




# TEST REPORT

Report No. .... : CHTEW19120172 Report Verification: 

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

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The test report merely correspond to the test sample.

## Contents

<b>1.</b>	<b>TEST STANDARDS AND REPORT VERSION</b>	<b>3</b>
1.1.	Test Standards	3
1.2.	Report version	3
<b>2.</b>	<b>TEST DESCRIPTION</b>	<b>4</b>
<b>3.</b>	<b>SUMMARY</b>	<b>5</b>
3.1.	Client Information	5
3.2.	Product Description	5
3.3.	Radio Specification Description	5
3.4.	Testing Laboratory Information	6
<b>4.</b>	<b>TEST CONFIGURATION</b>	<b>7</b>
4.1.	Test frequency list	7
4.2.	Descriptions of Test mode	7
4.3.	Test mode	7
4.4.	Support unit used in test configuration and system	8
4.5.	Testing environmental condition	8
4.6.	Measurement uncertainty	8
4.7.	Equipment Used during the Test	9
<b>5.</b>	<b>TEST CONDITIONS AND RESULTS</b>	<b>11</b>
5.1.	Antenna Requirement	11
5.2.	AC Conducted Emission	12
5.3.	Maximum Conducted Output Power	15
5.4.	Power Spectral Density	16
5.5.	26dB bandwidth and 99% Occupy bandwidth	18
5.6.	6dB Bandwidth	19
5.7.	Band edge	20
5.8.	Radiated Spurious Emissions	22
5.9.	Frequency stability	26
<b>6.</b>	<b>TEST SETUP PHOTOS</b>	<b>27</b>
<b>7.</b>	<b>EXTERANAL AND INTERNAL PHOTOS</b>	<b>28</b>
<b>8.</b>	<b>APPENDIX REPORT</b>	<b>28</b>

## 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% Occupancy bandwidth	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 <sup>*1</sup>	<input checked="" type="checkbox"/> 802.11a	<input checked="" type="checkbox"/> 802.11n(HT20)	<input type="checkbox"/> 802.11n(HT40)
	<input type="checkbox"/> 802.11ac(HT20)	<input type="checkbox"/> 802.11ac(HT40)	<input type="checkbox"/> 802.11ac(HT80)
Function:	<input type="checkbox"/> Outdoor AP	<input type="checkbox"/> Indoor AP	<input type="checkbox"/> Fixed P2P
	<input checked="" type="checkbox"/> Client		
Modulation:	BPSK, QPSK, 16QAM, 64QAM		
Operation frequency:	<input checked="" type="checkbox"/> Band I: 5150MHz~5250MHz		
	<input type="checkbox"/> 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 <sub>L</sub>	36	5180
	CH <sub>M</sub>	44	5220
	CH <sub>H</sub>	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-Amplifier	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

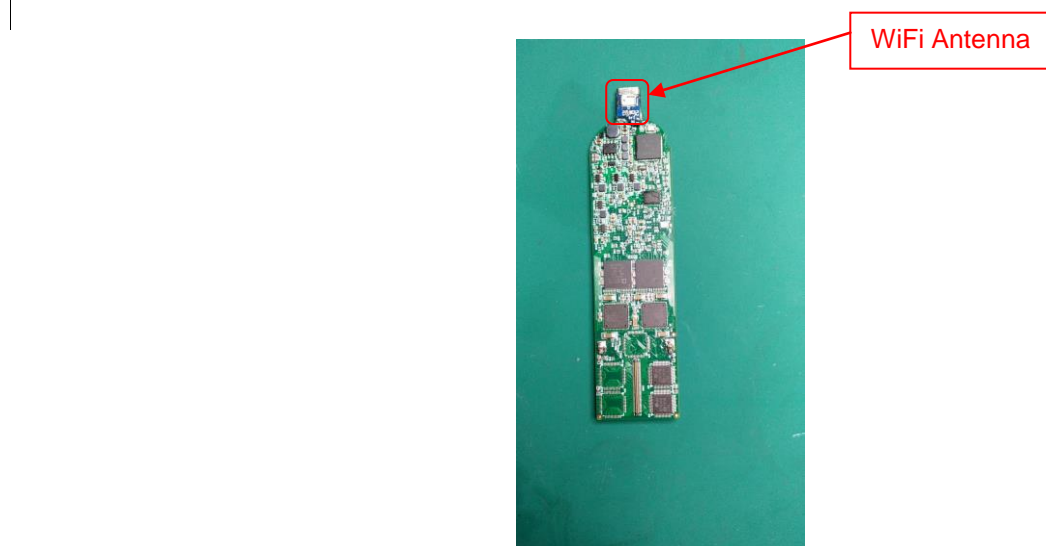
##### **FCC CFR Title 47 Part 15 Subpart C Section 15.203:**

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

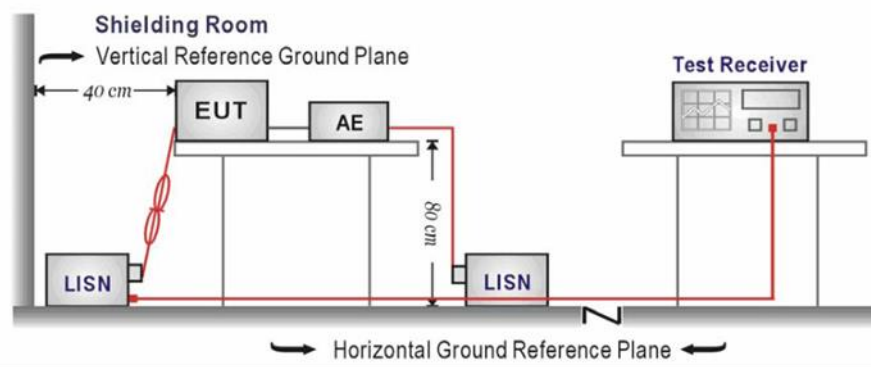
### LIMIT

#### 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:

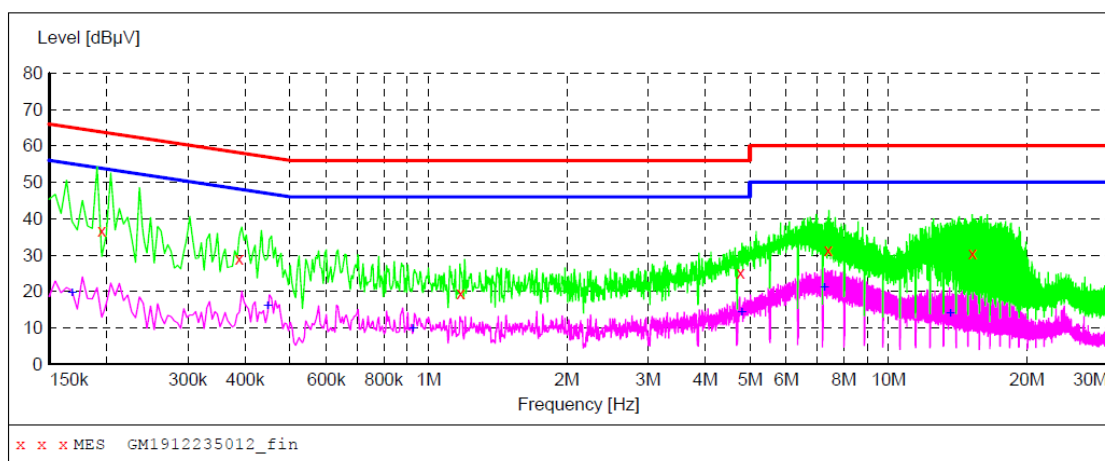
Please refer to the clause 4.3

### 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

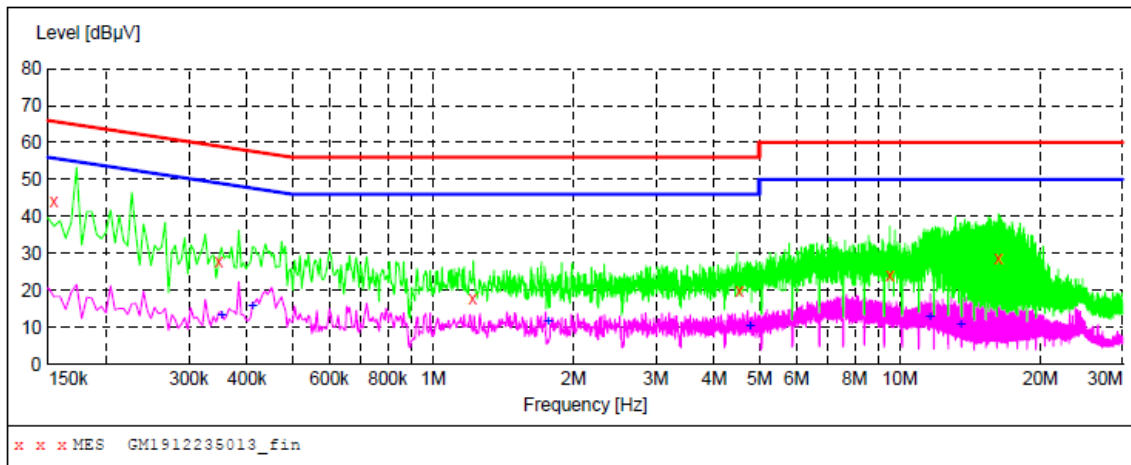
**MEASUREMENT RESULT: "GM1912235012\_fin2"**

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

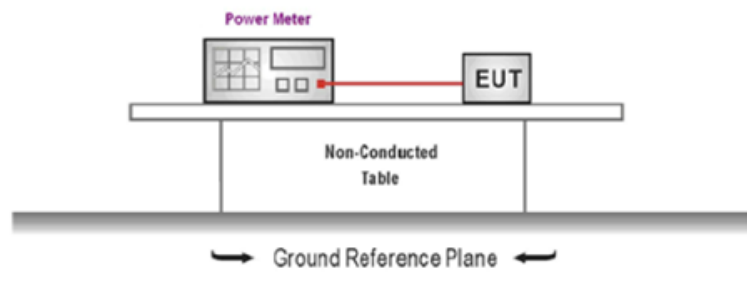
#### LIMIT

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

#### 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

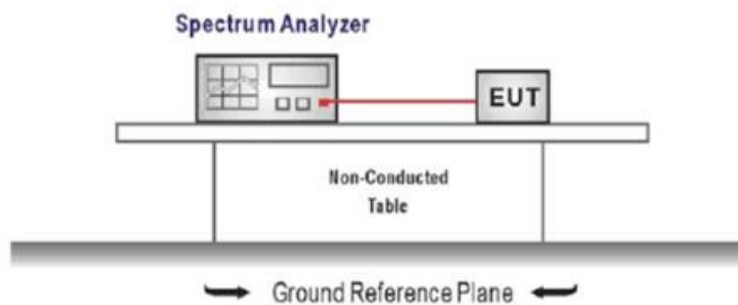
### LIMIT

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

### 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  $\geq 3$  RBW  
Number of sweep points  $> 2 \times (\text{span}/\text{RBW})$   
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**

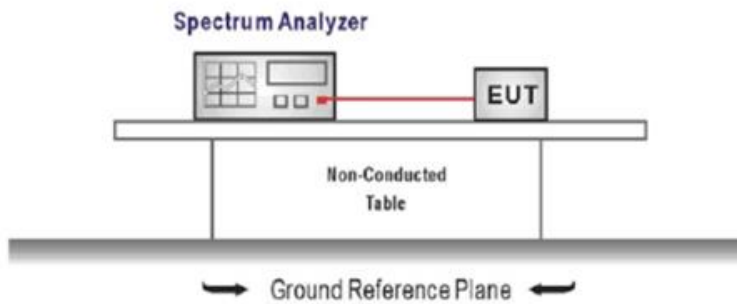
Please refer to appendix B on the appendix report

## 5.5. 26dB bandwidth and 99% Occupancy 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

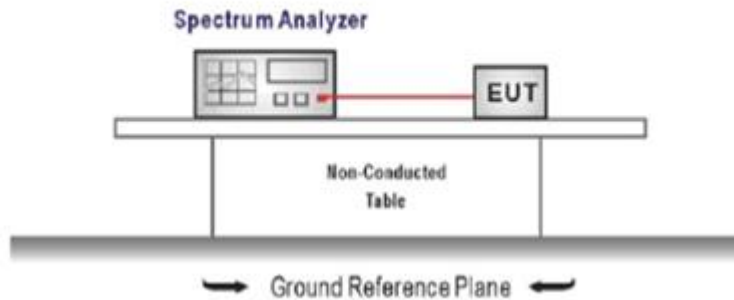
## 5.6. 6dB Bandwidth

### 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  $\geq 3 \times$  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

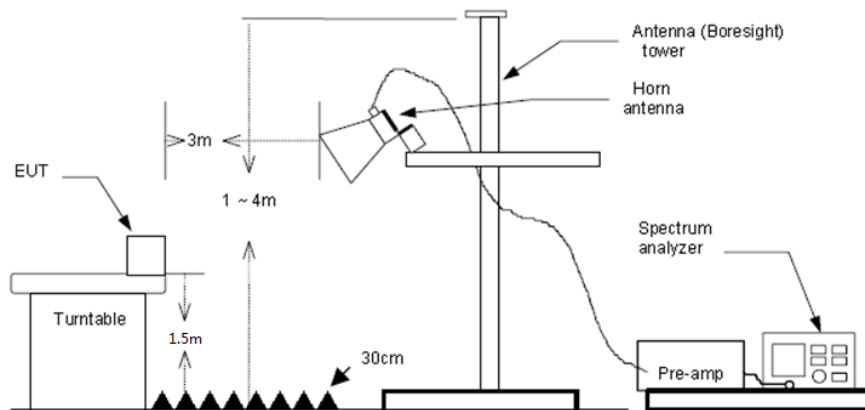
FCC CFR Title 47 Part 15 Subpart E Section 15.407(b)

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.  $E[dB\mu V/m] = EIRP[dBm] + 95.2$ , 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 was positioned 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. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum 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 <sub>L</sub>		
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 <sub>H</sub>		
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

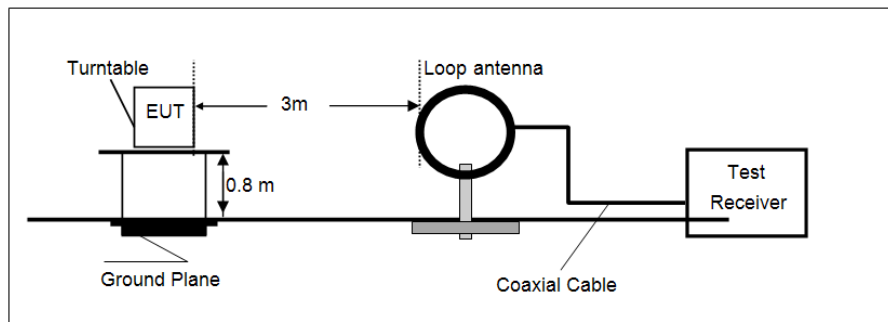
Note: Limit dBuV/m @3m = Limit dBuV/m @300m + 40\*log(300/3)= Limit dBuV/m @300m +80,

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

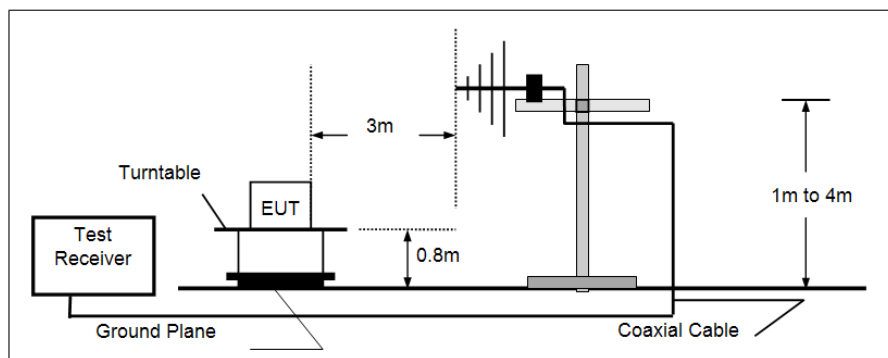
Unwanted emissions below 1GHz and Restricted band emissions above 1GHz		
Frequency	Limit (dBuV/m @3m)	Value
30MHz-88MHz	40.00	Quasi-peak
88MHz-216MHz	43.50	Quasi-peak
216MHz-960MHz	46.00	Quasi-peak
960MHz-1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

### TEST CONFIGURATION

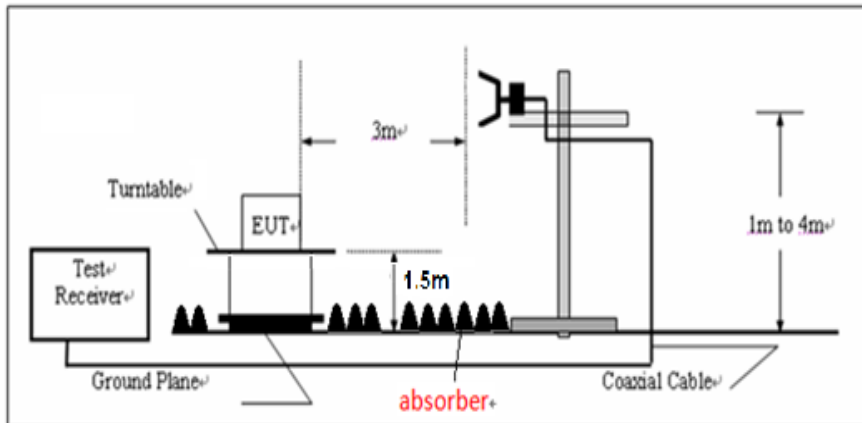
- 9KHz ~30MHz



- 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 10<sup>th</sup> 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

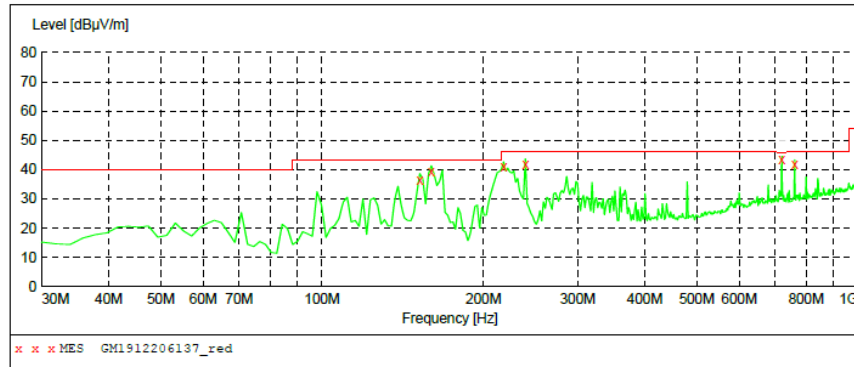
**TEST Data****TEST DATA FOR 9 kHz ~ 30 MHz**

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

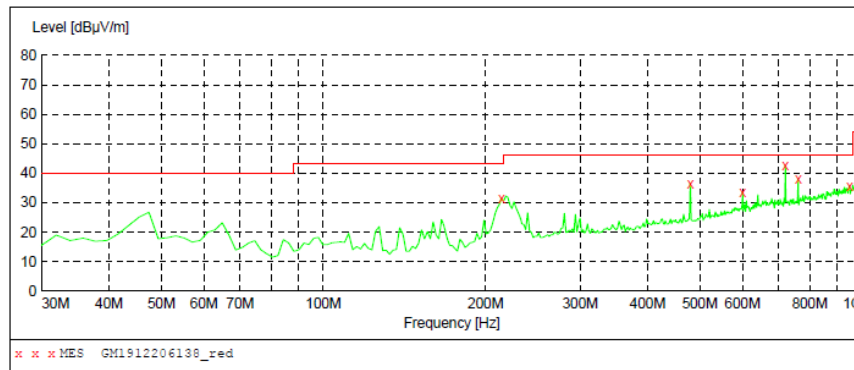
**MEASUREMENT RESULT: "GM1912206137\_red"**

12/20/2019 11:47PM

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/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 dBuV/m	Transd dB	Limit dBuV/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 CH<sub>M</sub> 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 <sub>L</sub>		
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 <sub>M</sub>		
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 <sub>H</sub>		
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:**

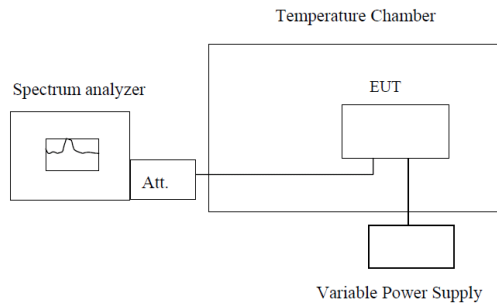
1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.
3. Measuring frequencies from 1 GHz to 40GHz.
4. Test 802.11a, 802.11n mode, all modulations have been tested, 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°C operating frequency as reference frequency.
5. Turn EUT off and set the chamber temperature to -20°C. After the temperature stabilized for approximately 30 minutes recorded the frequency.
6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached..

### TEST MODE:

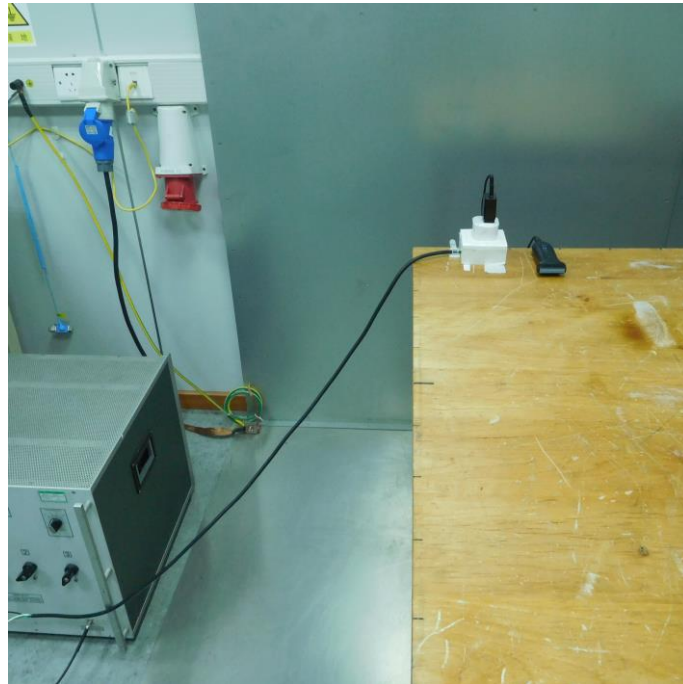
Please refer to the clause 4.3

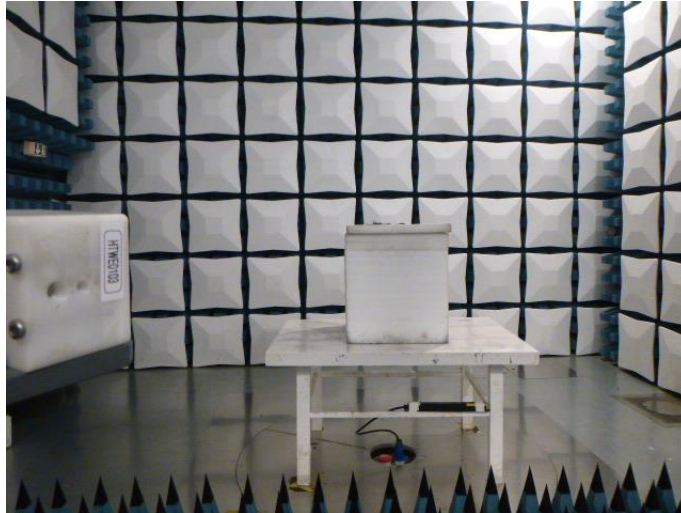
### TEST RESULT

☒ 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

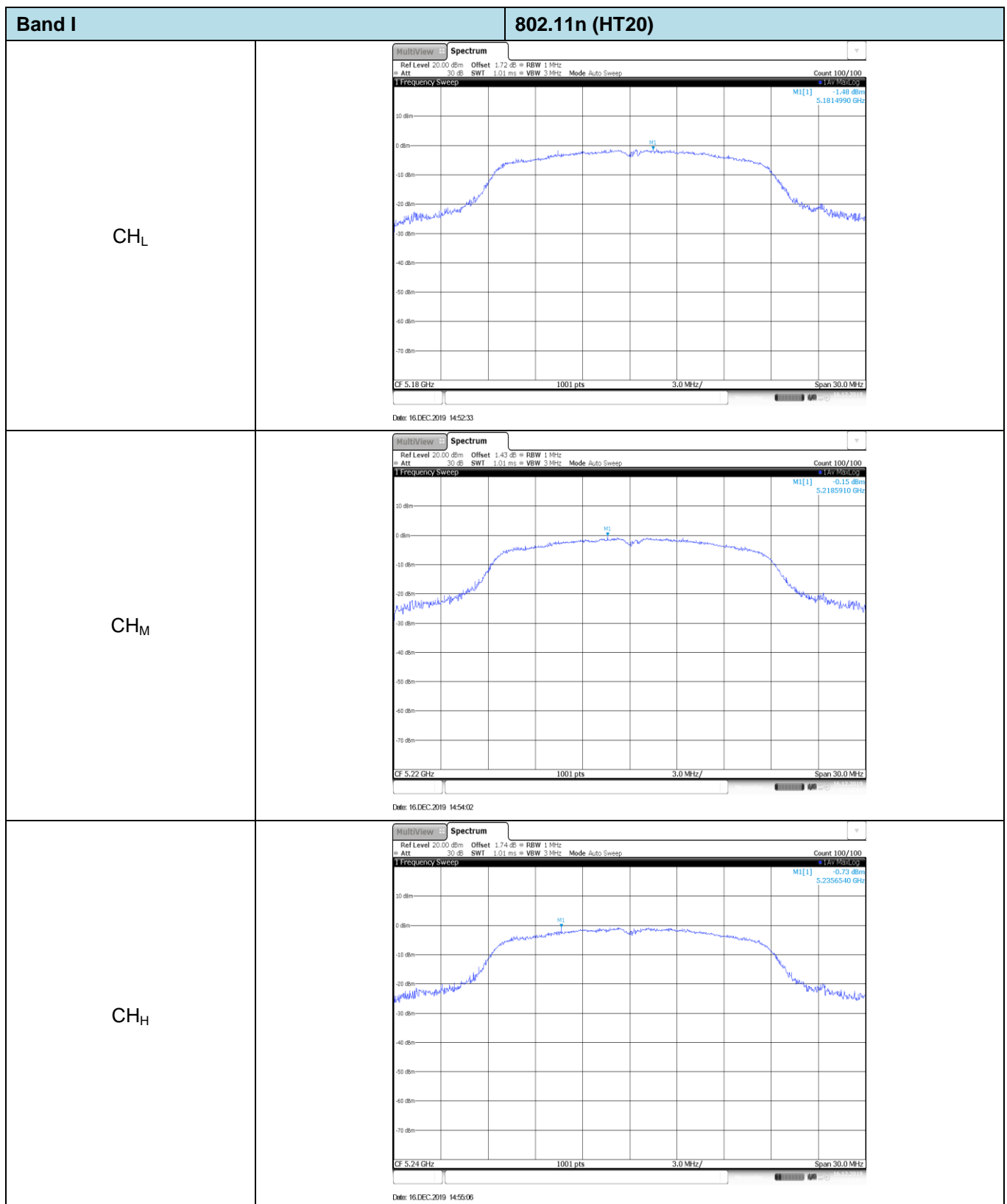
## **8. APPENDIX REPORT**

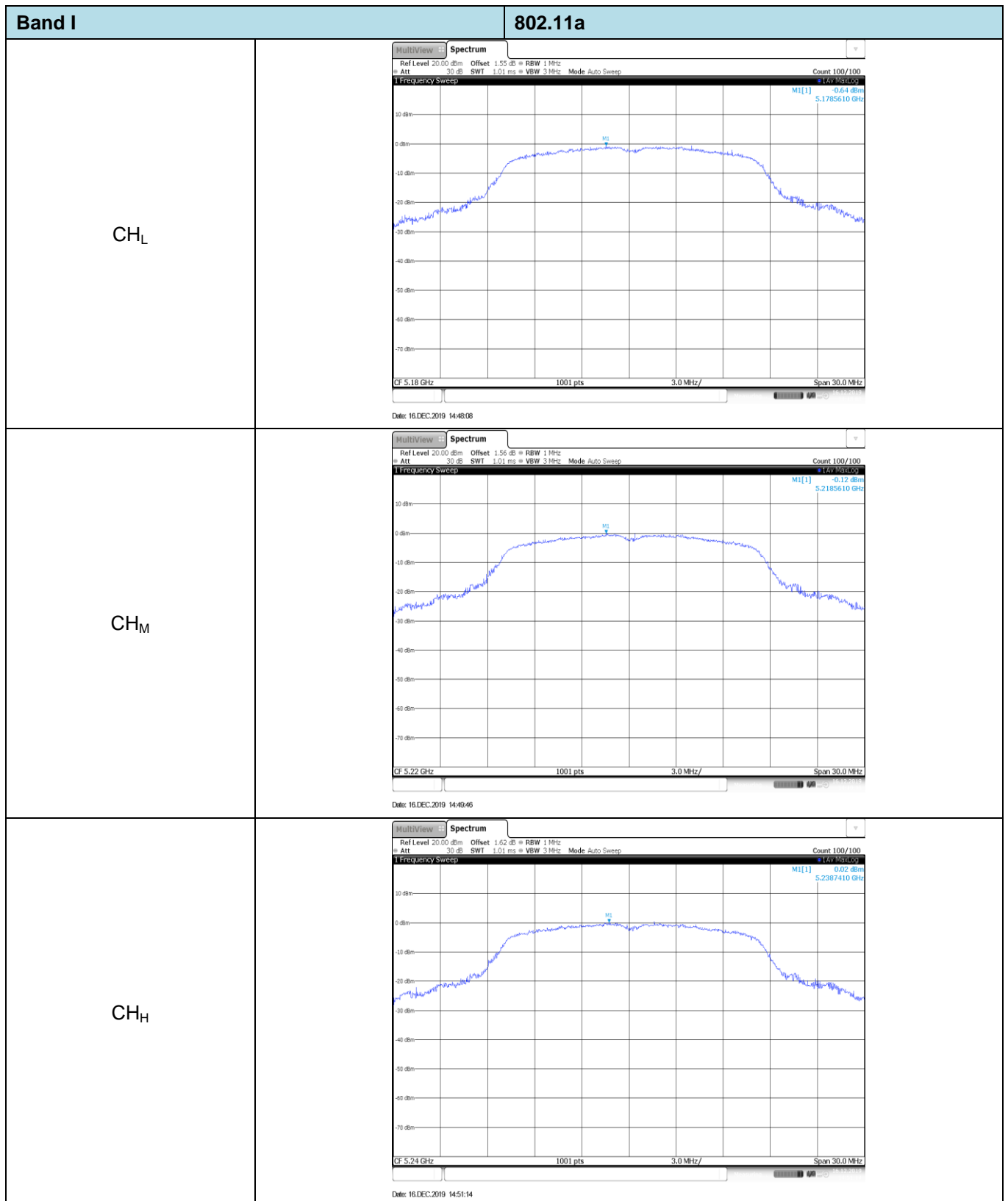
**Appendix A: Maximum Conducted Output Power**

Band	Bandwidth (MHz)	Type	Channel	Conducted Output Power (dBm)	Limit (dBm)	Result
I	20	802.11n	CH <sub>L</sub>	7.58	24.00	Pass
			CH <sub>M</sub>	7.19		
			CH <sub>H</sub>	7.56		
		802.11a	CH <sub>L</sub>	7.14	24.00	Pass
			CH <sub>M</sub>	7.69		
			CH <sub>H</sub>	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 <sub>L</sub>	-1.48	11.00	Pass
			CH <sub>M</sub>	-0.15		
			CH <sub>H</sub>	-0.73		
		802.11a	CH <sub>L</sub>	-0.64	11.00	Pass
			CH <sub>M</sub>	-0.12		
			CH <sub>H</sub>	0.02		





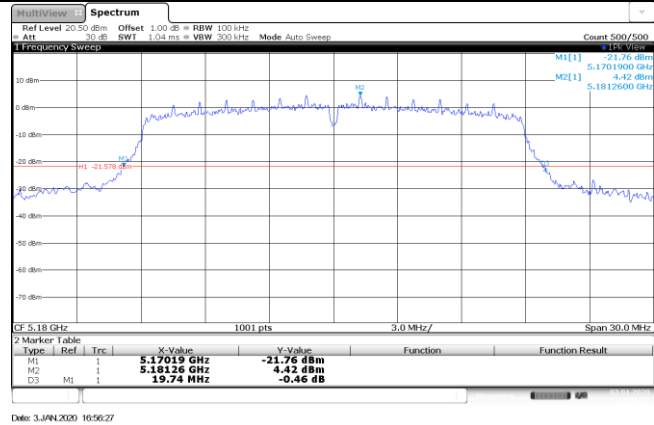
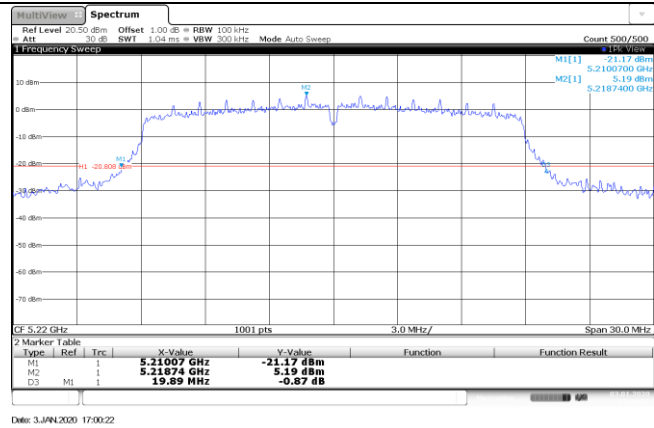
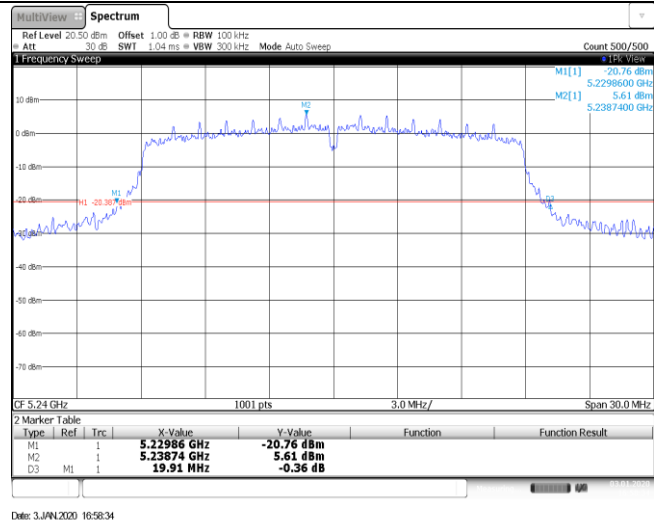


**Appendix C: 26dB bandwidth**

Band	Bandwidth (MHz)	Type	Channel	26dB bandwidth (MHz)	Result
I	20	802.11n	CH <sub>L</sub>	19.74	Pass
			CH <sub>M</sub>	19.89	
			CH <sub>H</sub>	19.91	
		802.11a	CH <sub>L</sub>	19.23	Pass
			CH <sub>M</sub>	19.35	
			CH <sub>H</sub>	19.47	

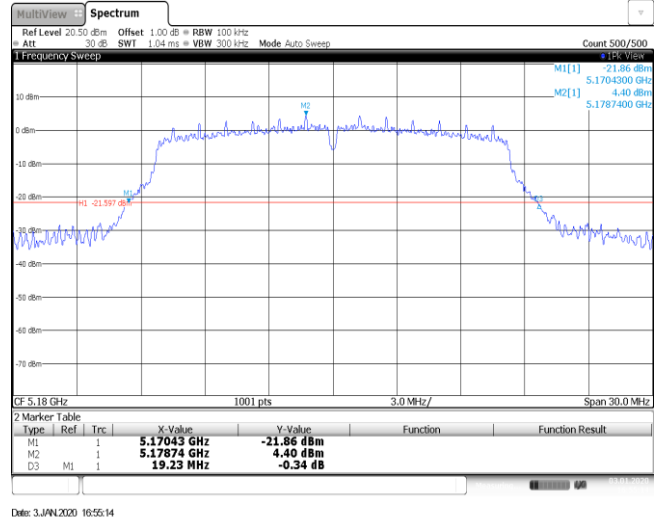
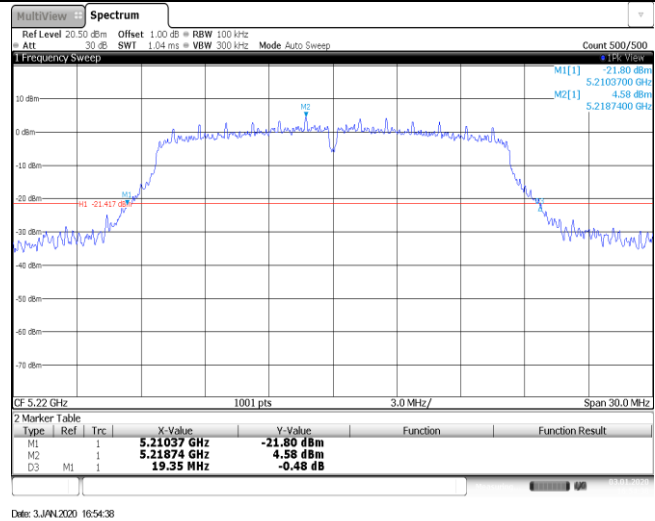
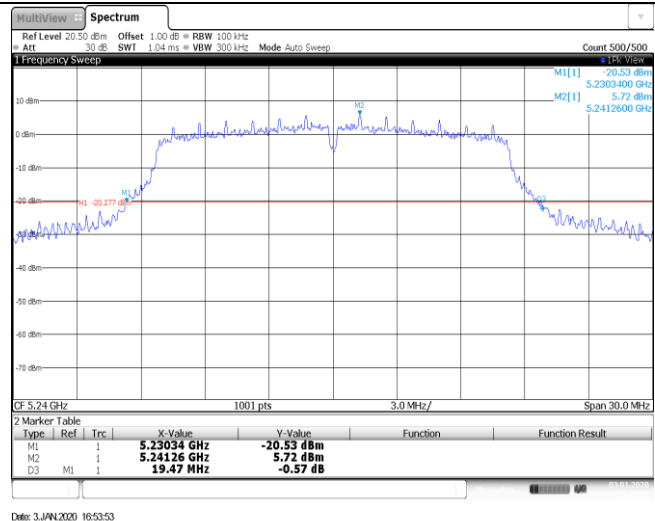
## Band I

## 802.11n (HT20)

CH<sub>L</sub>CH<sub>M</sub>CH<sub>H</sub>

## Band I

802.11a

CH<sub>L</sub>CH<sub>M</sub>CH<sub>H</sub>

**Appendix D: 99% Occupy bandwidth**

Band	Bandwidth (MHz)	Type	Channel	99% Occupy bandwidth (MHz)	Result
I	20	802.11n	CH <sub>L</sub>	17.77	Pass
			CH <sub>M</sub>	17.77	
			CH <sub>H</sub>	17.80	
		802.11a	CH <sub>L</sub>	16.72	Pass
			CH <sub>M</sub>	16.75	
			CH <sub>H</sub>	16.72	

# Band I

# 802.11n (HT20)

CH<sub>L</sub>

MultiView Spectrum

Ref Level 20.50 dBm Offset 1.00 dB BW 300 kHz  
Att 30 dB SWT 1.01 ms VBW 1 MHz Mode Auto Sweep

Count 500/500

1 Occupied Bandwidth

M1 [1] 7.66 dBm  
5.1783520 GHz

CF 5.18 GHz 1001 pts 3.0 MHz/ Span 30.0 MHz

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1	1		5.178352 GHz	-7.66 dBm		
T1	1		5.1711289 GHz	-1.96 dBm	Occ BW	17.77227772 MHz
T2	1		5.1889011 GHz	-1.75 dBm		

Date: 3.JAN.2020 16:59:11

CH<sub>M</sub>

MultiView Spectrum

Ref Level 20.50 dBm Offset 1.00 dB BW 300 kHz  
Att 30 dB SWT 1.01 ms VBW 1 MHz Mode Auto Sweep

Count 500/500

1 Occupied Bandwidth

M1 [1] 7.78 dBm  
5.2208990 GHz

CF 5.22 GHz 1001 pts 3.0 MHz/ Span 30.0 MHz

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1	1		5.220899 GHz	-7.78 dBm		
T1	1		5.2110989 GHz	-1.34 dBm	Occ BW	17.77227772 MHz
T2	1		5.2288711 GHz	-1.06 dBm		

Date: 3.JAN.2020 17:00:13

CH<sub>H</sub>

MultiView Spectrum

Ref Level 20.50 dBm Offset 1.00 dB BW 300 kHz  
Att 30 dB SWT 1.01 ms VBW 1 MHz Mode Auto Sweep

Count 500/500

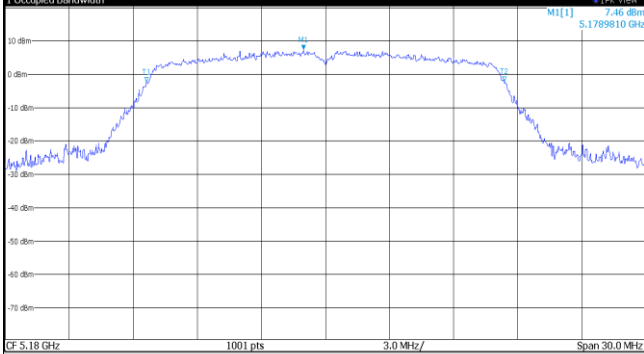
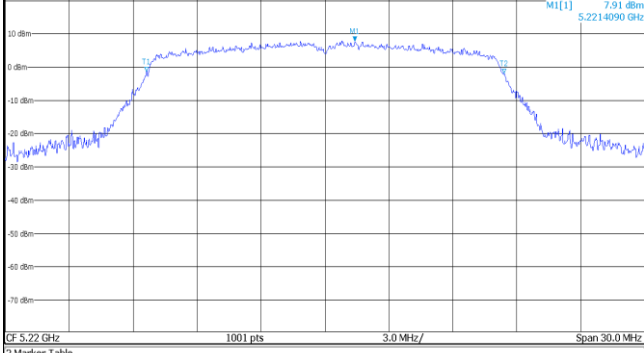
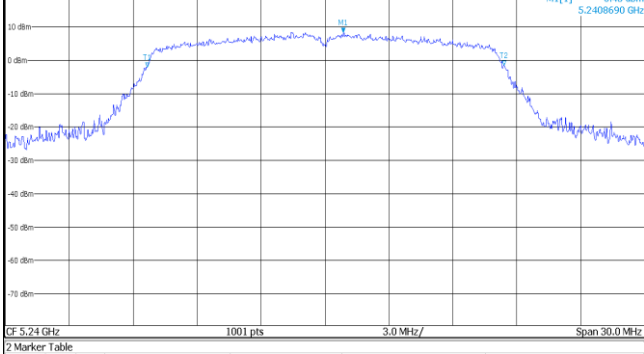
1 Occupied Bandwidth

M1 [1] 8.00 dBm  
5.2408690 GHz

CF 5.24 GHz 1001 pts 3.0 MHz/ Span 30.0 MHz

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1	1		5.240869 GHz	-8.00 dBm		
T1	1		5.2310989 GHz	-2.15 dBm	Occ BW	17.802197802 MHz
T2	1		5.2489011 GHz	-1.61 dBm		

Date: 3.JAN.2020 16:59:40

Band I		802.11a																											
CH <sub>L</sub>	<div><div><div><div><div>MultiView</div><div>Spectrum</div><div></div></div><div><div>Ref Level 20.50 dBm</div><div>Offset 1.00 dB</div><div>RBW 300 kHz</div><div>Att 30 dB</div><div>SWT 1.01 ms</div><div>VBW 1 MHz</div><div>Mode Auto Sweep</div><div>Count 500/500</div></div><div>1 Occupied Bandwidth</div><div></div><div>CF 5.18 GHz1001 pts3.0 MHz/Span 30.0 MHz</div><div><table><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-Value</th><th>Y-Value</th><th>Function</th><th>Function Result</th></tr><tr><td>M1</td><td>1</td><td></td><td>5.178981 GHz</td><td>7.46 dBm</td><td></td><td></td></tr><tr><td>T1</td><td>1</td><td></td><td>5.1716384 GHz</td><td>-2.30 dBm</td><td>Occ Bw</td><td>16.723276723 MHz</td></tr><tr><td>T2</td><td>1</td><td></td><td>5.1883616 GHz</td><td>-2.10 dBm</td><td></td><td></td></tr></table></div><div>Date: 3.JAN.2020 17:02:32</div></div></div></div>	Type	Ref	Trc	X-Value	Y-Value	Function	Function Result	M1	1		5.178981 GHz	7.46 dBm			T1	1		5.1716384 GHz	-2.30 dBm	Occ Bw	16.723276723 MHz	T2	1		5.1883616 GHz	-2.10 dBm		
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result																							
M1	1		5.178981 GHz	7.46 dBm																									
T1	1		5.1716384 GHz	-2.30 dBm	Occ Bw	16.723276723 MHz																							
T2	1		5.1883616 GHz	-2.10 dBm																									
CH <sub>M</sub>	<div><div><div><div><div>MultiView</div><div>Spectrum</div><div></div></div><div><div>Ref Level 20.50 dBm</div><div>Offset 1.00 dB</div><div>RBW 300 kHz</div><div>Att 30 dB</div><div>SWT 1.01 ms</div><div>VBW 1 MHz</div><div>Mode Auto Sweep</div><div>Count 500/500</div></div><div>1 Occupied Bandwidth</div><div></div><div>CF 5.22 GHz1001 pts3.0 MHz/Span 30.0 MHz</div><div><table><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-Value</th><th>Y-Value</th><th>Function</th><th>Function Result</th></tr><tr><td>M1</td><td>1</td><td></td><td>5.221409 GHz</td><td>7.91 dBm</td><td></td><td></td></tr><tr><td>T1</td><td>1</td><td></td><td>5.2116384 GHz</td><td>-1.29 dBm</td><td>Occ Bw</td><td>16.753246753 MHz</td></tr><tr><td>T2</td><td>1</td><td></td><td>5.2283916 GHz</td><td>-1.76 dBm</td><td></td><td></td></tr></table></div><div>Date: 3.JAN.2020 17:02:45</div></div></div></div>	Type	Ref	Trc	X-Value	Y-Value	Function	Function Result	M1	1		5.221409 GHz	7.91 dBm			T1	1		5.2116384 GHz	-1.29 dBm	Occ Bw	16.753246753 MHz	T2	1		5.2283916 GHz	-1.76 dBm		
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result																							
M1	1		5.221409 GHz	7.91 dBm																									
T1	1		5.2116384 GHz	-1.29 dBm	Occ Bw	16.753246753 MHz																							
T2	1		5.2283916 GHz	-1.76 dBm																									
CH <sub>H</sub>	<div><div><div><div><div>MultiView</div><div>Spectrum</div><div></div></div><div><div>Ref Level 20.50 dBm</div><div>Offset 1.00 dB</div><div>RBW 300 kHz</div><div>Att 30 dB</div><div>SWT 1.01 ms</div><div>VBW 1 MHz</div><div>Mode Auto Sweep</div><div>Count 500/500</div></div><div>1 Occupied Bandwidth</div><div></div><div>CF 5.24 GHz1001 pts3.0 MHz/Span 30.0 MHz</div><div><table><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-Value</th><th>Y-Value</th><th>Function</th><th>Function Result</th></tr><tr><td>M1</td><td>1</td><td></td><td>5.240869 GHz</td><td>8.43 dBm</td><td></td><td></td></tr><tr><td>T1</td><td>1</td><td></td><td>5.2316683 GHz</td><td>-2.06 dBm</td><td>Occ Bw</td><td>16.723276723 MHz</td></tr><tr><td>T2</td><td>1</td><td></td><td>5.2483916 GHz</td><td>-1.44 dBm</td><td></td><td></td></tr></table></div><div>Date: 3.JAN.2020 17:02:56</div></div></div></div>	Type	Ref	Trc	X-Value	Y-Value	Function	Function Result	M1	1		5.240869 GHz	8.43 dBm			T1	1		5.2316683 GHz	-2.06 dBm	Occ Bw	16.723276723 MHz	T2	1		5.2483916 GHz	-1.44 dBm		
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result																							
M1	1		5.240869 GHz	8.43 dBm																									
T1	1		5.2316683 GHz	-2.06 dBm	Occ Bw	16.723276723 MHz																							
T2	1		5.2483916 GHz	-1.44 dBm																									

**Appendix E: Frequency stability****Voltage VS Frequency stability**

Band: I			Test Frequency: 5180.00MHz	
Temperature (°C)	Voltage (V)	Frequency Deviation (Hz)	Frequency Deviation (ppm)	Result
T <sub>N</sub>	V <sub>L</sub>	-2000.00	-0.38610	PASS
T <sub>N</sub>	V <sub>N</sub>	-2000.00	-0.38610	PASS
T <sub>N</sub>	V <sub>H</sub>	-2000.00	-0.38610	PASS

**Temperature VS Frequency stability**

Band: I			Test Frequency: 5180.00MHz	
Voltage (V)	Temperature (°C)	Frequency Deviation (Hz)	Frequency Deviation (ppm)	Result
T <sub>N</sub>	-20	-2000.00	-0.38610	PASS
T <sub>N</sub>	-10	-2000.00	-0.38610	PASS
T <sub>N</sub>	0	-2000.00	-0.38610	PASS
T <sub>N</sub>	10	-2000.00	-0.38610	PASS
T <sub>N</sub>	20	-2000.00	-0.38610	PASS
T <sub>N</sub>	30	-2000.00	-0.38610	PASS
T <sub>N</sub>	40	-2000.00	-0.38610	PASS
T <sub>N</sub>	50	-2000.00	-0.38610	PASS

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