

TEST REPORT

CERTIFICATE OF CONFORMITY

Standard: 47 CFR FCC Part 15, Subpart C (Section 15.247)

Report No.: RFBEMI-WTW-P25060631-3

FCC ID: NOIKBN428B

Product: Electronic Display Device

Brand: Rakuten kobo

Model No.: N428B

Received Date: 2025/6/26

Test Date: 2025/7/17 ~ 2025/7/28

Issued Date: 2025/9/18

Applicant: NETRONIX, INC.

Address: No. 945, Boai St., Jubei City, Hsin-Chu, 30265, Taiwan

Factory: (1) NETRONIX, INC.
(2) NTX Electronics YANGZHOU CO., LTD.

Address: (1) No. 945, Boai St., Jubei City, Hsin-Chu, 30265, Taiwan
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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Hsin Chu Laboratory

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Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

FCC Registration / 723255 / TW2022

Designation Number:

Approved by:



Wen Yu / Assistant Manager

, Date:

2025/9/18

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Prepared by : Claire Kuan / Specialist

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Release Control Record

Issue No.	Description	Date Issued
RFBEMI-WTW-P25060631-3	Original release.	2025/9/18

1 Certificate

Product: Electronic Display Device

Brand: Rakuten kobo

Test Model: N428B

Sample Status: Engineering sample

Applicant: NETRONIX, INC.

Test Date: 2025/7/17 ~ 2025/7/28

Standard: 47 CFR FCC Part 15, Subpart C (Section 15.247)

Measurement ANSI C63.10-2013

procedure: KDB 558074 D01 15.247 Meas Guidance v05r02

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.

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
Standard / Clause	Test Item	Result	Remark
15.247(b)	RF Output Power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.247(a)(2)	6 dB Bandwidth	Pass	Meet the requirement of limit.
15.247(d)	Conducted Out of Band Emissions	Pass	Meet the requirement of limit.
15.207	AC Power Conducted Emissions	Pass	Minimum passing margin is -8.60 dB at 0.76328 MHz
15.205 / 15.209 / 15.247(d)	Unwanted Emissions below 1 GHz	Pass	Minimum passing margin is -5.8 dB at 150.01 MHz
15.205 / 15.209 / 15.247(d)	Unwanted Emissions above 1 GHz	Pass	Minimum passing margin is -10.1 dB at 2390.00 MHz
15.203	Antenna Requirement	Pass	No antenna connector is used.

Note: 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:

Parameter	Specification	Expanded Uncertainty (k=2) (±)
RF Output Power	-	1.1 dB
Power Spectral Density	-	1.3 dB
6 dB Bandwidth	-	1050.00 Hz
Conducted Out of Band Emissions	9 kHz ~ 40 GHz	2.6 dB
AC Power Conducted Emissions	150 kHz ~ 30 MHz	1.9 dB
Unwanted Emissions below 1 GHz	9 kHz ~ 30 MHz	3.1 dB
	30 MHz ~ 1 GHz	5.1 dB
Unwanted Emissions above 1 GHz	1 GHz ~ 18 GHz	5.1 dB
	18 GHz ~ 40 GHz	5.3 dB

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

3 General Information

3.1 General Description

Product	Electronic Display Device
Brand	Rakuten kobo
Test Model	N428B
Status of EUT	Engineering sample
Power Supply Rating	3.87 Vdc from battery 5 Vdc from USB interface
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	1 Mbps
Operating Frequency	2.402 GHz ~ 2.48 GHz
Number of Channel	40
Output Power	1.932 mW (2.86 dBm)

Note:

1. The EUT model is listed as below.

No.	Model	Color	Different
1	N428B	Black	EUT has two colors: only the color is different, the circuit design is the same.
2		White	

2. The EUT must be supplied with a battery as the following table:

Item	Brand	Model	Specification
Battery	DESAY BATTERY TECHNOLOGY CO., LTD.	K24072300-2410878	Power Rating:3.87 Vdc, 8.91Wh, 2300mAh

3. The EUT uses following accessories.

Item	Brand	Model	Supplier Model	Color	Specification	Material	TID number
1st source USB Cable	Yih Fone	SH-0846	YF-USB2-A-C-1M(K)	Black	Shielded, 1.0M	TPE	12574
	Yih Fone	SH-0837	YF-USB2-A-C-1M-WH(K)	White	Shielded, 1.0M	TPE	12575
2nd source USB Cable	LUXSHARE-ICT	LB93US005-1H	---	Black	Shielded, 1.0M	TPE	---
	LUXSHARE-ICT	LB93US006-1H	---	White	Shielded, 1.0M	TPE	---

4. The EUT will be supported with the following eMMC and DRAM source.

Source	Item	Brand	Model
Main Source	1st source eMMC	PHISON	PTE7A0YJ-32GE
	1st source DRAM	MICRON	MT53D512M16D1DS-046 WT:D
2nd Source	2nd source eMMC	MK FOUNDER	MKEMF032GT1E-C
	1st source DRAM	MICRON	MT53D512M16D1DS-046 WT:D
3rd Source	3rd source eMMC	FORESEE	FEMDNN032G-C9A55
	2nd source DRAM	KINGSTON	D0811PM2FDGUK

5. There are Bluetooth and WLAN (2.4 GHz & 5 GHz) technology used for the EUT.

6. Simultaneously transmission combination.

Combination	Technology	
1	WLAN (2.4 GHz)	Bluetooth
2	WLAN (5 GHz)	Bluetooth

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

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.

3.2 Antenna Description of EUT

1. The antenna information is listed as below.

Brand	Model	Antenna Net Gain(dBi)	Frequency range (GHz)	Antenna Type	Connector Type
INPAQ	ACM3-3216-P1-CC-S	3.91	2.4~2.5	Chip	none
		3.41	5.15~5.85		

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

3.3 Channel List

40 channels are provided for BT-LE:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (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

3.4 Test Mode Applicability and Tested Channel Detail

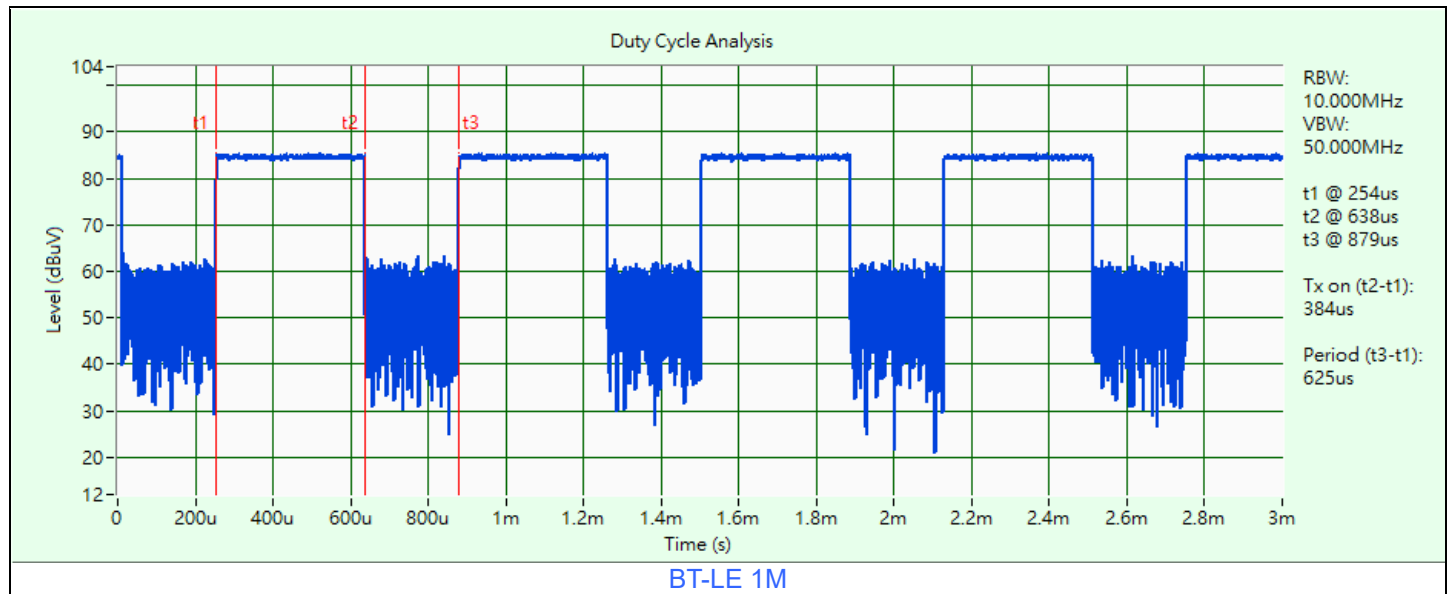
Pre-Scan:	1. For Radiated, pre-scan Power from AC Adapter via USB Cable / Laptop via USB Cable / Battery and find the worst case as a representative test condition. 2. For AC conduction, pre-scan Power from AC Adapter via USB Cable / Laptop via USB Cable and find the worst case as a representative test condition. 3. EUT can be used in the following ways: X-axis/ Y-axis/ Z-axis. Pre-scan these ways and find the worst case as a representative test condition. 4. The USB Cable has the following models: SH-0846 / LB93US005-1H. Pre-scan these models of USB Cables and find the worst case as a representative test condition. 5. The eMMC has the following models: PTE7A0YJ-32GE / MKEMF032GT1E-C / FEMDNN032GC9A55. Pre-scan these models of eMMC and find the worst case as a representative test condition. 6. The DRAM has the following models: MT53D512M16D1DS-046 WT:D / D0811PM2FDGUK. Pre-scan these models of DRAM and find the worst case as a representative test condition. 7. 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).
Worst Case:	1. For Radiated Worst Condition: Laptop via USB Cable 2. For AC conduction Worst Condition: AC Adapter via USB Cable 3. X-axis/ Y-axis/ Z-axis Worst Condition: Z-axis 4. USB Cable Worst Condition: LB93US005-1H 5. eMMC Worst Condition: PTE7A0YJ-32GE 6. DRAM Worst Condition: MT53D512M16D1DS-046 WT:D

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

Test Item	Mode	Tested Channel	Modulation	Data Rate Parameter
RF Output Power / Power Spectral Density	BT-LE 1M	0, 19, 39	GFSK	1Mb/s
6 dB Bandwidth / Conducted Out of Band Emissions	BT-LE 1M	0, 19, 39	GFSK	1Mb/s
AC Power Conducted Emissions	BT-LE 1M	0	GFSK	1Mb/s
Unwanted Emissions below 1 GHz	BT-LE 1M	0	GFSK	1Mb/s
Unwanted Emissions above 1 GHz	BT-LE 1M	0, 19, 39	GFSK	1Mb/s
Note: Both USB cables from the same brand are identical to each other except for exterior color and model names.				

3.5 Duty Cycle of Test Signal

BT-LE 1M: Duty cycle = $0.384 \text{ ms} / 0.625 \text{ ms} \times 100\% = 61.4\%$, duty factor = $10 * \log (1/\text{Duty cycle}) = 2.12 \text{ dB}$

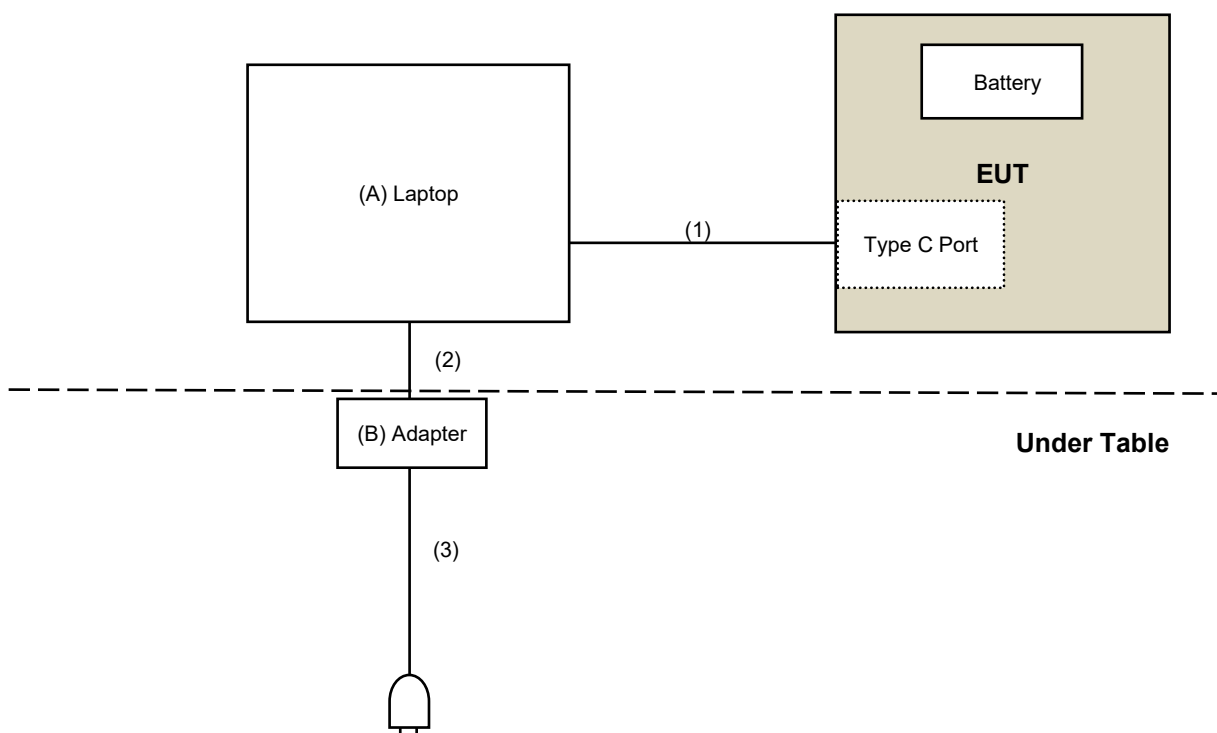


3.6 Test Program Used and Operation Descriptions

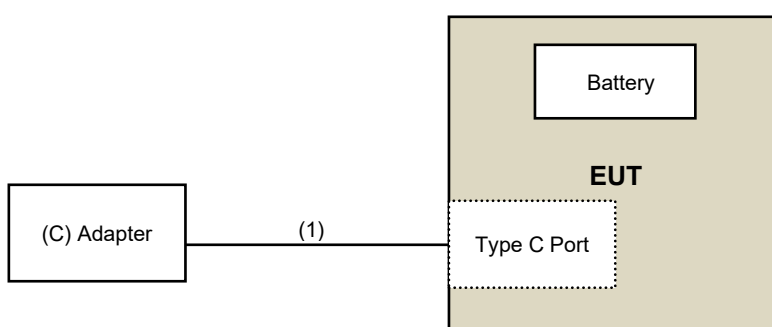
Controlling software (HyperTerminal paste wifitesttool 20250310.txt command) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

3.7 Connection Diagram of EUT and Peripheral Devices

For Unwanted Emissions test:



For AC Power Conducted Emission test:



3.8 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Laptop	DELL	E5520	8Y4DMQ1	N/A	Provided by Lab
B	Adapter	LENOVO	ADLX45YLC3D	N/A	N/A	Provided by Lab
C	Adapter	ASUS	EXA1205UA	N/A	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	USB Cable	1	1	YES	0	Supplied by applicant
2	DC Cable	1	1.7	NO	0	Provided by Lab
3	AC Cable	1	0.9	NO	0	Provided by Lab

4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1 RF Output Power

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Fixed Attenuator Woken	00800A1K01A-20	00800A1K01A-20-02	2025/5/23	2026/5/22
Pulse Power Sensor Anritsu	MA2411B	1726434	2025/6/3	2026/6/2
RF Power Meter Anritsu	ML2495A	1529002	2025/6/3	2026/6/2

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2025/7/21

4.2 Power Spectral Density

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Fixed Attenuator Woken	00800A1K01A-10	00800A1K01A-10-01	2025/5/23	2026/5/22
PXA Signal Analyzer Keysight	N9030A	MY55330160	2025/1/16	2026/1/15
Software	ADT_RF Test Software V8	N/A	N/A	N/A

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2025/7/21

4.3 6 dB Bandwidth

Refer to section 4.2 to get the tested date and information of the instruments.

4.4 Conducted Out of Band Emissions

Refer to section 4.2 to get the tested date and information of the instruments.

4.5 AC Power Conducted Emissions

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
50 ohm terminal resistance Telegartner	50 ohm	3	2024/11/1	2025/10/31
EMI Test Receiver R&S	ESCS 30	100375	2025/5/21	2026/5/20
Fixed Attenuator STI	STI02-2200-10	005	2025/2/17	2026/2/16
LISN R&S	ESH3-Z5	835239/001	2025/3/27	2026/3/26
		848773/004	2024/10/7	2025/10/6
RF Coaxial Cable JYEBAO	5D-FB	COCCAB-001	2025/2/17	2026/2/16
Software BVADT	BVADT_Cond_V7.3.7.4	N/A	N/A	N/A

Notes:

1. The test was performed in Conduction 1
2. Tested Date: 2025/7/24

4.6 Unwanted Emissions below 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Bi_Log Antenna Schwarzbeck	VULB 9168	9168-0842	2024/10/8	2025/10/7
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	N/A	N/A
EMI Test Receiver R&S	ESR7	102026	2025/3/25	2026/3/24
Fixed Attenuator Mini-Circuits	UNAT-5+	PAD-ATT5-02	2025/3/29	2026/3/28
Loop Antenna TESEQ	HLA 6121	63620	2024/10/17	2025/10/16
Preamplifier EMCI	EMC330N	980538	2025/3/29	2026/3/28
	EMC001340	980142	2025/2/17	2026/2/16
PXA Signal Analyzer Keysight	N9030B	MY57141948	2025/5/20	2026/5/19
RF Coaxial Cable PEWC	8D	966-5-1	2025/3/29	2026/3/28
		966-5-2	2025/3/29	2026/3/28
		966-5-3	2025/3/29	2026/3/28
Software	ADT_Radiated_V8.7.08	N/A	N/A	N/A

Notes:

1. The test was performed in 966 Chamber No. 5.
2. Tested Date: 2025/7/22 ~ 2025/7/28

4.7 Unwanted Emissions above 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	N/A	N/A
EMI Test Receiver R&S	ESR7	102026	2025/3/25	2026/3/24
Horn Antenna Schwarzbeck	BBHA 9120D	9120D-1819	2024/11/10	2025/11/9
	BBHA 9170	9170-739	2024/11/10	2025/11/9
Preamplifier EMCI	EMC12630SE	980509	2025/1/18	2026/1/17
	EMC184045SE	980387	2024/8/8	2025/8/7
PXA Signal Analyzer Keysight	N9030B	MY57141948	2025/5/20	2026/5/19
RF Coaxial Cable EMCI	EMC102-KM-KM-1200	160924	2025/1/24	2026/1/23
	EMC102-KM-KM-4000	200214	2025/1/24	2026/1/23
	EMC104-SM-SM-1500	180503	2025/3/8	2026/3/7
	EMC104-SM-SM-2000	180501	2025/3/8	2026/3/7
	EMC104-SM-SM-6000	180506	2025/3/8	2026/3/7
Software	ADT_Radiated_V8.7.08	N/A	N/A	N/A

Notes:

1. The test was performed in 966 Chamber No. 5.
2. Tested Date: 2025/7/17 ~ 2025/7/23

5 Limits of Test Items

5.1 RF Output Power

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

5.2 Power Spectral Density

The Maximum of Power Spectral Density Measurement is 8 dBm in any 3 kHz.

5.3 6 dB Bandwidth

The minimum of 6 dB Bandwidth Measurement is 0.5 MHz.

5.4 Conducted Out of Band Emissions

Below 20 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

5.5 AC Power Conducted Emissions

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

Notes:

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.

5.6 Unwanted Emissions below 1 GHz

Radiated emissions up to 1 GHz 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

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

5.7 Unwanted Emissions above 1 GHz

Radiated emissions above 1 GHz 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)
Above 960	500	3

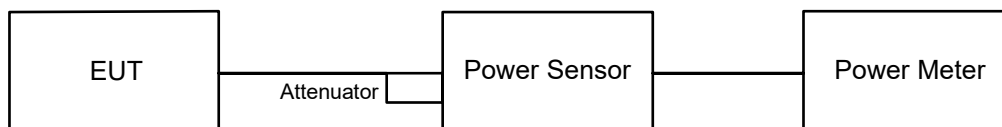
Notes:

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.

6 Test Arrangements

6.1 RF Output Power

6.1.1 Test Setup



6.1.2 Test Procedure

Peak Power:

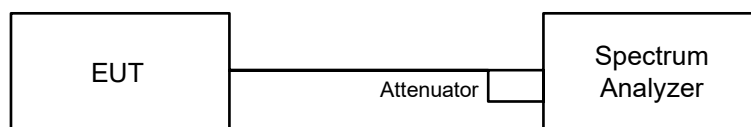
A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Average Power:

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.

6.2 Power Spectral Density

6.2.1 Test Setup

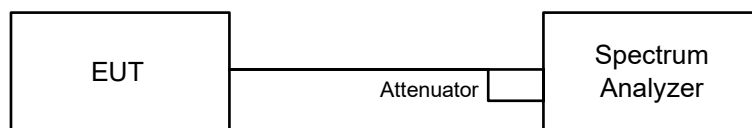


6.2.2 Test Procedure

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: 3 kHz.
- Set the VBW $\geq 3 \times$ RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.

6.3 6 dB Bandwidth

6.3.1 Test Setup

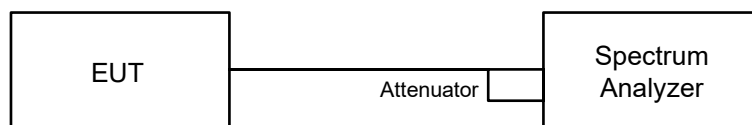


6.3.2 Test Procedure

- Set resolution bandwidth (RBW) = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

6.4 Conducted Out of Band Emissions

6.4.1 Test Setup



6.4.2 Test Procedure

MEASUREMENT PROCEDURE REF

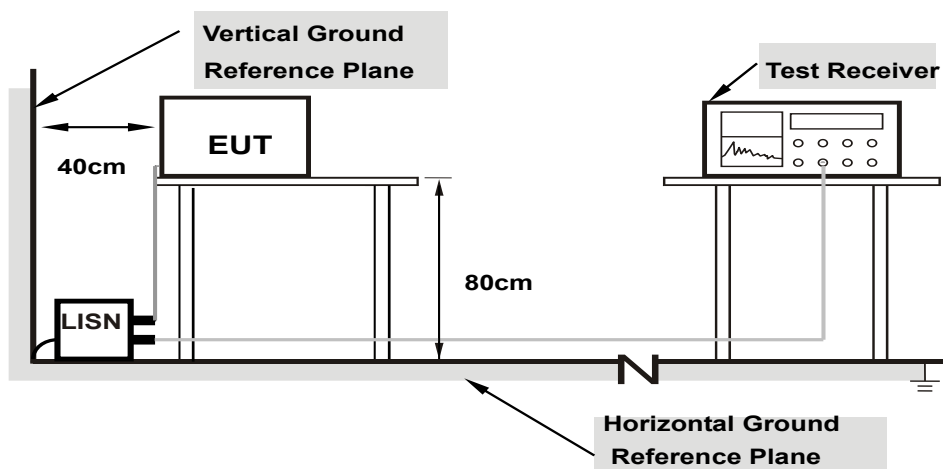
- Set the RBW = 100 kHz.
- Set the VBW ≥ 300 kHz.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

- Set RBW = 100 kHz.
- Set VBW ≥ 300 kHz.
- Detector = peak.
- Sweep = auto couple.
- Trace Mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

6.5 AC Power Conducted Emissions

6.5.1 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).

6.5.2 Test Procedure

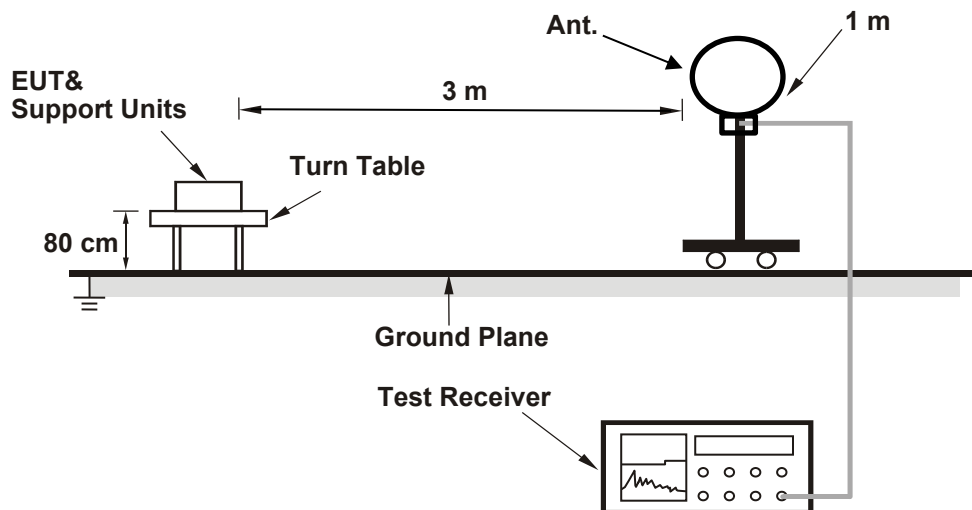
- The EUT was placed on a 0.8 meter to the top of table and placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50 uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- 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.

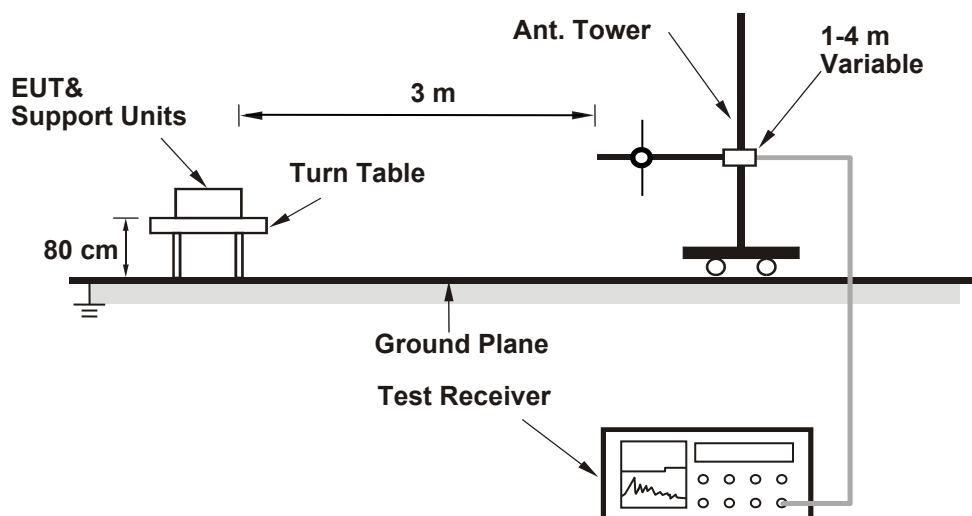
6.6 Unwanted Emissions below 1 GHz

6.6.1 Test Setup

For Radiated emission below 30 MHz



For Radiated emission above 30 MHz



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

6.6.2 Test Procedure

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 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. 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, except for the frequency band (9 kHz to 90 kHz and 110 kHz to 490 kHz) set to average detect function and peak detect function.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200 Hz at frequency below 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz or 10 kHz at frequency (150 kHz to 30 MHz).
3. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated emission above 30 MHz

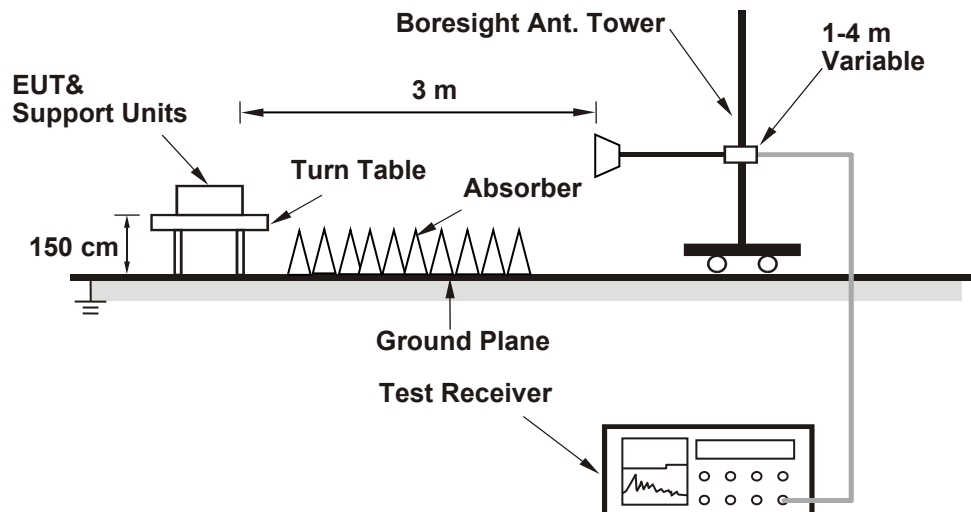
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the 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.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

6.7 Unwanted Emissions above 1 GHz

6.7.1 Test Setup



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

6.7.2 Test Procedure

- The EUT was placed on the top of a rotating table 1.5 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- The test-receiver/spectrum analyzer 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.

Notes:

- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection (AV) at frequency above 1 GHz.
- For fundamental and harmonic signal measurement, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $< 98\%$) or 10 Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1 GHz.
- All modes of operation were investigated and the worst-case emissions are reported.

7 Test Results of Test Item

7.1 RF Output Power

Input Power:	3.87 Vdc	Environmental Conditions:	23°C, 62% RH	Tested By:	Dolly Chung
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For Peak Power

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
0	2402	1.932	2.86	30	Pass
19	2440	1.871	2.72	30	Pass
39	2480	1.762	2.46	30	Pass

Note: The antenna gain is 3.91 dBi <= 6 dBi, so the output power limit shall not be reduced.

For Average Power

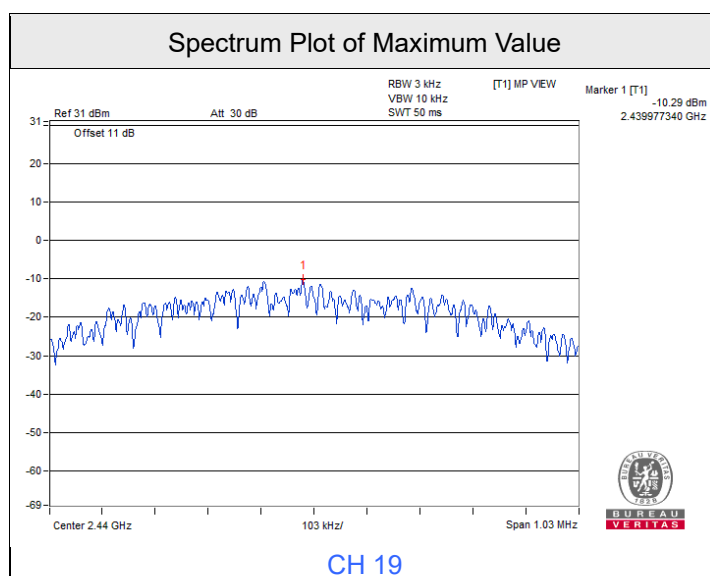
Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	1.803	2.56
19	2440	1.742	2.41
39	2480	1.644	2.16

7.2 Power Spectral Density

Input Power:	3.87 Vdc	Environmental Conditions:	23°C, 62% RH	Tested By:	Dolly Chung
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Chan.	Chan. Freq. (MHz)	PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Test Result
0	2402	-10.51	8	Pass
19	2440	-10.29	8	Pass
39	2480	-10.69	8	Pass

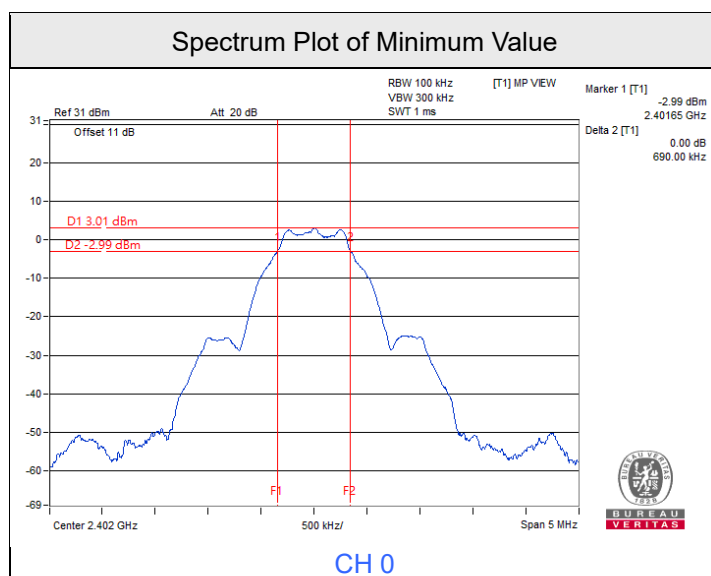
Note: The antenna gain is 3.91 dBi <= 6 dBi, so the power density limit shall not be reduced.



7.3 6 dB Bandwidth

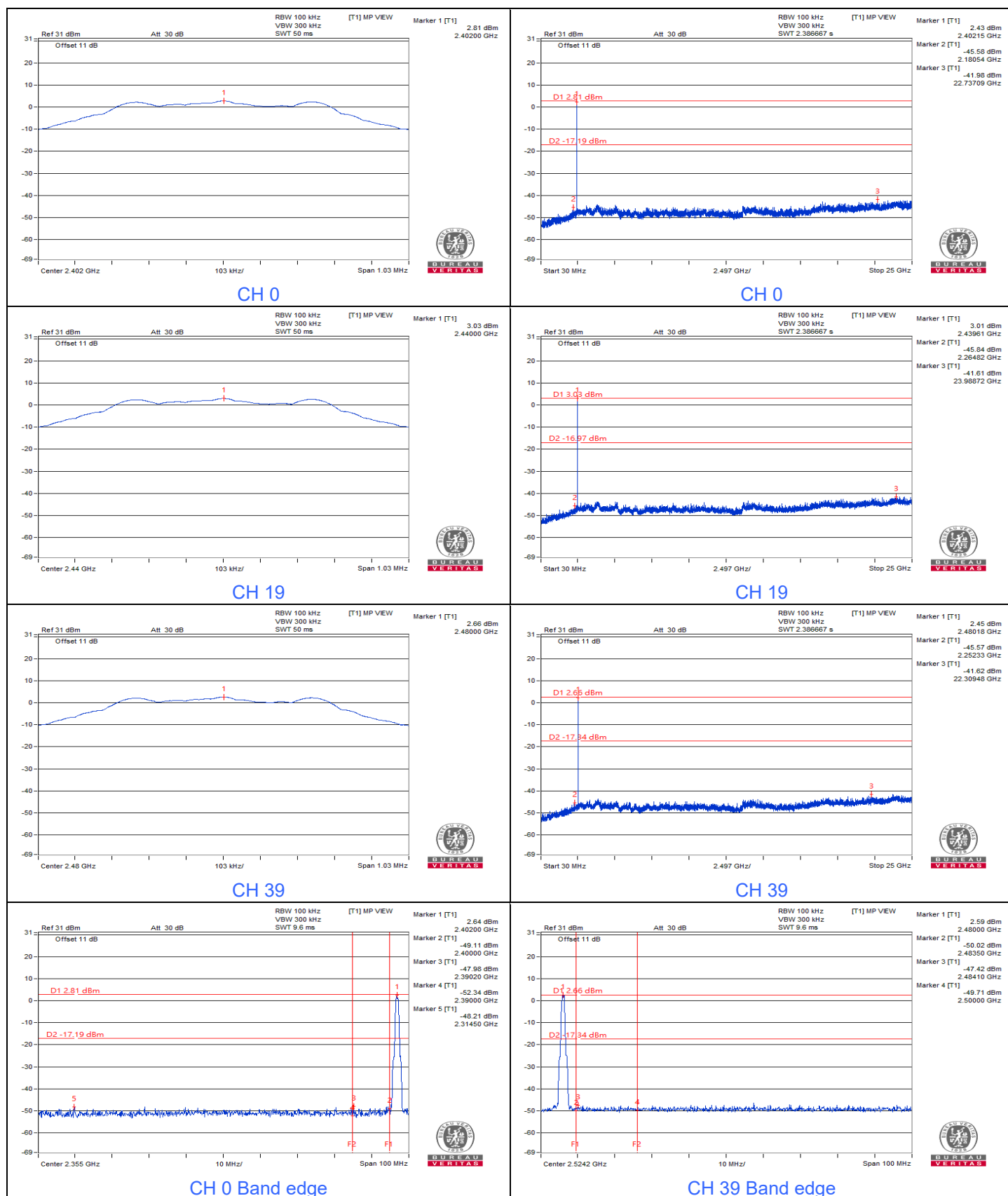
Input Power:	3.87 Vdc	Environmental Conditions:	23°C, 62% RH	Tested By:	Dolly Chung
--------------	----------	---------------------------	--------------	------------	-------------

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
0	2402	0.69	0.5	Pass
19	2440	0.69	0.5	Pass
39	2480	0.69	0.5	Pass



7.4 Conducted Out of Band Emissions

Input Power:	3.87 Vdc	Environmental Conditions:	23°C, 62% RH	Tested By:	Dolly Chung
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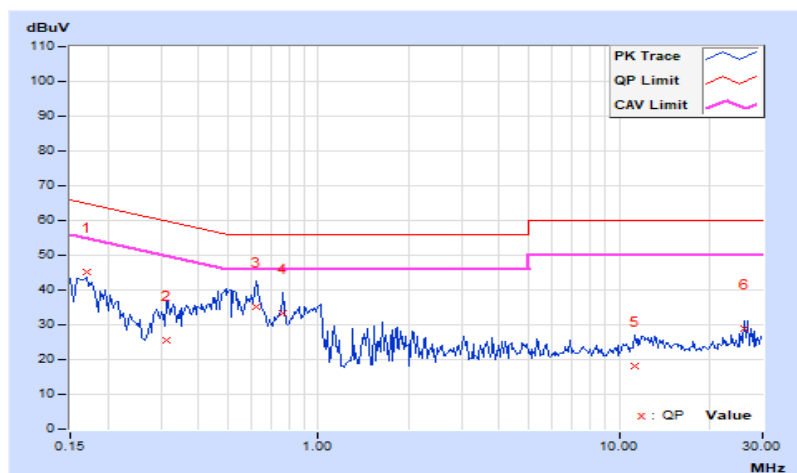
7.5 AC Power Conducted Emissions

RF Mode	BT-LE 1M	Channel	CH 0 : 2402 MHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68% RH
Tested By	Roy Mai		

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	0.16953	9.97	35.10	7.62	45.07	17.59	64.98	54.98	-19.91	-37.39
2	0.31406	9.99	15.74	-6.35	25.73	3.64	59.86	49.86	-34.13	-46.22
3	0.61875	10.00	25.17	2.43	35.17	12.43	56.00	46.00	-20.83	-33.57
4	0.76719	10.01	23.27	22.18	33.28	32.19	56.00	46.00	-22.72	-13.81
5	11.20703	10.52	7.62	-8.45	18.14	2.07	60.00	50.00	-41.86	-47.93
6	25.95703	11.04	18.01	16.84	29.05	27.88	60.00	50.00	-30.95	-22.12

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

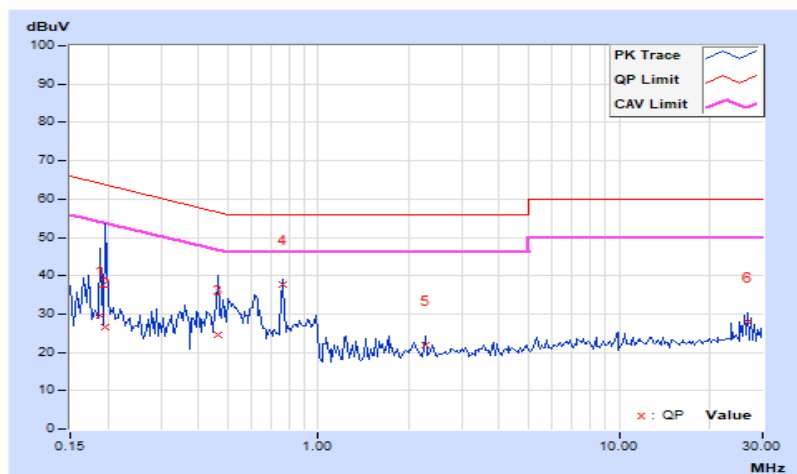


RF Mode	BT-LE 1M	Channel	CH 0 : 2402 MHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	24 °C, 75% RH
Tested By	Roy Mai		

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	0.18906	10.02	19.58	-3.12	29.60	6.90	64.08	54.08	-34.48	-47.18
2	0.19687	10.02	16.67	-3.24	26.69	6.78	63.74	53.74	-37.05	-46.96
3	0.46641	10.01	14.44	-6.33	24.45	3.68	56.58	46.58	-32.13	-42.90
4	0.76328	10.03	27.56	27.37	37.59	37.40	56.00	46.00	-18.41	-8.60
5	2.28906	10.11	11.81	10.04	21.92	20.15	56.00	46.00	-34.08	-25.85
6	26.71875	10.86	17.15	16.11	28.01	26.97	60.00	50.00	-31.99	-23.03

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



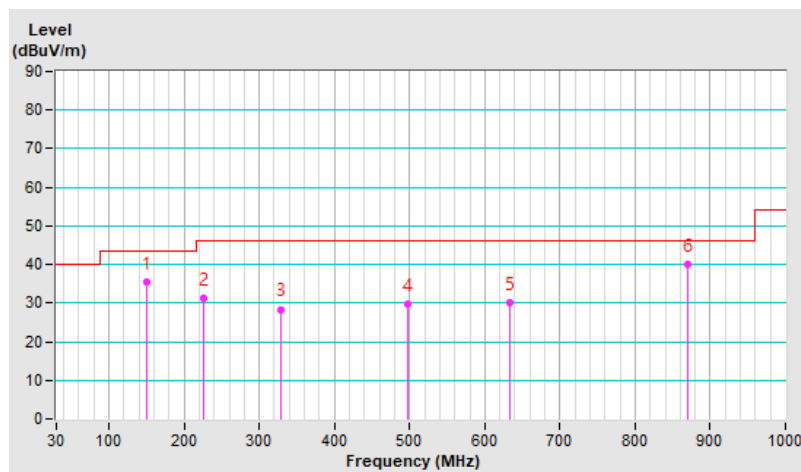
7.6 Unwanted Emissions below 1 GHz

RF Mode	BT-LE 1M	Channel	CH 0 : 2402 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	8 °C, 52% RH
Tested By	Roy Mai		

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	150.01	35.4 QP	43.5	-8.1	1.00 H	257	47.8	-12.4
2	226.72	31.2 QP	46.0	-14.8	3.00 H	58	46.4	-15.2
3	329.22	28.4 QP	46.0	-17.6	3.00 H	128	39.2	-10.8
4	497.88	29.8 QP	46.0	-16.2	1.50 H	298	36.6	-6.8
5	632.52	30.1 QP	46.0	-15.9	2.00 H	78	33.9	-3.8
6	869.83	40.1 QP	46.0	-5.9	1.50 H	25	40.4	-0.3

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 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.

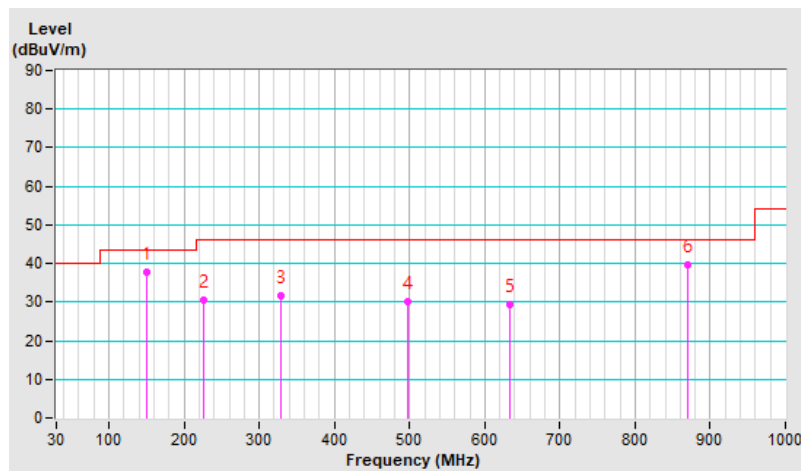


RF Mode	BT-LE 1M	Channel	CH 0 : 2402 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	8 °C, 52% RH
Tested By	Roy Mai		

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	150.01	37.7 QP	43.5	-5.8	2.00 V	36	50.1	-12.4
2	226.72	30.4 QP	46.0	-15.6	2.00 V	113	45.6	-15.2
3	329.22	31.6 QP	46.0	-14.4	1.50 V	35	42.4	-10.8
4	497.88	30.2 QP	46.0	-15.8	1.00 V	125	37.0	-6.8
5	632.52	29.4 QP	46.0	-16.6	1.00 V	58	33.2	-3.8
6	869.83	39.6 QP	46.0	-6.4	2.00 V	149	39.9	-0.3

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 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.



7.7 Unwanted Emissions above 1 GHz

RF Mode	BT-LE 1M	Channel	CH 0 : 2402 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 kHz, DET=Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	24 °C, 72% RH
Tested By	Roy Mai		

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	55.2 PK	74.0	-18.8	1.36 H	112	58.3	-3.1
2	2390.00	43.3 AV	54.0	-10.7	1.36 H	112	46.4	-3.1
3	*2402.00	104.0 PK			1.36 H	112	107.2	-3.2
4	*2402.00	103.1 AV			1.36 H	112	106.3	-3.2
5	4804.00	40.0 PK	74.0	-34.0	3.03 H	354	37.8	2.2
6	4804.00	31.2 AV	54.0	-22.8	3.03 H	354	29.0	2.2
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	55.6 PK	74.0	-18.4	1.30 V	82	58.7	-3.1
2	2390.00	43.9 AV	54.0	-10.1	1.30 V	82	47.0	-3.1
3	*2402.00	103.2 PK			1.30 V	82	106.4	-3.2
4	*2402.00	102.9 AV			1.30 V	82	106.1	-3.2
5	4804.00	38.1 PK	74.0	-35.9	1.07 V	70	35.9	2.2
6	4804.00	29.3 AV	54.0	-24.7	1.07 V	70	27.1	2.2

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.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	BT-LE 1M	Channel	CH 19 : 2440 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 kHz, DET=Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	24 °C, 72% RH
Tested By	Roy Mai		

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	103.9 PK			1.72 H	197	107.2	-3.3
2	*2440.00	103.1 AV			1.72 H	197	106.4	-3.3
3	4880.00	42.1 PK	74.0	-31.9	2.99 H	340	40.0	2.1
4	4880.00	32.9 AV	54.0	-21.1	2.99 H	340	30.8	2.1
5	7320.00	38.5 PK	74.0	-35.5	3.33 H	305	31.1	7.4
6	7320.00	29.4 AV	54.0	-24.6	3.33 H	305	22.0	7.4
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	102.3 PK			1.50 V	87	105.6	-3.3
2	*2440.00	101.3 AV			1.50 V	87	104.6	-3.3
3	4880.00	37.6 PK	74.0	-36.4	1.02 V	74	35.5	2.1
4	4880.00	28.9 AV	54.0	-25.1	1.02 V	74	26.8	2.1
5	7320.00	39.8 PK	74.0	-34.2	2.22 V	143	32.4	7.4
6	7320.00	27.4 AV	54.0	-26.6	2.22 V	143	20.0	7.4

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.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.

RF Mode	BT-LE 1M	Channel	CH 39 : 2480 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 kHz, DET=Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	24 °C, 72% RH
Tested By	Roy Mai		

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	103.6 PK			1.97 H	196	106.7	-3.1
2	*2480.00	102.5 AV			1.97 H	196	105.6	-3.1
3	2483.50	56.1 PK	74.0	-17.9	1.97 H	196	59.2	-3.1
4	2483.50	43.5 AV	54.0	-10.5	1.97 H	196	46.6	-3.1
5	4960.00	41.4 PK	74.0	-32.6	2.98 H	348	39.0	2.4
6	4960.00	32.4 AV	54.0	-21.6	2.98 H	348	30.0	2.4
7	7440.00	38.9 PK	74.0	-35.1	3.38 H	319	31.2	7.7
8	7440.00	29.6 AV	54.0	-24.4	3.38 H	319	21.9	7.7
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	103.5 PK			1.06 V	83	106.6	-3.1
2	*2480.00	102.2 AV			1.06 V	83	105.3	-3.1
3	2483.50	55.6 PK	74.0	-18.4	1.06 V	83	58.7	-3.1
4	2483.50	43.2 AV	54.0	-10.8	1.06 V	83	46.3	-3.1
5	4960.00	37.8 PK	74.0	-36.2	1.05 V	77	35.4	2.4
6	4960.00	29.2 AV	54.0	-24.8	1.05 V	77	26.8	2.4
7	7440.00	39.8 PK	74.0	-34.2	2.22 V	151	32.1	7.7
8	7440.00	27.2 AV	54.0	-26.8	2.22 V	151	19.5	7.7

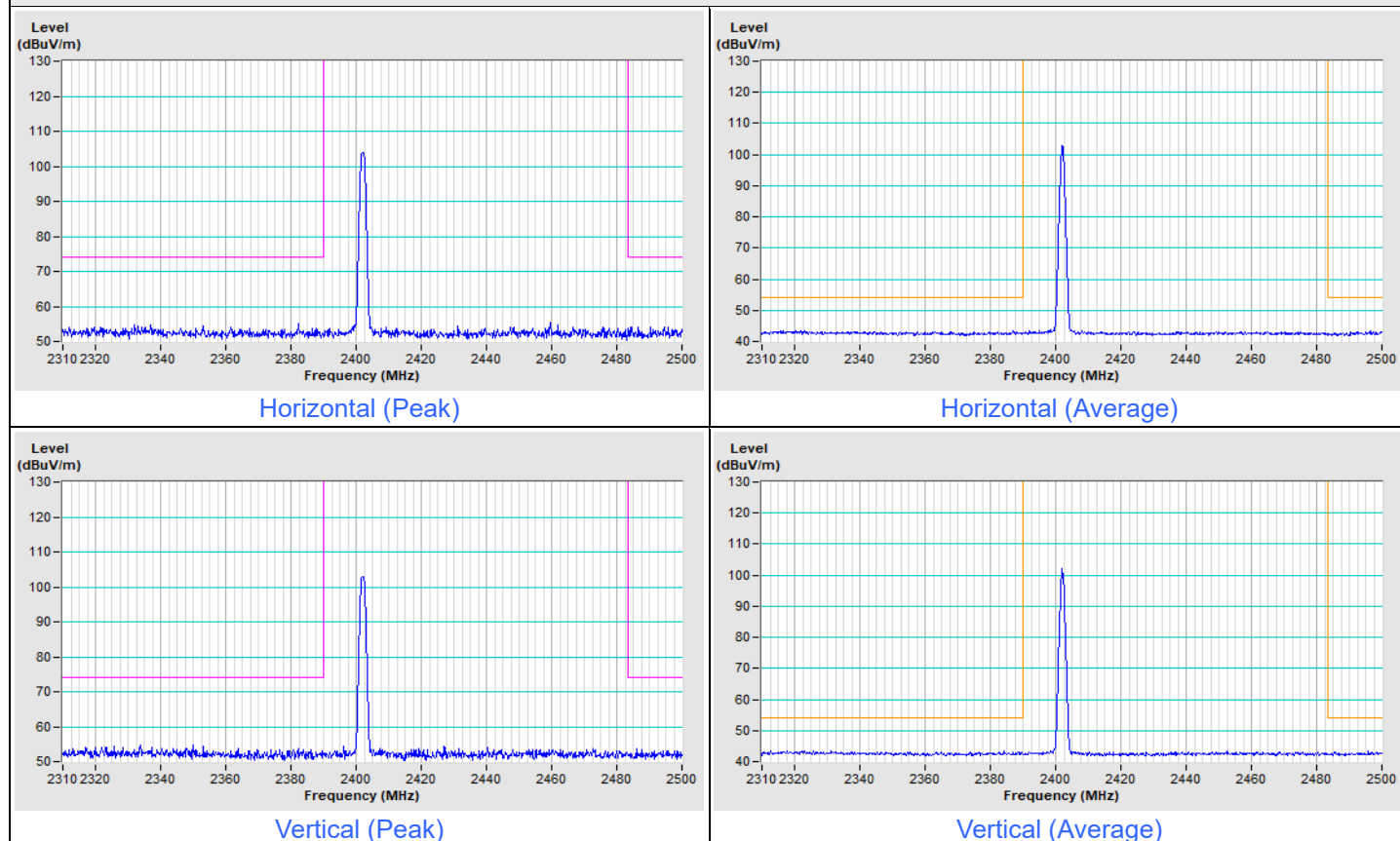
Remarks:

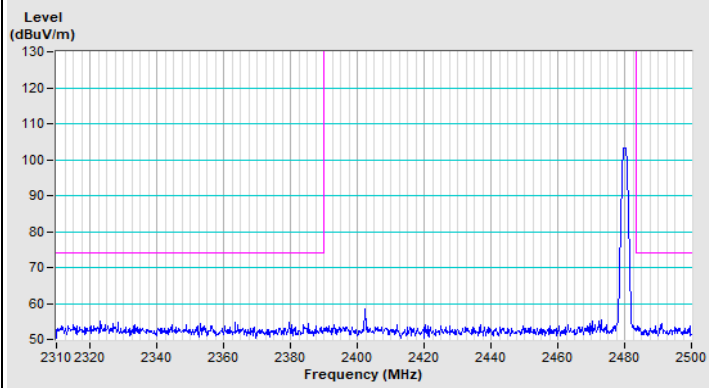
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency,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

Plot of Band Edge

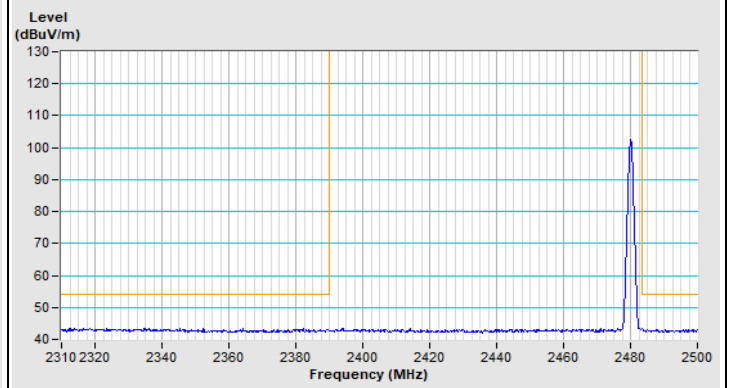
Frequency Range	2.31 GHz ~ 2.5 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 kHz, DET=Peak
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BT-LE 1M Channel 0

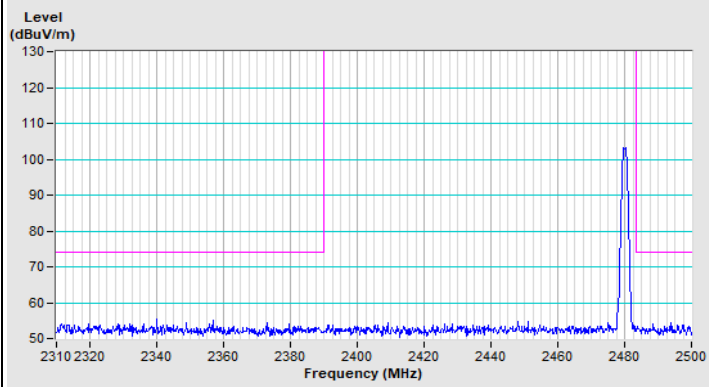


BT-LE 1M Channel 39

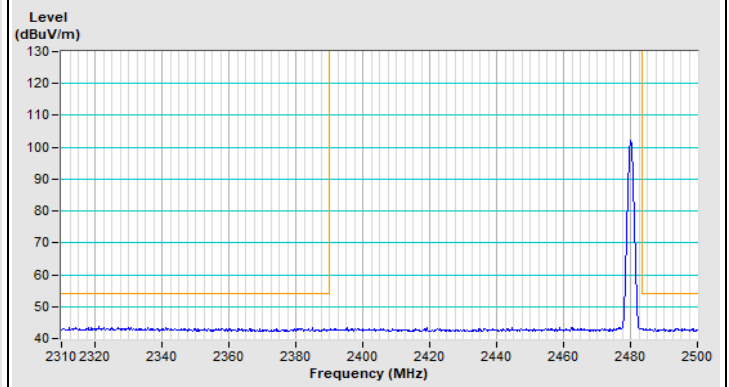
Horizontal (Peak)



Horizontal (Average)



Vertical (Peak)



Vertical (Average)

8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo)

9 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

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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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