




TEST REPORT

Report Reference No. : CHTEW19040139 Report verification: 

Project No. : SHT1901069902EW

FCC ID. : 2AETW-8009

Applicant's name : Cleer Limited

Address : Unit518, Lakeside 1, Science Park West Ave. HK Science Park

Manufacturer : Cleer Limited

Address : Unit518, Lakeside 1, Science Park West Ave. HK Science Park

Test item description : Smart Home Speaker

Trade Mark : Cleer

Model/Type reference : SPACE

Listed Model(s) : -

Standard : FCC CFR Title 47 Part 15 Subpart E Section 15.407

Date of receipt of test sample : Feb 26, 2019

Date of testing : Feb 27, 2019- Apr 18, 2019

Date of issue : Apr 19, 2019

Result : PASS

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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	2019-04-19	Original

2. TEST DESCRIPTION

Test Item	FCC Rule	Result	Test Engineer
Antenna Requirement	15.203	PASS	Jiongsheng Feng
Line Conducted Emissions (AC Main)	15.207	PASS	Jiongsheng Feng
Maximum Conducted Output Power	15.407(a)	PASS	Jiongsheng Feng
Maximum Power Spectral Density	15.407(a)	PASS	Jiongsheng Feng
26dB Bandwidth and 99% Occupancy bandwidth	15.407(a)	PASS	Jiongsheng Feng
6dB Bandwidth	15.407(a)	PASS	Jiongsheng Feng
Band edge	15.407(b)	PASS	Jiongsheng Feng
Radiated Spurious Emissions	15.209	PASS	Shower Dai
Frequency Stability	15.407(g)	PASS	Jiongsheng Feng

Remark: The measurement uncertainty is not included in the test result.

3. SUMMARY

3.1. Client Information

Applicant:	Cleer Limited
Address:	Unit518, Lakeside 1, Science Park West Ave. HK Science Park
Manufacturer:	Cleer Limited
Address:	Unit518, Lakeside 1, Science Park West Ave. HK Science Park

3.2. Product Description

Name of EUT	Smart Home Speaker		
Trade Mark:	Cleer		
Model No.:	SPACE		
Listed Model(s):	-		
Power supply:	DC 18V		
Adapter information:	Model:GPE060D-180388D Input:100-240Va.c., 50/60Hz, 1.5A Output:18Vd.c., 3880mA		
5G WIFI			
Supported type:	<input checked="" type="checkbox"/> 802.11n(HT20)		<input checked="" type="checkbox"/> 802.11n(HT40)
Function:	<input type="checkbox"/> Outdoor AP <input checked="" type="checkbox"/> Client	<input type="checkbox"/> Indoor AP	<input type="checkbox"/> Fixed P2P
DFS type:	<input type="checkbox"/> master devices	<input type="checkbox"/> Slave devices with radar detection	<input checked="" type="checkbox"/> Slave devices without radar detection
Modulation:	BPSK, QPSK, 16QAM, 64QAM		
Operation frequency:	<input checked="" type="checkbox"/> Band I: 5150MHz~5250MHz		
Supported Bandwidth	20MHz:	802.11n	
	40MHz:	802.11n	
Antenna type:	FPC Anternna		
Antenna gain:	4.9dBi		

3.3. Operation state

➤ Frequency list

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

Band	Test Channel	20MHz		40MHz	
		Channel	Frequency (MHz)	Channel	Frequency (MHz)
I	CH _L	36	5180	38	5190
	CH _M	44	5220	-	-
	CH _H	48	5240	46	5230

➤ Data Rated

Preliminary tests were performed in different data rate, and found which the below bit rate is worst case mode, so only show data which it is a worst case mode.

Mode	Data rate (worst mode)
802.11n(HT20)	MCS0
802.11n(HT40)	MCS0

➤ Test mode

For RF test items
The engineering test program was provided and enabled to make EUT continuous transmit (duty cycle>98%).
For AC power line conducted emissions:
The EUT was set to connect with the WLAN AP under large package sizes transmission.
For Radiated suprious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit(duty cycle>98%). The EUT in each of three orthogonal axis emissions had been tested ,but only the worst case (X axis) data Recorded in the report.

3.4. EUT configuration

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

- - supplied by the manufacturer
- - supplied by the lab

○	N/A	Manufacturer :	N/A
		Model No. :	N/A
○	N/A	Manufacturer :	N/A
		Model No. :	N/A

3.5. Modifications

No modifications were implemented to meet testing criteria.

4. TEST ENVIRONMENT

4.1. Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.

Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

Phone: 86-755-26748019 Fax: 86-755-26748089

4.2. Test Facility

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 3902.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 762235

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files.

IC-Registration No.: 5377B-1

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No.: 5377B-1.

ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

4.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

4.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors in calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd. quality system according to ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Here after the best measurement capability for Shenzhen Huatongwei International Inspection Co., Ltd. is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.63 dB	(1)
Conducted spurious emissions 9kHz~40GHz	0.63 dB	(1)
Conducted Disturbance 150kHz~30MHz	3.35 dB	(1)
Radiated Emissions below 1GHz	4.28 dB	(1)
Radiated Emissions above 1GHz	5.16 dB	(1)
Occupied Bandwidth	69 Hz	(1)
Frequency error	69 Hz	(1)

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

4.5. Equipments Used during the Test

● Conducted Emission						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Shielded Room	Albatross projects	N/A	N/A	2018/09/28	2023/09/27
●	EMI Test Receiver	R&S	ESCI	101247	2018/10/27	2019/10/26
●	Artificial Mains	SCHWARZBECK	NNLK 8121	573	2018/10/27	2019/10/26
●	Pulse Limiter	R&S	ESH3-Z2	100499	2018/10/27	2019/10/26
●	RF Connection Cable	HUBER+SUHNER	EF400	N/A	2018/11/15	2019/11/14
●	Test Software	R&S	ES-K1	N/A	N/A	N/A
○	Single Balanced Telecom Pair ISN	FCC	FCC-TLISN-T2-02	20371	2018/10/28	2019/10/27
○	Two Balanced Telecom Pairs ISN	FCC	FCC-TLISN-T4-02	20373	2018/10/28	2019/10/27
○	Four Balanced Telecom Pairs ISN	FCC	FCC-TLISN-T8-02	20375	2018/10/28	2019/10/27
○	V-Network	R&S	ESH3-Z6	100211	2018/10/27	2019/10/26
○	V-Network	R&S	ESH3-Z6	100210	2018/10/27	2019/10/26
○	2-Line V-Network	R&S	ESH3-Z5	100049	2018/10/27	2019/10/26

● Radiated Emission-6th test site						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	SAC-3m-02	N/A	2018/09/30	2021/09/29
●	EMI Test Receiver	R&S	ESCI	100900	2018/10/28	2019/10/27
○	Loop Antenna	R&S	HFH2-Z2	100020	2017/11/20	2020/11/19
●	Ultra-Broadband Antenna	SCHWARZBECK	VULB9163	546	2017/04/05	2020/04/04
●	Pre-Amplifier	SCHWARZBECK	BBV 9742	N/A	2018/11/15	2019/11/14
●	RF Connection Cable	HUBER+SUHNER	N/A	N/A	2018/09/28	2019/09/27
●	RF Connection Cable	HUBER+SUHNER	SUCOFLEX104	501184/4	2018/09/28	2019/09/27
●	Test Software	R&S	ES-K1	N/A	N/A	N/A
●	Turntable	Maturo Germany	TT2.0-1T	N/A	N/A	N/A
●	Antenna Mast	Maturo Germany	CAM-4.0-P-12	N/A	N/A	N/A

● Radiated emission-7th test site						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	SAC-3m-01	N/A	2018/09/30	2021/09/29
●	Spectrum Analyzer	R&S	FSP40	100597	2018/10/27	2019/10/26
●	Horn Antenna	SCHWARZBECK	9120D	1011	2017/03/27	2020/03/26
●	Pre-amplifier	BONN	BLWA0160-2M	1811887	2018/11/14	2019/11/13
●	Pre-amplifier	CD	PAP-0102	12004	2018/11/14	2019/11/13
●	Broadband Pre-amplifier	SCHWARZBECK	BBV 9718	9718-248	2018/04/28	2019/04/27
●	RF Connection Cable	HUBER+SUHNER	RE-7-FH	N/A	2018/11/15	2019/11/14
●	RF Connection Cable	HUBER+SUHNER	RE-7-FL	N/A	2018/11/15	2019/11/14
●	Test Software	Audix	E3	N/A	N/A	N/A

●	Turntable	Maturo Germany	TT2.0-1T	N/A	N/A	N/A
●	Antenna Mast	Maturo Germany	CAM-4.0-P-12	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	2018/10/28	2019/10/27
●	Spectrum Analyzer	Agilent	N9020A	MY50510187	2018/09/29	2019/09/28
●	OSP	R&S	OSP120	101317	N/A	N/A
○	Radio communication tester	R&S	CMW500	137688-Lv	2018/09/29	2019/09/28
○	Test software	Tonscend	JS1120-1(LTE)	N/A	N/A	N/A
○	Test software	Tonscend	JS1120-2(WIFI)	N/A	N/A	N/A
○	Test software	Tonscend	JS1120-3(WCDMA)	N/A	N/A	N/A
○	Test software	Tonscend	JS1120-4(GSM)	N/A	N/A	N/A

5. TEST CONDITIONS AND RESULTS

5.1. Antenna requirement

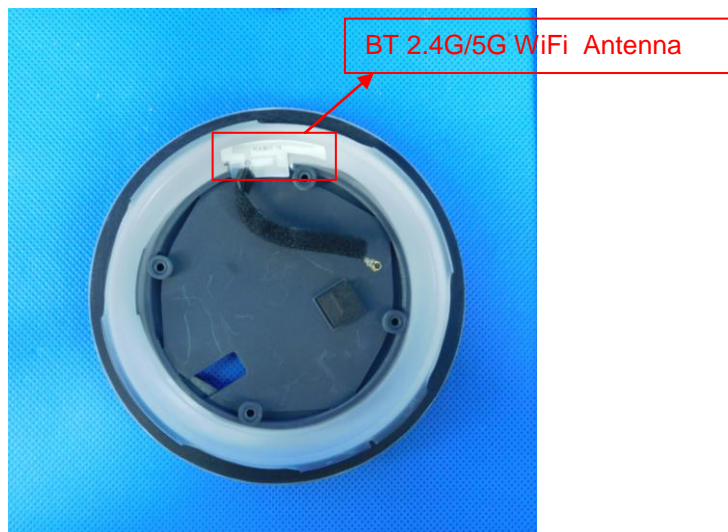
Requirement

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:

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



5.2. Conducted Emissions (AC Main)

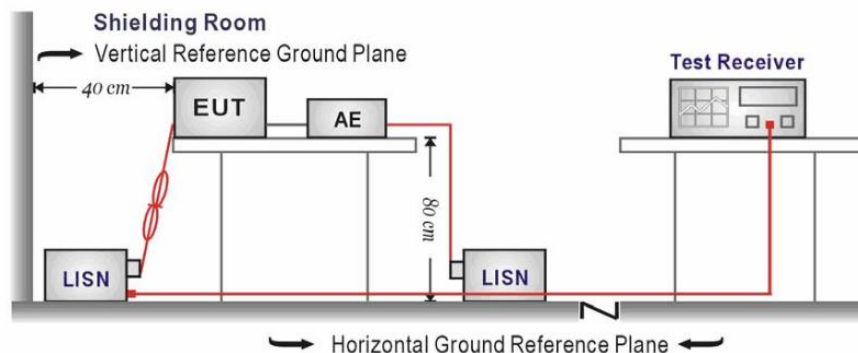
LIMIT

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 C63.10:2013 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 3.3

TEST RESULTS

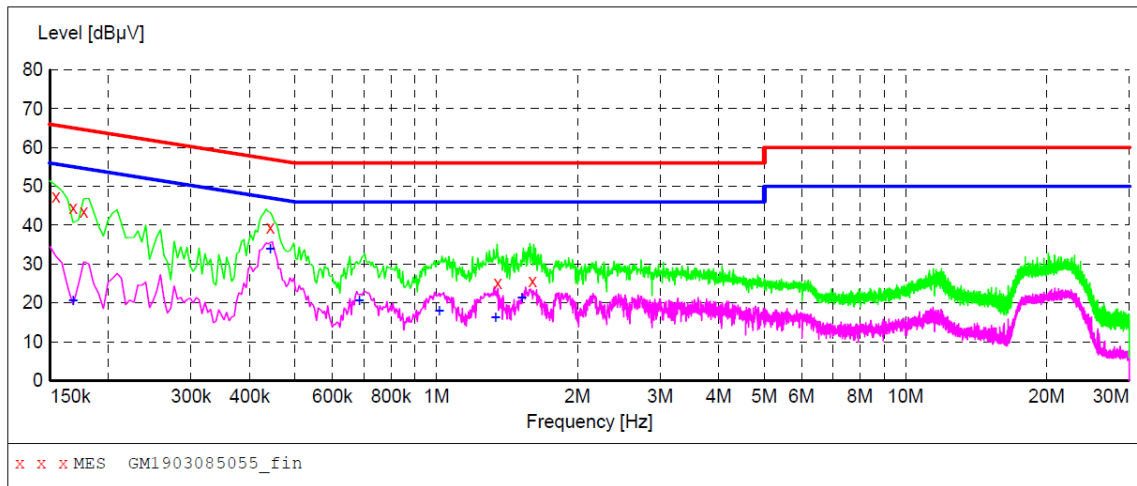
☒ Passed ☐ Not Applicable

Note:

- 1) Transd=Cable lose+ Pulse Limiter Factor + Artificial Mains Factor
- 2) Margin= Limit -Level

Test Line:

L

**MEASUREMENT RESULT: "GM1903085055_fin"**

3/8/2019 3:38PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.154500	47.30	10.1	66	18.5	QP	L1	GND
0.168000	44.60	10.1	65	20.5	QP	L1	GND
0.177000	43.50	10.1	65	21.1	QP	L1	GND
0.442500	39.50	10.1	57	17.5	QP	L1	GND
1.351500	25.30	10.0	56	30.7	QP	L1	GND
1.603500	25.70	10.0	56	30.3	QP	L1	GND

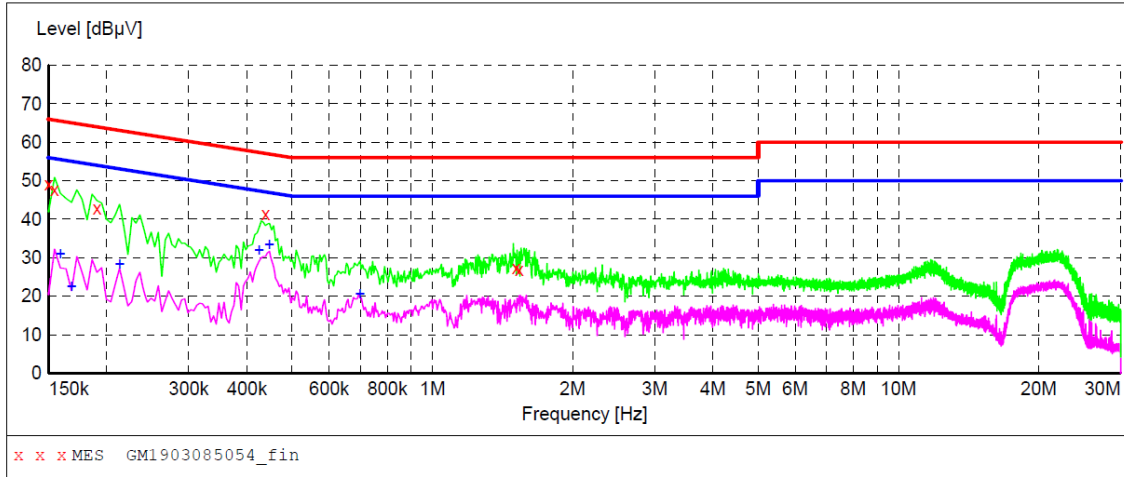
MEASUREMENT RESULT: "GM1903085055_fin2"

3/8/2019 3:38PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.168000	20.70	10.1	55	34.4	AV	L1	GND
0.442500	33.90	10.1	47	13.1	AV	L1	GND
0.685500	20.70	10.0	46	25.3	AV	L1	GND
1.014000	18.00	10.0	46	28.0	AV	L1	GND
1.338000	16.30	10.0	46	29.7	AV	L1	GND
1.522500	21.40	10.0	46	24.6	AV	L1	GND

Test Line:

N

**MEASUREMENT RESULT: "GM1903085054_fin"**

3/8/2019 3:36PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.150000	49.10	10.1	66	16.9	QP	N	GND
0.154500	47.60	10.1	66	18.2	QP	N	GND
0.190500	42.70	10.1	64	21.3	QP	N	GND
0.438000	41.30	10.1	57	15.8	QP	N	GND
1.513500	27.40	10.0	56	28.6	QP	N	GND
1.536000	26.90	10.0	56	29.1	QP	N	GND

MEASUREMENT RESULT: "GM1903085054_fin2"

3/8/2019 3:36PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.159000	31.10	10.1	56	24.4	AV	N	GND
0.168000	22.40	10.1	55	32.7	AV	N	GND
0.213000	28.20	10.2	53	24.9	AV	N	GND
0.424500	31.90	10.1	47	15.5	AV	N	GND
0.447000	33.30	10.1	47	13.6	AV	N	GND
0.699000	20.70	10.0	46	25.3	AV	N	GND

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 $P_{out} = 24 - (G_{TX} - 6)$.

For the 5.25~5.35GHz band:

The maximum conducted output power (P_{out}) shall not exceed the lesser of 250mW (24dBm) or 11dBm+10 log B, where B is the 26dB emission bandwidth in MHz.
if $G_{TX} > 6\text{dBi}$, then $P_{out} = 24 - (G_{TX} - 6)$.

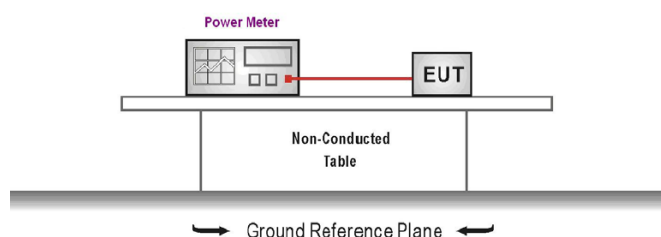
For the 5.47~5.725GHz band:

The maximum conducted output power (P_{out}) shall not exceed the lesser of 250mW (24dBm) or 11dBm+10 log B, where B is the 26dB emission bandwidth in MHz.
if $G_{TX} > 6\text{dBi}$, then $P_{out} = 24 - (G_{TX} - 6)$.

For the 5.725~5.85GHz band:

- Point-to-multipoint systems (P2M)
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 systems (P2P)
The maximum conducted output power (P_{out}) shall not exceed the lesser of 1W (30dBm).

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.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Band	Bandwidth (MHz)	Type	Channel	Conducted Output Power (dBm)	Limit (dBm)	Result
I	20	802.11n	CH _L	16.40	24.00	Pass
			CH _M	17.70		
			CH _H	17.92		
		802.11a	CH _L	16.19	24.00	Pass
			CH _M	17.67		
			CH _H	17.86		
	40	802.11n	CH _L	16.63	24.00	Pass
			CH _H	17.67		

5.4. Maximum 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 $\text{PSD} = 11 - (G_{TX} - 6)$.

For the 5.25~5.35GHz band:

The peak power spectral density (PSD) shall not exceed the lesser of 11dBm/MHz.
if $G_{TX} > 6\text{dBi}$, then $\text{PSD} = 11 - (G_{TX} - 6)$.

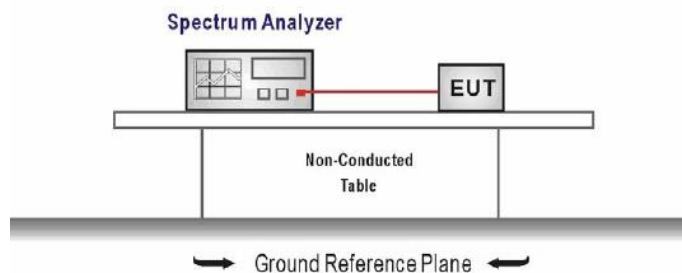
For the 5.47~5.725GHz band:

The peak power spectral density (PSD) shall not exceed the lesser of 11dBm/MHz.
if $G_{TX} > 6\text{dBi}$, then $\text{PSD} = 11 - (G_{TX} - 6)$.

For the 5.725~5.85GHz band:

- Point-to-multipoint systems (P2M)
The peak power spectral density (PSD) shall not exceed the lesser of 30dBm/500kHz.
if $G_{TX} > 6\text{dBi}$, then $\text{PSD} = 30 - (G_{TX} - 6)$.
- Point-to-point systems (P2P)
The peak power spectral density (PSD) shall not exceed the lesser of 30dBm/500kHz.

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.

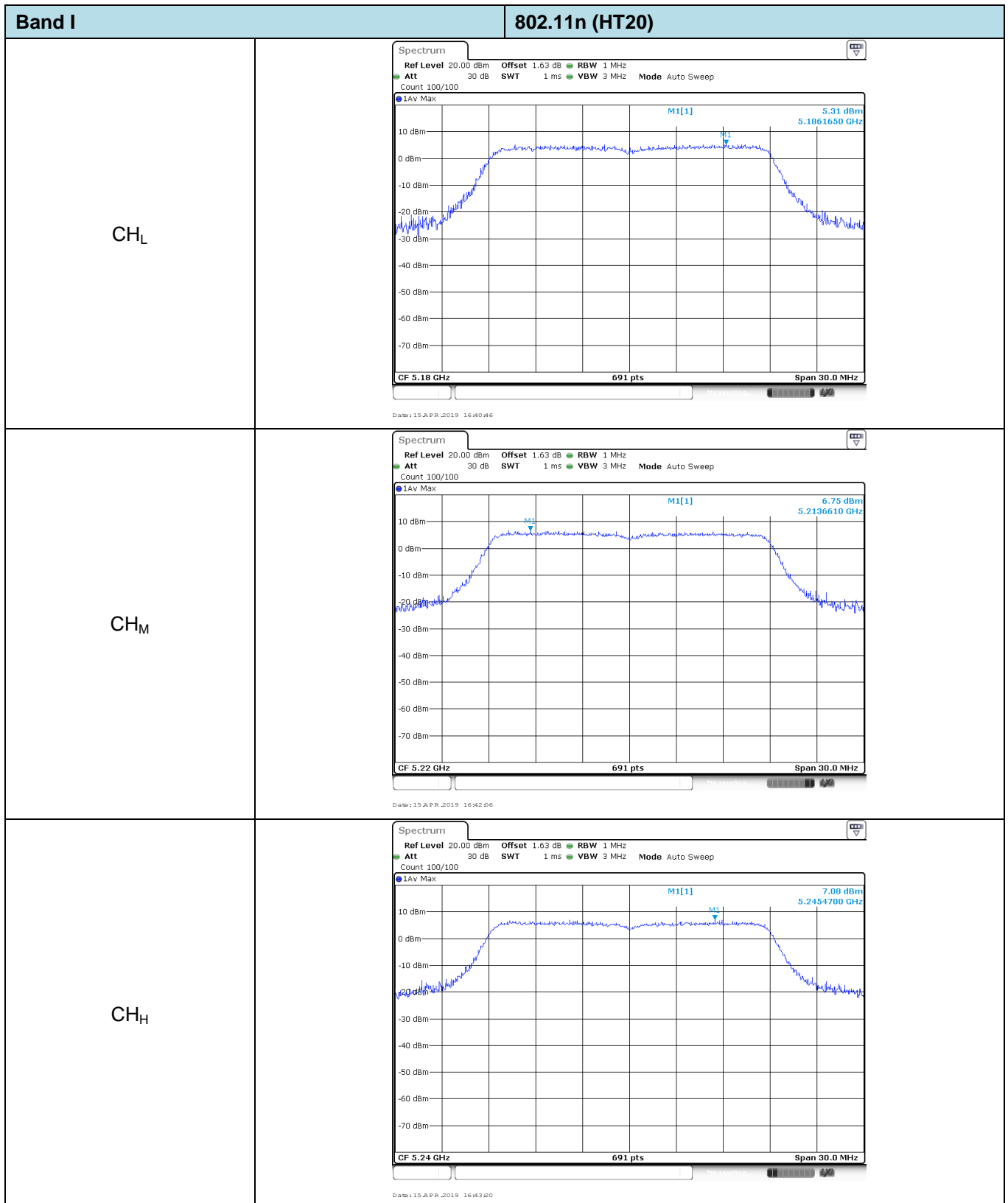
TEST MODE:

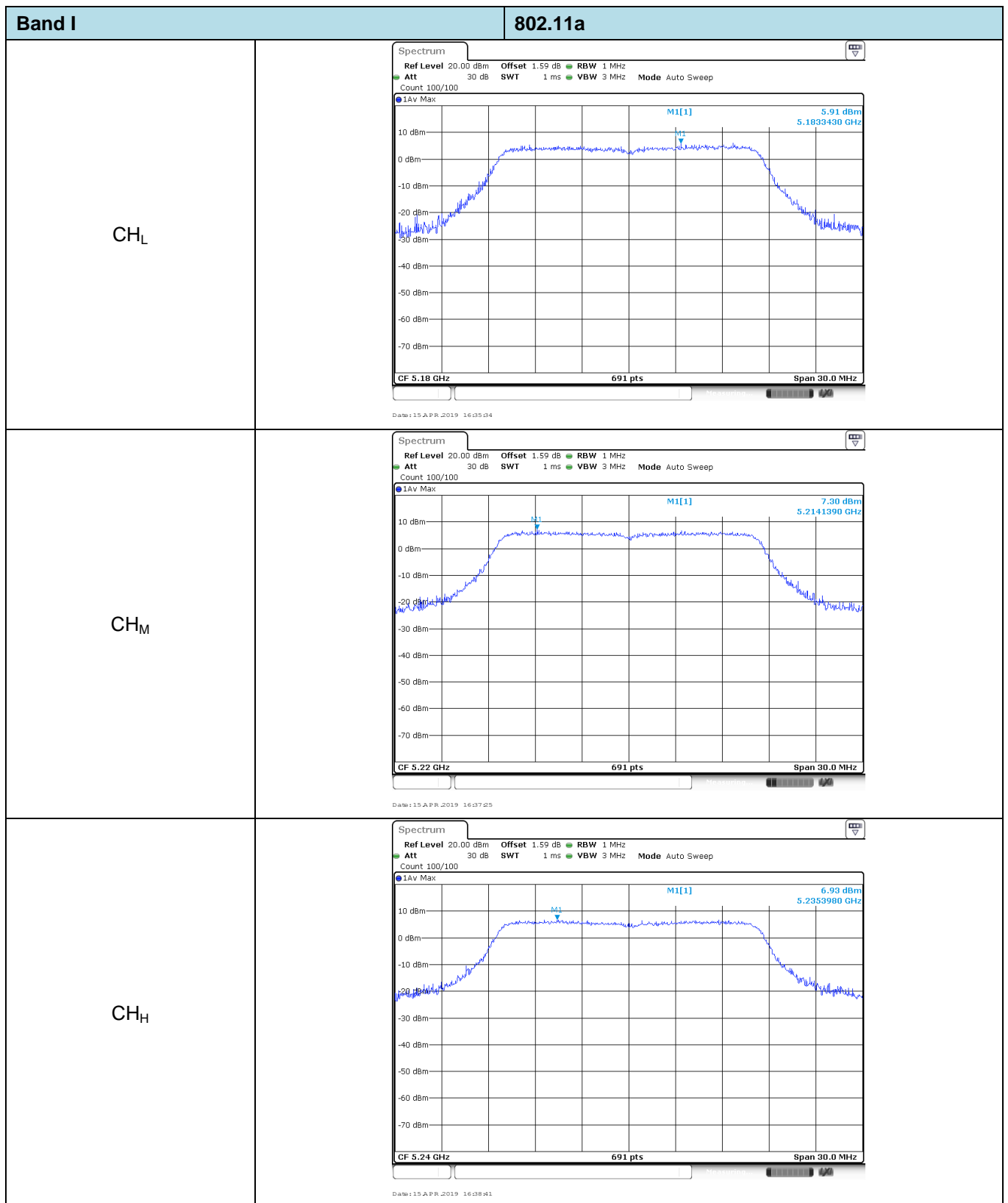
Please refer to the clause 3.3

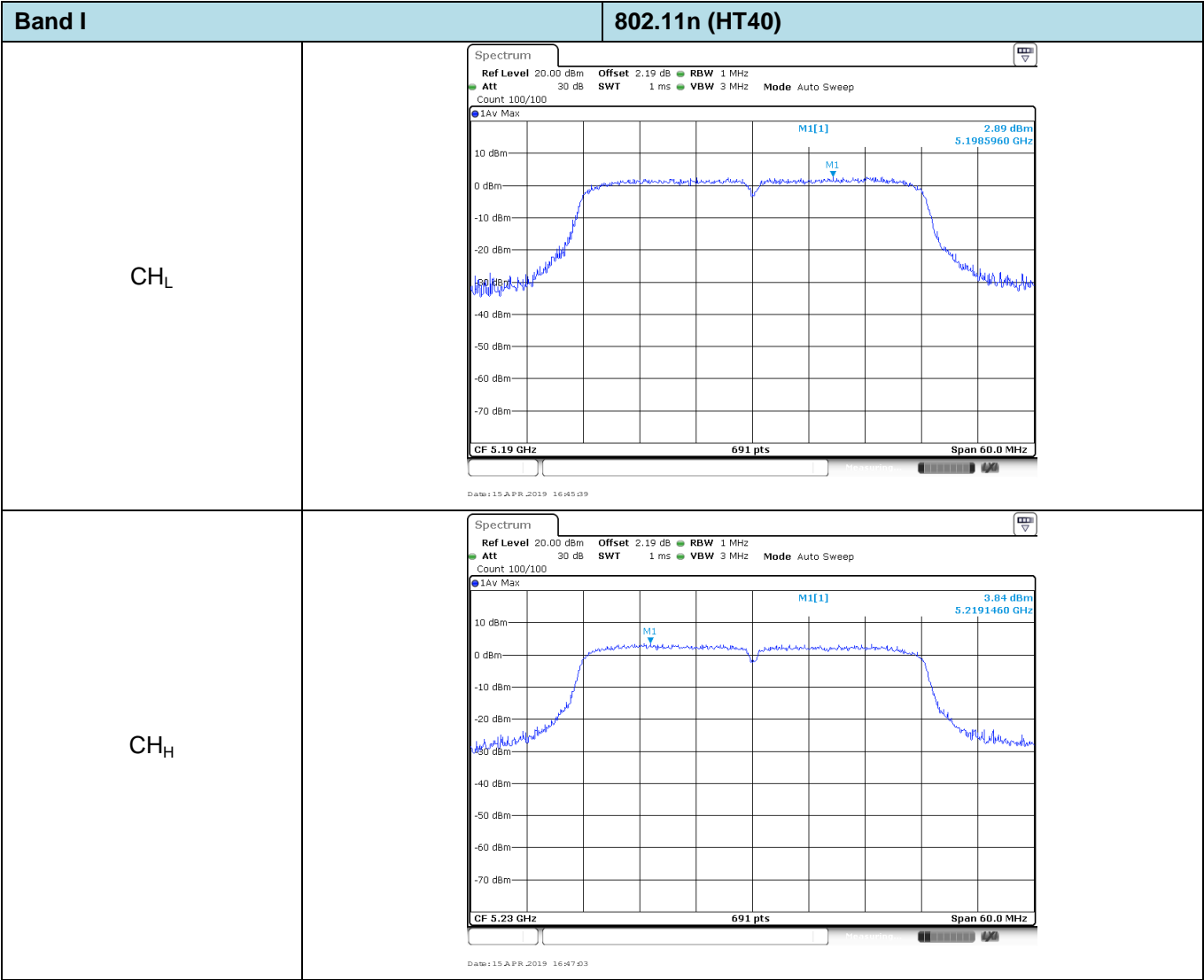
TEST RESULTS
☒ **Passed**
☐ **Not Applicable**

Band	Bandwidth (MHz)	Type	Channel	Power Spectral Density (dBm/MHz)	Limit (dBm/MHz)	Result
I	20	802.11n	CH _L	5.31	11.00	Pass
			CH _M	6.75		
			CH _H	7.08		
		802.11a	CH _L	5.91	11.00	Pass
			CH _M	7.30		
			CH _H	6.93		
	40	802.11n	CH _L	2.89	11.00	Pass
			CH _H	3.84		

Test plot as follows:





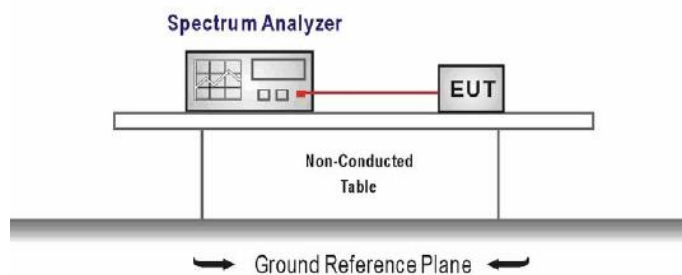


5.5. 26dB bandwidth and 99% Occupancy bandwidth

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 3.3

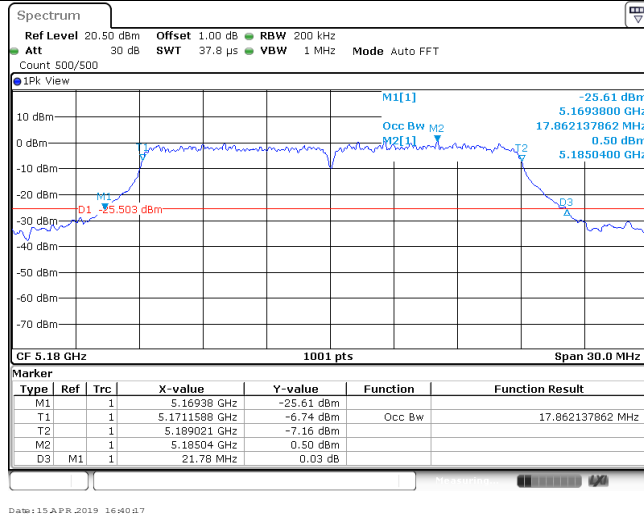
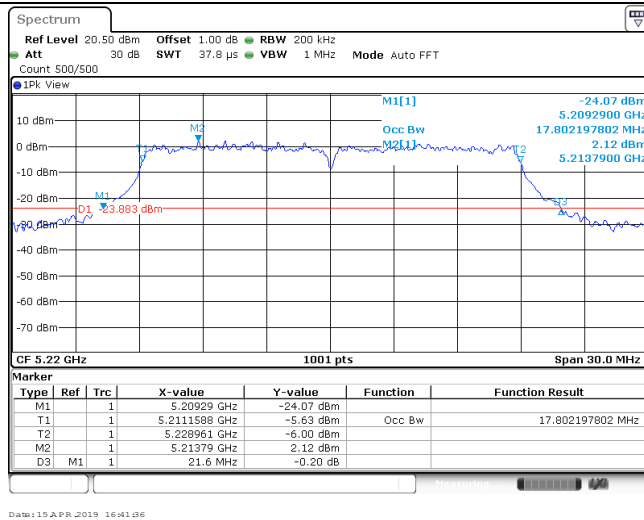
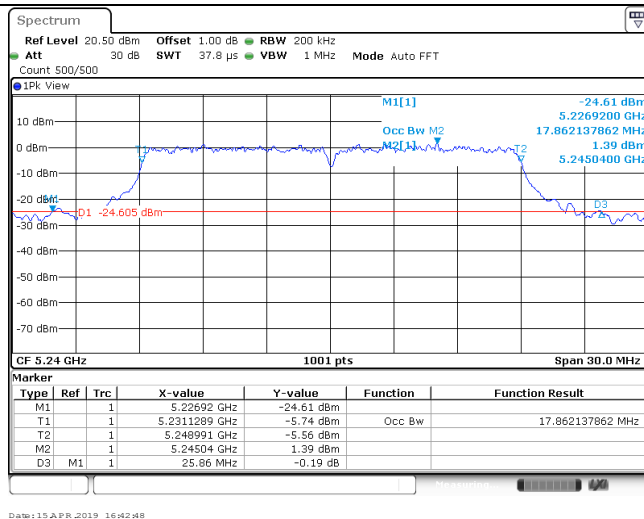
TEST RESULTS

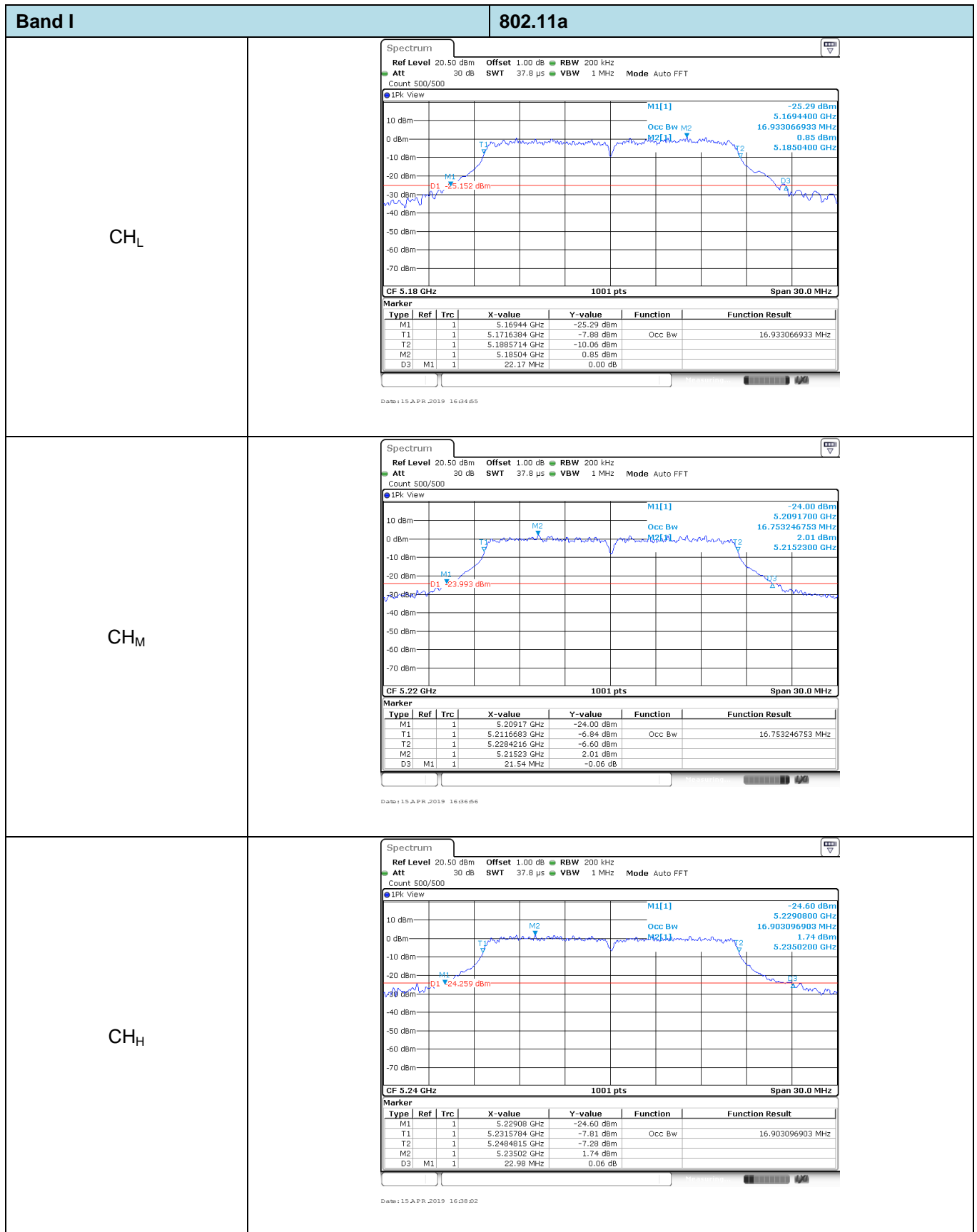
☒ Passed ☐ Not Applicable

Band	Bandwidth (MHz)	Type	Channel	99% Occupy bandwidth (MHz)	26dB bandwidth (MHz)	Result
I	20	802.11n	CH _L	17.86	21.78	Pass
			CH _M	17.80	21.60	
			CH _H	17.86	25.86	
		802.11a	CH _L	16.93	22.17	Pass
			CH _M	16.75	21.54	
			CH _H	16.90	22.98	
	40	802.11n	CH _L	36.32	44.16	Pass
			CH _H	36.44	46.62	

Band I

802.11n (HT20)

CH_LCH_MCH_H





5.6. Band edge

LIMIT

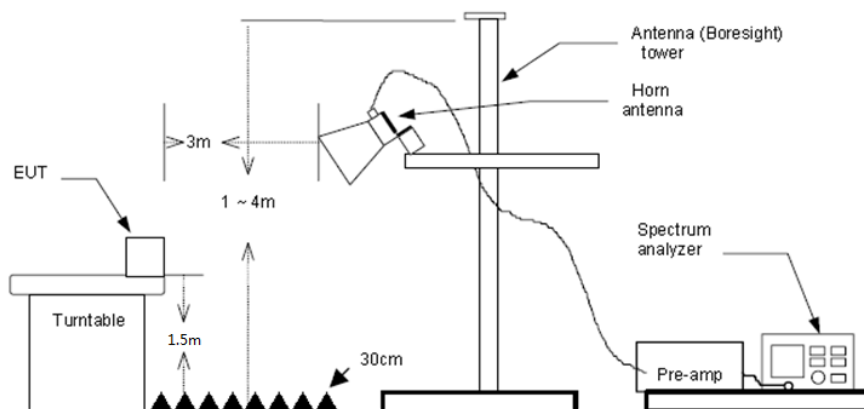
FCC CFR Title 47 Part 15 Subpart E Section 15.407(b)

Un-restricted band emissions above 1GHz			
Operating Band	Frequency	EIRP Limit	Value
5150-5250MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
5250-5350MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
5470-5725MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
5725-5850 MHz	1GHz-5.65GHz	-27 dBm/MHz(68.2dBuV/m)@3m	Peak
	5.65GHz-5.7GHz	-27*dBm/MHz to 10dBm/MHz (68.2* dBuV/m to 105.6dBuV/m)	Peak
	5.7GHz-5.72GHz	10*dBm/MHz to 15.6dBm/MHz (105.6*dBuV/m to 110.8dBuV/m)	Peak
	5.72GHz-5.725GHz	15.6*dBm/MHz to 27dBm/MHz (110.8dBuV/m to* 122.2dBuV/m)	Peak
	5.85GHz-5.855GHz	27dBm/MHz to 15.6*dBm/MHz (122.2dBuV/m to110.8* dBuV/m)	Peak
	5.855GHz-5.875GHz	15.6dBm/MHz to 10*dBm/MHz (110.8dBuV/m to 105.6* dBuV/m)	Peak
	5.875GHz-5.925GHz	10dBm/MHz to -27*dBm/MHz (105.6dBuV/m to 68.2* dBuV/m)	Peak
	Above 5.925GHz	-27 dBm/MHz(68.2dBuV/m)@3m	Peak

* Increase/Decreases with the linearity 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. $E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] + 95.2$, 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 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Band: I					Worst mode: 802.11n		Test channel: CH _L		
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
5149.67	9.37	31.70	9.79	0.00	50.86	54.00	-3.14	Horizontal	Average
5349.35	8.53	31.40	10.05	0.00	49.98	54.00	-4.02	Horizontal	Average
5149.67	7.18	31.70	9.79	0.00	48.67	54.00	-5.33	Vertical	Average
5349.35	7.38	31.40	10.05	0.00	48.83	54.00	-5.17	Vertical	Average
5149.67	16.38	31.70	9.79	0.00	57.87	74.00	-16.13	Horizontal	Peak
5349.35	15.33	31.40	10.05	0.00	56.78	74.00	-17.22	Horizontal	Peak
5149.67	16.48	31.70	9.79	0.00	57.97	74.00	-16.03	Vertical	Peak
5349.35	15.09	31.40	10.05	0.00	56.54	74.00	-17.46	Vertical	Peak

Band: I					Worst mode: 802.11n		Test channel: CH _H		
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
5149.67	9.95	31.70	9.79	0.00	51.44	54.00	-2.56	Horizontal	Average
5349.35	9.18	31.40	10.05	0.00	50.63	54.00	-3.37	Horizontal	Average
5149.67	8.76	31.70	9.79	0.00	50.25	54.00	-3.75	Vertical	Average
5349.35	8.64	31.40	10.05	0.00	50.09	54.00	-3.91	Vertical	Average
5149.67	14.54	31.70	9.79	0.00	56.03	74.00	-17.97	Horizontal	Peak
5349.35	15.34	31.40	10.05	0.00	56.79	74.00	-17.21	Horizontal	Peak
5149.67	16.48	31.70	9.79	0.00	57.97	74.00	-16.03	Vertical	Peak
5349.35	15.09	31.40	10.05	0.00	56.54	74.00	-17.46	Vertical	Peak

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. Test 802.11a, 802.11n mode, all modulations have been tested, only worst case is reported

5.7. Radiated Spurious Emissions

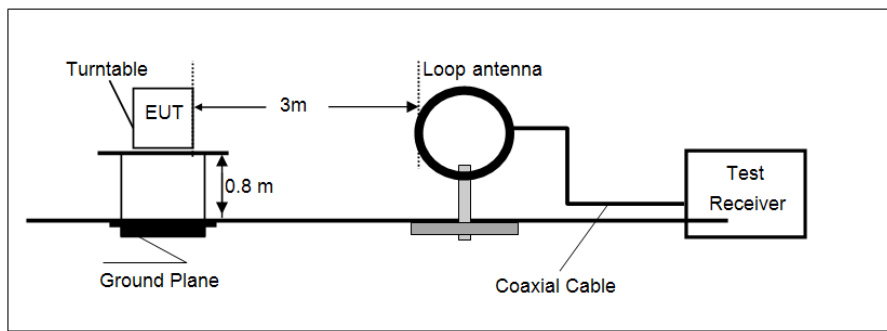
LIMIT

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

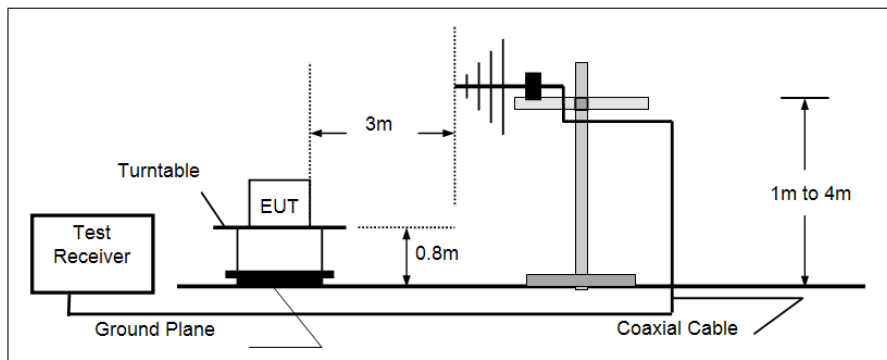
Unwanted emissions below 1GHz and Restricted band emissions above 1GHz		
Frequency	Limit (dBuV/m @3m)	Value
30MHz-88MHz	40.00	Quasi-peak
88MHz-216MHz	43.50	Quasi-peak
216MHz-960MHz	46.00	Quasi-peak
960MHz-1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

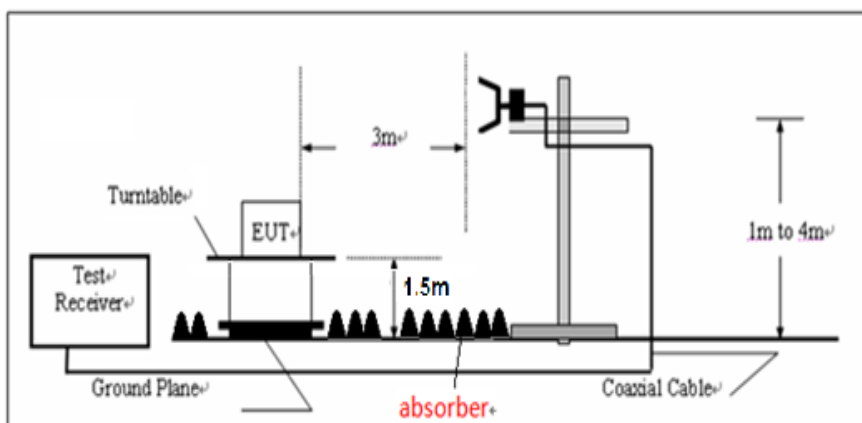
- 9KHz ~30MHz



- 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
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) 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.
 - (3) 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:

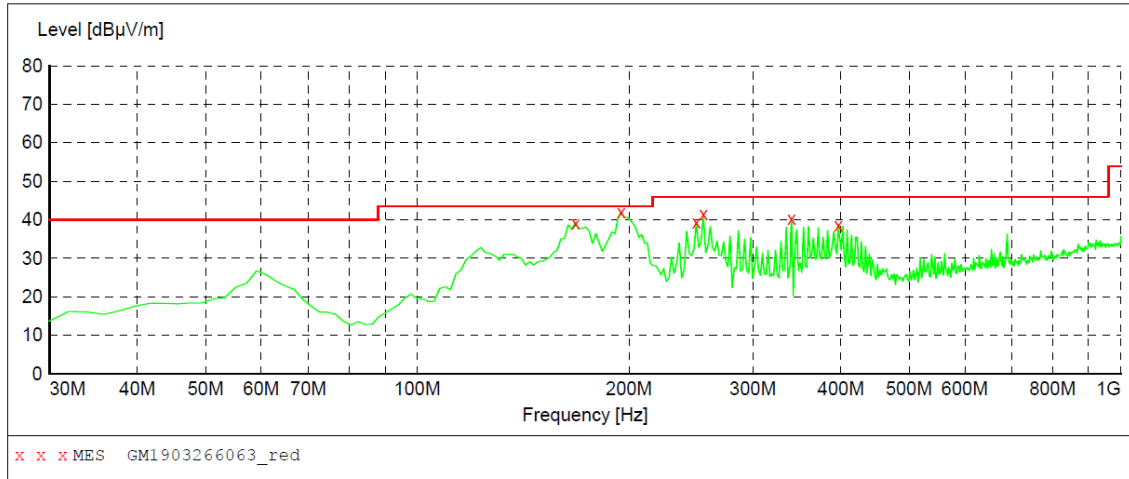
Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

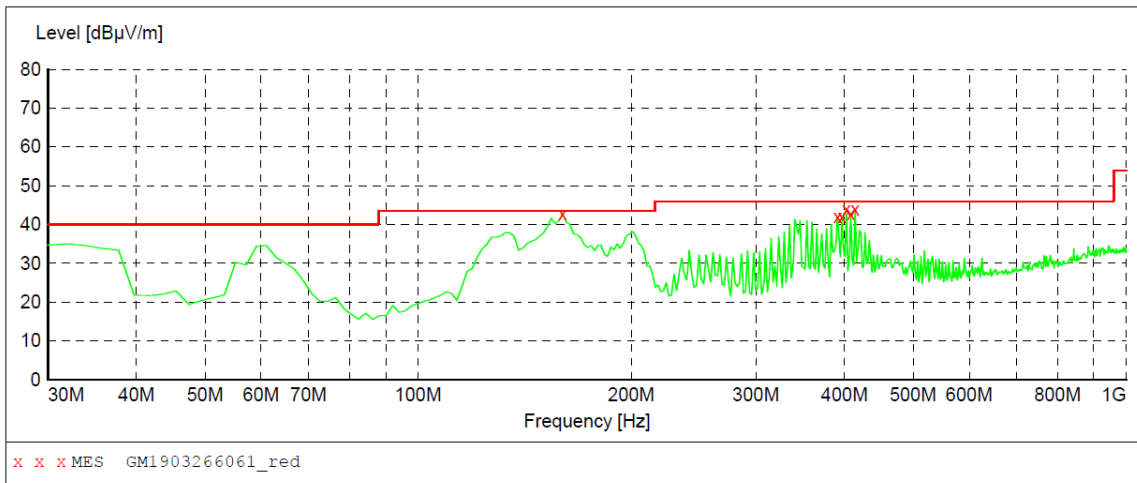
Measurement data:**■ 9kHz ~ 30MHz**

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.

■ 30MHz ~ 1GHz**MEASUREMENT RESULT: "GM1903266063_red"**

3/26/2019 3:23PM

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
167.740000	39.20	-13.3	43.5	4.3	QP	100.0	71.00	HORIZONTAL
194.900000	42.00	-10.3	43.5	1.5	QP	100.0	252.00	HORIZONTAL
249.220000	39.30	-8.6	46.0	6.7	QP	100.0	266.00	HORIZONTAL
255.040000	41.50	-8.5	46.0	4.5	QP	100.0	266.00	HORIZONTAL
340.400000	40.30	-5.9	46.0	5.7	QP	100.0	266.00	HORIZONTAL
396.660000	38.70	-4.6	46.0	7.3	QP	100.0	117.00	HORIZONTAL

**MEASUREMENT RESULT: "GM1903266061_red"**

3/26/2019 3:14PM

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
159.980000	42.80	-13.6	43.5	0.7	QP	100.0	314.00	VERTICAL
390.840000	42.00	-4.8	46.0	4.0	QP	100.0	356.00	VERTICAL
396.660000	42.00	-4.6	46.0	4.0	QP	100.0	335.00	VERTICAL
402.480000	44.00	-4.5	46.0	2.0	QP	100.0	325.00	VERTICAL
408.300000	42.80	-4.3	46.0	3.2	QP	100.0	314.00	VERTICAL
414.120000	44.00	-4.1	46.0	2.0	QP	100.0	305.00	VERTICAL

Remark:

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

■ Above 1GHz

Band: I		Worst mode: 802.11n					Test channel: CH _L		
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
2201.45	34.67	27.51	6.44	37.34	31.28	74.00	-42.72	Vertical	Peak
3041.64	34.89	28.68	7.53	38.22	32.88	74.00	-41.12	Vertical	Peak
4920.96	31.84	31.42	9.62	36.62	36.26	74.00	-37.74	Vertical	Peak
8462.98	30.90	36.79	12.86	34.34	46.21	74.00	-27.79	Vertical	Peak
2733.23	31.59	28.10	7.22	38.19	28.72	74.00	-45.28	Horizontal	Peak
5230.96	33.72	31.44	9.88	36.29	38.75	74.00	-35.25	Horizontal	Peak
9611.66	30.85	39.07	13.73	35.19	48.46	74.00	-25.54	Horizontal	Peak
11226.25	29.25	40.30	13.48	33.47	49.56	74.00	-24.44	Horizontal	Peak

Band: I		Worst mode: 802.11n					Test channel: CH _M		
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
3088.45	34.79	28.78	7.59	38.22	32.94	74.00	-41.06	Vertical	Peak
3923.37	33.05	29.70	8.67	38.16	33.26	74.00	-40.74	Vertical	Peak
5271.06	32.74	31.36	9.94	36.41	37.63	74.00	-36.37	Vertical	Peak
8882.35	29.45	37.78	13.19	34.33	46.09	74.00	-27.91	Vertical	Peak
2754.19	32.07	28.10	7.26	38.24	29.19	74.00	-44.81	Horizontal	Peak
3445.70	34.80	28.57	8.03	38.49	32.91	74.00	-41.09	Horizontal	Peak
3913.39	33.26	29.70	8.66	38.16	33.46	74.00	-40.54	Horizontal	Peak
6678.99	30.45	34.20	11.45	35.21	40.89	74.00	-33.11	Horizontal	Peak

Band: I		Worst mode: 802.11n					Test channel: CH _H		
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
1805.01	34.05	25.39	5.97	37.14	28.27	74.00	-45.73	Vertical	Peak
3342.04	33.45	28.20	7.89	38.45	31.09	74.00	-42.91	Vertical	Peak
6833.77	30.85	34.24	11.64	34.96	41.77	74.00	-32.23	Vertical	Peak
9514.29	31.53	39.04	13.72	35.22	49.07	74.00	-24.93	Vertical	Peak
1569.19	33.46	25.17	5.48	36.68	27.43	74.00	-46.57	Horizontal	Peak
3913.39	33.26	29.70	8.66	38.16	33.46	74.00	-40.54	Horizontal	Peak
5880.78	30.26	32.26	10.62	35.37	37.77	74.00	-36.23	Horizontal	Peak
8859.77	30.65	37.76	13.16	34.32	47.25	74.00	-26.75	Horizontal	Peak

Remark:

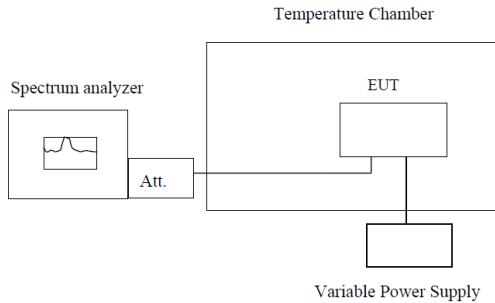
1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.
3. Measuring frequencies from 1 GHz to 40GHz.
4. Test 802.11a, 802.11n mode, all modulations have been tested,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

5.8. 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:

Transmitting with unmodulation

TEST RESULTS

☒ Passed ☐ Not Applicable

Voltage VS Frequency stability

Band: I			Test Frequency: 5180.00MHz	
Temperature (°C)	Voltage (V)	Frequency Deviation (Hz)	Frequency Deviation (ppm)	Result
25	18.00	39000.00	7.52896	PASS
25	10.00	41000.00	7.91506	PASS
25	28.00	38000.00	7.33591	PASS

Temperature VS Frequency stability

Band: I			Test Frequency: 5180.00MHz	
Voltage (V)	Temperature (°C)	Frequency Deviation (Hz)	Frequency Deviation (ppm)	Result
18.00	-20	37000.00	7.14286	PASS
18.00	-10	36000.00	6.94981	PASS
18.00	0	36000.00	6.94981	PASS
18.00	10	35000.00	6.75676	PASS
18.00	20	35000.00	6.75676	PASS
18.00	30	35000.00	6.75676	PASS
18.00	40	34000.00	6.56371	PASS
18.00	50	34000.00	6.56371	PASS

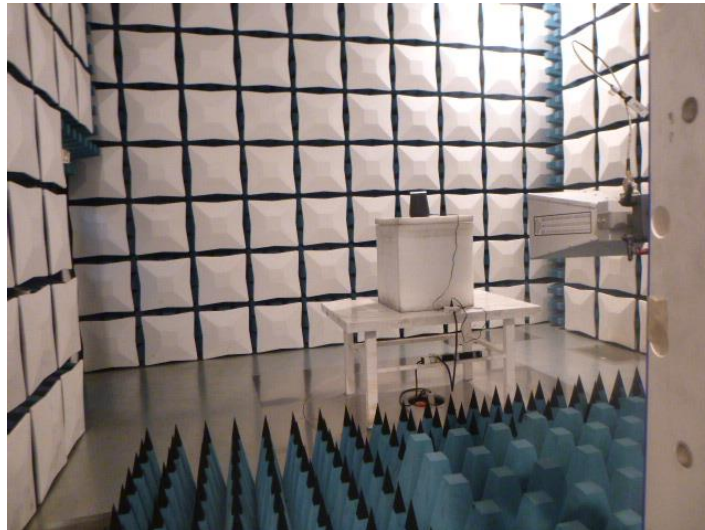
6. Test Setup Photos of the EUT

Conducted Emissions (AC Mains)



Radiated Emissions





7. External and Internal Photos of the EUT

Reference to the report No.: CHTEW19040136

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