Test Report

Report No.:	MTi220218004-03E1
Date of issue:	Mar. 05, 2022
Applicant:	SHENZHEN BOYYE TECHNOLOGY Co., LTD
Product name:	Wireless laser presenter
Model(s):	P6000
FCC ID:	2A4NB-P6000

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

Address: 101, No. 7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao' an District, Shenzhen, Guangdong, China.
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Instructions

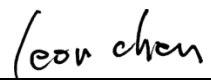
1. The report shall not be partially reproduced without the written consent of the laboratory;
2. The test results of this report are only responsible for the samples submitted;
3. This report is invalid without the seal and signature of the laboratory;
4. This report is invalid if transferred, altered or tampered with in any form without authorization;
5. Any objection to this report shall be submitted to the laboratory within 15 days from the date of receipt of the report.

Table of Contents

TEST RESULT CERTIFICATION	
Applicant's name	SHENZHEN BOYYE TECHNOLOGY Co., LTD
Address	BLD A, CHENGHEDE INDUSTRIA PARK HUAWANG ROAD, DALANG STR HUANGJIANG TOWN, SHENZHEN, GUANGDONG
Manufacturer's Name	SHENZHEN BOYYE TECHNOLOGY Co., LTD
Address	BLD A, CHENGHEDE INDUSTRIA PARK HUAWANG ROAD, DALANG STR HUANGJIANG TOWN, SHENZHEN, GUANGDONG
Product description	
Product name	Wireless laser presenter
Trademark	N/A
Model Name	P6000
Serial Model	N/A
Standards	FCC Part 15.249
Test procedure	ANSI C63.10-2013
Date of Test	
Date (s) of performance of tests ..... :	2022-02-26~2022-03-05
Test Result ..... :	Pass
This device described above has been tested by Shenzhen Microtest Co., Ltd. and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.	

Testing Engineer : 

(Danny Xu)

Technical Manager : 

(Leon Chen)

Authorized Signatory : 

(Tom Xue)

1 General description

1.1 Feature of equipment under test (EUT)

Equipment:	Wireless laser presenter
Trade Name:	N/A
Model Name:	P6000
Serial Model:	N/A
Model Difference:	N/A
Operation Frequency:	2408- 2474MHz
Modulation Type:	FSK
Antenna Type:	PCB antenna
Antenna Gain:	-1.56 dBi
Max. Field Strength:	88.32dBuV/m
Power Source:	DC 3V from2* 1.5V (AAA) size alkaline, carbon zinc or zinc battery
Battery:	N/A
Hardware version:	385P-3
Software version:	B4C9

1.2 Operation channel list

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
01	2408	21	2448
02	2410	22	2450
03	2412	23	2452
04	2414	24	2454
05	2416	25	2456
06	2418	26	2458
07	2420	27	2460
08	2422	28	2462
09	2424	29	2464
10	2426	30	2466
11	2428	31	2468
12	2430	32	2470
13	2432	33	2472
14	2434	34	2474
15	2436	/	/
16	2438	/	/
17	2440	/	/
18	2442	/	/
19	2444	/	/
20	2446	/	/

1.3 Test Frequency Channel

Channel	Frequency(MHz)
Low	2408
Middle	2440
High	2474

1.4 EUT operation mode

During testing, RF test program provided by the manufacture to control the Tx operation followed the test requirement.

1.5 Ancillary equipment list

Equipment	Model	S/N	Manufacturer
/	/	/	/

2 Summary of Test Result

Test procedures according to the technical standards:

Item	FCC Part No.	Description of Test	Result
1	FCC Part15.203	Antenna Requirement	Pass
2	FCC Part15.207	AC power line conducted emission	N/A
5	FCC Part15.249(d)	Radiated spurious emission	Pass
4	FCC Part 15.215	20dB and 99% Bandwidth	Pass

3 Test Facilities and Accreditations

3.1 Test laboratory

Test Laboratory	Shenzhen Microtest Co., Ltd
Location	101, No. 7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao' an District, Shenzhen, Guangdong, China.
FCC Registration No.	448573

3.2 Environmental conditions

Temperature:	15ºC~35ºC
Humidity	20%~75%
Atmospheric pressure	98kPa~101kPa

3.3 Measurement uncertainty

The reported uncertainty of measurement y ± U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %

RF frequency	1 x 10-7
RF power, conducted	± 1 dB
Conducted emission(150kHz~30MHz)	± 2.5 dB
Radiated emission(30MHz~1GHz)	± 4.2 dB
Radiated emission (above 1GHz)	± 4.3 dB
Temperature	±1 degree
Humidity	± 5 %

3.4 Test software

Software Name	Manufacturer	Model	Version
Bluetooth and WiFi Test System	Shenzhen JS tonscend co,.ltd	JS1120-3	2.5.77.0418

4 List of test equipment

Equipment No.	Equipment Name	Manufacturer	Model	Serial No.	Calibration date	Due date
MTI-E043	EMI Test Receiver	Rohde&schwarz	ESCI7	101166	2021/06/02	2022/06/01
MTI-E044	TRILOG Broadband Antenna	schwarabeck	VULB 9163	9163-1338	2021/05/30	2023/05/29
MTI-E047	Amplifier	Hewlett-Packard	8447F	3113A06150	2021/06/02	2022/06/01
MTI-E089	ESG Vector Signal Generator	Agilent	N5182A	MY49060455	2021/06/02	2022/06/01
MTI-E058	ESG Series Analog Ssignal Generator	Agilent	E4421B	GB40051240	2021/06/02	2022/06/01
MTI-E062	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2021/06/02	2022/06/01
MTI-E066	MXA Signal Analyzer	Agilent	N9020A	MY50143483	2021/06/02	2022/06/01
MTI-E078	Synthesized Sweeper	Agilent	83752A	3610A01957	2021/06/02	2022/06/01
MTI-E079	DC Power Supply	Agilent	E3632A	MY40027695	2021/06/02	2022/06/01
MTI-E045	Double Ridged Broadband Horn Antenna	schwarabeck	BBHA 9120D	9120D-2278	2021/05/30	2023/05/29
MTI-E021	EMI Test Receiver	Rohde&schwarz	ESCS30	100210	2021/06/02	2022/06/01
MTI-E022	Pulse Limiter	Schwarzbeck	VSTD 9561-F	00679	2021/06/02	2022/06/01
MTI-E023	Artificial mains network	Schwarzbeck	NSLK 8127	NSLK 8127 #841	2021/06/02	2022/06/01
MTI-E046	Active Loop Antenna	Schwarzbeck	FMZB 1519 B	00044	2021/05/30	2023/05/29
MTI-E048	Amplifier	Agilent	8449B	3008A02400	2021/06/02	2022/06/01
MTI-E072	Thermometer Clock Humidity Monitor	-	HTC-1	/	2021/06/02	2022/06/01
Note: the calibration interval of the above test instruments is 12 or 24 months and the calibrations are traceable to international system unit (SI).						

5 Test Result

5.1 Antenna requirement

5.1.1 Standard requirement

FCC PART 15.203;

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.

5.1.2 EUT Antenna

The antenna is a PCB antenna, which was permanently affixed to the device and un-replaced, complies with 15.203. In addition, the maximum antenna gain is -1.56dBi.

5.2 AC power line conducted emission

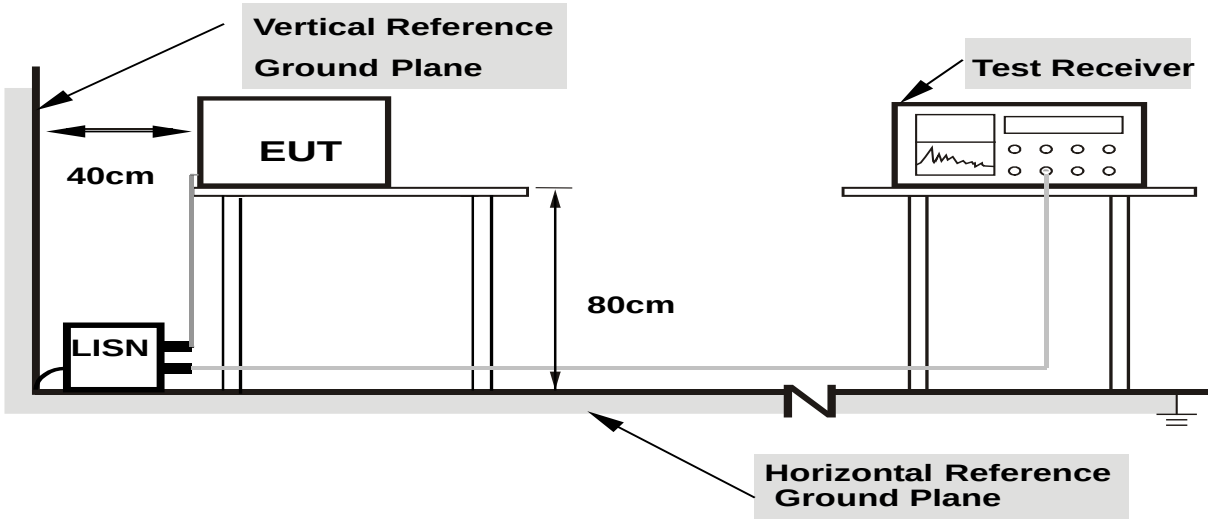
5.2.1 Limits

FCC §15.207;

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency (MHz)	Quasi-peak	Average
0.15 -0.5	66 - 56 note2	56 - 46 note2
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00
Note1: The tighter limit applies at the band edges. Note2: The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.		

5.2.2 Test setup



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

5.2.3 Test procedure

a. EUT Operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

b. The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

c. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment's powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

d. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

e. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

f. LISN at least 80 cm from nearest part of EUT chassis.

For the actual test configuration, please refer to the related Item –EUT Test Photos.

5.2.4 Test results

Note: The device is a DC alkaline battery power supply and does not apply to conducted emissions.

5.3 Radiated spurious emission

5.3.1 Limit

FCC PART 15.249(a);

Except as provided in paragraph (a) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Frequency (MHz)	Field Strength of Fundamental (mV/m)	Field Strength of Harmonics (μV/m)
902-928	50	500
2400-2483.5	50	500
5725-5875	50	500

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
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

5.3.2 Test method

a) The EUT is placed on a turntable, which is 0.8m above ground plane for test frequency range blew 1GHz, and 1.5m above ground plane for test frequency range above 1GHz.

b) EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.

c) Use the following spectrum analyser settings:

1) Span = wide enough to fully capture the emission being measured

2) RBW = 1 MHz for f ≥ 1GHz, 100 kHz for f < 1 GHz

3) VBW ≥ RBW, Sweep = auto

4) Detector function = peak

5) Trace = max hold

d) Follow the guidelines in ANSI C63.4-2014 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

e) The peak level, once corrected, must comply with the limit specified in Section 15.209. Set the RBW = 1MHz, VBW = 10Hz, Detector = PK for AV value, while maintaining all of the other instrument settings.

5.3.3 Test Result

Below 30MHz

EUT：	Wireless laser presenter	Model name. ：	P6000
Pressure：	1010 hPa	Test voltage：	DC 3V
Test mode：	TX	Polarization :	--

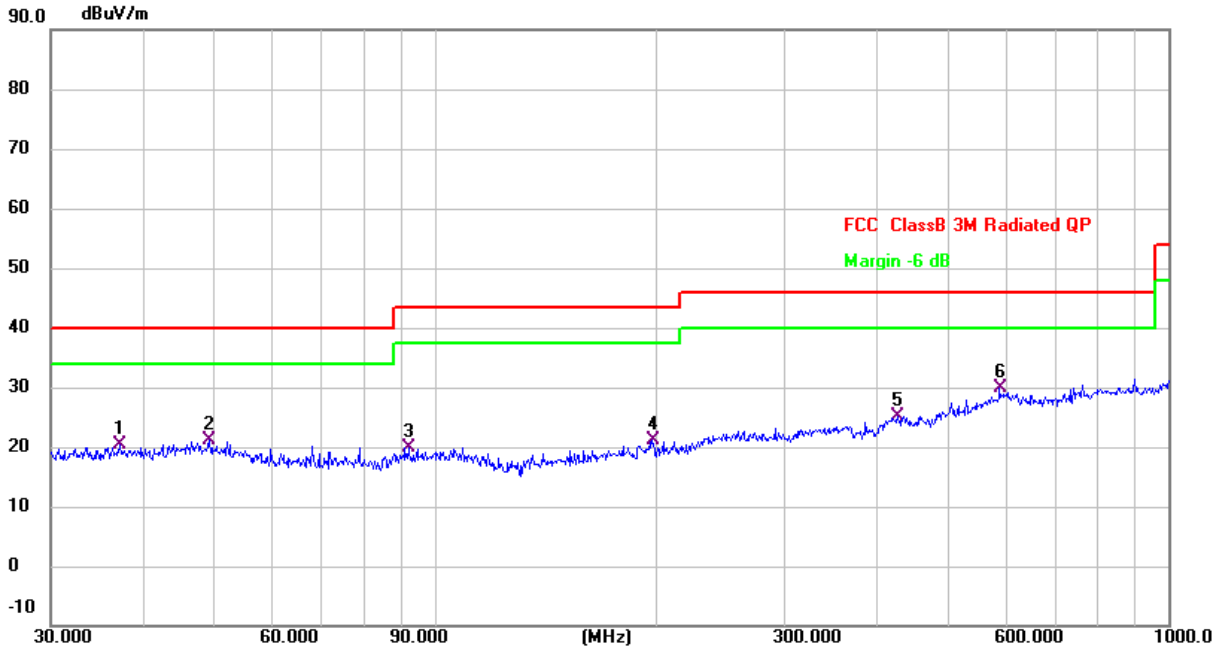
Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	Pass
--	--	--	--	Pass

Note:

1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
2. Distance extrapolation factor =40 log (specific distance/test distance)(dB);
3. Limit line = specific limits (dBuV) + distance extrapolation factor.

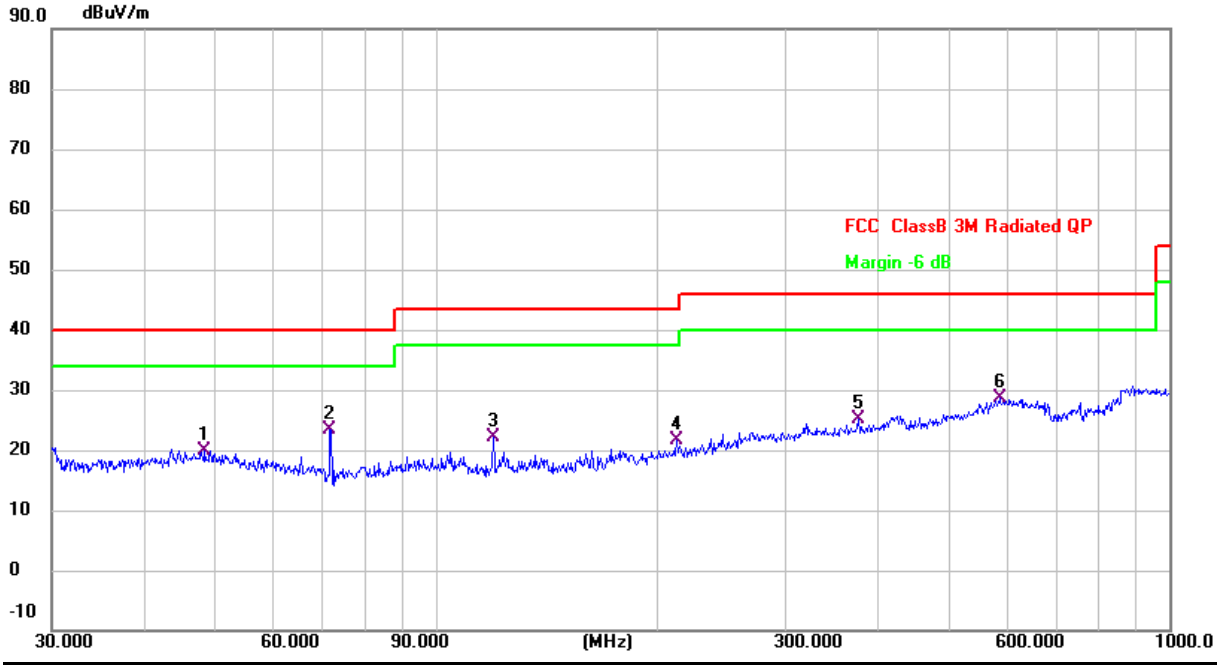
30MHz-1GHz

EUT:	Wireless laser presenter	Model Name:	P6000
Pressure:	101kPa	Polarization:	Horizontal
Test voltage:	DC 3V	Test Mode:	TX-2474MHz



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		37.2854	28.51	-8.15	20.36	40.00	-19.64	QP
2		49.3594	28.69	-7.61	21.08	40.00	-18.92	QP
3		92.1386	28.78	-8.82	19.96	43.50	-23.54	QP
4		197.8926	29.04	-7.84	21.20	43.50	-22.30	QP
5		428.0192	28.27	-3.21	25.06	46.00	-20.94	QP
6	*	588.9049	29.97	-0.03	29.94	46.00	-16.06	QP

EUT:	Wireless laser presenter	Model Name:	P6000
Pressure:	101kPa	Polarization:	Vertical
Test voltage:	DC 3V	Test Mode:	TX-2474MHz



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		48.5015	27.36	-7.56	19.80	40.00	-20.20	QP
2	*	71.8319	33.36	-10.03	23.33	40.00	-16.67	QP
3		119.8555	32.33	-10.21	22.12	43.50	-21.38	QP
4		213.0149	29.03	-7.31	21.72	43.50	-21.78	QP
5		377.2590	29.62	-4.45	25.17	46.00	-20.83	QP
6		586.8436	28.81	-0.07	28.74	46.00	-17.26	QP

Note:

1. Emission Level = Meter Reading + Factor, Margin= Emission Level- Limit, Factor = Antenna Factor + Cable Loss – Pre-amplifier.
2. The high, medium and low channels have been tested. The report only shows the worst mode. The worst mode is CH34.

1GHz-26.5GHz:

Frequency	Read Level	Correct Factor	Emission Level	Limits	Margin	Remark	Comment
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
Low Channel (2408 MHz)-Above 1G							
4816	52.58	1.55	54.13	74	-19.87	Pk	Vertical
4816	48.56	1.55	50.11	54	-3.89	AV	Vertical
7222	47.06	5.46	52.52	74	-21.48	Pk	Vertical
7222	42.85	5.46	48.31	54	-5.69	AV	Vertical
4816	53.86	1.55	55.41	74	-18.59	Pk	Horizontal
4816	49.46	1.55	51.01	54	-2.99	AV	Horizontal
7224	47.64	5.46	53.1	74	-20.9	Pk	Horizontal
7224	42.87	5.46	48.33	54	-5.67	AV	Horizontal
Mid Channel (2440 MHz)-Above 1G							
4876	52.41	1.67	54.08	74	-19.92	Pk	Vertical
4876	48.44	1.67	50.11	54	-3.89	AV	Vertical
7320	46.17	5.45	51.62	74	-22.38	Pk	Vertical
7320	42.17	5.45	47.62	54	-6.38	AV	Vertical
4876	54.27	1.67	55.94	74	-18.06	Pk	Horizontal
4876	49.98	1.67	51.65	54	-2.35	AV	Horizontal
7320	47.19	5.45	52.64	74	-21.36	Pk	Horizontal
7320	43.19	5.45	48.64	54	-5.36	AV	Horizontal
High Channel (2474 MHz)- Above 1G							
4944	53.5	1.81	55.31	74	-18.69	Pk	Vertical
4944	47.83	1.81	49.64	54	-4.36	AV	Vertical
7422	47.67	5.44	53.11	74	-20.89	Pk	Vertical
7422	42.71	5.44	48.15	54	-5.85	AV	Vertical
4944	53.54	1.81	55.35	74	-18.65	Pk	Horizontal
4944	49.94	1.81	51.75	54	-2.25	AV	Horizontal
7422	47.57	5.44	53.01	74	-20.99	Pk	Horizontal
7422	40.72	5.44	46.16	54	-7.84	AV	Horizontal

Note:

1. All Readings are Peak Value (VBW=3MHz) and AV Value (VBW=10Hz).
2. Correct Factor= Antenna Factor + Cable Loss - Preamp Factor
3. Emission Level= Correct Factor + Read Level

5.3.4 Field strength of fundamental

Frequency	Read Level	Correct Factor	Emission Level	Limits	Margin	Remark	Comment
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
Low Channel (2408 MHz)							
2408	91.63	-6.15	85.48	114	-28.52	Pk	Horizontal
2408	93.53	-6.15	87.38	94	-6.62	AV	Horizontal
2408	84.35	-6.15	78.20	114	-35.8	Pk	Vertical
2408	86.32	-6.15	80.17	94	-13.83	AV	Vertical
Mid Channel (2440 MHz)							
2440	91.52	-6.00	85.52	114	-28.48	Pk	Horizontal
2440	90.55	-6.00	84.55	94	-9.45	AV	Horizontal
2440	87.39	-6.00	81.39	114	-32.61	Pk	Vertical
2440	86.40	-6.00	80.40	94	-13.6	AV	Vertical
High Channel (2474 MHz)							
2474	90.13	-5.85	84.28	114	-29.72	Pk	Horizontal
2474	90.07	-5.85	84.22	94	-9.78	AV	Horizontal
2474	94.17	-5.85	88.32	114	-25.68	Pk	Vertical
2474	94.09	-5.85	88.24	94	-5.76	AV	Vertical

Note:

1. All Readings are Peak Value (VBW=3MHz) and AV Value (VBW=10Hz).
2. Correct Factor= Antenna Factor + Cable Loss - Preamp Factor
3. Emission Level= Correct Factor + Read Level

5.3.5 Band edge-radiated

Frequency	Read Level	Correct Factor	Emission Level	Limits	Margin	Remark	Comment
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
2310.000	47.39	-6.6	40.79	74	-33.21	Pk	Horizontal
2310.000	38.20	-6.6	31.6	54	-22.4	AV	Horizontal
2310.000	47.88	-6.6	41.28	74	-32.72	Pk	Vertical
2310.000	38.32	-6.6	31.72	54	-22.28	AV	Vertical
2390.000	51.64	-6.23	45.41	74	-28.59	Pk	Horizontal
2390.000	42.25	-6.23	36.02	54	-17.98	AV	Horizontal
2390.000	49.62	-6.23	43.39	74	-30.61	Pk	Vertical
2390.000	39.07	-6.23	32.84	54	-21.16	AV	Vertical
2483.500	50.26	-5.79	44.47	74	-29.53	Pk	Horizontal
2483.500	41.39	-5.79	35.6	54	-18.4	AV	Horizontal
2483.500	49.42	-5.79	43.63	74	-30.37	Pk	Vertical
2483.500	40.12	-5.79	34.33	54	-19.67	AV	Vertical
2500.000	45.59	-5.72	39.87	54	-14.13	Pk	Horizontal
2500.000	53.91	-5.72	48.19	74	-25.81	AV	Horizontal
2500.000	41.76	-5.72	36.04	54	-17.96	Pk	Vertical
2500.000	51.33	-5.72	45.61	74	-28.39	AV	Vertical

Note:

1. All Readings are Peak Value (VBW=3MHz) and AV Value (VBW=10Hz).
2. Correct Factor= Antenna Factor + Cable Loss - Preamp Factor
3. Emission Level= Correct Factor + Read Level

5.4 20dB and 99% bandwidth

5.4.1 Limits

FCC §15.215(c)

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

5.4.2 Test method

Use the following spectrum analyzer settings:

For 20 dB bandwidth

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW ≥1% of the 20 dB bandwidth

VBW ≥RBW

Sweep = auto

Detector function = peak

Trace = max hold

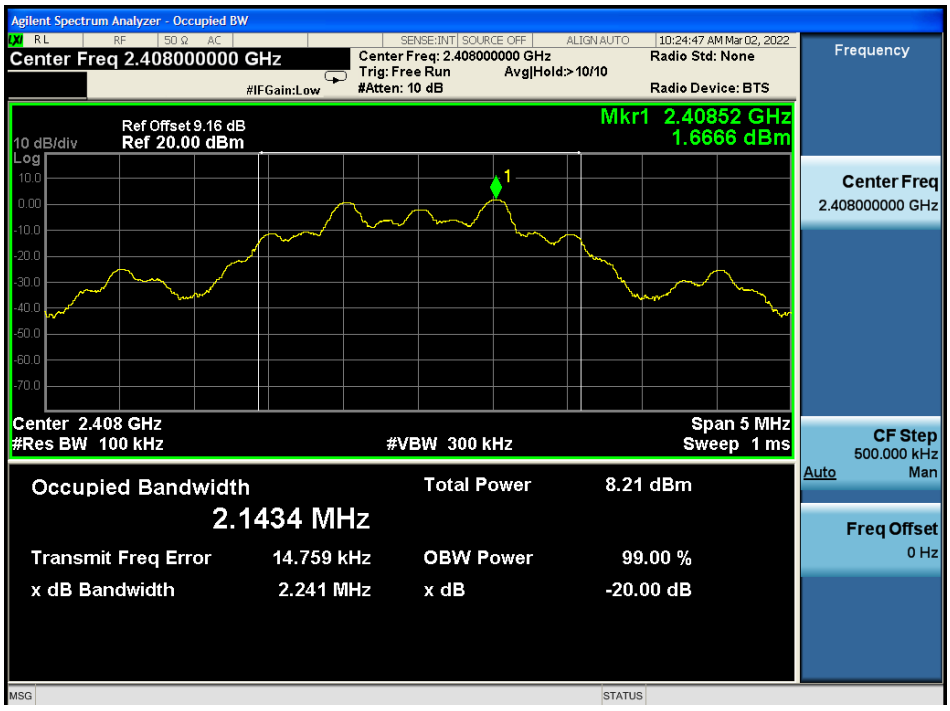
The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth and 99% occupied bandwidth of the emission

5.4.3 Test result

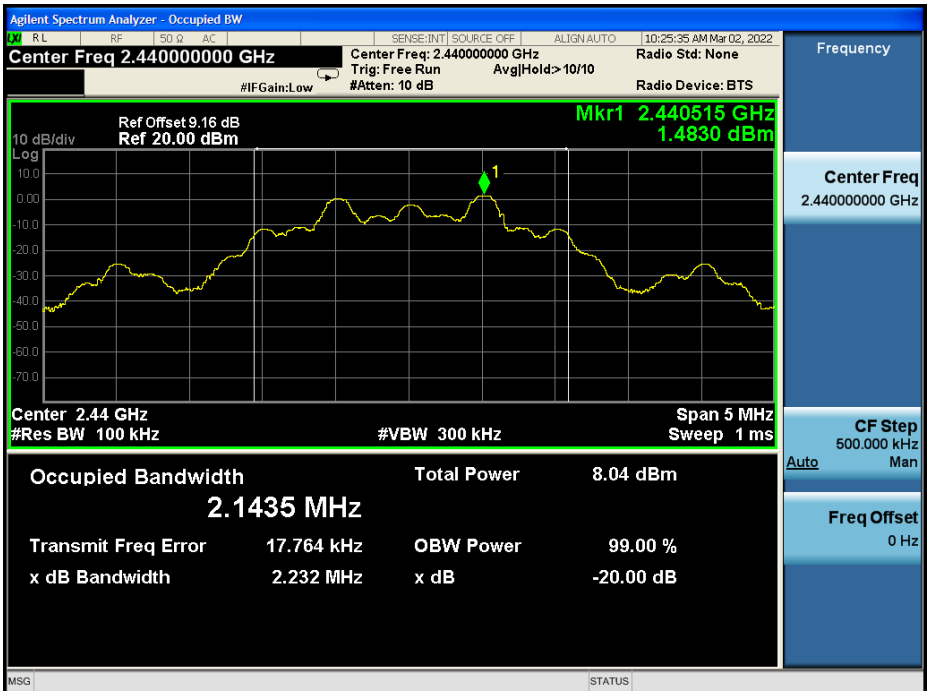
Frequency (MHz)	20dB bandwidth (MHz)	99% bandwidth (MHz)
2408	2.241	2.1434
2440	2.232	2.1435
2474	2.232	2.1414

Test plots

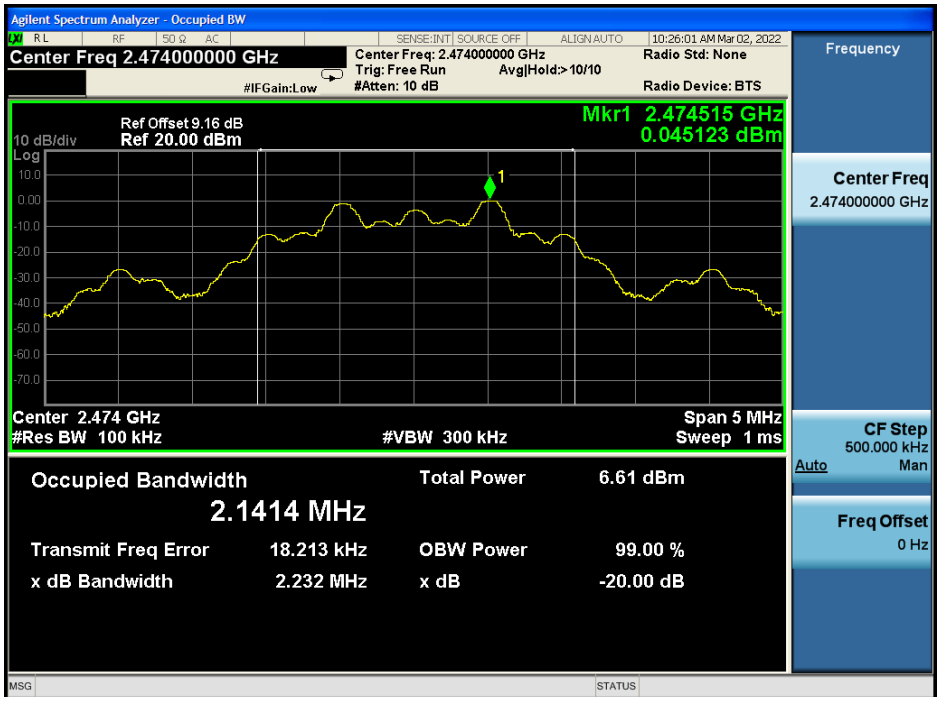
2408MHz



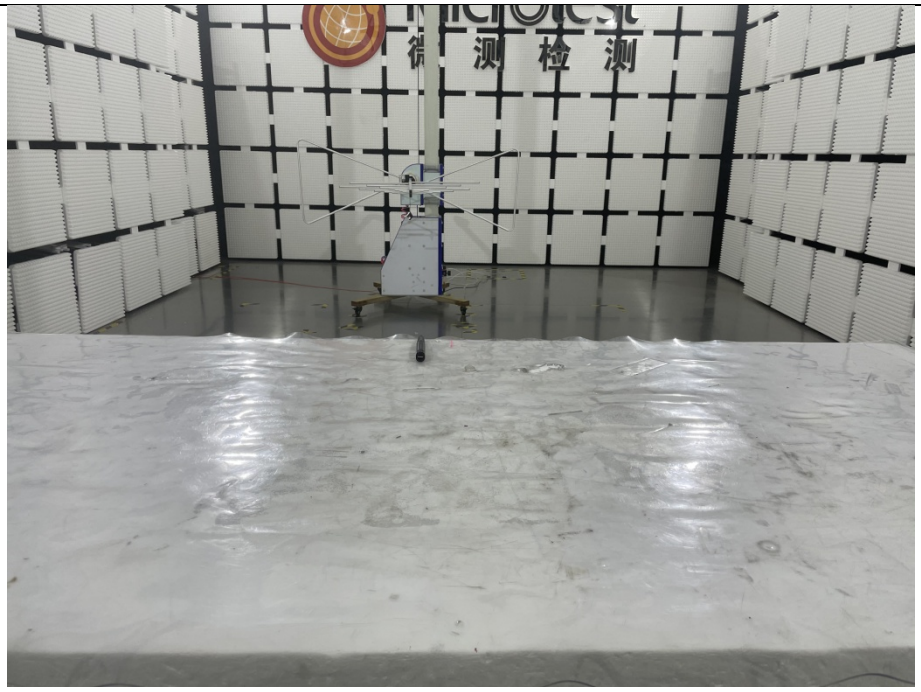
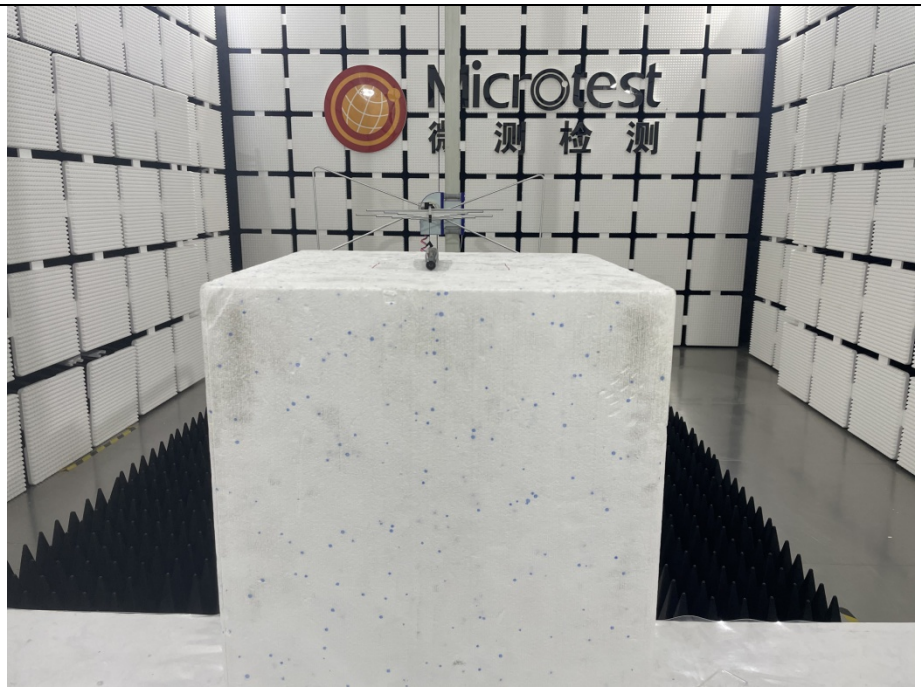
2440MHz



2474MHz



Photographs of the Test Setup

Radiated emission – below 1GHz

Radiated emission – above 1GHz


Photographs of the EUT

See the APPENDIX 1- EUT PHOTO.

----END OF REPORT----