TEST REPORT

Report No. ..... :	**CHTEW19120172**
Project No……:	**SHT1911014903EW**
FCC ID..... :	**2AVGZWF-1V**
Applicant's name..... :	**WireFree Ultrasound, LLC**
Address.....:	1400 112th Ave SE, Suite 100, Bellevue, WA 98004, USA
Manufacturer.....:	WuHan Youkey Bio-Medical Electronics Co., Ltd.
Address.....:	2nd Floor, Dingxin Industry Park, Jiayuan Road, East Lake Development Zone, 430074, Wuhan, P. R. China
Test item description ..... :	**Veterinarian Pocket Ultrasound System**
Trade Mark .....:	Wirefree
Model/Type reference.....:	WF-1v
Listed Model(s) .....:	C5-2v, C5-2Sv, L11-4v, L11-4Sv, E10-4v, C8-5v
Standard ..... :	**FCC CFR Title 47 Part 15 Subpart E Section 15.407**
Date of receipt of test sample……....:	Nov.26, 2019
Date of testing……..:	Nov.26, 2019- Dec.24, 2019
Date of issue……....:	Dec.25, 2019
Result..... ……..:	**PASS**

Report Verification:

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Testing Laboratory Name ..... :	**Shenzhen Huatongwei International Inspection Co., Ltd.**
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The test report merely correspond to the test sample.

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1. TEST STANDARDS AND REPORT VERSION

1.1. Test Standards

The tests were performed according to following standards:

– FCC Rules Part 15.407: General technical requirements.

– ANSI C63.10:2013: American National Standard for Testing Unlicensed Wireless Devices

– KDB789033 D02 v02r01: GUIDELINES FOR COMPLIANCE TESTING OF UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII) DEVICES PART 15, SUBPART E

1.2. Report version

Revision No.	Date of issue	Description
N/A	2019-12-25	Original

2. TEST DESCRIPTION

Report clause	Test Items	Standard Requirement	Result
5.1	Antenna Requirement	15.203/15.247(c)	PASS
5.2	AC Conducted Emission	15.207	PASS
5.3	Maximum Conducted Output Power	15.407(a)	PASS
5.4	Maximum Power Spectral Density	15.407(a)	PASS
5.5	26dB Bandwidth and 99% Ocuppy bandwith	15.407(a)	PASS
5.6	6dB Bandwidth	15.407(a)	PASS
5.7	Band edge	15.407(b)	PASS
5.8	Radiated Spurious Emissions	15.209	PASS
5.9	Frequency Stability	15.407(g)	PASS

Note:

– The measurement uncertainty is not included in the test result.

3. SUMMARY

3.1. Client Information

Applicant:	WireFree Ultrasound, LLC
Address:	1400 112th Ave SE, Suite 100, Bellevue, WA 98004, USA
Manufacturer:	WuHan Youkey Bio-Medical Electronics Co., Ltd.
Address:	2nd Floor, Dingxin Industry Park, Jiayuan Road, East Lake Development Zone, 430074, Wuhan, P. R. China

3.2. Product Description

Name of EUT:	Veterinarian Pocket Ultrasound System
Trade Mark:	Wirefree
Model No.:	WF-1v
Listed Model(s):	C5-2v, C5-2Sv, L11-4v, L11-4Sv, E10-4v, C8-5v
Power supply:	DC 7.4V
Hardware version:	PCB B 1000 MB101 0
Software version:	V1.3.2
Adapter information:	Model:GS-551 Input:110-240Va.c., 50/60Hz 0.6A Max Output:5Vd.c., 3A max or 9Vd.c., 2A max or 12Vd.c., 1.5A max

3.3. Radio Specification Description

Support type*1	☒ 802.11a	☒ 802.11n(HT20)	☐ 802.11n(HT40)
	☐ 802.11ac(HT20)	☐ 802.11ac(HT40)	☐ 802.11ac(HT80)
Function:	☐ Outdoor AP	☐ Indoor AP	☐ Fixed P2P
	☒ Client		
Modulation:	BPSK, QPSK, 16QAM, 64QAM		
Operation frequency:	☒ Band I:	5150MHz~5250MHz	
	☐ Band IV:	5725MHz~5850MHz	
Channel number:	4 for 802.11a/802.11n(HT20)		
Supported Bandwidth	20MHz:	802.11n, 802.11a	
Antenna type:	Chip antenna		
Antenna gain:	3.3dBi		

Note:

*1: only show the RF function associated with this report.

3.4. Testing Laboratory Information

Laboratory Name	Shenzhen Huatongwei International Inspection Co., Ltd.	
Laboratory Location	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China	
Qualifications	Type	Accreditation Number
	CNAS	L1225
	A2LA	3902.01
	FCC	762235
	Canada	5377A

4. TEST CONFIGURATION

4.1. Test frequency list

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channels which were tested. The Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the below blue front.

Band	Test Channel	20MHz	
		Channel	Frequency (MHz)
I	CH_L	36	5180
	CH_M	44	5220
	CH_H	48	5240

4.2. Descriptions of Test mode

Preliminary tests were performed in different data rates, final test modes are considering the modulation and worse data rates as below table.

Modulation	Data rate
802.11a	6Mbps
802.11n(HT20)	MCS0

4.3. Test mode

For RF test items
The engineering test program was provided and enabled to make EUT continuous transmit.
For AC power line conducted emissions:
The EUT was set to connect with the WLAN AP under large package sizes transmission.
For Radiated spurious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data Recorded in the report.

4.4. Support unit used in test configuration and system

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The following peripheral devices and interface cables were connected during the measurement:

Whether support unit is used?					
✓ Yes					
Item	Equipement	Trade Name	Model No.	CMIIT ID	Power cord
1	Tablet PC	Lenovo	YT-X703F	2016AJ3408	N/A
2					

4.5. Testing environmental condition

Type	Requirement	Actual
Temperature:	15~35°C	25°C
Relative Humidity:	25~75%	50%
Air Pressure:	860~1060mbar	1000mbar

4.6. Measurement uncertainty

Test Item	Measurement Uncertainty
AC Conducted Emission (150kHz~30MHz)	3.02 dB
Radiated Emission (30MHz~1000MHz	4.90 dB
Radiated Emissions (1GHz~25GHz)	4.96 dB
Peak Output Power	0.51 dB
Power Spectral Density	0.51 dB
Conducted Spurious Emission	0.51 dB
6dB Bandwidth	70 Hz
Frequency error	70 Hz

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.7. Equipment Used during the Test

● Conducted Emission							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Shielded Room	Albatross projects	HTWE0114	N/A	N/A	2018/09/28	2023/09/27
●	EMI Test Receiver	R&S	HTWE0111	ESCI	101247	2019/10/26	2020/10/25
●	Artificial Mains	SCHWARZBECK	HTWE0113	NNLK 8121	573	2019/10/23	2020/10/22
●	Pulse Limiter	R&S	HTWE0033	ESH3-Z2	100499	2019/10/23	2020/10/22
●	RF Connection Cable	HUBER+SUHNER	HTWE0113-02	ENVIROFLEX_142	EF-NM-BNCM-2M	2019/10/23	2020/10/22
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Radiated emission-6th test site							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0127	SAC-3m-02	C11121	2018/09/30	2021/09/29
●	EMI Test Receiver	R&S	HTWE0099	ESCI	100900	2019/10/26	2020/10/25
●	Loop Antenna	R&S	HTWE0170	HFH2-Z2	100020	2018/04/02	2021/04/01
●	Ultra-Broadband Antenna	SCHWARZBECK	HTWE0119	VULB9163	546	2017/04/05	2020/04/04
●	Pre-Amplifer	SCHWARZBECK	HTWE0295	BBV 9742	N/A	2019/11/14	2020/11/13
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-01	N/A	N/A	2019/08/21	2020/08/20
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-02	SUCOFLEX 104	501184/4	2019/05/27	2020/05/26
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Radiated emission-7th test site							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0122	SAC-3m-01	N/A	2018/09/27	2021/09/26
●	Spectrum Analyzer	R&S	HTWE0098	FSP40	100597	2019/10/26	2020/10/25
●	Horn Antenna	SCHWARZBECK	HTWE0126	9120D	1011	2017/04/01	2020/03/31
●	Horn Antenna	SCHWARZBECK	HTWE0103	BBHA9170	25841	2017/03/27	2020/03/26
●	Broadband Horn Antenna	SCHWARZBECK	HTWE0103	BBHA9170	BBHA9170472	2018/10/11	2021/10/10
●	Pre-amplifier	CD	HTWE0071	PAP-0102	12004	2019/11/14	2020/11/13
●	Broadband Pre-amplifier	SCHWARZBECK	HTWE0201	BBV 9718	9718-248	2019/05/23	2020/05/22
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-01	6m 18GHz S Serisa	N/A	2019/05/10	2020/05/09
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-02	6m 3GHz RG Serisa	N/A	2019/05/10	2020/05/09
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-03	6m 3GHz RG Serisa	N/A	2019/05/10	2020/05/09
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-04	6m 3GHz RG Serisa	N/A	2019/05/10	2020/05/09
●	RF Connection Cable	HUBER+SUHNER	HTWE0121-01	6m 18GHz S Serisa	N/A	2019/05/10	2020/05/09
●	Test Software	Audix	N/A	E3	N/A	N/A	N/A

●	RF Conducted Method					
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Signal and spectrum Analyzer	R&S	FSV40	100048	2019/10/26	2020/10/25
●	Spectrum Analyzer	Agilent	N9020A	MY50510187	2019/10/26	2020/10/25
●	Power Meter	Anritsu	ML249A	N/A	2019/10/26	2020/10/25
○	Radio communication tester	R&S	CMW500	137688-Lv	2019/10/26	2020/10/25

5. TEST CONDITIONS AND RESULTS

5.1. Antenna Requirement

Requirement

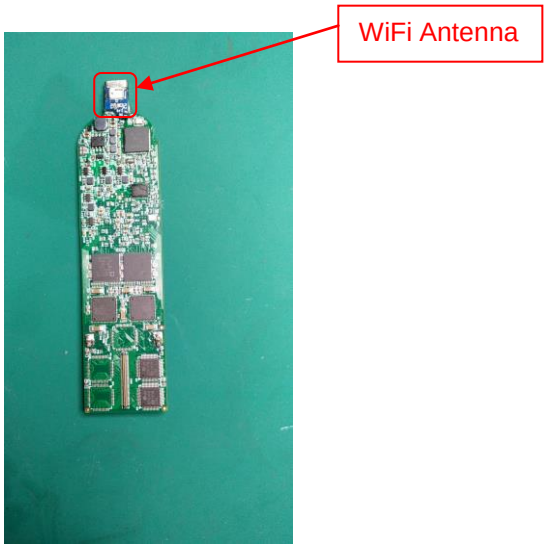
FCC CFR Title 47 Part 15 Subpart C Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

The antenna type is a chip antenna, the directional gain of the antenna less than 6 dBi, please refer to the below antenna photo.



5.2. AC Conducted Emission

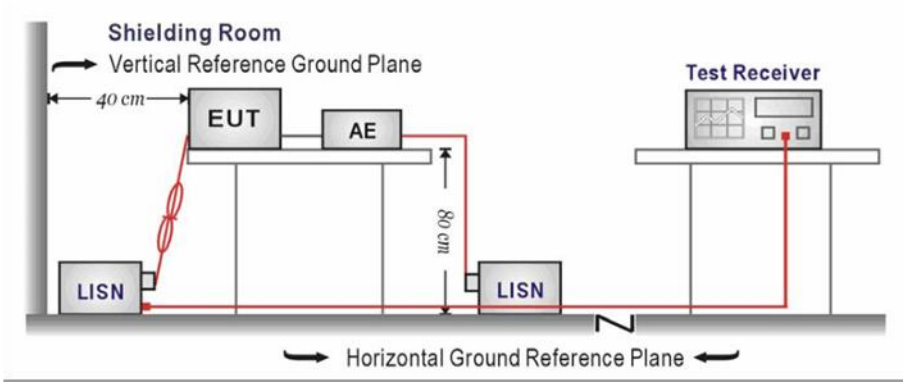
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup according to ANSI C63.10 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

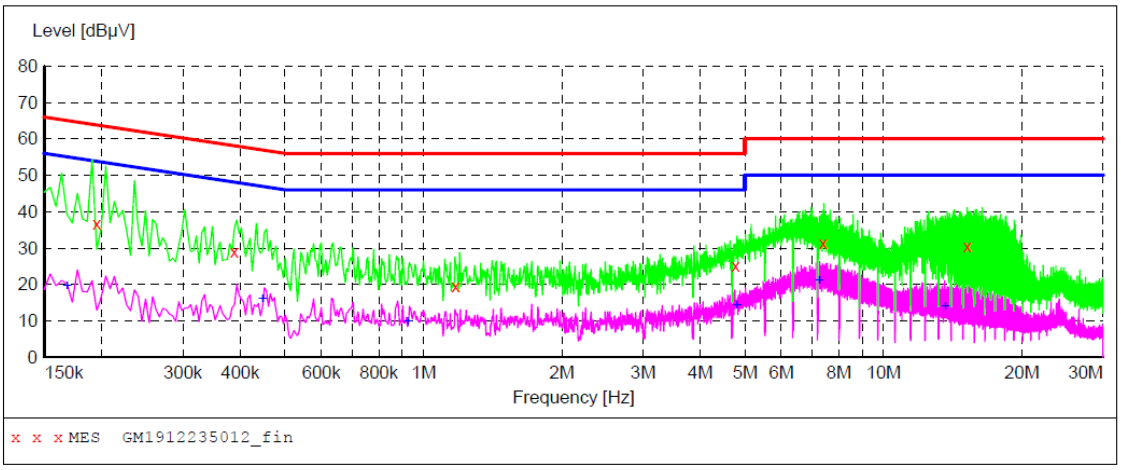
TEST MODE:

Please refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

Test Line:	L



MEASUREMENT RESULT: "GM1912235012_fin"

12/23/2019 11:56AM

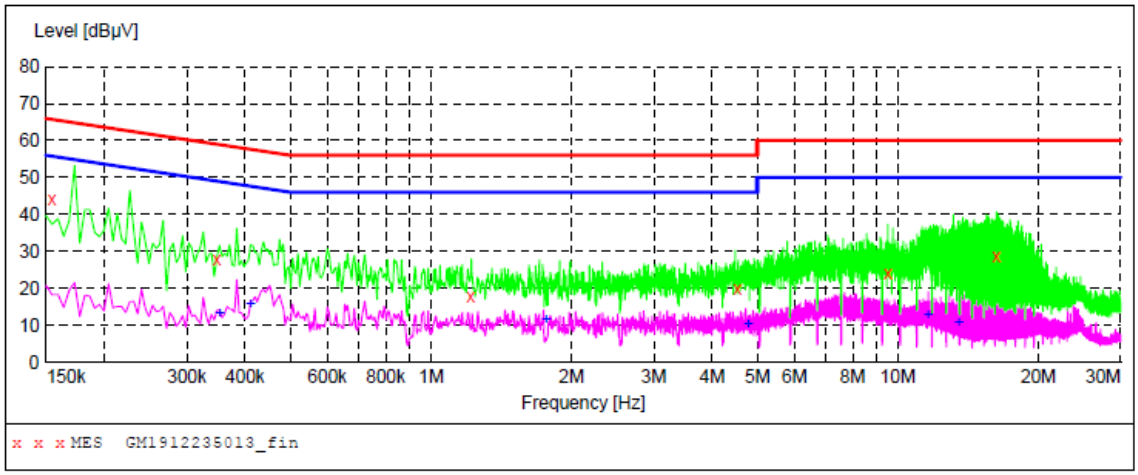
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.195000	36.60	10.1	64	27.2	QP	L1	GND
0.388500	29.10	10.1	58	29.0	QP	L1	GND
1.176000	19.60	10.1	56	36.4	QP	L1	GND
4.771500	25.10	10.1	56	30.9	QP	L1	GND
7.404000	31.50	10.2	60	28.5	QP	L1	GND
15.234000	30.40	10.2	60	29.6	QP	L1	GND

MEASUREMENT RESULT: "GM1912235012_fin2"

12/23/2019 11:56AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.168000	19.60	10.1	55	35.5	AV	L1	GND
0.447000	15.90	10.1	47	31.0	AV	L1	GND
0.924000	9.80	10.1	46	36.2	AV	L1	GND
4.794000	14.30	10.1	46	31.7	AV	L1	GND
7.255500	20.90	10.2	50	29.1	AV	L1	GND
13.609500	13.90	10.2	50	36.1	AV	L1	GND

Test Line:	N



MEASUREMENT RESULT: "GM1912235013_fin"

12/23/2019 11:59AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.154500	44.30	10.1	66	21.5	QP	N	GND
0.348000	27.80	10.1	59	31.2	QP	N	GND
1.216500	17.80	10.1	56	38.2	QP	N	GND
4.528500	19.90	10.1	56	36.1	QP	N	GND
9.523500	24.10	10.2	60	35.9	QP	N	GND
16.278000	28.60	10.2	60	31.4	QP	N	GND

MEASUREMENT RESULT: "GM1912235013_fin2"

12/23/2019 11:59AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.352500	13.40	10.1	49	35.5	AV	N	GND
0.411000	15.50	10.1	48	32.1	AV	N	GND
1.765500	11.70	10.1	46	34.3	AV	N	GND
4.771500	10.30	10.1	46	35.7	AV	N	GND
11.593500	12.70	10.2	50	37.3	AV	N	GND
13.465500	10.80	10.2	50	39.2	AV	N	GND

Note: During the test. All of the C5-2v, C5-2Sv, L11-4v, L11-4Sv, E10-4v, C8-5v transducers are matching with the main unit respectively. And the L11-4v transducer test data is the worst case, so only show this test data on the report.

5.3. Maximum Conducted Output Power

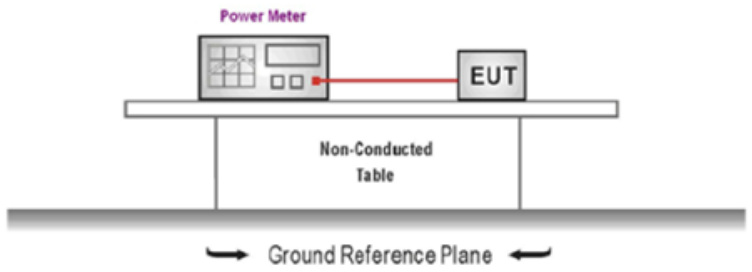
LIMIT

FCC CFR Title 47 Part 15 Subpart E Section 15.407(a):

For the 5.15~5.25GHz band:

- Outdoor AP
  The maximum conducted output power (P_{out}) shall not exceed the lesser of 1W (30dBm).
  if G_{Tx}>6dBi, then P_{out} =30-(G_{Tx}-6). e.i.r.p. at any elevation angle above 30 degrees≤125mW (21dBm)
- Indoor AP
  The maximum conducted output power (P_{out}) shall not exceed the lesser of 1W (30dBm).
  if G_{Tx}>6dBi, then Pout =30-(G_{Tx}-6).
- Point-to-point AP
  The maximum conducted output power (P_{out}) shall not exceed the lesser of 1W (30dBm).
  if G_{Tx}>23dBi, then Pout =30-(G_{Tx}-23).
- Client devices
  The maximum conducted output power (P_{out}) shall not exceed the lesser of 250W (24dBm).
  if G_{Tx}>6dBi, then Pout =24-(G_{Tx}-6).

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was tested according to KDB789033 Section E-3-b)
2. The maximum conducted output power may be measured using a broadband AVG RF power meter.
3. Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor.
4. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.
5. Record the measurement data.
6. **TEST MODE:**

Please refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

Please refer to appendix A on the appendix report

5.4. Power Spectral Density

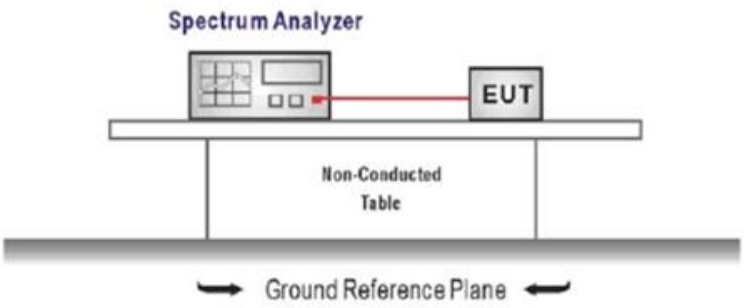
LIMIT

FCC CFR Title 47 Part 15 Subpart E Section 15.407(a):

For the 5.15~5.25GHz band:

- Outdoor AP
  The peak power spectral density (PSD) shall not exceed the lesser of 17dBm/MHz.
  if G_{Tx}>6dBi, then PSD =17-(G_{Tx}-6).
- Indoor AP
  The peak power spectral density (PSD) shall not exceed the lesser of 17dBm/MHz.
  if G_{Tx}>6dBi, then PSD =17-(G_{Tx}-6).
- Point-to-point AP
  The peak power spectral density (PSD) shall not exceed the lesser of 17dBm/MHz.
  if G_{Tx}>23dBi, then PSD =17-(G_{Tx}-23).
- Client devices
  The peak power spectral density (PSD) shall not exceed the lesser of 11dBm/MHz.
  if G_{Tx}>6dBi, then PSD =11-(G_{Tx}-6).

TEST CONFIGURATION



TEST PROCEDURE

1. According KDB 789033 D02 – Section F
2. Analyzer was setting as follow:
   Center frequency: test channel
   Span was set to encompass the entire emission bandwidth of the signal
   RBW=1MHz for devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz
   RBW=500kHz for devices operating in the band 5.725-5.85 GHz
   VBW ≥ 3 RBW
   Number of sweep points > 2 x (span/RBW)
   Sweep time = auto
   Detector = Peak
   Trigger was set to free run for all modes, trace was averaged over 100 sweeps
3. The peak search function of the spectrum analyzer was used to find the peak of the spectrum.

TEST MODE:

Please refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

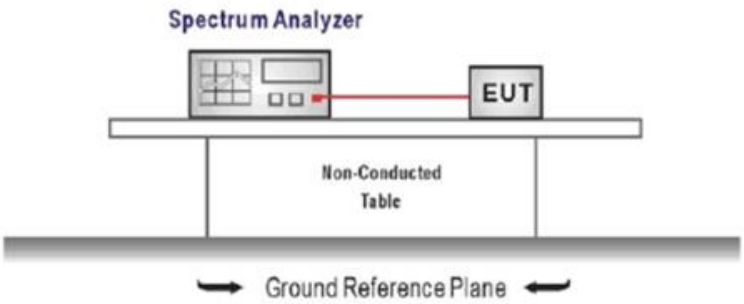
Please refer to appendix B on the appendix report

5.5. 26dB bandwidth and 99% Occupy bandwidth

LIMIT

The bandwidth at 26dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in KDB 789033 D02 , and at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26dB bandwidth.

TEST CONFIGURATION



TEST PROCEDURE

1. According KDB 789033 D02 – Section C
2. Connect the antenna port(s) to the spectrum analyzer input.
3. Configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).
   Center Frequency =Channel center frequency
   Span=2 x emission bandwidth
   RBW = 1% to 5% of the emission bandwidth
   VBW>3 x RBW
   Sweep time= auto couple
   Detector = Peak
   Trace mode = max hold
4. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter wave form on the spectrum analyzer.
5. Measure the maximum width of the emission that is 26 dB down from the maximum of the emission, and use the 99 % power bandwidth function of the instrument

TEST MODE:

Please refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

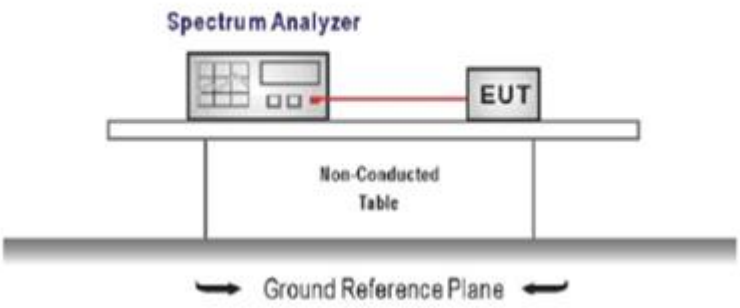
Please refer to appendix C and D on the appendix report

5.6. 6dB Bandwidth

LIMIT

FCC CFR Title 47 Part 15 Subpart E Section 15.407(e)
Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz

TEST CONFIGURATION



TEST PROCEDURE

1. C Connect the antenna port(s) to the spectrum analyzer input.
2. Configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).
   Center Frequency =test channel center frequency
   Span=2 x emission bandwidth
   RBW = 100 kHz, VBW ≥ 3 × RBW
   Sweep time= auto couple
   Detector = Peak
   Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter wave form on the spectrum analyzer.
4. 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, and record the pertinent measurements.

TEST MODE:

Please refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

5.7. Band edge

LIMIT

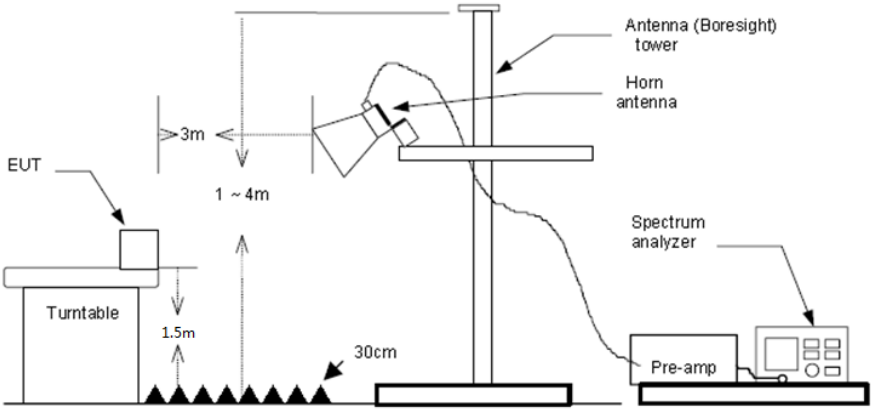
FCC CFR Title 47 Part 15 Subpart E Section 15.407(b)

Un-restricted band emissions above 1GHz			
Operating Band	Frequency	EIRP Limit	Value
5150-5250MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak

* Increase/Decreases with the linearly of the frequency.

For emission above 1GHz and in restricted band, according to FCC KDB 789033 D02 General UNII Test Procedure, all emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit. E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT waspositioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. Thisis repeated for both horizontal and vertical polarization of the antenna. In order to find themaximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
   RBW=1MHz, VBW=3MHz PEAK detector for Peak value.
   RBW=1MHz, VBW=3MHz RMS detector for Average value.

TEST MODE:

Please refer to the clause 4.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

TEST Data

Band: I		Worst mode: 802.11a			Test channel: CH_L		
Frequency (MHz)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Factor (dB)	Test value	Polarization
5150.00	17.42	26.31	54.00	27.69	8.89	Vertical	Average
5150.00	24.49	33.38	68.20	34.82	8.89	Vertical	Peak
5150.00	18.88	27.77	54.00	26.23	8.89	Horizontal	Average
5150.00	25.42	34.31	68.20	33.89	8.89	Horizontal	Peak

Band: I		Worst mode: 802.11a			Test channel: CH_H		
Frequency (MHz)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Factor (dB)	Test value	Polarization
5350.00	17.66	26.20	54.00	27.80	8.54	Vertical	Average
5350.00	23.21	31.75	68.20	36.45	8.54	Vertical	Peak
5350.00	18.48	27.02	54.00	26.98	8.54	Horizontal	Average
5350.00	24.64	33.18	68.20	35.02	8.54	Horizontal	Peak

Remark:

1. *Final Level =Receiver Read level + Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *Test 802.11a, 802.11n mode,all modulations have been tested,only worst case is reported*

5.8. Radiated Spurious Emissions

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209 and Part 15 Subpart E Section 15.407

Frequency	Limit (dBuV/m)	Value
0.009 MHz ~0.49 MHz	2400/F(kHz) @300m	Quasi-peak
0.49 MHz ~ 1.705 MHz	24000/F(kHz) @30m	Quasi-peak
1.705 MHz ~30 MHz	30 @30m	Quasi-peak

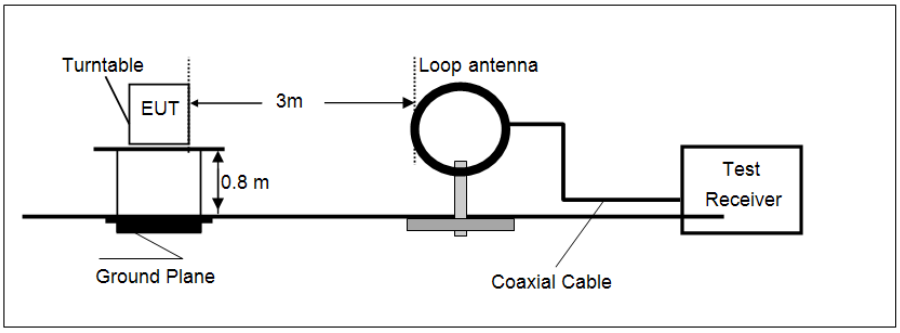
Note: Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3)= Limit dBuV/m @300m +80,

Limit dBuV/m @3m = Limit dBuV/m @30m +40*log(30/3)= Limit dBuV/m @30m + 40.

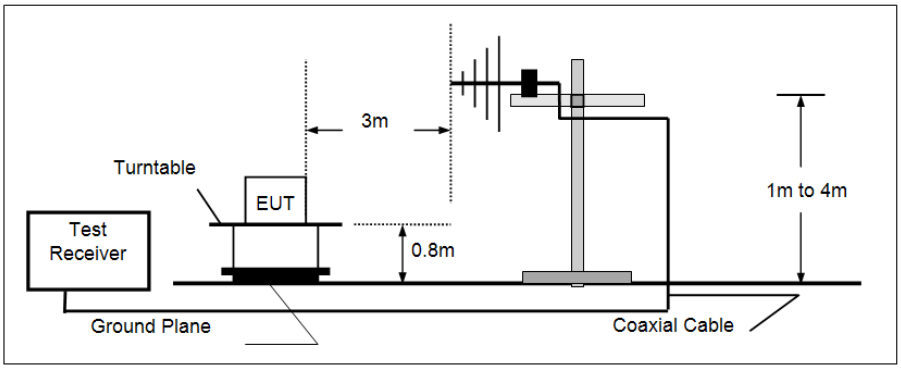
Unwanted emissions below 1GHz and Restricted band emissions above 1GHz		
Frequency	Limit (dBuV/m @3m)	Value
30MHz-88MHz	40.00	Quasi-peak
88MHz-216MHz	43.50	Quasi-peak
216MHz-960MHz	46.00	Quasi-peak
960MHz-1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

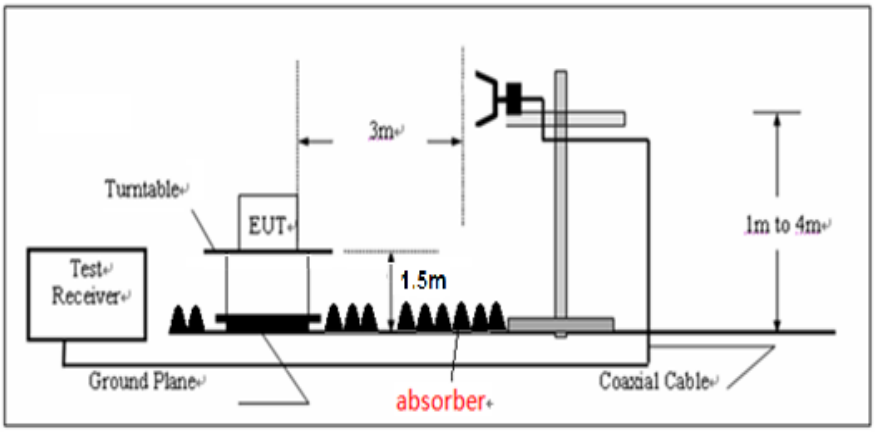
- 9KHz ~30MHz



- 30MHz ~ 1GHz



➢ Above 1GHz



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
   a) Span shall wide enough to fully capture the emission being measured;
   b) Below 1 GHz:
      RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
      If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
   c) From 1 GHz to 10th harmonic:
      RBW=1MHz, VBW=3MHz Peak detector for Peak value.
      RBW=1MHz, VBW=3MHz RMS detector for Average value.

TEST MODE:

Please refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

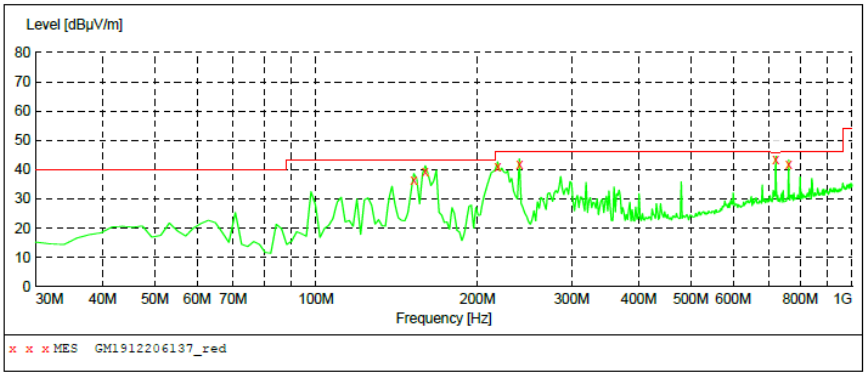
TEST Data

TEST DATA FOR 9 kHz ~ 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

TEST DATA FOR 30MHz-1GHz

Polarization:	Horizontal

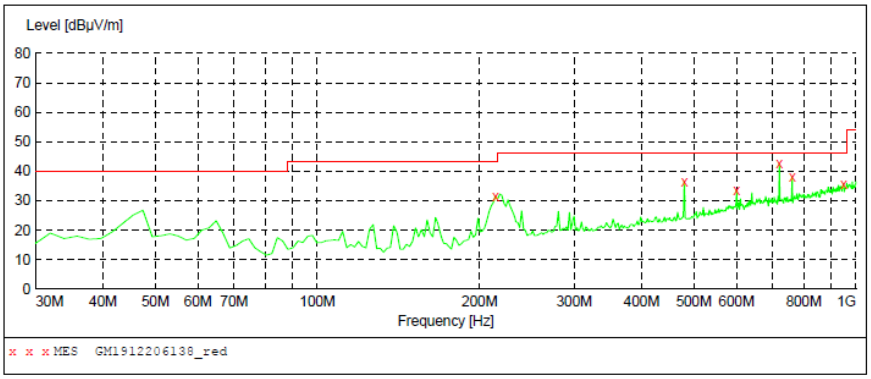


MEASUREMENT RESULT: "GM1912206137_red"

12/20/2019 11:47PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
152.220000	36.40	-13.2	43.5	7.1	QP	300.0	276.00	HORIZONTAL
159.980000	39.20	-12.7	43.5	4.2	QP	100.0	273.00	HORIZONTAL
218.180000	40.60	-9.5	46.0	5.4	QP	100.0	67.00	HORIZONTAL
239.520000	41.70	-8.5	46.0	4.3	QP	100.0	197.00	HORIZONTAL
720.640000	43.00	3.6	46.0	3.0	QP	100.0	91.00	HORIZONTAL
761.380000	41.40	4.6	46.0	4.6	QP	100.0	51.00	HORIZONTAL

Polarization:	Vertical



MEASUREMENT RESULT: "GM1912206138_red"

12/20/2019 11:49PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
214.300000	31.50	-9.7	43.5	12.0	QP	100.0	132.00	VERTICAL
480.080000	36.60	-2.0	46.0	9.4	QP	100.0	359.00	VERTICAL
600.360000	33.50	1.7	46.0	12.5	QP	100.0	238.00	VERTICAL
720.640000	42.50	3.6	46.0	3.5	QP	100.0	6.00	VERTICAL
761.380000	38.00	4.6	46.0	8.0	QP	100.0	0.00	VERTICAL
947.620000	35.70	8.1	46.0	10.3	QP	100.0	44.00	VERTICAL

Remark:
Transd=Cable lose+ Antenna factor- Pre-amplifier; Margin=Limit –Level

Note: During the test. All of the C5-2v, C5-2Sv, L11-4v, L11-4Sv, E10-4v, C8-5v transducers are matching with the main unit respectively. And the E10-4v transducer test data under channel CHM of 802.11n mode which is the worst case, so only show this test data on the report.

TEST DATA FOR Above 1GHz

Band: I			Worst mode: 802.11a		Test channel: CH_L		
Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
4620.47	26.28	5.89	32.17	74.00	41.83	Peak	Horizontal
5968.78	26.48	10.31	36.79	74.00	37.21	Peak	Horizontal
8061.75	28.64	16.28	44.92	74.00	29.08	Peak	Horizontal
8650.72	29.98	16.00	45.98	74.00	28.02	Peak	Horizontal
2667.03	22.66	-0.04	22.62	74.00	51.38	Peak	Vertical
7528.59	28.33	15.54	43.87	74.00	30.13	Peak	Vertical
6662.03	27.42	13.35	40.77	74.00	33.23	Peak	Vertical
11542.69	28.45	17.39	45.84	74.00	28.16	Peak	Vertical

Band: I			Worst mode: 802.11a		Test channel: CH_M		
Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
2202.91	22.93	-2.95	19.98	74.00	54.02	Peak	Horizontal
4501.50	26.63	5.36	31.99	74.00	42.01	Peak	Horizontal
6150.91	27.52	10.80	38.32	74.00	35.68	Peak	Horizontal
8007.41	28.62	16.20	44.82	74.00	29.18	Peak	Horizontal
1810.75	22.35	-5.80	16.55	74.00	57.45	Peak	Vertical
2530.44	23.13	-1.87	21.26	74.00	52.74	Peak	Vertical
4282.66	26.96	3.78	30.74	74.00	43.26	Peak	Vertical
8119.03	28.92	16.28	45.20	74.00	28.80	Peak	Vertical

Band: I			Worst mode: 802.11a		Test channel: CH_H		
Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
1387.75	22.36	-5.58	16.78	74.00	57.22	Peak	Horizontal
3147.31	29.12	0.57	29.69	74.00	44.31	Peak	Horizontal
4711.53	26.87	6.46	33.33	74.00	40.67	Peak	Horizontal
7510.97	28.08	15.46	43.54	74.00	30.46	Peak	Horizontal
2122.13	22.23	-3.78	18.45	74.00	55.55	Peak	Vertical
3305.94	29.68	-0.34	29.34	74.00	44.66	Peak	Vertical
6518.09	26.03	12.63	38.66	74.00	35.34	Peak	Vertical
9098.69	28.90	16.67	45.57	74.00	28.43	Peak	Vertical

Remark:

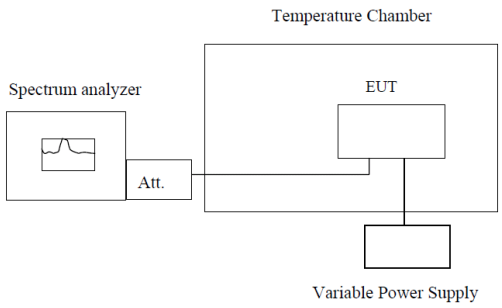
1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *Measuring frequencies from 1 GHz to 40GHz.*
4. *Test 802.11a, 802.11n mode,all modulations have been tested,only worst case is reported*

5.9. Frequency stability

LIMIT

Within Operation Band

TEST CONFIGURATION



Note : Measurement setup for testing on Antenna connector

TEST PROCEDURE

1. The equipment under test was connected to an external power supply.
2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators.
3. The EUT was placed inside the temperature chamber.
4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25℃ operating frequency as reference frequency.
5. Turn EUT off and set the chamber temperature to –20℃. After the temperature stabilized for approximately 30 minutes recorded the frequency.
6. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached..

TEST MODE:

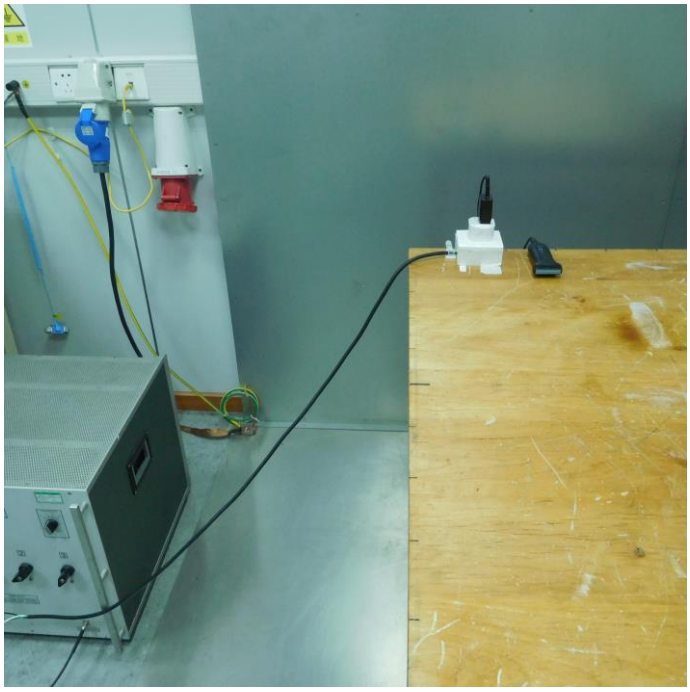
Please refer to the clause 4.3

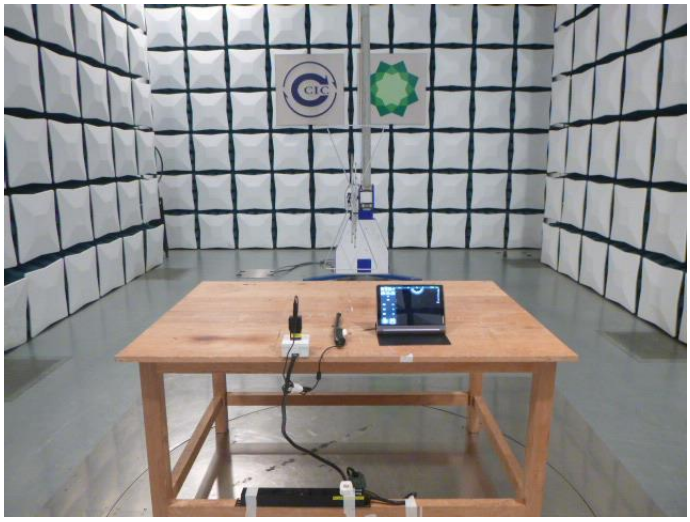
TEST RESULT

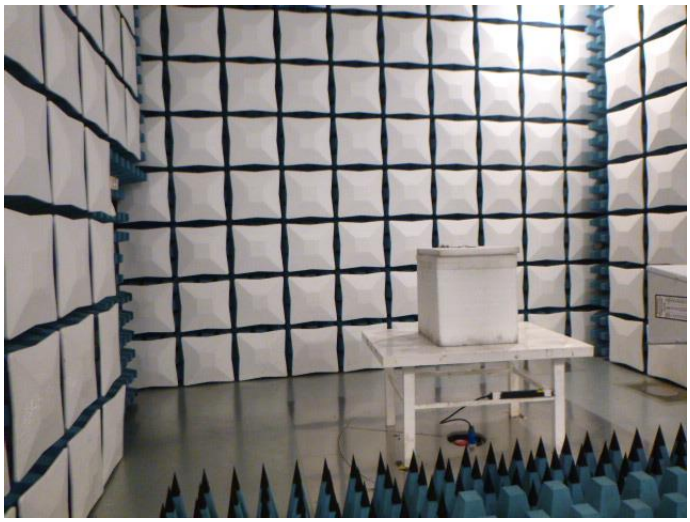
☒ **Passed** ☐ **Not Applicable**

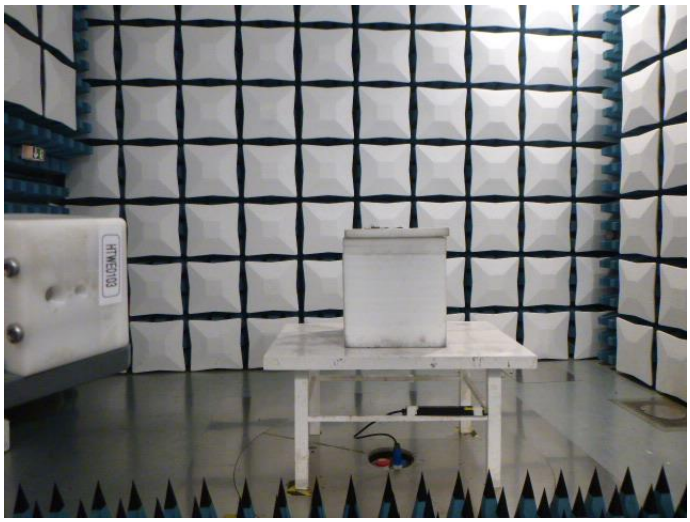
Please refer to appendix E on the appendix report

6. TEST SETUP PHOTOS









7. EXTERANAL AND INTERNAL PHOTOS

Reference to the test report No.: CHTEW19120171

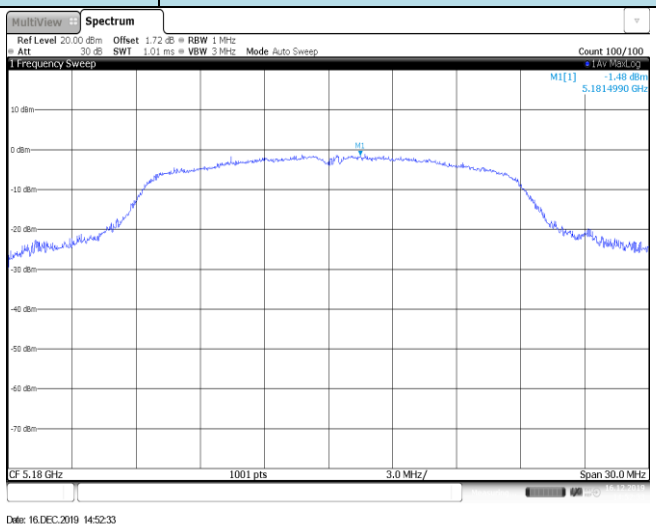
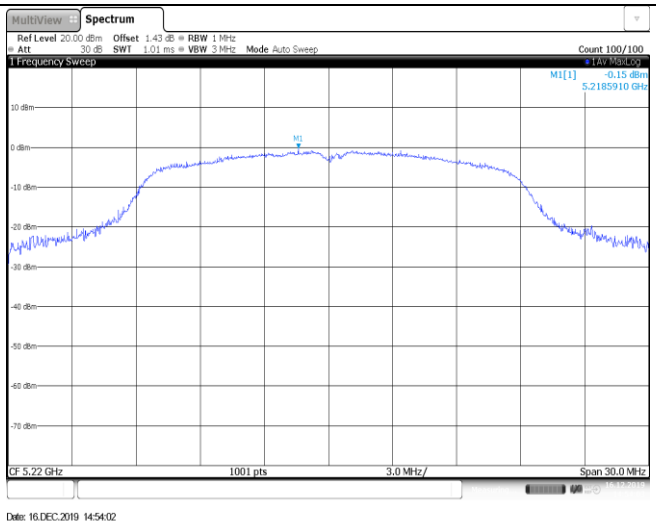
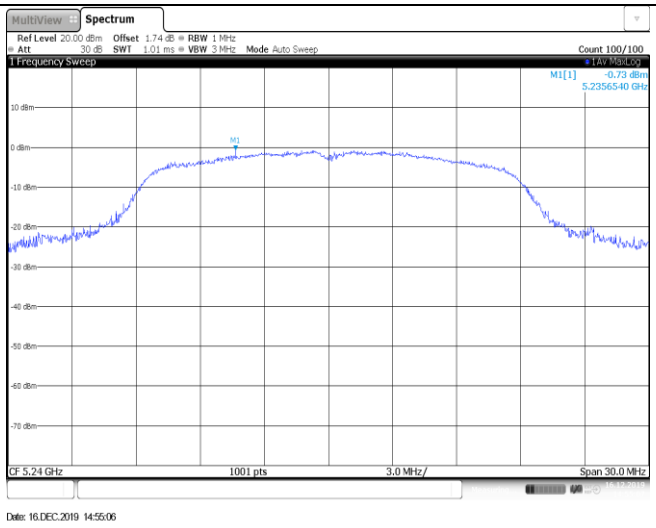
8. APPENDIX REPORT

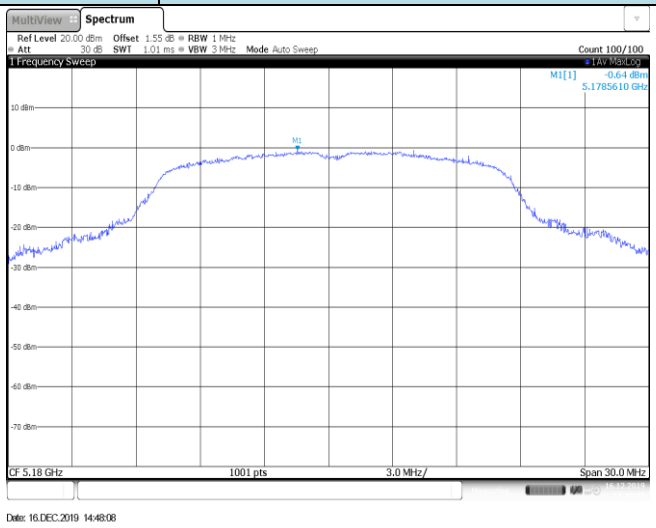
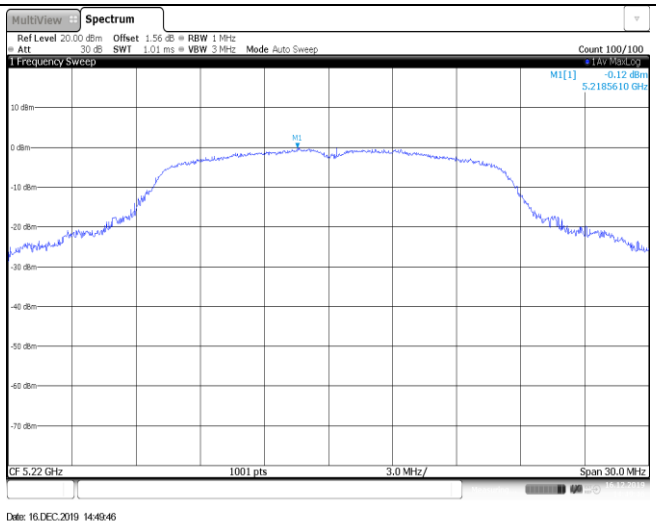
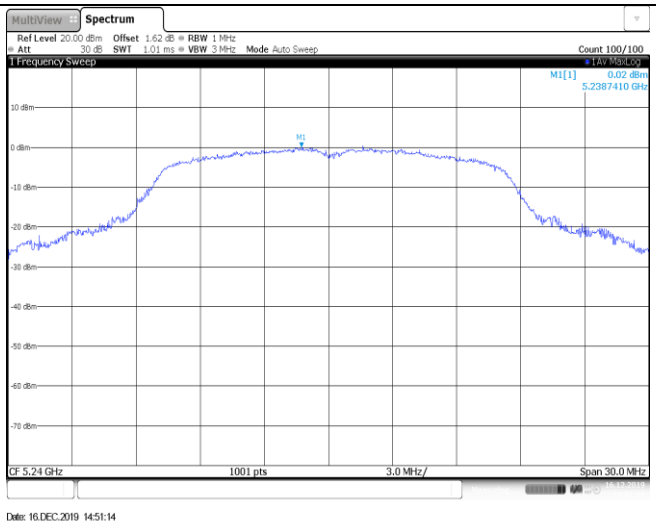
Appendix A：Maximum Conducted Output Power

Band	Bandwidth (MHz)	Type	Channel	Conducted Output Power (dBm)	Limit (dBm)	Result
I	20	802.11n	CH_L	7.58	24.00	Pass
			CH_M	7.19		
			CH_H	7.56		
		802.11a	CH_L	7.14	24.00	Pass
			CH_M	7.69		
			CH_H	7.62		

Appendix B：Maximum Power Spectral Density

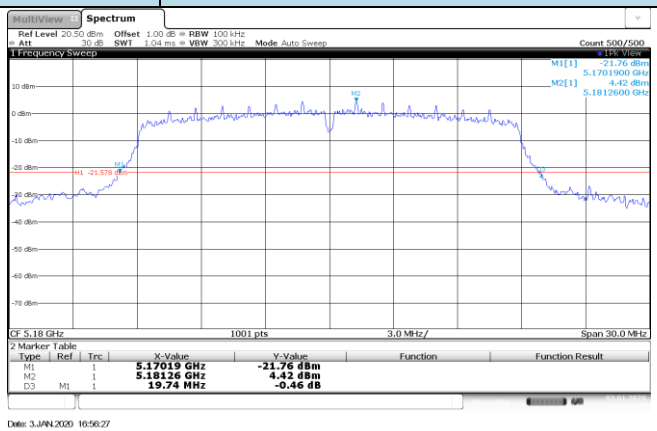
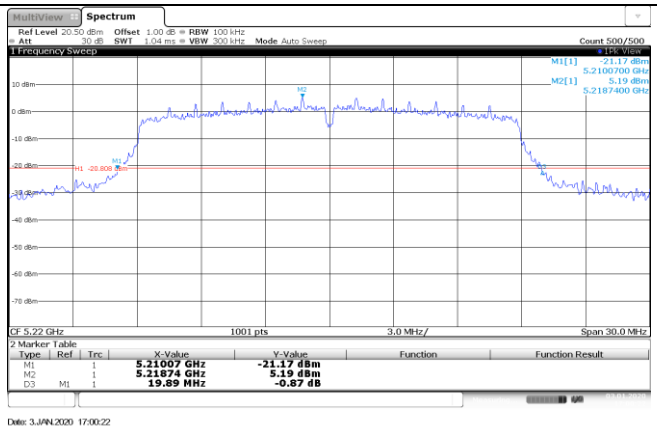
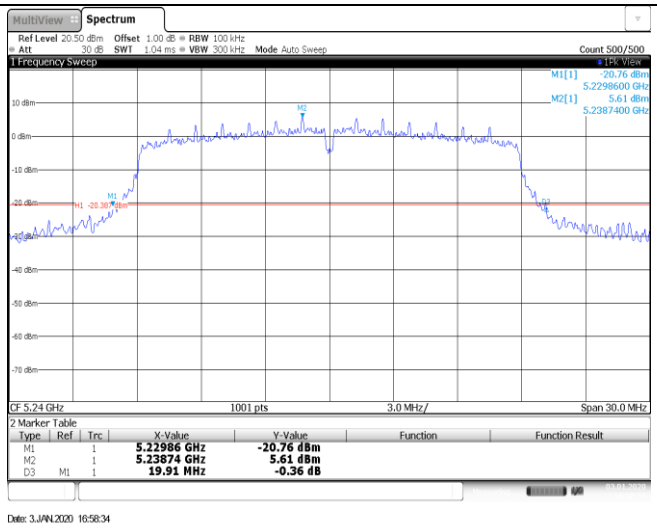
Band	Bandwidth (MHz)	Type	Channel	Power Spectral Density (dBm/MHz)	Limit (dBm/MHz)	Result
I	20	802.11n	CH_L	-1.48	11.00	Pass
			CH_M	-0.15		
			CH_H	-0.73		
		802.11a	CH_L	-0.64	11.00	Pass
			CH_M	-0.12		
			CH_H	0.02		

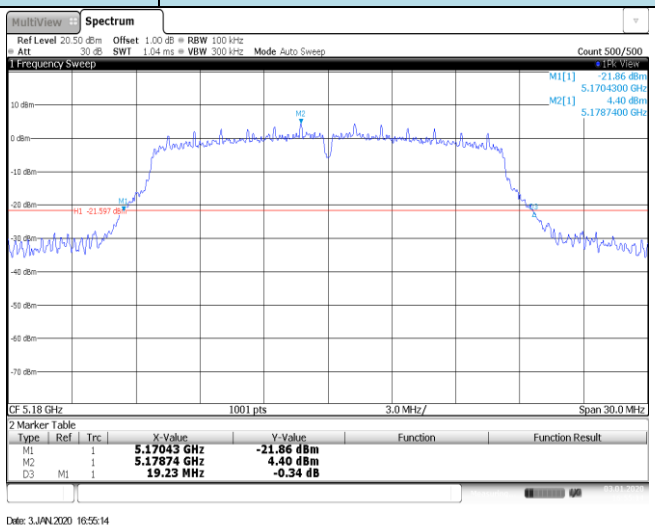
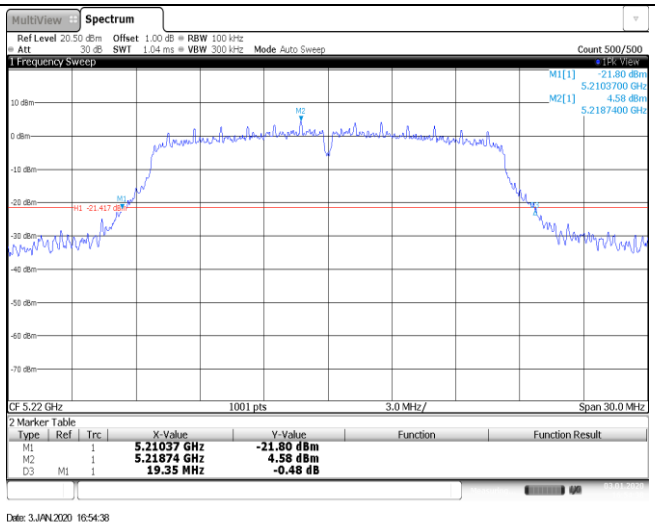
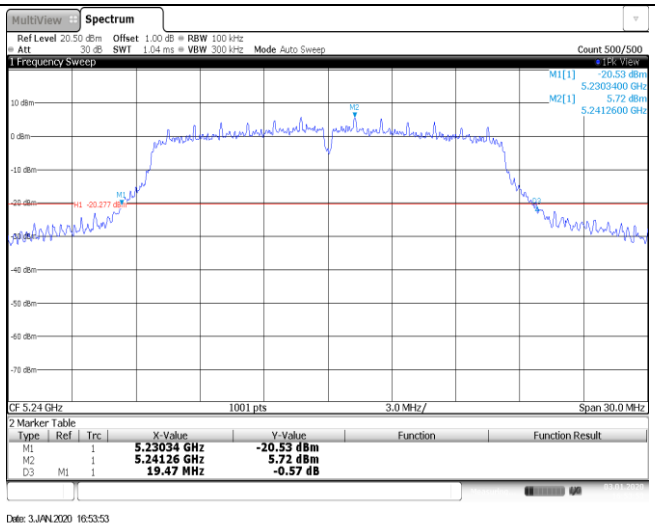
Band I	802.11n (HT20)
CH_L	
CH_M	
CH_H	

Band I	802.11a
CH_L	
CH_M	
CH_H	

Appendix C：26dB bandwidth

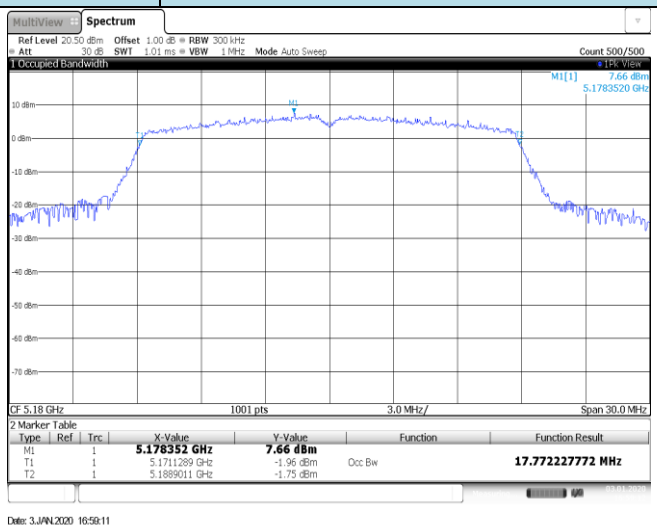
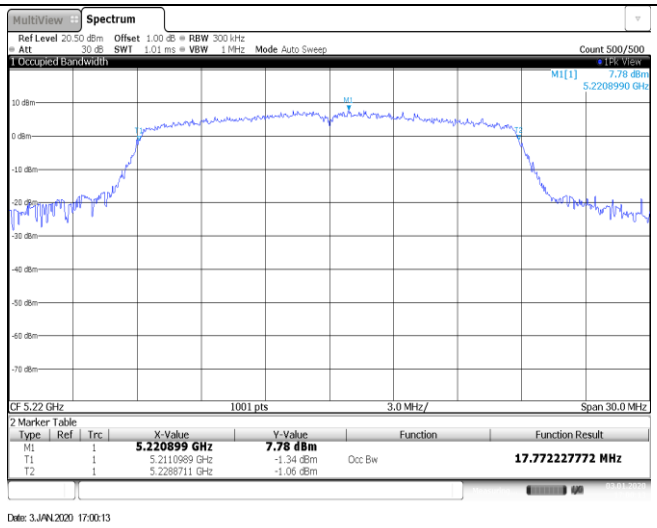
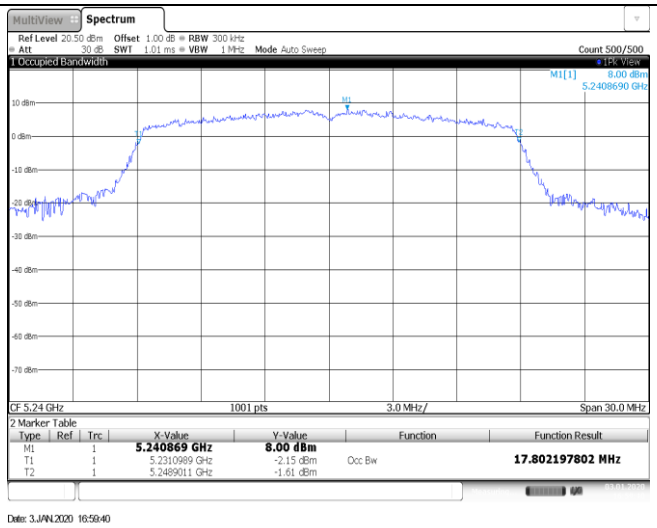
Band	Bandwidth (MHz)	Type	Channel	26dB bandwidth (MHz)	Result
I	20	802.11n	CH_L	19.74	Pass
			CH_M	19.89	
			CH_H	19.91	
		802.11a	CH_L	19.23	Pass
			CH_M	19.35	
			CH_H	19.47	

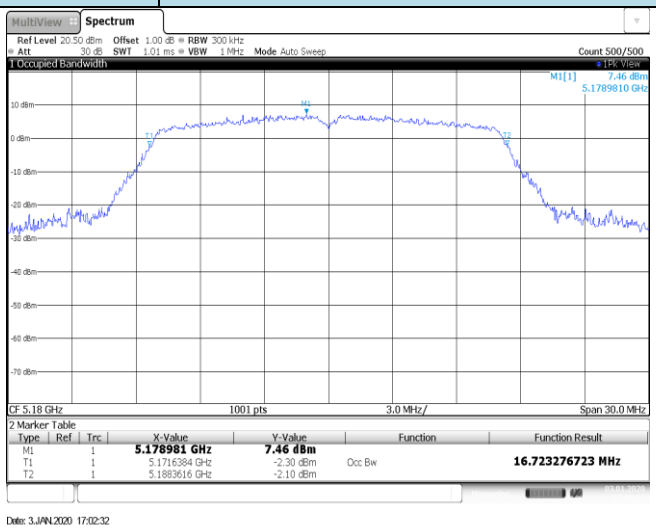
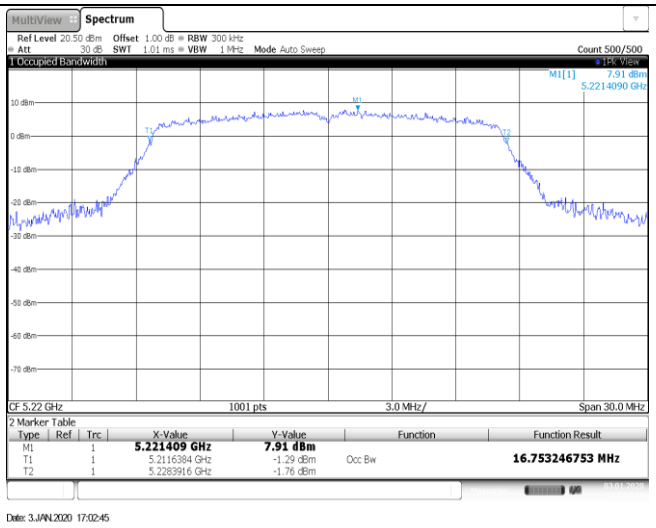
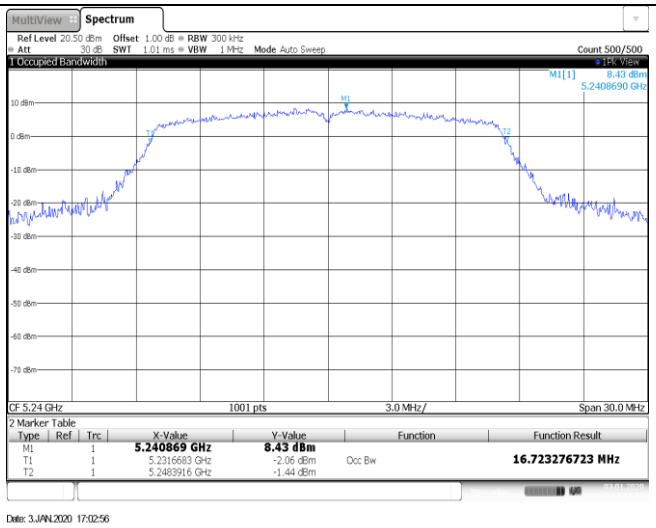
Band I	802.11n (HT20)
CH_L	
CH_M	
CH_H	

Band I	802.11a
CH_L	
CH_M	
CH_H	

Appendix D：99% Occupy bandwidth

Band	Bandwidth (MHz)	Type	Channel	99% Occupy bandwith (MHz)	Result
I	20	802.11n	CH_L	17.77	Pass
			CH_M	17.77	
			CH_H	17.80	
		802.11a	CH_L	16.72	Pass
			CH_M	16.75	
			CH_H	16.72	

Band I	802.11n (HT20)
CH_L	
CH_M	
CH_H	

Band I	802.11a
CH_L	
CH_M	
CH_H	

Appendix E：Frequency stability

Voltage VS Frequency stability

Band: I			Test Frequency: 5180.00MHz	
Temperature (℃)	Voltage (V)	Frequency Deviation (Hz)	Frequency Deviation (ppm)	Result
T_N	V_L	-2000.00	-0.38610	PASS
T_N	V_N	-2000.00	-0.38610	PASS
T_N	V_H	-2000.00	-0.38610	PASS

Temperature VS Frequency stability

Band: I			Test Frequency: 5180.00MHz	
Voltage (V)	Temperature (℃)	Frequency Deviation (Hz)	Frequency Deviation (ppm)	Result
T_N	-20	-2000.00	-0.38610	PASS
T_N	-10	-2000.00	-0.38610	PASS
T_N	0	-2000.00	-0.38610	PASS
T_N	10	-2000.00	-0.38610	PASS
T_N	20	-2000.00	-0.38610	PASS
T_N	30	-2000.00	-0.38610	PASS
T_N	40	-2000.00	-0.38610	PASS
T_N	50	-2000.00	-0.38610	PASS

----------End of Report----------