FCC TEST REPORT

Client Name	:	Veise (GuangZhou) Electronics Co., Ltd.
Address	:	3-4F, No.18th, Huayuan St., Shatai Rd., Baiyun District, Guangzhou China
Product Name	:	Wireless camera monitor system (transmitter)
Date	:	Feb. 03, 2021

Shenzhen Anbotek Compliance Laboratory Limited

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TEST REPORT

Applicant	:	Veise (GuangZhou) Electronics Co., Ltd.
Manufacturer	:	Veise (GuangZhou) Electronics Co., Ltd.
Product Name	:	Wireless camera monitor system (transmitter)
Model No.	:	SP-536A+DF-8275HA-SFS-CUT, SP-536H+DF-8275H-SFS-CUT, SP-723H+DF-8275H-SFS-CUT, SP-723H4+DF-8275H-SFS-CUT, SP-766H+DF-8275H-SFS-CUT, SP-766H4+DF-8275H-SFS-CUT, SP-755H+DF-8275H-SFS-CUT, SP-755H4+DF-8275H-SFS-CUT, SP-966H+DF-8275H-SFS-CUT, SP-966H4+DF-8275H-SFS-CUT, MWHD-772S+CWHD-161M
Trade Mark	:	veise
Rating(s)	:	Input: DC 11-32V
Test Standard(s)	**:**	**FCC Part15 Subpart C, Section 15.247**
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	Dec. 26, 2020
Date of Test	Dec. 26, 2020~Feb. 01, 2021
Prepared by	Yilia Zhong (Engineer / Yilia Zhong)
Reviewer	Bibo Zhang (Supervisor / Bibo Zhang)
Approved & Authorized Signer	KingKong Jin (Manager / Kingkong Jin)

1. General Information

1.1. Client Information

Applicant	:	Veise (GuangZhou) Electronics Co., Ltd.
Address	:	3-4F, No.18th, Huayuan St., Shatai Rd., Baiyun District, Guangzhou China
Manufacturer	:	Veise (GuangZhou) Electronics Co., Ltd.
Address	:	3-4F, No.18th, Huayuan St., Shatai Rd., Baiyun District, Guangzhou China
Factory	:	Veise (GuangZhou) Electronics Co., Ltd.
Address	:	3-4F, No.18th, Huayuan St., Shatai Rd., Baiyun District, Guangzhou China

1.2. Description of Device (EUT)

Product Name	:	Wireless camera monitor system (transmitter)	
Model No.	:	SP-536A+DF-8275HA-SFS-CUT, SP-536H+DF-8275H-SFS-CUT, SP-723H+DF-8275H-SFS-CUT, SP-723H4+DF-8275H-SFS-CUT, SP-766H+DF-8275H-SFS-CUT, SP-766H4+DF-8275H-SFS-CUT, SP-755H+DF-8275H-SFS-CUT, SP-755H4+DF-8275H-SFS-CUT, SP-966H+DF-8275H-SFS-CUT, SP-966H4+DF-8275H-SFS-CUT, MWHD-772S+CWHD-161M (Note: All samples are the same except the model number, so we prepare "SP-536A+DF-8275HA-SFS-CUT" for test only.)	
Trade Mark	:	veise	
Test Power Supply	:	DC 11-32V	
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)	
Product Description	:	Operation Frequency:	2406~2472.5MHz
		Number of Channel:	20 Channels
		Modulation Type:	GFSK
		Antenna Type:	Columnar 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.

TEST MODE:

Mode 1	GFSK	CH01	TX Only
Mode 2		CH11	
Mode 3		CH20	

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

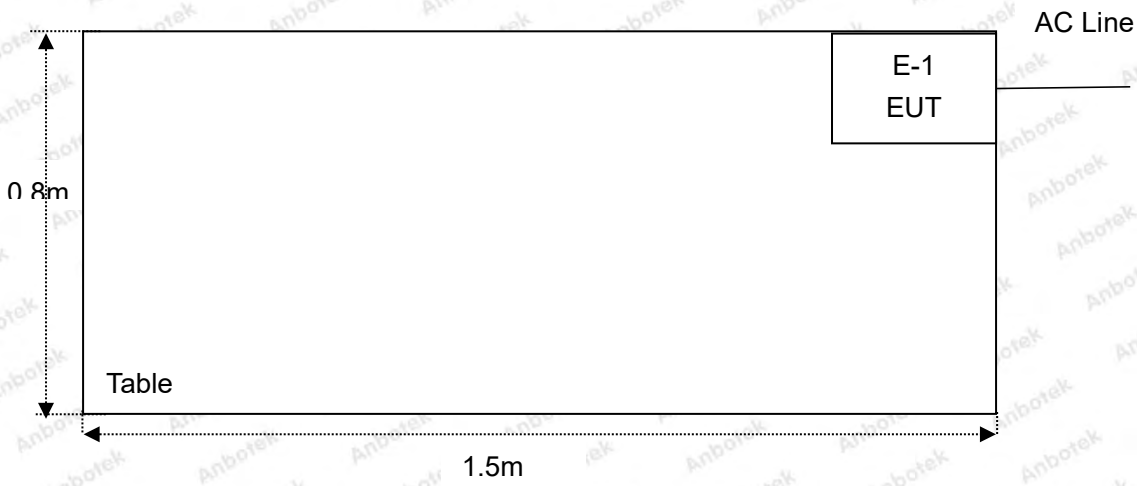
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	2406	05	2420	09	2434	13	2448	17	2462
02	2409.5	06	2423.5	10	2437.5	14	2451.5	18	2465.5
03	2413	07	2427	11	2441	15	2455	19	2469
04	2416.5	08	2430.5	12	2444.5	16	248.5	20	2472.5

Note:

1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.
2. EUT built-in battery-powered, fully-charged battery use of the test battery.

1.6. Description Of Test Setup

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	Oct. 26, 2020	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Oct. 26, 2020	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESR26	101481	Oct. 26, 2020	1 Year
4.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Oct. 26, 2020	1 Year
5.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Oct. 26, 2020	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	Oct. 26, 2020	1 Year
7.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Nov. 02, 2020	2 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 02, 2020	2 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Nov. 02, 2020	2 Year
10.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Nov. 02, 2020	2 Year
11.	Pre-amplifier	SONOMA	310N	186860	Oct. 26, 2020	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	Oct. 26, 2020	1 Year
14.	Power Sensor	DAER	RPR3006W	15I00041SN045	Oct. 26, 2020	1 Year
15.	Power Sensor	DAER	RPR3006W	15I00041SN046	Oct. 26, 2020	1 Year
16.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Oct. 26, 2020	1 Year
17.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Oct. 26, 2020	1 Year
18.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 26, 2020	1 Year
19.	DC Power Supply	IVYTECH	IV3605	1804D360510	Oct. 26, 2020	1 Year
20.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Oct. 26, 2020	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 30, 2020.

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, September 30, 2020.

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

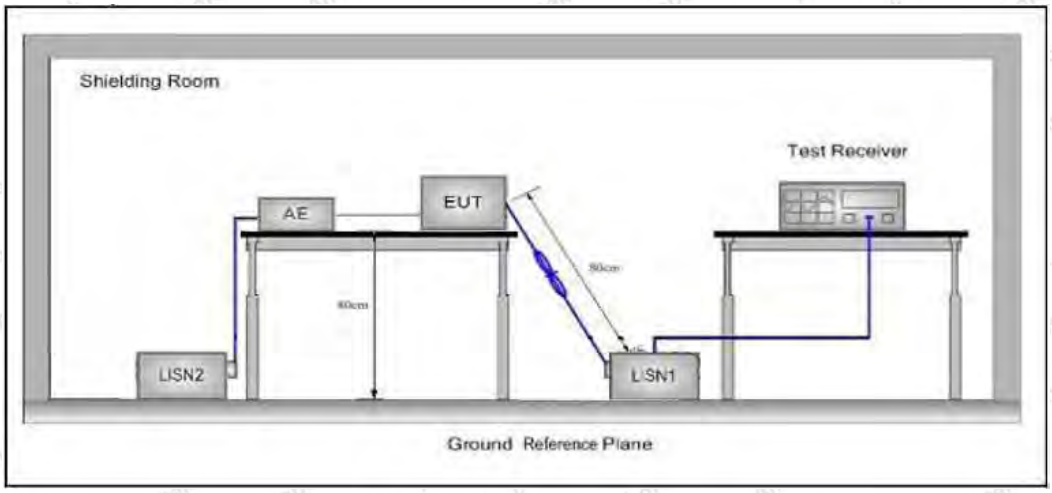
Standard Section	Test Item	Result
15.203/15.247(c)	Antenna Requirement	PASS
15.207	Conducted Emission	N/A
15.205/15.209	Spurious Emission	PASS
15.247(b)(1)	Conducted Peak Output Power	PASS
15.247(a)(1)	20dB Occupied Bandwidth	PASS
15.247(a)(1)	Carrier Frequencies Separation	PASS
15.247(a)(1)	Hopping Channel Number	PASS
15.247(a)(1)	Dwell Time	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

Not Applicable.

The EUT is powered by DC 11-32V, so there is no need for conducted emission test.

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

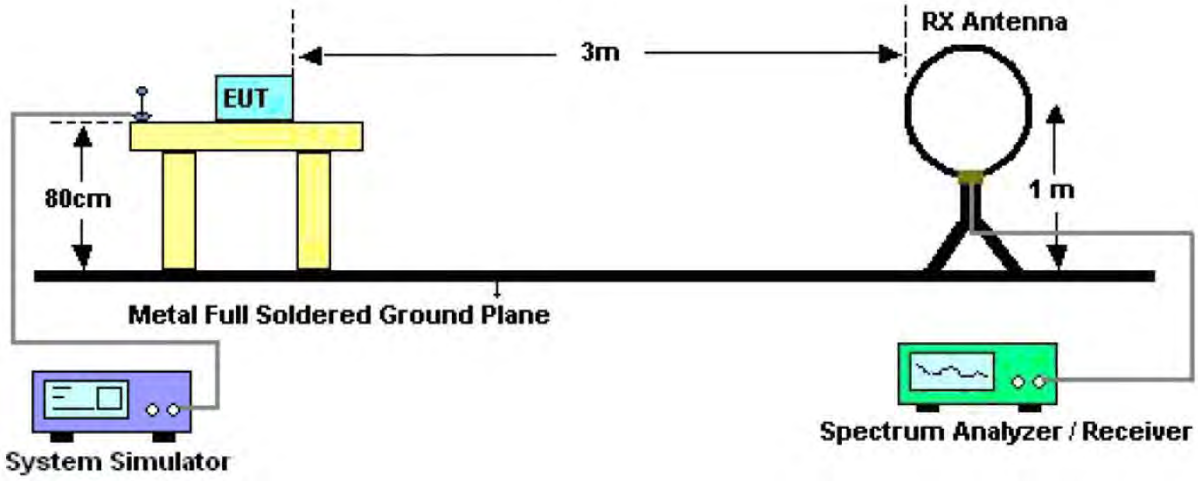


Figure 1. Below 30MHz

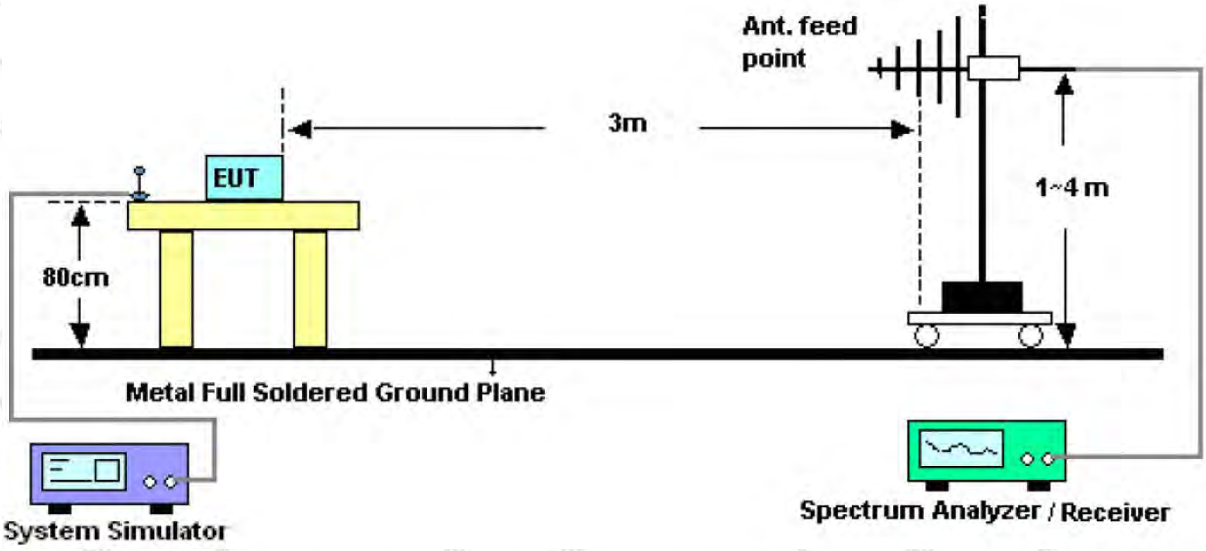


Figure 2. 30MHz to 1GHz

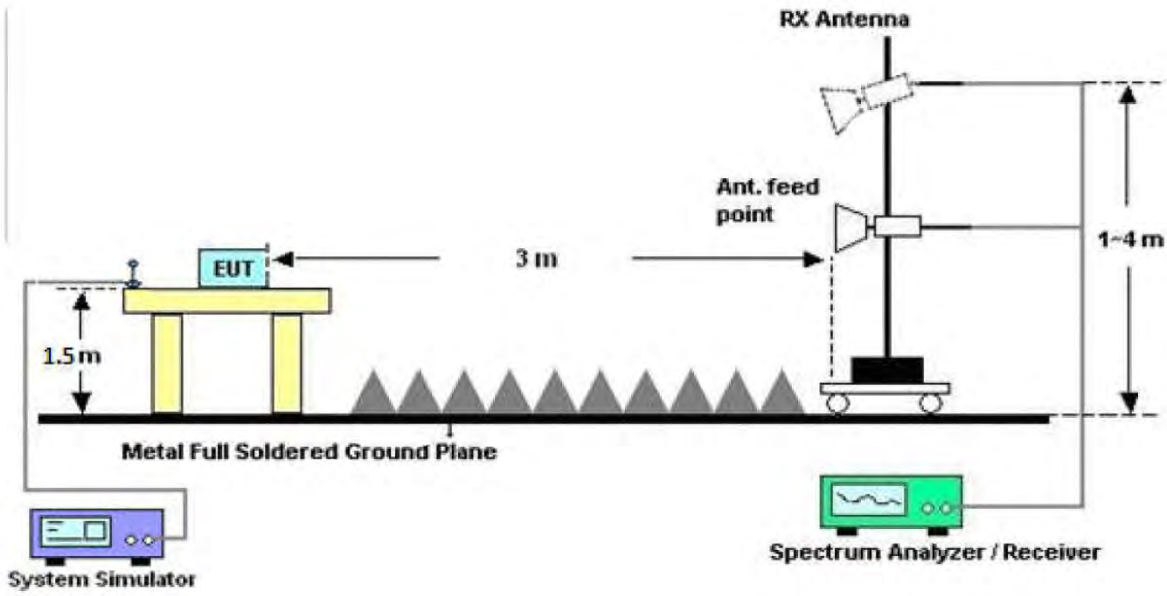


Figure 3. Above 1 GHz

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 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

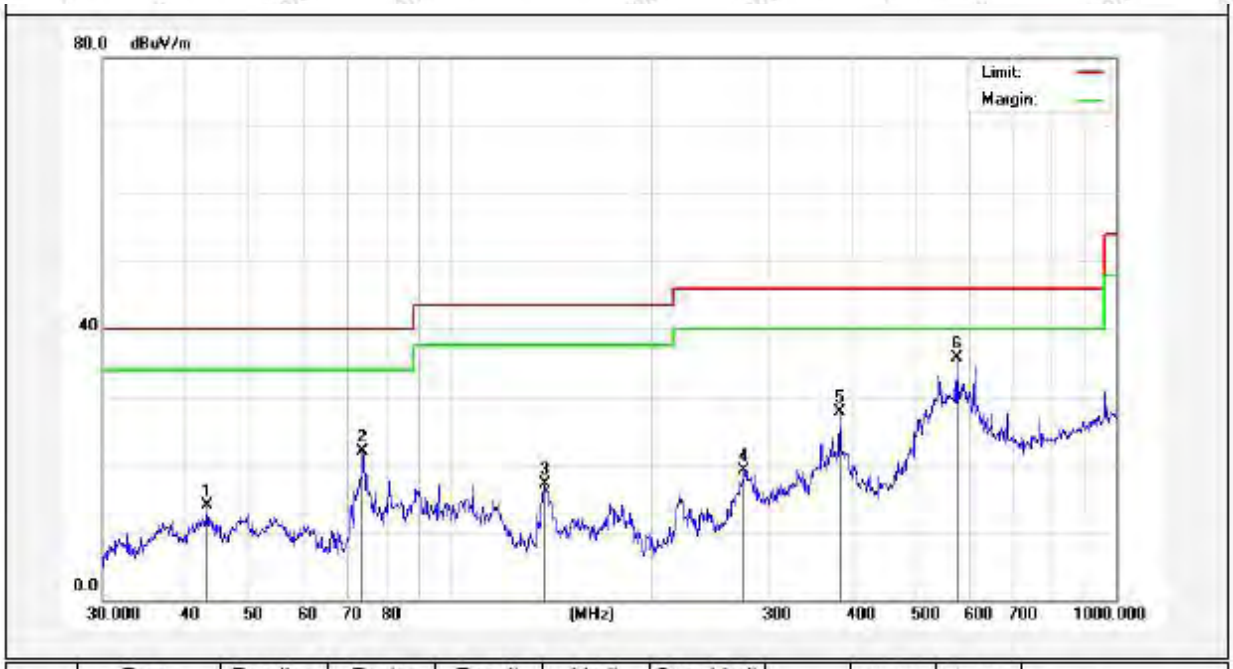
PASS

During the test, pre-scan the GFSK modulation, and found Middle channel(TX Only) which is the worst case, only the worst case is recorded in the report.

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

Test Results (30~1000MHz)

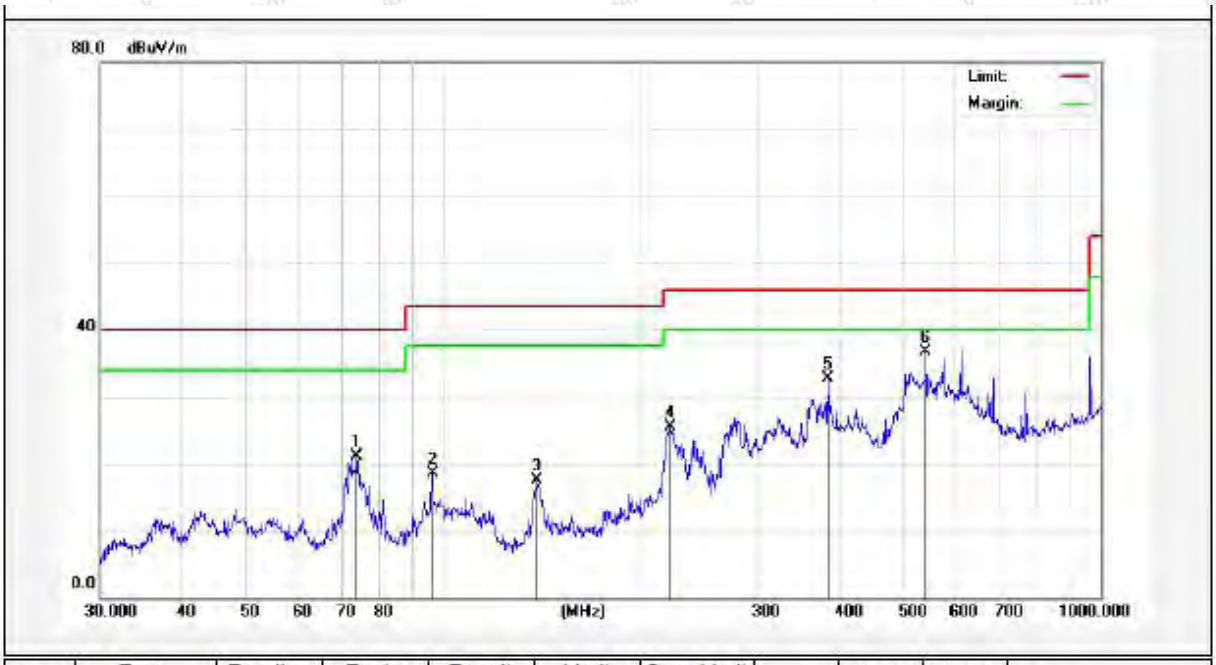
Test Mode: Mode 2
Power Source: DC 32V
Polarization: Vertical
Temp.(℃)/Hum.(%RH): 22℃/45%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	43.0504	27.80	-13.90	13.90	40.00	-26.10	QP	100	0	
2	73.8756	40.24	-18.41	21.83	40.00	-18.17	QP	100	360	
3	138.8735	37.01	-19.99	17.02	43.50	-26.48	QP	100	0	
4	276.1235	33.36	-14.30	19.06	46.00	-26.94	QP	100	360	
5	383.9318	39.14	-11.51	27.63	46.00	-18.37	QP	100	0	
6	576.6443	42.96	-7.34	35.62	46.00	-10.38	QP	100	360	

Test Results (30~1000MHz)

Test Mode:	Mode 2
Power Source:	DC 32V
Polarization:	Horizontal
Temp.(℃)/Hum.(%RH):	22℃/45%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	73.8756	41.60	-20.55	21.05	40.00	-18.95	QP	100	0	
2	96.0986	38.30	-19.76	18.54	43.50	-24.96	QP	100	360	
3	138.8735	38.36	-20.89	17.47	43.50	-26.03	QP	100	0	
4	221.3920	44.98	-19.43	25.55	46.00	-20.45	QP	100	360	
5	383.9318	45.70	-12.98	32.72	46.00	-13.28	QP	100	0	
6	541.3724	45.18	-8.38	36.80	46.00	-9.20	QP	100	360	

Test Results (1GHz-25GHz)

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.
4812.00	36.77	34.04	6.58	34.09	43.30	74.00	-30.70	V
7218.00	31.48	37.11	7.73	34.50	41.82	74.00	-32.18	V
7218.00	31.15	39.31	9.23	34.79	44.90	74.00	-29.10	V
9624.00	*					74.00		V
12030.00	*					74.00		V
4812.00	40.95	34.04	6.58	34.09	47.48	74.00	-26.52	H
7218.00	33.19	37.11	7.73	34.50	43.53	74.00	-30.47	H
7218.00	30.53	39.31	9.23	34.79	44.28	74.00	-29.72	H
9624.00	*					74.00		H
12030.00	*					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.
4812.00	25.69	34.04	6.58	34.09	32.22	54.00	-21.78	V
7218.00	20.22	37.11	7.73	34.50	30.56	54.00	-23.44	V
7218.00	19.33	39.31	9.23	34.79	33.08	54.00	-20.92	V
9624.00	*					54.00		V
12030.00	*					54.00		V
4812.00	29.86	34.04	6.58	34.09	36.39	54.00	-17.61	H
7218.00	22.36	37.11	7.73	34.50	32.70	54.00	-21.30	H
7218.00	19.02	39.31	9.23	34.79	32.77	54.00	-21.23	H
9624.00	*					54.00		H
12030.00	*					54.00		H

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 Results (1GHz-25GHz)

Test Mode: CH11					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.
4882.00	37.36	34.38	6.69	34.09	44.34	74.00	-29.66	V
7323.00	31.87	37.22	7.78	34.53	42.34	74.00	-31.66	V
9764.00	31.50	39.46	9.35	34.80	45.51	74.00	-28.49	V
12205.00	*					74.00		V
14646.00	*					74.00		V
4882.00	41.66	34.38	6.69	34.09	48.64	74.00	-25.36	H
7323.00	33.63	37.22	7.78	34.53	44.10	74.00	-29.90	H
9764.00	30.93	39.46	9.35	34.80	44.94	74.00	-29.06	H
12205.00	*					74.00		H
14646.00	*					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.
4882.00	26.18	34.38	6.69	34.09	33.16	54.00	-20.84	V
7323.00	20.56	37.22	7.78	34.53	31.03	54.00	-22.97	V
9764.00	19.63	39.46	9.35	34.80	33.64	54.00	-20.36	V
12205.00	*					54.00		V
14646.00	*					54.00		V
4882.00	30.42	34.38	6.69	34.09	37.40	54.00	-16.60	H
7323.00	22.74	37.22	7.78	34.53	33.21	54.00	-20.79	H
9764.00	19.37	39.46	9.35	34.80	33.38	54.00	-20.62	H
12205.00	*					54.00		H
14646.00	*					54.00		H

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 Results (1GHz-25GHz)

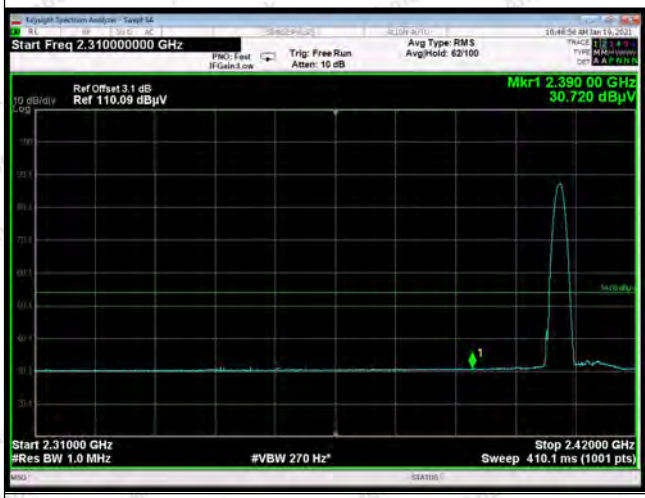
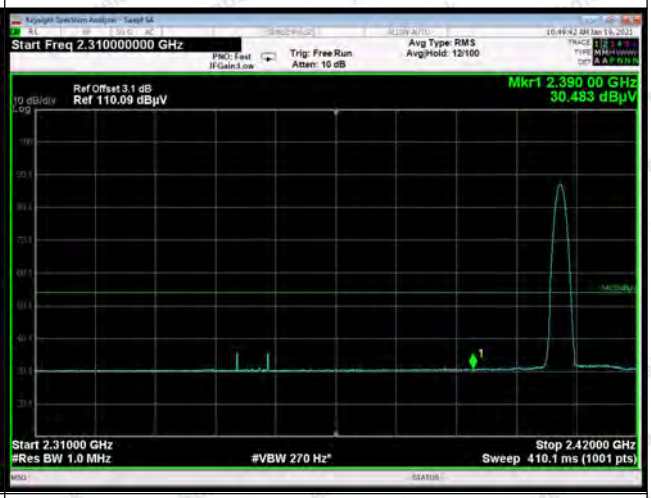
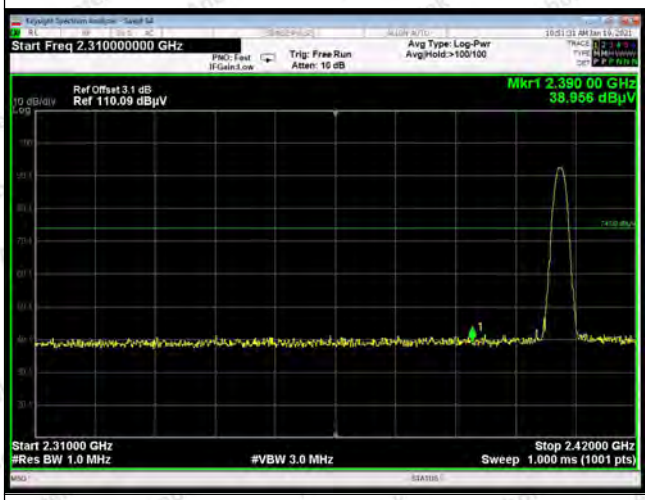
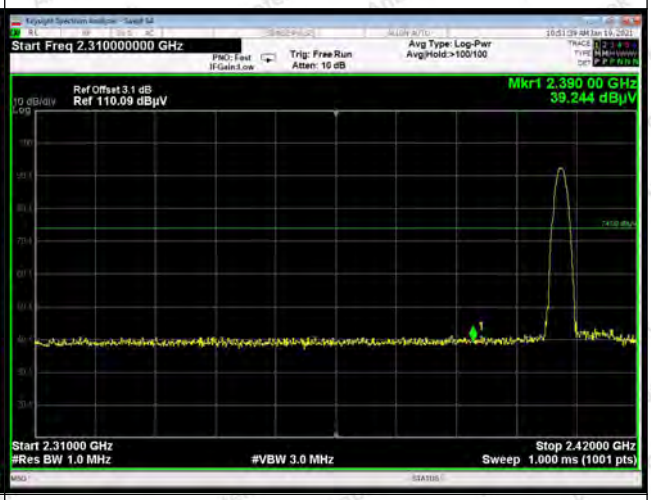
Test Mode: CH20					Test channel: Highest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4945.00	37.37	34.72	6.79	34.09	44.79	74.00	-29.21	V
7417.50	31.88	37.34	7.82	34.57	42.47	74.00	-31.53	V
9890.00	31.51	39.62	9.46	34.81	45.78	74.00	-28.22	V
12362.50	*					74.00		V
14835.00	*					74.00		V
4945.00	41.67	34.72	6.79	34.09	49.09	74.00	-24.91	H
7417.50	33.64	37.34	7.82	34.57	44.23	74.00	-29.77	H
9890.00	30.94	39.62	9.46	34.81	45.21	74.00	-28.79	H
12362.50	*					74.00		H
14835.00	*					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.
4945.00	26.27	34.72	6.79	34.09	33.69	54.00	-20.31	V
7417.50	20.62	37.34	7.82	34.57	31.21	54.00	-22.79	V
9890.00	19.68	39.62	9.46	34.81	33.95	54.00	-20.05	V
12362.50	*					54.00		V
14835.00	*					54.00		V
4945.00	30.51	34.72	6.79	34.09	37.93	54.00	-16.07	H
7417.50	22.80	37.34	7.82	34.57	33.39	54.00	-20.61	H
9890.00	19.43	39.62	9.46	34.81	33.70	54.00	-20.30	H
12362.50	*					54.00		H
14835.00	*					54.00		H

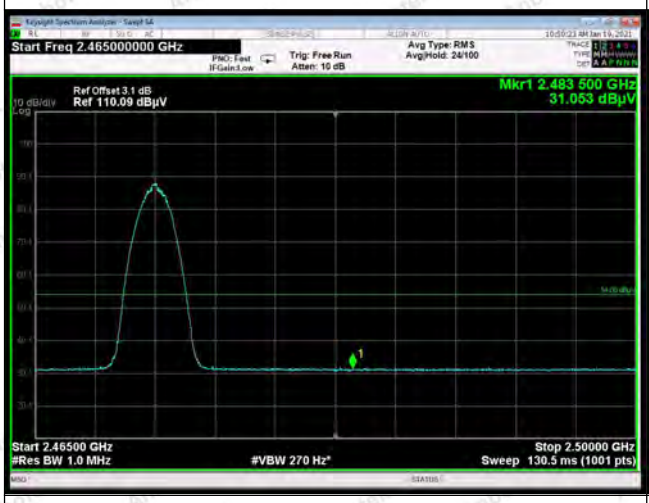
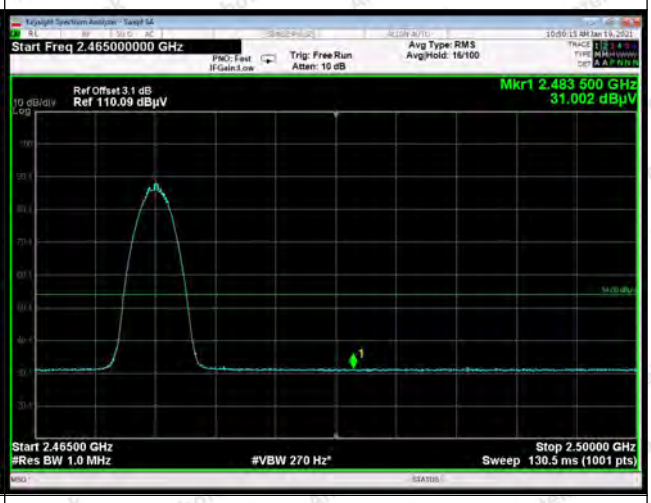
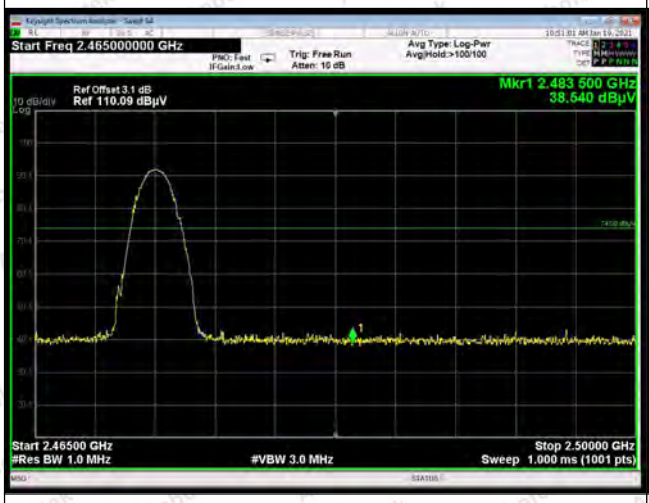
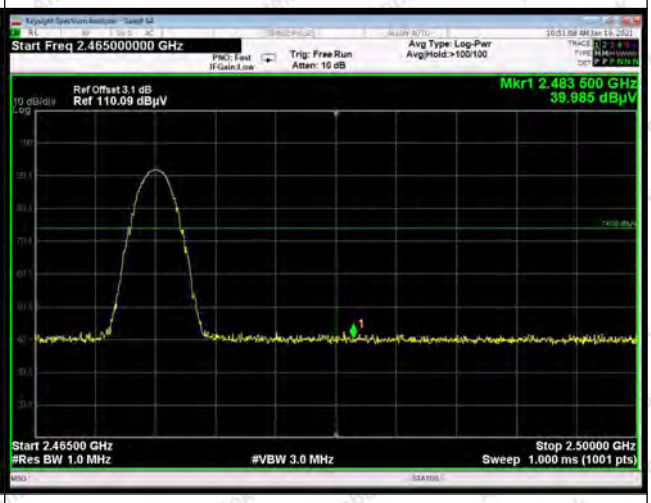
Remark:

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.

Radiated Band Edge:

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

Test Mode: CH20	Test channel: Highest
	
Average Value(Vertical)	Average Value(Horizontal)
	
Peak Value(Vertical)	Peak Value(Horizontal)

Remark:

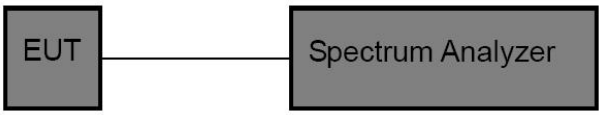
1. Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

5. Maximum Peak Output Power Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1)
Test Limit	125mW

5.2. Test Setup



5.3. Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above,
2. 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

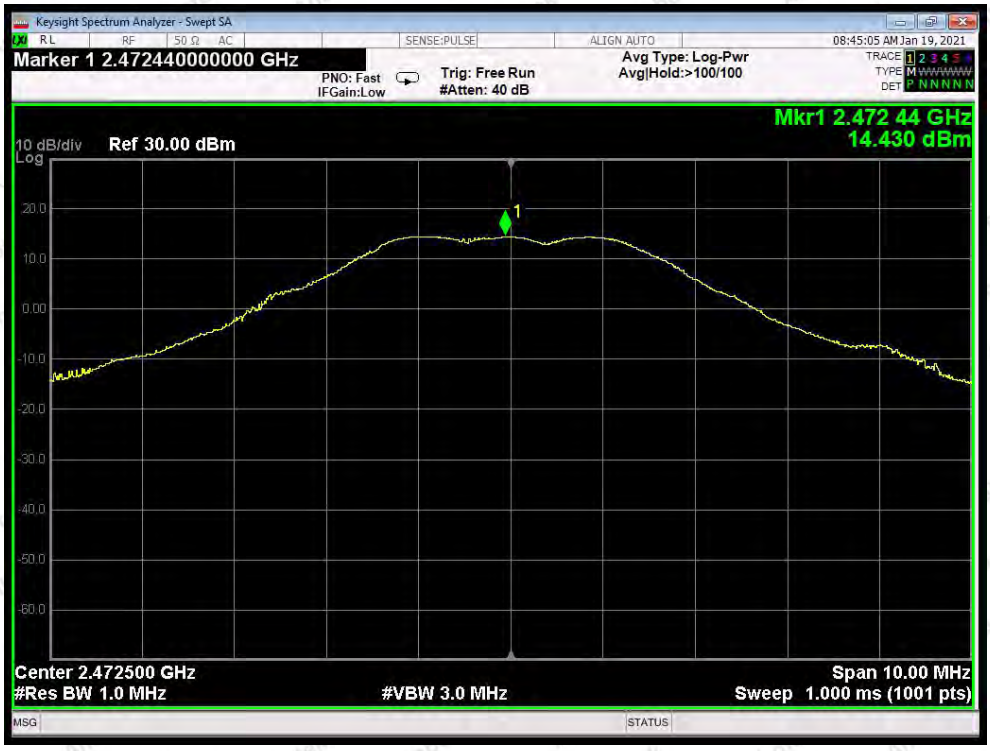
5.4. Test Data

Test Item	:	Max. peak output power	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 32V	Temperature	:	23.2℃
Test Result	:	PASS	Humidity	:	55%RH

Channel Frequency (MHz)	Peak Power output (dBm)	Limit (dBm)	Results	Modulation
2406	14.321	20.96	PASS	GFSK
2441	14.768	20.96	PASS	GFSK
2472.5	14.430	20.96	PASS	GFSK

Test Mode: GFSK---Low

Test Mode: GFSK---Middle



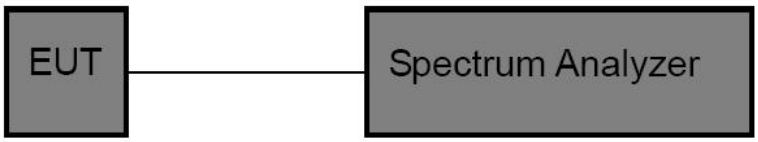
Test Mode: GFSK---High

6. 20DB Occupy Bandwidth Test

6.1. Test Standard

Test Standard	FCC Part15 C Section 15.247 (a)(1)

6.2. Test Setup



6.3. Test Procedure

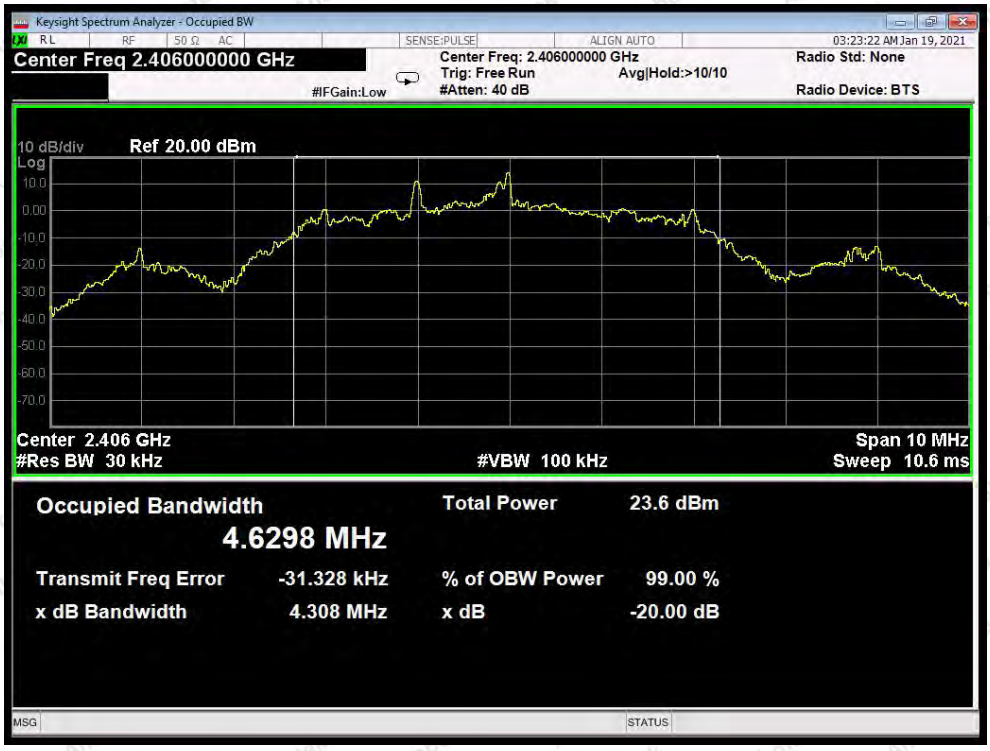
Using the following spectrum analyzer settings:

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.

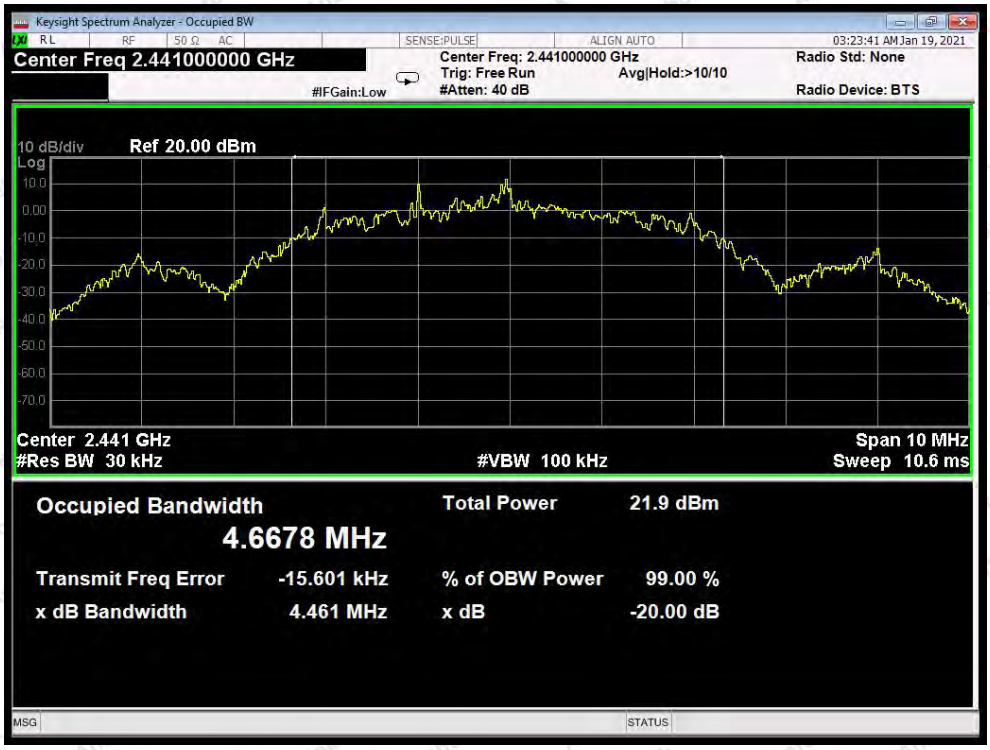
6.4. Test Data

Test Item	:	20dB BW	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 32V	Temperature	:	23.2℃
Test Result	:	PASS	Humidity	:	55%RH

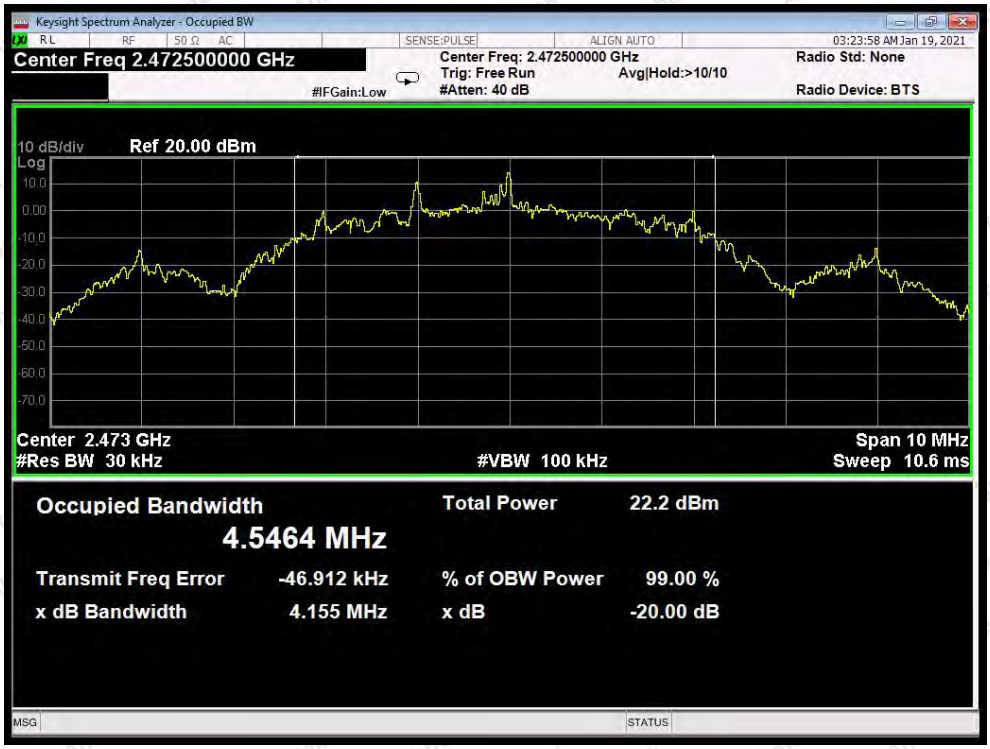
Channel	Frequency(MHz)	20dB Down BW(kHz)	Modulation Mode
Low	2406	4308	GFSK
Middle	2441	4461	GFSK
High	2472.5	4155	GFSK



Test Mode: Low



Test Mode: Middle



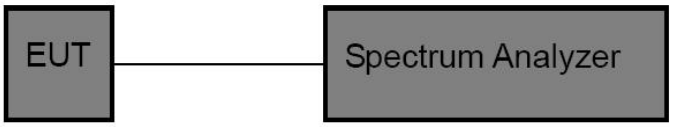
Test Mode: High

7. Carrier Frequency Separation Test

7.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1)
Test Limit	>25KHz or >two-thirds of the 20 dB bandwidth

7.2. Test Setup



7.3. Test 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 = 300 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

7.4. Test Data

Test Item	:	Frequency Separation	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 32V	Temperature	:	23.2℃
Test Result	:	PASS	Humidity	:	55%RH

Channel	Frequency (MHz)	Separation Read Value (kHz)	Limit (kHz)
Low	2406	3500	2872
Middle	2441	3500	2974
High	2472.5	3500	2770
Remark:The limit is 2/3 of 20dB BW.			

Test Mode: Low

Test Mode: Middle

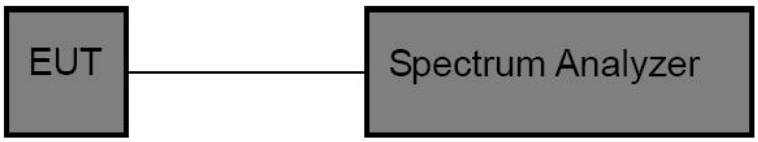
Test Mode: High

8. Number of Hopping Channel Test

8.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1)
Test Limit	>15 channels

8.2. Test Setup



8.3. Test Procedure

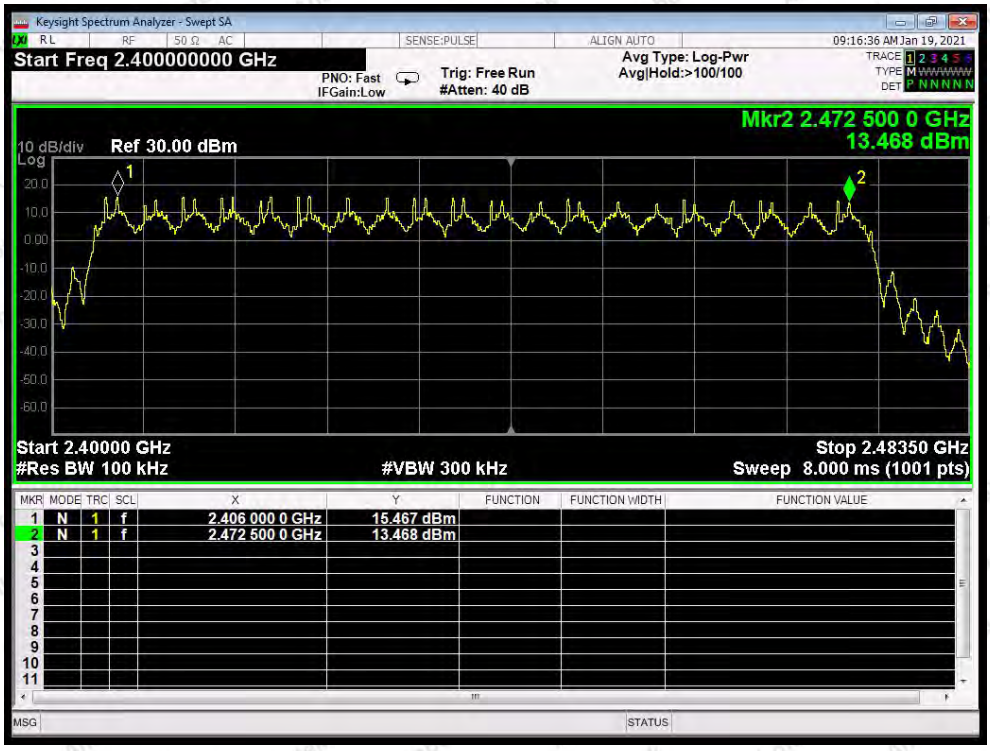
The EUT must have its hopping function enabled. Using the following spectrum analyzer setting:

1. Span= the frequency band of operation
2. Set the RBW = 100kHz.
3. Set the VBW = 300kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

8.4. Test Data

Test Item	:	Number of Hopping Frequency	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 32V	Temperature	:	23.2℃
Test Result	:	PASS	Humidity	:	55%RH

Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel
2406-2472.5MHz	20	＞15

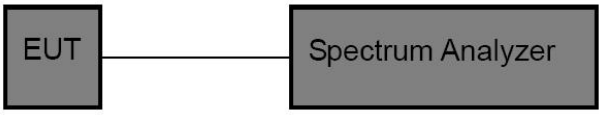

Keysight Spectrum Analyzer - Swept SA
Start Freq 2.400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:16:36 AM Jan 19, 2021
Mkr2 2.472 500 0 GHz
13.468 dBm
10 dB/div
Ref 30.00 dBm
Start 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.48350 GHz
Sweep 8.000 ms (1001 pts)
1 N 1 f 2.406 000 0 GHz 15.467 dBm
2 N 1 f 2.472 500 0 GHz 13.468 dBm

9. Dwell Time Test

9.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1)
Test Limit	0.4 sec

9.2. Test Setup



9.3. Test 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.

9.4. Test Data

Test Item	:	Time of Occupancy	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 32V	Temperature	:	23.2℃
Test Result	:	PASS	Humidity	:	55%RH

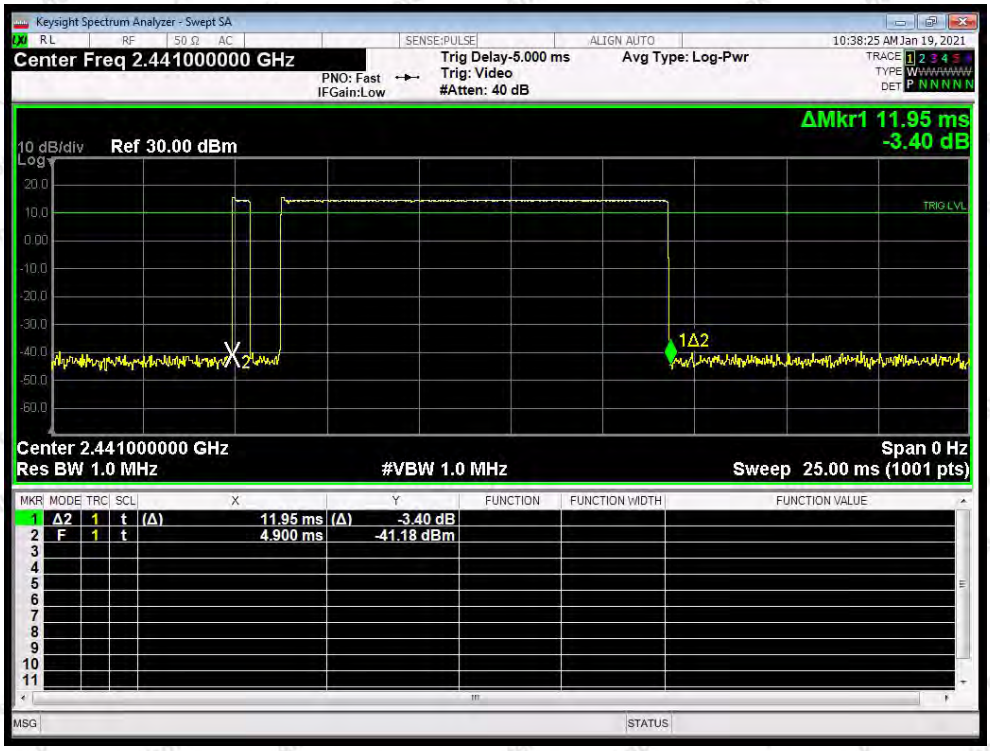
Channel	Burst width (ms)	Total hopping number in 8s	Total dwell time (s)	Limit (s)	Rusult
Hopping	11.95	32	0.3824	≤0.4	Pass

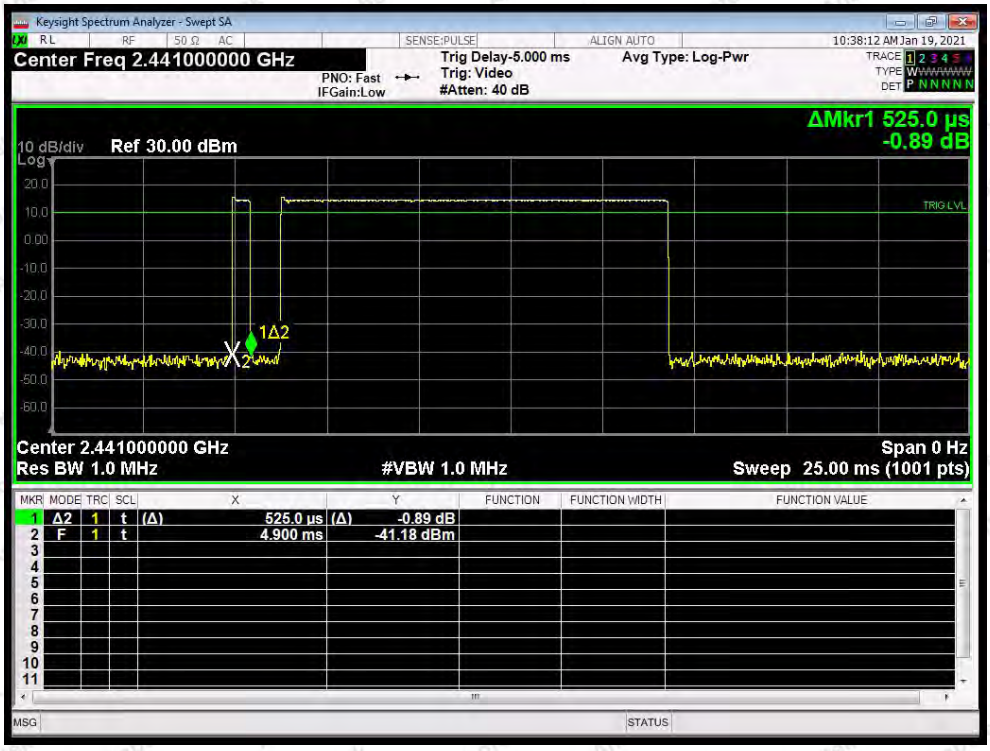
Note:

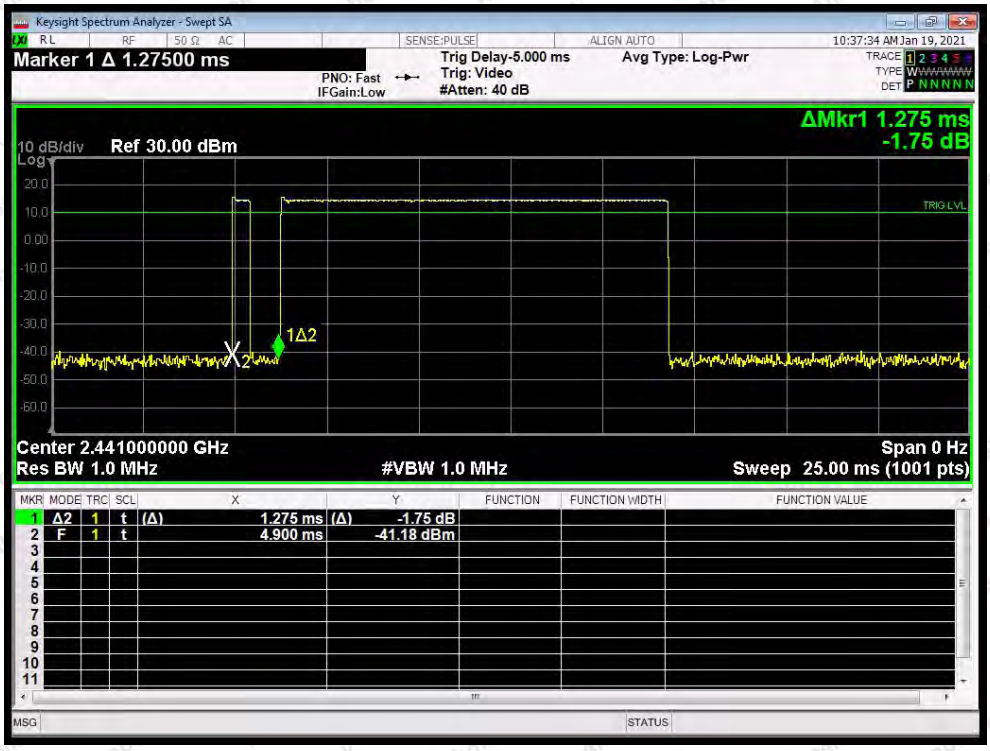
(1) Total dwell time=Burst width*Total hopping number

(2)There are total 20 channels were active at any time. So the test period is 0.4*20s=8s.

Test Mode: Hopping






Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 1.27500 ms
Trig Delay-5.000 ms
Trig: Video
#Atten: 40 dB
Avg Type: Log-Pwr
10:37:34 AM Jan 19, 2021
ΔMkr1 1.275 ms
-1.75 dB
10 dB/div Ref 30.00 dBm
Center 2.441000000 GHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 1.0 MHz
Sweep 25.00 ms (1001 pts)
1 Δ2 1 t (Δ) 1.275 ms (Δ) -1.75 dB
2 F 1 t 4.900 ms -41.18 dBm

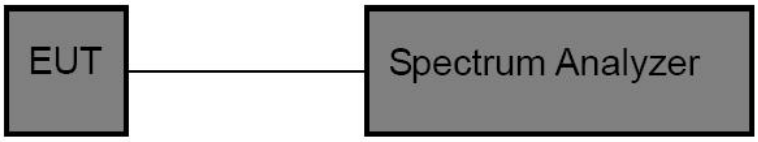
Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
Trig: Line
#Atten: 40 dB
Avg Type: Log-Pwr
10:30:08 AM Jan 19, 2021
10 dB/div Ref 30.00 dBm
Center 2.441000000 GHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 1.0 MHz
Sweep 8.000 s (1001 pts)

10. 100kHz Bandwidth of Frequency Band Edge Requirement

10.1. 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 in 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).

10.2. Test Setup



10.3. Test Procedure

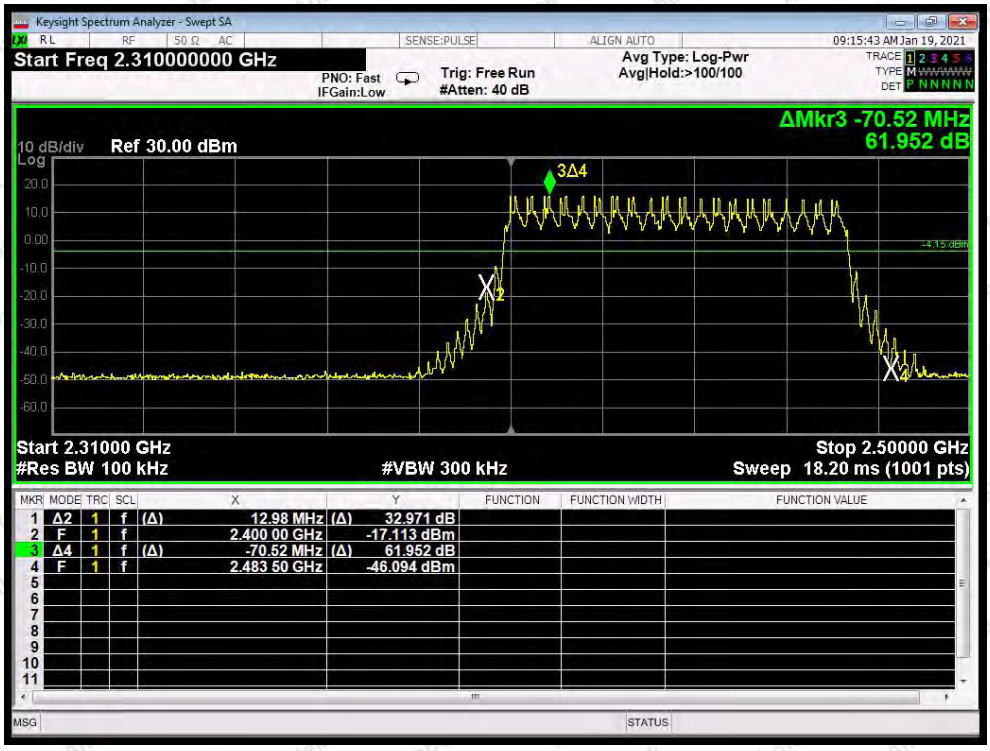
The EUT must have its hopping/Non-hopping function enabled. Using the following spectrum analyzer setting:

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.

10.4. Test Data

Test Item	:	Band edge	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 32V	Temperature	:	23.2℃
Test Result	:	PASS	Humidity	:	55%RH

For Hopping Mode

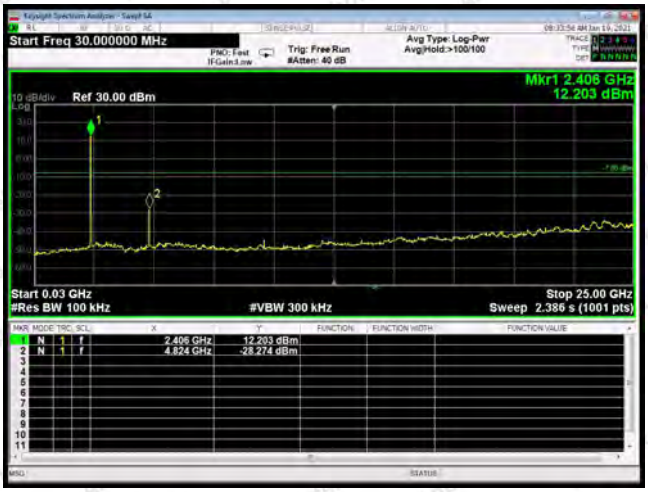


For Non-Hopping Mode

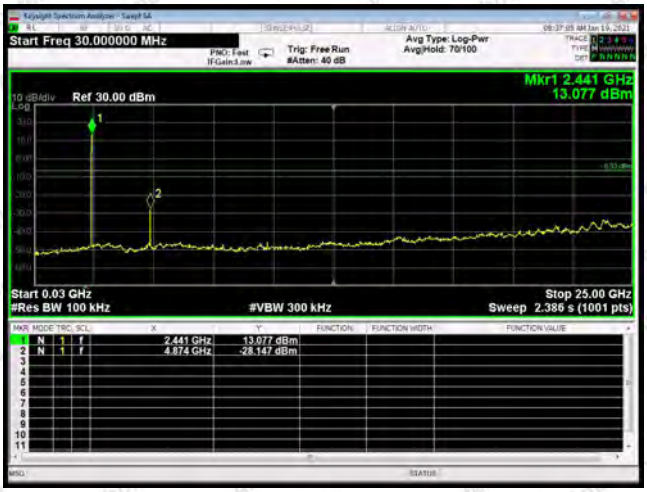
Lowest

Highest

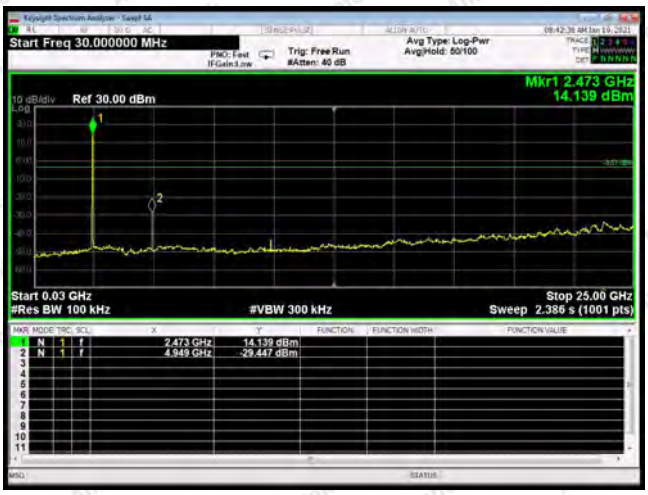
Conducted Emission Method



Test Mode: Low



Test Mode: Mid



Test Mode: High

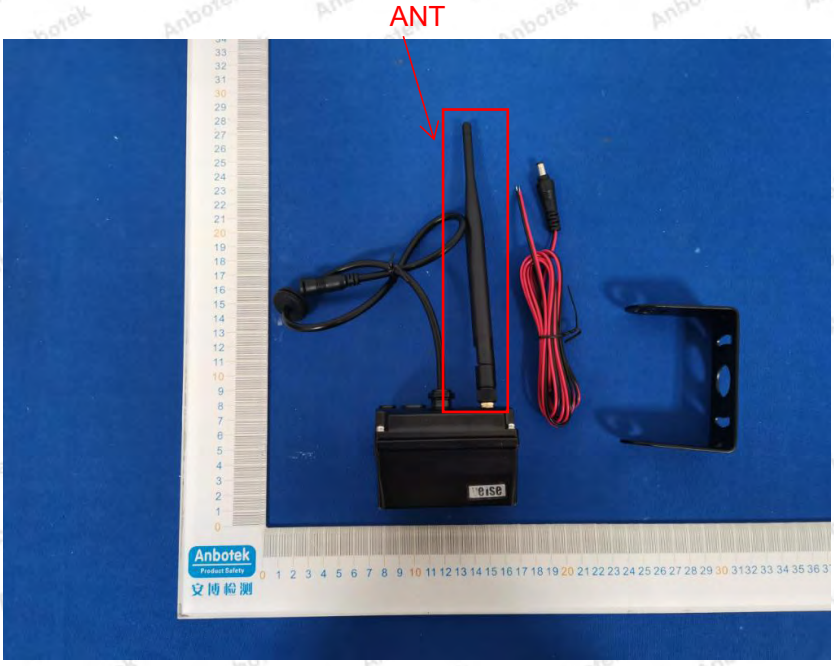
11. Antenna Requirement

11.1. 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

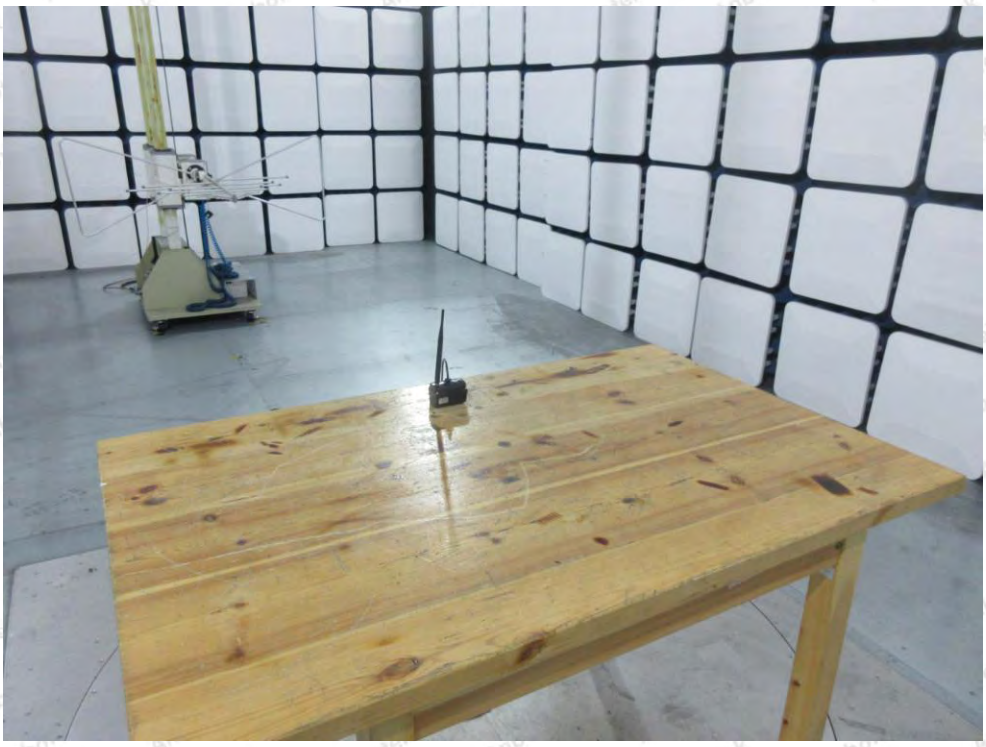
11.2. Antenna Connected Construction

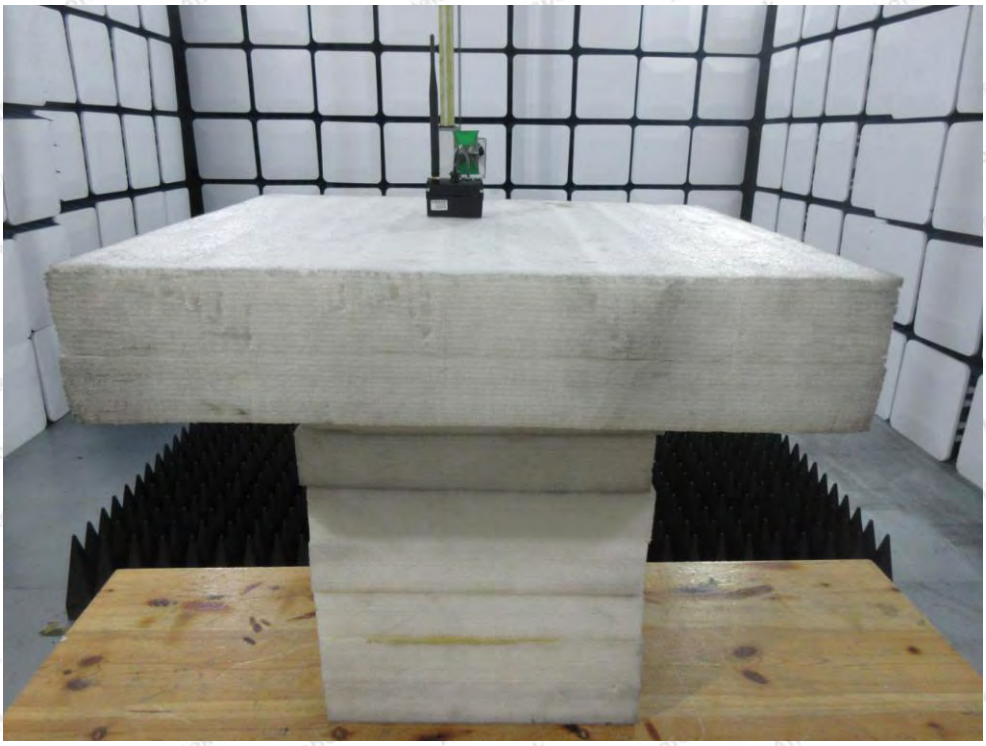
The antenna is Columnar Antenna which permanently attached, and the best case gain of the antenna is 5 dBi. It complies with the standard requirement.



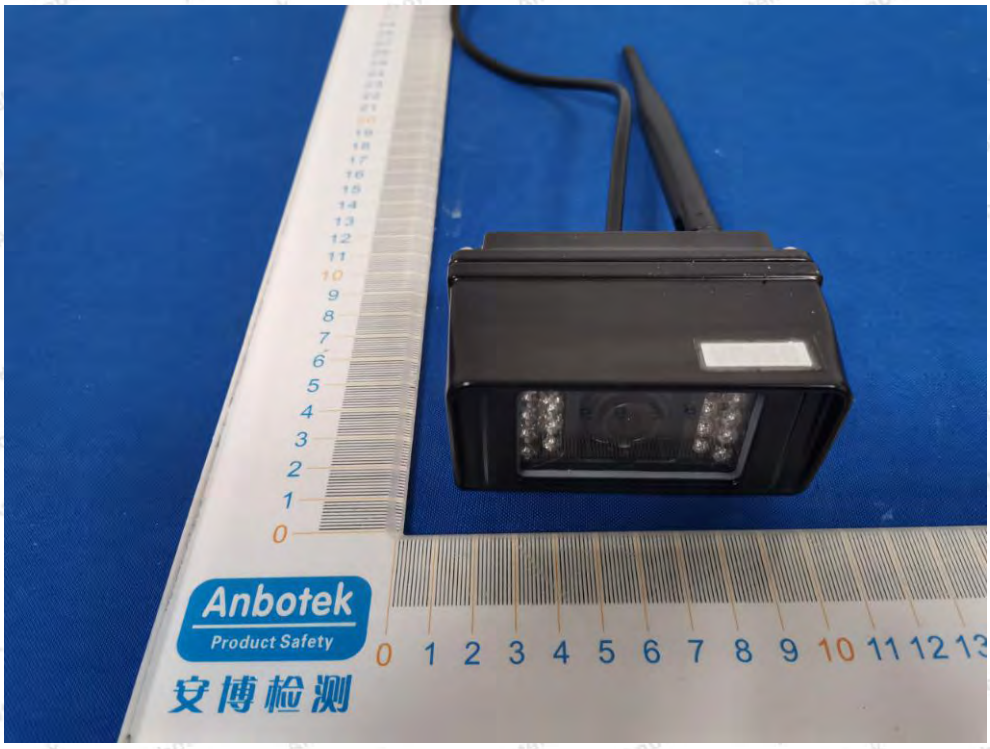
APPENDIX I -- TEST SETUP PHOTOGRAPH

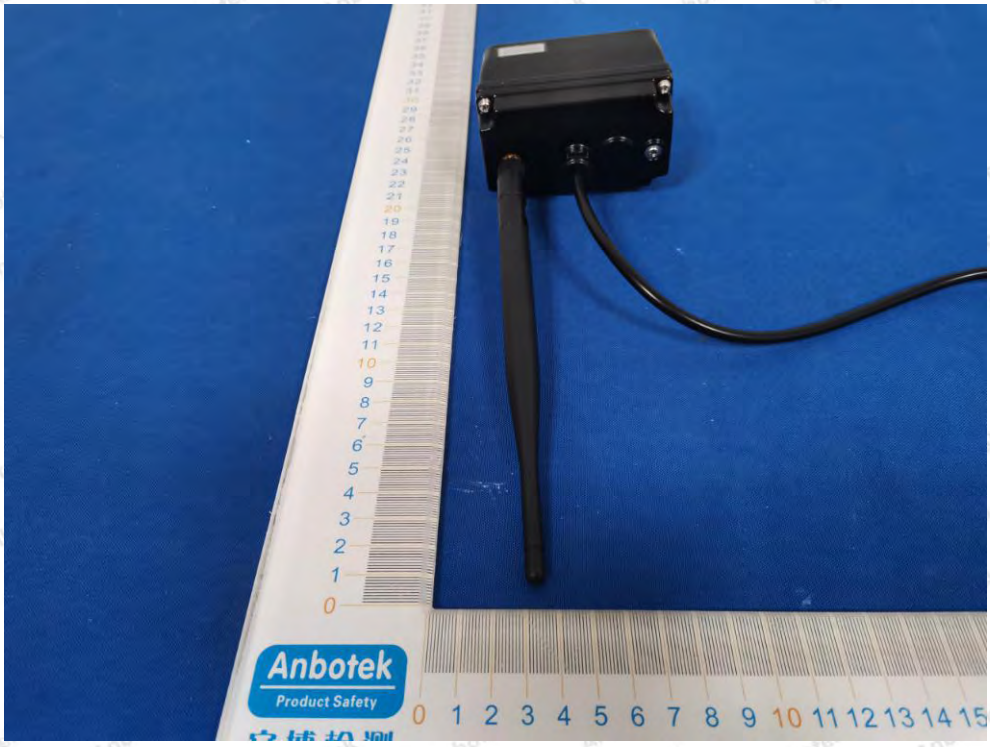
Photo of Radiation Emission Test





APPENDIX II -- EXTERNAL PHOTOGRAPH

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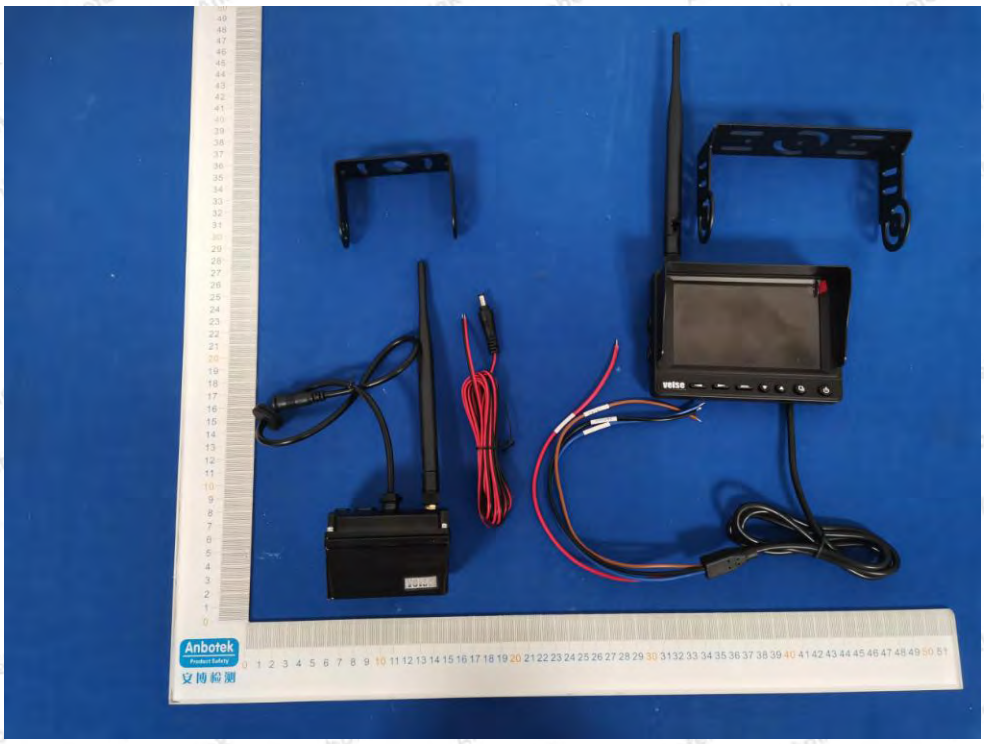
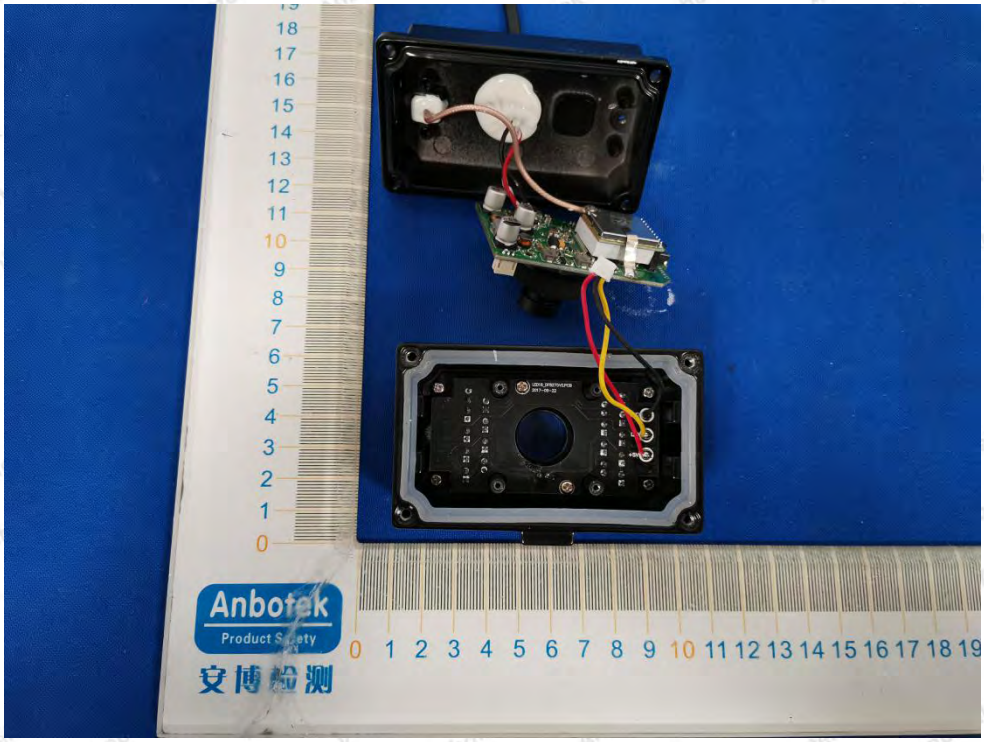
APPENDIX III -- INTERNAL PHOTOGRAPH

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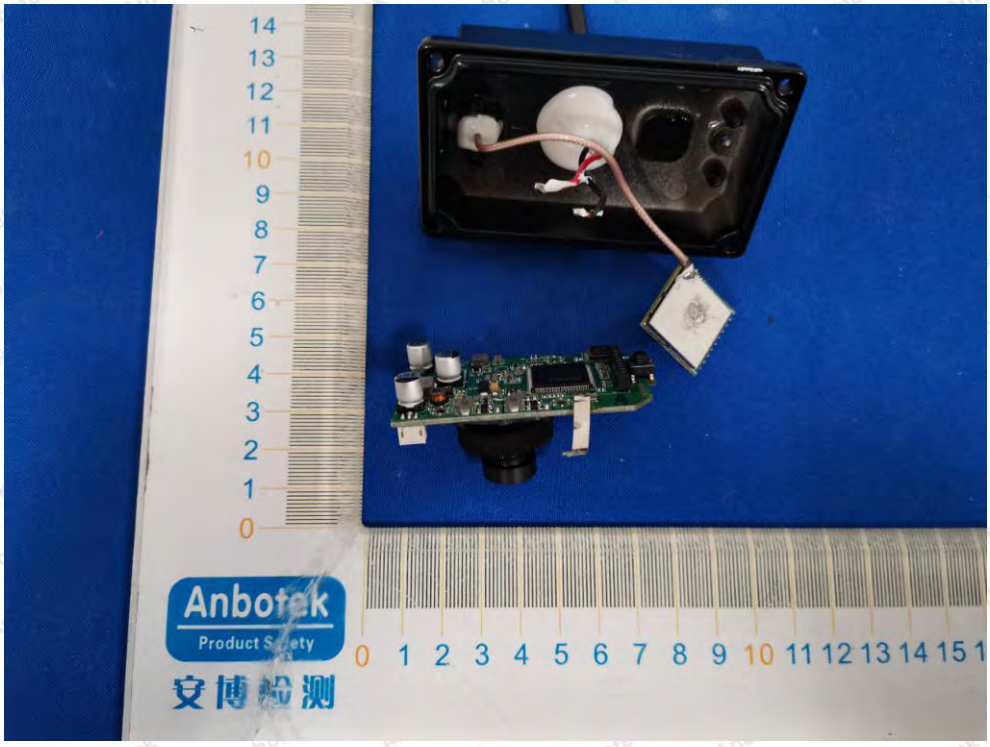
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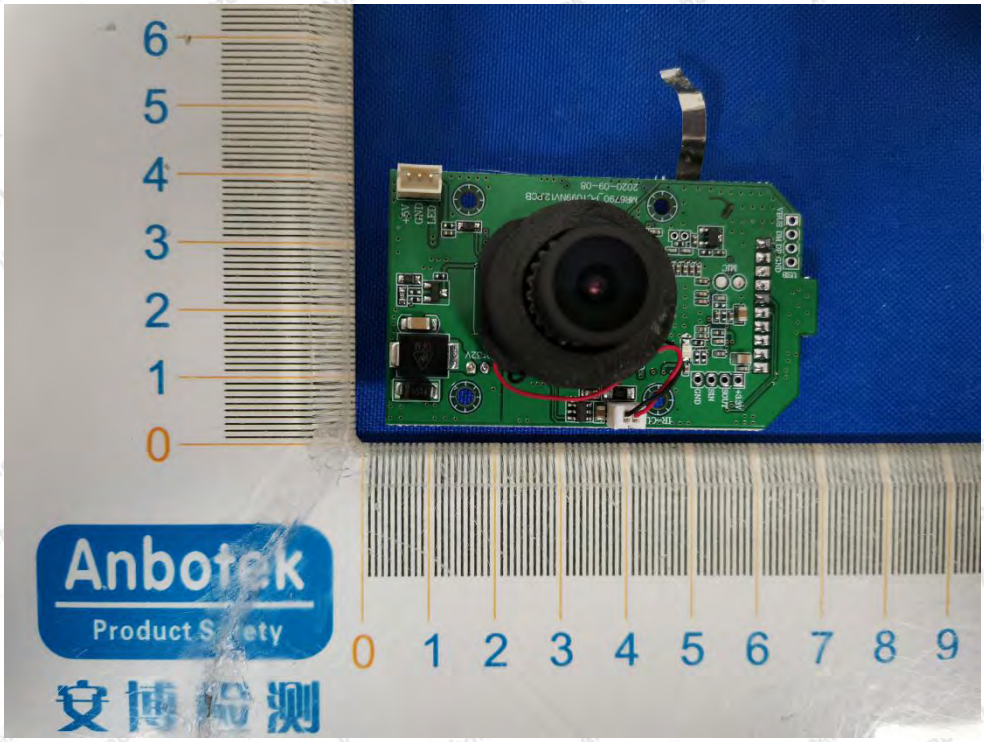

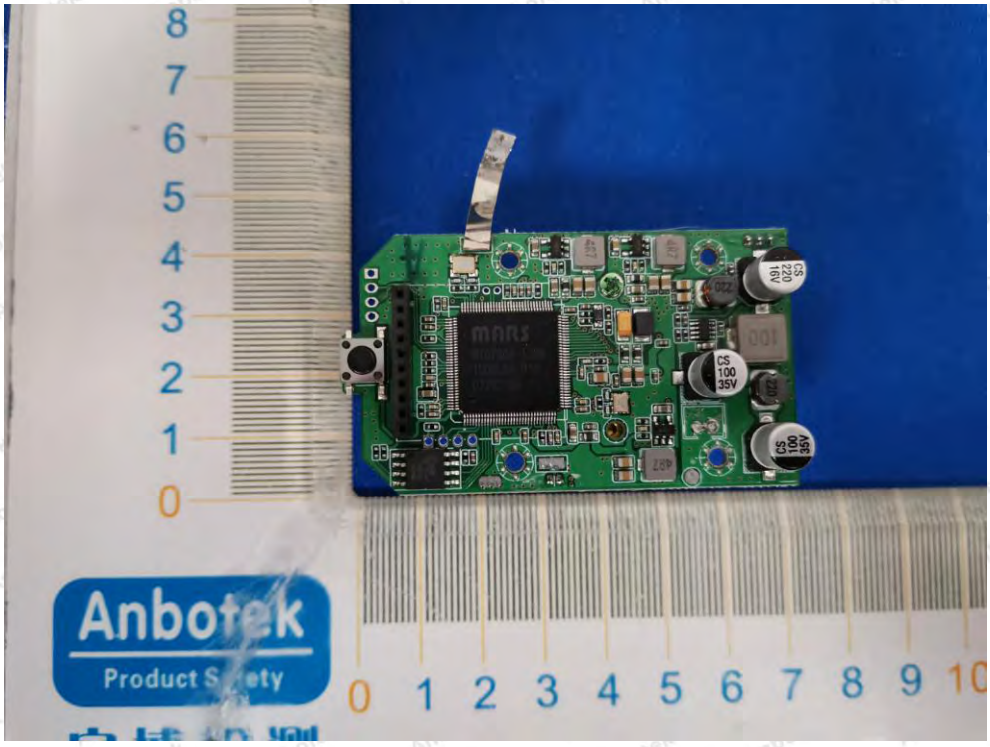

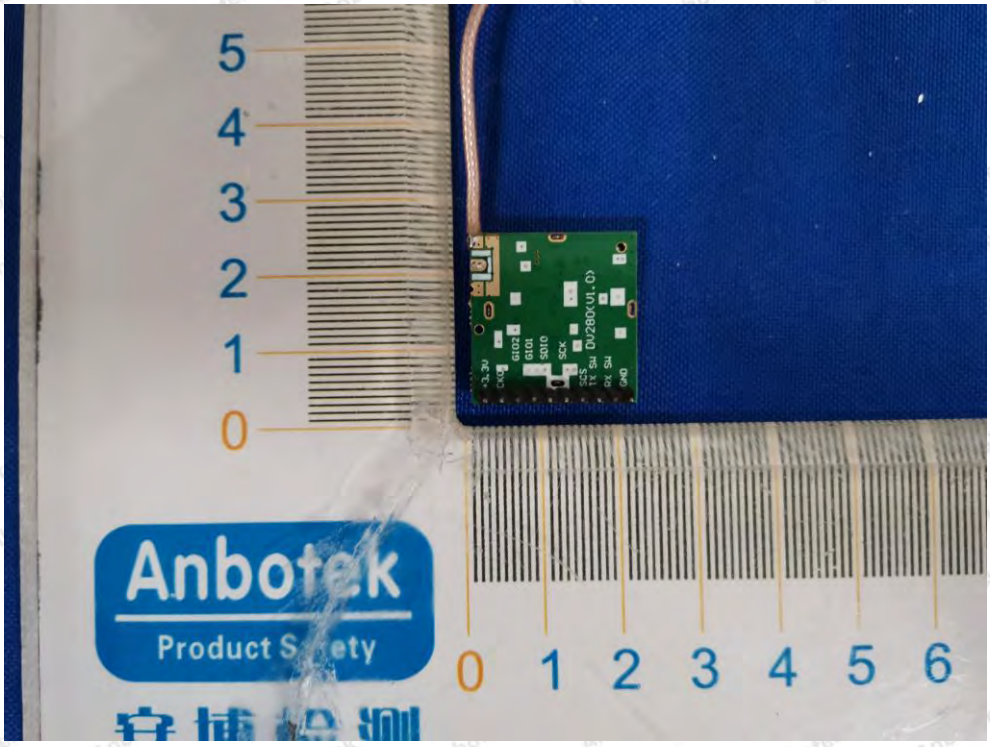
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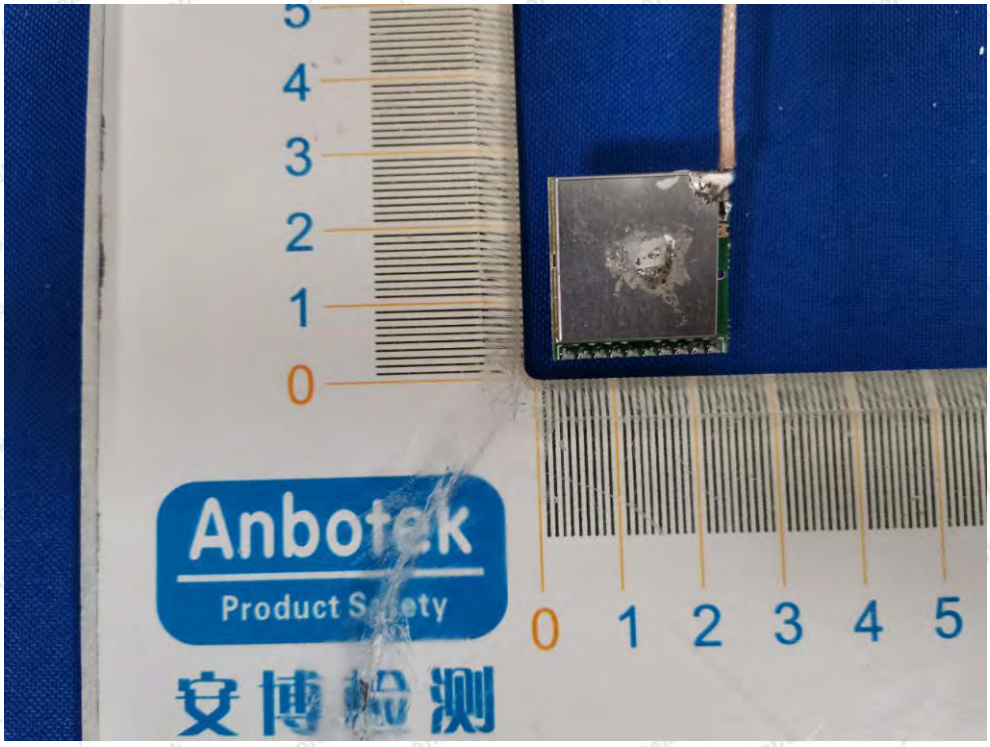
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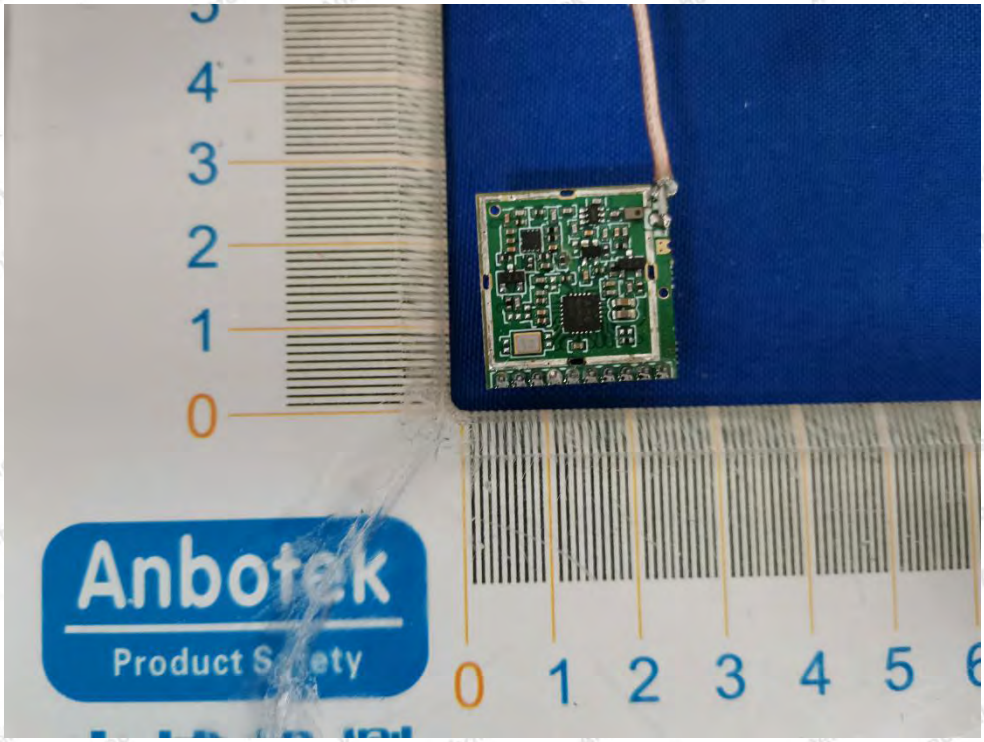

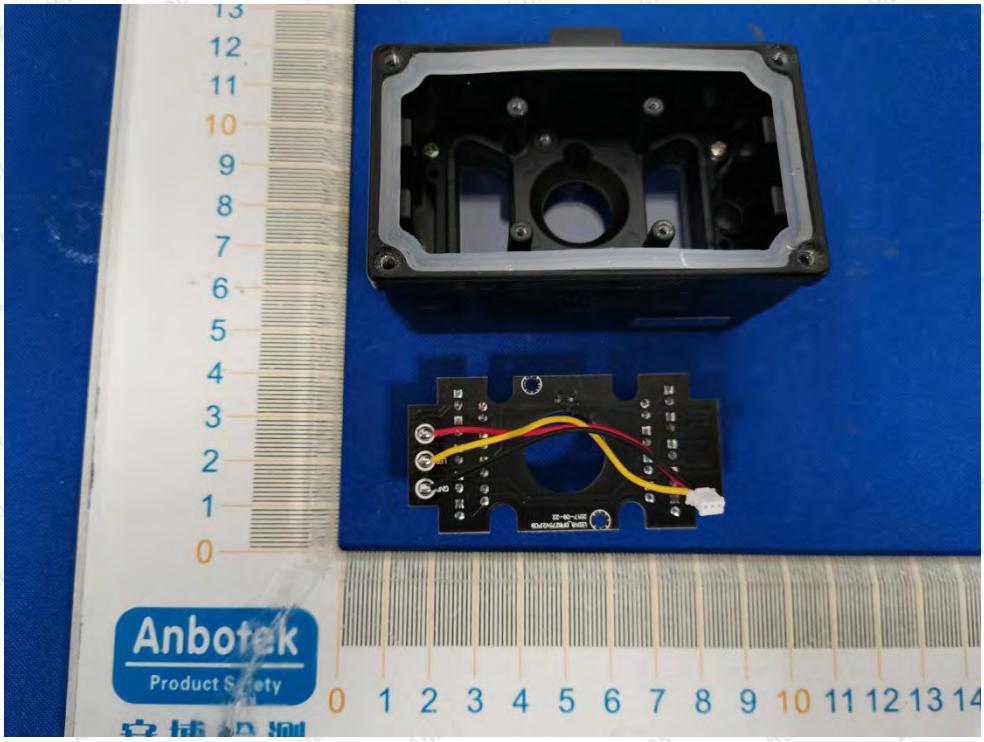

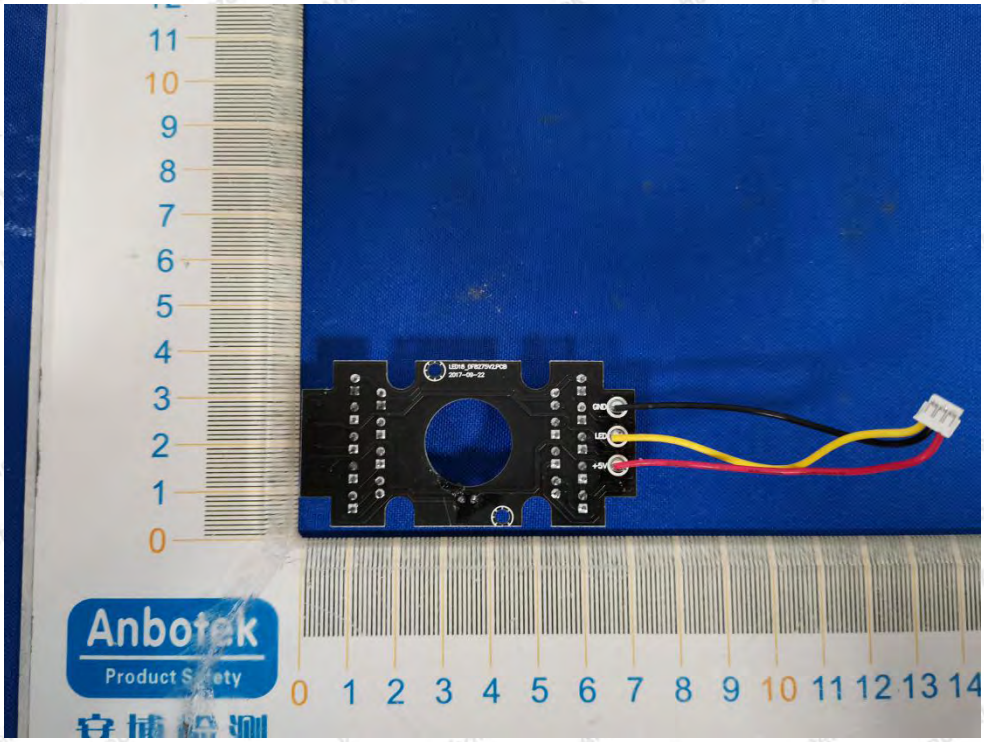

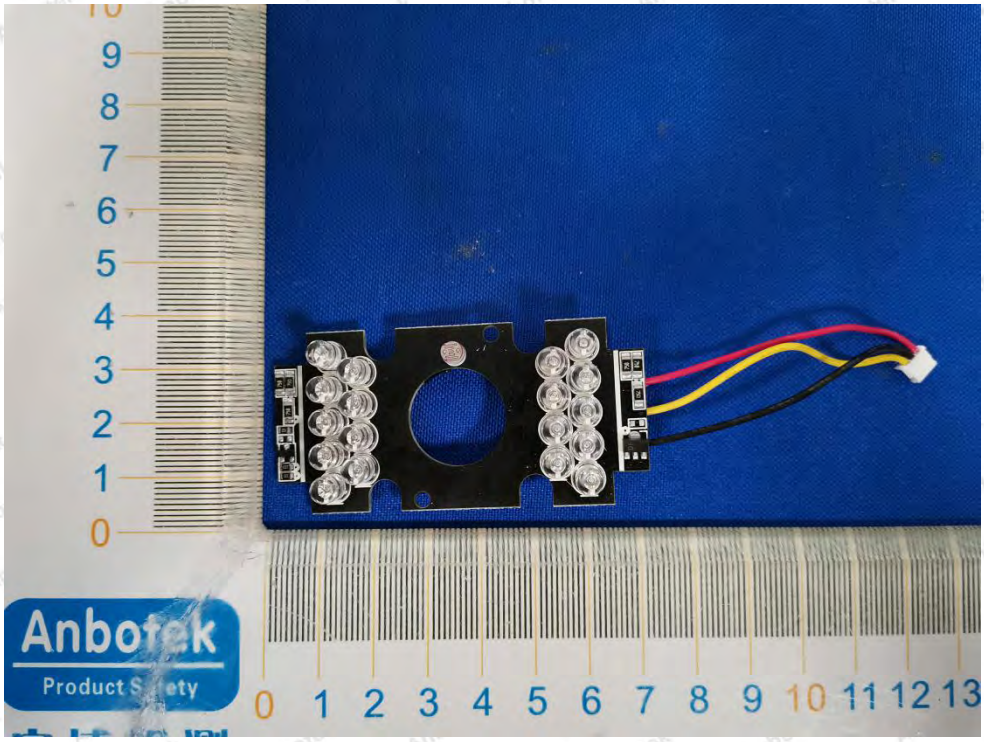

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