FCC TEST REPORT

FOR

ChargePoint, Inc.

WIFI & BT Module

Test Model: SU60-2230C

Prepared for	:	ChargePoint, Inc.
Address	:	254 E. Hacienda Ave, Campbell, CA 95008, USA
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	:	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China
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Date of receipt of test sample	:	June 06, 2022
Number of tested samples	:	3
Sample No.	:	A060122034-1
Serial number	:	Prototype
Date of Test	:	June 06, 2022 ~ July 01, 2022
Date of Report	:	July 01, 2022

FCC TEST REPORT

Report Reference No. ..... :		**LCSA060122034EA**
Date of Issue	:	July 01, 2022
Testing Laboratory Name ..... :		**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	:	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China
Testing Location/ Procedure.....	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name..... :		**ChargePoint, Inc.**
Address	:	254 E. Hacienda Ave, Campbell, CA 95008, USA
Test Specification		
Standard.....	:	FCC CFR 47 PART 15 C (15.247) RSS-247 Issue 2 / RSS-Gen Issue 5 / ANSI C63.10: 2013
Test Report Form No.	:	LCSEMC-1.0
TRF Originator	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	:	Dated 2011-03

Test Item Description. ..... :		**WIFI & BT Module**
Trade Mark.....	:	ChargePoint
Test Model	:	SU60-2230C
Ratings	:	Input: DC 5V
Result ..... :		**Positive**

Compiled by:	Supervised by:	Approved by:
Vera Deng	Jin Wang	Gavin Liang
Vera Deng/ Administrator	Jin Wang/ Technique principal	Gavin Liang / Manager

FCC -- TEST REPORT

Test Report No. : LCSA060122034EA	July 01, 2022 Date of issue

Test Model.....	: SU60-2230C
EUT.....	: WIFI & BT Module
Applicant.....	**: ChargePoint, Inc.**
Address.....	: 254 E. Hacienda Ave, Campbell, CA 95008, USA
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: ChargePoint, Inc.**
Address.....	: 254 E. Hacienda Ave, Campbell, CA 95008, USA
Telephone.....	: /
Fax.....	: /
Factory.....	**: ChargePoint, Inc.**
Address.....	: 254 E. Hacienda Ave, Campbell, CA 95008, USA
Telephone.....	: /
Fax.....	: /

Test Result	**Positive**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Report Version	Issue Date	Revision Content	Revised By
000	July 01, 2022	Initial Issue	---

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1. GENERAL INFORMATION

1.1 Description of Device (EUT)

This test report was prepared on behef of ChargePoint, Inc., and their product model: SU60-2230C, FCCID:W38-60SIPT, IC:8854A-602230C, or the “EUT” as referred to in this report.

The EUT is WIFI&BT module and is contain within a Network Module host device mOwhich also contains a Cell Modem.

1.2 Objective

This report was prepared on behef of ChargePoint, Inc. in accordance with Part2, Subpart J, and Part 15, Subpart C of the Federal Communication Commission’s rules and ISEDC RSS-247 Issue 2, February 2017.

The objective was to determine compliance with FCC Part 15.247 and ISEDC RSS-247 for Anterna Requirement, RF Exposure & Radiated Spurious Emissions.

This project was a Permissive Change II submission for the purpose of changing the Wifi/BT module antenna used by the EUT, disabling DFS band and enabling co-location with cell modem(FCCID: W38-201903EG25G, IC: 8854A-201903EG25G).

1.3 Related Submittal(s)/Grant(s)

Equipment Class:DSS/DTS, FCCID:W38-60SIPT, IC:8854A-602230C

1.4 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC KDB 558074 D01 DTS Meas Guidance v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems(DTS) Operating Under §15.247

1.5 Description of Test Facility

NVLAP Accreditation Code is 600167-0.
FCC Designation Number is CN5024.
CAB identifier is CN0071.
CNAS Registration Number is L4595.
Test Firm Registration Number: 254912.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10:2013 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.6 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 within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN 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.

1.7 Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	3.10dB	(1)
		30MHz~200MHz	2.96dB	(1)
		200MHz~1000MHz	3.10dB	(1)
		1GHz~26.5GHz	3.80dB	(1)
		26.5GHz~40GHz	3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	1.63dB	(1)
Power disturbance	:	30MHz~300MHz	1.60dB	(1)

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

2. SYSTERM TEST CONFIGURATION

2.1 Justification

The EUT was configured for testing according to ANSI C63.10-2013 and FCC KDB 558074 D01 DTS Meas Guidance v05r02

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

2.2 EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by Command Prompt provided by application.

Power Settings:

Modulation	Frequency(MHz)	Power Setting
802.11b	2412	19
	2437	19
	2462	18
802.11g	2412	17
	2437	19
	2462	15
802.11n20	2412	16
	2437	19
	2462	13
802.11n40	2422	14
	2437	17
	2452	12

Antenna & Bandwidth

Antenna	Chain 0 (ANT0)		Chain 1 (ANT1)		Simultaneously
Bandwidth Mode	20MHz	40MHz	20MHz	40MHz	/
IEEE 802.11b	☑	☐	☑	☐	☐
IEEE 802.11g	☑	☐	☑	☐	☐
IEEE 802.11n	☑	☑	☑	☑	☑

Data rates tested:

IEEE 802.11b Mode: 1 Mbps

IEEE 802.11g Mode: 6 Mbps

IEEE 802.11n Mode HT20: MCS0

IEEE 802.11n Mode HT40: MCS0

Note:Power setting were determined from settings used in previous test report of device(Test Report: FR740701AC Rev.02 issued by Internationnal Certification Corp. on 07/21/2017)

Modulation	Frequency(MHz)	Power Setting
DH1	2402	Default
	2442	Default
	2480	Default
2DH1	2402	Default
	2442	Default
	2480	Default
3DH1	2402	Default
	2442	Default
	2480	Default
BLE	2402	10
	2442	10
	2480	10

Data rates tested:

DH1: 1 Mbps

2DH1: 2 Mbps

3DH1: 3 Mbps

BLE M: 1 Mbps

Note:Power setting were determined from settings used in previous test report of device(Test Report: FR740701AE Rev.02 issued by Internationnal Certification Corp. on 07/21/2017 for BLE and Test Report, FR7401AD Rev.02 issued by International Certificational Corp.on 07/21/2017 for BT Classic)

2.3. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
DELL	Notebook	G15 5520	---	FCC

2.4. On Time and Duty Cycle

According to KDB 558074 D01 DTS Meas Guidance v05r02 section 6.0:

Preferably, all measurement of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e, with duty cycle of greater than or equal to 98%).When continuous operation cannot be realized, the the use of sweep triggering/signal getting techniques can be utilized to ensure that triggering/signal getting techniques will require knowledge of the minimum transmission duration(T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal getting techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any tiome that data is being accquired (i.e., no transmitter off-time is to be considered).

Radio mode	On Time(ms)	Period (ms)	Duty Cycle(%)	Duty Cycle Correction Factor(dB)
802.11b	-	-	100	0
802.11g	-	-	100	0
802.11n20	-	-	100	0
802.11n40	-	-	100	0
DH1	0.383	1.25	30.64	5.14
2-DH1	0.383	1.25	30.64	5.14
3-DH1	0.383	1.25	30.64	5.14
BLE	2.117	2.5	84.68	0.72

Duty Cycle= On time(ms) / Period (ms)

Duty Cycle Correction Factor(dB) = 10*1og(1/Duty Cycle)

3. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C & RSS-247		
FCC Rules	Description of Test	Test Sample
§15.209(a) RSS-Gen§8.9	Radiated Spurious Emissions	Compliant
§15.203 RSS-Gen §6.8; RSP-100	Antenna Requirements	Compliant
§15.247(i)§1.1310 §15.247(i)§2.1091 RSS-102	RF Exposure	Compliant

5. SUMMARY OF TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Power Meter	R&S	NRVS	100444	2022-06-16	2023-06-15
2	Power Sensor	R&S	NRV-Z81	100458	2022-06-16	2023-06-15
3	Power Sensor	R&S	NRV-Z32	10057	2022-06-16	2023-06-15
4	Test Software	Tonscend	JS1120-2	/	N/A	N/A
5	RF Control Unit	Tonscend	JS0806-2	N/A	2021-11-16	2022-11-15
6	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2021-11-16	2022-11-15
7	DC Power Supply	Agilent	E3642A	N/A	2021-11-25	2022-11-24
8	EMI Test Software	AUDIX	E3	/	N/A	N/A
9	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2022-06-16	2023-06-15
10	Positioning Controller	MF	MF7082	MF78020803	2022-06-16	2023-06-15
11	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2021-07-25	2024-07-24
12	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2021-07-25	2024-07-24
13	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2021-07-01	2024-06-30
14	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2020-09-20	2023-09-19
15	Broadband Preamplifier	SCHWARZBECK	BBV9745	9719-025	2022-06-16	2023-06-15
16	EMI Test Receiver	R&S	ESR 7	101181	2022-06-16	2023-06-15
17	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2021-11-16	2022-11-15
18	Broadband Preamplifier	/	BP-01M18G	P190501	2022-06-16	2023-06-15
19	6dB Attenuator	/	100W/6dB	1172040	2022-06-16	2023-06-15
20	3dB Attenuator	/	2N-3dB	/	2021-11-16	2022-11-15
21	EMI Test Receiver	R&S	ESPI	101840	2022-06-16	2023-06-15
22	Artificial Mains	R&S	ENV216	101288	2022-06-16	2023-06-15
23	10dB Attenuator	SCHWARZBECK	MTS-IMP-136	261115-001-0032	2022-06-16	2023-06-15
24	EMI Test Software	Farad	EZ	/	N/A	N/A

6. MEASUREMENT RESULTS

6.1. Restricted Band Emission Limit

6.1.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

\2\ Above 38.6

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a).

According to RSS-Gen §8.9: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

In case the emission fall within the restricted band specified on RSS-Gen, then the limit in the table below has to be followed.

Frequencies (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

6.1.2. Measuring Instruments and Setting

Please refer to of equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10^{th} carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/T kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/T kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

6.1.3. Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 1.0 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 4 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 4 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

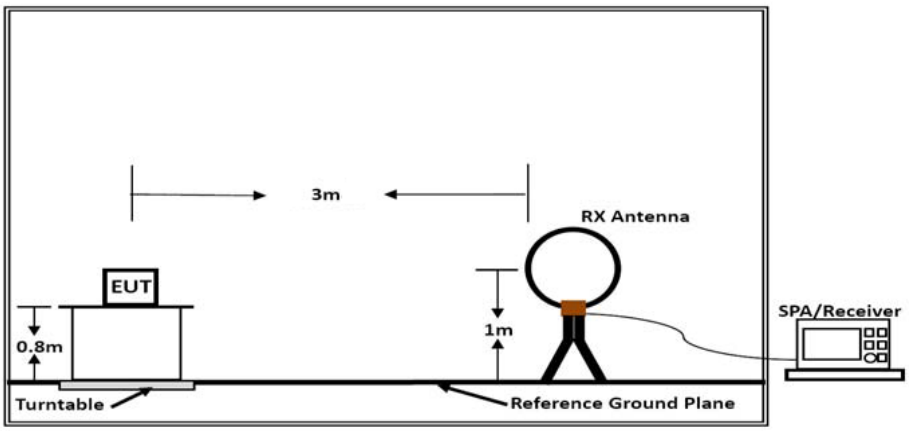
--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

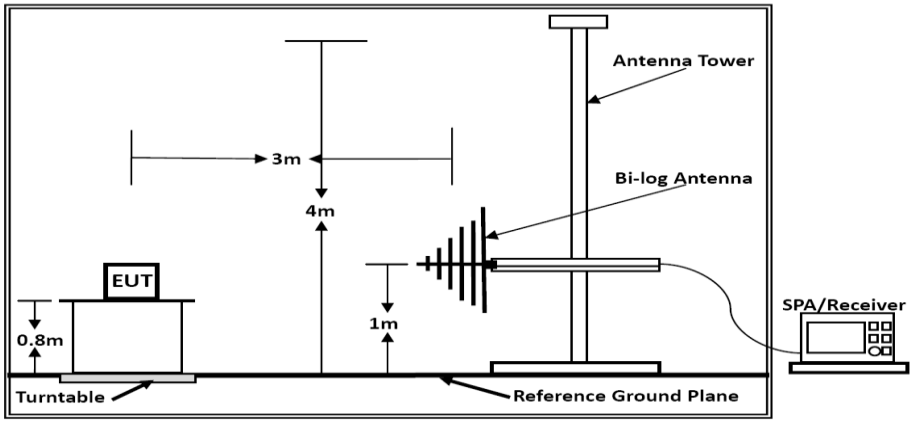
--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

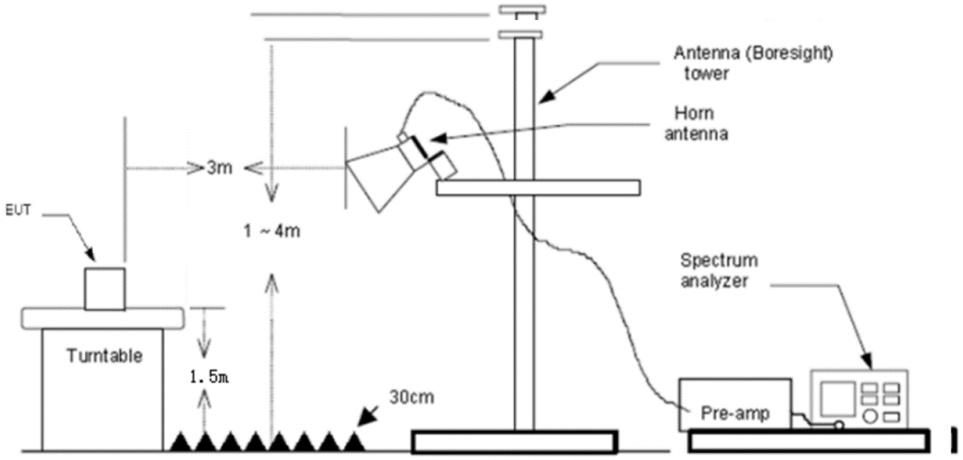
6.1.4. Test Setup Layout



Below 30MHz



Below 1GHz



Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1.5m.

6.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.1.6. Results of Radiated Emissions (9 KHz~30MHz)

Temperature	23.5℃	Humidity	52.2%
Test Engineer	Ling Zhu		

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

6.1.7. Results of Radiated Emissions (30 MHz~1000 MHz)

Temperature	23.5℃	Humidity	52.2%
Test Engineer	Ling Zhu		

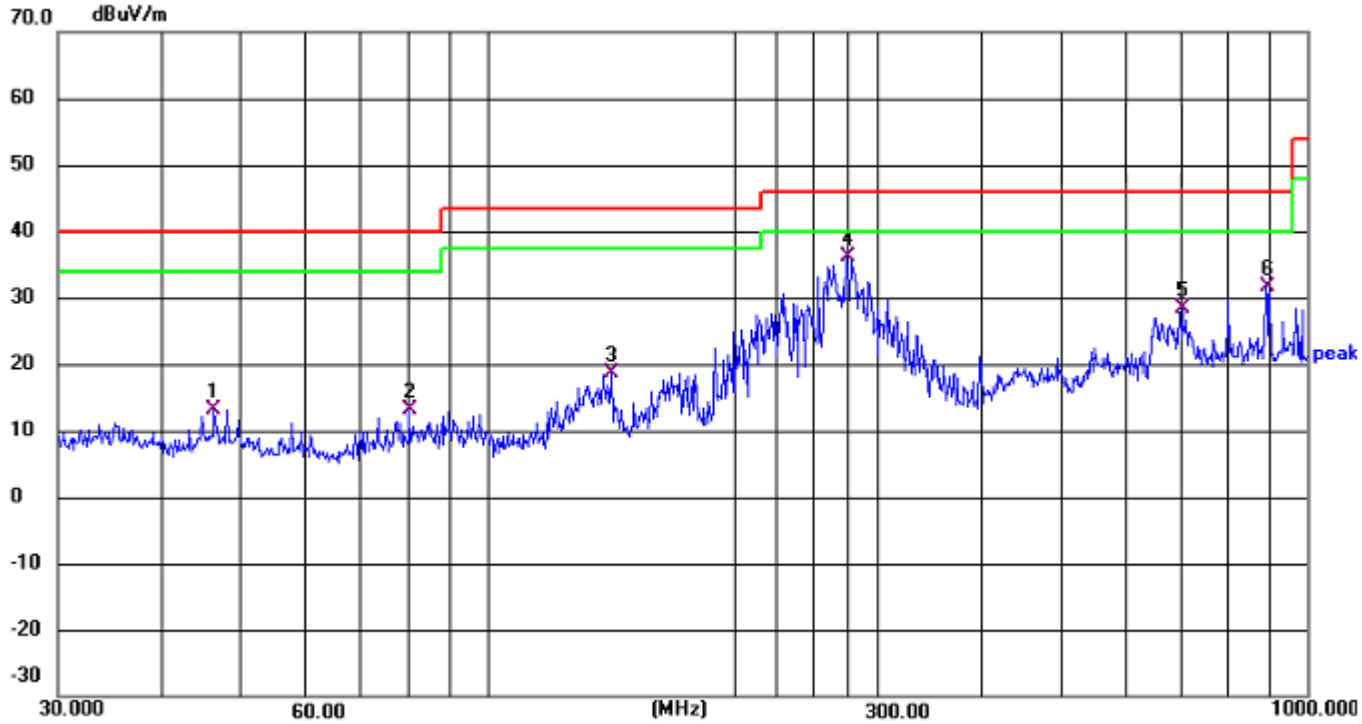
PASS.

Only record the worst test result in this report.

The test data please refer to following page.

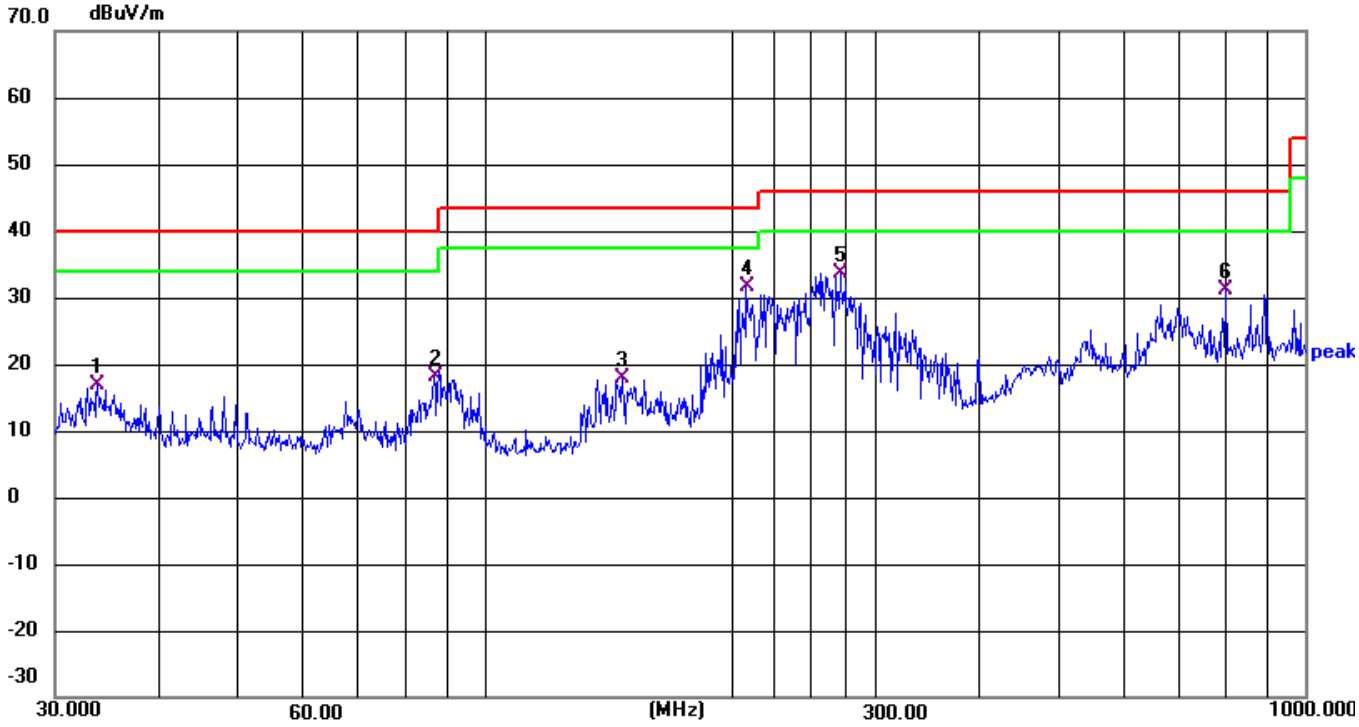
Below 1GHz

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	46.5030	37.98	-16.94	21.04	40.00	-18.96	QP
2	181.9202	42.50	-18.42	24.08	43.50	-19.42	QP
3	215.2678	49.37	-16.99	32.38	43.50	-11.12	QP
4	268.4853	55.74	-15.42	40.32	46.00	-5.68	QP
5	400.4319	41.02	-14.39	26.63	46.00	-19.37	QP
6	857.0247	35.33	-8.90	26.43	46.00	-19.57	QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	33.7986	34.74	-17.95	16.79	40.00	-23.21	QP
2	86.8068	37.45	-19.20	18.25	40.00	-21.75	QP
3	147.4036	38.06	-20.11	17.95	43.50	-25.55	QP
4	208.5803	48.74	-17.16	31.58	43.50	-11.92	QP
5	271.3246	49.11	-15.40	33.71	46.00	-12.29	QP
6	801.7863	41.11	-9.89	31.22	46.00	-14.78	QP

Note:

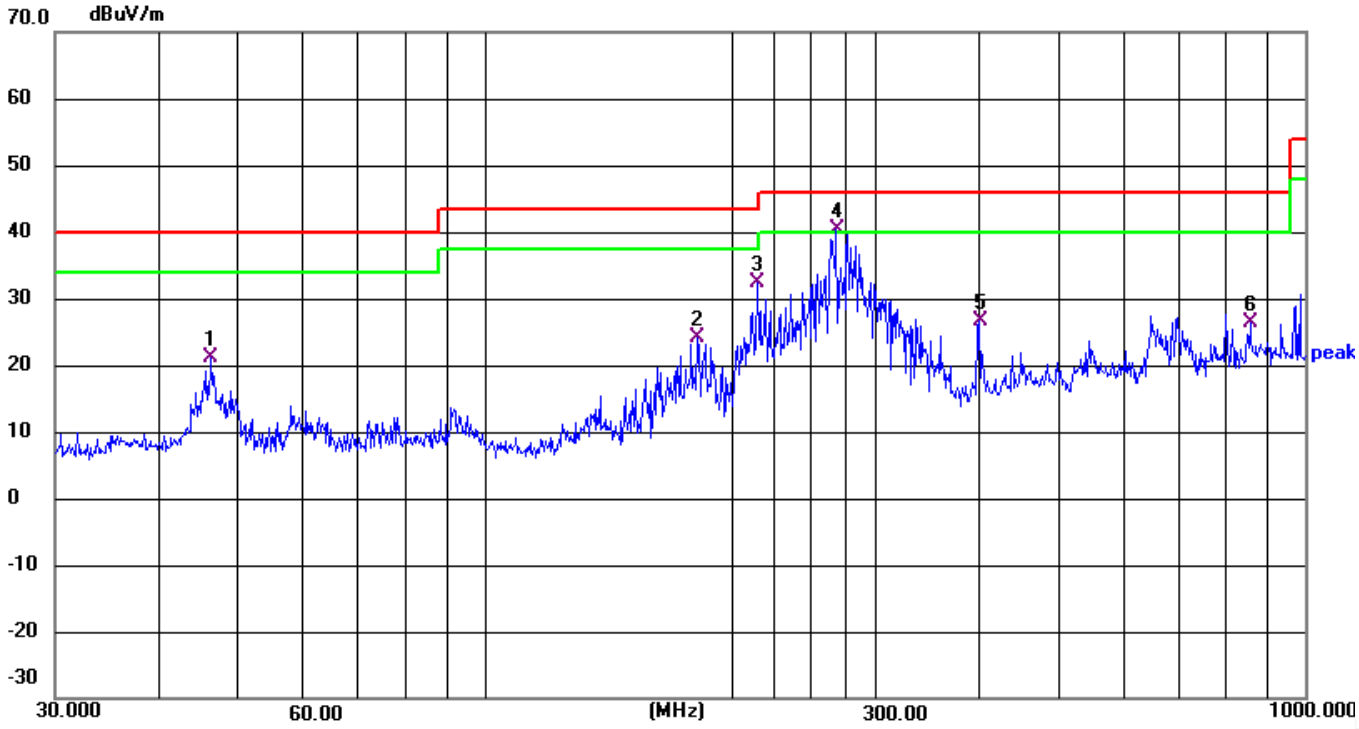
1). Pre-scan all modes and recorded the worst case results in this report (BT-DH5 Low Channel).

2). Emission level (dBuV/m) = 20 log Emission level (uV/m).

3). Level = Reading + Factor, Margin = Level–Limit, Factor = Antenna Factor + Cable Loss - Preamp Factor.

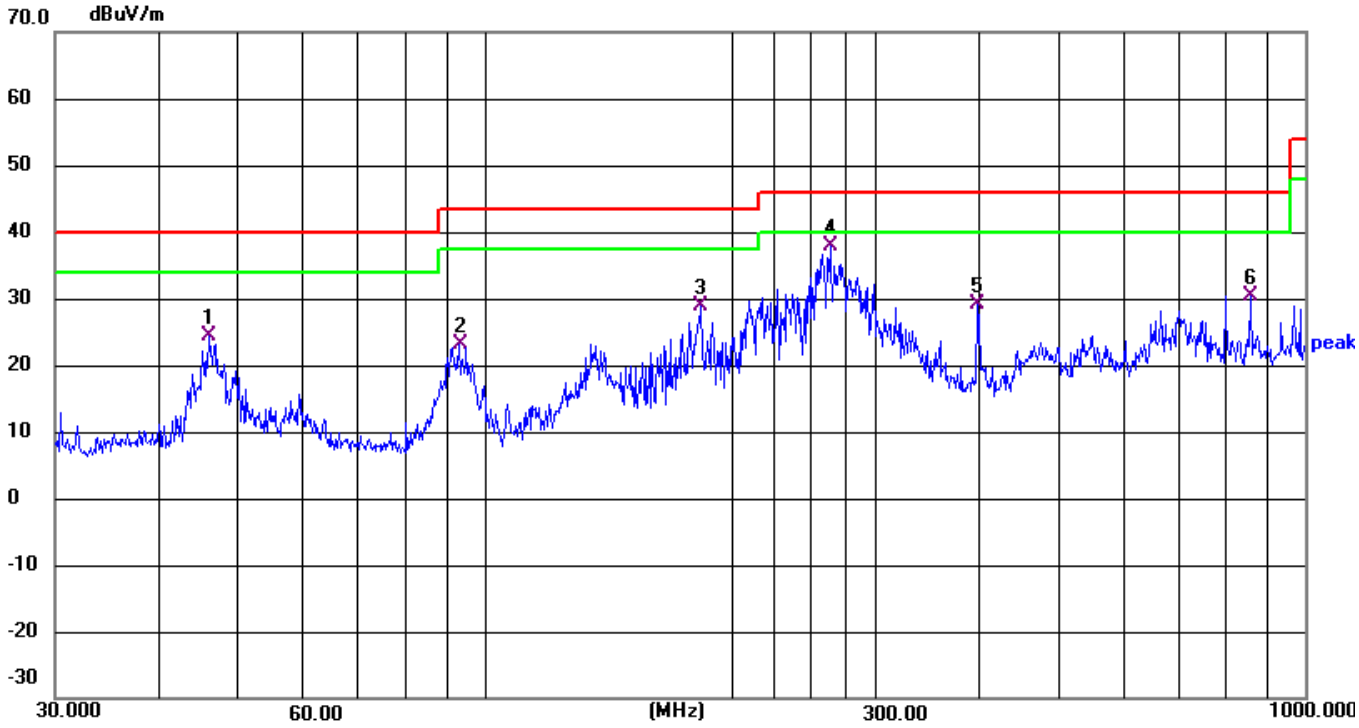
Below 1GHz

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	46.5030	37.98	-16.94	21.04	40.00	-18.96	QP
2	181.9202	42.50	-18.42	24.08	43.50	-19.42	QP
3	215.2678	49.37	-16.99	32.38	43.50	-11.12	QP
4	268.4853	55.74	-15.42	40.32	46.00	-5.68	QP
5	400.4319	41.02	-14.39	26.63	46.00	-19.37	QP
6	857.0247	35.33	-8.90	26.43	46.00	-19.57	QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	46.1779	41.27	-16.93	24.34	40.00	-15.66	QP
2	93.1132	41.72	-18.66	23.06	43.50	-20.44	QP
3	183.8440	47.32	-18.55	28.77	43.50	-14.73	QP
4	263.8190	53.30	-15.48	37.82	46.00	-8.18	QP
5	399.0302	43.48	-14.43	29.05	46.00	-16.95	QP
6	857.0247	39.29	-8.90	30.39	46.00	-15.61	QP

Note:

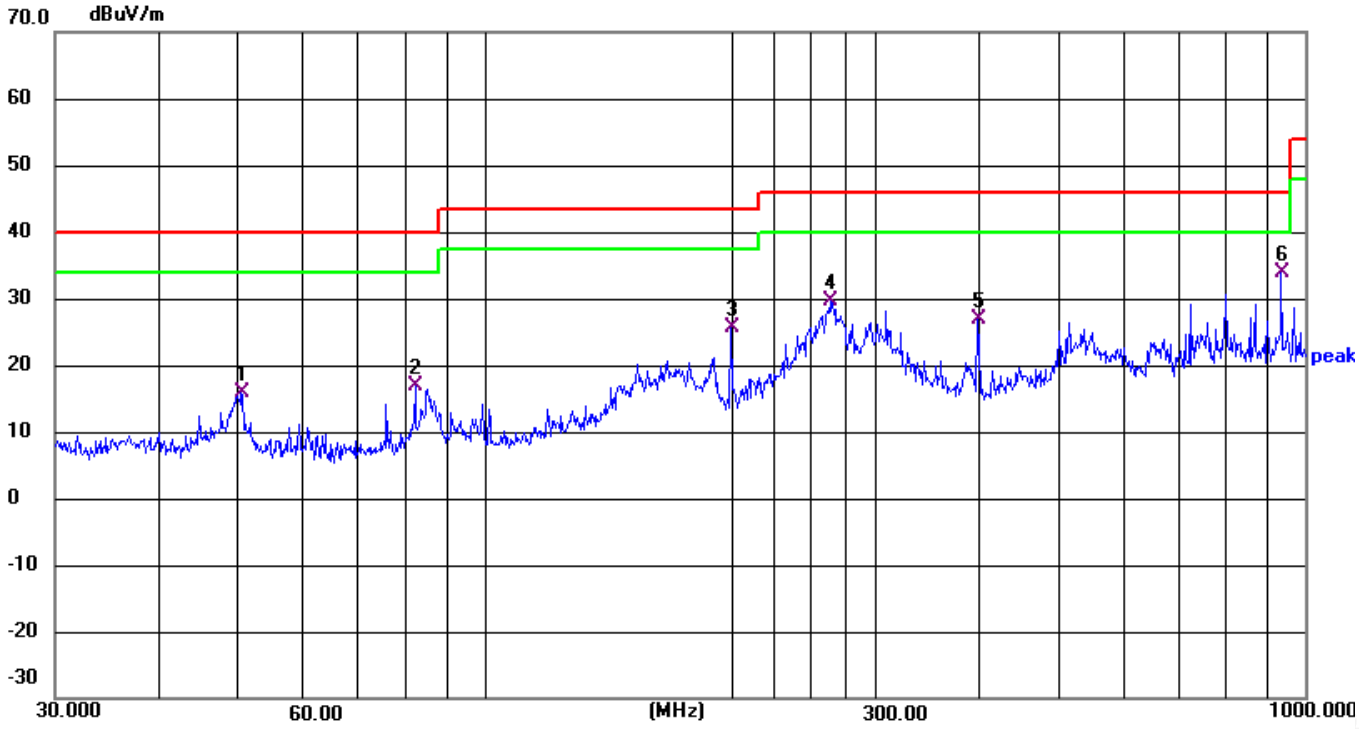
1). Pre-scan all modes and recorded the worst case results in this report (BLE Low Channel).

2). Emission level (dBuV/m) = 20 log Emission level (uV/m).

3). Level = Reading + Factor, Margin = Level–Limit, Factor = Antenna Factor + Cable Loss - Preamp Factor.

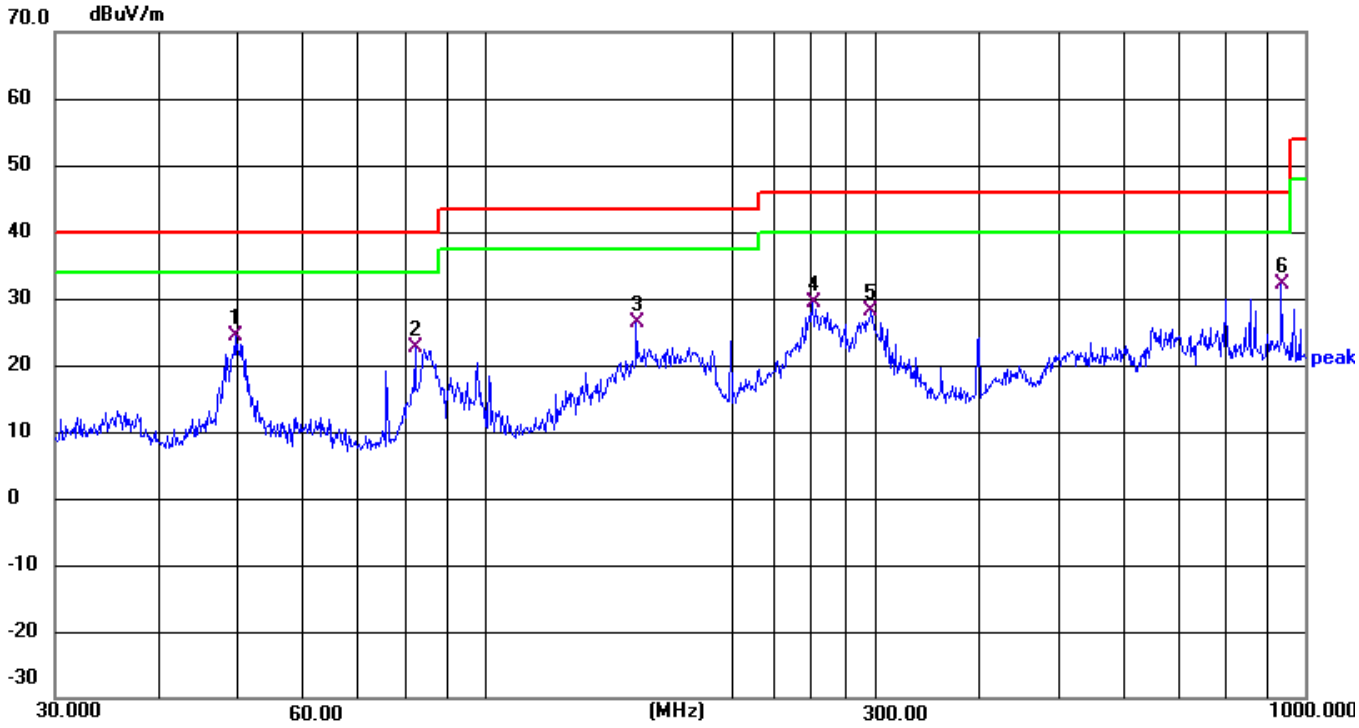
Below 1GHz

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	50.5860	32.94	-17.15	15.79	40.00	-24.21	QP
2	82.3588	36.58	-19.64	16.94	40.00	-23.06	QP
3	199.9856	43.03	-17.39	25.64	43.50	-17.86	QP
4	263.8190	45.13	-15.48	29.65	46.00	-16.35	QP
5	399.0302	41.41	-14.43	26.98	46.00	-19.02	QP
6	935.5463	41.85	-7.90	33.95	46.00	-12.05	QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	49.7068	41.33	-17.03	24.30	40.00	-15.70	QP
2	82.3588	42.25	-19.64	22.61	40.00	-17.39	QP
3	153.2004	46.15	-19.78	26.37	43.50	-17.13	QP
4	251.1804	44.97	-15.60	29.37	46.00	-16.63	QP
5	296.1836	43.73	-15.57	28.16	46.00	-17.84	QP
6	935.5463	40.08	-8.03	32.05	46.00	-13.95	QP

Note:

1). Pre-scan all modes and recorded the worst case results in this report (802.11g High Channel).

2). Emission level (dBuV/m) = 20 log Emission level (uV/m).

3). Level = Reading + Factor, Margin = Level–Limit, Factor = Antenna Factor + Cable Loss - Preamp Factor.

6.1.8. Results of Radiated Emissions (1 GHz~26 GHz)

BT

GFSK, Channel 0 / 2402 MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4804.00	54.64	33.06	35.04	3.94	56.60	74.00	-17.40	Peak	Horizontal
4804.00	40.97	33.06	35.04	3.94	42.93	54.00	-11.07	Average	Horizontal
4804.00	54.38	33.06	35.04	3.94	56.34	74.00	-17.66	Peak	Vertical
4804.00	39.43	33.06	35.04	3.94	41.39	54.00	-12.61	Average	Vertical

GFSK, Channel 39 / 2441 MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4882.00	50.53	33.16	35.15	3.96	52.50	74.00	-21.50	Peak	Horizontal
4882.00	38.19	33.16	35.15	3.96	40.16	54.00	-13.84	Average	Horizontal
4882.00	51.00	33.16	35.15	3.96	52.97	74.00	-21.03	Peak	Vertical
4882.00	36.46	33.16	35.15	3.96	38.43	54.00	-15.57	Average	Vertical

GFSK, Channel 78 / 2480 MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4960.00	51.41	33.26	35.14	3.98	53.51	74.00	-20.49	Peak	Horizontal
4960.00	40.48	33.26	35.14	3.98	42.58	54.00	-11.42	Average	Horizontal
4960.00	56.08	33.26	35.14	3.98	58.18	74.00	-15.82	Peak	Vertical
4960.00	43.37	33.26	35.14	3.98	45.47	54.00	-8.53	Average	Vertical

π/4-DQPSK, Channel 0 / 2402 MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4804.00	59.96	33.06	35.04	3.94	61.92	74.00	-12.08	Peak	Horizontal
4804.00	43.88	33.06	35.04	3.94	45.84	54.00	-8.16	Average	Horizontal
4804.00	51.37	33.06	35.04	3.94	53.33	74.00	-20.67	Peak	Vertical
4804.00	42.53	33.06	35.04	3.94	44.49	54.00	-9.51	Average	Vertical

π/4-DQPSK, Channel 39 / 2441 MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4882.00	53.96	33.16	35.15	3.96	55.93	74.00	-18.07	Peak	Horizontal
4882.00	39.06	33.16	35.15	3.96	41.03	54.00	-12.97	Average	Horizontal
4882.00	53.06	33.16	35.15	3.96	55.03	74.00	-18.97	Peak	Vertical
4882.00	37.74	33.16	35.15	3.96	39.71	54.00	-14.29	Average	Vertical

π/4-DQPSK, Channel 78 / 2480 MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4960.00	56.32	33.26	35.14	3.98	58.42	74.00	-15.58	Peak	Horizontal
4960.00	45.96	33.26	35.14	3.98	48.06	54.00	-5.94	Average	Horizontal
4960.00	51.34	33.26	35.14	3.98	53.44	74.00	-20.56	Peak	Vertical
4960.00	38.36	33.26	35.14	3.98	40.46	54.00	-13.54	Average	Vertical

8-DPSK, Channel 0 / 2402 MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4804.00	54.87	33.06	35.04	3.94	56.83	74.00	-17.17	Peak	Horizontal
4804.00	42.14	33.06	35.04	3.94	44.10	54.00	-9.90	Average	Horizontal
4804.00	54.58	33.06	35.04	3.94	56.54	74.00	-17.46	Peak	Vertical
4804.00	43.29	33.06	35.04	3.94	45.25	54.00	-8.75	Average	Vertical

8-DPSK, Channel 39 / 2441 MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4882.00	54.78	33.16	35.15	3.96	56.75	74.00	-17.25	Peak	Horizontal
4882.00	39.96	33.16	35.15	3.96	41.93	54.00	-12.07	Average	Horizontal
4882.00	54.66	33.16	35.15	3.96	56.63	74.00	-17.37	Peak	Vertical
4882.00	35.14	33.16	35.15	3.96	37.11	54.00	-16.89	Average	Vertical

8-DPSK, Channel 78 / 2480 MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4960.00	54.19	33.26	35.14	3.98	56.29	74.00	-17.71	Peak	Horizontal
4960.00	42.65	33.26	35.14	3.98	44.75	54.00	-9.25	Average	Horizontal
4960.00	52.16	33.26	35.14	3.98	54.26	74.00	-19.74	Peak	Vertical
4960.00	38.50	33.26	35.14	3.98	40.60	54.00	-13.40	Average	Vertical

BT LE

Channel 0 / 2402 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4804.00	54.94	33.06	35.04	3.94	56.90	74.00	-17.10	Peak	Horizontal
4804.00	41.96	33.06	35.04	3.94	43.92	54.00	-10.08	Average	Horizontal
4804.00	55.94	33.06	35.04	3.94	57.90	74.00	-16.10	Peak	Vertical
4804.00	41.30	33.06	35.04	3.94	43.26	54.00	-10.74	Average	Vertical

Channel 19 / 2440 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4880.00	50.93	33.16	35.15	3.96	52.90	74.00	-21.10	Peak	Horizontal
4880.00	39.48	33.16	35.15	3.96	41.45	54.00	-12.55	Average	Horizontal
4880.00	50.86	33.16	35.15	3.96	52.83	74.00	-21.17	Peak	Vertical
4880.00	35.68	33.16	35.15	3.96	37.65	54.00	-16.35	Average	Vertical

Channel 39 / 2480 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4960.00	52.83	33.26	35.14	3.98	54.93	74.00	-19.07	Peak	Horizontal
4960.00	39.59	33.26	35.14	3.98	41.69	54.00	-12.31	Average	Horizontal
4960.00	52.96	33.26	35.14	3.98	55.06	74.00	-18.94	Peak	Vertical
4960.00	36.98	33.26	35.14	3.98	39.08	54.00	-14.92	Average	Vertical

IEEE 802.11b

Channel 1 / 2412 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4824.00	54.12	33.06	35.04	3.94	56.08	74.00	-17.92	Peak	Horizontal
4824.00	40.30	33.06	35.04	3.94	42.26	54.00	-11.74	Average	Horizontal
4824.00	54.29	33.06	35.04	3.94	56.25	74.00	-17.75	Peak	Vertical
4824.00	40.14	33.06	35.04	3.94	42.10	54.00	-11.90	Average	Vertical

Channel 6 / 2437 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4874.00	58.15	33.16	35.15	3.96	60.12	74.00	-13.88	Peak	Horizontal
4874.00	43.55	33.16	35.15	3.96	45.52	54.00	-8.48	Average	Horizontal
4874.00	55.35	33.16	35.15	3.96	57.32	74.00	-16.68	Peak	Vertical
4874.00	38.87	33.16	35.15	3.96	40.84	54.00	-13.16	Average	Vertical

Channel 11 / 2462 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4924.00	56.61	33.26	35.14	3.98	58.71	74.00	-15.29	Peak	Horizontal
4924.00	42.45	33.26	35.14	3.98	44.55	54.00	-9.45	Average	Horizontal
4924.00	53.69	33.26	35.14	3.98	55.79	74.00	-18.21	Peak	Vertical
4924.00	40.81	33.26	35.14	3.98	42.91	54.00	-11.09	Average	Vertical

IEEE 802.11g

Channel 1 / 2412 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4824.00	55.25	33.06	35.04	3.94	57.21	74.00	-16.79	Peak	Horizontal
4824.00	40.92	33.06	35.04	3.94	42.88	54.00	-11.12	Average	Horizontal
4824.00	54.15	33.06	35.04	3.94	56.11	74.00	-17.89	Peak	Vertical
4824.00	38.92	33.06	35.04	3.94	40.88	54.00	-13.12	Average	Vertical

Channel 6 / 2437 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4874.00	58.44	33.16	35.15	3.96	60.41	74.00	-13.59	Peak	Horizontal
4874.00	41.31	33.16	35.15	3.96	43.28	54.00	-10.72	Average	Horizontal
4874.00	53.71	33.16	35.15	3.96	55.68	74.00	-18.32	Peak	Vertical
4874.00	40.23	33.16	35.15	3.96	42.20	54.00	-11.80	Average	Vertical

Channel 11 / 2462 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4924.00	58.98	33.26	35.14	3.98	61.08	74.00	-12.92	Peak	Horizontal
4924.00	43.02	33.26	35.14	3.98	45.12	54.00	-8.88	Average	Horizontal
4924.00	54.38	33.26	35.14	3.98	56.48	74.00	-17.52	Peak	Vertical
4924.00	38.98	33.26	35.14	3.98	41.08	54.00	-12.92	Average	Vertical

IEEE802.11 n HT20(Worst Case:Ant0 +Ant1)

Channel 1 / 2412 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4824.00	56.99	33.06	35.04	3.94	58.95	74.00	-15.05	Peak	Horizontal
4824.00	40.18	33.06	35.04	3.94	42.14	54.00	-11.86	Average	Horizontal
4824.00	54.79	33.06	35.04	3.94	56.75	74.00	-17.25	Peak	Vertical
4824.00	40.91	33.06	35.04	3.94	42.87	54.00	-11.13	Average	Vertical

Channel 6 / 2437 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4874.00	59.49	33.16	35.15	3.96	61.46	74.00	-12.54	Peak	Horizontal
4874.00	40.72	33.16	35.15	3.96	42.69	54.00	-11.31	Average	Horizontal
4874.00	55.20	33.16	35.15	3.96	57.17	74.00	-16.83	Peak	Vertical
4874.00	39.95	33.16	35.15	3.96	41.92	54.00	-12.08	Average	Vertical

Channel 11 / 2462 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4924.00	56.47	33.26	35.14	3.98	58.57	74.00	-15.43	Peak	Horizontal
4924.00	41.21	33.26	35.14	3.98	43.31	54.00	-10.69	Average	Horizontal
4924.00	55.51	33.26	35.14	3.98	57.61	74.00	-16.39	Peak	Vertical
4924.00	40.81	33.26	35.14	3.98	42.91	54.00	-11.09	Average	Vertical

IEEE802.11 n HT40(Worst Case:Ant0 +Ant1)

Channel 3/ 2422 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4844.00	55.29	33.06	35.04	3.94	57.25	74.00	-16.75	Peak	Horizontal
4844.00	42.29	33.06	35.04	3.94	44.25	54.00	-9.75	Average	Horizontal
4844.00	55.14	33.06	35.04	3.94	57.10	74.00	-16.90	Peak	Vertical
4844.00	39.94	33.06	35.04	3.94	41.90	54.00	-12.10	Average	Vertical

Channel 6 / 2437 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4874.00	59.44	33.16	35.15	3.96	61.41	74.00	-12.59	Peak	Horizontal
4874.00	42.83	33.16	35.15	3.96	44.80	54.00	-9.20	Average	Horizontal
4874.00	54.96	33.16	35.15	3.96	56.93	74.00	-17.07	Peak	Vertical
4874.00	39.24	33.16	35.15	3.96	41.21	54.00	-12.79	Average	Vertical

Channel 9 / 2452 MHz

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4904.00	56.62	33.26	35.14	3.98	58.72	74.00	-15.28	Peak	Horizontal
4904.00	42.88	33.26	35.14	3.98	44.98	54.00	-9.02	Average	Horizontal
4904.00	52.95	33.26	35.14	3.98	55.05	74.00	-18.95	Peak	Vertical
4904.00	39.29	33.26	35.14	3.98	41.39	54.00	-12.61	Average	Vertical

Notes:

1). Measuring frequencies from 9 KHz~10th harmonic (ex. 26GHz), at least have 20dB margin found between lowest internal used/generated frequency to 30 MHz.

2). Radiated emissions measured in frequency range from 9 KHz~10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.

3). 18~25GHz at least have 20dB margin. No recording in the test report.

4). Measured Level = Reading Level + Factor, Margin = Measured Level – Limit, Factor = Antenna Factor + Cable Loss - Preamp Factor

6.2. Antenna Requirement

6.2.1 Standard Applicable

According to antenna requirement of §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 shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

According to RSS-Gen§6.8:

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.9 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device’s antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

6.2.2 Antenna Connected Construction

6.2.2.1. Standard Applicable

According to § 15.203 & RSS-Gen, 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.

6.2.2.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 3.4dBi(Max), and the antenna is an Ceramic Antenna0 and Ceramic Antenna1 connect to PCB board and no consideration of replacement. Please see EUT photo for details.

6.2.2.3. Results: Compliance.

6.3. RF Exposure

6.3.1 Evaluation Method

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modelled or measured field strengths or power density, is ≤ 1.0. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

RSS-102 Section 2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation
RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:
• below 20 MHz6 and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
• at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 4.49/f0.5 W (adjusted for tune-up tolerance), where f is in MHz;
• at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
• at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10-2 f0.6834 W (adjusted for tune-up tolerance), where f is in MHz;
• at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).
In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

6.3.2 Limit

6.3.2.1 Refer Evaluation Method

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

FCC KDB publication 447498 D01 General 1 RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radiofrequency radiation exposure evaluation: mobile devices

RSS-102 Issue 5 March 2015: Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

6.3.2.2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	6
3.0 – 30	1842/f	4.89/f	(900/f2)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 30	824/f	2.19/f	(180/f2)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	/	/	f/1500	30
1500 – 100,000	/	/	1.0	30

F=frequency in MHz

*=Plane-wave equivalent power density

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	0.73/ ƒ	-	6**
1.1-10	87/ $ƒ^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ $ƒ^{0.25}$	0.1540/ $ƒ^{0.25}$	8.944/ $ƒ^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $ƒ^{0.3417}$	0.008335 $ƒ^{0.3417}$	0.02619 $ƒ^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $ƒ^{1.2}$
150000-300000	0.158 $ƒ^{0.5}$	4.21 x 10^{-4} $ƒ^{0.5}$	6.67 x 10^{-5} ƒ	616000/$ƒ^{1.2}$

Note: ƒ is frequency in MHz.
* Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

6.3.3. MPE Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S=PG/4\pi R^2$

Where: S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

6.3.4. Antenna Information

Antenna can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
Antenna 0	Ceramic Antenna	2400 MHz – 2500 MHz 5000 MHz -6000 MHz	3.4 dBi(max.) For2400 MHz – 2500 MHz 6.7dBi(max.) For 5000 MHz – 6000 MHz	WLAN Antenna
Antenna 1	Ceramic Antenna	2400 MHz – 2500 MHz 5000 MHz -6000 MHz	3.4 dBi(max.) For2400 MHz – 2500 MHz 6.7dBi(max.) For 5000 MHz – 6000 MHz	BT/WLAN Antenna

6.3.5. Measurement Results

6.3.5.1. Standalone MPE Evaluation

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 50 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, r =20cm, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

[Antenna 0]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
2.4GWIFI (IEEE 802.11b)	19.00	79.4328	3.4	2.1878	0.0346	1.0000

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Power Density (W/m^2)	MPE Exclusion Limits (W/m^2)	MPE $_{Ratio}$
	dBm	W					
2.4GWIFI (IEEE 802.11b)	19.00	0.0794	3.4	2.1878	0.3457	5.35	0.065

[Antenna1]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
BT	11.00	12.5893	3.4	2.1878	0.0055	1.0000
BLE	11.00	12.5893	3.4	2.1878	0.0055	1.0000
2.4GWIFI (IEEE 802.11b)	19.00	79.4328	3.4	2.1878	0.0346	1.0000

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Power Density (W/m^2)	MPE Exclusion Limits (W/m^2)	MPE $_{Ratio}$
	dBm	W					
BT	11.00	0.0126	3.4	2.1878	0.1171	5.35	0.022
BLE	11.00	0.0126	3.4	2.1878	0.1171	5.35	0.022
2.4GWIFI (IEEE 802.11b)	19.00	0.0794	3.4	2.1878	0.7391	5.35	0.138

Remark:

1. Output power including turn-up tolerance;
2. Output power is burst average power;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer;
4. MPE values = $PG/4\pi R^2$
5. recorded the worst case results in this antennas

6.3.5.2 Simultaneous Transmission MPE

The sample support one BT&BLE&2.4GWLAN&5GWIFI and another one 2.4GWLAN&5GWIFI transmit antenna, so need consider simultaneous transmission;

Simultaneous transmission MPE

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

∑∑of MPE ratios ≤ 1.0

Mode	MPE1 Max.	MPE2 Max.	∑ MPE ratios	Limit	Results
2.4GWIFI(Ant0)+BT(Ant1)	0.0346	0.0055	0.0401	1.000	Pass
2.4GWIFI(Ant0)+2.4GWIFI(Ant1)	0.0346	0.0346	0.0692	1.000	Pass
2.4GWIFI(Ant0)+5.2GWIFI(Ant1)	0.0346	0.0739	0.1085	1.000	Pass

Note: recorded the worst case results in this antennas simultaneous transmission MPE.

Mode	MPE1 Max.	MPE2 Max.	∑ MPE ratios	Limit	Results
2.4GWIFI(Ant0)+BT(Ant1)	0.065	0.022	0.087	1.000	Pass
2.4GWIFI(Ant0)+2.4GWIFI(Ant1)	0.065	0.138	0.203	1.000	Pass
2.4GWIFI(Ant0)+5.2GWIFI(Ant1)	0.065	0.082	0.147	1.000	Pass
2.4GWIFI(Ant0)+5.8GWIFI(Ant1)	0.065	0.076	0.141	1.000	Pass

Note: recorded the worst case results in this antennas simultaneous transmission MPE.

7. TEST SETUP PHOTOGRAPHS OF EUT

Please refer to separated files for Test Setup Photos of the EUT.

8. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

9. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

----------THE END OF TEST REPORT----------