



# Test Report

FCC ID.: 2AFW2B024

Date of issue: Oct. 10, 2015

Sample Description:	2.4G keyboard
Model(s):	B020 2.4G, B024 2.4GB0, 27 2.4G, B028 2.4G
Applicant:	Shenzhen DZH Industrial Co., Ltd
Address:	3th Floor, YiTuo Mike Industrial A building, Bu Yong Industrial D zone, ShaJing, Shenzhen
Date of Test:	Sep, 12. 2015 to Oct. 09, 2015

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



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TEST RESULT CERTIFICATION	
<b>Applicant's name:</b>	Shenzhen DZH Industrial Co., Ltd
Address:	3th Floor, YiTuo Mike Industrial A building, Bu Yong Industrial D zone, ShaJing, Shenzhen
<b>Manufacture's Name:</b>	Shenzhen DZH Industrial Co., Ltd
Address:	3th Floor, YiTuo Mike Industrial A building, Bu Yong Industrial D zone, ShaJing, Shenzhen
<b>Product description</b>	
Product name:	2.4G Keyboard
Trademark:	千业
Model name:	B020 2.4G
Serial Model:	B024 2.4G, B027 2.4G, B028 2.4G
<b>Standards:</b>	FCC Part 15.249
<b>Test Procedure:</b>	ANSI C63.4-2009

*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 R&TTE requirements. And it is applicable only to the tested sample identified in the report.*

Tested By :

*David Chen*

David Chen

Oct, 10, 2015

Reviewed By :

*Leon Chen*

Leon Chen

Oct, 10, 2015

Approved By :

*Ares Liu*

Ares Liu

Oct, 10, 2015

### SUMMARY OF TEST RESULT

Item	FCC Part No.	Description of Test	Result
1	15.203	Antenna requirement	Pass
2	15.207	AC power line conducted emission	N/A*
3	15.215	20dB bandwidth	Pass
4	15.249(a), 15.249(d)	Field strength of fundamental, field strength of harmonics, emissions radiated outside of the specified frequency bands	Pass

\* the EUT was power by battery only.

## 1. General description

### 1.1 Feature of equipment under test (EUT)

Product name:	2.4G Keyboard
Model name:	B020 2.4G
Serial Model:	B024 2.4G, B027 2.4G, B028 2.4G
Tx/Rx frequency range:	Tx: 2406MHz~2476MHz
Modulation Type:	GFSK
Power Source:	3VDC (AAA battery × 2)
Antenna Designation:	PCBA antenna (Antenna Gain: 0dBi)
Hardware Version:	V1.0
Software Version:	V1.0
Remark:	All the models above are identical in interior structure, electrical circuits and components; just model names are different for marking requirement.

## 1.2 operation channel list

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2406	24	2430	48	2454
1	2407	25	2431	49	2455
2	2408	26	2432	50	2456
3	2409	27	2433	51	2457
4	2410	28	2434	52	2458
5	2411	29	2435	53	2459
6	2412	30	2436	54	2460
7	2413	31	2437	55	2461
8	2414	32	2438	56	2462
9	2415	33	2439	57	2463
10	2416	34	2440	58	2464
11	2417	35	2441	59	2465
12	2418	36	2442	60	2466
13	2419	37	2443	61	2467
14	2420	38	2444	62	2468
15	2421	39	2445	63	2469
16	2422	40	2446	64	2470
17	2423	41	2447	65	2471
18	2424	42	2448	66	2472
19	2425	43	2449	67	2473
20	2426	44	2450	68	2474
21	2427	45	2451	69	2475
22	2428	46	2452	70	2476
23	2429	47	2453	/	/

## 2. Test Configuration of EUT

### 2.1 Test Frequency Channel

Low	2406MHz
Middle	2444MHz
High	2476MHz

### 2.2 EUT operation mode

During testing, EUT is set up to test mode provided by the manufacture to control the Tx operation followed the test requirement.

### 2.3 Test conditions

During the measurement the environmental conditions were within the listed ranges:

- Temperature: 22°C~27°C
- Humidity: 52%~58%
- Atmospheric pressure: 98kPa~101kPa

### 2.4 Testing site

Test Site	Shenzhen Toby Technology Co., Ltd.
Test Site Location	1 A/F., Bldg.6, Yusheng Industrial Zone The National Road No.107 Xixiang Section 467
FCC Registration No.:	811562
CNAS Registration No.:	CNAS L5813

### 2.5 Ancillary equipment list

Equipment	Model	S/N	Manufacturer
/	/	/	/

### 2.6 Measurement uncertainty

Measurement Uncertainty for a Level of Confidence of 95 %,  $U=2xUc(y)$

RF frequency	$1 \times 10^{-7}$
RF power, conducted	$\pm 1$ dB
Conducted emission of receivers	$\pm 1$ dB
Radiated emission of transmitter	$\pm 6$ dB
Radiated emission of receiver	$\pm 6$ dB
Temperature	$\pm 1$ degree
Humidity	$\pm 5$ %

### 3. List of test equipment

For AC power line conducted emission:

Equipment	Manufacturer	Model	Serial No.	Calibration Due
LISN	R&S	ENV216	101313	2015.12.06
LISN	SCHWARZBECK	NNLK 8129	8129245	2015.12.25
Pulse Limiter	SCHWARZBECK	VTSD 9561F	9716	2015.12.25
Test Cable	N/A	N/A	C01	2015.12.06
EMI Test Receiver	R&S	ESCI	101160	2015.12.06

For Radiated emission:

Equipment	Manufacturer	Model	Serial No.	Calibration Due
Log-Bicon Antenna	MESS-ELEKTRO NIK	VULB 9160	3058	2015.12.11
Horn Antenna	Schwarzbeck	BBHA 9120D	631	2015.12.05
Horn Antenna	Schwarzbeck	BBHA 9170	373	2015.12.05
Test Cable	United Microwave	57793	1m	2015.12.05
Test Cable	United Microwave	A30A30-5006	10M	2015.12.05
Microwave Pre amplifier	Agilent	8449B	3008A01714	2015.12.05
Pre-Amplifier	Anritsu	MH648A	M09961	2015.12.05
EMI Test Receiver	R&S	ESCI-7	101318	2015.12.05

For RF conducted emission:

Equipment	Manufacturer	Model	Serial No.	Calibration Due
Receiver	R&S	ESCI	101368	2016.06.01
Spectrum analyzer	Agilent	E4470B	MY41441082	2016.06.01

Note: the calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



## 4. Test Result

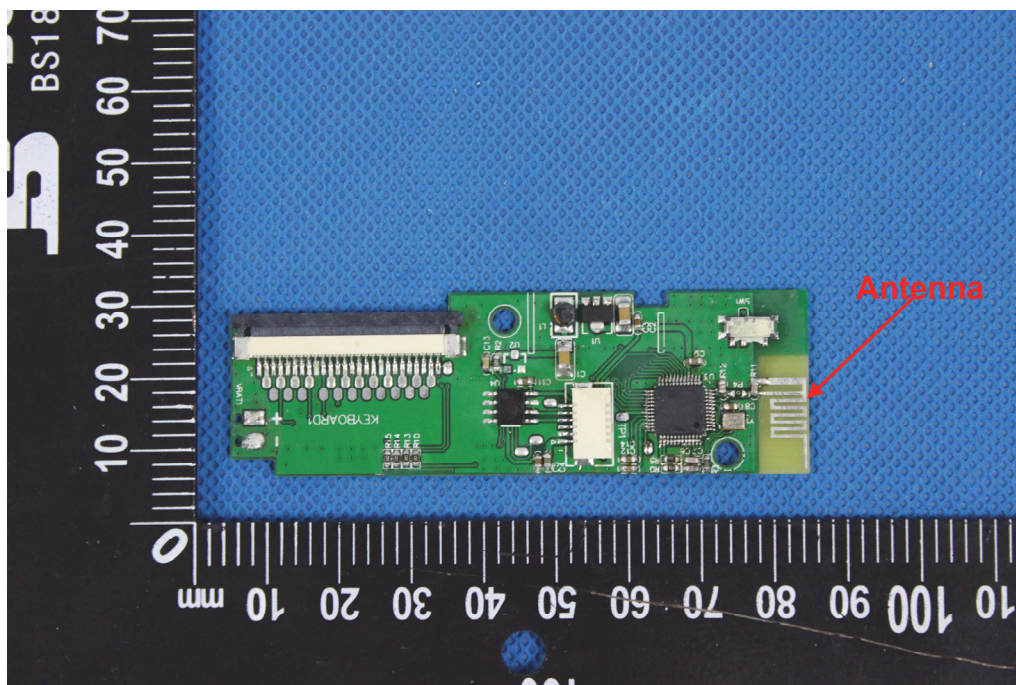
### 4.1 Antenna requirement

#### 4.1.1 Requirement defined in FCC 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, or §15.221. 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.

#### 4.1.2 EUT antenna description

The Bluetooth antenna of EUT is an internal permanently attached antenna which the maximum gain is 0dBi. So the antenna meets the requirement of this part.



## 4.2 20dB emission bandwidth

### 4.2.1 Test method

Use the following spectrum analyzer settings:

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

RBW  $\geq$  1% of the 20 dB bandwidth

VBW  $\geq$  RBW

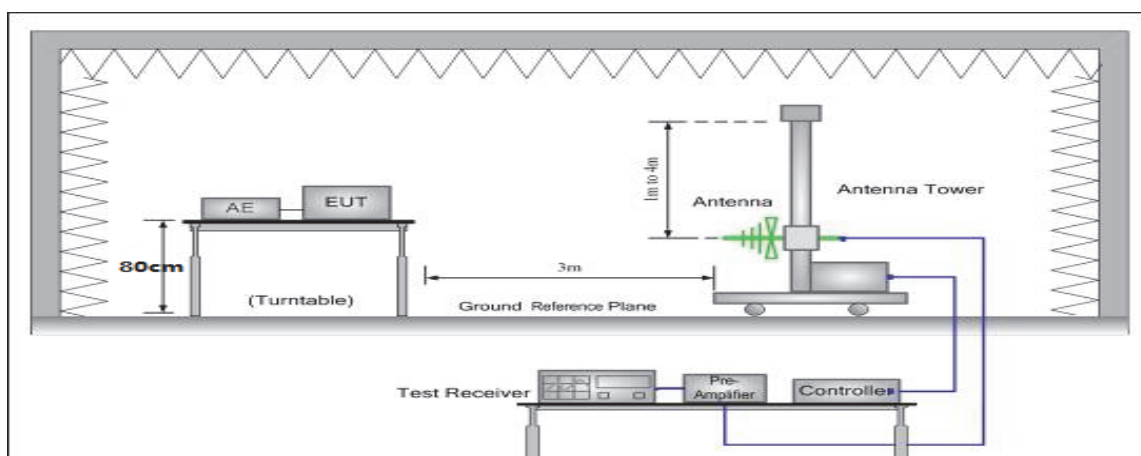
Sweep = auto

Detector function = peak

Trace = max hold

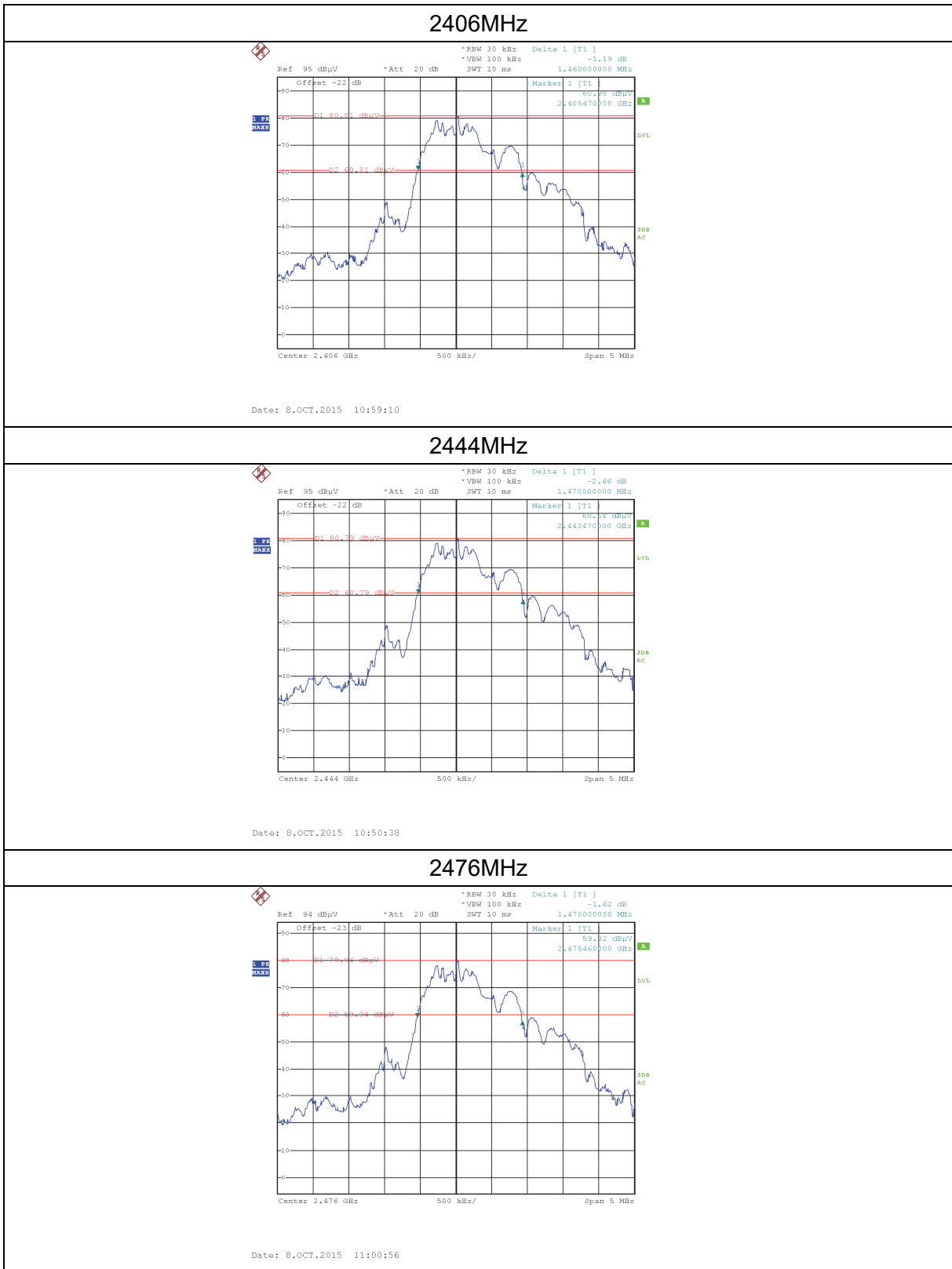
The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the 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 of the emission.

### 4.2.2 Test Setup



### 4.2.2 Test result

Frequency (MHz)	20dB emission bandwidth (MHz)
2404	1.46
2444	1.47
2476	1.47



### 4.3 Field strength of fundamental, field strength of harmonics, emissions radiated outside of the specified frequency bands

#### 4.3.1 Limit

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 dB $\mu$ V/m	Detector	Measurement distance
2400-2483.5	50	500	AV	3m

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.

Frequency (MHz)	Field strength $\mu$ V/m	Field strength dB $\mu$ V/m	Detector	Measurement distance
30-88	100	40	QP	3m
88-216	150	43.5	QP	
216-960	200	46	QP	
960-1000	500	46	QP	
Above 1000	500	54	AV	
Above 1000	5000	74	PK	

#### 4.3.2 Test method

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
3. Use the following spectrum analyzer settings:

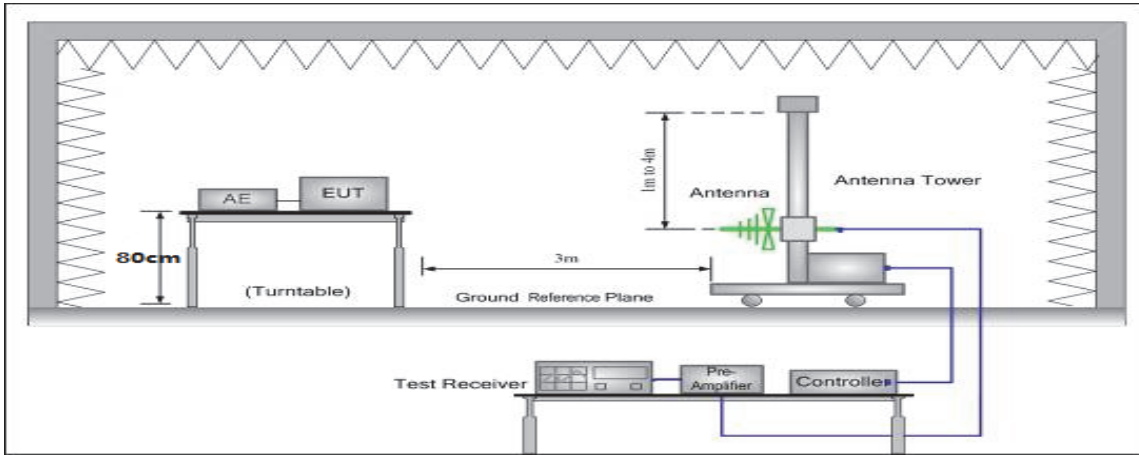
Span = wide enough to fully capture the emission being measured, RBW = 1 MHz for  $f \geq 1$ GHz, 100 kHz for  $f < 1$  GHz, VBW  $\geq$  RBW, Sweep = auto, Detector function = peak, Trace = max hold

4. Follow the guidelines in ANSI C63.4-2009 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.

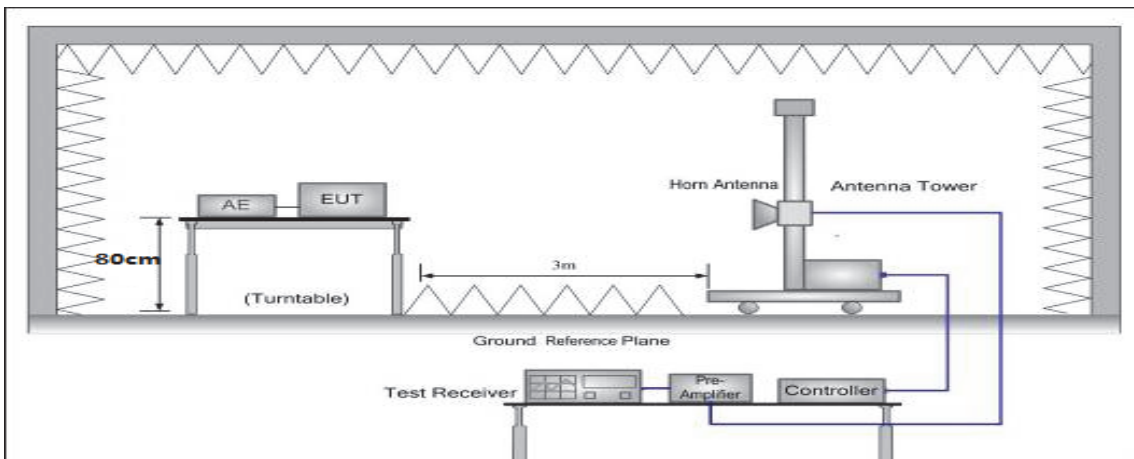
5. Set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the duty cycle per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from  $20\log(\text{duty cycle}/100 \text{ ms})$ , in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

### 4.3.3 Test Setup

Blew 1GHz:



Above 1GHz:



### 4.3.3 Test Result

2406MHz

Frequency (MHz)	Ant. Polarization	Emission level dBμV/m	Duty factor dB	Result dBμV/m	Limits dBμV/m	Detect or	Result
2406	H	87.71	/	87.71	114	PK	
2406	H	87.71	-24.78	62.93	94	AV	
2406	V	90.65	/	90.65	114	PK	
2406	V	90.65	-24.78	65.87	94	AV	
386.63	H	14.45	/	14.45	46	QP	
925.75	V	21.73	/	21.73	46	QP	
4812	H	57.07	/	57.07	74	PK	
4812	H	57.07	-24.78	32.29	54	AV	
4812	V	57.99	/	57.99	74	PK	
4812	V	57.99	-24.78	33.21	54	AV	

2444MHz

Frequency (MHz)	Ant. Polarization	Emission level dBμV/m	Duty factor dB	Result dBμV/m	Limits dBμV/m	Detect or	Result
2444	H	88.3	/	88.3	114	PK	
2444	H	88.3	-24.78	63.52	94	AV	
2444	V	90.95	/	90.95	114	PK	
2444	V	90.95	-24.78	66.17	94	AV	
826.34	H	20.61	/	20.61	46	QP	
558.73	V	18.77	/	18.77	46	QP	
4888	H	58.62	/	58.62	74	PK	
4888	H	58.62	-24.78	33.84	54	AV	
4888	V	59.11	/	59.11	74	PK	
4888	V	59.11	-24.78	34.33	54	AV	

2476MHz

Frequency (MHz)	Ant. Polarization	Emission level dBμV/m	Duty factor dB	Result dBμV/m	Limits dBμV/m	Detect or	Result
2476	H	88.16	/	88.16	114	PK	Pass
2476	H	88.16	-24.78	63.38	94	AV	
2476	V	91.41	/	91.41	114	PK	
2476	V	91.41	-24.78	66.63	94	AV	
268.67	H	22.38	/	22.38	46	QP	
487.93	V	25.61	/	25.61	46	QP	
4952	H	59.45	/	59.45	74	PK	
4952	H	59.45	-24.78	34.67	54	AV	
4952	V	59.73	/	59.73	74	PK	
4952	V	59.73	-24.78	34.95	54	AV	

Note:

AV Emission Level= PK Emission Level + Duty factor

Duty Factor =  $20 \cdot \log_{10}(\text{Duty cycle}) = 20 \cdot \log_{10}((0.22 \cdot 3)/11.44) = -24.78$  (Please see the following plots for the detail of duty cycle).

other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

If the PK measured values lower than average mode limit, the EUT shall be deemed to meet average limits and then no additional average mode measurement performed.

Duty Cycle:

