

FCC TEST REPORT

Client Name : Shenzhen Hwellyi Technology Co., Ltd

Address : No.503-508, Block A, Area C Baoan Internet Industry
Base, Baoan District, Shenzhen, Guangdong, China
518101

Product Name : 4ch Smart Light Switch

Date : May 23, 2019

Shenzhen Anbotech Compliance Laboratory Limited

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TEST REPORT

Applicant : Shenzhen Hwellyi Technology Co., Ltd

Manufacturer : Shenzhen Hwellyi Technology Co., Ltd

Product Name : 4ch Smart Light Switch

Model No. : H101-SK-LI40, H101-SK-LI20

Trade Mark :  HWELLYI

Rating(s) : Input: 100-240V ~ 50/60Hz, 0.8A

Test Standard(s) : FCC Part15 Subpart C 2018, Section 15.247

Test Method(s) : ANSI C63.10: 2013, KDB558074 D01 DTS Meas Guidance v05

The device described above is tested by Shenzhen Anbotech 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 Anbotech 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 Anbotech Compliance Laboratory Limited.

Date of Receipt

Apr. 26, 2019

Date of Test

Apr. 26~May 08, 2019

Prepared by



(Engineer / Oliay Yang)

Reviewer

(Supervisor / Snowy Meng)

Approved & Authorized Signer

(Manager / Sally Zhang)

1. General Information

1.1. Client Information

Applicant	:	Shenzhen Hwellyi Technology Co., Ltd
Address	:	No.503-508, Block A, Area C Baoan Internet Industry Base, Baoan District, Shenzhen, Guangdong, China 518101
Manufacturer	:	Shenzhen Hwellyi Technology Co., Ltd
Address	:	No.503-508, Block A, Area C Baoan Internet Industry Base, Baoan District, Shenzhen, Guangdong, China 518101
Factory	:	Shenzhen Hwellyi Technology Co., Ltd
Address	:	No.503-508, Block A, Area C Baoan Internet Industry Base, Baoan District, Shenzhen, Guangdong, China 518101

1.2. Description of Device (EUT)

Product Name	:	4ch Smart Light Switch	
Model No.	:	H101-SK-LI40, H101-SK-LI20 (Note: All samples are the same except the name, so we prepare "H101-SK-LI40" for test only.)	
Trade Mark	:		
Test Power Supply	:	AC 240V, 60Hz/ AC 120V, 60Hz	
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)	
Product Description	:	Operation Frequency:	2405-2480MHz
	:	Number of Channel:	16 Channels
	:	Modulation Type:	GFSK
	:	Antenna Type:	FPCB Antenna
	:	Antenna Gain(Peak):	5 dBi
Remark: 1)For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.			

1.3. Auxiliary Equipment Used During Test

N/A	
-----	--

1.4. Description of Test Modes

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description	
Mode 1	CH01	Keeping TX+ Charging Mode/ TX Only
Mode 2	CH08	
Mode 3	CH16	

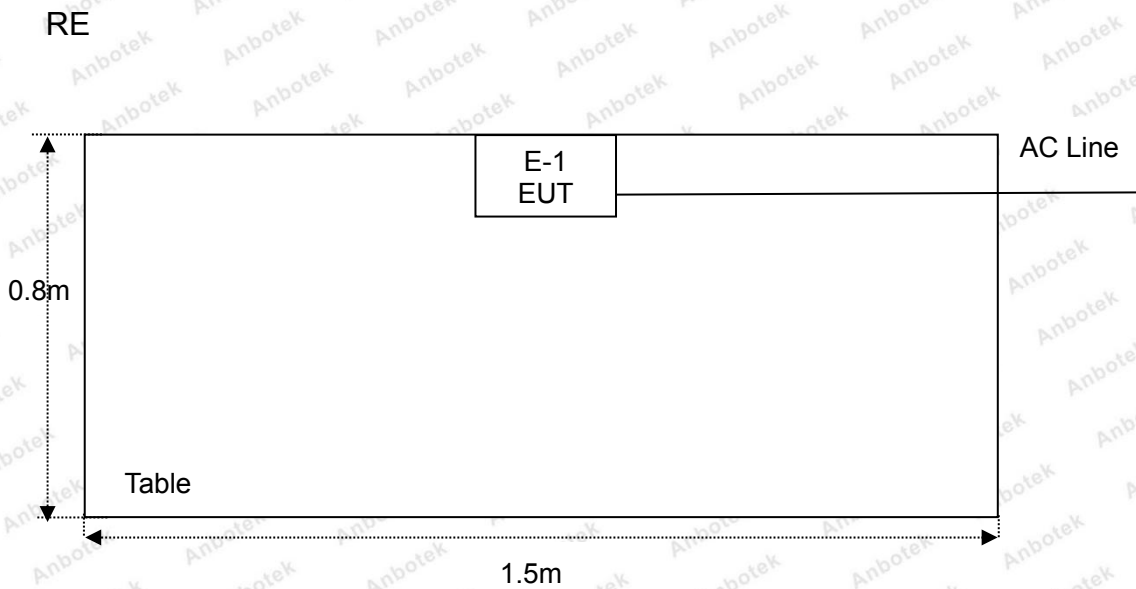
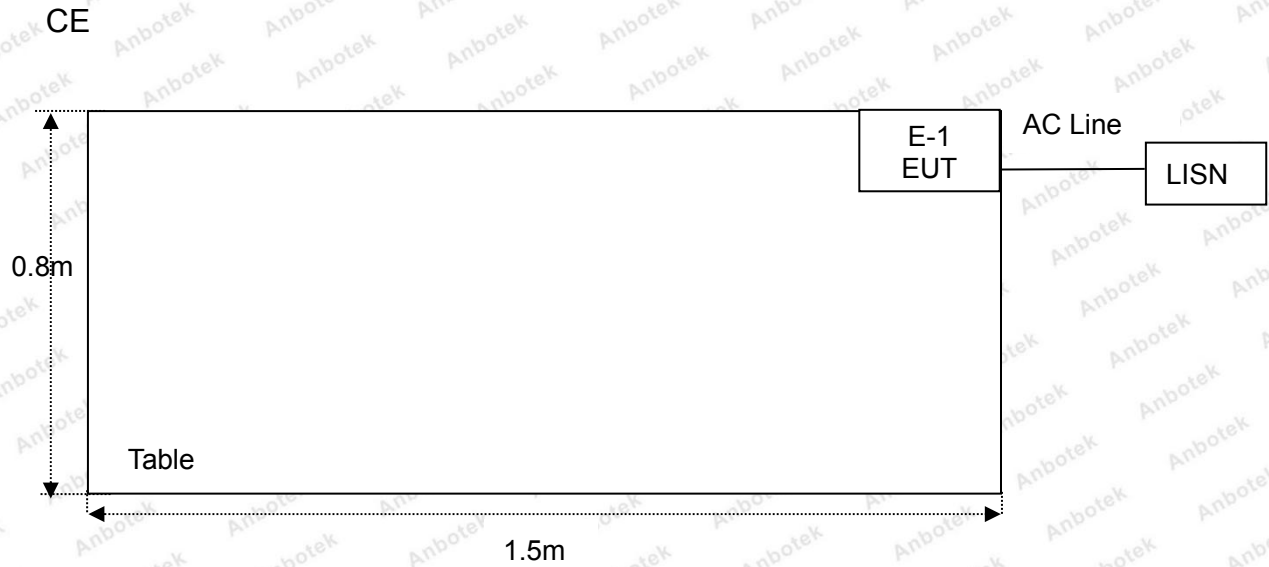
Note:

- (1) The measurements are performed at the highest, middle, lowest available channels.
- (2)The data rate was set in 1Mbps for radiated emission due to the highest RF output power.

1.5. List of channels

Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	2405	11	2455
02	2410	12	2460
03	2415	13	2465
04	2420	14	2470
05	2425	15	2475
06	2440	16	2480
07	2435		
08	2440		
09	2445		
10	2480		

1.6. Description Of Test Setup



1.7. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Nov. 05, 2018	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESPI3	101604	Nov. 05, 2018	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Nov. 05, 2018	1 Year
4.	Spectrum Analysis	Agilent	E4407B	US39390582	Nov. 05, 2018	1 Year
5.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 05, 2018	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G30 D	KD17503	Nov. 05, 2018	1 Year
7.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Nov. 20, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 19, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Nov. 20, 2018	1 Year
10.	Horn Antenna	A-INFO	LB-180400- KF	J211060628	Nov. 20, 2018	1 Year
11.	Pre-amplifier	SONOMA	310N	186860	Nov. 05, 2018	1 Year
12.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
13.	RF Test Control System	YIHENG	YH3000	2017430	Nov. 05, 2018	1 Year
14.	Power Sensor	DAER	RPR3006W	15I00041SN045	Nov. 05, 2018	1 Year
15.	Power Sensor	DAER	RPR3006W	15I00041SN046	Nov. 05, 2018	1 Year
16.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 05, 2018	1 Year
17.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Nov. 05, 2018	1 Year
18.	Signal Generator	Agilent	E4421B	MY41000743	Nov. 05, 2018	1 Year
19.	DC Power Supply	LW	TPR-6420D	374470	Oct. 31, 2018	1 Year
20.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80 B	N/A	Nov. 01, 2018	1 Year

1.8. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 3.9 dB (Horizontal)
		Ur = 3.8 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4 dB

1.9. Description of Test Facility

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

FCC-Registration No.: 184111

Shenzhen Anbotech 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 No. 184111, July 31, 2017.

ISED-Registration No.: 8058A-1

Shenzhen Anbotech Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A-1, June 13, 2016.

Test Location

Shenzhen Anbotech Compliance Laboratory Limited.

1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102

2. Summary of Test Results

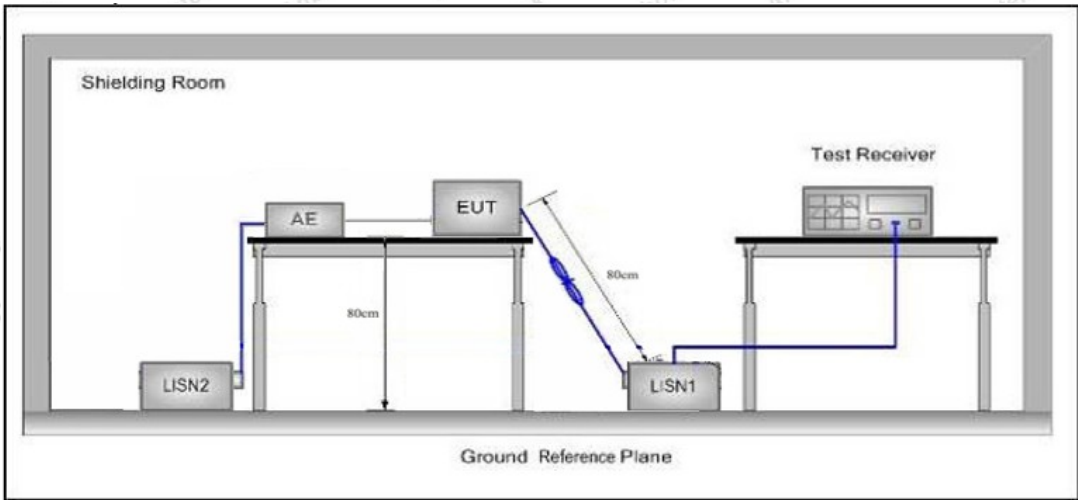
Standard Section	Test Item	Result
15.203/15.247(c)	Antenna Requirement	PASS
15.207	Conducted Emission	PASS
15.205/15.209	Spurious Emission	PASS
15.247(b)(3)	Maximum Peak Output Power	PASS
15.247(a)(2)	6dB Occupied Bandwidth	PASS
15.247(e)	Power Spectral Density	PASS
15.247(d)	Band Edge	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

3. Conducted Emission Test

3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.207		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50
Remark: (1) *Decreasing linearly with logarithm of the frequency. (2) The lower limit shall apply at the transition frequency.			

3.2. Test Setup



3.3. 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.

3.4. Test Data

Please to see the following pages.

During the test, pre-scan all the modes, and found Low channel(TX+Charging Mode) which is the worst case, only the worst case is recorded in the report.

The item was tested on (ANT 1, ANT 2) modes, only the worst data of (ANT 1+ANT 2) is attached in the following pages.



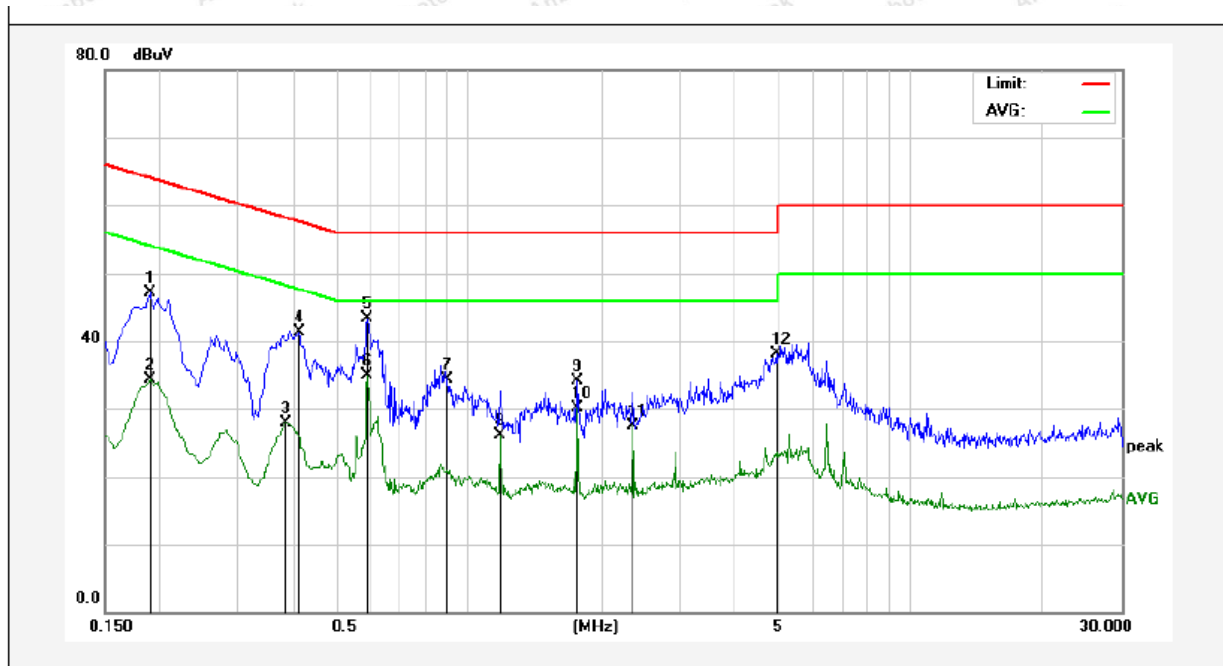
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Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: CH01
Test Specification: AC 240V, 60Hz
Comment: Live Line
Tem.: 22.0°C Hum.: 68%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1900	27.19	19.90	47.09	64.03	-16.94	QP	
2	0.1900	14.37	19.90	34.27	54.03	-19.76	AVG	
3	0.3860	8.01	19.93	27.94	48.15	-20.21	AVG	
4	0.4140	21.30	19.94	41.24	57.57	-16.33	QP	
5	0.5899	23.26	20.01	43.27	56.00	-12.73	QP	
6	0.5899	14.91	20.01	34.92	46.00	-11.08	AVG	
7	0.8980	14.22	20.09	34.31	56.00	-21.69	QP	
8	1.1780	5.98	20.12	26.10	46.00	-19.90	AVG	
9	1.7660	13.93	20.14	34.07	56.00	-21.93	QP	
10	1.7660	9.97	20.14	30.11	46.00	-15.89	AVG	
11	2.3580	7.43	20.15	27.58	46.00	-18.42	AVG	
12	4.9780	17.87	20.21	38.08	56.00	-17.92	QP	



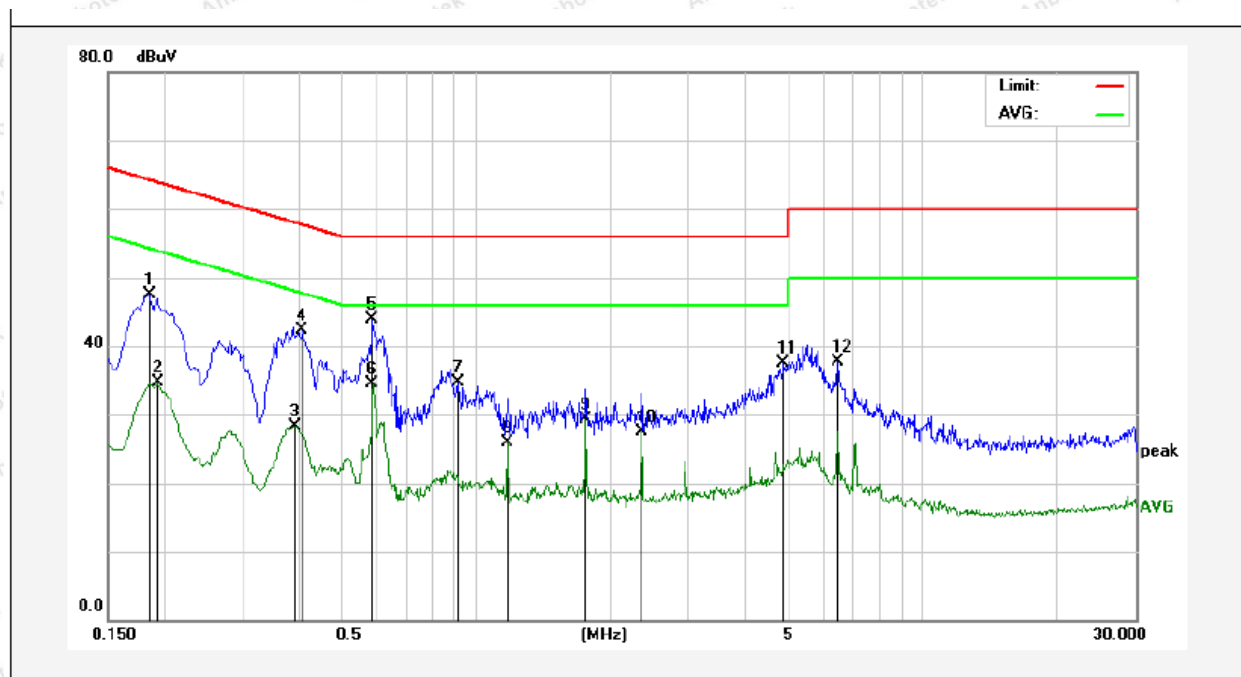
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Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: CH01
Test Specification: AC 240V, 60Hz
Comment: Neutral Line
Tem.: 22.0°C Hum.: 68%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1860	27.54	19.90	47.44	64.21	-16.77	QP	
2	0.1940	14.78	19.90	34.68	53.86	-19.18	AVG	
3	0.3940	8.38	19.93	28.31	47.98	-19.67	AVG	
4	0.4100	22.42	19.94	42.36	57.65	-15.29	QP	
5	0.5860	23.91	20.01	43.92	56.00	-12.08	QP	
6	0.5899	14.45	20.01	34.46	46.00	-11.54	AVG	
7	0.9100	14.53	20.10	34.63	56.00	-21.37	QP	
8	1.1780	5.81	20.12	25.93	46.00	-20.07	AVG	
9	1.7660	9.24	20.14	29.38	46.00	-16.62	AVG	
10	2.3580	7.40	20.15	27.55	46.00	-18.45	AVG	
11	4.8900	17.37	20.20	37.57	56.00	-18.43	QP	
12	6.4780	17.51	20.25	37.76	60.00	-22.24	QP	

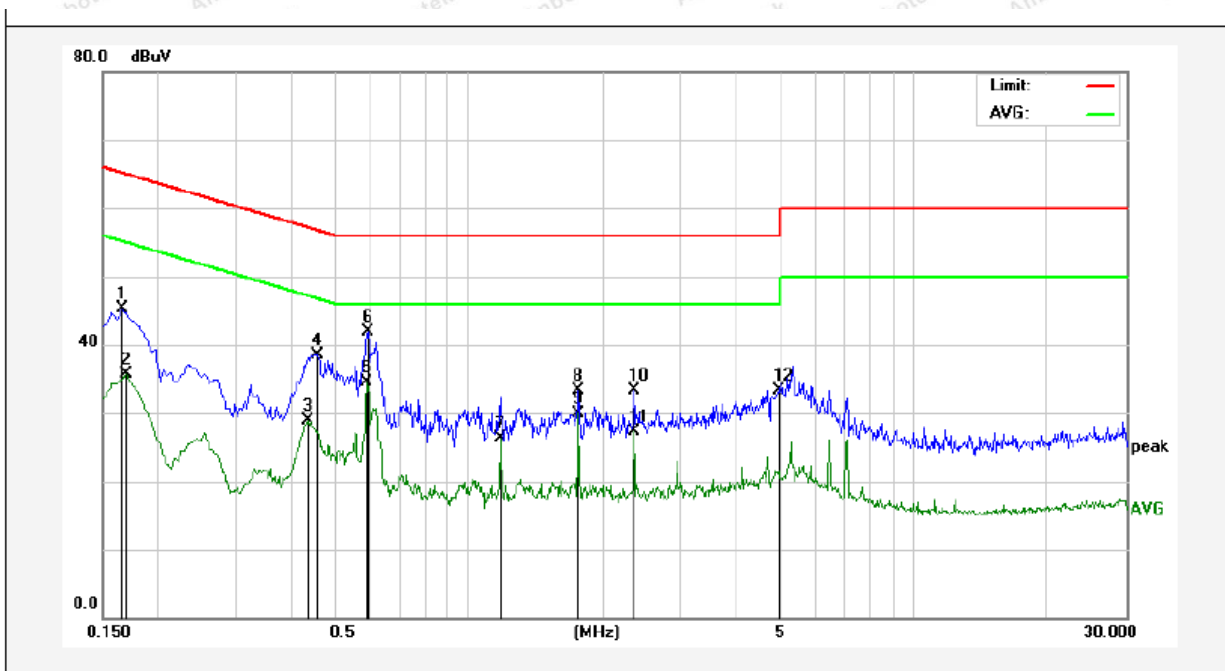
Report No.: SZAWW190426001-01

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Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: CH01
Test Specification: AC 120V, 60Hz
Comment: Live Line
Tem.: 22.0°C Hum.: 68%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1660	25.37	19.90	45.27	65.15	-19.88	QP	
2	0.1700	15.77	19.90	35.67	54.96	-19.29	AVG	
3	0.4340	8.88	19.95	28.83	47.18	-18.35	AVG	
4	0.4580	18.60	19.96	38.56	56.73	-18.17	QP	
5	0.5899	14.52	20.01	34.53	46.00	-11.47	AVG	
6	0.5940	21.94	20.01	41.95	56.00	-14.05	QP	
7	1.1780	6.27	20.12	26.39	46.00	-19.61	AVG	
8	1.7660	13.10	20.14	33.24	56.00	-22.76	QP	
9	1.7660	9.78	20.14	29.92	46.00	-16.08	AVG	
10	2.3580	13.11	20.15	33.26	56.00	-22.74	QP	
11	2.3580	7.13	20.15	27.28	46.00	-18.72	AVG	
12	4.9740	13.09	20.21	33.30	56.00	-22.70	QP	

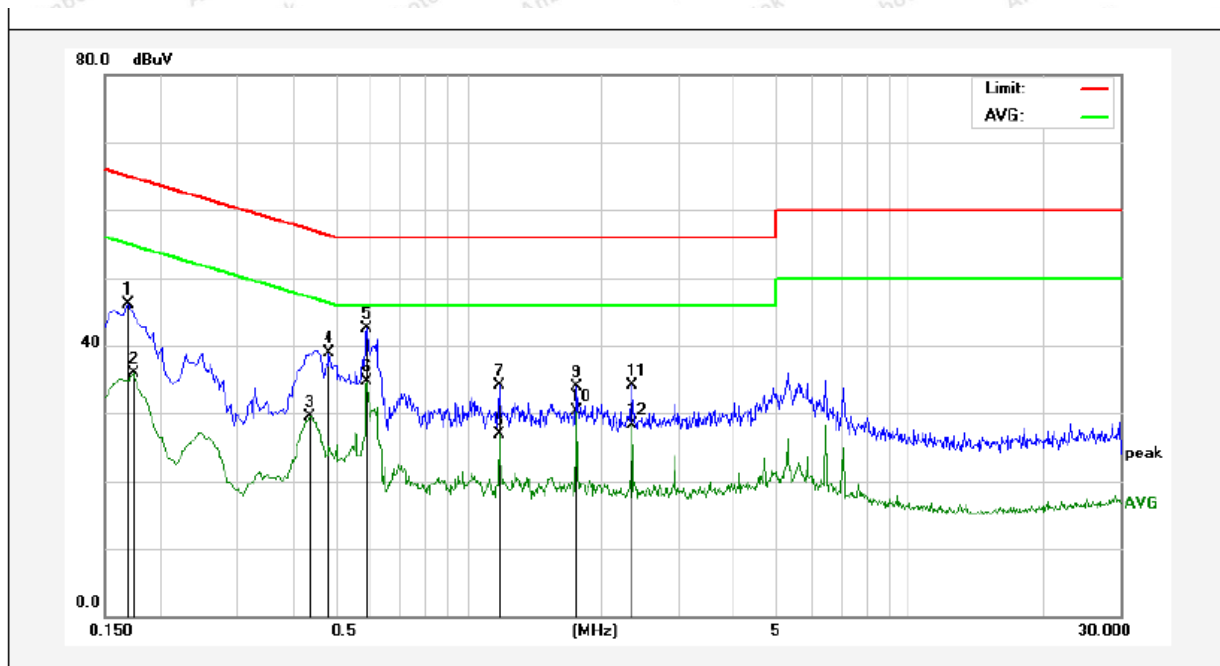
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Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: CH01
Test Specification: AC 120V, 60Hz
Comment: Neutral Line
Tem.: 22.0°C Hum.: 68%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1700	26.22	19.90	46.12	64.96	-18.84	QP	
2	0.1740	16.06	19.90	35.96	54.76	-18.80	AVG	
3	0.4380	9.54	19.95	29.49	47.10	-17.61	AVG	
4	0.4860	18.95	19.97	38.92	56.24	-17.32	QP	
5	0.5899	22.48	20.01	42.49	56.00	-13.51	QP	
6	0.5899	14.68	20.01	34.69	46.00	-11.31	AVG	
7	1.1780	13.89	20.12	34.01	56.00	-21.99	QP	
8	1.1780	6.76	20.12	26.88	46.00	-19.12	AVG	
9	1.7660	13.84	20.14	33.98	56.00	-22.02	QP	
10	1.7660	10.20	20.14	30.34	46.00	-15.66	AVG	
11	2.3580	13.97	20.15	34.12	56.00	-21.88	QP	
12	2.3580	8.10	20.15	28.25	46.00	-17.75	AVG	



4. Radiation Spurious Emission and Band Edge

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209 and 15.205				
Test Limit	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/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~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3

Remark:

(1)The lower limit shall apply at the transition frequency.

(2) 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.

4.2. Test Setup

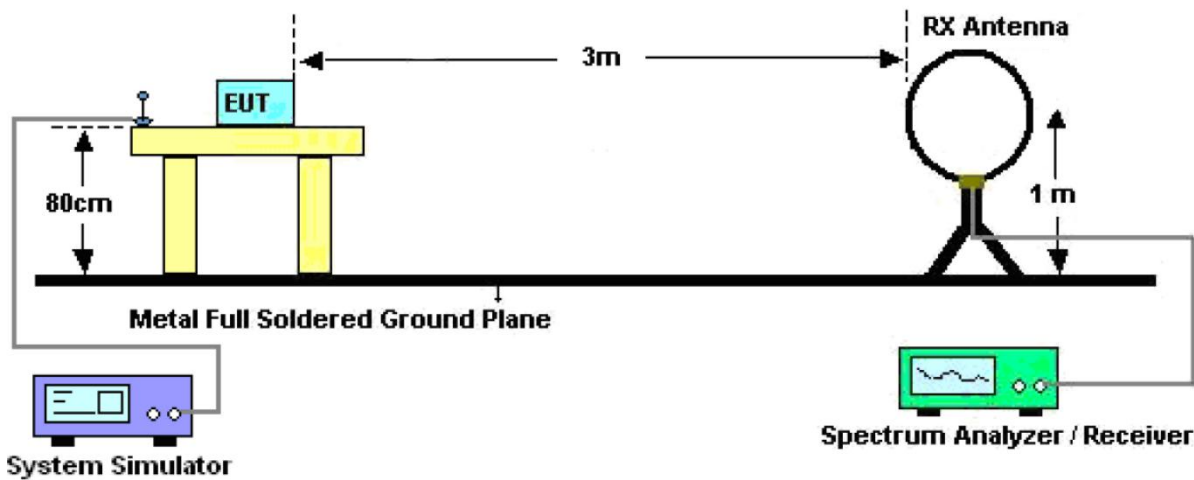


Figure 1. Below 30MHz

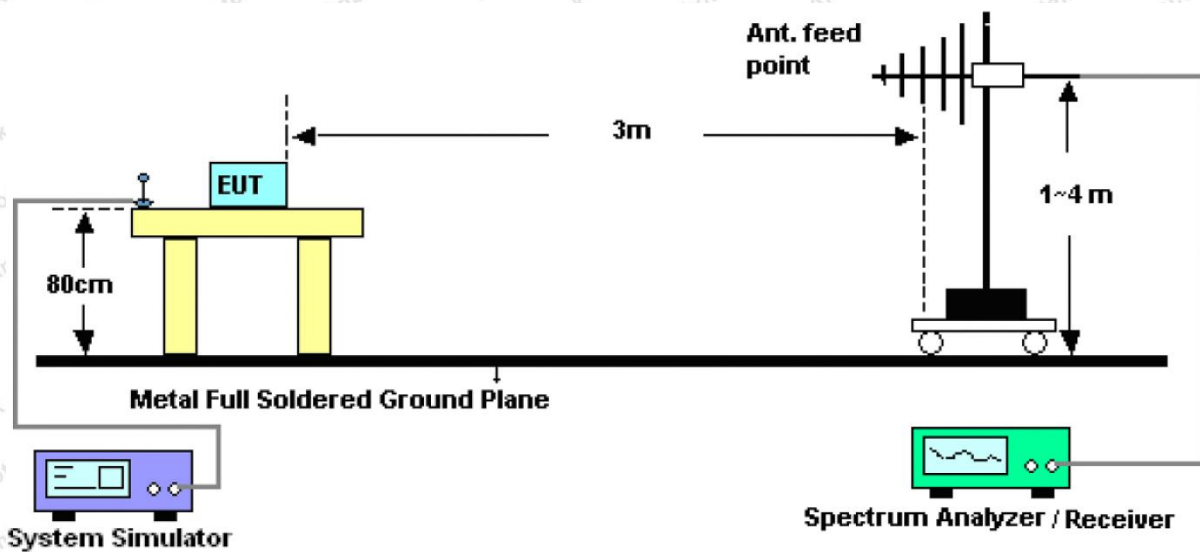


Figure 2. 30MHz to 1GHz

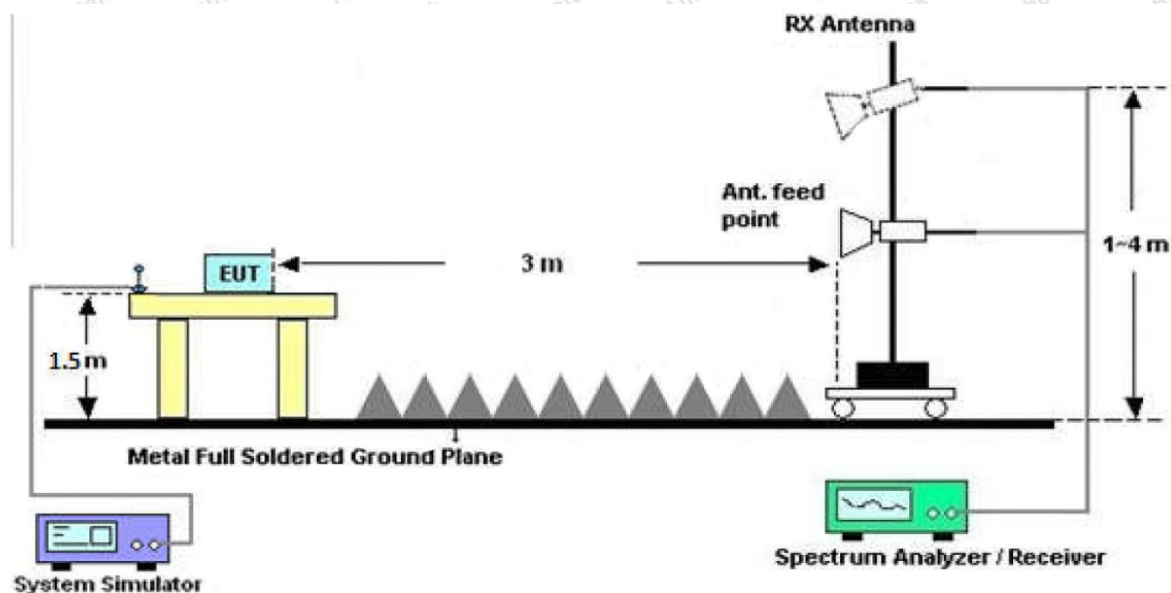


Figure 3. Above 1 GHz

4.3. 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 9kHz to 150kHz, Set the spectrum analyzer as:

RBW = 200Hz, VBW = 1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:

RBW = 9KHz, VBW = 30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

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 = 1MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.

RBW = 1MHz, VBW = 10Hz, Detector= Average, Trace mode= Max hold, Sweep- auto couple.

4.4. Test Data

PASS

During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

The test results of 9kHz-30MHz and above 18000MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.

During the test, pre-scan the GFSK modulation, and found the GFSK modulation Low channel (Module 1) which is the worst case, only the worst case is recorded in the report.

The item was tested on (ANT 1, ANT 2) modes, only the worst data of (ANT 1+ANT 2) is attached in the following pages.

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Test Results (30~1000MHz)

Job No.: SZAWW190426001-01

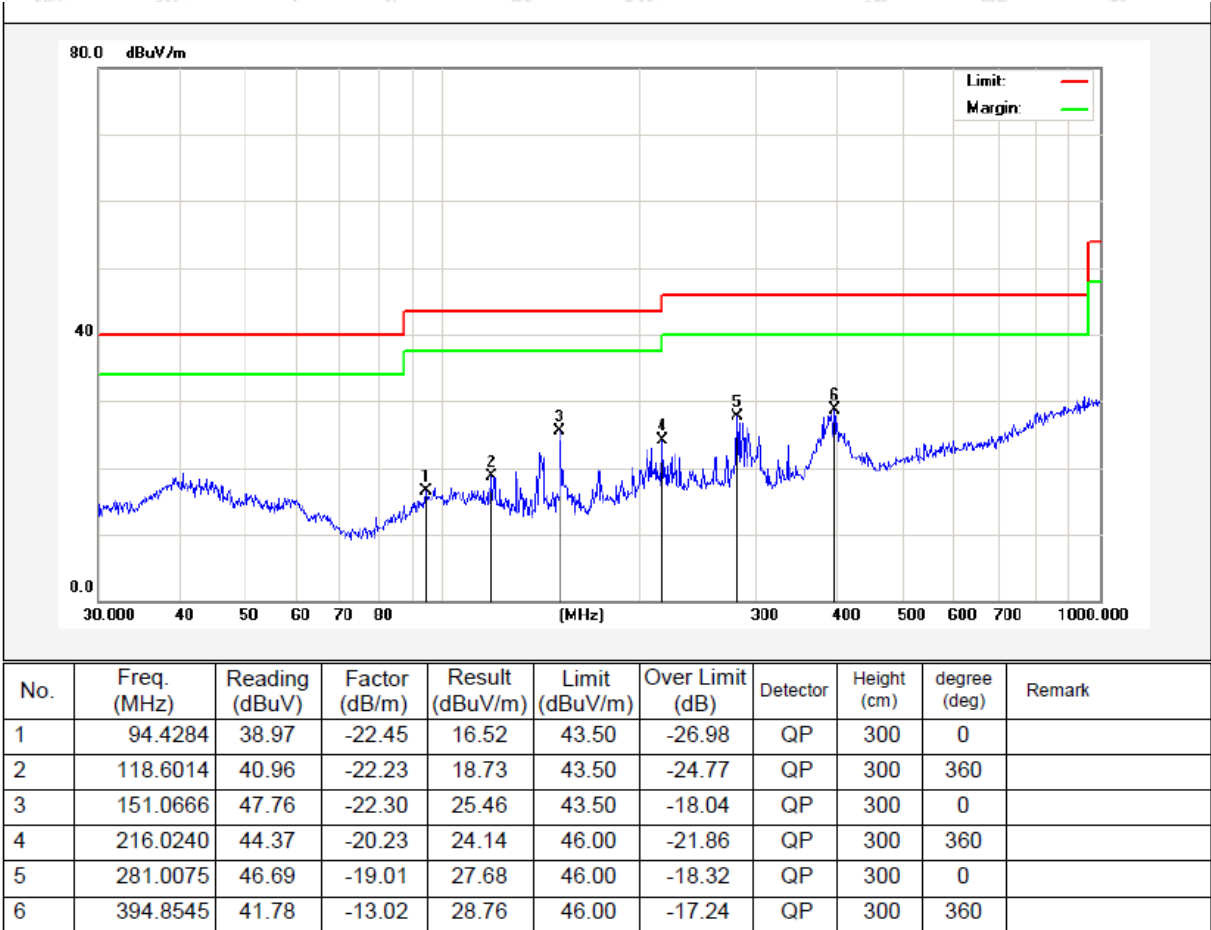
Temp.(°C)/Hum.(%RH): 23.1°C/54%RH

Standard: FCC PART 15C

Power Source: AC 240V, 60Hz

Test Mode: CH01

Polarization: Horizontal



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Test Results (30~1000MHz)

Job No.: SZAWW190426001-01

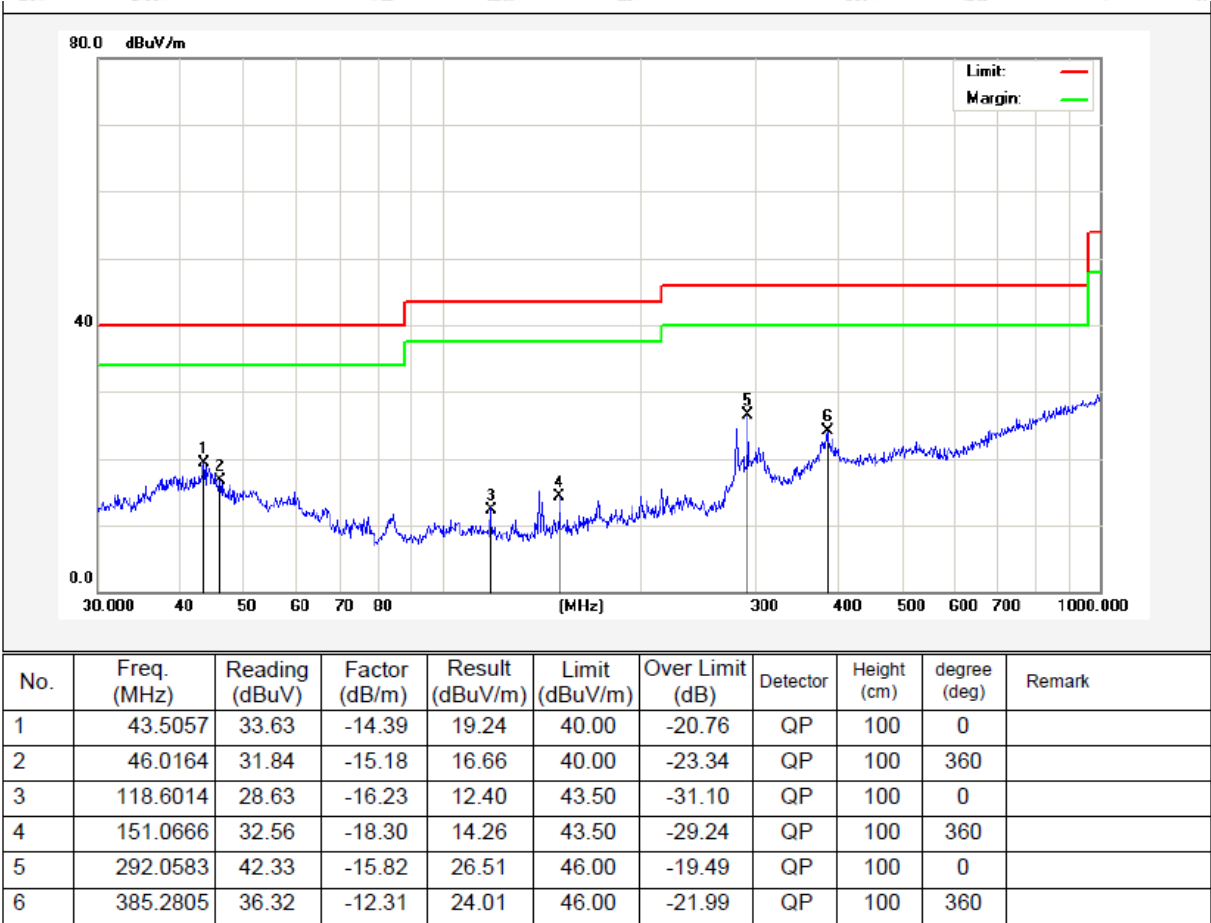
Temp.(°C)/Hum.(%RH): 23.1°C/54%RH

Standard: FCC PART 15C

Power Source: AC 240V, 60Hz

Test Mode: CH01

Polarization: Vertical



Report No.: SZAWW190426001-01

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Test Results (30~1000MHz)

Job No.:

SZAWW190426001-01

Temp.(°C)/Hum.(%RH):

23.1°C/54%RH

Standard:

FCC PART 15C

Power Source:

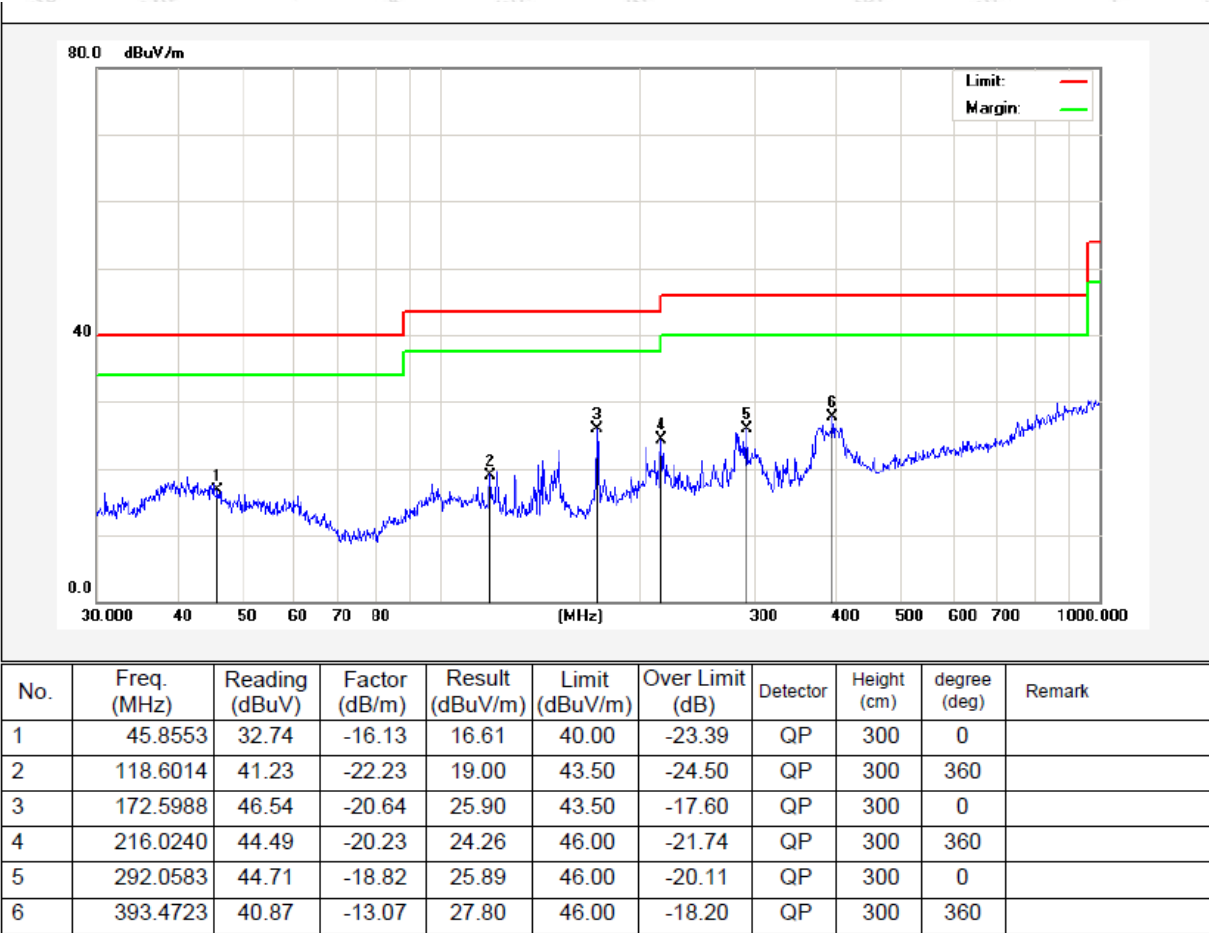
AC 120V, 60Hz

Test Mode:

CH01

Polarization:

Horizontal



Report No.: SZAWW190426001-01

Test Results (30~1000MHz)

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Job No.: SZAWW190426001-01

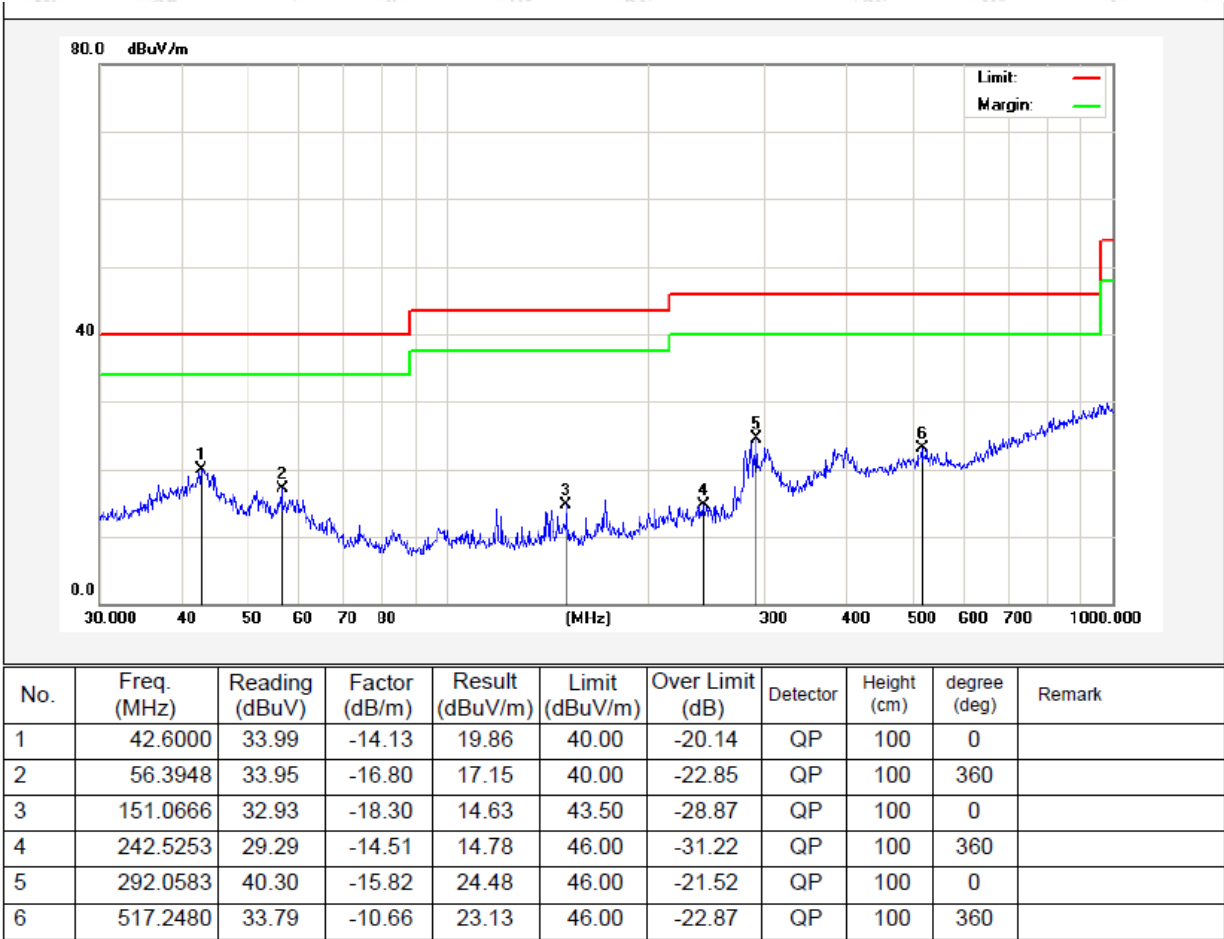
Standard: FCC PART 15C

Test Mode: CH01

Temp.(°C)/Hum.(%RH): 23.1°C/54%RH

Power Source: AC 120V, 60Hz

Polarization: Vertical



Test Results (Above 1000MHz)

Test Mode: CH01					Test channel: Lowest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4810.00	38.23	34.04	6.58	34.09	44.76	74.00	-29.24	V
7215.00	32.44	37.11	7.73	34.50	42.78	74.00	-31.22	V
9620.00	32.01	39.31	9.23	34.79	45.76	74.00	-28.24	V
12025.00	*					74.00		V
14430.00	*					74.00		V
4810.00	42.70	34.04	6.58	34.09	49.23	74.00	-24.77	H
7215.00	34.28	37.11	7.73	34.50	44.62	74.00	-29.38	H
9620.00	31.52	39.31	9.23	34.79	45.27	74.00	-28.73	H
12025.00	*					74.00		H
14430.00	*					74.00		H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4810.00	26.87	34.04	6.58	34.09	33.40	54.00	-20.60	V
7215.00	21.03	37.11	7.73	34.50	31.37	54.00	-22.63	V
9620.00	20.04	39.31	9.23	34.79	33.79	54.00	-20.21	V
12025.00	*					54.00		V
14430.00	*					54.00		V
4810.00	31.20	34.04	6.58	34.09	37.73	54.00	-16.27	H
7215.00	23.26	37.11	7.73	34.50	33.60	54.00	-20.40	H
9620.00	19.85	39.31	9.23	34.79	33.60	54.00	-20.40	H
12025.00	*					54.00		H
14430.00	*					54.00		H

Test Results (Above 1000MHz)

Test Mode: CH08					Test channel: Middle			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4880.00	37.55	34.38	6.69	34.09	44.53	74.00	-29.47	V
7320.00	32.00	37.22	7.78	34.53	42.47	74.00	-31.53	V
9760.00	31.62	39.46	9.35	34.80	45.63	74.00	-28.37	V
12200.00	*					74.00		V
14640.00	*					74.00		V
4880.00	41.89	34.38	6.69	34.09	48.87	74.00	-25.13	H
7320.00	33.77	37.22	7.78	34.53	44.24	74.00	-29.76	H
9760.00	31.06	39.46	9.35	34.80	45.07	74.00	-28.93	H
12200.00	*					74.00		H
14640.00	*					74.00		H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4880.00	26.34	34.38	6.69	34.09	33.32	54.00	-20.68	V
7320.00	20.66	37.22	7.78	34.53	31.13	54.00	-22.87	V
9760.00	19.72	39.46	9.35	34.80	33.73	54.00	-20.27	V
12200.00	*					54.00		V
14640.00	*					54.00		V
4880.00	30.59	34.38	6.69	34.09	37.57	54.00	-16.43	H
7320.00	22.85	37.22	7.78	34.53	33.32	54.00	-20.68	H
9760.00	19.48	39.46	9.35	34.80	33.49	54.00	-20.51	H
12200.00	*					54.00		H
14640.00	*					54.00		H

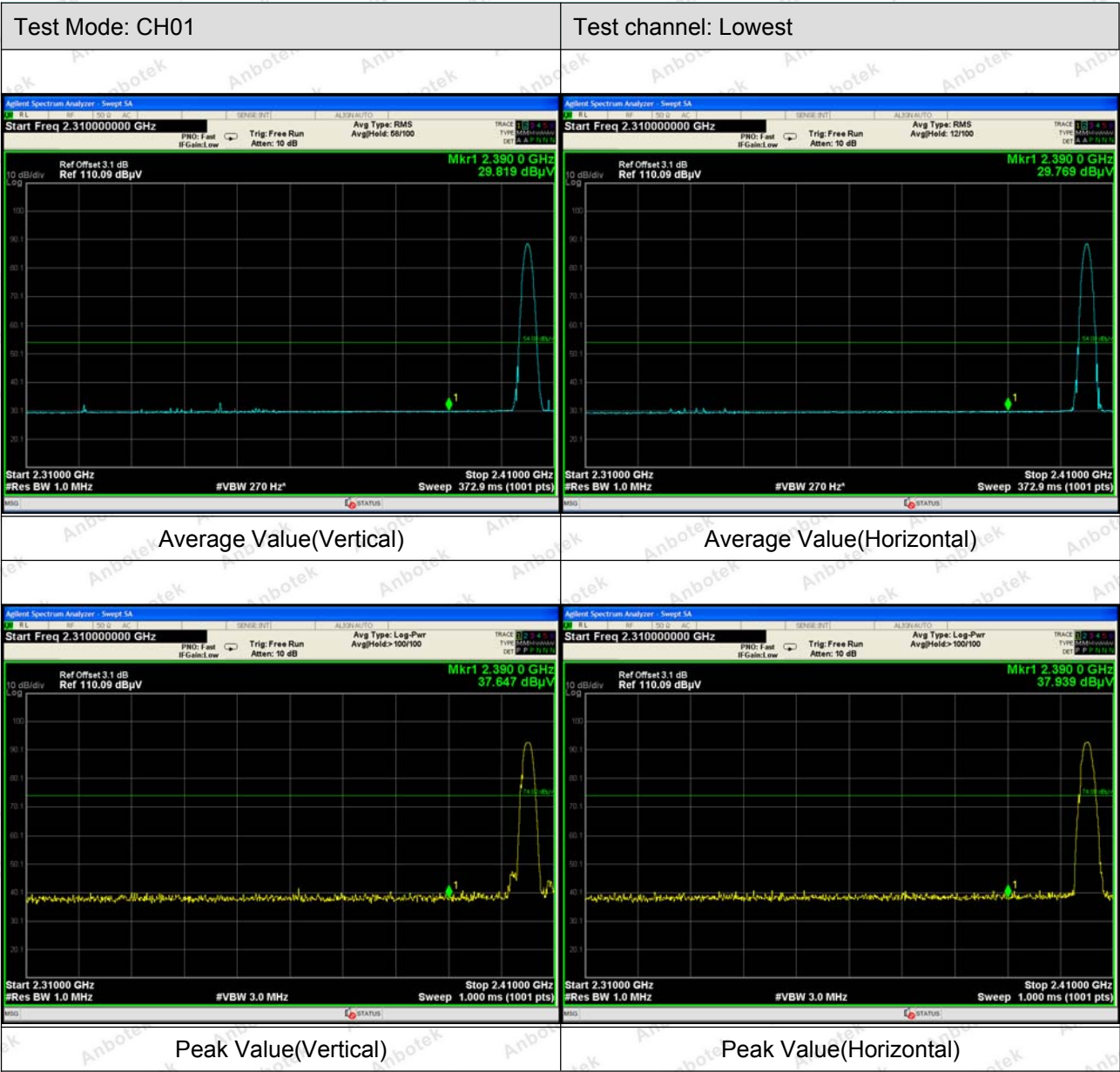
Test Results (Above 1000MHz)

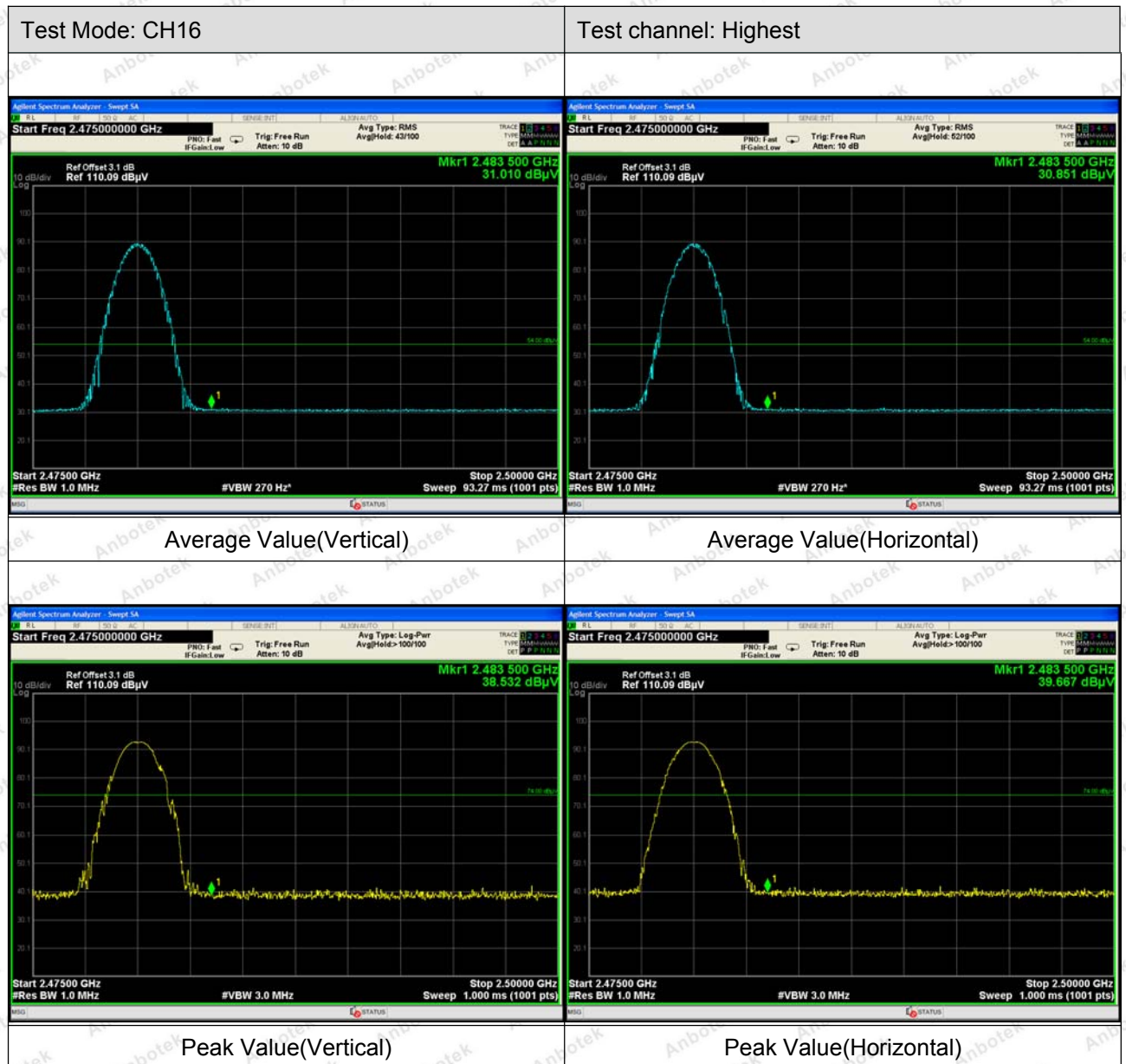
Test Mode: CH16					Test channel: Highest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4960.00	36.79	34.72	6.79	34.09	44.21	74.00	-29.79	V
7440.00	31.49	37.34	7.82	34.57	42.08	74.00	-31.92	V
9920.00	31.16	39.62	9.46	34.81	45.43	74.00	-28.57	V
12400.00	*					74.00		V
14880.00	*					74.00		V
4960.00	40.97	34.72	6.79	34.09	48.39	74.00	-25.61	H
7440.00	33.20	37.34	7.82	34.57	43.79	74.00	-30.21	H
9920.00	30.54	39.62	9.46	34.81	44.81	74.00	-29.19	H
12400.00	*					74.00		H
14880.00	*					74.00		H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4960.00	25.77	34.72	6.79	34.09	33.19	54.00	-20.81	V
7440.00	20.28	37.34	7.82	34.57	30.87	54.00	-23.13	V
9920.00	19.38	39.62	9.46	34.81	33.65	54.00	-20.35	V
12400.00	*					54.00		V
14880.00	*					54.00		V
4960.00	29.95	34.72	6.79	34.09	37.37	54.00	-16.63	H
7440.00	22.42	37.34	7.82	34.57	33.01	54.00	-20.99	H
9920.00	19.08	39.62	9.46	34.81	33.35	54.00	-20.65	H
12400.00	*					54.00		H
14880.00	*					54.00		H

Remark:

1. Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means this data is the too weak instrument of signal is unable to test.

Radiated Band Edge:





Remark:

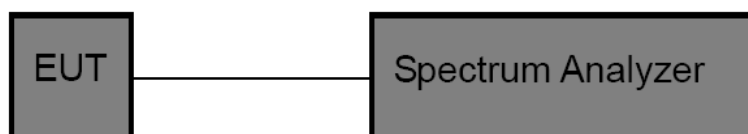
1. Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

5. Output Power Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (b)(3)
Test Limit	30dBm

5.2. Test Setup



5.3. Test Procedure

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above,
- Spectrum Setting:
 - RBW > the 20 dB bandwidth of the emission being measured
 - Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
 - VBW ≥ RBW
 - Sweep = auto
 - Detector function = peak
 - Trace = max hold

5.4. Test Data

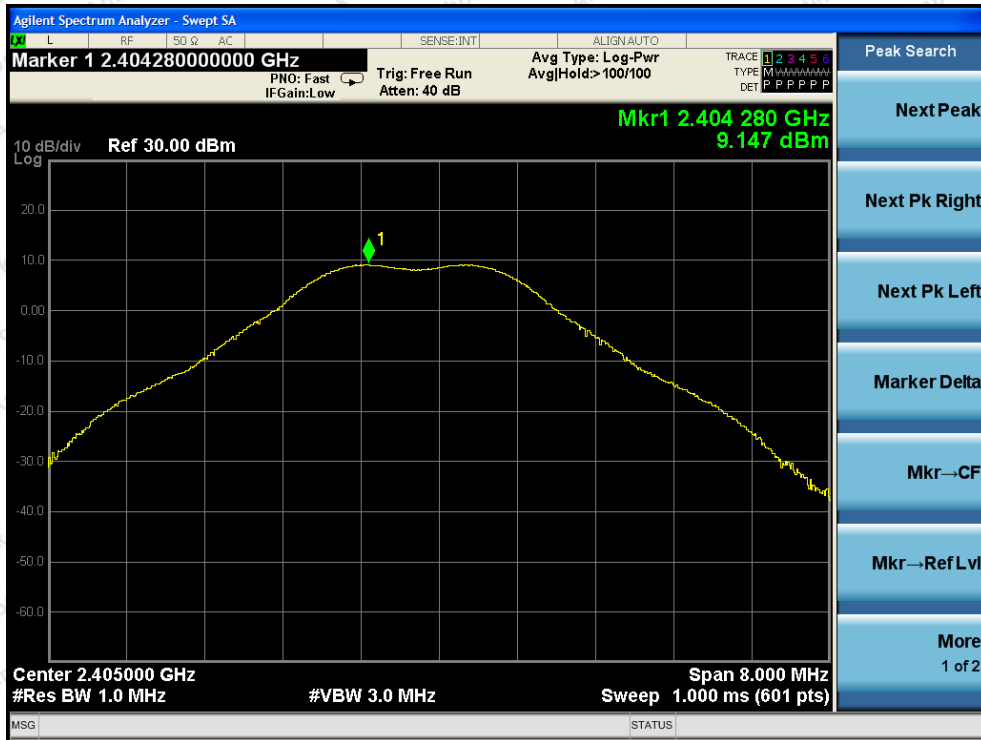
Test Item	:	Output power
Test Voltage	:	AC 120V, 60Hz
Test Result	:	PASS

Test Mode	:	CH Low ~ CH High
Temperature	:	24℃
Humidity	:	55%RH

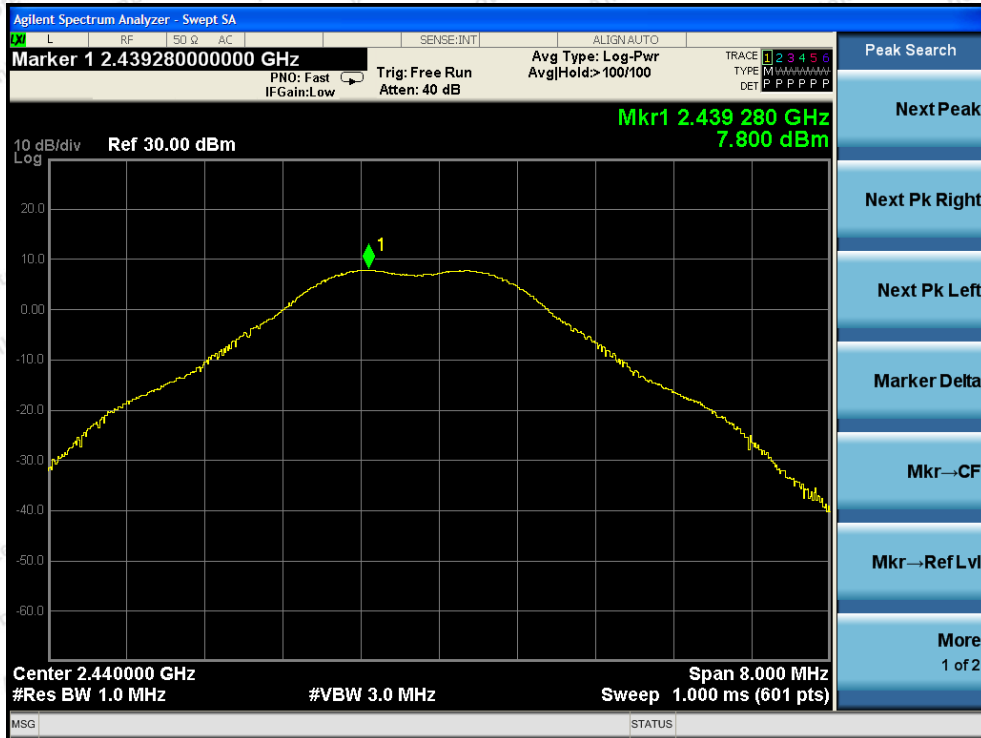
Module 1:

Channel Frequency (MHz)	Maximum Power output(AV) (dBm)	Limit (dBm)	Results
2405	9.147	30	PASS
2440	7.800	30	PASS
2480	6.843	30	PASS

For power test the duty cycle is 100% in continous transmitting mode



Test Mode: Low



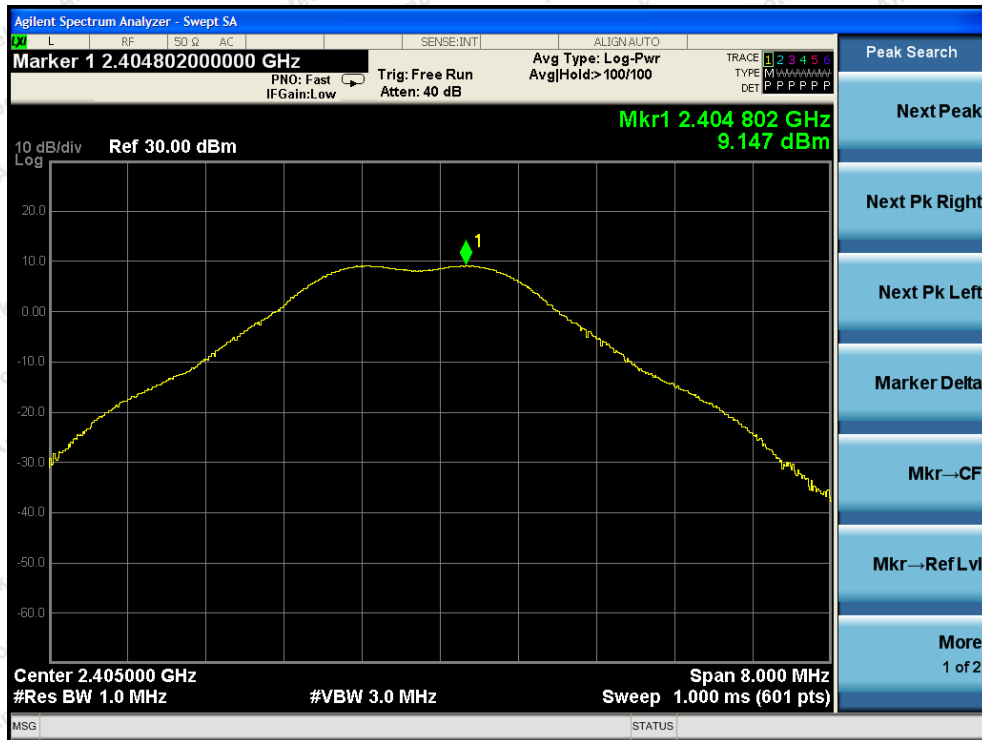
Test Mode: Middle



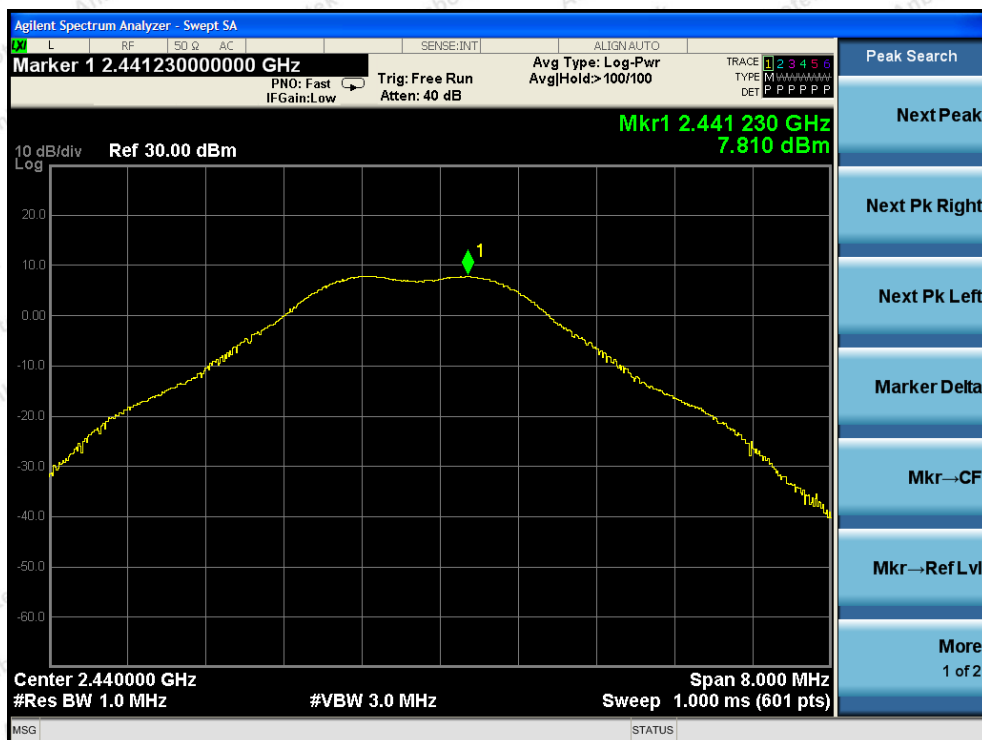
Module 2:

Channel Frequency (MHz)	Maximum Power output(AV) (dBm)	Limit (dBm)	Results
2405	9.147	30	PASS
2440	7.810	30	PASS
2480	6.347	30	PASS

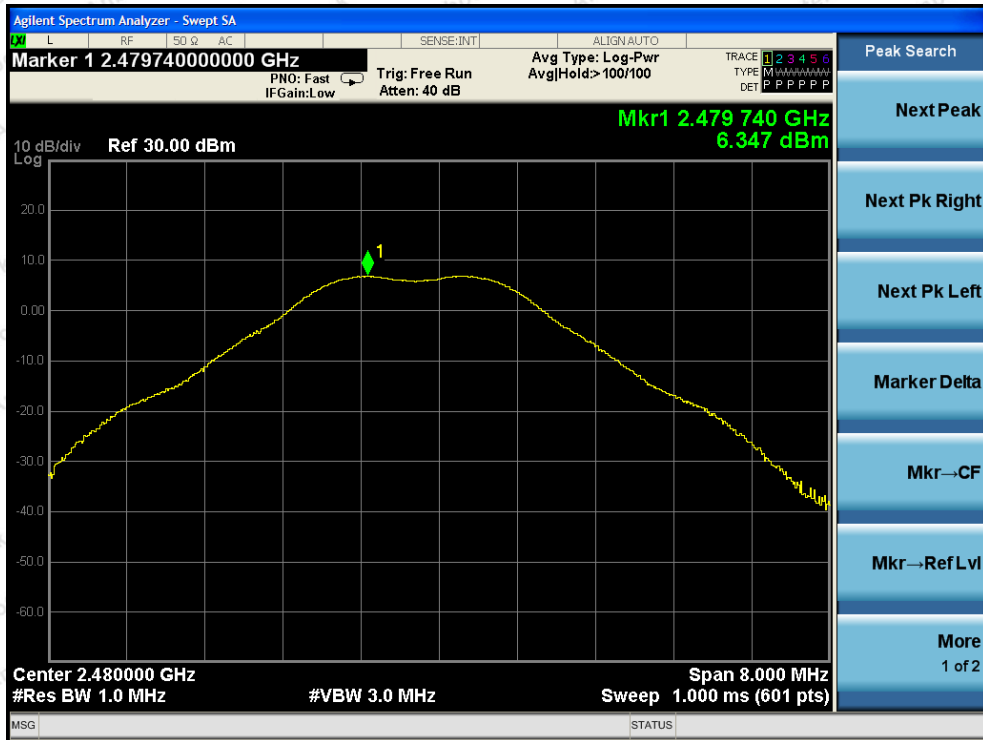
For power test the duty cycle is 100% in continuous transmitting mode



Test Mode: Low



Test Mode: Middle



Test Mode: High

6. Duty cycle

a. Test Procedure

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

Set the center frequency of the instrument to the center frequency of the transmission.

Set RBW $\geq$ OBW if possible; otherwise, set RBW to the largest available value.

Set VBW $\geq$ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$ and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T \leq 16.7$ microseconds.)

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = Zero Span

RBW = 8MHz

VBW = 8MHz

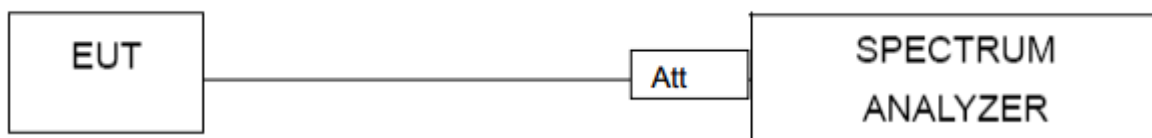
Number of points in Sweep > 100

Detector function = peak

Trace = Clear write Measure Ttotal and Ton

Calculate Duty Cycle = T_{on} / T_{total} and Duty Cycle Factor = $10 \cdot \log(1/\text{Duty Cycle})$

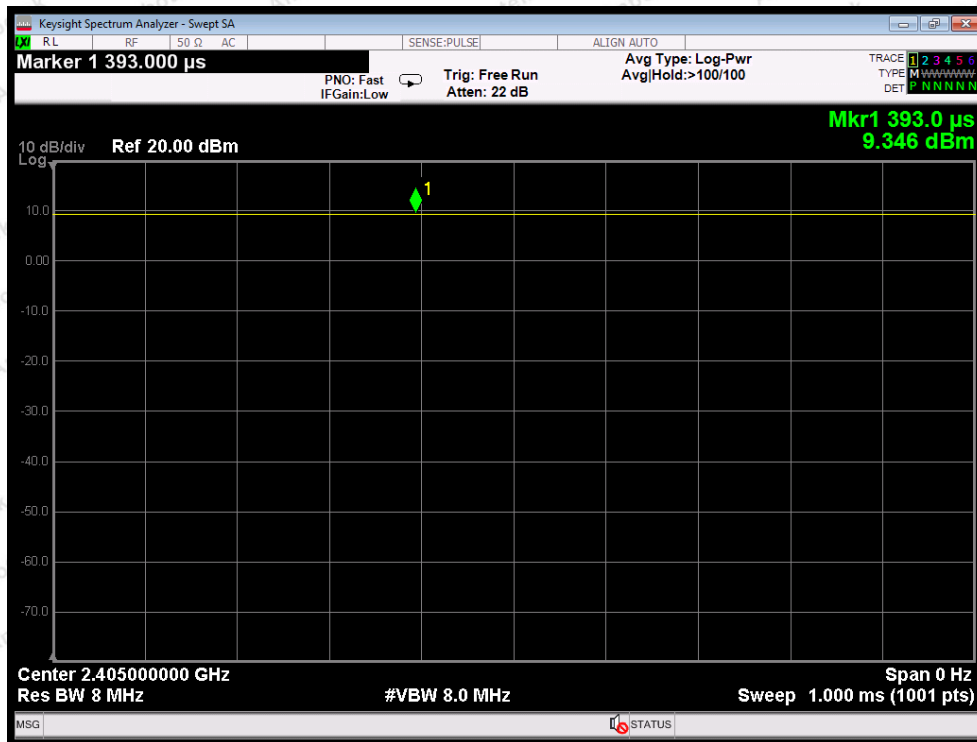
b. TEST SETUP



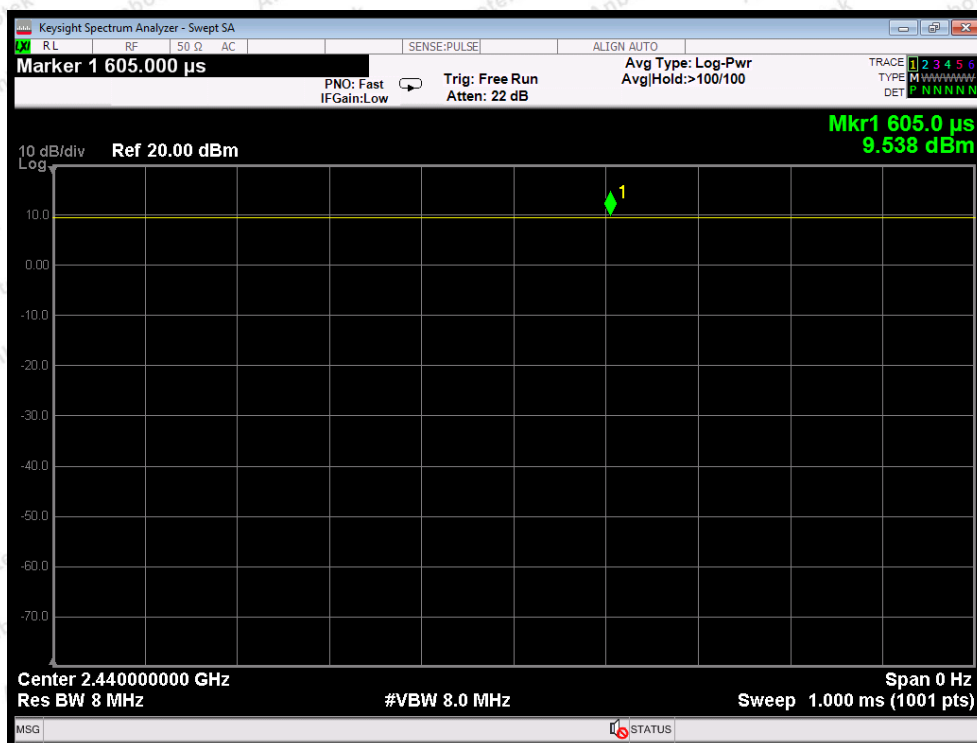
C. TEST RESULT

The item was tested on (Module 1, Module 2) modes, only the worst data of (Module 1) is attached in the following pages.

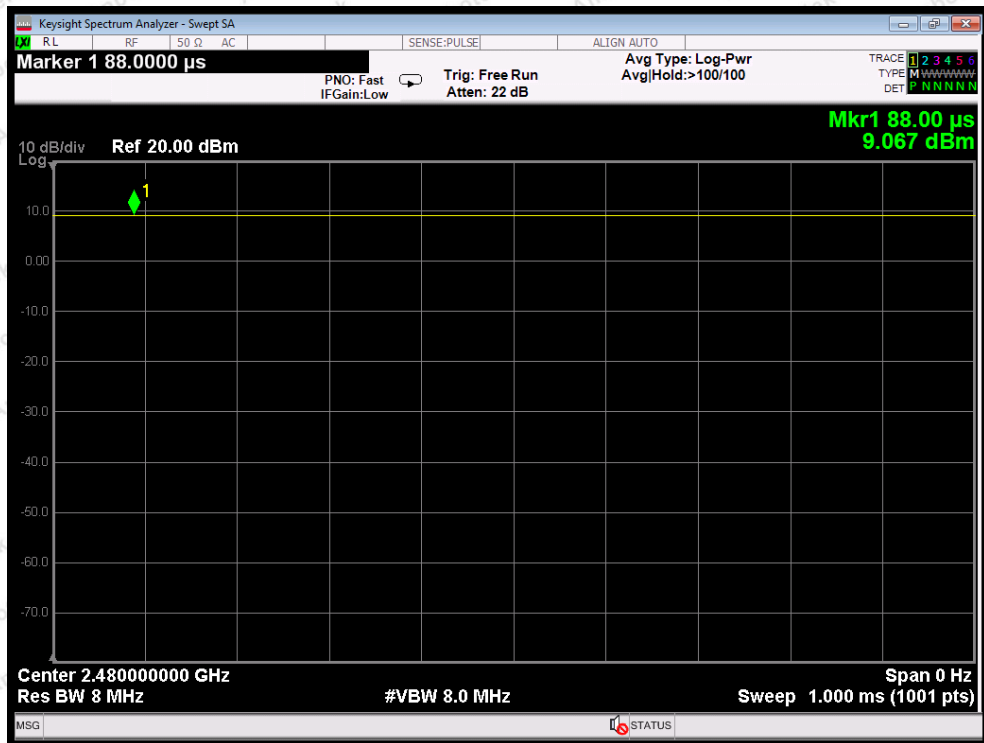
Test plot of Duty Cycle (Module 1)



Test Mode: Low



Test Mode: Middle



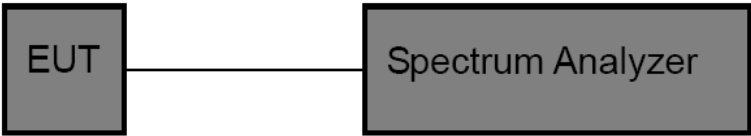
Test Mode: High

7. 6DB Occupy Bandwidth Test

7.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(2)
Test Limit	>500kHz

7.2. Test Setup



7.3. Test Procedure

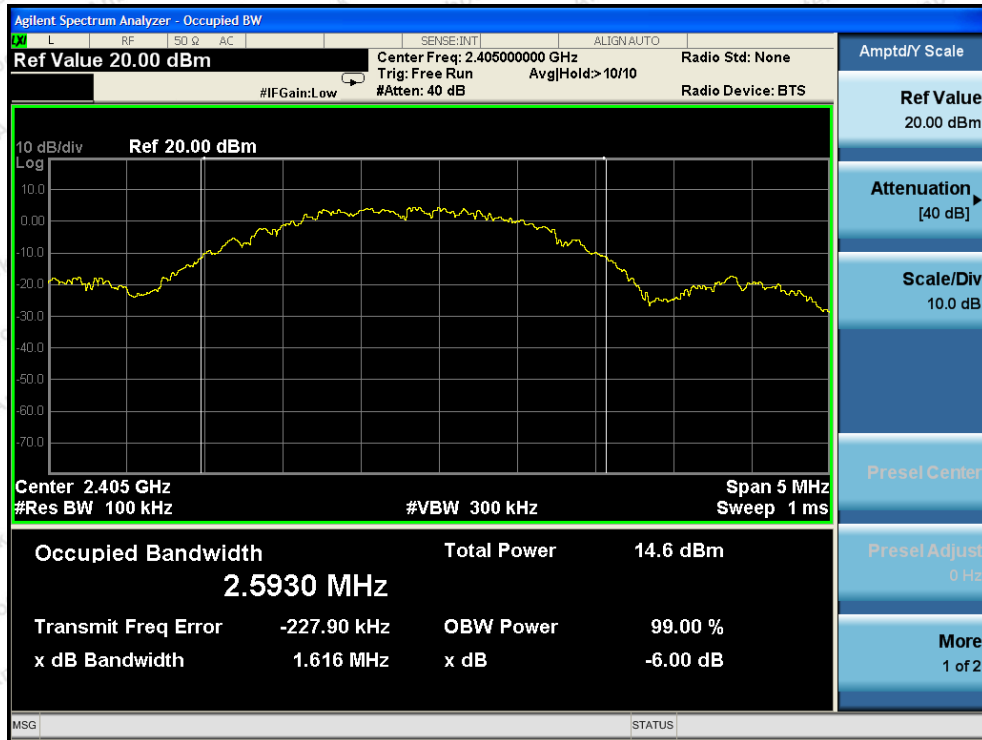
- Place the EUT on the table and set it in the transmitting mode.
- Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- Set the spectrum analyzer as:
RBW = 100kHz, VBW≥3*RBW =300kHz,
Detector= Peak
Trace mode= Max hold.
Sweep- auto couple.
- Mark the peak frequency and -6dB (upper and lower) frequency.
- Repeat until all the rest channels are investigated.

7.4. Test Data

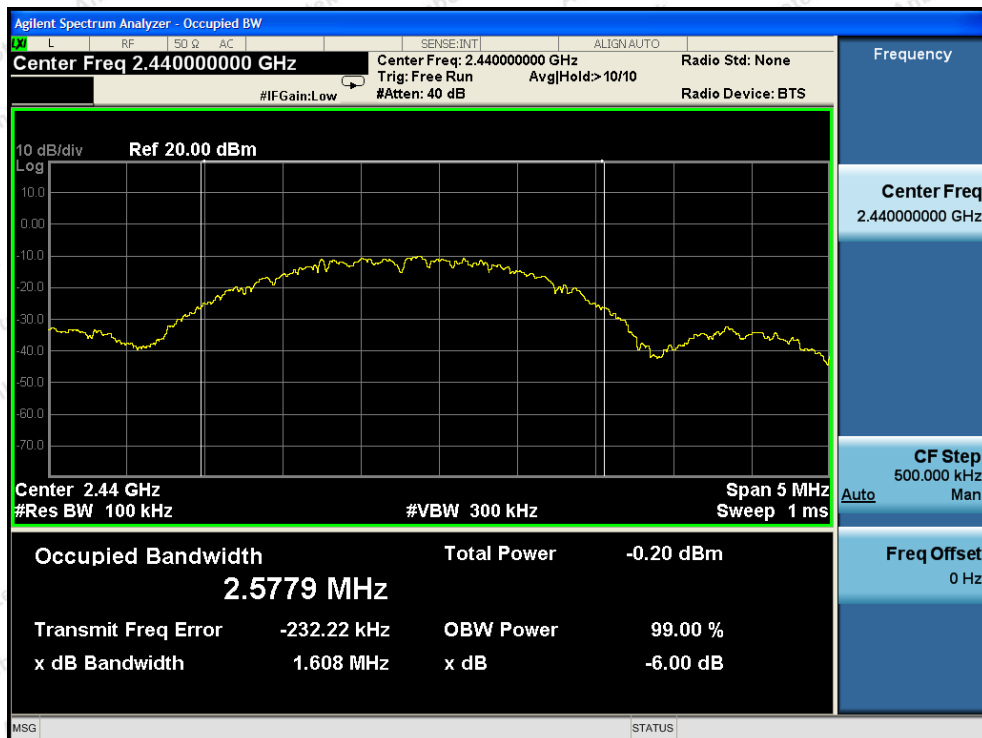
Test Item	: 6dB Bandwidth	Test Mode	: CH Low ~ CH High
Test Voltage	: AC 120V, 60Hz	Temperature	: 24℃
Test Result	: PASS	Humidity	: 55%RH

Module 1:

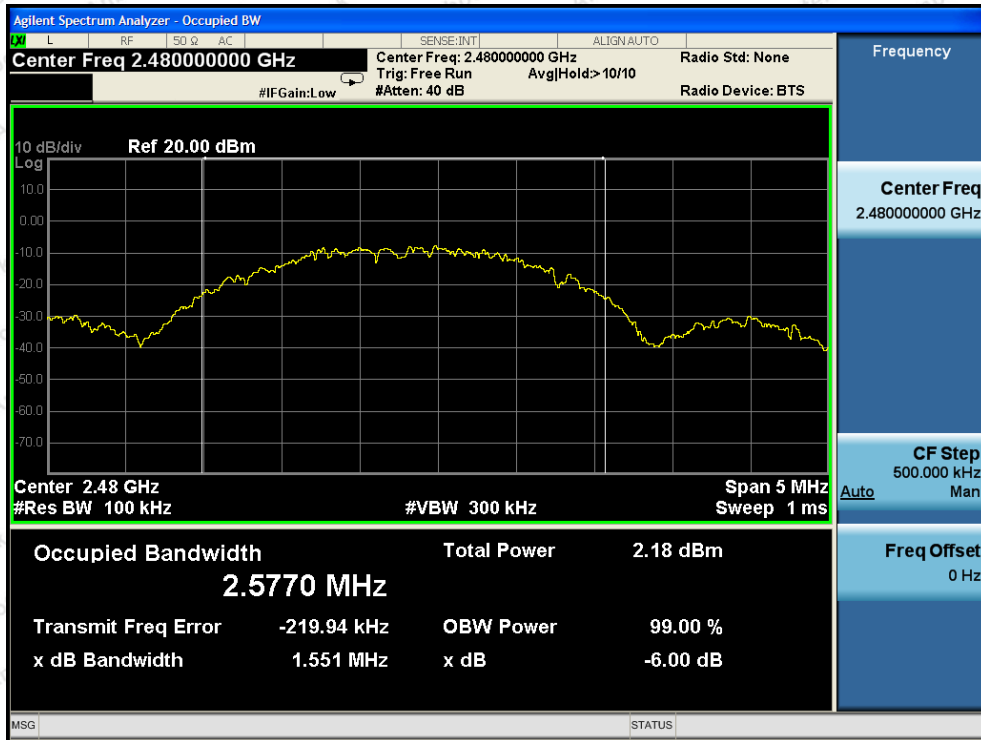
Channel	Frequency(MHz)	Bandwidth (kHz)	Limit (kHz)	Results
Low	2405	1616	>500	PASS
Middle	2440	1608		PASS
High	2480	1551		PASS



CH: Low



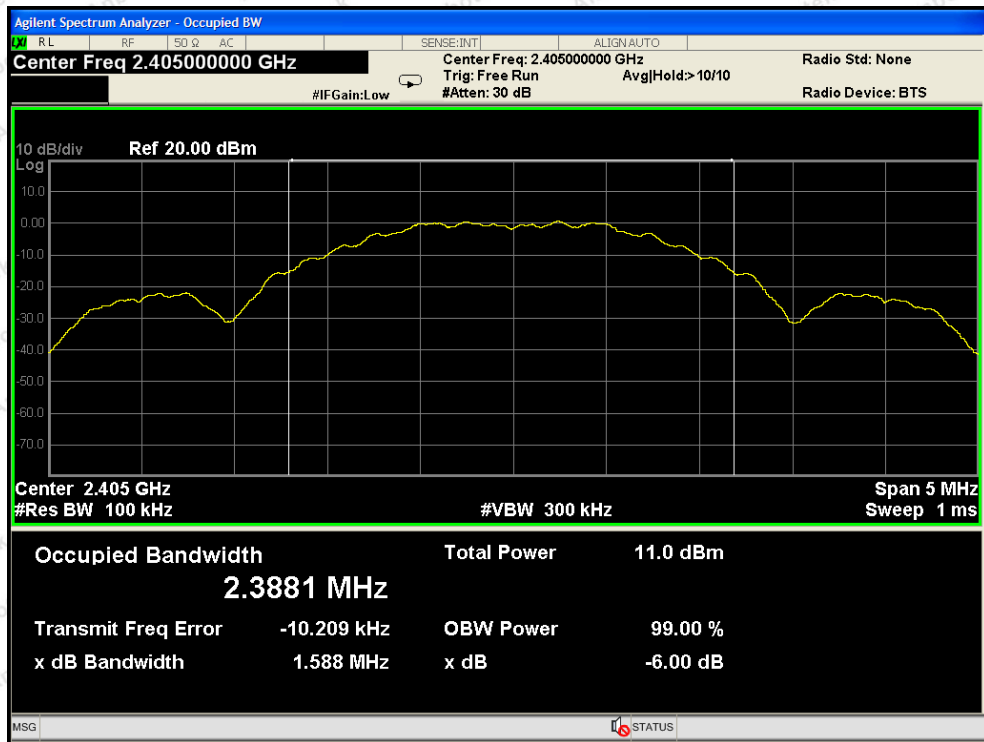
CH: Middle



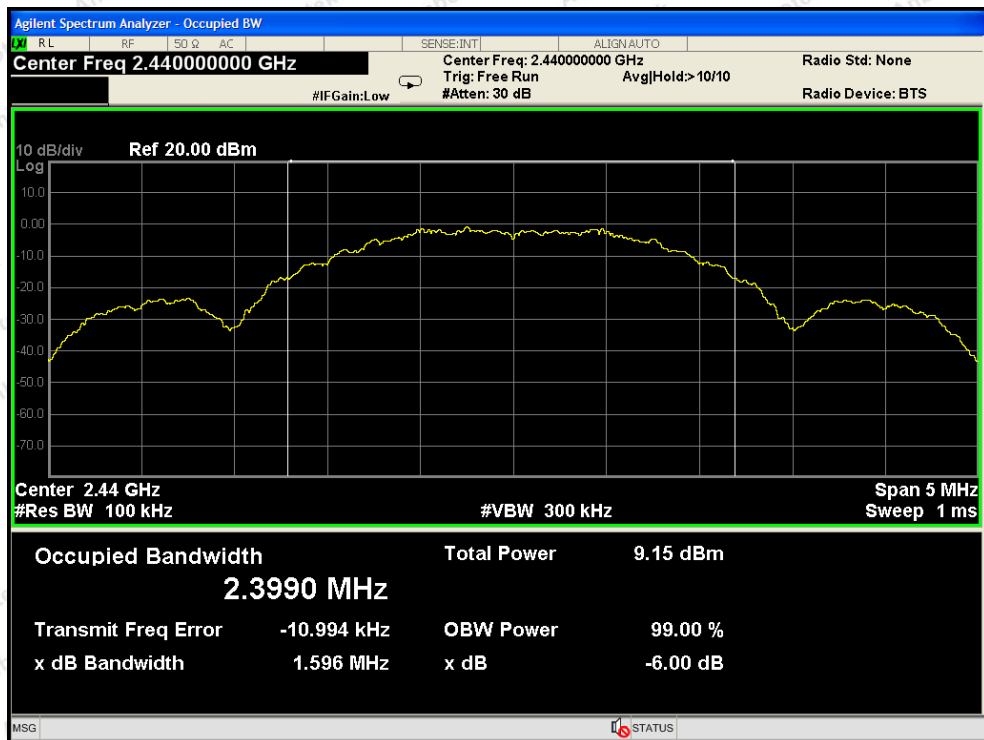
CH: High

Module 2:

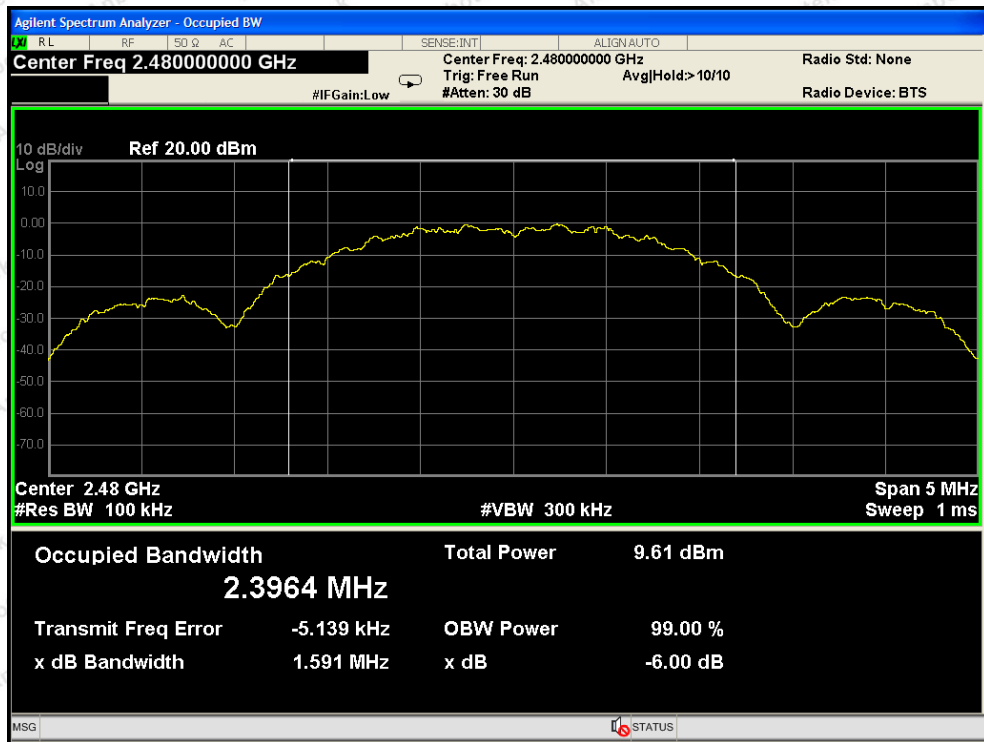
Channel	Frequency(MHz)	Bandwidth (kHz)	Limit (kHz)	Results
Low	2405	1588	>500	PASS
Middle	2440	1596		PASS
High	2480	1591		PASS



CH: Low



CH: Middle



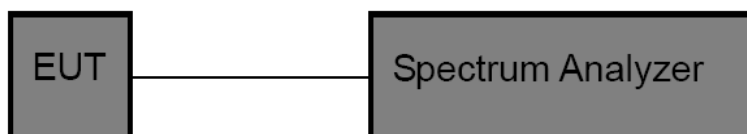
CH: High

8. Power Spectral Density Test

8.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (e)
Test Limit	8dBm

8.2. Test Setup



8.3. Test Procedure

1. Place the EUT on the table and set it in transmitting mode. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 1.5xDTS BW
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

8.4. Test Data

Test Item	: Power Spectral Density
Test Voltage	: AC 120V, 60Hz
Test Result	: PASS

Test Mode	: CH Low ~ CH High
Temperature	: 24℃
Humidity	: 55%RH

Module 1:

Channel	Frequency (MHz)	PSD (dBm/3KHz)	Limit (dBm/3KHz)	Results
Low	2405	-6.701	8.00	PASS
Middle	2440	-7.729	8.00	PASS
High	2480	-9.893	8.00	PASS

Module 2:

Channel	Frequency (MHz)	PSD (dBm/3KHz)	Limit (dBm/3KHz)	Results
Low	2405	-6.721	8.00	PASS
Middle	2440	-8.729	8.00	PASS
High	2480	-9.793	8.00	PASS

Module 1



CH: Low



CH: Middle



CH: High

Module 2



CH: Low



CH: Middle



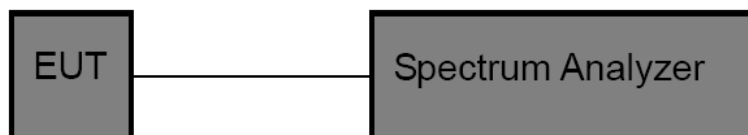
CH: High

9. 100kHz Bandwidth of Frequency Band Edge Requirement

9.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (d)
Test Limit	in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, 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).

9.2. Test Setup



9.3. Test Procedure

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.

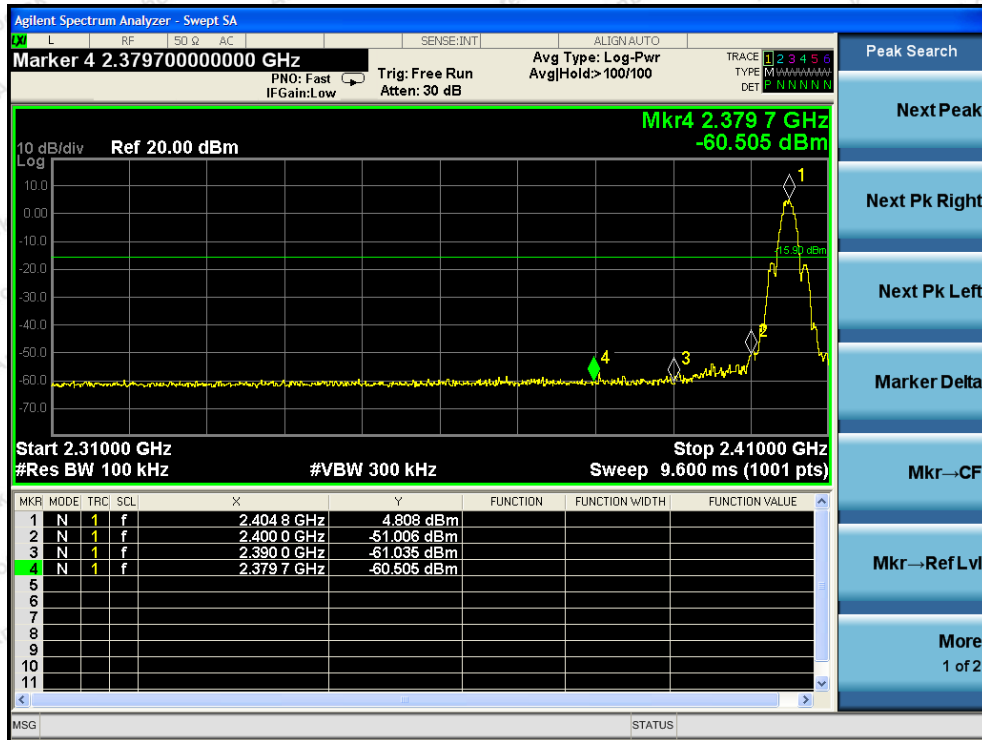
9.4. Test Data

Test Item : Band edge
Test Voltage : AC 120V, 60Hz
Test Result : PASS

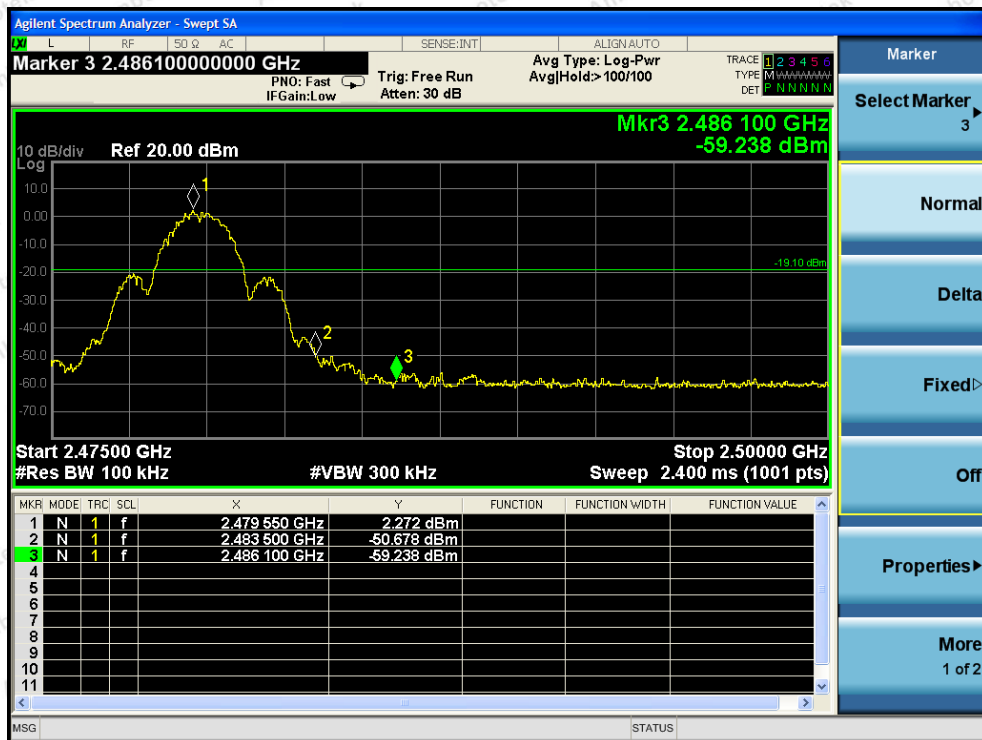
Test Mode : CH Low ~ CH High
Temperature : 24℃
Humidity : 55%RH

Module 1:

Frequency Band (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Results
2405	55.814	>30	PASS
2483.5	52.950	>30	PASS



CH: Low



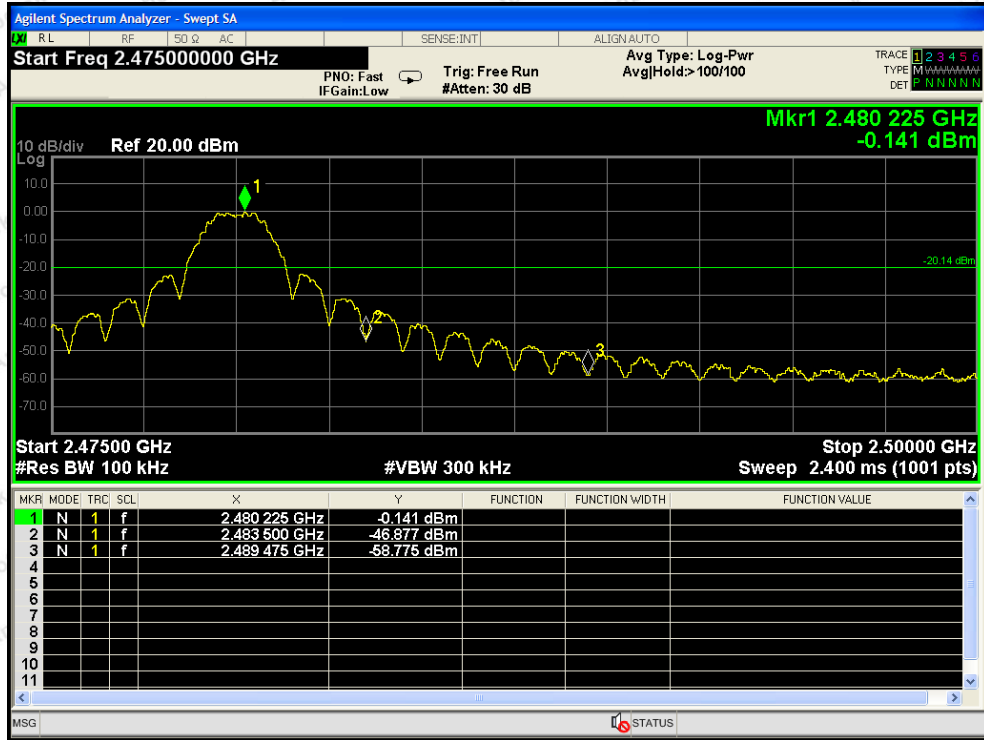
CH: High

Module 2:

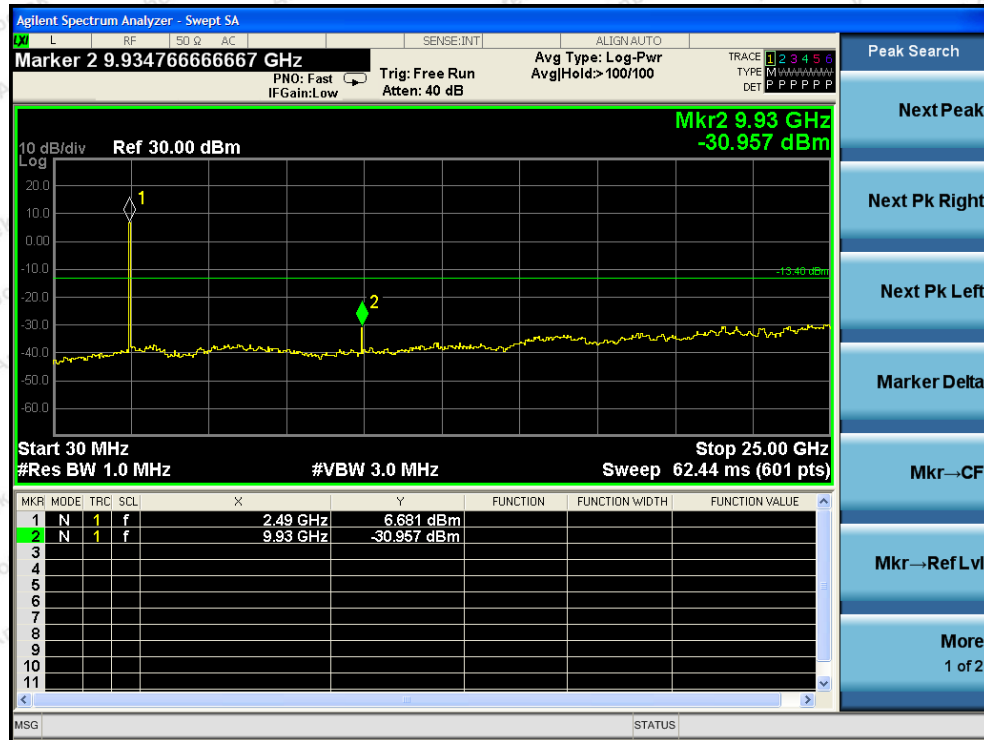
Frequency Band (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Results
2405	40.467	>30	PASS
2483.5	46.736	>30	PASS



CH: Low



CH: High



CH: High

Remark: The Conducted Emission Method was tested on (Module 1, Module 2) modes, only the worst data of (Module 1) is attached in the following pages.

10. Antenna Requirement

10.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203 /247(c)
Requirement	1) 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. 2) 15.247(c) (1)(i) requirement: Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

10.2. Antenna Connected Construction

The antenna is a FPCB antenna which permanently attached, and the best case gain of the antenna is 5 dBi. It complies with the standard requirement.

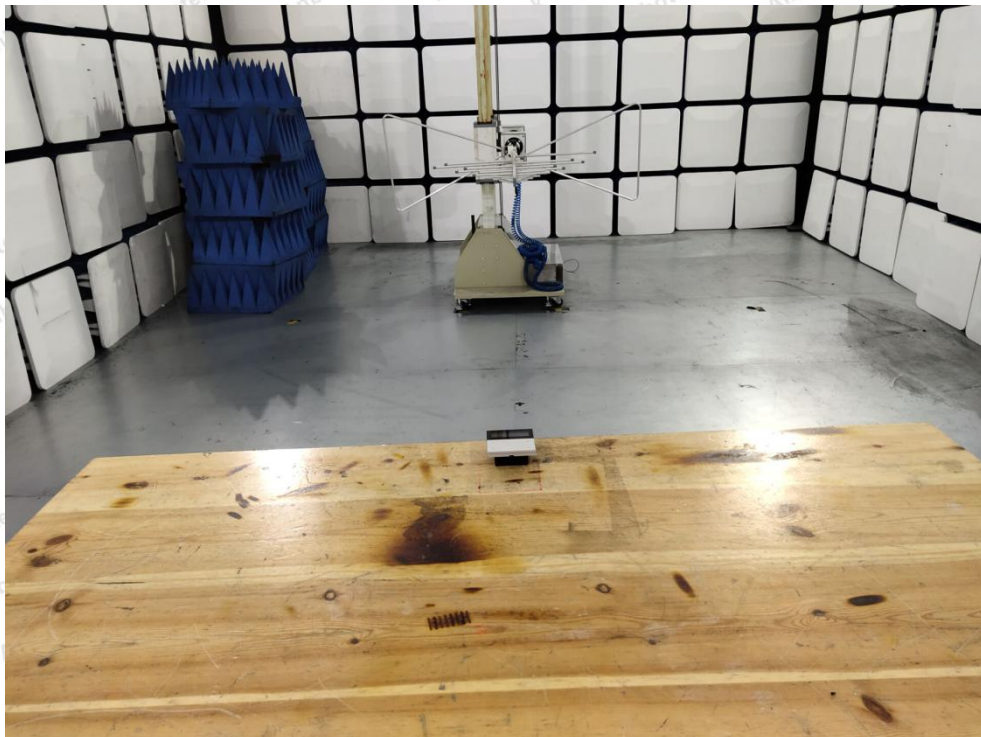


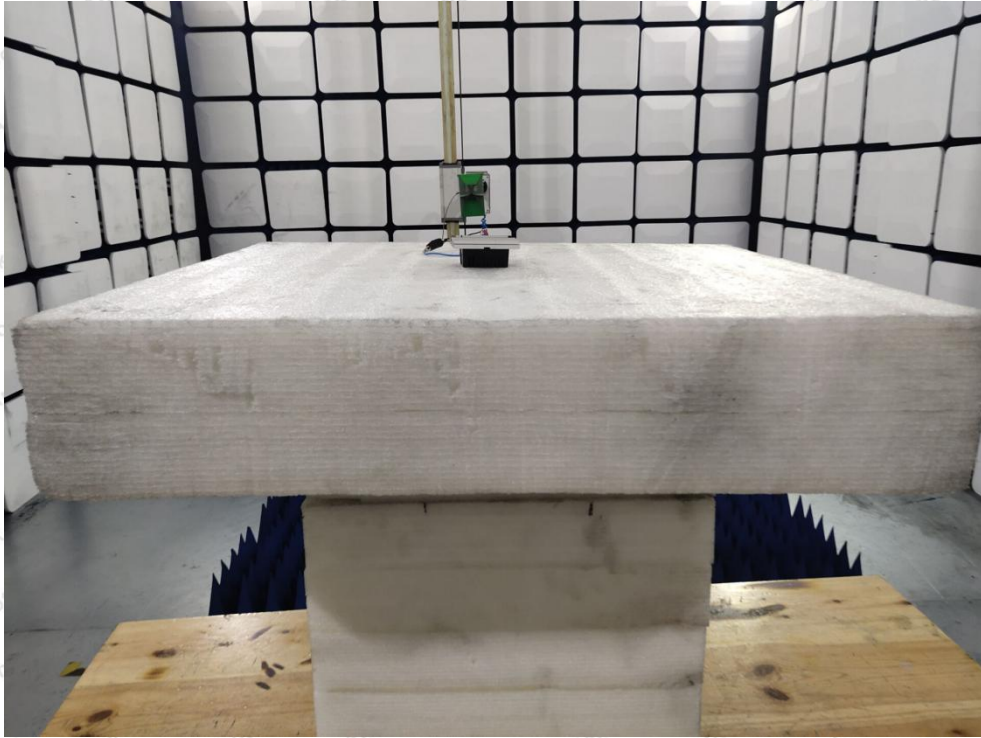
APPENDIX I -- TEST SETUP PHOTOGRAPH

Photo of Conducted Emission Measurement

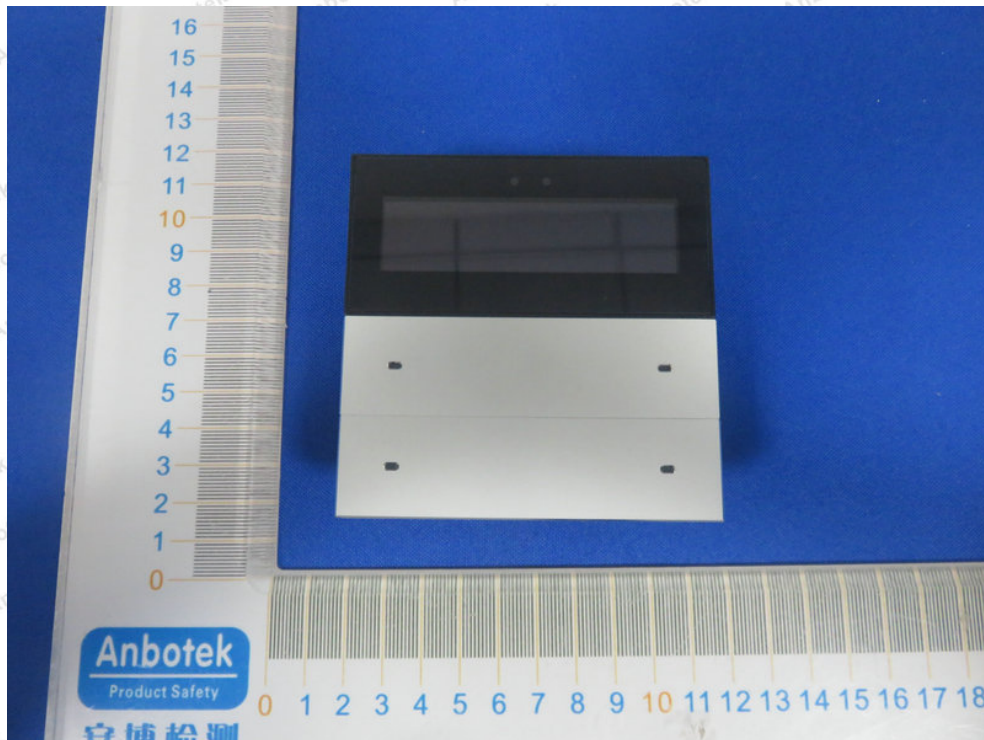


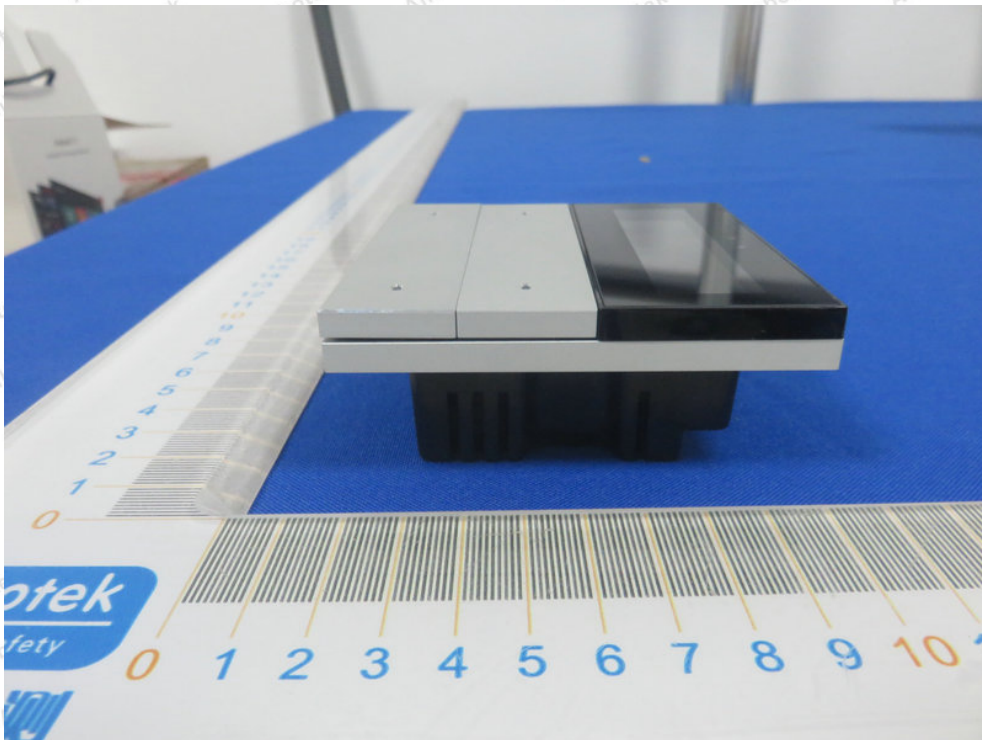
Photo of Radiation Emission Test



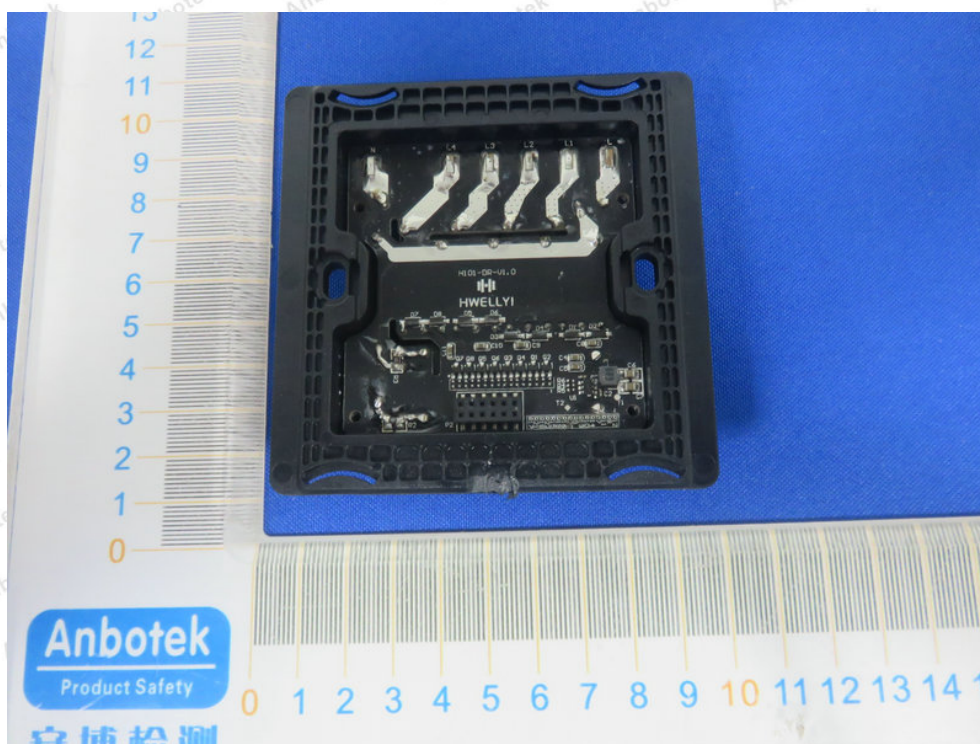


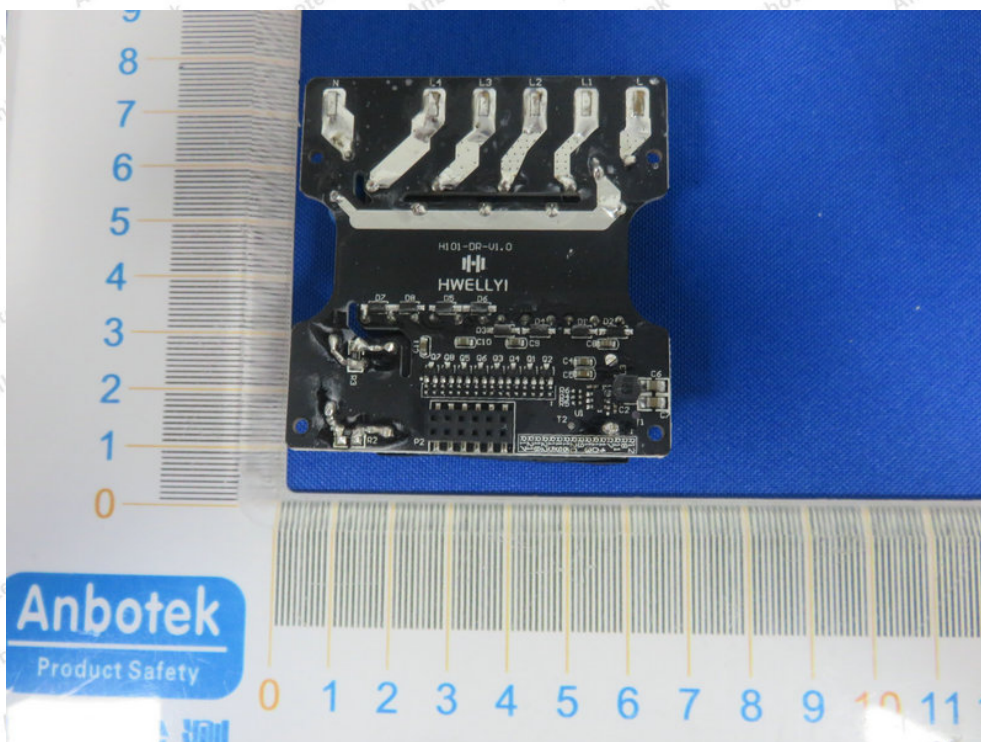
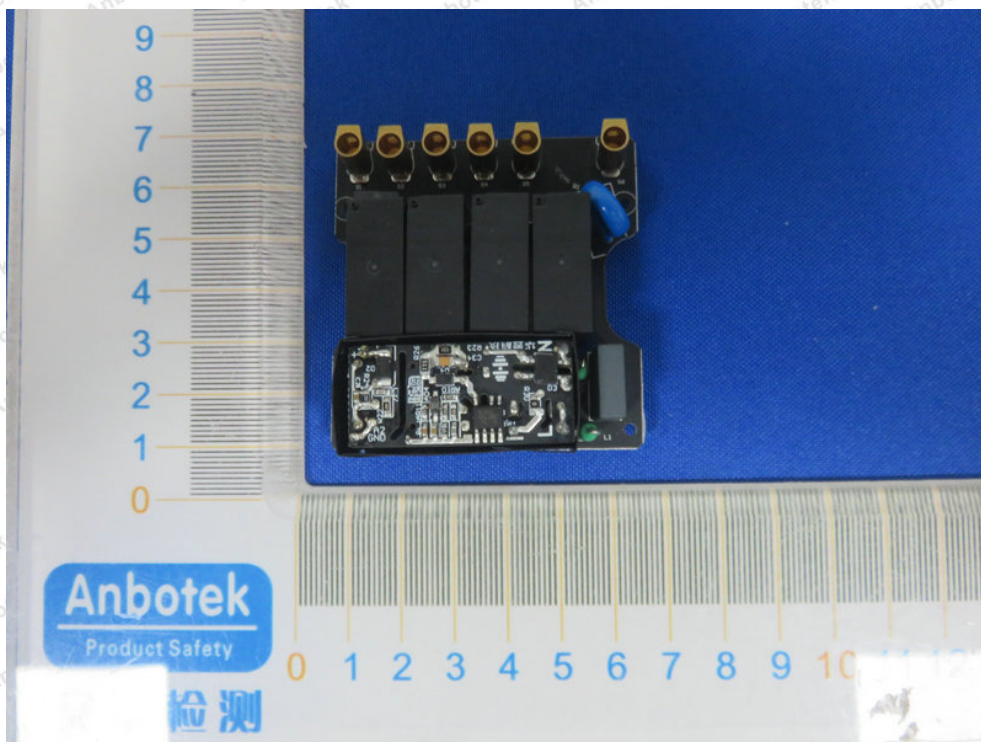
APPENDIX II -- EXTERNAL PHOTOGRAPH

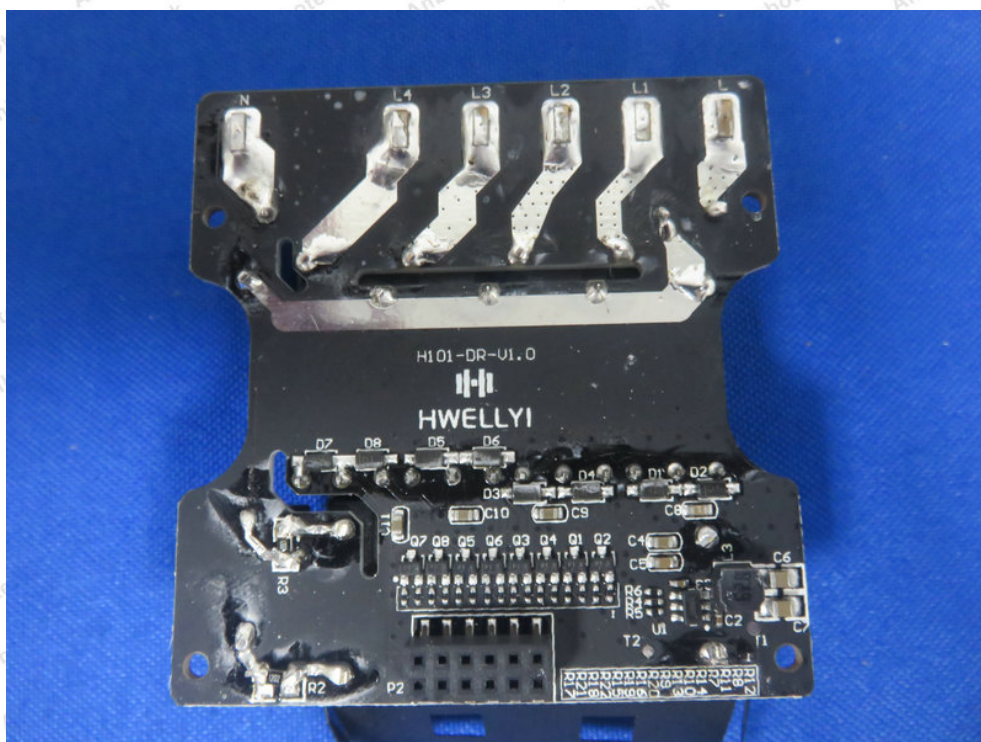
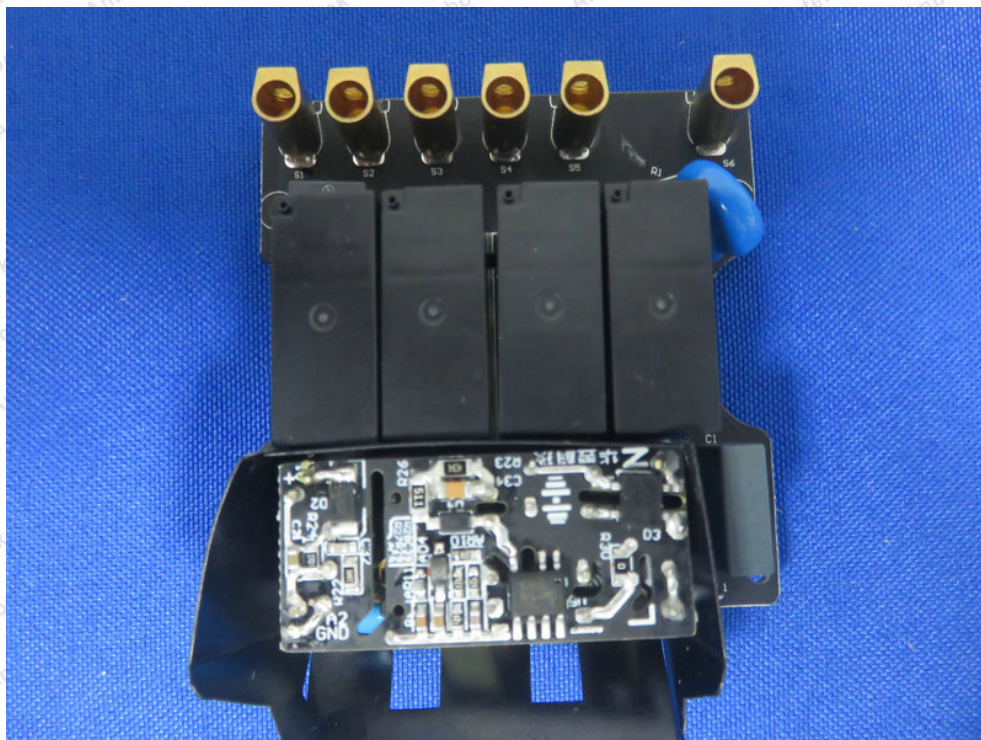


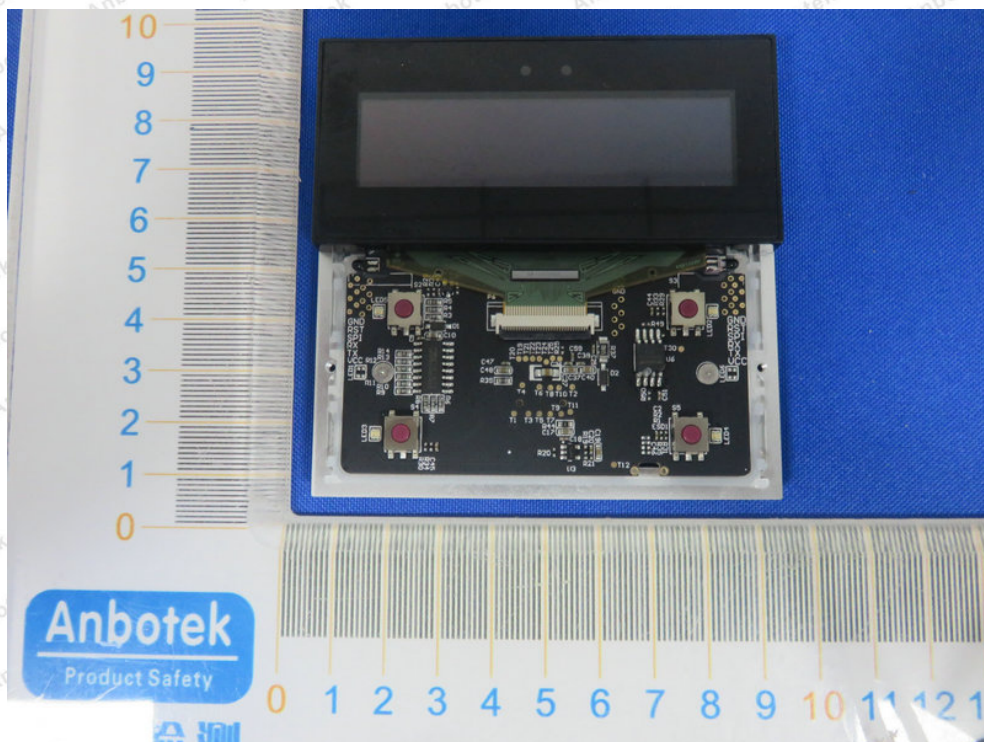


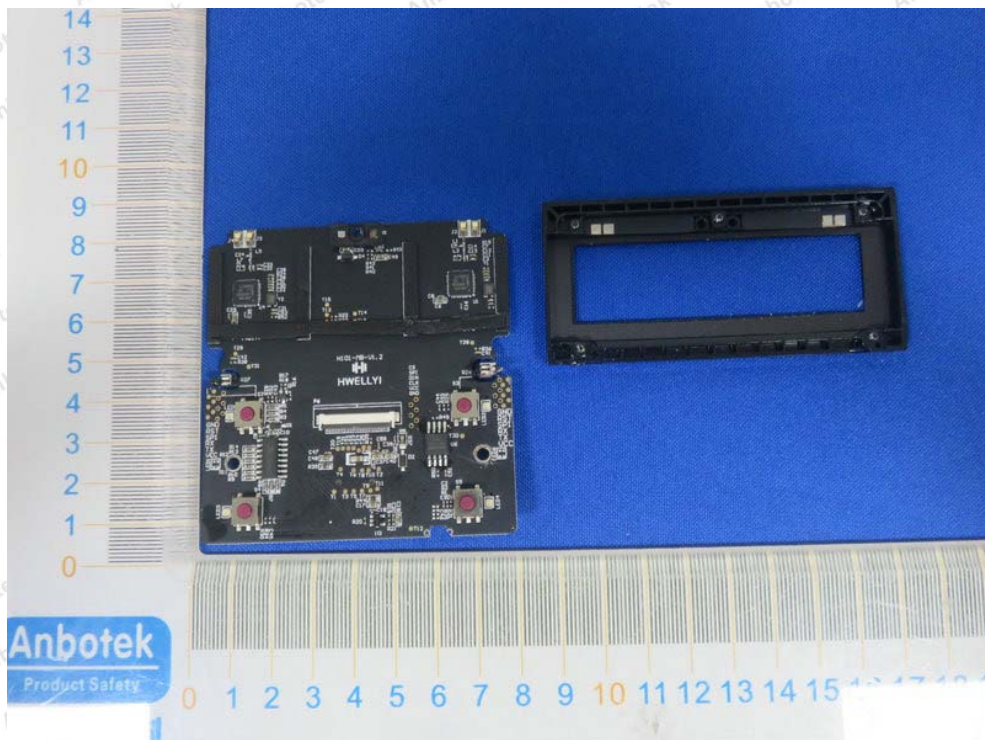
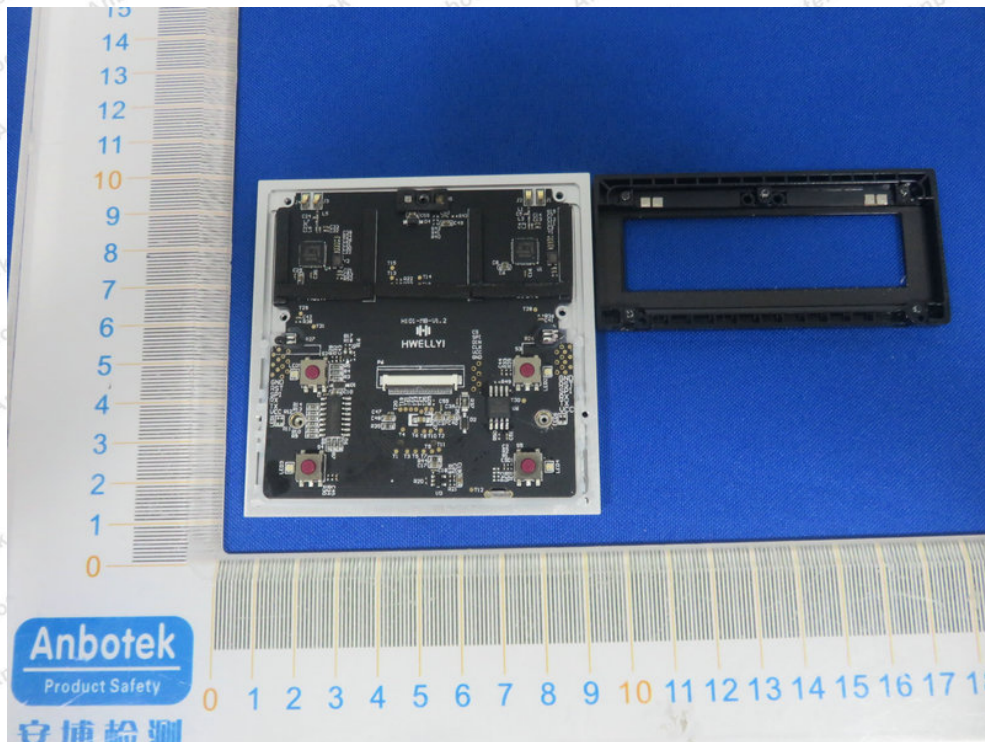


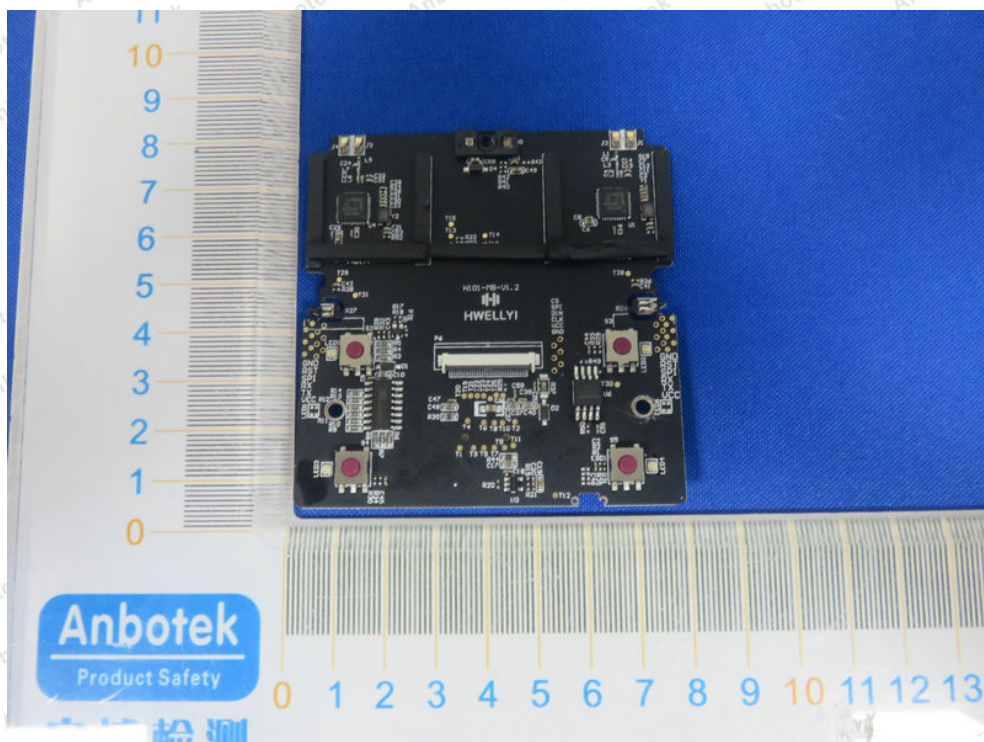
APPENDIX III -- INTERNAL PHOTOGRAPH

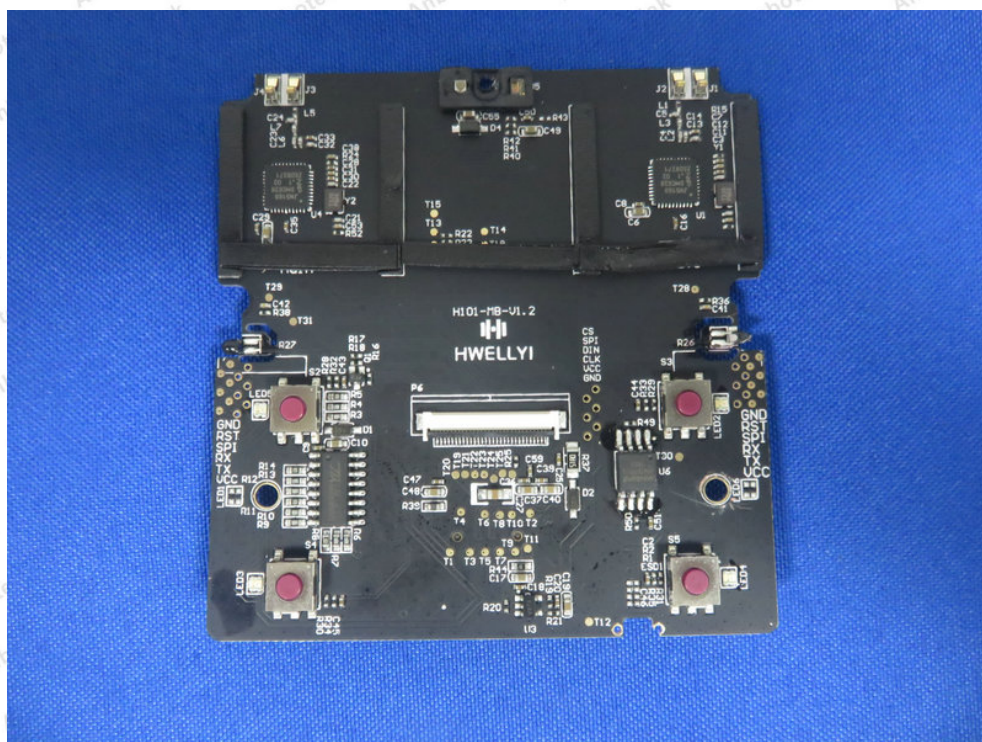
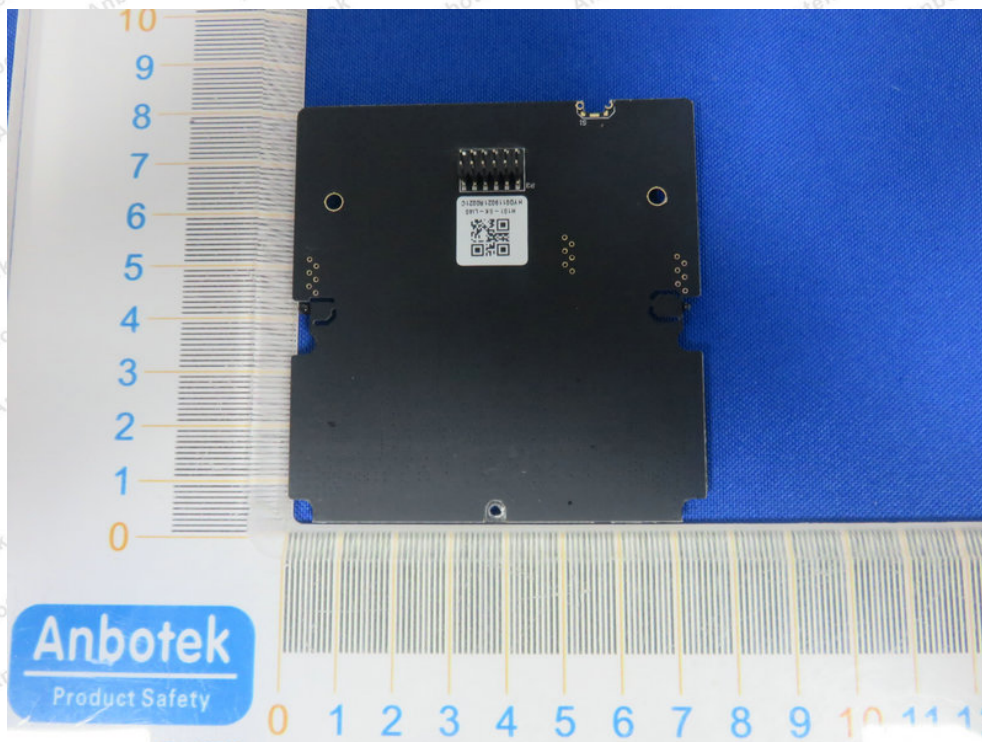


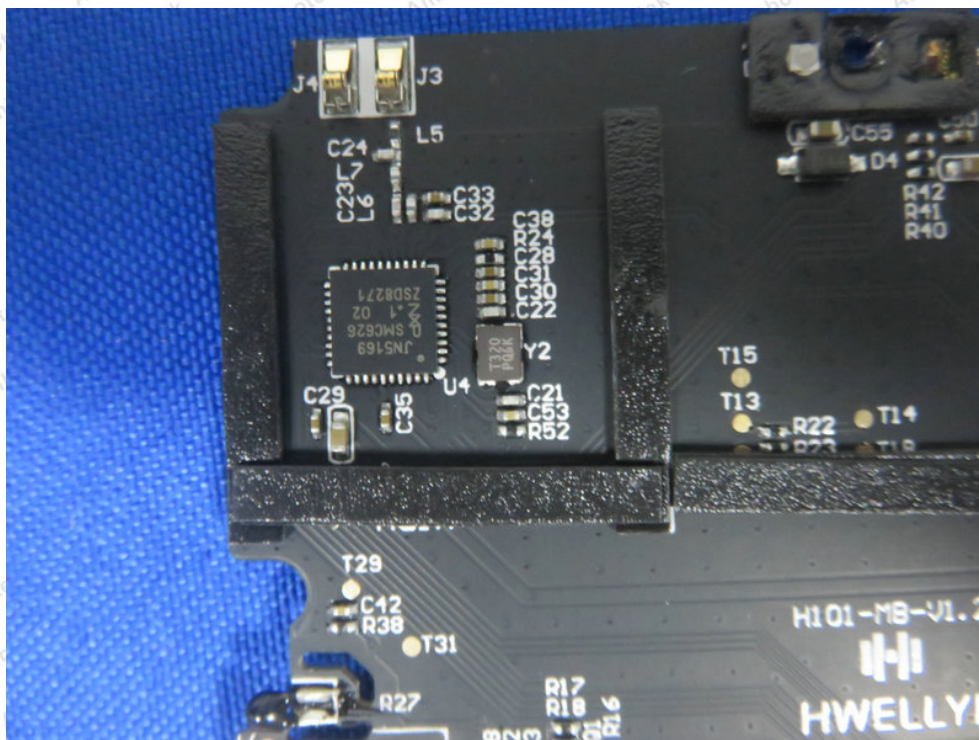
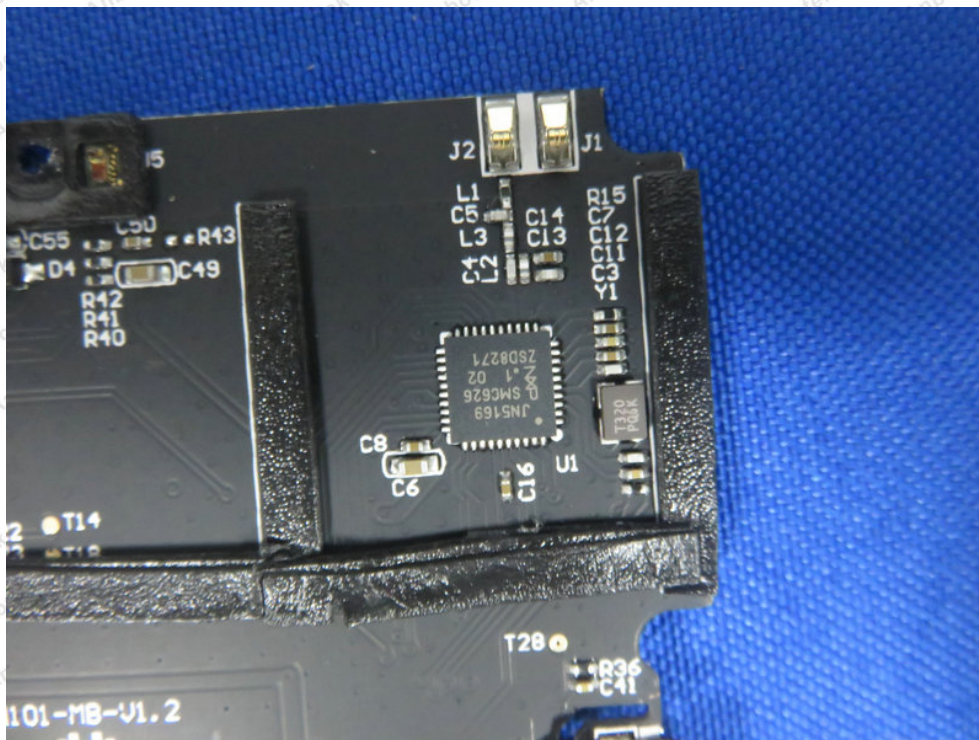












----- End of Report -----