

VARIANT RADIO TEST REPORT

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

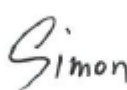
Applicant:	Honeywell International Inc Honeywell Safety and Productivity Solutions
Address:	9680 Old Bailes Road, Fort Mill, SC 29707 United States

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
 Date: Jan. 18, 2022	 Date: Jan. 18, 2022

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Report Revise Record

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RFBGDJ-W7L-P21060011-4	Original release	Jul. 14, 2021
W7L-211129W004RF09	Based on the original report RFBGDJ-W7L-P21060011-4 changing components.	Jan. 18, 2022

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Summary of Test Result

FCC Rule	IC Rule	Description	Limit	Result	Remark
15.247(a)(1)	RSS-247 5.1(a)	20dB Bandwidth	NA	(See Note 3)	-
-	RSS-Gen 6.7	99% Bandwidth	-	(See Note 3)	-
15.247(a)(1)	RSS-247 5.1(b)	Hopping Channel Separation	$\geq 2/3$ of 20dB BW	(See Note 3)	-
15.247(a)(1)	RSS-247 5.1(d)	Number of Channels	≥ 15 Chs	(See Note 3)	-
15.247(a)(1)	RSS-247 5.1(d)	Average Time of Occupancy	≤ 0.4 sec in 31.6sec period	(See Note 3)	-
15.247(b)(1)	RSS-247 5.4(b)	Peak Output Power	≤ 125 mW	Compliance (See Note 2)	-
15.247(d)	RSS-247 5.5	Conducted Band Edges	≤ 20 dBc	(See Note 3)	-
15.247(d)	RSS-247 5.5	Conducted Spurious Emission	≤ 20 dBc	(See Note 3)	-
15.247(d)	RSS-247 5.5	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	(See Note 2)	-
15.207	RSS-Gen 8.8	AC Conducted Emission	15.207(a)	(See Note 3)	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 3)	-

Note:

1. If the Frequency Hopping System operating in 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.



BUREAU
VERITAS

Test Report No.: W7L-211129W004RF09

2. 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.
3. Please refer to original report RFBGDJ-W7L-P21060011-4

1 Test Laboratory

1.1 Test facility

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 General Description

2.1 Applicant

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

2.2 Manufacturer

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

2.3 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	FHSS
Modulation Type	GFSK, 8DPSK, $\pi/4$ DQPSK
Operating Frequency	2402MHz~2480MHz
Number Of Channel	79
Max. Output Power	Bluetooth BR(1Mbps) : 6.36 dBm (0.0043W) Bluetooth BR(2Mbps) : 5.54 dBm (0.0036W) Bluetooth BR(3Mbps) : 5.89 dBm (0.0039W)
Max. e.i.r.p.	7.76 dBm (0.0060W)
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
Cable Supplied	N/A

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.

2.4 Modification of EUT

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

2.5 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.

3 Test Configuration of Equipment Under Test

3.1 Descriptions of Test Mode

The transmitter has a maximum peak conducted output power as follows:

Mode	Channel	Frequency	Bluetooth RF Output Power
GFSK	Ch00	2402MHz	4.72
	Ch39	2441MHz	5.34
	Ch78	2480MHz	6.36
4 π -DQPSK	Ch00	2402MHz	3.67
	Ch39	2441MHz	4.38
	Ch78	2480MHz	5.54
8DPSK	Ch00	2402MHz	4.03
	Ch39	2441MHz	4.73
	Ch78	2480MHz	5.89

Remark:

1. All the test data for each data rate were verified, but only the worst case was reported.
2. The data rate was set in 1Mbps for all the test items due to the highest RF output power.

3.2 Test Mode

3.2.1 Antenna Port Conducted Measurement

Summary table of Test Cases			
Test Item	Data Rate / Modulation		
	Bluetooth BR 1Mbps GFSK	Bluetooth EDR 2Mbps $\pi/4$ -DQPSK	Bluetooth EDR 3Mbps 8-DPSK
Conducted Test Cases	Mode 1: CH00_2402 MHz	Mode 4: CH00_2402 MHz	Mode 7: CH00_2402 MHz
	Mode 2: CH39_2441 MHz	Mode 5: CH39_2441 MHz	Mode 8: CH39_2441 MHz
	Mode 3: CH78_2480 MHz	Mode 6: CH78_2480 MHz	Mode 9: CH78_2480 MHz

3.2.2 Radiated Emission Test (Below 1GHz)

Radiated Test Cases	Bluetooth BR 1Mbps GFSK
	Mode 1: CH00_2402MHz

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. Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

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

3.2.3 Radiated Emission Test (Above 1GHz)

Radiated Test Cases	Bluetooth BR 1Mbps GFSK
	Mode 1: CH00_2402 MHz
	Mode 2: CH39_2441 MHz
	Mode 3: CH78_2480 MHz

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

3.2.4 Power Line Conducted Emission Test:

AC Conducted Emission	Mode 1 : BT Linking + Earphone + Adapter
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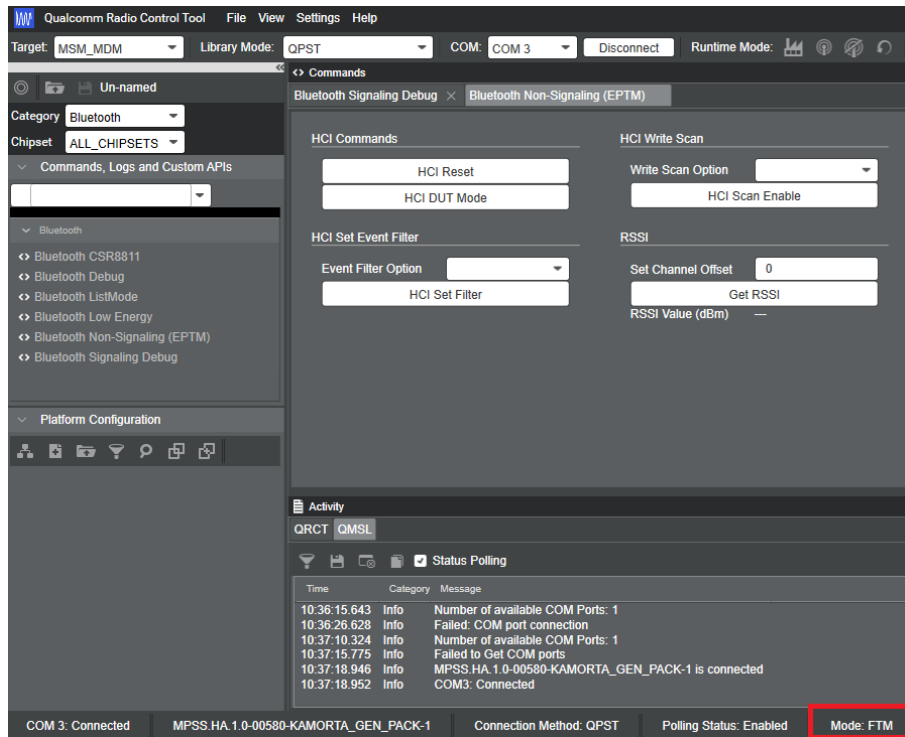
3.3 Support Equipment

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

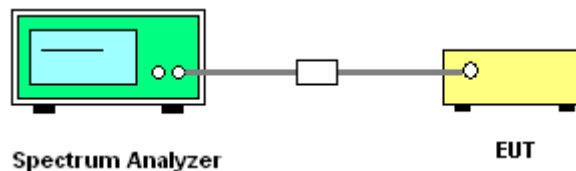
3.4 Test Setup

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

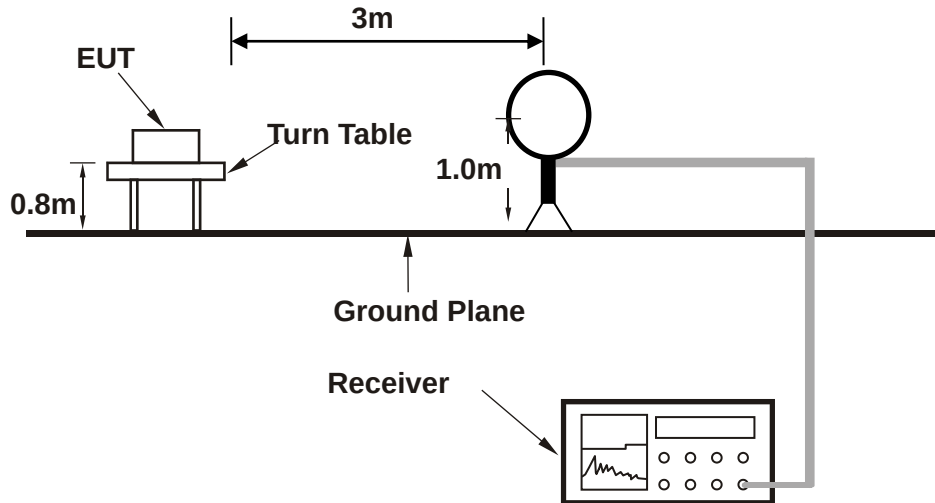
EUT was set in the Hidden menu mode to enable BT communications.



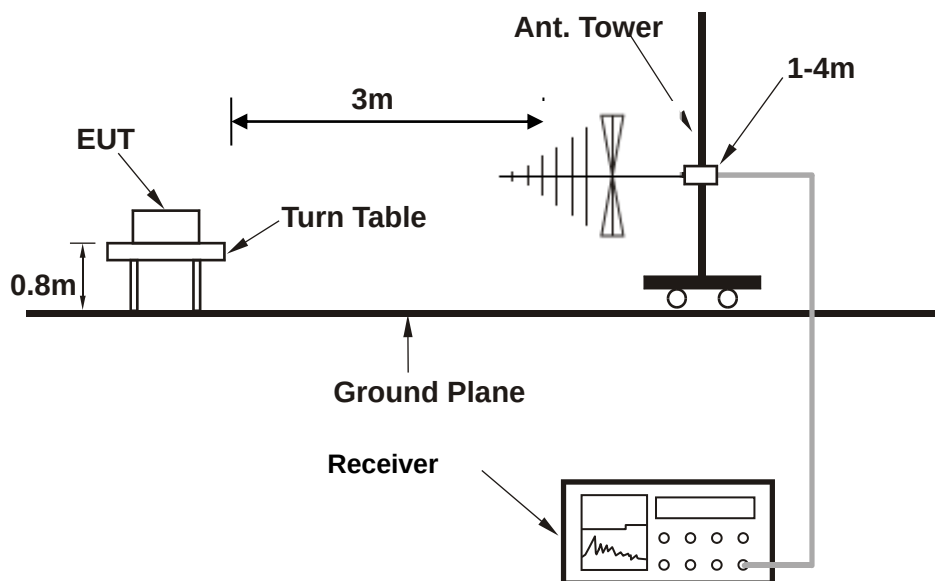
Setup diagram for Conducted Test



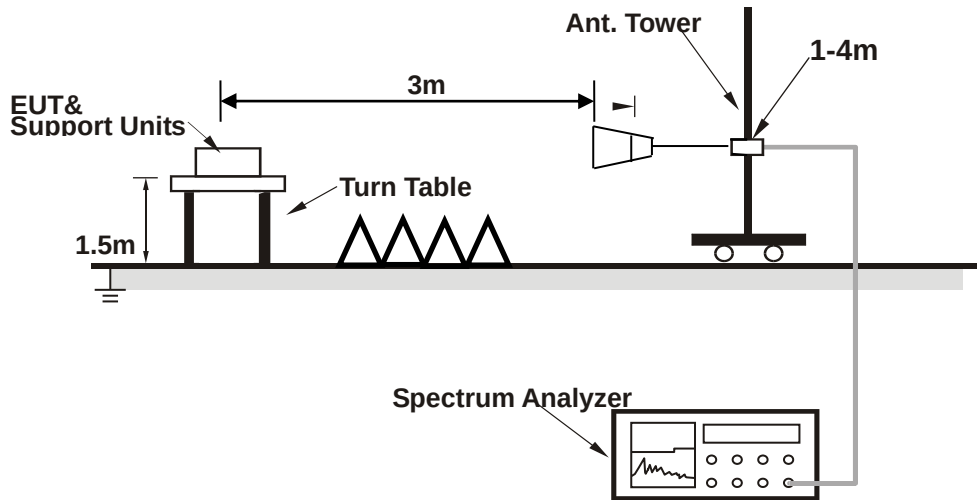
Setup diagram for Raidation(9KHz~30MHz) Test



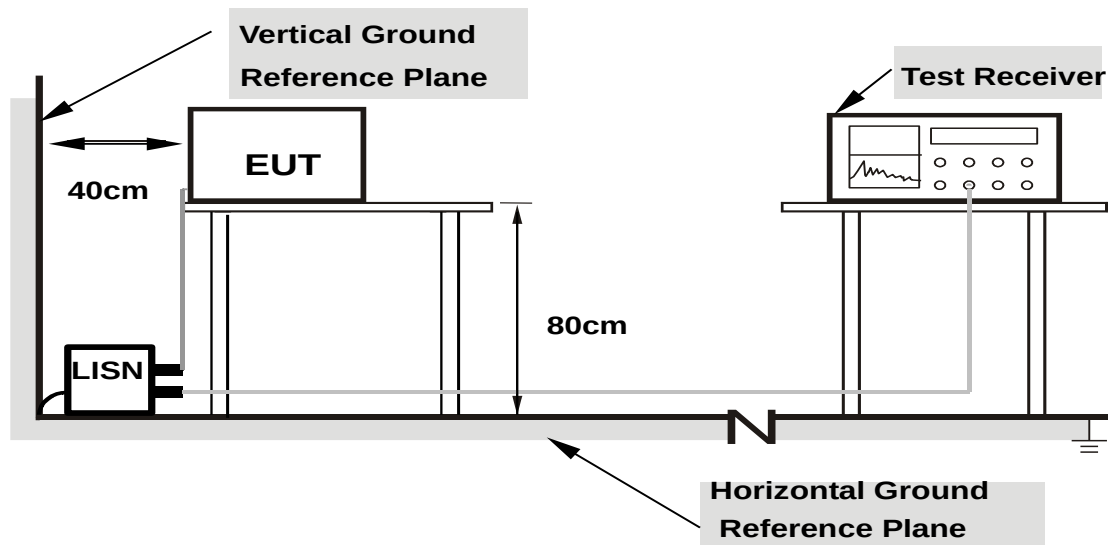
Setup diagram for Raidation(Below 1G) Test



Setup diagram for Raidation(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

3.5 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.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 5 + 10 = 15 \text{ (dB)}\end{aligned}$$

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)

3.6 Peak Output Power Measurement

3.6.1 Limit of Peak Output Power

Section 15.247 (b)

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

RSS-247 5.4(b)

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W

3.6.2 Test Procedures

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

3.6.3 Test Result of Peak Output Power

Refer to Appendix A of this test report.

3.7 Radiated Band Edges and Spurious Emission Measurement

3.7.1 Limit of Radiated Band Edges and Spurious Emission

FCC §15.247 (d)

IC RSS-247 5.5

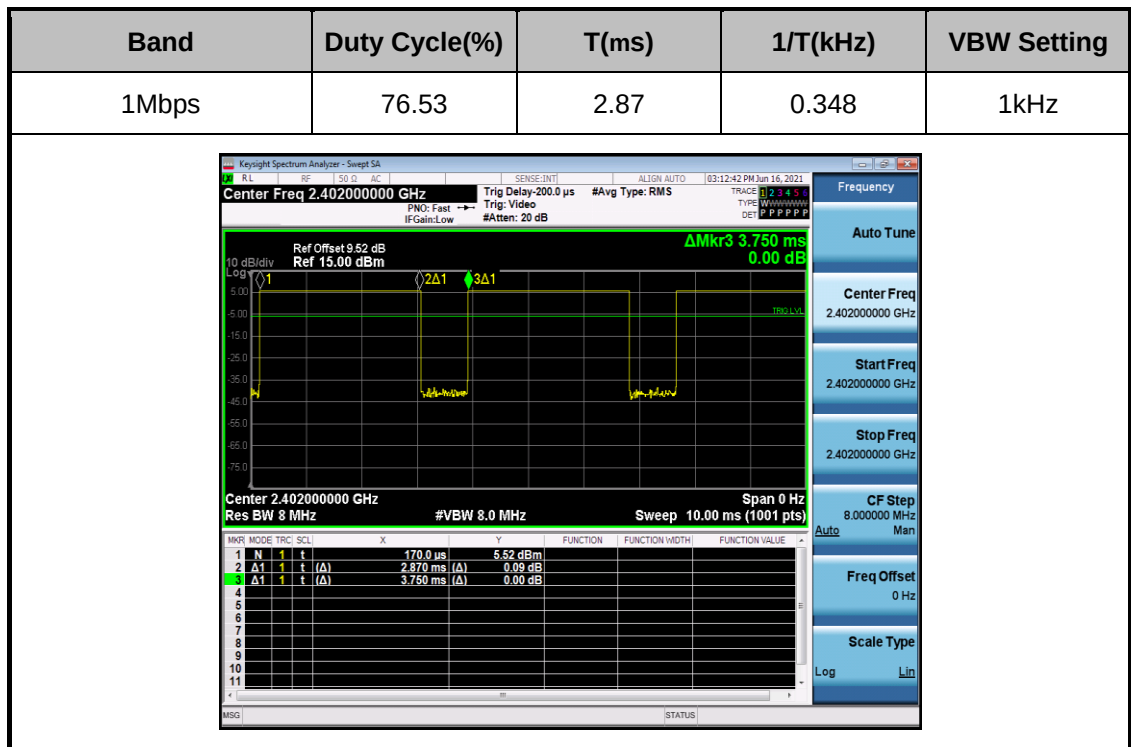
In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as 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

Note: The frequency range from 9KHz to 10th harmonic (25GHz) are checked, and no any emissions were found from 18GHz to 25GHz, So the radiated emissions from 18GHz to 25GHz were not record.

3.7.2 Test Procedures

4. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
5. Turn on the EUT and connect it to measurement instrument.
6. Set to the maximum power setting and enable the EUT transmit continuously.
7. 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 $f > 1$ GHz ; VBW=3RBW; 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 $\geq 1/T$, 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.
8. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP.
9. Convert the resultant EIRP to an equivalent electric field strength using the following relationship:
$$E = \text{EIRP} - 20 \log d + 104.8$$
Where:
 - E is the electric field strength in dB μ V/m
 - EIRP is the equivalent isotropically radiated power in dBm
 - d is the specified measurement distance in m
 - $E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] + 95.2$, for $d = 3$ m.
10. Compare the resultant electric field strength level with the applicable regulatory limit.



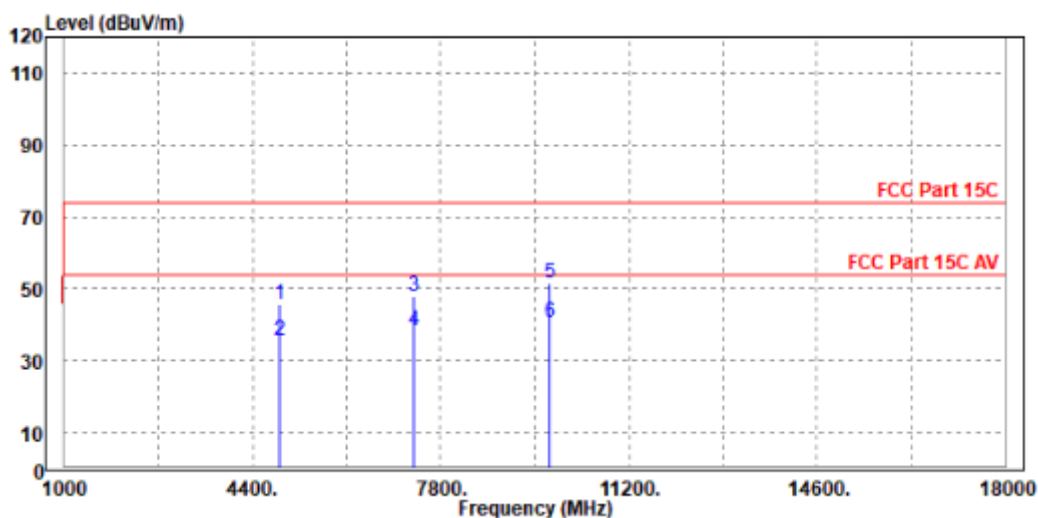
3.7.3 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

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.

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

Test Mode :	Bluetooth (1Mbps) CH39 (2441MHz)	Temperature :	23~25°C
Test Engineer :	Jace Hu	Relative Humidity :	63~65%
Frequency Range	1GHz~18GHz	Polarization :	Horizontal

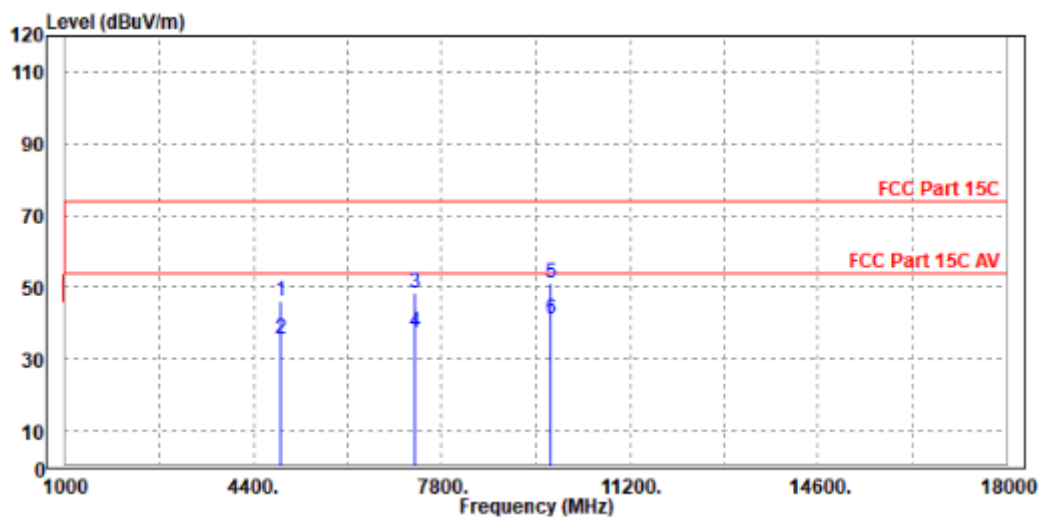
	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1	4876.000	45.61	48.78	74.00	-28.39	-3.17	Peak	Horizontal
2	4876.000	35.77	38.94	54.00	-18.23	-3.17	Average	Horizontal
3	7323.000	48.05	45.97	74.00	-25.95	2.08	Peak	Horizontal
4	7323.000	38.43	36.35	54.00	-15.57	2.08	Average	Horizontal
5 PK	9764.000	51.72	46.83	74.00	-22.28	4.89	Peak	Horizontal
6 PP	9764.000	40.82	35.93	54.00	-13.18	4.89	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 :	Bluetooth (1Mbps) CH39 (2441MHz)	Temperature :	23~25°C
Test Engineer :	Jace Hu	Relative Humidity :	63~65%
Frequency Range	1GHz~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	4876.000	46.18	49.15	74.00	-27.82	-2.97	Peak	Vertical
2	4876.000	35.68	38.65	54.00	-18.32	-2.97	Average	Vertical
3	7323.000	48.31	46.16	74.00	-25.69	2.15	Peak	Vertical
4	7323.000	37.47	35.32	54.00	-16.53	2.15	Average	Vertical
5 PK	9764.000	51.29	46.06	74.00	-22.71	5.23	Peak	Vertical
6 PP	9764.000	41.16	35.93	54.00	-12.84	5.23	Average	Vertical

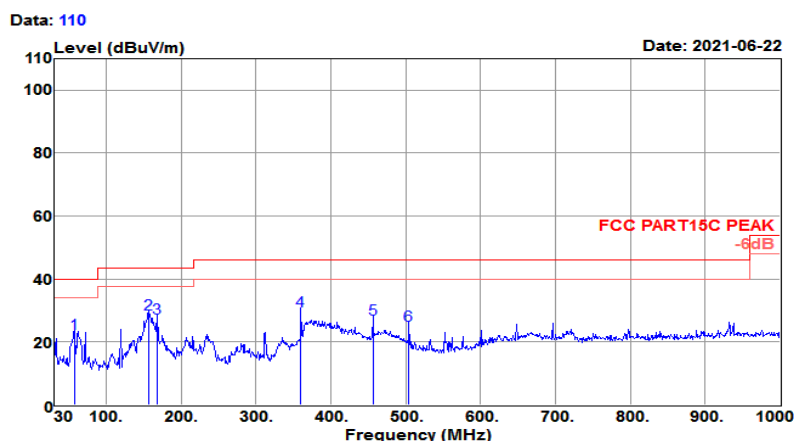


Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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

Test Mode :	Bluetooth (3Mbps) CH00 (2402MHz)	Temperature :	23~25°C
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequency Range	30MHz~1GHz	Polarization :	Horizontal

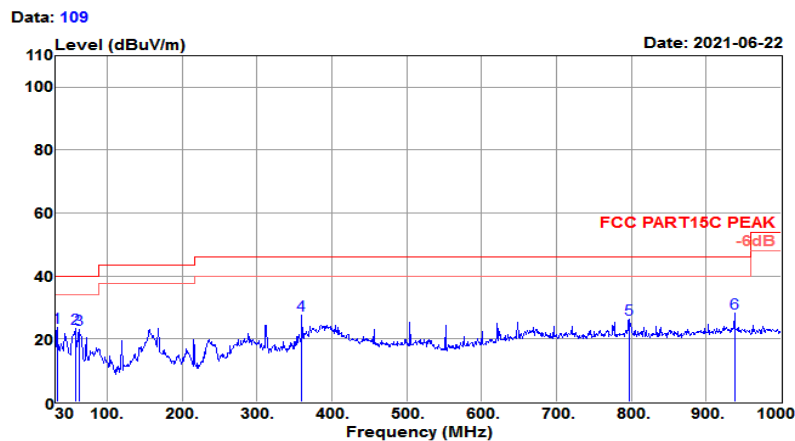
Test Site	: 3m Chamber	Temp/Humi	: 25°C / 64%
Tested by	: Jack	Pol/Phase	: HORIZONTAL
Test Mode	: BT CH00(2402MHz)	Power rating	: DC 3.85V
EUT	: Mobile Computer		
Model No.	: CT45-L0N		



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
57.160	38.97	14.89	1.26	32.51	22.61	40.00	-17.39	QP
156.100	45.02	14.11	2.14	32.48	28.79	43.50	-14.71	QP
167.740	44.45	13.45	2.22	32.48	27.64	43.50	-15.86	QP
359.800	44.89	14.24	3.34	32.53	29.94	46.00	-16.06	QP
455.830	39.82	16.25	3.75	32.59	27.23	46.00	-18.77	QP
504.330	36.90	16.92	4.02	32.63	25.21	46.00	-20.79	QP

Test Mode :	Bluetooth (3Mbps) CH00 (2402MHz)	Temperature :	23~25°C
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequency Range	30MHz~1GHz	Polarization :	Vertical

Test Site	: 3m Chamber	Temp/Humi	: 25°C / 64%
Tested by	: Jack	Pol/Phase	: VERTICAL
Test Mode	: BT CH00(2402MHz)	Power rating:	DC 3.85V
EUT	: Mobile Computer		
Model No.	: CT45-L0N		



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
32.910	41.11	13.94	0.95	32.45	23.55	40.00	-16.45	QP
57.160	39.60	14.89	1.26	32.51	23.24	40.00	-16.76	QP
62.010	40.06	14.31	1.31	32.51	23.17	40.00	-16.83	QP
359.800	42.60	14.24	3.34	32.53	27.65	46.00	-18.35	QP
797.270	32.48	20.99	5.16	32.32	26.31	46.00	-19.69	QP
937.920	32.20	22.41	5.76	32.15	28.22	46.00	-17.78	QP

4 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~30MHz	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
DH5	Ant1	2402	4.72	<=30	1.4	6.12	36.02	PASS
		2441	5.34	<=30	1.4	6.74	36.02	PASS
		2480	6.36	<=30	1.4	7.76	36.02	PASS
2DH5	Ant1	2402	3.67	<=30	1.4	5.07	36.02	PASS
		2441	4.38	<=30	1.4	5.78	36.02	PASS
		2480	5.54	<=30	1.4	6.94	36.02	PASS
3DH5	Ant1	2402	4.03	<=30	1.4	5.43	36.02	PASS
		2441	4.73	<=30	1.4	6.13	36.02	PASS
		2480	5.89	<=30	1.4	7.29	36.02	PASS