

TEST REPORT

Product Name : DataHub
Model Number : DataHub1000

Prepared for : SolaX Power Network Technology (Zhejiang) Co., Ltd.
Address : No.288, Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province 310000,P. R. CHINA

Prepared by : EMTEK (NINGBO) CO., LTD.
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Report Number : ENB2111250113W00901R
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1. TEST RESULT CERTIFICATION

Applicant : SolaX Power Network Technology (Zhejiang) Co., Ltd.
 Address : No.288, Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province 310000,P. R. CHINA
 Manufacturer : SolaX Power Network Technology (Zhejiang) Co., Ltd.
 Address : No.288, Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province 310000,P. R. CHINA
 EUT : DataHub
 Model Name : DataHub1000
 Trademark : SolaX Power

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
AS/NZS 4268: 2017	PASS

The device described above is tested by EMTEK (NINGBO) CO., LTD. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and EMTEK (NINGBO) CO., LTD. is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the AS/NZS 4268 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of EMTEK (NINGBO) CO., LTD.

Date of Test : November 25, 2021 to January 22, 2022

Prepared by : *June Gao*
 June Gao /Editor

Reviewer : *Vinay*
 Vinay /Supervisor

Approve & Authorized Signer : *Tony Wei*
 Tony Wei/Manager

2. EUT DESCRIPTION

Product:	DataHub
Model Number:	DATAHUB1000
Sample Number:	1#
WLAN Supported:	<input checked="" type="checkbox"/> 802.11b <input checked="" type="checkbox"/> 802.11g <input checked="" type="checkbox"/> 802.11n(20MHz channel bandwidth) <input type="checkbox"/> 802.11n(40MHz channel bandwidth)
Modulation:	<input checked="" type="checkbox"/> DSSS with DBPSK/DQPSK/CCK for 802.11b <input checked="" type="checkbox"/> OFDM with BPSK/QPSK/16QAM/64QAM for 802.11g/n
Frequency Range:	<input checked="" type="checkbox"/> 2412-2472MHz for 802.11b/g/n(HT20) <input type="checkbox"/> 2422-2462MHz for 802.11n(HT40)
Number of Channels:	<input checked="" type="checkbox"/> 13 Channels for 802.11b/g/n(HT20) <input type="checkbox"/> 9 Channels for 802.11n(HT40)
Max Transmit Power:	18.68 dBm
Antenna:	External antenna
Antenna Gain:	5.0 dBi,
Test Voltage:	AC230V, 50Hz
AC Adapter:	M/N: ABT020120D Input: AC 100-240V, 50/60Hz, 1.5A Output: DC 12V, 2A, 24W
Date of Received:	November 25, 2021
Temperature Range:	-20°C ~+60°C

Note: for more details, please refer to the User's manual of the EUT.

Modified History

Version	Summary	Date of Rev.	Report No.
/	Original Report	/	ENB2111250113W00901R



3. SUMMARY OF TEST RESULT

AS/NZS 4268:2017	Description of Test	Result
§6.3	EIRP	Compliant
§6.4	Transmitter Spurious Emissions	Compliant
§6.5	Emission Bandwidth	Compliant
§6.6	Operating Frequencies	Compliant
§7.2	Receiver Emissions	Compliant
Table 1	Power Spectral Density	Compliant
Table 1	Frequency Hopping Requirements	N/A



4. TEST METHODOLOGY

4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards:

AS/NZS 4268:2017 Radio equipment and systems—Short range devices—Limits and methods of measurement

4.2 MEASUREMENT EQUIPMENT USED

For Spurious Emissions Test

Equ.No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
ENE-002	Spectrum Analyzer	Rohde & Schwarz	ESCI	101107	July 08, 2021	1 Year
ENE-002	EMI Test Receiver	Rohde & Schwarz	ESCI	101107	July 08, 2021	1 Year
ENE-009	Pre-Amplifier	CD	PAP-0203	22015	July 08, 2021	1 Year
ENE-010	Bilog Antenna	Schwarzbeck	VULB9163	9163-467	July 08, 2021	2 Year
ENE-025-1	Cable	Huber + Suhner	CBL3-NN-3m	100319-2140500-1	July 08, 2021	1 Year
ENE-025-2	Cable	Huber + Suhner	CBL3-NN-0.5 m	100319-2140500-2	July 08, 2021	1 Year
ENE-025-3	Cable	Huber + Suhner	CBL3-NN-6m	100319-2140500-3	July 08, 2021	1 Year
ENE-088	Spectrum Analyzer	Agilent	E4407B	MY45107013	April 08, 2021	1 Year
ENE-090	Pre-Amplifier	Connphy Microwave Inc.	GLN-1G40G-4165-K	0319104	Nov 22, 2021	1 Year
ENE-060	Horn Antenna	Schwarzbeck	BBHA 9120	9120D-707	July 08, 2021	2 Year
ENE-101-1	Cable	SMAMSMAM	A50-SMAMSM AM-0.5M	19101157	April 28, 2021	1 Year
ENE-101-2	Cable	SMAMSMAM	A50-SMAMSM AM-3M	19101158	July 08, 2021	1 Year
ENE-101-4	Cable	SMAMSMAM	A50-SMAMSM AM-6M	19101160	July 08, 2021	1 Year

For other test items:

Equ.No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
ENE-088	Spectrum Analyzer	Agilent	E4407B	88156318	April 08, 2021	1 Year
ENE-093	Attenuator 10dB	Suzhou talent Microwave	TA10A2-S-18	N/A	July 08, 2021	1 Year

4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

The EUT has been tested under its typical operating condition. so those data rate (802.11b: 1 Mbps; 802.11g: 6 Mbps; 802.11n(HT20):) were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	5	2432	10	2457
2	2417	6	2437	11	2462
3	2422	7	2442	12	2467
4	2427	8	2447	13	2472
		9	2452		

Test Frequency and channel:

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442	13	2472

4.4 Test Software

Item	Software
RF conducted:	EZ-EMC (Ver. CON-03A1)
Radiated Emission:	EMC (Ver. EMEC-3A1)

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

1F Building 4, 1177#, Lingyun Road, Ningbo National Hi-Tech Zone, Ningbo, Zhejiang, China.

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 32.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5.3 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description

EMC Lab.

: **Accredited by CNAS**

The Certificate Registration Number is L6666.

The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2018 (identical to ISO/IEC 17025:2017)

Accredited by FCC

Designation Number: CN1302

Test Firm Registration Number: 436491

Accredited by A2LA

The certificate is valid until May 31, 2023

Accredited by Industry Canada

The Conformity Assessment Body Identifier is CN0114

Name of Firm : EMTEK (NINGBO) CO., LTD.

Site Location : 1F Building 4, 1177#, Lingyun Road, Ningbo National Hi-Tech Zone, Ningbo, Zhejiang, China.

6. TEST SYSTEM UNCERTAINTY

Maximum measurement uncertainty of the test system

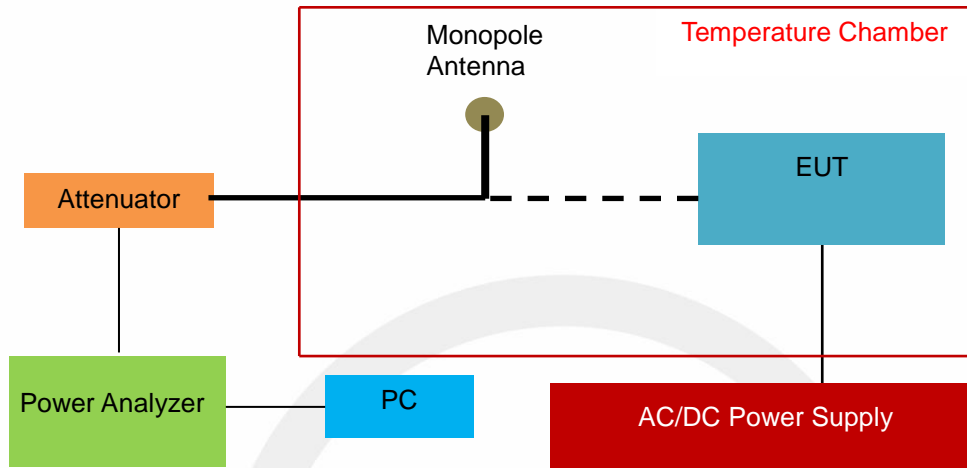
Test Parameter	Measurement Uncertainty
RF Output Power	±1.0%
Power Spectral Density	±0.9%
Medium Utilisation Factor	±1.5%
Occupied Channel Bandwidth	±2.3%
Transmitter Unwanted Emission in the Out-of Band	±1.2%
Transmitter Unwanted Emissions in the Spurious Domain	±2.7%
Receiver Spurious Emissions	±2.7%
Temperature	±3.2%
Humidity	±2.5%



7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

Conducted measurements configuration of EUT shall be as follows:

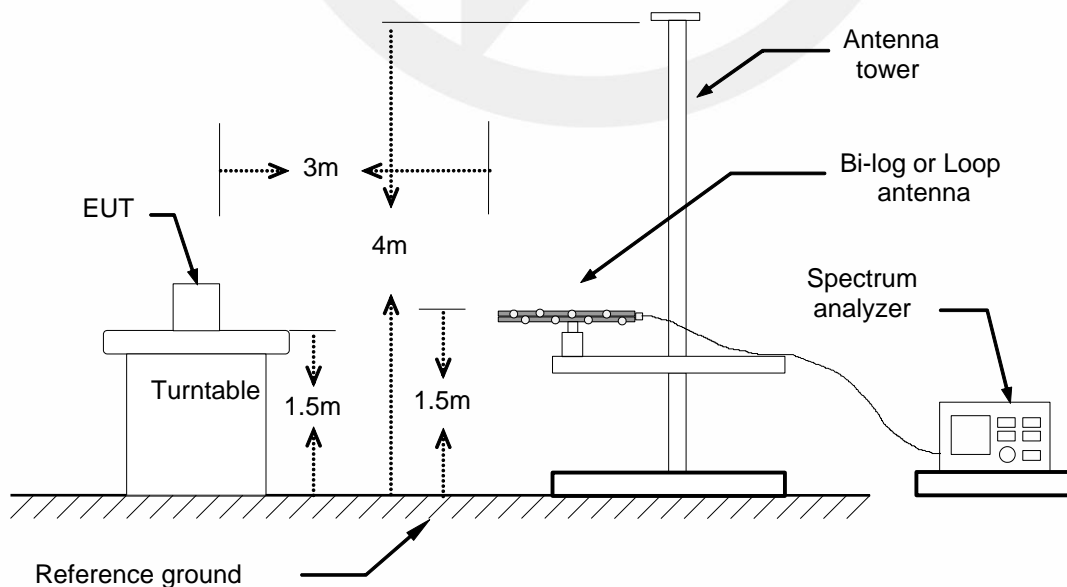


Remarks:

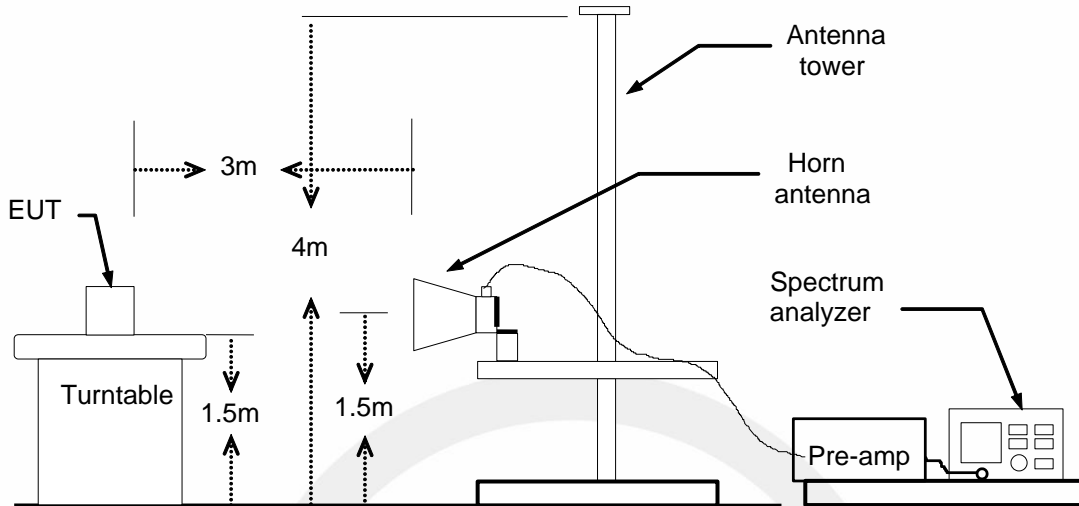
The Signal Analyzer could be connected to a monopole antenna or directly connected to the EUT, if the EUT has already employing an antenna connector.

Radiated measurements configuration of EUT shall be as follows:

Below 1GHz



Above 1GHz



7.2 SUPPORT EQUIPMENT

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

8. TEST REQUIREMENTS

8.1 EQUIVALENT ISOTROPICALLY RADIATED POWER

8.1.1 Applicable standard

According to AS/NZS 4268:2017 section 6.3.1

8.1.2 Conformance Limit

The EIRP shall be not exceeding the value of the following table:

Transmitter application	Permitted operating frequency band	Maximum EIRP
Frequency hopping transmitters	2400.0 to 2483.5 MHz	500mW
Digital modulation transmitters	2400.0 to 2483.5 MHz	4W

8.1.3 Test Configuration

Test according to clause 7.1 radio frequency test setup

8.1.4 Test Procedure

To measure e.i.r.p. it is first necessary to determine the appropriate method of measurement: see clauses 4.2.2.3.1 and 4.2.2.3.2. The -6 dB transmitter bandwidth shall be determined using a 100 kHz measuring bandwidth in order to establish which measurement method is applicable:

- clause 4.2.2.3.1 for Non spread spectrum transmitters with a -6 dB bandwidth of up to 20 MHz and spread spectrum transmitters with channel bandwidth of up to 1 MHz;
- clause 4.2.2.3.2 for all other transmitter bandwidths.

Using the applicable measurement procedure as described in clause 4.2.2.3.2 and annex B, the power output shall be measured and recorded in the test report. The method of measurement shall be documented in the test report.

Measurements shall be performed at normal test conditions (see clause 5.6).

Where possible, the equipment shall be able to operate in a continuous transmit mode for testing purposes.

■ Non spread spectrum transmitters with a -6 dB bandwidth of up to 20 MHz and spread spectrum transmitters with channel bandwidth of up to 1 MHz

● General

The method of measurement in clauses 4.2.2.3.1.1 or 4.2.2.3.1.2 shall only be used for:

- non spread spectrum equipment with a -6 dB bandwidth of 20 MHz or less and a duty cycle above 50 %;
- spread spectrum equipment with a -6 dB channel bandwidth of 1 MHz or less.

For peak power measurements, a spectrum analyser or frequency-selective voltmeter shall be used and tuned to the transmitter carrier at which the highest level is detected.

For FHSS systems, the hop frequency which provides the maximum indicated level shall be used. The frequency shall be indicated in the test report.

Other transmitters are tested according to clause 4.2.2.3.2.

- Equipment measured as constant envelope modulation equipment

For practical reasons, measurements shall be performed only at the highest power level at which

the transmitter is intended to operate.

The measurement shall be performed preferably in the absence of modulation.

When it is not possible to measure it in the absence of modulation, this fact shall be stated in test reports.

The transmitter shall be set in continuous transmission mode. If this is not possible, the measurements shall be carried out in a period shorter than the duration of the transmitted burst. It may be necessary to extend the duration of the burst.

The transmitter shall be connected to an artificial antenna (see clause 5.8.2) and the power delivered to this artificial antenna shall be measured.

The equivalent isotropically radiated power is then calculated from the measured value, the known antenna gain, relative to an isotropic antenna, and if applicable, any losses due to cables and connectors in the measurement system.

● Equipment measured as non-constant envelope modulation equipment

The measurement shall be performed with test signals D-M2 or D-M3 as appropriate.

The transmitter shall be preferably set in continuous transmission mode. If this is not possible, the measurement can be performed in discontinuous mode.

The transmitter shall be connected to an artificial antenna (see clause 5.8.2) and the power delivered to this artificial antenna shall be measured. The measuring instrument shall have a measurement bandwidth not less than sixteen times the channel bandwidth.

The equivalent isotropically radiated power is then calculated from the measured value, the known antenna gain, relative to an isotropic antenna, and if applicable, any losses due to cables and connectors in the measurement system.

■ Transmitters other than those defined in clause 4.2.2.3.1

This method of measurement shall be used for:

- a) equipment with a -6 dB bandwidth greater than 20 MHz, and equipment with a duty cycle below 50 %; or for
- b) spread spectrum equipment with a channel bandwidth above 1 MHz.

The equivalent isotropically radiated power shall be determined and recorded.

In case of radiated measurements on smart antenna systems using symmetrical power distribution across the available transmit chains, the EUT should, where possible, be configured so that only one transmit chain (antenna) is activated while the other transmit chains are disabled. Where this is not possible, the method used shall be documented in the test report. If only one transmit chain was tested, the result for the active transmit chain shall be corrected to be valid for the whole system (all transmit chains).

NOTE: The power (in mW) for one transmit chain needs to be multiplied with the number of transmit chains to obtain the total power for the system.

The measurement shall be performed using normal operation of the equipment with the test modulation applied (see clause 5.8.1).

The test procedure shall be as follows:

Step 1:

- using a suitable means, the output of the transmitter shall be coupled to a matched diode detector;
- the output of the diode detector shall be connected to the vertical channel of an oscilloscope;
- the combination of the diode detector and the oscilloscope shall be capable of faithfully reproducing the envelope peaks and the duty cycle of the transmitter output signal;
- the observed duty cycle of the transmitter ($T_x \text{ on} / (T_x \text{ on} + T_x \text{ off})$) shall be noted as x , ($0 < x < 1$)

and recorded.

Step 2:

- the average output power of the transmitter shall be determined using a wideband, calibrated RF power meter with a matched thermocouple detector or an equivalent thereof and, where applicable, with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);
- the e.i.r.p. shall be calculated from the above measured power output A, the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:
 - $P = A + G + 10 \log (1/x)$;
 - P shall not exceed the value specified in clause 4.2.2.4.

The measurement shall be repeated at the lowest, the middle, and the highest frequency of the stated frequency range.

These frequencies shall be recorded. FHSS equipment shall be made to hop continuously to each of these three frequencies separately.

8.1.5 Test Results

Test Conditions			Transmitter Power (dBm)		
			Temp (25)°C	Temp (-20)°C	Temp (60)°C
MODES	CHANNEL	VOLT POWER	AC 230V	AC 230V	AC 230V
☑ 802.11b	2412 MHz	RMS	18.68	18.21	18.33
	2442 MHz	RMS	18.64	18.33	18.17
	2472 MHz	RMS	17.92	17.64	17.56
☑ 802.11g	2412 MHz	RMS	17.12	17.09	17.11
	2442 MHz	RMS	17.69	17.32	17.24
	2472 MHz	RMS	17.26	17.11	17.16
☑ 802.11n (HT20)	2412 MHz	RMS	17.93	17.87	17.79
	2442 MHz	RMS	17.01	16.97	16.88
	2472 MHz	RMS	17.18	17.14	16.80
Limit			<= 20dBm		
Verdict			PASS	PASS	PASS

8.2 POWER SPECTRAL DENSITY

8.2.1 Applicable standard

According to AS/NZS 4268:2017 table 1 note 2

8.2.2 Conformance Limit

The radiated peak power spectral density in any 3 kHz is limited to 25 mW per 3 kHz

8.2.3 Test Configuration

The measurements for power spectral density shall only be performed at normal test conditions.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s) provided.

8.2.4 Test Procedure

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

The transmitter output (antenna port) was connected to the spectrum analyzer

Set analyzer center frequency to DTS channel center frequency.

Set the span to 1.5 times the DTS bandwidth.

Set the RBW to: 3 kHz

Set the VBW to: 10 kHz.

Set Detector = peak.

Set Sweep time = auto couple.

Set Trace mode = max hold.

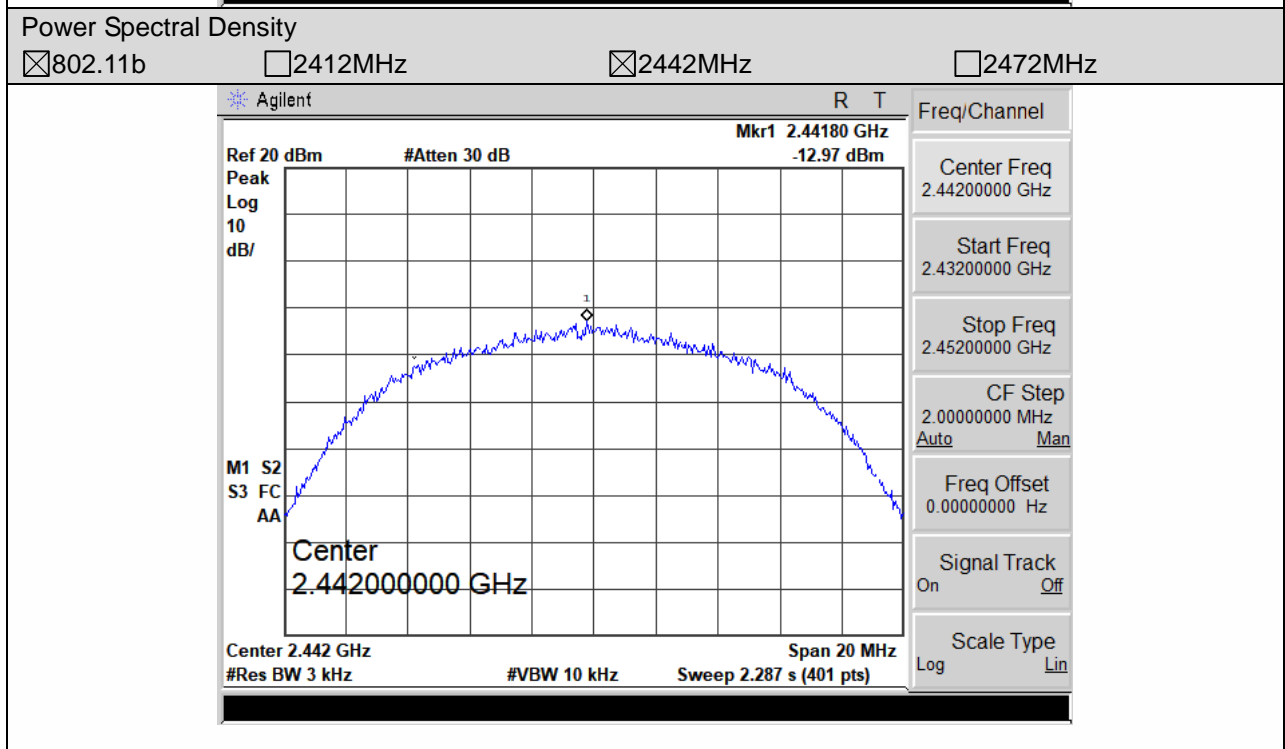
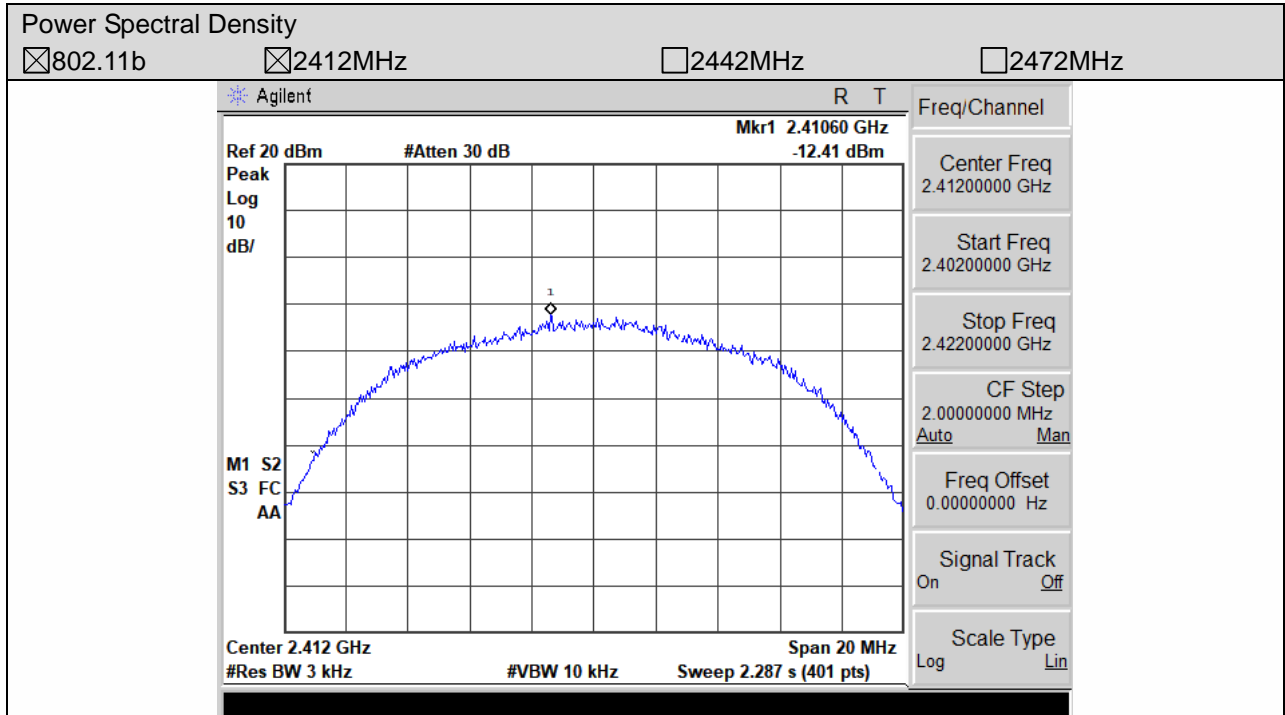
Allow trace to fully stabilize.

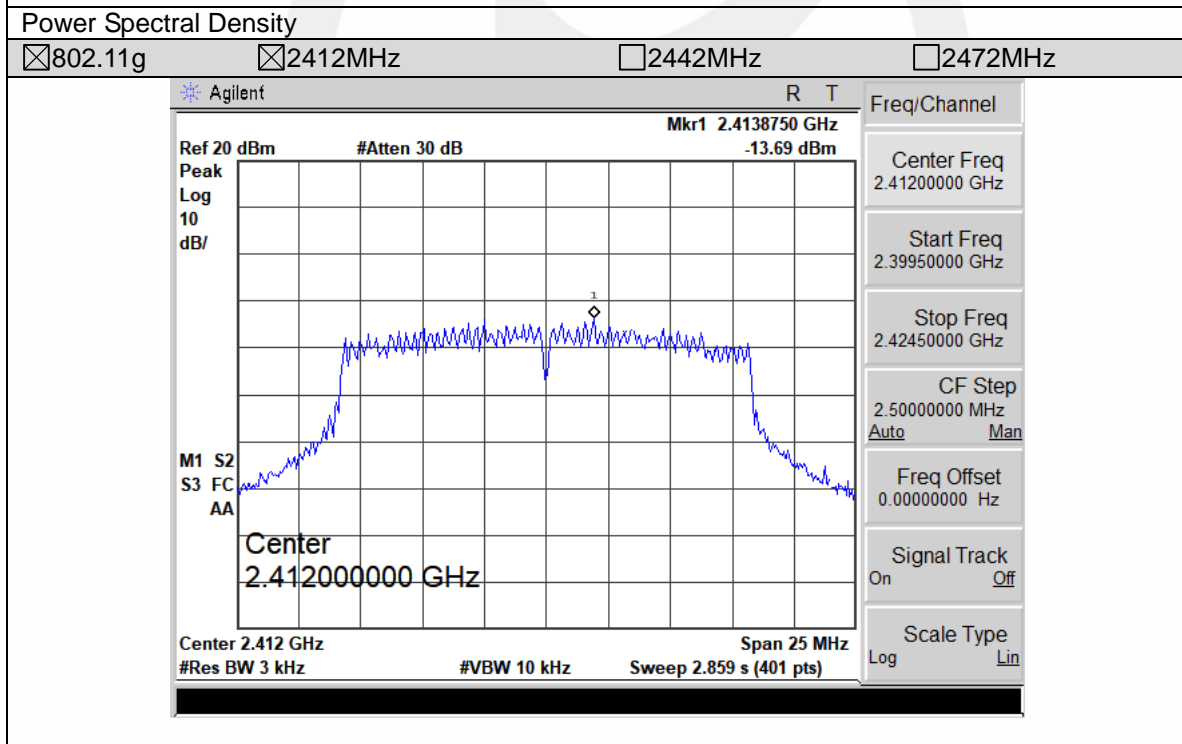
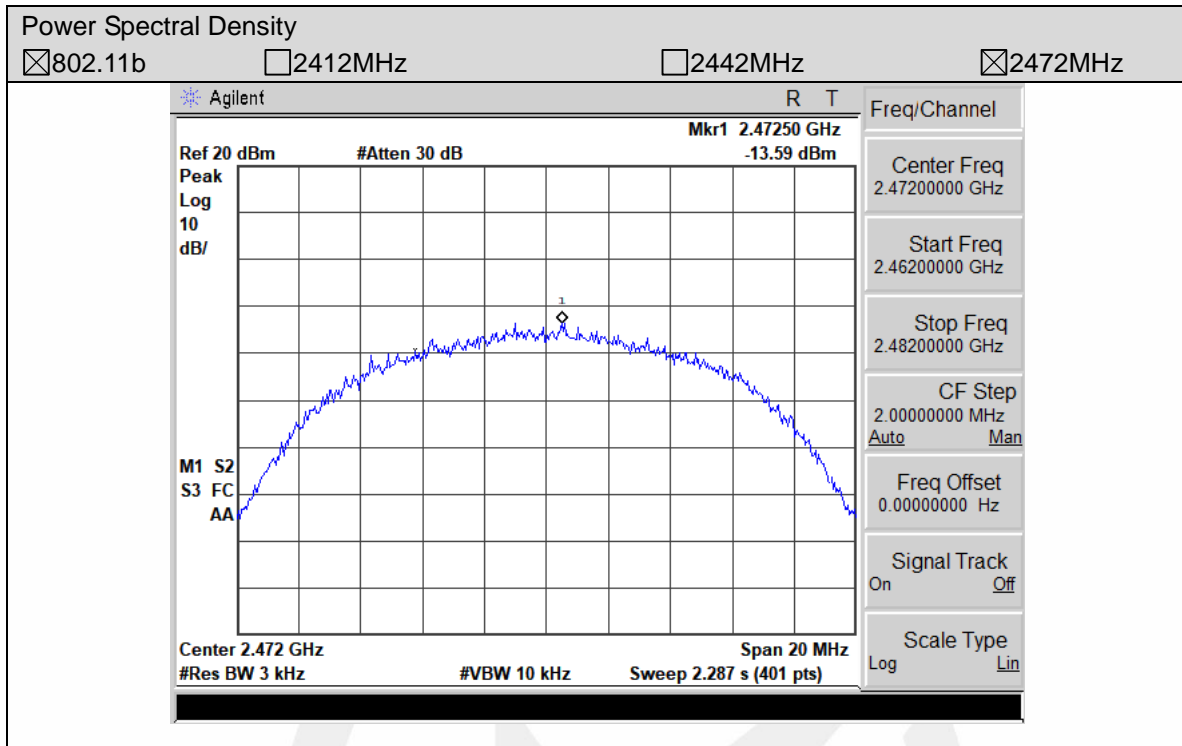
Use the peak marker function to determine the maximum amplitude level within the RBW.

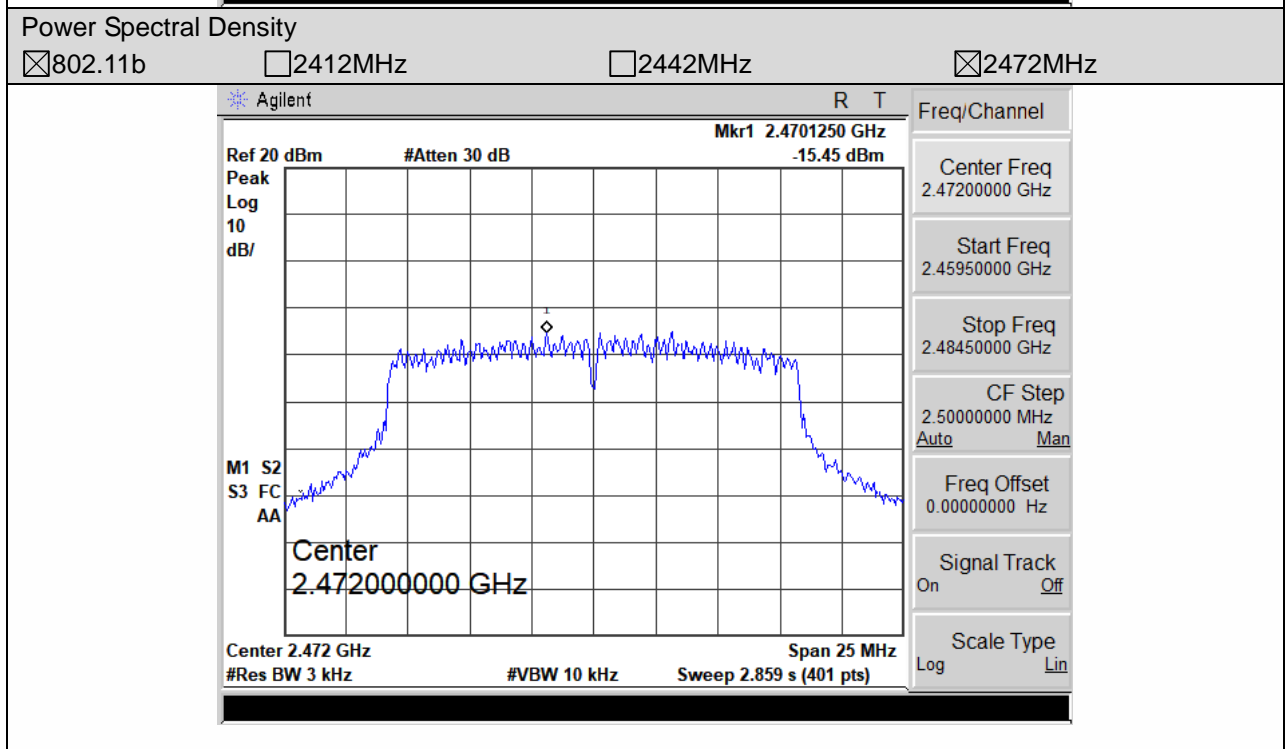
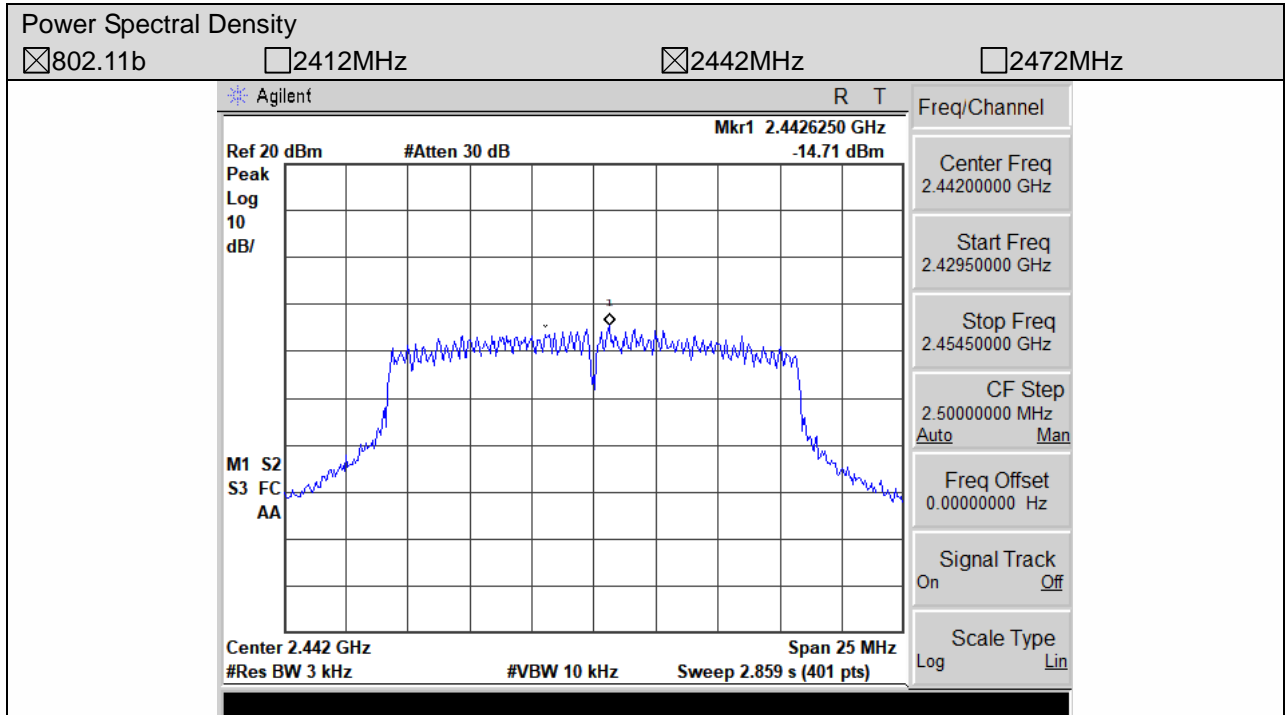
8.2.5 Test Results

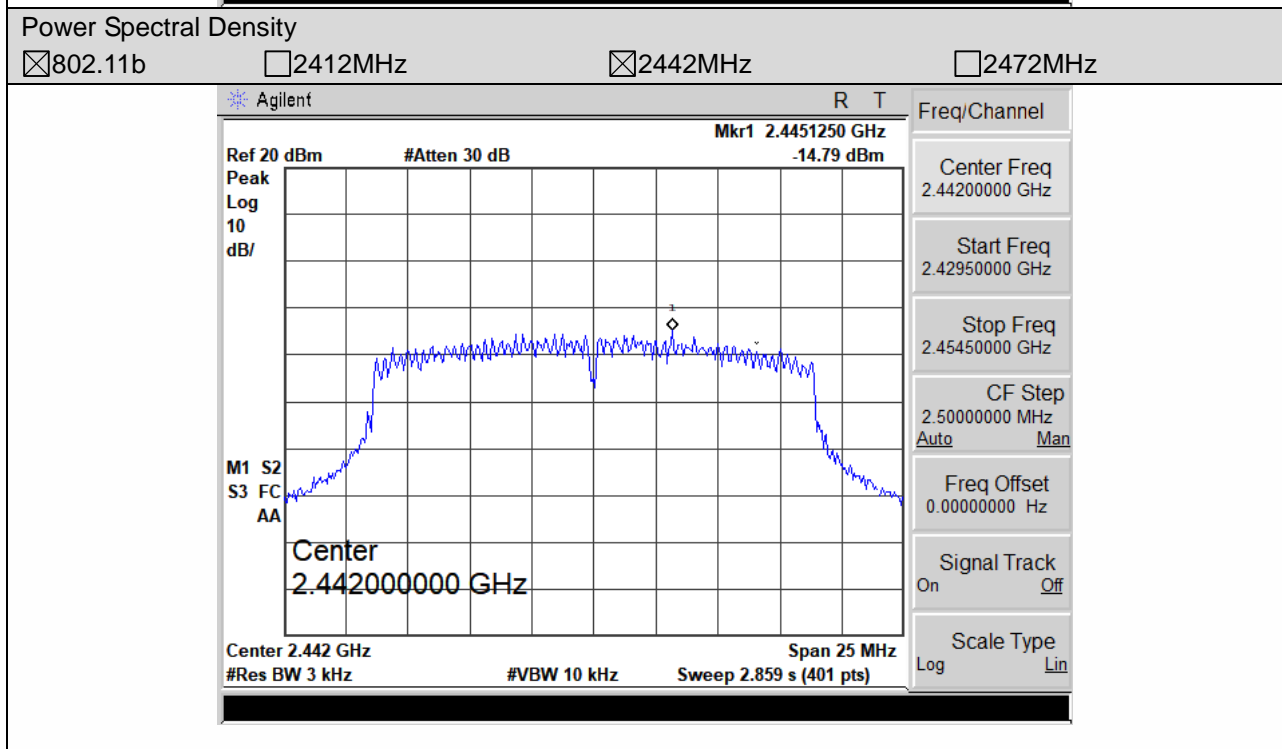
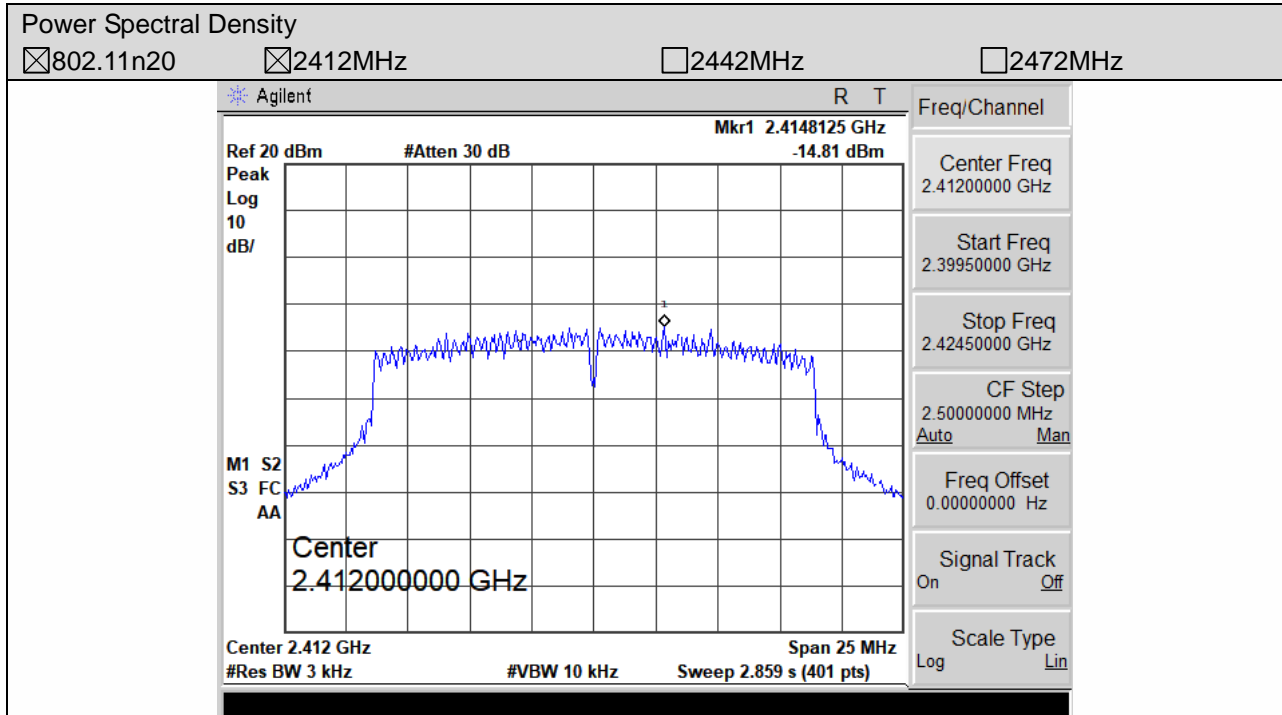
Temperature:		25°C			
Humidity:		55 % RH		Tested by: XSJ	
Test Condition		Measured Data (dBm/3 kHz)	ERP-PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Verdict
☒802.11b	2412MHz	-12.41	-7.41	<=14	PASS
	2442 MHz	-12.97	-7.97	<=14	PASS
	2472 MHz	-13.59	-8.59	<=14	PASS
☒802.11g	2412MHz	-13.69	-8.69	<=14	PASS
	2442 MHz	-13.69	-8.69	<=14	PASS
	2472 MHz	-14.71	-9.71	<=14	PASS
☒802.11n20	2412MHz	-15.45	-10.45	<=14	PASS
	2442 MHz	-14.81	-9.81	<=14	PASS
	2472 MHz	-14.79	-9.79	<=14	PASS

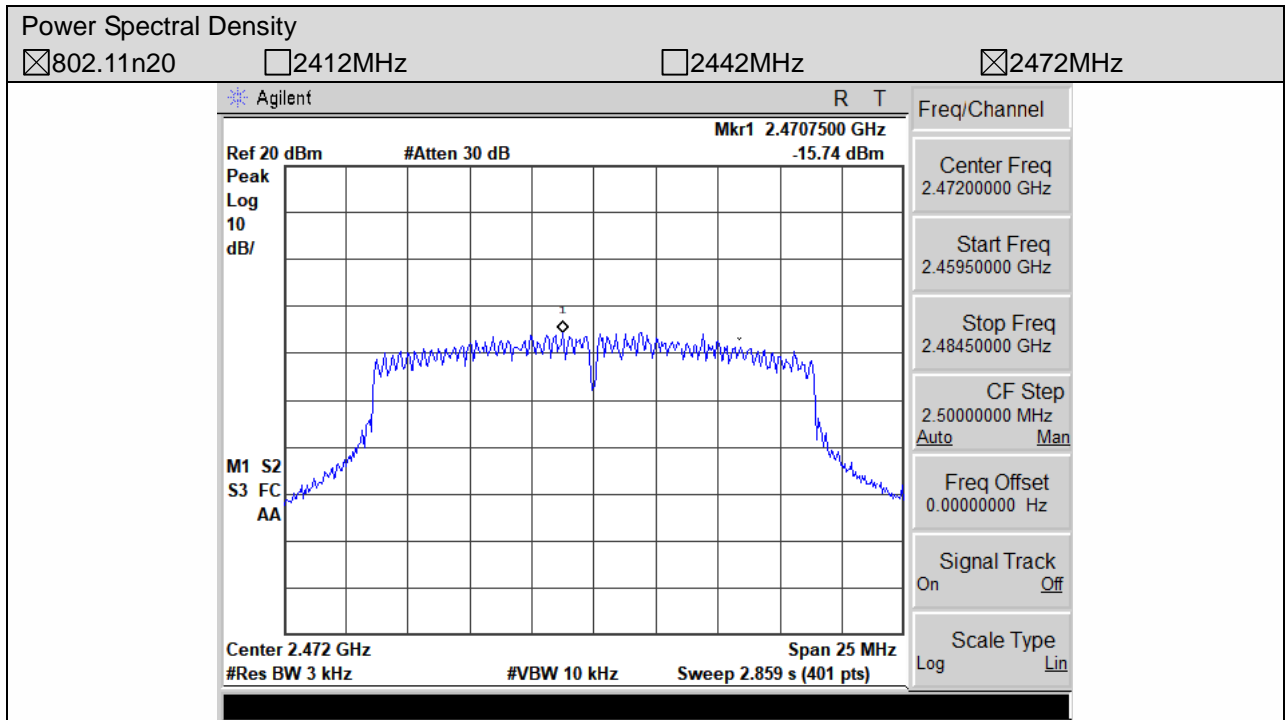
All the modulation modes were tested, the data of the worst mode are described in the following table.











8.3 EMISSION BANDWIDTH

8.3.1 Applicable standard

According to AS/NZS 4268:2017 section 6.5

8.3.2 Conformance Limit

The upper and lower frequency limits of the transmitter 99% emission power bandwidth shall at all times remain within the operating frequency limits.

Some transmitter categories require a specific limit for emission bandwidth. In such cases, the emission bandwidth shall be established by testing in accordance with the relevant specified Standard.

8.3.3 Test Configuration

The measurements for Occupied Channel Bandwidth shall only be performed at normal test conditions.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

8.3.4 Test Procedure

The EUT was operating in 802.11b/g/n mode and controlled its channel. Printed out the test result from the spectrum by hard copy function

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously

Set RBW = 100 kHz.

Set the video bandwidth (VBW) =300 kHz.

Set Span=2 times OBW

Set Detector = Peak.

Set Trace mode = max hold.

Set Sweep = auto couple.

Allow the trace to stabilize.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

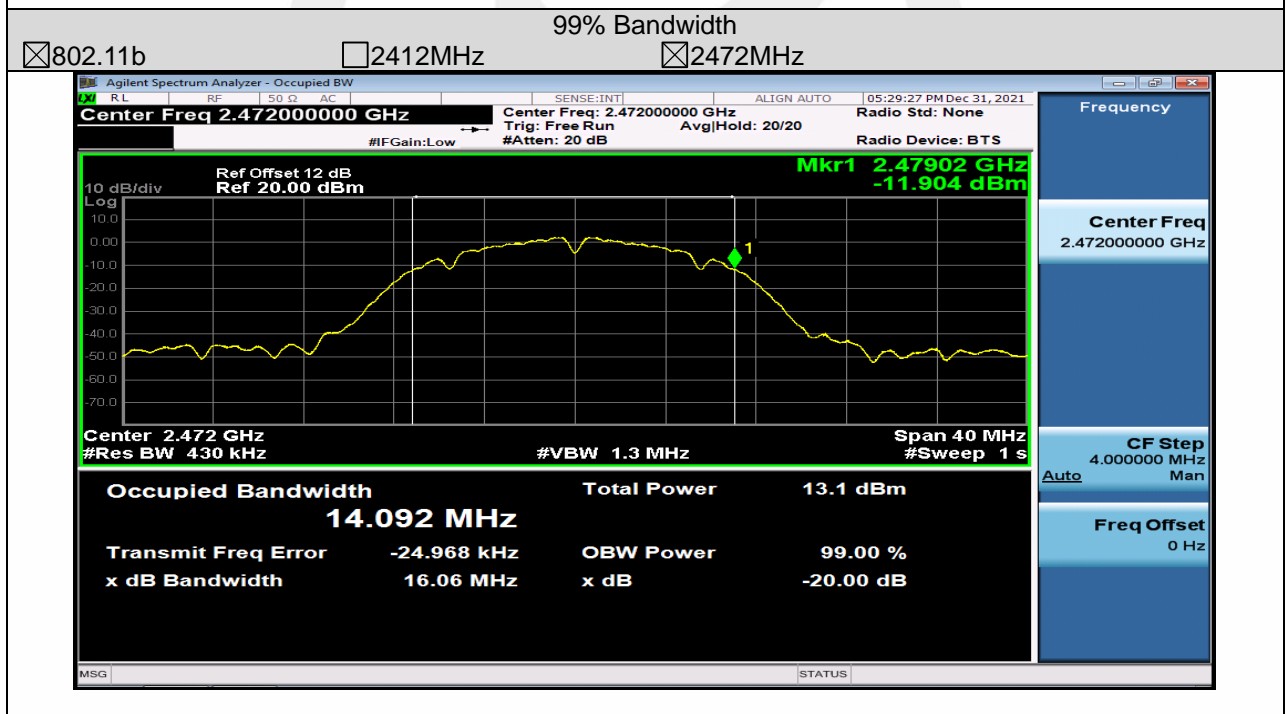
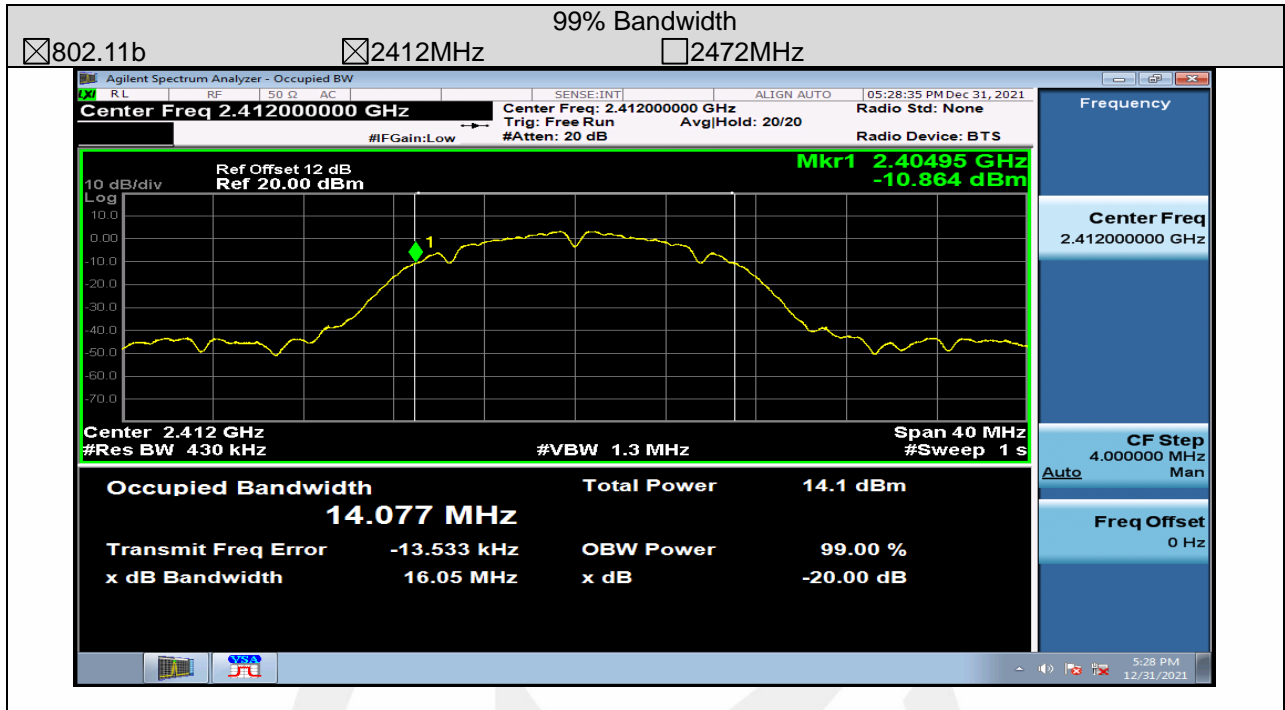
Measure and record the results in the test report.

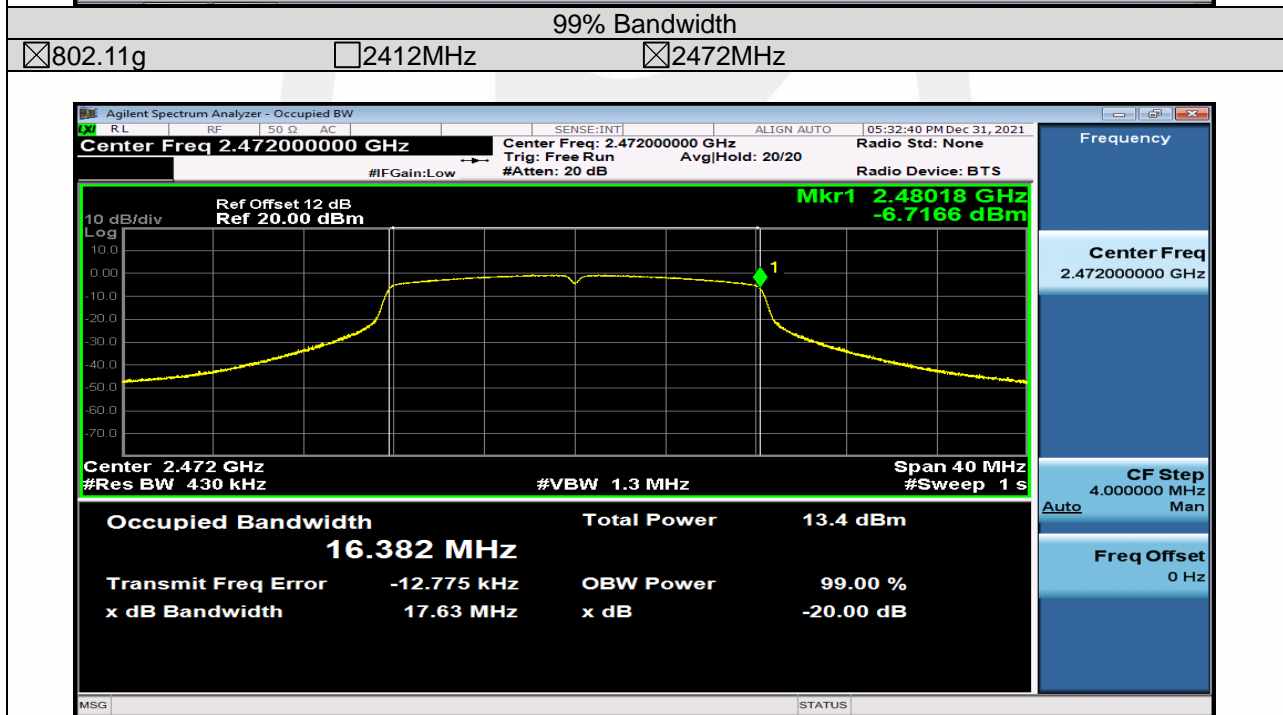
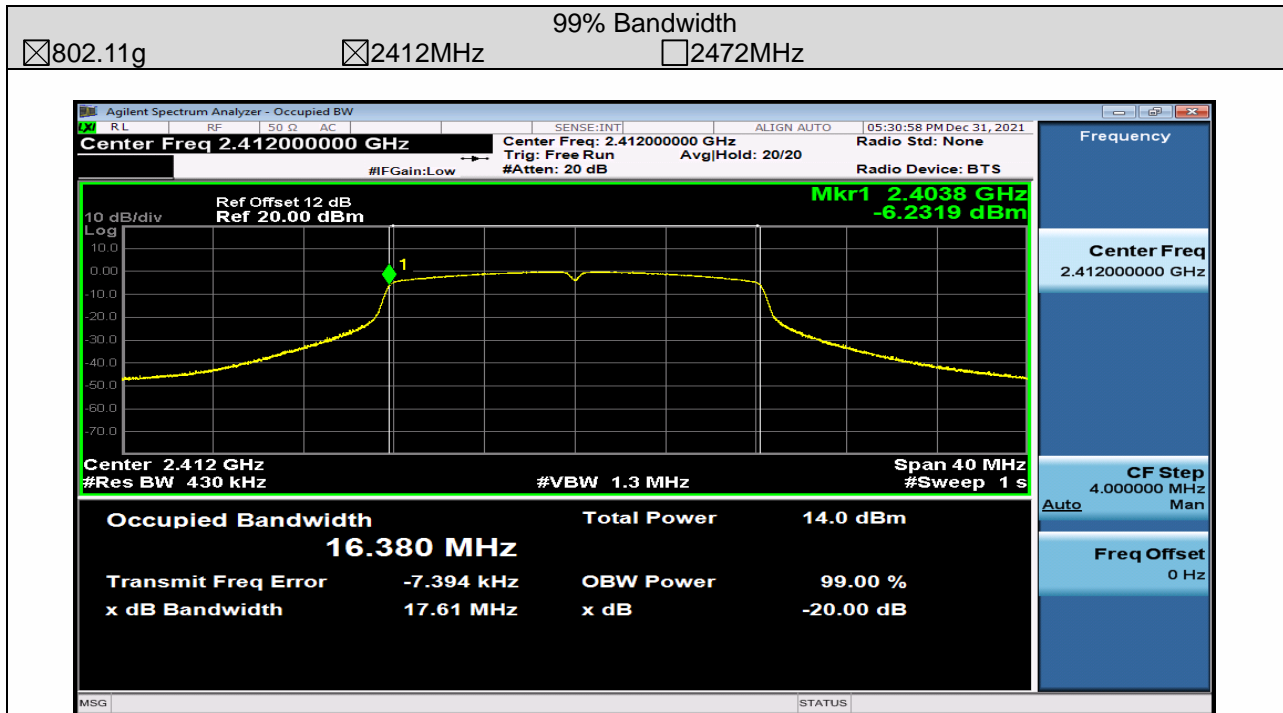
8.3.5 Test Results

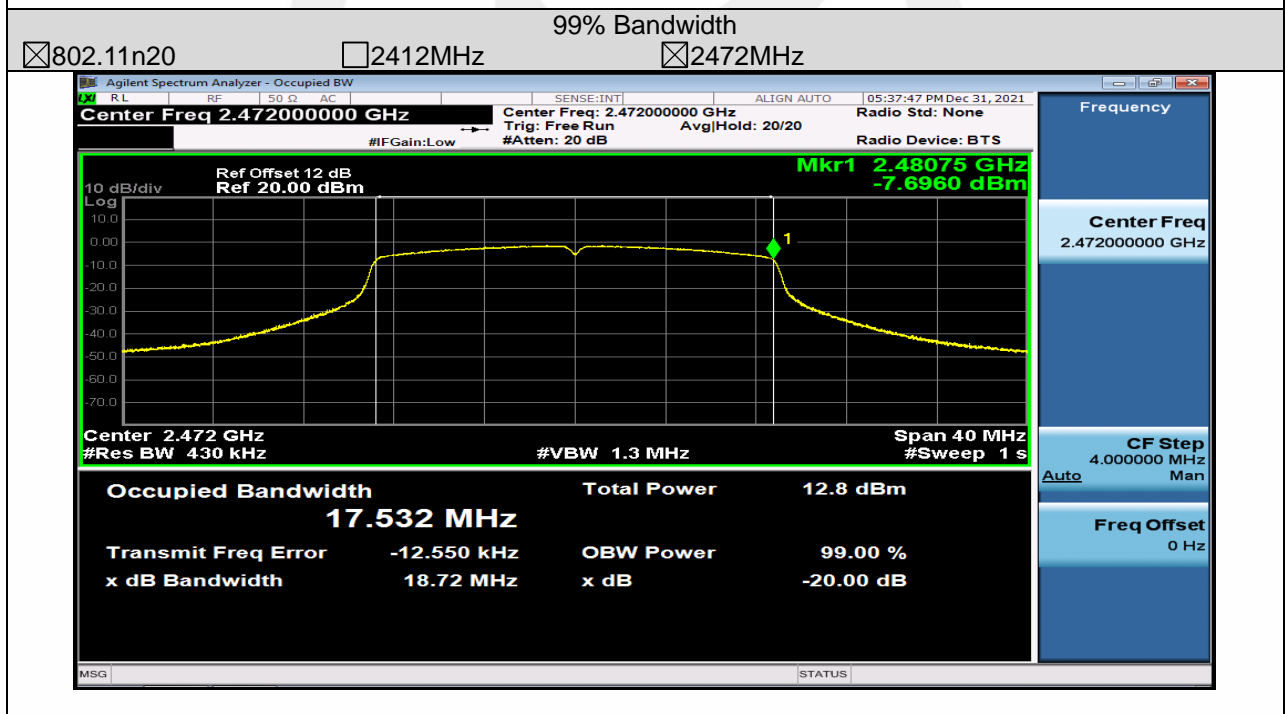
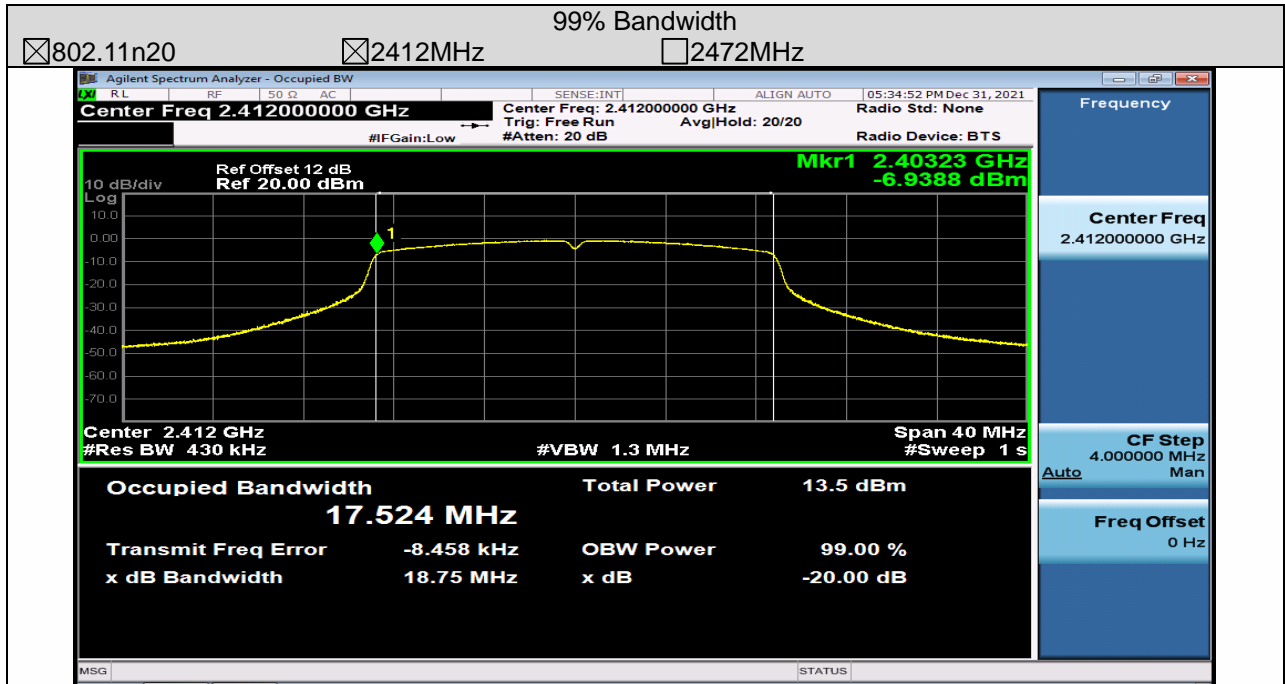
Temperature:		25°C	
Humidity:		55 % RH	XSJ
Operation Mode	Frequency (MHz)	OBW (MHz)	Results
☒802.11b	2412 MHz	14.077	Pass
	2472 MHz	14.092	Pass
☒802.11g	2412 MHz	16.380	Pass
	2472 MHz	16.382	Pass
☒802.11n20	2412 MHz	17.524	Pass
	2472 MHz	17.532	Pass

All the modulation modes were tested, the data of the worst mode are described in the following table









8.4 Operating Frequencies

8.4.1 Applicable standard

According to AS/NZS 4268:2017 section 6.6

8.4.2 Conformance Limit

The emission bandwidth shall be within the designated frequency band, the requirement applies to all transmitter, whether single frequency or multi-channel. And the frequency band is 2400 to 2483.5 MHz

8.4.3 Test Configuration

The measurements for emission in the out-of band shall only be performed at normal test conditions.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

8.4.4 Test Procedure

Please refer to ETSI EN 300 440 clause 4.2.3.3 for the measurement method

■ Description

The permitted range of operating frequencies includes all frequencies on which the equipment may operate within an assigned frequency band. The operating frequency range shall be declared by the manufacturer.

The frequency range of the equipment is determined by the lowest and highest frequencies occupied by the power envelope in accordance with clause 4.2.2.4, table 2.

FH is the highest frequency of the power envelope, it is the frequency furthest above the frequency of maximum power where the output power envelope drops below the level of -75 dBm/Hz spectral power density (e.g. -30 dBm if measured in a 30 kHz reference bandwidth) e.i.r.p.

FL is the lowest frequency of the power envelope; it is the frequency furthest below the frequency of maximum power where the output power drops below the level of -75 dBm/Hz spectral power density (e.g. -30 dBm if measured in a 30 kHz reference bandwidth) e.i.r.p.

The occupied bandwidths and OCW of the transmitter shall be declared. Where differing modes of emission are available, all modes and their associated bandwidths shall be stated.

The range of frequencies, determined by clause 4.2.3, shall be specified in the test report.

■ Method of measurement

The method of measurement for equipment employing FHSS and stepped frequency modulation is given in clause 4.2.3.4.

Using applicable conducted measurement procedures, as described in annex C, the frequency range(s) shall be measured and recorded in the test report.

Where applicable, during these measurements the test data sequence as specified in clauses 5.8.1 and 5.8.1.1 shall be used. The transmitter power level shall be set to the rated power level.

These measurements shall be performed under both normal and extreme operating conditions except for the occupied bandwidth assessment for which measurement at normal operating conditions is sufficient.

The measurement procedure shall be as follows:

- a) put the spectrum analyser in video averaging mode with a minimum of 50 sweeps selected;
- b) select the lowest operating frequency of the equipment under test and activate the transmitter with modulation applied. The RF emission of the equipment shall be displayed on the spectrum analyser;

c) using the marker of the spectrum analyser, find the lowest frequency below the operating frequency at which the spectral power density drops below the level given in clause 4.2.3. This frequency shall be recorded in the test report;

d) select the highest operating frequency of the equipment under test and find the highest frequency at which the spectral power density drops below the value given in clause 4.2.3. This frequency shall be recorded in the test report;

e) the difference between the frequencies measured in steps c) and d) is the operating frequency range. It shall be recorded in the test report.

This measurement shall be repeated for each frequency range declared by the manufacturer.



8.4.5 Test Results

Test conditions		Operating frequency(802.11b)	
		$f_{low}>2400.00\text{MHz}$	$f_{high}<2483.50\text{MHz}$
Tnom(25°C)	Vnom(AC 230V)	2404.948	2479.021
Tmin(-20°C)	Vmin(AC 207V)	2404.886	2479.067
	Vnom(AC 230V)	2404.945	2479.011
	Vmax(AC 254V)	2404.876	2479.018
Tmax(+60°)	Vmin(AC 207V)	2404.698	2479.045
	Vnom(AC 230V)	2404.988	2479.056
	Vmax(AC 254V)	2404.966	2479.073

Note: N/A

Test conditions		Operating frequency(802.11g)	
		$f_{low}>2400.00\text{MHz}$	$f_{high}<2483.50\text{MHz}$
Tnom(25°C)	Vnom(AC 230V)	2403.803	2480.178
Tmin(-20°C)	Vmin(AC 207V)	2403.973	2480.202
	Vnom(AC 230V)	2403.921	2480.166
	Vmax(AC 254V)	2403.665	2480.097
Tmax(+60°)	Vmin(AC 207V)	2403.832	2480.064
	Vnom(AC 230V)	2403.2561	2480.145
	Vmax(AC 254V)	2403.973	2480.115

Note: N/A

Test conditions		Operating frequency(802.11n-HT20)	
		$f_{low}>2400.00\text{MHz}$	$f_{high}<2483.50\text{MHz}$
Tnom(25°C)	Vnom(AC 230V)	2403.230	2480.753
Tmin(-20°C)	Vmin(AC 207V)	2403.246	2480.863
	Vnom(AC 230V)	2403.275	2480.764
	Vmax(AC 254V)	2403.561	2480.778
Tmax(+60°)	Vmin(AC 207V)	2403.534	2480.796
	Vnom(AC 230V)	2403.332	2480.792
	Vmax(AC 254V)	2403.512	2480.798

Note: N/A

8.5 TRANSMITTER SPURIOUS DOMAIN

8.5.1 Applicable standard

According to AS/NZS 4268 clause 6.4

8.5.2 Conformance Limit

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in below. In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.

Frequency Range	Maximum power	bandwidth
30 MHz to 47 MHz	-36dBm	100kHz
47 MHz to 74 MHz	-54dBm	100kHz
74 MHz to 87.5 MHz	-36dBm	100kHz
87.5MHz to118 MHz	-54dBm	100kHz
118 MHz to174MHz	-36dBm	100kHz
174MHz to 230MHz	-54dBm	100kHz
230 MHz to 470 MHz	-36dBm	100kHz
470 MHz to 862 MHz	-54dBm	100kHz
862 MHz to1 GHz	-36dBm	100kHz
1GHz to12.75 GHz	-30dBm	1MHz

8.5.3 Test Configuration

The measurements for emissions in the spurious domain shall only be performed at normal test conditions.

The level of spurious emissions shall be measured as either:

- a)
 - i) their power level in a specified load (conducted emission); and
 - ii) their effective radiated power when radiated by the cabinet and structure of the equipment (cabinet radiation); or
- b) their effective radiated power when radiated by the cabinet and the integral or dedicated antenna, in the case of equipment fitted with such an antenna and no permanent RF connector..

8.5.4 Test Procedure

Please refer to ETSI EN 300 440 clause 4.2.4.3 for the measurement methods..

■ Conducted spurious emission

This method of measurement applies to transmitters having a permanent antenna connector.

Additional requirements for equipment employing FHSS modulation are given in clause 4.2.4.3.4.

- a) The transmitter shall be connected to a measuring receiver through a test load, 50 Ω power attenuator, and if necessary, an appropriate filter to avoid overload of the measuring receiver. The bandwidth of the measuring receiver shall be adjusted until the sensitivity of the measuring receiver is at least 6 dB below the spurious emission limit given in table 3, see clause 4.2.4.4. This bandwidth shall be recorded in the test report.

For the measurement of spurious emissions below the second harmonic of the carrier frequency, the filter used shall be a high "Q" (notch) filter centred on the transmitter carrier frequency, which attenuates this signal by at least 30 dB.

For the measurement of spurious emissions at and above the second harmonic of the carrier frequency the filter used shall be a high pass filter with a stop band rejection exceeding 40 dB. The cut-off frequency of the high pass filter shall be approximately 1,5 times the transmitter carrier frequency.

Precautions may be required to ensure that the test load does not generate or that the high pass filter does not attenuate, the harmonics of the carrier.

b) The transmitter shall be unmodulated and operating at the maximum limit of its specified power range. If modulation cannot be inhibited then the test shall be carried out with modulation (see clause 5.8.1) and this fact shall be recorded in the test report.

c) For carrier frequencies in the range 1 GHz to 20 GHz the frequency of the measuring receiver shall be adjusted over the frequency range 25 MHz to 10 times the carrier frequency, not exceeding 40 GHz. For carrier frequencies above 20 GHz the measuring receiver shall be tuned over the range 25 MHz up to twice the carrier frequency, not exceeding 66 GHz. The frequency and level of every spurious emission found shall be noted.

The emissions within the channel occupied by the transmitter carrier and, for channelized systems its adjacent channels, shall not be recorded.

d) If the measuring receiver has not been calibrated in terms of power level at the transmitter output, the level of any detected components shall be determined by replacing the transmitter by the signal generator and adjusting it to reproduce the frequency and level of every spurious emission noted in step c). The absolute power level of each of the emissions shall be noted.

e) The frequency and level of each spurious emission measured and the bandwidth of the measuring receiver shall be recorded in the test report.

f) If a user accessible power adjustment is provided then the tests in steps c) to e) shall be repeated at the lowest power setting available.

g) The measurement in steps c) to f) shall be repeated with the transmitter in the standby condition if this option is available.

■ Method of measurement - cabinet spurious radiation

This method of measurement applies to transmitters having a permanent antenna connector. For equipment without a permanent antenna connector see clause 4.2.4.3.3.

Additional requirements for equipment employing FHSS modulation are given in clause 4.2.4.3.4.

a) A test site selected from annex B which fulfils the requirements of the specified frequency range of this measurement shall be used. The test antenna shall be oriented initially for vertical polarization and connected to a measuring receiver. The bandwidth of the measuring receiver shall be adjusted until the sensitivity of the measuring receiver, after allowing for the coupling loss, is at least 6 dB below the spurious emission limit given in table 3, see clause 4.2.4.4. This bandwidth shall be recorded in the test report.

The transmitter under test shall be placed on the support in its standard position, connected to an artificial antenna (see clause 5.8.2) and switched on without modulation. If modulation cannot be inhibited then the test shall be carried out with modulation, (see clause 5.8.1), and this fact shall be recorded in the test report.

b) For carrier frequencies in the range 1 GHz to 20 GHz the frequency of the measuring receiver shall be adjusted over the frequency range 25 MHz to 10 times the carrier frequency, not exceeding 40 GHz. For carrier frequencies above 20 GHz the measuring receiver shall be tuned over the range 25 MHz up to twice the carrier frequency, not exceeding 66 GHz, except for the channel on which the transmitter is intended to operate and for channelized systems, its adjacent channels. The frequency of each spurious emission detected shall be noted. If the test site is disturbed by interference coming from outside the site, this qualitative search may be performed in a screened room, with a reduced distance between the transmitter and the test antenna.

c) At each frequency at which an emission has been detected, the measuring receiver shall be tuned and

the test antenna shall be raised or lowered through the specified height range until the maximum signal level is detected on the measuring receiver.

- d) The transmitter shall be rotated through 360° about a vertical axis, to maximize the received signal.
- e) The test antenna shall be raised or lowered again through the specified height range until a maximum is obtained. This level shall be noted.
- f) The substitution antenna (see clause B.2.3) shall replace the transmitter antenna in the same position and in vertical polarization. It shall be connected to the signal generator.
- g) At each frequency at which an emission has been detected, the signal generator, substitution antenna, and measuring receiver shall be tuned. The test antenna shall be raised or lowered through the specified height range until the maximum signal level is detected on the measuring receiver. The level of the signal generator giving the same signal level on the measuring receiver as in item e) shall be noted. After corrections due to the gain of the substitution antenna and the cable loss between the signal generator and the substitution antenna, is the radiated spurious emission at this frequency.
- h) The frequency and level of each spurious emission measured and the bandwidth of the measuring receiver shall be recorded in the test report.
- i) Steps c) to h) shall be repeated with the test antenna oriented in horizontal polarization.
- j) If a user accessible power adjustment is provided then the tests in steps c) to h) shall be repeated at the lowest power setting available.
- k) Steps c) to i) shall be repeated with the transmitter in the standby condition if this option is available.

■ Method of measurement - radiated spurious emission

This method of measurement applies to transmitters having an integral antenna.

Additional requirements for equipment employing FHSS modulation are given in clause 4.2.4.3.4.

a) A test site selected from annex B which fulfils the requirements of the specified frequency range of this measurement shall be used. The test antenna shall be oriented initially for vertical polarization and connected to a measuring receiver, through a suitable filter to avoid overloading of the measuring receiver if required.

The bandwidth of the measuring receiver shall be adjusted until the sensitivity of the measuring receiver, after allowing for the coupling loss, is at least 6 dB below the spurious emission limit given in table 3, see clause 4.2.4.4. This bandwidth shall be recorded in the test report.

For the measurement of spurious emissions below the second harmonic of the carrier frequency the optional filter used shall be a high "Q" (notch) filter centred on the transmitter carrier frequency and attenuating this signal by at least 30 dB.

For the measurement of spurious emissions at and above the second harmonic of the carrier frequency the optional filter used shall be a high pass filter with a stop band rejection exceeding 40 dB. The cut-off frequency of the high pass filter shall be approximately 1,5 times the transmitter carrier frequency.

The transmitter under test shall be placed on the support in its standard position and shall be switched on without modulation. If modulation cannot be inhibited then the test shall be carried out with modulation (see clause 6.1) and this fact shall be recorded in the test report.

b) The same method of measurement as steps b) and k) of clause 4.2.4.3.2 shall be used.

8.5.5 Test Results

All the modulation modes were tested, the data of the worst mode are recorded in the following pages and the others modulation methods do not exceed the limits.

Radiation Spurious Emission

■ Emissions In the Spurious Domain below 1GHz

Operation Mode: <input checked="" type="checkbox"/> 802.11b		Tested by: XSJ			
Operation frequency: <input checked="" type="checkbox"/> 2412MHz					
Temperature: 25°C		Humidity: 55 % RH			
Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Verdict	
250.3011	<input checked="" type="checkbox"/> V	<input type="checkbox"/> conducted	-49.06	-36.00	PASS
334.8588			-49.73	-36.00	PASS
400.4318			-39.97	-36.00	PASS
451.1350			-45.24	-36.00	PASS
477.1693			-57.41	-54.00	PASS
651.9417			-57.45	-54.00	PASS
337.2155	<input checked="" type="checkbox"/> H	<input type="checkbox"/> conducted	-44.46	-36.00	PASS
350.4767			-42.10	-36.00	PASS
400.4318			-39.95	-36.00	PASS
495.9344			-60.11	-54.00	PASS
535.7073			-62.48	-54.00	PASS
651.9417			-58.19	-54.00	PASS

Emissions In the Spurious Domain above 1GHz.

Operation Mode: <input checked="" type="checkbox"/> 802.11b		Tested by: XSJ			
Operation frequency: <input checked="" type="checkbox"/> 2412MHz					
Temperature: 25°C		Humidity: 55 % RH			
Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Frequency (MHz)	
3620.250	<input checked="" type="checkbox"/> V	<input type="checkbox"/> conducted	-43.06	-30.00	PASS
4824.625			-40.25	-30.00	PASS
6593.000			-41.95	-30.00	PASS
8079.375			-39.23	-30.00	PASS
10335.37			-36.08	-30.00	PASS
11046.25			-35.05	-30.00	PASS
3620.250	<input checked="" type="checkbox"/> H	<input type="checkbox"/> conducted	-45.41	-30.00	PASS
4824.625			-42.92	-30.00	PASS
6845.625			-41.09	-30.00	PASS
8802.000			-38.43	-30.00	PASS
9559.875			-36.71	-30.00	PASS
10652.62			-34.46	-30.00	PASS

■ Conducted measurement

Operation Mode: 802.11b

Operation frequency: 2412MHz

Temperature: 25°C

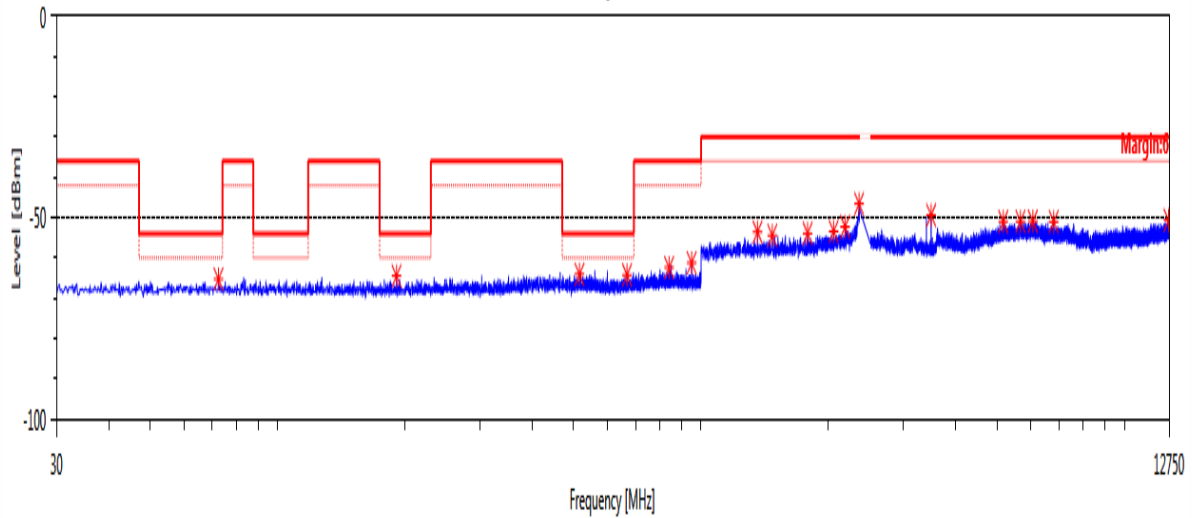
Test date: August 28, 2020

Humidity: 55 % RH

Tested by: XW

Frequency (MHz)	Antenna Polarization		Emission level (dBm)	Limit (dBm)	Verdict
1244.99	<input checked="" type="checkbox"/> H	<input type="checkbox"/> conducted	-68.78	-47.00	PASS
4144.30			-59.44	-47.00	PASS
7016.59			-53.93	-47.00	PASS
9056.39			-51.74	-47.00	PASS
10439.95			-50.11	-47.00	PASS
11639.03			-50.35	-47.00	PASS
2414.11	<input checked="" type="checkbox"/> V		-67.77	-47.00	PASS
4614.89			-59.41	-47.00	PASS
7182.85			-55.11	-47.00	PASS
9046.40			-52.49	-47.00	PASS
10043.97			-50.34	-47.00	PASS
11569.71			-50.24	-47.00	PASS

Antenna 1 Tx Spurious Emission



8.6 RECEIVER SPURIOUS EMISSIONS

8.6.1 Applicable standard

According to AS/NZS 4268 clause 7.2

8.6.2 Conformance Limit

The spurious emissions of the receiver shall not exceed the values given in below.

In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

Frequency Range	Maximum power	bandwidth
below 1GHz	-57.00dBm	120kHz
above 1000MHz	-47.00dBm	1MHz

8.6.3 Test Configuration

The measurements for spurious radiations shall only be performed at normal test conditions.

The level of spurious radiations shall be measured by either:

- a) their power level in a specified load (conducted spurious emission) and their effective radiated power when radiated by the cabinet and structure of the equipment (cabinet radiation); or
- b) their effective radiated power when radiated by the cabinet and the integral or dedicated antenna, in the case of portable equipment fitted with such an antenna and no permanent RF connector.

8.6.4 Test Procedure

Please refer to ETSI EN 300 440 clause 4.3.5.3 for the measurement methods

■ General Requirements

For measurements above 1 000 MHz the peak value shall be measured using a spectrum analyser. The "max hold" function of a spectrum analyser shall be used. For measurements up to 1 000 MHz the quasi-peak detector set in accordance with the specification of CISPR 16 [1], [2] and [3] shall be used.

■ Method of measurement conducted spurious components

This method of measurement applies to receivers having a permanent antenna connector.

A test load, 50 Ω power attenuator, may be used to protect the measuring receiver (see clause 6.5) against damage when testing a receiver combined in one unit with a transmitter.

The measuring receiver used shall have sufficient dynamic range and sensitivity to achieve the required measurement accuracy at the specified limit. The bandwidth of the measuring receiver shall be adjusted until the sensitivity of the measuring receiver is at least 6 dB below the spurious emission limit given in clause 4.3.5.4. This bandwidth shall be recorded in the test report:

- a) The receiver input terminals shall be connected to a measuring receiver having an input impedance of 50 Ω and the receiver is switched on.
- b) For carrier frequencies in the range 1 GHz to 20 GHz the frequency of the measuring receiver shall be adjusted over the frequency range 25 MHz to 10 times the carrier frequency, not exceeding 40 GHz. For carrier frequencies above 20 GHz the measuring receiver shall be tuned over the range 25 MHz up to twice the carrier frequency not exceeding 66 GHz. The frequency and the absolute power level of each of

the spurious components found shall be noted.

c) If the detecting device is not calibrated in terms of power input, the level of any detected components shall be determined by replacing the receiver by the signal generator and adjusting it to reproduce the frequency and level of every spurious component noted in step b). The absolute power level of each spurious component shall be noted.

d) The frequency and level of each spurious emission measured and the bandwidth of the measuring receiver shall be recorded in the test report.

■ Method of measurement cabinet radiation

This method of measurement applies to receivers having a permanent antenna connector.

a) A test site selected from annex B which fulfils the requirements of the specified frequency range of this measurement shall be used. The test antenna shall be oriented initially for vertical polarization and connected to a measuring receiver. The bandwidth of the measuring receiver shall be adjusted until the sensitivity of the measuring receiver is at least 6 dB below the spurious emission limit given in clause 4.3.5.4. This bandwidth shall be recorded in the test report.

The receiver under test shall be placed on the support in its standard position and connected to an artificial antenna, see clause 5.8.2.

b) For carrier frequencies in the range 1 GHz to 20 GHz the frequency of the measuring receiver shall be adjusted over the frequency range 25 MHz to 10 times the carrier frequency, not exceeding 40 GHz. For carrier frequencies above 20 GHz the measuring receiver shall be tuned over the range 25 MHz up to twice the carrier frequency not exceeding 66 GHz. The frequency of each spurious component shall be noted. If the test site is disturbed by radiation coming from outside the site, this qualitative search may be performed in a screened room with reduced distance between the transmitter and the test antenna.

c) At each frequency at which a component has been detected, the measuring receiver shall be tuned and the test antenna shall be raised or lowered through the specified height range until the maximum signal level is detected on the measuring receiver.

d) The receiver shall be rotated up to 360° about a vertical axis, to maximize the received signal.

e) The test antenna shall be raised or lowered again through the specified height range until a maximum is obtained. This level shall be noted.

f) The substitution antenna (see clause B.3.2) shall replace the receiver antenna in the same position and in vertical polarization. It shall be connected to the signal generator.

g) At each frequency at which a component has been detected, the signal generator, substitution antenna and measuring receiver shall be tuned. The test antenna shall be raised or lowered through the specified height range until the maximum signal level is detected on the measuring receiver. The level of the signal generator giving the same signal level on the measuring receiver as in step e) shall be noted. This level, after correction due to the gain of the substitution antenna and the cable loss, is the radiated spurious component at this frequency.

h) The frequency and level of each spurious emission measured and the bandwidth of the measuring receiver shall be recorded in the test report.

i) Measurements b) to h) shall be repeated with the test antenna oriented in horizontal polarization.

■ Method of measurement radiated spurious components

This method of measurement applies to receivers having an integral antenna.

a) A test site selected from annex B which fulfils the requirements of the specified frequency range of this measurement shall be used. The test antenna shall be oriented initially for vertical polarization and connected to a measuring receiver. The bandwidth of the measuring receiver shall be adjusted until the sensitivity of the measuring receiver is at least 6 dB below the spurious emission limit given in clause 4.3.5.4. This bandwidth shall be recorded in the test report.

The receiver under test shall be placed on the support in its standard position.

b) The same method of measurement as items b) to i) of clause 4.3.5.3.2 shall apply.

8.6.5 Test Results

All the modulation modes were tested, the data of the worst mode are described in the following table
Radiation spurious Emission

■ Receiver Spurious Emissions below 1GHz

Operation Mode:		<input checked="" type="checkbox"/> 802.11b	
Operation frequency:		<input checked="" type="checkbox"/> 2412MHz	
Temperature:		25°C	
Humidity:		55 % RH	
		Tested by: XSJ	

Frequency (MHz)	Antenna Polarization		Emission level (dBm)	Limit (dBm)	Verdict
250.3011	<input checked="" type="checkbox"/> V	<input type="checkbox"/> conducted	-62.49	-57.00	PASS
350.4767			-60.88	-57.00	PASS
400.4318			-62.20	-57.00	PASS
451.1350			-61.53	-57.00	PASS
729.3582			-60.82	-57.00	PASS
900.1474			-61.76	-57.00	PASS
170.1947	<input checked="" type="checkbox"/> H		-65.05	-57.00	PASS
350.4767			-63.53	-57.00	PASS
400.4318			-61.19	-57.00	PASS
485.6092			-61.09	-57.00	PASS
750.1082			-62.73	-57.00	PASS
952.0937			-60.77	-57.00	PASS

■ Receiver Spurious Emissions above 1GHz

Operation Mode:		<input checked="" type="checkbox"/> 802.11b	
Operation frequency:		<input checked="" type="checkbox"/> 2412MHz	
Temperature:		25°C	
Humidity:		55 % RH	
		Tested by: XSJ	

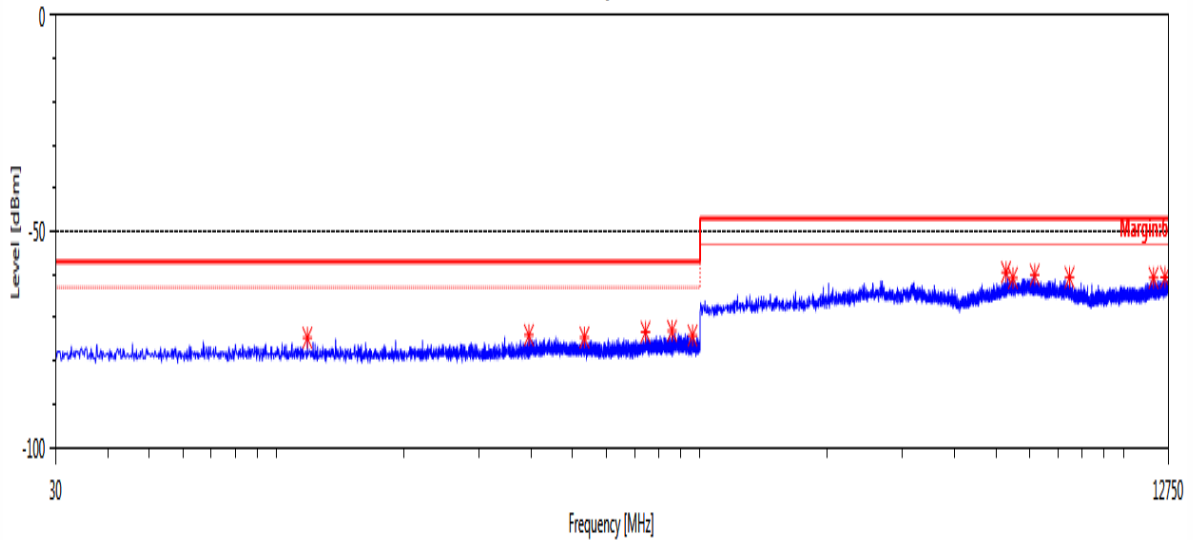
Frequency (MHz)	Antenna Polarization		Emission level (dBm)	Limit (dBm)	Verdict
3620.250	<input checked="" type="checkbox"/> V	<input type="checkbox"/> conducted	-43.06	-47.00	PASS
4824.625			-40.25	-47.00	PASS
6593.000			-41.95	-47.00	PASS
8079.375			-39.23	-47.00	PASS
10335.37			-36.08	-47.00	PASS
11046.25			-35.05	-47.00	PASS
3620.250	<input checked="" type="checkbox"/> H		-45.41	-47.00	PASS
4824.625			-42.92	-47.00	PASS
6845.625			-41.09	-47.00	PASS
8802.000			-38.43	-47.00	PASS
9559.875			-36.71	-47.00	PASS
10652.62			-34.46	-47.00	PASS

■ Conducted measurement

Operation Mode: 802.11b 802.11g 802.11n(HT20) 802.11n(HT40)
 Operation frequency: 2412MHz Temperature: 24°C
 Humidity: 55 % RH Tested by: ZXL

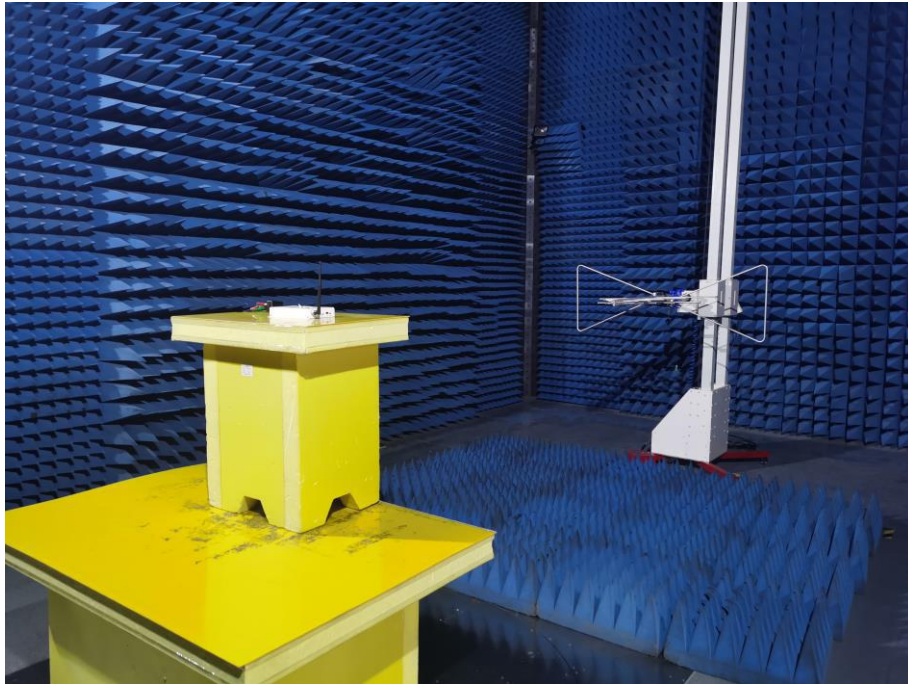
Frequency (MHz)	Antenna Polarization		Emission level (dBm)	Limit (dBm)	Verdict
118.100	<input type="checkbox"/> V	<input checked="" type="checkbox"/> conducted	-74.64	-57.00	PASS
394.100			-74.04	-57.00	PASS
533.100			-74.58	-57.00	PASS
743.200			-73.31	-57.00	PASS
858.300			-73.05	-57.00	PASS
959.800			-74.13	-57.00	PASS
5282.000	<input type="checkbox"/> H		-59.47	-47.00	PASS
5484.000			-60.80	-47.00	PASS
6175.000			-60.09	-47.00	PASS
7462.000			-60.67	-47.00	PASS
11780.000			-60.74	-47.00	PASS
12543.000			-60.61	-47.00	PASS

Antenna 1 Rx Spurious Emission

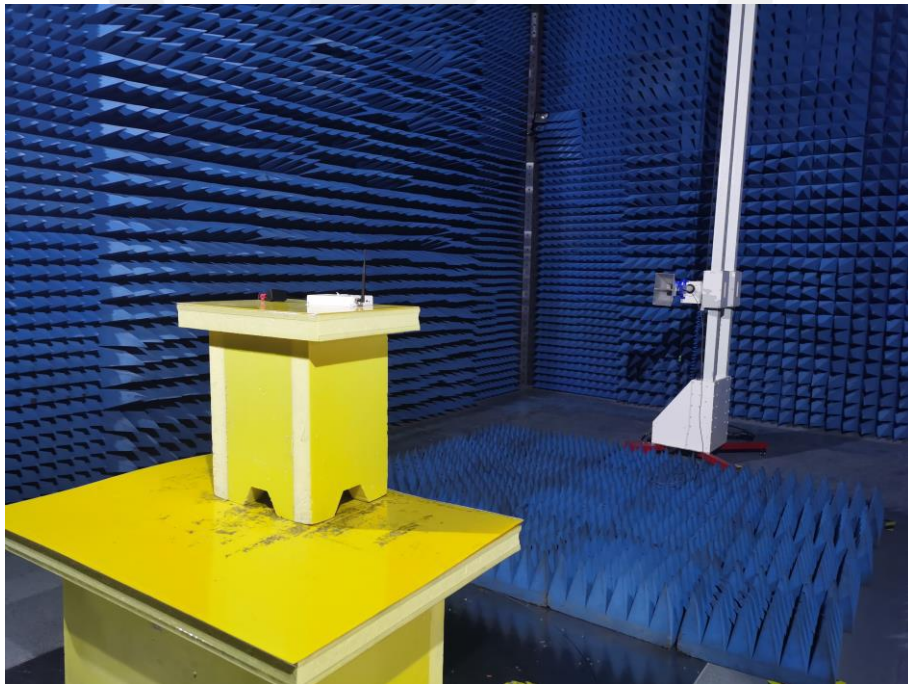


9. PHOTOGRAPH OF TEST

Below 1GHz



Above 1GHz



10. PHOTOGRAPHS OF EUT

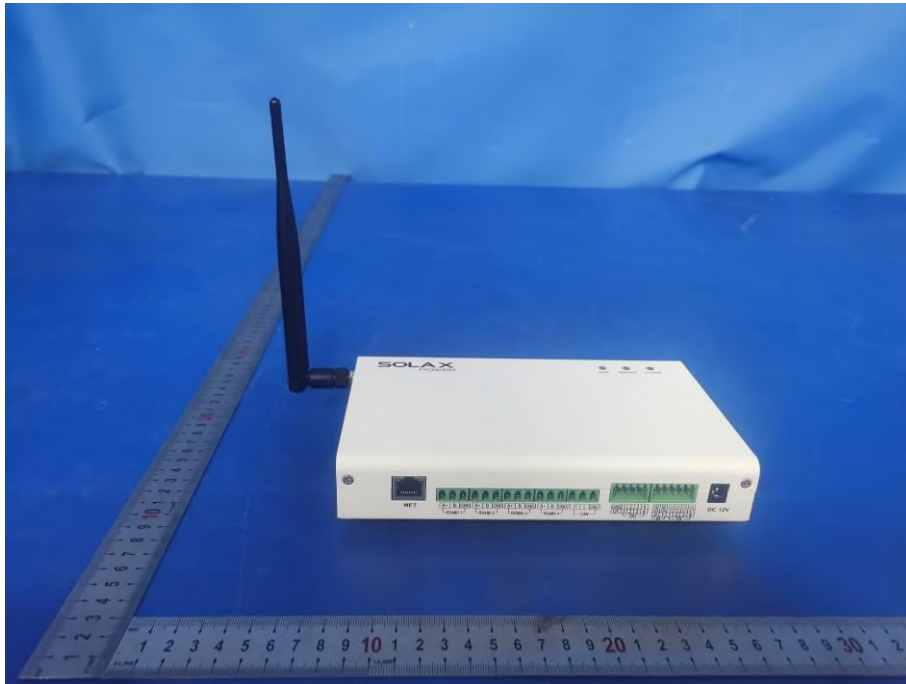
EUT View 1



EUT View 2



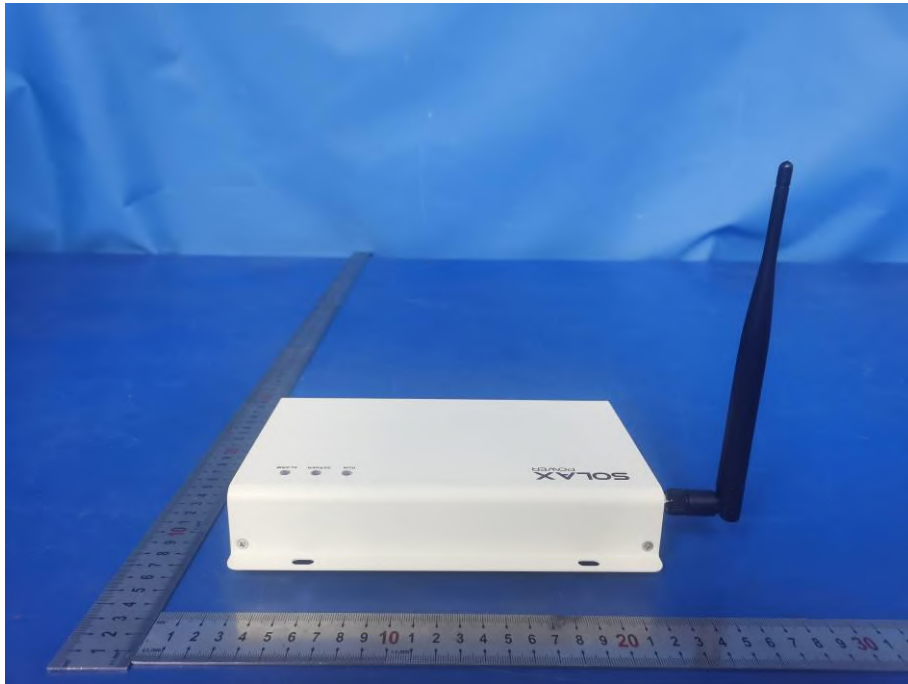
EUT View 3



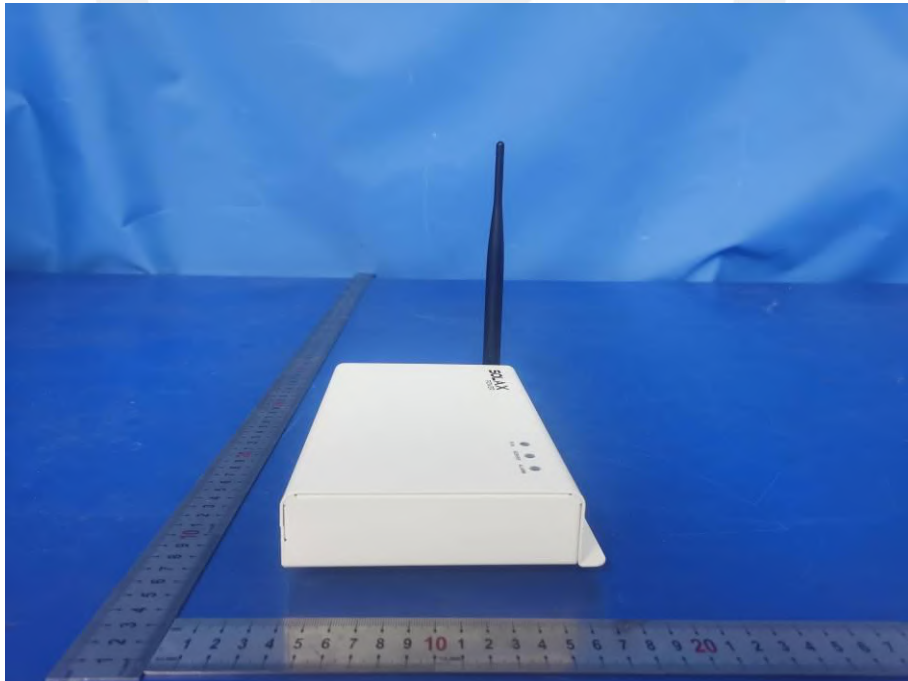
EUT View 4



EUT View 5



EUT View 6



EUT View 7



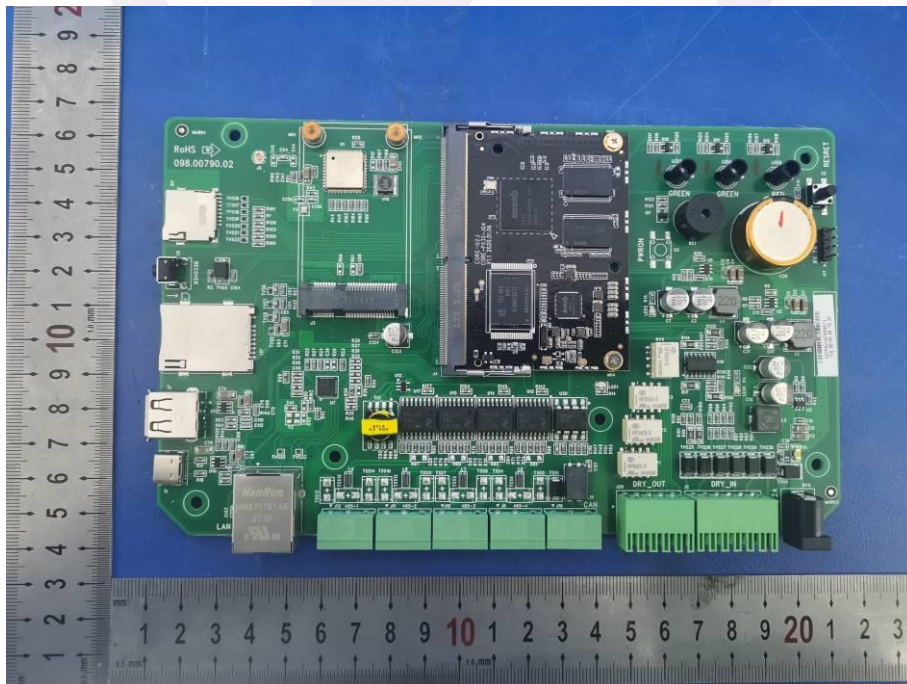
EUT View 8



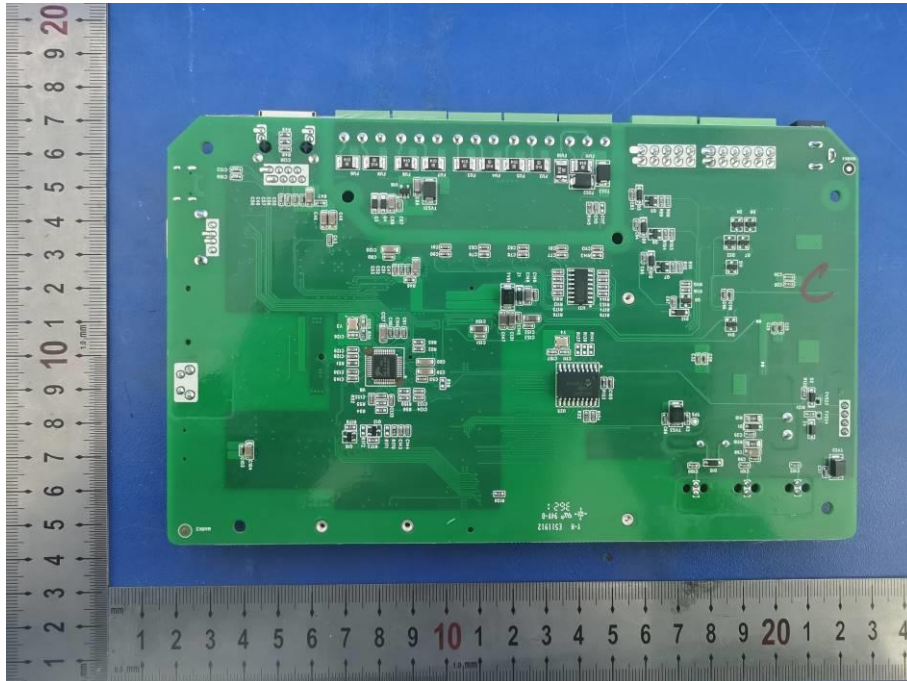
EUT Housing and Board View 1



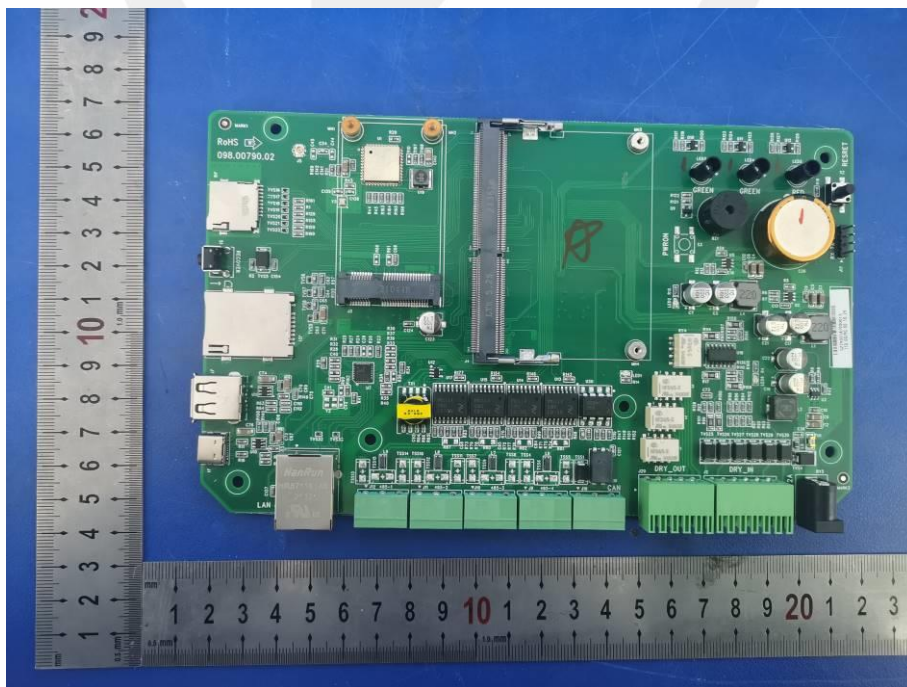
Solder Board-Component View 1



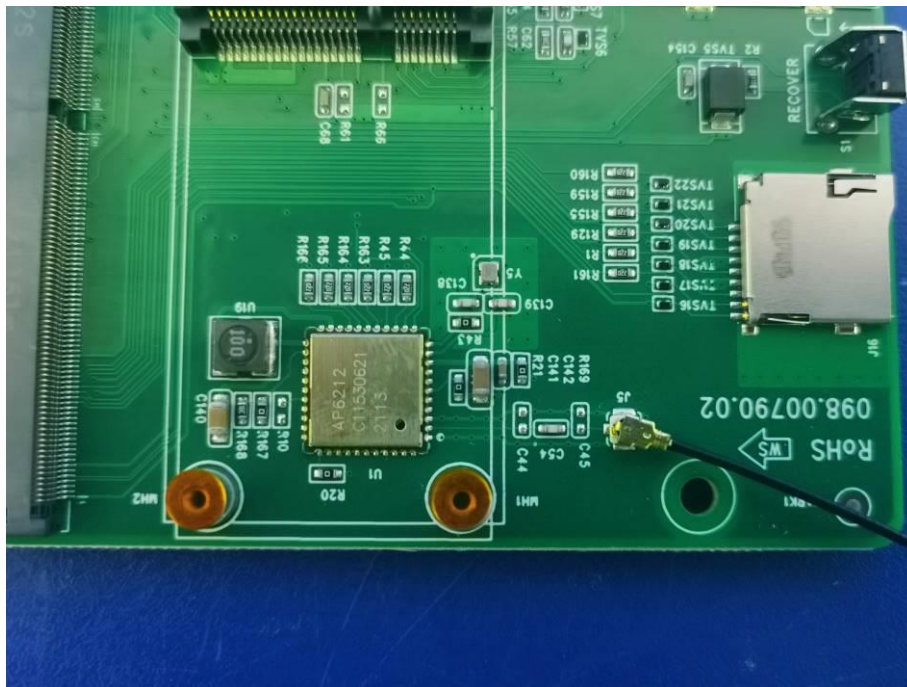
Solder Board-Component View 2



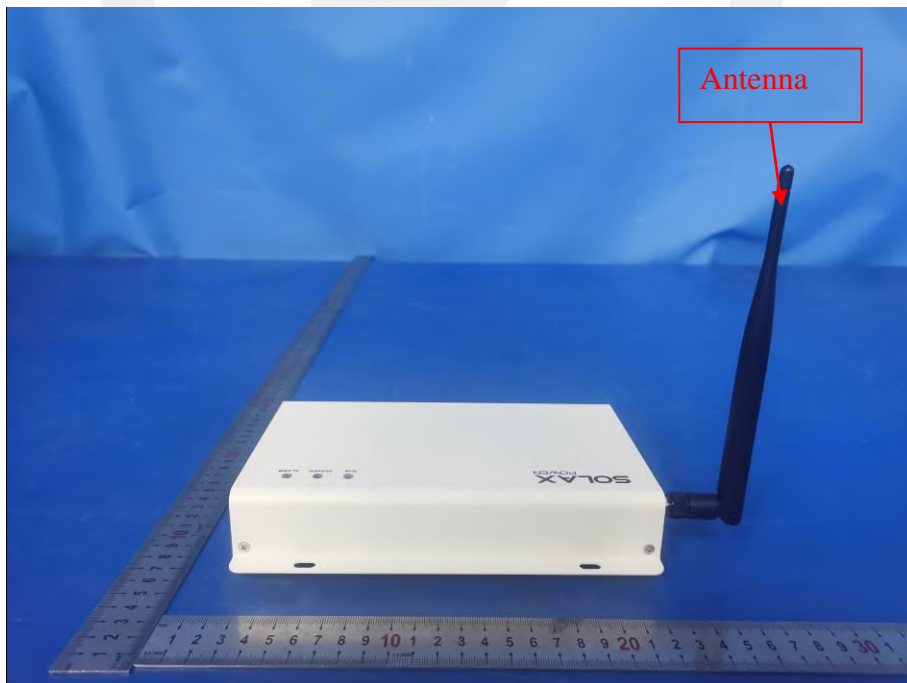
Solder Board-Component View 3



Solder Board-Component View 6



Antenna



*** End of Report ***

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