TEST REPORT

Product	:	Wireless Smart Audio Module
Trade mark	:	Linkplay
Model/Type reference	:	A98, A98M, A98M-12, A98M-22, A98MG, A98-12, A98-22, A98G
Serial Number	:	N/A
Report Number	:	EED32L00167701
FCC ID	:	2ANOG-A98XX
Date of Issue	:	Aug. 09, 2019
Test Standards	:	47 CFR Part 15Subpart C
Test result	:	PASS

Prepared for:

Linkplay Technology Inc
8F-8036, Qianren Building, No. 7, Yingcui Road, Jiangning District, Nanjing, China

Prepared by:

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Tested By:	Jay Zheng	Compiled by:	Alex Wu
Reviewed by:	Ware Xin	Approved by:	Kevin Yang
Date:	Aug. 09, 2019		Check No.: 3915522376

CENTRE TESTING INTERNATIONAL GROUP CO., LTD. CTI Report Seal

2 Version

Version No.	Date	Description
00	Aug. 09, 2019	Original

3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15Subpart C Section 15.203/15.247 (c)	ANSI C63.10-2013	PASS
AC Power Line Conducted Emission	47 CFR Part 15Subpart C Section 15.207	ANSI C63.10-2013	PASS
Conducted Peak Output Power	47 CFR Part 15Subpart C Section 15.247 (b)(3)	ANSI C63.10-2013	PASS
6dB Occupied Bandwidth	47 CFR Part 15Subpart C Section 15.247 (a)(2)	ANSI C63.10-2013	PASS
Power Spectral Density	47 CFR Part 15Subpart C Section 15.247 (e)	ANSI C63.10-2013	PASS
Band-edge for RF Conducted Emissions	47 CFR Part 15Subpart C Section 15.247(d)	ANSI C63.10-2013	PASS
RF Conducted Spurious Emissions	47 CFR Part 15Subpart C Section 15.247(d)	ANSI C63.10-2013	PASS
Radiated Spurious Emissions	47 CFR Part 15Subpart C Section 15.205/15.209	ANSI C63.10-2013	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15Subpart C Section 15.205/15.209	ANSI C63.10-2013	PASS

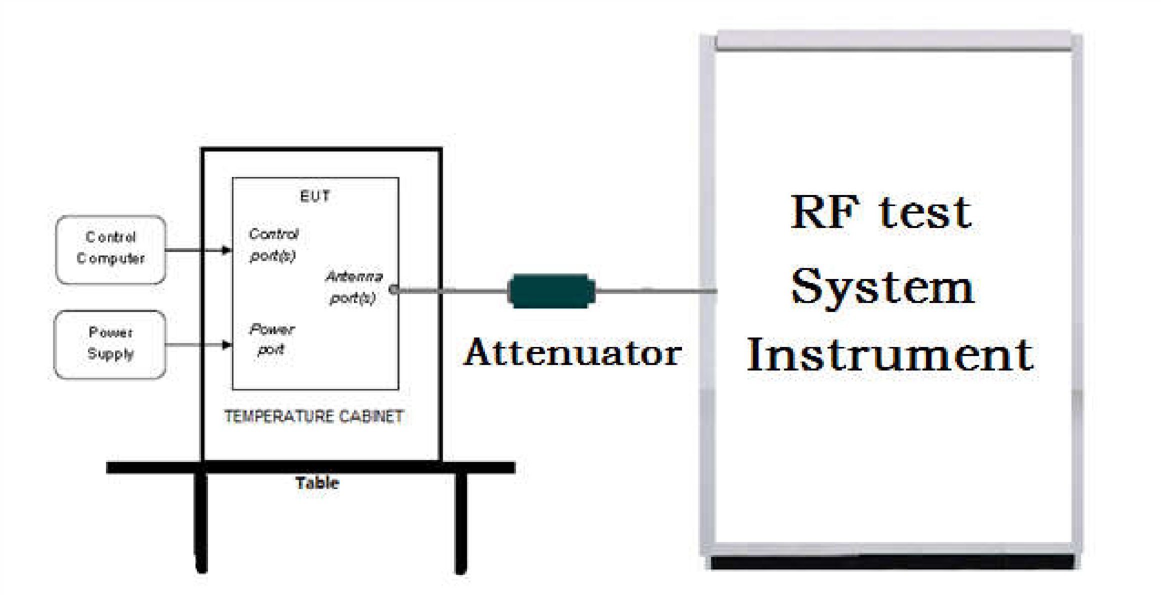
Remark:
Test according to ANSI C63.4-2014 & ANSI C63.10-2013.
The tested sample(s) and the sample information are provided by the client.
Model No.: A98, A98M, A98M-12, A98M-22, A98MG, A98-12, A98-22, A98G
Only the model A98 was tested, The difference is that ROM and RAM are different in size or customer.

4 Content

5 Test Requirement

5.1 Test setup

5.1.1 For Conducted test setup



5.1.2 For Radiated Emissions test setup

Radiated Emissions setup:

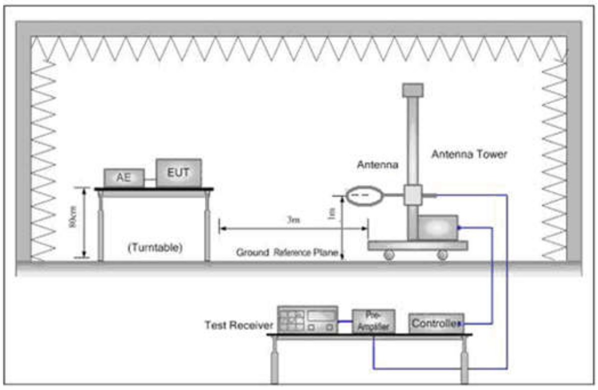


Figure 1. Below 30MHz

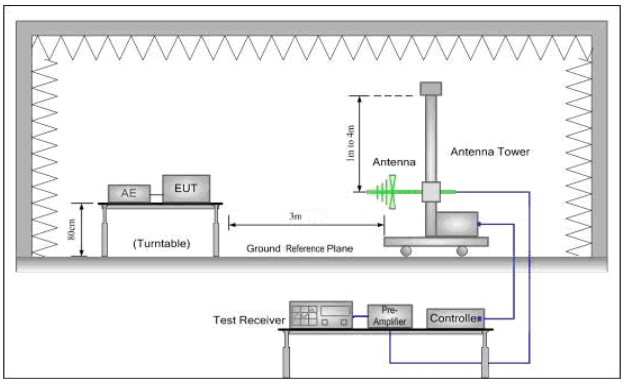


Figure 2. 30MHz to 1GHz

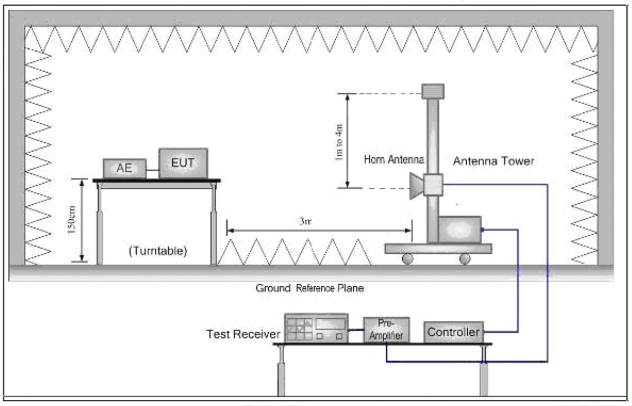
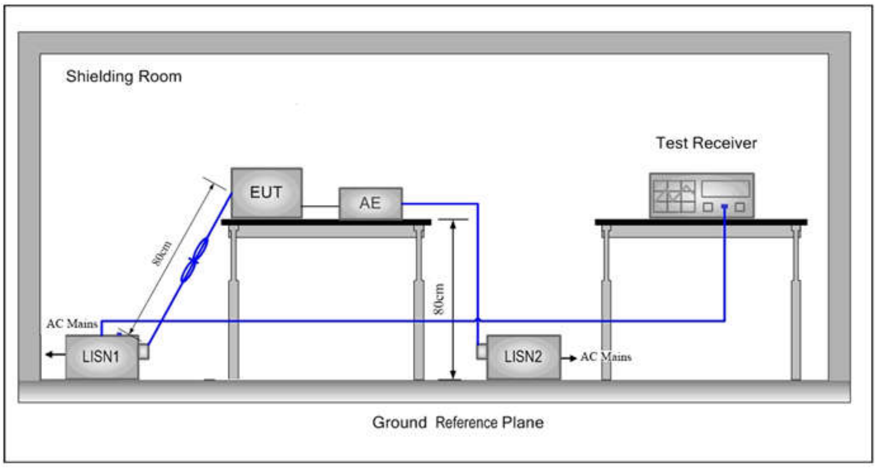


Figure 3. Above 1GHz

5.1.3 For Conducted Emissions test setup

Conducted Emissions setup



5.2 Test Environment

Operating Environment:	
Temperature:	25.0 °C
Humidity:	57 % RH
Atmospheric Pressure:	1010mbar

5.3 Test Condition

Test channel:

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(M)	High(H)
GFSK	2402MHz ~2480 MHz	Channel 1	Channel 20	Channel 40
		2402MHz	2440MHz	2480MHz
Transmitting mode:	Keep the EUT in transmitting mode with all kind of modulation and all kind of data rate.			

6 General Information

6.1 Client Information

Applicant:	Linkplay Technology Inc
Address of Applicant:	8F-8036, Qianren Building, No. 7, Yingcui Road, Jiangning District, Nanjing, China
Manufacturer:	Linkplay Technology Inc
Address of Manufacturer:	8F-8036, Qianren Building, No. 7, Yingcui Road, Jiangning District, Nanjing, China
Factory:	Linkplay Technology Inc
Address of Factory:	8F-8036, Qianren Building, No. 7, Yingcui Road, Jiangning District, Nanjing, China

6.2 General Description of EUT

Product Name:	Wireless Smart Audio Module
Model No.(EUT):	A98, A98M, A98M-12, A98M-22, A98MG, A98-12, A98-22, A98G
Test Model No.:	A98
Trade mark:	Linkplay
EUT Supports Radios application:	BT 4.0 Dual mode, 2402-2480MHz
Power Supply:	DC 5V
Sample Received Date:	Jun. 26, 2019
Sample tested Date:	Jun. 26, 2019 to Aug. 09, 2018

6.3 Product Specification subjective to this standard

Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	4.0
Modulation Technique:	FHSS
Modulation Type:	GFSK
Number of Channel:	40
Test Power Grade:	Default Setting
Test Software of EUT:	Linkplay Factory Tool For Custom (manufacturer declare)
Antenna Type and Gain:	Type: PIFA antenna Gain:2.62dBi
Test Voltage:	DC 5V

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	11	2422MHz	21	2442MHz	31	2462MHz
2	2404MHz	12	2424MHz	22	2444MHz	32	2464MHz
3	2406MHz	13	2426MHz	23	2446MHz	33	2466MHz
4	2408MHz	14	2428MHz	24	2448MHz	34	2468MHz
5	2410MHz	15	2430MHz	25	2450MHz	35	2470MHz
6	2412MHz	16	2432MHz	26	2452MHz	36	2472MHz
7	2414MHz	17	2434MHz	27	2454MHz	37	2474MHz
8	2416MHz	18	2436MHz	28	2456MHz	38	2476MHz
9	2418MHz	19	2438MHz	29	2458MHz	39	2478MHz
10	2420MHz	20	2440MHz	30	2460MHz	40	2480MHz

6.4 Description of Support Units

The EUT has been tested independently

6.5 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd
Building C, Hongwei Industrial Park Block 70, Bao'an District, Shenzhen, China
Telephone: +86 (0) 755 33683668   Fax:+86 (0) 755 33683385
No tests were sub-contracted.
FCC Designation No.: CN1164

6.6 Deviation from Standards

None.

6.7 Abnormalities from Standard Conditions

None.

6.8 Other Information Requested by the Customer

None.

6.9 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.9×10^{-8}
2	RF power, conducted	0.46dB (30MHz-1GHz)
		0.55dB (1GHz-18GHz)
3	Radiated Spurious emission test	4.3dB (30MHz-1GHz)
		4.5dB (1GHz-12.75GHz)
4	Conduction emission	3.5dB (9kHz to 150kHz)
		3.1dB (150kHz to 30MHz)
5	Temperature test	0.64°C
6	Humidity test	3.8%
7	DC power voltages	0.026%

7 Equipment List

RF test system					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. Date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
Signal Generator	Keysight	E8257D	MY53401106	03-01-2019	02-28-2020
Spectrum Analyzer	Keysight	N9010A	MY54510339	03-01-2019	02-28-2020
Signal Generator	Keysight	N5182B	MY53051549	03-01-2019	02-28-2020
High-pass filter	Sinoscite	FL3CX03WG18NM12-0398-002	---	01-09-2019	01-08-2020
High-pass filter	MICRO-TRONICS	SPA-F-63029-4	---	01-09-2019	01-08-2020
DC Power	Keysight	E3642A	MY54426035	03-01-2019	02-28-2020
PC-1	Lenovo	R4960d	---	03-01-2019	02-28-2020
BT&WI-FI Automatic control	R&S	OSP120	101374	03-01-2019	02-28-2020
RF control unit	JS Tonscend	JS0806-2	15860006	03-01-2019	02-28-2020
RF control unit	JS Tonscend	JS0806-1	15860004	03-01-2019	02-28-2020
RF control unit	JS Tonscend	JS0806-4	158060007	03-01-2019	02-28-2020
BT&WI-FI Automatic test software	JS Tonscend	JS1120-2	---	03-01-2019	02-28-2020
Temperature/ Humidity Indicator	biaozhi	HM10	1804186	10-12-2018	10-11-2019

Conducted disturbance Test					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
Receiver	R&S	ESCI	100435	05-20-2019	05-18-2020
Temperature/ Humidity Indicator	Defu	TH128	/	06-14-2019	06-12-2020
Communication test set	Agilent	E5515C	GB47050 534	03-01-2019	02-28-2020
Communication test set	R&S	CMW500	102898	01-18-2019	01-17-2020
LISN	R&S	ENV216	100098	05-08-2019	05-06-2020
LISN	schwarzbeck	NNLK8121	8121-529	05-08-2019	05-06-2020
Voltage Probe	R&S	ESH2-Z3 0299.7810.5 6	100042	06-13-2017	06-11-2020
Current Probe	R&S	EZ-17 816.2063.03	100106	05-20-2019	05-18-2020
ISN	TESEQ	ISN T800	30297	01-06-2019	01-15-2020
Barometer	changchun	DYM3	1188	06-20-2019	06-18-2020

3M Semi/full-anechoic Chamber					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
3M Chamber & Accessory Equipment	TDK	SAC-3	---	05-24-2019	05-22-2020
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-401	12-21-2018	12-20-2019
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-618	07-26-2019	07-24-2020
Microwave Preamplifier	Agilent	8449B	3008A024 25	08-21-2018	08-20-2019
Microwave Preamplifier	Tonscend	EMC051845 SE	980380	01-16-2019	01-15-2020
Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-1869	04-25-2018	04-23-2021
Horn Antenna	ETS-LINDGREN	3117	00057410	06-05-2018	06-03-2021
Double ridge horn antenna	A.H.SYSTEMS	SAS-574	374	06-05-2018	06-04-2021
Pre-amplifier	A.H.SYSTEMS	PAP-1840-60	6041.604 1	07-26-2019	07-24-2020
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-076	04-25-2018	04-25-2021
Spectrum Analyzer	R&S	FSP40	100416	04-28-2019	04-26-2020
Receiver	R&S	ESCI	100435	05-20-2019	05-18-2020
Receiver	R&S	ESCI7	100938-003	11-23-2018	11-22-2019
Multi device Controller	maturo	NCD/070/107 11112	---	01-09-2019	01-08-2020
Signal Generator	Agilent	E4438C	MY45095 744	03-01-2019	02-28-2020
Signal Generator	Keysight	E8257D	MY53401 106	03-01-2019	02-28-2020
Temperature/ Humidity Indicator	Shanghai qixiang	HM10	1804298	10-12-2018	10-11-2019
Communication test set	Agilent	E5515C	GB47050 534	03-01-2019	02-28-2020
Cable line	Fulai(7M)	SF106	5219/6A	01-09-2019	01-08-2020
Cable line	Fulai(6M)	SF106	5220/6A	01-09-2019	01-08-2020
Cable line	Fulai(3M)	SF106	5216/6A	01-09-2019	01-08-2020
Cable line	Fulai(3M)	SF106	5217/6A	01-09-2019	01-08-2020
High-pass filter	Sinoscite	FL3CX03WG 18NM12-0398-002	---	01-09-2019	01-08-2020
High-pass filter	MICRO-TRONICS	SPA-F-63029-4	---	01-09-2019	01-08-2020
band rejection filter	Sinoscite	FL5CX01CA0 9CL12-0395-001	---	01-09-2019	01-08-2020
band rejection filter	Sinoscite	FL5CX01CA0 8CL12-0393-001	---	01-09-2019	01-08-2020
band rejection filter	Sinoscite	FL5CX02CA0 4CL12-0396-002	---	01-09-2019	01-08-2020
band rejection filter	Sinoscite	FL5CX02CA0 3CL12-0394-001	---	01-09-2019	01-08-2020

3M full-anechoic Chamber					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
RSE Automatic test software	JS Tonscend	JS36-RSE	10166	06-19-2019	06-17-2020
Receiver	Keysight	N9038A	MY57290136	03-27-2019	03-25-2020
Spectrum Analyzer	Keysight	N9020B	MY57111112	03-27-2019	03-25-2020
Spectrum Analyzer	Keysight	N9030B	MY57140871	03-27-2019	03-25-2020
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-075	04-25-2018	04-23-2021
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-076	04-25-2018	04-23-2021
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	9163-1148	04-25-2018	04-23-2021
Horn Antenna	Schwarzbeck	BBHA 9170	9170-832	04-25-2018	04-23-2021
Horn Antenna	Schwarzbeck	BBHA 9170	9170-829	04-25-2018	04-23-2021
Communication Antenna	Schwarzbeck	CLSA 0110L	1014	02-14-2019	02-13-2020
Biconical antenna	Schwarzbeck	VUBA 9117	9117-381	04-25-2018	04-23-2021
Horn Antenna	ETS-LINDGREN	3117	00057407	07-10-2018	07-08-2021
Preamplifier	EMCI	EMC184055SE	980596	05-22-2019	5-20-2020
Communication test set	R&S	CMW500	102898	01-18-2019	01-17-2020
Preamplifier	EMCI	EMC001330	980563	05-08-2019	05-06-2020
Preamplifier	Agilent	8449B	3008A02425	08-21-2018	08-20-2019
Temperature/ Humidity Indicator	biaozhi	GM1360	EE1186631	05-01-2019	04-30-2020
Signal Generator	KEYSIGHT	E8257D	MY53401106	03-01-2019	02-28-2020
Fully Anechoic Chamber	TDK	FAC-3	---	01-17-2018	01-15-2021
Filter bank	JS Tonscend	JS0806-F	188060094	04-10-2018	04-08-2021
Cable line	Times	SFT205-NMSM-2.50M	394812-0001	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-2.50M	394812-0002	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-2.50M	394812-0003	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-2.50M	393495-0001	01-09-2019	01-08-2020
Cable line	Times	EMC104-NMNM-1000	SN160710	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-3.00M	394813-0001	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMNM-1.50M	381964-0001	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-7.00M	394815-0001	01-09-2019	01-08-2020
Cable line	Times	HF160-KMKM-3.00M	393493-0001	01-09-2019	01-08-2020

8 Radio Technical Requirements Specification

Reference documents for testing:

No.	Identity	Document Title
1	FCC Part15C	Subpart C-Intentional Radiators
2	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices

Test Results List:

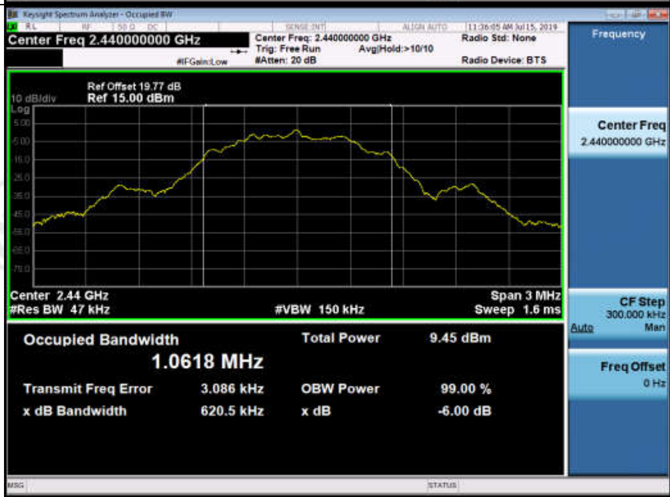
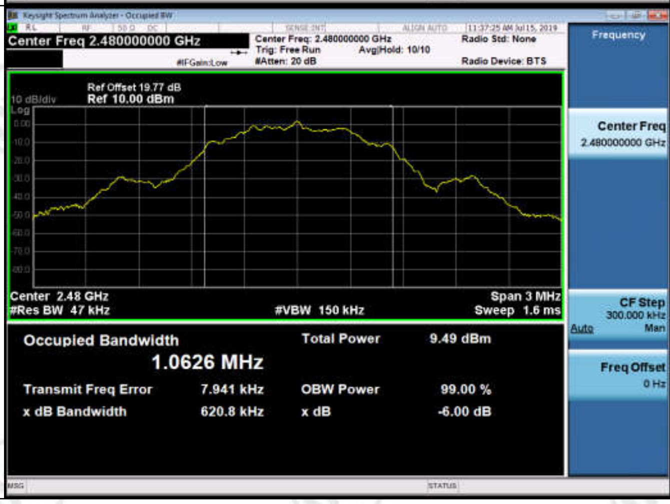
Test Requirement	Test method	Test item	Verdict	Note
Part15C Section 15.247 (a)(2)	ANSI C63.10	6dB Occupied Bandwidth	PASS	Appendix A)
Part15C Section 15.247 (b)(3)	ANSI C63.10	Conducted Peak Output Power	PASS	Appendix B)
Part15C Section 15.247(d)	ANSI C63.10	Band-edge for RF Conducted Emissions	PASS	Appendix C)
Part15C Section 15.247(d)	ANSI C63.10	RF Conducted Spurious Emissions	PASS	Appendix D)
Part15C Section 15.247 (e)	ANSI C63.10	Power Spectral Density	PASS	Appendix E)
Part15C Section 15.203/15.247 (c)	ANSI C63.10	Antenna Requirement	PASS	Appendix F)
Part15C Section 15.207	ANSI C63.10	AC Power Line Conducted Emission	PASS	Appendix G)
Part15C Section 15.205/15.209	ANSI C63.10	Restricted bands around fundamental frequency (Radiated Emission)	PASS	Appendix H)
Part15C Section 15.205/15.209	ANSI C63.10	Radiated Spurious Emissions	PASS	Appendix I)

Appendix A): 6dB Occupied Bandwidth

Test Result

Mode	Channel	6dB Bandwidth [MHz]	99% OBW[MHz]	Verdict
BLE	LCH	0.6263	1.0617	PASS
BLE	MCH	0.6205	1.0618	PASS
BLE	HCH	0.6208	1.0626	PASS

Test Graphs

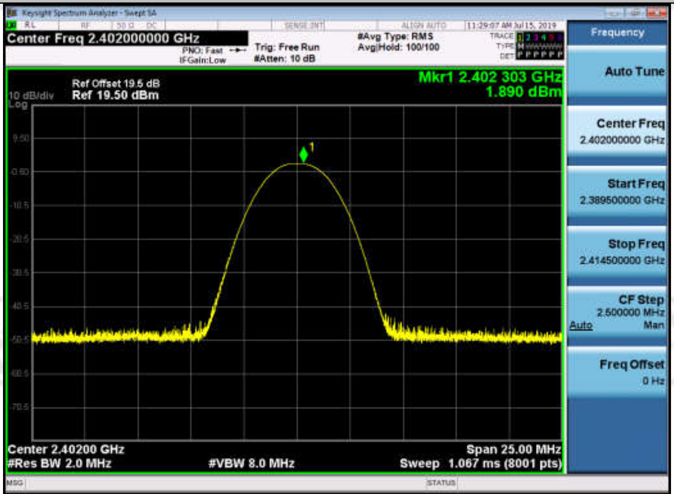
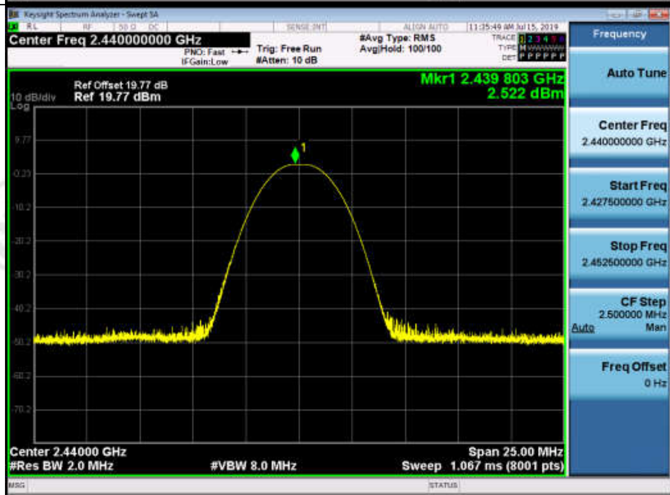
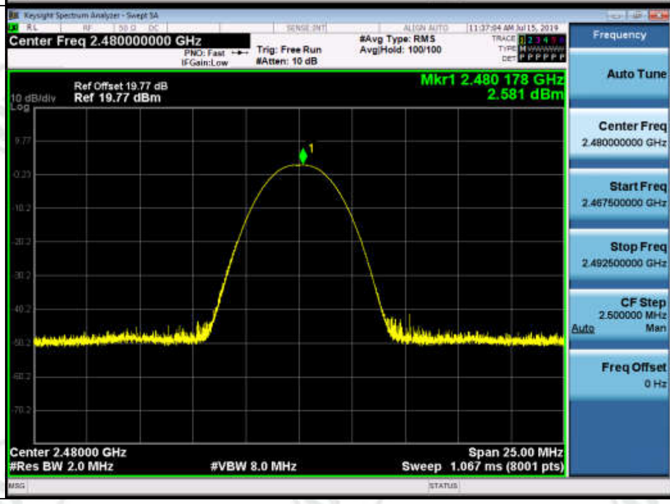
		Graphs
LCH		
MCH		
HCH		

Appendix B): Conducted Peak Output Power

Test Result

Mode	Channel	Conduct Peak Power[dBm]	Verdict
BLE	LCH	1.89	PASS
BLE	MCH	2.522	PASS
BLE	HCH	2.581	PASS

Test Graphs

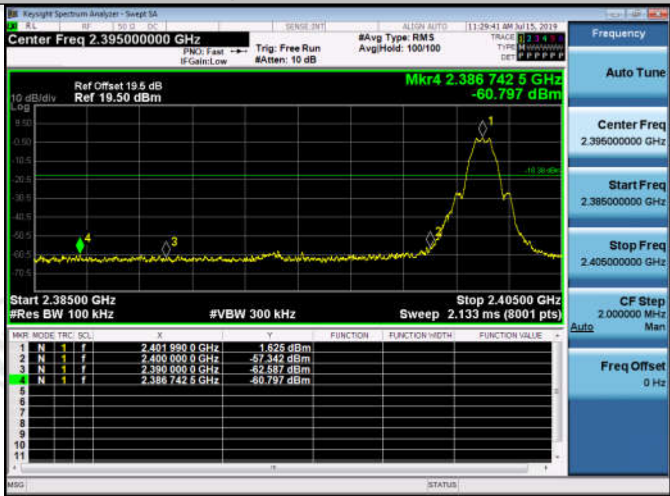
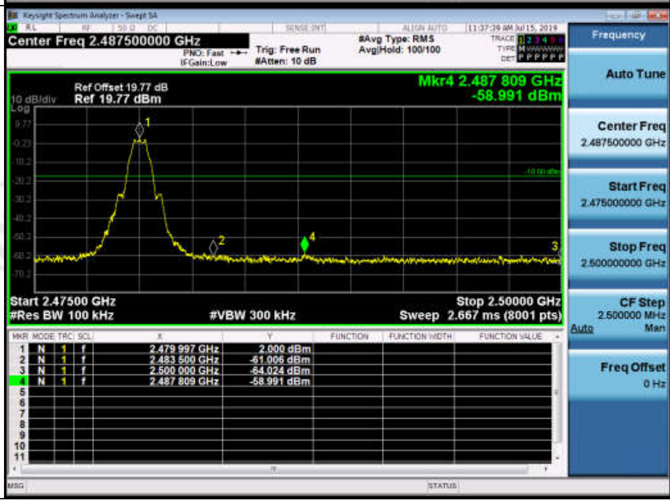
Graphs		
LCH		
MCH		
HCH		

Appendix C): Band-edge for RF Conducted Emissions

Result Table

Mode	Channel	Carrier Power[dBm]	Max.Spurious Level [dBm]	Limit [dBm]	Verdict
BLE	LCH	1.625	-60.797	-18.38	PASS
BLE	HCH	2.000	-58.991	-18	PASS

Test Graphs

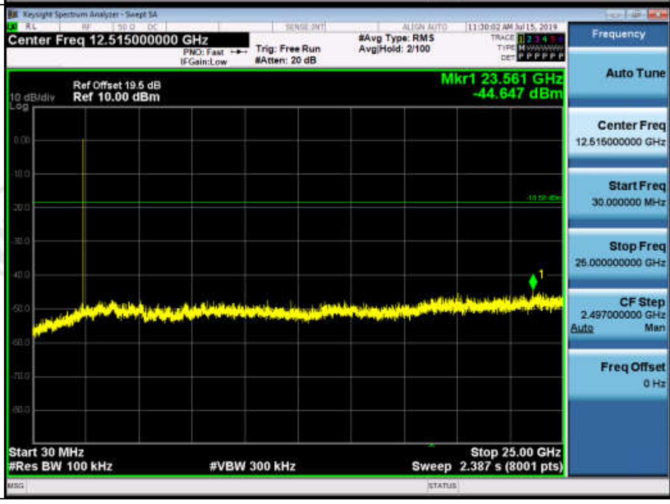
Graphs			
LCH			
HCH			

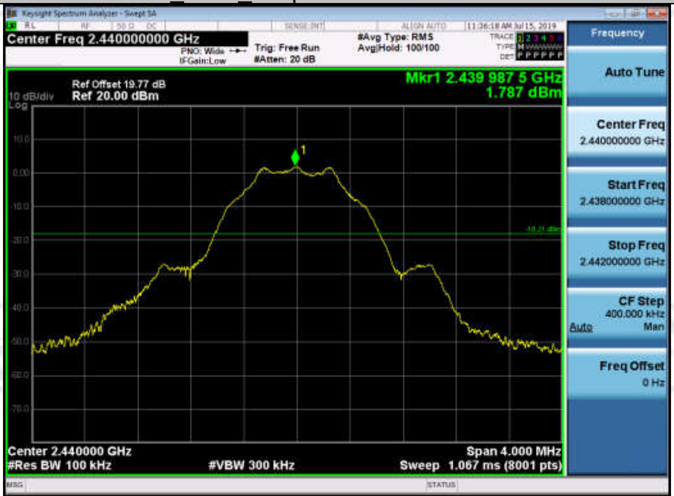
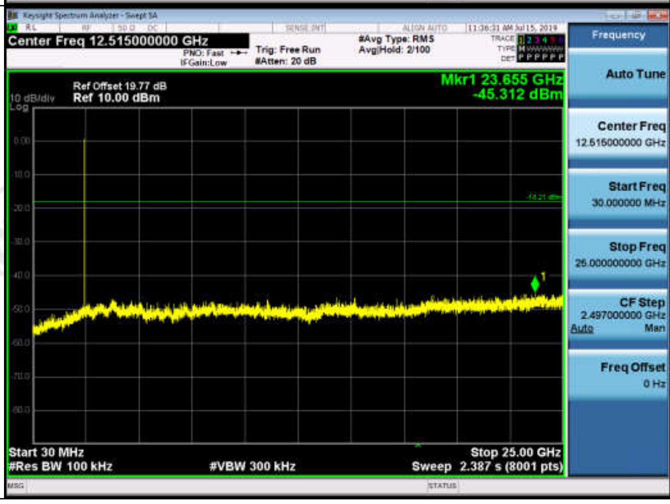
Appendix D): RF Conducted Spurious Emissions

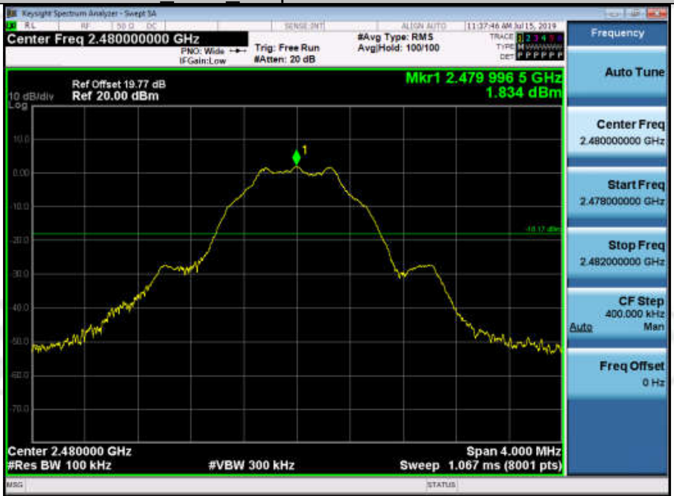
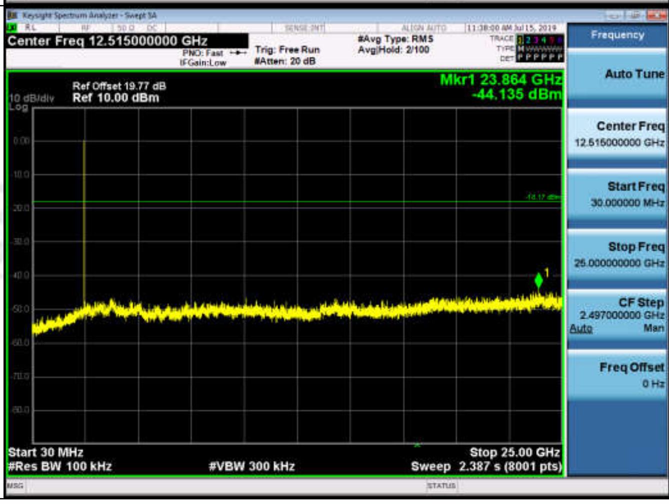
Result Table

Mode	Channel	Pref [dBm]	Puw[dBm]	Verdict
BLE	LCH	1.416	<Limit	PASS
BLE	MCH	1.787	<Limit	PASS
BLE	HCH	1.834	<Limit	PASS

Test Graphs

BLE_LCH_Graphs			
Pref/BLE/LCH			
Puw/BLE/LCH			

BLE_MCH_Graphs			
Pref/BLE/MCH			
Puw/BLE/MCH			

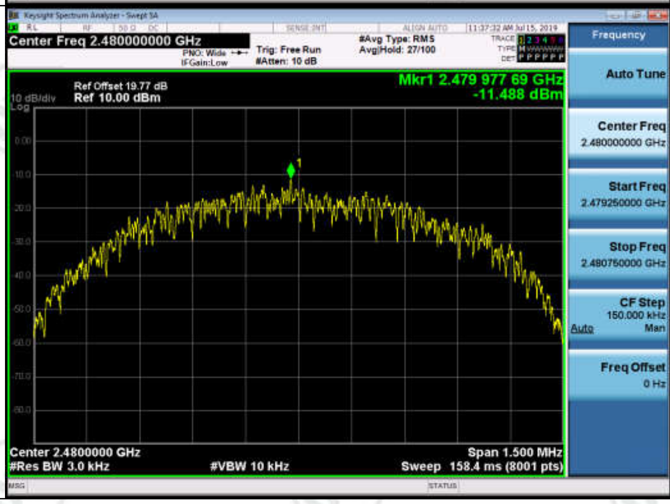
BLE_HCH_Graphs		
Pref/BLE/HCH		
Puw/BLE/HCH		

Appendix E): Power Spectral Density

Result Table

Mode	Channel	PSD [dBm]	Verdict
BLE	LCH	-12.087	PASS
BLE	MCH	-11.678	PASS
BLE	HCH	-11.488	PASS

Test Graphs

Graphs		
LCH		
MCH		
HCH		

Appendix F): Antenna Requirement

<table>
<tr><td colspan="2">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.
15.247(b) (4) requirement:
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</td></tr>
<tr><td>EUT Antenna:</td><td>
</td></tr>
<tr><td colspan="2">The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 2.62dBi.</td></tr>
</table>

Appendix G): AC Power Line Conducted Emission

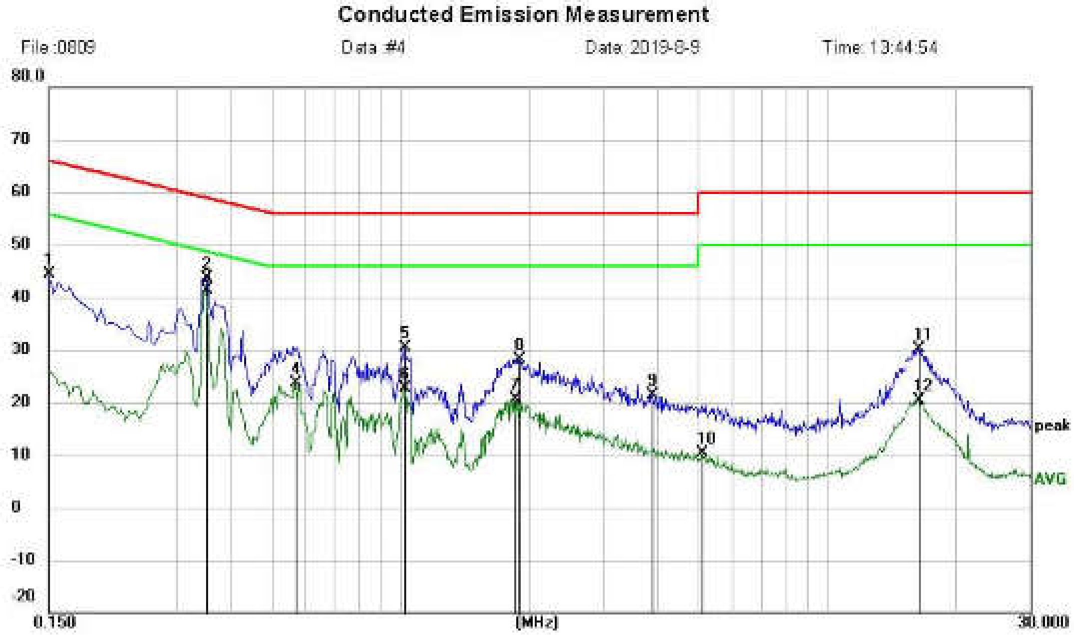
<table>
<tr><td>Test Procedure:</td><td>Test frequency range :150KHz-30MHz
1)The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3)The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.</td></tr>
<tr><td>Limit:</td><td><table><tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBμV)</td></tr><tr><td>Quasi-peak</td><td>Average</td></tr><tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr><tr><td>0.5-5</td><td>56</td><td>46</td></tr><tr><td>5-30</td><td>60</td><td>50</td></tr></table>* The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.
NOTE : The lower limit is applicable at the transition frequency</td></tr>
</table>

Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live line:



Site: LAB | Phase: L1 | Temperature: 21
Limit: FCC Class B CE(QP) | Power: AC120/60Hz | Humidity: 51 %
EUT:
M/N:
Mode: BLE
Note:

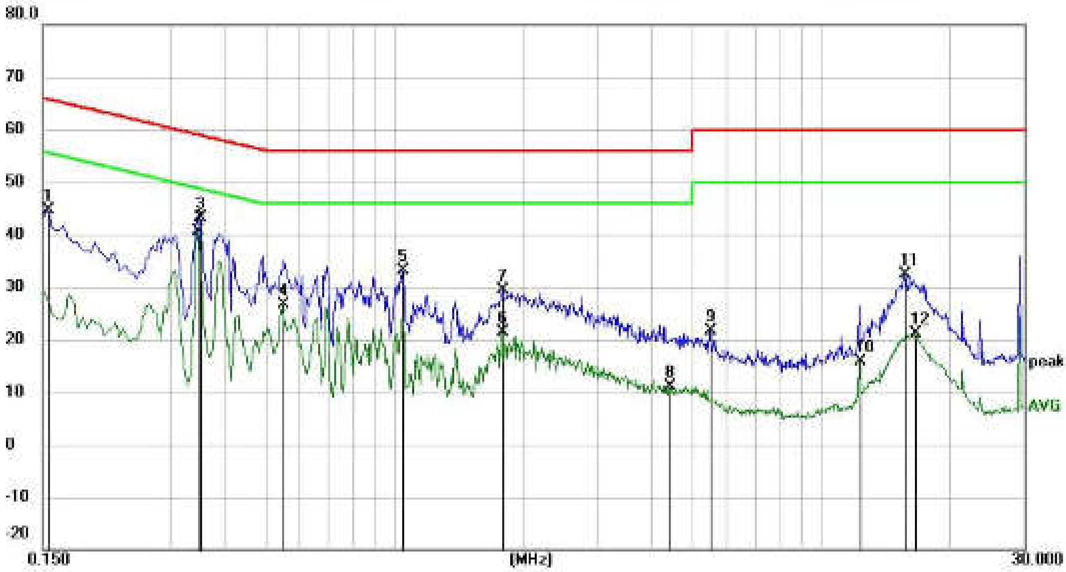
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1500	34.34	9.97	44.31	66.00	-21.69	peak	
2		0.3525	33.64	10.05	43.69	58.90	-15.21	peak	
3	*	0.3525	31.26	10.05	41.31	48.90	-7.59	AVG	
4		0.5685	13.53	10.08	23.61	46.00	-22.39	AVG	
5		1.0230	20.43	9.91	30.34	56.00	-25.66	peak	
6		1.0230	12.65	9.91	22.56	46.00	-23.44	AVG	
7		1.8555	10.87	9.84	20.71	46.00	-25.29	AVG	
8		1.8960	18.35	9.84	28.19	56.00	-27.81	peak	
9		3.8850	11.55	9.83	21.38	56.00	-34.62	peak	
10		5.1090	0.64	9.83	10.47	50.00	-39.53	AVG	
11		16.4490	20.25	9.97	30.22	60.00	-29.78	peak	
12		16.4490	10.44	9.97	20.41	50.00	-29.59	AVG	

*:Maximum data x:Over limit !:over margin (Reference Only

Neutral line:

Conducted Emission Measurement

File :0809 Data: #3 Date: 2019-8-9 Time: 13:43:13



Site: LAB Phase: N Temperature: 21

Limit: FCC Class B CE(QP) Power: AC120/60Hz Humidity: 51 %

EUT:

M/N:

Mode: BLE

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1545	34.76	9.98	44.74	65.75	-21.01	peak	
2	*	0.3480	30.52	10.05	40.57	49.01	-8.44	AVG	
3		0.3525	33.18	10.05	43.23	58.90	-15.67	peak	
4		0.5505	16.52	10.06	26.58	46.00	-19.42	AVG	
5		1.0455	23.16	9.91	33.07	56.00	-22.93	peak	
6		1.7880	11.63	9.85	21.48	46.00	-24.52	AVG	
7		1.7970	19.63	9.85	29.48	56.00	-26.52	peak	
8		4.4205	1.27	9.83	11.10	46.00	-34.90	AVG	
9		5.4825	11.91	9.83	21.74	60.00	-38.26	peak	
10		12.2910	5.88	9.97	15.85	50.00	-34.15	AVG	
11		15.7785	22.44	9.97	32.41	60.00	-27.59	peak	
12		16.6785	11.08	9.96	21.04	50.00	-28.96	AVG	

*:Maximum data x:Over limit !:over margin (Reference Only

Notes:

1. *The following Quasi-Peak and Average measurements were performed on the EUT:*
2. *Final Test Level =Receiver Reading + LISN Factor + Cable Loss.*

Appendix H): Restricted bands around fundamental frequency (Radiated)

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

Test Procedure:

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel

Above 1GHz test procedure as below:

g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).
h. . Test the EUT in the lowest channel , the Highest channel
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.
j. Repeat above procedures until all frequencies measured was complete.

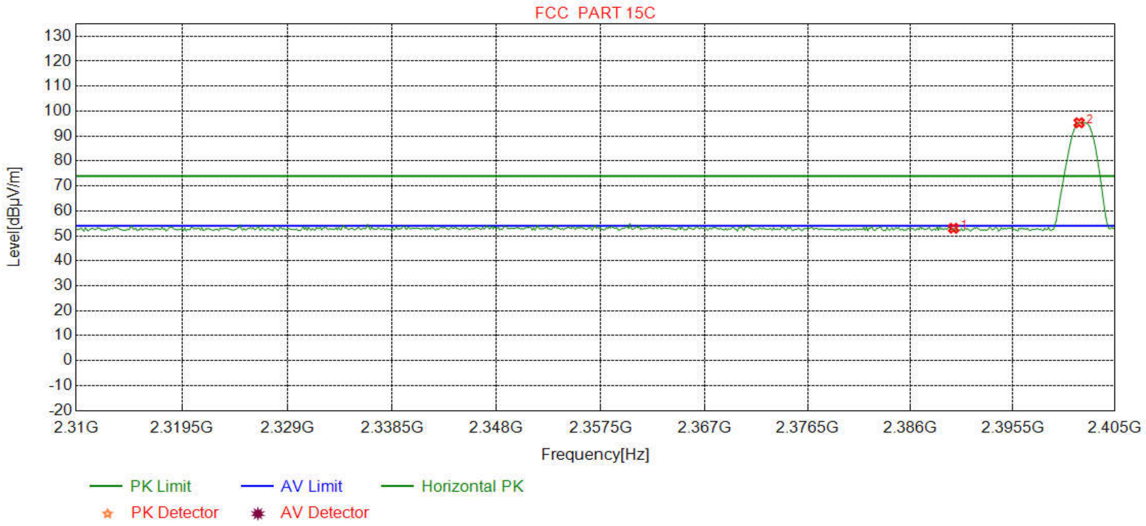
Limit:

Frequency	Limit (dBμV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

Test plot as follows:

Mode:	BLE GFSK Transmitting	Channel:	2402
Remark:	PK		

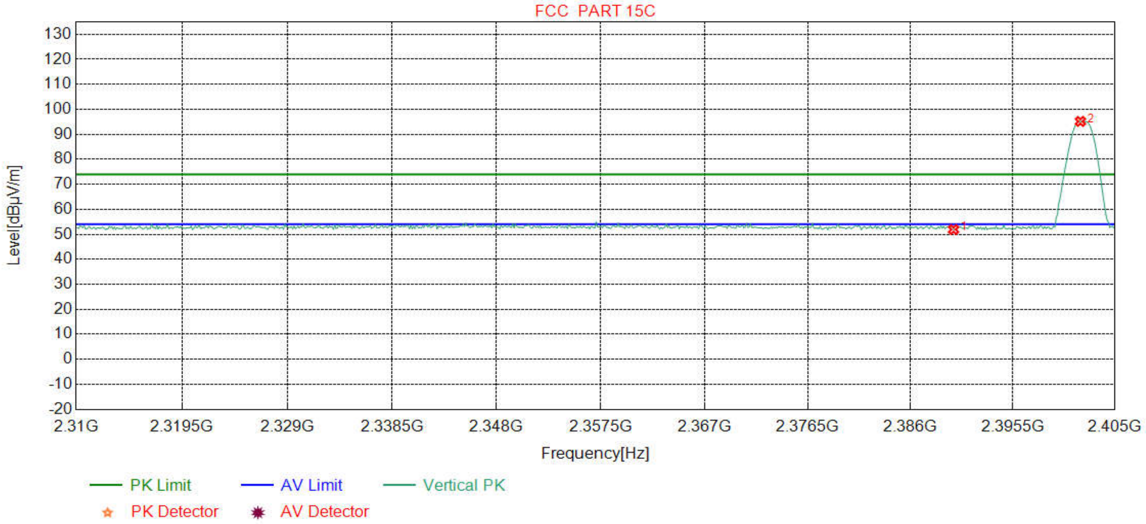
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-42.44	49.85	53.03	74.00	20.97	Pass	Horizontal
2	2401.6708	32.26	13.31	-42.43	92.17	95.31	74.00	-21.31	Pass	Horizontal

Mode:	BLE GFSK Transmitting	Channel:	2402
Remark:	PK		

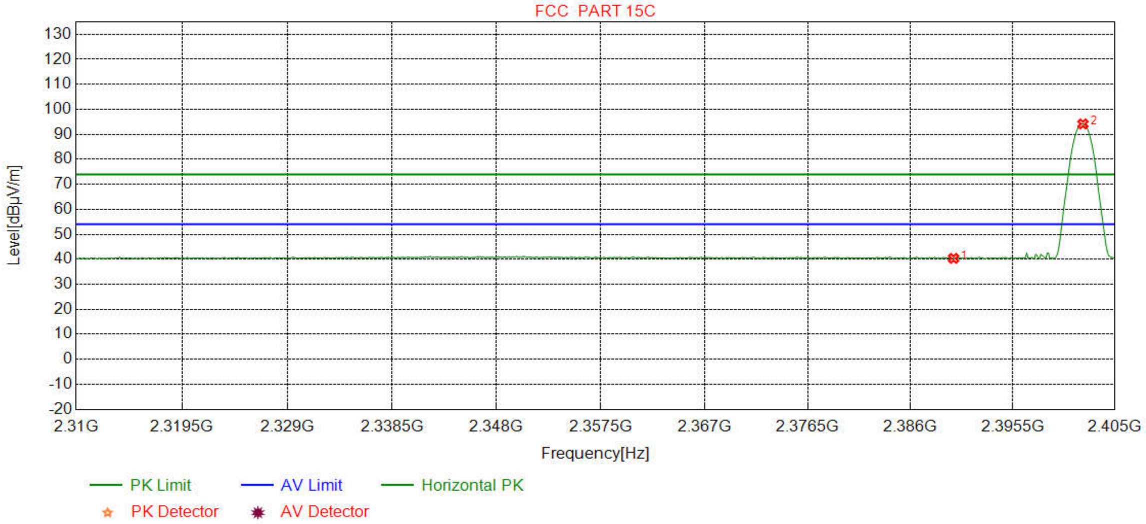
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-42.44	48.71	51.89	74.00	22.11	Pass	Vertical
2	2401.7897	32.26	13.31	-42.43	92.02	95.16	74.00	-21.16	Pass	Vertical

Mode:	BLE GFSK Transmitting	Channel:	2402
Remark:	AV		

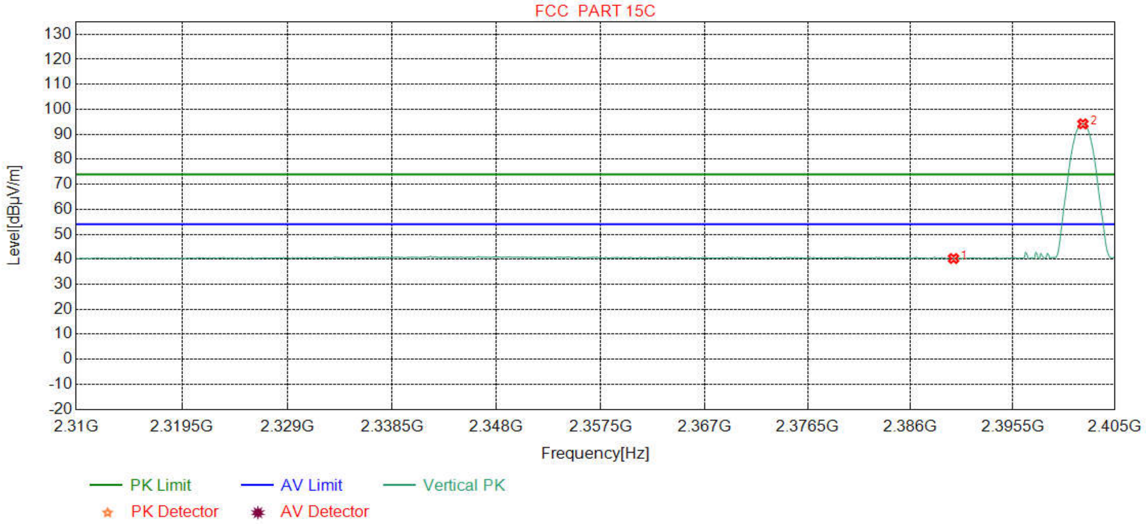
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-42.44	37.19	40.37	54.00	13.63	Pass	Horizontal
2	2402.0275	32.26	13.31	-42.43	91.02	94.16	54.00	-40.16	Pass	Horizontal

Mode:	BLE GFSK Transmitting	Channel:	2402
Remark:	AV		

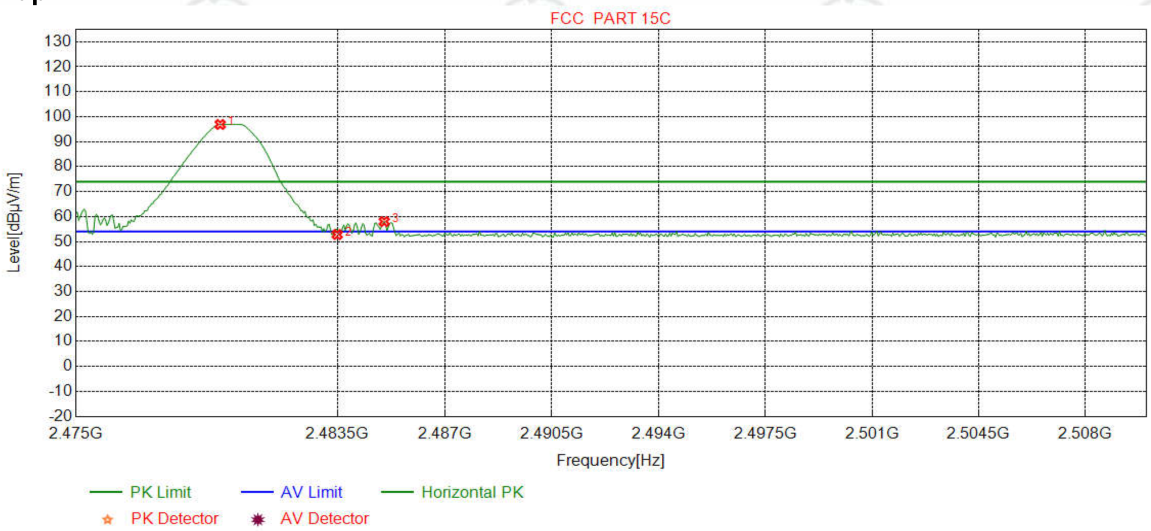
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-42.44	37.12	40.30	54.00	13.70	Pass	Vertical
2	2402.0275	32.26	13.31	-42.43	91.04	94.18	54.00	-40.18	Pass	Vertical

Mode:	BLE GFSK Transmitting	Channel:	2480
Remark:	PK		

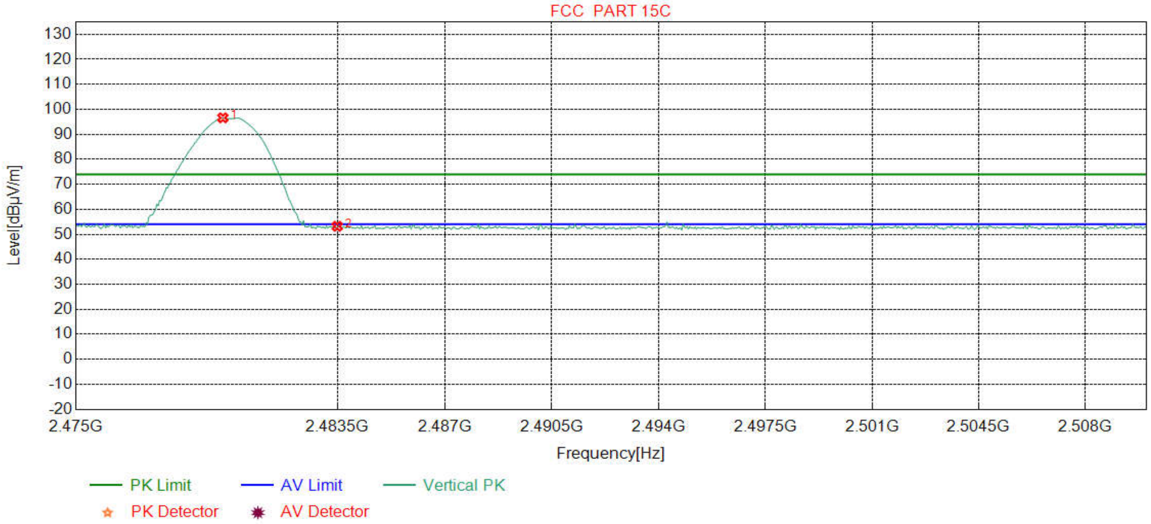
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	2479.6871	32.37	13.39	-42.39	93.52	96.89	74.00	-22.89	Pass	Horizontal
2	2483.5000	32.38	13.38	-42.40	49.46	52.82	74.00	21.18	Pass	Horizontal
3	2485.0313	32.38	13.37	-42.40	54.65	58.00	74.00	16.00	Pass	Horizontal

Mode:	BLE GFSK Transmitting	Channel:	2480
Remark:	PK		

Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2479.7747	32.37	13.39	-42.39	93.23	96.60	74.00	-22.60	Pass	Vertical
2	2483.5000	32.38	13.38	-42.40	49.82	53.18	74.00	20.82	Pass	Vertical

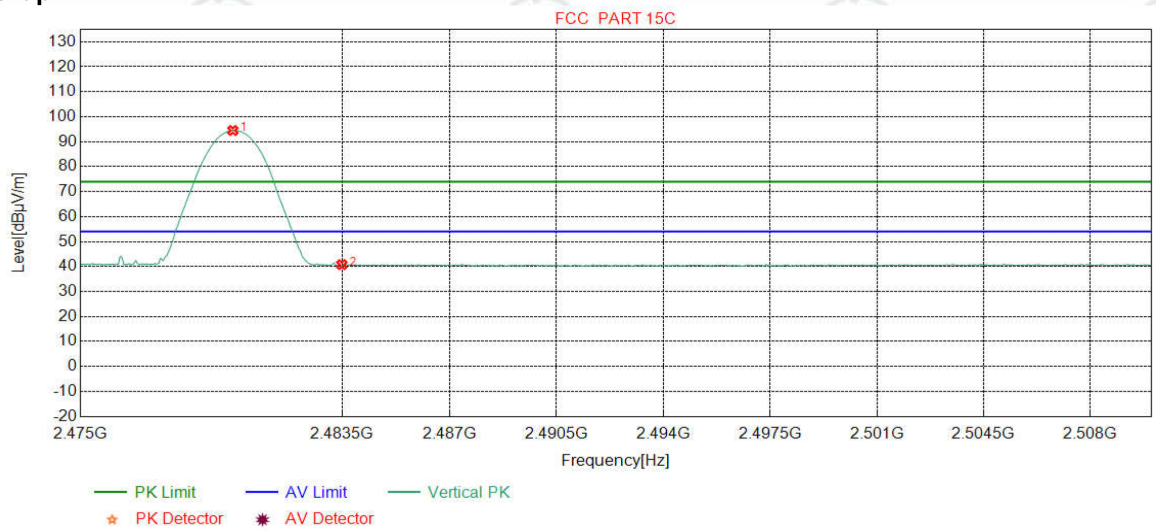
Mode:	BLE GFSK Transmitting	Channel:	2480
Remark:	AV		

Test Graph

NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2479.9937	32.37	13.39	-42.39	91.83	95.20	54.00	-41.20	Pass	Horizontal
2	2483.5000	32.38	13.38	-42.40	37.76	41.12	54.00	12.88	Pass	Horizontal
3	2484.7685	32.38	13.37	-42.40	43.45	46.80	54.00	7.20	Pass	Horizontal

Mode:	BLE GFSK Transmitting	Channel:	2480
Remark:	AV		

Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	2479.9499	32.37	13.39	-42.39	91.10	94.47	54.00	-40.47	Pass	Vertical
2	2483.5000	32.38	13.38	-42.40	37.39	40.75	54.00	13.25	Pass	Vertical

Note:

1) Through Pre-scan Non-hopping transmitting mode and charge+transmitter mode with all kind of data type, find the DH5 of data type is the worse case ofGFSK modulation type in charge + transmitter mode.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading -Correct Factor

Correct Factor = *Preamplifier Factor– Antenna Factor–Cable Factor*

Appendix I) Radiated Spurious Emissions

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

Test Procedure:

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, whichwas mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).

h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.

j. Repeat above procedures until all frequencies measured was complete.

Limit:

Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

Radiated Spurious Emissions test Data:

Radiated Emission below 1GHz

Mode:		BLE GFSK Transmitting				Channel:		2402		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	55.3195	12.35	0.84	-32.07	51.42	32.54	40.00	7.46	Pass	H
2	62.4983	10.95	0.91	-32.04	52.39	32.21	40.00	7.79	Pass	H
3	67.5428	9.64	0.94	-32.05	54.40	32.93	40.00	7.07	Pass	H
4	152.0382	7.62	1.45	-32.00	57.74	34.81	43.50	8.69	Pass	H
5	233.4293	11.77	1.81	-31.90	51.02	32.70	46.00	13.30	Pass	H
6	396.0176	15.31	2.37	-31.78	47.42	33.32	46.00	12.68	Pass	H
7	42.6113	12.77	0.74	-32.12	45.33	26.72	40.00	13.28	Pass	V
8	55.2225	12.36	0.84	-32.07	46.60	27.73	40.00	12.27	Pass	V
9	62.0132	11.08	0.91	-32.05	48.08	28.02	40.00	11.98	Pass	V
10	67.6398	9.61	0.94	-32.05	50.35	28.85	40.00	11.15	Pass	V
11	208.8859	11.13	1.71	-31.94	46.70	27.60	43.50	15.90	Pass	V
12	304.1494	13.29	2.07	-31.87	43.59	27.08	46.00	18.92	Pass	V

Mode:		BLE GFSK Transmitting				Channel:		2440		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	55.3195	12.35	0.84	-32.07	51.32	32.44	40.00	7.56	Pass	H
2	62.7893	10.87	0.91	-32.04	53.48	33.22	40.00	6.78	Pass	H
3	72.0052	8.62	0.97	-32.05	55.02	32.56	40.00	7.44	Pass	H
4	150.4860	7.57	1.45	-32.01	57.24	34.25	43.50	9.25	Pass	H
5	233.4293	11.77	1.81	-31.90	52.20	33.88	46.00	12.12	Pass	H
6	400.4800	15.41	2.38	-31.76	46.77	32.80	46.00	13.20	Pass	H
7	42.4172	12.74	0.73	-32.11	45.01	26.37	40.00	13.63	Pass	V
8	55.2225	12.36	0.84	-32.07	46.26	27.39	40.00	12.61	Pass	V
9	64.8265	10.35	0.92	-32.05	49.20	28.42	40.00	11.58	Pass	V
10	175.4175	8.75	1.56	-31.98	44.78	23.11	43.50	20.39	Pass	V
11	208.8859	11.13	1.71	-31.94	46.98	27.88	43.50	15.62	Pass	V
12	304.1494	13.29	2.07	-31.87	43.75	27.24	46.00	18.76	Pass	V

Mode:		BLE GFSK Transmitting				Channel:		2480		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	55.3195	12.35	0.84	-32.07	51.14	32.26	40.00	7.74	Pass	H
2	61.9162	11.10	0.91	-32.04	52.63	32.60	40.00	7.40	Pass	H
3	74.7215	8.10	1.01	-32.06	56.21	33.26	40.00	6.74	Pass	H
4	152.1352	7.62	1.45	-31.99	57.59	34.67	43.50	8.83	Pass	H
5	240.0260	11.94	1.84	-31.90	51.39	33.27	46.00	12.73	Pass	H
6	393.8834	15.27	2.36	-31.79	47.63	33.47	46.00	12.53	Pass	H
7	41.8352	12.63	0.73	-32.11	49.80	31.05	40.00	8.95	Pass	V
8	61.4311	11.23	0.91	-32.05	47.60	27.69	40.00	12.31	Pass	V
9	67.5428	9.64	0.94	-32.05	49.65	28.18	40.00	11.82	Pass	V
10	208.8859	11.13	1.71	-31.94	46.71	27.61	43.50	15.89	Pass	V
11	304.1494	13.29	2.07	-31.87	44.06	27.55	46.00	18.45	Pass	V
12	402.1292	15.43	2.39	-31.77	39.44	25.49	46.00	20.51	Pass	V

Transmitter Emission above 1GHz

Mode:		BLE GFSK Transmitting				Channel:		2402		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	1440.4440	28.34	2.94	-42.68	57.80	46.40	74.00	27.60	Pass	H
2	1920.4920	31.18	3.42	-42.65	57.08	49.03	74.00	24.97	Pass	H
3	4804.0000	34.50	4.55	-40.66	43.42	41.81	74.00	32.19	Pass	H
4	7206.0000	36.31	5.81	-41.02	43.96	45.06	74.00	28.94	Pass	H
5	9608.0000	37.64	6.63	-40.76	42.93	46.44	74.00	27.56	Pass	H
6	12010.0000	39.31	7.60	-41.21	43.37	49.07	74.00	24.93	Pass	H
7	1436.8437	28.34	2.94	-42.68	53.84	42.44	74.00	31.56	Pass	V
8	1919.6920	31.17	3.42	-42.65	52.44	44.38	74.00	29.62	Pass	V
9	4804.0000	34.50	4.55	-40.66	44.46	42.85	74.00	31.15	Pass	V
10	7206.0000	36.31	5.81	-41.02	43.32	44.42	74.00	29.58	Pass	V
11	9608.0000	37.64	6.63	-40.76	43.66	47.17	74.00	26.83	Pass	V
12	12010.0000	39.31	7.60	-41.21	43.33	49.03	74.00	24.97	Pass	V

Mode:		BLE GFSK Transmitting				Channel:		2440		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	1442.0442	28.34	2.94	-42.67	57.76	46.37	74.00	27.63	Pass	H
2	1920.0920	31.17	3.42	-42.65	56.74	48.68	74.00	25.32	Pass	H
3	4880.0000	34.50	4.80	-40.60	43.42	42.12	74.00	31.88	Pass	H
4	7320.0000	36.42	5.85	-40.92	43.03	44.38	74.00	29.62	Pass	H
5	9760.0000	37.70	6.73	-40.62	41.84	45.65	74.00	28.35	Pass	H
6	12200.0000	39.42	7.67	-41.17	44.49	50.41	74.00	23.59	Pass	H
7	1917.6918	31.16	3.42	-42.65	52.57	44.50	74.00	29.50	Pass	V
8	3363.0242	33.35	4.53	-41.91	50.20	46.17	74.00	27.83	Pass	V
9	4880.0000	34.50	4.80	-40.60	43.36	42.06	74.00	31.94	Pass	V
10	7320.0000	36.42	5.85	-40.92	43.49	44.84	74.00	29.16	Pass	V
11	9760.0000	37.70	6.73	-40.62	42.38	46.19	74.00	27.81	Pass	V
12	12200.0000	39.42	7.67	-41.17	42.90	48.82	74.00	25.18	Pass	V

Mode:		BLE GFSK Transmitting				Channel:		2480		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	1440.6441	28.34	2.94	-42.67	57.81	46.42	74.00	27.58	Pass	H
2	1919.4919	31.17	3.42	-42.65	56.51	48.45	74.00	25.55	Pass	H
3	4960.0000	34.50	4.82	-40.53	44.98	43.77	74.00	30.23	Pass	H
4	7440.0000	36.54	5.85	-40.82	44.15	45.72	74.00	28.28	Pass	H
5	9920.0000	37.77	6.79	-40.48	41.22	45.30	74.00	28.70	Pass	H
6	12400.0000	39.54	7.86	-41.12	43.51	49.79	74.00	24.21	Pass	H
7	1441.6442	28.34	2.94	-42.67	53.91	42.52	74.00	31.48	Pass	V
8	2014.3014	31.72	3.50	-42.61	51.51	44.12	74.00	29.88	Pass	V
9	4960.0000	34.50	4.82	-40.53	44.18	42.97	74.00	31.03	Pass	V
10	7440.0000	36.54	5.85	-40.82	43.30	44.87	74.00	29.13	Pass	V
11	9920.0000	37.77	6.79	-40.48	42.30	46.38	74.00	27.62	Pass	V
12	12400.0000	39.54	7.86	-41.12	44.63	50.91	74.00	23.09	Pass	V

Note:

1) Through Pre-scan Non-hopping transmitting mode and charge+transmitter mode with all kind of data type, find the DH5 of data type is the worse case of GFSK modulation type in charge + transmitter mode.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

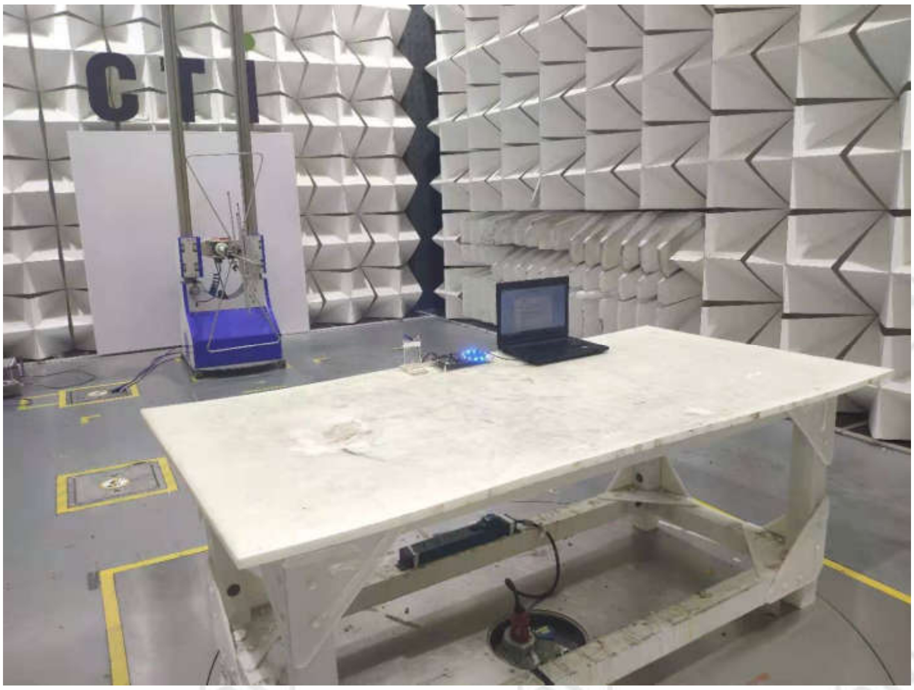
Final Test Level =Receiver Reading -Correct Factor

Correct Factor = *Preamplifier Factor– Antenna Factor–Cable Factor*

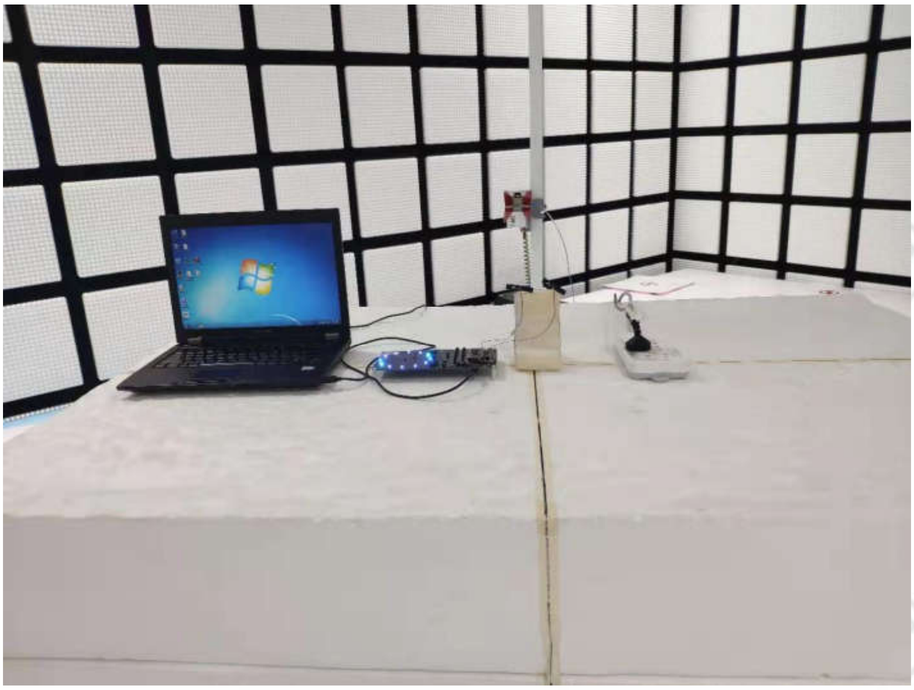
3) Scan from 9kHz to 25GHz, the disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

PHOTOGRAPHS OF TEST SETUP

Test model No.: A98



Radiated spurious emission Test Setup-1(Below 1GHz)

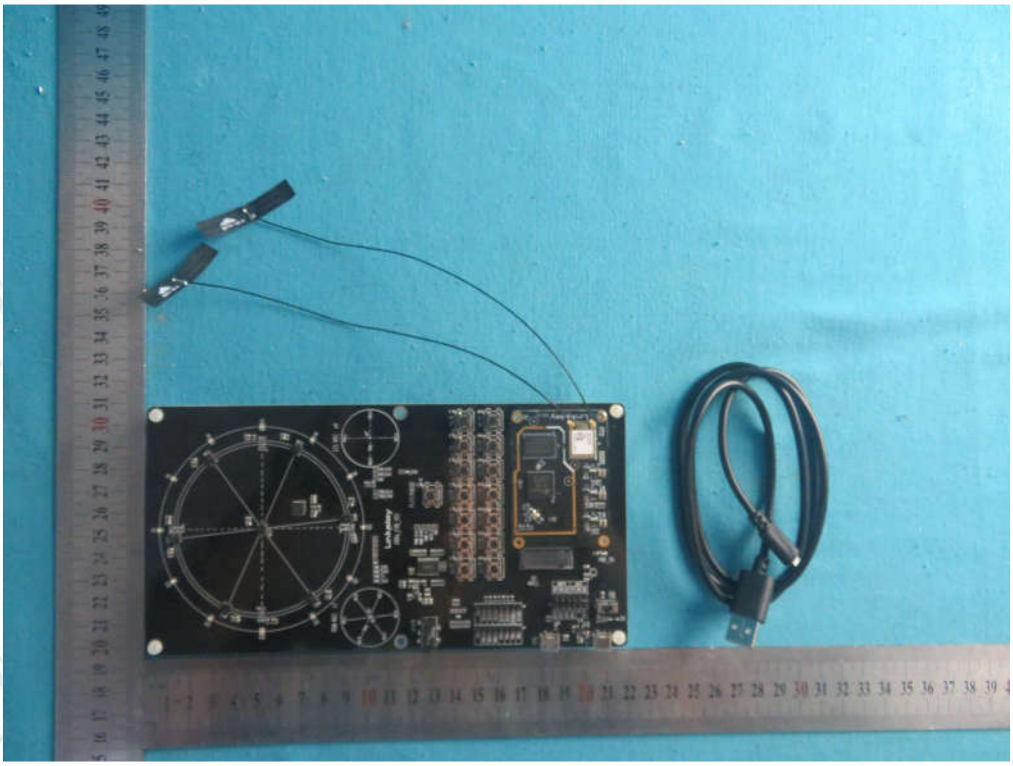


Radiated spurious emission Test Setup-2(Above 1GHz)

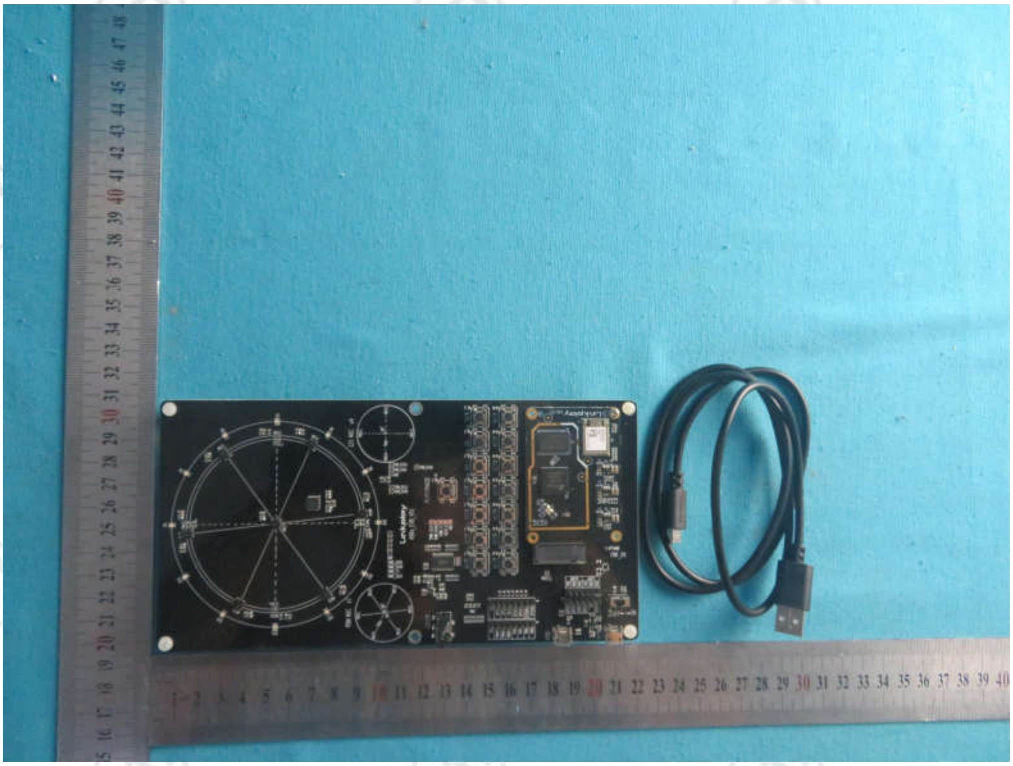
Conducted Emissions Test Setup

PHOTOGRAPHS OF EUT Constructional Details

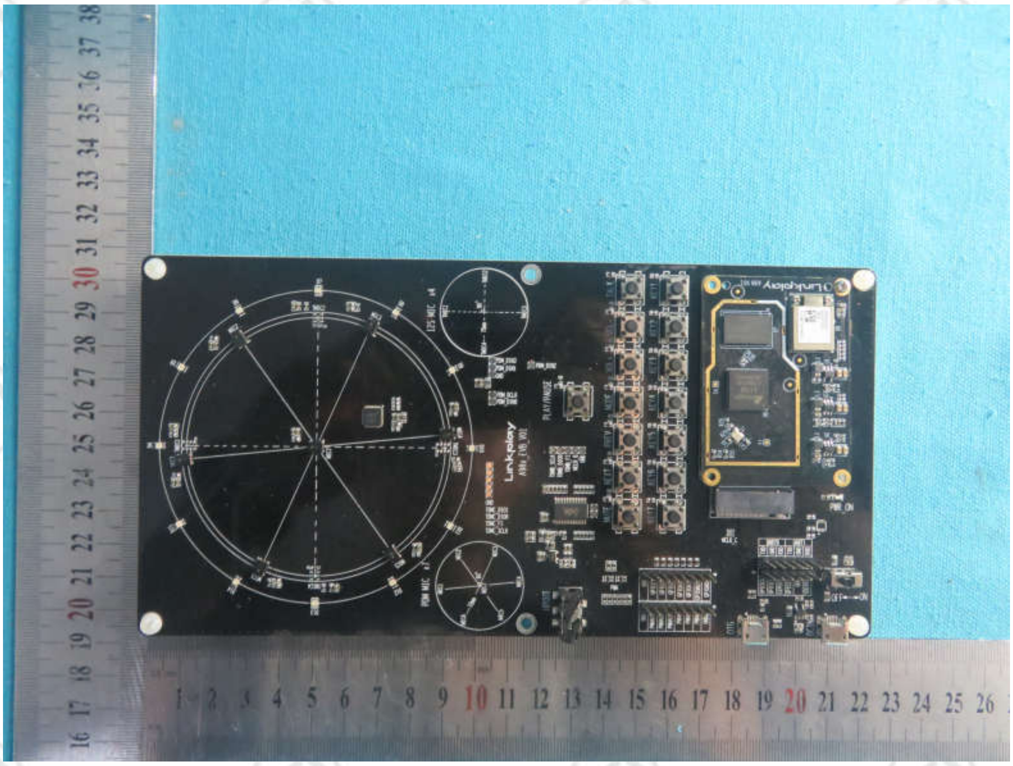
Test model No.: A98



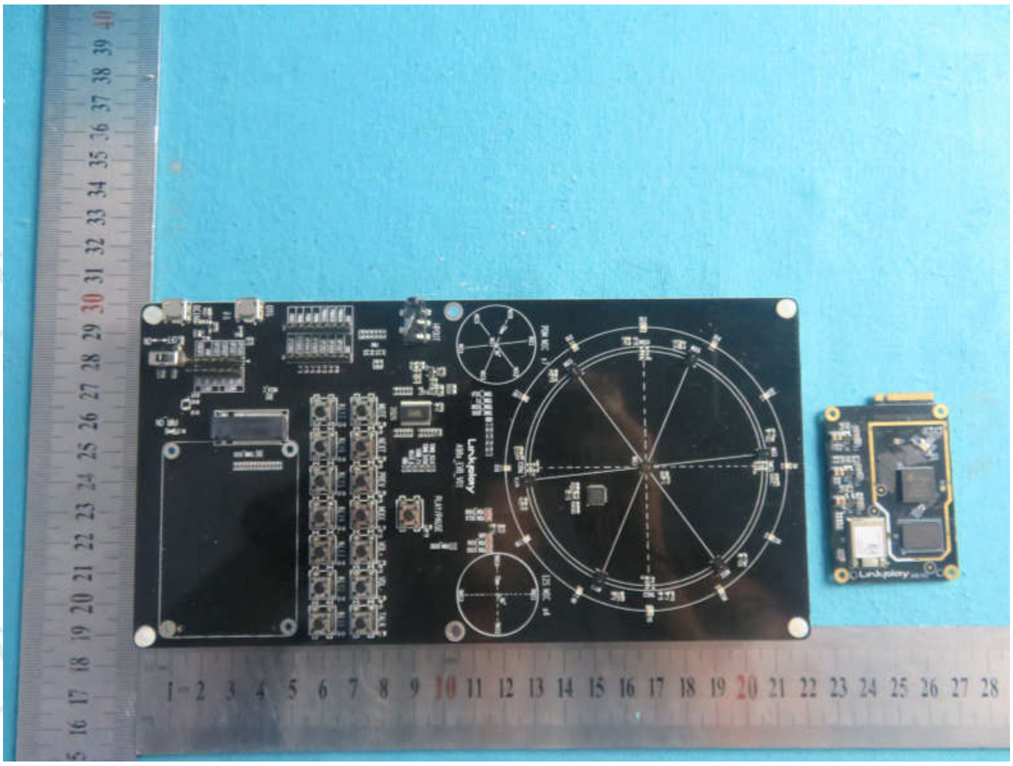
View of Product-1



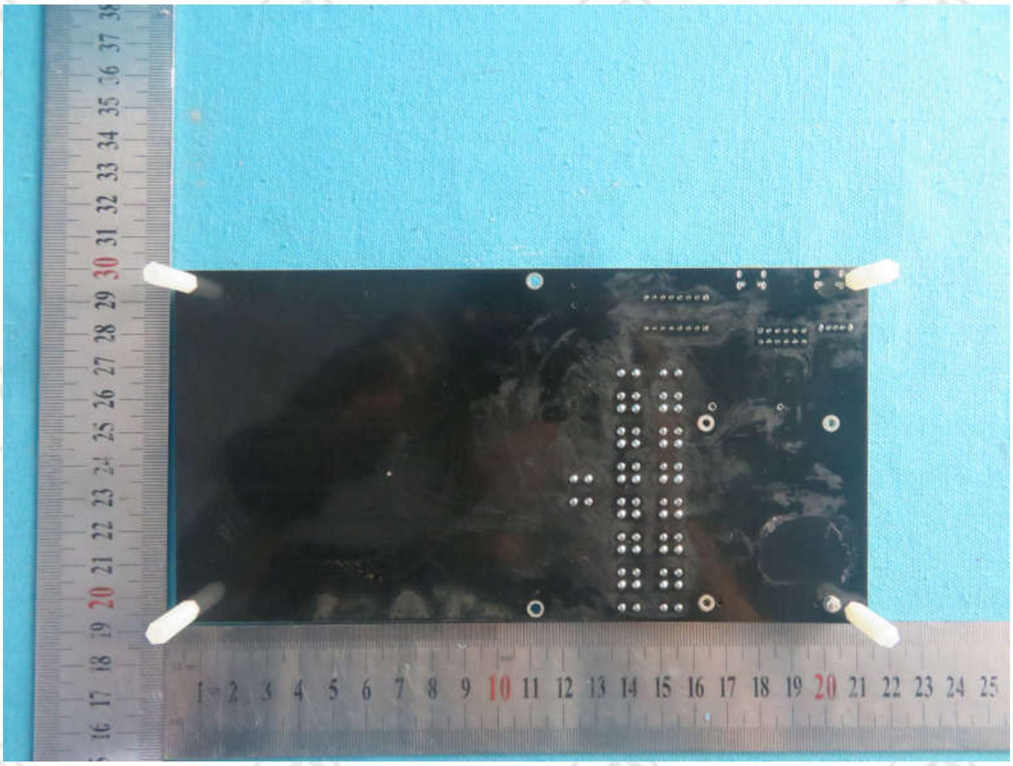
View of Product-2



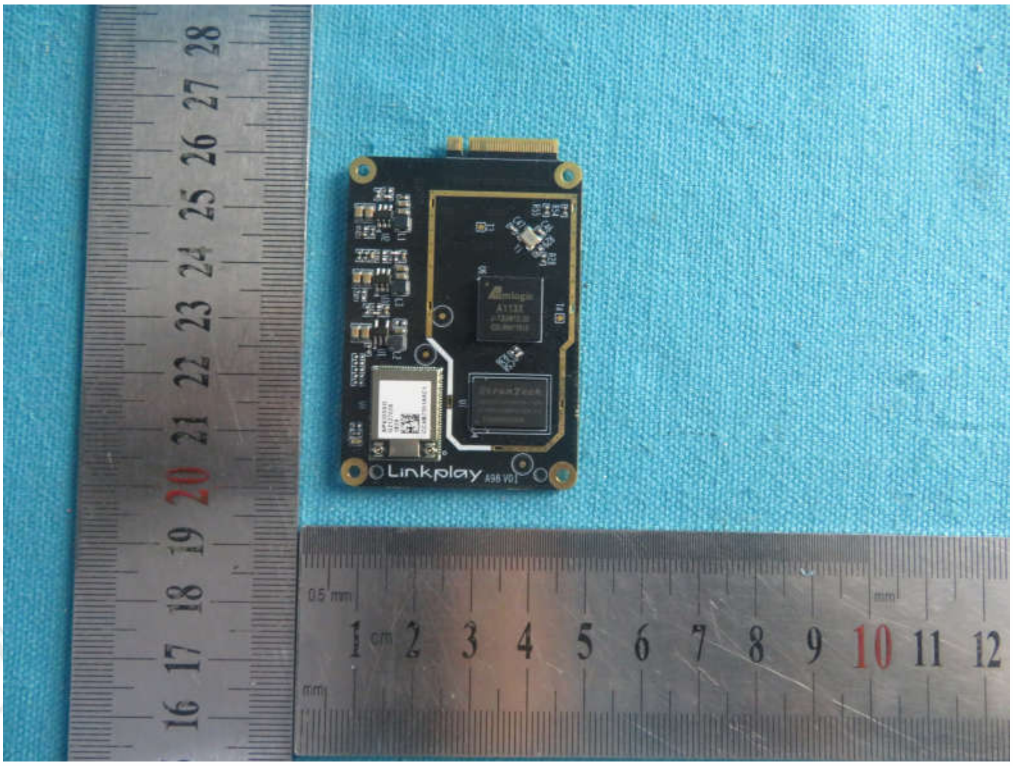
View of Product-3



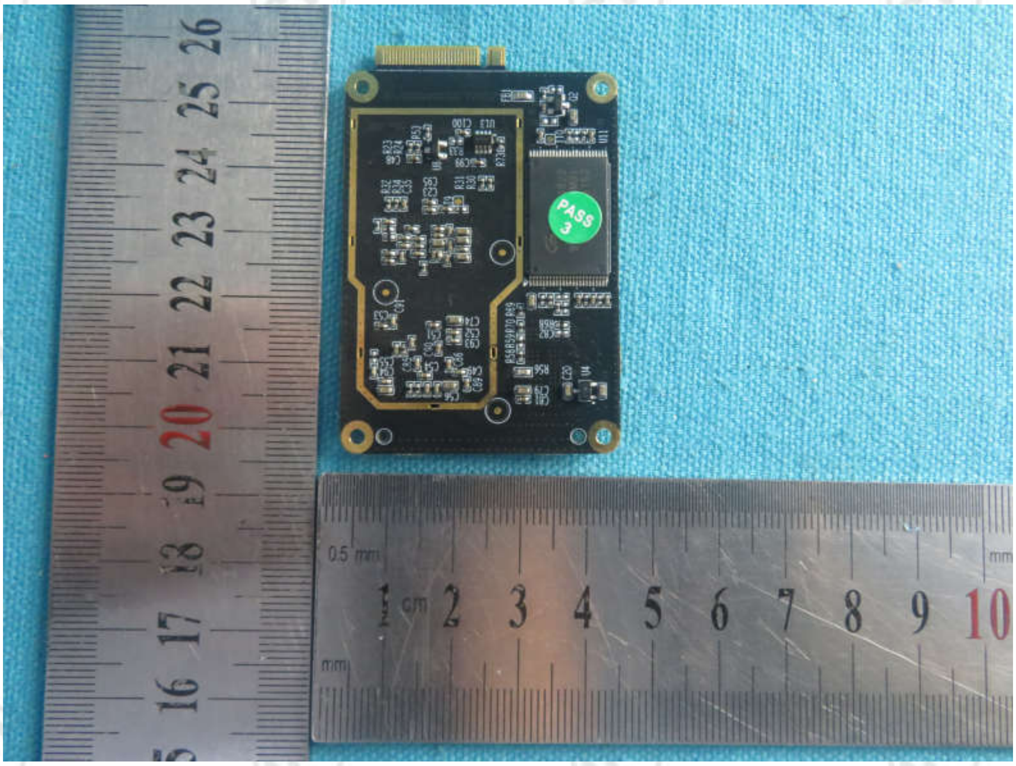
View of Product-4



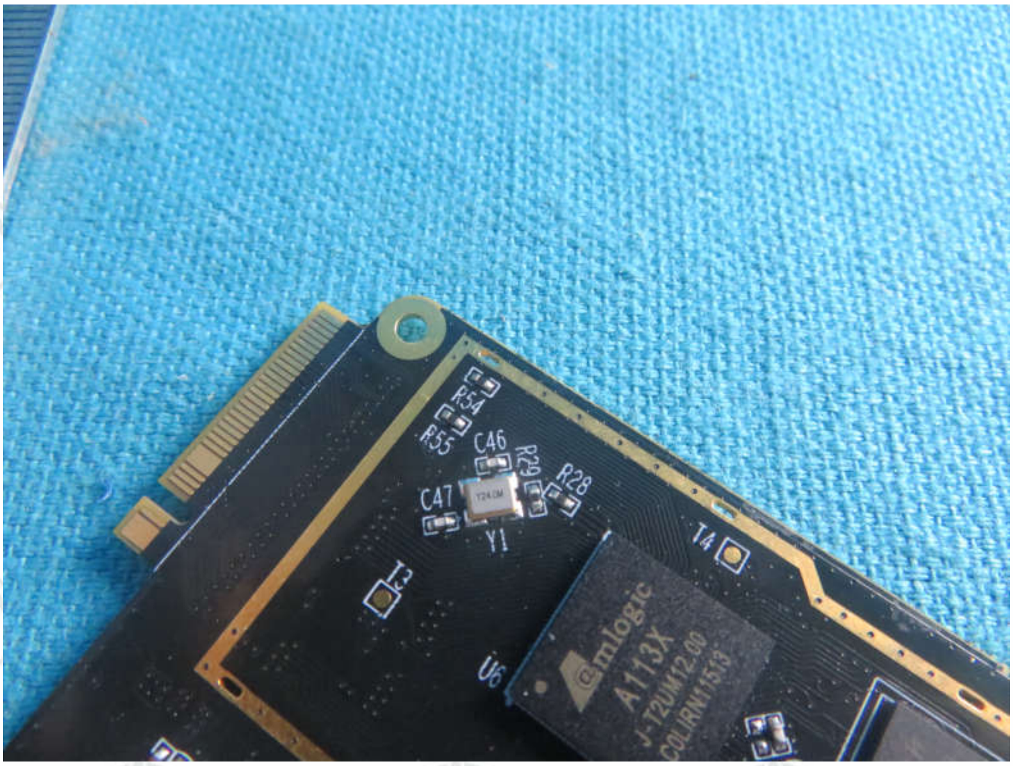
View of Product-5



View of Product-6

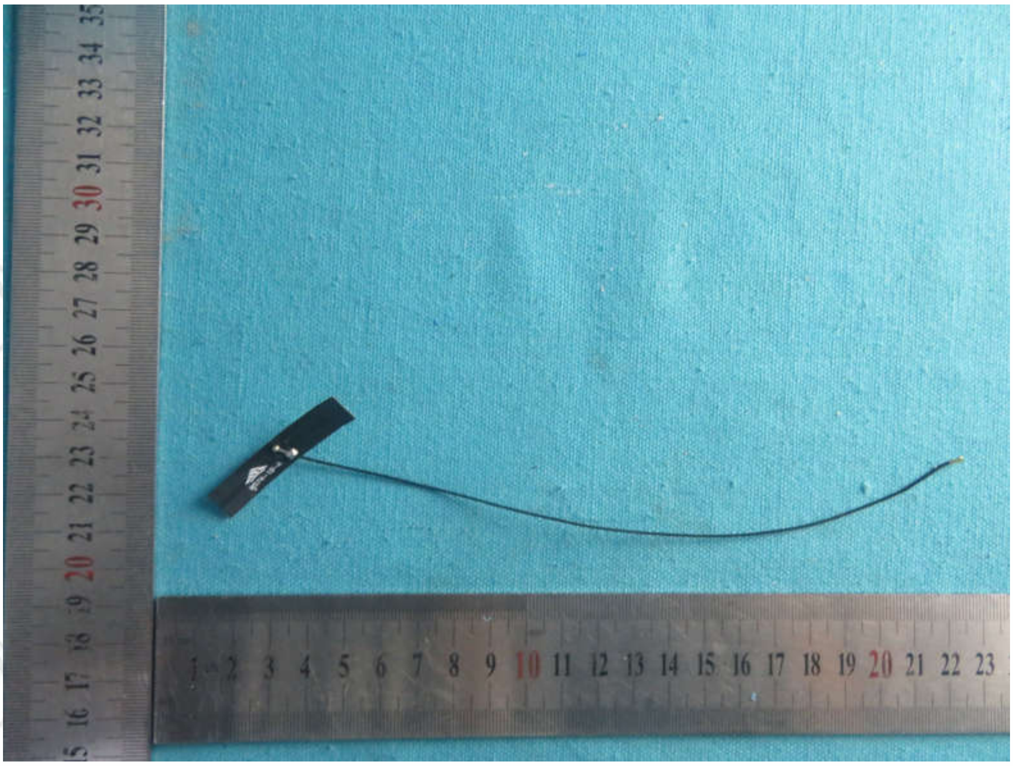


View of Product-7

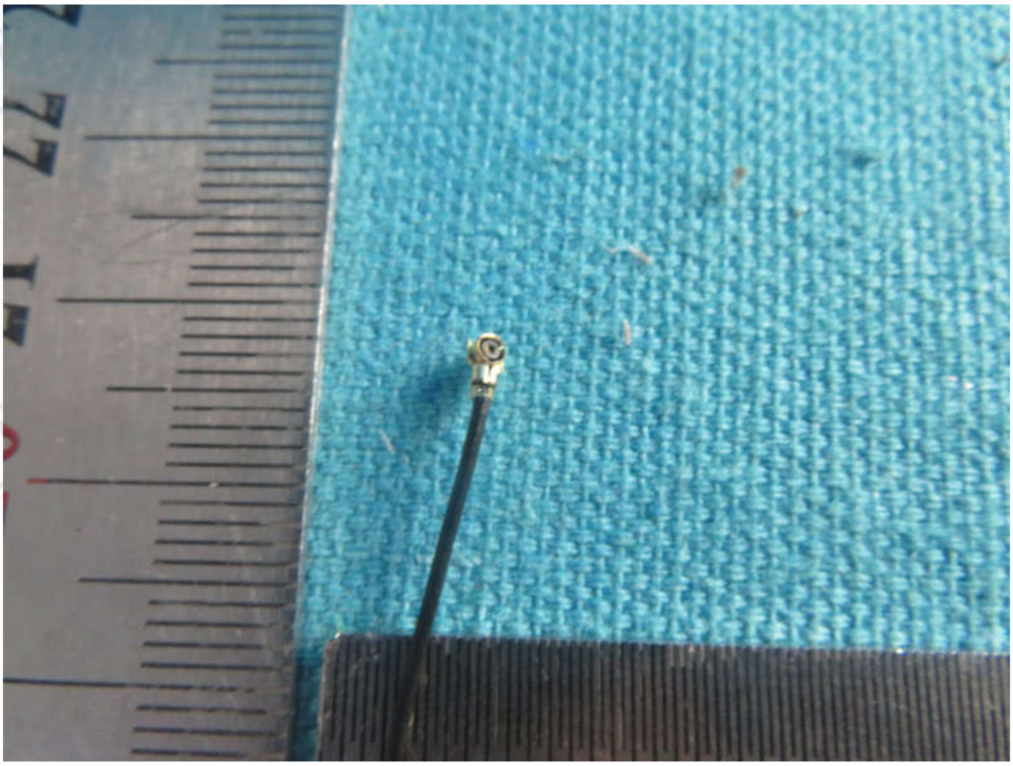


View of Product-8

View of Product-9

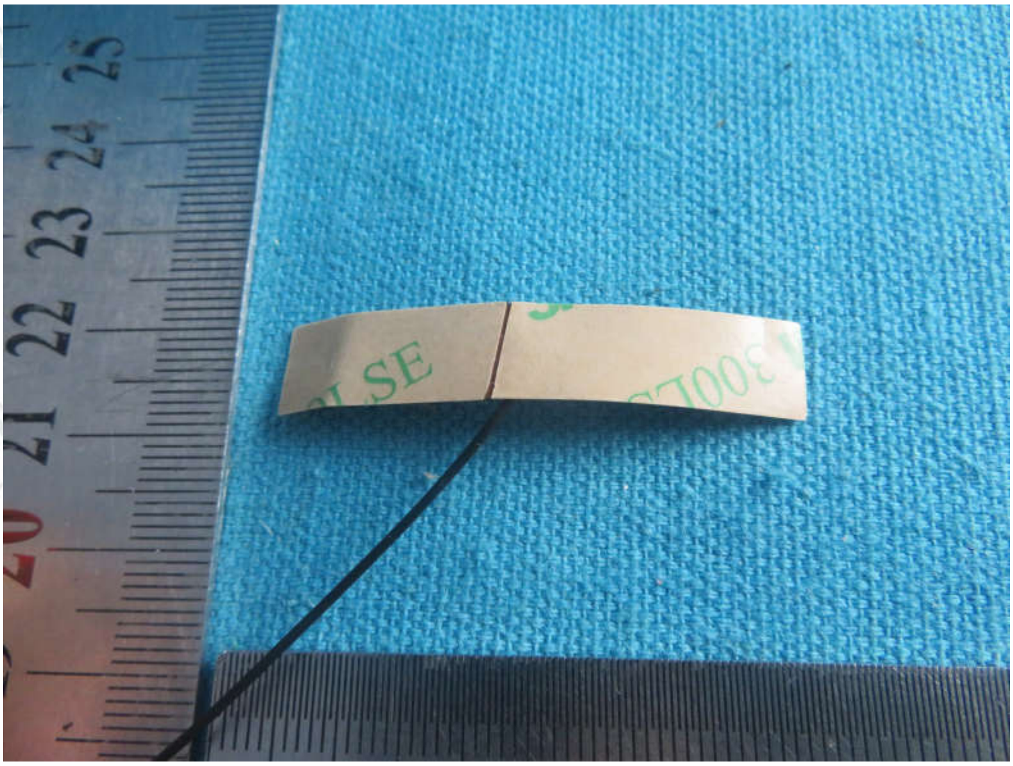


View of Product-10



View of Product-11

View of Product-12



View of Product-13

*** End of Report ***