



JAPAN MIC
TEST REPORT
For
ESPRESSIF SYSTEMS (SHANGHAI) CO., LTD.

Suite 204, Block 2, 690 Bibo Road, Zhang Jiang Hi-Tech Park,
Shanghai, China (201203)

Tested Model: ESP-EYE

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: WIFI & Bluetooth Development Board
Test Engineer: Max Min	
Report Number: RSHD190123002-24B	
Report Date: 2019-02-27	
Reviewed By: Oscar Ye RF Leader	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

Applicant:	ESPRESSIF SYSTEMS (SHANGHAI) CO., LTD.
Tested Model:	ESP-EYE
Product Type:	WIFI & Bluetooth Development Board
Dimension:	41mm(L)× 21mm(W)×6.5mm(H)
Power Supply:	DC 5V

**All measurement and test data in this report was gathered from production sample serial number: 20190123002.
(Assigned by the BACL. The EUT supplied by the applicant was received on 2019-01-23)*

Objective

The objective of the manufacturer is to demonstrate compliance with Radio Law of Japan item 19 of Article 2 Paragraph 1.

Related Submittal(s)/Grant(s)

Item 19 of Article 2 Paragraph 1 for BT3.0
Item 19 of Article 2 Paragraph 1 for Wi-Fi 2412-2472MHz
Item 19-2 of Article 2 Paragraph 1 for Wi-Fi 2484MHz

Test Methodology

All measurements contained in this report were conducted with technical regulations of the Radio Law of Japan.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

EUT TEST CONFIGURATION

Description of Test Configuration

Channel list for BLE mode:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404
...
...
...	...	38	2478
19	2440	39	2480

EUT was tested with channel 0, 19 and 39.

EUT Exercise Software

RF test tool: espRFTool

Power level setting: 5

Equipment Modifications

No modification was made to the EUT tested.

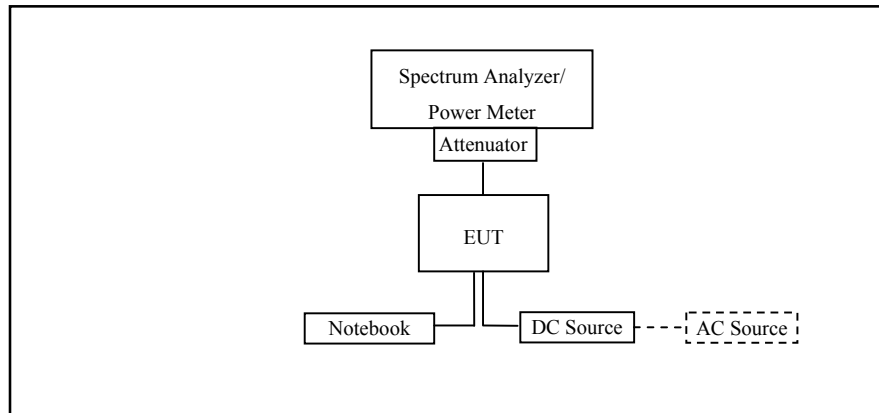
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Narda	Attenuator/6dB	10690812-2	26850-6
BEST	DC Power Supply	PS-1502D+	DC001
DELL	Notebook	GX620	D65874152

External I/O Cable

Cable Description	Length (m)	From/Port	To
RF Cable	0.1	Attenuator	EUT
DC Cable	0.8	EUT	DC Source
USB Cable	1.2	EUT	Notebook

Configuration of Test Setup



SUMMARY OF TEST RESULTS

MIC Notice No.88 Appendix No.43 Article 2, Paragraph 1, Item 19 Rules Section	Description of Test	Result
3	Frequency Error	Compliance
4	Occupied Bandwidth	Compliance
5	Transmitter Spurious Emission and Unwanted Emission Intensity	Compliance
6	Antenna Output Power and Output Power Tolerance	Compliance
7	Receiver Spurious Emission and Unwanted Emission Intensity	Compliance
8	Transmission Antenna Gain	Not Applicable (See Note 1)
9	Transmission Radiation Angle Width	Not Applicable (See Note 1)
10	Carrier sense capability	Not Applicable (See Note 3)
11	Frequency Hopping Dwell Time	Not Applicable (See Note 2)
12	Interference prevention function	Compliance
Appendix	Construction Protection Confirmation	Compliance

Note:

1. This test item will not be applied to the transmission antenna which EIRP is less than 12.14dBm.
2. Testing is only required for FHSS system devices;
3. The test only required for bandwidth more than 26MHz and less than 38MHz.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	FSV40 Signal Analyzer	FSV40	101116	2018-07-23	2019-07-22
Agilent	Power Meter	E4419B	MY41291878	2019-01-23	2020-01-22
Narda	Attenuator/6dB	10690812-2	26850-6	2019-01-10	2020-01-09
BEST	DC Power Supply	PS-1502D+	DC001	2018-10-10	2019-10-09
Rohde & Schwarz	SMBV100A Vector Signal Generator	SMBV100A	261558	2018-07-22	2019-07-21
R & S	Wideband Radio Communication Tester	CMW500	104478	2018-07-22	2019-07-21

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

FREQUENCY ERROR

Limit

The Tolerance of frequency should be ± 50 ppm.

Test Procedure

Set the EUT to the measurement frequency without modulation.

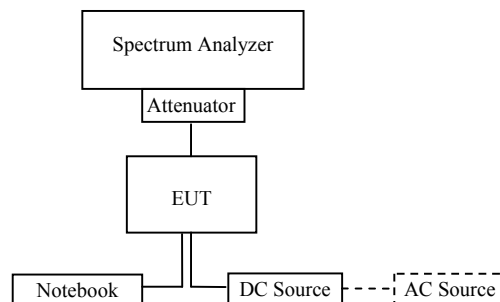
Setting of SA is following as: RB: 1 kHz / VB: 30 kHz / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold.

Record the peak spot frequency.

If the EUT can't set at un-modulation mode.

Setting of SA is following as: RB: 100 kHz / VB: 300 kHz / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold.

Record the peak spot frequency, measure the 10dBc center frequency



Test Data

Environmental Conditions

Temperature:	23.5°C
Relative Humidity:	51 %
ATM Pressure:	102.1kPa

The testing was performed by Max Min on 2019-02-14.

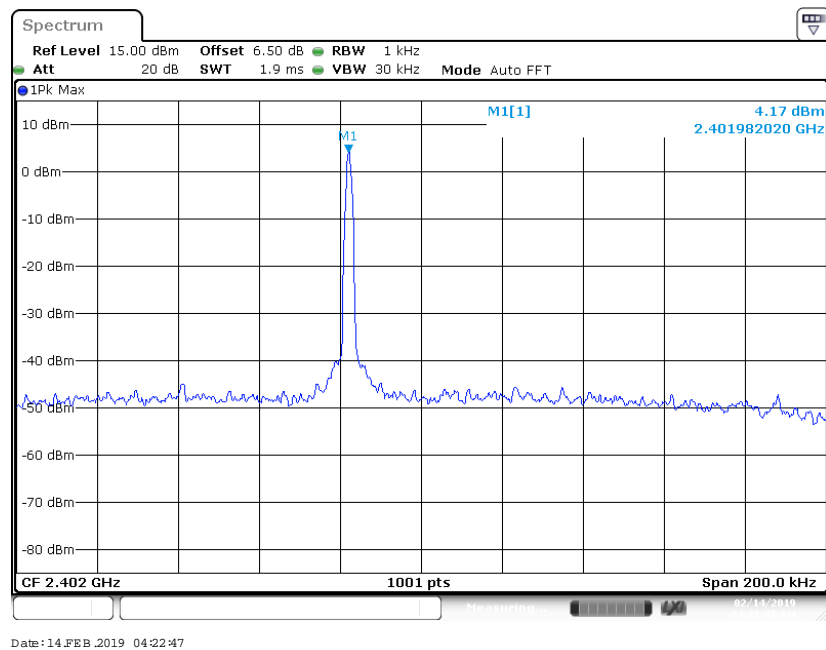
Test Result: Compliant

Test Mode: Transmitting

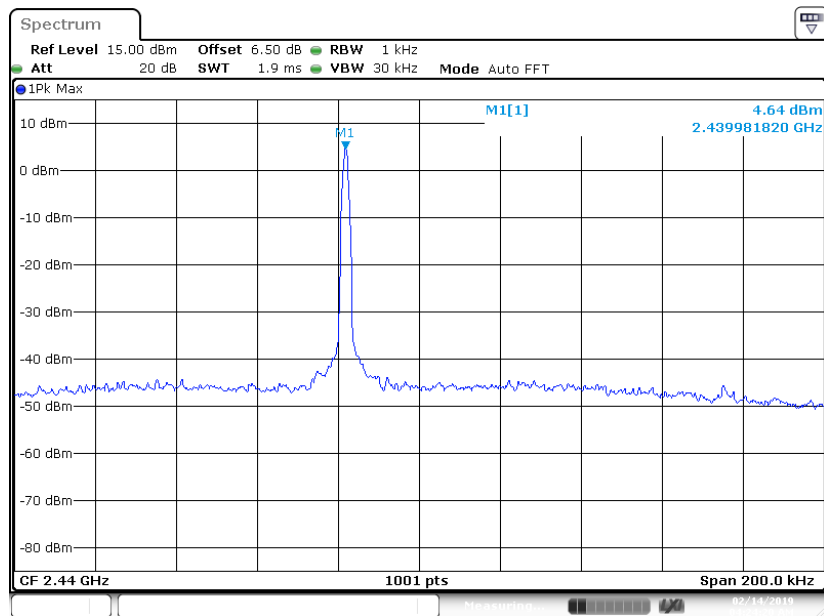
Frequency (MHz)	Voltage (V _{DC})	Measure Frequency (MHz)	Frequency Tolerance (ppm)	Limit (ppm)
2402	4.5	2401.98076	-8.01	±50
	5.0	2401.98202	-7.49	
	5.5	2401.98060	-8.08	
2440	4.5	2439.97992	-8.23	
	5.0	2439.98182	-7.45	
	5.5	2439.98262	-7.12	
2480	4.5	2479.97997	-8.08	
	5.0	2479.98182	-7.33	
	5.5	2479.98174	-7.36	

Please refer to the plots for normal voltage test.

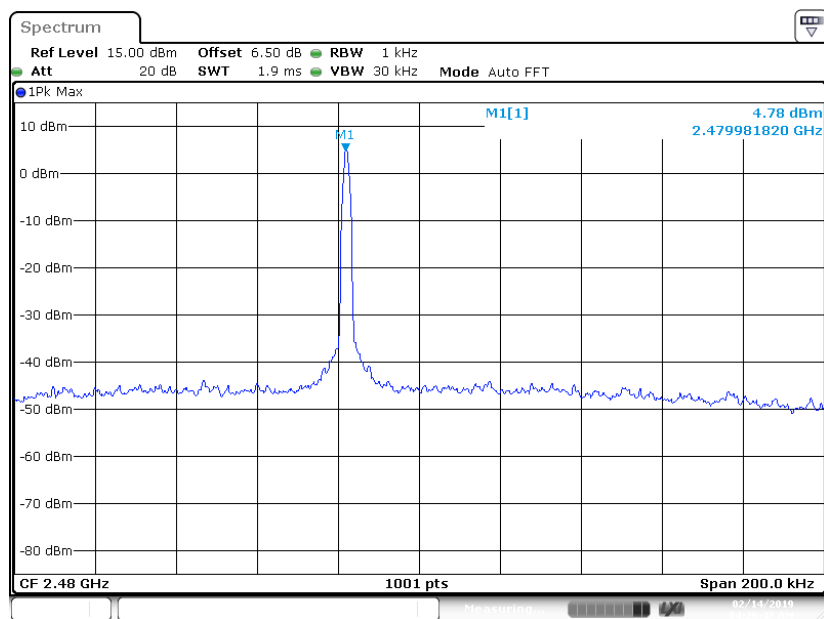
Low Channel



Middle Channel



High Channel



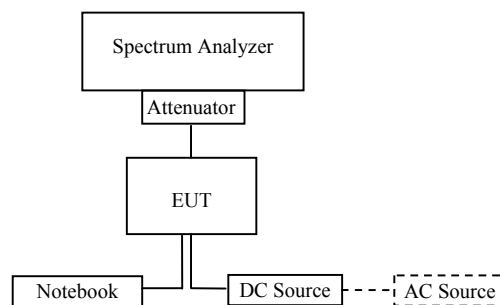
OCCUPIED BANDWIDTH

Limit

- Occupied bandwidth: FH \leq 83.5 MHz; OFDM, DS \leq 26 MHz; Others \leq 26 MHz

Test Procedure

- Setting of SA is following as: RB: 30 kHz / VB: 30 kHz / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
- EUT have transmitted the maximum modulation signal and fixed channelize. SA set to 99% of occupied bandwidth to measure occupied bandwidth.



Test Data

Environmental Conditions

Temperature:	22.4 °C
Relative Humidity:	50 %
ATM Pressure:	101.2kPa

The testing was performed by Max Min on 2019-02-14.

Test Result: Compliant

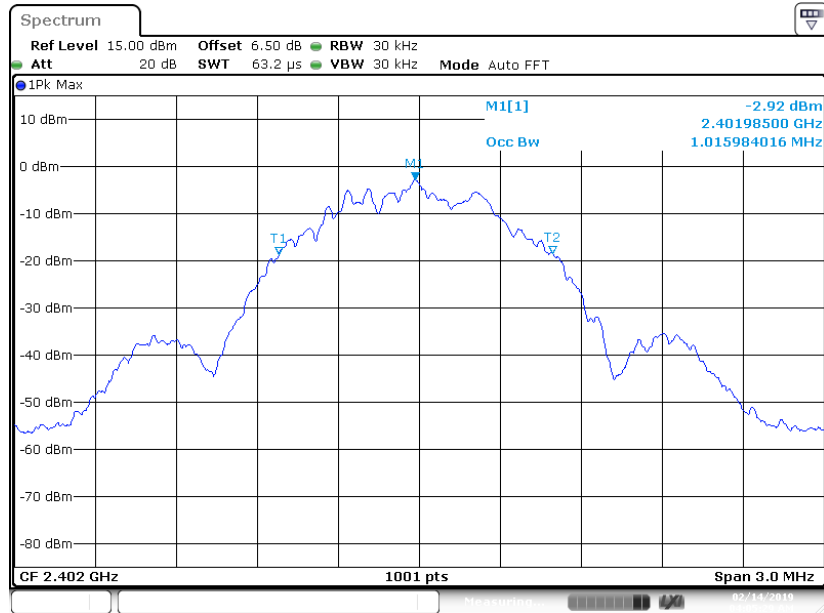
Test Mode: Transmitting

Frequency	2402 MHz			2440 MHz			2480 MHz			Limit
Voltage (V _{DC})	4.5	5.0	5.5	4.5	5.0	5.5	4.5	5.0	5.5	
Occupied Bandwidth (MHz)	1.02	1.02	1.02	1.04	1.02	1.02	1.02	1.02	1.02	\leq 26MHz

Please refer to the plots for normal voltage test.

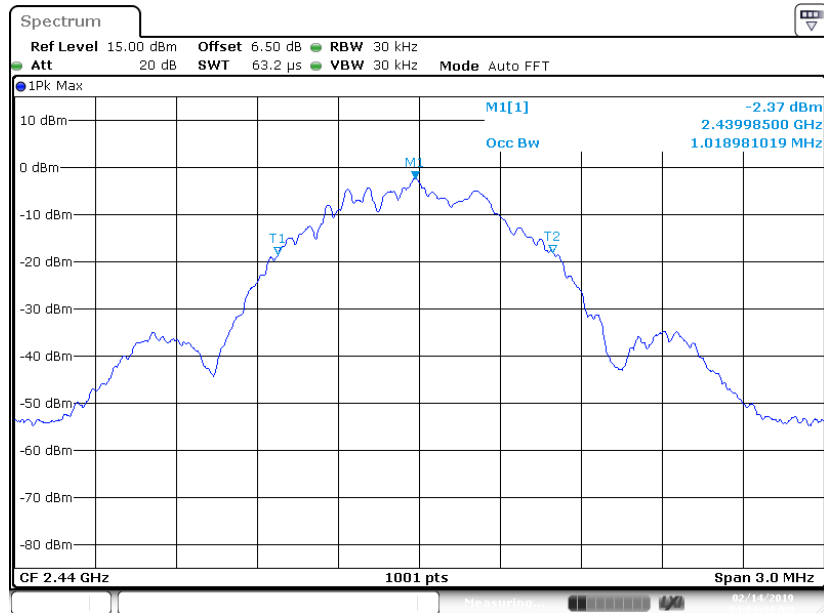
Occupied Bandwidth:

Low Channel



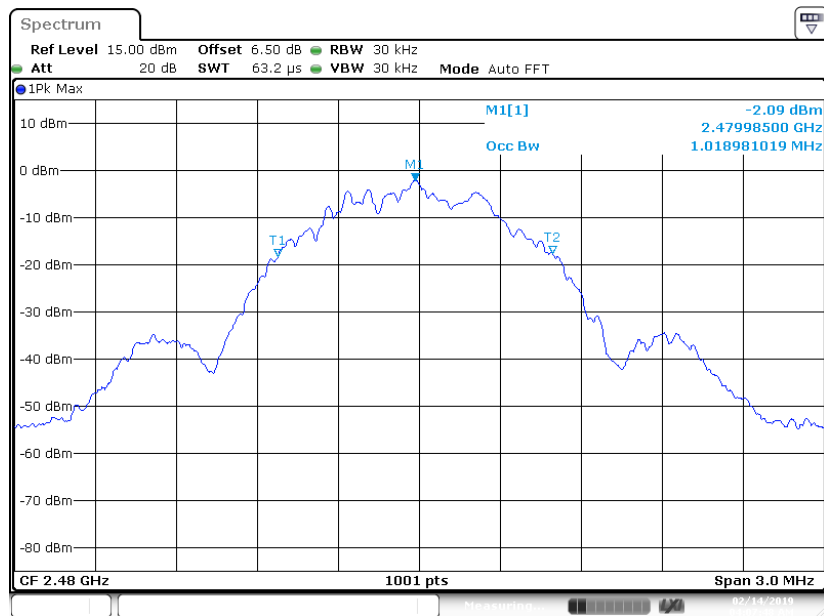
Date: 14.FEB.2019 04:05:29

Middle Channel



Date: 14.FEB.2019 04:04:44

High Channel



Date: 14.FEB.2019 04:07:48

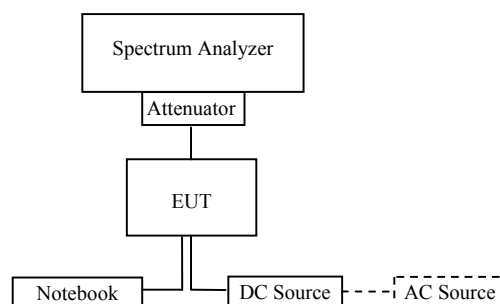
TRANSMITTER SPURIOUS EMISSION STRENGTH AND UNWANTED EMISSION INTENSITY

Limit

- $30\text{MHz} \leq f \leq 1\text{GHz}$: $0.25 \mu\text{W}/100\text{kHz}$
- $1\text{GHz} < f < 2387\text{MHz}$; $2496.5\text{MHz} < f \leq 12500\text{MHz}$: $\leq 2.5\mu\text{W}/\text{MHz}$
- $2387\text{MHz} \leq f \leq 2400\text{MHz}$; $2483.5\text{MHz} < f \leq 2496.5\text{MHz}$: $\leq 25\mu\text{W}/\text{MHz}$

Test Procedure

❖ Measurement System Diagram



❖ Conditions of Application Equipment (EUT)

- The modulation state shall be in continuously transmitting mode.

❖ Spectrum Analyzer Conditions

- Setting of SA start 30MHz and stop frequency 1GHz, RB: 100kHz/VB: 100kHz, Sweep time: Auto. Sweep mode: continuous sweep .Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. reading value + cable loss shall be less than $0.25\mu\text{W}$.
- Setting of SA start 1GHz and stop frequency 2387MHz, RB: 1MHz/VB: 1MHz, Sweep time: Auto. Sweep mode: continuous sweep .Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. reading value + cable loss shall be less than $2.5\mu\text{W}$.
- Setting of SA start 2387MHz and stop frequency 2400MHz, RB: 1MHz/VB: 1MHz, Sweep time: Auto. Sweep mode: continuous sweep .Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. reading value + cable loss shall be less than $25\mu\text{W}$.
- Setting of SA start 2483.5MHz and stop frequency 2496.5MHz, RB: 1MHz/VB: 1MHz, Sweep time: Auto. Sweep mode: continuous sweep .Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. reading value + cable loss shall be less than $25\mu\text{W}$.
- Setting of SA start 2496.5MHz and stop frequency 12500MHz, RB: 1MHz/VB: 1MHz, Sweep time: Auto. Sweep mode: continuous sweep .Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. reading value + cable loss shall be less than $2.5\mu\text{W}$.

Test Data**Environmental Conditions**

Temperature:	22.4°C
Relative Humidity:	50 %
ATM Pressure:	101.2kPa

The testing was performed by Max Min on 2019-02-14.

Test Result: Compliant

Test Mode: Transmitting

Frequency band		2402 MHz			2440 MHz			2480 MHz			Limit
Voltage (V _{DC})		4.5	5.0	5.5	4.5	5.0	5.5	4.5	5.0	5.5	
Unwanted Emission Intensity	Band I (dBm/100kHz)	-60.58	-59.62	-60.02	-59.31	-58.84	-58.42	-59.11	-58.59	-59.36	-36dBm/100kHz (0.25 μW/100kHz)
	Band II (dBm/MHz)	-50.41	-50.96	-51.37	-52.11	-51.91	-52.04	-52.37	-52.08	-52.12	-26dBm/MHz (2.5 μW/MHz)
	Band III (dBm/MHz)	-32.83	-32.86	-33.75	-49.44	-50.18	-49.31	-49.26	-49.73	-49.53	-16dBm/MHz (25 μW/MHz)
	Band IV (dBm/MHz)	-50.61	-50.70	-51.07	-50.80	-50.28	-51.00	-39.55	-39.47	-39.57	-16dBm/MHz (25 μW/MHz)
	Band V (dBm/MHz)	-47.24	-47.33	-46.37	-49.22	-48.35	-48.46	-48.19	-48.29	-47.90	-26dBm/MHz (2.5 μW/MHz)

Note:

Band I: 30MHz ~ 1000MHz

Band II: 1000MHz ~ 2387MHz

Band III: 2387MHz ~ 2400MHz

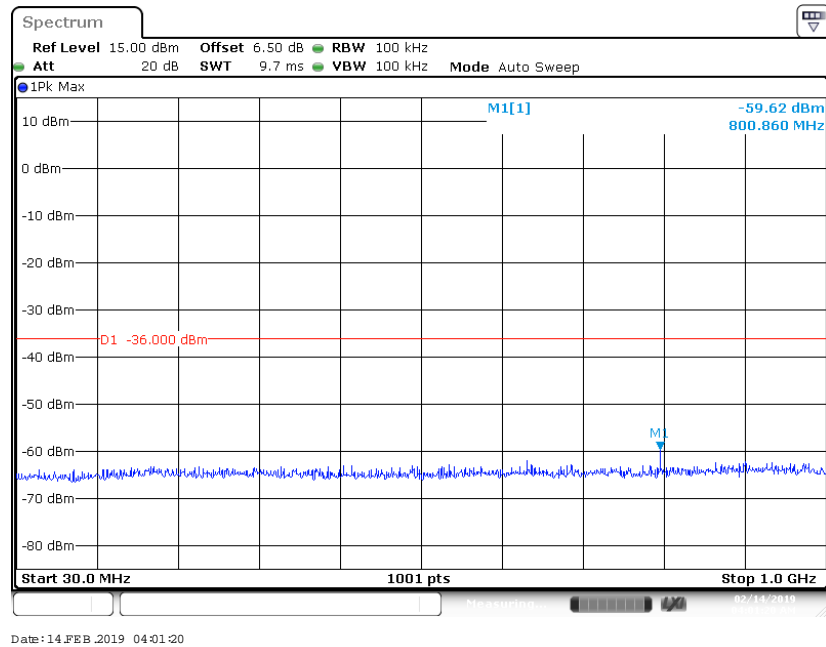
Band IV: 2483.5MHz ~ 2496.5MHz

Band V: 2496.5MHz ~ 12500MHz

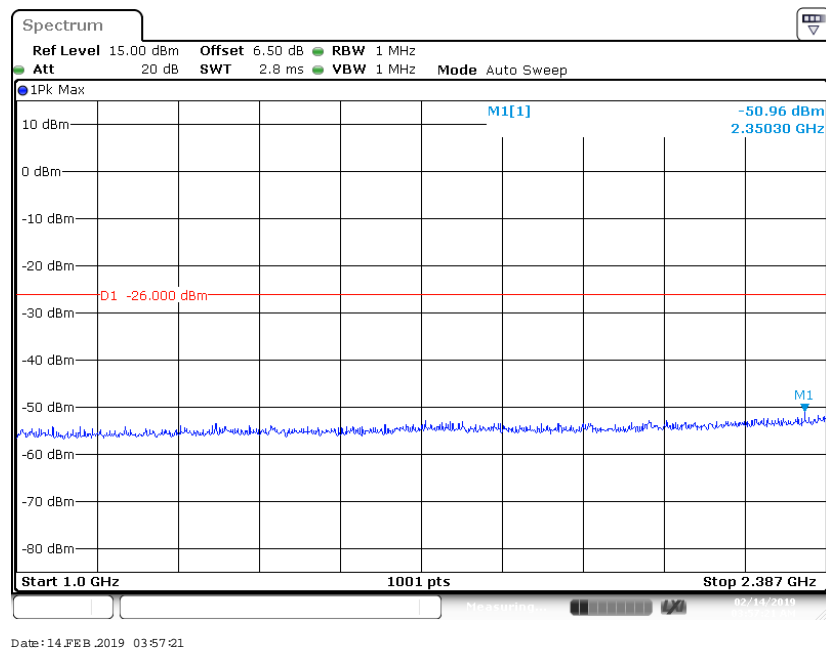
Please refer to the plots for normal voltage test.

Low Channel

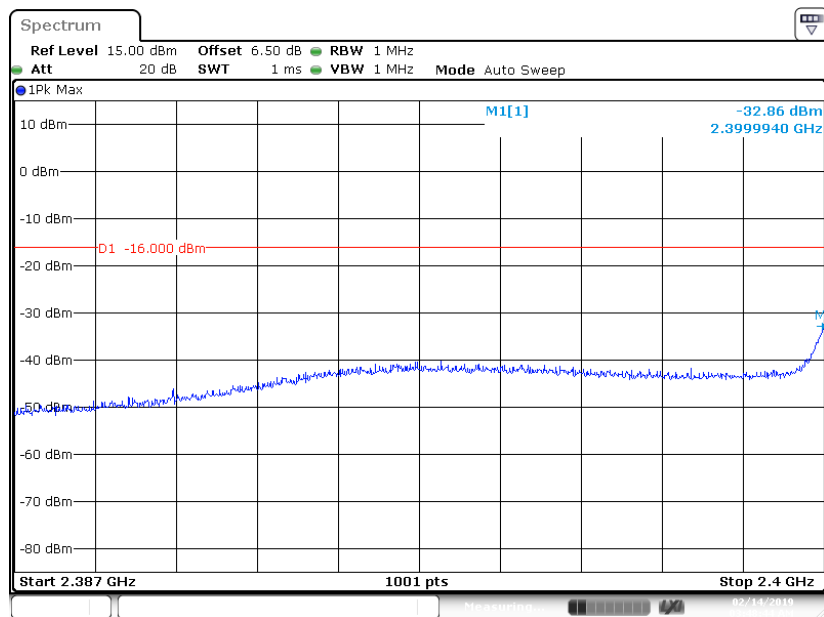
30MHz~1000MHz



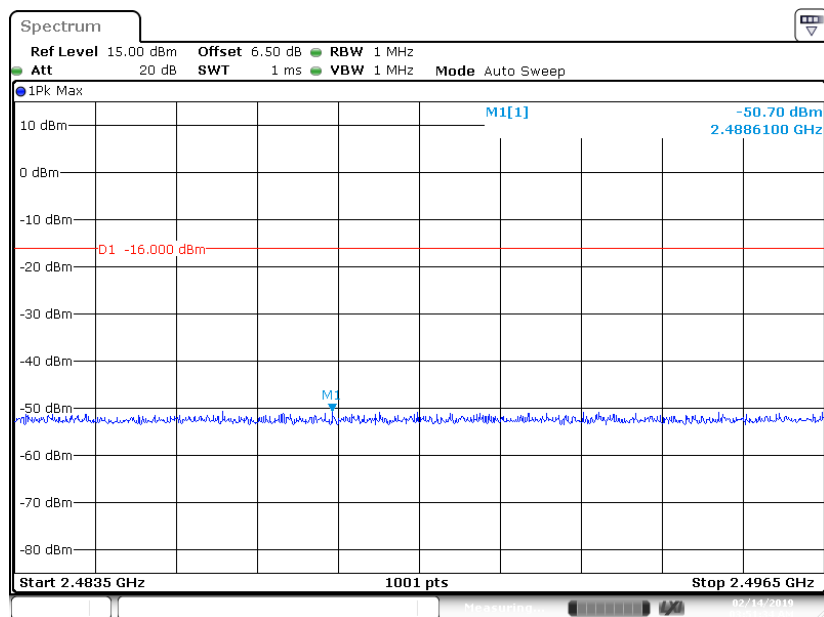
1000MHz~2387MHz



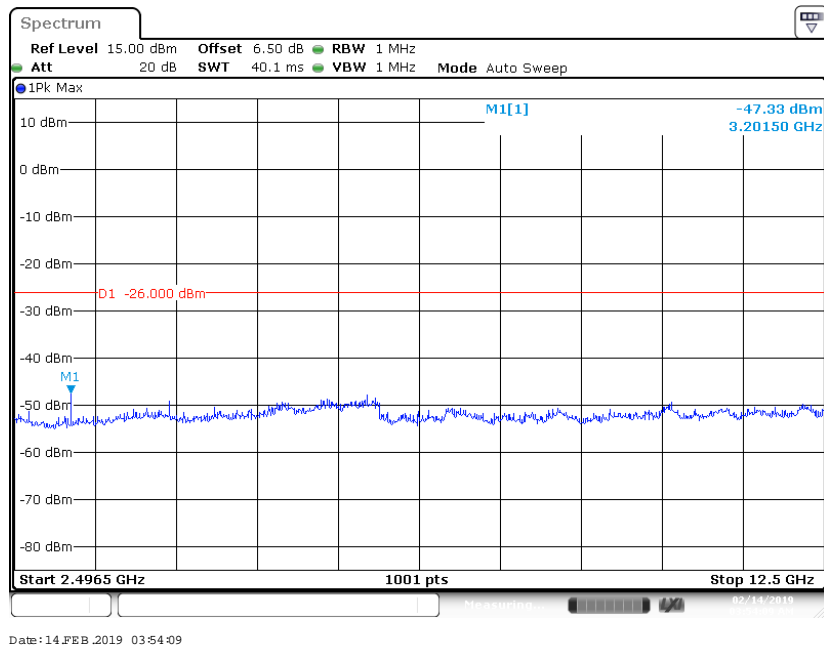
2387MHz~2400MHz



2483.5MHz~2496.5MHz

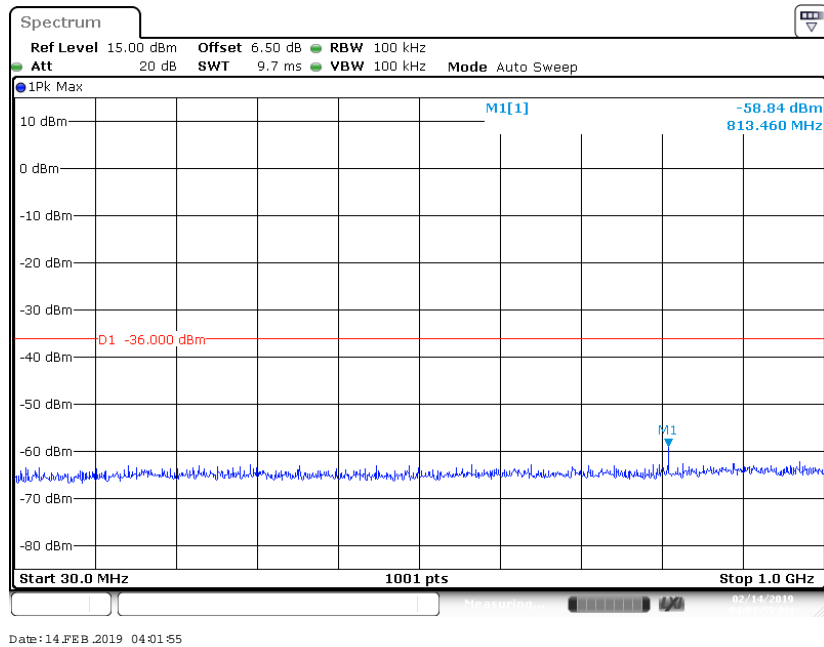


2496.5MHz~12500MHz

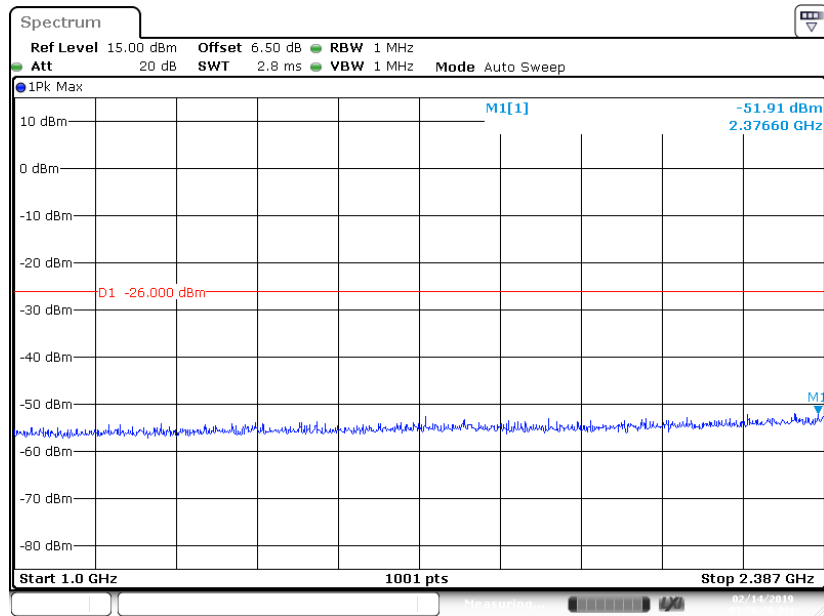


Middle Channel:

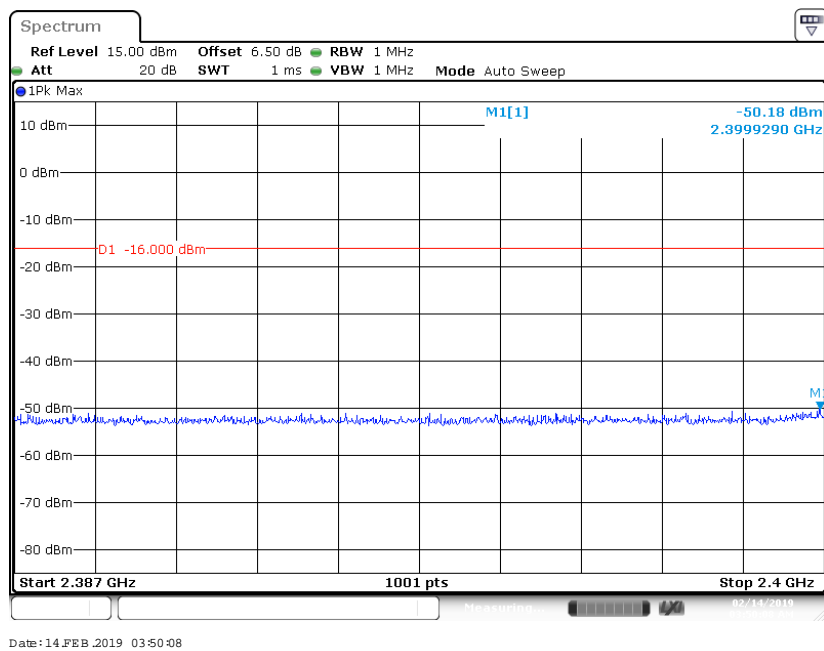
30MHz~1000MHz



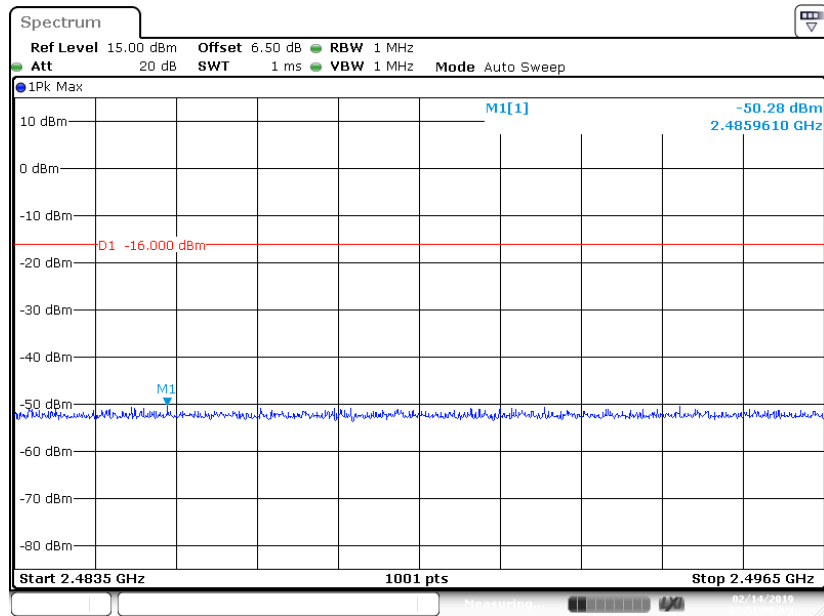
1000MHz~2387MHz



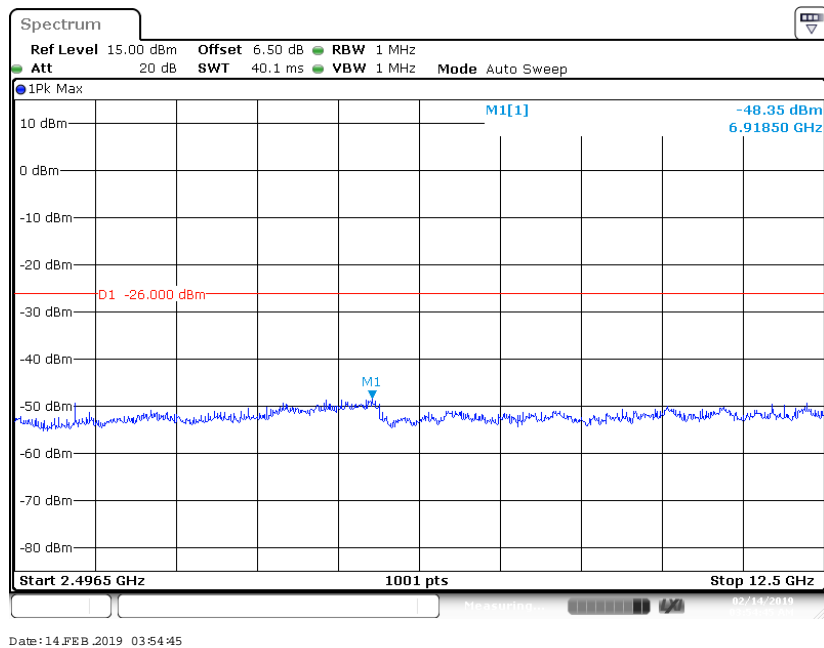
2387MHz~2400MHz



2483.5MHz~2496.5MHz

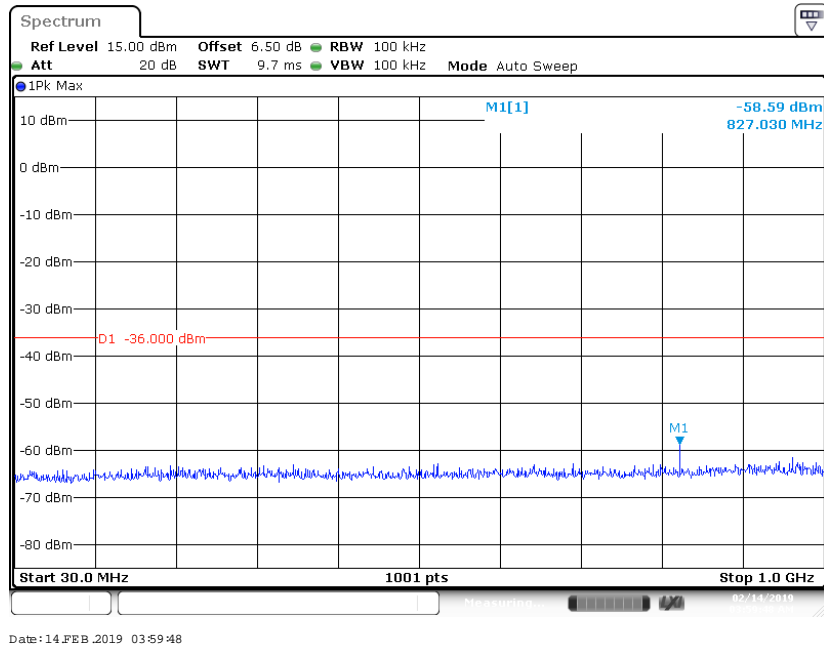


2496.5MHz~12500MHz

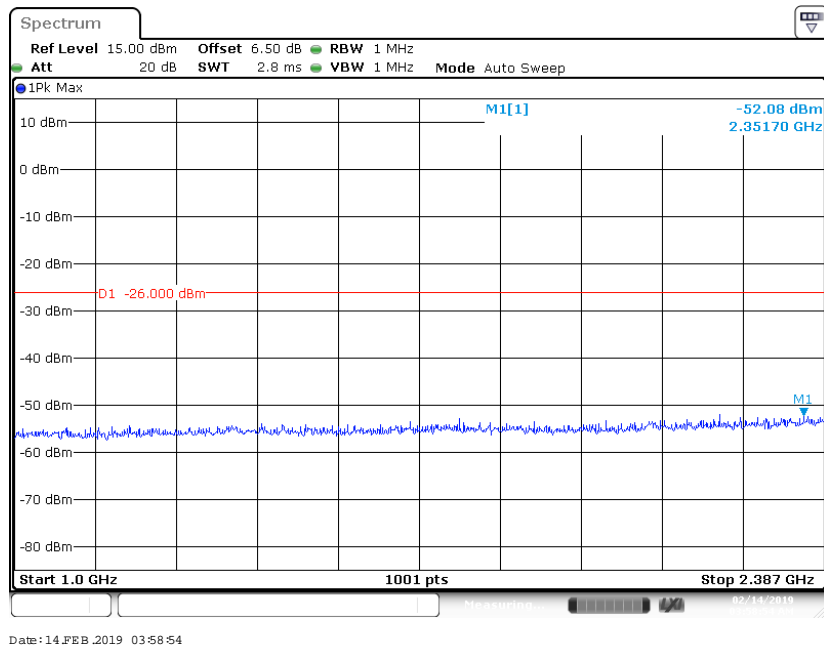


High Channel:

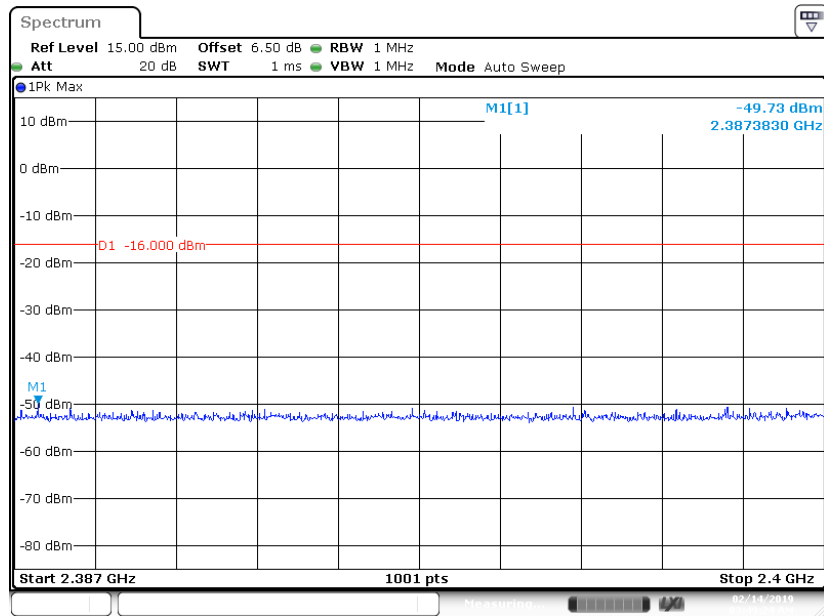
30MHz~1000MHz



1000MHz~2387MHz

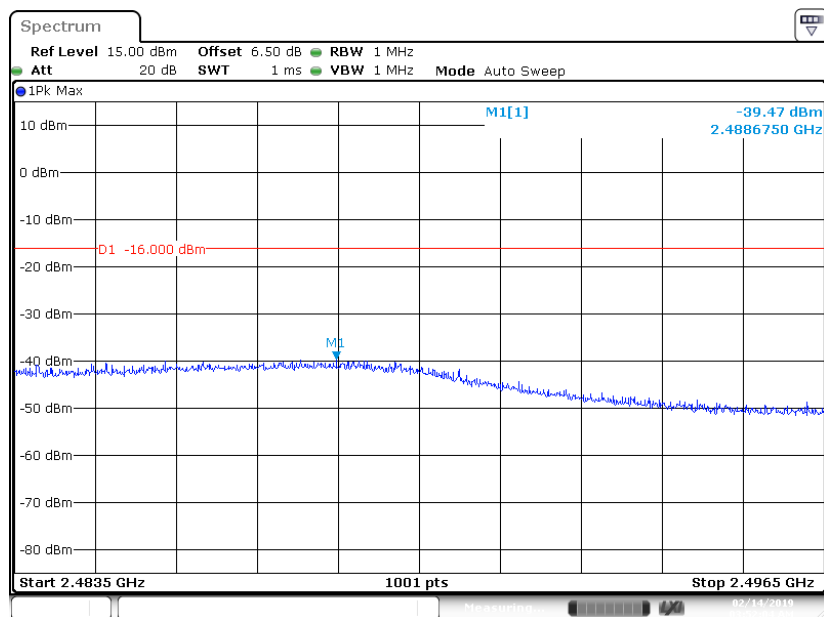


2387MHz~2400MHz



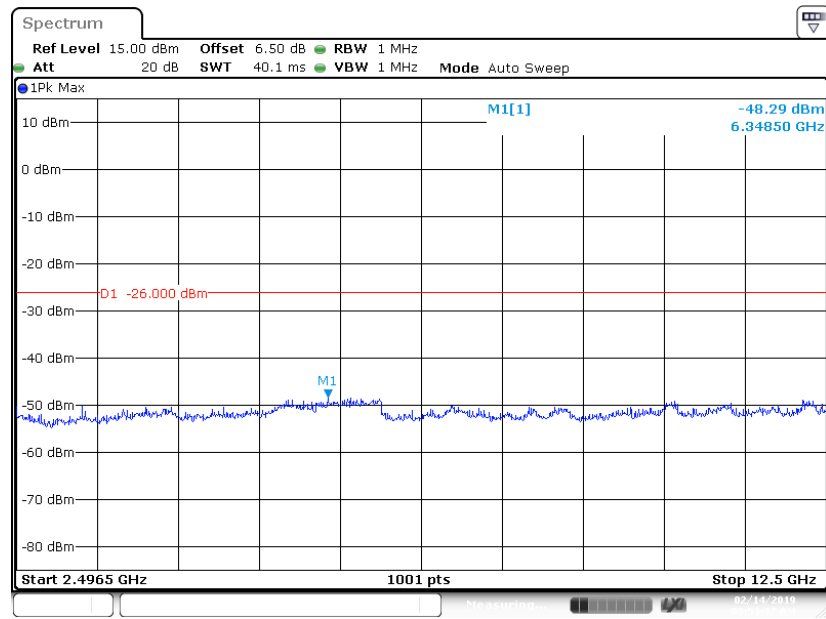
Date:14.FEB.2019 03:49:25

2483.5MHz~2496.5MHz



Date:14.FEB.2019 03:52:04

2496.5MHz~12500MHz



ANTENNA OUTPUT POWER AND ANTENNA POWER TOLERANCE

Limit

- $\leq 3 \text{ mW /MHz}$ (FHSS from 2402 - 2480 MHz)
- $\leq 10 \text{ mW/MHz}$ (OFDM, DSSS from 2400 - 2483.5 MHz)
- $\leq 10 \text{ mW}$ (other from 2400 - 2483.5 MHz)

The Output Power Tolerance must be within +20%, -80%.

Test Procedure

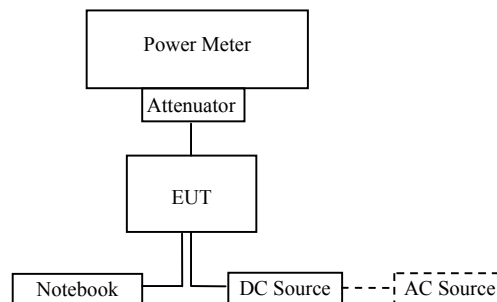
Step1; Measure the total power by Power Meter in a state of hopping mode or non-hopping mode (with Average Sensor).

Step2; If it's the burst wave, please measure the burst ratio. Then calculate the real total power by burst ratio.

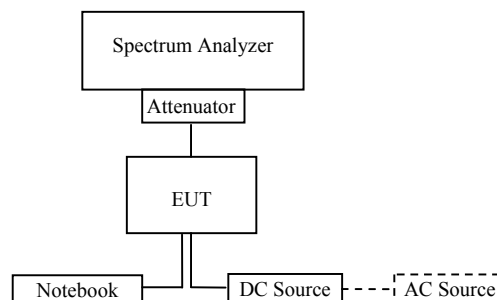
Step3; Calculate the mean output power.

Test Setup Block diagram

Power:



Duty Cycle:



Test Data**Environmental Conditions**

Temperature:	22.4 °C
Relative Humidity:	50 %
ATM Pressure:	101.2kPa

The testing was performed by Max Min on 2019-02-14.

Test Result: Compliant

Test Mode: Transmitting

Frequency	2402 MHz			2440 MHz			2480 MHz		
Voltage (V _{DC})	4.5	5.0	5.5	4.5	5.0	5.5	4.5	5.0	5.5
Power Meter Reading (dBm)	0.13	0.20	0.24	0.57	0.65	0.72	0.94	0.99	1.03
Power Meter Reading (mW)	1.03	1.05	1.06	1.14	1.16	1.18	1.24	1.26	1.27
Burst Ratio	83.27%	83.27%	83.27%	81.42%	81.42%	81.42%	81.09%	81.09%	81.09%
Antenna Output Power (mW)	1.237	1.261	1.273	1.400	1.425	1.449	1.529	1.554	1.566
Antenna Output Power (dBm)	0.92	1.01	1.05	1.46	1.54	1.61	1.84	1.91	1.95
EIRP (dBm)	3.90	3.99	4.03	4.44	4.52	4.59	4.82	4.89	4.93
Declared Power (mW)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Antenna Output Power Tolerance	-17.54%	-15.94%	-15.14%	-6.66%	-5.02%	-3.38%	1.94%	3.59%	4.41%
Antenna Power Limit				10mW					
EIRP Limit				12.14dBm					
Antenna Tolerance Limit				+20% ~ -80%					
Result				Pass					

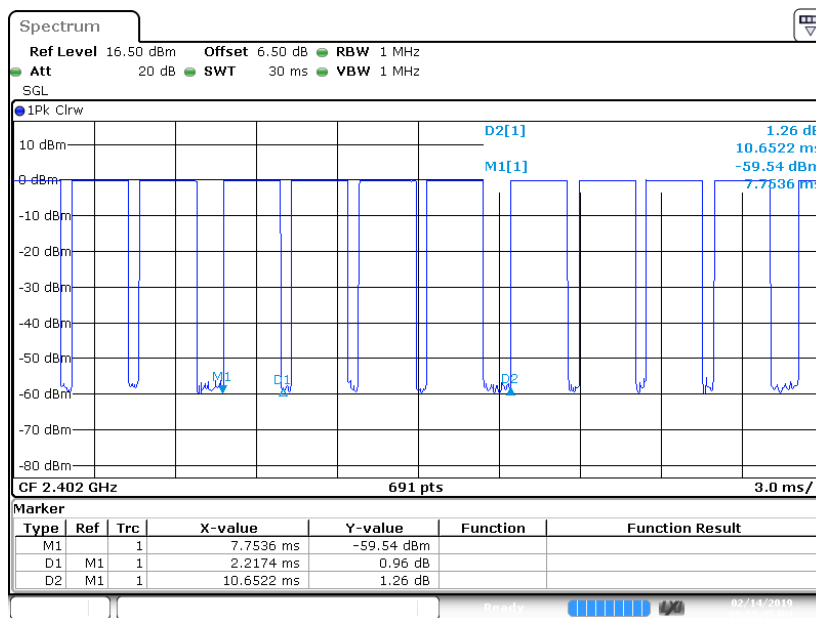
Note:

1. The nominal Output power is 1.50 mW, which is declared by manufacturer.
2. Antenna gain is 2.98dBi.
3. Antenna Output Power = Power Meter Reading / Burst Ratio
4. Antenna Output Power Tolerance = (Antenna Output Power - Declared Power) / Declared Power *100%

Please refer to the plots for normal voltage test.

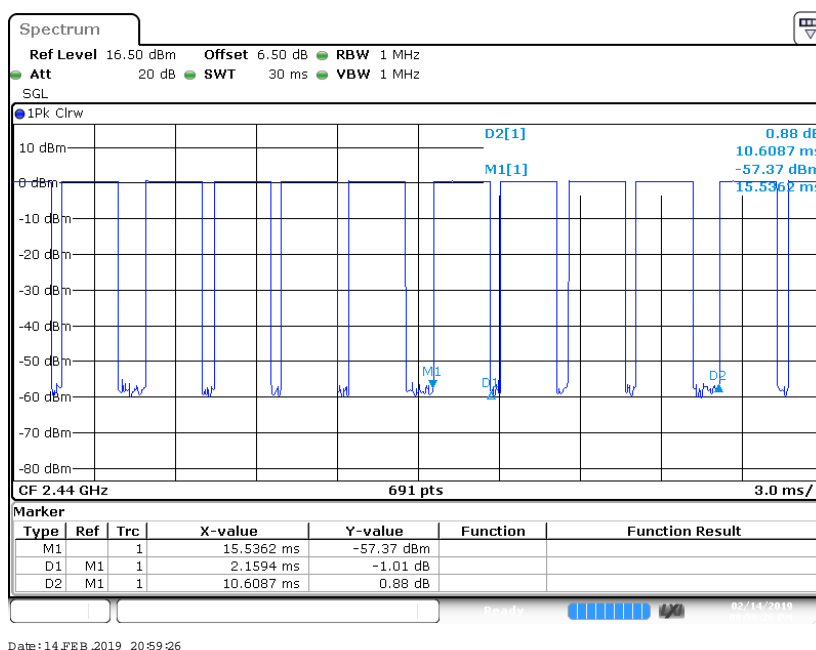
Duty Cycle:

Low Channel



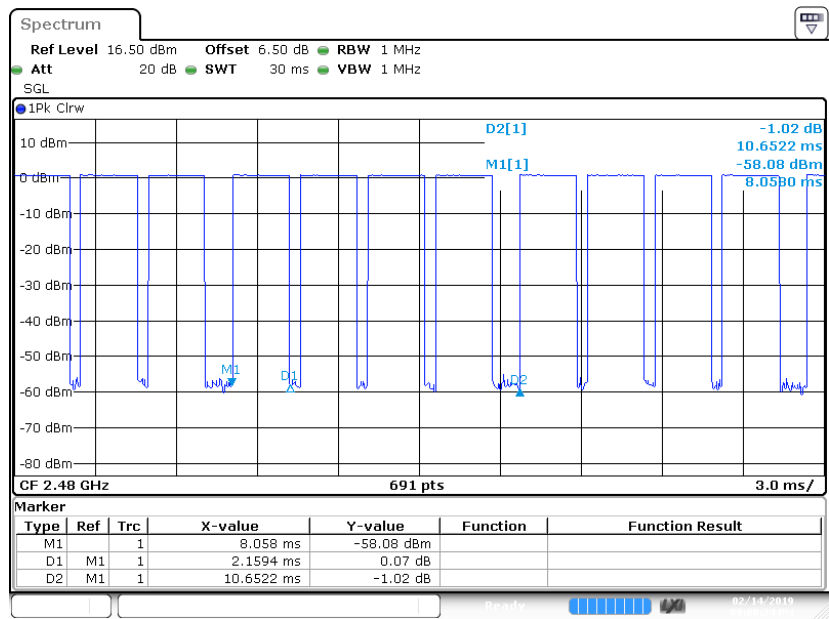
Note: $T_{on}=2.2174*4=8.8696\text{ms}$, $T_p=10.6522\text{ms}$

Middle Channel



Note: $T_{on}=2.1594*4=8.6376\text{ms}$, $T_p=10.6087\text{ms}$

High Channel



Date: 14.FEB.2019 21:00:24

Note: $T_{on}=2.1594*4=8.6376ms$, $T_p=10.6522ms$

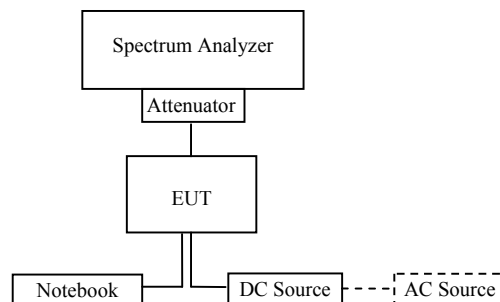
RECEIVER SPURIOUS EMISSION AND UNWANTED EMISSION INTENSITY

Limit

- $\leq 4 \text{ nW}$ ($30 \text{ MHz} \leq f \leq 1000 \text{ MHz}$)
- $\leq 20 \text{ nW}$ ($1 \text{ GHz} \leq f \leq 12.5 \text{ GHz}$)

Test Procedure

❖ Measurement System Diagram



❖ Conditions of Application Equipment (EUT)

- The modulation state shall be “continuous receiving mode”.

❖ Spectrum Analyzer Conditions

- Start Frequency: Start Frequency of frequency range to measure (30MHz or 1GHz)
- Stop Frequency: Stop Frequency of frequency range to measure (1GHz or 12.5GHz)
- Span: AUTO (Measurement Range)
- RBW: 100 kHz, VBW: 100 kHz for Frequency < 1 GHz
- RBW: 1MHz, VBW: 1MHz for Frequency > 1 GHz
- Sweep time: AUTO or more
- Sweep mode: Auto Sweep
- Detection: Positive Peak
- Reference Level: Enough level for maximum dynamic range

Measurement Result**Environmental Conditions**

Temperature:	22.4 °C
Relative Humidity:	50 %
ATM Pressure:	101.2kPa

The testing was performed by Max Min on 2019-02-14.

Test Result: Compliant.

Test Mode: Receiving

Frequency Band		2402 MHz			2440 MHz			2480 MHz			Limit
Voltage (V _{DC})		4.5	5.0	5.5	4.5	5.0	5.5	4.5	5.0	5.5	
Unwanted Emission Intensity	Band VI (dBm)	-85.05	-82.69	-84.62	-85.49	-81.31	-84.92	-86.72	-81.28	-85.19	-54dBm (4nW)
	Band VII (dBm)	-64.91	-60.06	-65.38	-64.87	-62.03	-64.97	-63.42	-63.83	-63.24	-47dBm (20nW)

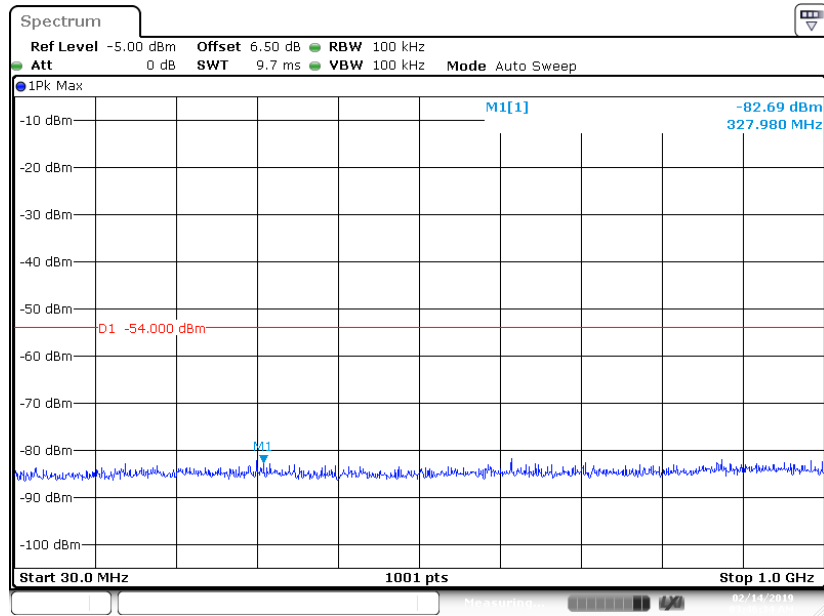
Note:

Band VI: 30MHz ~ 1000MHz

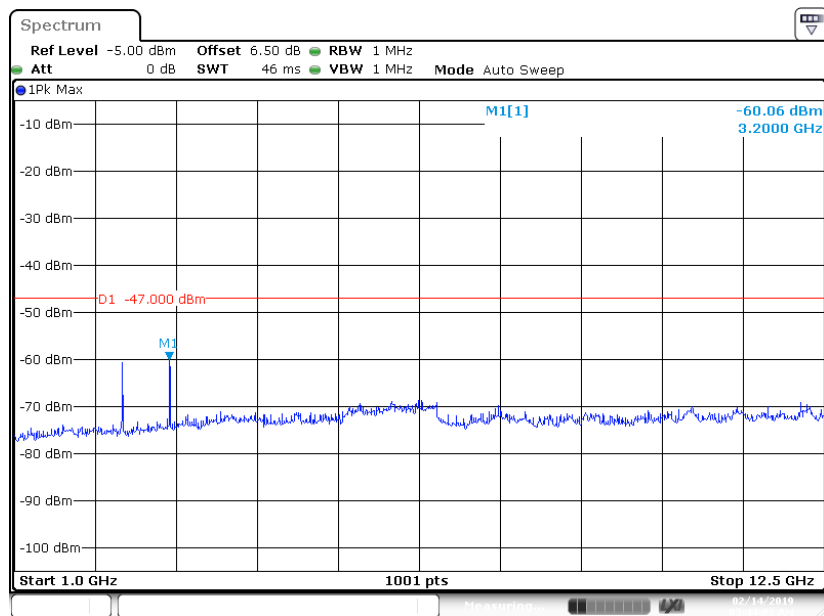
Band VII: 1000MHz ~ 12500MHz

Please refer to the plots for normal voltage test.

Low Channel:

 $30\text{MHz} \sim 1000\text{MHz}$ 

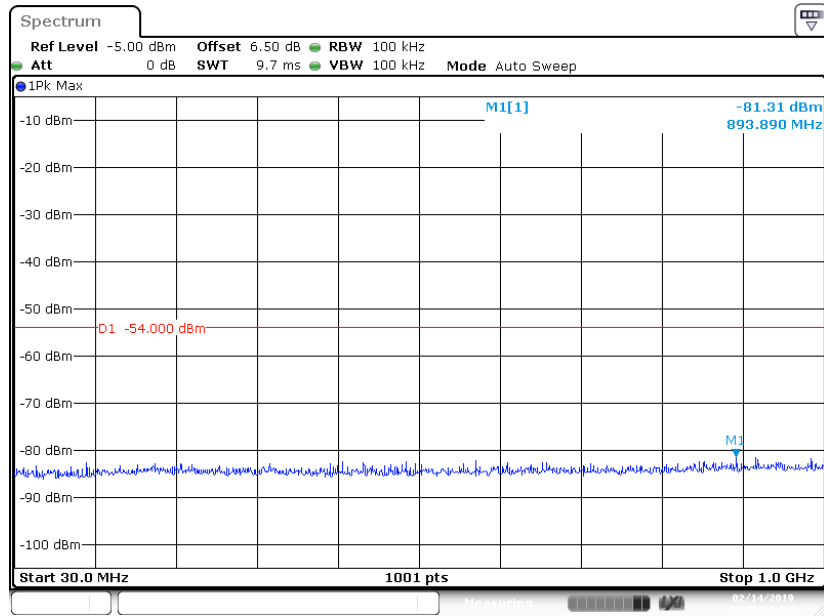
Date: 14.FEB.2019 03:46:34

 $1000\text{MHz} \sim 12500\text{MHz}$ 

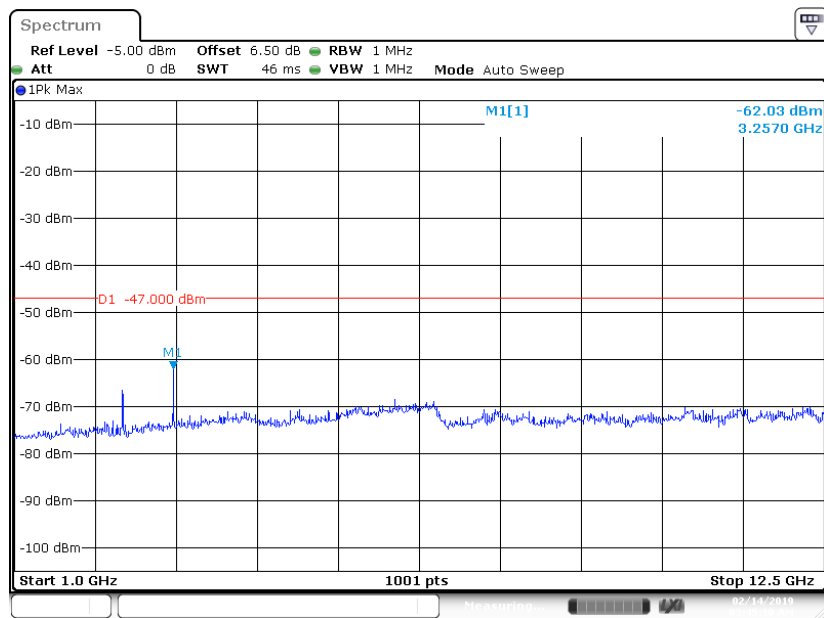
Date: 14.FEB.2019 03:44:03

Middle Channel:

30MHz~1000MHz

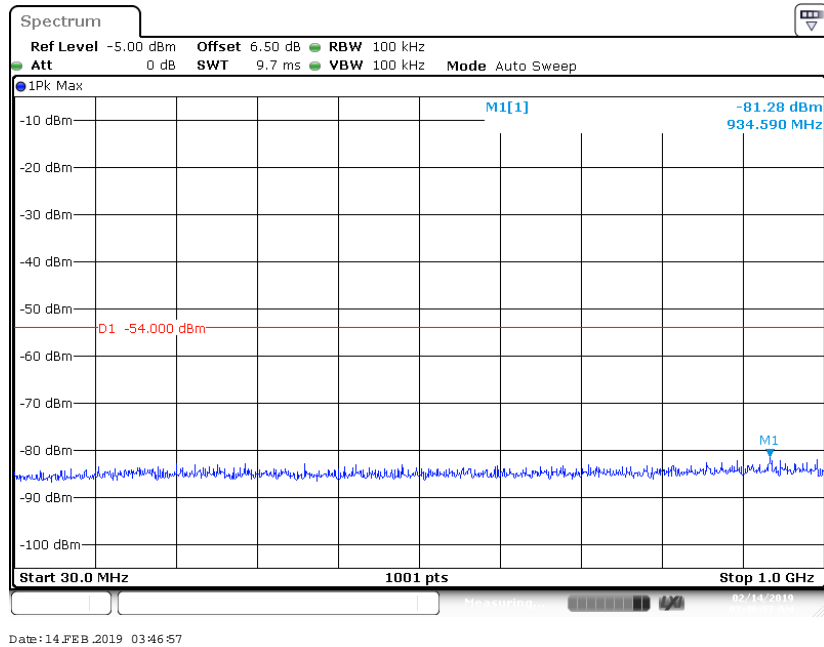


1000MHz~12500MHz

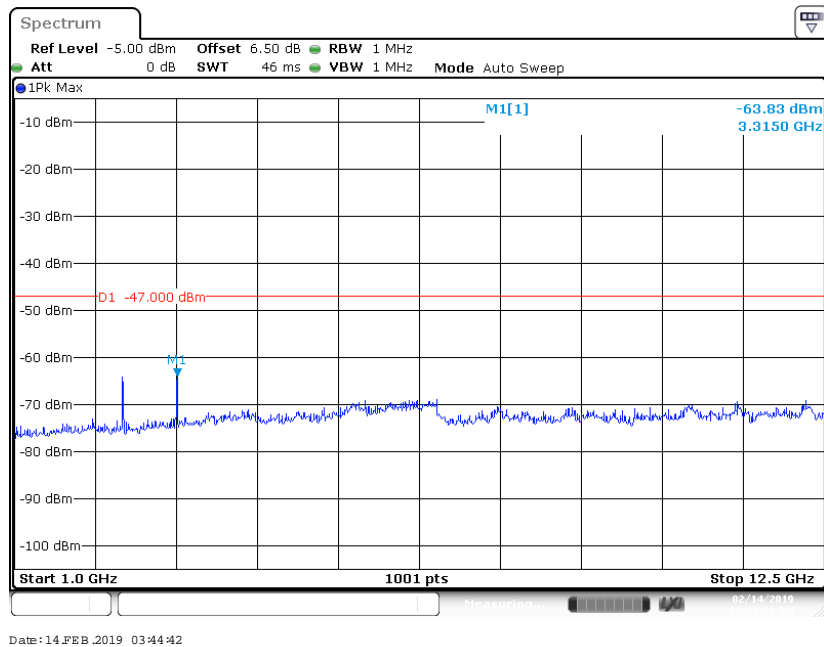


High Channel:

30MHz~1000MHz



1000MHz~12500MHz



INTERFERENCE PREVENTION FUNCTION

Requirement

The EUT shall have the interference prevention capability to transmit or to receive the identification automatically, so that sender and receiver shall exclude other equipment.

Test Procedure

In the case that the EUT has the function of automatically transmitting the identification code:

1. Transmit the predetermined identification codes from EUT
2. Check the transmitted identification codes with the demodulator.

In the case of receiving the identification codes:

1. Transmit the predetermined identification codes from the counterpart.
2. Check if communication is normal
3. Transmit the signal other than predetermined ID codes from the counterpart.
4. Check if the EUT stops the transmission, or if it displays that identification codes are different from the predetermined ones.

Test Data

Environmental Conditions

Temperature:	22.4 °C
Relative Humidity:	50 %
ATM Pressure:	101.2kPa

The testing was performed by Max Min on 2019-02-14.

Test Result: Good

CONSTRUCTION PROTECTION CONFIRMATION

Limit

The high-frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

Confirmation Method

The EUT is used for OEM (original equipment manufacturer) to install the final device, the high frequency section and modulation section will be protected by the host device. Please refer the external photographs.

******END OF REPORT******