

FCC TEST REPORT(2.4G)
for
Eleven Engineering Incorporated
Gemma
Model Number: PL5559
FCC ID: OP5PL5559

Prepared for : Eleven Engineering Incorporated
Address : 10150 100 street, Suite 800, Edmonton, Alberta,
Canada, T5J 0P6.

Prepared by : Keyway Testing Technology Co., Ltd.
Address : Baishun Industrial Zone, Zhangmutou Town,
Dongguan, Guangdong, China

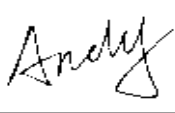
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Report No. : 14KWE07173601F
Date of Test : Jul. 31~ Aug. 4, 2014
Date of Report : Aug. 4, 2014

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Keyway Testing Technology Co., Ltd.

Applicant:	Eleven Engineering Incorporated		
Address:	10150 100 street, Suite 800, Edmonton, Alberta, Canada, T5J 0P6.		
Manufacturer:	AML Industrial Electronic Ltd.		
Address:	Po Shan Industrial Estate, Zhangmutou Town, Dongguan City, Guangdong, CHINA, 523622		
E.U.T:	Gemma		
Model Number:	PL5559		
Trade Name:	SKAA	Serial No.:	-----
Date of Receipt:	Jul. 31 , 2014	Date of Test:	Jul. 31~ Aug. 4, 2014
Test Specification:	FCC Part 15, Subpart 15.247: Oct. 1, 2013 ANSI C63.4:2009 RSS 210 Issue 8.0:2010 RSS-Gen Issue 3:2010		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied.		
Issue Date: Aug. 4, 2014			
Tested by:	Reviewed by:	Approved by:	
 	 	 	
Jack Bu / Engineer	Andy Gao / Supervisor	Jade Yang / Supervisor	
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	Result
Conducted Emissions	15.207,RSS-210, ISSUE 8 RSS-GEN Clause 7.2.4	N/A
Radiated Emissions	15.205(a)/15.209/15.247(d) RSS-210, ISSUE 8	PASS
20dB&99% Bandwidth	15.247(a)(1) RSS-210, ISSUE 8 RSS-GEN Clause 4.6.1	PASS
Frequency Separation	15.247(a)(1) RSS-210, ISSUE 8 Clause A8.1(b)	PASS
Maximum Peak Output Power	15.247(b)(1) RSS-210, ISSUE 8 Clause A8.4	PASS
Number of Hopping Frequency	15.247(a)(1)(iii) RSS-210, ISSUE 8 Clause A8.1(d)	PASS
Dwell time	15.247(a)(1)(iii) RSS-210, ISSUE 8 Clause A8.1(d)	PASS
Emissions from out of band	15.247(d) RSS-210, ISSUE 8 Clause 2.5	PASS
Antenna Requirement	15.203 RSS-GEN	PASS

Remark: N/A means not application.

2. GENERAL PRODUCT INFORMATION

2.1. Product Function

Refer to Technical Construction Form and User Manual.

2.2. Description of Device (EUT)

Product Name:	Gemma
Model No.:	PL5559
Operation Frequency:	2403.585MHz~2477.313MHz
Channel numbers:	49 Channels
Modulation technology:	FSK
Antenna Type:	Internal
Antenna gain:	0dBi for
Power supply:	DC 5V

2.3. Independent Operation Modes

The basic operation modes are:

Channel	Frequency
Low	2403.585MHz
Middle	2438.913MHz
High	2477.313MHz

2.4. Test Supporting System

Mobile Phone

Manufacturer : SAMSUNG

Model No. : GT-I9158

FCC approved : FCC DOC

2.5. Channel List

Channel List					
Ch Number	Center Frequency (MHz)	Ch Number	Center Frequency (MHz)	Ch #	Center Frequency (MHz)
1	2403.585	18	2429.697	35	2455.809
2	2405.121	19	2431.233	36	2457.345
3	2406.657	20	2432.769	37	2458.881
4	2408.193	21	2434.305	38	2460.417
5	2409.729	22	2435.841	39	2461.953
6	2411.265	23	2437.377	40	2463.489
7	2412.801	24	2438.913	41	2465.025
8	2414.337	25	2440.449	42	2466.561
9	2415.873	26	2441.985	43	2468.097
10	2417.409	27	2443.521	44	2469.633
11	2418.945	28	2445.057	45	2471.169
12	2420.481	29	2446.593	46	2472.705
13	2422.017	30	2448.129	47	2474.241
14	2423.553	31	2449.665	48	2475.777
15	2425.089	32	2451.201	49	2477.313
16	2426.625	33	2452.737		
17	2428.161	34	2454.273		

2.6. TEST SITES

2.6.1. 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

Certificated by CNAS China
 Registration No.: CNAS L5783
 Date of registration: August 8, 2012

2.7. List of Test and Measurement Instruments

2.7.1. For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,14	Apr. 27,15
System Simulator	Agilent	E5515C	GB43130245	Apr. 27,14	Apr. 27,15
Power Splitter	Weinschel	1506A	NW425	Apr. 27,14	Apr. 27,15
Power Meter	R&S	NRVS	101824	Apr. 27,14	Apr. 27,15
Peak and Avg Power Sensor	Rohde&Schwarz	URV5-Z7	100655	Apr. 27,14	Apr. 27,15
Bilog Antenna	ETS-LINDGREEN	3142D	135452	Apr. 27,14	Apr. 27,15
Spectrum Analyzer	Agilent	E4411B	MY4511304	Apr. 27,14	Apr. 27,15
Spectrum Analyzer	R&S	FSV40	132.1.3008K39 -100967	Apr. 27,14	Apr. 27,15
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	Apr. 27,14	Apr. 27,15
Signal Amplifier	SONOMA	310	187016	Apr. 27,14	Apr. 27,15
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 27,14	Apr. 27,15
RF Cable	IMRO	IMRO-400	966 Cable 1#	N/A	N/A
MULTI-DEVICE Controller	ETS-LINDGREEN	2090	126913	N/A	N/A
Horn Antenna	DAZE	ZN30701	11003	Apr. 27,14	Apr. 27,15
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	Apr. 27,14	Apr. 27,15
Spectrum Analyzer	Agilent	8593E	3911A04271	Apr. 27,14	Apr. 27,15
Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 27,14	Apr. 27,15
Signal Amplifier	DAZE	ZN3380C	11001	Apr. 27,14	Apr. 27,15
High Pass filter	Micro	HPM50111	324216	Apr. 27,14	Apr. 27,15
Filter	COM-MW	ZBSF-C836.5-25-X	KW032	Apr. 27,14	Apr. 27,15
Filter	COM-MW	ZBSF-C1747.5-75-X2	KW035	Apr. 27,14	Apr. 27,15
Filter	COM-MW	ZBSF-C1880-60-X2	KW037	Apr. 27,14	Apr. 27,15
DC Power Supply	LongWei	PS-305D	010964729	Apr. 27,14	Apr. 27,15
Constant temperature and humidity box	GF	GTH-800-40-1P	MAA9906-005	Apr. 27,14	Apr. 27,15
Universal radio communication tester	Rohde&Schwarz	CMU200	3215420	Apr. 27,14	Apr. 27,15
Splitter	Agilent	11636B	0025164	Apr. 27,14	Apr. 27,15

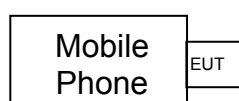
3. TEST SET-UP AND OPERATION MODES

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: Gemma)

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.

3.6. Test Environment:

Ambient conditions in the test laboratory:

Items	Actual
Temperature (°C)	21~23
Humidity (%RH)	50~65

4. EMISSION TEST RESULTS

4.1. Radiated Emission Test

4.1.1. Limit 15.209 limits

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		$\mu\text{V/m}$	$\text{dB}(\mu\text{V})/\text{m}$
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. 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.

4.1.3. 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.

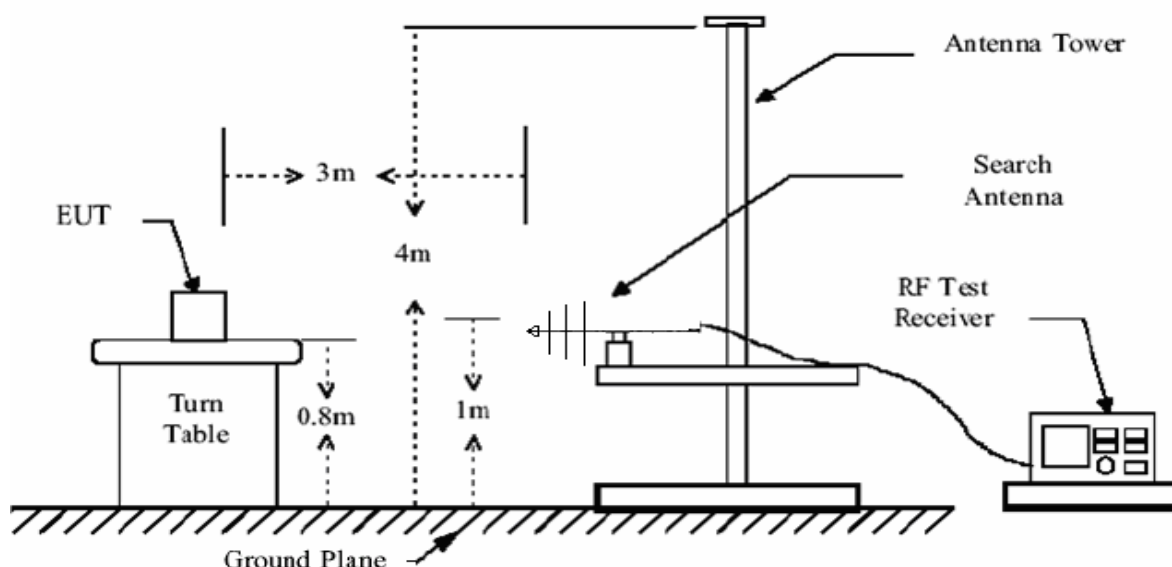
The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

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

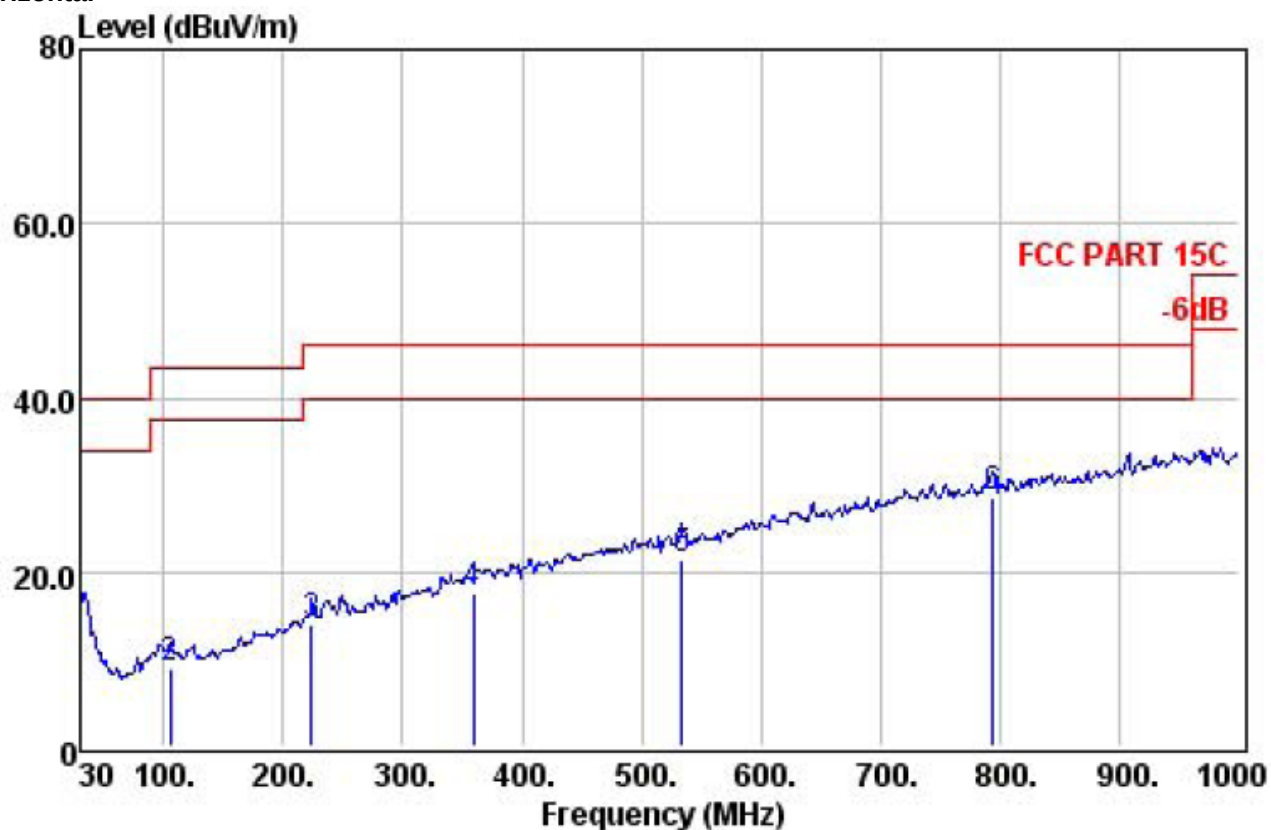
The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz.

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.

- Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.
2. Measurement Uncertainty: ± 3.2 dB at a level of confidence of 95%.
3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
4. For emissions below 1GHz, pretest for all mode, The test data of the worst case condition(s) was reported on the following pages.
5. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis which it is worse case.
- 6: Pre-scan below 1GHz for all model, The other test only show worst model in report.

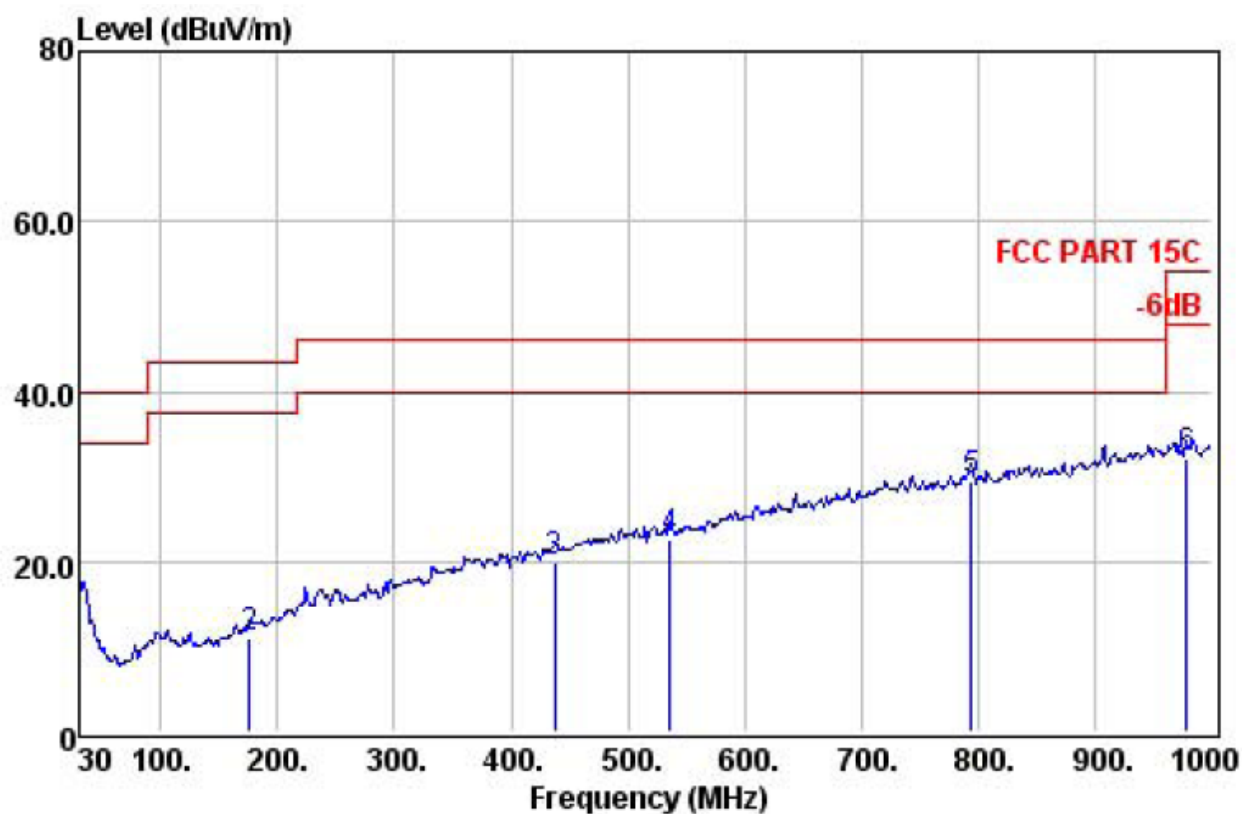


Below 1GHz
Horizontal



	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	30.00	31.41	30.68	0.56	18.80	18.63	40.00	-21.37	QP
2	105.66	31.33	29.70	1.03	9.43	8.83	43.50	-34.67	QP
3	224.00	30.95	31.20	1.53	12.15	13.93	46.00	-32.07	QP
4	359.80	30.62	29.93	2.18	16.11	17.60	46.00	-28.40	QP
5	534.40	30.77	29.86	3.03	19.31	21.43	46.00	-24.57	QP
6	794.36	30.58	31.88	4.29	22.93	28.52	46.00	-17.48	QP

Vertical



	Preamp	Read	CableAntenna		Limit	Over	
	Freq	Factor	Level	Loss Factor	Level	Line	Limit Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dB
1	30.00	31.41	31.68	0.56	18.80	19.63	40.00 -20.37 QP
2	175.50	31.17	30.60	1.39	10.27	11.09	43.50 -32.41 QP
3	437.40	30.62	30.74	2.55	17.35	20.02	46.00 -25.98 QP
4	536.34	30.78	31.08	3.03	19.34	22.67	46.00 -23.33 QP
5	794.36	30.58	32.88	4.29	22.93	29.52	46.00 -16.48 QP
6	978.66	29.36	31.84	4.93	24.80	32.21	54.00 -21.79 QP

Above 1GHz
TX 2403.585MHz
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	3193.00	26.59	30.99	9.95	30.19	44.54	74.00	-29.46	Peak
2	4807.17	27.49	32.57	11.96	32.94	49.98	74.00	-24.02	Peak
3	7210.76	27.94	21.15	16.61	37.28	47.10	74.00	-26.90	Peak
4	10928.00	28.89	13.21	17.15	39.46	40.93	74.00	-33.07	Peak
5	13104.00	29.22	12.19	18.34	41.18	42.49	74.00	-31.51	Peak
6	14719.00	29.51	14.30	19.83	39.69	44.31	74.00	-29.69	Peak

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	3040.00	26.52	30.99	9.93	30.03	44.43	74.00	-29.57	Peak
2	4807.17	27.49	31.85	11.96	32.94	49.26	74.00	-24.74	Peak
3	7210.76	27.94	20.73	16.61	37.28	46.68	74.00	-27.32	Peak
4	9602.00	28.64	16.11	16.93	38.08	42.48	74.00	-31.52	Peak
5	12883.00	29.18	14.03	18.11	40.42	43.38	74.00	-30.62	Peak
6	14719.00	29.51	15.34	19.83	39.69	45.35	74.00	-28.65	Peak

TX 2438.913MHz
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	3142.00	26.57	26.83	9.94	30.14	40.34	74.00	-33.66	Peak
2	4877.83	27.53	31.62	12.14	33.11	49.34	74.00	-24.66	Peak
3	7316.74	27.96	20.07	16.62	37.33	46.06	74.00	-27.94	Peak
4	10758.00	28.88	16.00	17.12	39.36	43.60	74.00	-30.40	Peak
5	13342.00	29.27	13.66	18.61	42.29	45.29	74.00	-28.71	Peak
6	17320.00	30.23	12.49	21.62	45.11	48.99	74.00	-25.01	Peak

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	3193.00	26.59	30.52	9.95	30.19	44.07	74.00	-29.93	Peak
2	4877.83	27.53	32.31	12.14	33.11	50.03	74.00	-23.97	Peak
3	7316.74	27.96	18.05	16.62	37.33	44.04	74.00	-29.96	Peak
4	10588.00	28.86	17.75	17.08	39.25	45.22	74.00	-28.78	Peak
5	12441.00	29.09	18.32	17.74	39.49	46.46	74.00	-27.54	Peak
6	14107.00	29.42	15.44	19.43	42.90	48.35	74.00	-25.65	Peak

TX 2477.313MHz

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	3414.00	26.71	25.82	9.97	30.41	39.49	74.00	-34.51	Peak
2	4954.63	27.58	31.57	12.32	33.32	49.63	74.00	-24.37	Peak
3	7431.94	27.98	15.49	16.62	37.37	41.50	74.00	-32.50	Peak
4	10061.00	28.81	12.24	16.98	38.51	38.92	74.00	-35.08	Peak
5	13002.00	29.20	12.67	18.22	40.70	42.39	74.00	-31.61	Peak
6	16861.00	30.05	10.74	21.23	44.27	46.19	74.00	-27.81	Peak

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	3006.00	26.50	27.29	9.93	30.00	40.72	74.00	-33.28	Peak
2	4954.63	27.58	31.81	12.32	33.32	49.87	74.00	-24.13	Peak
3	7431.94	27.98	21.91	16.62	37.37	47.92	74.00	-26.08	Peak
4	7987.00	28.10	19.20	16.66	36.43	44.19	74.00	-29.81	Peak
5	11421.00	28.94	13.58	17.25	39.83	41.72	74.00	-32.28	Peak
6	15484.00	29.62	15.56	20.31	38.40	44.65	74.00	-29.35	Peak

5. 20DB & 99% 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 $\geq 1\%$ of the 20dB bandwidth

VBW $\geq$ RBW

Sweep=auto

Detector function=peak

Trace=max hold

Test data:

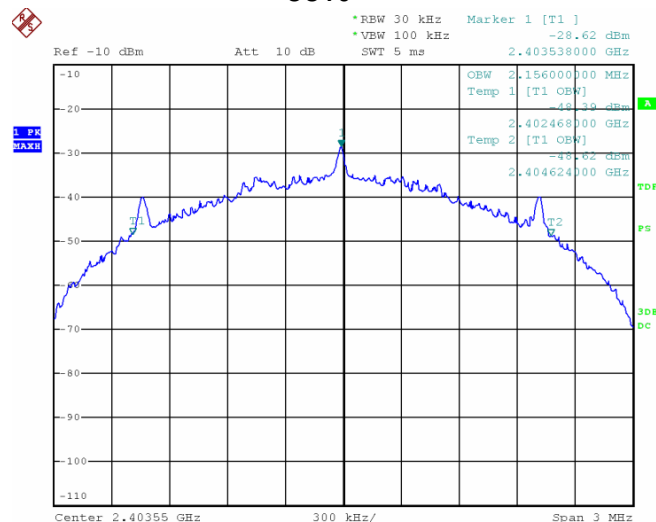
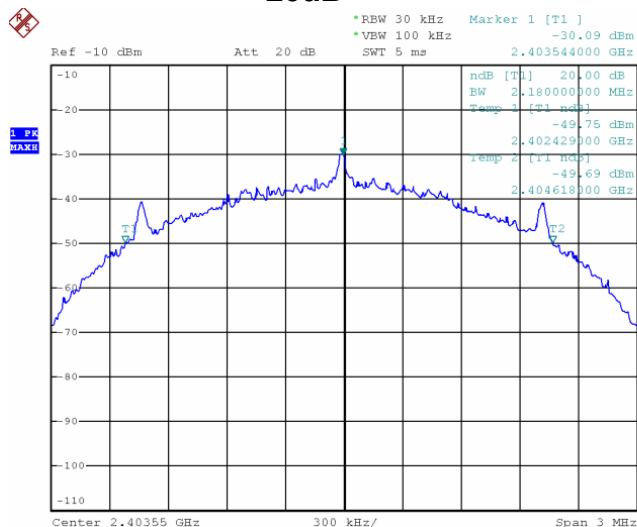
Channel Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
2403.585	2.18	2.16	Pass
2438.913	2.16	2.15	Pass
2477.313	2.18	2.13	Pass

Test plot as follows:

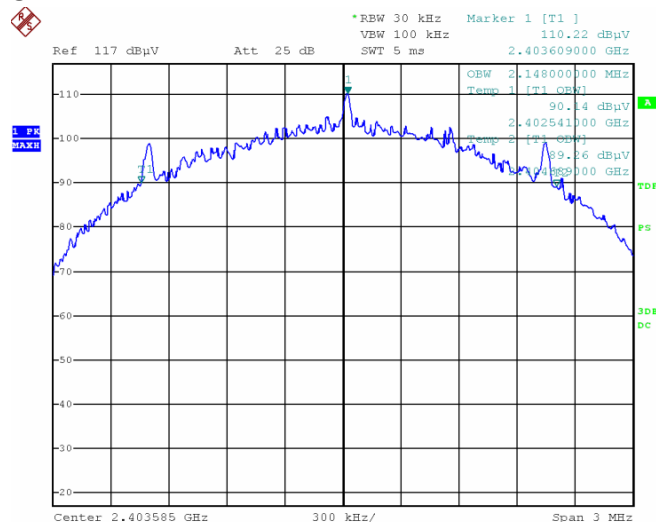
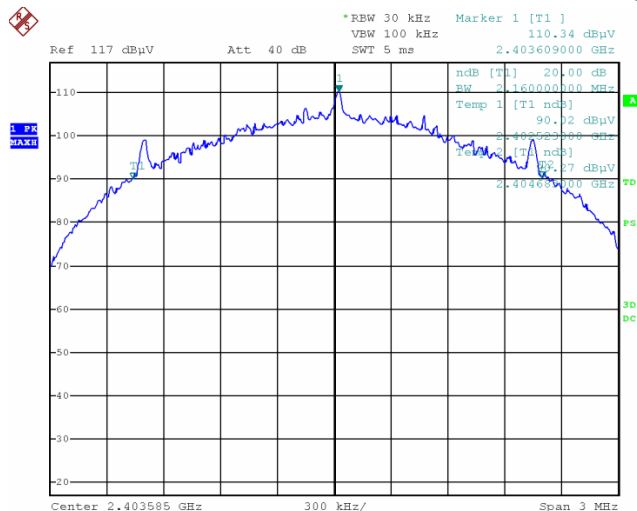
2403.585 MHz

20dB

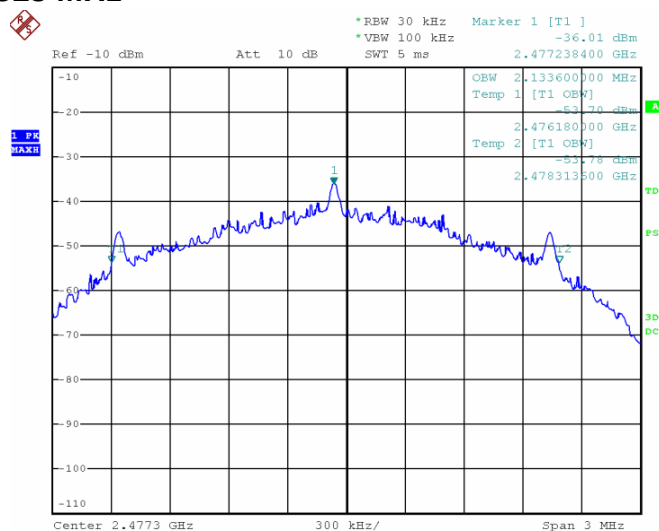
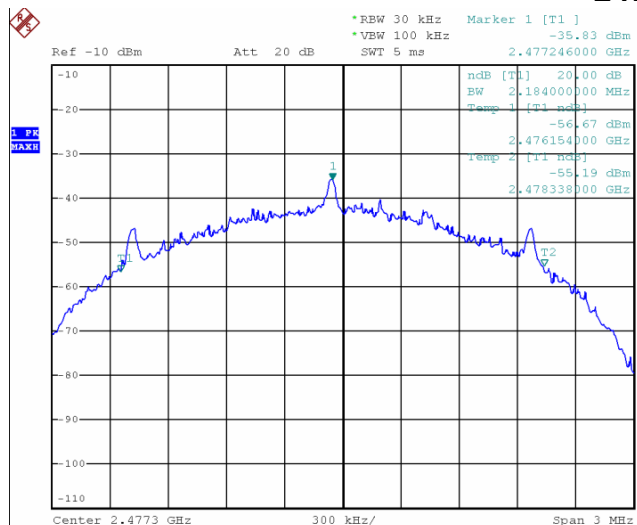
99%



2438.913 MHz



2477.313 MHz



6. FREQUENCY SEPARATION

6.1. Limits

According to FCC Section 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

6.2. 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: wide enough to capture the peaks of two adjacent channels

RBW $\geq 1\%$ of the span

VBW $\geq$ RBW

Sweep=auto

Detector function=peak

Trace=max hold

	Separation (MHz)	Limit (MHz)	Result
Low	1.54	1.45	PASS
Middle	1.54	1.44	PASS
High	1.56	1.45	PASS

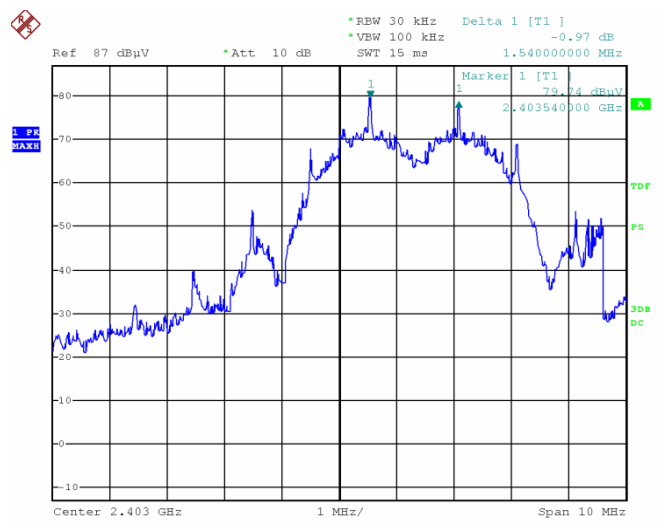
Note: we pretest low, middle, high channel. The middle channel's data record in the report.

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
Low	2.18	1.45
Middle	2.16	1.44
High	2.18	1.45

Note1: Limit according to section 5

Test plot as follows:

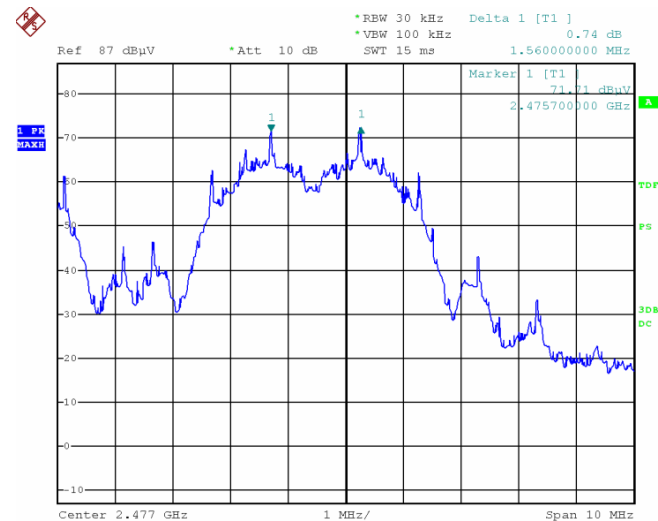
Low



Middle



High



7. MAXIMUM PEAK OUTPUT POWER

7.1. Limits

According to FCC Section 15.247(b)(1), For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

7.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the power meter, 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.

Test data:

Channel Frequency (MHz)	Peak output Power dBm	Limit dBm	Result
2403.585	9.67	21.00	Pass
2438.913	9.58	21.00	Pass
2477.313	9.61	21.00	Pass

8. NUMBER OF HOPPING FREQUENCY

8.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

8.2. 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: the frequency band of operation

RBW $\geq 1\%$ of the span

VBW $\geq$ RBW

Sweep=auto

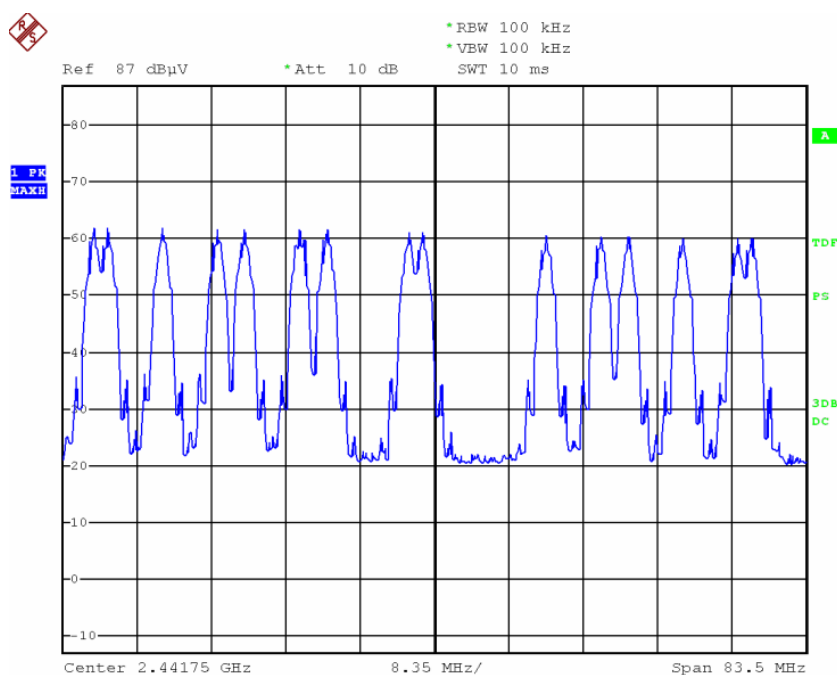
Detector function=peak

Trace=max hold

Test data:

	Measured channel numbers	Limit	Result
	15	≥ 15	PASS

Test plot as follows:



9. DWELL TIME

9.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

9.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum,

2. Set the spectrum analyzer:

Span= 0Hz

RBW =100 kHz

VBW = 300 kHz

Sweep=auto

Detector function=peak

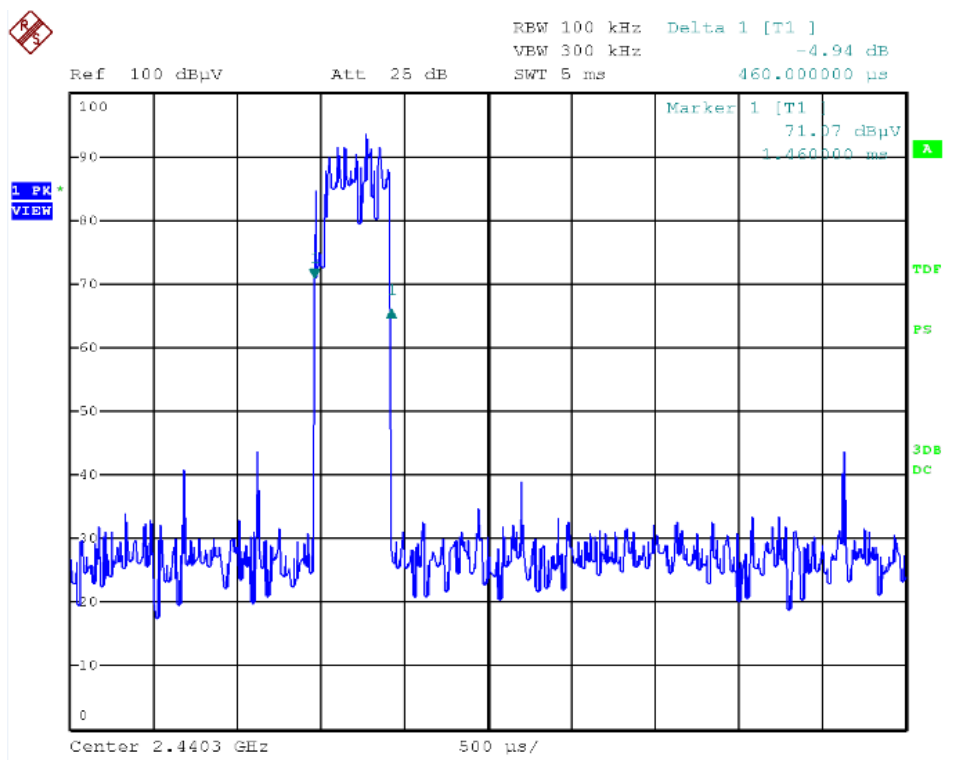
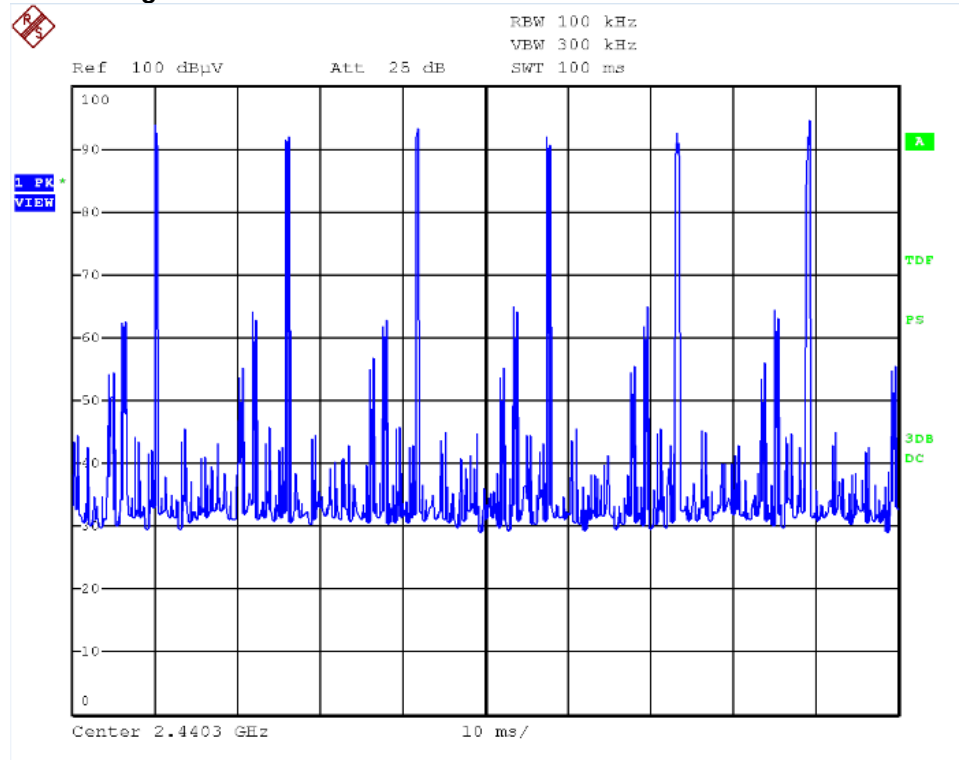
Test data:

	Dwell time(ms)	Limit(ms)	Result
	220.8	<400	Pass

The test period: $T = 60\text{hop}(\text{per sec}) * 0.4 * 20 * 0.46\text{ms} = 220.8\text{ms}$

Test plot as follows:

Low/Middle/High



10. BAND EDGE COMPLIANCE TEST

10.1. Limits

According to FCC Section 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

10.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set to span from the lowest frequency generated in the device up to and including the tenth harmonic of the highest fundamental frequency

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.

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

Test data as follows:

For radiated test as follows:

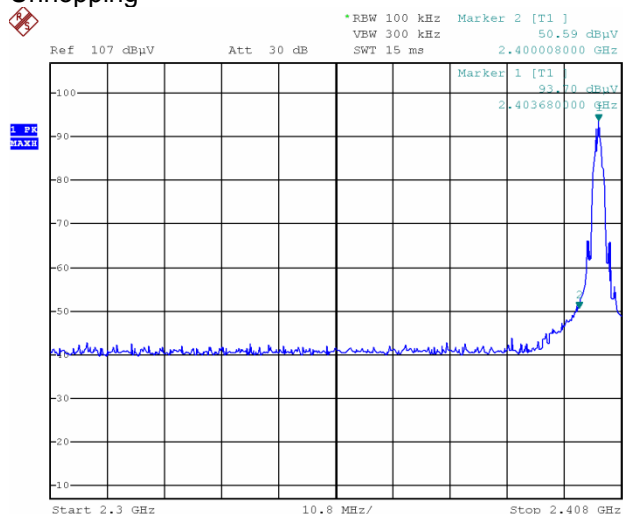
Unhopping

	Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)	Band edge Limit (dBuV/m)		Result
			PK	PK	AV	
Unhopping	<2400	H	50.89	74.00	54.00	Pass
	<2400	V	50.46	74.00	54.00	Pass
	>2483.5	H	50.75	74.00	54.00	Pass
	>2483.5	V	50.42	74.00	54.00	Pass
Hopping	<2400	H	51.02	74.00	54.00	Pass
	<2400	V	50.97	74.00	54.00	Pass
	>2483.5	H	50.79	74.00	54.00	Pass
	>2483.5	V	50.87	74.00	54.00	Pass

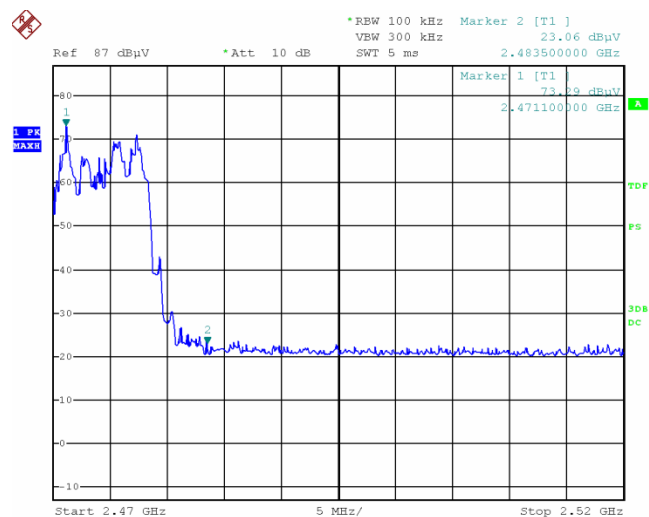
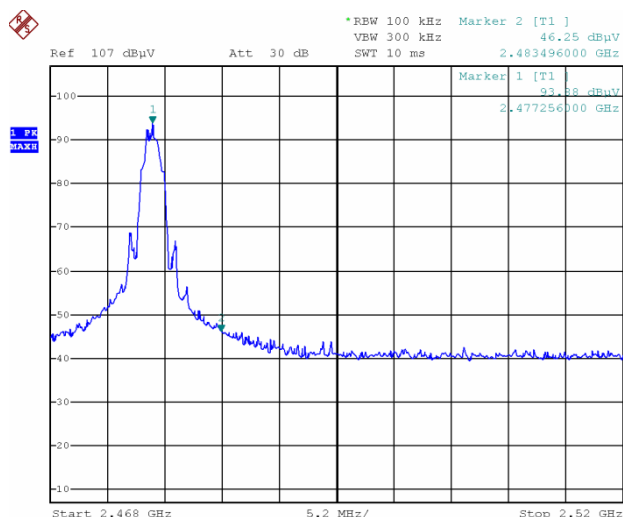
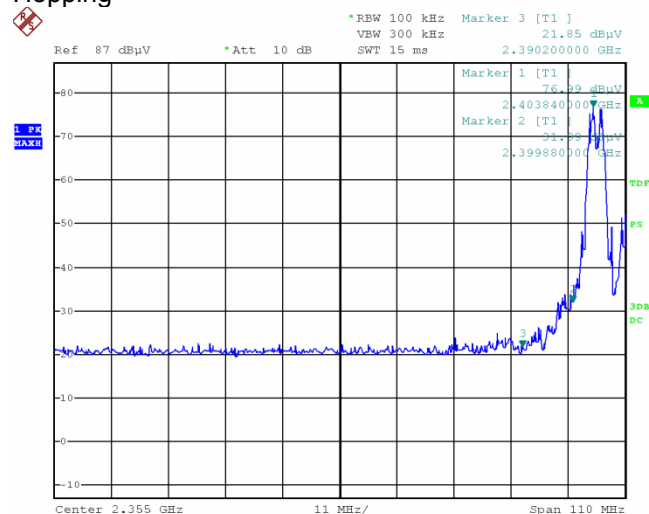
If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

For conducted test

Unhopping



Hopping



11. ANTENNA REQUIREMENTS

11.1. Limits

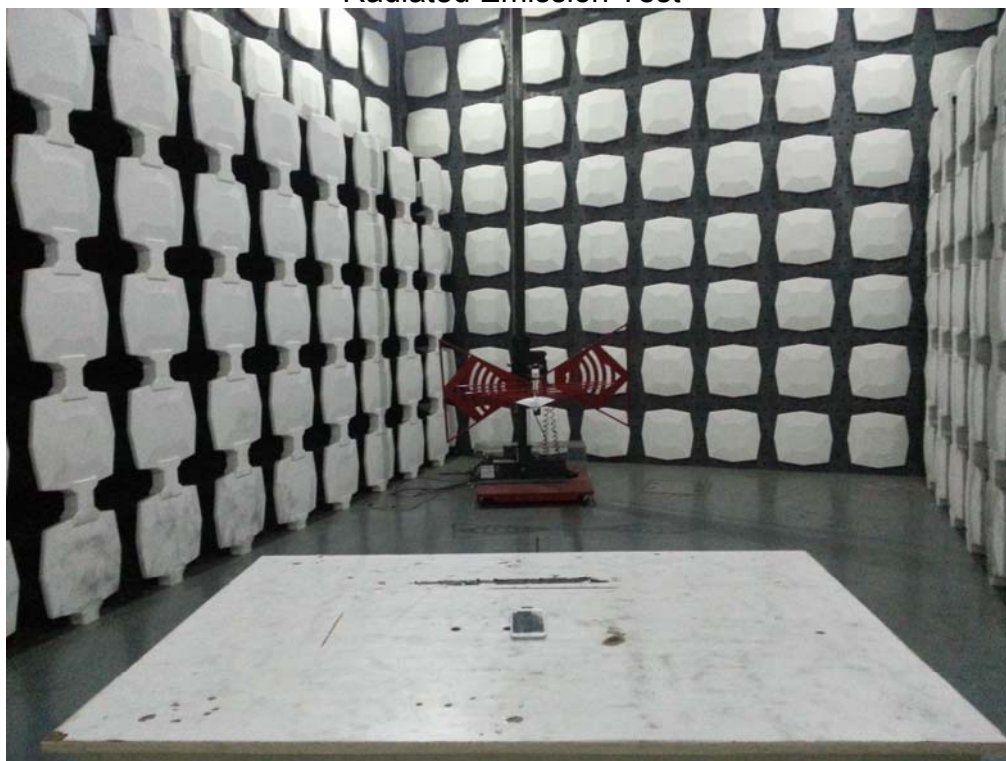
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

11.2. Result

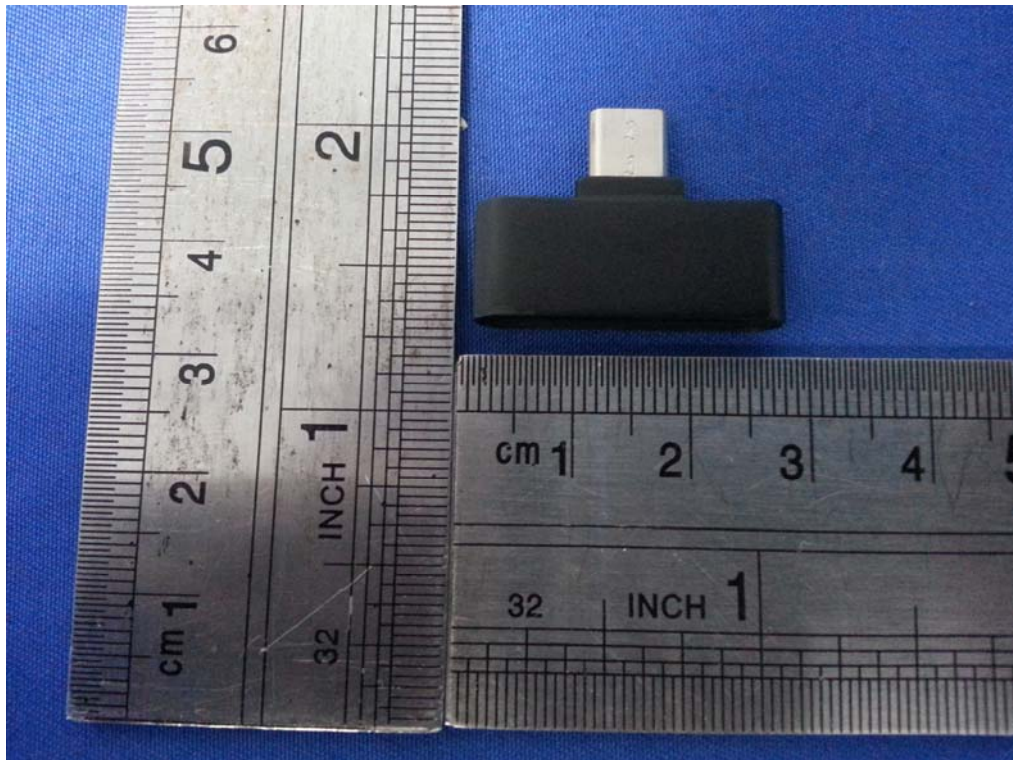
The antennas used for this product are integral Antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0dBi.

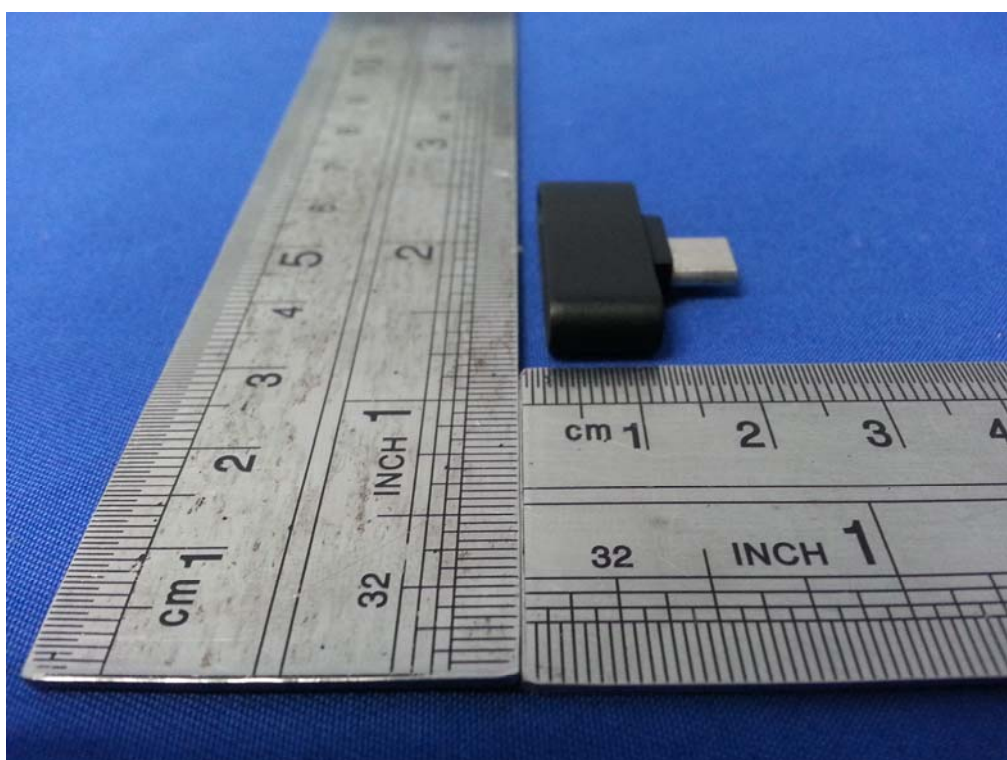
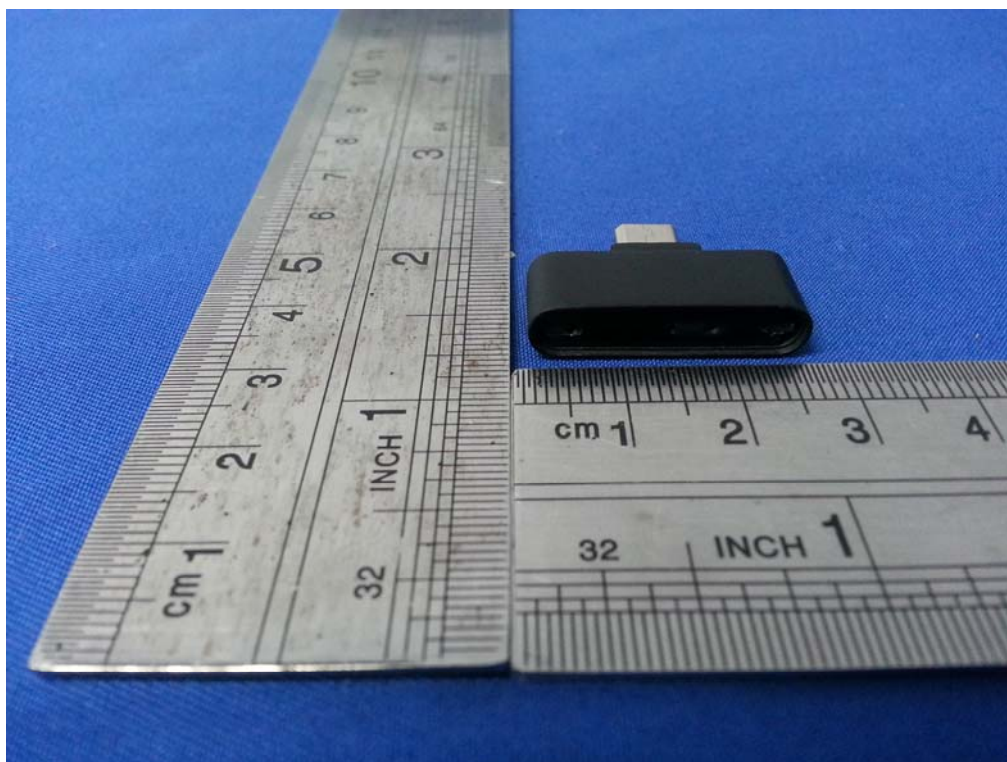
12. PHOTOGRAPHS OF TEST SET-UP

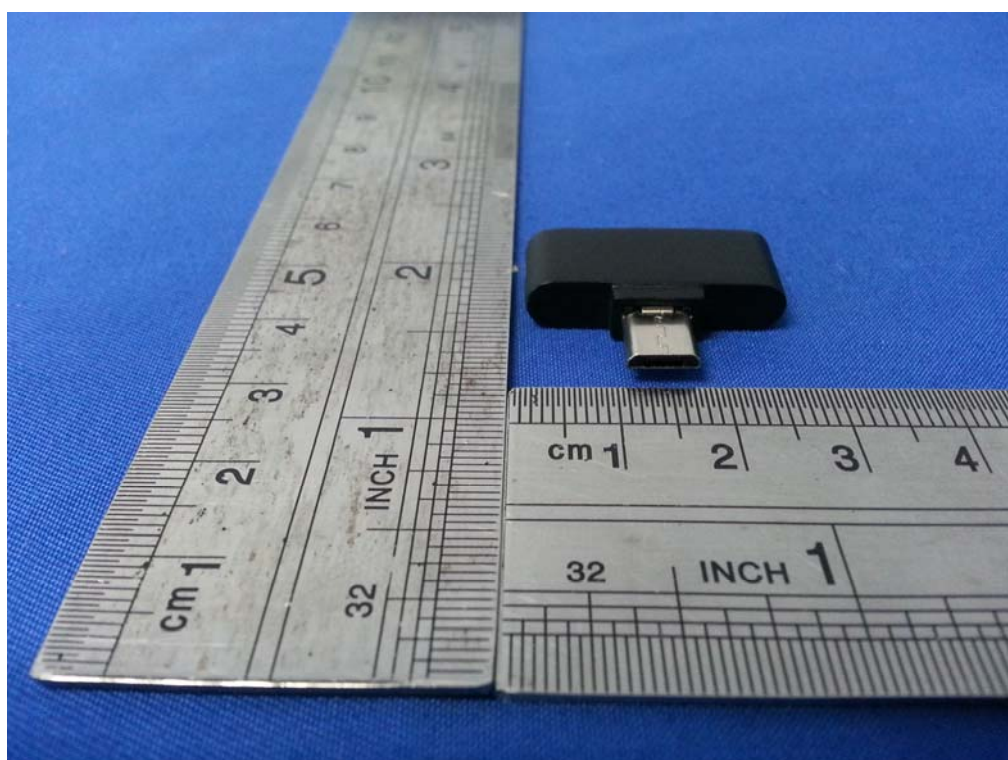
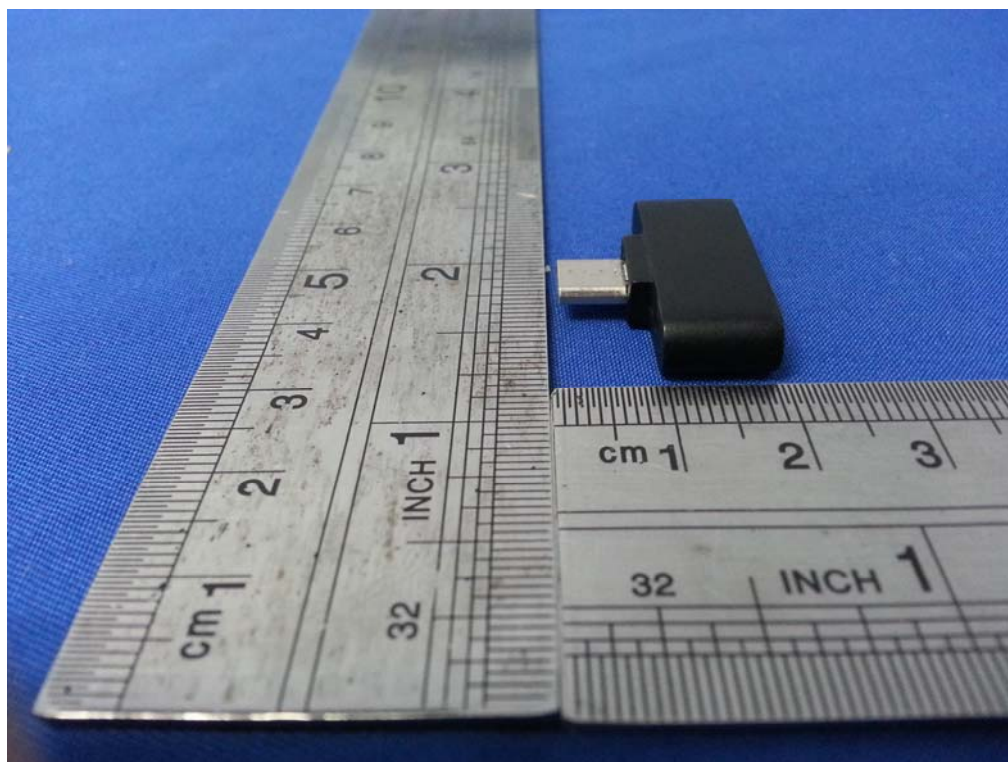
Radiated Emission Test

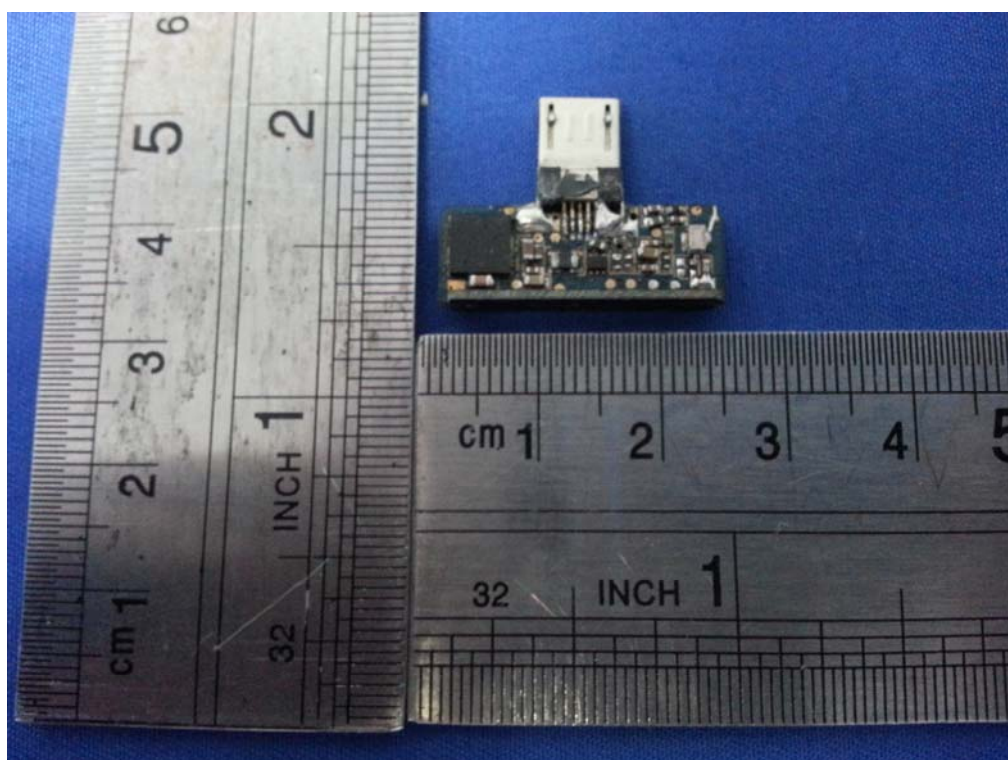
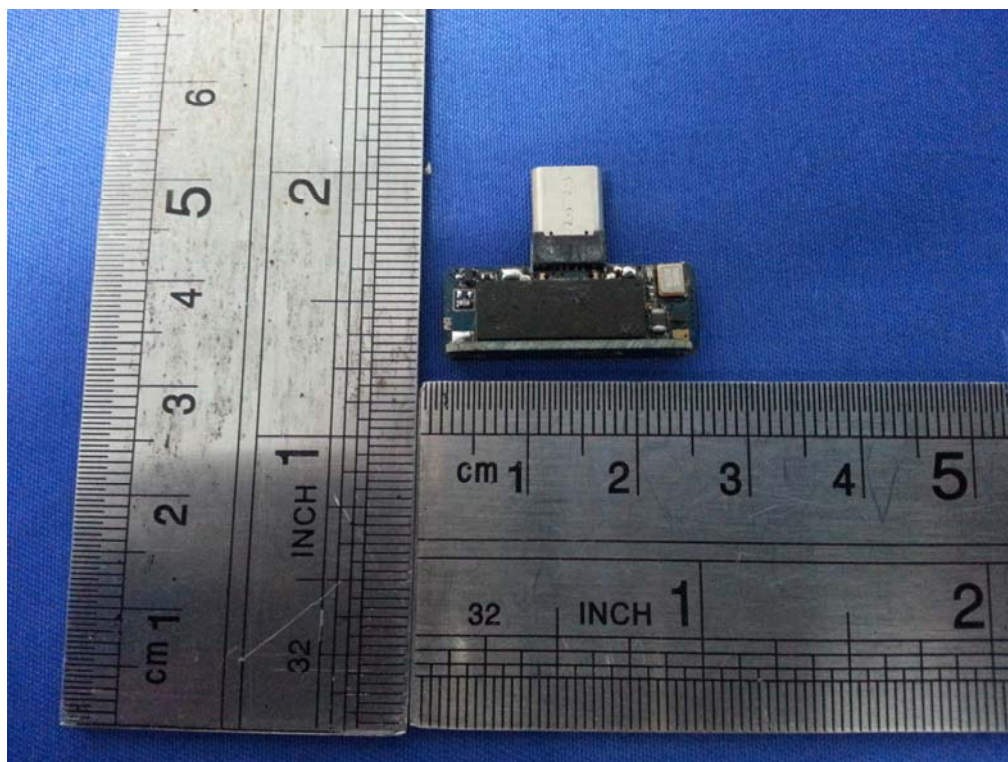


13. PHOTOGRAPHS OF THE EUT









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