

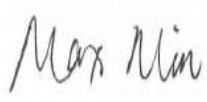
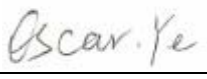
JAPAN MIC TEST REPORT

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: RSHD190123002-24D	
Report Date: 2019-02-27	
Reviewed By: Oscar Ye RF Leader	
Test Laboratory: Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road,Kunshan,Jiangsu province,China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn	

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TABLE OF CONTENTS

GENERAL INFORMATION.....	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY	4
EUT TEST CONFIGURATION.....	5
DESCRIPTION OF TEST CONFIGURATION	5
EUT EXERCISE SOFTWARE	5
EQUIPMENT MODIFICATIONS	6
SUPPORT EQUIPMENT LIST AND DETAILS	6
EXTERNAL I/O CABLE.....	6
CONFIGURATION OF TEST SETUP	6
SUMMARY OF TEST RESULTS	7
TEST EQUIPMENT LIST	8
FREQUENCY ERROR	9
LIMIT	9
TEST PROCEDURE	9
MEASUREMENT RESULT	10
OCCUPIED BANDWIDTH AND SPREADING BANDWIDTH	11
LIMIT	11
TEST PROCEDURE	11
MEASUREMENT RESULT	11
TRANSMITTER SPURIOUS EMISSION STRENGTH AND UNWANTED EMISSION INTENSITY.....	14
LIMIT	14
TEST PROCEDURE	14
MEASUREMENT RESULT	15
ANTENNA OUTPUT POWER, ANTENNA POWER TOLERANCE AND TRANSMISSION ANTENNA GAIN.....	19
LIMIT	19
TEST PROCEDURE	19
TEST SETUP BLOCK DIAGRAM.....	20
MEASUREMENT RESULT	20
RECEIVER SPURIOUS EMISSION AND UNWANTED EMISSION INTENSITY	22
LIMIT	22
TEST PROCEDURE	22
MEASUREMENT RESULT	23
INTERFERENCE PREVENTION FUNCTION.....	25
REQUIREMENT	25
TEST PROCEDURE	25
TEST BLOCK	错误！未定义书签。
MEASUREMENT RESULT	25

CONSTRUCTION PROTECTION CONFIRMATION	26
LIMIT	26
CONFIRMATION METHOD.....	26

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 19-2 of Article 2 Paragraph 1, rules and limits for this device including:

Related Submittal(s)/Grant(s)

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

Test Methodology

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

EUT TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a testing mode which was selected by manufacturer.

For frequency 2484MHz, EUT was tested with Channel 14.

Channel	Frequency (MHz)
14	2484

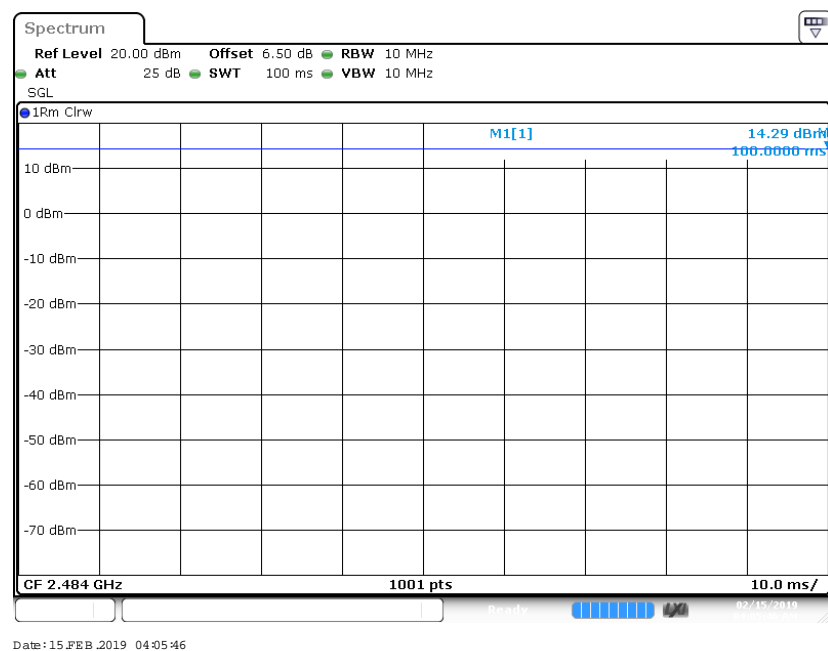
EUT Exercise Software

RF test tool: espRFTool

The worst condition was performed under:

802.11b 2484MHz: Data rate: 1 Mbps, power level: 8

2484MHz Duty Cycle



Equipment Modifications

No modification was made to the EUT tested.

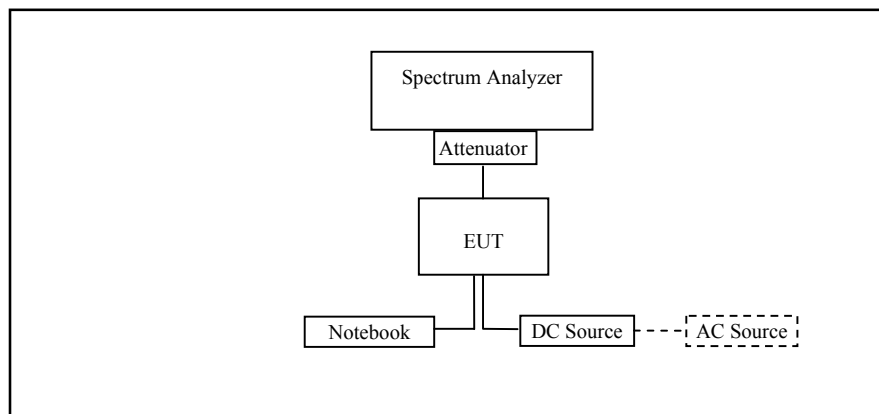
Support Equipment List and Details

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.44 Article 2, Paragraph 1, Item 19-2 Rules Section	Description of Test	Result
3	Frequency Error	Compliance
4	Occupied Bandwidth and Spreading 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 Function	Not Applicable (See Note 2)
11	Frequency Hopping Dwell Time	Not Applicable (See Note 3)
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/MHz.
2. The test only required for bandwidth more than 26MHz and less than 38MHz.
3. This test item is only required for FHSS system devices.

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
Narda	Attenuator/6dB	10690812-2	26850-6	2019-01-10	2020-01-09
Rohde & Schwarz	SMB 100A Signal Generator	SMB100A	110390	2018-07-22	2019-07-21
Mini-Circuits	Power Splitter	ZFRSC-14-S+	SF019411452	2018-11-10	2019-11-09
BEST	DC Power Supply	PS-1502D+	DC001	2018-10-10	2019-10-09
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).

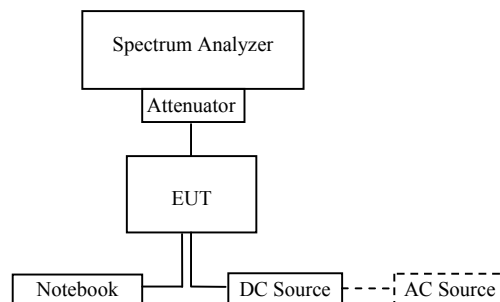
FREQUENCY ERROR

Limit

50 ppm or below

Test Procedure

Measurement System Diagram



Conditions of Application Equipment (EUT)

- Set the application equipment (EUT) to the measurement frequency.
- The modulation state shall be “continuous carrier wave without modulation” mode.

Spectrum Analyzer Conditions

- Center Frequency: Frequency to measure (2484 MHz)
- RBW: 1 kHz, VBW: 30 kHz
- Sweep time: Auto
- Log scale: 10dB/Div, Data points: 501points (400 points or more)
- Detection: Positive Peak, Sweep mode: Continuous
- Marker: Spot

If the EUT can't set at un-modulation mode, measure the 10dBc center frequency.

Measurement Result**Environmental Conditions**

Temperature:	23.2°C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Max Min on 2019-02-15.

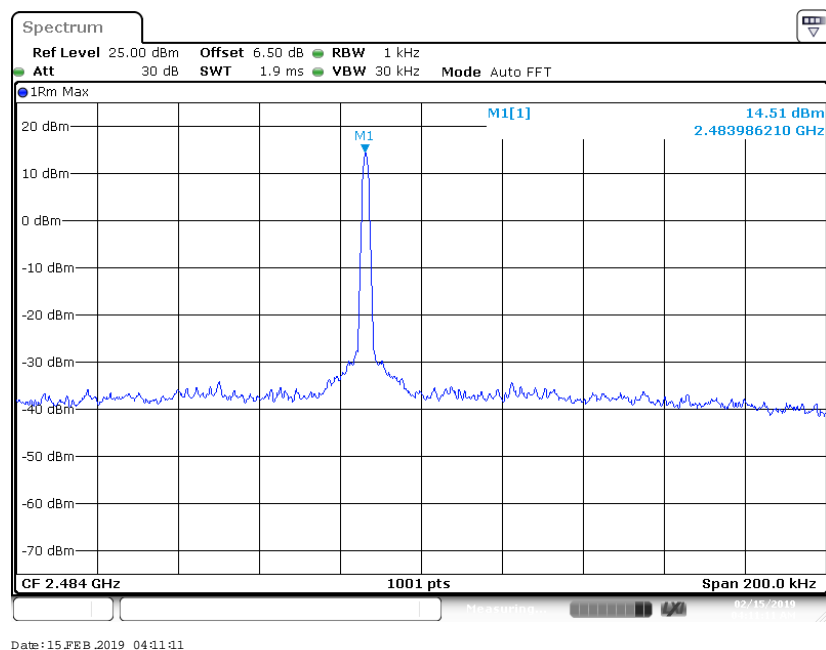
Test Result: Compliant

Test Mode: Transmitting

Frequency (MHz)	Voltage (V _{DC})	Measure Frequency (MHz)	Frequency Tolerance (ppm)	Limit (ppm)
2484	4.5	2483.98576	-5.73	± 50
	5.0	2483.98621	-5.55	
	5.5	2483.98430	-6.32	

Please refer to the following plots for normal voltage:

Test Frequency: 2484MHz



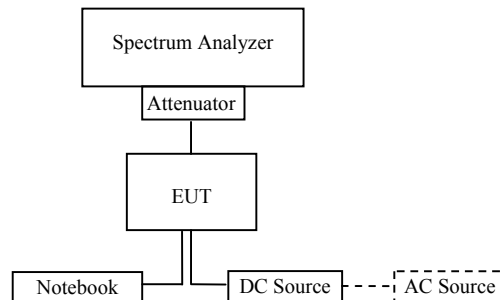
OCCUPIED BANDWIDTH AND SPREADING BANDWIDTH

Limit

- Occupied bandwidth: DS \leq 26 MHz; Others \leq 26 MHz
- Spread Bandwidth: \geq 500 kHz (FH, DS), Spread factor $>$ 10.

Test Procedure

1. Setting of SA is following as: RB: 300 kHz / VB: 300 kHz / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
2. EUT have transmitted the maximum modulation signal and fixed channelize. SA set to 99% of occupied bandwidth to measure occupied bandwidth.
3. EUT have transmitted the maximum modulation signal and fixed channelize. SA set to 90% of occupied bandwidth to measure spread bandwidth.
4. Spread Factor=Spread Bandwidth/modulation rate. The modulation rate: MR=1.375 for 802.11b



Measurement Result

Environmental Conditions

Temperature:	23.2°C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Max Min on 2019-02-15.

Test Result: Compliant*Test Mode: Transmitting*

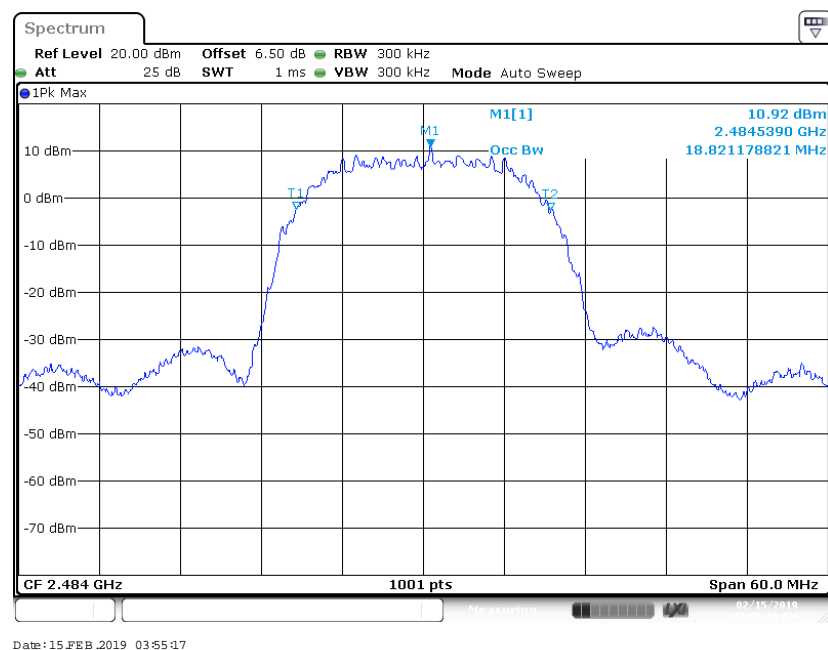
Frequency	2484MHz			Limit
Voltage(V _{DC})	4.5	5.0	5.5	
Occupied Bandwidth (MHz)	18.82	18.82	18.84	≤26MHz
Spread Bandwidth (MHz)	14.11	14.15	14.15	≥0.5MHz
Spread Factor	10.26	10.29	10.29	>10

Note: Spread factor = Spread bandwidth/Modulation rate
Modulation rate: 802.11b=1.375

Please refer to the following plots for normal voltage:

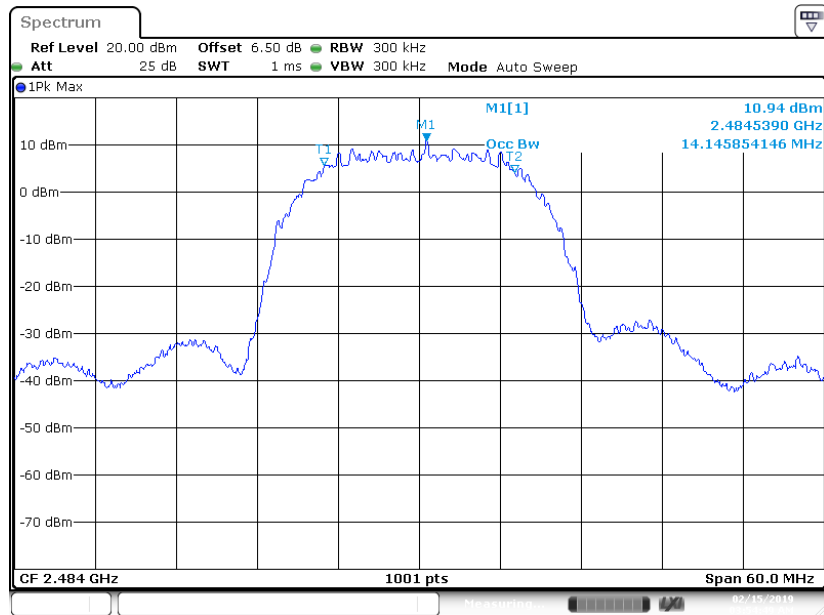
Occupied Bandwidth:

802.11b Mode Test Frequency:2484MHz



Spread Bandwidth:

802.11b Mode Test Frequency: 2484MHz



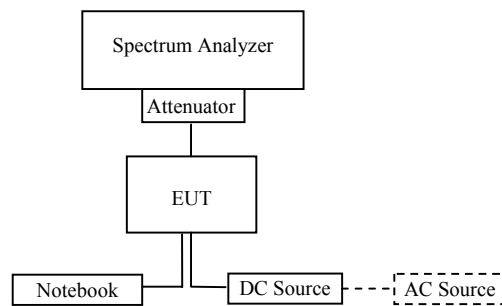
TRANSMITTER SPURIOUS EMISSION STRENGTH AND UNWANTED EMISSION INTENSITY

Limit

- $30 \text{ MHz} \leq f \leq 1 \text{ GHz}$: $\leq 0.25 \mu\text{W}/100\text{kHz}$
- $1 \text{ GHz} < f \leq 2458 \text{ MHz}$: $\leq 2.5 \mu\text{W}/\text{MHz}$
- $2458 \text{ MHz} < f \leq 2471 \text{ MHz}$: $\leq 25 \mu\text{W}/\text{MHz}$
- $2497 \text{ MHz} < f \leq 2510 \text{ MHz}$: $\leq 25 \mu\text{W}/\text{MHz}$
- $2510 \text{ MHz} < f \leq 12500 \text{ MHz}$: $\leq 2.5 \mu\text{W}/\text{MHz}$

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 2458MHz, 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 2458MHz and stop frequency 2471MHz, 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 μ W.
- Setting of SA start 2497MHz and stop frequency 2510MHz, 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 μ W.
- Setting of SA start 2510MHz 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 μ W.

Measurement Result

Environmental Conditions

Temperature:	23.2°C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Max Min on 2019-02-15.

Test Mode: Transmitting

Test Result: Compliant

Frequency (MHz)		2484			Limit
Voltage(V _{DC})		4.5	5.0	5.5	
802.11b Mode					
Raw data	Band I	-55.68	-55.94	-55.09	-36 dBm/100kHz
	(dBm/100kHz)				(0.25μW/100kHz)
	Band II	-30.51	-30.44	-29.81	-26 dBm/MHz
	(dBm/MHz)				(2.5μW/MHz)
	Band III	-21.36	-22.06	-21.63	-16dBm/MHz
	(dBm/MHz)				(25 μW/MHz)
	Band IV	-21.86	-20.89	-20.23	-16dBm/MHz
	(dBm/MHz)				(25 μW/MHz)
	Band V	-32.51	-31.57	-32.56	-26 dBm/MHz
	(dBm/MHz)				(2.5μW/MHz)

Note:

Band I: 30 MHz~1GHz

Band II: 1GHz~2458 MHz

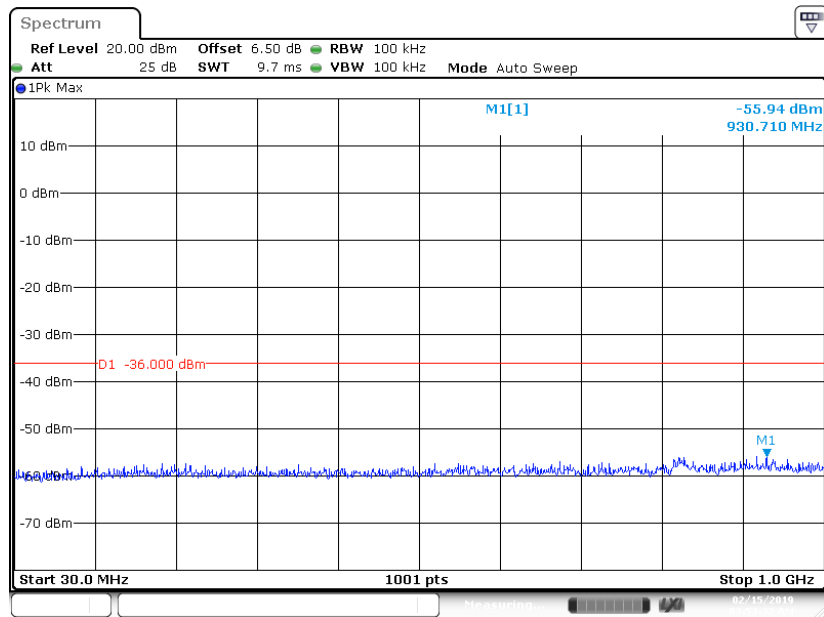
Band III: 2458 MHz~2471 MHz

Band IV: 2497 MHz~2510 MHz

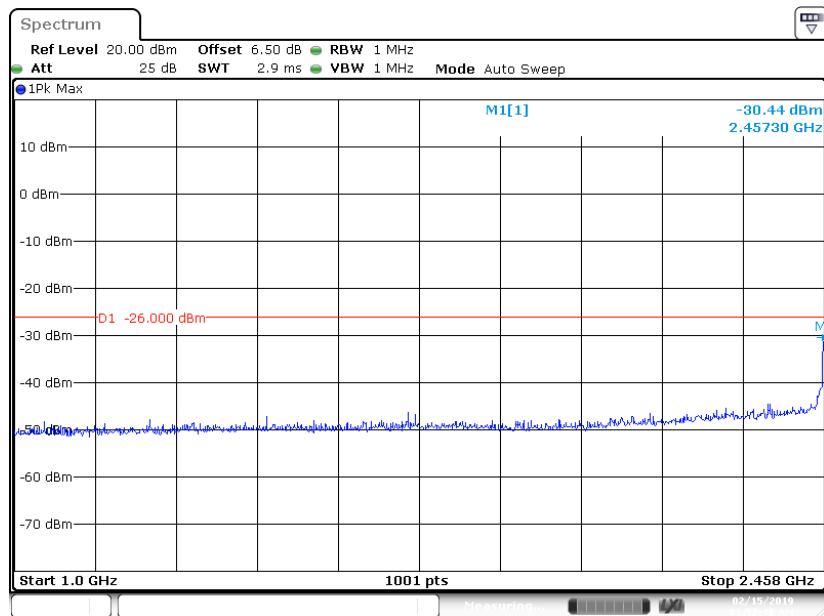
Band V: 2510 MHz~12500 MHz

Please refer to the plots for normal voltage test.

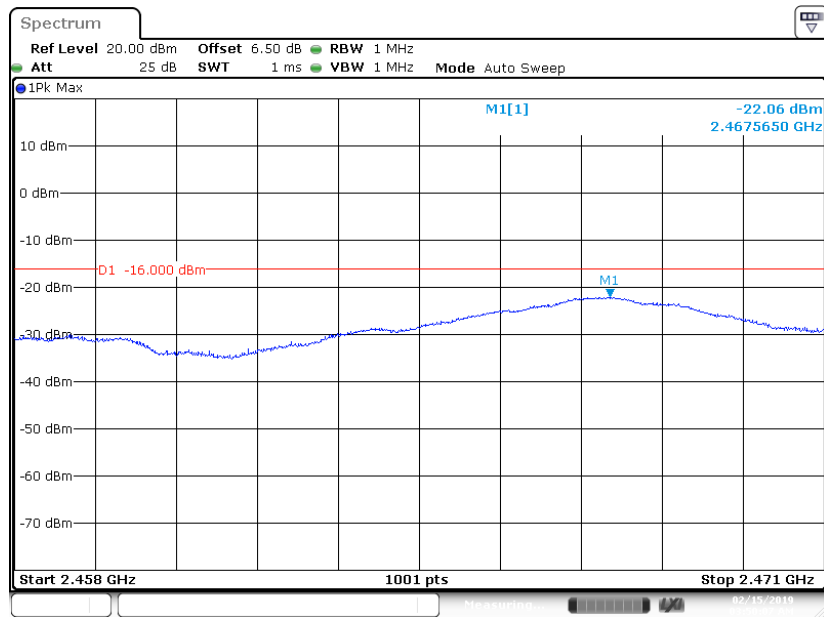
30MHz~1GHz



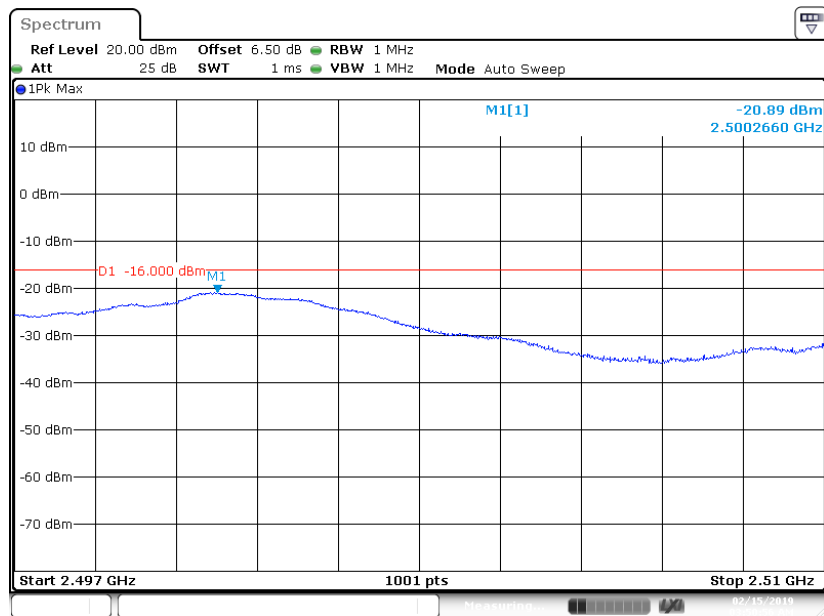
1GHz~2458MHz



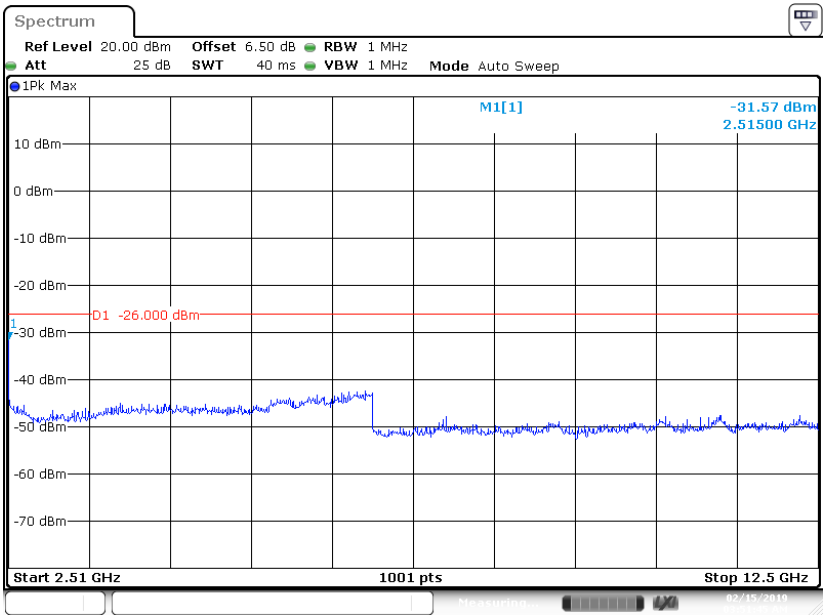
2458MHz~2471MHz



2497MHz~2510MHz



2510MHz~12500MHz



ANTENNA OUTPUT POWER, ANTENNA POWER TOLERANCE AND TRANSMISSION ANTENNA GAIN

Limit

- $\leq 10 \text{ mW/MHz}$

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

E.i.r.p:

- $\leq 12.14 \text{ dBm/MHz}$

Test Procedure

Step 1:

Connect the UUT to the spectrum analyser and use the following settings:

- Centre Frequency: The centre frequency of the channel under test.
- Resolution BW: 1 MHz.
- Video BW: 1 MHz.
- Span: Wide enough to cover the complete power envelope of the signal of the UUT.
- Detector: Peak.
- Trace Mode: Max Hold.

Step 2:

When the trace is complete, find the peak value of the power envelope and record the frequency.

Step 3:

Make the following changes to the settings of the spectrum analyser:

- Centre Frequency: Equal to the frequency recorded in step 2.
- Span: 3 MHz.
- Resolution BW: 1 MHz.
- Video BW: 1 MHz.
- Sweep time: 1 minute.
- Detector: Average (see note).
- Trace Mode: Max Hold.

NOTE: The detector mode "Average" is often referred to as "RMS Average" or "Sample" but do not use Video Average.

Step 4:

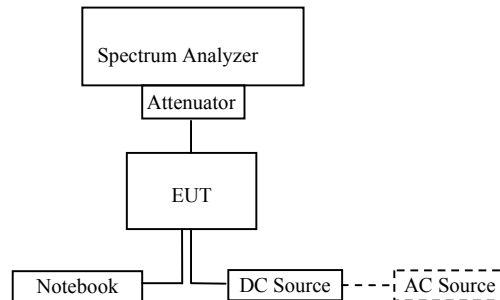
When the trace is complete, capture the trace, for example using the "View" option on the spectrum analyser.

Find the peak value of the trace and place the analyser marker on this peak. This level is recorded as the highest mean power (spectral power density) D in a 1 MHz band.

Alternatively, where a spectrum analyser is equipped with a facility to measure spectral power density, this facility may be used to display the spectral power density D in dBm/MHz.

D shall be recorded in the test report.

Test Setup Block diagram



Measurement Result

Environmental Conditions

Temperature:	23.2°C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Max Min on 2019-02-15.

Test Result: Compliant

Test Mode: Transmitting

Frequency Band	2484 MHz			Limit
Voltage(V _{DC})	4.5	5.0	5.5	
802.11b Mode				
Antenna Output Power (dBm/MHz)	5.15	5.18	5.22	10dBm/MHz
EIRP (dBm/MHz)	8.13	8.16	8.20	12.14dBm/MHz
Declared Power (mW/MHz)	3.50	3.50	3.50	/
Antenna Output Power (mW/MHz)	3.27	3.30	3.33	10mW/MHz
Antenna Output Power Tolerance (%)	-6.47	-5.83	-4.95	+20% ~ -80%

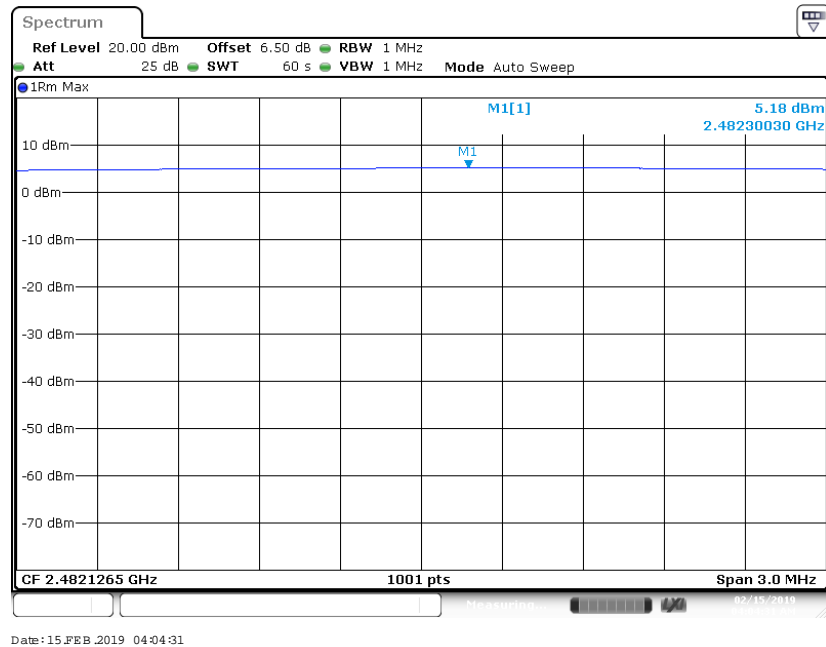
Note 1: Antenna Power Error = (Antenna Output Power - Declared Antenna power)/ Declared Antenna power *100%

Note 2: The antenna gain is 2.98 dBi which is declared by manufacturer.

Please refer to the plots for normal voltage test.

ANTENNA OUTPUT POWER:

802.11b mode Test Frequency:2484MHz



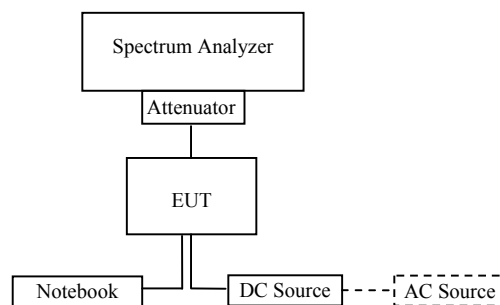
RECEIVER SPURIOUS EMISSION AND UNWANTED EMISSION INTENSITY

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 (30 MHz or 1 GHz)
- Stop Frequency: Stop Frequency of frequency range to measure (1 GHz or 12.5 GHz)
- 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:	23.2°C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Max Min on 2019-02-15.

Test Mode: Receiving

Frequency Band		2484 MHz			Limit
Voltage(V _{DC})		4.5	5.0	5.5	
802.11b Mode					
Unwanted Emission Intensity	Band V (dBm)	-76.96	-76.43	-75.73	-54dBm (4nW)
	Band VI (dBm)	-64.46	-65.42	-66.27	-47dBm (20nW)

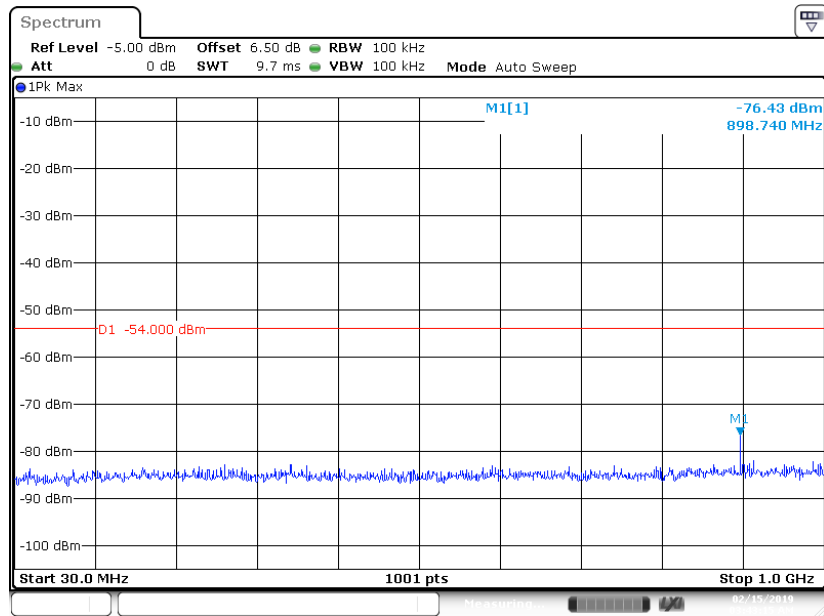
Note:

Band V: 30 MHz~1000 MHz

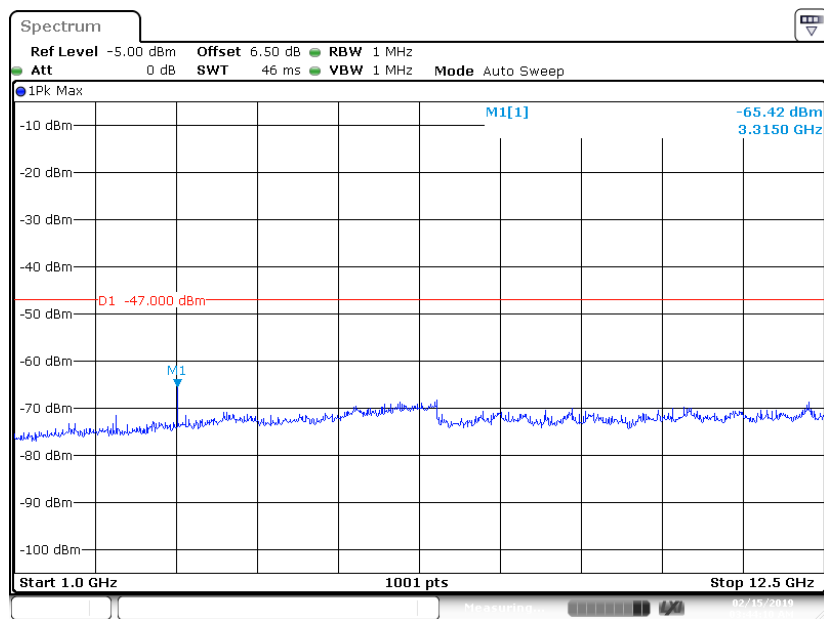
Band VI: 1000 MHz~12500 MHz

Please refer to the plots for normal voltage test.

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.

Measurement Result

Environmental Conditions

Temperature:	23.2°C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Max Min on 2019-02-15.

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 *******