FCC TEST REPORT

Client Name	:	Beijing Lingyu century Information Technology Co.,Ltd.
Address	:	Room 101-05, 2f, building 20, yard 1, Baosheng South Road, Haidian District, Beijing, China
Product Name	:	NOLO Headset Marker
Date	:	Feb. 18, 2020

Shenzhen Anbotek Compliance Laboratory Limited

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TEST REPORT

Applicant	:	Beijing Lingyu century Information Technology Co.,Ltd.
Manufacturer	:	Beijing Lingyu century Information Technology Co.,Ltd.
Product Name	:	NOLO Headset Marker
Model No.	:	CV1 Air
Trade Mark	:	NOLO
Rating(s)	:	Input: DC 5V, 60mA, 0.3W

Test Standard(s)	**:**	**FCC Part15 Subpart C, Paragraph 15.249**
Test Method(s)	**:**	**ANSI C63.10: 2013**

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 Receipt	Nov. 18, 2019
Date of Test	Nov. 18~Dec. 21, 2019
Prepared by	(Engineer / Dolly Mo)
Reviewer	(Supervisor / Bibo Zhang)
Approved & Authorized Signer	(Manager / Tom Chen)

1. General Information

1.1. Client Information

Applicant	:	Beijing Lingyu century Information Technology Co.,Ltd.
Address	:	Room 101-05, 2f, building 20, yard 1, Baosheng South Road, Haidian District, Beijing, China
Manufacturer	:	Beijing Lingyu century Information Technology Co.,Ltd.
Address	:	Room 101-05, 2f, building 20, yard 1, Baosheng South Road, Haidian District, Beijing, China
Factory	:	SHENZHEN YONGJIA ELECTRONIC TECHNOLOGY CO.,LTD.
Address	:	SHENZHEN PNGSHAN LONGTIAN STREET LONGTIAN COMMUNITY YINGZHAN ELECTRONIC TECHNOLOGY(SHENZHEN) CO.,LTD.PARK B5B BUILDING 301 EAST.P,R CHINA

1.2. Description of Device (EUT)

Product Name	:	NOLO Headset Marker	
Model No.	:	CV1 Air	
Trade Mark	:	NOLO	
Test Power Supply	:	AC 120V, 60Hz for MacBook Air	
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)	
Product Description	:	Operation Frequency:	2402~2475MHz
		Number of Channel:	3 Channels
		Modulation Type:	GFSK
		Antenna Type:	FPC Antenna
		Antenna Gain(Peak):	ANT A: 1 dBi ANT B: 1 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

MacBook Air	:	Model: A1466 Input: 14.85V/3.05A CMIIT ID:C02HXB48DRVC
		Adapter:
		Input: AC 100-240V, 1A, 50-60Hz Output: 14.85V/3.05A

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
Mode 2	CH02
Mode 3	CH03

For Conducted Emission	
Final Test Mode	Description
Mode 1	CH01
Mode 2	CH02
Mode 3	CH03

For Radiated Emission	
Final Test Mode	Description
Mode 1	CH01
Mode 2	CH02
Mode 3	CH03

Note:

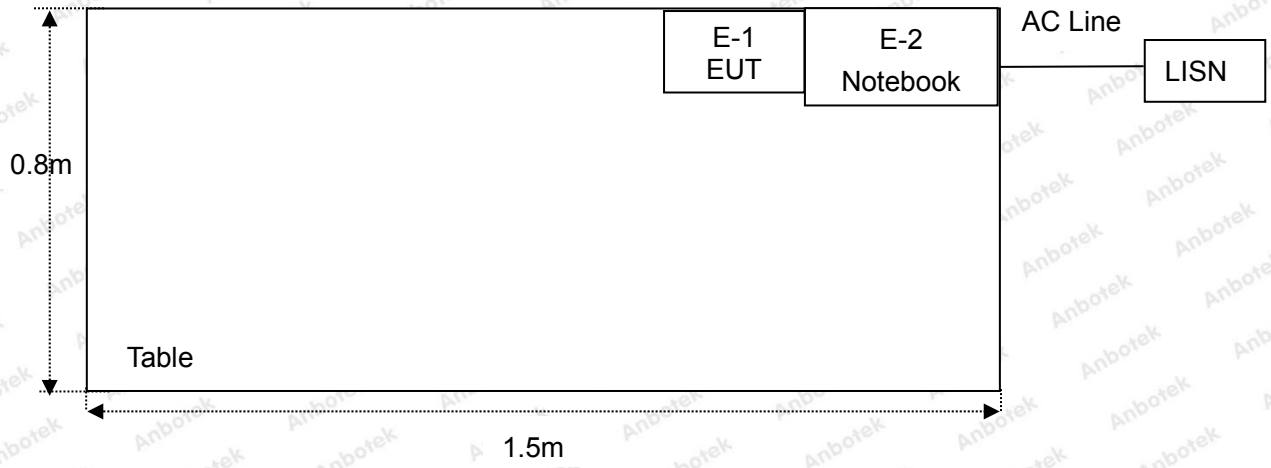
1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.

1.5. List of Channels

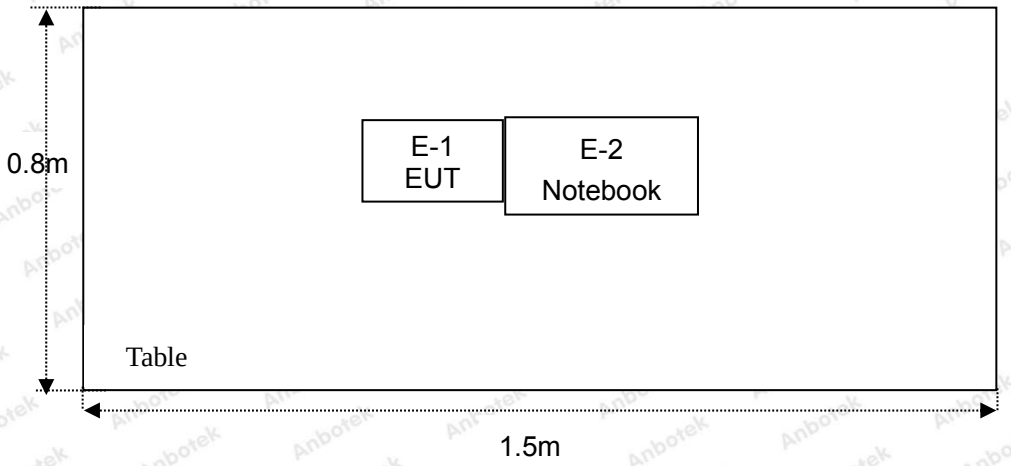
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	2402	2	2441	3	2475

1.6. Description of Test Setup

CE



RE



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. 04, 2019	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESPI3	101604	Nov. 04, 2019	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Nov. 04, 2019	1 Year
4.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 04, 2019	1 Year
5.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	Nov. 04, 2019	1 Year
6.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Nov. 01, 2019	1 Year
7.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 01, 2019	1 Year
8.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Nov. 01, 2019	1 Year
9.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Nov. 01, 2019	1 Year
10.	Pre-amplifier	SONOMA	310N	186860	Nov. 04, 2019	1 Year
11.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
12.	RF Test Control System	YIHENG	YH3000	2017430	Nov. 04, 2019	1 Year
13.	Power Sensor	DAER	RPR3006W	15I00041SN045	Nov. 04, 2019	1 Year
14.	Power Sensor	DAER	RPR3006W	15I00041SN046	Nov. 04, 2019	1 Year
15.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 04, 2019	1 Year
16.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Nov. 04, 2019	1 Year
17.	Signal Generator	Agilent	E4421B	MY41000743	Nov. 04, 2019	1 Year
18.	DC Power Supply	LW	TPR-6420D	374470	Nov. 04, 2019	1 Year
19.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Nov. 04, 2019	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 Anbotek Compliance Laboratory Limited, EMC Laboratory has been registed 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, September 27, 2019.

ISED-Registration No.: 8058A

Shenzhen Anbotek 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, March 07, 2019.

Test Location

Shenzhen Anbotek 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

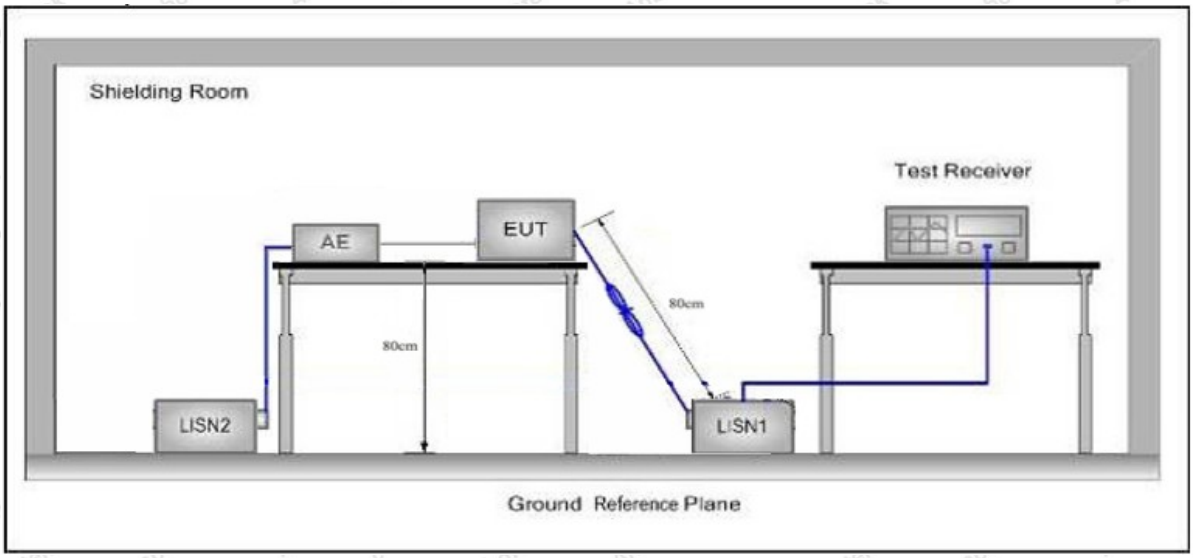
Standard Section	Test Item	Result
15.203	Antenna Requirement	PASS
15.207	Conducted Emission	PASS
15.249	Radiated Emission	PASS
15.215(c)	20dB Bandwidth	PASS
15.249(c)	Band Edge	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

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 NOLO Headset Marker (ESCI) set at 9kHz.

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

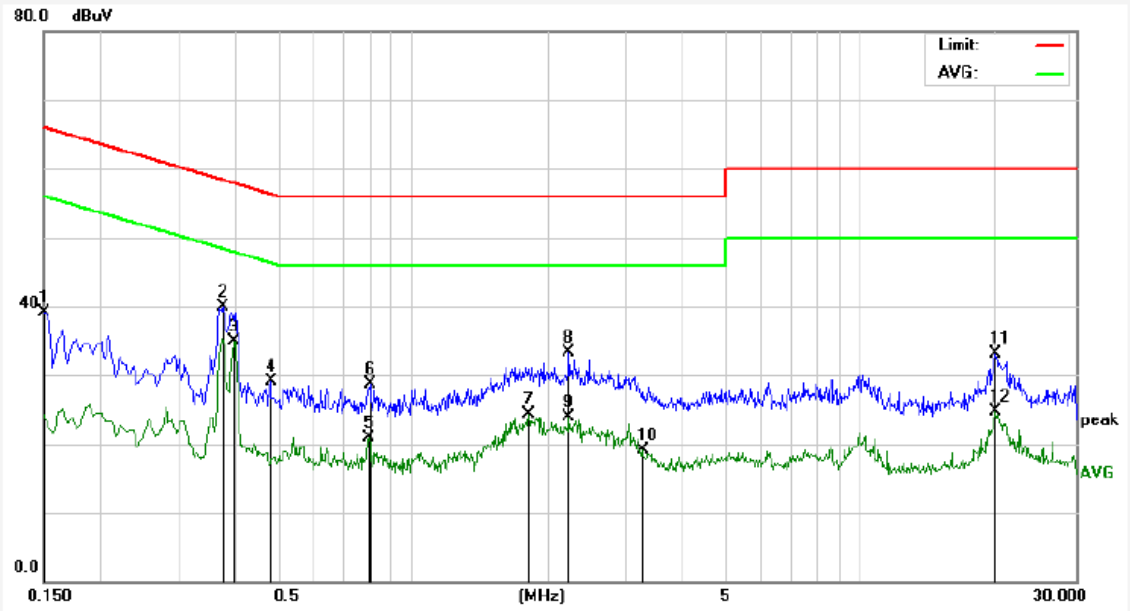
3.4. Test Data

PASS

During the test, pre-scan all the modes, and found the Low channel which is the worst case, only the worst case is recorded in the report.

Conducted Emission Test Data

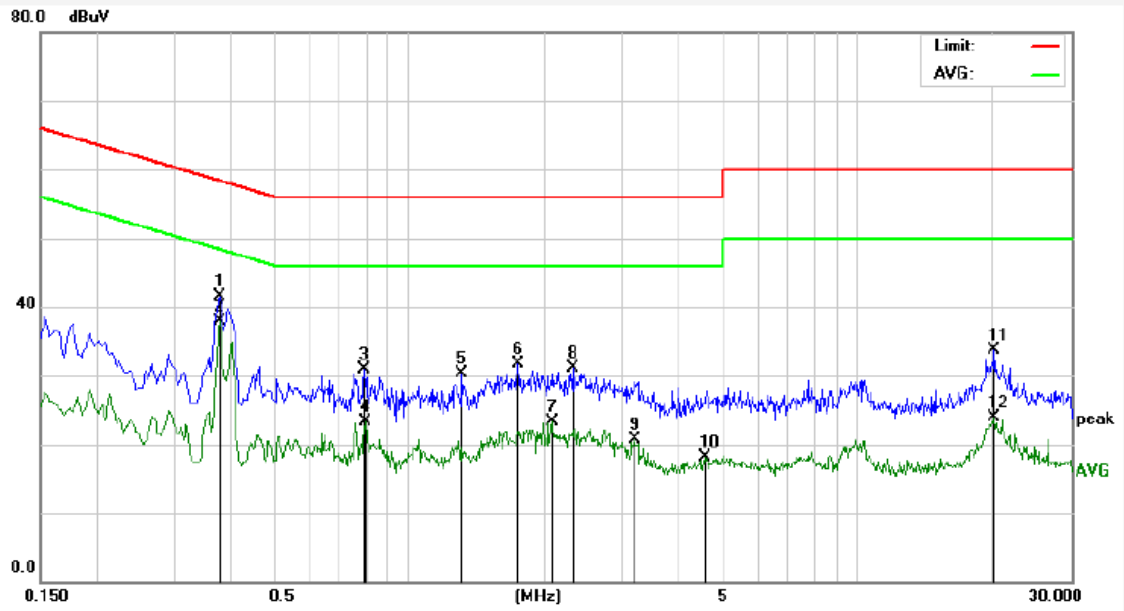
Test Site: 1# Shielded Room
Operating Condition: CH 01
Test Specification: AC 120V, 60Hz for MacBook Air
Comment: Live Line
Tem.: 22.5℃ Hum.: 52%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1500	19.20	19.90	39.10	65.99	-26.89	QP	
2	0.3780	20.05	19.93	39.98	58.32	-18.34	QP	
3	0.3980	15.01	19.93	34.94	47.89	-12.95	AVG	
4	0.4820	9.11	19.97	29.08	56.30	-27.22	QP	
5	0.7980	0.87	20.07	20.94	46.00	-25.06	AVG	
6	0.8020	8.72	20.07	28.79	56.00	-27.21	QP	
7	1.8180	4.08	20.14	24.22	46.00	-21.78	AVG	
8	2.2340	13.20	20.14	33.34	56.00	-22.66	QP	
9	2.2340	3.75	20.14	23.89	46.00	-22.11	AVG	
10	3.2460	-1.06	20.16	19.10	46.00	-26.90	AVG	
11	19.8900	12.75	20.34	33.09	60.00	-26.91	QP	
12	19.8900	4.29	20.34	24.63	50.00	-25.37	AVG	

Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: CH 01
Test Specification: AC 120V, 60Hz for MacBook Air
Comment: Neutral Line
Tem.: 22.5℃ Hum.: 52%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.3780	21.49	19.93	41.42	58.32	-16.90	QP	
2	0.3780	18.04	19.93	37.97	48.32	-10.35	AVG	
3	0.7940	10.78	20.06	30.84	56.00	-25.16	QP	
4	0.7980	3.17	20.07	23.24	46.00	-22.76	AVG	
5	1.3140	10.09	20.13	30.22	56.00	-25.78	QP	
6	1.7460	11.65	20.13	31.78	56.00	-24.22	QP	
7	2.0780	3.17	20.14	23.31	46.00	-22.69	AVG	
8	2.3100	10.89	20.15	31.04	56.00	-24.96	QP	
9	3.1820	0.52	20.16	20.68	46.00	-25.32	AVG	
10	4.5580	-2.16	20.19	18.03	46.00	-27.97	AVG	
11	20.2300	13.40	20.34	33.74	60.00	-26.26	QP	
12	20.2300	3.61	20.34	23.95	50.00	-26.05	AVG	

4. Radiated 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.

Test Standard	FCC Part15 C Section 15.249					
Test Limit	Frequency (MHz)	Field Strength of fundamental ((millivolts /meter)	Field Strength of Harmonics (microvolts/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	2400~2483.5	50	-	114.0	Peak	3
	2400~2483.5	50	-	94.0	Average	3
	2400~2483.5	-	500	74.0	Peak	3
	2400~2483.5	-	500	54.0	Average	3

Remark:
(1) 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

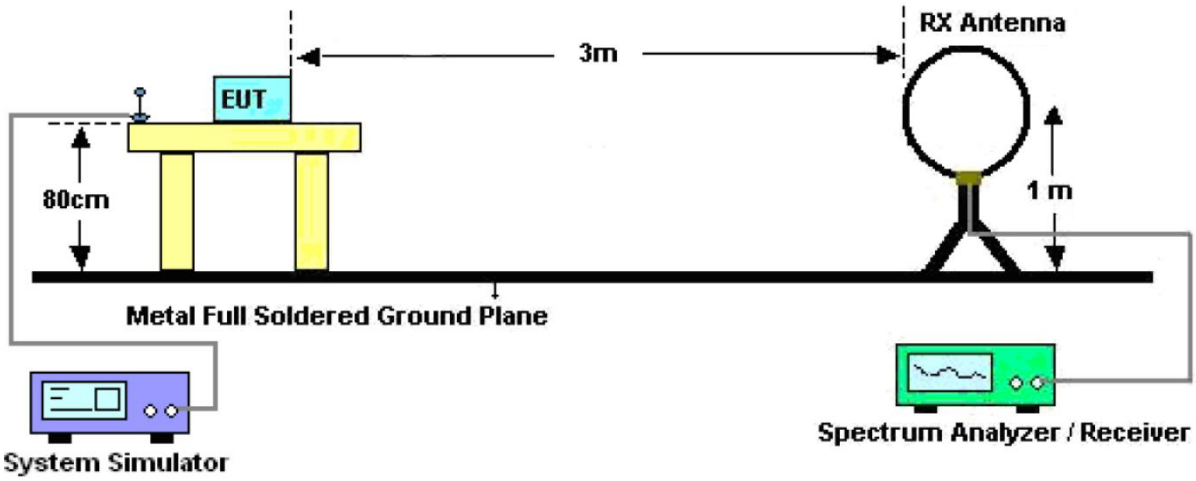


Figure 2. 30MHz to 1GHz

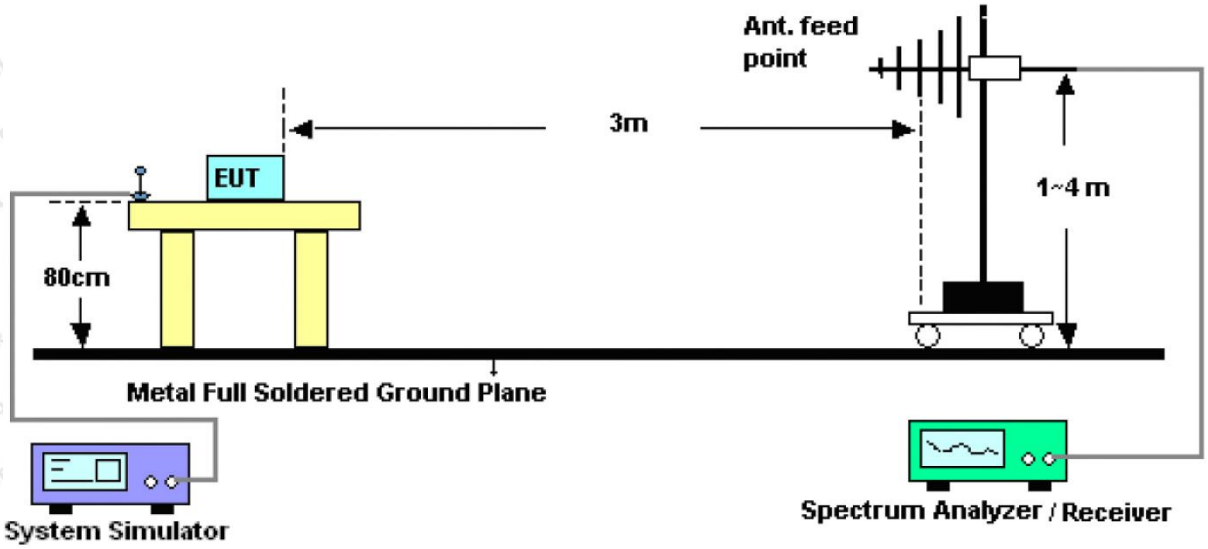
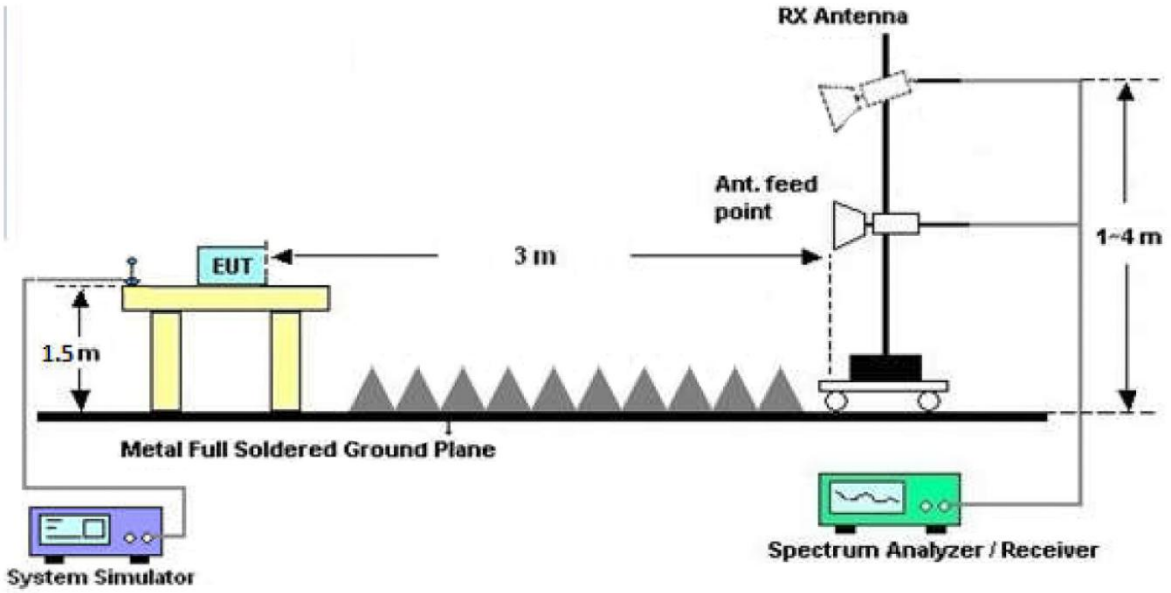


Figure 3. Above 1 GHz



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 the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

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

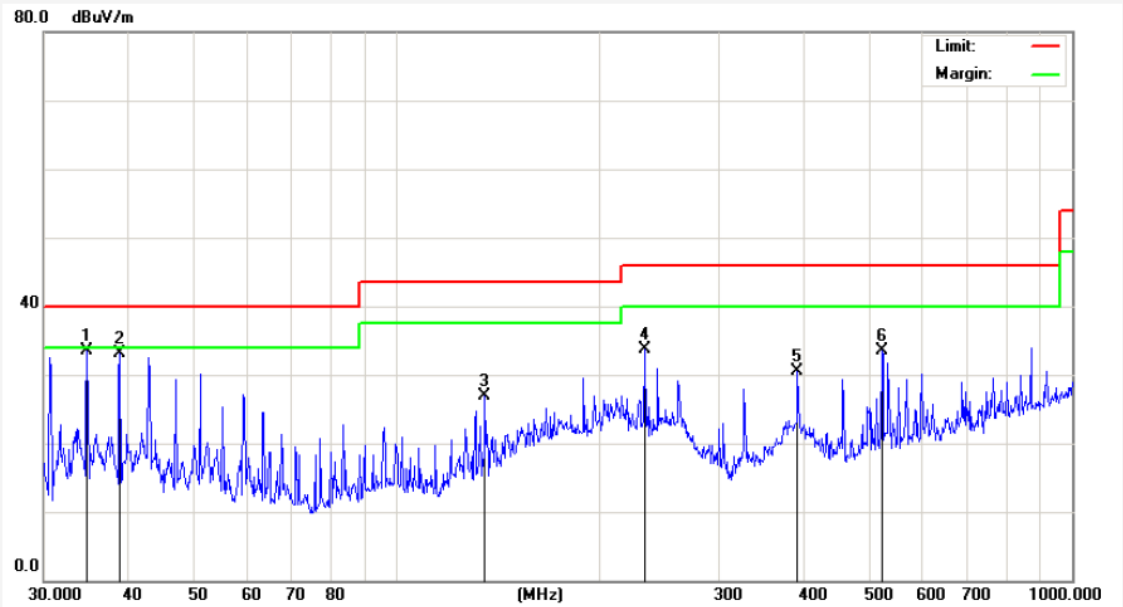
During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

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

During the test, pre-scan all the modes, and found the ANT A + ANT B works which is the worst case, only the worst case is recorded in the report

Test Results (30~1000MHz)

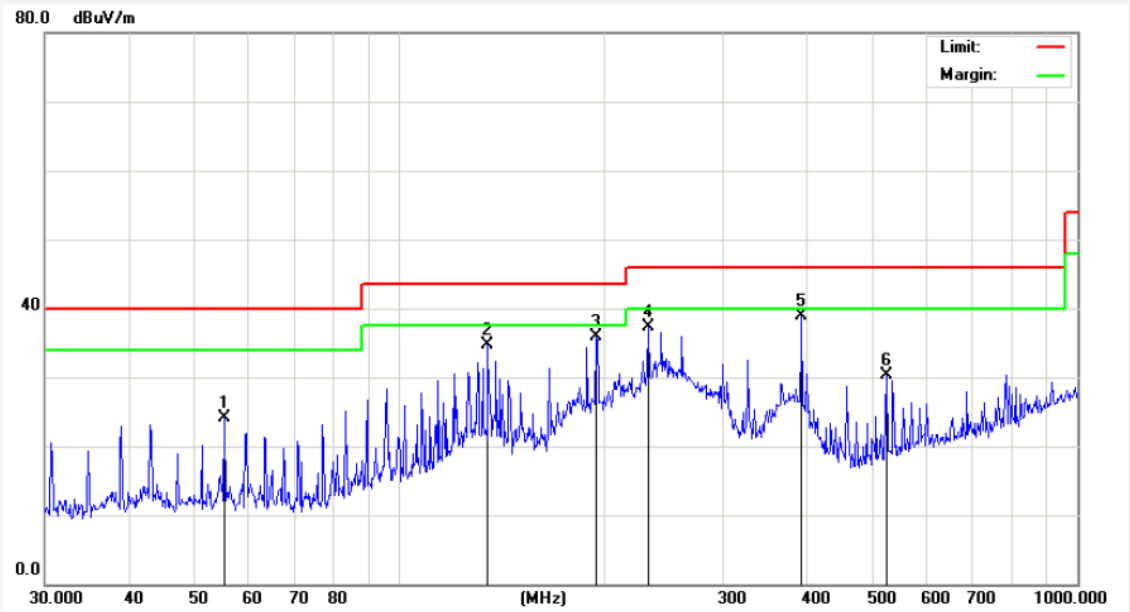
Test Mode:	Mode 2
Power Source:	AC 120V, 60Hz for MacBook Air
Polarization:	Vertical
Temp.(℃)/Hum.(%RH):	23℃/54%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	34.7602	51.74	-18.18	33.56	40.00	-6.44	QP	100	0	
2	38.8878	50.24	-17.08	33.16	40.00	-6.84	QP	100	360	
3	135.0319	47.67	-20.76	26.91	43.50	-16.59	QP	100	0	
4	233.3487	50.24	-16.55	33.69	46.00	-12.31	QP	100	360	
5	392.0951	44.88	-14.42	30.46	46.00	-15.54	QP	100	0	
6	522.7180	46.09	-12.57	33.52	46.00	-12.48	QP	100	360	

Test Results (30~1000MHz)

Test Mode:	Mode 2
Power Source:	AC 120V, 60Hz for MacBook Air
Polarization:	Horizontal
Temp.(℃)/Hum.(%RH):	23℃/54%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	55.2207	42.30	-18.22	24.08	40.00	-15.92	QP	100	360	
2	135.0319	59.87	-25.21	34.66	43.50	-8.84	QP	100	0	
3	195.1365	58.52	-22.60	35.92	43.50	-7.58	QP	100	360	
4	232.5318	58.33	-20.97	37.36	46.00	-8.64	QP	100	0	
5	392.0951	54.42	-15.42	39.00	46.00	-7.00	QP	100	360	
6	522.7180	43.38	-13.02	30.36	46.00	-15.64	QP	100	0	

Test Results (1GHz-25GHz)

Test Mode: CH01 (Low channel)									
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.	Detector
2402.0000	93.66	31.12	2.18	35.33	91.63	114.00	-22.37	V	Peak
2402.0000	83.45	31.12	2.18	35.33	81.42	94.00	-12.58	V	AVG
4804.0000	49.56	34.01	2.58	34.65	51.50	74.00	-22.50	V	Peak
4804.0000	40.92	34.01	2.58	34.65	42.86	54.00	-11.14	V	AVG
7206.0000	47.95	36.16	2.97	35.07	52.01	74.00	-21.99	V	Peak
7206.0000	37.14	36.16	2.97	35.07	41.20	54.00	-12.80	V	AVG
9608.0000	*								
12010.0000	*								
14412.0000	*								
16814.0000	*								
2402.0000	93.41	31.12	2.18	35.33	91.38	114.00	-22.62	H	Peak
2402.0000	82.35	31.12	2.18	35.33	80.32	94.00	-13.68	H	AVG
4804.0000	47.01	34.01	2.58	34.65	48.95	74.00	-25.05	H	Peak
4804.0000	40.67	34.01	2.58	34.65	42.61	54.00	-11.39	H	AVG
7206.0000	47.83	36.16	2.97	35.07	51.89	74.00	-22.11	H	Peak
7206.0000	35.31	36.16	2.97	35.07	39.37	54.00	-14.63	H	AVG
9608.0000	*								
12010.0000	*								
14412.0000	*								
16814.0000	*								

Note:

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

2. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.

3. The data that ANT A + ANT B works at the same time is a worst case.

Test Mode: CH02 (Middle channel)									
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.	Detector
2441.0000	94.26	31.12	2.20	34.51	93.07	114.00	-20.93	V	Peak
2441.0000	85.64	31.22	2.20	34.51	84.55	94.00	-9.45	V	AVG
4882.0000	47.92	34.98	2.49	34.14	51.25	74.00	-22.75	V	Peak
4882.0000	40.22	34.98	2.49	34.14	43.55	54.00	-10.45	V	AVG
7323.0000	46.02	36.01	3.01	34.56	50.48	74.00	-23.52	V	Peak
7323.0000	35.96	36.01	3.01	34.56	40.42	54.00	-13.58	V	AVG
9764.0000	*								
12205.0000	*								
14646.0000	*								
17087.0000	*								
2441.0000	95.80	31.12	2.20	34.51	94.61	114.00	-19.39	H	Peak
2441.0000	83.71	31.12	2.20	34.51	82.52	94.00	-11.48	H	AVG
4882.0000	48.49	34.98	2.49	34.14	51.82	74.00	-22.18	H	Peak
4882.0000	38.84	34.98	2.49	34.14	42.17	54.00	-11.83	H	AVG
7323.0000	48.44	36.01	3.01	34.56	52.90	74.00	-21.10	H	Peak
7323.0000	38.53	36.01	3.01	34.56	42.99	54.00	-11.01	H	AVG
9764.0000	*								
12205.0000	*								
14646.0000	*								
17087.0000	*								

Note:

1. Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.
3. The data that ANT A + ANT B works at the same time is a worst case

Address: 1/F., Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86) 755-26066440 Fax: (86) 755-26014772 Email: service@anbotek.com
Hotline 400-003-0500
www.anbotek.com

Test Mode: CH03(High channel)									
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.	Detector
2475.0000	94.96	31.65	2.23	36.07	92.77	114.00	-21.23	V	Peak
2475.0000	82.12	31.65	2.23	36.07	79.93	94.00	-14.07	V	AVG
4950.0000	47.81	35.06	2.60	34.93	50.54	74.00	-23.46	V	Peak
4950.0000	41.33	35.06	2.60	34.93	44.06	54.00	-9.94	V	AVG
7425.0000	46.14	36.19	3.12	35.11	50.34	74.00	-23.66	V	Peak
7425.0000	37.85	36.19	3.12	35.11	42.05	54.00	-11.95	V	AVG
9900.0000	*								
12375.0000	*								
14850.0000	*								
17325.0000	*								
2475.0000	96.69	31.65	2.23	36.07	94.50	114.00	-19.50	H	Peak
2475.0000	85.24	31.65	2.23	36.07	83.05	94.00	-10.95	H	AVG
4950.0000	49.68	35.06	2.60	34.93	52.41	74.00	-21.59	H	Peak
4950.0000	40.07	35.06	2.60	34.93	42.80	54.00	-11.20	H	AVG
7425.0000	46.56	36.19	3.12	35.11	50.76	74.00	-23.24	H	Peak
7425.0000	36.45	36.19	3.12	35.11	40.65	54.00	-13.35	H	AVG
9900.0000	*								
12375.0000	*								
14850.0000	*								
17325.0000	*								

Note:

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

2. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.

3. The data that ANT A + ANT B works at the same time is a worst case

Address: 1/F., Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.
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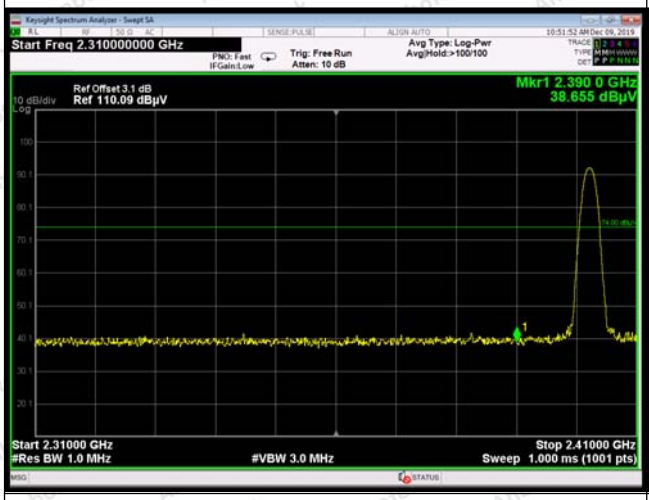
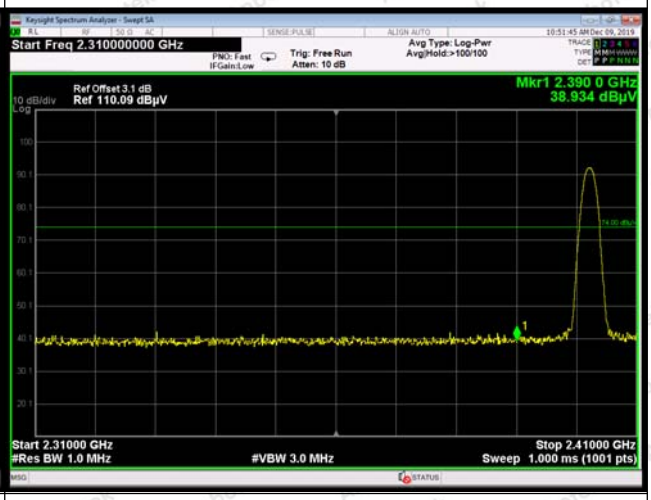
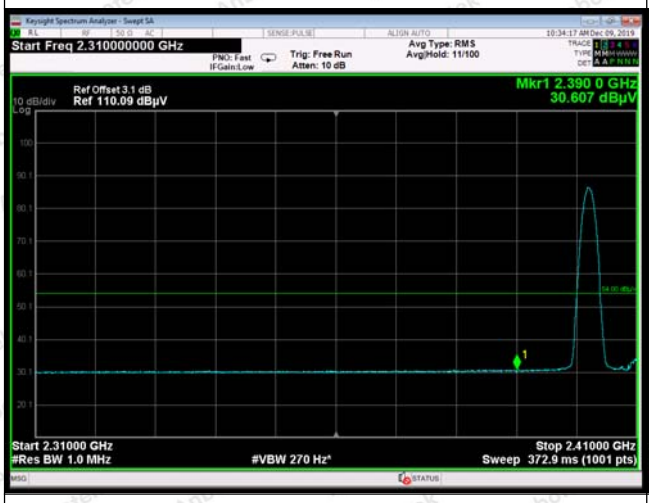
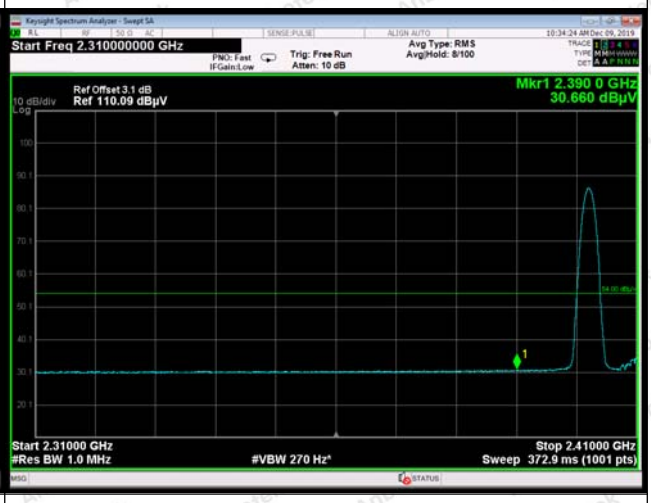
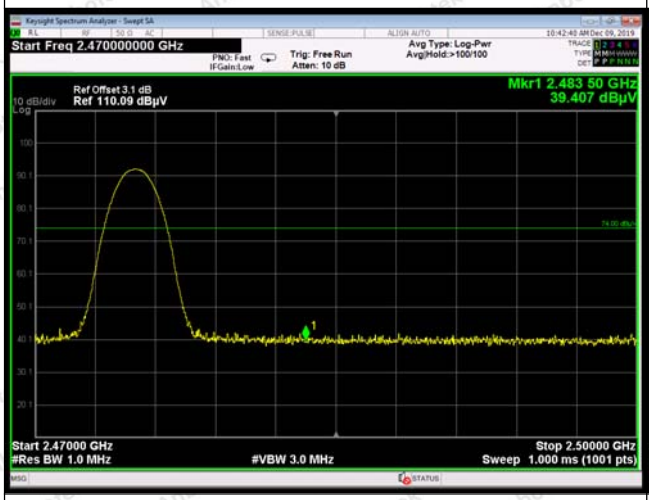
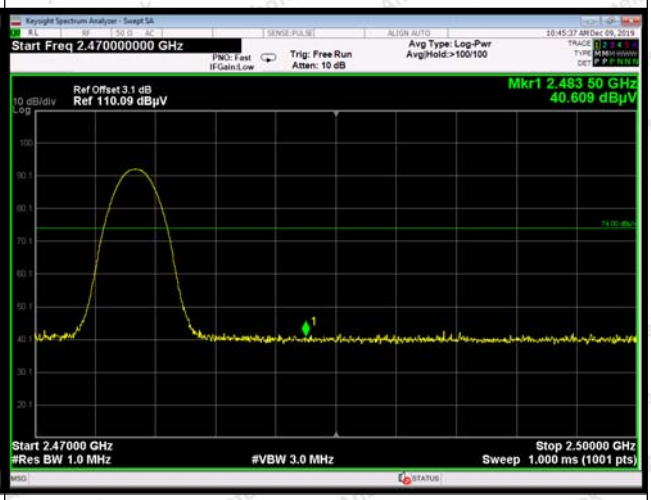
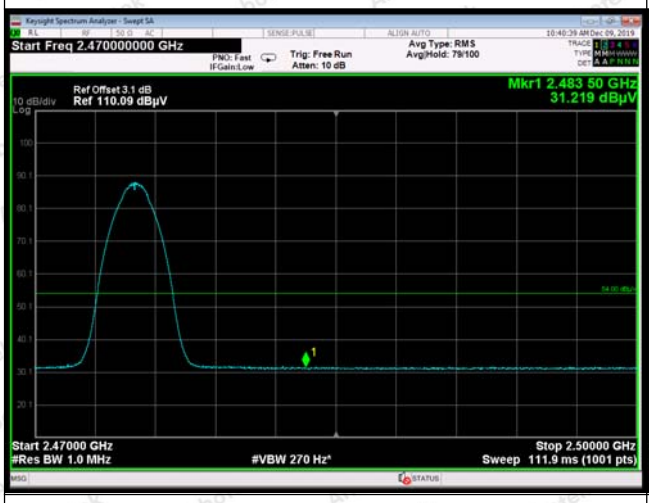
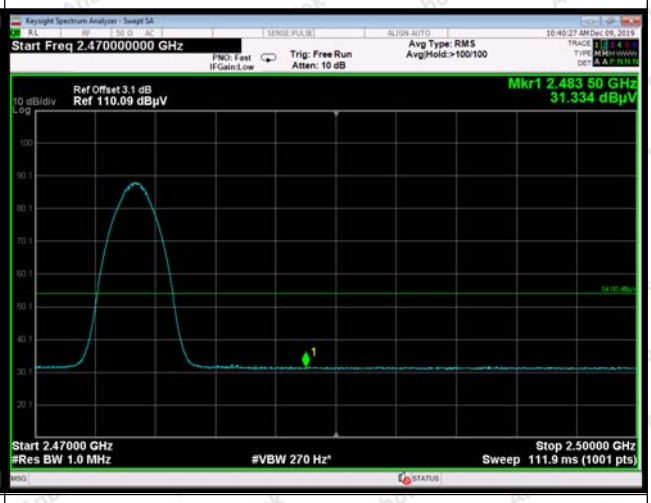
Hotline 400-003-0500
www.anbotek.com

Radiated Band Edge:

ANT A:

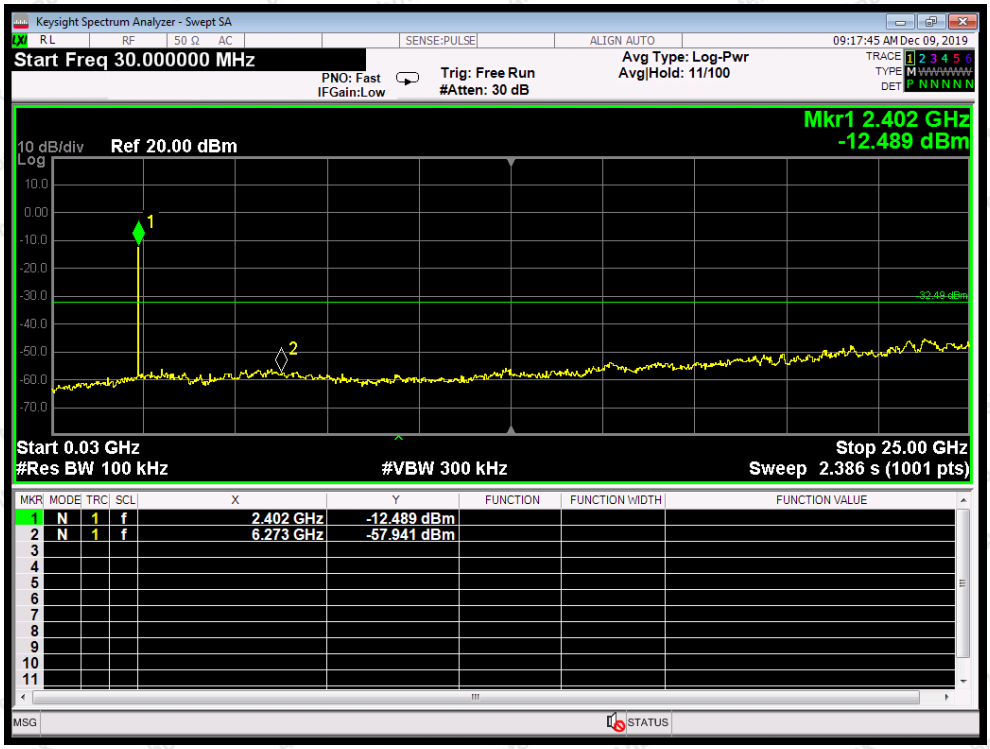
Test Mode: CH01	Test channel: Lowest
	
Peak Value(Vertical)	Peak Value(Horizontal)
	
Average Value(Vertical)	Average Value(Horizontal)

Test Mode: CH03	Test channel: Highest
	
Peak Value(Vertical)	Peak Value(Horizontal)
	
Average Value(Vertical)	Average Value(Horizontal)

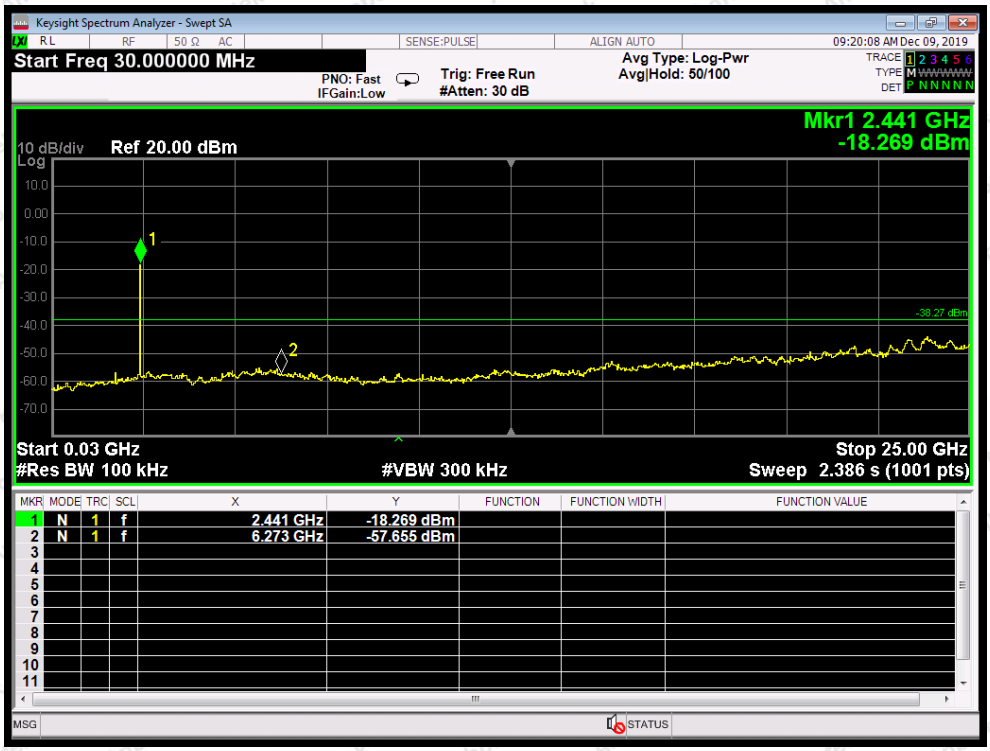
Remark:

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

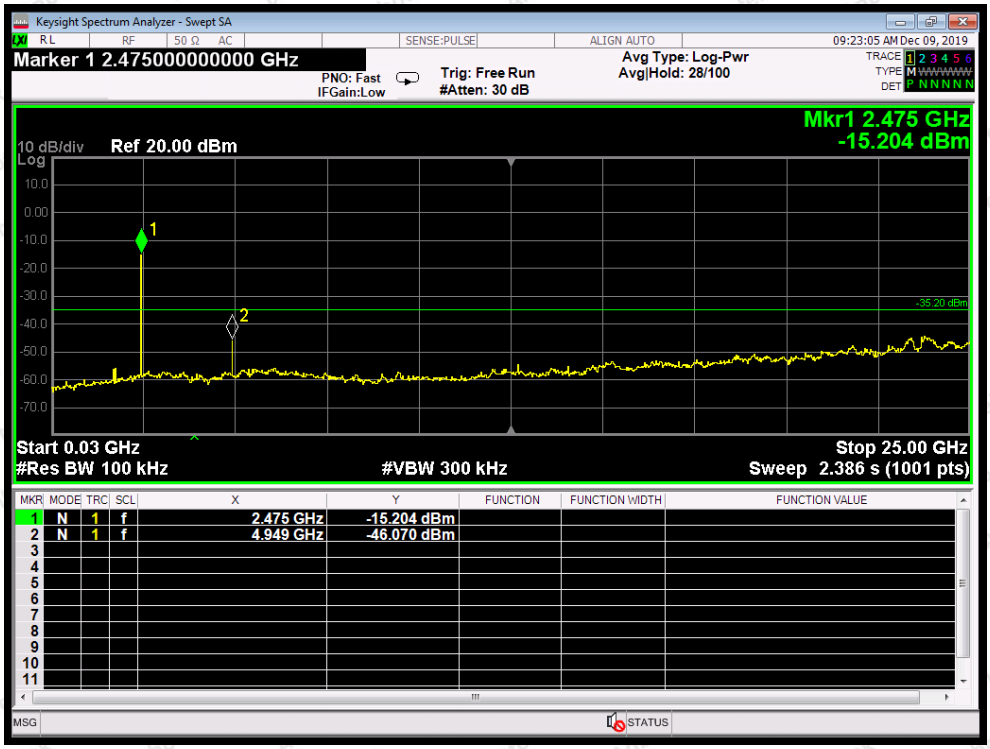
Conducted Emission Method



CH: Low



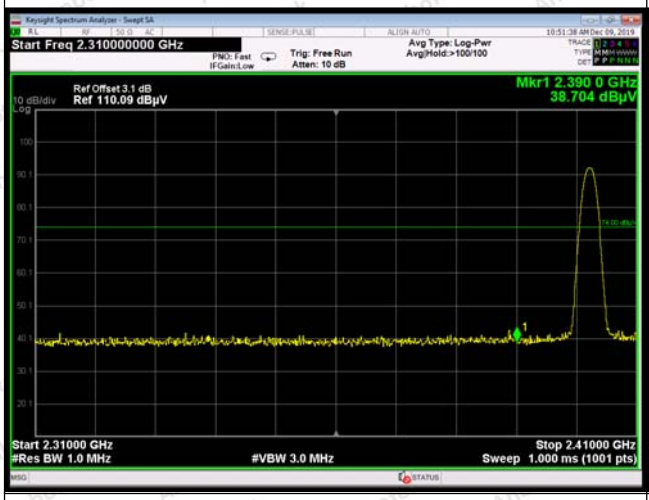
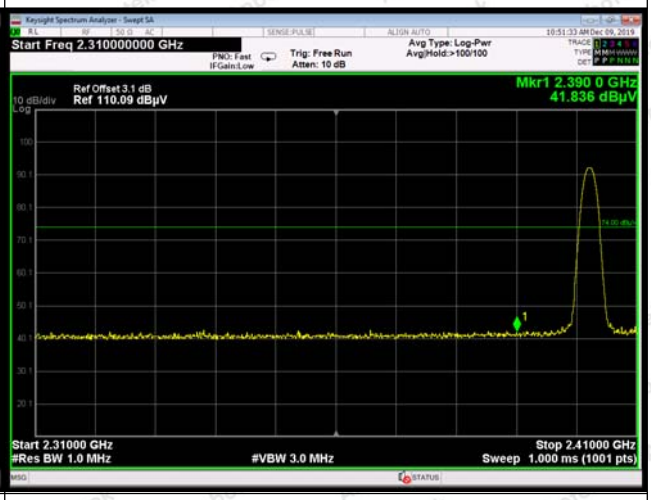
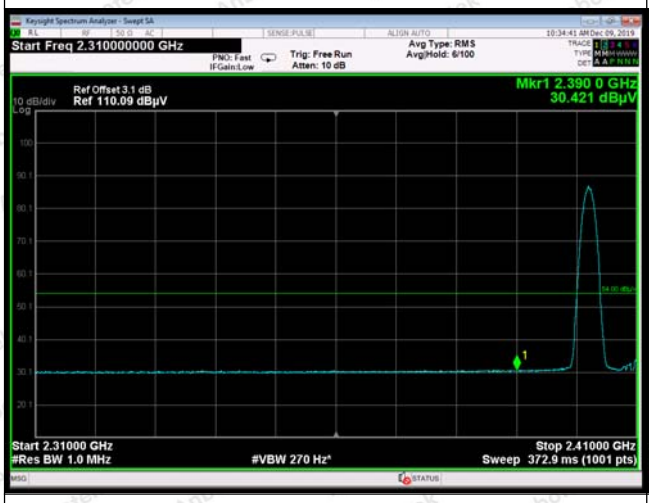
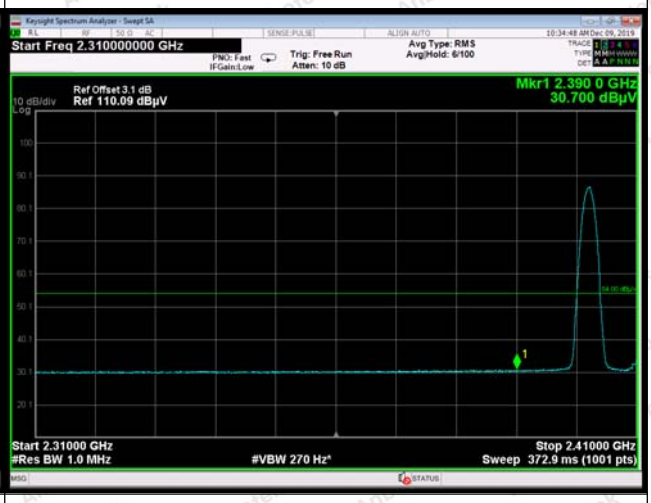
CH: Middle

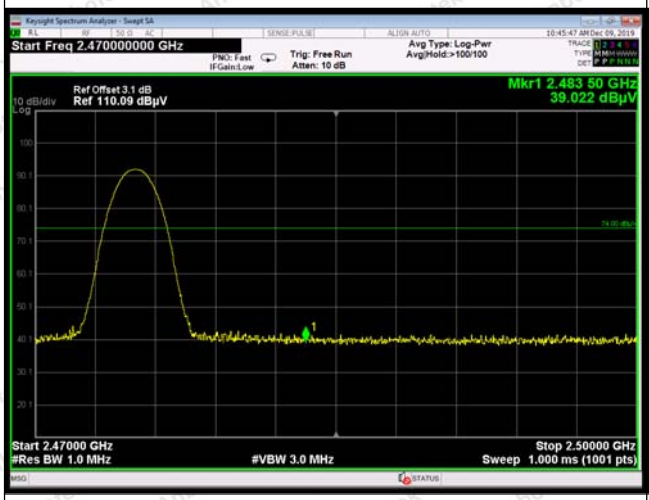
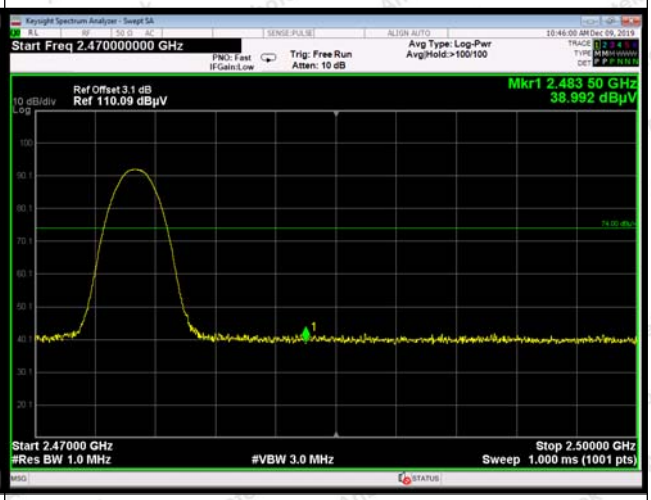
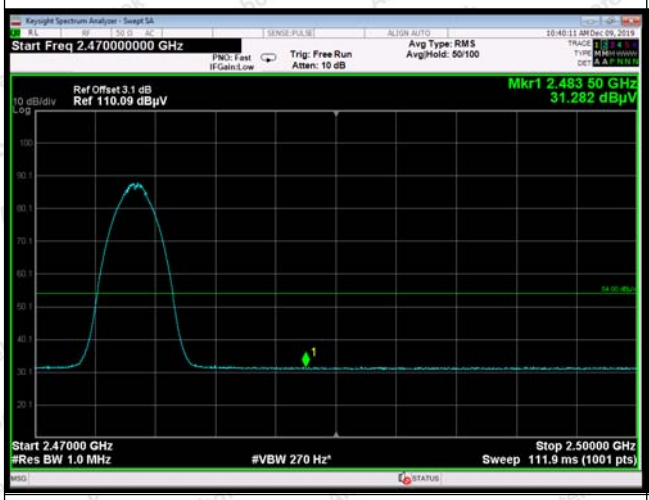
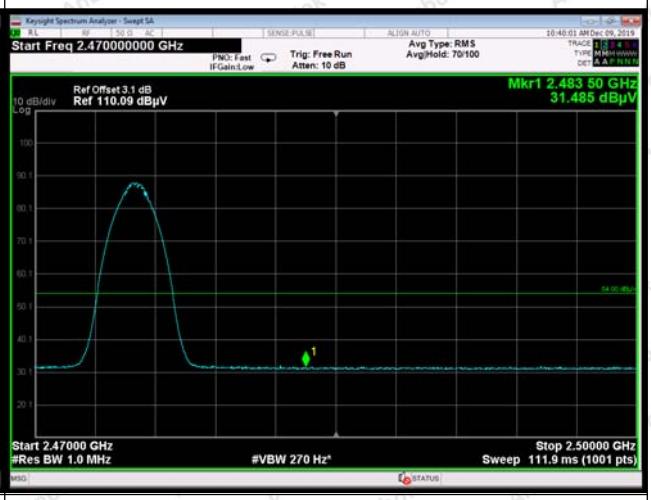

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.475000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 28/100
09:23:05 AM Dec 09, 2019
Mkr1 2.475 GHz
-15.204 dBm
10 dB/div
Ref 20.00 dBm
-35.20 dBm
Start 0.03 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
1 N 1 f 2.475 GHz -15.204 dBm
2 N 1 f 4.949 GHz -46.070 dBm

CH: High

Radiated Band Edge:

ANT B:

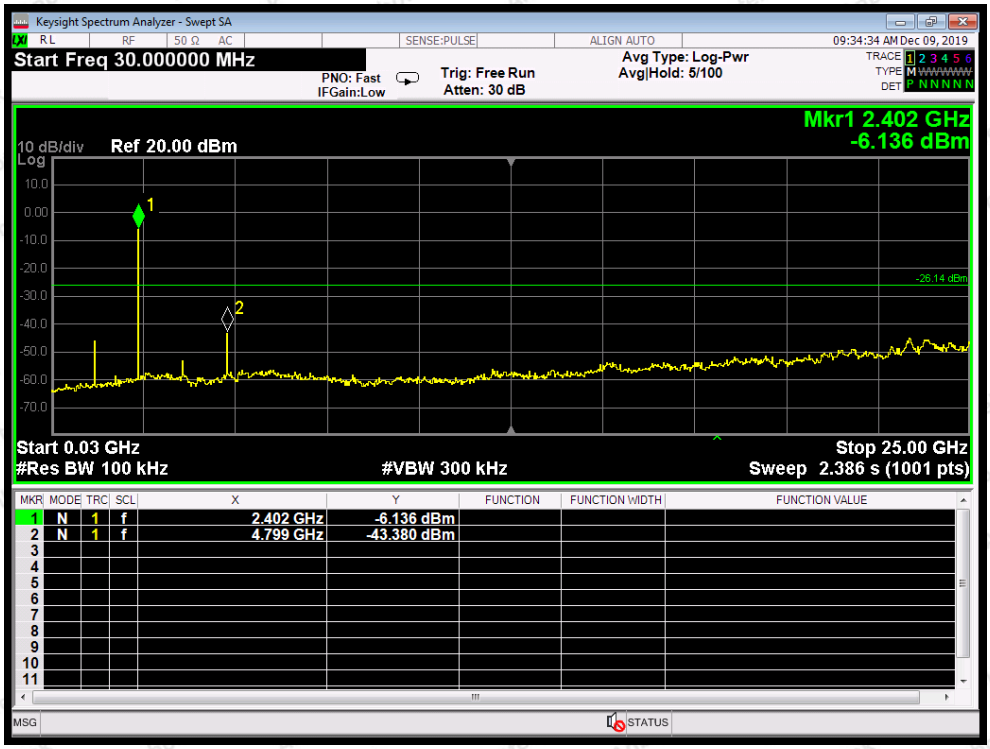
Test Mode: CH01	Test channel: Lowest
	
Peak Value(Vertical)	Peak Value(Horizontal)
	
Average Value(Vertical)	Average Value(Horizontal)

Test Mode: CH03	Test channel: Highest
	
Peak Value(Vertical)	Peak Value(Horizontal)
	
Average Value(Vertical)	Average Value(Horizontal)

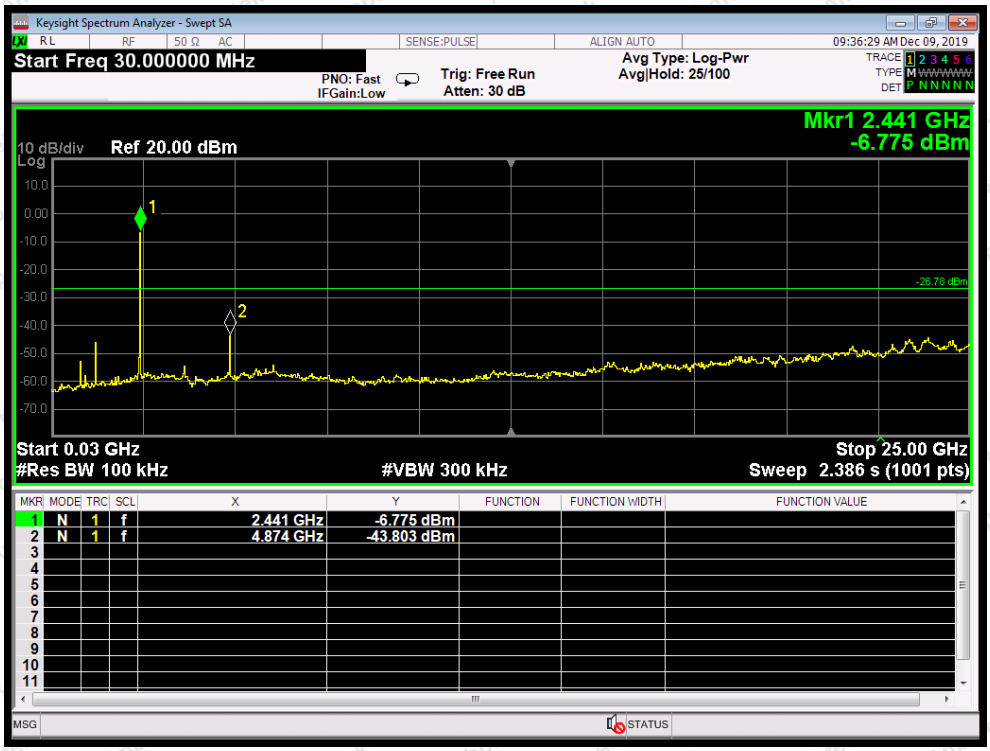
Remark:

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

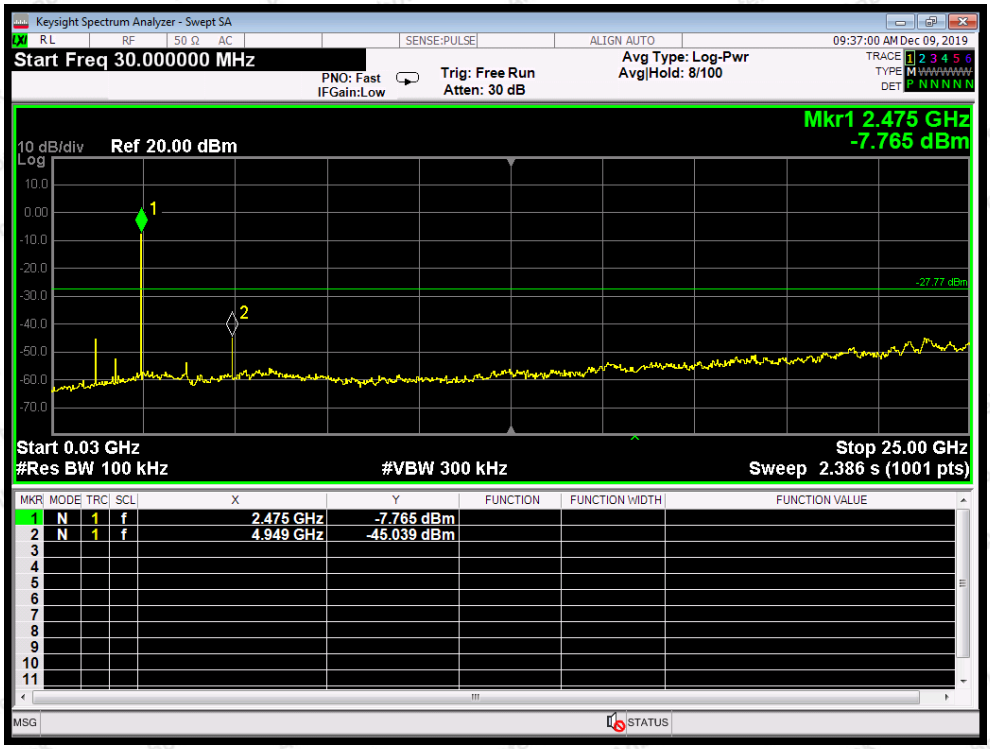
Conducted Emission Method



CH: Low



CH: Middle


Keysight Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 8/100
09:37:00 AM Dec 09, 2019
Mkr1 2.475 GHz
-7.765 dBm
10 dB/div
Ref 20.00 dBm
-27.77 dBm
Start 0.03 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
1 N 1 f 2.475 GHz -7.765 dBm
2 N 1 f 4.949 GHz -45.039 dBm

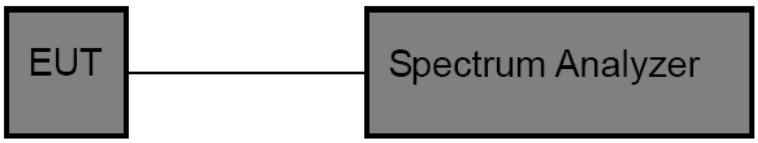
CH: High

5. 20dB Bandwidth Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.249

5.2. Test Setup



5.3. Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:

RBW = 30kHz, VBW≥3*RBW =100kHz,

Detector= Average

Trace mode= Max hold.

Sweep- auto couple.

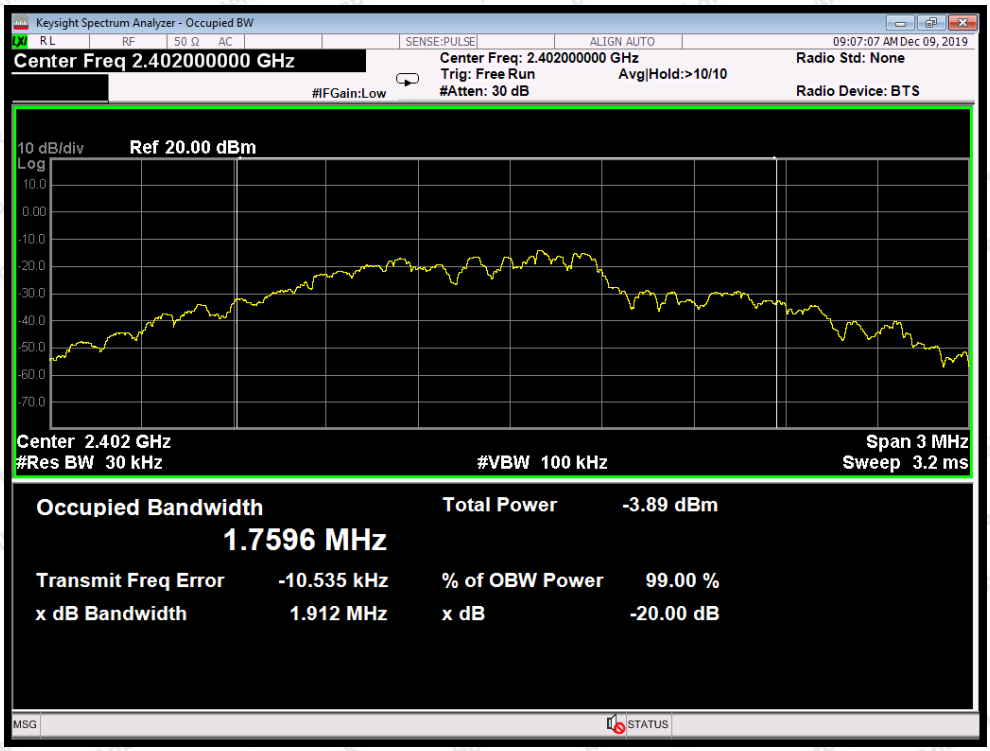
4. Mark the peak frequency and –20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

5.4. Test Data

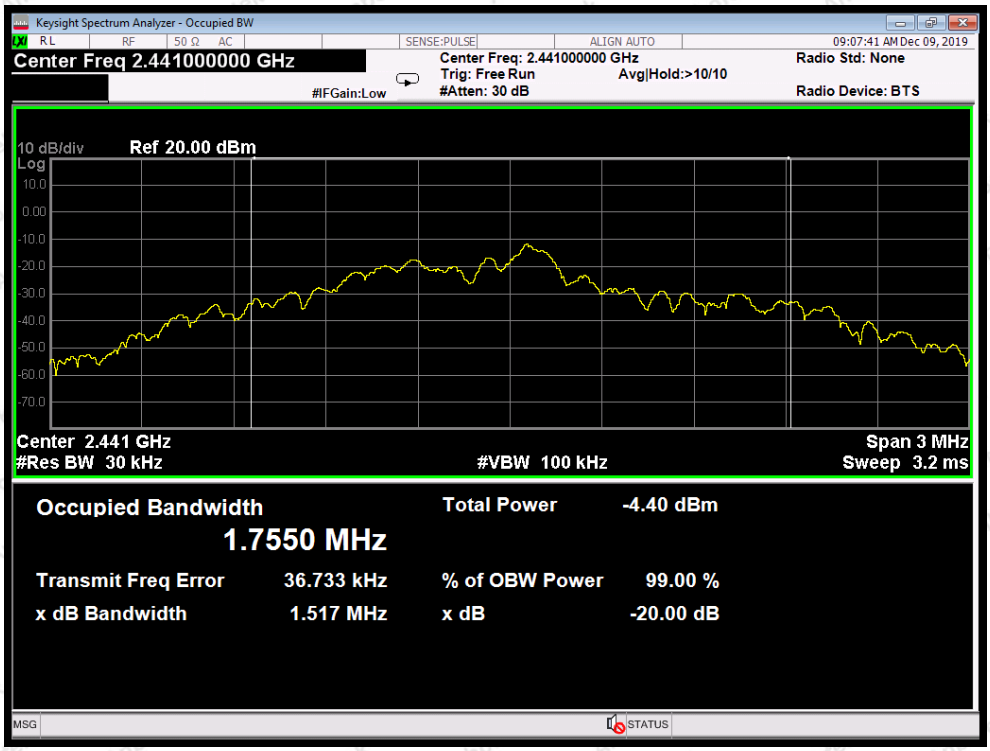
Test Item	:	20dB Bandwidth	Test Mode	:	Mode 1
Test Voltage	:	AC 120V, 60Hz for MacBook Air	Temperature	:	22.4℃
Test Result	:	PASS	Humidity	:	55%RH

ANT A:

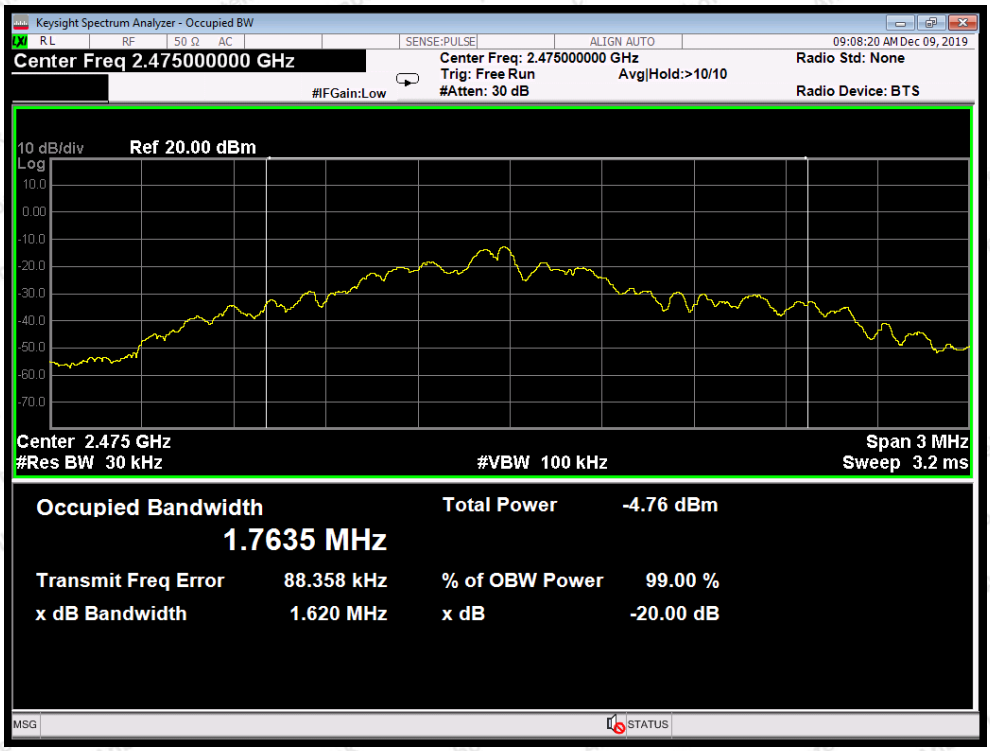
Frequency (MHz)	Bandwidth (kHz)	Result
2402MHZ	1912	PASS
2441MHZ	1517	PASS
2475MHZ	1620	PASS



Test Mode: Low



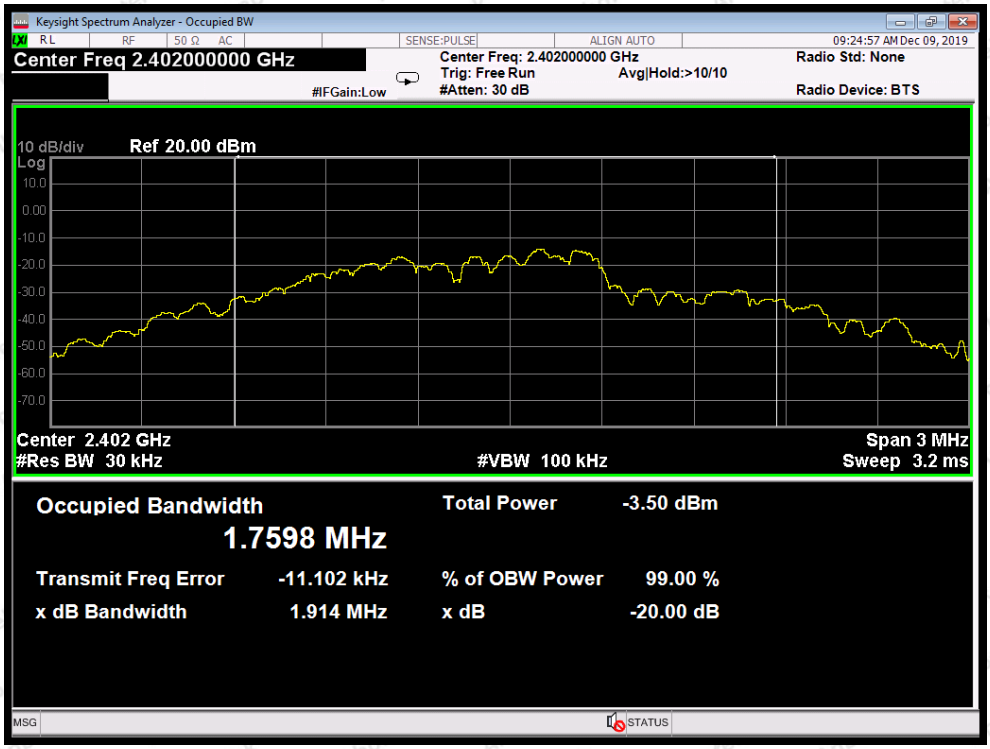
Test Mode: Middle



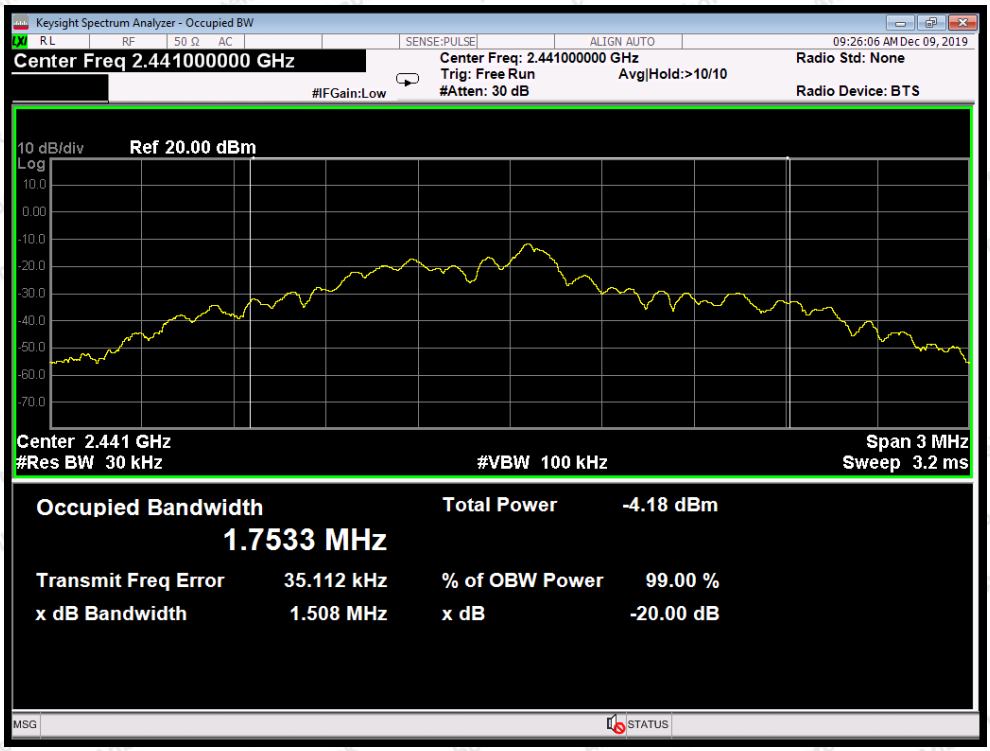
Test Mode: High

ANT B:

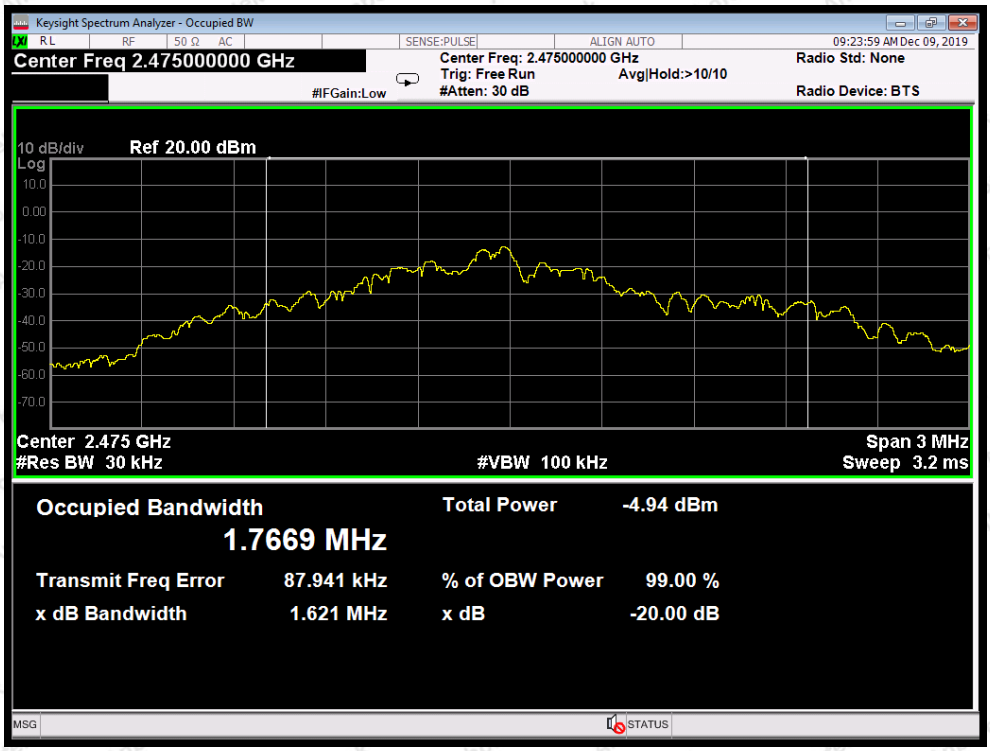
Frequency (MHz)	Bandwidth (kHz)	Result
2402MHZ	1914	PASS
2441MHZ	1508	PASS
2475MHZ	1621	PASS



Test Mode: Low



Test Mode: Middle



Test Mode: High

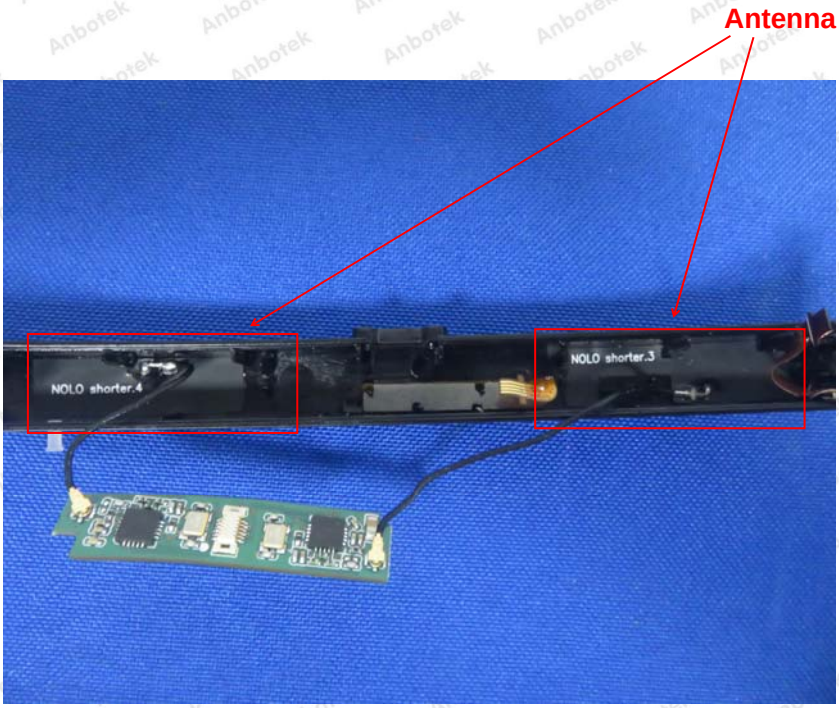
6. Antenna Requirement

6.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203
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.

6.2. Antenna Connected Construction

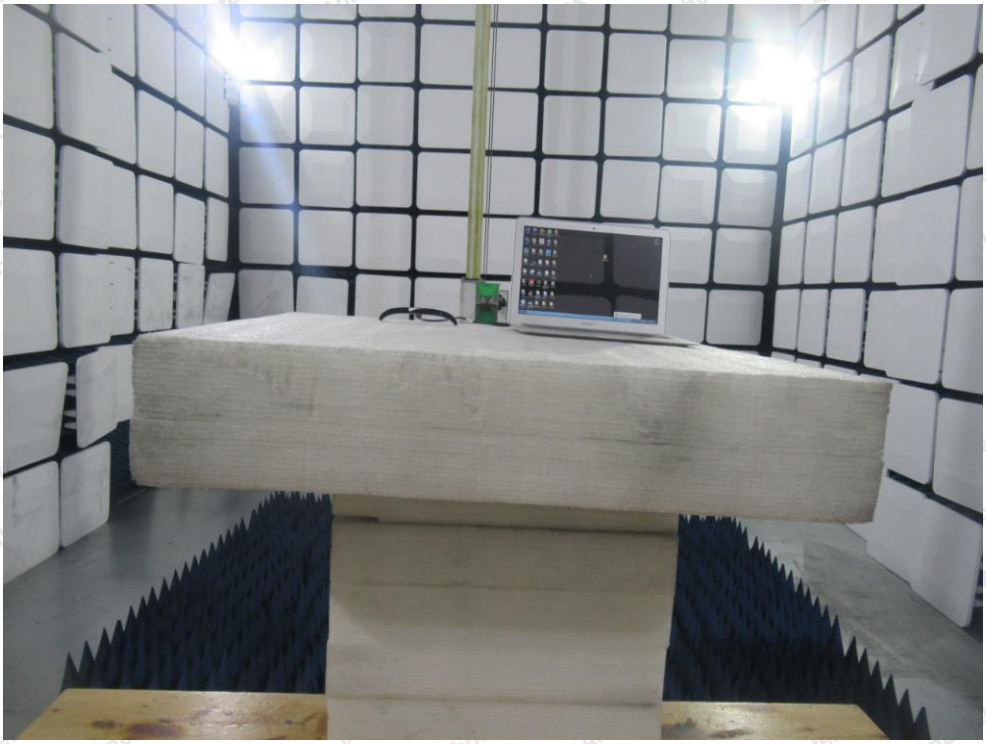
The antenna is a FPC Antenna which permanently attached, and the best case gain of the antenna is 1 dBi. It complies with the standard requirement.



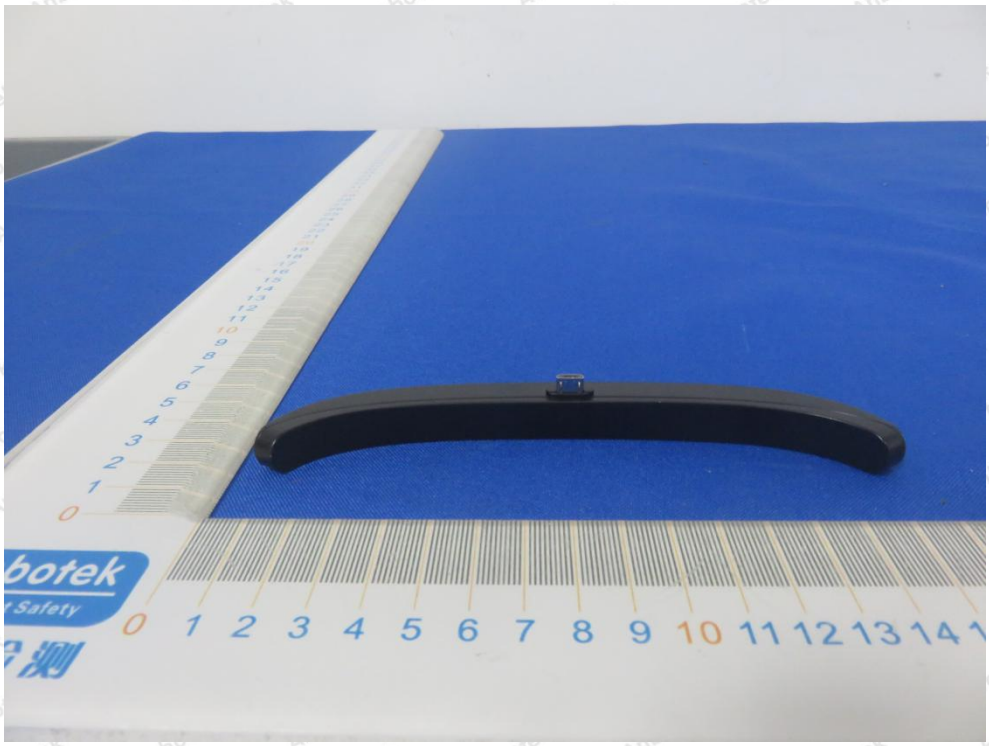
APPENDIX I -- TEST SETUP PHOTOGRAPH

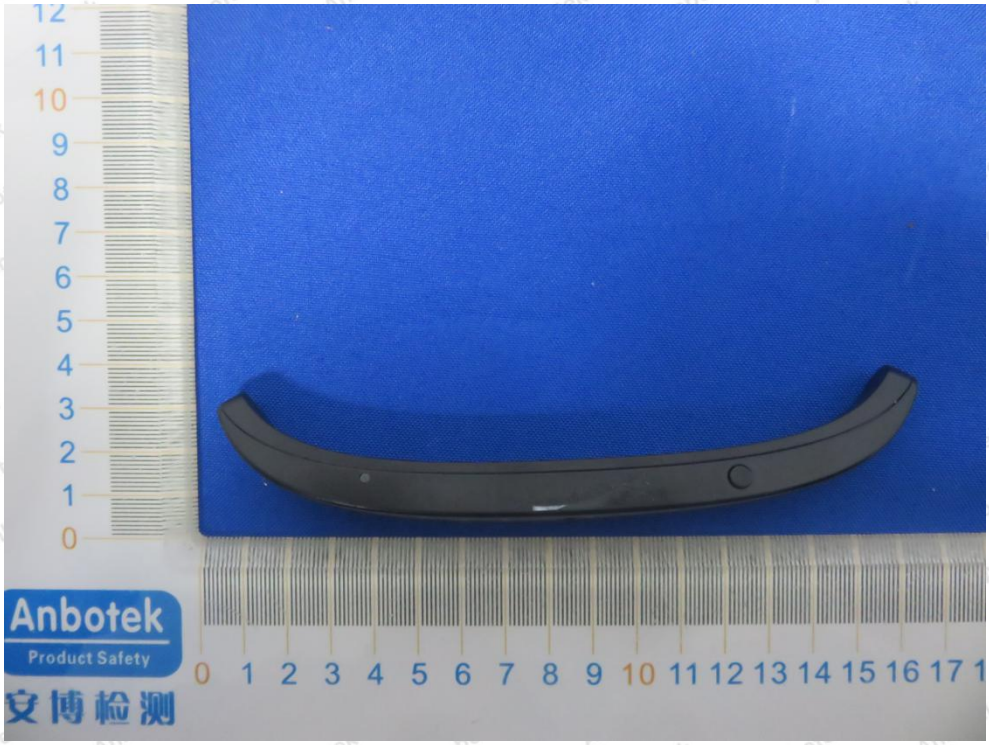
Photo of Conducted Emission Test

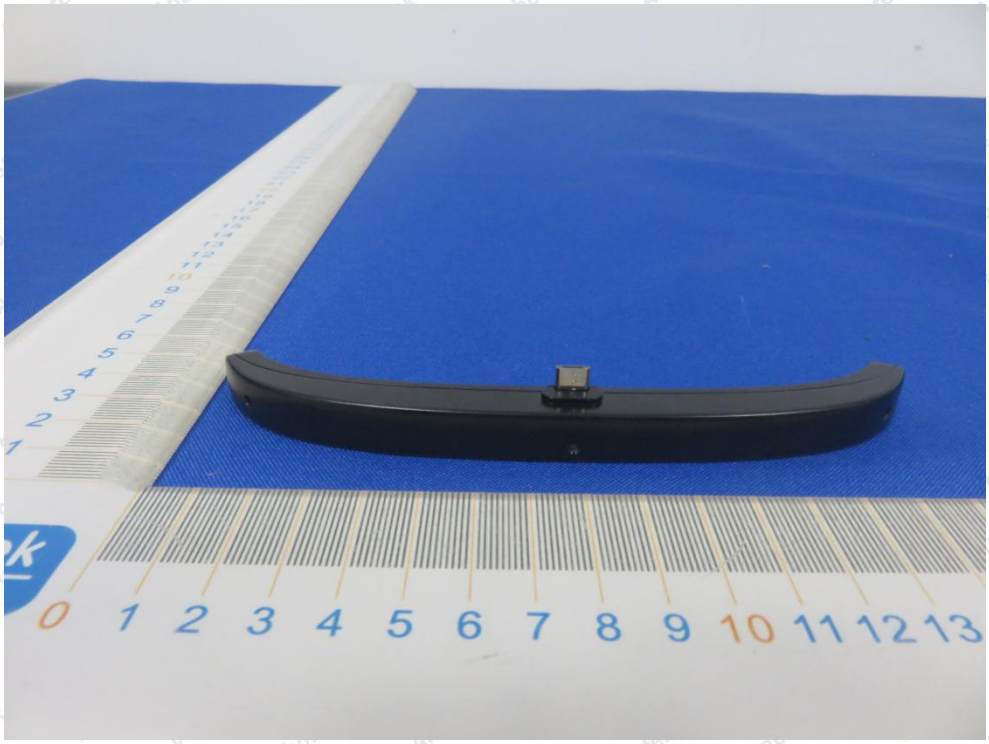
Photo of Radiation Emission Test



APPENDIX II -- EXTERNAL PHOTOGRAPH




Anbotek
Product Safety
安博检测

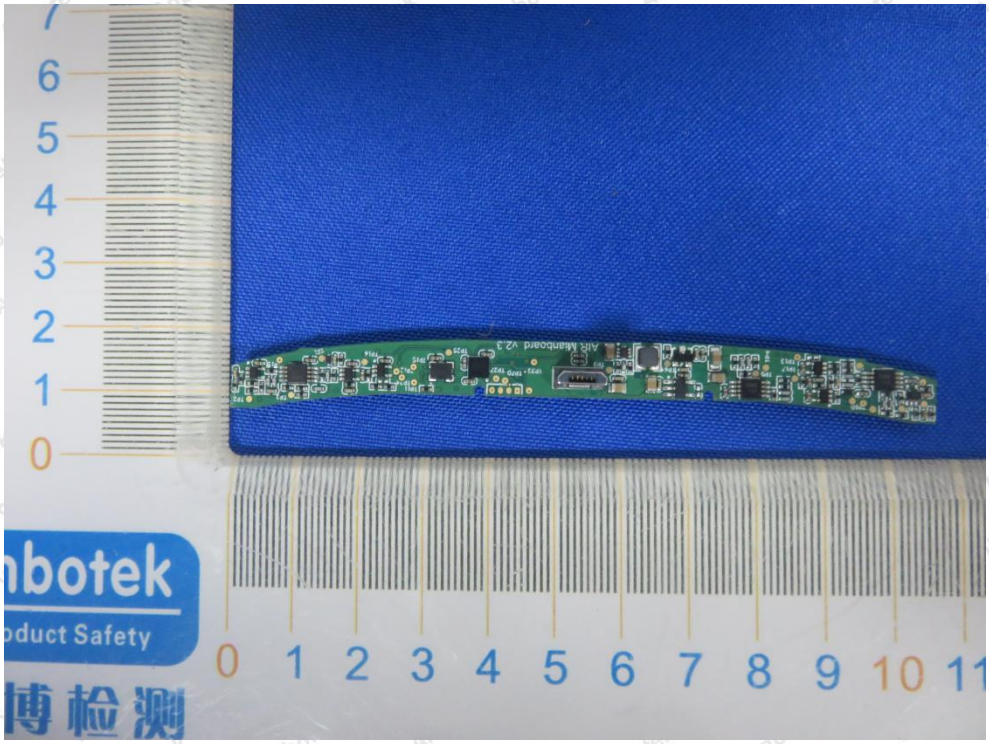


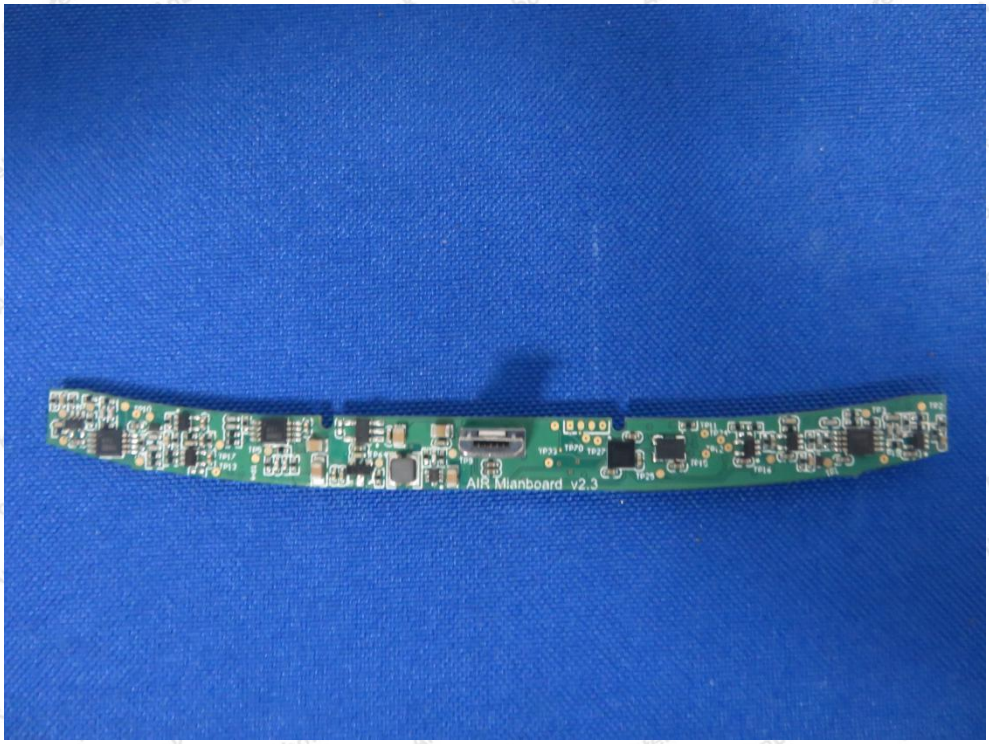
Anbotek
Product Safety

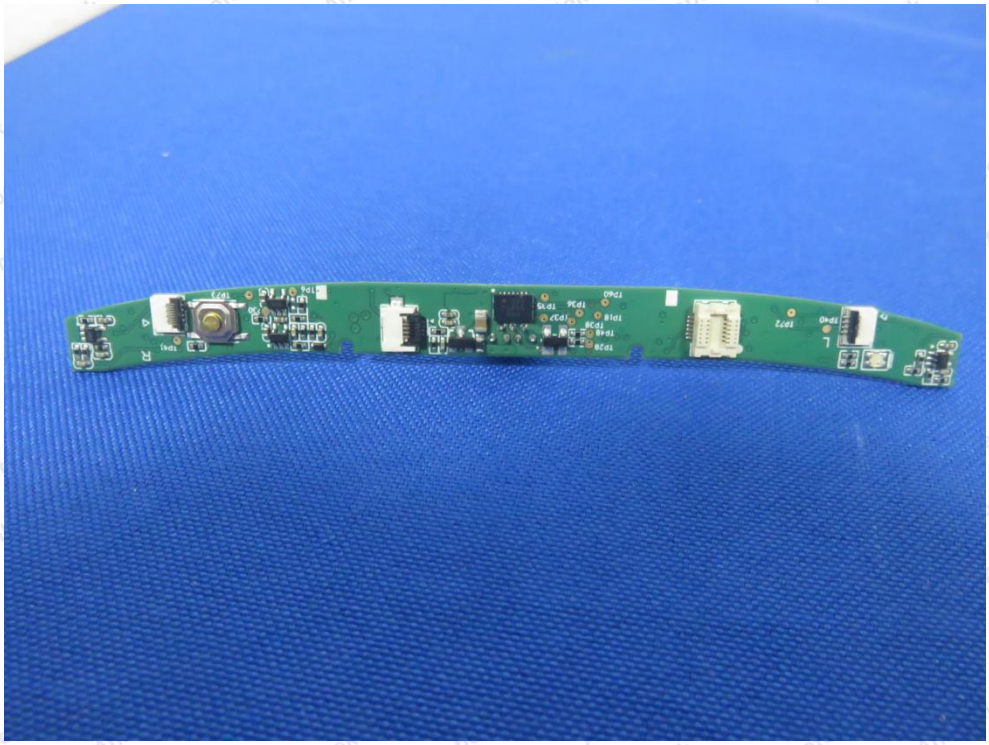
Anbotek
Product Safety

APPENDIX III -- INTERNAL PHOTOGRAPH

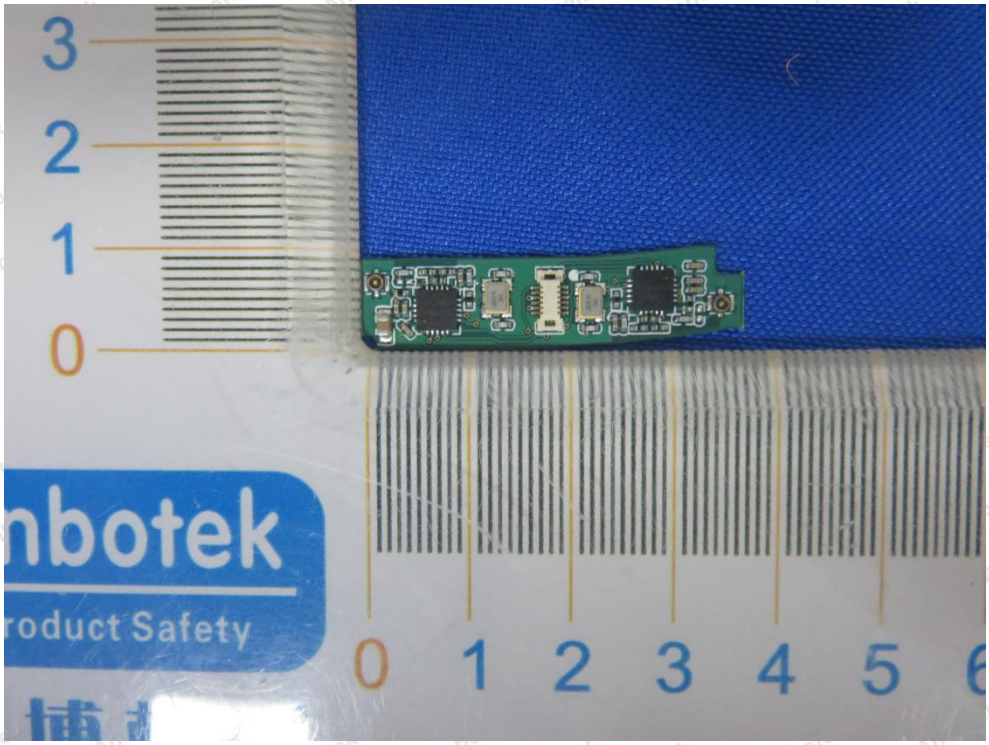
NOLO shorter.4
NOLO shorter.3

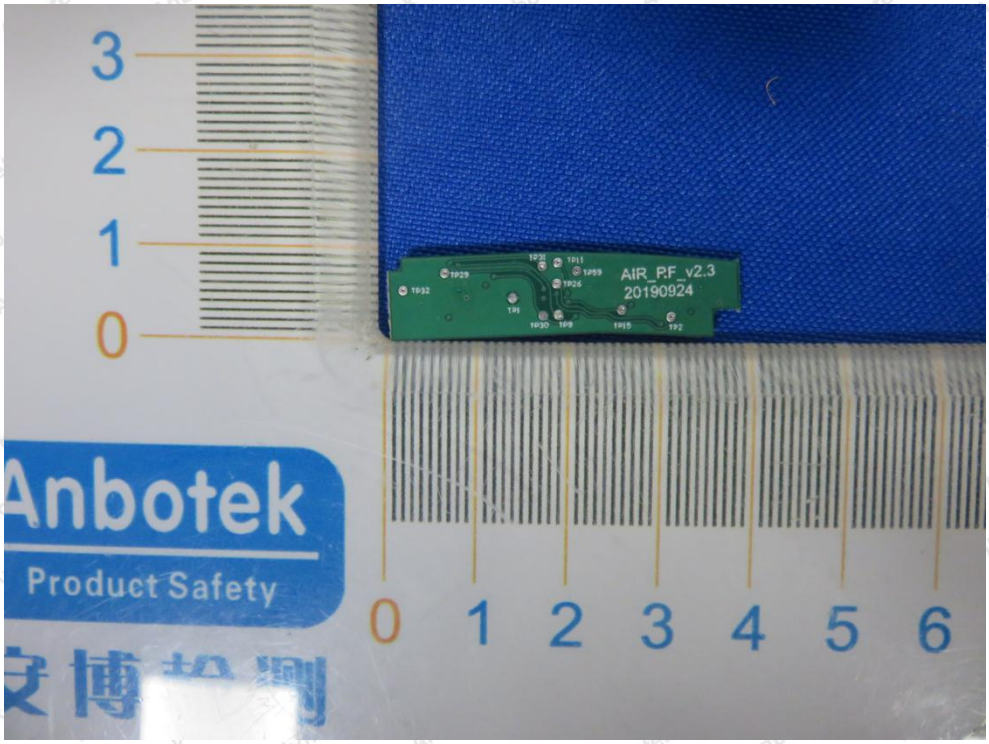



AIR Mianboard v2.3



Anbotek
Product Safety

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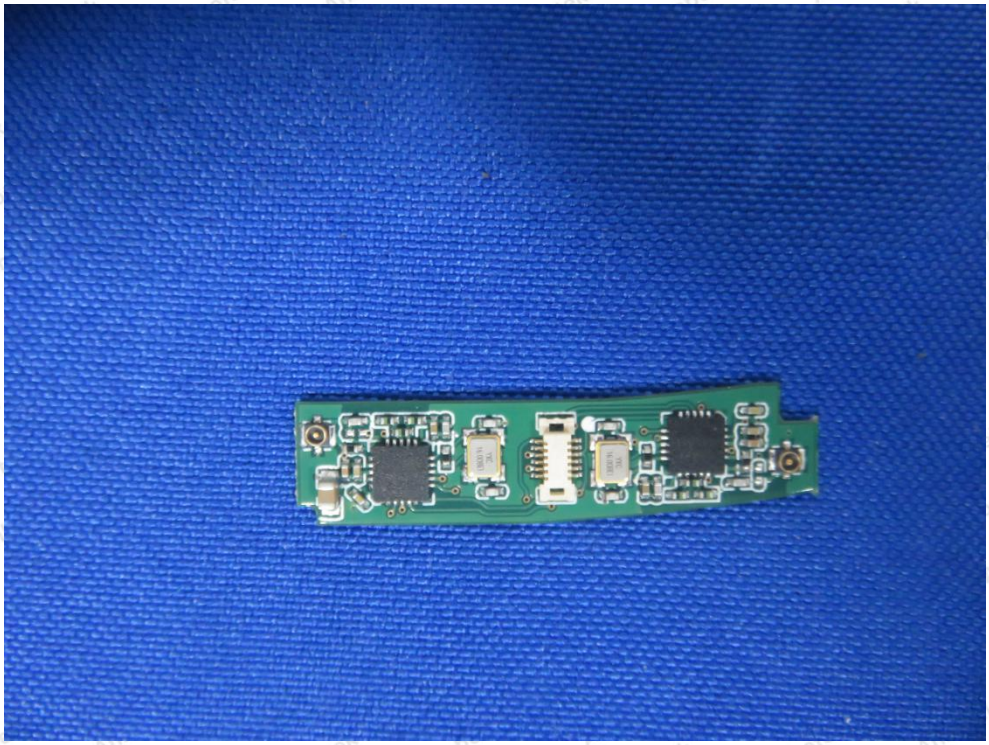

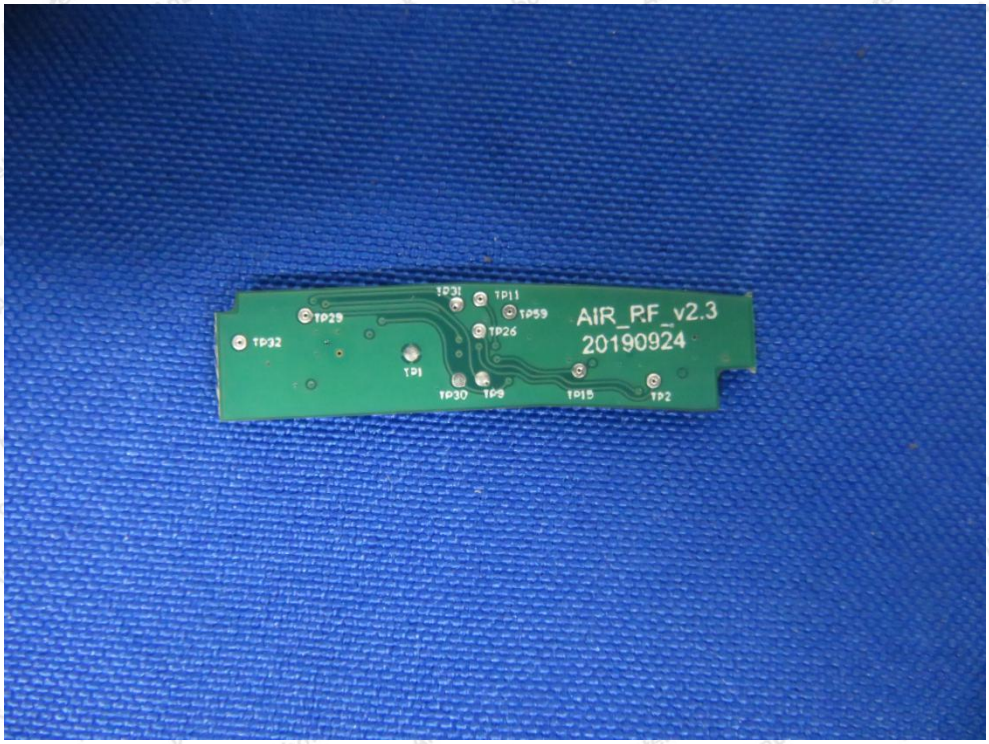
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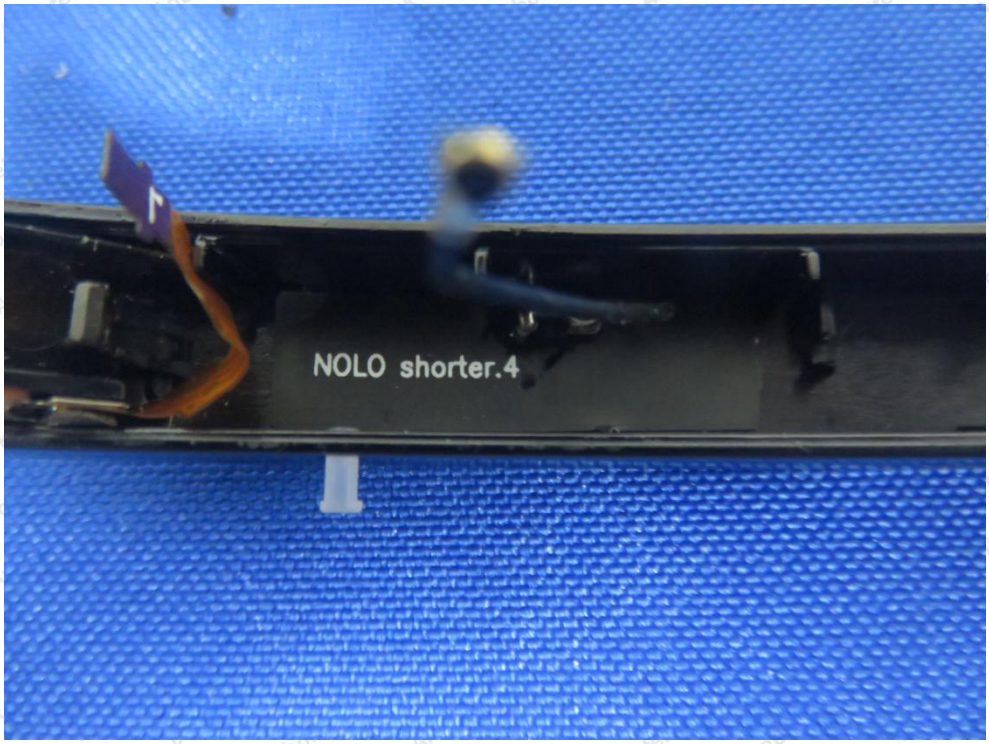

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