

FCC Test Report

FCC ID : 2ALXJ-MTW200

Equipment : Meeting OWL™

Model No. : MTW200

Brand Name : OWLLabs™

Applicant : Owl Labs Inc

Address : 33-1/2 Union Sq

Somerville US 02143 United States Of America

Standard : 47 CFR FCC Part 15.247

Received Date : Jul. 17, 2019

Tested Date : Jul. 25 ~ Jul. 31, 2019

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by: Approved by:

Along Chen / Assistant Manager Gary Chang / Manager

Testing Laboratory

2732

Report No.: FR971702AE Report Version: Rev. 01



Table of Contents

1	GENERAL DESCRIPTION	5
1.1	Information	5
1.2	Local Support Equipment List	
1.3	Test Setup Chart	
1.4	Test Equipment List and Calibration Data	8
1.5	Test Standards	
1.6	Deviation from Test Standard and Measurement Procedure	g
1.7	Measurement Uncertainty	g
2	TEST CONFIGURATION	10
2.1	Testing Condition	10
2.2	The Worst Test Modes and Channel Details	10
3	TRANSMITTER TEST RESULTS	11
3.1	Conducted Emissions	11
3.2	6dB and Occupied Bandwidth	16
3.3	RF Output Power	20
3.4	Power Spectral Density	23
3.5	Emissions in Restricted Frequency Bands	27
3.6	Emissions in non-restricted Frequency Bands	45
4	TEST LABORATORY INFORMATION	48



Release Record

Report No.	Version	Description	Issued Date
FR971702AE	Rev. 01	Initial issue	Aug. 12, 2019

Report No.: FR971702AE Page: 3 of 48



Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	AC Power Line Conducted Emissions	[dBuV]: 4.549MHz 50.32 (Margin -5.68dB) -QP	Pass
15.247(d)	Radiated Emissions	[dBuV/m at 3m]: 264.54MHz	Pass
15.209	Radiated Effissions	35.93 (Margin -10.07dB) - PK	F a 3 3
15.247(b)(3)	Maximum Output Power	Power [dBm]: 6.55	Pass
15.247(a)(2)	6dB Bandwidth	Meet the requirement of limit	Pass
15.247(e)	Power Spectral Density	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Report No.: FR971702AE Page: 4 of 48



1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information							
Frequency Range (MHz) Bluetooth Ch. Freq. (MHz) Channel Number Data Rate							
2400-2483.5	2400-2483.5 V5.0 LE		0-39 [40]	1 Mbps			
2400-2483.5 V5.0 LE 2402-2480 0-39 [40] 2 Mbps							
Note 1: Bluetooth LE	Note 1: Bluetooth LE (Low energy) uses GFSK modulation.						

1.1.2 Antenna Details

Ant. No.	Model	Туре	Connector	Gain (dBi)	Remarks
1	SRF2W012-150	PCB	MHF IPEX	3.0dBi	

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	12Vdc from adapter
-------------------	--------------------

1.1.4 Accessories

	Accessories					
No.	Equipment	Description				
1	AC Adapter	Brand: HOLOTO Model: ADS-40SI-12-2 12036E Power Rating: I/P: 100-240Vac, 50/60Hz, 1A Max O/P: 12Vdc, 3A Power Line: DC 1.49m non-shielded without core AC 2.13m non-shielded without core				
2	USB Cable	1.97m non-shielded without core				

Report No.: FR971702AE Page: 5 of 48



1.1.5 Channel List

	Frequency band (MHz)				2400~	2483.5	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
37	2402	9	2422	18	2442	28	2462
0	2404	10	2424	19	2444	29	2464
1	2406	38	2426	20	2446	30	2466
2	2408	11	2428	21	2448	31	2468
3	2410	12	2430	22	2450	32	2470
4	2412	13	2432	23	2452	33	2472
5	2414	14	2434	24	2454	34	2474
6	2416	15	2436	25	2456	35	2476
7	2418	16	2438	26	2458	36	2478
8	2420	17	2440	27	2460	39	2480

1.1.6 Test Tool and Duty Cycle

Test Tool	QRCT, version: 3.0.298.0				
	Modulation Mode	Duty Cycle (%)	Duty Factor (dB)		
Duty Cycle and Duty Factor	GFSK/1Mbps	63.89%	1.95		
	GFSK/2Mbps	34.26%	4.65		

1.1.7 Power Index of Test Tool

Madulation Mada	Test Frequency (MHz)			
Modulation Mode	2402	2440	2480	
GFSK/1Mbps	Default	Default	Default	
GFSK/2Mbps	Default	Default	Default	

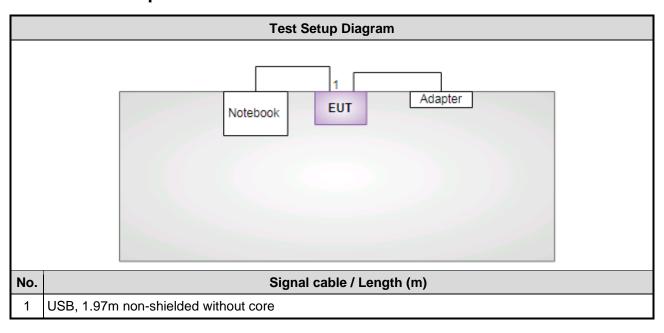
Report No.: FR971702AE Page: 6 of 48



1.2 Local Support Equipment List

	Support Equipment List						
No. Equipment Brand Model FCC ID Remarks					Remarks		
1	Notebook	DELL	Latitude E5470	DoC			

1.3 Test Setup Chart



Report No.: FR971702AE Page: 7 of 48



1.4 Test Equipment List and Calibration Data

Test Item	Conducted Emission							
Test Site	Conduction room 1 / (Conduction room 1 / (CO01-WS)						
Instrument	Manufacturer Model No. Serial No. Calibration Date Calibration Until							
Receiver	R&S	ESR3	101657	Jan. 08, 2019	Jan. 07, 2020			
LISN	R&S	ENV216	101579	Mar. 08, 2019	Mar. 07, 2020			
LISN (Support Unit)	SCHWARZBECK	Schwarzbeck 8127	8127-666	Nov. 29, 2018	Nov. 28, 2019			
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 23, 2018	Oct. 22, 2019			
50 ohm terminal (Support Unit)	NA	50	04	May 28, 2019	May 27, 2020			
Measurement Software	AUDIX	e3	6.120210k	NA	NA			
Note: Calibration Int	Note: Calibration Interval of instruments listed above is one year.							

Test Item	Radiated Emission						
Test Site	966 chamber1 / (03CH01-WS)						
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until		
Spectrum Analyzer	R&S	FSV40	101498	Dec. 27, 2018	Dec. 26, 2019		
Receiver	R&S	ESR3	101658	Dec. 11, 2018	Dec. 10, 2019		
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 12, 2019	Jul. 11, 2020		
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 18, 2018	Dec. 17, 2019		
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2018	Nov. 14, 2019		
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 09, 2018	Nov. 08, 2019		
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 08, 2018	Oct. 07, 2019		
Preamplifier	EMC	EMC02325	980225	Jul. 09, 2019	Jul. 08, 2020		
Preamplifier	Agilent	83017A	MY39501308	Oct. 04, 2018	Oct. 03, 2019		
Preamplifier	EMC	EMC184045B	980192	Aug. 09, 2018	Aug. 08, 2019		
RF Cable	EMC	EMC104-SM-SM-80 00	181106	Oct. 08, 2018	Oct. 07, 2019		
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 08, 2018	Oct. 07, 2019		
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Oct. 08, 2018	Oct. 07, 2019		
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	Oct. 08, 2018	Oct. 07, 2019		
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 08, 2018	Oct. 07, 2019		
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Oct. 08, 2018	Oct. 07, 2019		
Measurement Software	AUDIX	e3	6.120210g	NA	NA		
Note: Calibration Inter	rval of instruments liste	d above is one year.					

Report No.: FR971702AE Page: 8 of 48



Test Item	RF Conducted								
Test Site	(TH01-WS)	(TH01-WS)							
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until				
Spectrum Analyzer	R&S	FSV40	101063	Apr. 17, 2019	Apr. 16, 2020				
Spectrum Analyzer	R& S	FSV40	101499	Jan. 07, 2019	Jan. 06, 2020				
Power Meter	Anritsu	ML2495A	1241002	Oct. 09, 2018	Oct. 08, 2019				
Power Sensor	Anritsu	MA2411B	1207366	Oct. 09, 2018	Oct. 08, 2019				
DC POWER SOURCE	GW INSTEK	GPC-6030D	EM892433	Oct. 25, 2018	Oct. 24, 2019				
AC POWER SOURCE	APC	AFC-500W	F312060012	Nov. 29, 2018	Nov. 28, 2019				
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA				
Note: Calibration Inte	rval of instruments liste	d above is one year.							

1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.247

ANSI C63.10-2013

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

1.6 Deviation from Test Standard and Measurement Procedure

None

1.7 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Measurement Uncertainty				
Parameters	Uncertainty			
Bandwidth	±34.130 Hz			
Conducted power	±0.808 dB			
Power density	±0.583 dB			
Conducted emission	±2.715 dB			
AC conducted emission	±2.92 dB			
Radiated emission ≤ 1GHz	±3.41 dB			
Radiated emission > 1GHz	±4.59 dB			

Report No.: FR971702AE Page: 9 of 48



2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	24°C / 58%	Alex Tsai
Radiated Emissions	03CH01-WS	25-27°C / 65-66%	Akun Chung
RF Conducted	TH01-WS	24°C / 65%	Brad Wu

FCC Designation No.: TW2732FCC site registration No.: 181692

➤ ISED#: 10807A

➤ CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Data Rate	Test Configuration
AC Power Line Conducted Emissions Radiated Emissions ≤ 1GHz	BT LE BT LE	2480 2480	1Mbps 2Mbps	
Maximum Output Power 6dB bandwidth Power spectral density Radiated Emissions > 1GHz	BT LE BT LE	2402, 2440, 2480 2402, 2440, 2480	1Mbps 2Mbps	

Report No.: FR971702AE Page: 10 of 48



3 Transmitter Test Results

3.1 Conducted Emissions

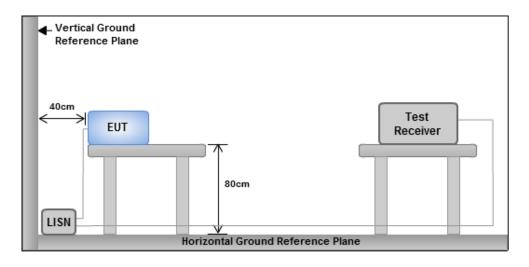
3.1.1 Limit of Conducted Emissions

Conducted Emissions Limit						
Frequency Emission (MHz) Quasi-Peak Average						
0.15-0.5	66 - 56 *	56 - 46 *				
0.5-5	56	46				
5-30 60 50						
Note 1: * Decreases with the logarithm of the frequency.						

3.1.2 Test Procedures

- 1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
- 2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50 Ω LISN port.
- 3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
- 4. This measurement was performed with AC 120V/60Hz

3.1.3 Test Setup



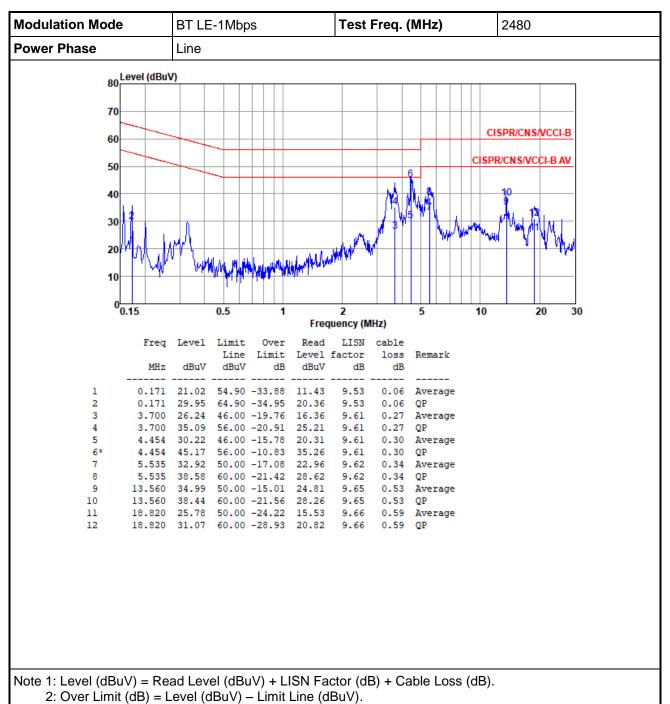
Note: 1. Support units were connected to second LISN.

Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

Report No.: FR971702AE Page: 11 of 48

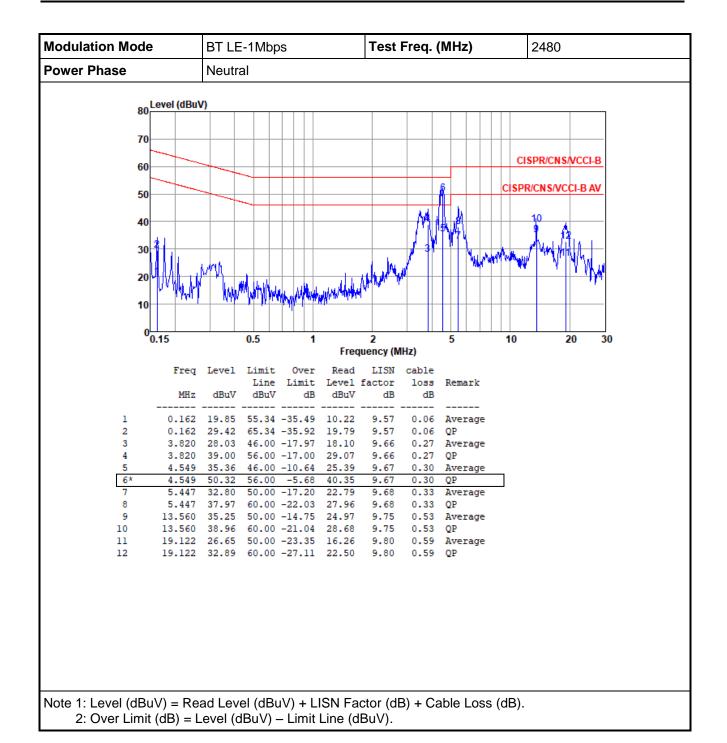


3.1.4 Test Result of Conducted Emissions



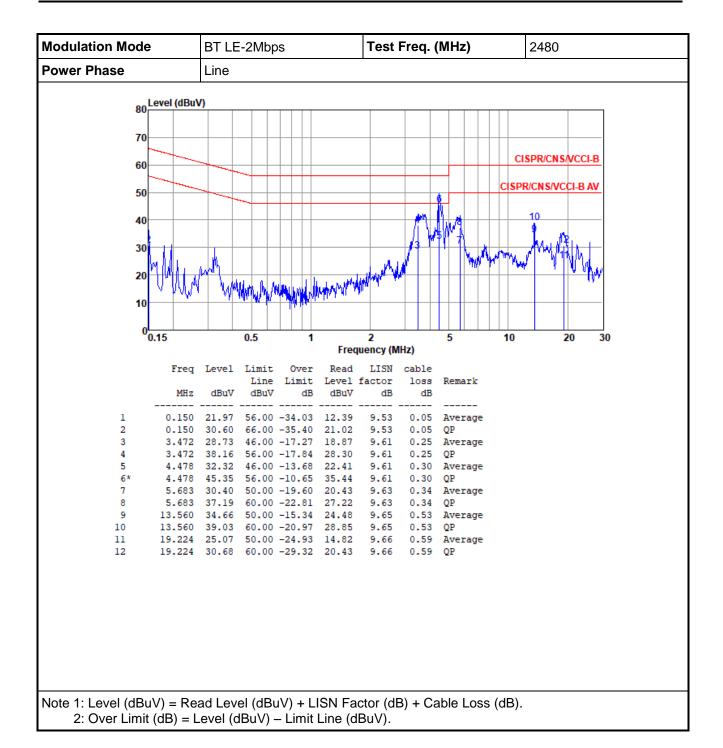
Report No.: FR971702AE Page: 12 of 48





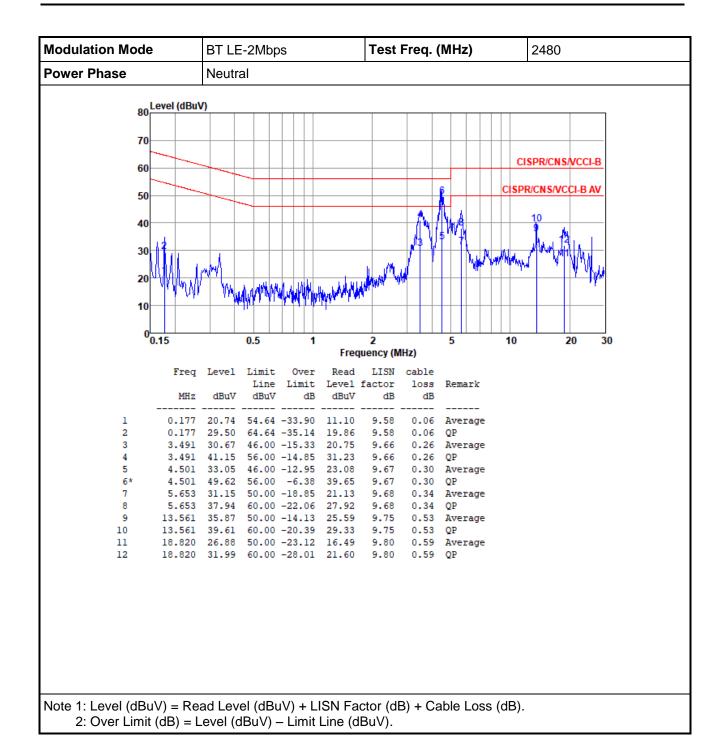
Report No.: FR971702AE Page: 13 of 48





Report No.: FR971702AE Page: 14 of 48





Report No.: FR971702AE Page: 15 of 48



3.2 6dB and Occupied Bandwidth

3.2.1 Limit of 6dB Bandwidth

The minimum 6dB bandwidth shall be at least 500 kHz.

3.2.2 Test Procedures

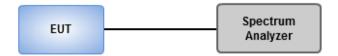
6dB Bandwidth

- 1. Set resolution bandwidth (RBW) = 100 kHz, Video bandwidth = 300 kHz.
- Detector = Peak, Trace mode = max hold.
- 3. Sweep = auto couple, Allow the trace to stabilize.
- 4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

- Set resolution bandwidth (RBW) = 1% ~ 5 % of OBW, Video bandwidth = 3 x RBW.
- 2. Detector = Sample, Trace mode = max hold.
- 3 Sweep = auto couple, Allow the trace to stabilize.
- 4. Use the OBW measurement function of spectrum analyzer to measure the occupied bandwidth.

3.2.3 Test Setup



Report No.: FR971702AE Page: 16 of 48



3.2.4 Test Result of 6dB and Occupied Bandwidth

Summary

Mode	Max-N dB	Max-OBW	ITU-Code	Min-N dB	Min-OBW
	(Hz)	(Hz)		(Hz)	(Hz)
2.4-2.4835GHz	-	1	-	1	-
BT-LE(1Mbps)	663.043k	1.024M	1M02F1D	655.797k	1.02M
BT-LE(2Mbps)	1.109M	2.033M	2M03F1D	1.094M	2.019M

Max-N dB = Maximum 6dB down bandwidth; Max-OBW = Maximum 99% occupied bandwidth; Min-N dB = Minimum 6dB down bandwidth; Min-OBW = Minimum 99% occupied bandwidth;

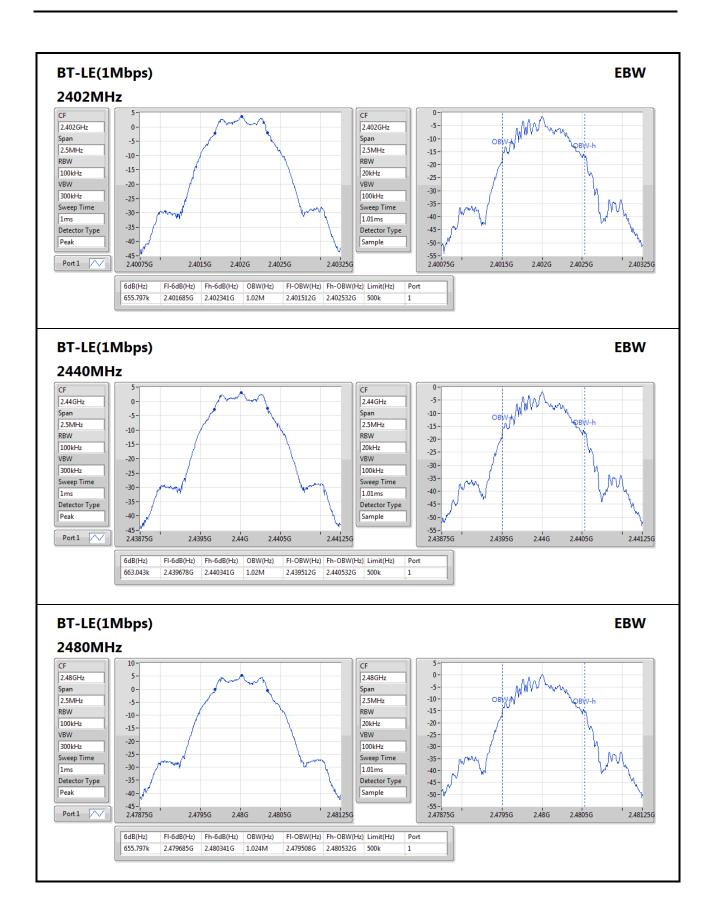
Result

Mode	Result	Limit	Port 1-N dB	Port 1-OBW
		(Hz)	(Hz)	(Hz)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	500k	655.797k	1.02M
2440MHz	Pass	500k	663.043k	1.02M
2480MHz	Pass	500k	655.797k	1.024M
BT-LE(2Mbps)	-	-	-	-
2402MHz	Pass	500k	1.094M	2.019M
2440MHz	Pass	500k	1.109M	2.019M
2480MHz	Pass	500k	1.094M	2.033M

Port X-N dB = Port X 6dB down bandwidth; Port X-OBW = Port X 99% occupied bandwidth;

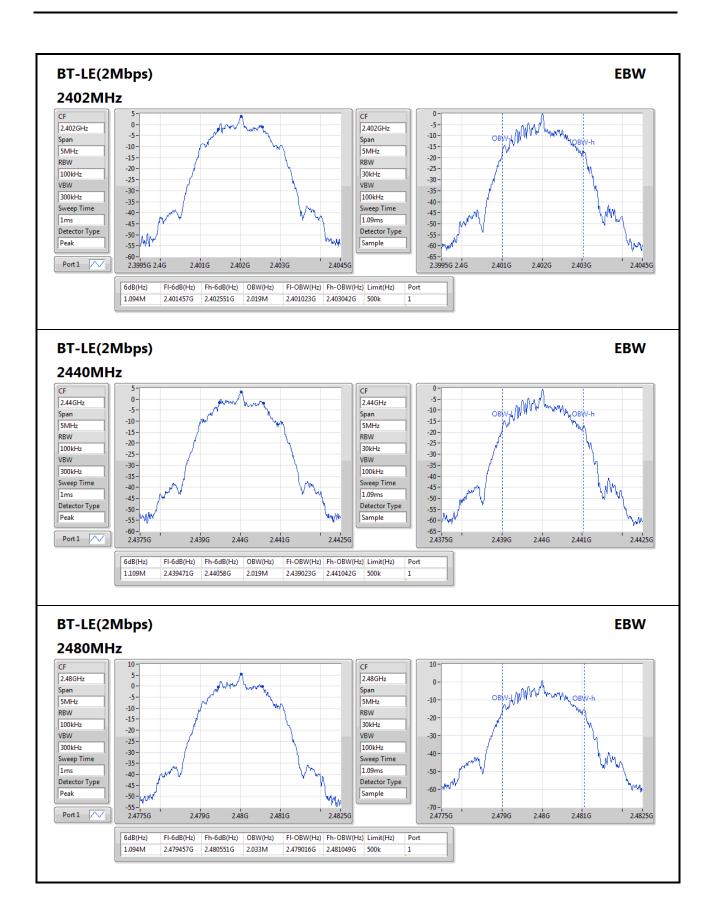
Report No.: FR971702AE Page: 17 of 48





Report No.: FR971702AE Page: 18 of 48





Report No.: FR971702AE Page: 19 of 48



3.3 RF Output Power

3.3.1 Limit of RF Output Power

Conducted power shall not exceed 1 Watt.

Antenna gain <= 6dBi, no any corresponding reduction is in output power limit.

3.3.2 Test Procedures

A broadband RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.

3.3.3 Test Setup



Report No.: FR971702AE Page: 20 of 48



3.3.4 Test Result of Maximum Output Power

Peak Power

Summary

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	6.29	0.00426
BT-LE(2Mbps)	6.55	0.00452

Result

Mode	Result	Gain	Power	Power Limit
		(dBi)	(dBm)	(dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	3.00	4.79	30.00
2440MHz	Pass	3.00	4.28	30.00
2480MHz	Pass	3.00	6.29	30.00
BT-LE(2Mbps)	-	-	-	-
2402MHz	Pass	3.00	5.08	30.00
2440MHz	Pass	3.00	4.53	30.00
2480MHz	Pass	3.00	6.55	30.00

Report No.: FR971702AE Page: 21 of 48



Average Power Summary

Mode	Power	Power
	(dBm)	(W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	6.10	0.00407
BT-LE(2Mbps)	6.08	0.00406

Result

Mode	Result	Gain (dBi)	Power (dBm)	Power Limit (dBm)
		(ubi)	(dBiii)	(abiii)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	3.00	4.60	-
2440MHz	Pass	3.00	4.08	-
2480MHz	Pass	3.00	6.10	-
BT-LE(2Mbps)	-	-	-	-
2402MHz	Pass	3.00	4.59	-
2440MHz	Pass	3.00	4.04	-
2480MHz	Pass	3.00	6.08	-

Note: Average power is for reference only.

Report No.: FR971702AE Page: 22 of 48



3.4 Power Spectral Density

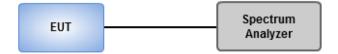
3.4.1 Limit of Power Spectral Density

Power spectral density shall not be greater than 8 dBm in any 3 kHz band.

3.4.2 Test Procedures

- 1. Set the RBW = 3 kHz, VBW = 10 kHz.
- 2. Detector = Peak, Sweep time = auto couple.
- 3. Trace mode = max hold, allow trace to fully stabilize.
- 4. Use the peak marker function to determine the maximum amplitude level.

3.4.3 Test Setup



Report No.: FR971702AE Page: 23 of 48



3.4.4 Test Result of Power Spectral Density

Summary

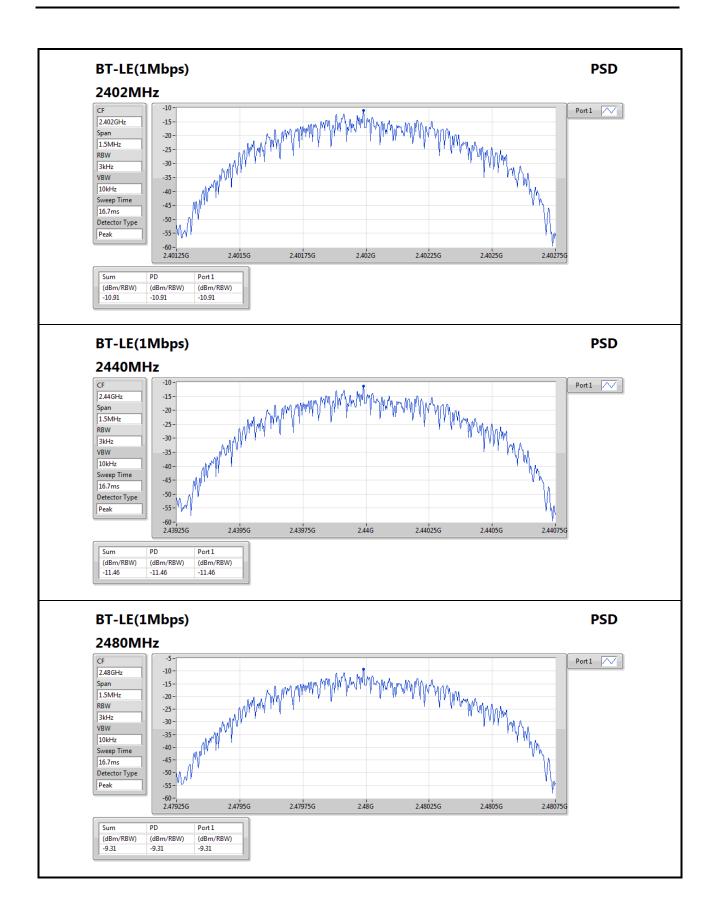
Mode	PD
	(dBm/RBW)
2.4-2.4835GHz	-
BT-LE(1Mbps)	-9.31
BT-LE(2Mbps)	-12.99

Result

Mode	Result	Gain	PD	PD Limit	
		(dBi)	(dBm/RBW)	(dBm/RBW)	
BT-LE(1Mbps)	-	-	-	-	
2402MHz	Pass	3.00	-10.91	8.00	
2440MHz	Pass	3.00	-11.46	8.00	
2480MHz	Pass	3.00	-9.31	8.00	
BT-LE(2Mbps)	-	-	-	-	
2402MHz	Pass	3.00	-14.51	8.00	
2440MHz	Pass	3.00	-14.95	8.00	
2480MHz	Pass	3.00	-12.99	8.00	

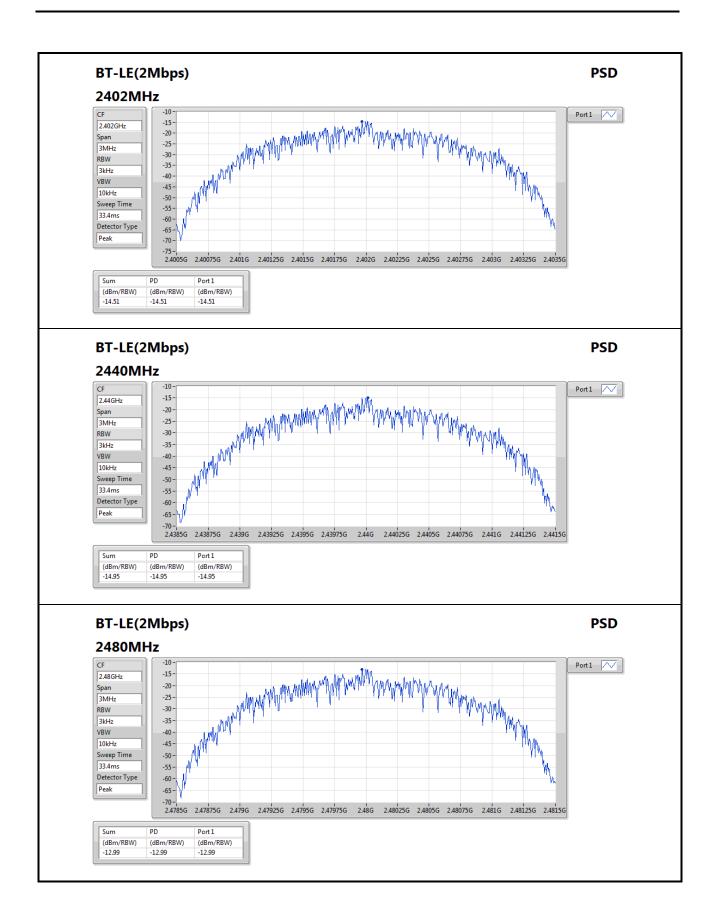
Report No.: FR971702AE Page: 24 of 48





Report No.: FR971702AE Page: 25 of 48





Report No.: FR971702AE Page: 26 of 48



3.5 Emissions in Restricted Frequency Bands

3.5.1 Limit of Emissions in Restricted Frequency Bands

	Restricted Band	Emissions Limit	
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:

Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit **Note 2:**

Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

3.5.2 Test Procedures

- 1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
- 2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
- 3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

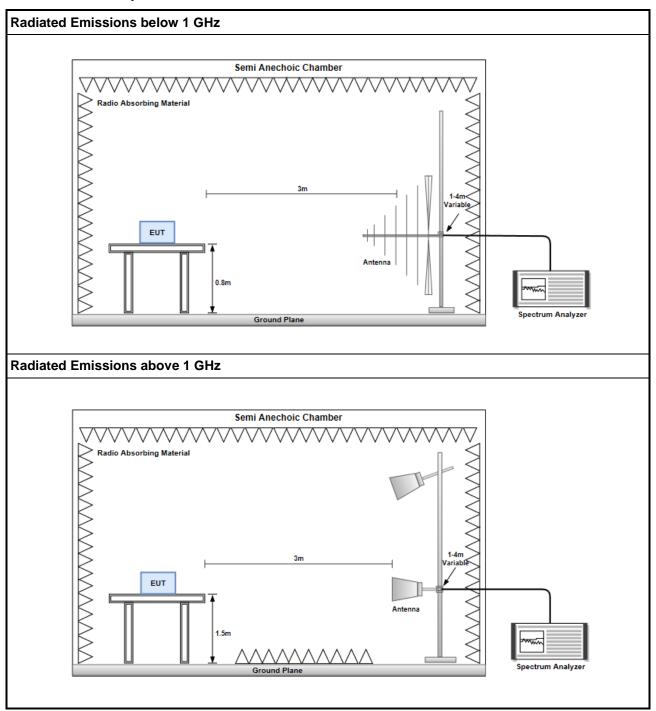
Note:

- 1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
- 2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
- RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

Report No.: FR971702AE Page: 27 of 48



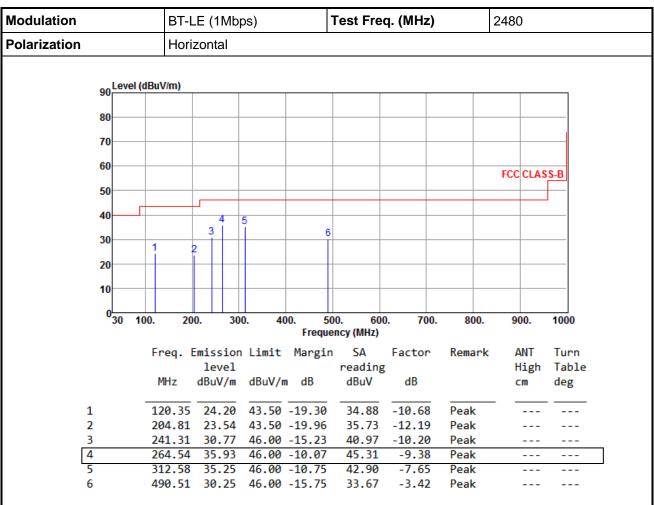
3.5.3 Test Setup



Report No.: FR971702AE Page: 28 of 48



3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Report No.: FR971702AE Page: 29 of 48



Modulation		BT-	LE (1Mb _l	os)	-	Test Fre	q. (MHz)		2480				
Polarization		Vertical											
	90 Leve	el (dBuV/m)											
	70 60 50								FCC CLAS	SS-B			
	40	2 3	4	5	6								
	20 10												
	030	100. 2	00. 30	0. 40	00. 50 Freque	0. 600 ncy (MHz)	0. 700.	800.	900.	1000			
		Freq. MHz	Emission level dBuV/m		Margin		Factor G dB	Remark	ANT High cm	Turn Table deg			
1 2		68.24 131.2	26.20	43.50	-17.30	35.51 35.82	-10.20 -9.62	Peak Peak					
3 4 5			26.44 1 29.63 1 32.54	46.00		34.94 39.03 40.20	-8.50 -9.40 -7.66	Peak Peak Peak					
6		456.8			-14.26	35.72	-3.98	Peak					

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Report No.: FR971702AE Page: 30 of 48



Modulation	BT-L	BT-LE (2Mbps) Test Freq. (MHz) 2480									
Polarization	Horizontal										
90 Level	l (dBuV/m)										
80											
70											
60											
00								FCC CLAS	SS-B		
50									+		
40											
40		3	5								
30	1 ,			6 							
20											
10											
030	400 200		2 40		0 000	700	000	000	4000		
30	100. 200). 30	0. 40		0. 600 ncy (MHz)). 700 .	800.	900.	1000		
	Freq. E	mission	Limit	Margin	SA	Factor	Remark	ANT	Turn		
		level		_	reading			High	Table		
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg		
1	121.54	24.54	43.50	-18.96	35.10	-10.56	Peak				
2	204.31	23.41		-20.09	35.59	-12.18	Peak				
3	241.61				41.47		Peak				
4	262.99	35.88	46.00	-10.12	45.36	-9.48	Peak				
5	312.54					-7.65	Peak				
6	490.54	29.52	46.00	-16.48	32.94	-3.42	Peak				

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Report No.: FR971702AE Page: 31 of 48



Modulation				BT-LE (2	2Mbp	os)		Т	est Fre	q. (MH	z)	2	2480		
Polarization			'	Vertical											
	90 ^L	evel (dBuV/r	m)			1								
	80-														
	80														
	70														
	60												FCC /	CL A C	
	50												FCC (LLAS	2-B
	40				-	5	١.,								
	30	1	2	3	4	<u></u>	6								
	20														
	10														
	03	0 1	00.	200.	300). 4	00. Fr	500 equer	0. 60 ncy (MHz)	0. 70	00.	800.	900	0.	1000
			Fre	q. Emis	sion	Limit		-	SA	Factor	r l	Remark	AN	NΤ	Turn
					vel			0	reading				Hi	igh	Table
			MH	z dBu	V/m	dBuV/r	n dB	3	dBuV	dB			CI	n	deg
	1		68	.24 25	.31	40.00	-14.	69	35.51	-10.20	 9 F	Peak	_		
	2			.24 25	.95	43.50			35.58	-9.6		Peak	-		
	3					43.50			35.31			Peak	-		
	4 5					46.00 46.00			38.76 39.51			Peak Peak			
	6					46.00			34.88			Peak			

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain

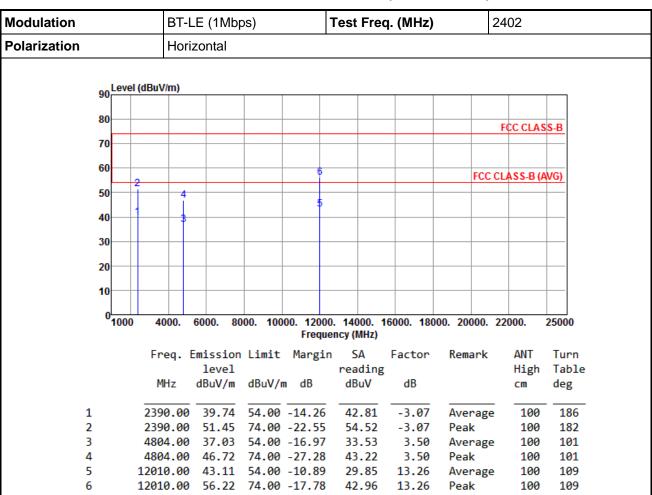
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Report No.: FR971702AE Page: 32 of 48



3.5.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR971702AE Page: 33 of 48

^{*}Factor includes antenna factor, cable loss and amplifier gain



3

4

5

Modulation	BT-L	E (1Mbp	os)		Test	Freq	ı. (MHz))	24	02			
Polarization		Vertical											
	90	Level	(dBuV/m)										
	80												
											F	CC CLAS	S-B
	70												
	60					6					500.01		100
		- 2				- Ĭ					FCC CL	ASS-B (A	WG)
	50		1			5							
	40		3										
	30												
	20												
	20												
	10												
	0												
		1000	4000.	6000. 80	00. 100		00. 14(uency (6000. 180	000. 20	000. 22	2000.	25000
			Freq. E	mission	Limit	Margi	in S	δA	Factor	Rem	ark	ANT	Turn
				level				ding				High	Table
			MHz	dBuV/m	dBuV/r	n dB		BuV	dB			cm	deg
	1		2390.00	39.75	54.00	-14.2	42	2.82	-3.07	Ave	rage	247	92
	2		2390.00					1.52	-3.07	Pea	_	247	92

54.00 -13.98

74.00 -26.47

36.52

44.03

30.55

42.47

3.50

3.50

13.26

13.26

Average

Average

Peak

Peak

100

100

100

100

156

156

147

147

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

4804.00 40.02

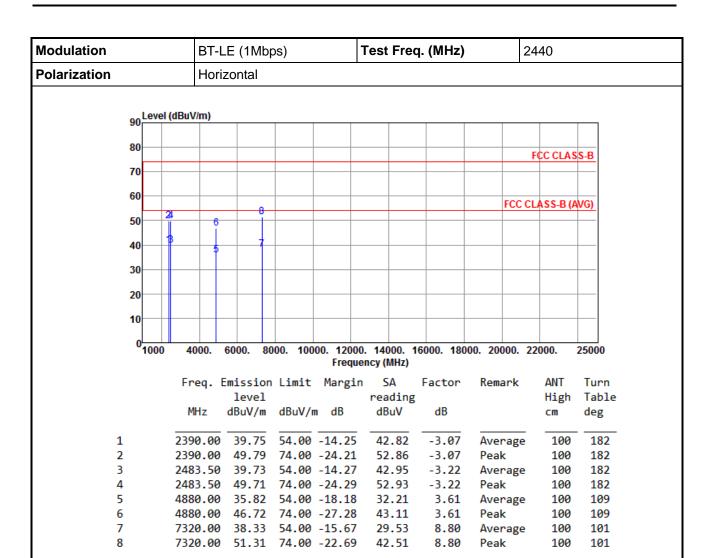
4804.00 47.53

12010.00 43.81 54.00 -10.19

12010.00 55.73 74.00 -18.27

Report No.: FR971702AE Page: 34 of 48





Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR971702AE Page: 35 of 48



Modulation			BT-	LE (1Mb	ops)		Test Fred	q. (MHz)		2440				
Polarization			Vertical											
	90	Level	(dBuV/m)											
	80													
										FCC CLAS	S-B			
	70													
	60										<u> </u>			
			24						FCC	CLASS-B (A	WG)			
	50		6											
	40	-	B 5	- 7										
	30													
	50													
	20													
	10													
	0													
	U	1000	4000.	6000. 8	3000. 100). 14000. 1 ency (MHz)	6000. 180	00. 20000.	22000.	25000			
			Enoa	Emiccio	n limit	Margir		Factor	Remark	ANT	Turn			
			rreq.	level		Hargi	reading		IVEIII A	High	Table			
			MHz	dBuV/m	dBuV/	m dB	dBuV	dB		cm	deg			
:	1		2390.00	39.75	54.00	-14.25	42.82	-3.07	Average	247	90			
	2		2390.00	49.90	74.00	-24.10	52.97	-3.07	Peak	247	90			
	3		2483.50				42.84	-3.22	Average	247	90			
	4					-23.72	53.50	-3.22	Peak	247	90			
	5		4880.00				34.88	3.61	Average		153			
	5		4880.00			-27.50	42.89	3.61	Peak	100	153			
	7		7320.00	38.74	54.00	-15.26	29.94	8.80	Average	100	148			

8.80

Peak

100

148

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain

7320.00 52.03 74.00 -21.97 43.23

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR971702AE Page: 36 of 48



Modulation			Į i	BT-L	.E (1M	bps)			Test	Fred	լ. (MHz)		2480		
Polarization			Horizontal												
	90 ^L	evel	(dBuV/ı	m)											
	80														
	00												F	CC CLAS	S-B
	70	-				-									
	60														
	00		2			6						F	CC CL/	ASS-B (A	WG)
	50	+		4		Ť									
	40	-	1	-		5									
	30														
	20														
	10	+													_
	ا														
	۲1	1000	400	00.	6000.	8000.	100		140) 10. 140 10. 140		6000. 180	00. 2000	0. 22	000.	25000
			Fre	a. E	missio	on Li	mit	Margi	n S	Δ	Factor	Remar	·k	ANT	Turn
					leve			6-		ding				High	Table
			MH	z	dBuV/r	n dB	uV/	m dB	dB	uV	dB			cm	deg
	1		2483	.50	40.02	2 54	.00	-13.98	43	.24	-3.22	Avera	nge	100	184
	2				53.36			-20.64		.58	-3.22	Peak		100	184
	3							-15.75		.39	3.86	Avera	ige	100	105
4	4		4960	.00	47.22	2 74	.00	-26.78	43	.36	3.86	Peak		100	105

8.54

8.54

Average

Peak

102

102

100

100

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain

7440.00 38.15 54.00 -15.85

7440.00 51.43 74.00 -22.57 42.89

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR971702AE Page: 37 of 48

Report Version: Rev. 01



4

5

Modulation			BT-l	_E (1Mbp	os)	-	Test Fred	q. (MHz)	2	2480					
Polarization			Vert	Vertical											
	90	Level	(dBuV/m)												
	80									TCC CLAS					
	70									FCC CLAS	3-B				
	70														
	60		2						ECC (CLASS-B (A	MC)				
	50		4	6					rcc	JLA33-D (F	WG)				
	50		1 1												
	40			- 5											
	30														
	20														
	10														
	0														
		1000	4000.	6000. 80	00. 100). 14000. 1 ency (MHz)	6000. 180	00. 20000. 2	22000.	25000				
			Frea.	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn				
				level			reading			High	Table				
			MHz	dBuV/m	dBuV/r	n dB	dBuV	dB		cm	deg				
	1		2483.50	40.66	54.00	-13.34	43.88	-3.22	Average	245	87				
	2		2483.50			-19.82	57.40	-3.22	Peak	245	87				
	3		4960.00	41.22	54.00	-12.78	37.36	3.86	Average	100	152				
	_														

74.00 -25.75

44.39

30.28

43.86

3.86

8.54

8.54

Peak

Peak

Average

100

100

100

152

150

150

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

4960.00 48.25

7440.00 38.82 54.00 -15.18

7440.00 52.40 74.00 -21.60

Report No.: FR971702AE Page: 38 of 48



2

3

4

5

Modulation	BT-LE (2Mbp	os)	Test Freq. (N	ЛHz)	2402								
Polarization	Horizontal												
90 Level	(dBuV/m)												
80													
70					FCC CLASS-B								
70													
60		6		FCC	C CLASS-B (AVG)								
50	4				3 32 13 3 (11 3)								
40	 	5											
30													
20													
10													
01000	4000. 6000. 80		00. 14000. 16000 iency (MHz)	. 18000. 20000.	. 22000. 2500								
	Freq. Emission	Limit Margi	n SA Fac	tor Remark	: ANT Tui								
	level		reading		High Tal								
	MHz dBuV/m	dBuV/m dB	dBuV d	IB	cm deg								
1	2390.00 39.14	54.00 -14.86	42.21 -3	3.07 Averag	ge 114 18								

53.82

33.18

43.86

29.94

43.85

-3.07

3.50

3.50

13.26

13.26

Peak

Peak

Peak

Average

Average

114

100

100

100

100

182

111

111

102

102

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

2390.00 50.75 74.00 -23.25

12010.00 43.20 54.00 -10.80

12010.00 57.11 74.00 -16.89

54.00 -17.32

74.00 -26.64

36.68

4804.00

4804.00 47.36

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR971702AE Page: 39 of 48



Modulation			BT-	LE (2Mbp	os)		Test Free	q. (MHz)		2402	2402			
Polarization			Vertical											
90	Level	(dBuV	//m)											
80														
										FCC CLAS	S-B			
70														
60	\vdash		-			6			FCC	CLASS-B (A	V(C)			
50			_						FCC	CLASS-B (A	WG)			
		2	ΙĪ			5								
40			T											
30	-													
20														
10														
(1000	40	000.	6000. 80	00. 100		0. 14000. 1 ency (MHz)	16000. 180	00. 20000.	22000.	25000			
		En	en	Emission	limit	_		Factor	Remark	ANT	Turn			
			-4.	level	LIMIL	nui gi	reading		Aciidi K	High	Table			
		М	Hz	dBuV/m	dBuV/ı	n dB	dBuV	dB		cm	deg			
4		220	0.00	39.88	E4 00	14 12	42.05	- 2 07	A	263				
1 2						-14.12 -33.23	42.95 43.84	-3.07 -3.07	Average Peak	263 263	87 87			
3						-15.35		3.50	Average		158			
4		480	4.00	46.79	74.00	-27.21	43.29	3.50	Peak	100	158			

13.26

13.26

Average

Peak

100

100

159

159

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain

12010.00 43.50 54.00 -10.50

12010.00 56.50 74.00 -17.50 43.24

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR971702AE Page: 40 of 48

Report Version: Rev. 01



Modulation			BT-I	_E (2Mb	ops)		Test Fre	q. (MHz)		2440				
Polarization			Horizontal											
	90	Level	(dBuV/m)											
	80									FCC CLAS	SS-B			
	70													
	60													
	00			8					FCC (CLASS-B (A	AVG)			
	50		24 6								+-			
	40		в	7							\perp			
			1											
	30										\vdash			
	20													
	40													
	10													
	0	1000	4000.	6000.	3000. 100			16000. 180	00. 20000.	22000.	25000			
						Frequ	ency (MHz)							
			Freq.			Margin		Factor	Remark	ANT	Turn			
				level			reading			High	Table			
			MHz	dBuV/m	dBuV/	m dB	dBuV	dB		CM	deg			
	1		2390.00	39.48	54.00	-14.52	42.55	-3.07	Average	115	185			
	2		2390.00			-24.27	52.80	-3.07	Peak	115	185			
	3		2483.50	39.92	54.00	-14.08	43.14	-3.22	Average		185			
	4		2483.50				52.96	-3.22	Peak	115	185			
	5		4882.00					3.61	Average		107			
	5		4882.00	46.75	74.00	-27.25	43.14	3.61	Peak	100	107			

8.79

8.79

Average

Peak

104

104

100

100

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain

7323.00 38.93 54.00 -15.07

7323.00 52.03 74.00 -21.97 43.24

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR971702AE Page: 41 of 48

Report Version: Rev. 01



Modulation			вт	-LE (21	Иbр	s)		T	est	Fred	դ. (M l	Hz)		2	2440		
Polarization			Vertical														
	90	Level	(dBuV/m)											1		$\overline{}$	
	80																
	•														FCC CLAS	SS-B	
	70	╙									_						
	60				_												
			24		8									FCC C	CLASS-B (A	AVG)	
	50)		5													
	40)	B		7												
	20																
	30	,															
	20	-			+			-								-	
	10																
	-	1															
	(1000	4000.	6000.	800	0. 100		12000. requei			6000.	180	000. 20	0000. 2	22000.	25000	
			Fred	Emiss	ion	limit					Fact	or	Rem	ıark	ANT	Turn	
				leve				8-11		ding					High		
			MHz	dBuV	/m	dBuV/ı	m d	В	dBı	_	dB	3			cm	deg	
	1		2390.0	0 39.	36	54.00	-1/	14	42	.93	-3.	97	Δνε	rage	263		
	2		2390.0			74.00				64	-3.		Pea	_	263		
	3		2483.5			54.00				70	-3.			rage	263		
	4		2483.5	0 49.	71	74.00	-24	.29	52	93	-3.	22	Pea	_	263	88	
	5		4882.0	0 36.	36	54.00	-17	.14	33.	25	3.	61	Ave	rage	100	158	
	5		4882.0	0 47.4	14	74.00	-26	.56	43.	.83	3.	61	Pea	k	100	158	
	_										_		_				

8.79

Average

Peak

100

100

166

166

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain

7323.00 39.64 54.00 -14.36 30.85

7323.00 52.04 74.00 -21.96 43.25

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR971702AE Page: 42 of 48

Report Version: Rev. 01



Modulation		BT-I	E (2Mb	ps)	,	Test Free	q. (MHz)		2480				
Polarization		Horizontal											
90	Level	(dBuV/m)											
80													
-									FCC CLAS	S-B			
70													
60		2											
	$\vdash \vdash$							FCC	CLASS-B (A	VG)			
50		4											
40		1 3	- 5										
30													
20													
10	\vdash												
0	1000	4000.	6000. 80	000. 100). 14000. 1 ency (MHz)	16000. 180	00. 20000.	22000.	25000			
		_			-					_			
		Freq.	level	Limit	Margin		Factor	Remark	ANT	Turn			
		MHz	dBuV/m	dBu\//	, dB	reading dBuV	dB		High cm	Table deg			
		МПZ	ubuv/m	ubuv/	ш ив	ubuv	uв		CIII	ueg			
1		2483.50	39.71	54.00	-14.29	42.93	-3.22	Average	113	184			
2		2483.50		74.00	-17.17	60.05	-3.22	Peak	113	184			
3		4960.00	37.68	54.00	-16.32	33.82	3.86	Average	100	109			
4		4960.00	47.28	74.00	-26.72	43.42	3.86	Peak	100	109			
5		7440.00	38.42	54.00	-15.58	29.88	8.54	Average	100	110			
_													

Peak

100

110

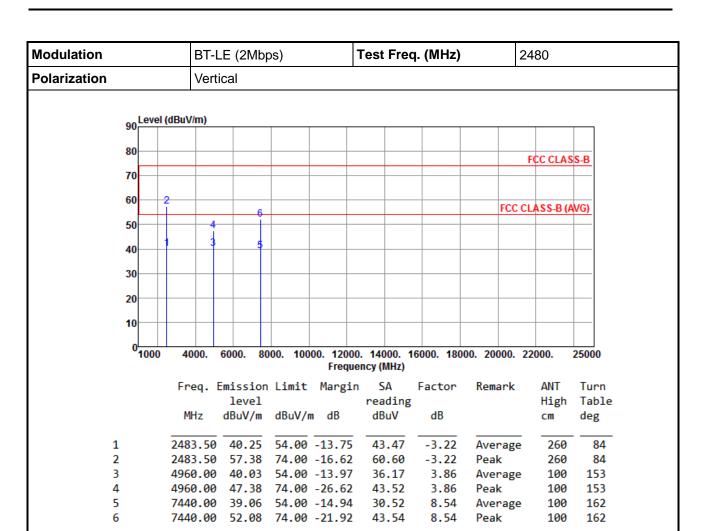
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain

7440.00 51.78 74.00 -22.22 43.24

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR971702AE Page: 43 of 48





Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Report No.: FR971702AE Page: 44 of 48



3.6 Emissions in non-restricted Frequency Bands

3.6.1 Emissions in non-restricted frequency bands limit

Peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz

3.6.2 Test Procedures

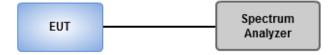
Reference level measurement

- 1. Set RBW=100kHz, VBW = 300kHz, Detector = Peak, Sweep time = Auto
- 2. Trace = max hold, Allow Trace to fully stabilize
- 3. Use the peak marker function to determine the maximum PSD level

Emission level measurement

- 1. Set RBW=100kHz, VBW = 300kHz, Detector = Peak, Sweep time = Auto
- 2. Trace = max hold, Allow Trace to fully stabilize
- 3. Scan Frequency range is up to 25GHz
- 4. Use the peak marker function to determine the maximum amplitude level

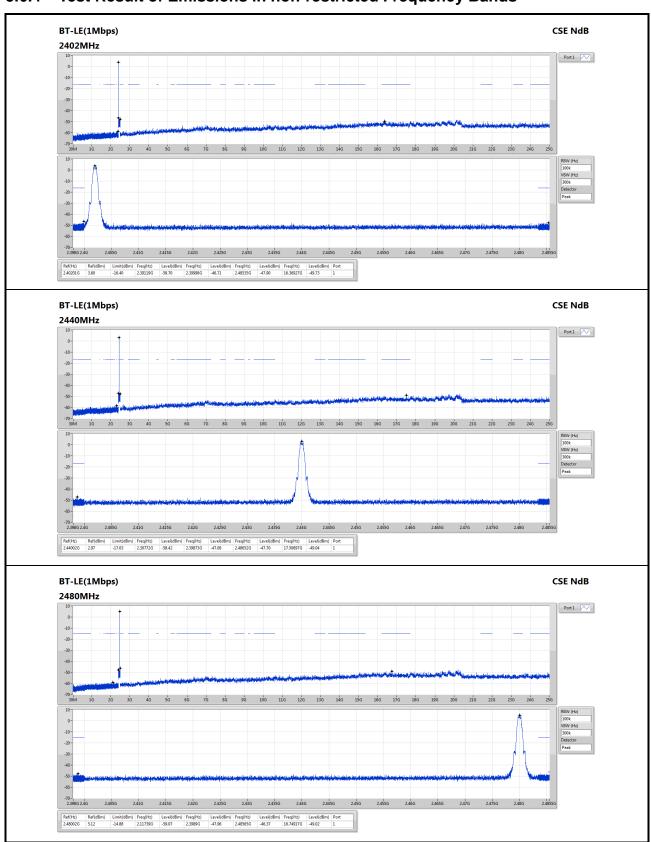
3.6.3 Test Setup



Report No.: FR971702AE Page: 45 of 48

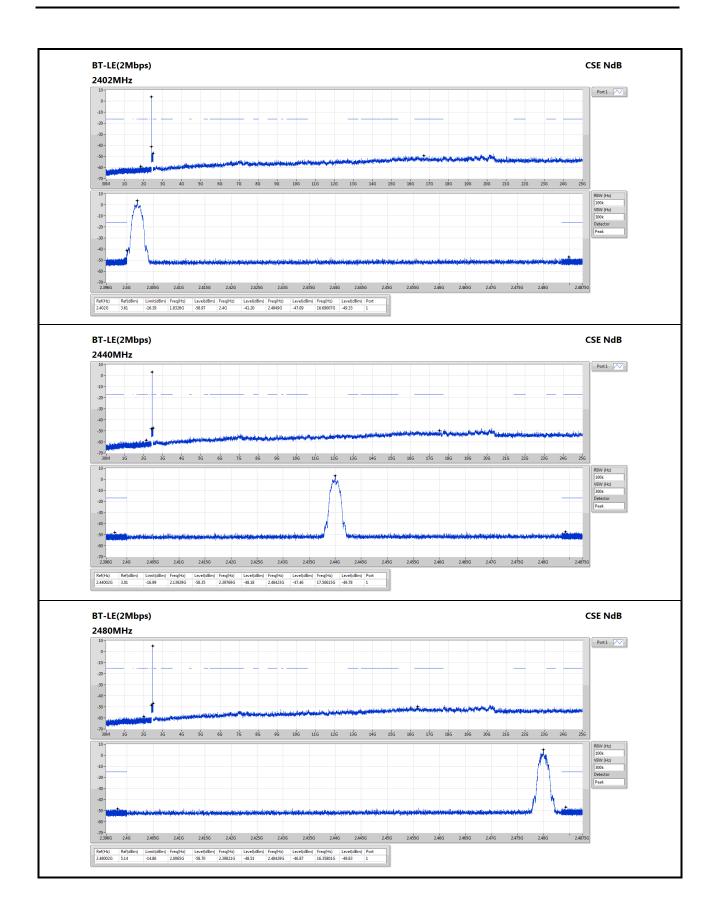


3.6.4 Test Result of Emissions in non-restricted Frequency Bands



Report No.: FR971702AE Page: 46 of 48





Report No.: FR971702AE Page: 47 of 48



4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website http://www.icertifi.com.tw.

Linkou

Tel: 886-2-2601-1640 No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.

Kwei Shan

Tel: 886-3-271-8666 No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

Kwei Shan Site II

Tel: 886-3-271-8640 No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information.

Tel: 886-3-271-8666 Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

==END==

Report No.: FR971702AE Page: 48 of 48