FCC Test Report

Report No.:	RFBHAT-WTW-P20121068A-1
FCC ID:	R68OQ845US
Test Model:	Open-Q 845 uSOM
Received Date:	Jul. 14, 2022
Test Date:	Aug. 02 ~ Aug. 22, 2022
Issued Date:	Oct. 06, 2022
Applicant:	Lantronix, Inc.
Address:	7535 Irvine Center Drive, Suite 100, Irvine, CA 92618 USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
FCC Registration / Designation Number:	788550 / TW0003

Testing Laboratory
2021

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RFBHAT-WTW-P20121068A-1	Original Release	Oct. 06, 2022

1 Certificate of Conformity

Product:	Open-Q 845 uSOM
Brand:	Lantronix
Test Model:	Open-Q 845 uSOM
Sample Status:	Engineering Sample
Applicant:	Lantronix, Inc.
Test Date:	Aug. 02 ~ Aug. 22, 2022
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 RF characteristics under the conditions specified in this report.

Prepared by : Lena Wang , **Date:** Oct. 06, 2022

Lena Wang / Specialist

Approved by : Jeremy Lin , **Date:** Oct. 06, 2022

Jeremy Lin / Project Engineer

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 -24.05 dB at 0.61400 MHz.
15.205 & 209	Radiated Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -5.4 dB at 2483.50 MHz.
15.247(d)	Band Edge Measurement	N/A	Refer to Note 1
15.247(d)	Antenna Port Emission	N/A	Refer to Note 1
15.247(a)(2)	6 dB Bandwidth	N/A	Refer to Note 1
---	Occupied Bandwidth Measurement	N/A	Refer to Note 1
15.247(b)	Conducted Power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	N/A	Refer to Note 1
15.203	Antenna Requirement	N/A	Refer to Note 1

Note:

1. This report is a partial report, only test item of AC Power Conducted Emission, Conducted Power and Radiated Emissions tests were performed for this report. Other testing data please refer to original report no.: RFBHAT-WTW-P20121068-1.
2. For 2.4G band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A. Test Procedures refer to report 4.1.3.
3. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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	150 kHz ~ 30 MHz	2.79 dB
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 dB
	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Open-Q 845 uSOM
Brand	Lantronix
Test Model	Open-Q 845 uSOM
Status of EUT	Engineering Sample
Power Supply Rating	12 Vdc (Adapter)
Modulation Type	GFSK
Transfer Rate	LE 4.0: 1 Mbps LE 5.0: 2 Mbps
Operating Frequency	2402 ~ 2480 MHz
Number of Channel	40
Output Power	LE 4.0: 12.05 mW LE 5.0: 12.134 mW
Antenna Type	Refer to Note as below
Antenna Connector	Refer to Note as below
Accessory Device	Refer to Note as below
Data Cable Supplied	N/A

Note:

1. This report is issued as a supplementary report to BV CPS report no. RFBHAT-WTW-P20121068-1. The difference compared with original report are adding antenna, therefore only test item of AC Power Conducted Emission, Conducted Power and Radiated Emissions tests were performed for this report.
2. The following antennas were provided to the EUT. (Ant. B is new)

Ant. A		
Ant. Type	Flexible Dipole Antenna	
Connector Type	U.FL	
Antenna Gain (dBi)		
Item	**2.4~2.5G**	**4.9~5.8G**
Ant 1	3.32	6.11
Ant 2	3.32	6.11
Ant. B		
Brand	Fractus Antennas	
Model	FR05-S1-NO-1-003	
Ant. Type	Chip Monopole	
Connector Type	SMA	
Antenna Gain (dBi)		
2.4~2.5G		**4.9~5.8G**
3.9		6

3. Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.
4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or User's Manual.
5. BT, 2.4G and 5GHz WLAN can transmit simultaneously. The emission of the simultaneous operation has been evaluated and no non-compliance was found.

3.2 Description of Test Modes

40 channels are provided to this EUT:

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

3.2.1 Test Mode Applicability and Tested Channel Detail

<LE 4.0>

EUT Configure Mode	Applicable To				Description
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where **RE≥1G:** Radiated Emission above 1 GHz **RE<1G:** Radiated Emission below 1 GHz
PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.
Note: "-"means no effect.
Note: For radiated emission (below 1GHz) and Power Line Conducted Emission, we had pre-test at LE4.0 and LE5.0, test mode at LE5.0 was the worst case and only this mode was presented in the report.

Radiated Emission Test (Above 1 GHz):

☒ 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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0, 19, 39	GFSK	1

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
☒ 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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0, 19, 39	GFSK	1

<LE 5.0>

EUT Configure Mode	Applicable To				Description
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where **RE≥1G:** Radiated Emission above 1 GHz **RE<1G:** Radiated Emission below 1 GHz
PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.
Note: "-"means no effect.
Note: For radiated emission (below 1GHz) and Power Line Conducted Emission, we had pre-test at LE4.0 and LE5.0, test mode at LE5.0 was the worst case and only this mode was presented in the report.

Radiated Emission Test (Above 1 GHz):

☒ 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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0, 19, 39	GFSK	2

Radiated Emission Test (Below 1 GHz):

☒ 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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	39	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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	39	GFSK	2

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
☒ 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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0, 19, 39	GFSK	2

Test Condition:

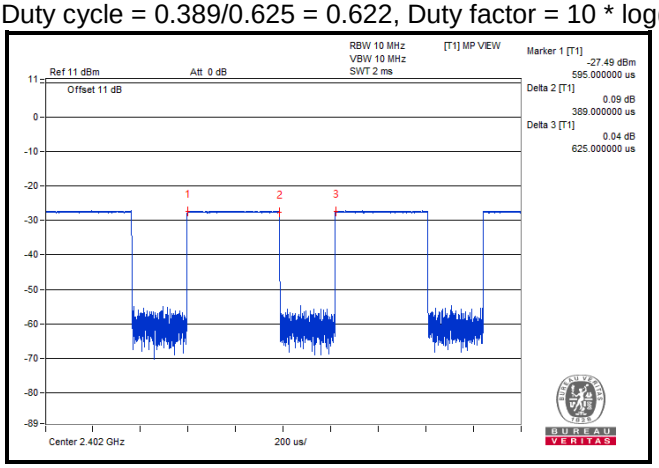
Applicable To	Environmental Conditions	Input Power	Tested by
RE≥1G	23 deg. C, 73 % RH	120 Vac, 60 Hz	Rex Wang
RE<1G	21 deg. C, 68 % RH	120 Vac, 60 Hz	Rex Wang
PLC	25 deg. C, 75 % RH	120 Vac, 60 Hz	Rex Wang
APCM	25 deg. C, 60 % RH	120 Vac, 60 Hz	Jisyong Wang

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %, duty factor shall be considered.

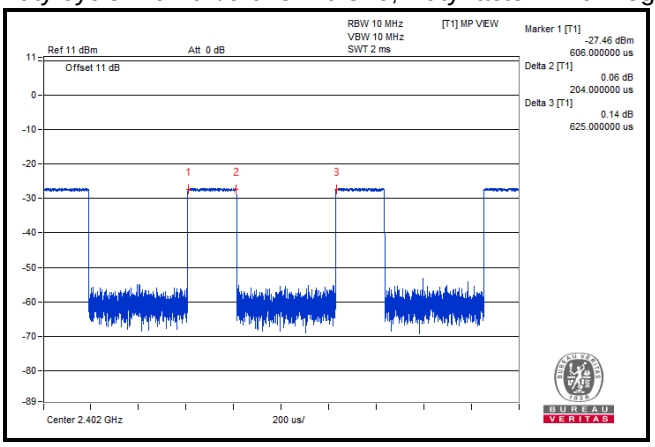
<LE 4.0>

Duty cycle = 0.389/0.625 = 0.622, Duty factor = 10 * log(1/0.622) = 2.06



<LE 5.0>

Duty cycle = 0.204/0.625 = 0.326, Duty factor = 10 * log(1/0.326) = 4.86



3.4 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.

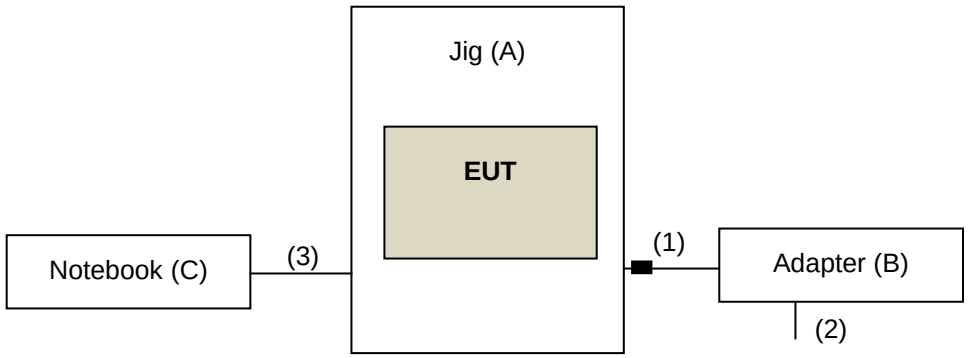
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Jig	N/A	N/A	N/A	N/A	Provided by client
B	Adapter	YINGHUIYUAN	YHY-12003000	N/A	N/A	Provided by client
C	Notebook	Dell	E5420	FHP75S1	N/A	--

Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Adapter Cable	1	1.2	Y	1	Provided by client
2.	Power Cable	1	1.15	N	0	Provided by client
3.	USB Type C Cable	1	1	Y	0	--

3.4.1 Configuration of System under Test



3.5 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 20 dB 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 1000 MHz, 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 20 dB under any condition of modulation.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower &Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
Test Receiver Agilent	N9038A	MY51210203	Sep. 22, 2021	Sep. 21, 2022
Spectrum Analyzer R&S	FSW43	101867	Jan. 07, 2022	Jan. 06, 2023
Pre-amplifier EMCI	EMC001340	980201	Sep. 15, 2021	Sep. 14, 2022
Pre-amplifier EMCI	EMC001340	980201	Sep. 15, 2021	Sep. 14, 2022
RF Coaxial Cable EMCI	5D-NM-BM	140903+140902	Jan. 15, 2022	Jan. 14, 2023
Preamplifier Agilent	8447D	2944A10638	May 14, 2022	May 13, 2023
Bi_Log Antenna Schwarbeck	VULB9168	9168-160	Oct. 28, 2021	Oct. 27, 2022
RF Coaxial Cable WOKEN	8D-FB	Cable-CH9-01	May 14, 2022	May 13, 2023
Horn Antenna Schwarzbeck	9120D	9120D-1169	Nov. 14, 2021	Nov. 13, 2022
Preamplifier Agilent	8449B	3008A02367	Feb. 16, 2022	Feb. 15, 2023
RF Coaxial Cable HUBER+SUHNER&EMCI	SUCOFLEX 104& EMC104-SM- SM8000	CABLE-CH9-02 (248780+171006)	Jan. 15, 2022	Jan. 14, 2023
RF Coaxial Cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9- (250795/4)	Jan. 15, 2022	Jan. 14, 2023
RF FLITER MICRO-TRONICS	BRM50716	060	Jan. 10, 2022	Jan. 09, 2023
RF FLITER MICRO-TRONICS	BRM17690	004	Jan. 10, 2022	Jan. 09, 2023
Boresight antenna tower fixture BV	BAF-02	5	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 HwaYa 966 chamber 4.

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

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 9 kHz at frequency below 30 MHz.

For Radiated Emission above 30 MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) 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 detected 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:

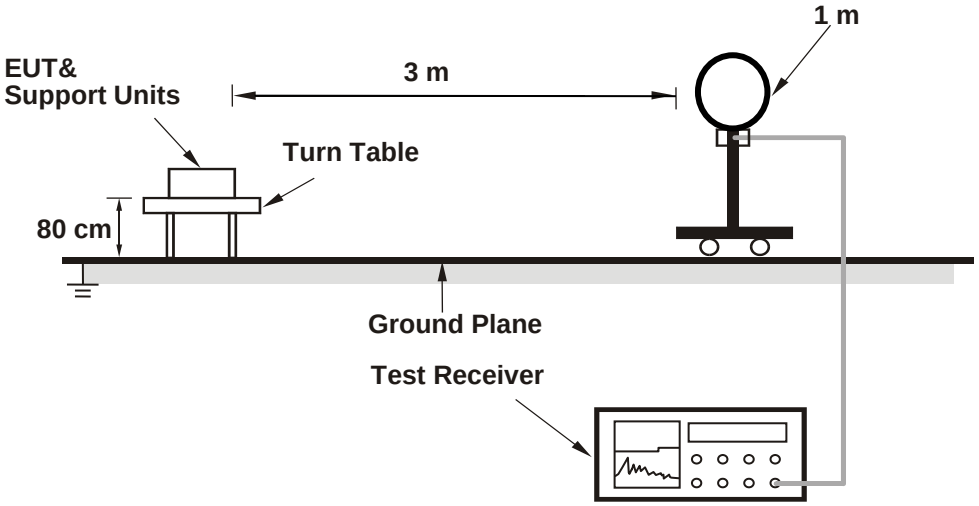
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz. (RBW = 1 MHz, VBW = 3 kHz for LE 4.0，RBW = 1 MHz, VBW = 5 kHz for LE 5.0)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

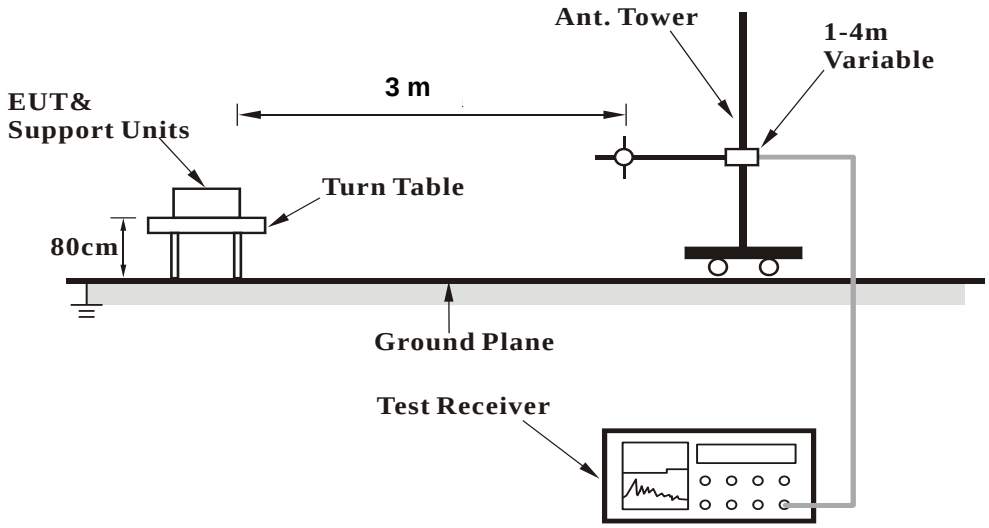
No deviation.

4.1.5 Test Set Up

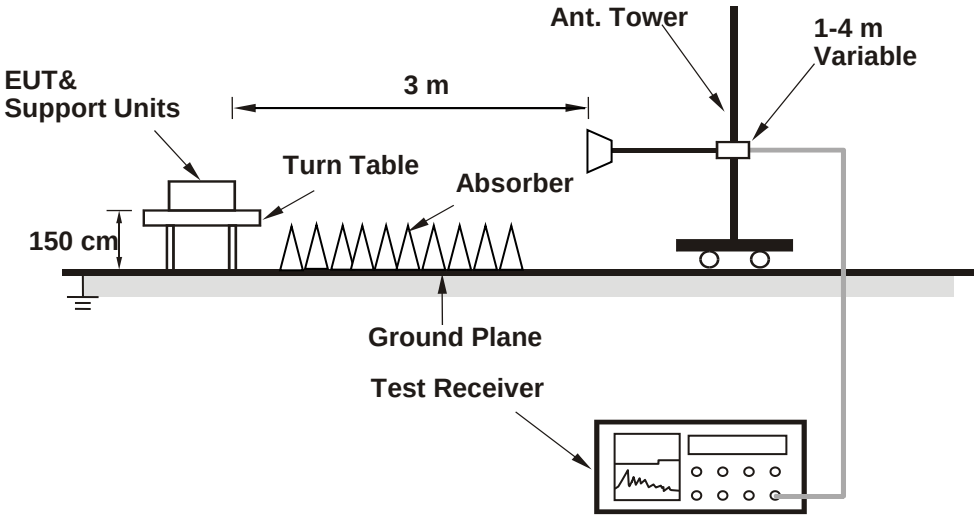
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



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. Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1 GHz Data:

<LE 4.0>

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	2390.00	58.4 PK	74.0	-15.6	1.47 H	305	25.6	32.8
2	2390.00	45.2 AV	54.0	-8.8	1.47 H	305	12.4	32.8
3	*2402.00	107.1 PK			1.47 H	305	74.3	32.8
4	*2402.00	106.0 AV			1.47 H	305	73.2	32.8
5	4804.00	47.7 PK	74.0	-26.3	1.55 H	300	41.9	5.8
6	4804.00	34.4 AV	54.0	-19.6	1.55 H	300	28.6	5.8
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	2390.00	58.3 PK	74.0	-15.7	3.66 V	217	25.5	32.8
2	2390.00	45.1 AV	54.0	-8.9	3.66 V	217	12.3	32.8
3	*2402.00	107.0 PK			3.66 V	217	74.2	32.8
4	*2402.00	105.9 AV			3.66 V	217	73.1	32.8
5	4804.00	47.6 PK	74.0	-26.4	3.60 V	200	41.8	5.8
6	4804.00	34.3 AV	54.0	-19.7	3.60 V	200	28.5	5.8

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	106.4 PK			1.41 H	301	73.6	32.8
2	*2440.00	105.3 AV			1.41 H	301	72.5	32.8
3	4880.00	47.1 PK	74.0	-26.9	1.46 H	305	41.6	5.5
4	4880.00	33.8 AV	54.0	-20.2	1.46 H	305	28.3	5.5
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	106.3 PK			3.52 V	220	73.5	32.8
2	*2440.00	105.2 AV			3.52 V	220	72.4	32.8
3	4880.00	46.9 PK	74.0	-27.1	3.57 V	210	41.4	5.5
4	4880.00	33.6 AV	54.0	-20.4	3.57 V	210	28.1	5.5

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	107.4 PK			3.45 H	306	74.5	32.9
2	*2480.00	106.4 AV			3.45 H	306	73.5	32.9
3	2483.50	58.3 PK	74.0	-15.7	3.45 H	306	25.4	32.9
4	2483.50	47.1 AV	54.0	-6.9	3.45 H	306	14.2	32.9
5	4960.00	47.5 PK	74.0	-26.5	1.61 H	302	41.8	5.7
6	4960.00	34.2 AV	54.0	-19.8	1.61 H	302	28.5	5.7
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	107.3 PK			3.46 V	222	74.4	32.9
2	*2480.00	106.3 AV			3.46 V	222	73.4	32.9
3	2483.50	58.2 PK	74.0	-15.8	3.46 V	222	25.3	32.9
4	2483.50	46.9 AV	54.0	-7.1	3.46 V	222	14.0	32.9
5	4960.00	47.4 PK	74.0	-26.6	3.65 V	211	41.7	5.7
6	4960.00	34.0 AV	54.0	-20.0	3.65 V	211	28.3	5.7

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.

<LE 5.0>

RF Mode	TX BT-LE 2M	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	2390.00	58.1 PK	74.0	-15.9	1.46 H	301	25.3	32.8
2	2390.00	46.0 AV	54.0	-8.0	1.46 H	301	13.2	32.8
3	*2402.00	107.4 PK			1.46 H	301	74.6	32.8
4	*2402.00	104.6 AV			1.46 H	301	71.8	32.8
5	4804.00	47.6 PK	74.0	-26.4	1.54 H	296	41.8	5.8
6	4804.00	34.8 AV	54.0	-19.2	1.54 H	296	29.0	5.8
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	2390.00	57.9 PK	74.0	-16.1	3.73 V	213	25.1	32.8
2	2390.00	45.9 AV	54.0	-8.1	3.73 V	213	13.1	32.8
3	*2402.00	107.0 PK			3.73 V	213	74.2	32.8
4	*2402.00	104.1 AV			3.73 V	213	71.3	32.8
5	4804.00	47.3 PK	74.0	-26.7	3.65 V	205	41.5	5.8
6	4804.00	34.6 AV	54.0	-19.4	3.65 V	205	28.8	5.8

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	106.6 PK			1.42 H	301	73.8	32.8
2	*2440.00	103.9 AV			1.42 H	301	71.1	32.8
3	4880.00	47.0 PK	74.0	-27.0	1.52 H	305	41.5	5.5
4	4880.00	34.4 AV	54.0	-19.6	1.52 H	305	28.9	5.5
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	106.4 PK			3.54 V	214	73.6	32.8
2	*2440.00	103.4 AV			3.54 V	214	70.6	32.8
3	4880.00	46.8 PK	74.0	-27.2	3.59 V	204	41.3	5.5
4	4880.00	34.1 AV	54.0	-19.9	3.59 V	204	28.6	5.5

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 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	107.7 PK			3.47 H	306	74.8	32.9
2	*2480.00	104.9 AV			3.47 H	306	72.0	32.9
3	2483.50	61.1 PK	74.0	-12.9	3.47 H	306	28.2	32.9
4	**2483.50**	**48.6 AV**	**54.0**	**-5.4**	**3.47 H**	**306**	**15.7**	**32.9**
5	4960.00	47.9 PK	74.0	-26.1	1.58 H	309	42.2	5.7
6	4960.00	34.8 AV	54.0	-19.2	1.58 H	309	29.1	5.7
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	107.5 PK			3.46 V	224	74.6	32.9
2	*2480.00	104.5 AV			3.46 V	224	71.6	32.9
3	2483.50	60.9 PK	74.0	-13.1	3.46 V	224	28.0	32.9
4	2483.50	48.2 AV	54.0	-5.8	3.46 V	224	15.3	32.9
5	4960.00	47.5 PK	74.0	-26.5	3.47 V	220	41.8	5.7
6	4960.00	34.5 AV	54.0	-19.5	3.47 V	220	28.8	5.7

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.

9 kHz ~ 30 MHz Data:

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz Worst-Case Data:

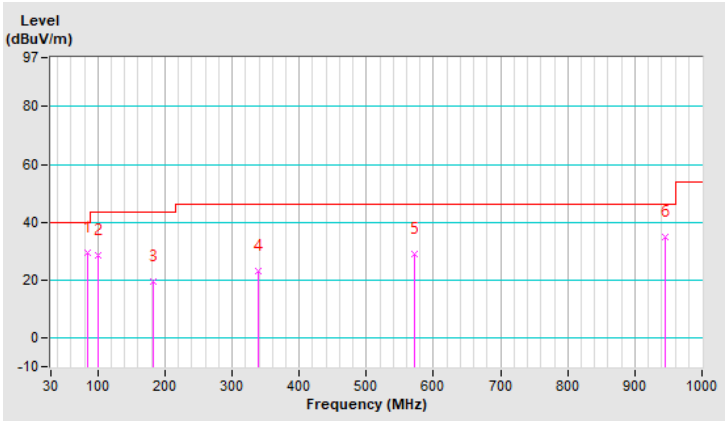
<LE 5.0>

RF Mode	TX BT-LE 2M	Channel	CH 39：2480 MHz
Frequency Range	30MHz ~ 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	84.32	29.3 QP	40.0	-10.7	1.00 H	18	43.7	-14.4
2	100.81	28.5 QP	43.5	-15.0	1.25 H	293	41.9	-13.4
3	183.26	19.3 QP	43.5	-24.2	1.50 H	2	29.9	-10.6
4	338.46	22.9 QP	46.0	-23.1	1.00 H	34	29.0	-6.1
5	571.26	29.0 QP	46.0	-17.0	1.00 H	13	30.2	-1.2
6	944.71	35.0 QP	46.0	-11.0	2.00 H	306	28.8	6.2

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.

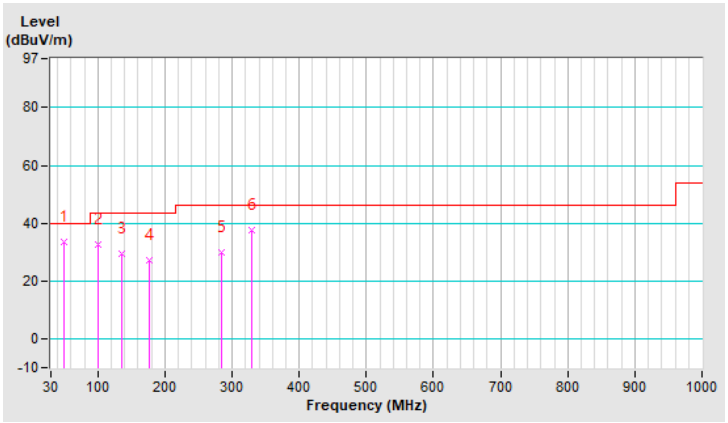


RF Mode	TX BT-LE 2M	Channel	CH 39：2480 MHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

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	50.37	33.4 QP	40.0	-6.6	1.99 V	136	42.4	-9.0
2	100.81	32.5 QP	43.5	-11.0	1.49 V	261	45.9	-13.4
3	135.73	29.5 QP	43.5	-14.0	1.49 V	251	39.2	-9.7
4	176.47	27.2 QP	43.5	-16.3	1.49 V	65	36.9	-9.7
5	285.11	29.8 QP	46.0	-16.2	1.49 V	222	37.1	-7.3
6	329.73	37.5 QP	46.0	-8.5	1.24 V	207	43.5	-6.0

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 0.50 MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver ROHDE & SCHWARZ	ESR3	102783	Dec. 20, 2021	Dec. 19, 2022
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Sep. 04, 2021	Sep. 03, 2022
LISN/AMN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Feb. 17, 2022	Feb. 16, 2023
LISN/AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Sep. 17, 2021	Sep. 16, 2022
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	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 HwaYa Shielded Room 2 (Conduction 2).
3. The VCCI Site Registration No. is C-12047.
4. Test Date: 2022/8/3

4.2.3 Test Procedures

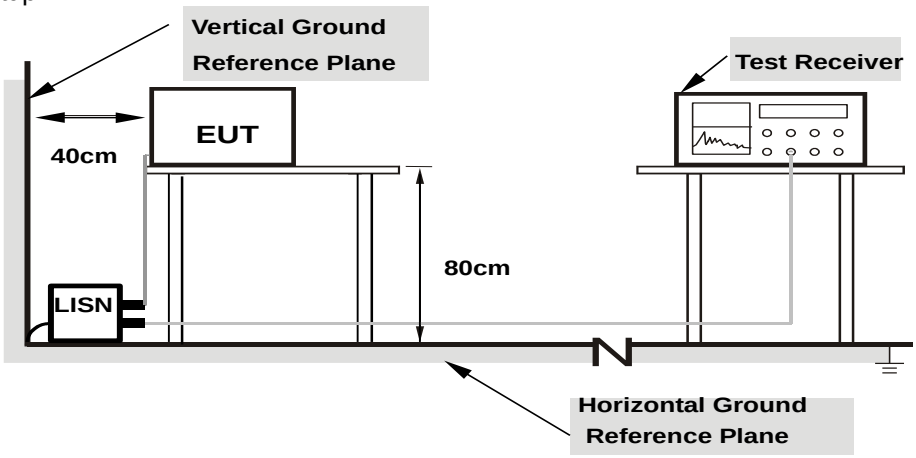
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling 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 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

4.2.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Set the EUT under transmission condition continuously at specific channel frequency.

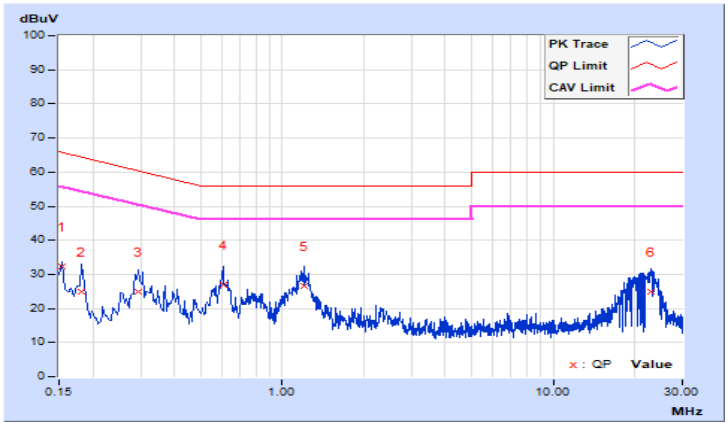
4.2.7 Test Results

RF Mode	TX BT-LE 2M	Channel	CH 39：2480 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	0.15400	10.13	22.35	16.09	32.48	26.22	65.78	55.78	-33.30	-29.56
2	0.18200	10.14	14.81	7.63	24.95	17.77	64.39	54.39	-39.44	-36.62
3	0.29400	10.15	14.79	8.98	24.94	19.13	60.41	50.41	-35.47	-31.28
4	0.60600	10.17	16.82	10.22	26.99	20.39	56.00	46.00	-29.01	-25.61
5	1.21000	10.20	16.52	9.74	26.72	19.94	56.00	46.00	-29.28	-26.06
6	22.96600	10.30	14.56	2.64	24.86	12.94	60.00	50.00	-35.14	-37.06

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

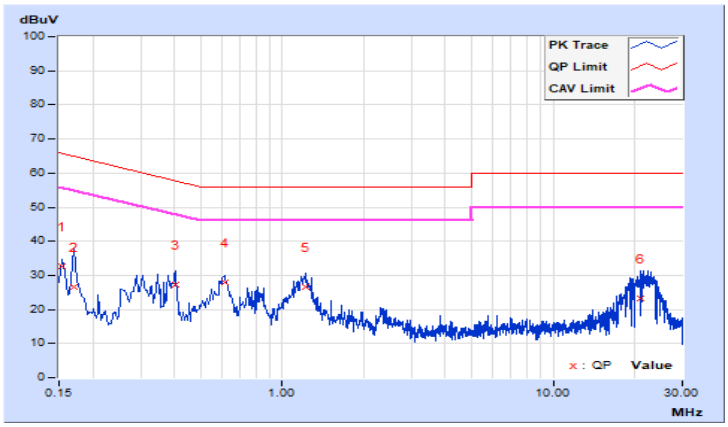


RF Mode	TX BT-LE 2M	Channel	CH 39：2480 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	0.15400	10.14	22.53	16.24	32.67	26.38	65.78	55.78	-33.11	-29.40
2	0.17000	10.14	16.36	6.77	26.50	16.91	64.96	54.96	-38.46	-38.05
3	0.40200	10.17	17.27	4.36	27.44	14.53	57.81	47.81	-30.37	-33.28
4	**0.61400**	**10.18**	**17.92**	**11.77**	**28.10**	**21.95**	**56.00**	**46.00**	**-27.90**	**-24.05**
5	1.21400	10.21	16.37	10.01	26.58	20.22	56.00	46.00	-29.42	-25.78
6	21.12200	10.51	12.88	4.23	23.39	14.74	60.00	50.00	-36.61	-35.26

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

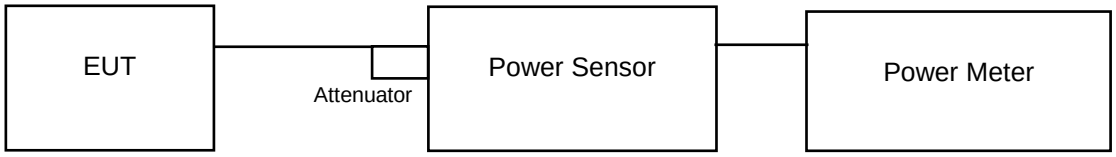


4.3 Conducted Output Power Measurement

4.3.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30 dBm)

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.3.7 Test Results

<LE 4.0>

Channel	Freq. (MHz)	Peak Power		Average Power		Power Limit (mW)	Pass / Fail
		(mW)	(dBm)	(mW)	(dBm)		
0	2402	**12.05**	**10.81**	11.561	10.63	1000	Pass
19	2440	9.977	9.99	9.354	9.71	1000	Pass
39	2480	11.776	10.71	11.429	10.58	1000	Pass

<LE 5.0>

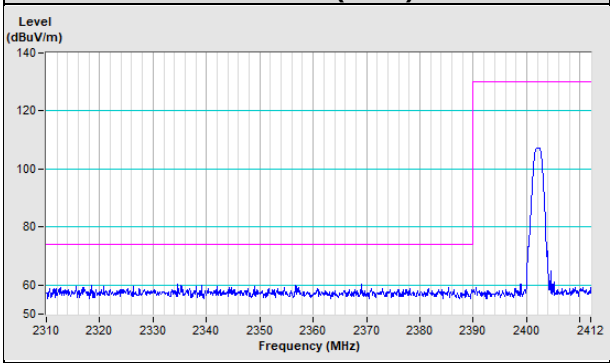
Channel	Freq. (MHz)	Peak Power		Average Power		Power Limit (mW)	Pass / Fail
		(mW)	(dBm)	(mW)	(dBm)		
0	2402	**12.134**	**10.84**	11.535	10.62	1000	Pass
19	2440	9.908	9.96	9.441	9.75	1000	Pass
39	2480	11.722	10.69	11.041	10.43	1000	Pass

Annex A- Band Edge Measurement

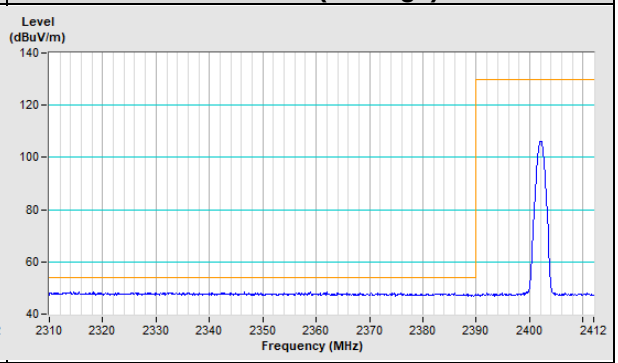
<LE 4.0>

BT-LE 1M Channel 0

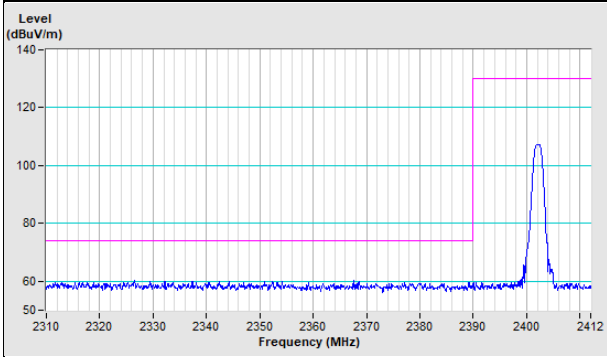
Horizontal (Peak)



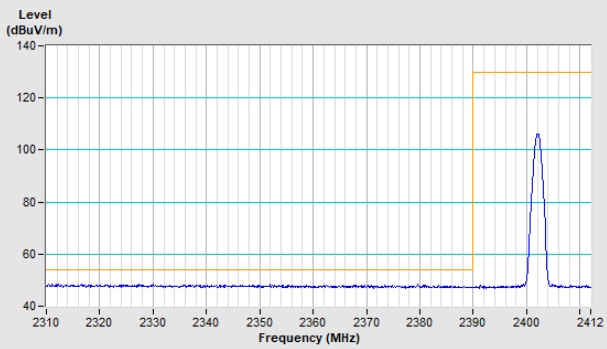
Horizontal (Average)



Vertical (Peak)

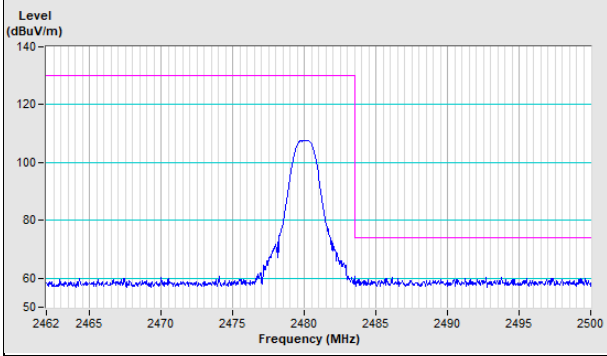


Vertical (Average)

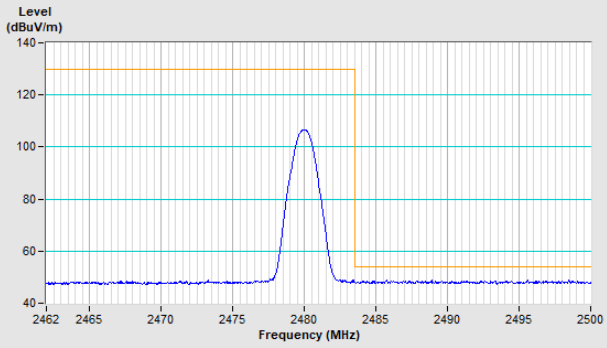


BT-LE 1M Channel 39

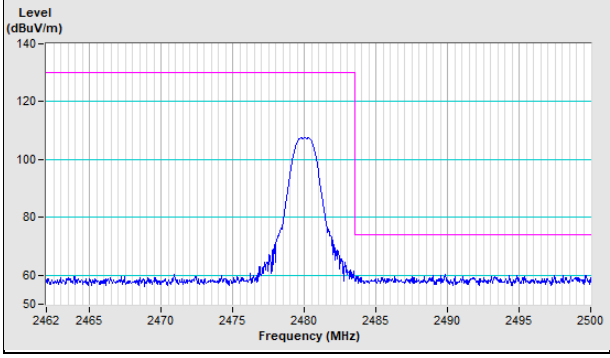
Horizontal (Peak)



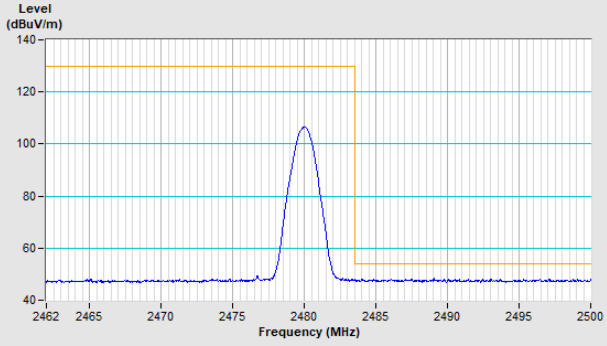
Horizontal (Average)



Vertical (Peak)



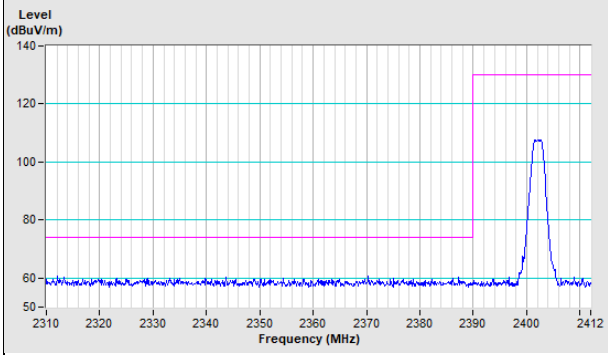
Vertical (Average)



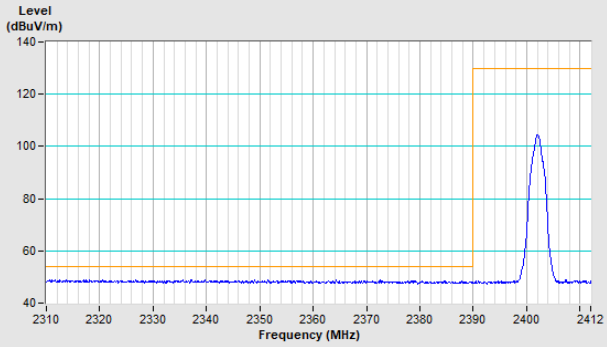
<LE 5.0>

BT-LE 2M Channel 0

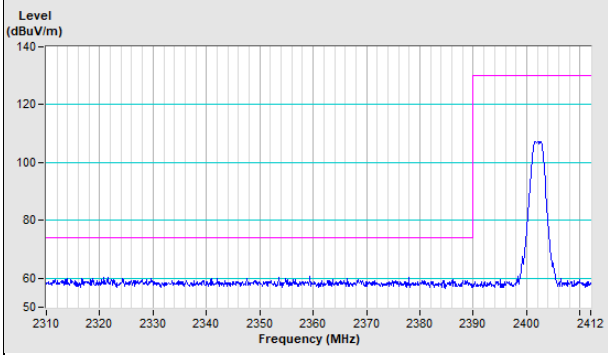
Horizontal (Peak)



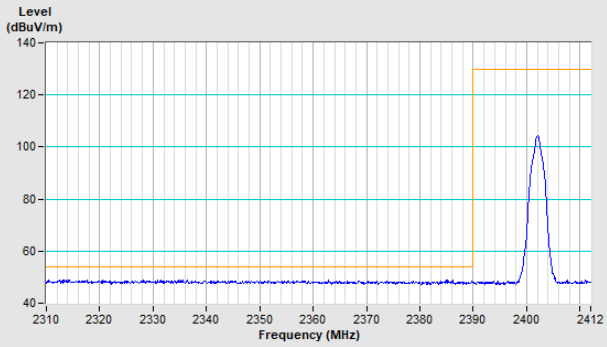
Horizontal (Average)



Vertical (Peak)

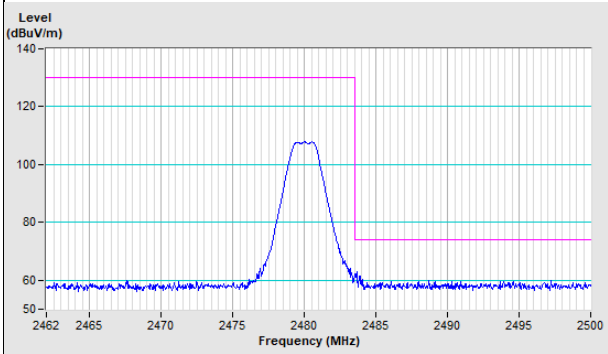


Vertical (Average)

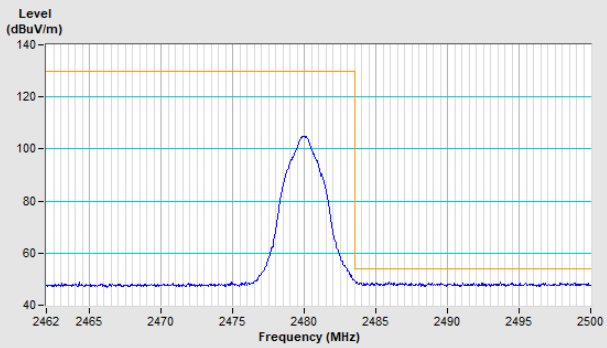


BT-LE 2M Channel 39

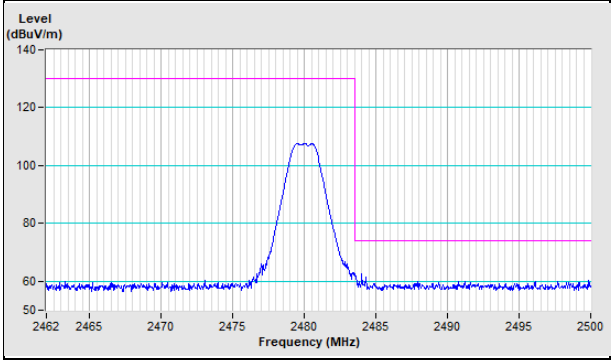
Horizontal (Peak)



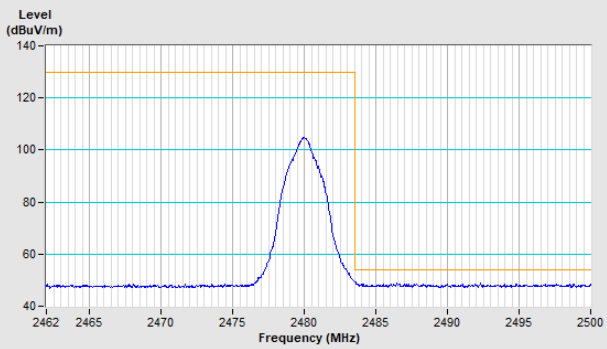
Horizontal (Average)



Vertical (Peak)



Vertical (Average)



5 Pictures of Test Arrangements

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

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.

If you have any comments, please feel free to contact us at the following:

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

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

--- END ---