

FCC TEST REPORT

for

TELEPHONE EST (HK) CO., LTD

Bluetooth Speaker

Model Number: X3

FCC ID: 2ACE5X3

Prepared for : TELEPHONE EST (HK) CO., LTD
Address : Room 709,7F, FuLi tianhe commercial building,
Linhe East Road and tianhe district, Guangzhou, China

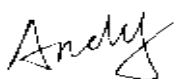
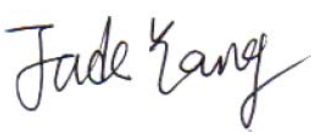

Prepared by : Keyway Testing Technology Co., Ltd.
Address : Baishun Industrial Zone, Zhangmutou Town,
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Report No. : 14KWE051289F
Date of Test : May 12~14, 2014
Date of Report : May 14,2014

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Keyway Testing Technology Co., Ltd.

Applicant:	TELEPHONE EST (HK) CO., LTD		
Address:	Room 709,7F, FuLi tianhe commercial building, Linhe East Road and tianhe district, Guangzhou, China		
Manufacturer:	TELEPHONE EST (HK) CO., LTD		
Address:	Room 709,7F, FuLi tianhe commercial building, Linhe East Road and tianhe district, Guangzhou, China		
E.U.T:	Bluetooth Speaker		
Model Number:	X3		
Trade Name:	-----	Serial No.:	-----
Date of Receipt:	May 12, 2014	Date of Test:	May 12~14, 2014
Test Specification:	FCC Part 15, Subpart C: Oct. 1, 2013 ANSI C63.4:2009		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied.		
Issue Date: May 14, 2013			
Tested by:	Reviewed by:	Approved by:	
			
Andy Gao / Engineer	Jade Yang/ Supervisor	Chris Du / Manager	
Other Aspects:	None.		
Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested			
This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd.			

1. TEST SUMMARY

Test Items	Test Requirement	Uncertainty	Result
Conducted Emissions	15.207 ANSI C63.4	$\pm 2.6\text{dB}$	PASS
Radiated Emissions	15.209 15.249 ANSI C63.4	$\pm 3.6\text{dB}$	PASS
20dB Bandwidth	15.249 ANSI C63.4	$\pm 1\text{kHz}$	PASS
Band Edge Compliance Test	15.249 ANSI C63.4	$\pm 3.6\text{dB}$	PASS
Antenna Requirement	15.203 ANSI C63.4	/	PASS

Note: N/A means not applicable.

2.GENERAL PRODUCT INFORMATION

2.1. Product Function

Refer to Technical Construction Form and User Manual.

2.2. Description of Device (EUT)

Description:	Bluetooth Speaker
M/N:	X3
Operation Frequency:	2402~2480MHz
Channel numbers:	79
Channel separation:	1M
Modulation Technology:	GFSK, Pi/4DQPSK, 8-DQPSK
Antenna Type:	PCB antenna
Antenna Gain:	0dBi
Power Supply:	DC 3.7V

2.3. Independent Operation Modes

The basic operation modes are:

2.3.1. EUT work continues TX mode and frequency as below:

Channel	Frequency
Low	2402MHz
Middle	2441MHz
High	2480MHz

2.4. Difference between Model Numbers

Note: The products different for trade name and outlook colors.

2.5. Test Supporting System

	Manufacturer: LEVEO
Notebook	M/N: G475
	S/N: GB144774

2.6. Test Facilities

Lab Qualifications	:	Certificated by Industry Canada Registration No.: 9868A Date of registration: December 8, 2011
		Certificated by FCC, USA Registration No.: 370994 Date of registration: February 21, 2012

2.7. List of Test and Measurement Instruments

2.7.1. For conducted emission at the mains terminals test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	May 9,14	May 9,15
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	May 9,14	May 9,15
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	May 9,14	May 9,15
RF Cable	FUJIKURA	3D-2W	944 Cable	May 9,14	May 9,15

2.7.2. For radiated emission test (Below 1GHz)

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	May 9,14	May 9,15
Bilog Antenna	ETS-LINDGREN	3142D	00135452	May 9,14	May 9,15
Spectrum Analyzer	Agilent	8593E	3911A04271	May 9,14	May 9,15
3m Semi-anechoic Chamber	ETS-LINDGREN	966	KW01	May 9,14	May 9,15
Signal Amplifier	SONOMA	310	187303	May 9,14	May 9,15
RF Cable	IMRO	IMRO-400	966 Cable 1#	May 9,14	May 9,15
MULTI-DEVICE Controller	ETS-LINDGREN	2090	126913	N/A	N/A
Antenna Holder	ETS-LINDGREN	2070B	00109601	N/A	N/A

2.7.3. For above 1GHz radiated emission, band edge, 20dB bandwidth test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Horn Antenna	DAZE	ZN30701	11003	May 9,14	May 9,15
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	May 9,14	May 9,15
Spectrum Analyzer	Agilent	8593E	3911A04271	May 9,14	May 9,15
Spectrum Analyzer	Agilent	E4408B	MY44211125	May 9,14	May 9,15
Spectrum Analyzer	Rohde&Schwarz	FSP	100394	May 9,14	May 9,15
3m Semi-anechoic Chamber	ETS-LINDGREN	966	KW01	May 9,14	May 9,15
Signal Amplifier	DAZE	ZN3380C	11001	May 9,14	May 9,15
Signal Amplifier	Agilent	8449B	3008A00251	May 9,14	May 9,15
High Pass filter	Micro	HPM50111	324216	May 9,14	May 9,15
Power Meter	R&S	NRVS	101824	May 9,14	May 9,15
Peak and Avg Power Sensor	Rohde&Schwarz	URV5-Z7	100655	May 9,14	May 9,15
RF Cable	IMRO	IMRO-400	966 Cable 1#	May 9,14	May 9,15
MULTI-DEVICE Controller	ETS-LINDGREN	2090	126913	N/A	N/A
Antenna Holder	ETS-LINDGREN	2070B	00109601	N/A	N/A

3. TEST SET-UP AND OPERATION MODES

3.1. Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



(EUT: Bluetooth Speaker)

Note: By preliminary testing three modulation of EUT transmitted status, it was found that “GFSK” modulation was the worst, then the final test was executed the worst condition and test data were recorded in this report. Test data as below.

Frequency (MHz)	Axis	Field Strength (dBuV/m)	Antenna Polarization
2402	GFSK	97.24	Vertical
2402	Pi/4DQPSK	95.06	Vertical
2402	8-DQPSK	95.59	Vertical

3.3. Test Operation Mode and Test Software

None.

3.4. Special Accessories and Auxiliary Equipment

None.

3.5. Countermeasures to Achieve EMC Compliance

None.

4. EMISSION TEST RESULTS

4.1. Radiated Emission Test

4.1.1. Limit 15.209 limits

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		$\mu\text{V}/\text{m}$	$\text{dB}(\mu\text{V})/\text{m}$
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 $\text{dB}(\mu\text{V})/\text{m}$ (Peak) 54.0 $\text{dB}(\mu\text{V})/\text{m}$ (Average)	

4.1.2. Fundamental and harmonics emission limits

Fundamental Frequency	Field Strength of Fundamental		Field Strength of Harmonics	
	mV/m	$\text{dB}\mu\text{V}/\text{m}$	$\mu\text{V}/\text{m}$	$\text{dB}\mu\text{V}/\text{m}$
902~928 MHz	50	94	500	54
2400~2483.5 MHz	50	94	500	54
5725~5875MHz	50	94	500	54
24.0~24.25GHz	250	108	2500	68

4.1.3. Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

4.1.4. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz.

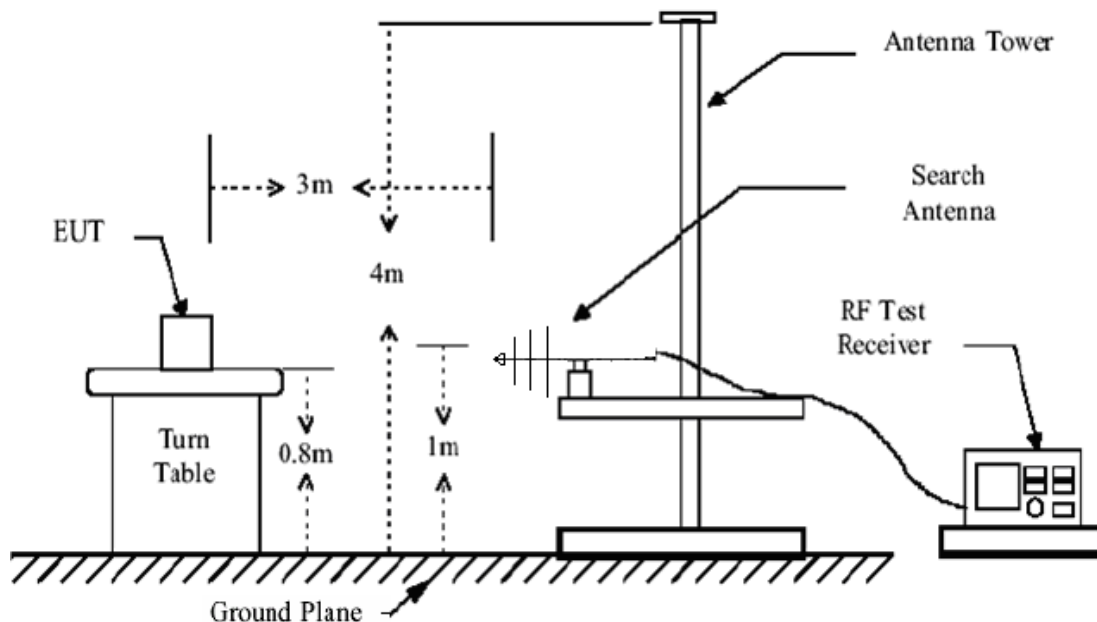
The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Y axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

The test data of the worst case condition(s) was reported on the following pages.

Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.

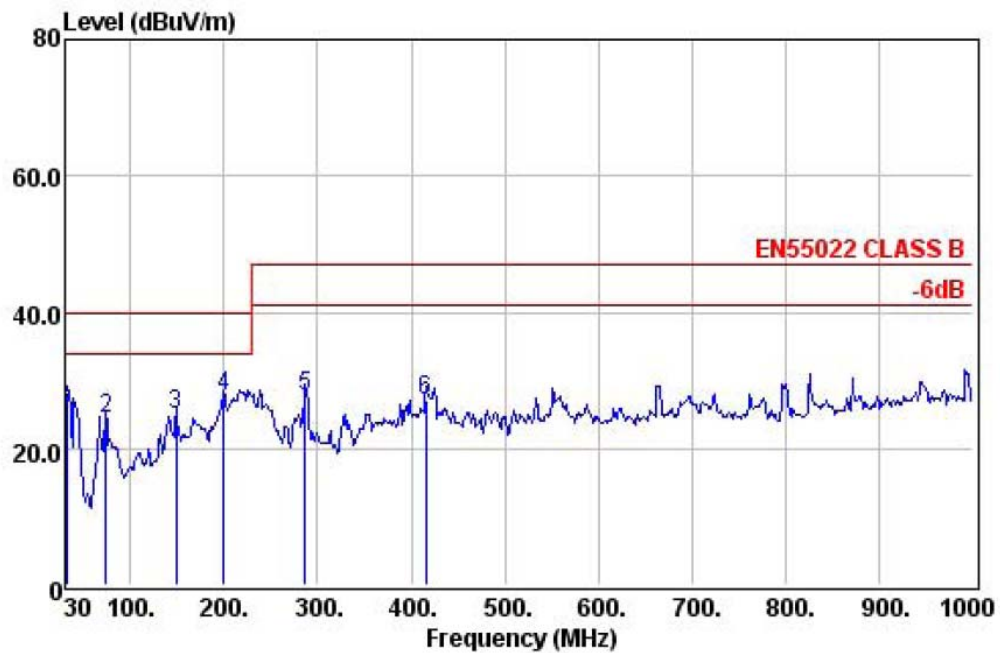
2. Measurement Uncertainty: ± 3.6 dB at a level of confidence of 95%.



Test Data

Test mode: TX Mode

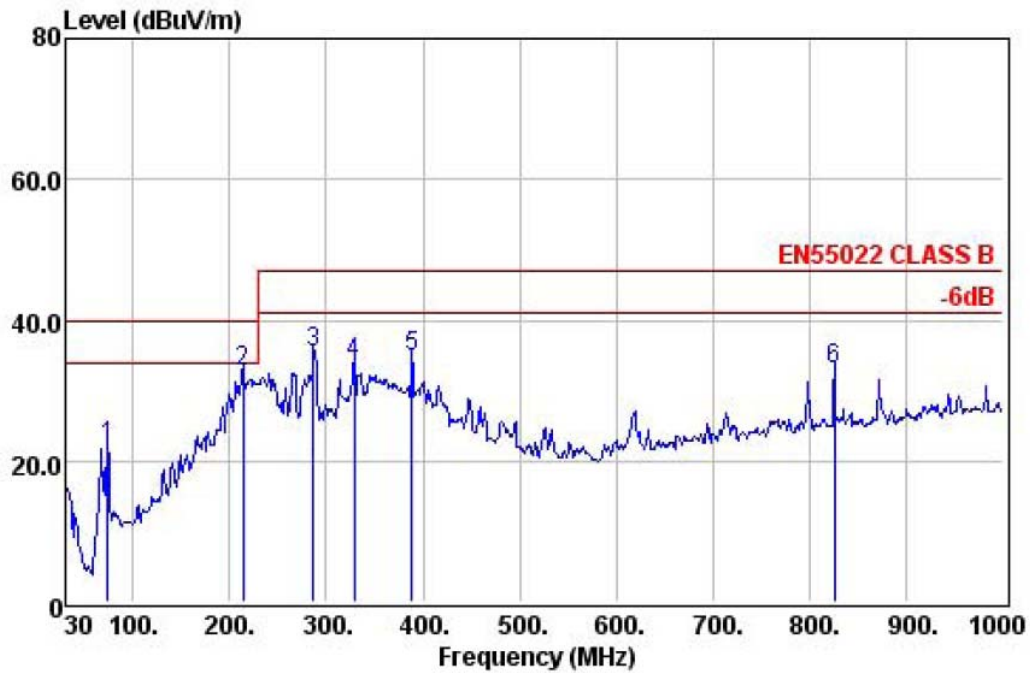
Polarization: VERTICAL



	Preamp Freq	Factor	Read Level	Cable&Antenna Loss Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB
1	31.94	31.40	41.47	0.56	17.66	28.29	40.00	-11.71 QP
2	73.65	31.33	47.29	0.85	7.68	24.49	40.00	-15.51 QP
3	148.34	31.24	46.01	1.22	8.90	24.89	40.00	-15.11 QP
4	199.75	31.10	46.29	1.46	10.98	27.63	40.00	-12.37 QP
5	287.05	30.94	43.21	1.87	13.39	27.53	47.00	-19.47 QP
6	416.06	30.63	38.37	2.48	16.81	27.03	47.00	-19.97 QP

Test mode: TX Mode

Polarization: HORIZONTAL



		Preamp	Read	CableAntenna		Limit	Over	
	Freq	Factor	Level	Loss	Factor	Level	Line	Limit
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB
1	73.65	31.33	44.83	0.85	7.68	22.03	40.00	-17.97 QP
2	214.30	31.04	50.45	1.53	11.69	32.63	40.00	-7.37 QP
3	287.05	30.94	50.96	1.87	13.39	35.28	47.00	-11.72 QP
4	328.76	30.79	48.04	2.02	14.65	33.92	47.00	-13.08 QP
5	388.90	30.62	46.93	2.37	16.25	34.93	47.00	-12.07 QP
6	825.40	30.47	35.87	4.49	23.10	32.99	47.00	-14.01 QP

Test mode: 2402MHz

Polarization: VERTICAL

		Preamp	Read	CableAntenna			Limit	Over	
	Freq	Factor	Level	Loss	Factor	Level	Line	Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2402.00	26.32	79.20	7.34	28.72	88.94	94.00	-5.06	Average
2	2402.00	26.32	87.50	7.34	28.72	97.24	114.00	-16.76	Peak
3	2955.00	26.48	38.36	9.74	29.88	51.50	74.00	-22.50	Peak
4	4804.00	27.49	32.78	11.96	32.94	50.19	74.00	-23.81	Peak
5	6134.00	27.73	24.50	16.60	35.39	48.76	74.00	-25.24	Peak
6	8225.00	28.17	21.99	16.70	36.58	47.10	74.00	-26.90	Peak
7	11880.00	28.99	18.05	17.34	39.52	45.92	74.00	-28.08	Peak

Test mode: 2402MHz

Polarization: HORIZONTAL

		Preamp	Read	CableAntenna			Limit	Over	
	Freq	Factor	Level	Loss	Factor	Level	Line	Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2402.00	26.32	79.41	7.34	28.72	89.15	94.00	-4.85	Average
2	2402.00	26.32	87.43	7.34	28.72	97.17	114.00	-16.83	Peak
3	4804.00	27.49	32.28	11.96	32.94	49.69	74.00	-24.31	Peak
4	7205.00	27.94	22.40	16.61	37.28	48.35	74.00	-25.65	Peak
5	10486.00	28.85	20.92	17.06	39.17	48.30	74.00	-25.70	Peak
6	14294.00	29.44	18.34	19.55	41.80	50.25	74.00	-23.75	Peak
7	15756.00	29.66	18.94	20.48	39.38	49.14	74.00	-24.86	Peak

Test mode: 2441MHz

Polarization: VERTICAL

		Preamp	Read	CableAntenna			Limit	Over	
	Freq	Factor	Level	Loss	Factor	Level	Line	Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2441.00	26.33	79.76	7.48	28.76	89.67	94.00	-4.33	Average
2	2441.00	26.33	87.00	7.48	28.76	96.91	114.00	-17.09	Peak
3	4882.00	27.53	27.51	12.14	33.11	45.23	74.00	-28.77	Peak
4	6406.00	27.78	21.62	16.60	35.76	46.20	74.00	-27.80	Peak
5	9517.00	28.61	19.43	16.92	38.01	45.75	74.00	-28.25	Peak
6	12135.00	29.03	18.68	17.49	39.43	46.57	74.00	-27.43	Peak
7	14634.00	29.49	17.17	19.77	40.04	47.49	74.00	-26.51	Peak

Test mode: 2441MHz

Polarization: HORIZONTAL

	Freq	Preamp Factor	Read Level	CableAntenna Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2441.00	26.33	79.90	7.48	28.76	89.81	94.00	-4.19	Average
2	2441.00	26.33	87.35	7.48	28.76	97.26	114.00	-16.74	Peak
3	4882.00	27.53	28.21	12.14	33.11	45.93	74.00	-28.07	Peak
4	6304.00	27.76	22.69	16.60	35.62	47.15	74.00	-26.85	Peak
5	9670.00	28.67	20.30	16.94	38.14	46.71	74.00	-27.29	Peak
6	11557.00	28.96	18.34	17.28	39.85	46.51	74.00	-27.49	Peak
7	12917.00	29.18	16.71	18.14	40.50	46.17	74.00	-27.83	Peak

Test mode: 2480MHz

Polarization: VERTICAL

	Freq	Preamp Factor	Read Level	CableAntenna Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2480.00	26.34	78.56	7.57	28.79	88.58	94.00	-5.42	Average
2	2480.00	26.34	87.20	7.57	28.79	97.22	114.00	-16.78	Peak
3	2955.00	26.48	36.06	9.74	29.88	49.20	74.00	-24.80	Peak
4	4960.00	27.58	33.57	12.36	33.32	51.67	74.00	-22.33	Peak
5	6814.00	27.86	23.40	16.60	36.71	48.85	74.00	-25.15	Peak
6	9755.00	28.70	22.65	16.94	38.21	49.10	74.00	-24.90	Peak
7	14005.00	29.40	15.80	19.37	43.50	49.27	74.00	-24.73	Peak

Test mode: 2480MHz

Polarization: HORIZONTAL

	Freq	Preamp Factor	Read Level	CableAntenna Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2480.00	26.34	78.76	7.57	28.79	88.78	94.00	-5.22	Average
2	2480.00	26.34	86.86	7.57	28.79	96.88	114.00	-17.12	Peak
3	4960.00	27.58	31.31	12.36	33.32	49.41	74.00	-24.59	Peak
4	6729.00	27.85	24.65	16.60	36.48	49.88	74.00	-24.12	Peak
5	9330.00	28.53	22.50	16.91	37.79	48.67	74.00	-25.33	Peak
6	11795.00	28.98	21.28	17.33	39.61	49.24	74.00	-24.76	Peak
7	14124.00	29.42	19.92	19.44	42.80	52.74	74.00	-21.26	Peak

5. 20DB OCCUPY BANDWIDTH

5.1. Limits

According to FCC Section 15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth($10 \cdot \log 1\% = 20\text{dB}$) taking the RF output power

5.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

2. Set the spectrum analyzer:

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

RBW =100kHz

VBW =100kHz

Sweep=auto

Detector function=peak

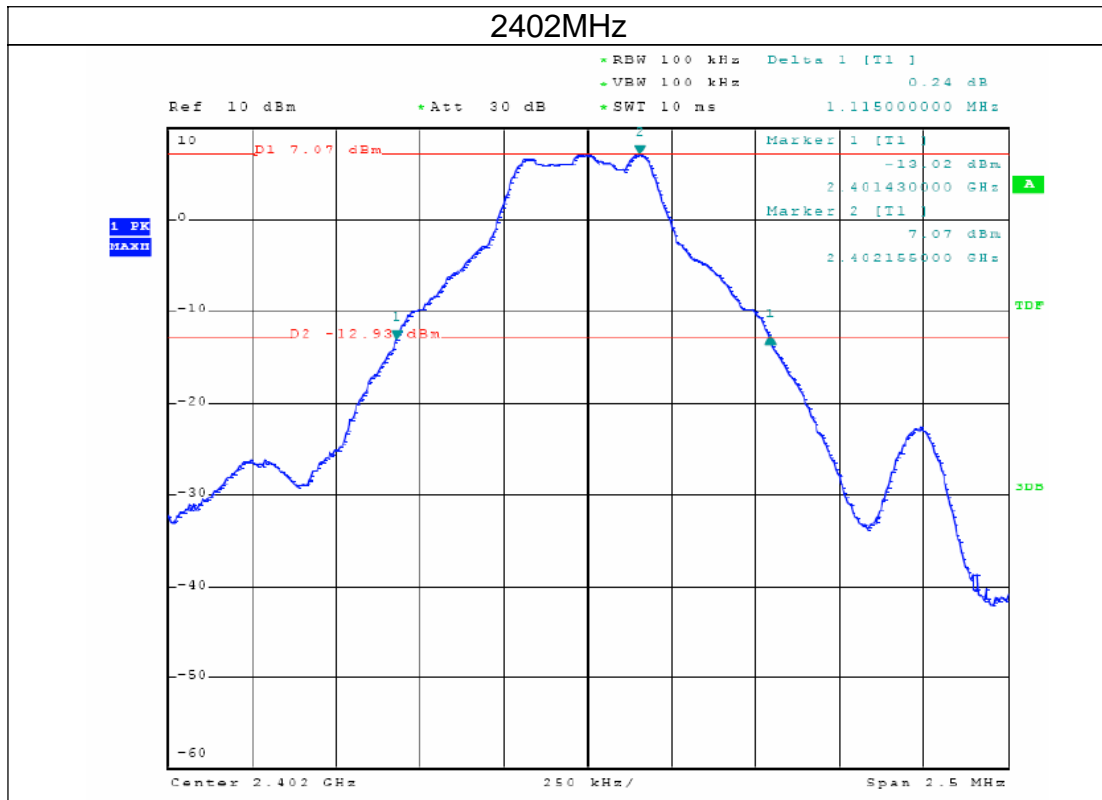
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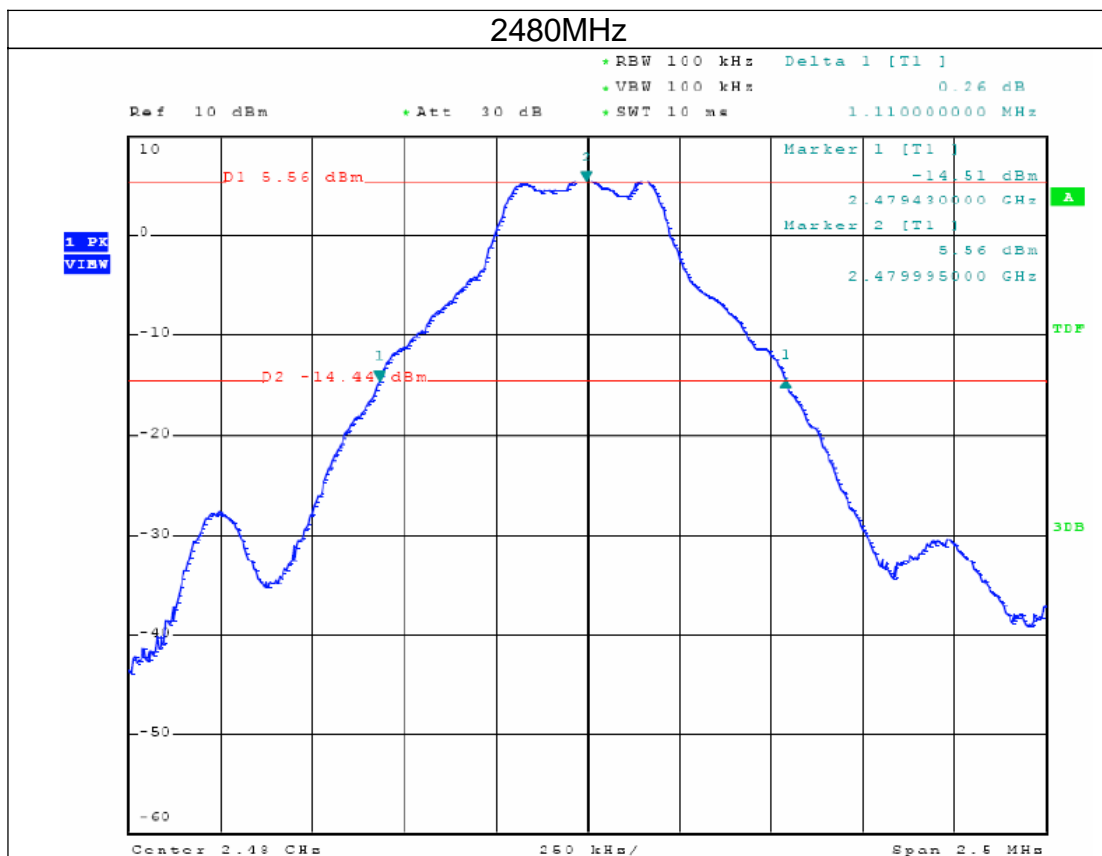
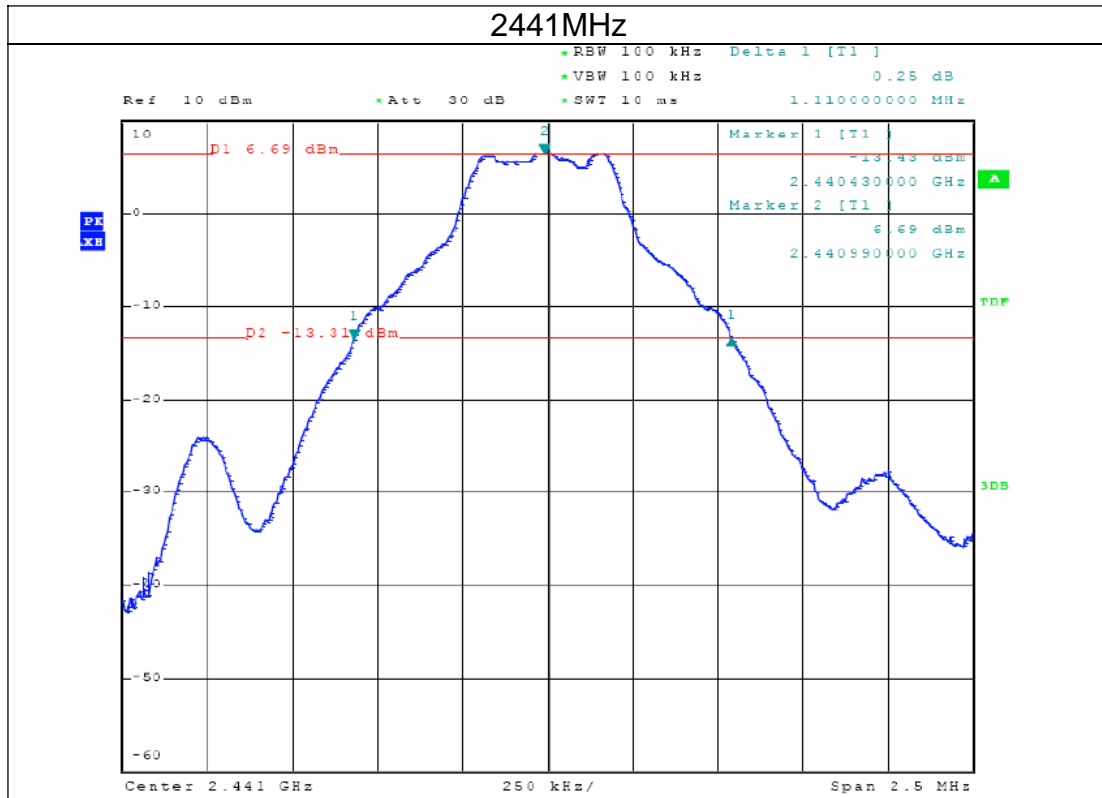
For pretest, the worst mode was GFSK, the data only show the GFSK mode.

Test data:

Channel Frequency (MHz)	20dB Bandwidth (MHz)	Limit (MHz)
2402	1.12	N/A
2441	1.11	N/A
2480	1.11	N/A

Test plot as follows:





6. BAND EDGE COMPLIANCE TEST

6.1. Limits

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

6.2. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure.

For pretest, the worst mode was GFSK, the data only show the GFSK mode.

Note: If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

For radiated test as follows:

Unhopping

	Frequency (MHz)	Antenna polarization (H/V)	Band edge	Limit (dBUV/m)	
			PK	PK	AV
GFSK	<2400	H	49.87	74.00	54.00
	<2400	V	50.21	74.00	54.00
	>2483.5	H	50.92	74.00	54.00
	>2483.5	V	50.26	74.00	54.00

Hopping

	Frequency (MHz)	Antenna polarization (H/V)	Band edge	Limit (dBUV/m)	
			PK	PK	AV
GFSK	<2400	H	50.04	74.00	54.00
	<2400	V	50.27	74.00	54.00
	>2483.5	H	49.76	74.00	54.00
	>2483.5	V	50.05	74.00	54.00

7. ANTENNA REQUIREMENT:

Standard requirement:	FCC Part15 C Section 15.203 /249(c)
<p>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, 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.</p> <p>15.249 requirement: Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.</p>	
E.U.T Antenna:	
The antenna is PCB antenna, the best case gain of the antenna is 0dBi	

8. PHOTOGRAPHS OF TEST SET-UP

Please see annex.

9. PHOTOGRAPHS OF THE EUT

Please see annex.

END