TEST REPORT

Report No.	CISRR24082921503
Project No.	CISR240829215
FCC ID	2BE3U-X1
Applicant	CND Electronic Technology (shenzhen) Co.,Ltd
Address	5th Floor,(A)CD,XingHua Building No.7,Naihai Road, Nanshan District, Shenzhen, China
Manufacturer	CND Electronic Technology (shenzhen) Co.,Ltd
Address	5th Floor,(A)CD,XingHua Building No.7,Naihai Road, Nanshan District, Shenzhen, China
Product Name	Bonding Encoder
Trade Mark	CND LIVE
Model/Type reference	X1
Listed Model(s)	X3, X10, X1 Plus
Standard	Part 15 Subpart E Section 15.407
Test date	August 29, 2024 ~ October 20, 2024
Issue date	November 15, 2024
Test result	**Complied**

Rory Huang

Prepared by: Rory Huang

Genry Long

Approved by: Genry Long

The test results relate only to the tested samples.

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Contents

1. REPORT VERSION

Version No.	Issue date	Description
00	November 15, 2024	Original

2. SUMMARY OF TEST RESULT

Report clause	Test Item	Standard Requirement	Result
5.1	Antenna Requirement	15.203	PASS
5.2	AC Conducted Emission	15.207	PASS
5.3	Peak Output Power	15.407 (a)(3)	PASS
5.4	26 dB Bandwidth	15.407 (a)	PASS
5.5	99% Occupied Bandwidth	-	PASS*1
5.6	Power spectral density	15.407 (a)	PASS
5.7	Conducted Band Edge and Spurious Emission	15.407 (b)	PASS
5.8	Radiated Band Edge Emission	15.407 (b)	PASS
5.9	Radiated Spurious Emission	15.407/15.209	PASS
5.10	Frequency Stability	15.407 (g)	PASS
5.11	Duty Cycle	--	PASS*1

Note:

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

– *1: No requirement on standard, only report these test data.

3. SUMMARY

3.1. Product Description

Main unit information:	
Product Name:	Bonding Encoder
Trade Mark:	CND LIVE
Model No.:	X1
Listed Model(s):	X3, X10, X1 Plus
Power supply:	Adapter Input: AC 100-240V, 50/60Hz, 0.8A Adapter Output: 5V⎓ 3A , 9V⎓ 3A,12V⎓ 2.5A, 20V⎓ 1.5A EUT Input: DC 5V DC 7.2V for Battery
Hardware version:	912A
Software version:	912A

3.2. Radio Specification Description

5.3GWIFI:	
Technology:	802.11a/n/ac(HT20), 802.11n/ac(HT40), 802.11ac(HT80)
Modulation:	802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Operation frequency:	5250MHz~5350MHz
Channel number:	4 channels for 20MHz bandwidth(5260MHz~5320MHz) 2 channels for 40MHz bandwidth(5270MHz~5310MHz) 1 channels for 80MHz bandwidth(5290MHz)
Antenna type:	FPC Antenna
Antenna gain:	-4.51dBi for 5.3G WIFI ANT1 -4.22dBi for 5.3G WIFI ANT2
5.5GWIFI:	
Technology:	802.11a/n/ac(HT20), 802.11n/ac(HT40), 802.11ac(HT80)
Modulation:	802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)

Operation frequency:	5470MHz~5725MHz
Channel number:	11 channels for 20MHz bandwidth(5500MHz~5700MHz) 5 channels for 40MHz bandwidth(5510MHz~5670MHz) 2 channels for 80MHz bandwidth(5530MHz~5610MHz)
Antenna type:	FPC Antenna
Antenna gain:	-4.23dBi for 5GWIFI ANT1 -4.51dBi for 5GWIFI ANT2

Channel list:

U-NI-2A

Frequency Band	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
5250-5350MHz	50	5250	58	5290
	52	5260	60	5300
	54	5270	62	5310
	56	5280	64	5320

U-NI-2C

Frequency Band	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
5470-5725MHz	100	5500	118	5590
	102	5510	120	5600
	104	5520	122	5610
	106	5530	124	5620
	108	5540	126	5630
	110	5550	128	5640
	112	5560	132	5660
	114	5570	134	5670
	116	5580	136	5680
	--	--	140	5700

3.3. Modification of EUT

No modifications are made to the EUT during all test items.

3.4. Testing Site

Laboratory Name	Shenzhen Bangce Testing Technology Co., Ltd.
Laboratory Location	101, building 10, Yunli Intelligent Park, Shutianpu community, Matian Street, Guangming District, Shenzhen, Guangdong, China
FCC registration number	736346

3.5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS (dBuV/m) = RA (dBuV) + AF (dB/m) + CL (dB) – AG (dB)

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

3.6. DISTURBANCE Calculation

The AC mains conducted disturbance is calculated by adding the 10dB Pulse Limiter and Cable Factor and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

CD (dBuV) = RA (dBuV) + PL (dB) + CL (dB)

Where CD = Conducted Disturbance	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	PL = 10 dB Pulse Limiter Factor

4. TEST CONFIGURATION

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

4.1. Test frequency list

Channel	Frequency (5250MHz~5350MHz)		
	802.11a/n/ac(HT20)	802.11n/ac(HT40)	802.11ac(HT80)
CH-L	5260	5270	5290
CH-M	5300	--	--
CH-H	5320	5310	--
Channel	Frequency (5470MHz~5725MHz)		
	802.11a/n/ac(HT20)	802.11n/ac(HT40)	802.11ac(HT80)
CH-L	5500	5510	5530
CH-M	5580	5550	--
CH-H	5700	5670	5610

4.2. Test mode

For RF test items:		
The engineering test program was provided(SecureCRTchs) and enabled to make EUT continuous transmitting.Power setting Default.		
Test Item	Test Mode	Modulation
Conducted test item	TX CH-L	802.11a/n/ac(HT20),802.11n/ac(HT40), 802.11ac(HT80)
	TX CH-M	802.11a/n/ac(HT20),802.11n/ac(HT40), 802.11ac(HT80)
	TX CH-H	802.11a/n/ac(HT20),802.11n/ac(HT40), 802.11ac(HT80)
	Normal link	--
	Charging	--
Radiated test item	TX CH-L	802.11a/n/ac(HT20),802.11n/ac(HT40), 802.11ac(HT80)
	TX CH-M	802.11a/n/ac(HT20),802.11n/ac(HT40), 802.11ac(HT80)
	TX CH-H	802.11a/n/ac(HT20),802.11n/ac(HT40), 802.11ac(HT80)
	Normal link	--
	Charging	--
Remark: – The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.All patterns have predictions, and the report only shows the worst pattern data.		

4.3. 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:

Item	Equipment name	Trade Name	Model No.
1	Adapter	SHENZHEN PUSHIDA ELECTRONIC TECHNOLOGYCO.LTD	--
2	Router	ASUS	GT-BE98 Pro

4.4. Test sample information

Type	sample no.
Engineer sample	CISR240829215-S01
Normal sample	CISR240829215-S02

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. Statement of the measurement uncertainty

No.	Test Items	Measurement Uncertainty
1	AC Conducted Emission	1.63dB
2	Peak Output Power	1.34dB
3	Power Spectral Density	1.34dB
4	26dB Bandwidth	0.002%
5	99% Occupied Bandwidth	0.002%
6	Conducted Band Edge and Spurious Emission	1.93dB
7	Radiated Band Edge Emission	3.76dB for 30MHz-1GHz 3.80dB for above 1GHz
8	Radiated Spurious Emission	3.76dB for 30MHz-1GHz 3.80dB for above 1GHz

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

Equipment	Manufacture	Model No.	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	SKET	9.3*6.3*6	N/A	2024.09.01	3Year
Spectrum analyzer	Agilent	N9020A	MY50530263	2024.01.08	1Year
Receiver	ROHDE&SCHWARZ	ESCI	100853	2024.01.08	1Year
Spectrum analyzer	R&S	FSV-40N	/	2024.01.08	1Year
Bilog Antenna	Schwarzbeck	VULB 9163	1463	2023.01.09	2Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	2487	2023.01.09	2Year
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	/	2023.01.09	2Year
RF Cable	Tonscend	Cable 1	/	2024.01.08	1Year
RF Cable	Tonscend	Cable 2	/	2024.01.08	1Year
RF Cable	SKET	Cable 3	/	2024.01.08	1Year
Pre-amplifier	Tonscend	TAP9K3G32	AP21G806153	2024.01.08	1Year
Pre-amplifier	Tonscend	TAP01018050	AP22E806229	2024.01.08	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8127	/	2024.01.08	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	/	2024.01.08	1 Year
Horn Antenna	SCHWARZBECK	BBHA9170	1130	2023.01.09	2 Year
Preamplifier	Tonscend	TAP18040048	AP21C806126	2024.01.08	1 Year
variable-frequency power source	Pinhong	PH1110	/	2024.01.08	1 Year
6dB Attenuator	SKET	DC-6G	/	N/A	N/A
Artificial power network	Schwarzbeck	NSLK8127	8127-01096	2024.01.08	1 Year
EMI Test Receiver	Rohde&schwarz	ESCI7	100853	2024.01.08	1 Year
8-wire Impedance Stabilization Network	Schwarzbeck	NTFM 8158	8158-00337	2024.01.08	1 Year
Artificial power network	Schwarzbeck	ENV216	/	2024.01.08	1 Year
Antenna tower	SKET	Bk-4AT-BS	AT2021040101-V1	N/A	N/A
Power Meter	WCS	WCS-PM	WCSPM230405A	2024.01.08	1 Year

5. TEST CONDITIONS AND RESULTS

5.1. Antenna Requirement

Standard Applicable	**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 response-ble 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.
Description	The EUT antenna is FPC antenna (5.3G WIFI ANT1 for -4.51dBi, 5.3G WIFI ANT2 for -4.22, 5.5G WIFI ANT1 for -4.23dBi, 5.5G WIFI ANT2 for -4.51), the directional gain of the antenna less than 6dBi. It comply with the standard requirement. In case of replacement of broken antenna the same antenna type must be used.Antenna structure please refer to the EUT internal photographs antenna photo.

Remark: The antenna gain is provided by the customer , if the data provided by the customer is not accurate, Shenzhen Bangce Testing Technology Co., Ltd. does not assume any responsibility.

5.2. AC Conducted Emission

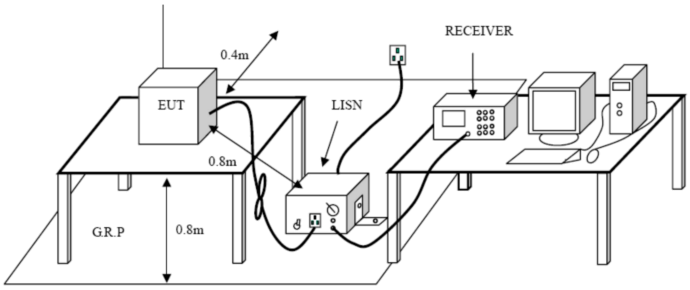
Limit:

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 X13.10 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. (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:

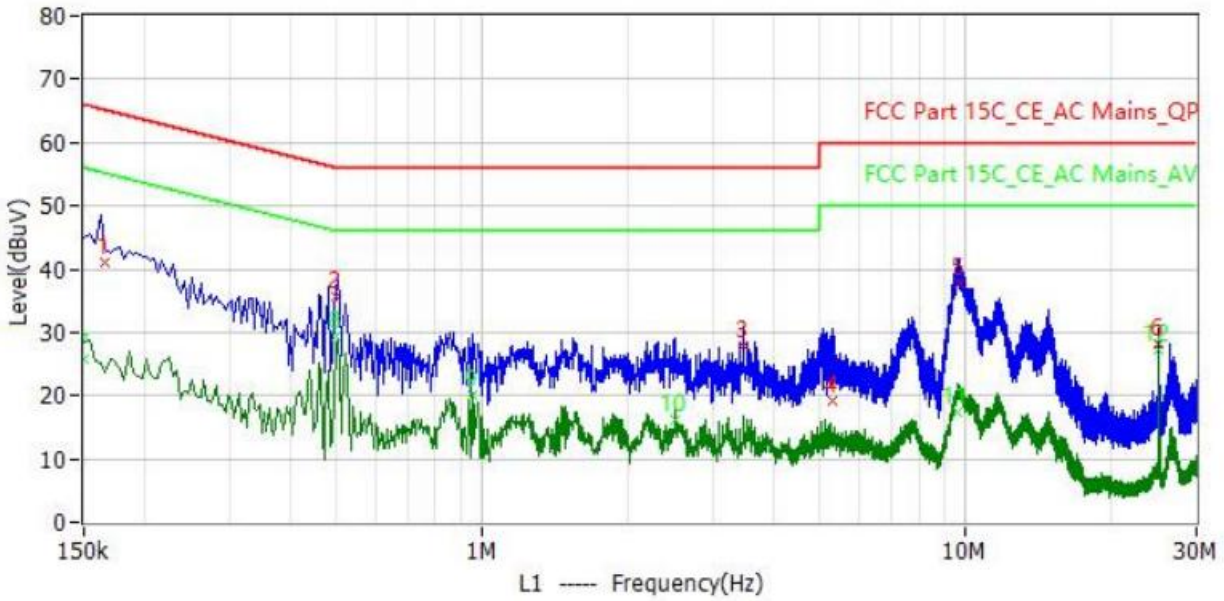
Refer to the clause 4.2

Result:

Passed

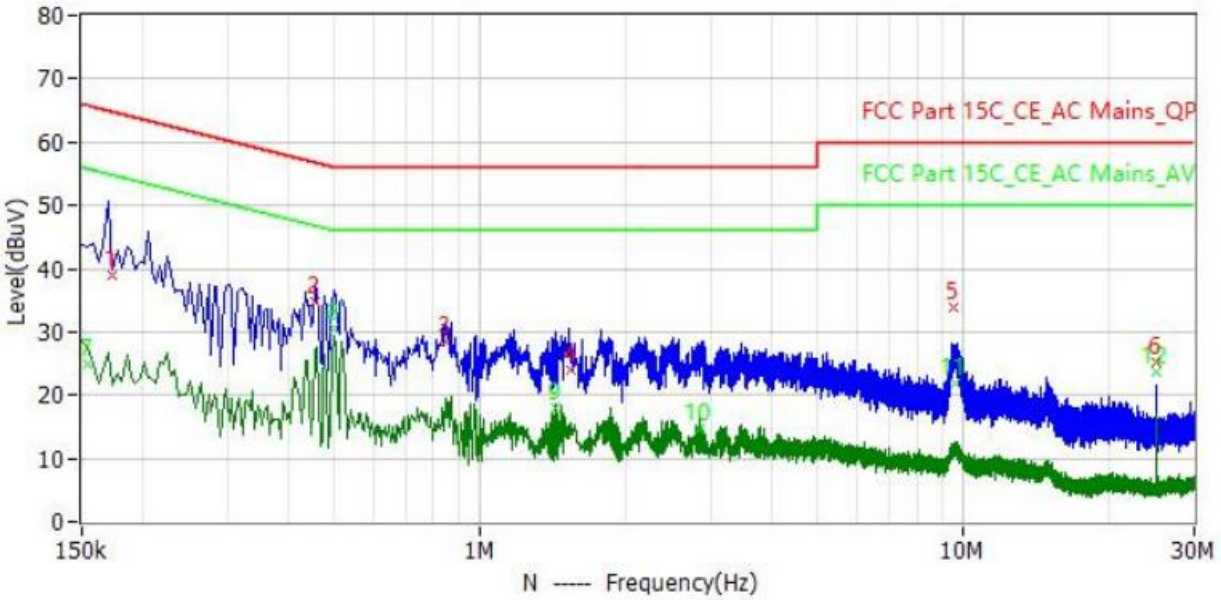
Test mode:Charging

Test Line:	L



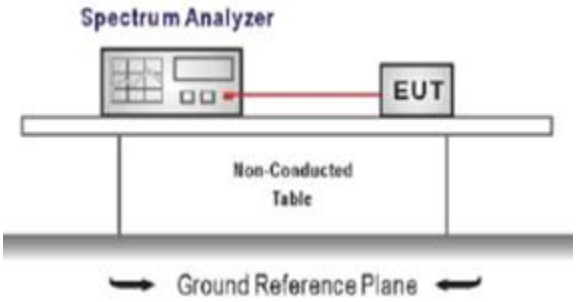
No.	Frequency	Limit dBuV	Level dBuV	Margin dB	Reading dBuV	Factor dB	Detector	Polar
1	166.000kHz	65.2	40.9	-24.3	40.9	0.0	QP	L1
2	498.000kHz	56.0	35.7	-20.3	35.6	0.1	QP	L1
3	3.466MHz	56.0	27.8	-28.2	27.7	0.1	QP	L1
4	5.302MHz	60.0	19.3	-40.7	19.1	0.2	QP	L1
5	9.690MHz	60.0	37.9	-22.1	37.6	0.3	QP	L1
6	25.154MHz	60.0	28.1	-31.9	27.5	0.6	QP	L1
7	150.000kHz	56.0	25.9	-30.1	25.9	0.0	CAV	L1
8	498.000kHz	46.0	29.3	-16.7	29.2	0.1	CAV	L1
9	958.000kHz	46.0	20.2	-25.8	20.1	0.1	CAV	L1
10	2.510MHz	46.0	16.2	-29.8	16.1	0.1	CAV	L1
11	9.626MHz	50.0	17.5	-32.5	17.2	0.3	CAV	L1
12	25.154MHz	50.0	27.3	-22.7	26.7	0.6	CAV	L1

Test Line:	N

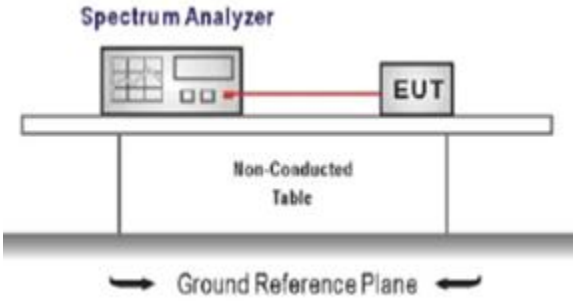


No.	Frequency	Limit dBuV	Level dBuV	Margin dB	Reading dBuV	Factor dB	Detector	Polar
1	174.000kHz	64.8	38.9	-25.9	38.9	0.0	QP	N
2	454.000kHz	56.8	34.8	-22.0	34.7	0.1	QP	N
3	850.000kHz	56.0	28.4	-27.6	28.3	0.1	QP	N
4	1.542MHz	56.0	24.1	-31.9	24.0	0.1	QP	N
5	9.510MHz	60.0	33.9	-26.1	33.6	0.3	QP	N
6	25.154MHz	60.0	25.3	-34.7	24.7	0.6	QP	N
7	154.000kHz	55.8	24.8	-31.0	24.8	0.0	CAV	N
8	498.000kHz	46.0	30.5	-15.5	30.4	0.1	CAV	N
9	1.430MHz	46.0	17.9	-28.1	17.8	0.1	CAV	N
10	2.842MHz	46.0	14.8	-31.2	14.7	0.1	CAV	N
11	9.630MHz	50.0	21.8	-28.2	21.5	0.3	CAV	N
12	25.154MHz	50.0	23.6	-26.4	23.0	0.6	CAV	N

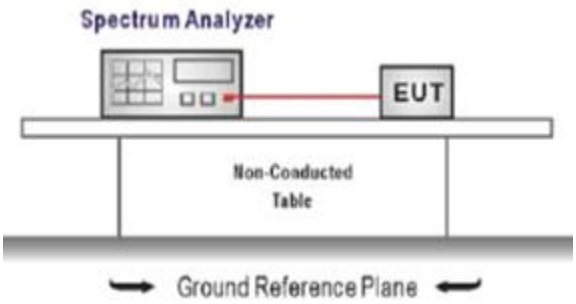
5.3. Peak Output Power

Limit:	**FCC CFR Title 47 Part 15 Subpart C Section 15.407 (a)(2):** For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
Test configuration:	
Test procedure:	1. The transmitter output was connected to the spectrum analyzer through an attenuator, the pathloss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously 3. Use the following spectrum analyzer settings: Span ≥ 1.5*DTS channel bandwidth. RBW= 1MHz VBW= 3MHz Sweep = auto, Detector function = power averaging(rms) 4. Measure and record the results in the test report.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix B
Result:	**Passed**

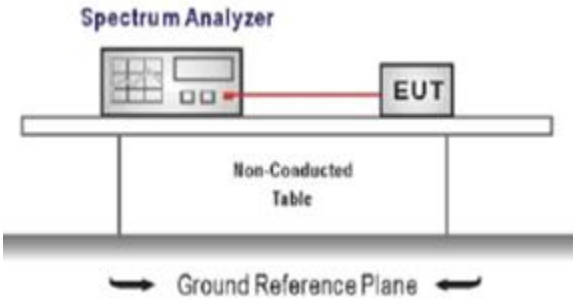
5.4. 26 dB Bandwidth

Limit:	No restriction limits
Test configuration:	
Test procedure:	1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously 3. Use the following spectrum analyzer settings: Span = approximately 2 to 3 times the 26 dB bandwidth, centered on a hopping channel RBW ≥ 1% of the 26 dB bandwidth, VBW ≥ RBW Sweep = auto, Detector function = peak, Trace = max hold 4. Measure and record the results in the test report.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix B
Result:	**Passed**

5.5. 99% Occupied Bandwidth

Limit:	--
Test configuration:	
Test procedure:	1. 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 andthe spectrum analyzer). Center Frequency =channel center frequency Span≥1.5 x OBW RBW = 1%~5%OBW, 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 waveform on the spectrum analyzer.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix B
Result:	**Passed**

5.6. Power spectral density

Limit:	**FCC CFR Title 47 Part 15 Subpart C Section 15.407 (a)(2):** For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
Test configuration:	
Test procedure:	1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance. 2. Set the RBW ⩾ 3 kHz. 3. Set the VBW ⩾ 3× RBW. 4. Set the span to 1.5 times the DTS channel bandwidth. 5. Detector = peak. 6. Sweep time = auto couple. 7. Trace mode = max hold. 8. Allow trace to fully stabilize. 9. Use the peak marker function to determine the maximum power level. 10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat. 11. The resulting peak less than 11dBm.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix B
Result:	**Passed**

5.7. Conducted Band edge and Spurious Emission

Limit:

FCC CFR Title 47 Part 15 Subpart C Section15.407 (b):

Except as shown in paragraph (b)(10) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating solely in the 5.725-5.850 GHz band:

(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in § 15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in § 15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.

(5) For transmitters operating solely in the 5.850-5.895 GHz band or operating on a channel that spans across 5.725-5.895 GHz:

(i) For an indoor access point or subordinate device, all emissions at or above 5.895 GHz shall not exceed an e.i.r.p. of 15 dBm/MHz and shall decrease linearly to an e.i.r.p. of −7 dBm/MHz at or above 5.925 GHz.

(ii) For a client device, all emissions at or above 5.895 GHz shall not exceed an e.i.r.p. of −5 dBm/MHz and shall decrease linearly to an e.i.r.p. of −27 dBm/MHz at or above 5.925 GHz.

(iii) For a client device or indoor access point or subordinate device, all emissions below 5.725 GHz shall not exceed an e.i.r.p. of −27 dBm/MHz at 5.65 GHz increasing linearly to 10 dBm/MHz at 5.7 GHz, and from 5.7 GHz increasing linearly to a level of 15.6 dBm/MHz at 5.72 GHz, and from 5.72 GHz increasing linearly to a level of 27 dBm/MHz at 5.725 GHz.

(6) For transmitters operating within the 5.925-7.125 GHz band: Any emissions outside of the 5.925-7.125 GHz band must not exceed an e.i.r.p. of −27 dBm/MHz.

(7) For transmitters operating within the 5.925-7.125 GHz bands: Power spectral density must be suppressed by 20 dB at 1 MHz outside of channel edge, by 28 dB at one channel bandwidth from the channel center, and by 40 dB at one- and one-half times the channel bandwidth away from channel center. At frequencies between one megahertz outside an unlicensed device's channel edge and one channel bandwidth from the center of the channel, the limits must be linearly interpolated between 20 dB and 28 dB suppression, and at frequencies between one and one- and one-half times an unlicensed device's channel bandwidth, the limits must be linearly interpolated between 28 dB and 40 dB suppression. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must be suppressed by at least 40 dB.

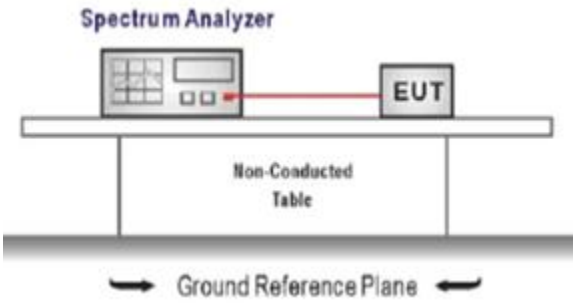
(8) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(9) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in § 15.207.

(10) The provisions of § 15.205 apply to intentional radiators operating under this section.

(11) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

Test configuration:



Test procedure:

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Emission level measurement

Set the center frequency and span to encompass frequency range to be measured

RBW = 100 kHz, VBW ≥ 3 x RBW

Detector = peak, Sweep time = auto couple, Trace mode = max hold

Allow trace to fully stabilize

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

3. Place the radio in continuous transmit mode, allow the trace to stabilize,

	view the transmitter waveform on the spectrum analyzer. 4. Ensure that the amplitude of all unwanted emission outside of the authorized frequency band excluding restricted frequency bands) are attenuated by at least the minimum requirements specified (at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz). Report the three highest emission relative to the limit.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix B
Result:	**Passed**

5.8. Radiated Band edge Emission

Limit:

FCC CFR Title 47 Part 15 Subpart C Section15.407 (b):

Except as shown in paragraph (b)(10) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating solely in the 5.725-5.850 GHz band:

(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in § 15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in § 15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.

(5) For transmitters operating solely in the 5.850-5.895 GHz band or operating on a channel that spans across 5.725-5.895 GHz:

(i) For an indoor access point or subordinate device, all emissions at or above 5.895 GHz shall not exceed an e.i.r.p. of 15 dBm/MHz and shall decrease linearly to an e.i.r.p. of −7 dBm/MHz at or above 5.925 GHz.

(ii) For a client device, all emissions at or above 5.895 GHz shall not exceed an e.i.r.p. of −5 dBm/MHz and shall decrease linearly to an e.i.r.p. of −27 dBm/MHz at or above 5.925 GHz.

(iii) For a client device or indoor access point or subordinate device, all emissions below 5.725 GHz shall not exceed an e.i.r.p. of −27 dBm/MHz at 5.65 GHz increasing linearly to 10 dBm/MHz at 5.7 GHz, and from 5.7 GHz increasing linearly to a level of 15.6 dBm/MHz at 5.72 GHz, and from 5.72 GHz increasing linearly to a level of 27 dBm/MHz at 5.725 GHz.

(6) For transmitters operating within the 5.925-7.125 GHz band: Any emissions outside of the 5.925-7.125 GHz band must not exceed an e.i.r.p. of −27 dBm/MHz.

(7) For transmitters operating within the 5.925-7.125 GHz bands: Power spectral density must be suppressed by 20 dB at 1 MHz outside of channel edge, by 28 dB at one channel bandwidth from the channel center, and by 40 dB at one- and one-half times the channel bandwidth away from channel center. At frequencies between one megahertz outside an unlicensed device's channel edge and one channel bandwidth from the center of the channel, the limits must be linearly interpolated between 20 dB and 28 dB suppression, and at frequencies between one and one- and one-half times an unlicensed device's channel bandwidth, the limits must be linearly interpolated between 28 dB and 40 dB suppression. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must be suppressed by at least 40 dB.

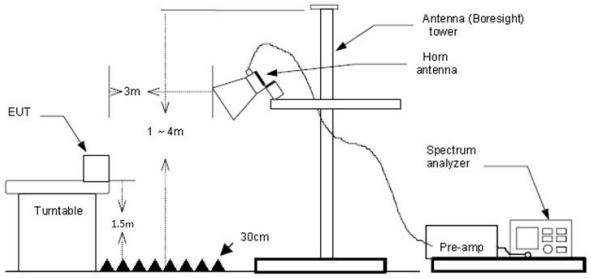
(8) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(9) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in § 15.207.

(10) The provisions of § 15.205 apply to intentional radiators operating under this section.

(11) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

Test configuration:



Test procedure:

1. The EUT was setup and tested according to ANSI X13.10 .
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 X13.10 on radiated measurement.

5. Use the following spectrum analyzer settings:
   a) Span shall wide enough to fully capture the emission being measured
   b) Set RBW=100kHz for <1GHz, VBW=3*RBW, Sweep time=auto, Detector=peak, Trace=max hold
   c) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement
      Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=Average, Trace=RMS for Average measurement

Test mode: Refer to the clause 4.2

Result: **Passed**

Note:

1) Level= Reading + Factor; Factor =Antenna Factor+ Cable Loss- Preamp Factor
2) Margin = Limit - Level
3) Average measurement was not performed if peak level is lower than average limit
4) The other emission levels were very low against the limit.
5) Have pre-scan all test channel, found 11a mode which it was worst case, so only show the worst case’s data on this report.

Test channel:CH52									
Freq. (MHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
5260.00	68.51	28.62	4.08	38.62	-5.92	74	11.41	Peak	Horizontal
5260.00	51.35	28.62	4.08	38.62	-5.92	54	8.57	Average	Horizontal
5260.00	68.44	28.62	4.08	38.62	-5.92	74	11.48	Peak	Vertical
5260.00	50.06	28.62	4.08	38.62	-5.92	54	9.86	Average	Vertical

Test channel:CH64									
Freq. (MHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
5320.00	68.83	29.45	3.91	40.17	-6.81	74	11.98	Peak	Horizontal
5320.00	50.29	29.45	3.91	40.17	-6.81	54	10.52	Average	Horizontal
5320.00	66.41	29.45	3.91	40.17	-6.81	74	14.40	Peak	Vertical
5320.00	51.47	29.45	3.91	40.17	-6.81	54	9.34	Average	Vertical

Test channel:CH100									
Freq. (MHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
5500.00	67.87	28.62	4.08	38.62	-5.92	74	12.05	Peak	Horizontal
5500.00	50.86	28.62	4.08	38.62	-5.92	54	9.06	Average	Horizontal
5500.00	69.49	28.62	4.08	38.62	-5.92	74	10.43	Peak	Vertical
5500.00	49.74	28.62	4.08	38.62	-5.92	54	10.18	Average	Vertical

Test channel:CH140									
Freq. (MHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
5700.00	70.87	29.45	3.91	40.17	-6.81	74	9.94	Peak	Horizontal
5700.00	49.90	29.45	3.91	40.17	-6.81	54	10.91	Average	Horizontal
5700.00	66.70	29.45	3.91	40.17	-6.81	74	14.11	Peak	Vertical
5700.00	49.09	29.45	3.91	40.17	-6.81	54	11.72	Average	Vertical

5.9. Radiated Spurious Emission

Limit:

FCC CFR Title 47 Part 15 Subpart C Section 15.209

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

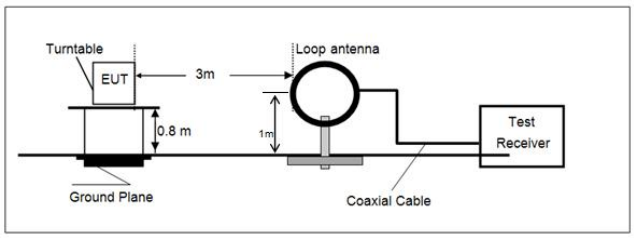
Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3

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

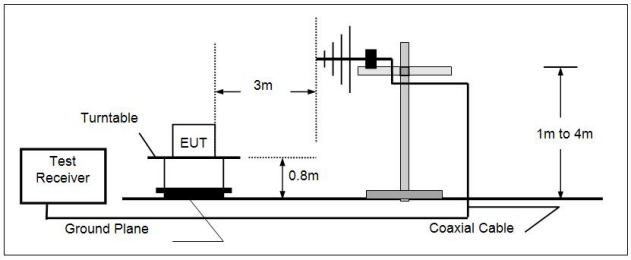
Frequency	Limit (dBuV/m @3m)	Value
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

Test configuration:

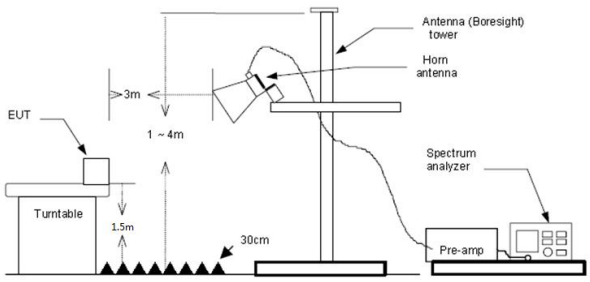
9kHz~30MHz



30 MHz ~ 1 GHz



Above 1 GHz



Test procedure:	1. The EUT was setup and tested according to ANSI X13.10. 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) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=Average, Trace=RMS for Average measurement
Test mode:	Refer to the clause 4.2
Result:	**Passed**

Note:

1) Level= Reading + Factor/Transd; Factor/Transd =Antenna Factor+ Cable Loss- Preamp Factor
2) Margin = Limit – Level
3) Average measurement was not performed if peak level is lower than average limit(54 dBuV/m) for above 1GHz.
4) The other emission levels were very low against the limit.
5) This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.

For 9 kHz ~ 30 MHz

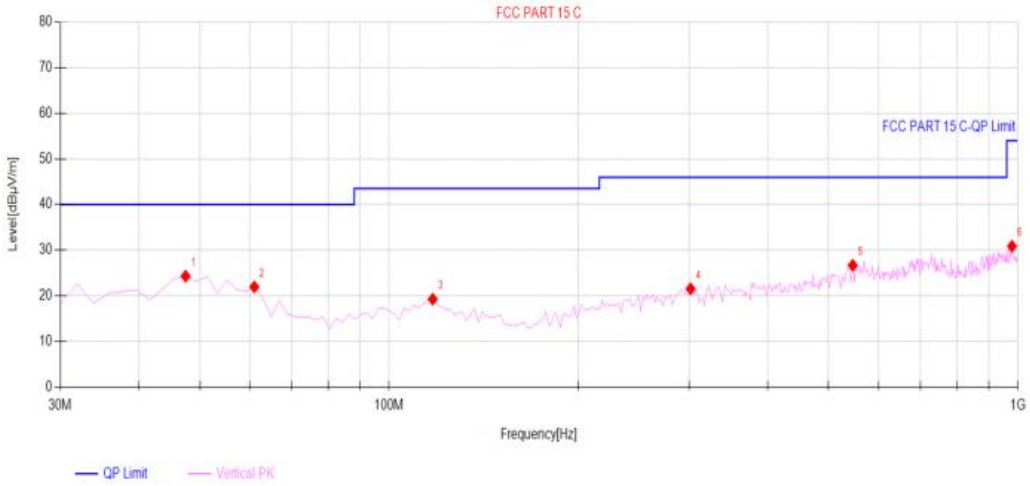
The EUT was pre-scanned this frequency band, found the radiated level 20dB lower than the limit, so don't show data on this report.

For 30 MHz ~ 1000 MHz

Have pre-scan all test channel, found 11a mode CH52 which it was worst case, so only show the worst case's data on this report.

Polarization:	Horizontal

Test Graph

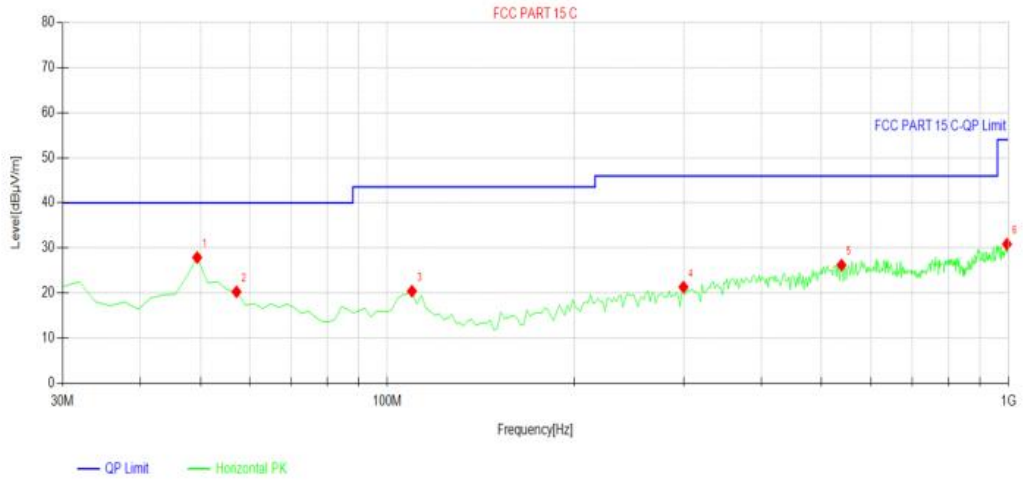


Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Polarity	Verdict
1	47.46	8.80	24.32	15.52	40.00	15.68	Vertical	PASS
2	61.04	8.18	21.97	13.79	40.00	18.03	Vertical	PASS
3	117.3	6.74	19.27	12.53	43.50	24.23	Vertical	PASS
4	301.6	5.94	21.55	15.61	46.00	24.45	Vertical	PASS
5	546.04	6.13	26.70	20.57	46.00	19.30	Vertical	PASS
6	978.66	4.73	30.87	26.14	54.00	23.13	Vertical	PASS

Polarization:	Vertical

Test Graph



Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Polarity	Verdict
1	49.4	12.38	27.89	15.51	40.00	12.11	Horizontal	PASS
2	57.16	5.82	20.28	14.46	40.00	19.72	Horizontal	PASS
3	109.54	6.81	20.42	13.61	43.50	23.08	Horizontal	PASS
4	299.66	5.81	21.33	15.52	46.00	24.67	Horizontal	PASS
5	538.28	5.79	26.21	20.42	46.00	19.79	Horizontal	PASS
6	994.18	4.53	30.86	26.33	54.00	23.14	Horizontal	PASS

For 1 GHz ~ 40 GHz

Have pre-scan all test channel, found 11a mode which it was worst case, so only show the worst case's data on this report.

Test channel:CH52										
Freq. (GHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Level (dBuv)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
10.52	70.31	31.33	4.23	38.62	-3.06	67.25	74	6.75	Peak	Horizontal
10.52	51.95	31.33	4.23	38.62	-3.06	48.89	54	5.11	Average	Horizontal
10.52	68.85	31.33	4.23	38.62	-3.06	65.79	74	8.21	Peak	Vertical
10.52	50.20	31.33	4.23	38.62	-3.06	47.14	54	6.86	Average	Vertical

Test channel:CH60										
Freq. (GHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Level (dBuv)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
10.60	69.91	30.26	4.09	38.29	-3.94	65.97	74	8.03	Peak	Horizontal
10.60	50.12	30.26	4.09	38.29	-3.94	46.18	54	7.82	Average	Horizontal
10.60	68.50	30.26	4.09	38.29	-3.94	64.56	74	9.44	Peak	Vertical
10.60	50.47	30.26	4.09	38.29	-3.94	46.53	54	7.47	Average	Vertical

Test channel:CH64										
Freq. (MHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Level (dBuv)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
10.64	68.76	31.97	4.11	38.47	-2.39	66.37	74	7.63	Peak	Horizontal
10.64	49.25	31.97	4.11	38.47	-2.39	46.86	54	7.14	Average	Horizontal
10.64	65.06	31.97	4.11	38.47	-2.39	62.67	74	11.33	Peak	Vertical
10.64	51.47	31.97	4.11	38.47	-2.39	49.08	54	4.92	Average	Vertical

Test channel:CH100										
Freq. (GHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Level (dBuv)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
11.00	70.11	31.33	4.23	38.62	-3.06	67.05	74	6.95	Peak	Horizontal
11.00	51.34	31.33	4.23	38.62	-3.06	48.28	54	5.72	Average	Horizontal
11.00	68.81	31.33	4.23	38.62	-3.06	65.75	74	8.25	Peak	Vertical
11.00	49.69	31.33	4.23	38.62	-3.06	46.63	54	7.37	Average	Vertical

Test channel:CH116										
Freq. (GHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Level (dBuv)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
11.16	69.65	30.26	4.09	38.29	-3.94	65.71	74	8.29	Peak	Horizontal
11.16	50.31	30.26	4.09	38.29	-3.94	46.37	54	7.63	Average	Horizontal
11.16	67.81	30.26	4.09	38.29	-3.94	63.87	74	10.13	Peak	Vertical
11.16	51.15	30.26	4.09	38.29	-3.94	47.21	54	6.79	Average	Vertical

Test channel:CH140										
Freq. (MHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Level (dBuv)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
11.40	69.23	31.97	4.11	38.47	-2.39	66.84	74	7.16	Peak	Horizontal
11.40	49.66	31.97	4.11	38.47	-2.39	47.27	54	6.73	Average	Horizontal
11.40	65.23	31.97	4.11	38.47	-2.39	62.84	74	11.16	Peak	Vertical
11.40	50.77	31.97	4.11	38.47	-2.39	48.38	54	5.62	Average	Vertical

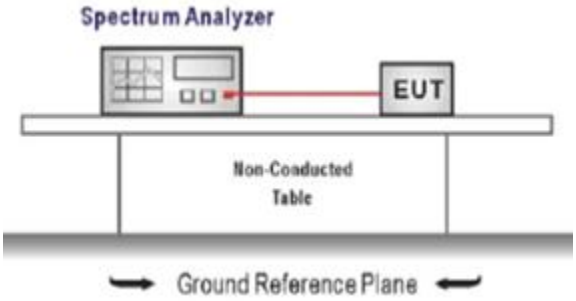
Notes:

1). Measuring frequencies from 9 KHz ~ 40GHz, emissions are attenuated more than 20dB below the permissible limits generated frequency to 30MHz.

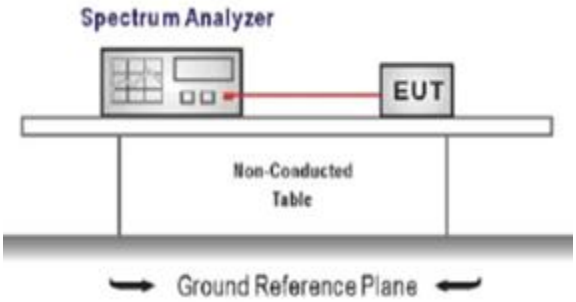
2). Radiated emissions measured in frequency range from 9 KHz ~ 40GHz were made with an instrument using Peak detector mode.

3). 18~40GHz at least have 20dB margin. No recording in the test report.

5.10. Frequency Stability

Limit:	According to FCC § 15.407(g) "Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual." According to FCC § 2.1055(a) "The frequency stability shall be measured with variation of ambient temperature as follows:" (1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section. (2) From −20° to + 50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter. (3)From 0° to + 50° centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.
Test configuration:	
Test procedure:	The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter via feed through attenators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low engouh to obtain the desired frequency resoluation and measure EUT 20 degree operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -30 degree. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure wuth 10 degree increased per stage until the highest temperature of +50 degree reached.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix B
Result:	**Passed**

5.11. Duty Cycle Correction Factor (DCCF)

Limit:	--
Test configuration:	
Test procedure:	1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously 3. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel, RBW= 10 MHz, VBW ≥ RBW, Sweep = as necessary to capture the entire dwell time channel Detector function = RMS, Trigger mode 4. Measure and record the duty cycle data
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix B
Result:	**Passed**

6. TEST SETUP PHOTOS

Please refer to Report: CISRR24082921501.

7. EXTERNAL AND INTERNAL PHOTOS

7.1. External Photos

Please refer to Report: CISRR24082921501.

7.2. Internal photos

Please refer to Report: CISRR24082921501.

------End of the report------