FCC Test Report (BT-LE)

Report No.:	RFBDKG-WTW-P21050968-1
FCC ID:	JNZB00040
Test Model:	B00040
Received Date:	May 28, 2021
Test Date:	June 23, 2021
Issued Date:	July 09, 2021
Applicant:	LOGITECH FAR EAST LTD.
Address:	7700 Gateway Boulevard Newark California United States
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
FCC Registration / Designation Number:	723255 / TW2022

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Release Control Record

Issue No.	Description	Date Issued
RFBDKG-WTW-P21050968-1	Original release.	July 09, 2021

1 Certificate of Conformity

Product:	Wireless Earphones
Brand:	ULTIMATE EARS
Test Model:	B00040
Sample Status:	ENGINEERING SAMPLE
Applicant:	LOGITECH FAR EAST LTD.
Test Date:	June 23, 2021
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Vivian Huang , **Date:** July 09, 2021

Vivian Huang / Specialist

Approved by : , **Date:** July 09, 2021

Clark Lin / Technical Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -25.18 dB at 4.56359 MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -5.1 dB at 4960.00 MHz.
15.247(d)	Antenna Port Emission	NA	Refer to Note 1 below
15.247(a)(2)	6dB bandwidth	NA	Refer to Note 1 below
15.247(b)	Conducted power	NA	Refer to Note 1 below
15.247(e)	Power Spectral Density	NA	Refer to Note 1 below
15.203	Antenna Requirement	PASS	No antenna connector is used.

Note:
1. AC Power Conducted Emission & Radiated Emissions & Band Edge Measurement were performed for this addendum. The others testing data refer to original test report.
2. For 2.4 GHz band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A.
3. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
4. This report is prepared for supplementary report.

2.1 Measurement Uncertainty

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	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.9 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.1 dB
	30MHz ~ 1GHz	5.4 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.0 dB
	18GHz ~ 40GHz	5.3 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (BT-LE)

Product	Wireless Earphones
Brand	ULTIMATE EARS
Test Model	B00040
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	Wireless earphone battery output is 3.7 Vdc, Wireless earphone inputs are (5Vdc/10mA to 5Vdc/60mA) each. Charging case output is 5Vdc, 60mA for each wireless earphone (5Vdc/120mA total).
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	**BT-LE:** Up to 2 Mbps (*Note 3)
Operating Frequency	**BT-LE:** 2.402 ~ 2.480 GHz (*Note 3)
Number of Channel	**BT-LE:** 40 (*Note 3)
Output Power	8.453 mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Charging case x 1
Data Cable Supplied	USB to type C cable x 1 (Unshielded, 0.6 m)

Note:

1. This is a supplementary report of Report No.: RF200611E06-1. The differences between them are as below information:
   - ◆ Updated Grantee's company address.
   - ◆ Added 2nd source of Flash.
   - ◆ Added 2nd source antenna.

Origianl				
Earphone	Antenna Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connector Type
Left	-1.02	2.4~2.4835	Chip	None
Right	-1.02	2.4~2.4835	Chip	None
Newly				
Earphone	Antenna Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connector Type
Left	-1.97	2.4~2.4835	Chip	None
Right	-1.97	2.4~2.4835	Chip	None

2. According to the applicant's requirements, only Conducted Emission, Radiated Emissions & Band Edge test items need to be performed. All data for meeting the requirement is verified.
3. BT-LE technique supports 1Mbps and 2Mbps data rates, both have been evaluated in this test report. Refer to "**section 3.2 Description of Test Modes**" for more detail specification.

4. The EUT (Wireless Earphones, Charging Case) power needs to be supplied from a battery, the information is as below table:

Wireless earphones battery		
Brand Name	Model No.	Spec.
VARTA or Logitech	CP1254 A3 or 533-000186	3.7Vdc, 60 mAh
Charging case		
Brand Name	Model No.	Spec.
ULTIMATE EARS	B00041	Input: 5 Vdc, 350 mA Output: 5 Vdc, 250 mA
Battery (For charging case used)		
Brand Name	Model No.	Spec.
Springpower Technology (Shenzhen) Co., Ltd. or Logitech	491032 or 533-000182 or 533-000193	3.8 Vdc, 135 mAh, 0.513 Wh

5. When charge case is open, wireless function will be operated, when charge case is close, wireless function will be not operated.
6. The EUT was pre-tested under the following modes:

AC Power Conducted Emission test	
Test Mode	Description
Mode A	**EUT powered by Charge case (use USB adapter)** (for new antenna)
Mode B	EUT powered by Charge case (use Laptop) (for new antenna)
Note: From the above modes, the worst case was found in **Mode A**. Therefore only the test data of the mode was recorded in this report.	

7. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.
8. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.2 Description of Test Modes

BT-LE channels:

RF Channel	RF Center Frequency	Channel Index	Channels Type for BT 5.x		Channels Type for BT 4.x
			Maximum Data Rate 2Mbps	Maximum Data Rate 1Mbps	Maximum Data Rate 1Mbps
0	2402 MHz	37		●	●
1	2404 MHz	0	●		●
2	2406 MHz	1	●		●
3	2408 MHz	2	●		●
4	2410 MHz	3	●		●
5	2412 MHz	4	●		●
6	2414 MHz	5	●		●
7	2416 MHz	6	●		●
8	2418 MHz	7	●		●
9	2420 MHz	8	●		●
10	2422 MHz	9	●		●
11	2424 MHz	10	●		●
12	2426 MHz	38		●	●
13	2428 MHz	11	●		●
14	2430 MHz	12	●		●
15	2432 MHz	13	●		●
16	2434 MHz	14	●		●
17	2436 MHz	15	●		●
18	2438 MHz	16	●		●
19	2440 MHz	17	●		●
20	2442 MHz	18	●		●
21	2444 MHz	19	●		●
22	2446 MHz	20	●		●
23	2448 MHz	21	●		●
24	2450 MHz	22	●		●
25	2452 MHz	23	●		●
26	2454 MHz	24	●		●
27	2456 MHz	25	●		●
28	2458 MHz	26	●		●
29	2460 MHz	27	●		●
30	2462 MHz	28	●		●
31	2464 MHz	29	●		●
32	2466 MHz	30	●		●
33	2468 MHz	31	●		●
34	2470 MHz	32	●		●
35	2472 MHz	33	●		●
36	2474 MHz	34	●		●
37	2476 MHz	35	●		●
38	2478 MHz	36	●		●
39	2480 MHz	39		●	●

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO			DESCRIPTION
	RE≥1G	RE<1G	PLC	
-	√	√	√	-

Where **RE≥1G:** Radiated Emission above 1GHz & Bandedge Measurement **RE<1G:** Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on X-plane (Below 1GHz) & Z-plane (Above 1GHz).

Radiated Emission Test (Above 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 19, 39	GFSK	1
1 to 38	1, 19, 38	GFSK	2

Radiated Emission Test (Below 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
1 to 38	19	GFSK	2

Power Line Conducted Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
1 to 38	19	GFSK	2

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25deg. C, 66%RH	120Vac, 60Hz (System)	Tom Yang
RE<1G	25deg. C, 66%RH	120Vac, 60Hz (System)	Tom Yang
PLC	25deg. C, 66%RH	120Vac, 60Hz (System)	Tom Yang

3.3 Description of Support Units

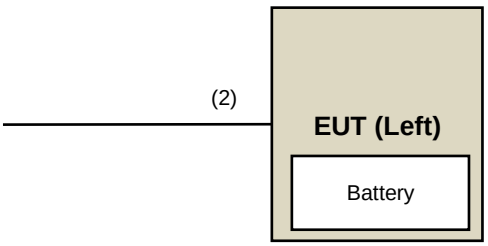
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	USB Adapter	ASUS	EXA1205UA	NA	NA	Provided by Lab

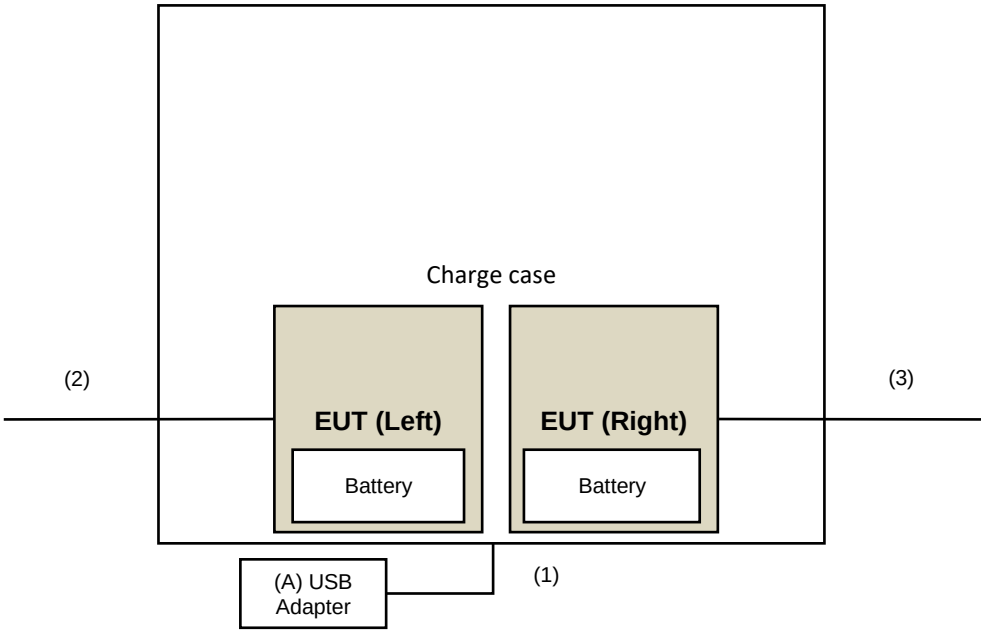
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB to type C Cable	1	0.6	No	0	Supplied by client
2.	Console Cable	1	0.03	No	0	Supplied by client (For RF Setup)
3.	Console Cable	1	0.03	No	0	Supplied by client (For RF Setup)

3.3.1 Configuration of System under Test

For Radiated Emisson test:



For AC Power Conducted Emission test



3.4 General Description of Applied Standards and References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

Test Standard:

FCC Part 15, Subpart C (15.247)

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

References Test Guidance:

KDB 558074 D01 15.247 Meas Guidance v05r02

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

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

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test Instruments

For Radiated Emission test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 06, 2020	July 05, 2021
Pre-Amplifier EMCI	EMC001340	980142	May 24, 2021	May 23, 2022
Loop Antenna Electro-Metrics	EM-6879	264	Mar. 05, 2021	Mar. 04, 2022
RF Cable	5D-FB	LOOPCAB-001	Jan. 07, 2021	Jan. 06, 2022
RF Cable	5D-FB	LOOPCAB-002	Jan. 07, 2021	Jan. 06, 2022
Pre-Amplifier Mini-Circuits	ZFL-1000VH2	QA0838008	Oct. 20, 2020	Oct. 19, 2021
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Nov. 05, 2020	Nov. 04, 2021
RF Cable	8D	966-3-1	Mar. 16, 2021	Mar. 15, 2022
RF Cable	8D	966-3-2	Mar. 16, 2021	Mar. 15, 2022
RF Cable	8D	966-3-3	Mar. 16, 2021	Mar. 15, 2022
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 24, 2020	Sep. 23, 2021
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Nov. 22, 2020	Nov. 21, 2021
Pre-Amplifier EMCI	EMC12630SE	980384	Jan. 11, 2021	Jan. 10, 2022
RF Cable	EMC104-SM-SM-1500	180504	Apr. 26, 2021	Apr. 25, 2022
RF Cable	EMC104-SM-SM-2000	180601	June 08, 2021	June 07, 2022
RF Cable	EMC104-SM-SM-6000	210201	May 13, 2021	May 12, 2022
Spectrum Analyzer Keysight	N9030A	MY54490679	July 13, 2020	July 12, 2021
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 11, 2021	Jan. 10, 2022
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 22, 2020	Nov. 21, 2021
RF Cable	EMC102-KM-KM-1200	160924	Jan. 11, 2021	Jan. 10, 2022
RF Cable	EMC-KM-KM-4000	200214	Mar. 10, 2021	Mar. 09, 2022
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 3.
3. Tested Date: June 23, 2021

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

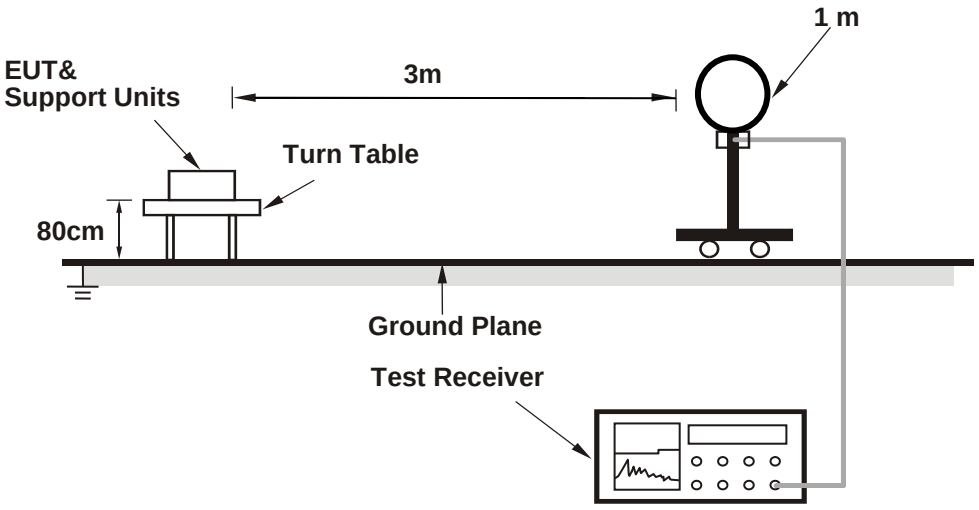
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

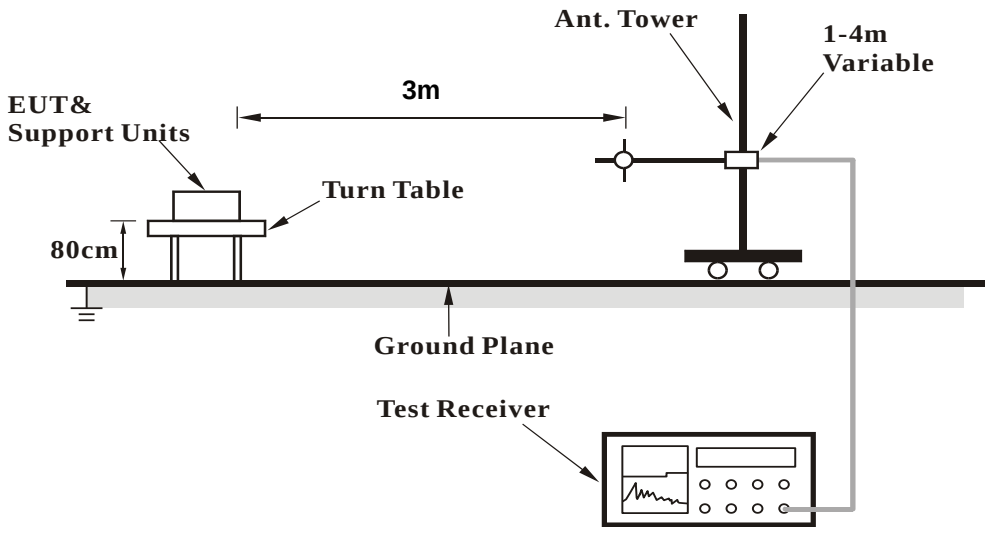
No deviation.

4.1.5 Test Setup

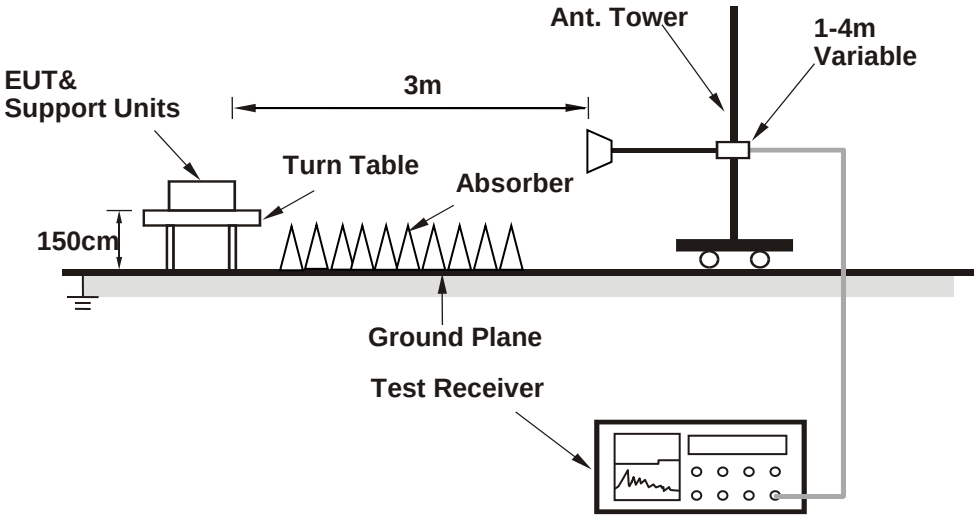
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.

b. Controlling software (BlueTest3_3_2_2_144) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data:

RF Mode	TX BT_LE-1M	Channel	CH 0：2402 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2375.60	56.3 PK	74.0	-17.7	2.91 H	320	57.5	-1.2
2	2375.60	44.0 AV	54.0	-10.0	2.91 H	320	45.2	-1.2
3	*2402.00	95.9 PK			2.91 H	320	97.1	-1.2
4	*2402.00	94.9 AV			2.91 H	320	96.1	-1.2
5	4804.00	54.9 PK	74.0	-19.1	1.03 H	100	51.1	3.8
6	4804.00	47.9 AV	54.0	-6.1	1.03 H	100	44.1	3.8
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2375.25	56.3 PK	74.0	-17.7	1.16 V	222	57.5	-1.2
2	2375.25	44.0 AV	54.0	-10.0	1.16 V	222	45.2	-1.2
3	*2402.00	93.0 PK			1.16 V	222	94.2	-1.2
4	*2402.00	91.9 AV			1.16 V	222	93.1	-1.2
5	4804.00	51.0 PK	74.0	-23.0	1.05 V	278	47.2	3.8
6	4804.00	45.3 AV	54.0	-8.7	1.05 V	278	41.5	3.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX BT_LE-1M	Channel	CH 19：2440 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2440.00	97.2 PK			1.08 H	111	98.4	-1.2
2	*2440.00	95.6 AV			1.08 H	111	96.8	-1.2
3	4880.00	54.6 PK	74.0	-19.4	1.05 H	92	50.8	3.8
4	4880.00	48.3 AV	54.0	-5.7	1.05 H	92	44.5	3.8
5	7320.00	53.4 PK	74.0	-20.6	1.06 H	156	43.7	9.7
6	7320.00	43.2 AV	54.0	-10.8	1.06 H	156	33.5	9.7
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2440.00	93.4 PK			1.21 V	230	94.6	-1.2
2	*2440.00	92.2 AV			1.21 V	230	93.4	-1.2
3	4880.00	50.9 PK	74.0	-23.1	1.11 V	262	47.1	3.8
4	4880.00	45.1 AV	54.0	-8.9	1.11 V	262	41.3	3.8
5	7320.00	48.2 PK	74.0	-25.8	1.31 V	291	38.5	9.7
6	7320.00	37.0 AV	54.0	-17.0	1.31 V	291	27.3	9.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX BT_LE-1M	Channel	CH 39：2480 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	98.2 PK			1.08 H	104	99.4	-1.2
2	*2480.00	96.5 AV			1.08 H	104	97.7	-1.2
3	2484.50	55.4 PK	74.0	-18.6	1.08 H	104	56.6	-1.2
4	2484.50	43.7 AV	54.0	-10.3	1.08 H	104	44.9	-1.2
5	4960.00	54.2 PK	74.0	-19.8	1.03 H	79	50.2	4.0
6	**4960.00**	**48.9 AV**	**54.0**	**-5.1**	**1.03 H**	**79**	**44.9**	**4.0**
7	7440.00	52.9 PK	74.0	-21.1	1.05 H	156	43.2	9.7
8	7440.00	43.0 AV	54.0	-11.0	1.05 H	156	33.3	9.7
Antenna Polarity & Test Distance : Vertical at 3 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	*2480.00	93.9 PK			1.56 V	230	95.1	-1.2
2	*2480.00	92.9 AV			1.56 V	230	94.1	-1.2
3	2486.30	55.7 PK	74.0	-18.3	1.56 V	230	56.9	-1.2
4	2486.30	43.7 AV	54.0	-10.3	1.56 V	230	44.9	-1.2
5	4960.00	50.8 PK	74.0	-23.2	1.10 V	262	46.8	4.0
6	4960.00	45.0 AV	54.0	-9.0	1.10 V	262	41.0	4.0
7	7440.00	48.2 PK	74.0	-25.8	1.33 V	303	38.5	9.7
8	7440.00	37.0 AV	54.0	-17.0	1.33 V	303	27.3	9.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX BT_LE-2M	Channel	CH 1：2404 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2319.40	56.4 PK	74.0	-17.6	3.03 H	318	57.5	-1.1
2	2319.40	44.1 AV	54.0	-9.9	3.03 H	318	45.2	-1.1
3	*2404.00	95.7 PK			3.03 H	318	96.9	-1.2
4	*2404.00	92.1 AV			3.03 H	318	93.3	-1.2
5	4808.00	53.3 PK	74.0	-20.7	1.08 H	86	49.5	3.8
6	4808.00	45.6 AV	54.0	-8.4	1.08 H	86	41.8	3.8
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2386.50	56.7 PK	74.0	-17.3	1.19 V	223	57.9	-1.2
2	2386.50	44.0 AV	54.0	-10.0	1.19 V	223	45.2	-1.2
3	*2404.00	94.0 PK			1.19 V	223	95.2	-1.2
4	*2404.00	90.3 AV			1.19 V	223	91.5	-1.2
5	4808.00	49.6 PK	74.0	-24.4	1.16 V	257	45.8	3.8
6	4808.00	42.0 AV	54.0	-12.0	1.16 V	257	38.2	3.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX BT_LE-2M	Channel	CH 19：2440 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2440.00	97.1 PK			2.97 H	311	98.3	-1.2
2	*2440.00	93.7 AV			2.97 H	311	94.9	-1.2
3	4880.00	53.7 PK	74.0	-20.3	1.14 H	73	49.9	3.8
4	4880.00	46.0 AV	54.0	-8.0	1.14 H	73	42.2	3.8
5	7320.00	49.7 PK	74.0	-24.3	1.03 H	181	40.0	9.7
6	7320.00	39.6 AV	54.0	-14.4	1.03 H	181	29.9	9.7
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2440.00	94.5 PK			1.49 V	224	95.7	-1.2
2	*2440.00	90.5 AV			1.49 V	224	91.7	-1.2
3	4880.00	49.7 PK	74.0	-24.3	1.11 V	267	45.9	3.8
4	4880.00	42.2 AV	54.0	-11.8	1.11 V	267	38.4	3.8
5	7320.00	48.2 PK	74.0	-25.8	1.31 V	293	38.5	9.7
6	7320.00	36.9 AV	54.0	-17.1	1.31 V	293	27.2	9.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX BT_LE-2M	Channel	CH 38：2478 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2478.00	97.7 PK			1.07 H	103	98.9	-1.2
2	*2478.00	94.3 AV			1.07 H	103	95.5	-1.2
3	2494.00	56.0 PK	74.0	-18.0	1.07 H	103	57.2	-1.2
4	2494.00	43.5 AV	54.0	-10.5	1.07 H	103	44.7	-1.2
5	4956.00	53.4 PK	74.0	-20.6	1.08 H	81	49.4	4.0
6	4956.00	45.6 AV	54.0	-8.4	1.08 H	81	41.6	4.0
7	7434.00	50.1 PK	74.0	-23.9	1.01 H	166	40.4	9.7
8	7434.00	39.8 AV	54.0	-14.2	1.01 H	166	30.1	9.7
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2478.00	94.5 PK			1.48 V	230	95.7	-1.2
2	*2478.00	91.0 AV			1.48 V	230	92.2	-1.2
3	2488.30	55.6 PK	74.0	-18.4	1.48 V	230	56.8	-1.2
4	2488.30	43.7 AV	54.0	-10.3	1.48 V	230	44.9	-1.2
5	4956.00	49.7 PK	74.0	-24.3	1.12 V	270	45.7	4.0
6	4956.00	42.2 AV	54.0	-11.8	1.12 V	270	38.2	4.0
7	7434.00	48.0 PK	74.0	-26.0	1.33 V	305	38.3	9.7
8	7434.00	36.6 AV	54.0	-17.4	1.33 V	305	26.9	9.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

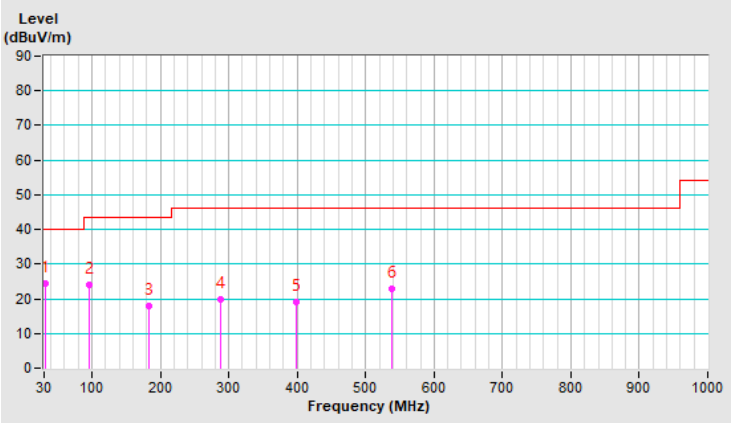
Below 1GHz Data:

RF Mode	TX BT_LE-2M	Channel	CH 19：2440 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	32.29	24.4 QP	40.0	-15.6	1.50 H	300	33.7	-9.3
2	96.33	24.1 QP	43.5	-19.4	2.00 H	156	37.1	-13.0
3	183.45	17.9 QP	43.5	-25.6	1.50 H	339	27.4	-9.5
4	288.54	19.8 QP	46.0	-26.2	1.00 H	176	26.8	-7.0
5	397.67	18.9 QP	46.0	-27.1	3.00 H	176	22.7	-3.8
6	538.04	22.7 QP	46.0	-23.3	1.00 H	359	23.1	-0.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

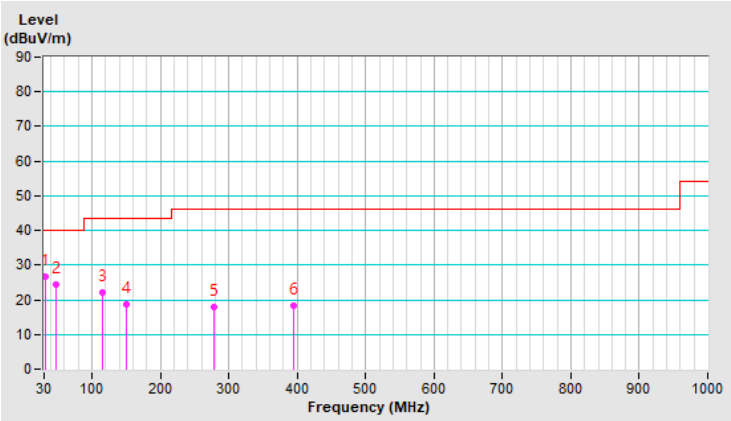


RF Mode	TX BT_LE-2M	Channel	CH 19：2440 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	31.87	26.8 QP	40.0	-13.2	1.50 V	300	36.1	-9.3
2	47.20	24.4 QP	40.0	-15.6	1.00 V	200	32.6	-8.2
3	114.39	22.0 QP	43.5	-21.5	1.00 V	150	32.3	-10.3
4	149.70	18.8 QP	43.5	-24.7	1.50 V	300	26.4	-7.6
5	278.46	18.0 QP	46.0	-28.0	1.50 V	300	25.4	-7.4
6	394.33	18.4 QP	46.0	-27.6	1.00 V	300	22.4	-4.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1.The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Oct. 20, 2020	Oct. 19, 2021
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 27, 2020	Oct. 26, 2021
Line-Impedance Stabilization Network (for Peripheral) R&S	ESH3-Z5	835239/001	Mar. 26, 2021	Mar. 25, 2022
50 ohms Terminator	50	3	Oct. 26, 2020	Oct. 25, 2021
RF Cable	5D-FB	COCCAB-001	Sep. 26, 2020	Sep. 25, 2021
Fixed attenuator EMCI	STI02-2200-10	005	Aug. 29, 2020	Aug. 28, 2021
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conduction 1.
3 Tested Date: June 23, 2021

4.2.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

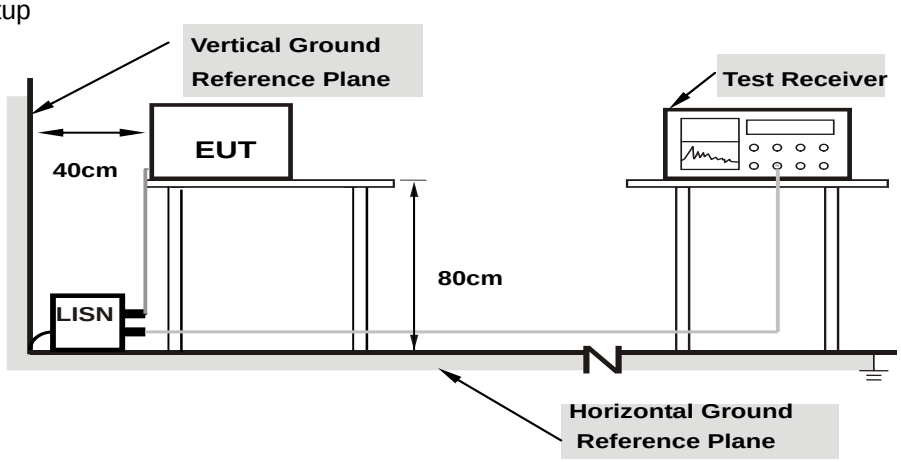
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

Same as 4.1.6.

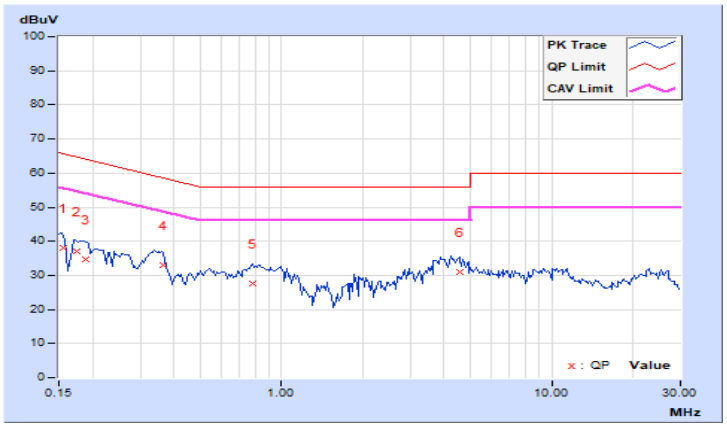
4.2.7 Test Results

RF Mode	TX BT_LE-2M	Channel	CH 19：2440 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15541	9.97	28.03	11.26	38.00	21.23	65.71	55.71	-27.71	-34.48
2	0.17562	9.99	27.15	14.33	37.14	24.32	64.69	54.69	-27.55	-30.37
3	0.18954	9.99	24.68	7.86	34.67	17.85	64.06	54.06	-29.39	-36.21
4	0.36708	10.03	22.82	10.43	32.85	20.46	58.57	48.57	-25.72	-28.11
5	0.78691	10.06	17.62	3.43	27.68	13.49	56.00	46.00	-28.32	-32.51
6	**4.56359**	**10.30**	**20.52**	**5.40**	**30.82**	**15.70**	**56.00**	**46.00**	**-25.18**	**-30.30**

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

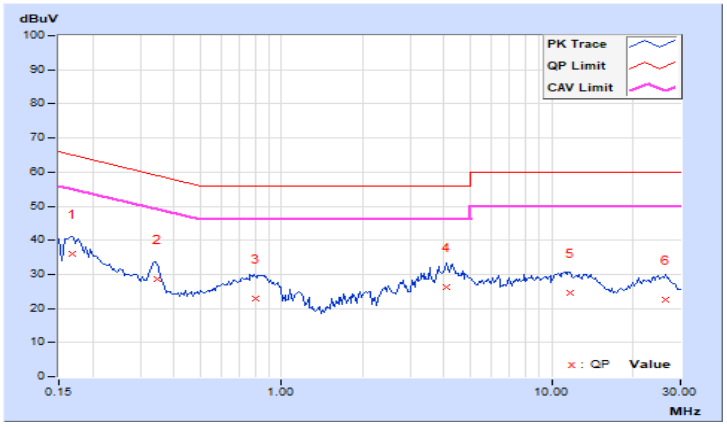


RF Mode	TX BT_LE-2M	Channel	CH 19：2440 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16754	9.97	26.06	8.71	36.03	18.68	65.08	55.08	-29.05	-36.40
2	0.34797	10.01	18.62	11.35	28.63	21.36	59.01	49.01	-30.38	-27.65
3	0.79766	10.05	12.69	-3.71	22.74	6.34	56.00	46.00	-33.26	-39.66
4	4.09549	10.25	16.17	-0.30	26.42	9.95	56.00	46.00	-29.58	-36.05
5	11.69971	10.70	13.75	2.76	24.45	13.46	60.00	50.00	-35.55	-36.54
6	26.31154	11.28	11.21	-1.16	22.49	10.12	60.00	50.00	-37.51	-39.88

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



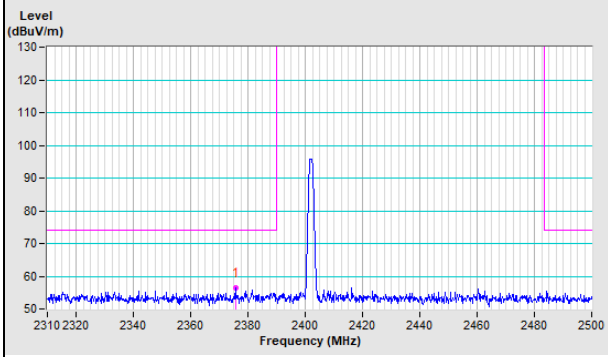
5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

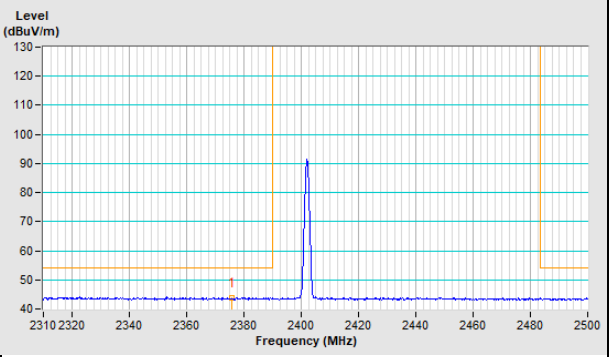
Annex A - Band-Edge Measurement

BT_LE-1M Channel 0

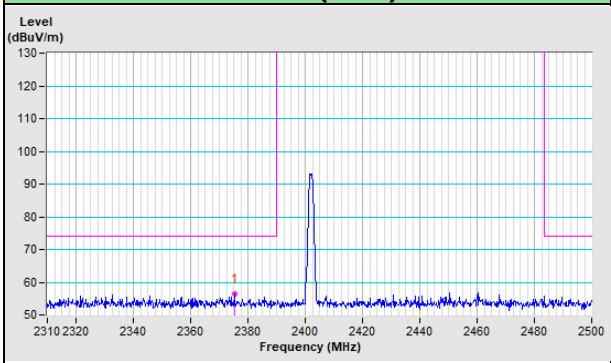
Horizontal (Peak)



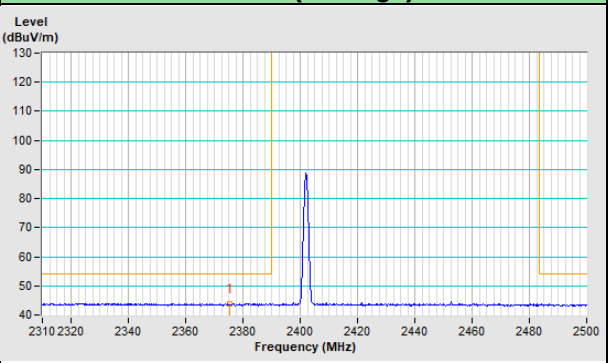
Horizontal (Average)



Vertical (Peak)

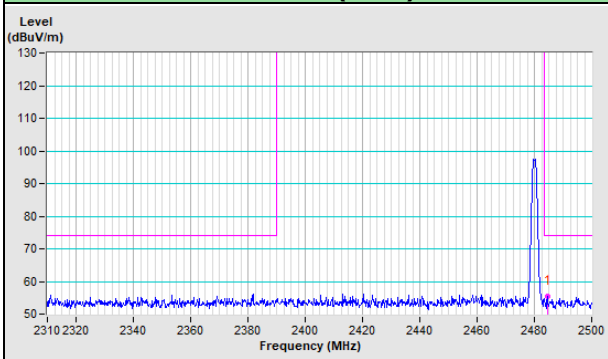


Vertical (Average)

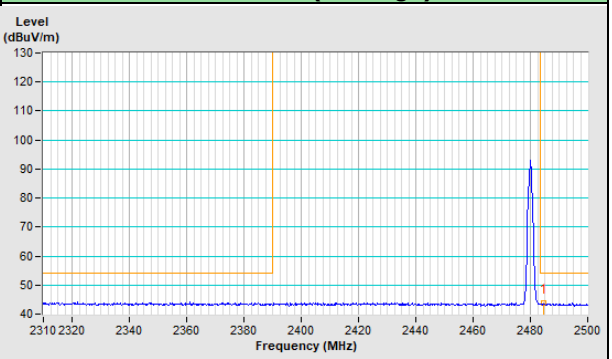


BT_LE-1M Channel 39

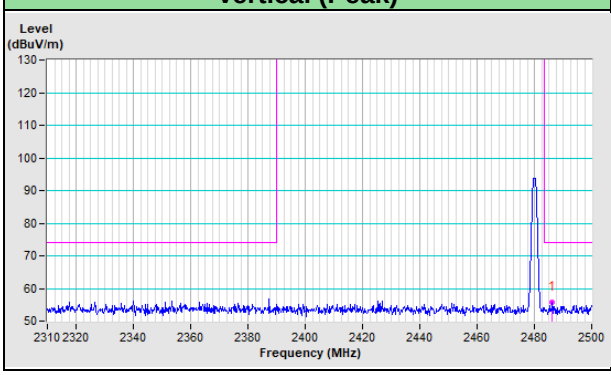
Horizontal (Peak)



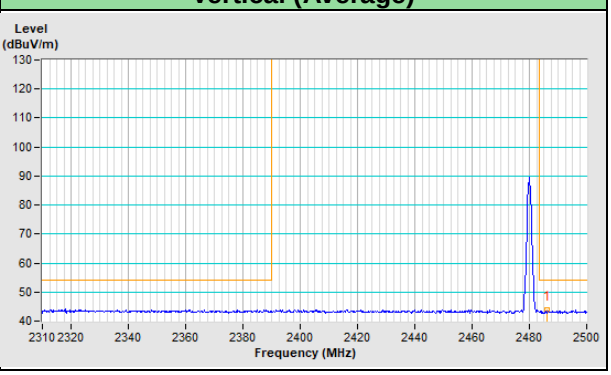
Horizontal (Average)



Vertical (Peak)

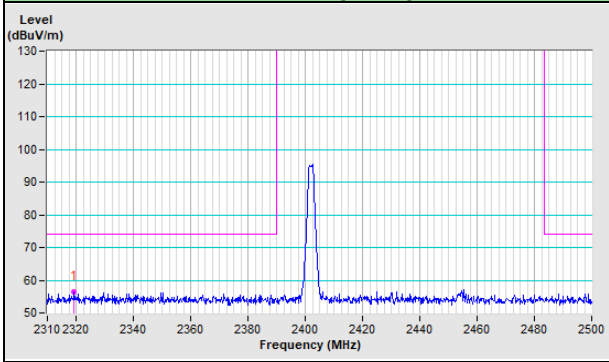


Vertical (Average)

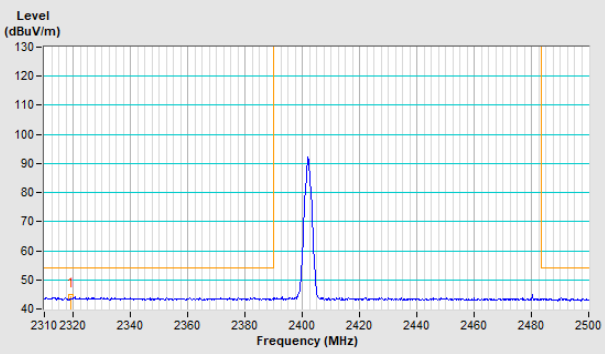


BT_LE-2M Channel 1

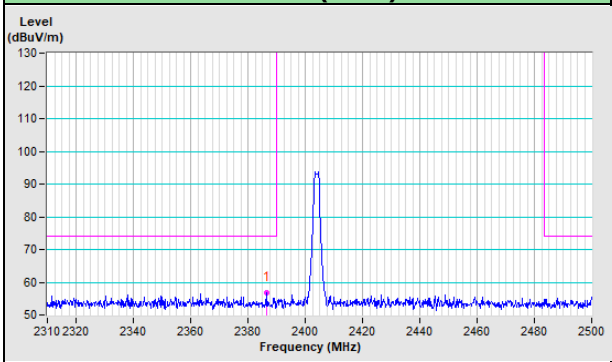
Horizontal (Peak)



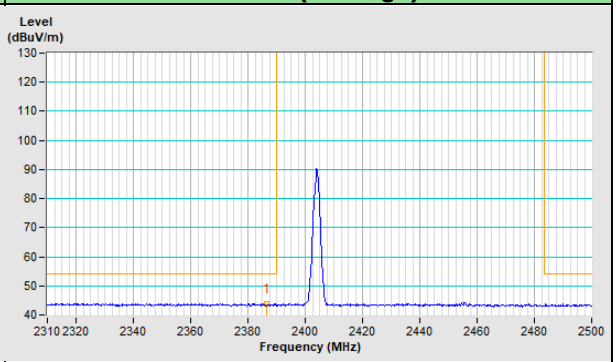
Horizontal (Average)



Vertical (Peak)

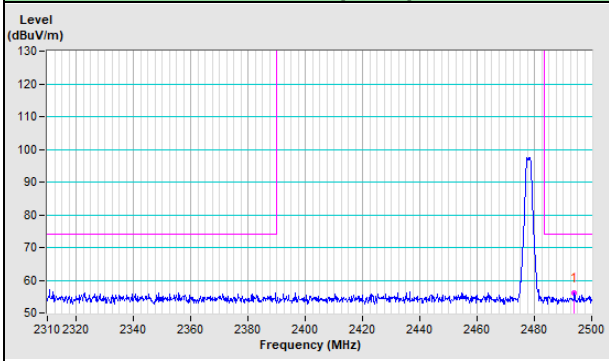


Vertical (Average)

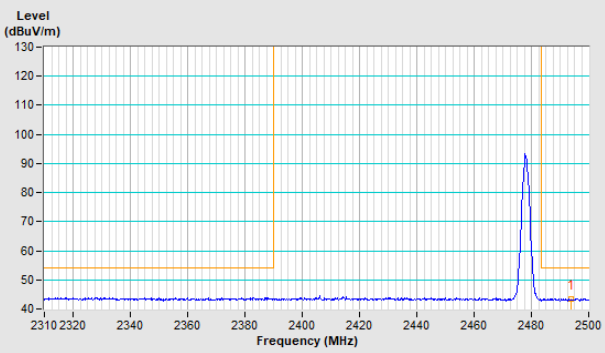


BT_LE-2M Channel 38

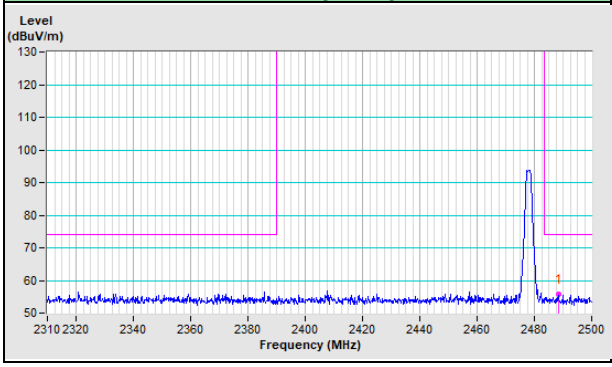
Horizontal (Peak)



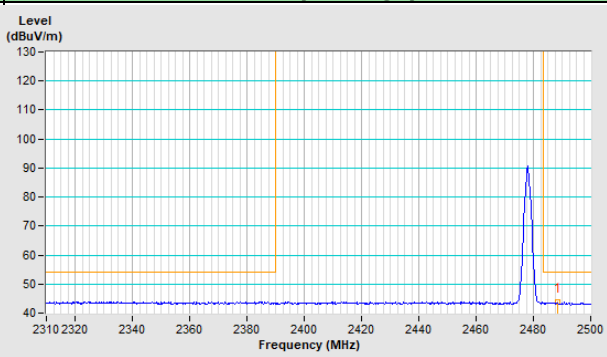
Horizontal (Average)



Vertical (Peak)



Vertical (Average)



Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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The address and road map of all our labs can be found in our web site also.

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