

FCC TEST REPORT
for
Sunco Electronic Co., Ltd

Action Camera
Model No.: SO91, SO81, SO33

Prepared for : Sunco Electronic Co., Ltd
Address : 5F, 5# Building, Minxing Industrial Park, Minkang Rd., Longhua District, Shenzhen, China

Prepared By : Shenzhen Anbotech Compliance Laboratory Limited
Address : 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China
Tel: (86) 755-26066544
Fax: (86) 755-26014772

Report Number : R011610755Z
Date of Test : Oct. 26~Nov. 16, 2016
Date of Report : Nov. 17, 2016

TABLE OF CONTENTS

Description

Page

Test Report

1. GENERAL INFORMATION.....	5
1.1 Description of Device (EUT).....	5
1.2 Auxiliary Equipment Used during Test.....	6
1.3 Description of Test Facility.....	6
1.4 Measurement Uncertainty.....	6
2. TEST PROCEDURE.....	7
3. CONDUCTED EMISSION.....	8
3.1 Block Diagram of Test Setup.....	8
3.2 Power Line Conducted Emission Measurement Limits (15.207).....	8
3.3 Configuration of EUT on Measurement.....	8
3.4 Operating Condition of EUT.....	8
3.5 Test Procedure.....	9
3.6 Power Line Conducted Emission Measurement Results.....	9
4. RADIATION INTERFERENCE.....	14
4.1 Requirements (15.247, 15.209):.....	14
4.2 Test Procedure.....	14
4.3 Test Configuration.....	15
4.4 Test Results.....	16
5. CHANNEL SEPARATION TEST.....	26
5.1 Measurement Procedure.....	26
5.2 Test SET-UP.....	26
5.3 Test Equipment.....	26
5.4 Test Results.....	27
6. 20DB BANDWIDTH TEST.....	29
6.1 Measurement Procedure.....	29
6.2 Test SET-UP.....	29
6.3 Test Equipment.....	29
6.4 Test Results.....	29
7. QUANTITY OF HOPPING CHANNEL TEST.....	31
7.1 Measurement Procedure.....	31
7.2 Test SET-UP.....	31
7.3 Test Equipment.....	31
7.4 Test Results.....	31
8. DWELL TIME TEST.....	33

8.1 Measurement Procedure.....	33
8.2 Test SET-UP.....	33
8.3 Test Equipment.....	33
8.4 Test Results.....	33
9. MAXIMUM PEAK OUTPUT POWER TEST.....	35
9.1 Measurement Procedure.....	35
9.2 Test SET-UP.....	35
9.3 Test Equipment.....	35
9.4 Test Results.....	36
10. 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE.....	38
a) 10.1 Applicable Standard.....	38
b) 10.2 Test SET-UP.....	38
c) 10.3 Test Equipment.....	38
d) 10.4 Test Results.....	38
11. ANTENNA APPLICATION.....	43
11.1 Antenna requirement.....	43
11.2 Result.....	43
12. PHOTOGRAPH.....	44
12.1 Photo of Power Line Conducted Emission Measurement.....	44
12.2 Photo of Radiation Emission Test.....	44
APPENDIX I (EXTERNAL PHOTOS).....	46
APPENDIX II (INTERNAL PHOTOS).....	49

TEST REPORT

Applicant : Sunco Electronic Co., Ltd
Manufacturer : Ekoo Electronic Co., Ltd.
EUT : Action Camera
Model No. : SO91, SO81, SO33
Serial No. : N.A.
Trade Mark : N.A
Rating : Input DC 5V, 1000mA (Battery DC 3.7V, 1050mAh)

Measurement Procedure Used:

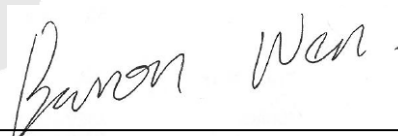
FCC Part15 Subpart C 2016, Paragraph 15.207, 15.247 & 15.209

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

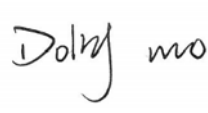
This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test : Oct. 26~Nov. 16, 2016

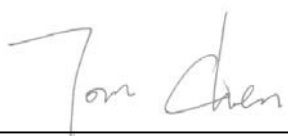
Prepared by :


(Tested Engineer / Baron Wen)

Reviewer :


(Project Manager / Dolly Mo)

Approved & Authorized Signer :


(Manager / Tom Chen)

1. GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT	: Action Camera
Model Number	: SO91, SO81, SO33 (Note: All samples are the same except the model number and colour, so we prepare "SO91" for test only.)
Test Power Supply	: AC 120V, 60Hz for adapter/ AC 240V, 60Hz for adapter/ DC 3.7V Battery inside
Frequency	: WiFi: 2412MHz~2462MHz (802.11b/802.11g/802.11n(HT20)) 2422MHz~2452MHz (802.11n(HT40)) BT3.0: 2402~2480MHz BT4.0: 2402~2480MHz
Modulation	: WiFi: 802.11b CCK; 802.11g OFDM; 802.11n MCS BT3.0: GFSK, $\pi/4$ DQPSK, 8DPSK BT4.0: GFSK
Channel	: WiFi: 11 For (802.11b/802.11g/802.11n(HT20)) 7 For (802.11n(HT40)) BT4.0: 40
Antenna Type	: External
Antenna Gain	: -3dBi
Applicant Address	: Sunco Electronic Co., Ltd 5F, 5# Building, Minxing Industrial Park, Minkang Rd., Longhua District, Shenzhen, China
Manufacturer Address	: Ekoo Electronic Co., Ltd. 3F, Building A, Mantong Industrial Pafu Industrial Zone, Guanlan Street, Longhua District, Shenzhen, China
Factory Address	: Ekoo Electronic Co., Ltd. 3F, Building A, Mantong Industrial Pafu Industrial Zone, Guanlan Street, Longhua District, Shenzhen, China
Date of receipt	: Oct. 26, 2016
Date of Test	: Oct. 26~Nov. 16, 2016
Note	: This report is for BT3.0 module

1.2 Auxiliary Equipment Used during Test

Adapter : Manufacturer: Samsung
M/N: ETA-U90CBC
S/N: RT6FB17ZS/B-E
Input: AC 100-240V, 50-60Hz, 0.35A
Output: DC 5V, 2A

1.3 Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 752021

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 752021, July 06, 2016.

IC-Registration No.: 8058A-1

Shenzhen Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A, Jun. 13, 2016.

Test Location

All Emissions tests were performed at
Shenzhen Anbotek Compliance Laboratory Limited. at 1/F., Building 1, SEC
Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong,
China

1.4 Measurement Uncertainty

Radiation Uncertainty : Ur = 4.1 dB (Horizontal)
Ur = 4.3 dB (Vertical)
Conduction Uncertainty : Uc = 3.4dB

2. Test Procedure

GENERAL: This report shall NOT be reproduced except in full without the written approval of Shenzhen Anbotek Compliance Laboratory Limited. The EUT was transmitting a test signal during the testing.

RADIATION INTERFERENCE: The test procedure used was ANSI STANDARD C63.10-2013 using a spectrum analyzer with a pre-selector. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100KHz and the video bandwidth was 300KHz up to 1.0GHz and 1.0MHz with a video BW of 3.0MHz above 1.0GHz. The ambient temperature of the EUT was 74.3oF with a humidity of 69%.

FORMULA OF CONVERSION FACTORS: The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the Preselector was accounted for in the Spectrum Analyzer Meter Reading.

Example:

Freq (MHz) METER READING + ACF = FS
20 dBuV + 10.36 dB = 30.36 dBuV/m @ 3m

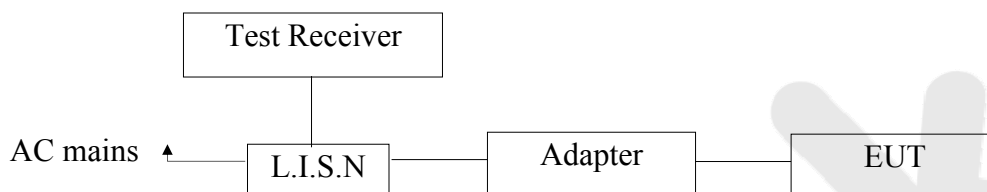
ANSI STANDARD C63.10-2013 10.1.7 MEASUREMENT PROCEDURES: The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

3. Conducted Emission

3.1 Block Diagram of Test Setup

3.1.1. Block diagram of connection between the EUT and simulators



3.2 Power Line Conducted Emission Measurement Limits (15.207)

Frequency MHz	Limits dB(μV)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66 ~ 56*	56 ~ 46*
0.50 ~ 5.00	56	46
5.00 ~ 30.00	60	50

Notes: 1. *Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

3.3 Configuration of EUT on Measurement

The following equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

3.4 Operating Condition of EUT

- 3.4.1. Setup the EUT and simulator as shown as Section 3.1.
- 3.4.2. Turn on the power of all equipment.
- 3.4.3. Let the EUT work in test mode (Charge Mode) and measure it.

3.5 Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2013 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9KHz.

The frequency range from 150KHz to 30MHz is checked.

The test results are reported on Section 3.6.

Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Two-Line V-network	Rohde & Schwarz	ENV216	100055	Apr. 16, 2016	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Apr. 16, 2016	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Apr. 16, 2016	1 Year

3.6 Power Line Conducted Emission Measurement Results

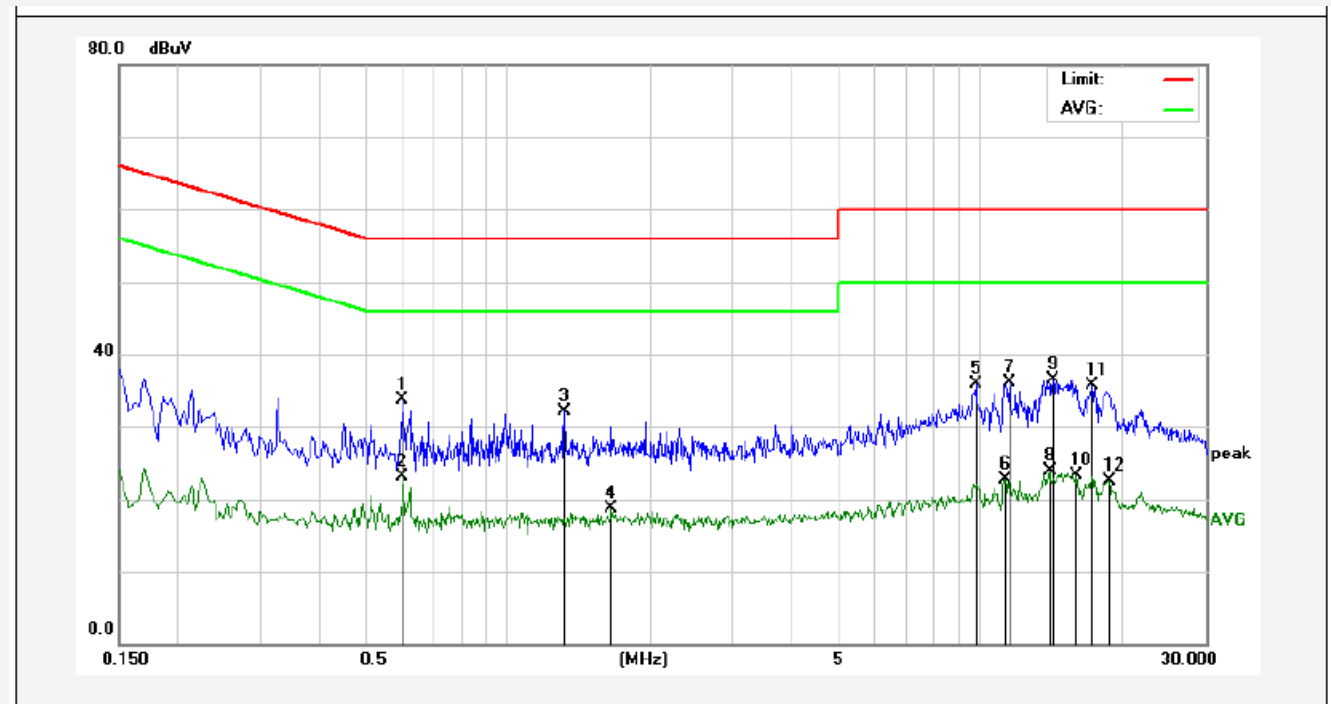
PASS.

The frequency range from 150KHz to 30 MHz is investigated.

Please refer the following pages.

CONDUCTED EMISSION TEST DATA

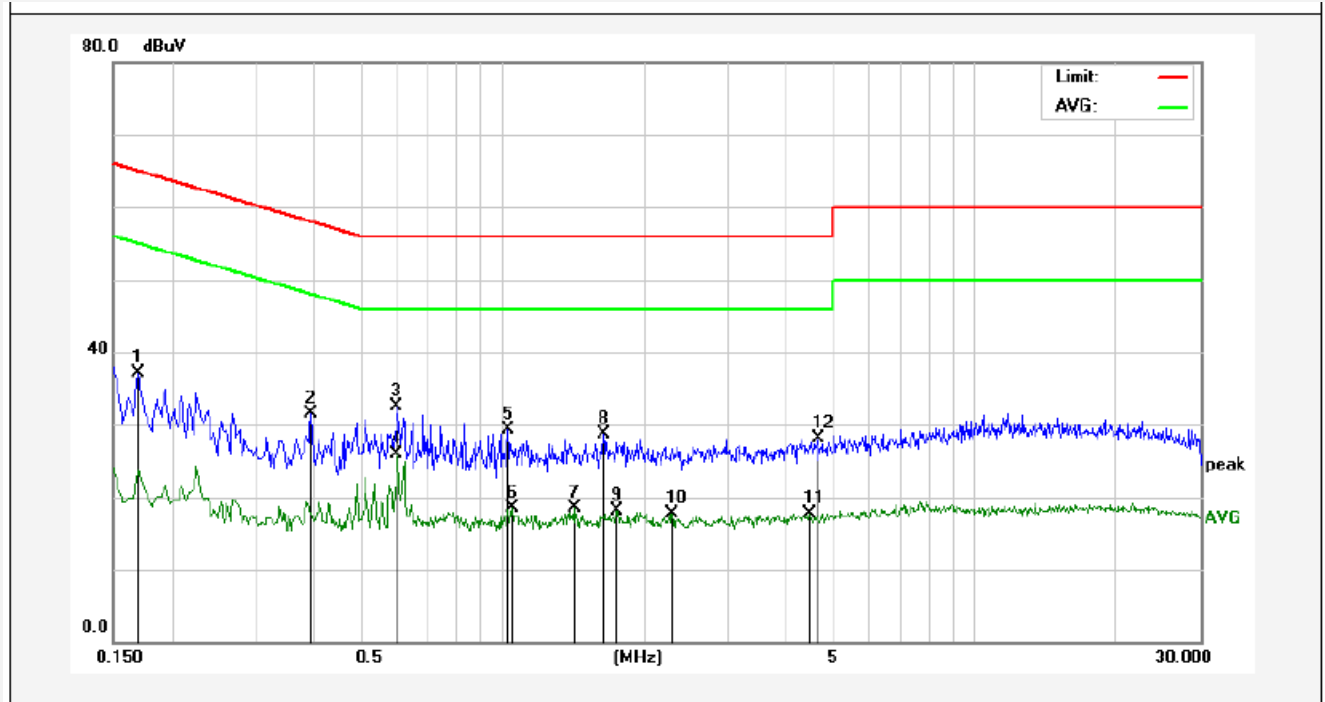
Test Site: 1# Shielded Room
Operating Condition: Charge Mode
Test Specification: AC 120V, 60Hz for adapter
Comment: Live Line
Tem.:25°C Hum.:50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.5980	13.67	20.01	33.68	56.00	-22.32	QP	
2	0.5980	3.01	20.01	23.02	46.00	-22.98	AVG	
3	1.3180	12.01	20.13	32.14	56.00	-23.86	QP	
4	1.6620	-1.39	20.13	18.74	46.00	-27.26	AVG	
5	9.7900	15.60	20.33	35.93	60.00	-24.07	QP	
6	11.2500	2.31	20.32	22.63	50.00	-27.37	AVG	
7	11.5500	15.74	20.32	36.06	60.00	-23.94	QP	
8	14.0100	3.65	20.28	23.93	50.00	-26.07	AVG	
9	14.2780	16.23	20.27	36.50	60.00	-23.50	QP	
10	16.0260	3.03	20.28	23.31	50.00	-26.69	AVG	
11	17.2340	15.46	20.30	35.76	60.00	-24.24	QP	
12	18.7580	2.17	20.32	22.49	50.00	-27.51	AVG	

CONDUCTED EMISSION TEST DATA

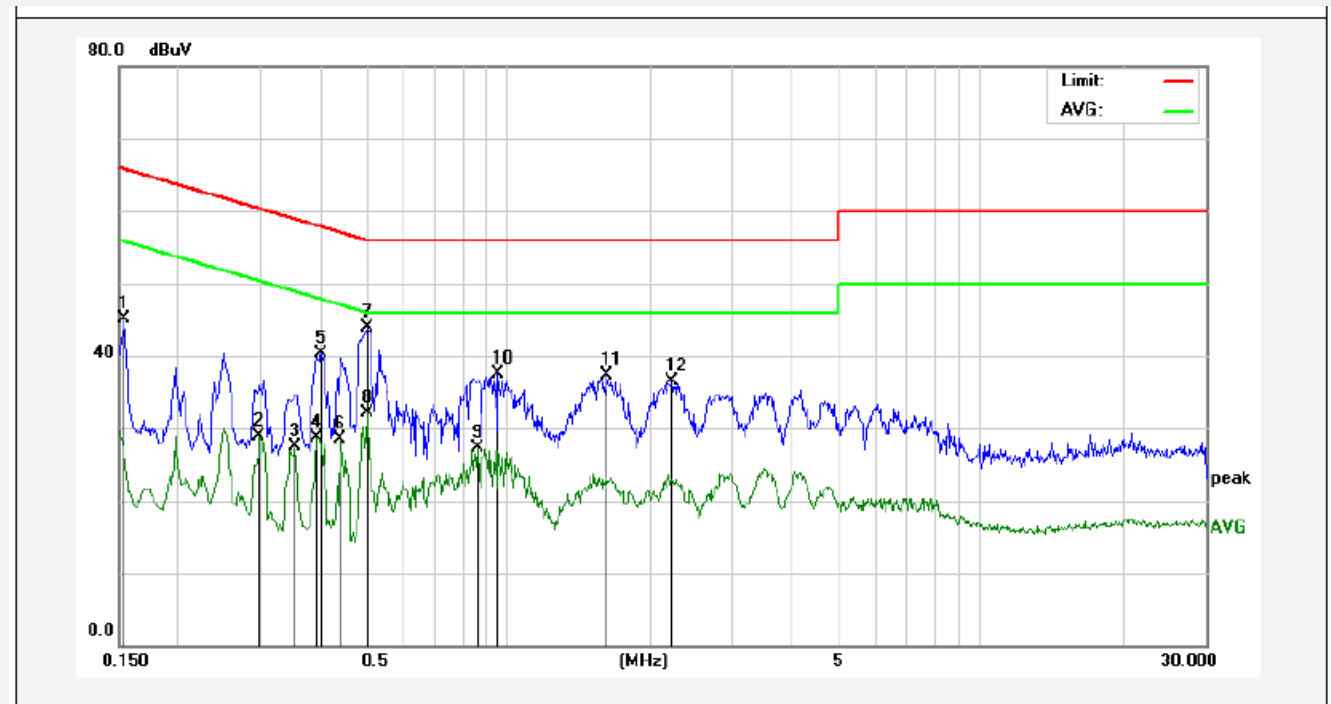
Test Site: 1# Shielded Room
Operating Condition: Charge Mode
Test Specification: AC 120V, 60Hz for adapter
Comment: Neutral Line
Tem.:25°C Hum.:50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1700	17.27	19.90	37.17	64.96	-27.79	QP	
2	0.3940	11.49	19.93	31.42	57.98	-26.56	QP	
3	0.5980	12.42	20.01	32.43	56.00	-23.57	QP	
4	0.5980	5.87	20.01	25.88	46.00	-20.12	AVG	
5	1.0300	9.20	20.12	29.32	56.00	-26.68	QP	
6	1.0540	-1.61	20.12	18.51	46.00	-27.49	AVG	
7	1.4220	-1.71	20.13	18.42	46.00	-27.58	AVG	
8	1.6420	8.53	20.13	28.66	56.00	-27.34	QP	
9	1.7500	-1.94	20.13	18.19	46.00	-27.81	AVG	
10	2.2860	-2.36	20.15	17.79	46.00	-28.21	AVG	
11	4.4620	-2.48	20.19	17.71	46.00	-28.29	AVG	
12	4.6700	7.98	20.20	28.18	56.00	-27.82	QP	

CONDUCTED EMISSION TEST DATA

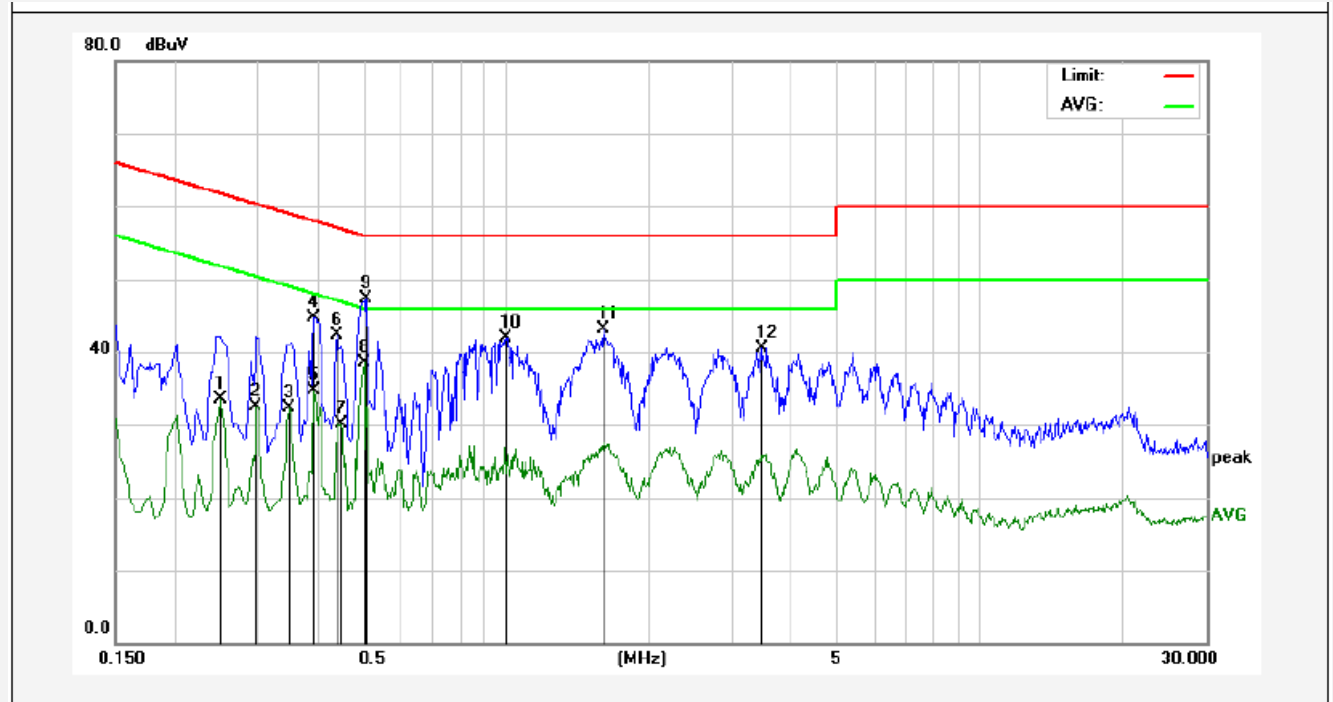
Test Site: 1# Shielded Room
Operating Condition: Charge Mode
Test Specification: AC 240V, 60Hz for adapter
Comment: Live Line
Tem.:25°C Hum.:50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1539	25.26	19.90	45.16	65.78	-20.62	QP	
2	0.2977	9.04	19.89	28.93	50.30	-21.37	AVG	
3	0.3537	7.53	19.91	27.44	48.87	-21.43	AVG	
4	0.3940	8.71	19.93	28.64	47.98	-19.34	AVG	
5	0.4020	20.36	19.94	40.30	57.81	-17.51	QP	
6	0.4420	8.48	19.95	28.43	47.02	-18.59	AVG	
7	0.5020	23.85	19.98	43.83	56.00	-12.17	QP	
8	0.5060	12.12	19.98	32.10	46.00	-13.90	AVG	
9	0.8618	7.18	20.08	27.26	46.00	-18.74	AVG	
10	0.9576	17.40	20.11	37.51	56.00	-18.49	QP	
11	1.6220	17.19	20.13	37.32	56.00	-18.68	QP	
12	2.2299	16.29	20.14	36.43	56.00	-19.57	QP	

CONDUCTED EMISSION TEST DATA

Test Site: 1# Shielded Room
Operating Condition: Charge Mode
Test Specification: AC 240V, 60Hz for adapter
Comment: Neutral Line
Tem.:25°C Hum.:50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.2500	13.63	19.89	33.52	51.75	-18.23	AVG	
2	0.2977	12.66	19.89	32.55	50.30	-17.75	AVG	
3	0.3497	12.30	19.91	32.21	48.97	-16.76	AVG	
4	0.3940	24.85	19.93	44.78	57.98	-13.20	QP	
5	0.3940	14.70	19.93	34.63	47.98	-13.35	AVG	
6	0.4420	22.33	19.95	42.28	57.02	-14.74	QP	
7	0.4500	10.06	19.96	30.02	46.87	-16.85	AVG	
8	0.5020	18.45	19.98	38.43	46.00	-7.57	AVG	
9	0.5100	27.32	19.98	47.30	56.00	-8.70	QP	
10	1.0020	21.82	20.12	41.94	56.00	-14.06	QP	
11	1.6019	22.91	20.13	43.04	56.00	-12.96	QP	
12	3.4580	20.39	20.17	40.56	56.00	-15.44	QP	

4. Radiation Interference

4.1 Requirements (15.247, 15.209):

4.1.1. Test Limits (< 30 MHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30

4.1.2. Test Limits (≥ 30 MHz)

FIELD STRENGTH of Fundamental: @3M	FIELD STRENGTH of Harmonics	S15.209 30 - 88 MHz	40 dBuV/m
902-928 MHz		88 - 216 MHz	43.5
2.4-2.4835 GHz		216 - 960 MHz	46
94 dBuV/m @3m	54 dBuV/m @3m	ABOVE 960 MHz	54dBuV/m

For range 9KHz~30MHz, The measured value is really too low to be recorded.

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.

4.2 Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.
For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.
The turn table can rotate 360 degrees to determine the position of the maximum emission level.
The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower.
The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For 30MHz to 1000MHz:

Set the spectrum analyzer as:
RBW = 100kHz, VBW =300kHz,
Detector= Quasi-Peak
Trace mode= Max hold.
Sweep- auto couple.

For Above 1GHz:

Set the spectrum analyzer as:
RBW = 1MHz, VBW =3MHz,
Detector= Peak
Trace mode= Max hold.
Sweep- auto couple.

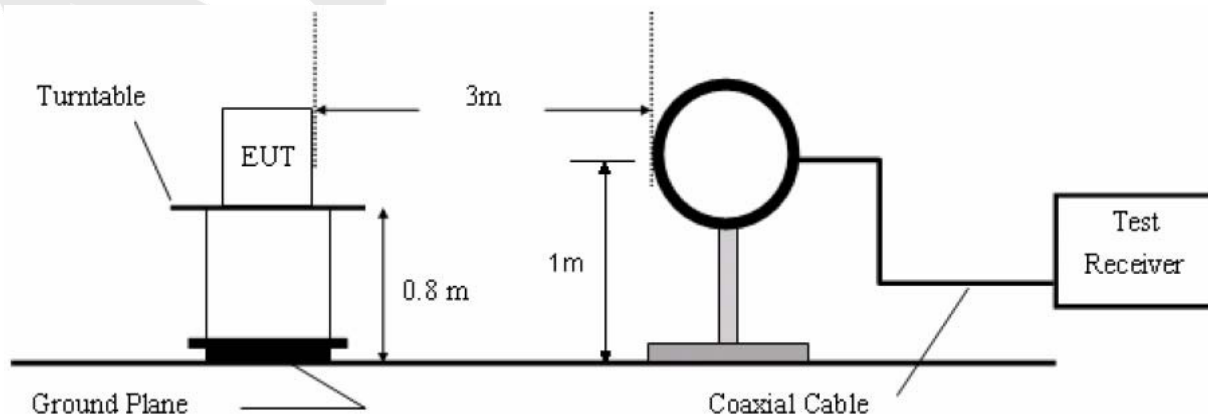
Set the spectrum analyzer as:
RBW =1MHz, VBW =10Hz
Detector= Average
Trace mode= Max hold.
Sweep- auto couple.

Test Equipment

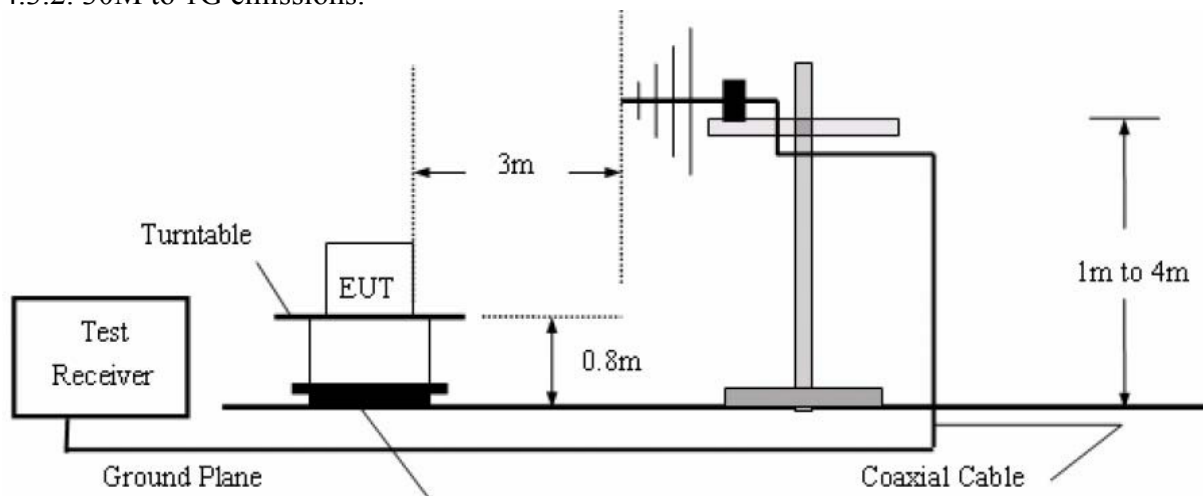
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Apr. 16, 2016	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 16, 2016	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 16, 2016	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 19, 2016	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 19, 2016	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 16, 2016	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
8	Power Sensor	DAER	RPR3006W	15I00041SN046	Jun 30, 2016	1 Year
9	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Jun 30, 2016	1 Year
10	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Jun 30, 2016	1 Year
11	Signal Generator	Agilent	E4421B	MY41000743	Jun 30, 2016	1 Year
12	DC Power supply	IV	IV-8080	YQSB0096	Jun 30, 2016	1 Year
13	TEMP&HUMI PROGRAMMABLE CHAMBER	Bell Group	BE-THK-150M8	SE-0137	Mar. 16, 2016	1 Year

4.3 Test Configuration

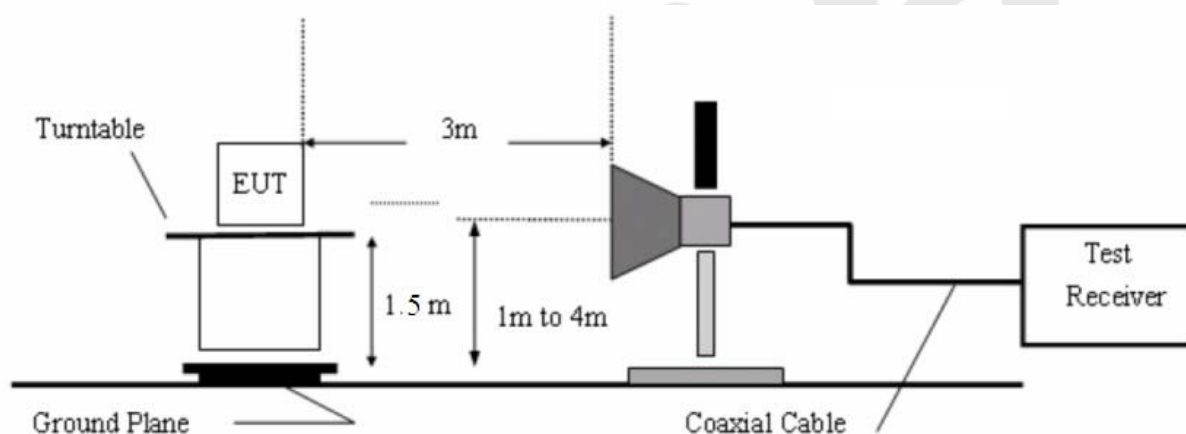
4.3.1. 9k to 30MHz emissions:



4.3.2. 30M to 1G emissions:



4.3.3. 1G to 40G emissions:



4.4 Test Results

PASS.

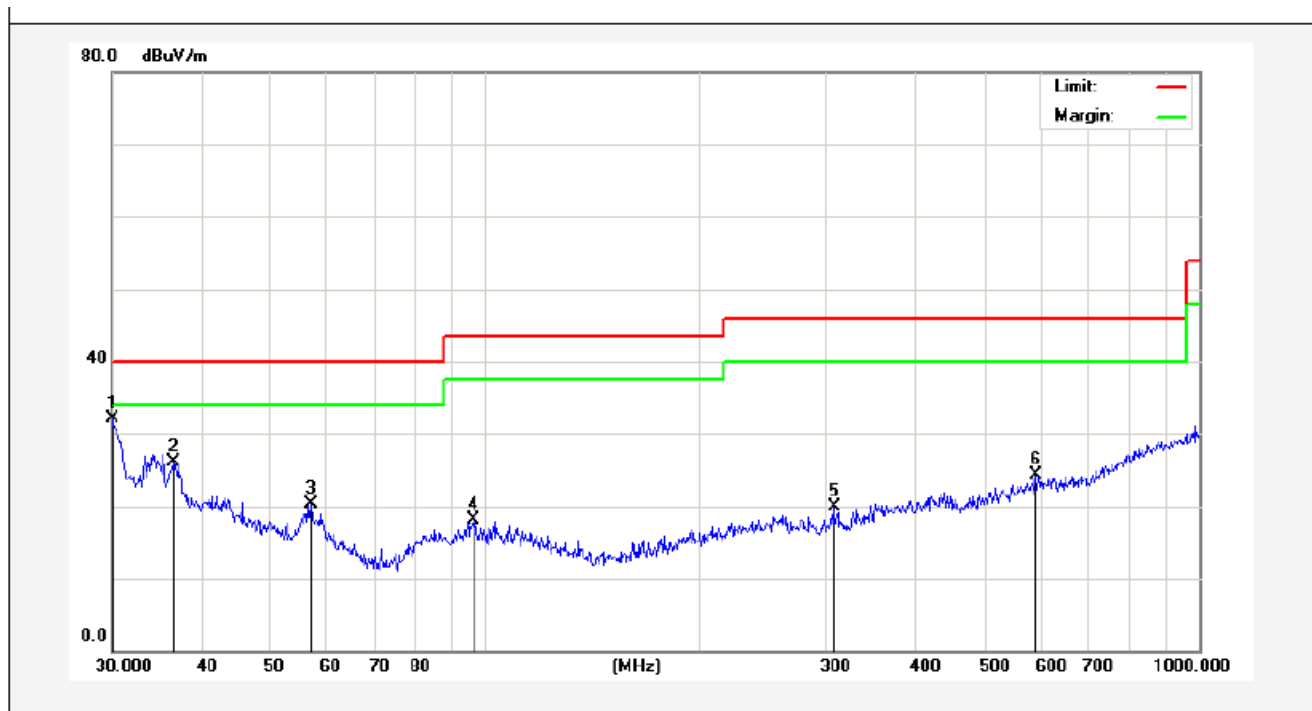
The EUT was tested on (Charge Mode, BT Mode, WiFi Mode, Record Mode, Play Back Mode) modes, only the worst data of (Charge Mode) is attached in the following pages.

Only the worst case (x orientation).

The EDR was tested on ($\pi/4$ DQPSK, 8DPSK) modes, only the worst data of ($\pi/4$ DQPSK) is attached in the following pages.

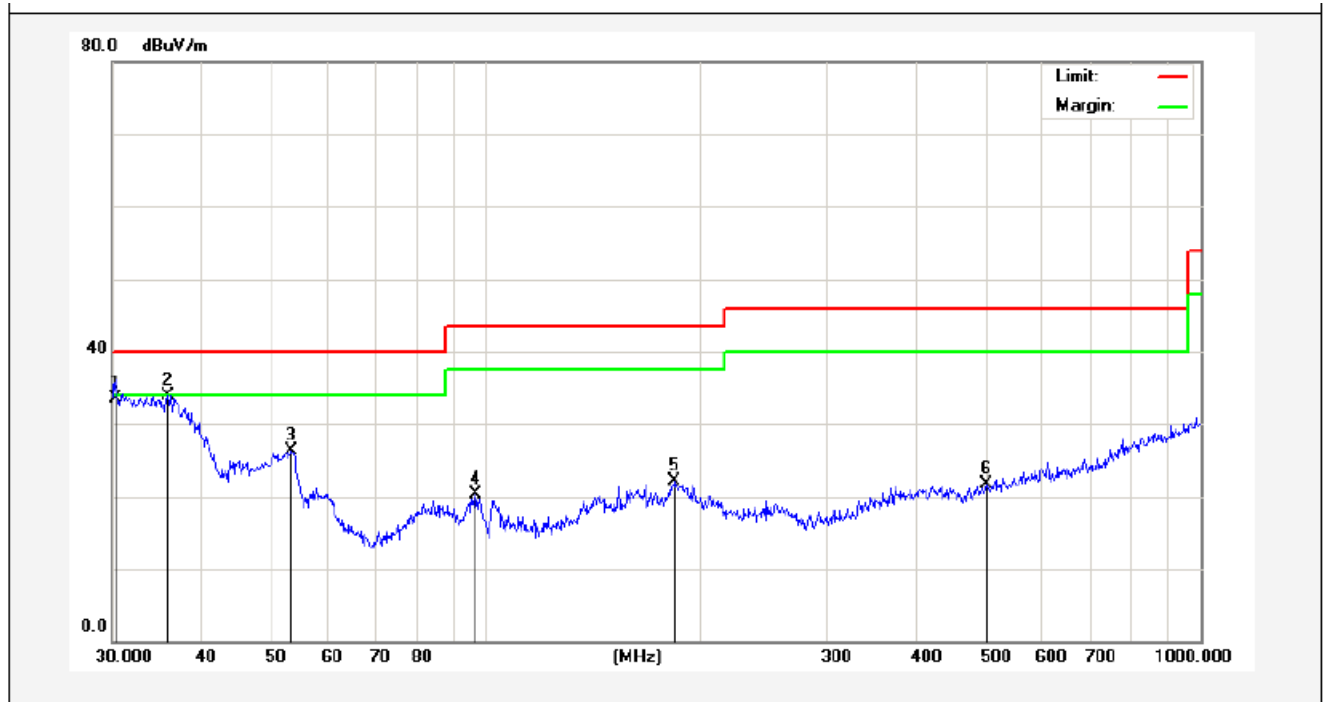
The test results of above 18000MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Job No.:	011610755I	Polarization:	Horizontal
Standard:	(RE)FCC PART 15C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test (30~1000MHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	Charge Mode	Distance:	3m



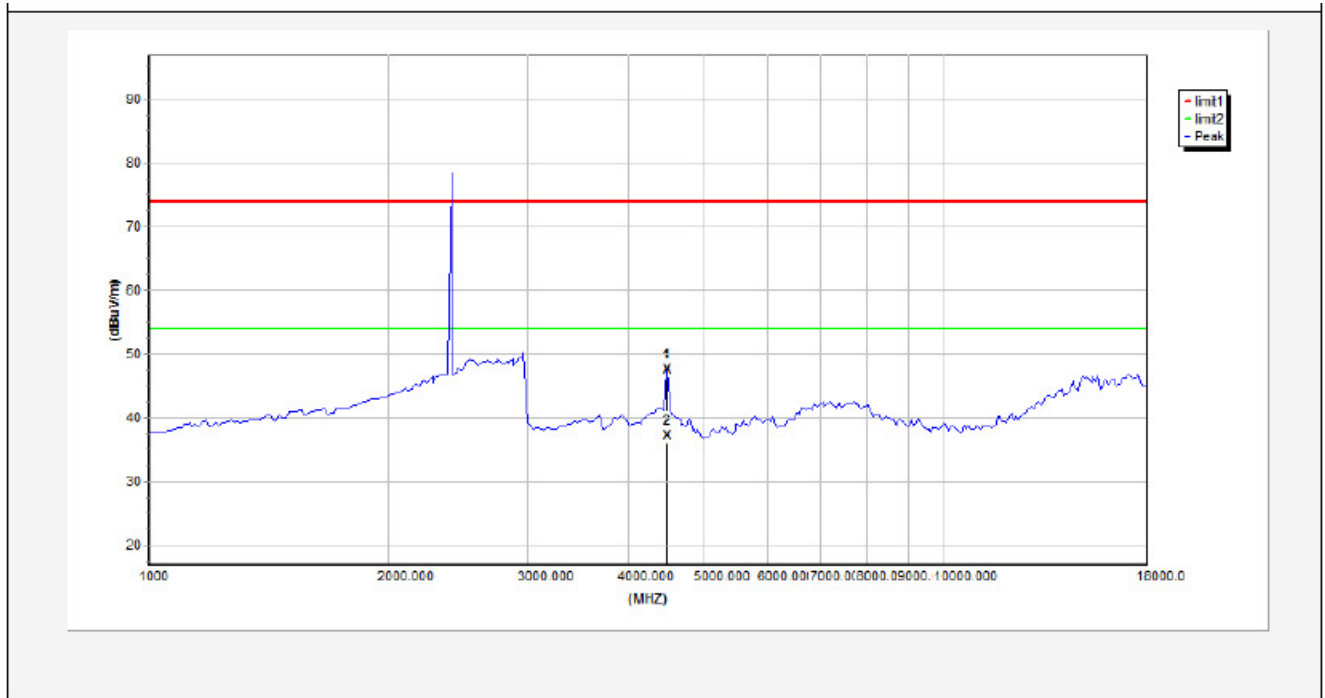
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	30.0000	48.98	-16.95	32.03	40.00	-7.97	peak			
2	36.5092	39.14	-13.11	26.03	40.00	-13.97	peak			
3	56.9912	35.41	-15.11	20.30	40.00	-19.70	peak			
4	96.0986	39.17	-20.97	18.20	43.50	-25.30	peak			
5	307.8313	36.59	-16.73	19.86	46.00	-26.14	peak			
6	590.9737	35.48	-11.21	24.27	46.00	-21.73	peak			

Job No.:	0116107551	Polarization:	Vertical
Standard:	(RE)FCC PART 15C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test (30~1000MHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55% RH
Test Mode:	Charge Mode	Distance:	3m



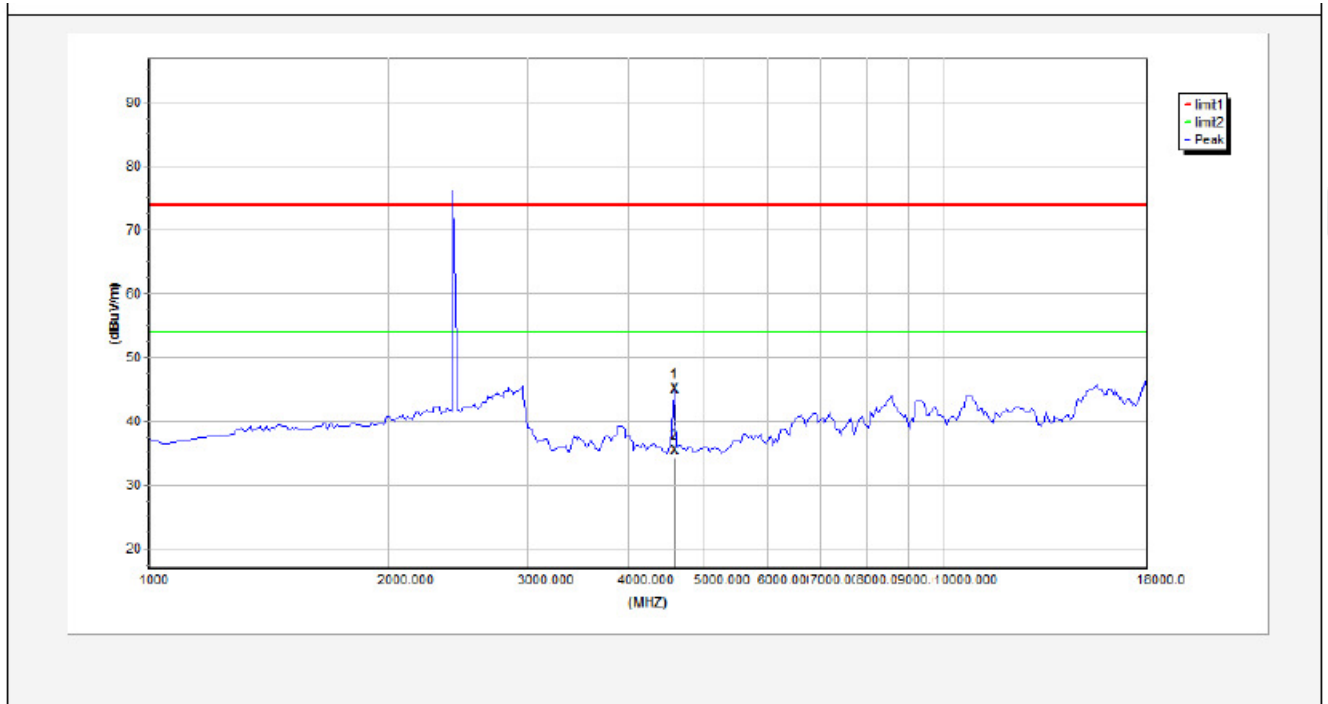
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	30.3173	50.28	-16.77	33.51	40.00	-6.49	QP	100	0	
2	35.8746	47.54	-13.61	33.93	40.00	-6.07	peak			
3	53.5052	41.12	-14.82	26.30	40.00	-13.70	peak			
4	96.7749	36.24	-15.93	20.31	43.50	-23.19	peak			
5	183.8440	38.58	-16.49	22.09	43.50	-21.41	peak			
6	501.1790	32.70	-10.94	21.76	46.00	-24.24	peak			

Job No.:	011610755I	Polarization:	Horizontal
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2402 MHz)	Distance:	3m



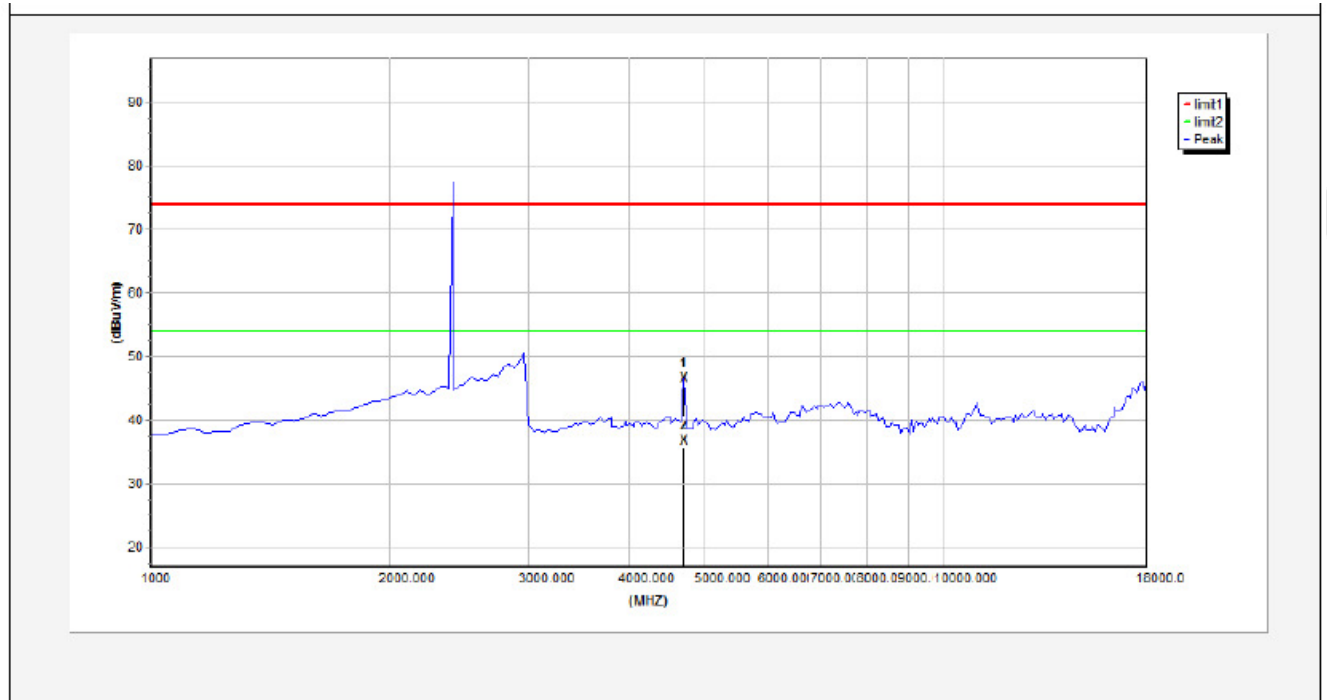
No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	4485.0000	42.63	32.72	34.08	6.16	47.43	74.00	-26.57	peak	---	---
2	4485.0000	32.31	32.72	34.08	6.16	37.11	54.00	-16.89	AVG	---	---

Job No.:	0116107551	Polarization:	Vertical
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2402 MHz)	Distance:	3m



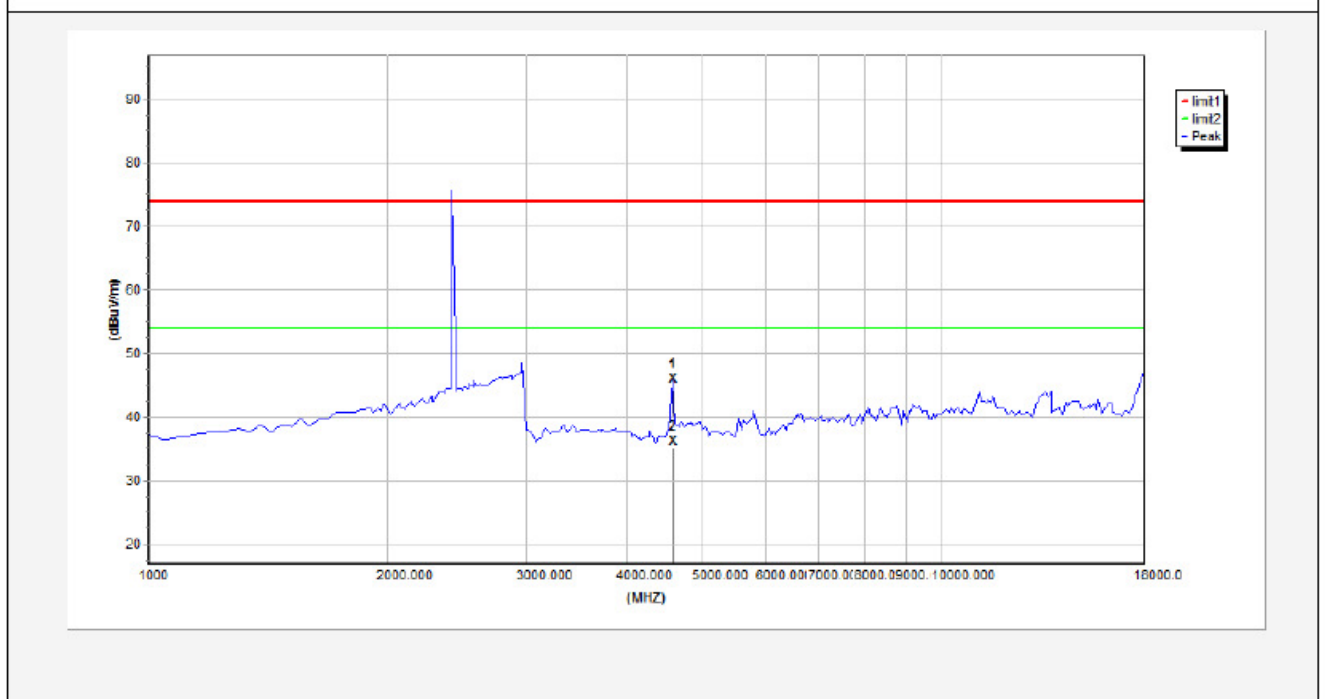
No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	4570.0000	39.80	33.01	34.09	6.28	45.00	74.00	-29.00	peak	---	---
2	4570.0000	30.12	33.01	34.09	6.28	35.32	54.00	-18.68	AVG	---	---

Job No.:	0116107551	Polarization:	Horizontal
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2441 MHz)	Distance:	3m



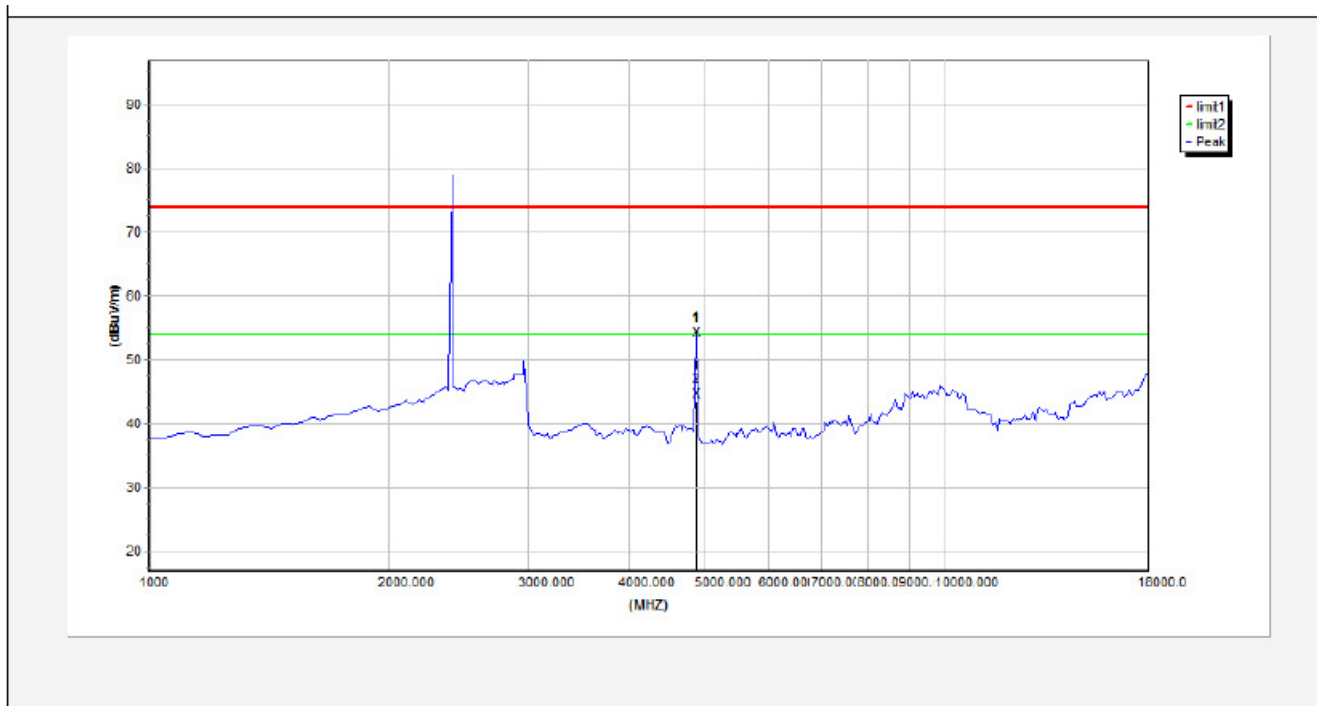
No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	4697.5000	40.63	33.57	34.09	6.44	46.55	74.00	-27.45	peak	---	---
2	4697.5000	30.87	33.57	34.09	6.44	36.79	54.00	-17.21	AVG	---	---

Job No.:	011610755I	Polarization:	Vertical
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2441 MHz)	Distance:	3m



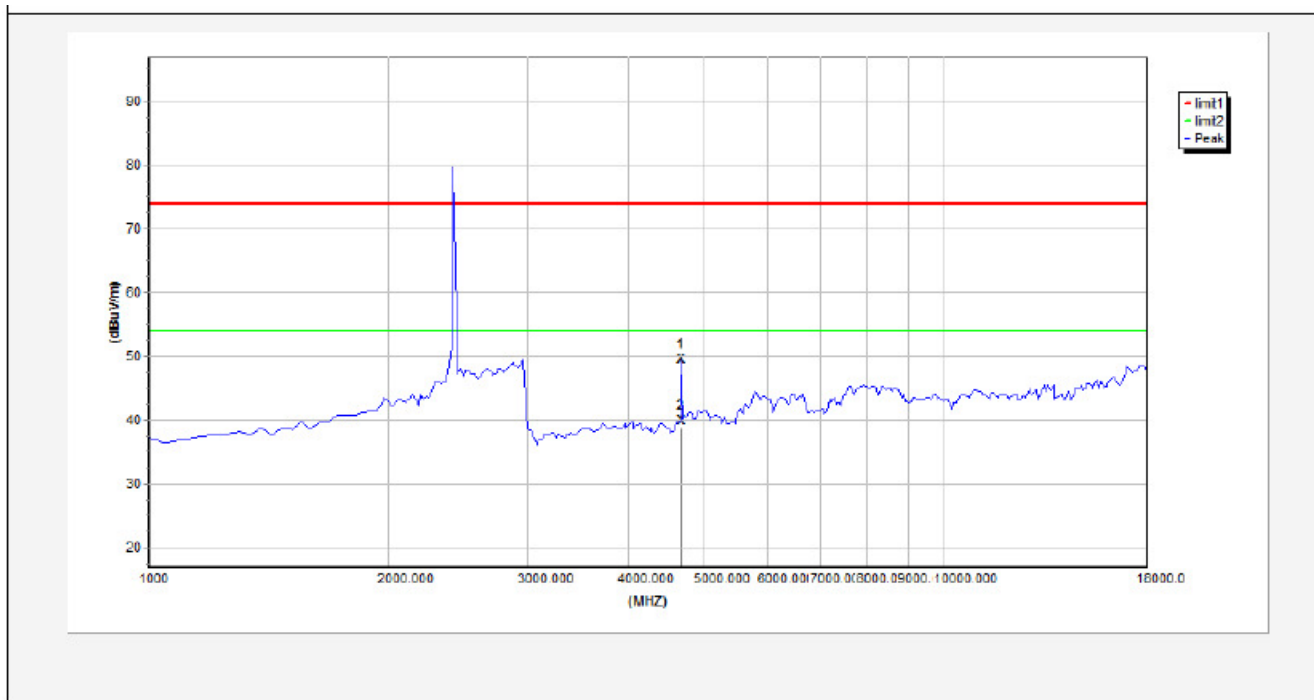
No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	4570.0000	40.80	33.01	34.09	6.28	46.00	74.00	-28.00	peak	---	---
2	4570.0000	30.93	33.01	34.09	6.28	36.13	54.00	-17.87	AVG	---	---

Job No.:	011610755I	Polarization:	Horizontal
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2480 MHz)	Distance:	3m



No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	4867.5000	47.28	34.32	34.09	6.67	54.18	74.00	-19.82	peak	---	---
2	4867.5000	37.65	34.32	34.09	6.67	44.55	54.00	-9.45	AVG	---	---

Job No.:	011610755I	Polarization:	Vertical
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55% RH
Test Mode:	TX(2480 MHz)	Distance:	3m



No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	4660.5010	43.65	33.41	34.09	6.39	49.36	74.00	-24.64	peak	---	---
2	4660.5010	34.08	33.41	34.09	6.39	39.79	54.00	-14.21	AVG	---	---

Radiated band edge:

Test channel:	Lowest CH
---------------	-----------

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2390.00	46.10	27.59	5.38	30.18	48.89	74.00	-25.11	Horizontal
2400.00	63.35	27.58	5.39	30.18	66.14	74.00	-7.86	Horizontal
2390.00	46.96	27.59	5.38	30.18	49.75	74.00	-24.25	Vertical
2400.00	65.73	27.58	5.39	30.18	68.52	74.00	-5.48	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2390.00	35.92	27.59	5.38	30.18	38.71	54.00	-15.29	Horizontal
2400.00	47.35	27.58	5.39	30.18	50.14	54.00	-3.86	Horizontal
2390.00	36.10	27.59	5.38	30.18	38.89	54.00	-15.11	Vertical
2400.00	49.31	27.58	5.39	30.18	52.10	54.00	-1.90	Vertical

Test channel:	Highest CH
---------------	------------

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	48.59	27.53	5.47	29.93	51.66	74.00	-22.34	Horizontal
2500.00	47.15	27.55	5.49	29.93	50.26	74.00	-23.74	Horizontal
2483.50	49.97	27.53	5.47	29.93	53.04	74.00	-20.96	Vertical
2500.00	48.45	27.55	5.49	29.93	51.56	74.00	-22.44	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	38.79	27.53	5.47	29.93	41.86	54.00	-12.14	Horizontal
2500.00	36.33	27.55	5.49	29.93	39.44	54.00	-14.56	Horizontal
2483.50	40.27	27.53	5.47	29.93	43.34	54.00	-10.66	Vertical
2500.00	36.52	27.55	5.49	29.93	39.63	54.00	-14.37	Vertical

Note:

- 1, During the test, pre-scan the GFSK, Pi/4QPSK, 8DPSK modulation, and found the GFSK modulation is worse case, the report only record this mode.
- 2, Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

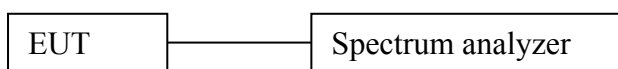
5. CHANNEL SEPARATION TEST

5.1 Measurement Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer settings:

1. Span= Wide enough to capture the peaks of two adjacent channels
2. Set the RBW = 100 kHz.
3. Set the VBW = 1.0 MHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

5.2 Test SET-UP



5.3 Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Apr. 16, 2016	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 16, 2016	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 16, 2016	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 19, 2016	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 19, 2016	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 16, 2016	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
8	Power Sensor	DAER	RPR3006W	15I00041SN046	Jun 30, 2016	1 Year
9	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Jun 30, 2016	1 Year
10	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Jun 30, 2016	1 Year
11	Signal Generator	Agilent	E4421B	MY41000743	Jun 30, 2016	1 Year
12	DC Power supply	IV	IV-8080	YQSB0096	Jun 30, 2016	1 Year
13	TEMP&HUMI PROGRAMMABLE CHAMBER	Bell Group	BE-THK-150M8	SE-0137	Mar. 16, 2016	1 Year

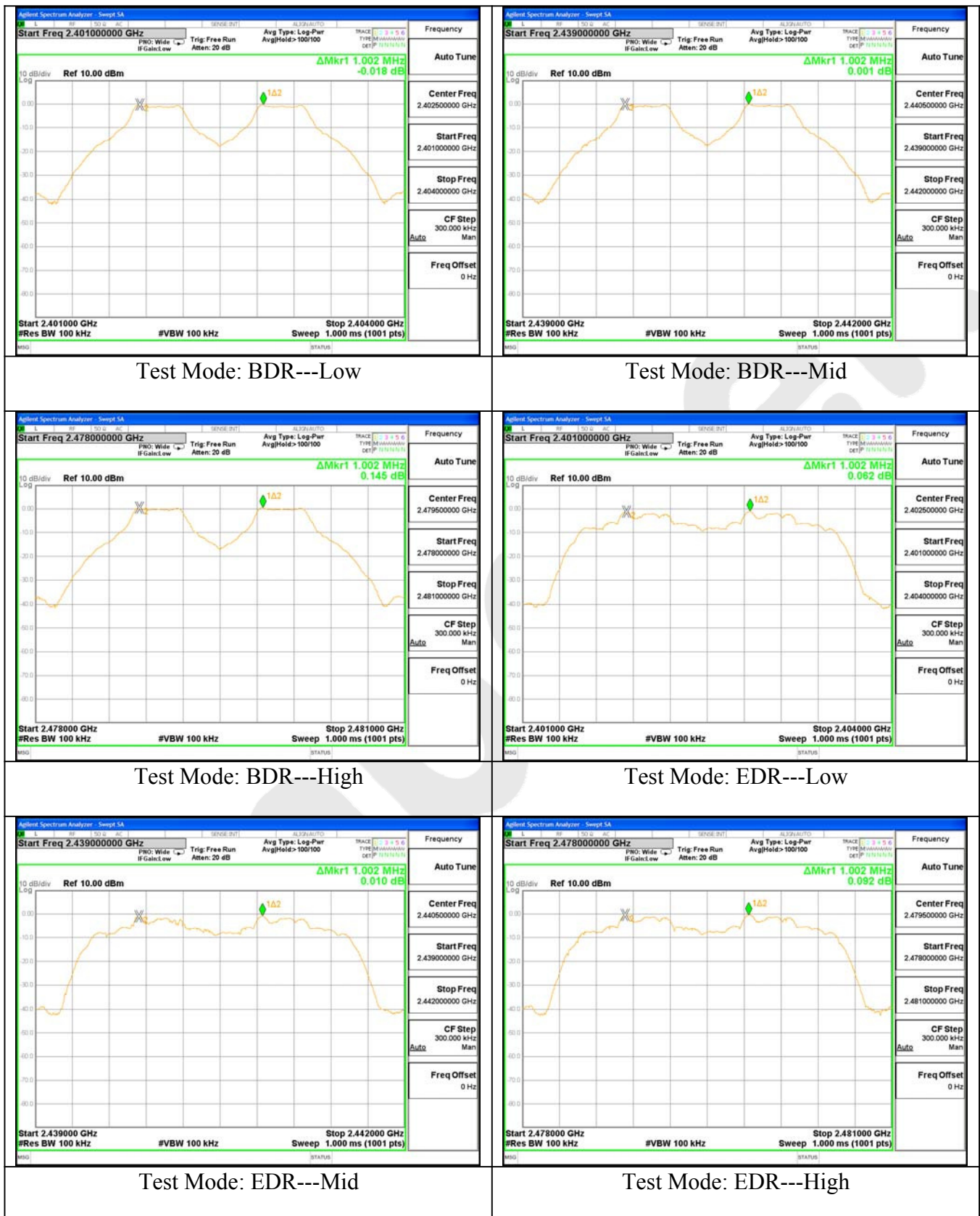
5.4 Test Results

Test Item : Frequency Separation Test Mode : CH Low ~ CH High
Test Voltage : DC 3.7V Battery inside Temperature : 24°C
Test Result : PASS Humidity : 55%RH

Channel	Frequency (MHz)	Separation Read Value (kHz)	Limit (kHz)	Modulation Mode
Low	2402	1002	926.9	BDR
Mid	2441	1002	928.5	BDR
High	2480	1002	930.0	BDR
Low	2402	1002	841.3	EDR
Mid	2441	1002	840.7	EDR
High	2480	1002	840.7	EDR

Remark:

1. The limit of mode (EDR) is 2/3 of 20dB BW;
2. The EDR was tested on ($\pi/4$ DQPSK, 8DPSK) modes, only the worst data of ($\pi/4$ DQPSK) is attached in the following pages.



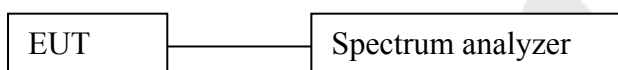
6. 20DB BANDWIDTH TEST

6.1 Measurement Procedure

Using the following spectrum analyzer settings:

1. Span= approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel.
2. Set the RBW = 30 kHz.
3. Set the VBW = 100 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

6.2 Test SET-UP



6.3 Test Equipment

Same as the equipment listed in 5.3.

6.4 Test Results

Test Item	: 20dB BW	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 3.7V Battery inside	Temperature	: 24°C
Test Result	: PASS	Humidity	: 55%RH

Channel	Frequency (MHz)	20dB Down BW(kHz)	Modulation Mode
Low	2402	926.9	BDR
Mid	2441	928.5	BDR
High	2480	930.0	BDR
Low	2402	1262.0	EDR
Mid	2441	1261.0	EDR
High	2480	1261.0	EDR

Remark: The EDR was tested on ($\pi/4$ DQPSK, 8DPSK) modes, only the worst data of ($\pi/4$ DQPSK) is attached in the following pages.



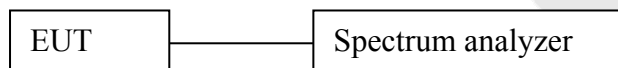
7. QUANTITY OF HOPPING CHANNEL TEST

7.1 Measurement Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer setting:

1. Span= the frequency band of operation
2. Set the RBW = 1 MHz.
3. Set the VBW = 1 MHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

7.2 Test SET-UP



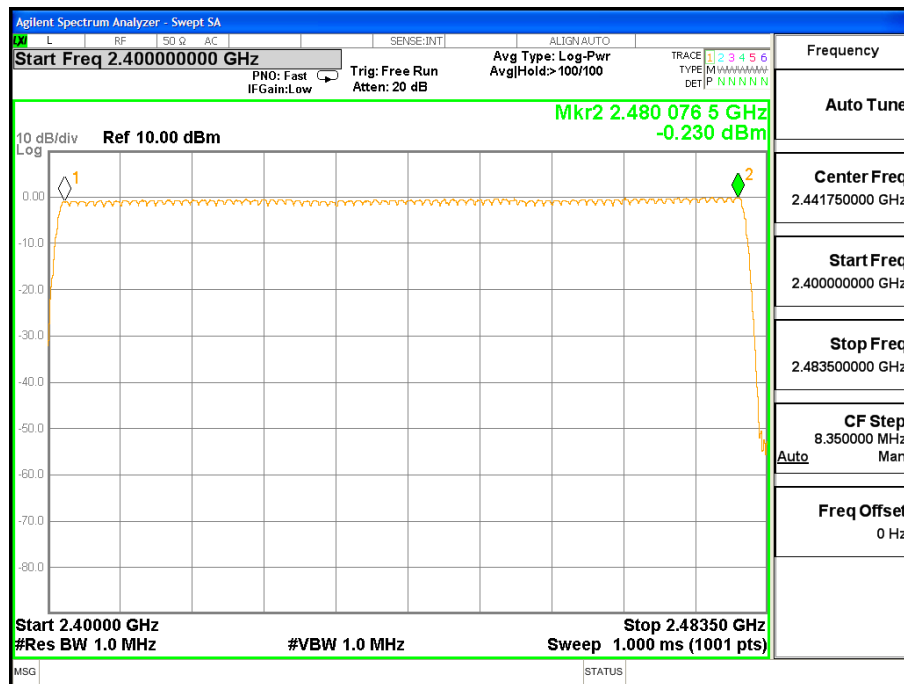
7.3 Test Equipment

Same as the equipment listed in 5.3.

7.4 Test Results

Test Item	: Number of Hopping Frequency	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 3.7V Battery inside	Temperature	: 24℃
Test Result	: PASS	Humidity	: 55%RH

Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel
2402-2480	79	>15



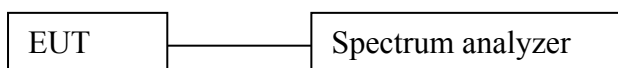
8. DWELL TIME TEST

8.1 Measurement Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span= zero span, centered on a hopping channel
2. Set the RBW = 1 MHz.
3. Set the VBW = 1 MHz.
4. Sweep time = as necessary to capture the entire dwell time per hopping channel.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

8.2 Test SET-UP



8.3 Test Equipment

Same as the equipment listed in 5.3.

8.4 Test Results

Test Item	:	Time of Occupancy	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.7V Battery inside	Temperature	:	24°C
Test Result	:	PASS	Humidity	:	55%RH

Package Type	Pulse width (ms)	Time slot length(ms)	Dwell time (ms)	Limit (s)	Modulation
DH1	0.374	time slot length *1600/2 /79 * 31.6	119.68	0.4	BDR
DH3	1.625	time slot length *1600/4 /79 * 31.6	260.00	0.4	BDR
DH5	2.863	time slot length *1600/6 /79 * 31.6	305.39	0.4	BDR
DH1	0.362	time slot length *1600/2 /79 * 31.6	115.84	0.4	EDR
DH3	1.605	time slot length *1600/4 /79 * 31.6	256.80	0.4	EDR
DH5	2.863	time slot length *1600/6 /79 * 31.6	305.39	0.4	EDR

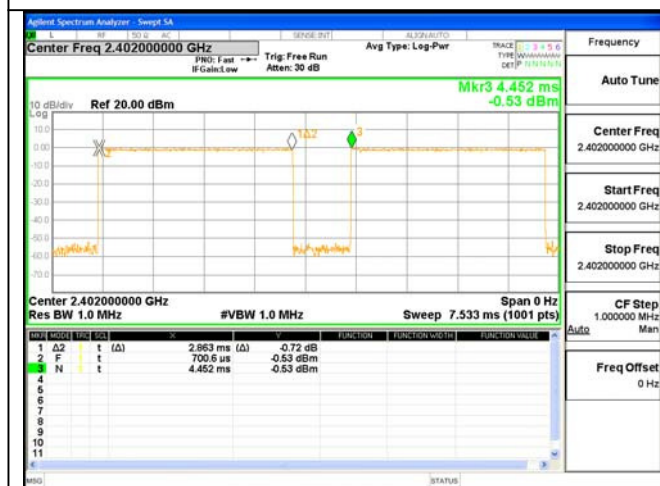
Remark: The EDR was tested on (π /4DQPSK, 8DPSK) modes, only the worst data of (π /4DQPSK) is attached in the following pages.



Test Mode: BDR---DH1



Test Mode: BDR---DH3



Test Mode: BDR---DH5



Test Mode: EDR---DH1



Test Mode: EDR---DH1



Test Mode: EDR---DH3

9. MAXIMUM PEAK OUTPUT POWER TEST

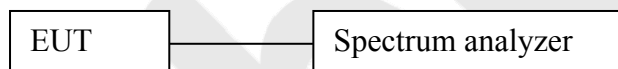
9.1 Measurement Procedure

- Check the calibration of the measuring instrument(SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- The center frequency of the spectrum analyzer is set to the fundamental frequency and using proper RBW and VBW setting.
- Measure the captured power within the band and recording the plot.
- Repeat above procedures until all frequencies required were complete.

Using the following spectrum analyzer settings:

- Span= approximately 5 times the 20dB bandwidth, centered on a hopping channel
- Set the RBW = 3 MHz.
- Set the VBW = 3 MHz.
- Sweep time = auto couple.
- Detector function = peak.
- Trace mode = max hold.
- Allow trace to fully stabilize.

9.2 Test SET-UP



9.3 Test Equipment

Same as the equipment listed in 5.3.

9.4 Test Results

Test Item : Max. peak output power Test Mode : CH Low ~ CH High
Test Voltage : DC 3.7V Battery inside Temperature : 24°C
Test Result : PASS Humidity : 55%RH

Channel Frequency (MHz)	Peak Power output(mW)	Peak Power output(dBm)	Peak Power Limit(mW)	Results	Modulation
2402	0.975	-0.011	1000	PASS	BDR
2441	1.058	0.245	1000	PASS	BDR
2480	1.210	0.831	1000	PASS	BDR
2402	0.973	-0.118	125	PASS	EDR
2441	1.049	0.209	125	PASS	EDR
2480	1.197	0.781	125	PASS	EDR

Remark: The EDR was tested on ($\pi/4$ DQPSK, 8DPSK) modes, only the worst data of ($\pi/4$ DQPSK) is attached in the following pages.



10. 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE

a) 10.1 Applicable Standard

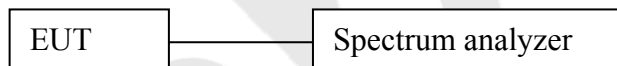
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Measurement Procedure

The EUT must have its hopping/Non-hopping function enabled. Using the following spectrum analyzer setting:

1. Set the RBW = 100KHz.
2. Set the VBW = 300KHz.
3. Sweep time = auto couple.
4. Detector function = peak.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.

b) 10.2 Test SET-UP



c) 10.3 Test Equipment

Same as the equipment listed in 5.3.

d) 10.4 Test Results

Pass.

Please refer the following data.

Test Item	: Band eadge	Test Mode	: CH Low ~ CH High
Test Voltage	: AC 110V, 60Hz	Temperature	: 24°C
Test Result	: PASS	Humidity	: 55%RH

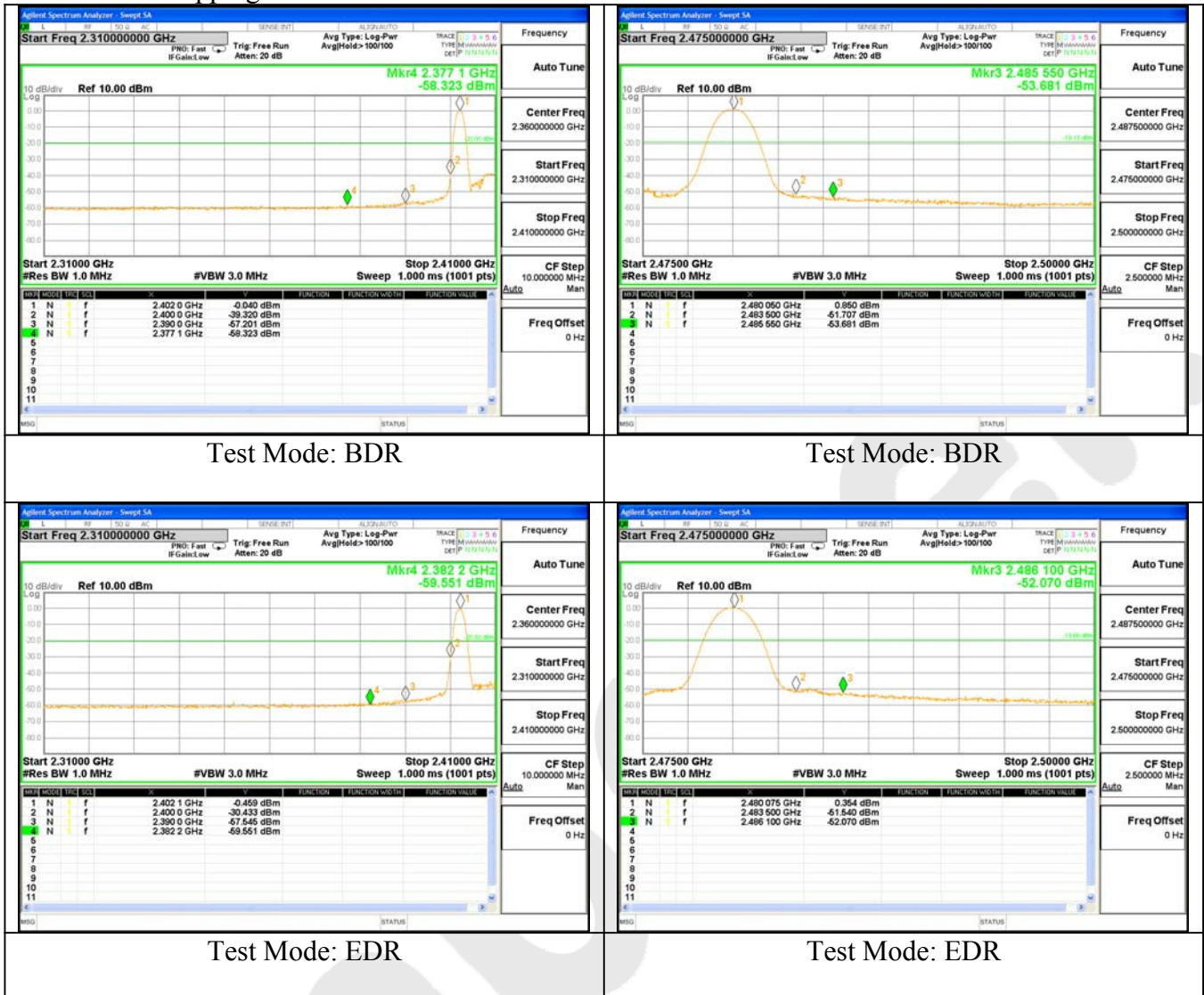
Remark: The EDR was tested on (π /4DQPSK, 8DPSK) modes, only the worst data of (π /4DQPSK) is attached in the following pages.

1. Conducted Emission Method

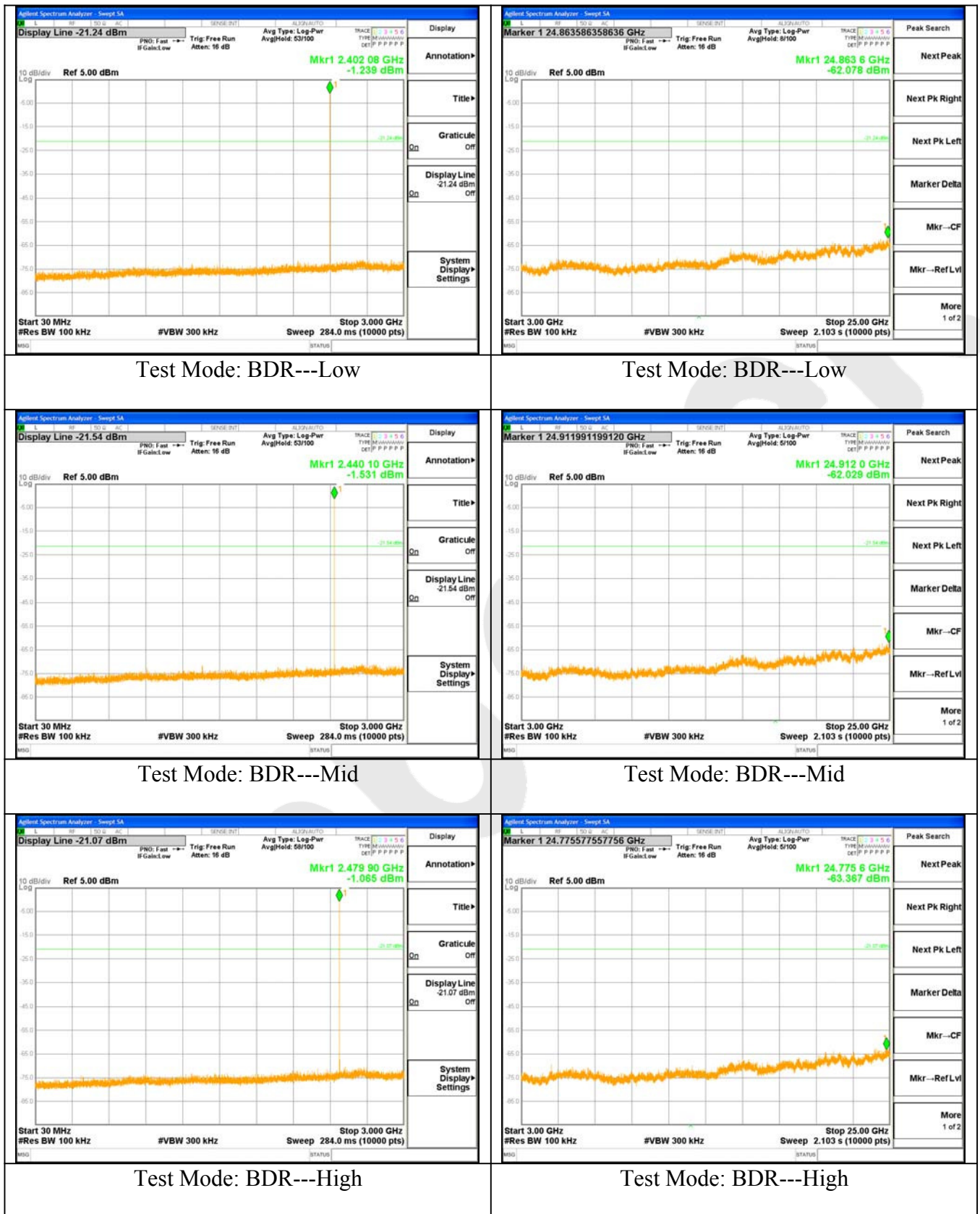
1.1 For Hopping Mode:

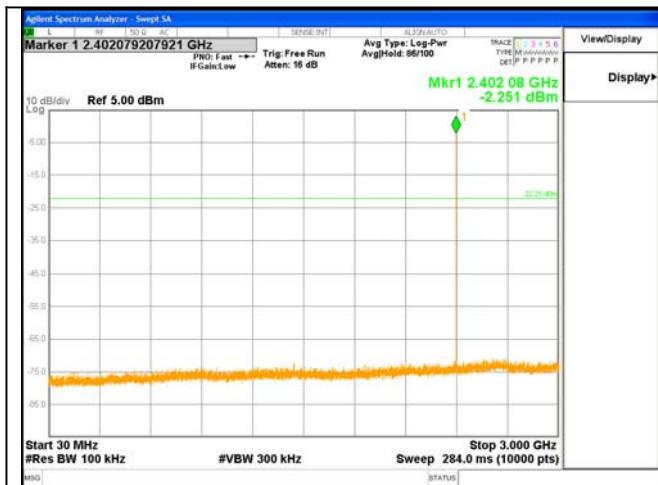


1.2 For Non-Hopping Mode:



1.3 Conducted Emission Method

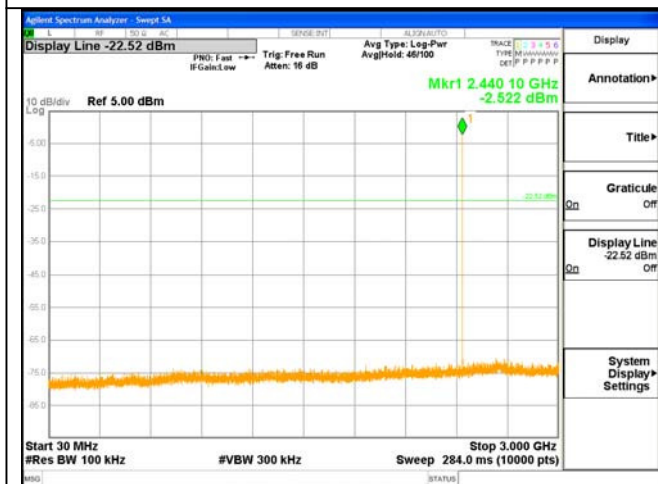




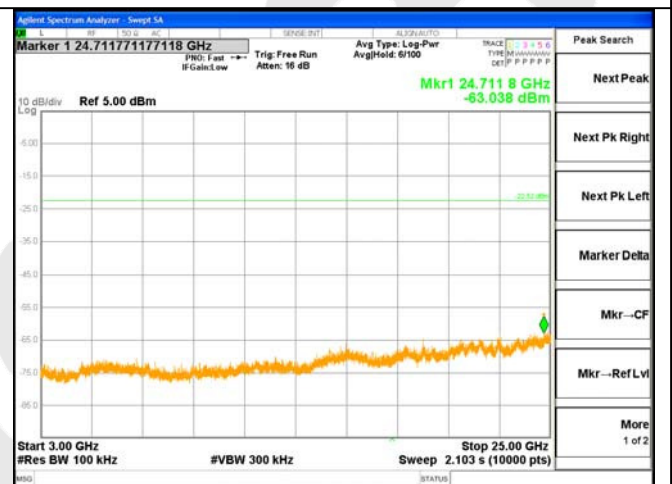
Test Mode: EDR---Low



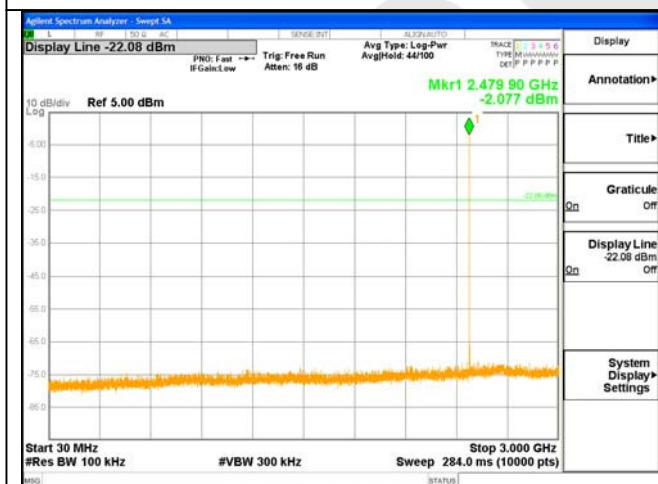
Test Mode: EDR---Low



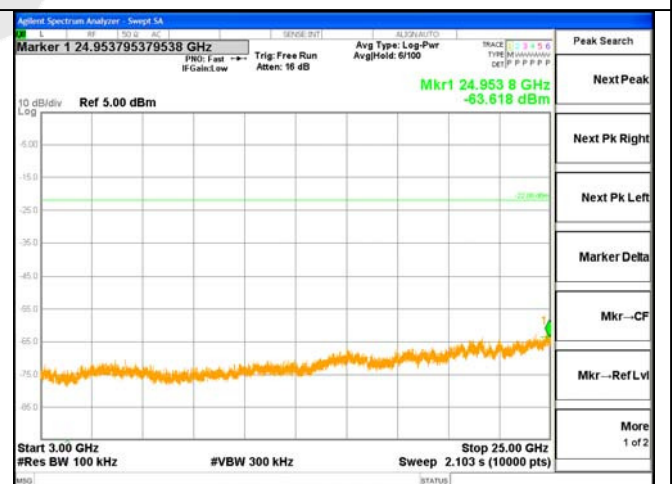
Test Mode: EDR---Mid



Test Mode: EDR---Mid



Test Mode: EDR---High



Test Mode: EDR---High

11. ANTENNA APPLICATION

11.1 Antenna requirement

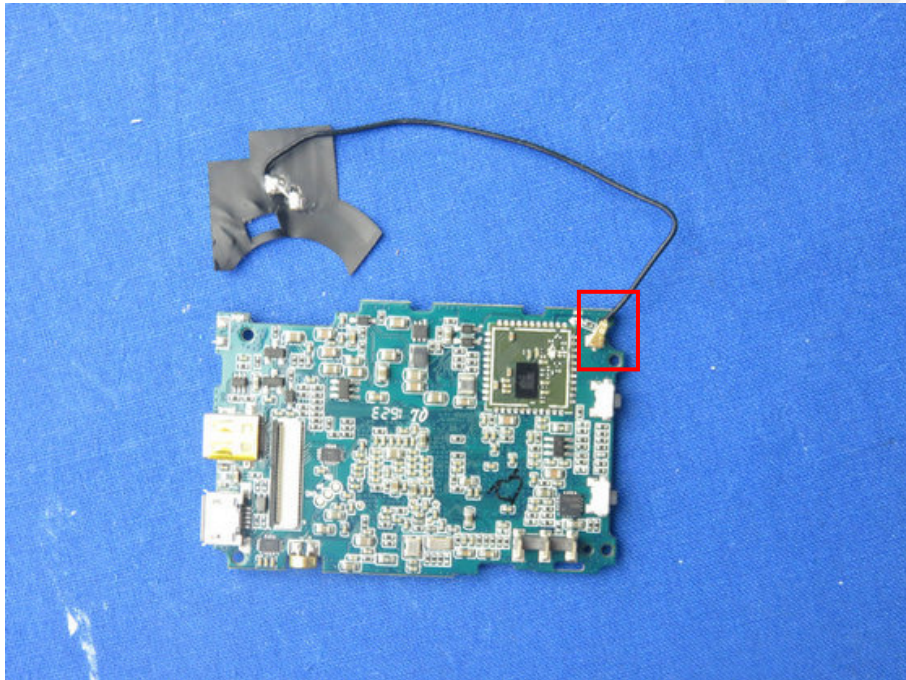
The EUT'S antenna is met the requirement of FCC part 15C section 15.203 and 15.247.

FCC part 15C section 15.247 requirements:

Systems operating in the 2402-2480MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

11.2 Result

The EUT's antenna used a external antenna, The antenna's gain is -3dBi and meets the requirement.

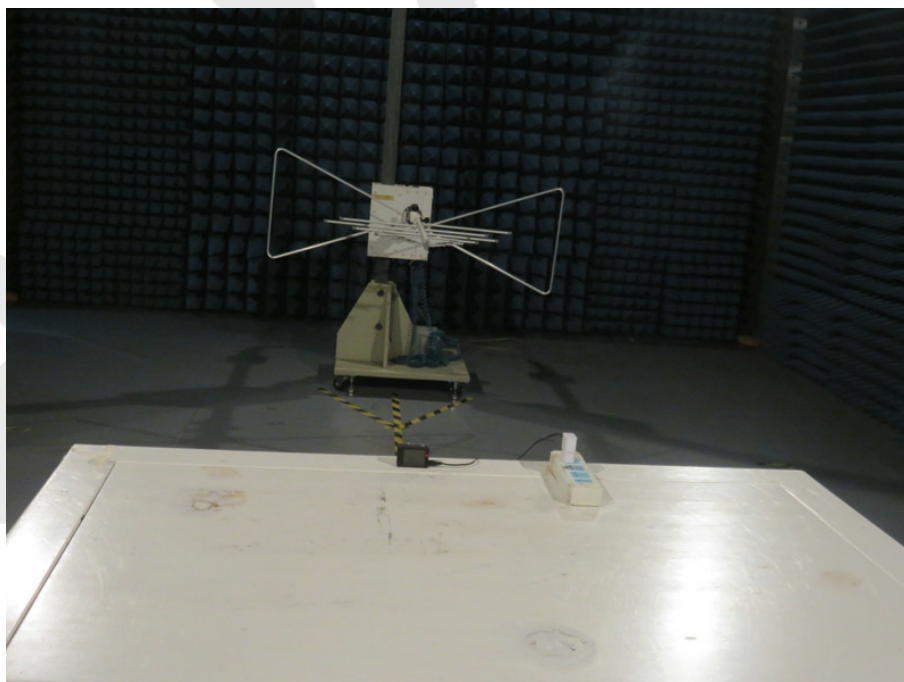


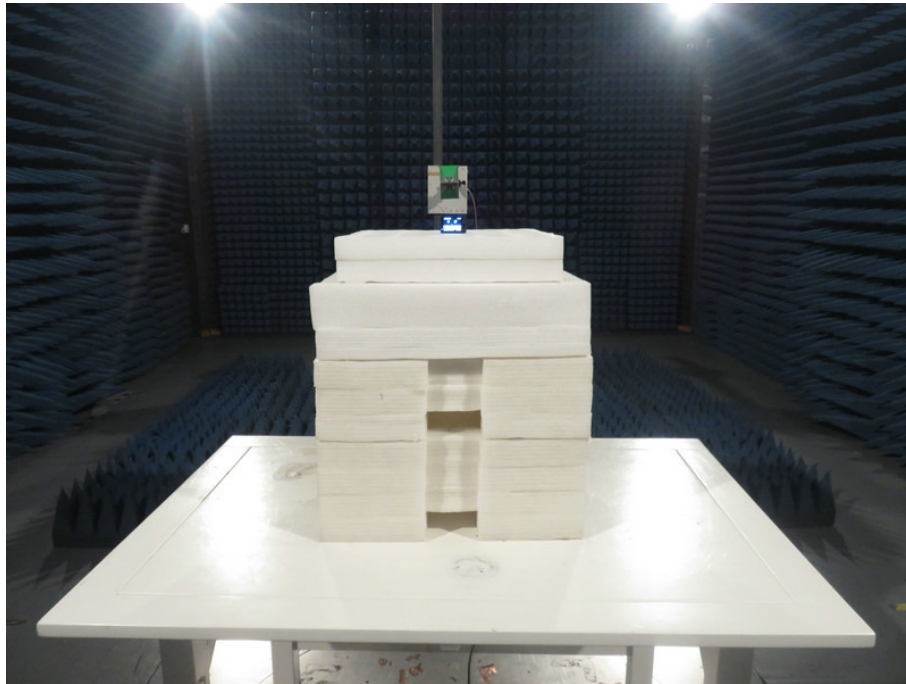
12. PHOTOGRAPH

12.1 Photo of Power Line Conducted Emission Measurement



12.2 Photo of Radiation Emission Test



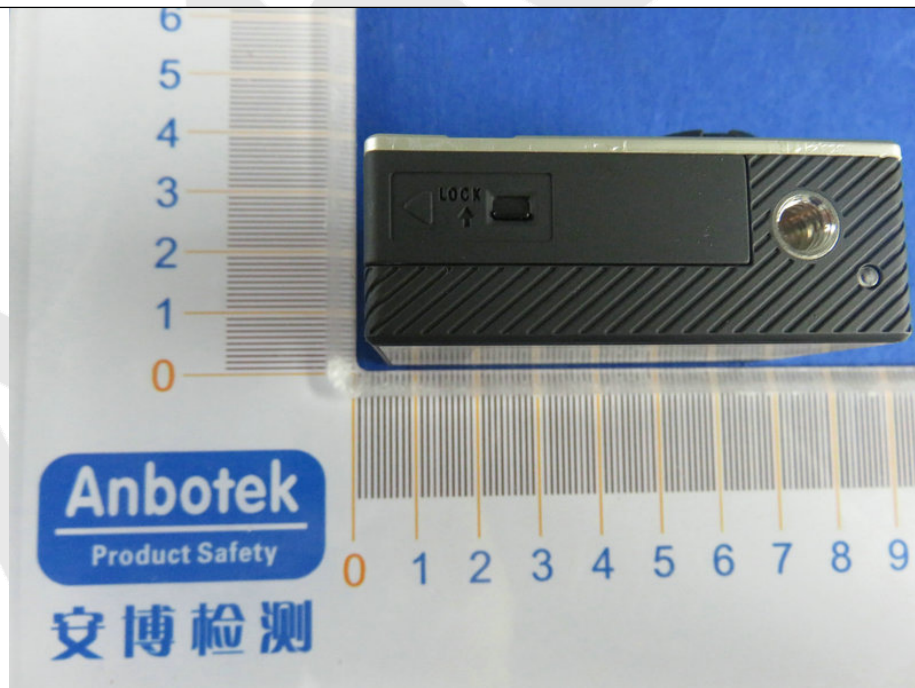


APPENDIX I (EXTERNAL PHOTOS)

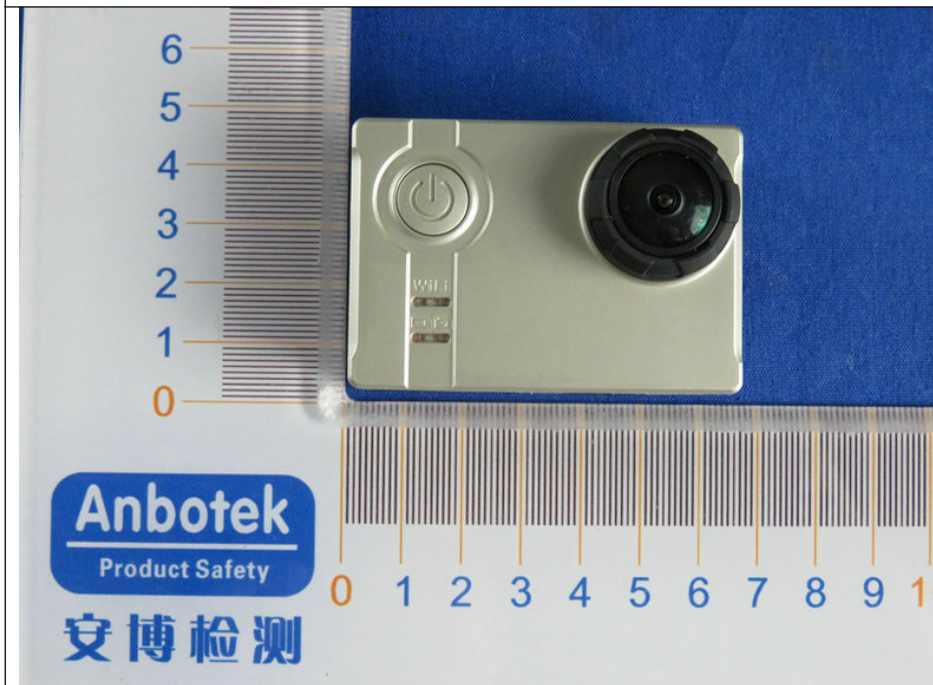
1. Figure
The EUT-Top View



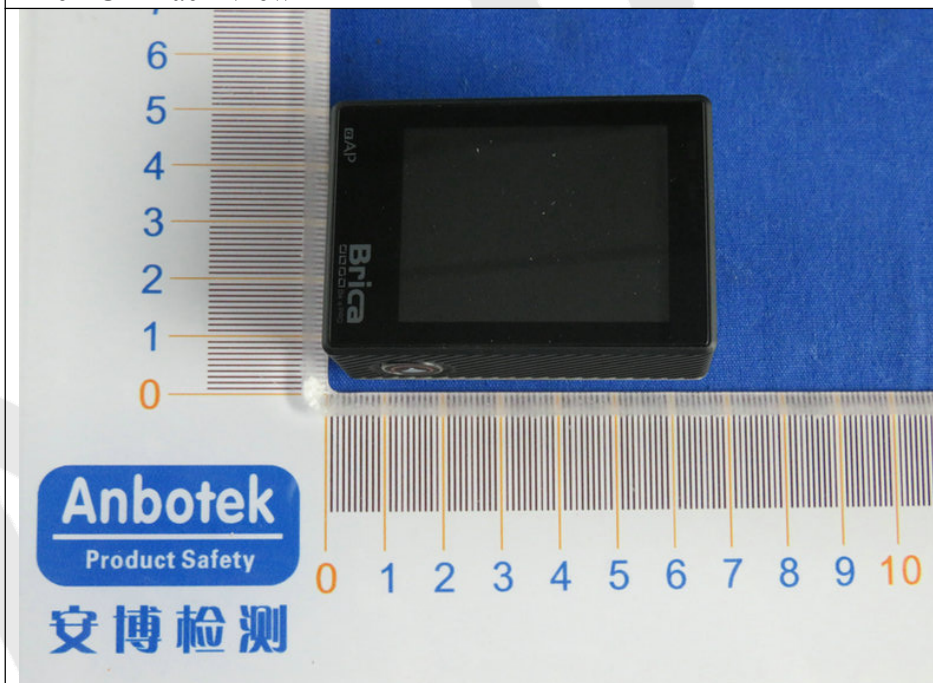
2. Figure
The EUT-Bottom View



3. Figure
The EUT-Front View



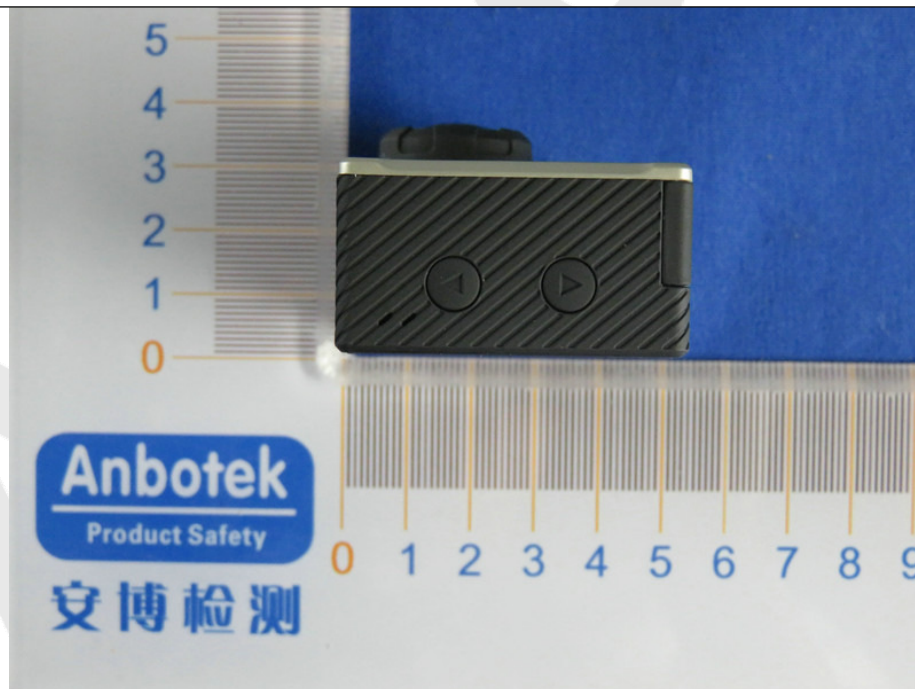
4. Figure
The EUT-Back View



5. Figure
The EUT-Right View



6. Figure
The EUT-Left View



APPENDIX II (INTERNAL PHOTOS)

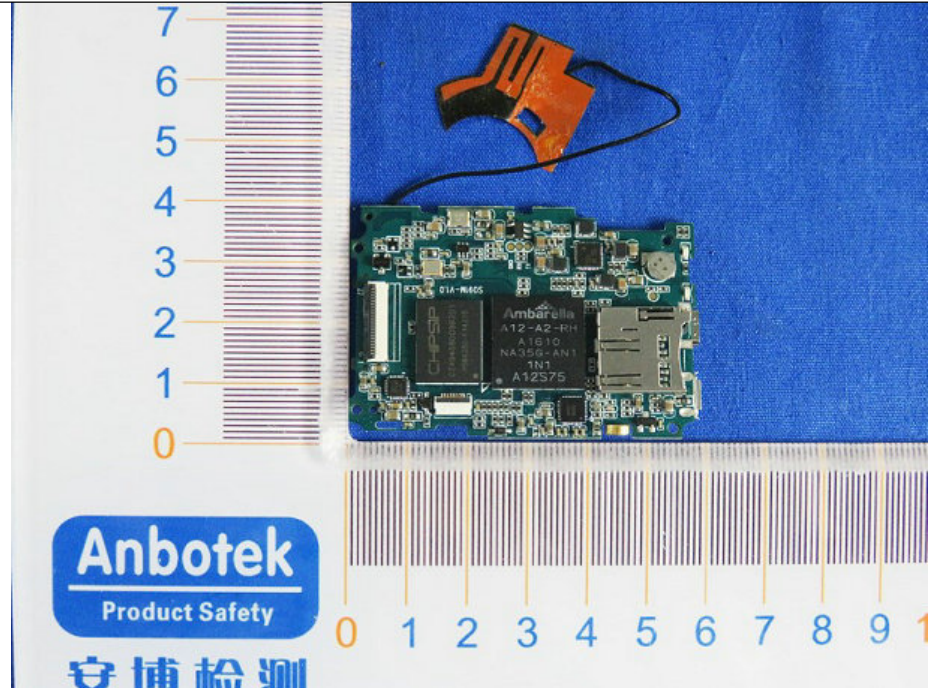
1. Figure
The EUT-Inside View



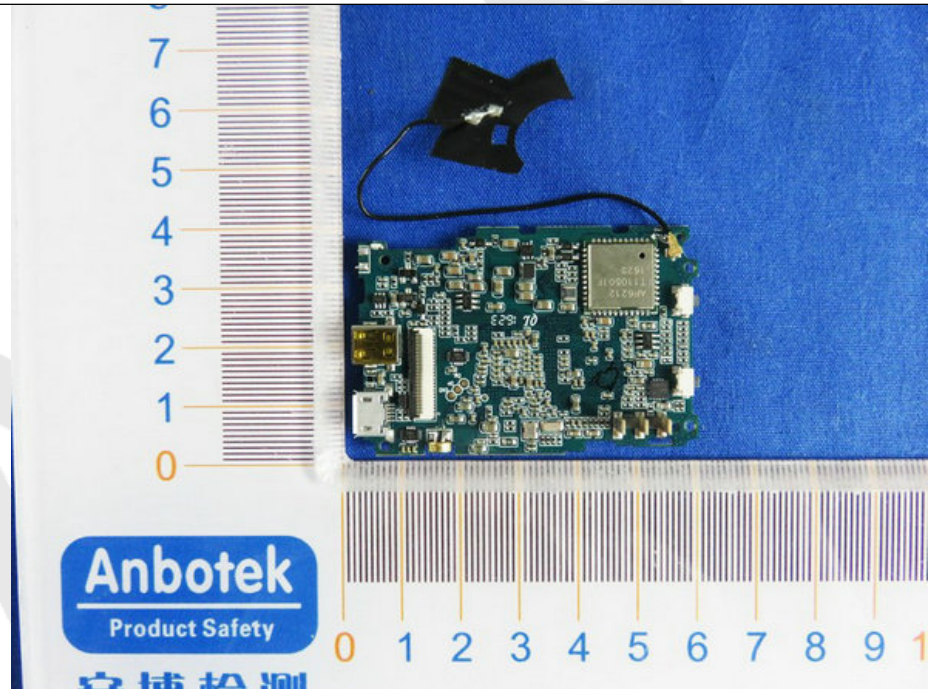
2. Figure
The EUT-Inside View



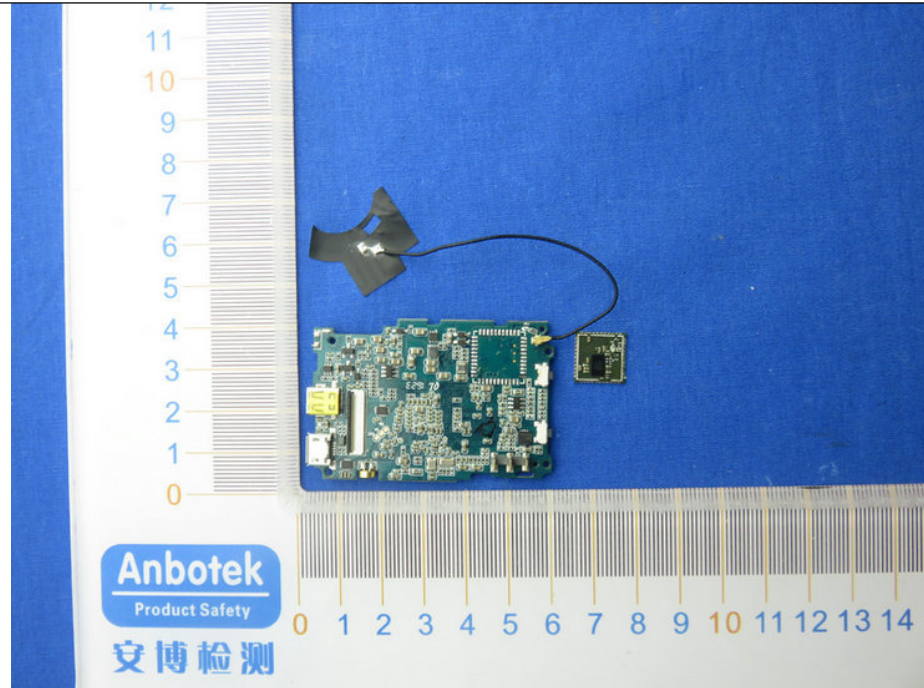
3. Figure
PCB of the EUT-Front View



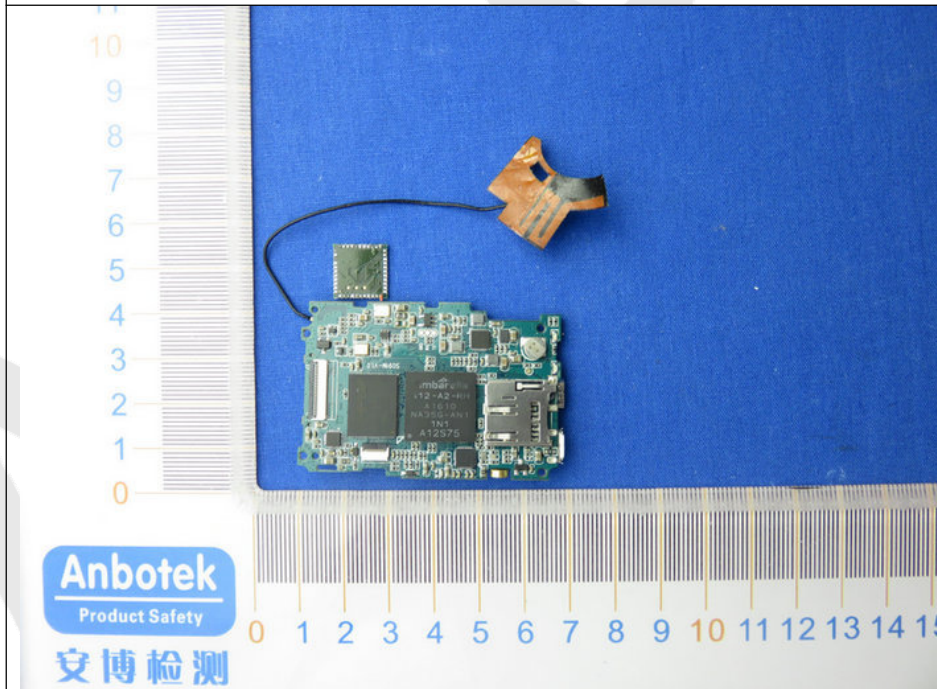
4. Figure
PCB of the EUT-Back View



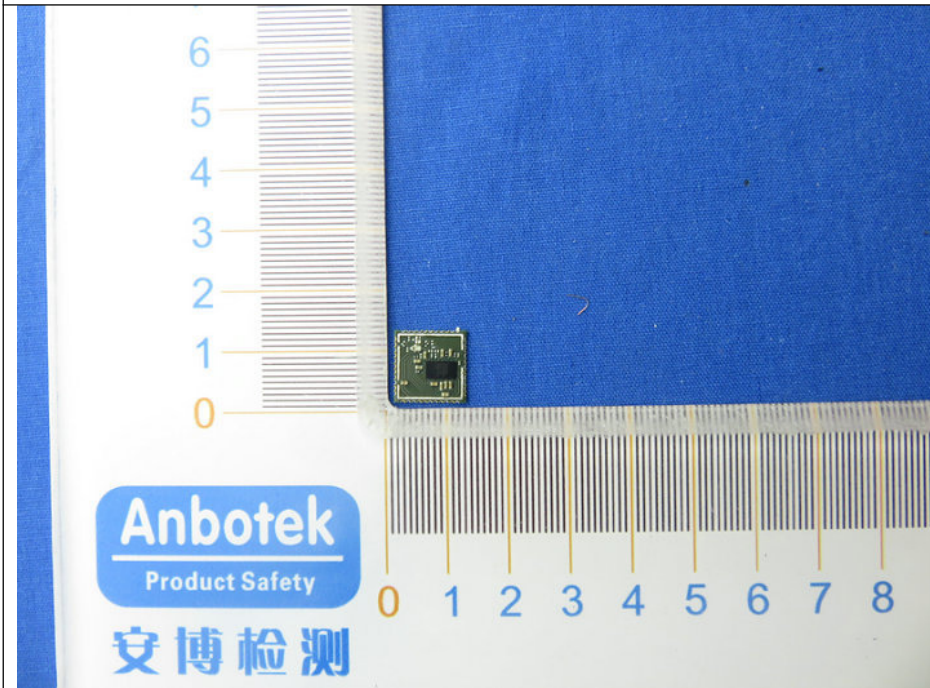
5. Figure
PCB of the EUT-Front View



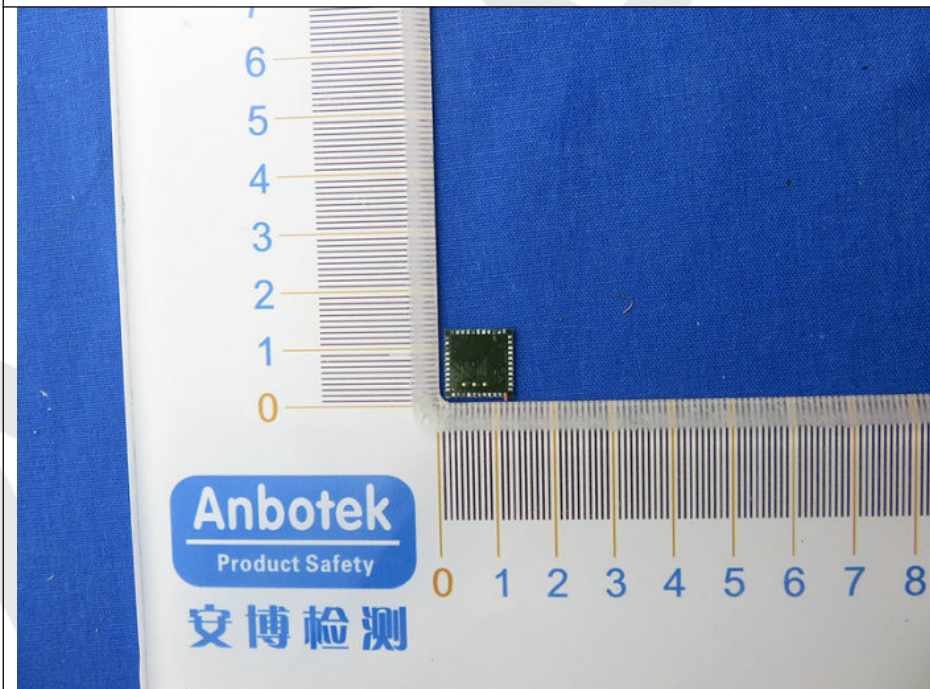
6. Figure
PCB of the EUT-Back View



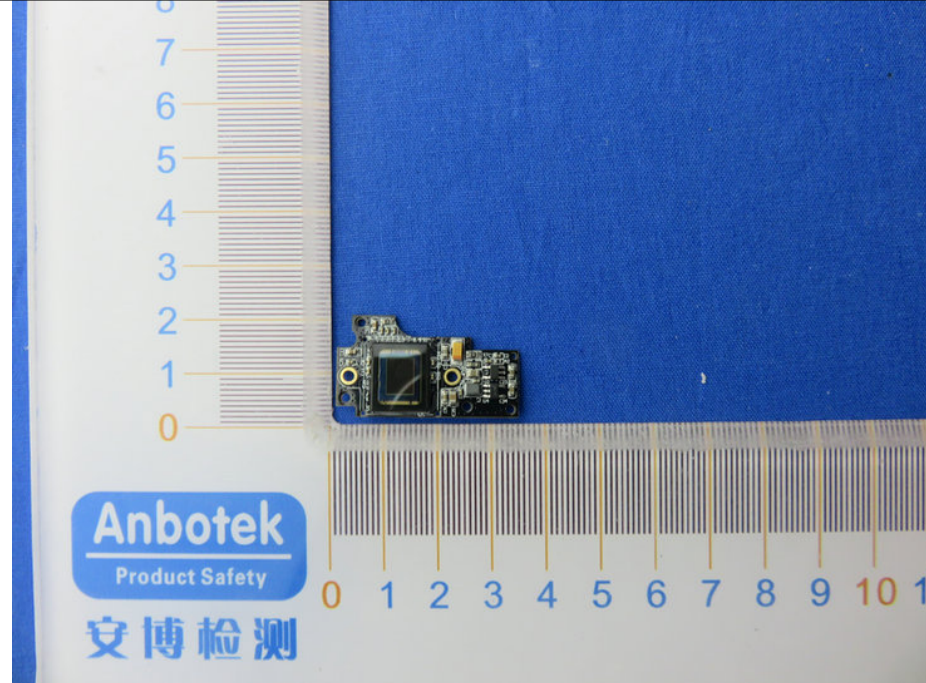
7. Figure
PCB of the EUT-Front View



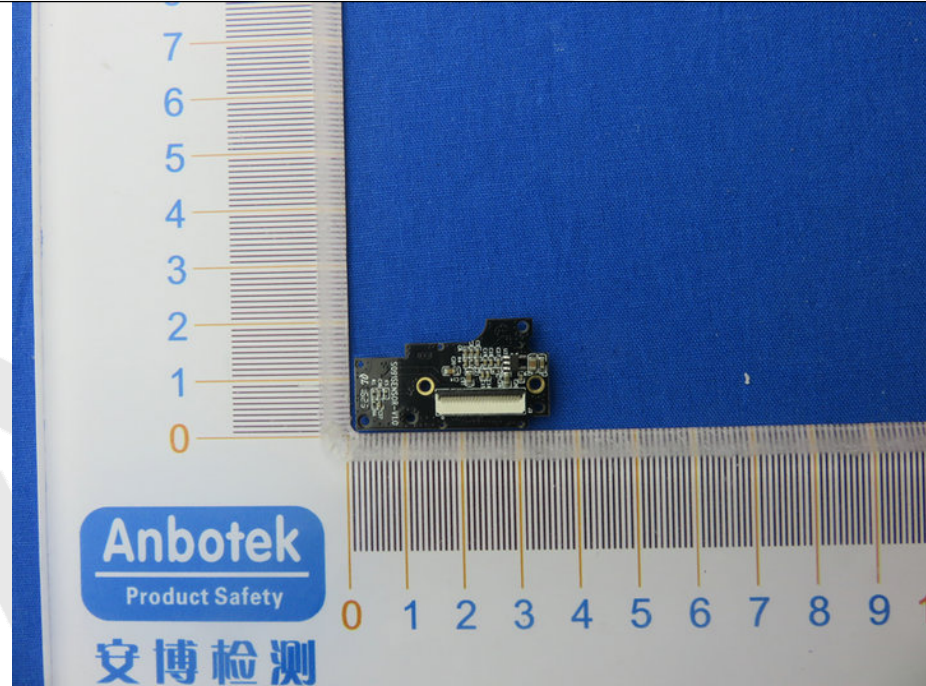
8. Figure
PCB of the EUT-Back View



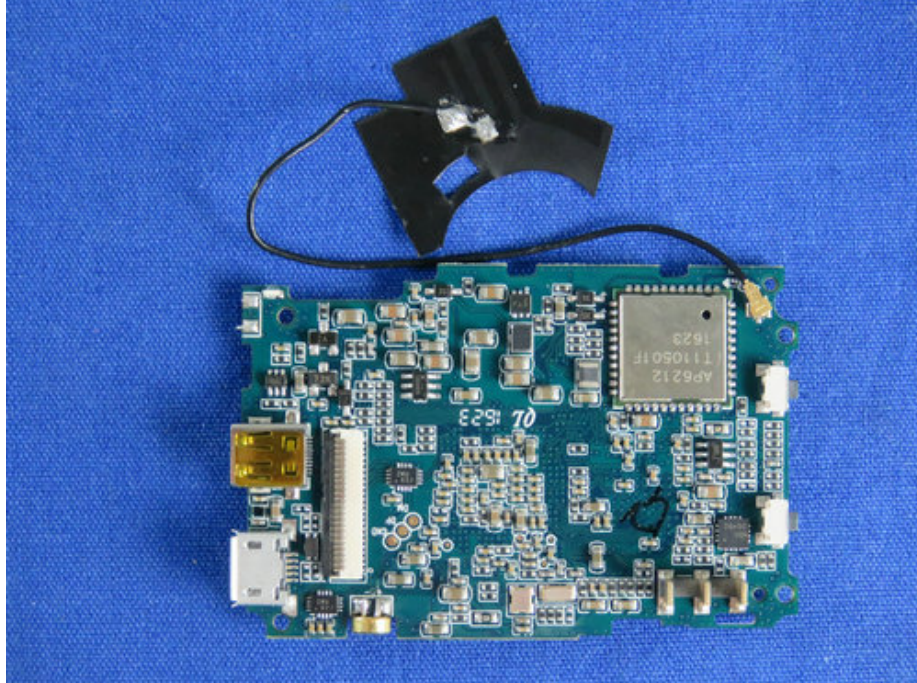
9. Figure
PCB of the EUT-Front View



10. Figure
PCB of the EUT-Back View



11. Figure
PCB of the EUT-Front View



12. Figure
PCB of the EUT-Back View

