

FCC - TEST REPORT

Report Number : **68.950.17.0163.01** Date of Issue: June 28, 2017

Model : **ZD-9688**

Product Type : movement

Applicant : DONGGUAN ZHUNDIAN PLASTIC ELECTRONICS., LTD

Address : A, 2F, E Licheng Industrial Zone, No.9 Meiyuan Rd, Xinan
: Community, Dongguan City, China

Manufacturer : DONGGUAN ZHUNDIAN PLASTIC ELECTRONICS., LTD

Address : A, 2F, E Licheng Industrial Zone, No.9 Meiyuan Rd, Xinan
: Community, Dongguan City, China

Test Result : ☒ **Positive** ☐ **Negative**

Total pages including Appendices : 27

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2 Details about the Test Laboratory

Details about the Test Laboratory

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 518052
P.R. China

Telephone: 86 755 8828 6998

Fax: 86 755 828 5299

FCC Registration No.: 502708

3 Description of the Equipment Under Test

Product:	movement
Model no.:	ZD-9688
FCC ID:	2AMJM-ZD9688
Options and accessories:	Nil
Rating:	3.0VDC (Supplied by 2*1.5V AA batteries)
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	40
Modulation:	GFSK
Antenna Type:	Internal Antenna
Antenna Gain:	0dBi
Description of the EUT:	The Equipment Under Test (EUT) is movement Support BLE function.



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

5 Summary of Test Results

Test Condition		Pages	Test Result
§15.207	Conducted emission AC power port	--	N/A
§15.247(b)(1)	Conducted peak output power	10	Pass
§15.247(e)	Power spectral density	12	Pass
§15.247(a)(2)	6dB bandwidth	14	Pass
§15.247(a)(1)	20dB bandwidth and 99% Occupied Bandwidth	--	N/A
§15.247(a)(1)	Carrier frequency separation	--	N/A
§15.247(a)(1)(iii)	Number of hopping frequencies	--	N/A
§15.247(a)(1)(iii)	Dwell Time	--	N/A
§15.247(d)	Spurious RF conducted emissions	16	Pass
§15.247(d)	Band edge	20	Pass
§15.247(d) & §15.209 &	Spurious radiated emissions for transmitter	22	Pass
§15.203	Antenna requirement	See note 1	Pass

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a Internal antenna, which gain is 0dBi. In accordance 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: 2AMJM-ZD9688 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules.

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 27, 2016

Testing Start Date: October 27, 2016

Testing End Date: May 9, 2017

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

Reviewed by:



Phoebe Hu
EMC Section Manager

Prepared by:



Mark Chen
EMC Project Engineer

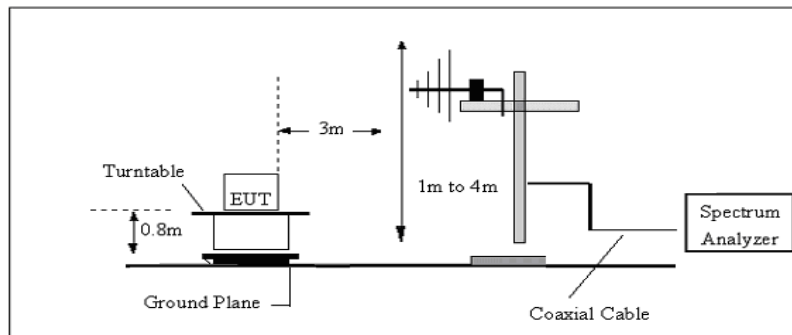
Tested by:



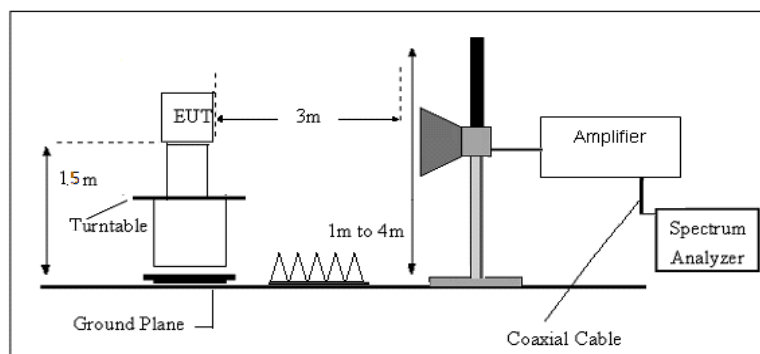
Endy Xie
EMC Test Engineer

7 Test Setups

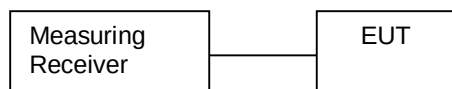
Below 1GHz



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)
Notebook	Lenovo	---	---

Test software: DRemover98_2K, 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 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.

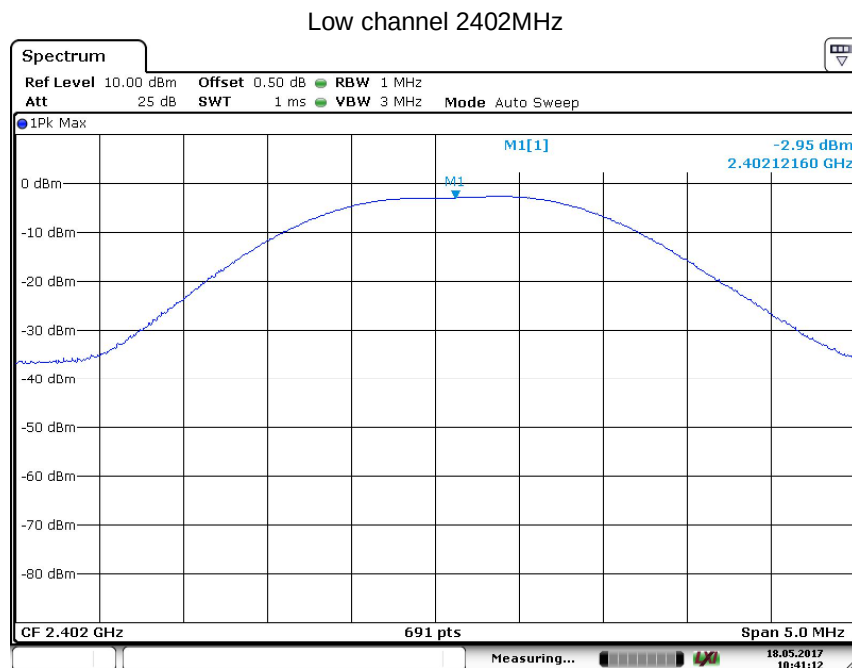
Limits

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

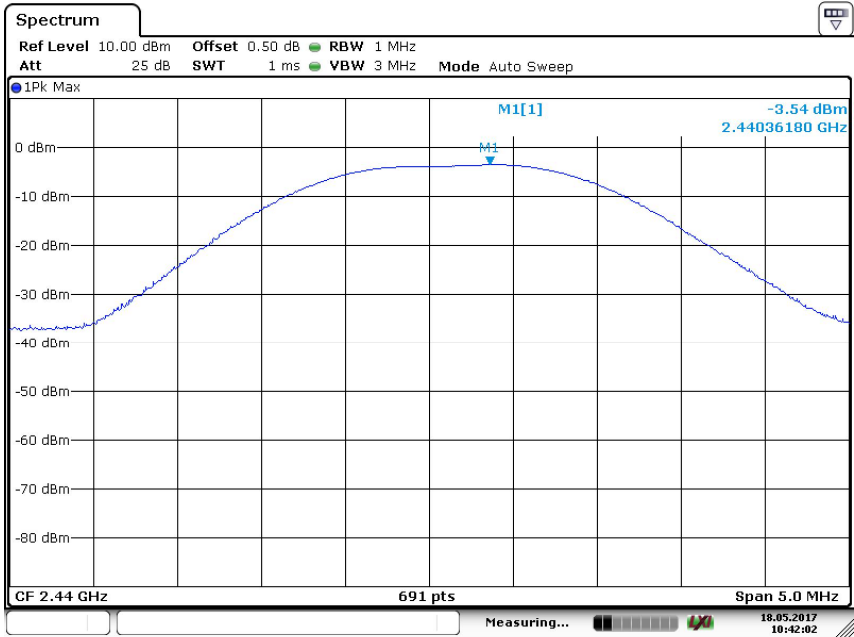
Frequency MHz	Conducted Peak Output Power dBm	Result
Bottom channel 2402MHz	-2.95	Pass
Middle channel 2440MHz	-3.54	Pass
Top channel 2480MHz	-4.25	Pass



Date: 18.MAY.2017 10:41:12

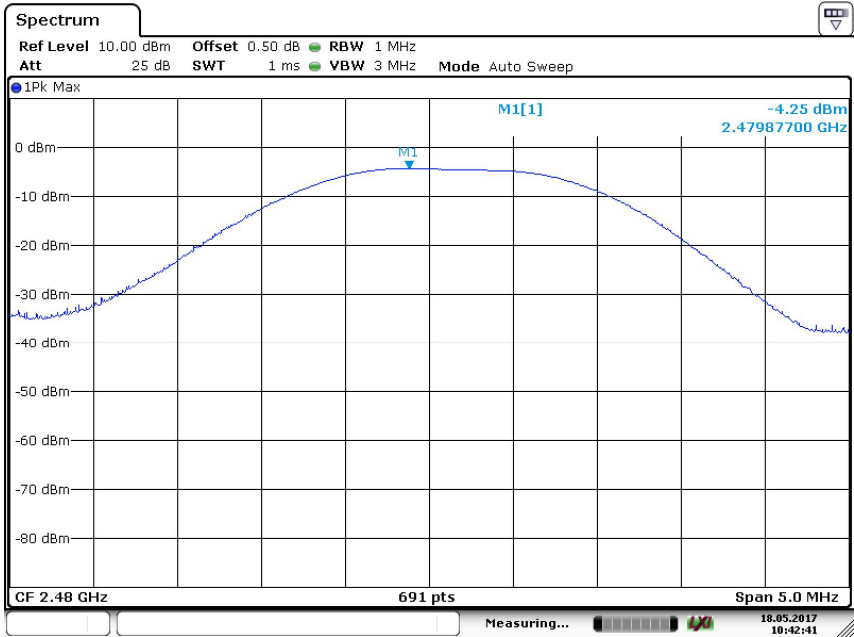


Middle channel 2440MHz



Date: 18.MAY.2017 10:42:02

High channel 2480MHz



Date: 18.MAY.2017 10:42:41

9.2 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

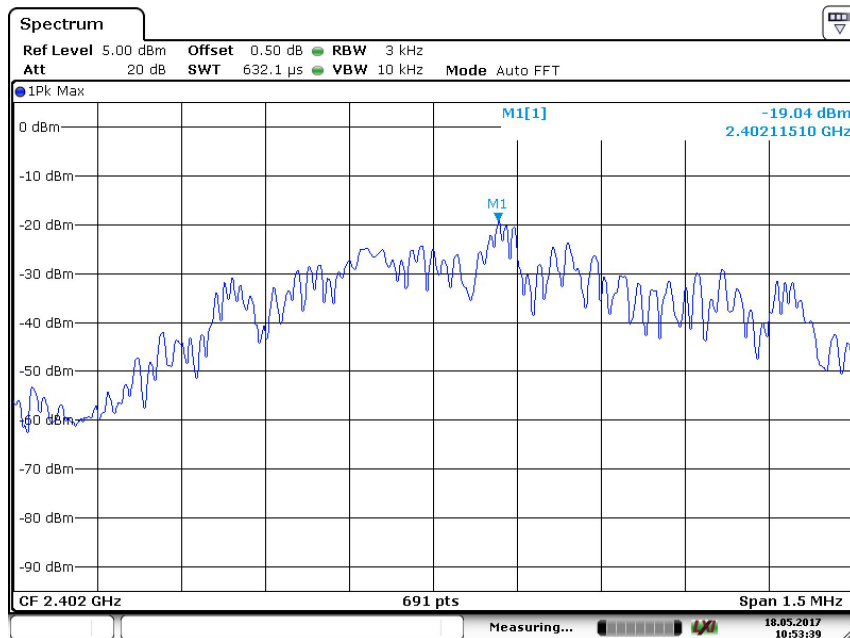
Limit [dBm]

≤ 8

Test result

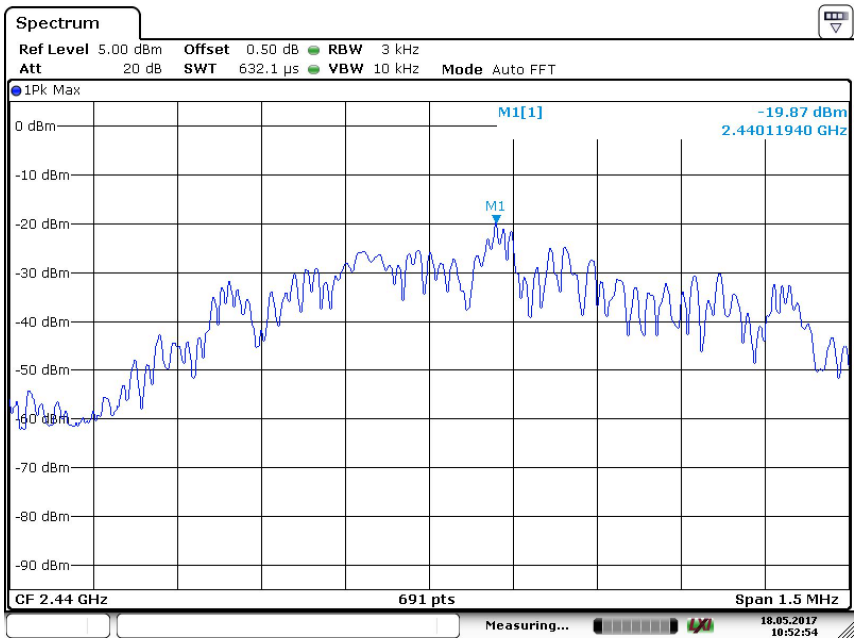
Frequency MHz	Power spectral density dBm	Result
Top channel 2402MHz	-19.04	Pass
Middle channel 2440MHz	-19.87	Pass
Bottom channel 2480MHz	-20.45	Pass

Low channel 2402MHz



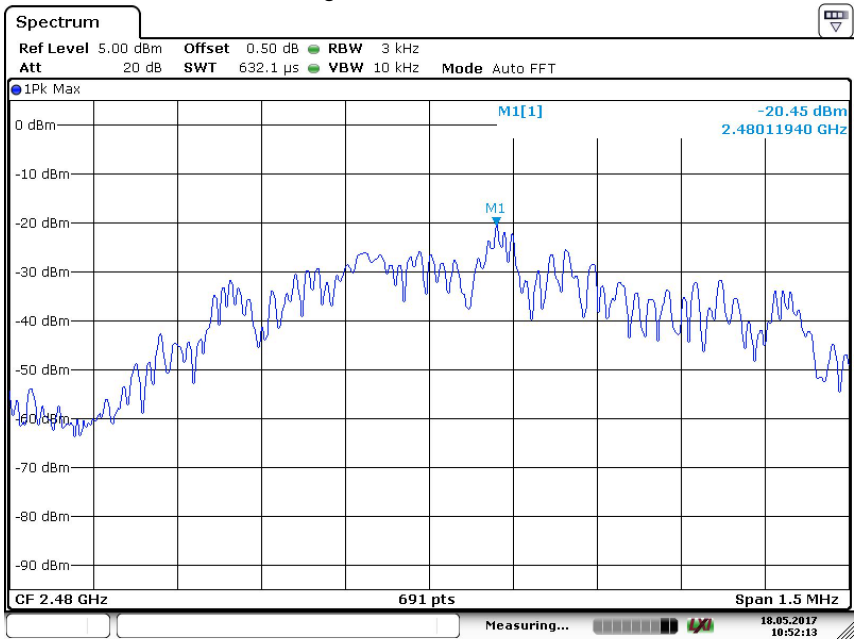


Middle channel 2440MHz



Date: 18.MAY.2017 10:52:54

High channel 2480MHz



Date: 18.MAY.2017 10:52:13

9.3 6 dB Bandwidth and 99% Occupied 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 ≥ 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

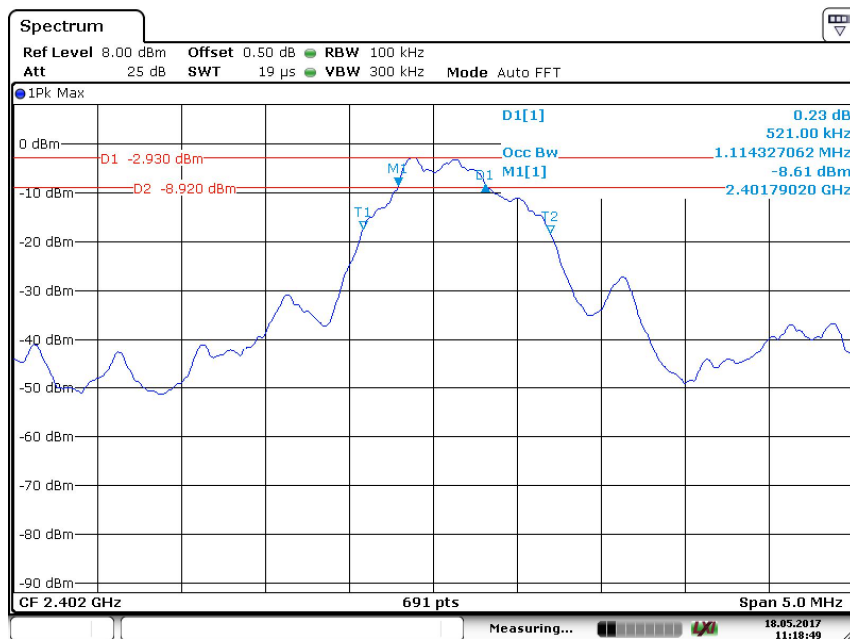
Limit [kHz]

≥ 500

Test result

Frequency MHz	6dB bandwidth kHz	99 bandwidth kHz	Result
Bottom channel 2402MHz	521	1114.33	Pass
Middle channel 2440MHz	528.2	1114.33	Pass
Top channel 2480MHz	506.5	1107.09	Pass

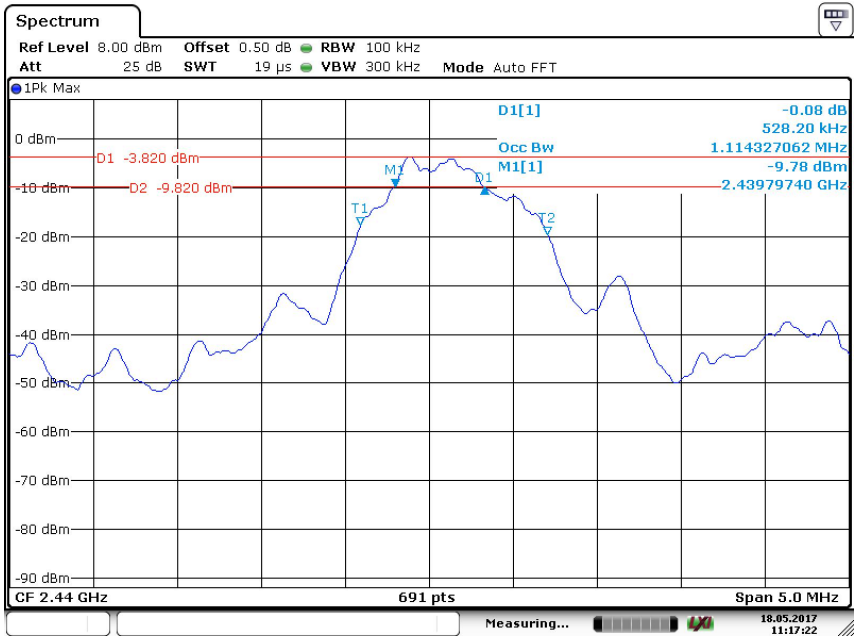
Low channel 2402MHz



Date: 18.MAY.2017 11:18:50

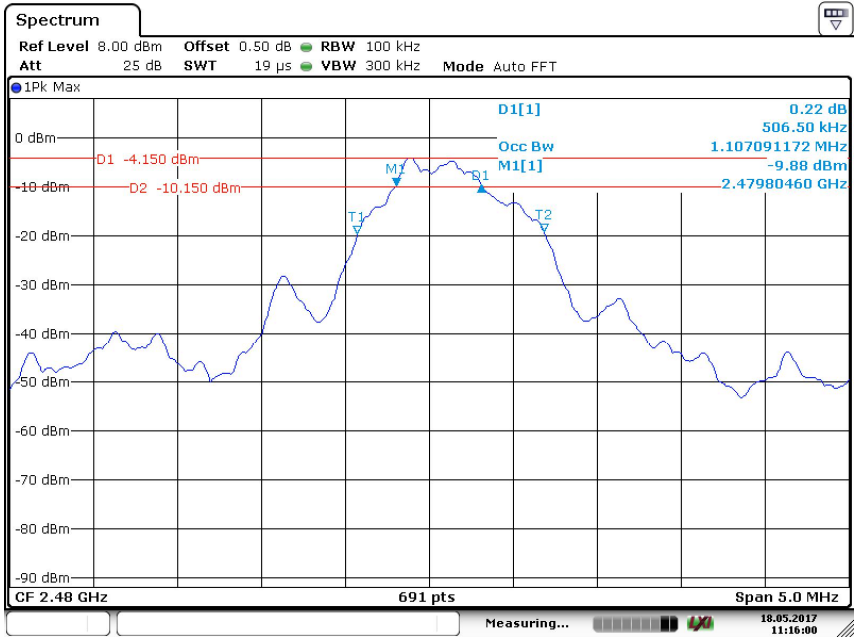


Middle channel 2440MHz



Date: 18.MAY.2017 11:17:22

High channel 2480MHz



Date: 18.MAY.2017 11:16:00

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.

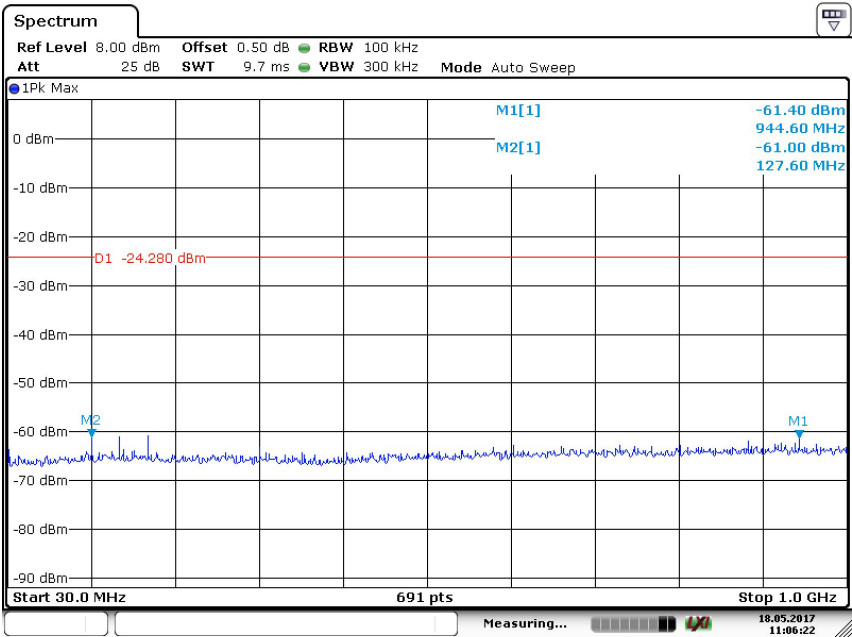
Limit

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

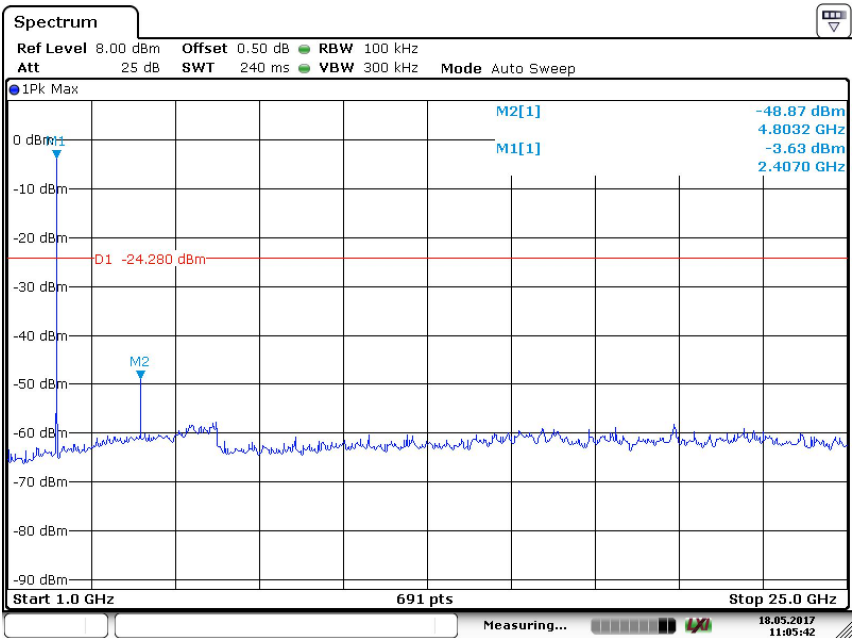


Spurious RF conducted emissions

2402MHz



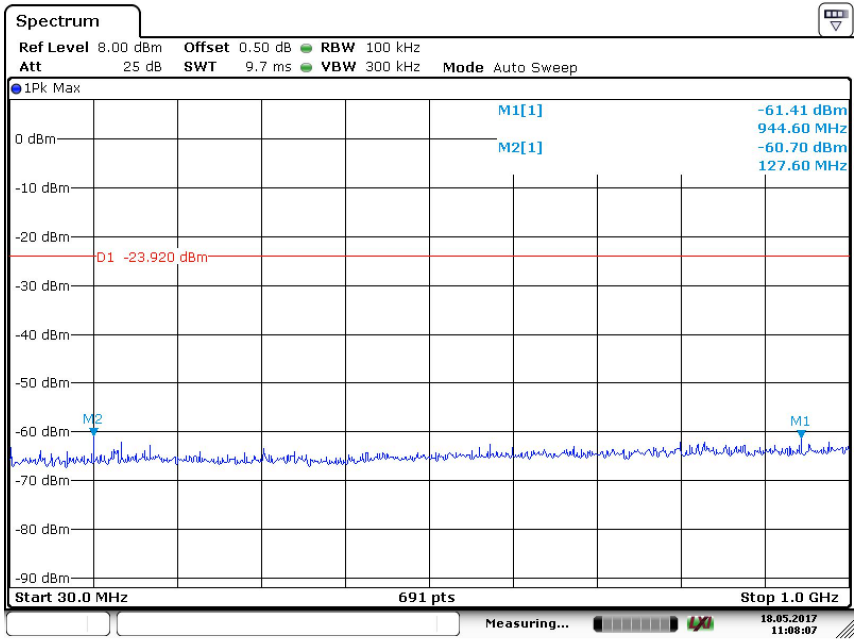
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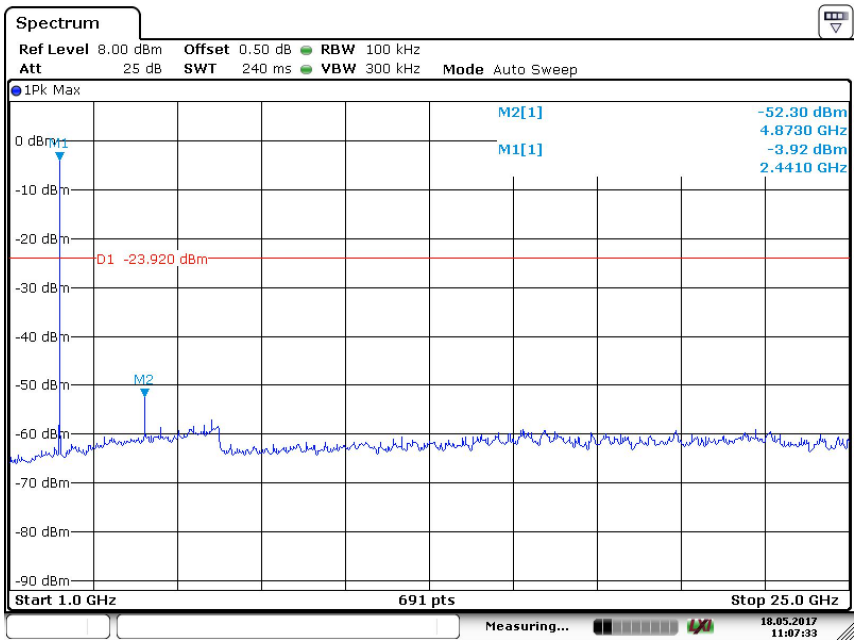
Date: 18.MAY.2017 11:05:42



2440MHz



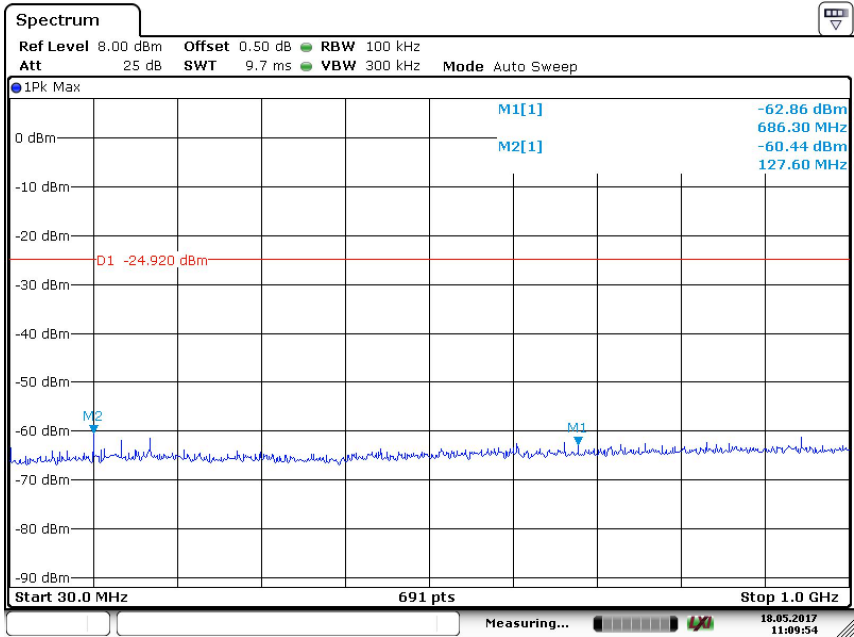
Date: 18.MAY.2017 11:08:08



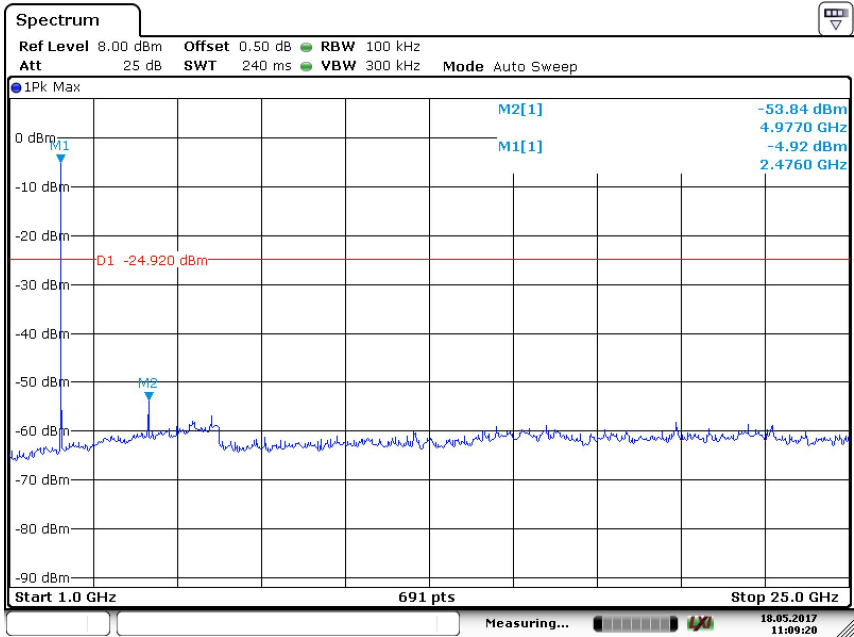
Date: 18.MAY.2017 11:07:33



2480MHz



Date: 18.MAY.2017 11:09:54



Date: 18.MAY.2017 11:09:20

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.

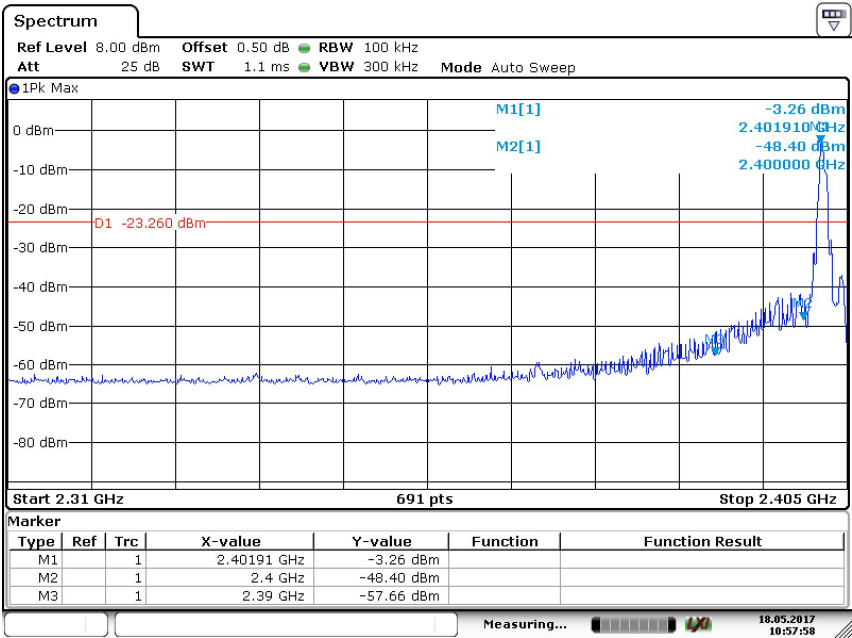
Limit

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



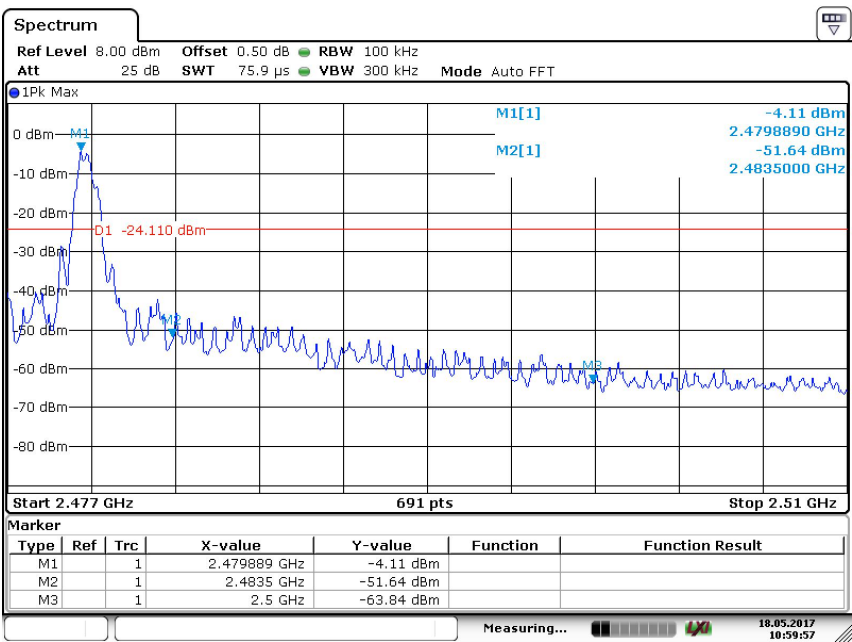
Band edge testing

2402MHz



Date: 18.MAY.2017 10:57:58

2480MHz



Date: 18.MAY.2017 10:59:58

9.6 Spurious radiated emissions for transmitter

Test Method

- 1: The EUT was placed 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 ($20\log(1/\text{duty cycle})$).
- 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 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

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:

Low channel 2402MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
	MHz	dBuV/m		dBuV/m		dBuV/m	
30-1000MHz	859.13	31.42	H	46	QP	14.58	Pass
	875.94	29.03	V	46	QP	16.97	Pass
1000-25000MHz	4804.22	49.53	H	74	PK	24.47	Pass
	--	--	H	54	AV	--	Pass
	15066.56	48	V	74	PK	26	Pass
	--	--	V	54	AV	--	Pass

Middle channel 2440MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
	MHz	dBuV/m		dBuV/m		dBuV/m	
30-1000MHz	859.13	31.42	H	46	QP	14.58	Pass
	875.94	29.03	V	46	QP	16.97	Pass
1000-25000MHz	14991.56	47.47	H	74	PK	26.53	Pass
	--	--	H	54	AV	--	Pass
	15209.53	46.47	V	74	PK	27.53	Pass
	--	--	V	54	AV	--	Pass

High channel 2480MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
	MHz	dBuV/m		dBuV/m		dBuV/m	
30-1000MHz	859.13	31.42	H	46	QP	14.58	Pass
	875.94	29.03	V	46	QP	16.97	Pass
1000-25000MHz	4959.84	47.93	H	74	PK	26.07	Pass
	--	--	H	54	AV	--	Pass
	4959.84	49.9	V	74	PK	24.10	Pass
	--	--	V	54	AV	--	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.

10 Test Equipment List

List of Test Instruments

Conducted Emission Test

Description	Manufacturer	Model no.	Serial no.	cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2017-7-15
LISN	Rohde & Schwarz	ENV4200	100249	2017-7-15
LISN	Rohde & Schwarz	ENV432	101318	2017-12-18
LISN	Rohde & Schwarz	ENV216	100326	2017-7-15
ISN	Rohde & Schwarz	ENY81	100177	2017-7-15
ISN	Rohde & Schwarz	ENY81-CA6	101664	2017-7-15
High Voltage Probe	Rohde & Schwarz	TK9420(VT9420)	9420-584	2017-7-15
RF Current Probe	Rohde & Schwarz	EZ-17	100816	2017-7-15
Attenuator	Shanghai Huaxiang	TS2-26-3	080928189	2017-7-17
Test software	Rohde & Schwarz	EMC32	Version9.15.00	N/A

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2017-7-15
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2017-7-15
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2017-8-3
Horn Antenna	Rohde & Schwarz	HF907	102294	2017-7-15
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2017-7-15
3m Semi-anechoic chamber	TDK	9X6X6	----	2019-5-29
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2017-7-15
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2017-8-3
Horn Antenna	Rohde & Schwarz	HF907	102294	2017-7-15

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth and 99% Occupied 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 Conducted Emission 150kHz-30MHz (for test using AMN ENV216 or ENV4200)	3.46dB
Uncertainty for Radiated Spurious Emission 25MHz-3000MHz	Horizontal: 4.98dB; Vertical: 5.06dB;
Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.95dB; Vertical: 4.94dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 5.14dB; Vertical: 5.12dB;
Uncertainty for Conducted RF test with TS 8997	Power level test involved: 2.06dB Frequency test involved: 1.16×10 ⁻⁷