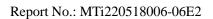


# **Test Report**

Report No.:	MTi220518006-06E2
Date of issue:	2022-07-05
Applicant:	Cherub Technology Co., Ltd.
Product:	Guitar and Bass Amp Modeling Earphone Amplug
Model(s):	MP-3
FCC ID:	2AOAA-MP-3

Shenzhen Microtest Co., Ltd. http://www.mtitest.com





## Instructions

1. This test report shall not be partially reproduced without the written consent of the laboratory.

2. The test results in this test report are only responsible for the samples submitted

3. This test report is invalid without the seal and signature of the laboratory.

4. This test report is invalid if transferred, altered, or tampered with in any form without authorization.

Any objection to this test report shall be submitted to the laboratory within
15 days from the date of receipt of the report.



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Test Result Certification					
Applicant: Cherub Technology Co., Ltd.					
Address: Room507, Block 1, Nanhai E-Cool, No. 6 Xinghua Road, Shekou, Nanshan D Shenzhen City, Guangdong Province, China, 518067					
Manufacturer:	Cherub Technology Co., Ltd.				
Address:	Room507, Block 1, Nanhai E-Cool, No. 6 Xinghua Road, Shekou, Nanshan District, Shenzhen City, Guangdong Province, China, 518067				
Factory:	Cherub Technology Co., Ltd. (Zhuhai High-tech Park)				
Address: No.10, Keji No.9Rd, Tangjiawan Town, Zhuhai National Hi-tech Industrial Development Zone, Zhuhai City, Guangdong Province, China, 519080					
Product description	on				
Product name:	Guitar and Bass Amp Modeling Earphone Amplug				
Trademark:	NUX				
Model name:	MP-3				
Serial Model:	N/A				
Standards:	FCC 47 CFR Part 15 Subpart C				
Test method:	ANSI C63.10-2013				
Date of Test	Date of Test				
Date of test:	2022-06-01 ~ 2022-06-15				
Test result:	Pass				

Test Engineer :

Yamice Xie

(Yanice Xie)

Reviewed By: :

loor chen

(Leon Chen)

Approved By: :

Tom Kue

(Tom Xue)



## **1** General Description

#### 1.1 Description of EUT

Product name:	Guitar and Bass Amp Modeling Earphone Amplug	
Model name:	MP-3	
Series Model:	N/A	
Model difference:	N/A	
Electrical rating:	Input: DC 5V/1A Battery: DC 3.7V 1450mAh	
Hardware version:	V1.0	
Software version:	V1.0	
Accessories:	Cable: USB-A to USB-C cable 1m	
EUT serial number:	MTi220518006-06-S0001	
RF specification:		
Bluetooth version:	V5.3	
Operation frequency:	2402 MHz ~ 2480 MHz	
Modulation type:	GFSK	
Antenna designation:	PCB antenna, antenna Gain: 1 dBi	
Max. peak conducted output power:	4.63 dBm	

#### 1.2 Description of test modes

#### 1.2.1 Operation channel list

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	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



#### 1.2.2 Test channels

Chanel	Frequency	
Lowest (CH0)	2402MHz	
Middle (CH19)	2440MHz	
Highest (CH39)	2480MHz	

Note: The test software has been used to control EUT for working in engineering mode, that enables selectable channel, and capable of continuous transmitting mode.

#### 1.2.3 Description of support units

Support equipment list					
Description	Model	Serial No.	Manufacturer		
Adapter	HW-090200CH0	/	Huizhou BYD Electronics Co., Ltd.		
Mobile phone	Mate 30	/	HUAWEI		
Laptop	/	/	Lenovo		
Earphone	/	/	/		

#### **1.3 Measurement uncertainty**

Parameter	Measurement uncertainty
AC power line conducted emission (9 kHz~30 MHz)	±2.5 dB
Occupied Bandwidth	±3 %
Conducted RF output power	±0.16 dB
Conducted spurious emissions	±0.21 dB
Radiated emission (9 kHz ~ 30 MHz)	±4.0 dB
Radiated emission (30 MHz~1 GHz)	±4.2 dB
Radiated emission (above 1 GHz)	±4.3 dB

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



## 2 Summary of Test Result

No.	FCC reference	Description of test	Result
1	§ 15.203	Antenna requirement	Pass
2	§ 15.207	AC power line conducted emissions	Pass
3	15.247(a)(2)	6dB occupied bandwidth	Pass
4	15.247(b)(3)	Conducted peak output power	Pass
5	15.247(e)	Power Spectral Density	Pass
6	15.247(d)	Conducted emission at the band edge	Pass
7	15.247(d)	Conducted spurious emissions	Pass
8	/	Duty Cycle	Pass
9	15.247(d)	Radiated spurious emissions	Pass

Note: N/A means not applicable.



## **3** Test Facilities and Accreditations

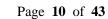
#### 3.1 Test laboratory

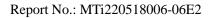
Test laboratory:	Shenzhen Microtest Co., Ltd.
Test site location:	101, No. 7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Telephone:	(86-755)88850135
Fax:	(86-755)88850136
CNAS Registration No.:	CNAS L5868
FCC Registration No.:	448573



## 4 Equipment List

No.	Equipment	Manufacturer	Model	Serial No.	Cal. date	Cal. Due
MTi-E002	EMI Test Receiver	R&S	ESCI3	101368	2022/05/05	2023/05/04
MTi-E023	Artificial power network	Schwarzbeck	NSLK8127	NSLK8127# 841	2022/05/05	2023/05/04
MTi-E025	Artificial power network	Schwarzbeck	NSLK8127	8127183	2022/05/05	2023/05/04
MTI-E043	EMI test receiver	R&S	ESCI7	101166	2022/05/05	2023/05/04
MTI-E046	Active Loop Antenna	Schwarzbeck	FMZB 1519 B	00044	2021/05/30	2023/05/29
MTI-E044	Broadband antenna	Schwarzbeck	VULB9163	9163-1338	2021/05/30	2023/05/29
MTI-E045	Horn antenna	Schwarzbeck	BBHA9120D	9120D-2278	2021/05/30	2023/05/29
MTI-E047	Pre-amplifier	Hewlett-Packard	8447F	3113A06184	2022/05/05	2023/05/04
MTI-E048	Pre-amplifier	Agilent	8449B	3008A01120	2022/05/05	2023/05/04
MTi-E120	Broadband antenna	Schwarzbeck	VULB9163	9163-1419	2021/05/30	2023/05/29
MTi-E121	Pre-amplifier	Hewlett-Packard	8447D	2944A09365	2022/04/15	2023/04/14
MTi-E123	Pre-amplifier	Agilent	8449B	3008A04723	2022/05/05	2023/05/04
MTi-E135	Horn antenna	Schwarzbeck	BBHA 9170	00987	2021/05/30	2023/05/29
MTi-E136	Pre-amplifier	Space-Dtronics	EWLAN1840G -G45	210405001	2022/05/05	2023/05/04
MTi-E062	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2022/05/05	2023/05/04
MTi-E067	RF Control Unit	Tonscend	JS0806-1	19D8060152	2022/05/05	2023/05/04
MTi-E068	RF Control Unit	Tonscend	JS0806-2	19D8060153	2022/05/05	2023/05/04
MTi-E069	Band Reject Filter Group	Tonscend	JS0806-F	19D8060160	2022/05/05	2023/05/04
MTI-E010S	EMI Measurement	Farad	EZ-EMC Ver. EMEC-3A1	/	/	/
MTI-E014S		Tonscend	TS®JS1120 V2.6.88.0330	/	/	/







### 5 Test Result

#### 5.1 Antenna requirement

#### 15.203 requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

#### Description of the antenna of EUT

The antenna of EUT is PCB antenna (Antenna Gain: 1 dBi). which is no consideration of replacement.



#### 5.2 AC power line conducted emissions

#### 5.2.1 Limits

Frequency (MHz)	Detector type / Bandwidth	Limit-Quasi-peak dBµV	Limit-Average dBµV
0.15 -0.5		66 to 56	56 to 46
0.5 -5	Average / 9 kHz	56	46
5 -30		60	50

Note 1: the limit decreases with the logarithm of the frequency in the range of 0.15 MHz to 0.5 MHz.

#### 5.2.2 Test Procedures

a) The test setup is refer to the standard ANSI C63.10-2013.

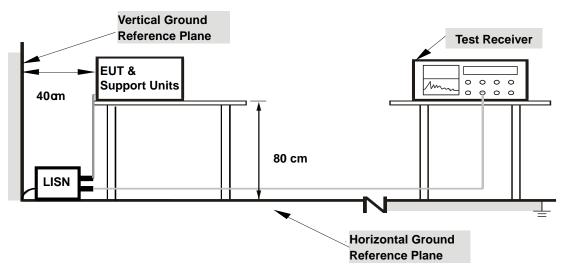
b) The EUT is connected to the main power through a line impedance stabilization network (LISN). All support equipment is powered from additional LISN(s).

c) Emissions were measured on each current carrying line of the EUT using an EMI test receiver connected to the LISN powering the EUT.

d) The test receiver scanned from 150 kHz to 30 MHz for emissions in each of the test modes described in Item 1.2.

e) The test data of the worst-case condition(s) was recorded.

#### 5.2.3 Test setup



For the actual test configuration, please refer to the related item – Photographs of the test setup.

#### 5.2.4 Test Result

#### Notes:

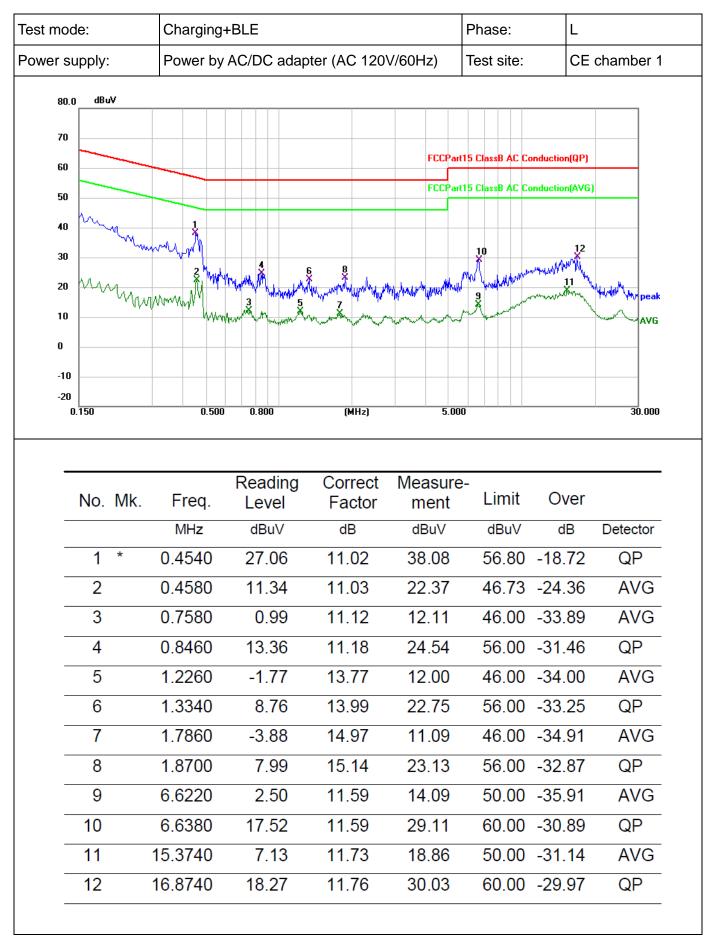
All modes of operation of the EUT were investigated, and only the worst-case results are reported.

#### Calculation formula:

Measurement (dB $\mu$ V) = Reading Level (dB $\mu$ V) + Correct Factor (dB) Over (dB) = Measurement (dB $\mu$ V) – Limit (dB $\mu$ V)

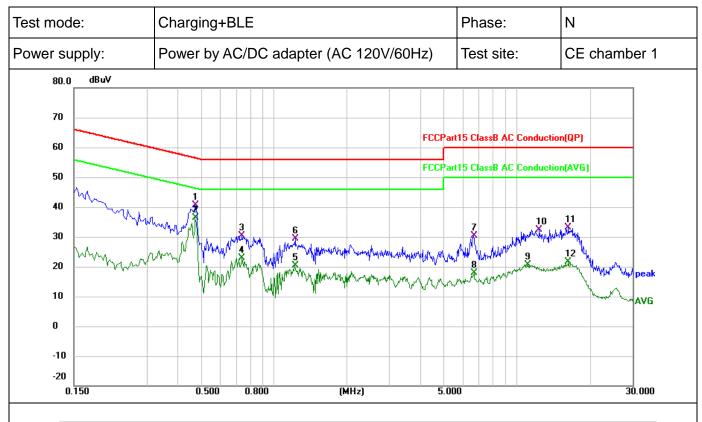


Report No.: MTi220518006-06E2





Report No.: MTi220518006-06E2



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.4739	29.78	10.89	40.67	56.45	-15.78	QP
2	*	0.4739	25.46	10.89	36.35	46.45	-10.10	AVG
3		0.7419	19.19	11.10	30.29	56.00	-25.71	QP
4		0.7419	11.74	11.10	22.84	46.00	-23.16	AVG
5		1.2219	6.77	13.68	20.45	46.00	-25.55	AVG
6		1.2259	15.57	13.71	29.28	56.00	-26.72	QP
7		6.6338	19.10	11.39	30.49	60.00	-29.51	QP
8		6.6700	6.37	11.39	17.76	50.00	-32.24	AVG
9		11.0818	9.10	11.58	20.68	50.00	-29.32	AVG
10		12.4100	20.80	11.63	32.43	60.00	-27.57	QP
11		16.3500	21.31	11.74	33.05	60.00	-26.95	QP
12		16.3500	9.79	11.74	21.53	50.00	-28.47	AVG

Note: EUT has two different voltage supports, reporting only the worst voltage mode.



#### 5.3 6dB occupied bandwidth

#### 5.3.1 Limits

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

#### 5.3.2 Test setup



#### 5.3.3 Test procedures

- a) Test method: ANSI C63.10-2013 Section 11.8.2.
- b) The transmitter output of EUT is connected to the spectrum analyzer.

c) Spectrum analyzer setting: RBW = 100 kHz, VBW = 300 kHz, detector = Peak

#### 5.3.4 Test results

Mode	Test channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
	CH0	2402	0.6916	≥ 0.5
BLE 1Mbps	CH19	2440	0.6792	≥ 0.5
	CH39	2480	0.7171	≥ 0.5
	CH0	2402	1.137	≥ 0.5
BLE 2Mbps	CH19	2440	1.144	≥ 0.5
	CH39	2480	1.160	≥ 0.5



#### 6dB occupied bandwidth

BLE\_1M CH0



#### BLE\_1M CH19



BLE\_1M CH39





#### BLE\_2M CH0



BLE\_2M CH19

Agilent Spectrum Analyzer - Occupied B	W				
Center Freq 2.440000000		er Freq: 2.440000000 GHz	ALIGN OFF	10:19:18 AM Jun 09, 2022 Radio Std: None	Frequency
		FreeRun Avg Hol n:40 dB	d: 100/100	Radio Device: BTS	
Ref Offset 9.04 dt 10 dB/div Ref 30.00 dBm			Mkr1	2.440012 GHz 1.8024 dBm	
20.0		1			Center Freq 2.440000000 GHz
-10.0	- water -	- Martin mart	- vy		
-20.0				- Challeson	,
-40.0					
-60.0					
Center 2.44 GHz #Res BW 100 kHz		#VBW 300 kHz		Span 4 MH; Sweep 2 ms	CF Step 400.000 kHz
Occupied Bandwidt	h	Total Power	9.24	dBm	<u>Auto</u> Man
2.	0705 MHz				Freq Offset
Transmit Freq Error	-12.337 kHz	OBW Power	99	.00 %	0 Hz
x dB Bandwidth	1.144 MHz	x dB	-6.0	00 dB	
MSG			STATUS		

#### BLE\_2M CH39





#### 5.4 Conducted peak output power

#### 5.4.1 Limits

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

#### 5.4.2 Test setup



#### 5.4.3 Test procedure

- a) Test method: ANSI C63.10-2013 Section 11.9.1.1.
- b) The EUT was set to continuously transmitting in the max power during the test.
- c) The transmitter output of EUT is connected to the spectrum analyzer.
- d) Spectrum analyzer setting: RBW  $\geq$  6dB occupied bandwidth, VBW  $\geq$  3 × RBW, detector = Peak

#### 5.4.4 Test results

Mode	Test channel	Frequency (MHz)	Conducted peak output power (dBm)	Limit (dBm)
	CH0	2402	4.63	≤ 30
BLE 1Mbps	CH19	2440	3.85	≤ 30
	CH39	2480	4.31	≤ 30
	CH0	2402	4.47	≤ 30
BLE 2Mbps	CH19	2440	3.68	≤ 30
	CH39	2480	4.27	≤ 30



#### Peak conducted output power



BLE\_1M CH19



BLE\_1M CH39







BLE\_2M CH0

BLE\_2M CH19



#### BLE\_2M CH39





#### 5.5 Power spectral density test

#### 5.5.1 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

#### 5.5.2 Test setup

сит	Spectrum	
EUT	Analyzer	

#### 5.5.3 Test Procedure

a) Test method: ANSI C63.10-2013 Section 11.10.2.

b) The EUT was set to continuously transmitting in the max power during the test.

- c) The transmitter output of EUT is connected to the spectrum analyzer.
- d) Spectrum analyzer setting: RBW = 3 kHz, VBW = 10 kHz, detector = Peak

#### 5.5.4 Test Results

Mode	Test channel	Frequency (MHz)	Power spectral density (dBm/3kHz)	Limit (dBm/3kHz)
	CH0	2402	-6.48	≤ 8
BLE 1Mbps	CH19	2440	-7.49	≤ 8
	CH39	2480	-6.8	≤ 8
	CH0	2402	-9.96	≤ 8
BLE 2Mbps	CH19	2440	-10.57	≤ 8
	CH39	2480	-10.4	≤ 8



#### Power spectral density

BLE\_1M CH0



BLE\_1M CH19



BLE\_1M CH39







BLE\_2M CH19



#### BLE\_2M CH39





#### 5.6 Conducted emissions at the band edge

#### 5.6.1 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

#### 5.6.2 Test setup

сит	Spectrum
EUT	Analyzer

#### 5.6.3 Test procedure

a) Test method: ANSI C63.10-2013 Section 11.13

b) The EUT was set to continuously transmitting in the max power during the test.

c) The transmitter output of EUT is connected to the spectrum analyzer.

d) Spectrum analyzer setting: RBW = 100 kHz, VBW = 300 kHz, Detector = Peak.

#### 5.6.4 Test results



#### BLE 1Mbps - conducted emissions at the band edge

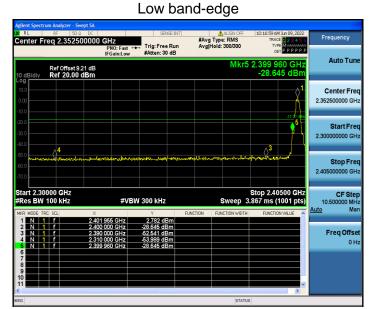
gilent Sp	ectrum Ana	lyzer - Swept SA				-			
RL enter	r Freq 2	50 Ω DC	GHz PNO: East	SENSE:IN	#Avg	ALIGN OFF g Type: RMS  Hold: 300/300	TRAC	1 Jun 09, 2022 E <b>1 2 3 4 5 6</b> E Mixture 1	Frequency
	Ref	Offset 9.21 dB	IFGain:Low	#Atten: 30 dB		Mkr5	2.399 6		Auto Tu
0 dB/d		20.00 dBm					-49.3	72 dBm	
0.0 1.00 0.0									Center Fr 2.352500000 G
20.0								-17.14 dBm	Start Fr 2.300000000 G
io.o		alah, manyakan	and and a start of the start of		hanna lenateria	to diamin	3 Marine Strategy		Stop Fr
'0.0									2.405000000 G
	.30000 (		#VB	W 300 kHz		Sweep 3.	Stop 2.40 867 ms (		CF St 10.500000 M
	SW 100							N VALLIE	Auto N
Res E		Х		Y	FUNCTION	FUNCTION WIDTH	FUNCTIO	it incor	
Res E KR MOD 1 N 2 N 3 N 4 N	3W 100 I	× 2.40 2.40 2.39 2.31	2 270 GHz 0 000 GHz 0 000 GHz 0 000 GHz 0 000 GHz 9 645 GHz	2.864 dBm -49.845 dBm -52.475 dBm -54.053 dBm	FUNCTION	FUNCTION WIDTH	FUNCTIO		
Res E KR MOD 1 N 2 N	3W 100 I	× 2.40 2.40 2.39 2.31	0 000 GHz 0 000 GHz	2.864 dBm -49.845 dBm -52.475 dBm	FUNCTION	FUNCTION WIDTH	FUNCTIO		Freq Off: 0

#### High band-edge

RL	RF	er - Swept SA		SENSE	INT	ALIGN OFF	10:14:06 AM 3	n N9, 2022	
enter F	req 2.5 <sup>.</sup>	10000000	PNO: Fast +	Trig: Free R	un Av	vg Type: RMS g Hold: 300/300	TYPE	23456 WWWWWWW	Frequency
0 dB/div		set 9.79 dB 0.00 dBm	IFGain:Low	#Atten: 30 d	8	Mk	r4 2.513 2 -49.574	8 GHz	Auto Tur
	Â								Center Fre 2.510000000 GF
0.0 0.0 0.0		2		3	4			-17.29 dBm	Start Fre 2.470000000 G
i0.0 i0.0 '0.0	und	Wasawala		and a second and a second s	n ohngahad	enterhefist <sup>i</sup> llinssoniolistis	*****	ulternela	<b>Stop Fro</b> 2.550000000 Gi
tart 2.47 Res BW	100 kHz	Z	#VB	W 300 kHz			Stop 2.550 3.000 ms (10	01 pts)	CF Ste 8.000000 Mi Auto M
KR MODE TR	HC SUL		80 00 GHz	Y 2.707 dBm		FUNCTION WIDTH	FUNCTION	/ALUE 🔺	
2 N 1 3 N 1 4 N 1 5	f	2.5	83 50 GHz 00 00 GHz 13 28 GHz	-52.111 dBm -53.825 dBm -49.574 dBm					Freq Offs 01
6 7 8 9									
1				щ				~	
G						STATU			



#### BLE 2Mbps - conducted emissions at the band edge



#### High band-edge

	RF	50 Q DC		SENSE:1		🔥 ALIGN OFF	10:21:33 AM 3		Frequency
nter F	req 2.51	10000000	PNO: Fast	Trig: Free Ru	n Avgi	g Type: RMS Hold: 300/300	TYPE	123456 Multino PPPPPP	Frequency
dB/div		et 9.79 dB .00 dBm	IFGain:Low	#Atten: 30 dB		Mkr	4 2.523 7 -49.306	6 GHz	Auto Tur
									Center Fre 2.510000000 GH
1.0 1.0 1.0		<u>2</u>				<u>4</u>		-18.05 dBm	Start Fre 2.470000000 Gi
0.0	and the second s	Contractor	Mumphasmatu	lander the strategy of the	aller an	welend and a strange	n na wang di Kamang da	t A for the second s	Stop Fre
0.0									2.550000000 G
tart 2.47	7000 GH2 100 kHz		#VE	300 kHz		Sweep 3	Stop 2.550 1.000 ms (10		CF Ste 8.000000 M
tart 2.47 Res BW	100 kHz	X		Y	FUNCTION	Sweep 3		001 pts)	CF Ste 8.000000 MI
	100 kHz	2.48 2.48 2.48 2.50	#VE 30 00 GHz 33 50 GHz 00 00 GHz 23 76 GHz		FUNCTION		1.000 ms (10	001 pts)	CF Ste 8.000000 Mi <u>Auto</u> Mi Freq Offs
tart 2.47 Res BW 1 N 1 2 N 1 3 N 1 4 N 1 5 6 7 8 8	100 kHz	2.48 2.48 2.48 2.50	80 00 GHz 83 50 GHz 00 00 GHz	Y 1.950 dBm -52.355 dBm -52.896 dBm	FUNCTION		1.000 ms (10	001 pts)	CF Ste 8.000000 Mi <u>Auto</u> Mi Freq Offs
tart 2.47 Res BW R MODE TR 1 N 1 2 N 1 3 N 1 4 N 1 5 6 6 7 7	100 kHz	2.48 2.48 2.48 2.50	80 00 GHz 83 50 GHz 00 00 GHz	Y 1.950 dBm -52.355 dBm -52.896 dBm	FUNCTION		1.000 ms (10	001 pts)	2.55000000 Gł CF Ste 8.000000 Mł <u>Auto</u> Mł Freq Offs 0 ł



#### 5.7 Conducted spurious emissions

#### 5.7.1 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

#### 5.7.2 Test setup

сит	Spectrum
EUT	Analyzer

#### 5.7.3 Test procedure

a) Test method: ANSI C63.10-2013 Section 11.11 & 11.12.

b) The EUT was set to continuously transmitting in the max power during the test.

c) The transmitter output of EUT is connected to the spectrum analyzer.

d) Spectrum analyzer setting: RBW = 100 kHz, VBW = 300 kHz, Detector = Peak.

#### 5.7.4 Test results

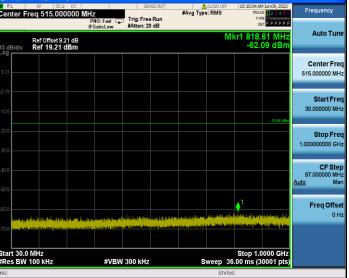


#### **BLE 1Mbps - conducted spurious emissions**

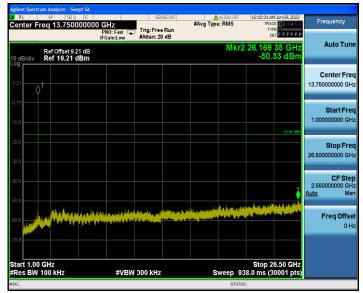




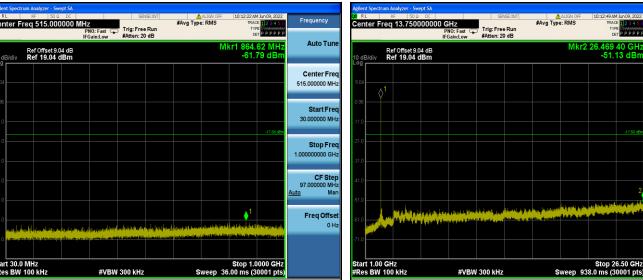
CH0



#### CH0



CH19



CH19

#Avg Type: RMS

Frequency

0 012 G 2.31 dE

Span 3.000 MH Sweep 1.533 ms (1001 pts Auto Tur

Center Free

Start Fre

Stop Free 2.441500000 GH

> CF Step 300.000 kHz Mar

Freq Offse

Frequency

Auto Tun

Center Free

Start Fred

Stop Fre

13.75000000 GH;

1.00000000 GH

26.50000000 GH

CF Step 2.55000000 GH

Freq Offse

Ma

0 H;

uto

0 H;

2 44000000 GH:

2.438500000 GH

MT Population RL 8F 50.0 DC enter Freq 2.440000000 GHZ PRG:Wilde C→ Frig:Free Run #Atten: 30 dB

> Ref Offset 9.04 dB Ref 29.04 dBm

nter 2.440000 GHz s BW 100 kHz

#VBW 300 kHz

CH19



#### **BLE 1Mbps - conducted spurious emissions**

CH39



CH39

	rum Analyzer - Swept SA							
Center F	RF  50 Ω DC   req 13.75000000	0 GHz	SENSE:1	#Avg Typ	ALIGN OFF e: RMS	TRACE	1 Jun 09, 2022	Frequency
10 dB/div	Ref Offset 9.79 dB Ref 19.79 dBm	PNO: Fast 😱 IFGain:Low	Trig: Free Ru #Atten: 20 dB	n	Mkr2	DE 26.165	10 GHz	Auto Tune
9.79	0 <sup>1</sup>							Center Freq 13.750000000 GHz
-0.21	Y						-15.21 dBn	Start Freq 1.000000000 GHz
-20.2								<b>Stop Freq</b> 26.50000000 GHz
-40.2								CF Step 2.55000000 GHz <u>Auto</u> Man
-60.2	un weinen in				1		an a los dallo apartes de la	<b>Freq Offset</b> 0 Hz
-70.2 Start 1.00 #Res BW		#VBW	300 kHz	s	weep 93	Stop 26	6.50 GHz	
MSG					STATUS			

CH39 ALIGN O #Avg Type: RMS Frequency nter Freq 515.000000 MHz ): Fast Trig: Free Run #Atten: 20 dB Auto Tun Ref Offset 9.79 dB Ref 19.79 dBm -61.06 dE Center Freq 515.000000 MH; Start Free 30.000000 MH Stop Freq 1.00000000 GH CF Step 97.000000 MHz MH Ma Freq Offse 0 H; Stop 1.0000 GHz Sweep 36.00 ms (30001 pts Start 30.0 MHz #Res BW 100 kHz #VBW 300 kHz

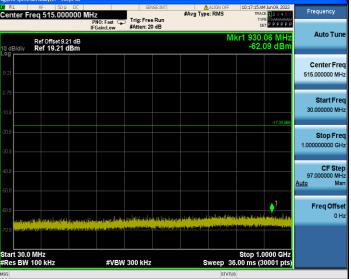


#### **BLE 2Mbps - conducted spurious emissions**

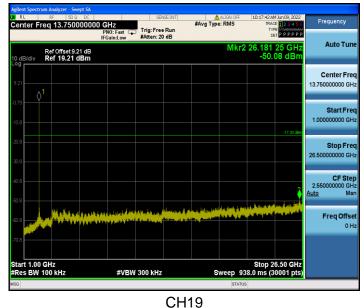




CH0



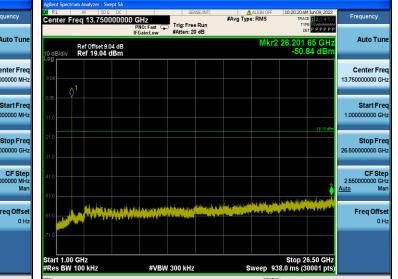
#### CH0



CH19



CH19



RL RF 50 0 DL Inter Freq 515.000000 MHz PN0: Fast Fight Free Run #Atten: 20 dB ALIGN ( #Avg Type: RMS Frequency Auto Tun -62.70 dB Ref Offset 9.04 dB Ref 19.04 dBm Center Free 515.000000 MH Start Free 30.000000 MI Stop Fre 1.00000000 GH 97.00 Freq Offse Stop 1.0000 GHz 30.0 MHz BW 100 kHz #VBW 300 kHz Sweet 36

Address: 101, No. 7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, ChinaTel: (86-755)88850135Fax: (86-755) 88850136Web: www.mtitest.comE-mail: mti@51mti.com



#### **BLE 2Mbps - conducted spurious emissions**

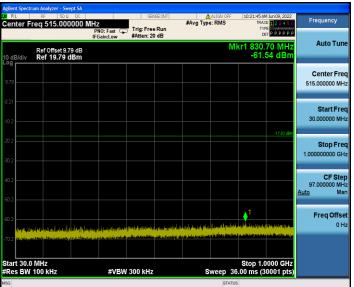
CH39



CH39

	rum Analyzer - Swept SA								
RL	reg 13.7500000		SEN	VSE:INT	#Avg Typ	ALIGN OFF		1 Jun 09, 2022 E 1 2 3 4 5 6	Frequency
Genter P	req 15.7500000	PNO: Fast 🗔	Trig: Free				TY	E M WARMAN	
		IFGain:Low	#Atten: 20	) dB					Auto Tun
	Ref Offset 9.79 dB					Mkr2		55 GHz 41 dBm	Autorun
10 dB/div Log	Ref 19.79 dBm						-50.4	41 авш	
-									Center Fre
9.79									13,750000000 GH
	1								
0.21									
									Start Fre
-10.2									1.00000000 GH
								-17.63 dBm	
-20.2									Stop Fre
									26.50000000 GH
30.2									
									CF Ste
40.2									2.550000000 GH
50.2									<u>Auto</u> Mai
50.2				h	A CARLES THE POPULA	al and a	Ly Harton	New Yorkson Mar	
60.2 <b>d</b>	A A A A A A A A A A A A A A A A A A A	The second	a kita an	Para and a second s	tentes, description	ALL ALL AND	لتعقيقهم	and should	Freq Offse
al a	Car Charles Add	II. and a second of a							0 H
70.2									
Start 1.00 #Res BW		#1/D1A	/ 300 kHz			woon 02	2 Stop 18.0 ms	6.50 GHz	
_	TOO KHZ	#VDW	1 JUU KH2		3		_	ooo r pisj	
ISG						STATUS	S		

CH39





#### 5.8 Duty Cycle

#### 5.8.1 Conformance Limit

None, for reporting purposes only.

#### 5.8.2 Test setup

сит	Spectrum	
EUT	Analyzer	

#### 5.8.3 Test procedure

- a) Test method: KDB 558074 Zero-span spectrum analyzer method.
- b) The EUT was set to continuously transmitting in the max power during the test.
- c) The transmitter output of EUT is connected to the spectrum analyzer.

d) Spectrum analyzer setting: RBW = 100 kHz, VBW = 300 kHz, Detector = Peak.

#### 5.8.4 Test Results

TestMode	Transmission Duration (ms]	Transmission Period (ms]	Duty Cycle (%)
BLE 1Mbps	2.13	2.49	85.54
BLE 2Mbps	1.07	1.25	85.60

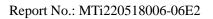


#### BLE 1Mbps

RL Center F	rum Analyzer - 5 RF 50 req 2.480	000000 C	Hz PNO: Fast	Trig Dela		#Avg Ty	ALIGN OFF	TRAI	M Jun 09, 2022 DE 123456 PE WWWWWWWW ET P P P P P	Frequency
0 dB/div	Ref Offset Ref 30.00						Δ		.488 ms 0.80 dB	Auto Tun
. <b>og</b> 20.0 10.0				·				2∆1		Center Fre 2.480000000 GH
10.0 20.0 30.0			andreise Periodes Periodes						™ <u>80 LVL</u> 3∆1	Start Fre 2.480000000 GH
40.0 50.0 60.0										Stop Fre 2.480000000 GH
enter 2. les BW 8		) GHz	#VE	W 8.0 MHz	FLINC	TION FI	Sweep 5	.000 ms (	pan 0 Hz 8000 pts)	CF Ste 8.000000 MH <u>Auto</u> Ma
1 Ν 2 Δ1 1 3 Δ1 1 4 5 5	t t (Δ) t (Δ)	2	998 ms 2.127 ms (/ 2.488 ms (/	-9.46 dE 12.20 10.80	dB					Freq Offs 0 H
6 7 8 9 0										
				Ш					>	

#### BLE 2Mbps

	RF 50 Ω DC		SENSE: Trig Delay-2.		ALIGN OFF		1 Jun 09, 2022	Frequency
enter Fre	q 2.480000000	PNO: Fast ↔ IFGain:Low			g Type: RMS	TYP	E WWWWWWW P P P P P P	, , , ,
0 dB/div	Ref Offset 9.79 dB Ref 30.00 dBm	I GUILLOW			Ĺ	\Mkr3 1.' (	250 ms 0.20 dB	Auto Tur
og 20.0 10.0		Ŷ <sup>2</sup>	∆1 3∆1		·····			Center Fr 2.480000000 G
0.0 0.0 0.0							TRIDLVL	<b>Start Fr</b> 2.480000000 G
0.0								<b>Stop Fr</b> 2.480000000 G
enter 2.48 es BW 8 N		#VB\	N 8.0 MHz	FUNCTION	Sweep 5	5.000 ms (8		CF St 8.000000 M Auto M
1 N 1 2 A1 1 3 A1 1 4 5 6	t (Δ)	747.6 μs 1.073 ms (Δ) 1.250 ms (Δ)	-7.29 dBm 7.86 dB 0.20 dB					Freq Offs 0
7 8 9 0								





#### 5.9 Radiated spurious emission

#### 5.9.1 Limits

§ 15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.205(c)).

#### § 15.209 Radiated emission limits at restricted bands:

Frequency (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 tighter limit applies at the band edges.

**Note 2:** the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector

#### § 15.35 (b) requirements:

When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.



According to ANSI C63.10-2013, the tests shall be performed in the frequency range shown in the following table:

#### Frequency range of measurements for unlicensed wireless device

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

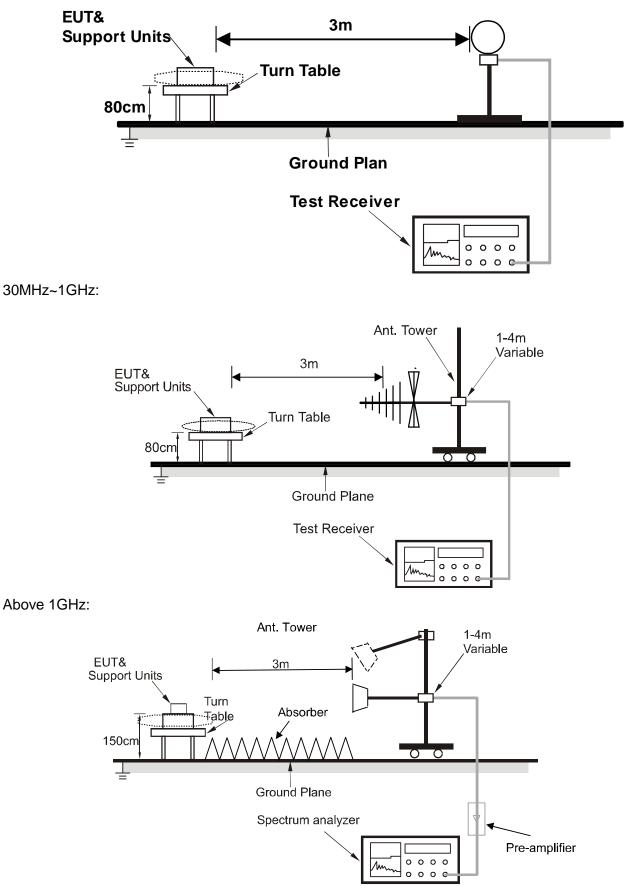
#### Frequency range of measurements for unlicensed wireless device with digital device

Highest frequency generated or used in the device or on which the device operates or tunes	Upper frequency range of measurement
Below 1.705 MHz	30 MHz
1.705 MHz to 108 MHz	1000 MHz
108 MHz to 500 MHz	2000 MHz
500 MHz to 1000 MHz	5000 MHz
	5th harmonic of the highest frequency or 40 GHz, whichever is lower



#### 5.9.2 Test setup

Below 30MHz:



For the actual test configuration, please refer to the related item - Photographs of the test setup.



#### 5.9.3 Test procedure

a) Test method: ANSI C63.10-2013 Section 6.3, 6.4, 6.5, 6.6, 11.11, 11.12, 11.13.

b) The EUT is placed on an on-conducting table 0.8 meters above the ground plane for measurement below 1GHz, 1.5 meters above the ground plane for measurement above 1GHz.

c) Emission blew 18 GHz were measured at a 3 meters test distance, above 18 GHz were measured at 1-meter test distance with the application of a distance correction factor

d) The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

#### Test instrument setup

Frequency	Test receiver / Spectrum analyzer setting
9 kHz ~ 150 kHz	Quasi Peak / RBW: 200 Hz
150 kHz ~ 30 MHz	Quasi Peak / RBW: 9 kHz
30 MHz ~ 1 GHz	Quasi Peak / RBW: 120 kHz
Above 1 GHz	Peak / RBW: 1 MHz, VBW: 3MHz, Peak detector AVG / RBW: 1 MHz, VBW: 3MHz, Average detector

#### 5.9.4 Test results

#### Notes:

The amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported.

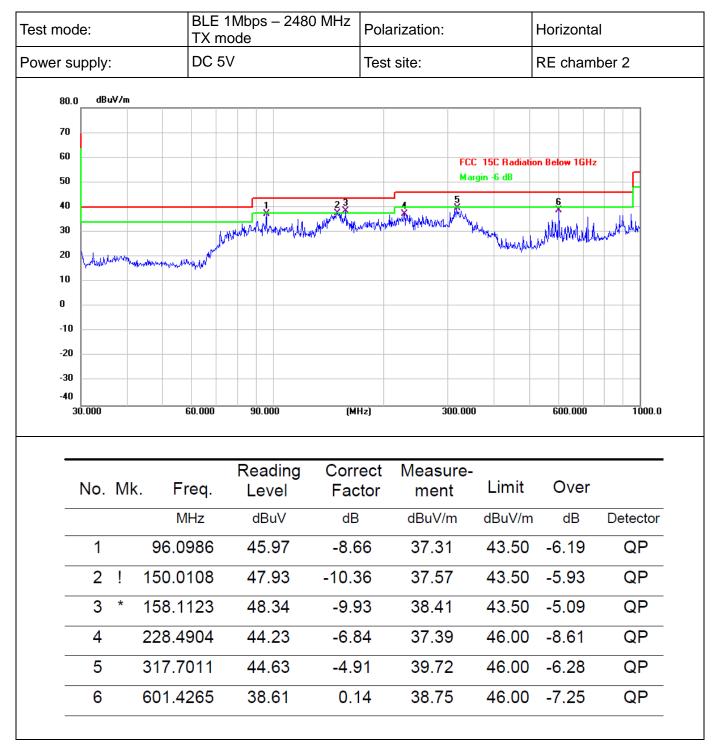
All modes of operation of the EUT were investigated, and only the worst-case results are reported. There were no emissions found below 30MHz within 20dB of the limit.

#### Calculation formula:

Measurement ( $dB\mu V/m$ ) = Reading Level ( $dB\mu V$ ) + Correct Factor (dB/m) Over (dB) = Measurement ( $dB\mu V/m$ ) – Limit ( $dB\mu V/m$ )

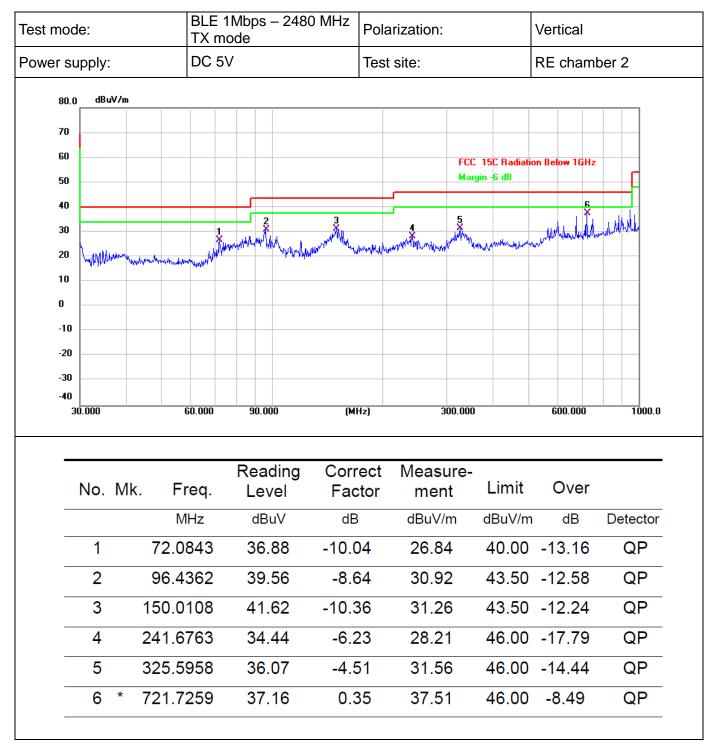


#### Radiated emissions between 30MHz – 1GHz





#### Radiated emissions between 30MHz – 1GHz





#### Radiated emissions 1 GHz ~ 25 GHz

Frequency	Reading Level	Correct Factor	Measurement	Limits	Over	Detector	Polarization						
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	Peak/AVG	H/V						
	BLE 1Mbps - 2402 MHz TX mode												
4804	40.98	1.52	42.50	74.00	-31.50	Peak	V						
4804	34.69	1.52	36.21	54.00	-17.79	AVG	V						
7206	42.98	5.46	48.44	74.00	-25.56	Peak	V						
7206	36.79	5.46	42.25	54.00	-11.75	AVG	V						
9608	39.71	6.33	46.04	74.00	-27.96	Peak	V						
9608	33.77	6.33	40.10	54.00	-13.90	AVG	V						
4804	40.29	1.52	41.81	74.00	-32.19	Peak	Н						
4804	33.80	1.52	35.32	54.00	-18.68	AVG	Н						
7206	40.99	5.46	46.45	74.00	-27.55	Peak	Н						
7206	34.70	5.46	40.16	54.00	-13.84	AVG	Н						
9608	40.84	6.33	47.17	74.00	-26.83	Peak	Н						
9608	34.77	6.33	41.10	54.00	-12.90	AVG	Н						
		BLE	E 1Mbps - 244	10 MHz TX m	ode								
4880	40.34	1.68	42.02	74.00	-31.98	Peak	V						
4880	34.42	1.68	36.10	54.00	-17.90	AVG	V						
7320	40.93	5.45	46.38	74.00	-27.62	Peak	V						
7320	34.70	5.45	40.15	54.00	-13.85	AVG	V						
9760	41.72	6.37	48.09	74.00	-25.91	Peak	V						
9760	35.75	6.37	42.12	54.00	-11.88	AVG	V						
4880	40.07	1.68	41.75	74.00	-32.25	Peak	Н						
4880	33.64	1.68	35.32	54.00	-18.68	AVG	Н						
7320	43.77	5.45	49.22	74.00	-24.78	Peak	Н						
7320	37.65	5.45	43.10	54.00	-10.90	AVG	Н						
9760	43.78	6.37	50.15	74.00	-23.85	Peak	Н						
9760	37.75	6.37	44.12	54.00	-9.88	AVG	Н						



Frequency	Reading Level	Correct Factor	Measurement	Limits	Over	Detector	Polarization						
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	Peak/AVG	H/V						
	BLE 1Mbps - 2480 MHz TX mode												
4960	44.91	1.83	46.74	74.00	-27.26	Peak	V						
4960	38.42	1.83	40.25	54.00	-13.75	AVG	V						
7440	41.17	5.43	46.60	74.00	-27.40	Peak	V						
7440	34.89	5.43	40.32	54.00	-13.68	AVG	V						
9920	42.25	6.41	48.66	74.00	-25.34	Peak	V						
9920	35.90	6.41	42.31	54.00	-11.69	AVG	V						
4960	44.37	1.83	46.20	74.00	-27.80	Peak	Н						
4960	38.30	1.83	40.13	54.00	-13.87	AVG	Н						
7440	42.55	5.43	47.98	74.00	-26.02	Peak	н						
7440	35.92	5.43	41.35	54.00	-12.65	AVG	н						
9920	41.88	6.41	48.29	74.00	-25.71	Peak	н						
9920	35.75	6.41	42.16	54.00	-11.84	AVG	Н						



#### Radiated emissions at band edge

Frequency	Reading Level	Correct Factor	Measurement	Limits	Over	Detector	Polarization					
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	Peak/AVG	H/V					
BLE 1Mbps – Low band-edge												
(MHz)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(dB)	Peak/AVG	H/V					
2310	48.11	-6.60	41.51	74.00	-32.49	Peak	V					
2310	37.51	-6.60	30.91	54.00	-23.09	AVG	V					
2390	49.13	-6.23	42.90	74.00	-31.10	Peak	V					
2390	38.13	-6.23	31.90	54.00	-22.10	AVG	V					
2310	47.61	-6.60	41.01	74.00	-32.99	Peak	Н					
2310	37.68	-6.60	31.08	54.00	-22.92	AVG	Н					
2390	47.96	-6.23	41.73	74.00	-32.27	Peak	Н					
2390	38.93	-6.23	32.70	54.00	-21.30	AVG	Н					
		E	BLE 1Mbps – H	ligh band-edg	je							
2483.5	47.81	-5.79	42.02	74.00	-31.98	Peak	V					
2483.5	38.33	-5.79	32.54	54.00	-21.46	AVG	V					
2500	47.10	-5.72	41.38	74.00	-32.62	Peak	V					
2500	37.84	-5.72	32.12	54.00	-21.88	AVG	V					
2483.5	48.51	-5.79	42.72	74.00	-31.28	Peak	Н					
2483.5	38.11	-5.79	32.32	54.00	-21.68	AVG	Н					
2500	48.22	-5.72	42.50	74.00	-31.50	Peak	Н					
2500	37.89	-5.72	32.17	54.00	-21.83	AVG	Н					



## Photographs of the Test Setup

See the Appendix – Test Setup Photos.



## Photographs of the EUT

See the Appendix - EUT Photos.

----End of Report----