	:	Blue Ocean Innovation Limited		
Address	:	Unit 50, 8/F, Phase 2, Wah Lok Ind Centre 31-35 Shan Mei Street, Fotan, Hong Kong		
Production Facility	:	JDI Electronics Factory		
Address	:	Sima Village, Chang Ping Town, Dongguan, Guangdong, China.		
Test Result	:	<input checked="" type="checkbox"/> Positive <input type="checkbox"/> Negative		
Total pages including Appendices	:	<u>28</u>		

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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,
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FCC Registration Number: 514049

IC Registration Number: 10320A-1

Telephone: 86 755 8828 6998
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3 Description of the Equipment under Test

Description of the Equipment Under Test

Product: Motion sensor with Bluetooth data transmission
Model no.: WOO 3.0
FCC ID: VU3-WOO3
IC: 6056A-WOO3
Options and accessories: NIL
Rating: 3.7VDC, 120mAh (Supplied by internal rechargeable battery Pack) or Charging by 5VDC, 1.0A (Supplied by USB Port)
RF Transmission Frequency: 2402-2480MHz
No. of Operated Channel: 40
Modulation: GFSK
Antenna Type: Integrated Antenna
Antenna Gain: 0dBi
Description of the EUT: The Equipment Under Test (EUT) is a Motion sensor with Bluetooth function operating at 2.4GHz

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2016 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 4 November 2014	General Requirements and Information for the Certification of Radio Apparatus
RSS-247Issue 2 February 2017	Digital Transmission Systems (DTS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

All the test methods were according to KDB558074 D01 DTS Meas Guidance v04 and ANSI C63.10 (2013).

5 Summary of Test Results

Technical Requirements					
FCC Part 15 Subpart C/RSS-247 Issue 2/RSS-Gen Issue 4					
Test Condition			Pages	Test Result	Test Site
§15.207	RSS-GEN 8.8	Conducted emission AC power port	--	N/A	--
§15.247(b)(1)	RSS-247 Clause 5.4(d)	Conducted peak output power	10	Pass	Site 1
§15.247(e)	RSS-247 Clause 5.2(b)	Power spectral density	15	Pass	Site 1
§15.247(a)(2)	RSS-247 Clause 5.2(a)	6dB bandwidth	13	Pass	Site 1
§15.247(a)(1)	RSS-247 Clause 5.1(a) & RSS-Gen 6.6	20dB bandwidth and 99% Occupied Bandwidth	--	N/A	--
§15.247(a)(1)	RSS-247 Clause 5.1(b)	Carrier frequency separation	--	N/A	--
§15.247(a)(1)(iii)	RSS-247 Clause 5.1(d)	Number of hopping frequencies	--	N/A	--
§15.247(a)(1)(iii)	RSS-247 Clause 5.1(d)	Dwell Time	--	N/A	--
§15.247(d)	RSS-247 Clause 5.5	Spurious RF conducted emissions	17	Pass	Site 1
§15.247(d)	RSS-247 Clause 5.5	Band edge	21	Pass	Site 1
§15.247(d) & §15.209 &	RSS-247 Clause 5.5 & RSS-GEN 6.13	Spurious radiated emissions for transmitter and receiver	23	Pass	Site 1
§15.203	RSS-GEN 8.3	Antenna requirement	See note 1	Pass	--

Remark 1: N/A – Not Applicable.

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

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: VU3-WOO3, IC: 6056A-WOO3, complies with Section 15.205, 15.209, 15.247 of the FCC Part 15, Subpart C and RSS 247 and RSS-Gen rules.

This report is for the Bluetooth LE.

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.

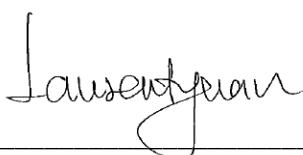
Sample Received Date: January 25, 2018

Testing Start Date: January 25, 2018

Testing End Date: February 13, 2018

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:



Laurent Yuan
EMC Project Manager

Prepared by:

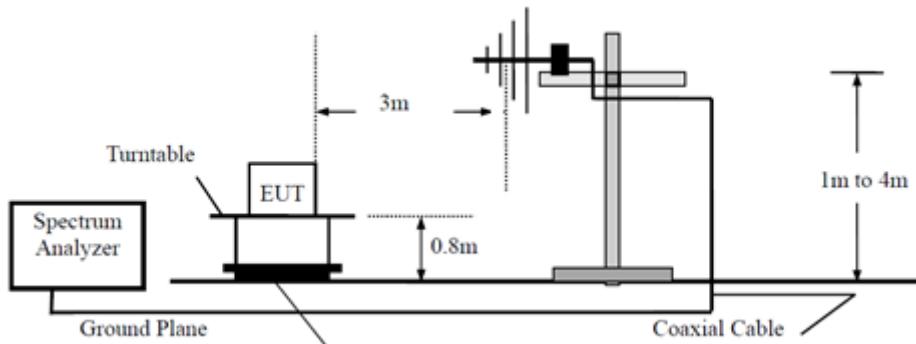


Aaron Lai
EMC Project Engineer

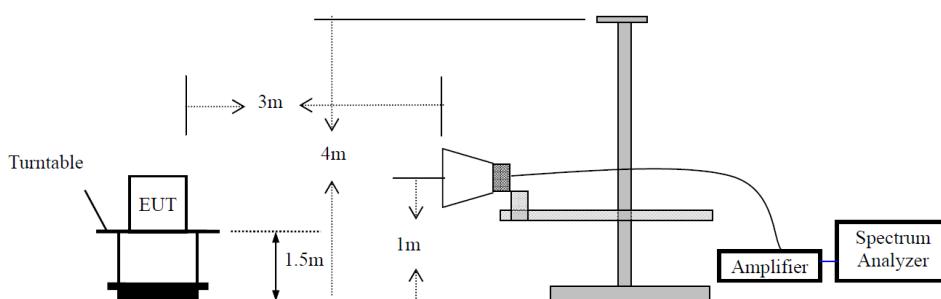


7 Test Setups

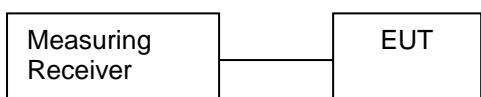
Below 1GHz



Above 1GHz



7.2 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
---	---	---	---

Test software: nRF go, which used to control the EUT in continues transmitting mode.

The system was configured to channel 0, 19, and 39 for the test.

9 Technical Requirement

9.1

9.1 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
RBW > the 6 dB bandwidth of the emission being measured, VBW \geq 3RBW, Span \geq 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

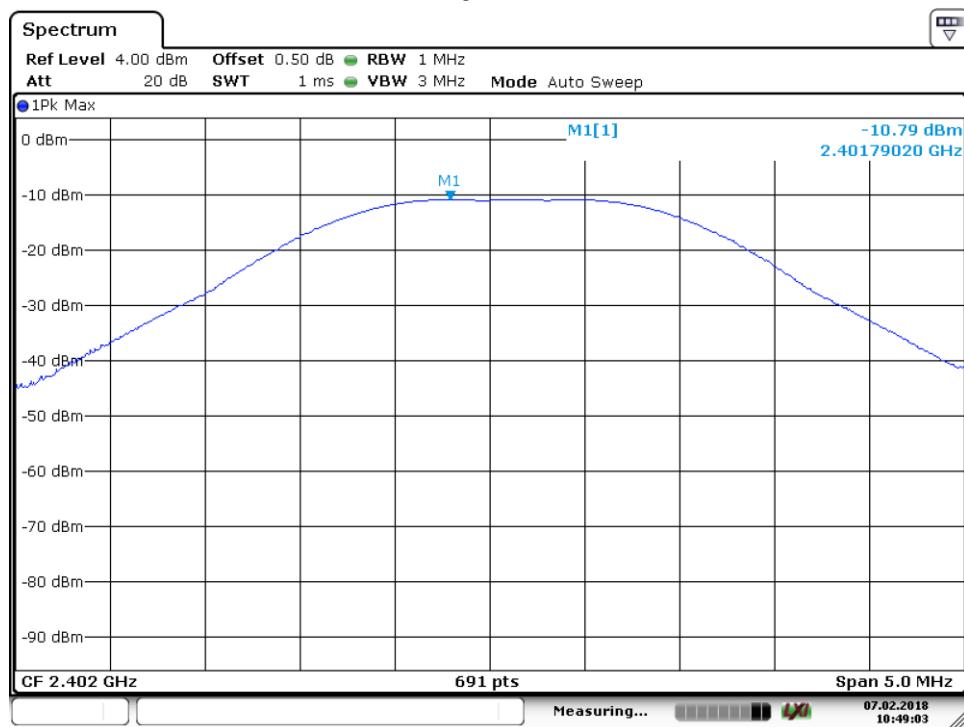
According to §15.247 (b) (1), conducted peak output power limit as below:

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

Test result as below table

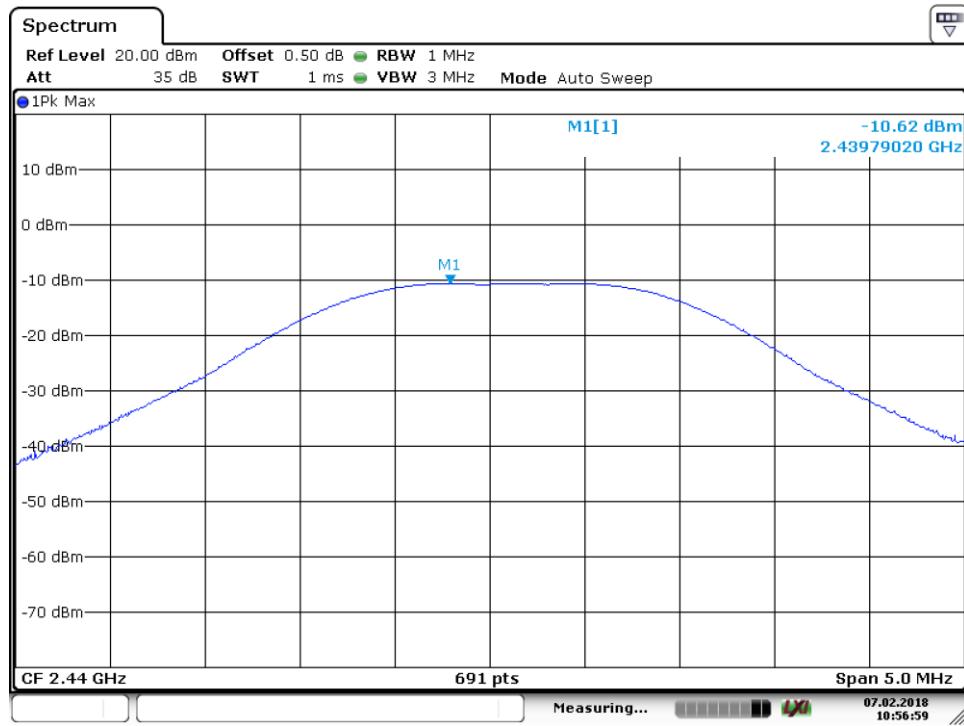
Frequency MHz	Conducted Peak Output Power dBm	Result
Bottom channel 2402MHz	-10.79	Pass
Middle channel 2440MHz	-10.62	Pass
Top channel 2480MHz	-11.05	Pass

2402MHz



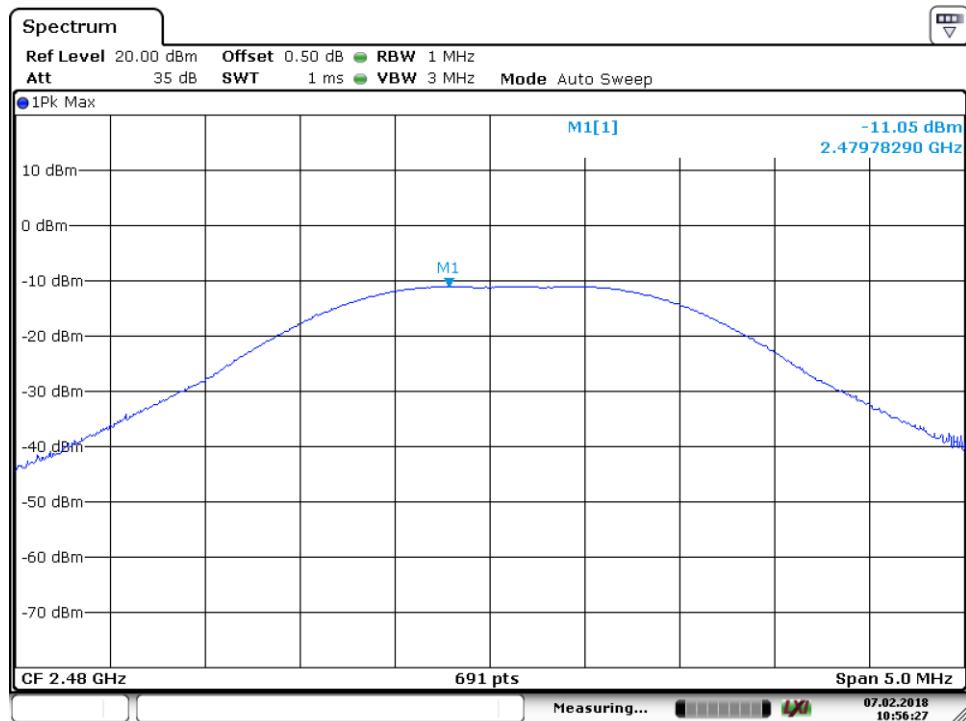
Date: 7.FEB.2018 10:49:03

2440MHz



Date: 7.FEB.2018 10:57:00

2480MHz



Date: 7.FEB.2018 10:56:27

9.2 6dB bandwidth

Test Method

1. Use the following spectrum analyzer settings:
RBW=100K, VBW \geq 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 \geq 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

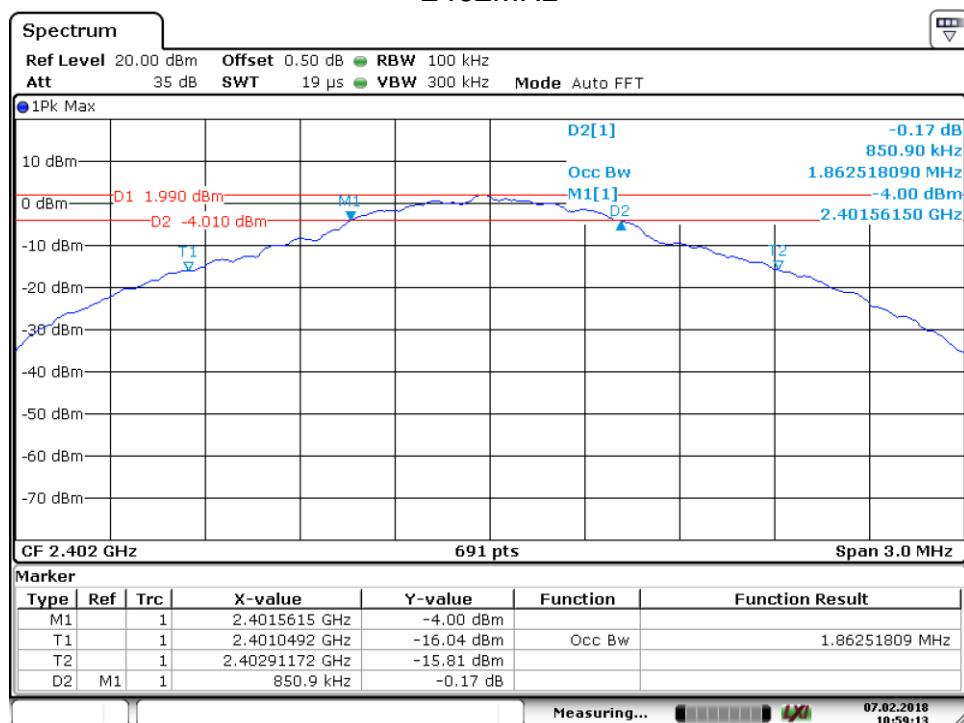
Limit [kHz]

≥ 500

Test result

Frequency MHz	6dB bandwidth kHz	99 bandwidth kHz	Result
Bottom channel 2402MHz	850.90	1862.51	Pass
Middle channel 2440MHz	868.30	1884.22	Pass
Top channel 2480MHz	872.60	1840.81	Pass

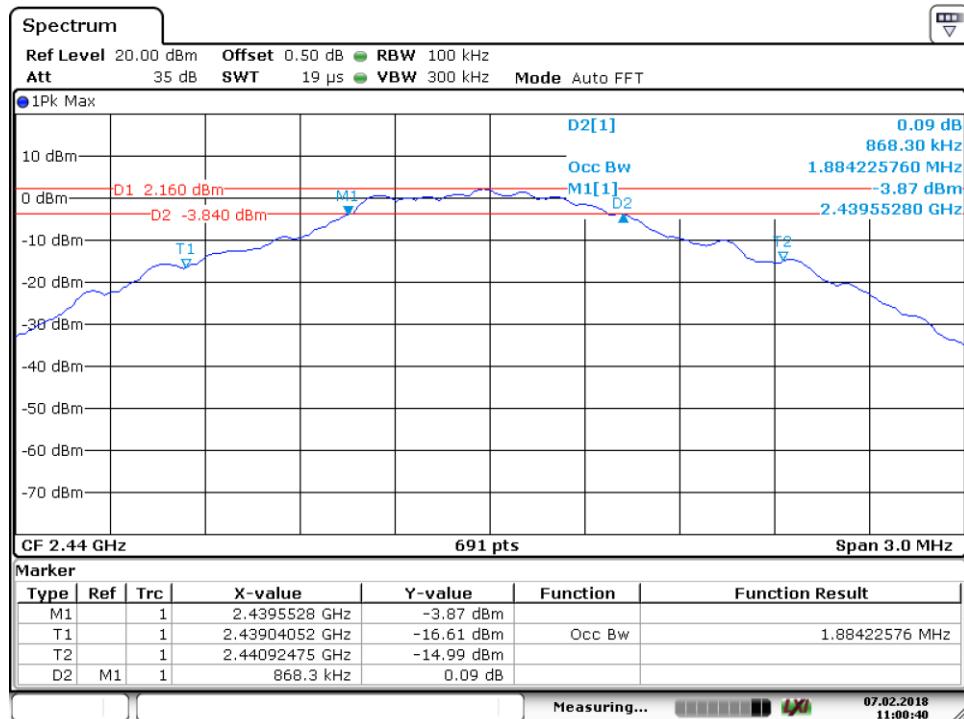
2402MHz



Date: 7.FEB.2018 10:59:13

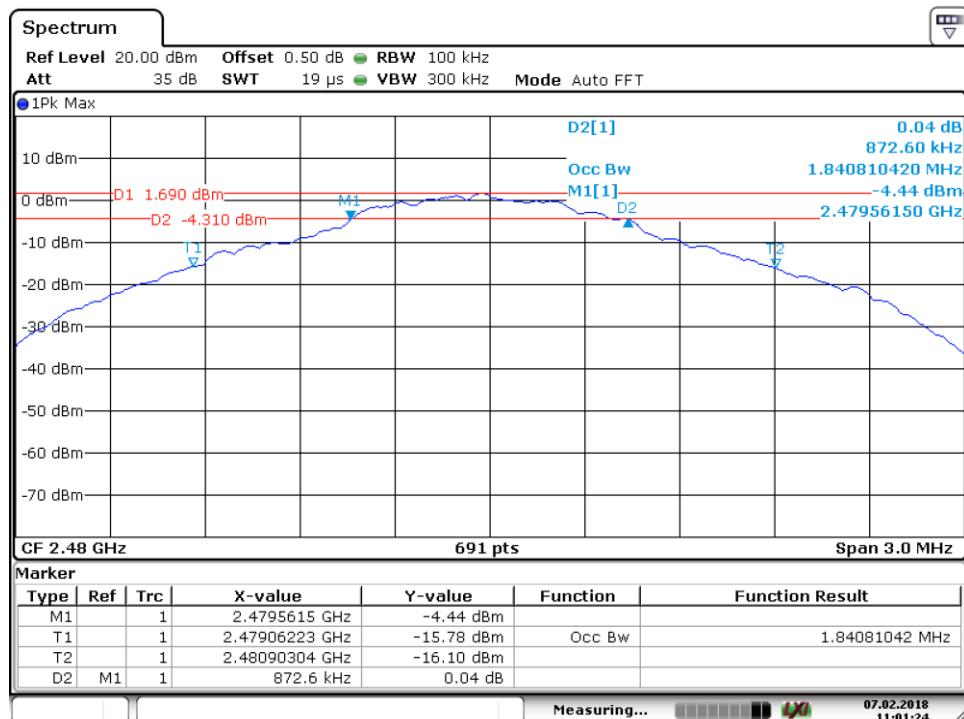
6 dB Bandwidth

2440MHz



Date: 7.FEB.2018 11:00:41

2480MHz



Date: 7.FEB.2018 11:01:24

9.3 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 \geq 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

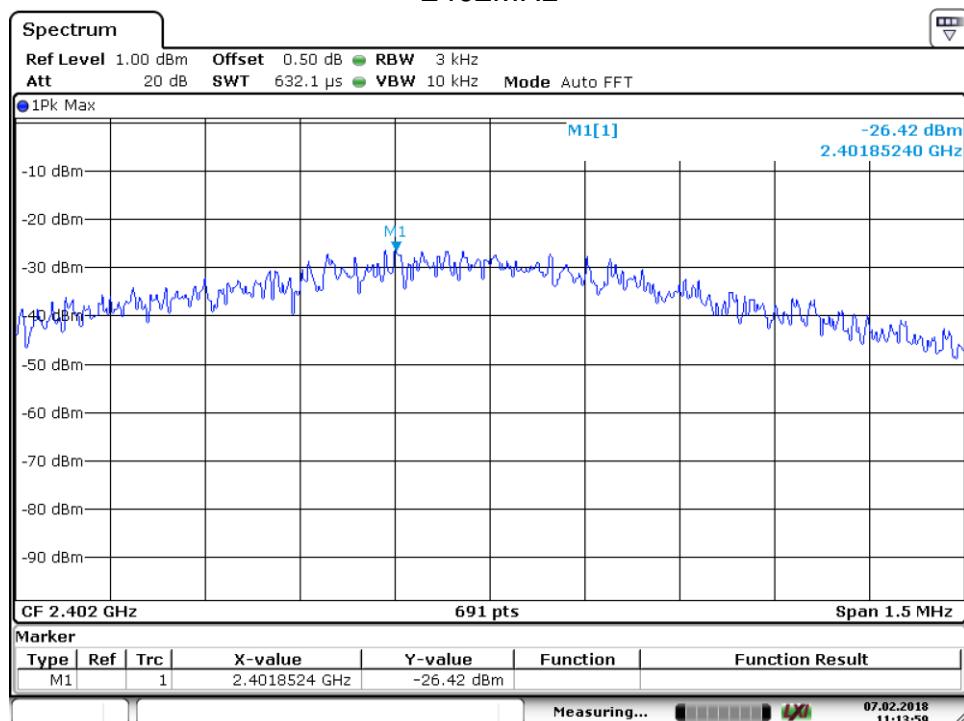
Limit [dBm]

≤ 8

Test result

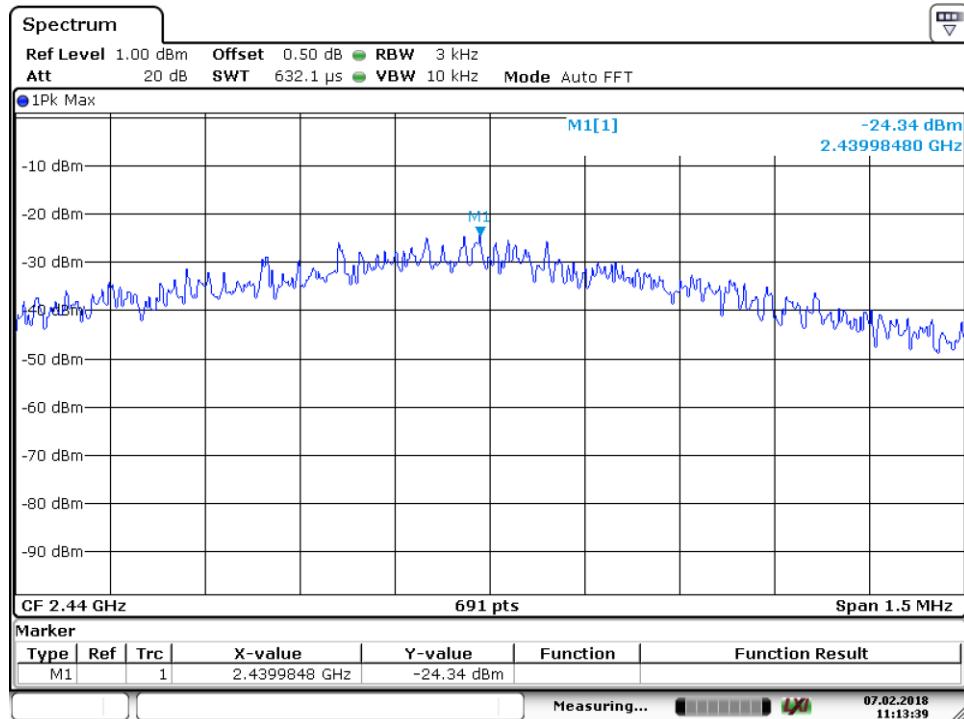
Frequency MHz	Power spectral density dBm	Result
Bottom channel 2402MHz	-26.42	Pass
Middle channel 2440MHz	-24.34	Pass
Top channel 2480MHz	-26.13	Pass

2402MHz



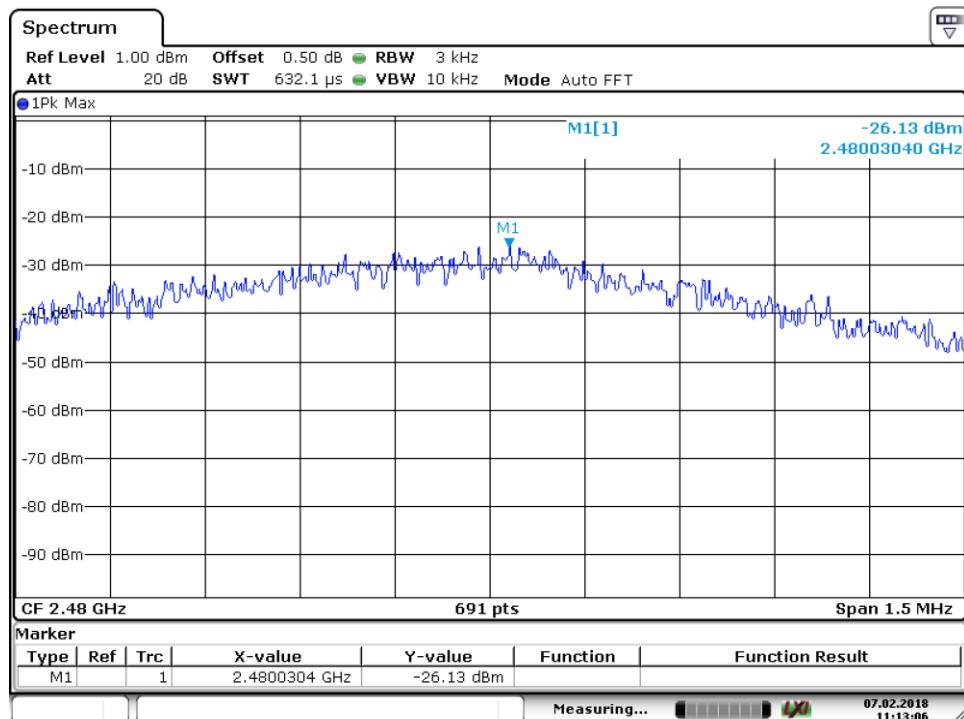
Date: 7.FEB.2018 11:14:00

2440MHz



Date: 7.FEB.2018 11:13:39

2480MHz



Date: 7.FEB.2018 11:13:06

9.4 Spurious RF conducted emissions

Test Method

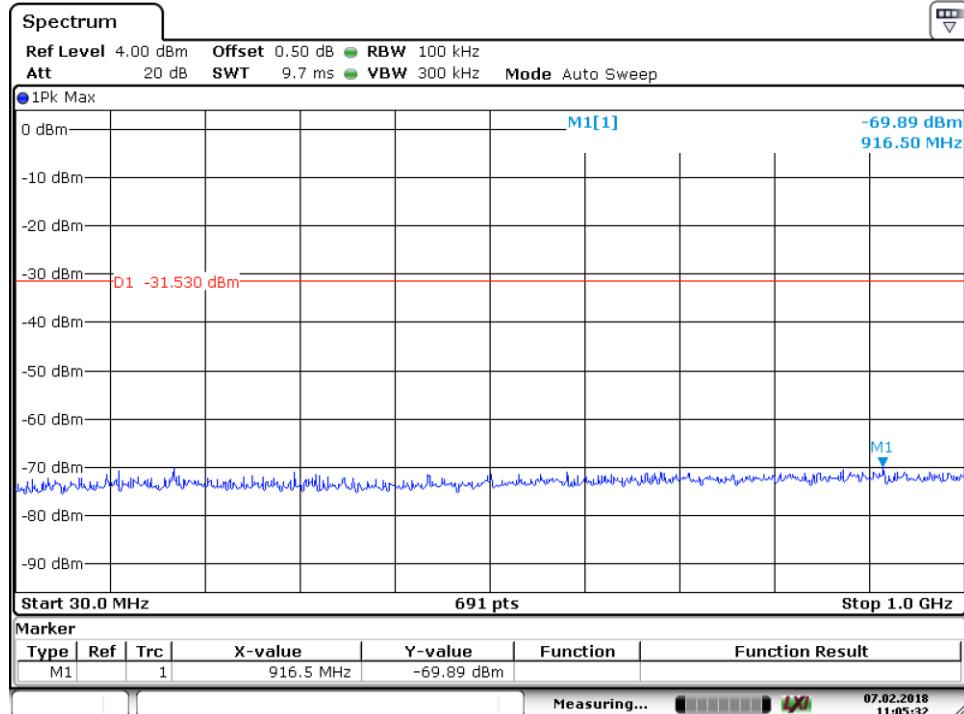
1. Establish a reference level by using the following procedure:
 - a. Set RBW=100 kHz. VBW \geq 3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
 - b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
2. Use the maximum PSD level to 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

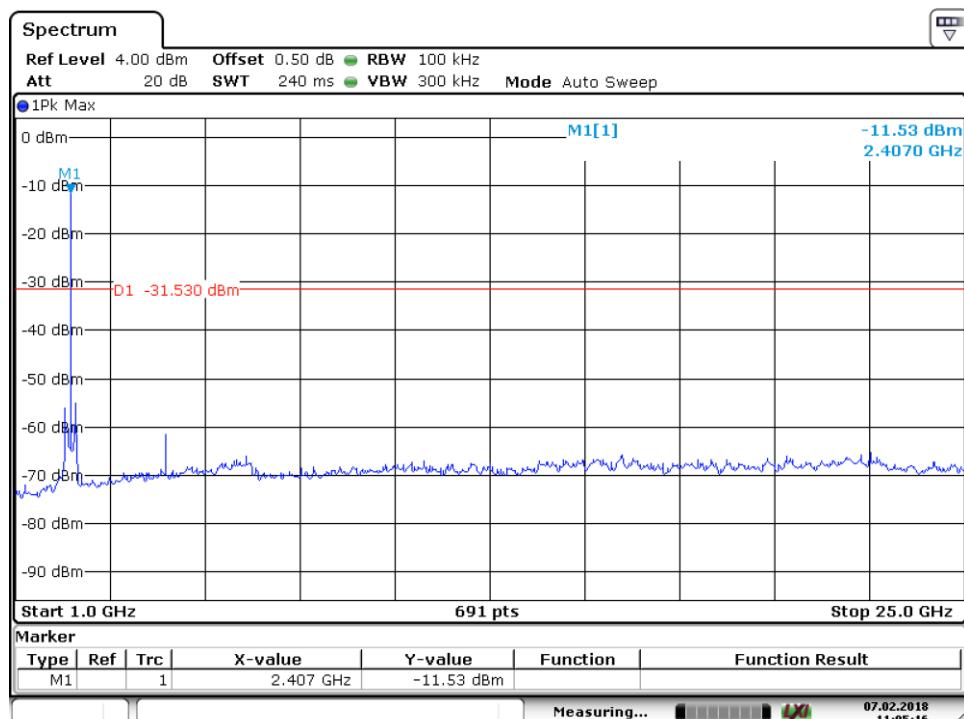
Frequency Range MHz	Limit (dBc)
30-25000	-20

Spurious RF conducted emissions

2402MHz



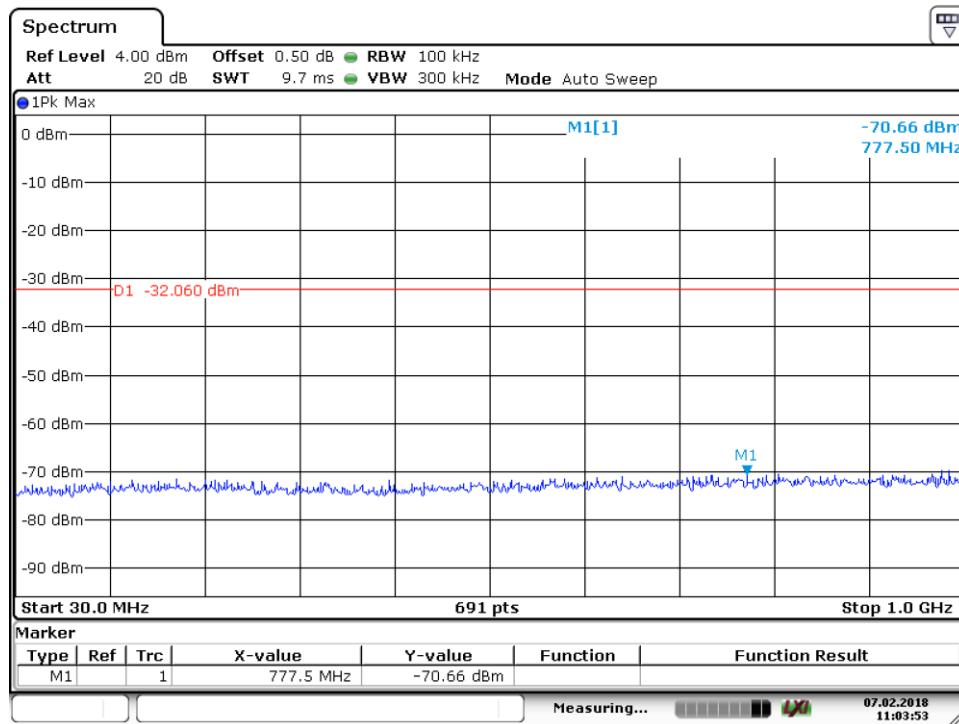
Date: 7.FEB.2018 11:05:32



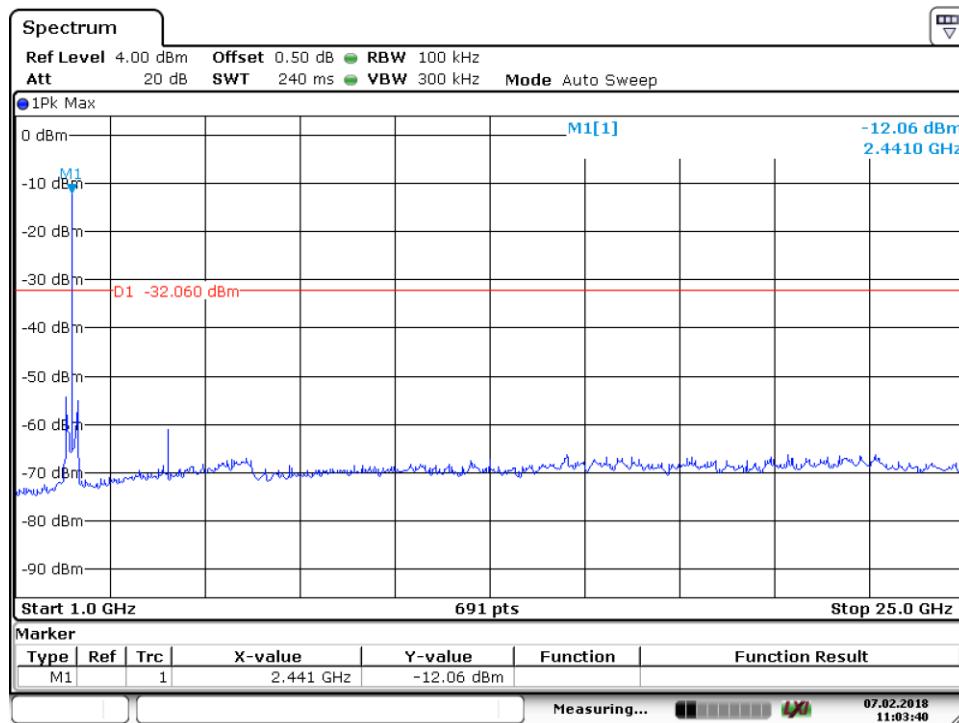
Date: 7.FEB.2018 11:05:16

Spurious RF conducted emissions

2440MHz



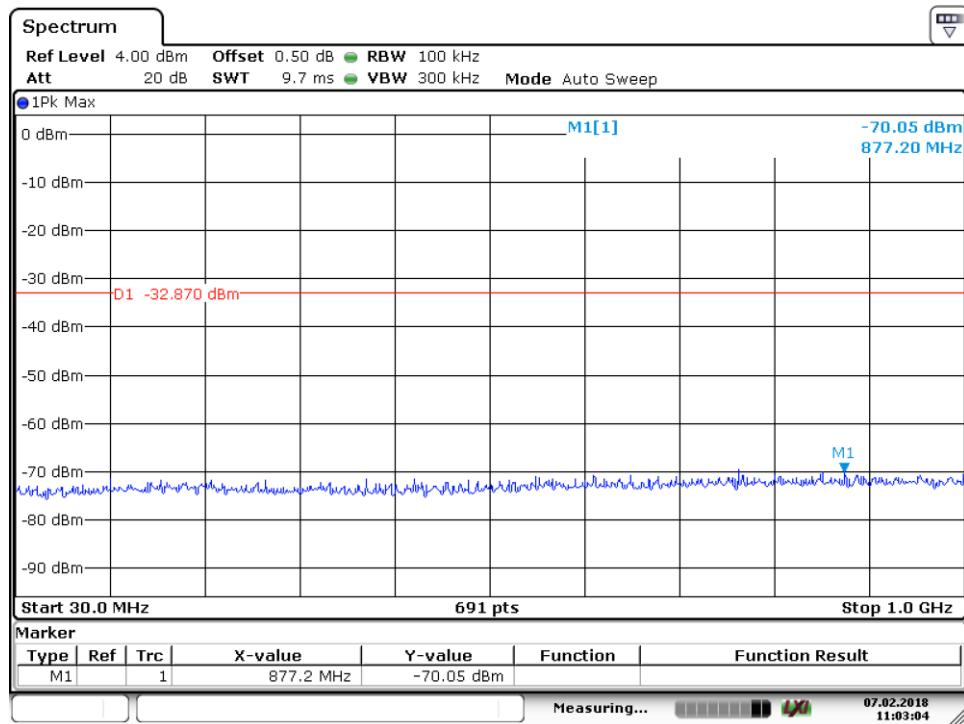
Date: 7.FEB.2018 11:03:53



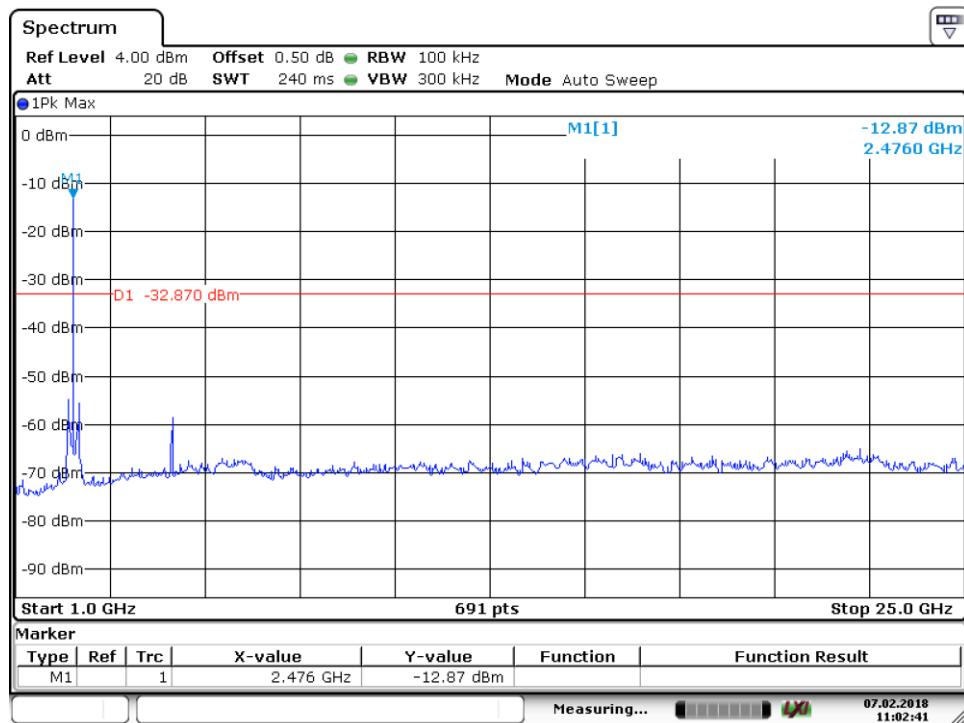
Date: 7.FEB.2018 11:03:40

Spurious RF conducted emissions

2480MHz



Date: 7.FEB.2018 11:03:04



Date: 7.FEB.2018 11:02:42

9.5 Band edge

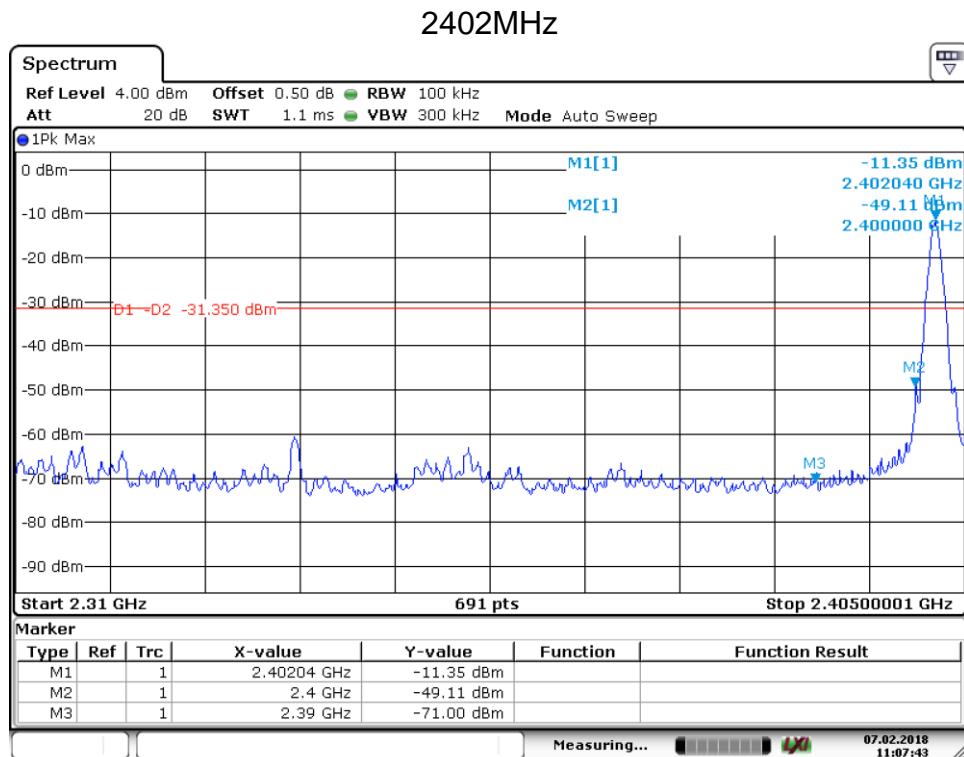
Test Method

- 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 \geq 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

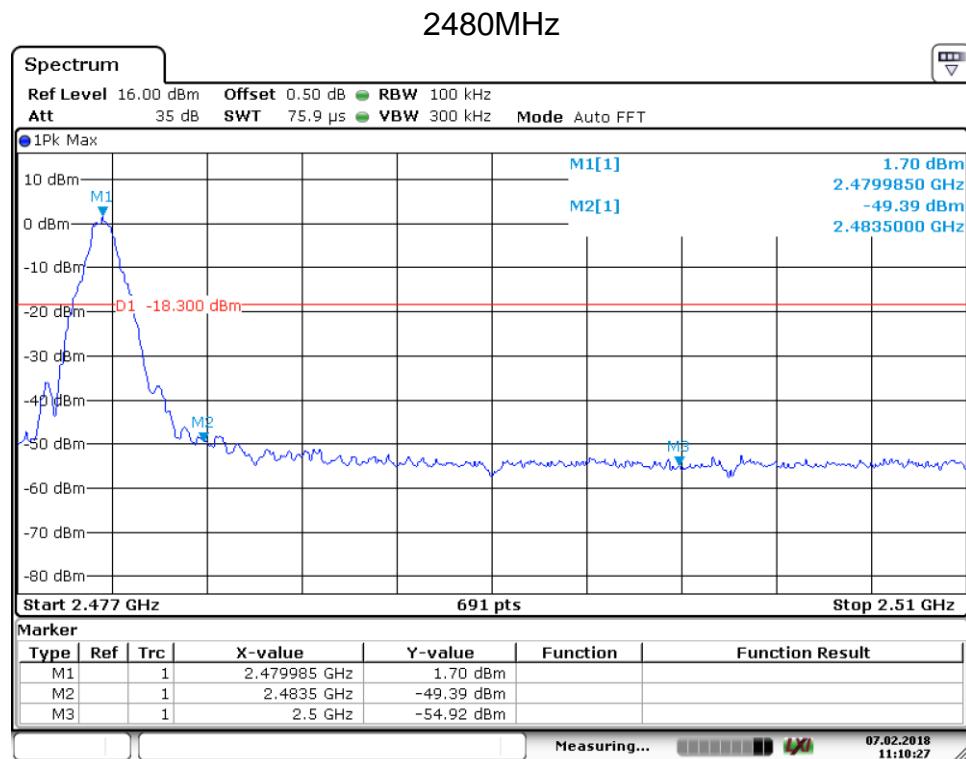
Frequency Range MHz	Limit (dBc)
30-25000	-20

Test result



Date: 7.FEB.2018 11:07:43

Band edge



Date: 7.FEB.2018 11:10:28

9.6 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 \geq 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 \geq 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.

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 section 15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dB μ V/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

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	Emission Level	Corr.	Polarization	Limit	Detector	Result
MHz	dB μ V/m	dB		dB μ V/m		
876.43	26.27	-15.70	Horizontal	46.00	QP	Pass
871.63	27.49	-15.20	Vertical	46.00	QP	Pass

2402MHz (Above 1GHz)

Frequency	Emission Level	Corr.	Polarization	Limit	Detector	Result
MHz	dB μ V/m	dB		dB μ V/m		
4804.28 *	45.06	2.50	Horizontal	74.00	QP	Pass
4803.75 *	44.12	2.60	Vertical	74.00	QP	Pass

2440MHz (30MHz – 1GHz)

Frequency	Emission Level	Corr.	Polarization	Limit	Detector	Result
MHz	dB μ V/m	dB		dB μ V/m		
-	-	-	Horizontal	46.00	QP	--
-	-	-	Vertical	46.00	QP	--

2440MHz (Above 1GHz)

Frequency	Emission Level	Corr.	Polarization	Limit	Detector	Result
MHz	dB μ V/m	dB		dB μ V/m		
4879.18 *	46.46	2.50	Horizontal	74.00	QP	Pass
4880.25 *	41.15	2.60	Vertical	74.00	QP	Pass

Remark:

- (1) Data of measurement within this frequency range shown “-” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (2) “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (3) Remark: “*” Corrector factor = Antenna Factor + Cable Loss

2480MHz (30MHz – 1GHz)

Frequency	Emission Level	Corr.	Polarization	Limit	Detector	Result
MHz	dBuV/m	dB		dB μ V/m		
-	-	-	Horizontal	46.00	QP	--
-	-	-	Vertical	46.00	QP	--

2480MHz (Above 1GHz)

Frequency	Emission Level	Corr.	Polarization	Limit	Detector	Result
MHz	dBuV/m	dB		dB μ V/m		
4960.46 *	44.75	2.70	Horizontal	74.00	QP	Pass
4960.46 *	42.26	2.80	Vertical	74.00	QP	Pass

Remark:

- (1) Data of measurement within this frequency range shown “-” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (2) “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (3) Remark: “*” Corrector factor = Antenna Factor + Cable Loss

10 Test Equipment List

List of Test Instruments

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
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
Signal Generator	Rohde & Schwarz	SMY01	839369/005	2018-7-7
Attenuator	Agilent	8491A	MY39264334	2018-7-7
3m Semi-anechoic chamber	TDK	9X6X6	----	2020-7-7
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

C - Conducted RF tests

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

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 Spurious Emission 25MHz-3000MHz	Horizontal: 4.95dB; Vertical: 5.02dB;
Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.89dB; Vertical: 4.88dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 4.93dB; Vertical: 4.92dB;
Uncertainty for Conducted Emission 150kHz-30MHz (for test using AMN ENV216)	3.50dB
Uncertainty for Conducted RF test	2.04dB