VARIANT RADIO TEST REPORT

(FCC Part 15 Subpart C / IC RSS-247)

Applicant:	Honeywell International Inc Honeywell Safety and Productivity Solutions
Address:	9680 Old Bailes Road, Fort Mill, SC 29707 United States

Manufacturer:	Honeywell International Inc Honeywell Safety and Productivity Solutions
Address:	9680 Old Bailes Road, Fort Mill, SC 29707 United States
Product:	Mobile Computer
Brand Name:	Honeywell
Model Name:	CT45-L0N
FCC ID:	HD5-CT45L0N
Date of tests:	2021-10-25 to 2022-01-18

The tests have been carried out according to the requirements of the following standard:

☒ **Part 15 Subpart C §15. 247 / IC RSS-247 issue 2**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Simon Wang Engineer / Mobile Department	Approved by Luke Lu Manager / Mobile Department
Simon Date: Jan. 18, 2022	Luke Lu Date: Jan. 18, 2022

Report Revise Record

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RFBGDJ-W7L-P21060011-3	Original release	Jul. 14, 2021
W7L-211129W004RF08	Based on the original report RFBGDJ-W7L-P21060011-3 changing components.	Jan. 18, 2022

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Summary Of Test Result

FCC Rule	IC Rule	Description	Limit	Result	Remark
15.247(a)(2)	RSS-247 5.2(a)	6dB Bandwidth	≥ 0.5MHz	(See Note 2)	-
-	RSS-Gen 6.7	99% Bandwidth	-	(See Note 2)	-
15.247(b)(3)	RSS-247 A5.4(d)	Output Power	≤ 30dBm	Compliance (See Note 1)	-
15.247(e)	RSS-247 5.2(b)	Power Spectral Density	≤ 8dBm/3kHz	(See Note 2)	-
15.247(d)	RSS-247 5.5	Conducted Band Edges and Spurious Emission	≤ 30dBc	(See Note 2)	-
15.247(d)	RSS-247 5.5	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	(See Note 1)	-
15.207	RSS-GEN 8.8	AC Conducted Emission	15.207(a)	(See Note 2)	Under limit 17.16 dB at 0.497 MHz
15.203 & 15.247(b)	RSS-GEN 6.8	Antenna Requirement	15.203 & 15.247(b) RSS-GEN 6.8	(See Note 2)	-

Note:

1. Per the change notice provide by manufactory, the difference is changing components, all the change no effect any RF parameter. Therefore only verify the power and radiated emission worse case. The report only show the verify test data. More test details please refer to the original report.
2. Please refer to original report RFBGDJ-W7L-P21060011-3

1 General Description

1.1 Applicant

Honeywell International Inc
Honeywell Safety and Productivity Solutions
9680 Old Bailes Road, Fort Mill, SC 29707 United States

1.2 Manufacturer

Honeywell International Inc
Honeywell Safety and Productivity Solutions
9680 Old Bailes Road, Fort Mill, SC 29707 United States

1.3 General Description Of EUT

Product	Mobile Computer
Model No.	CT45-L0N
Additional No.	N/A
Difference Description	N/A
Power Supply	3.85Vdc for EUT
Modulation Technology	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Type	802.11b : DSSS 802.11g/n : OFDM
Operating Frequency	2412-2462MHz
Number Of Channel	11
Max. Output Power	802.11b : 14.89 dBm (0.0308 W) 802.11g : 14.22 dBm (0.0264 W) 802.11n HT20 : 14.18 dBm (0.0262 W) 802.11n HT40 : 15.44 dBm (0.0350 W)
Max. e.i.r.p.	16.84 dBm (0.0483W)
Antenna Type	LDS type Antenna with 1.4dBi gain
HW Version	V1.0
SW Version	OS.11.001
I/O Ports	Refer to user's manual

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

1.4 Modification of EUT

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

1.5 Applicable Standards

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

- FCC Part 15 Subpart C §15.247
- ANSI C63.10-2013
- IC RSS-247 Issue 2
- IC RSS-Gen Issue 5
- KDB 558074 D01 15.247 Meas Guidance v05r02

Remark:

1. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B&ICES-003, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

11 channels are provided for 802.11b, 802.11g and 802.11n(HT20):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
1	2412 MHz	7	2442 MHz
2	2417 MHz	8	2447 MHz
3	2422 MHz	9	2452 MHz
4	2427 MHz	10	2457 MHz
5	2432 MHz	11	2462 MHz
6	2437 MHz		

7 channels are provided for 802.11n(HT40):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
		7	2442 MHz
		8	2447 MHz
3	2422 MHz	9	2452 MHz
4	2427 MHz		
5	2432 MHz		
6	2437 MHz		

The transmitter has a maximum conducted output power as follows:

Frequency Range(MHz)	Mode	Rate	Output Power(dBm)
2412~2462	802.11b	1Mbps	14.89
2412~2462	802.11g	6Mbps	14.22
2412~2462	802.11n HT20	MCS0	14.18
2422~2452	802.11n HT40	MCS0	15.44

a. Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

2.2 Test Mode

2.2.1 Antenna Port Conducted Measurement

Summary table of Test Cases				
Test Item	Modulation			
	802.11 b	802.11 g	802.11n HT20	802.11n HT40
Conducted	Mode 1: CH01	Mode 1: CH01	Mode 1: CH01	Mode 1: CH03

Test Cases	Mode 2: CH06 Mode 3: CH011	Mode 2: CH06 Mode 3: CH011	Mode 2: CH06 Mode 3: CH011	Mode 2: CH06 Mode 3: CH09

2.2.2 Radiated Emission Test (Below 1GHz)

Radiated Test Cases	802.11 N20
	Mode 1: CH01

Note : 1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type. Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

2. Following channel(s) was (were) selected for the final test as listed above

2.2.3 Radiated Emission Test (Above 1GHz)

Test Item	Modulation			
	802.11 b	802.11 g	802.11n HT20	802.11n HT40
Radiated Test Cases	Mode 1: CH01 Mode 2: CH06 Mode 3: CH11	Mode 1: CH01 Mode 2: CH06 Mode 3: CH11	Mode 1: CH01 Mode 2: CH06 Mode 3: CH11	Mode 1: CH03 Mode 2: CH06 Mode 3: CH09

Note : 1. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

2. Following channel(s) was (were) selected for the final test as listed above

3. For frequency above 18GHz, the measured value is much lower than the limit, therefore, it is not reflected in the report.

2.2.4 Power Line Conducted Emission Test:

AC Conducted Emission	Mode 1 : WLAN Linking + Earphone + Adapter

2.3 Support Equipment

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	NETGEAR	R7800	PY315100319	N/A	shielded, 1.8 m
2.	Notebook	Lenovo	E470C	FCC sDoC	N/A	shielded cable DC O/P 1.8 m unshielded AC

						I/P cable1.2 m
3.	Earphone	Honeywell	PTE-300N	FCC sDoC	N/A	N/A
4.	Adapter	Honeywell	ADS-12B-06 05010E	FCC sDoC	N/A	N/A

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	May. 19,20	May. 18,23
Bilog Antenna	ETS-LINDGREN	3143B	00161965	Mar. 05,21	Mar. 04,22
Horn Antenna	ETS-LINDGREN	3117	00168728	Apr. 02,21	Apr. 01,22
Horn Antenna (18GHz-40GHz)	N/A	QWH-SL-18-40-K-SG/QMS-00361	15433	Aug. 25, 21	Aug. 24, 22
Test Software	E3	V 9.160323	N/A	N/A	N/A
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A	N/A
10dB Attenuator	JFW/USA	50HF-010-SMA	1505	Jun. 03,21	Jun. 02,22
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Apr. 22,21	Apr. 21,22
Signal Pre-Amplifier	EMSI	EMC 9135	980249	Jun. 02,21	Jun. 01,22
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	Jun. 03,21	Jun. 02,22
Signal Pre-Amplifier	EMSI	EMC 184045B	980259	Apr. 22,21	Apr. 21,22
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-051	Sep. 05,21	Sep. 04,22

NOTE: 1. The calibration interval of the above test instruments is 12 months or 36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

2. The test was performed in 3m Chamber.

3. The FCC Site Registration No. is 525120; The Designation No. is CN1171.

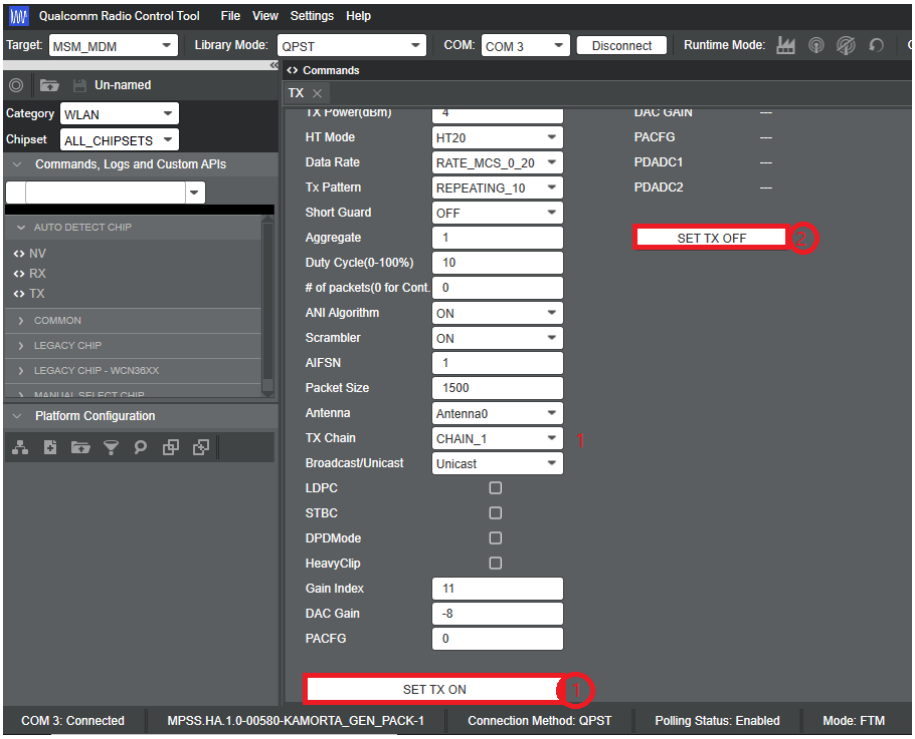
4. The IC test Site Registration No. is 21771-1; The CAB Identifier No. is CN0007.

2.4 Test Setup

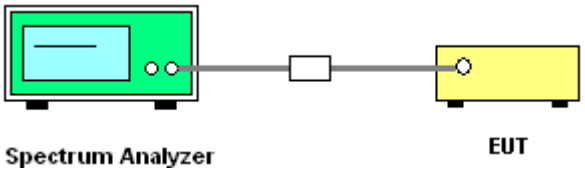
The EUT is continuously communicating to the WIFI tester during the tests.

EUT was set in the Hidden menu mode to enable WIFI communications.

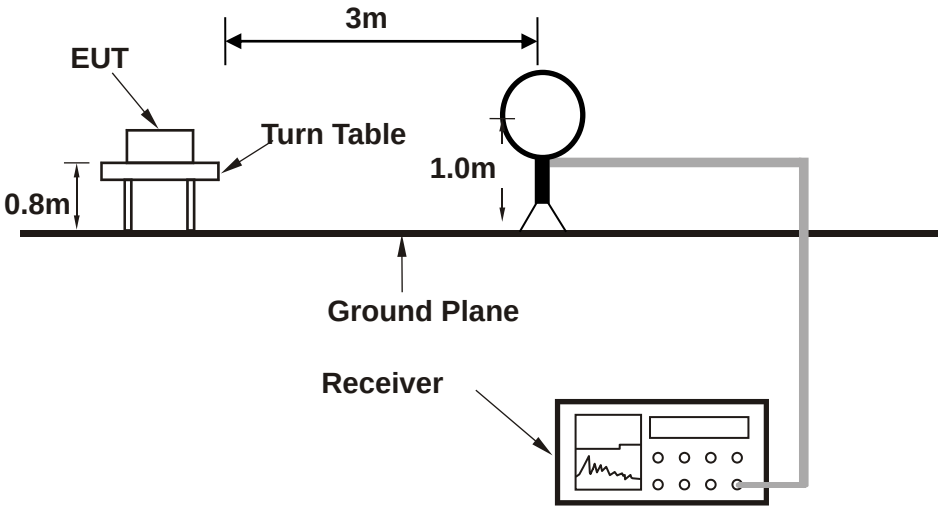
The following picture is a screenshot of the test software



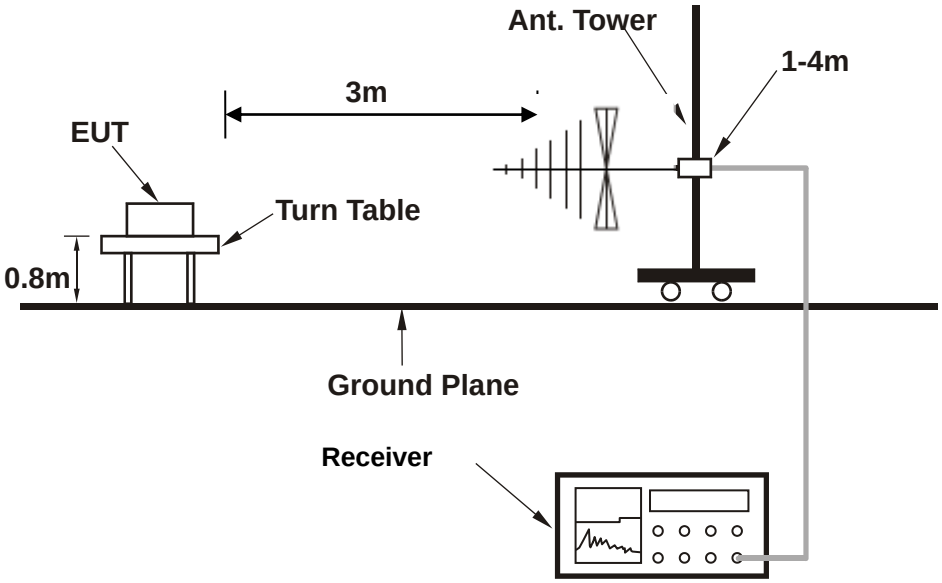
Setup diagram for Conducted Test



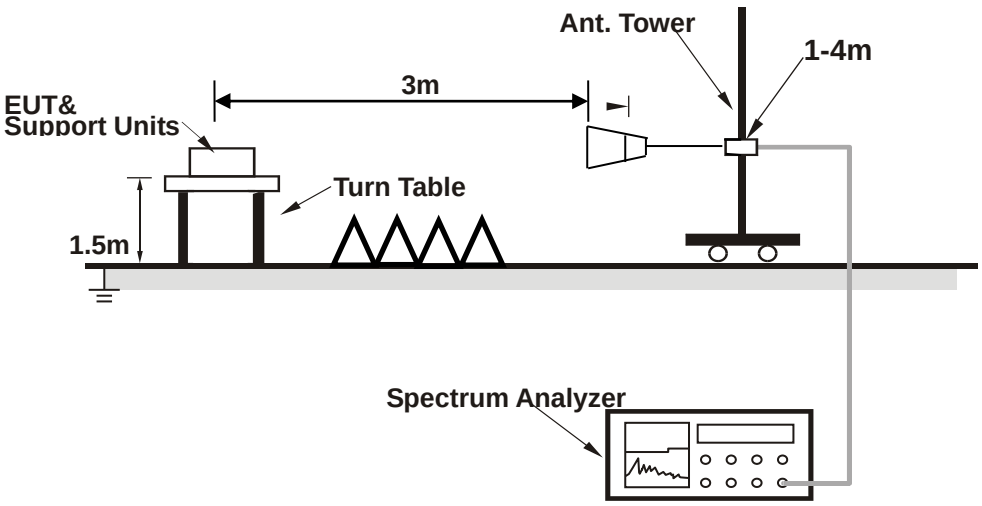
Setup diagram for Radiation(9KHz~30MHz) Test



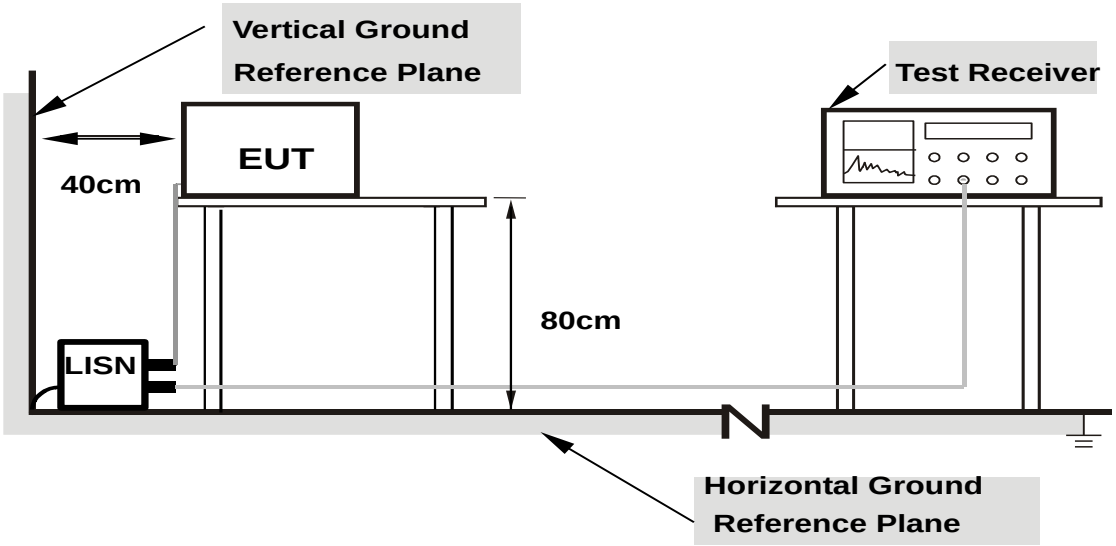
Setup diagram for Radiation(Below 1G) Test



Setup diagram for Radiation(Above1G) Test



Setup diagram for AC Conducted Emission Test



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

2.5 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 5 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 5 + 10 = 15 (dB)

For all radiated test items:

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

Over Limit (dB μ V/m) = Level(dB μ V/m) - Limit Level (dB μ V/m)

2.6 Maximum Conducted Output Power Measurement

2.6.1 Limit of Output Power

FCC §15.247 (b)(3)

For systems using digital modulation in the 2400-2483.5 MHz bands: 30dBm.

IC RSS-247 A5.4(d)

For DTSs employing digital modulation techniques operating in the bands 902-928MHz and 2400-2483.5MHz, the maximum conducted output power shall not exceed 1 W.

The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e)

2.6.2 Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013 section 11.9.2.2.4 Measurement using a spectrum analyzer.
2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. Turn on the EUT and connect it to spectrum analyzer.
4. Set to the maximum power setting and enaBle Transmitting the EUT transmit continuously
5. Measure the duty cycle, x, of the transmitter output signal as described in below:
   a. Set the center frequency of the instrument to the center frequency of the transmission.
   b. Set RBW to the largest available Transmitting value.
   c. Set detector = peak
6. Set span to at least 1.5*OBW.Set RBW=510KHz,VBW=2MHz, Number of points in sweep ≥ 2/3* span, Sweep time = auto. Detector = RMS
7. Allow the sweep to “free run”. Trace average 100 traces in RMS mode
8. Compute power by integrating the spectrum across the OBW of the signal using the instrument’s Channel power measurement function with band limits set equal to the OBW band edges.
9. Add 10 log (1/x), where x is the duty cycle. The duty cycle factor has been compensated to the ‘offset ” of the spectrum analyser.

2.6.3 Test Result of Output Power

Refer to Appendix A of this test report.

2.7 Radiated Band Edges and Spurious Emission Measurement

2.7.1 Limit of Radiated Band Edges and Spurious Emission

FCC §15.247 (d)

IC RSS-247 5.5

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 30 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

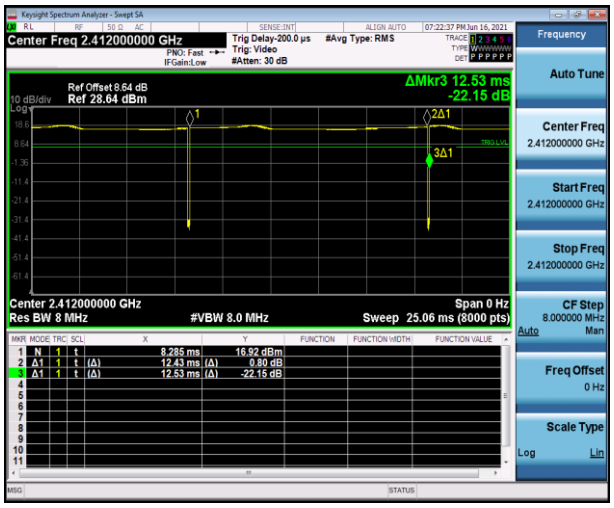
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

2.7.2 Test Procedures

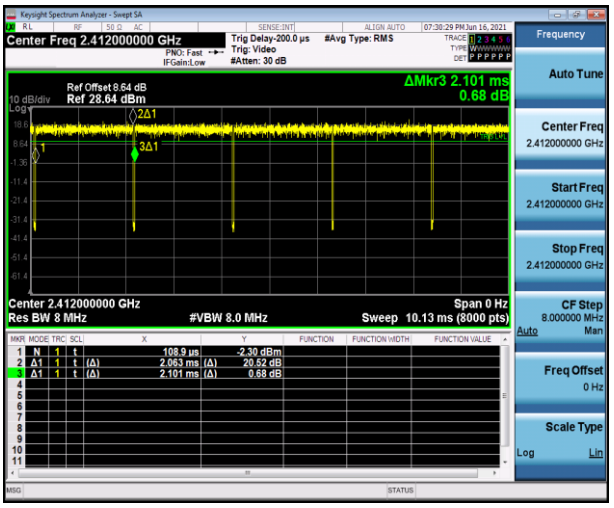
10. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
11. The measurement distance is 3 meter.
12. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 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.
13. Set to the maximum power setting and enable the EUT transmit continuously.
14. Use the following spectrum analyzer settings:
    (1) Span shall wide enough to fully capture the emission being measured;
    (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
    (3) For average measurement:
    VBW = 10 Hz, when duty cycle is no less than 98 percent.
    VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control

level for the tested mode of operation.

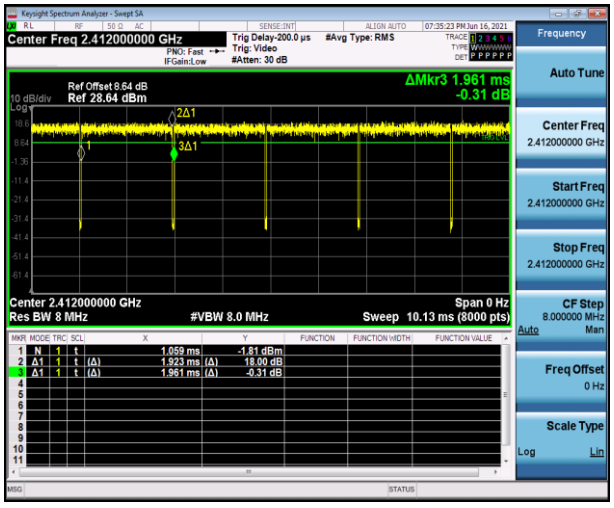
Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11b	99.20	-	-	10Hz
802.11g	98.10	-	-	10Hz
802.11n HT20	97.96	1.92	0.52	1kHz
802.11n HT40	95.00	0.95	1.05	3kHz



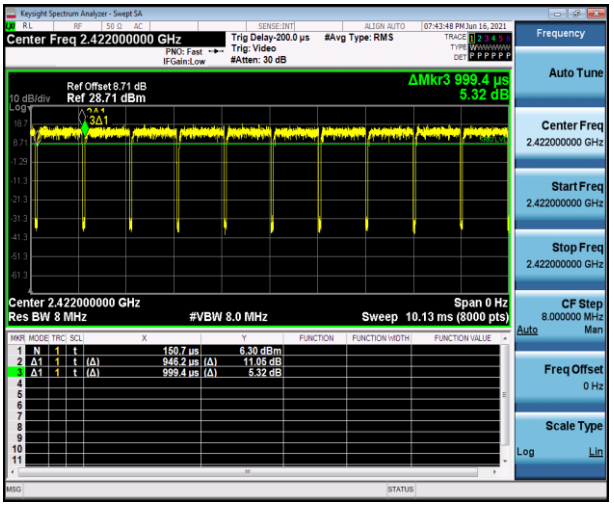
802.11b



802.11g



802.11n HT20



802.11n HT40

15. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

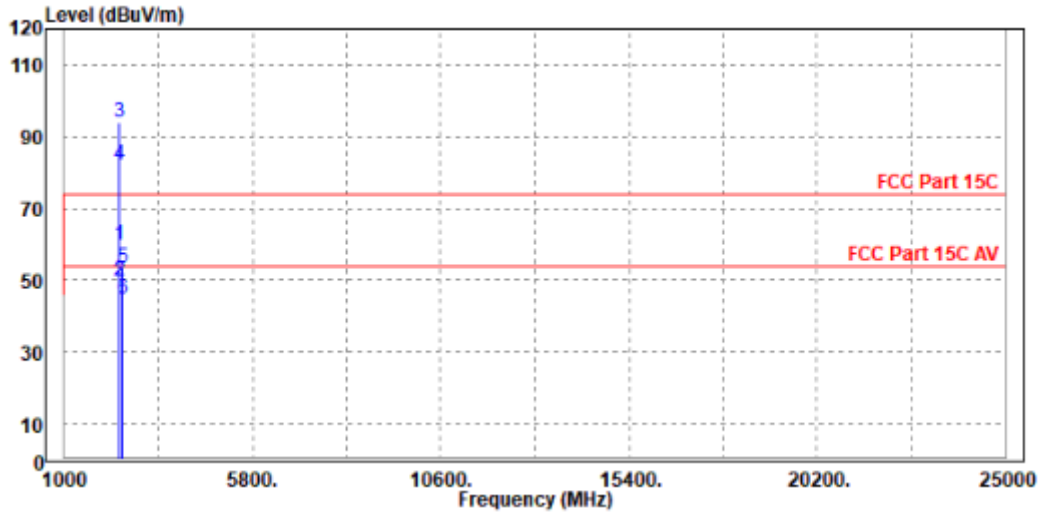
2.7.3 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

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.

2.7.1 Test Result of Radiated Spurious Emission (1GHz ~ 10th Harmonic)

Test Mode :	802.11n HT20 CH01 (2412 MHz)	Temperature :	23~25℃
Test Engineer :	Jace Hu	Relative Humidity :	63~65%
Frequencey Range	3GHz~18GHz	Polarization :	Horizontal

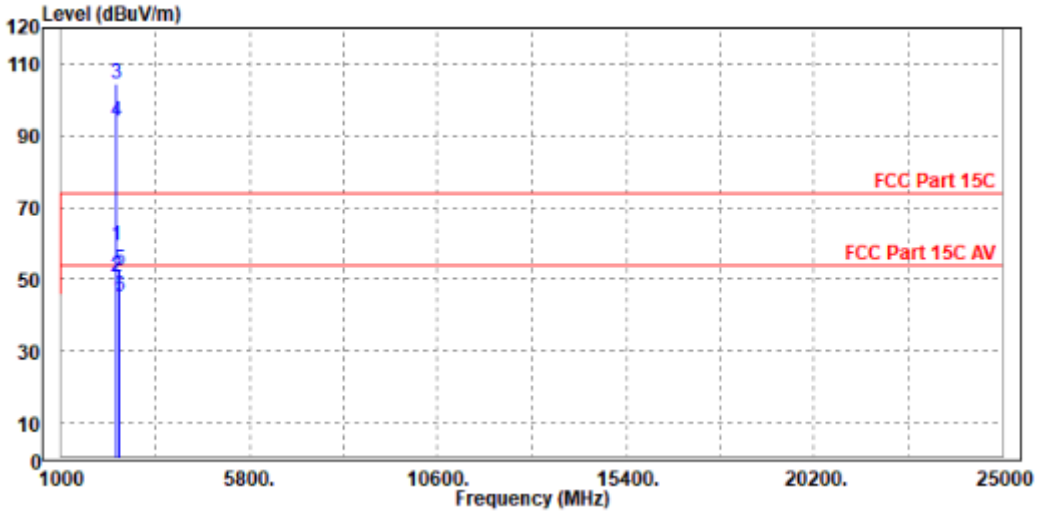
		Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
		MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1		2390.000	59.88	68.64	74.00	-14.12	-8.76	Peak	Horizontal
2		2390.000	49.56	58.32	54.00	-4.44	-8.76	Average	Horizontal
3	PK	2412.000	93.98	102.64	74.00	19.98	-8.66	Peak	Horizontal
4	PP	2412.000	81.98	90.64	54.00	27.98	-8.66	Average	Horizontal
5		2483.500	53.31	61.64	74.00	-20.69	-8.33	Peak	Horizontal
6		2483.500	44.59	52.92	54.00	-9.41	-8.33	Average	Horizontal



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

Test Mode :	802.11n HT20 CH01 (2412 MHz)	Temperature :	23~25℃
Test Engineer :	Jace Hu	Relative Humidity :	63~65%
Frequencey Range	3GHz~18GHz	Polarization :	Vertical

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1	2390.000	59.27	67.64	74.00	-14.73	-8.37	Peak	Vertical
2	2390.000	50.56	58.93	54.00	-3.44	-8.37	Average	Vertical
3 PK	2412.000	104.36	112.65	74.00	30.36	-8.29	Peak	Vertical
4 PP	2412.000	94.21	102.50	54.00	40.21	-8.29	Average	Vertical
5	2483.500	52.33	60.35	74.00	-21.67	-8.02	Peak	Vertical
6	2483.500	45.30	53.32	54.00	-8.70	-8.02	Average	Vertical

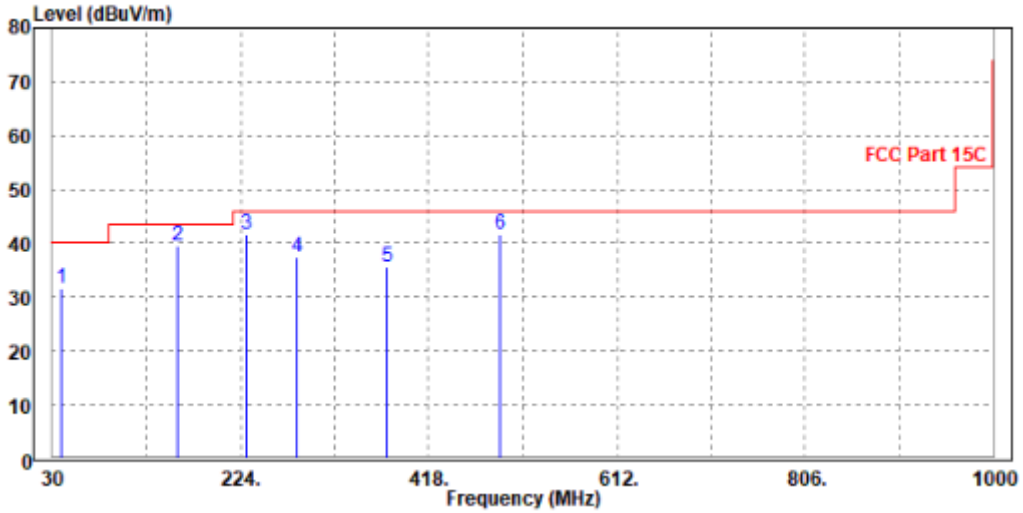


Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

2.7.2 Test Result of Radiated Spurious Emission (30MHz ~ 1GHz)

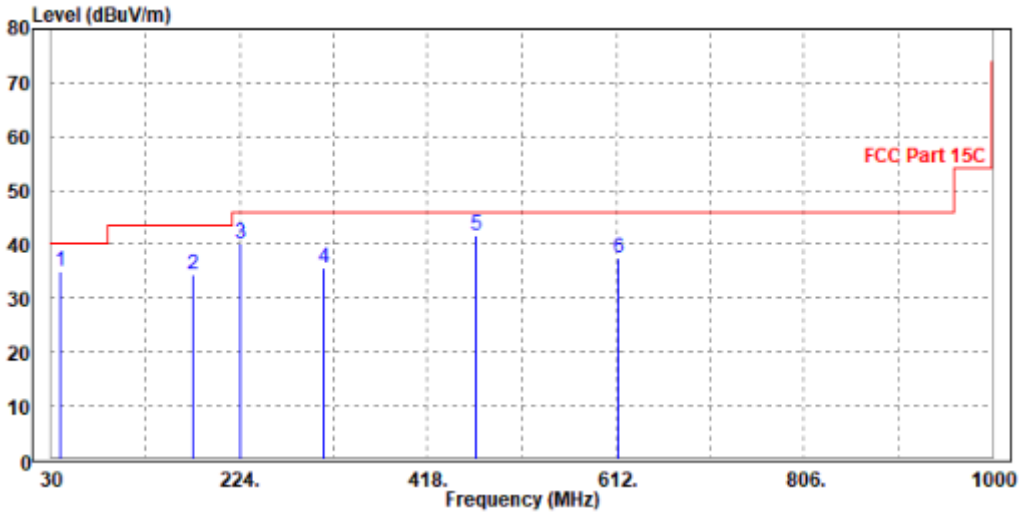
Test Mode :	802.11n HT20 CH01 (2412 MHz)	Temperature :	23~25℃
Test Engineer :	Jace Hu	Relative Humidity :	63~65%
Frequencey Range	30MHz~1GHz	Polarization :	Horizontal

		Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
		MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1		39.640	31.64	54.64	40.00	-8.36	-23.00	Peak	Horizontal
2	PP	158.648	39.66	64.08	43.50	-3.84	-24.42	Peak	Horizontal
3		230.640	41.55	63.88	46.00	-4.45	-22.33	Peak	Horizontal
4		282.640	37.45	58.31	46.00	-8.55	-20.86	Peak	Horizontal
5		375.320	35.64	53.80	46.00	-10.36	-18.16	Peak	Horizontal
6		491.500	41.77	57.32	46.00	-4.23	-15.55	Peak	Horizontal



Test Mode :	802.11n HT20 CH01 (2412 MHz)	Temperature :	23~25℃
Test Engineer :	Jace Hu	Relative Humidity :	63~65%
Frequencey Range	30MHz~1GHz	Polarization :	Vertical

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1	39.340	34.94	58.68	40.00	-5.06	-23.74	Peak	Vertical
2	175.348	34.24	58.64	43.50	-9.26	-24.40	Peak	Vertical
3	224.970	40.04	62.09	46.00	-5.96	-22.05	Peak	Vertical
4	310.540	35.54	54.83	46.00	-10.46	-19.29	Peak	Vertical
5 PP	468.480	41.58	57.22	46.00	-4.42	-15.64	Peak	Vertical
6	614.340	37.45	50.47	46.00	-8.55	-13.02	Peak	Vertical



3 Uncertainty of Evaluation

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.42dB
Radiated emission	9KHz-30M Hz	2.68dB
	30MHz ~ 1GMHz	2.50dB
	1GHz ~ 18GHz	3.51dB
	18GHz ~ 40GHz	3.96dB

MEASUREMENT	UNCERTAINTY
Occupied Channel Bandwidth	±196.4Hz
RF output power, conducted	±2.31dB
Power density, conducted	±2.31dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Appendix A: Maximum conducted output power & E.I.R.P.

Test Result

TestMode	Antenna	Channel	Result [dBm]	Limit[dBm]	Antenna Gain(dBi)	EIRP [dBm]	EIRP Limit [dBm]	Verdict
11B	Ant1	2412	12.69	<=30	1.4	14.09	36.02	PASS
		2437	13.47	<=30	1.4	14.87	36.02	PASS
		2462	14.89	<=30	1.4	16.29	36.02	PASS
11G	Ant1	2412	14.31	<=30	1.4	15.71	36.02	PASS
		2437	13.96	<=30	1.4	15.36	36.02	PASS
		2462	14.22	<=30	1.4	15.62	36.02	PASS
11N20SISO	Ant1	2412	14.18	<=30	1.4	15.58	36.02	PASS
		2437	13.61	<=30	1.4	15.01	36.02	PASS
		2462	13.84	<=30	1.4	15.24	36.02	PASS
11N40SISO	Ant1	2422	15.44	<=30	1.4	16.84	36.02	PASS
		2437	15.25	<=30	1.4	16.65	36.02	PASS
		2452	14.98	<=30	1.4	16.38	36.02	PASS