



TEST REPORT

Report No......: **CHTEW19120034** Report verification: 
Project No.: **SHT1906057602EW**
FCC ID: **2AUW4-LW-SH900-909**
Applicant's name: **Shanghai LEWIN Intelligent Technology Co., Ltd.**
Address: Room 2312, Office Tower 1, Henglung Plaza No.1266, Nanjing Xi Road, Shanghai, China, P.R.
Manufacturer.....: Shanghai LEWIN Intelligent Technology Co., Ltd.
Address.....: Room 2312, Office Tower 1, Henglung Plaza No.1266, Nanjing Xi Road, Shanghai, China, P.R.
Test item description: **Smart Home System**
Trade Mark.....: Léwin
Model/Type reference: LW-SH900MDA-P4-Z
Listed Model(s).....: Refers to page 3, Table of list models
Standard.....: **FCC CFR Title 47 Part 15 Subpart C Section 15.247**
Date of receipt of test sample.....: Sep.26, 2019
Date of testing.....: Sep.30, 2019- Oct.19, 2019
Date of issue.....: Dec.05, 2019
Result: **PASS**

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Testing Laboratory Name.....: **Shenzhen Huatongwei International Inspection Co., Ltd.**
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

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The test report merely correspond to the test sample.

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1. TEST STANDARDS AND REPORT VERSION

1.1. Test Standards

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

[ANSI C63.10:2013](#): American National Standard for Testing Unlicensed Wireless Devices

[KDB 558074 D01 15.247 Meas Guidance v05r02](#): Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of The FCC Rules

1.2. Report version

Revision No.	Date of issue	Description
N/A	2019-12-05	Original

Table of list models

Description	Model
Wireless Gateway	LW-SH900-App-Z,LW-SH900/909-P/T/N/DA/S/H/B/M/A/G/W/C/J/TL/APP/CM/SD/AJ/WJ-Z
Smart Panel(4 inch screen)	LW-SH900MDA-P4-Z,LW-SH900/909MDA/MDG/MDQ/MSB/MFA/MSC/MTS/LOR/LBG/LCB/GMB/GSG/GSW-T4/5/7/10-Z
Smart Panel (Intelligent Key Control)	LW-SH900MDA-P1-6-Z,LW-SH900/909MDA/MDG/MDQ/MSB/MFA/MSC/MTS/LOR/LBG/LCB/GMB/GSG/GSW-P/1/2/4/5/7/10-Z

2. TEST DESCRIPTION

Test Item	FCC Rule	Result	Test Engineer
Antenna requirement	15.203/15.247(c)	PASS	Ximing Huang
Line Conducted Emissions (AC Main)	15.207	PASS	Kang Yang
Conducted Peak Output Power	15.247(b)(3)	PASS	Ximing Huang
Power Spectral Density	15.247(e)	PASS	Ximing Huang
6dB Bandwidth	15.247(a)(2)	PASS	Ximing Huang
Restricted band	15.247(d)/15.205	PASS	Ximing Huang
Spurious Emissions	15.247(d)/15.209	PASS	Ximing Huang

Note: The measurement uncertainty is not included in the test result.

3. SUMMARY

3.1. Client Information

Applicant:	Shanghai LEWIN Intelligent Technology Co., Ltd.
Address:	Room 2312, Office Tower 1, Henglung Plaza No.1266, Nanjing Xi Road, Shanghai, China, P.R.
Manufacturer:	Shanghai LEWIN Intelligent Technology Co., Ltd.
Address:	Room 2312, Office Tower 1, Henglung Plaza No.1266, Nanjing Xi Road, Shanghai, China, P.R.

3.2. Product Description

Name of EUT:	Smart Home System
Trade Mark:	Léwin
Model No.:	LW-SH900MDA-P4-Z
Listed Model(s):	Refers to page 3, Table of list models
Power supply:	DC 12V for Wireless Gateway AC 100-240V, 50/60Hz for Smart Panel(4 inch screen) and Smart Panel (Intelligent Key Control)
ZigBee Specification	
Operation frequency:	2405MHz~2480MHz
Modulation:	OQPSK
Channel number:	16
Channel separation:	5MHz
Antenna type:	PCB Antenna
Antenna gain:	0dBi

3.3. Operation state

➤ Test frequency list

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channel which were tested. the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above gray bottom.

Channel	Frequency (MHz)
01	2405
02	2410
:	:
08	2440
:	:
15	2475
16	2480

➤ Test mode

For RF test items
The engineering test program was provided and enabled to make EUT continuous transmit (duty cycle>98%).
For AC power line conducted emissions:
The EUT was set to connect with the Bluetooth instrument under large package sizes transmission.
For Radiated suprious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit(duty cycle>98%). The EUT in each of three orthogonal axis emissions had been tested ,but only the worst case (X axis) data Recorded in the report.

3.4. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

/	Manufacturer:	/
	Model No.:	/
/	Manufacturer:	/
	Model No.:	/

3.5. Modifications

No modifications were implemented to meet testing criteria.

4. TEST ENVIRONMENT

4.1. Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.

Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

4.2. Test Facility

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 3902.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 762235

Shenzhen Huatongwei International Inspection Co., Ltd. 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.

IC-Registration No.:5377A

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No.: 5377A.

ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

4.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

4.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors in calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd. quality system according to ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Here after the best measurement capability for Shenzhen Huatongwei International Inspection Co., Ltd. is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.51 dB	(1)
Conducted spurious emissions 9kHz~40GHz	0.51 dB	(1)
Conducted Disturbance 150kHz~30MHz	3.02 dB	(1)
Radiated Emissions below 1GHz	4.90 dB	(1)
Radiated Emissions above 1GHz	4.96 dB	(1)
Occupied Bandwidth	70 Hz	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.5. Equipments Used during the Test

● Conducted Emission						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Shielded Room	Albatross projects	N/A	N/A	2018/09/28	2023/09/27
●	EMI Test Receiver	R&S	ESCI	101247	2018/10/27	2019/10/26
●	Artificial Mains	SCHWARZBECK	NNLK 8121	573	2018/10/27	2019/10/26
●	Pulse Limiter	R&S	ESH3-Z2	100499	2018/10/27	2019/10/26
●	RF Connection Cable	HUBER+SUHNER	EF400	N/A	2018/11/15	2019/11/14
●	Test Software	R&S	ES-K1	N/A	N/A	N/A
○	Single Balanced Telecom Pair ISN	FCC	FCC-TLISN-T2-02	20371	2018/10/28	2019/10/27
○	Two Balanced Telecom Pairs ISN	FCC	FCC-TLISN-T4-02	20373	2018/10/28	2019/10/27
○	Four Balanced Telecom Pairs ISN	FCC	FCC-TLISN-T8-02	20375	2018/10/28	2019/10/27
○	V-Network	R&S	ESH3-Z6	100211	2018/10/27	2019/10/26
○	V-Network	R&S	ESH3-Z6	100210	2018/10/27	2019/10/26
○	2-Line V-Network	R&S	ESH3-Z5	100049	2018/10/27	2019/10/26
● Radiated Emission-6th test site						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	SAC-3m-02	N/A	2018/09/30	2021/09/29
●	EMI Test Receiver	R&S	ESCI	100900	2018/10/28	2019/10/27
●	Loop Antenna	R&S	HFH2-Z2	100020	2017/11/20	2020/11/19
●	Ultra-Broadband Antenna	SCHWARZBECK	VULB9163	546	2017/04/05	2020/04/04
●	Pre-Amplifier	SCHWARZBECK	BBV 9742	N/A	2018/11/15	2019/11/14
●	RF Connection Cable	HUBER+SUHNER	N/A	N/A	2019/08/21	2020/08/20
●	RF Connection Cable	HUBER+SUHNER	SUCOFLEX104	501184/4	2019/05/27	2020/05/26
●	Test Software	R&S	ES-K1	N/A	N/A	N/A
●	Turntable	Maturo Germany	TT2.0-1T	N/A	N/A	N/A
●	Antenna Mast	Maturo Germany	CAM-4.0-P-12	N/A	N/A	N/A
● Radiated emission-7th test site						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	SAC-3m-01	N/A	2018/09/30	2021/09/29
●	Spectrum Analyzer	R&S	FSP40	100597	2018/10/27	2019/10/26
●	Horn Antenna	SCHWARZBECK	9120D	1011	2017/03/27	2020/03/26
●	Pre-amplifier	BONN	BLWA0160-2M	1811887	2018/11/14	2019/11/13
●	Pre-amplifier	CD	PAP-0102	12004	2018/11/14	2019/11/13
●	Broadband Pre-amplifier	SCHWARZBECK	BBV 9718	9718-248	2019/04/26	2020/04/25
●	RF Connection Cable	HUBER+SUHNER	RE-7-FH	N/A	2018/11/15	2019/11/14
●	RF Connection Cable	HUBER+SUHNER	RE-7-FL	N/A	2018/11/15	2019/11/14
●	Test Software	Audix	E3	N/A	N/A	N/A
●	Turntable	Maturo Germany	TT2.0-1T	N/A	N/A	N/A
●	Antenna Mast	Maturo Germany	CAM-4.0-P-12	N/A	N/A	N/A

● RF Conducted Method						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Signal and spectrum Analyzer	R&S	FSV40	100048	2018/10/28	2019/10/27
●	Spectrum Analyzer	Agilent	N9020A	MY50510187	2018/09/29	2020/10/25
○	Radio communication tester	R&S	CMW500	137688-Lv	2018/09/29	2020/10/25
○	Test software	Tonscend	JS1120-1(LTE)	N/A	N/A	N/A
○	Test software	Tonscend	JS1120-2(WIFI)	N/A	N/A	N/A
○	Test software	Tonscend	JS1120-3(WCDMA)	N/A	N/A	N/A
○	Test software	Tonscend	JS1120-4(GSM)	N/A	N/A	N/A

5. TEST CONDITIONS AND RESULTS

5.1. Antenna Requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 15.203:

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.

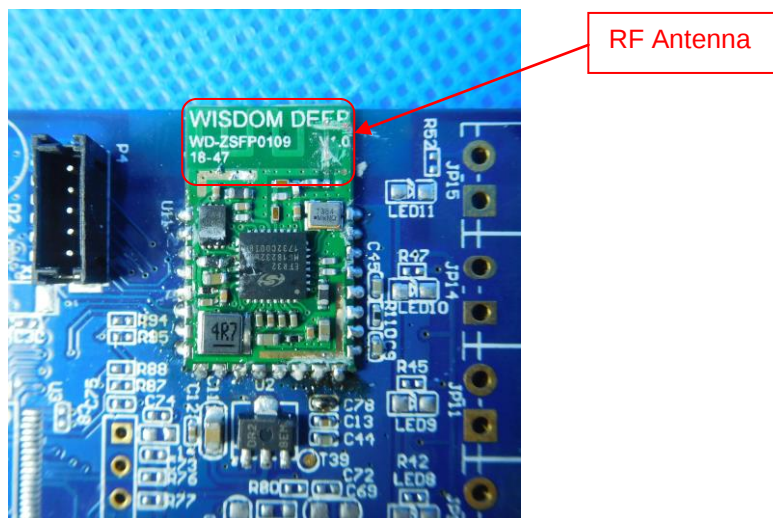
FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(i) 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 6 dBi 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.

TEST RESULTS

☒ Passed ☐ Not Applicable

The directional gain of the antenna less than 6 dBi, please refer to the below antenna photo.



5.2. Conducted Emissions (AC Main)

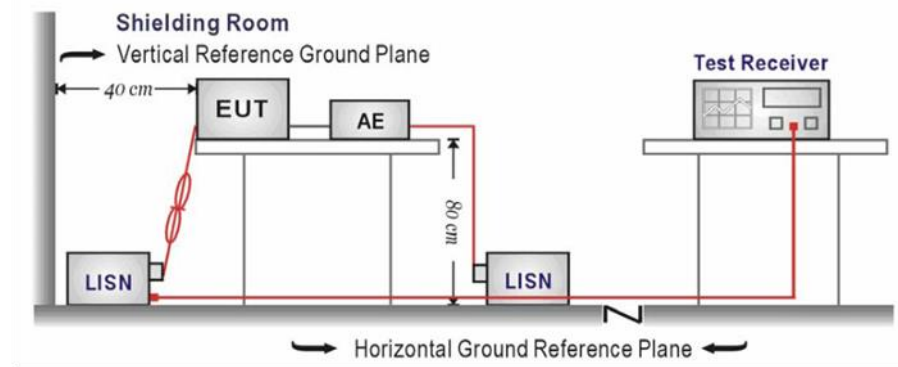
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ Passed ☐ Not Applicable

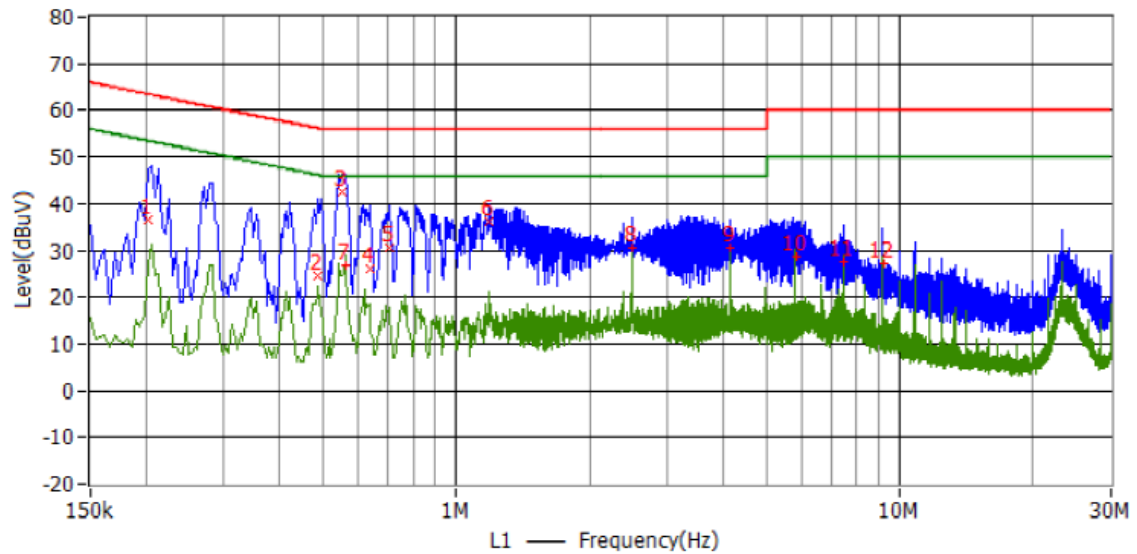
Note:

- 1) Transd = Cable lose + Pulse Limiter Factor + Artificial Mains Factor
- 2) Margin = Limit - Level

Smart Panel(4 inch screen)

Test Line:

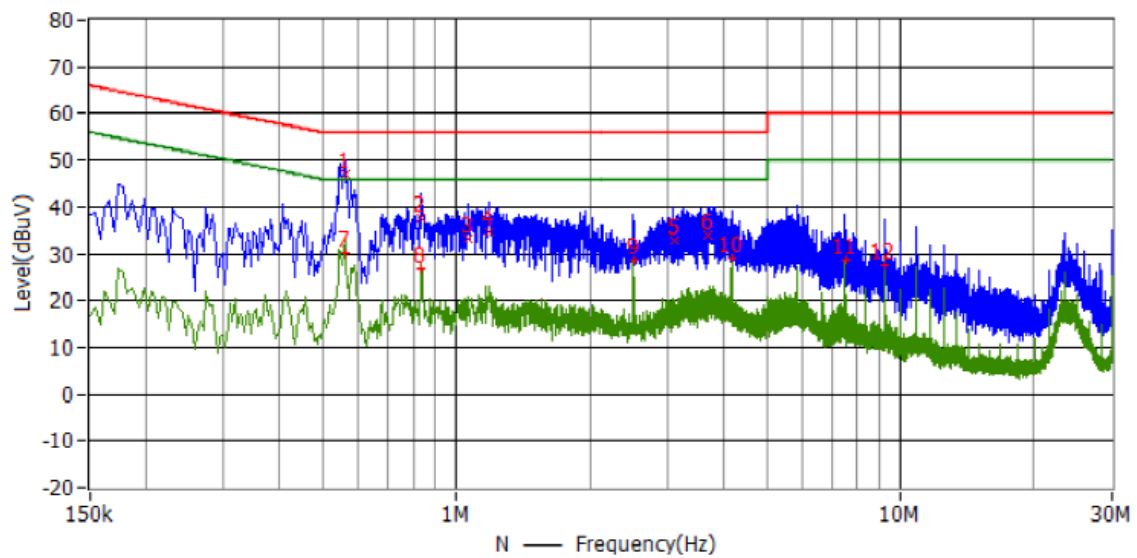
L



No.	Frequency	Limit dBuV	Level dBuV	Delta dB	Factor dB	Detector	Phase
1	202.000 kHz	63.5	36.5	-27.0	10.1	QP	L1
2	490.000 kHz	56.2	24.6	-31.6	10.1	QP	L1
3	554.000 kHz	56.0	42.7	-13.3	10.1	QP	L1
4	642.000 kHz	56.0	25.9	-30.1	10.1	QP	L1
5	706.000 kHz	56.0	30.6	-25.4	10.1	QP	L1
6	1.190 MHz	56.0	36.3	-19.7	10.1	QP	L1
7	562.000 kHz	46.0	26.8	-19.2	10.1	AV	L1
8	2.502 MHz	46.0	30.6	-15.4	10.1	AV	L1
9	4.170 MHz	46.0	30.4	-15.6	10.1	AV	L1
10	5.842 MHz	50.0	28.7	-21.3	10.2	AV	L1
11	7.510 MHz	50.0	27.7	-22.3	10.2	AV	L1
12	9.182 MHz	50.0	27.3	-22.7	10.2	AV	L1

Test Line:

N

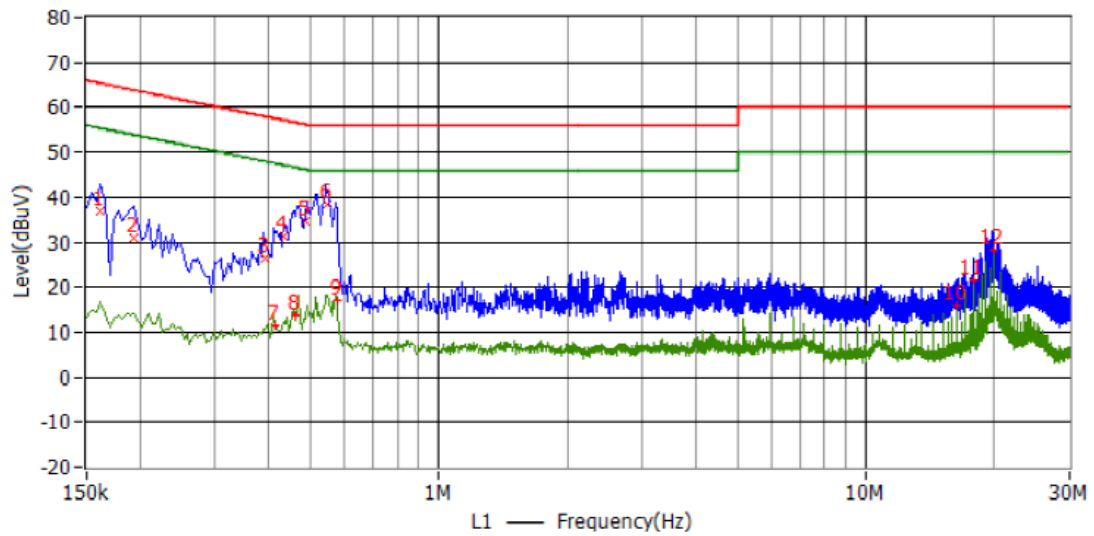


No.	Frequency	Limit dBuV	Level dBuV	Delta dB	Factor dB	Detector	Phase
1	562.000 kHz	56.0	47.2	-8.8	9.9	QP	N
2	834.000 kHz	56.0	37.5	-18.5	9.9	QP	N
3	1.062 MHz	56.0	33.0	-23.0	9.9	QP	N
4	1.182 MHz	56.0	34.7	-21.3	9.9	QP	N
5	3.098 MHz	56.0	32.9	-23.1	10.0	QP	N
6	3.678 MHz	56.0	33.9	-22.1	10.0	QP	N
7	562.000 kHz	46.0	30.2	-15.8	9.9	AV	N
8	834.000 kHz	46.0	26.9	-19.1	9.9	AV	N
9	2.510 MHz	46.0	28.7	-17.3	10.0	AV	N
10	4.182 MHz	46.0	28.9	-17.1	10.0	AV	N
11	7.526 MHz	50.0	28.6	-21.4	10.1	AV	N
12	9.206 MHz	50.0	27.6	-22.4	10.1	AV	N

Wireless Gateway

Test Line:

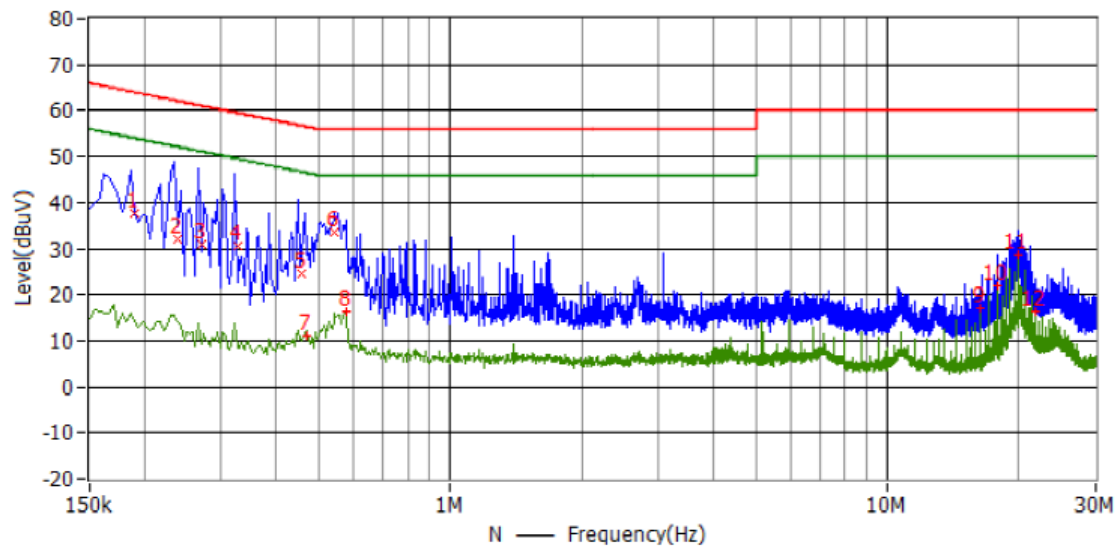
L



No.	Frequency	Limit dBuV	Level dBuV	Delta dB	Factor dB	Detector	Phase
1	162.000 kHz	65.4	37.0	-28.4	10.1	QP	L1
2	194.000 kHz	63.9	31.1	-32.8	10.1	QP	L1
3	394.000 kHz	58.0	26.3	-31.7	10.1	QP	L1
4	434.000 kHz	57.2	31.2	-26.0	10.1	QP	L1
5	490.000 kHz	56.2	34.8	-21.3	10.1	QP	L1
6	550.000 kHz	56.0	38.4	-17.6	10.1	QP	L1
7	414.000 kHz	47.6	11.5	-36.0	10.1	AV	L1
8	462.000 kHz	46.7	13.6	-33.1	10.1	AV	L1
9	578.000 kHz	46.0	16.9	-29.1	10.1	AV	L1
10	16.342 MHz	50.0	16.1	-33.9	10.2	AV	L1
11	17.938 MHz	50.0	21.5	-28.5	10.2	AV	L1
12	19.930 MHz	50.0	28.5	-21.5	10.2	AV	L1

Test Line:

N

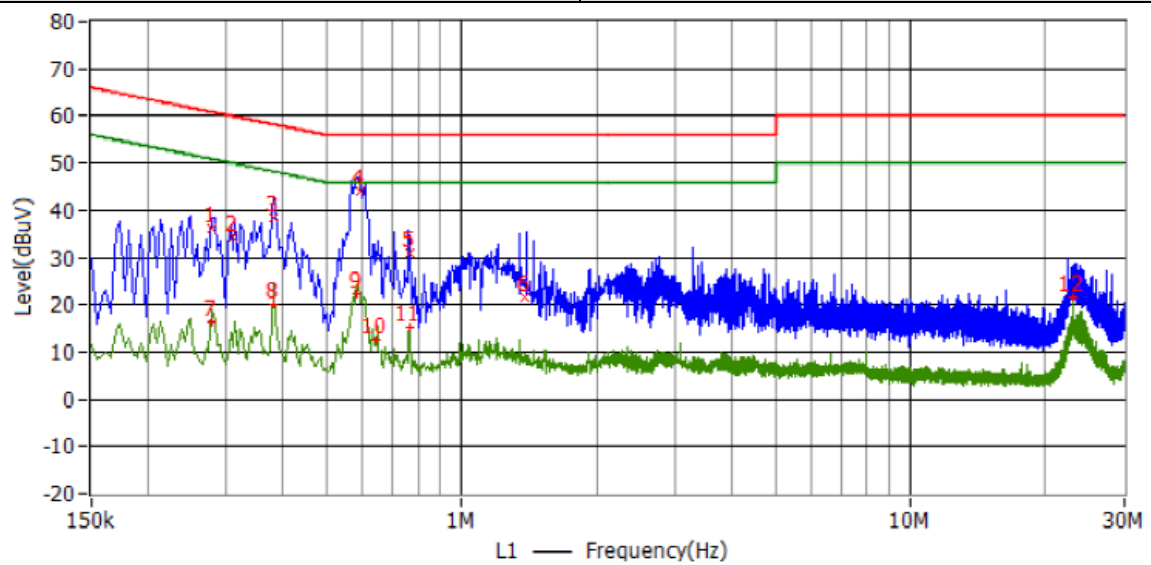


No.	Frequency	Limit dBuV	Level dBuV	Delta dB	Factor dB	Detector	Phase
1	190.000 kHz	64.0	37.7	-26.3	9.9	QP	N
2	238.000 kHz	62.2	32.2	-30.0	9.9	QP	N
3	270.000 kHz	61.1	31.0	-30.1	9.9	QP	N
4	326.000 kHz	59.6	30.5	-29.0	9.9	QP	N
5	458.000 kHz	56.7	24.7	-32.0	9.9	QP	N
6	542.000 kHz	56.0	33.5	-22.5	9.9	QP	N
7	470.000 kHz	46.5	10.9	-35.6	9.9	AV	N
8	578.000 kHz	46.0	16.4	-29.6	9.9	AV	N
9	16.342 MHz	50.0	16.9	-33.1	10.2	AV	N
10	17.934 MHz	50.0	21.9	-28.1	10.2	AV	N
11	19.926 MHz	50.0	28.7	-21.3	10.2	AV	N
12	21.922 MHz	50.0	16.4	-33.6	10.3	AV	N

Smart Panel (Intelligent Key Control)

Test Line:

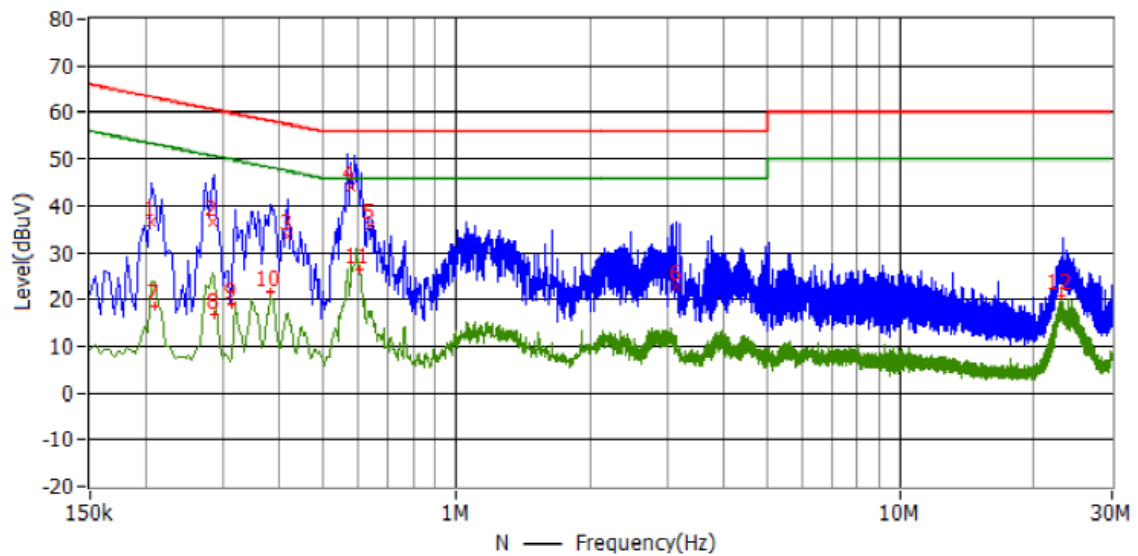
L



No.	Frequency	Limit dBuV	Level dBuV	Delta dB	Factor dB	Detector	Phase
1	278.000 kHz	60.9	36.1	-24.8	10.1	QP	L1
2	310.000 kHz	60.0	34.2	-25.8	10.1	QP	L1
3	382.000 kHz	58.2	38.3	-20.0	10.1	QP	L1
4	594.000 kHz	56.0	44.0	-12.0	10.1	QP	L1
5	766.000 kHz	56.0	31.1	-24.9	10.1	QP	L1
6	1.386 MHz	56.0	21.6	-34.4	10.1	QP	L1
7	278.000 kHz	50.9	16.5	-34.4	10.1	AV	L1
8	382.000 kHz	48.2	20.2	-28.0	10.1	AV	L1
9	586.000 kHz	46.0	22.4	-23.6	10.1	AV	L1
10	646.000 kHz	46.0	12.6	-33.4	10.1	AV	L1
11	766.000 kHz	46.0	15.1	-30.9	10.1	AV	L1
12	23.130 MHz	50.0	21.4	-28.6	10.2	AV	L1

Test Line:

N



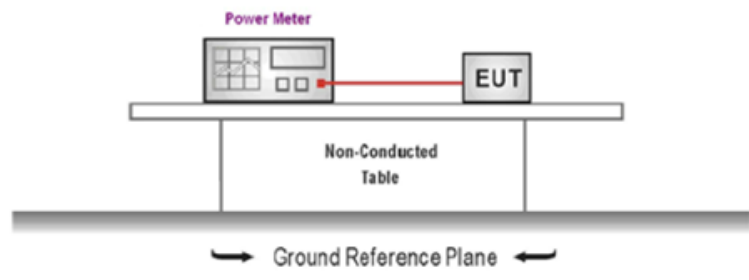
No.	Frequency	Limit dBuV	Level dBuV	Delta dB	Factor dB	Detector	Phase
1	206.000 kHz	63.4	36.4	-27.0	9.9	QP	N
2	282.000 kHz	60.8	36.6	-24.2	9.9	QP	N
3	418.000 kHz	57.5	33.5	-24.0	9.9	QP	N
4	578.000 kHz	56.0	44.0	-12.0	9.9	QP	N
5	638.000 kHz	56.0	35.8	-20.2	9.9	QP	N
6	3.134 MHz	56.0	22.8	-33.2	10.0	QP	N
7	210.000 kHz	53.2	18.4	-34.8	9.9	AV	N
8	286.000 kHz	50.6	16.6	-34.0	9.9	AV	N
9	314.000 kHz	49.9	19.1	-30.8	9.9	AV	N
10	382.000 kHz	48.2	21.7	-26.5	9.9	AV	N
11	606.000 kHz	46.0	26.6	-19.4	9.9	AV	N
12	23.130 MHz	50.0	21.0	-29.0	10.3	AV	N

5.3. Conducted Peak Output Power

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(3): 30 dBm

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was tested according to ANSI C63.10: 2013 and KDB 558074 D01 for compliance to FCC 47 CFR 15.247 requirements.
2. The maximum peak conducted output power may be measured using a broadband peak RF power meter.
3. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.
4. Record the measurement data.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ Passed ☐ Not Applicable

Type	Channel	Output power (dBm)	Limit (dBm)	Result
ZigBee	01	8.80	≤30.00	Pass
	08	8.79		
	16	9.50		

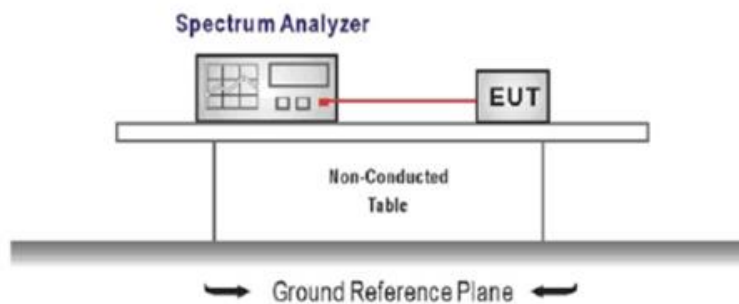
5.4. Power Spectral Density

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (e):

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input,
2. Configure the spectrum analyzer as shown below:
Center frequency=DTS channel center frequency
Span =1.5 times the DTS bandwidth
 $RBW = 3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$, $VBW \geq 3 \times RBW$
Sweep time = auto couple
Detector = peak
Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter wave form on the spectrum analyzer.
4. Use the peak marker function to determine the maximum amplitude level within the RBW.
5. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST MODE:

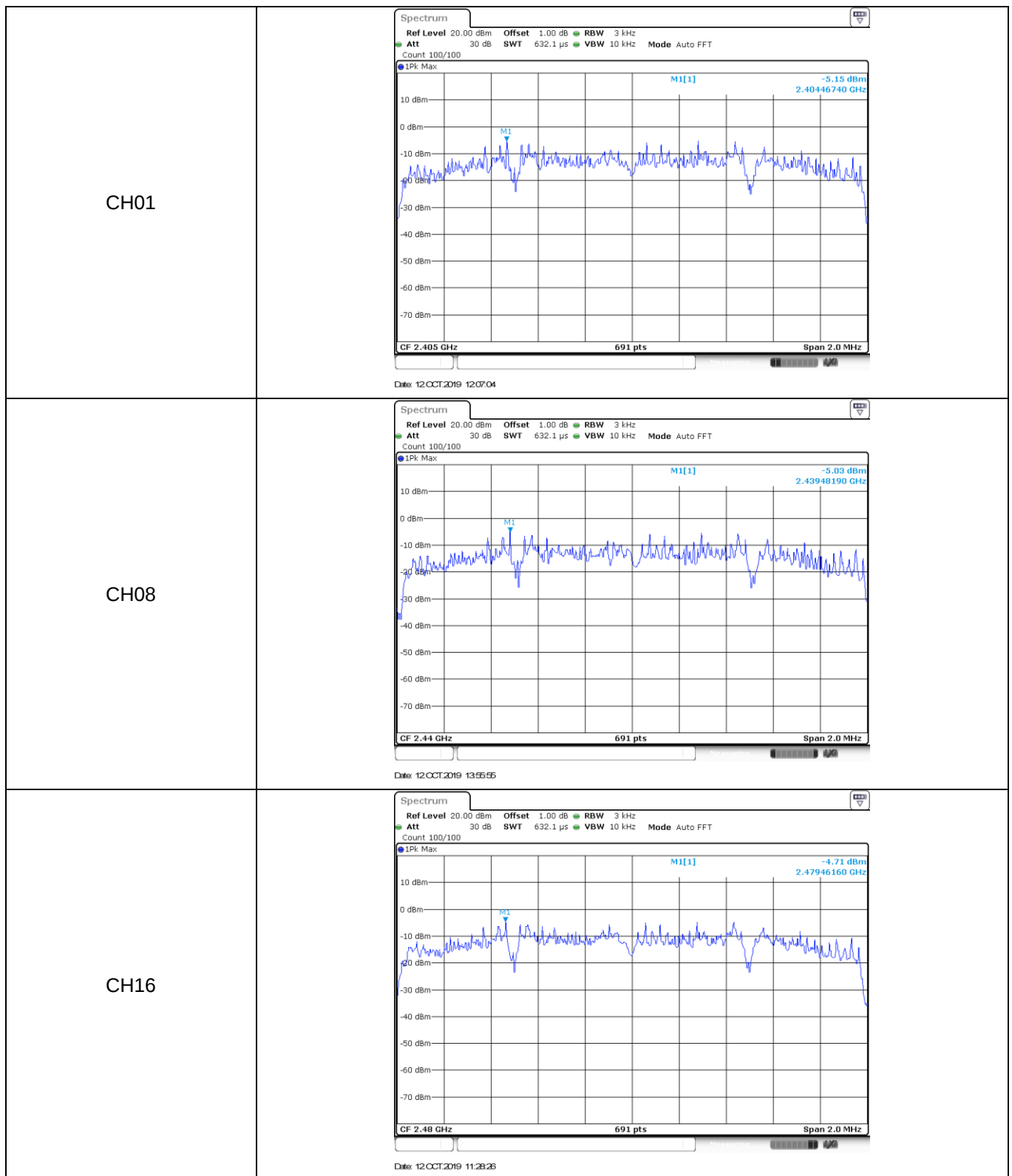
Please refer to the clause 3.3

TEST RESULTS

☒ Passed ☐ Not Applicable

Type	Channel	Power Spectral Density(dBm/3KHz)	Limit (dBm/3KHz)	Result
ZigBee	01	-5.15	≤8.00	Pass
	08	-5.03		
	16	-4.71		

Test plot as follows:



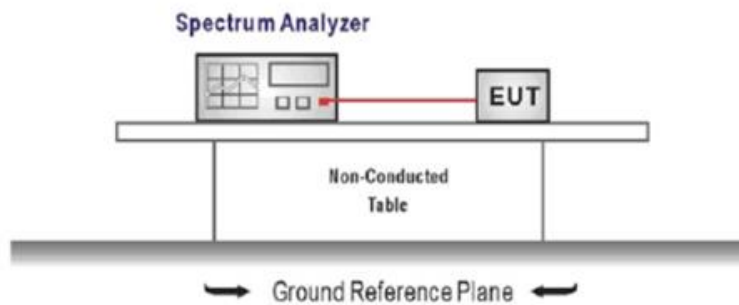
5.5. 6dB bandwidth

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(2):

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).
 Center Frequency = DTS channel center frequency
 Span = 2 x DTS bandwidth
 RBW = 100 kHz, VBW ≥ 3 × RBW
 Sweep time = auto couple
 Detector = Peak
 Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission, and record the pertinent measurements.

TEST MODE:

Please refer to the clause 3.3

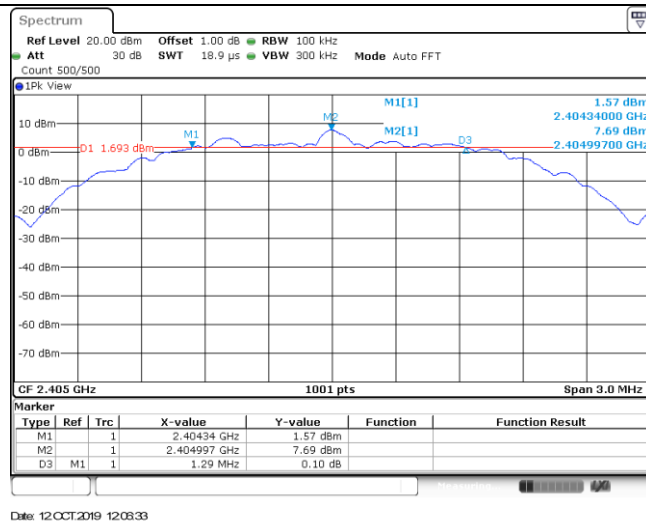
TEST RESULTS

☒ Passed ☐ Not Applicable

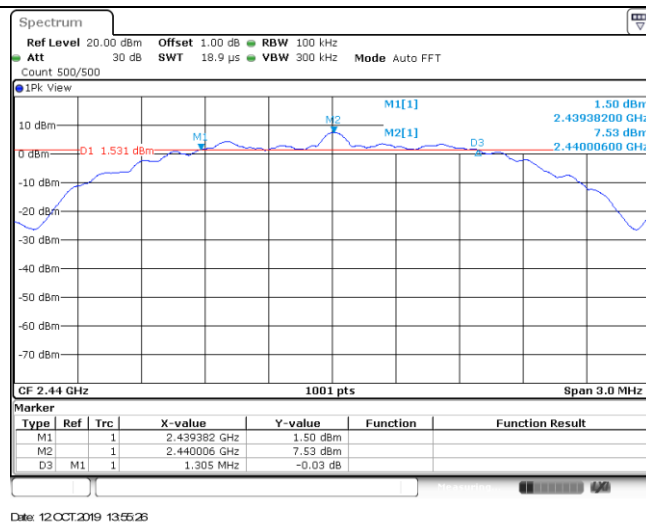
Type	Channel	6dB Bandwidth(KHz)	Limit (KHz)	Result
ZigBee	01	1290.00	≥500	Pass
	08	1305.00		
	16	1380.00		

Test plot as follows:

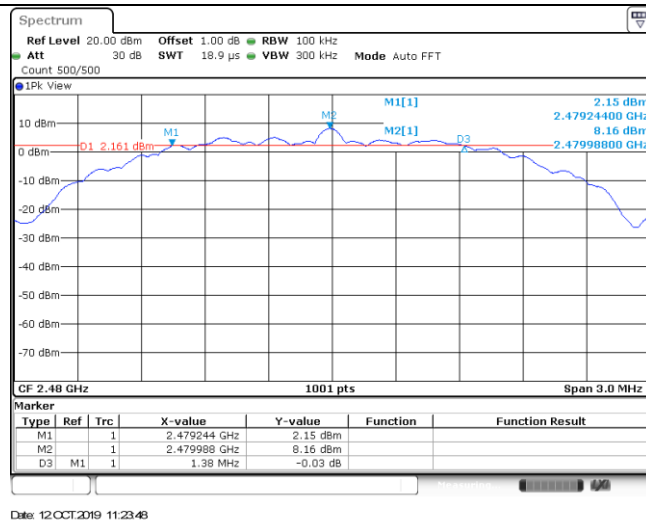
CH01



CH08



CH16



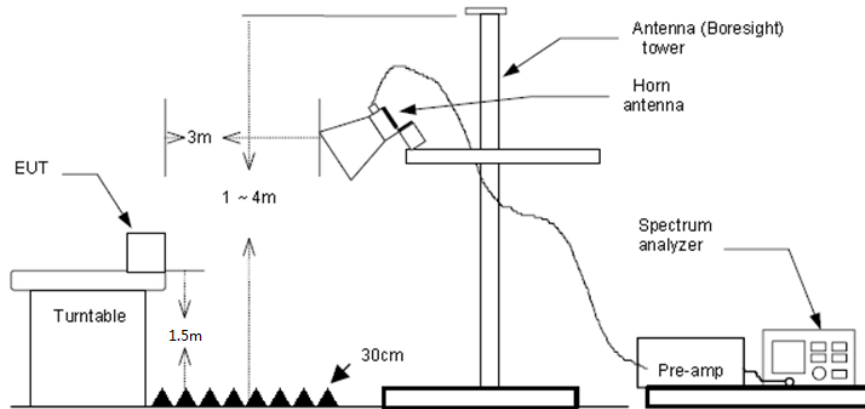
5.6. Restricted band

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, Radiated Emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the Radiated Emissions limits specified in §15.209(a) (see §15.205(c)).

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
RBW=1MHz, VBW=3MHz Peak detector for Peak value.
RBW=1MHz, VBW=3MHz RMS detector for Average value.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

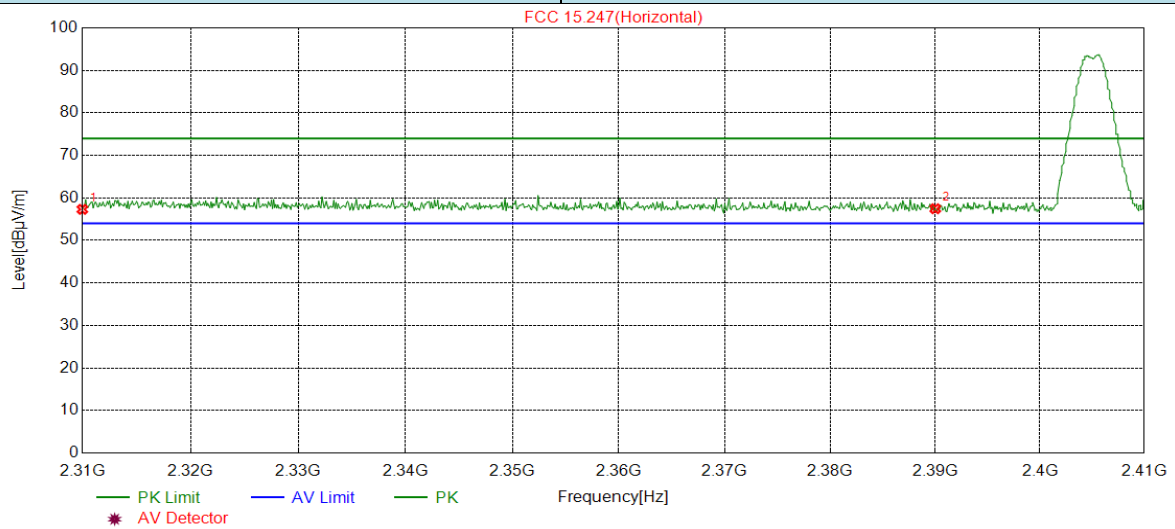
☒ Passed ☐ Not Applicable

Note:

- 1) Final level= Read level + Antenna Factor+ Cable Loss- Preamp Factor
- 2) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

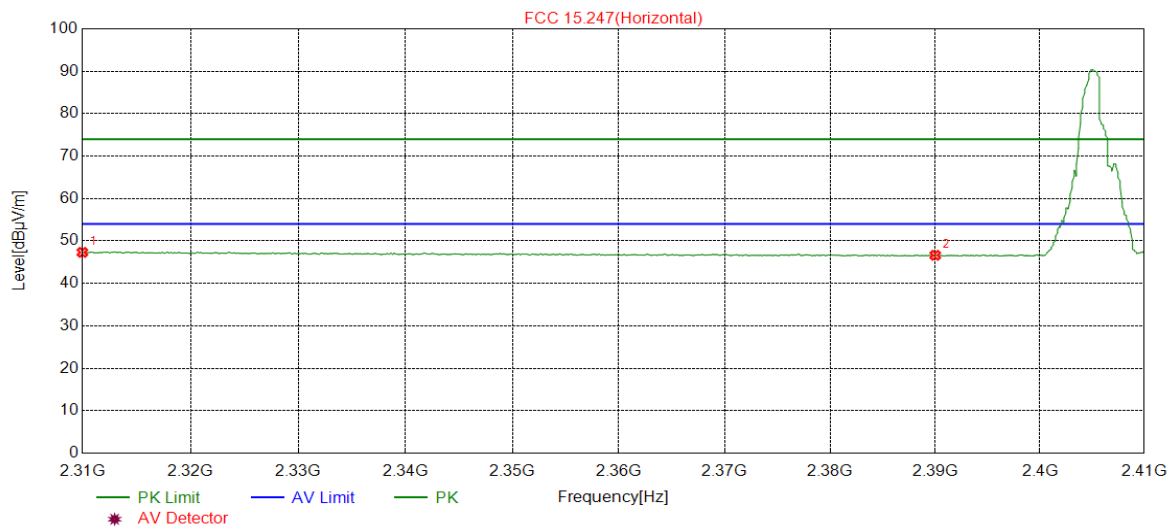
Test channel

CH01



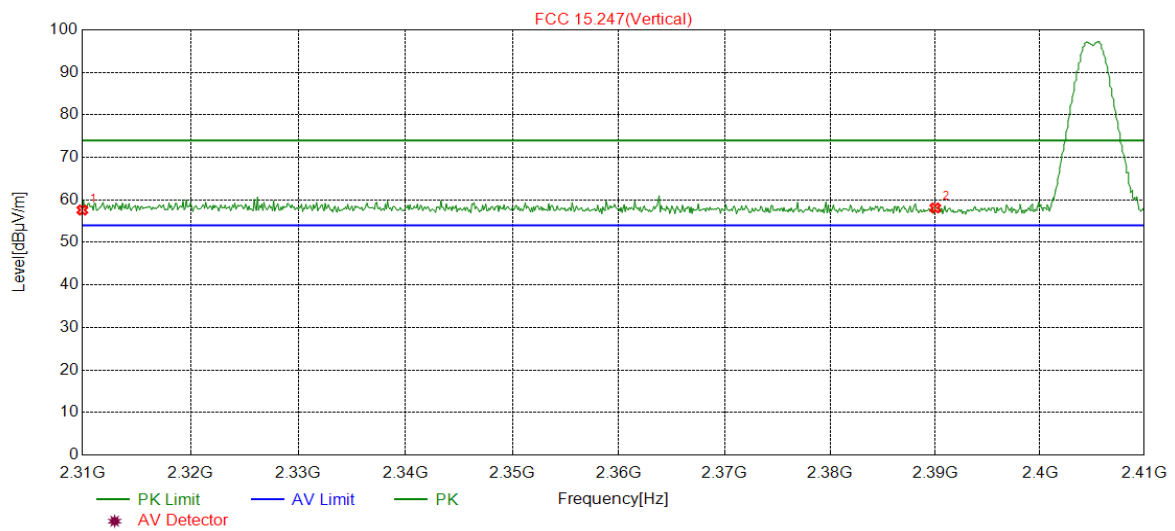
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2310.000	21.53	35.78	57.31	74.00	16.69	Horizontal	PK
2	2390.000	21.95	35.50	57.45	74.00	16.55	Horizontal	PK



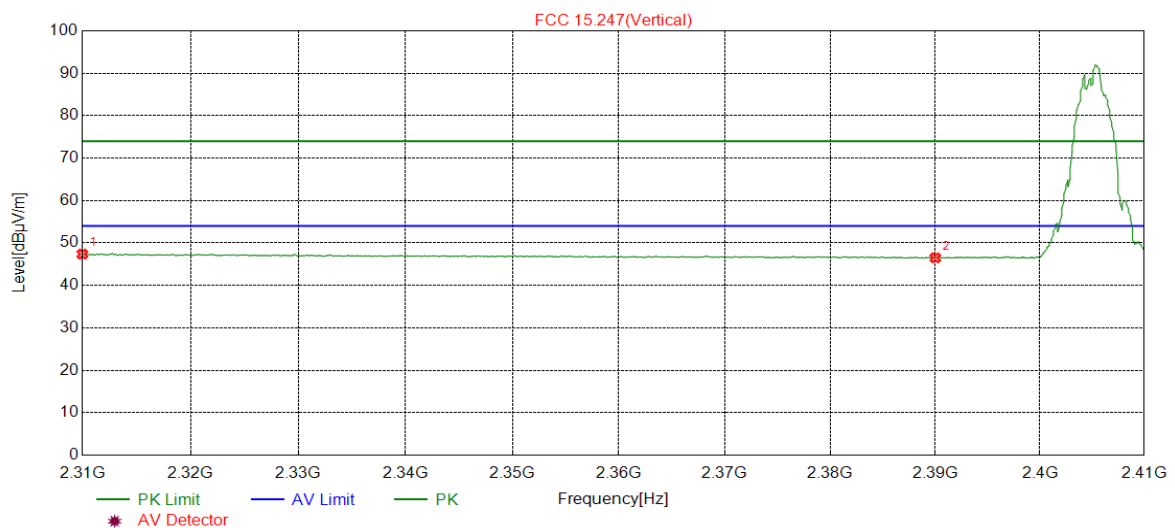
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2310.000	11.54	35.78	47.32	54.00	6.68	Horizontal	AV
2	2390.000	11.13	35.50	46.63	54.00	7.37	Horizontal	AV



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2310.000	21.84	35.78	57.62	74.00	16.38	Vertical	PK
2	2390.000	22.62	35.50	58.12	74.00	15.88	Vertical	PK

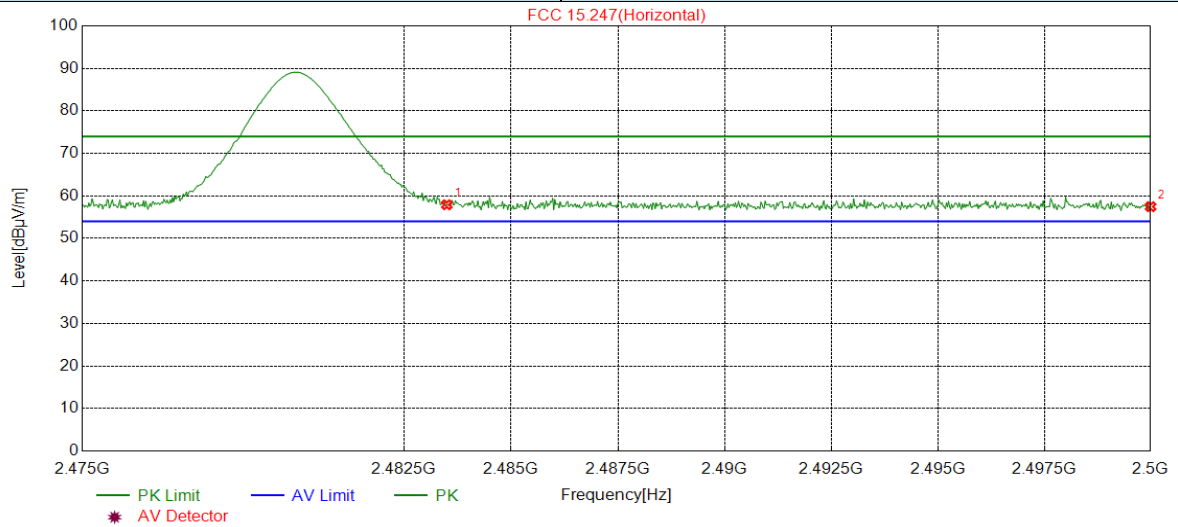


Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2310.000	11.60	35.78	47.38	54.00	6.62	Vertical	AV
2	2390.000	11.00	35.50	46.50	54.00	7.50	Vertical	AV

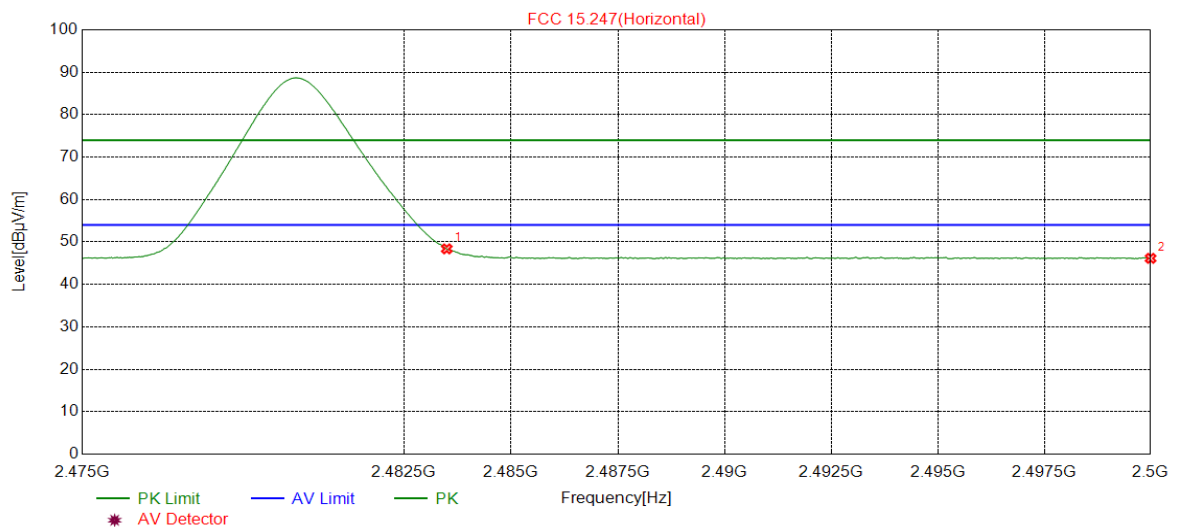
Test channel

CH16



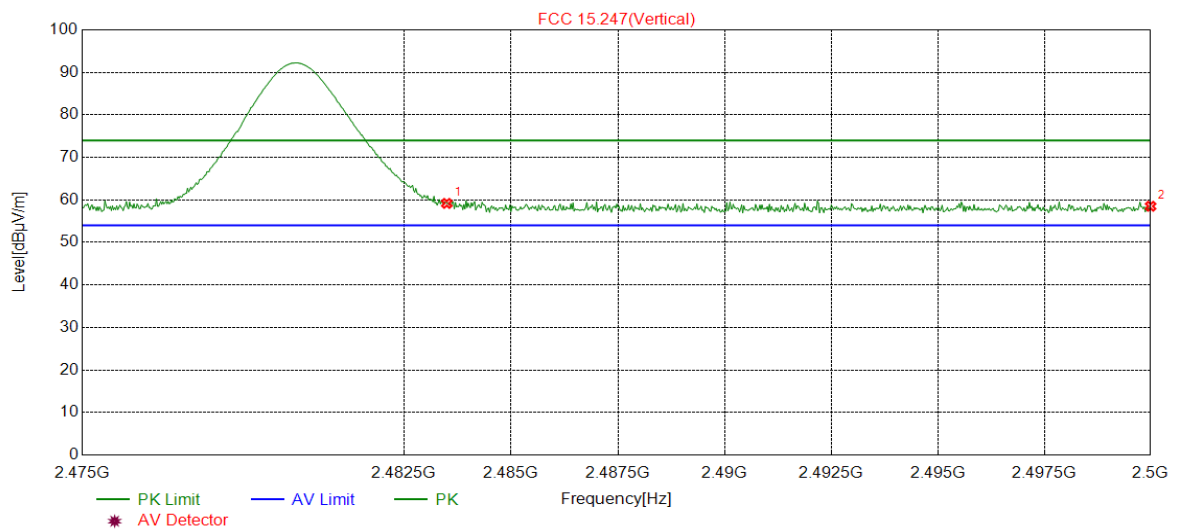
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2483.500	22.61	35.31	57.92	74.00	16.08	Horizontal	PK
2	2500.000	22.19	35.28	57.47	74.00	16.53	Horizontal	PK



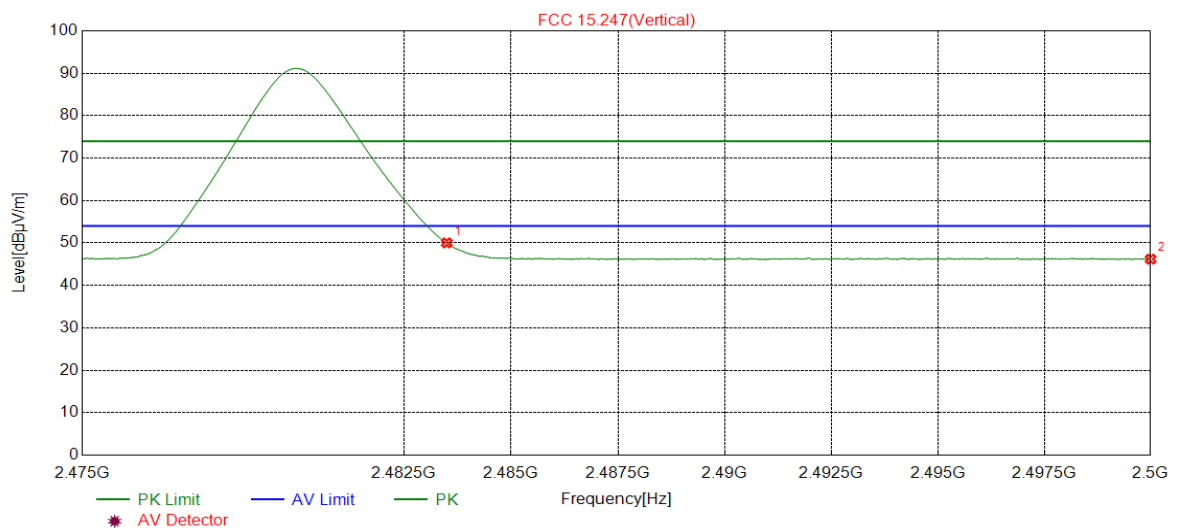
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2483.500	13.07	35.31	48.38	54.00	5.62	Horizontal	AV
2	2500.000	10.87	35.28	46.15	54.00	7.85	Horizontal	AV



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2483.500	23.87	35.31	59.18	74.00	14.82	Vertical	PK
2	2500.000	23.23	35.28	58.51	74.00	15.49	Vertical	PK



Suspected Data List

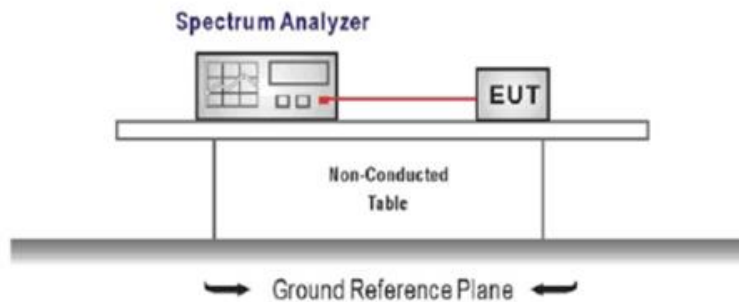
NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2483.500	14.73	35.31	50.04	54.00	3.96	Vertical	AV
2	2500.000	10.92	35.28	46.20	54.00	7.80	Vertical	AV

5.7. Band edge and Spurious Emissions (conducted)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Establish a reference level by using the following procedure
Center frequency=DTS channel center frequency
The span = 1.5 times the DTS bandwidth.
RBW = 100 kHz, VBW $\geq 3 \times$ RBW
Detector = peak, Sweep time = auto couple, Trace mode = max hold
Allow trace to fully stabilize
Use the peak marker function to determine the maximum PSD level

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

3. Emission level measurement
Set the center frequency and span to encompass frequency range to be measured
RBW = 100 kHz, VBW $\geq 3 \times$ RBW
Detector = peak, Sweep time = auto couple, Trace mode = max hold
Allow trace to fully stabilize
Use the peak marker function to determine the maximum amplitude level.
4. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
5. Ensure that the amplitude of all unwanted emission outside of the authorized frequency band excluding restricted frequency bands) are attenuated by at least the minimum requirements specified (at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz). Report the three highest emission relative to the limit.

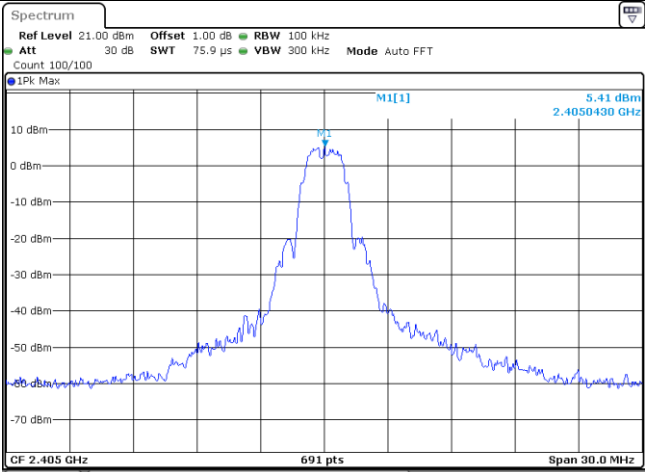
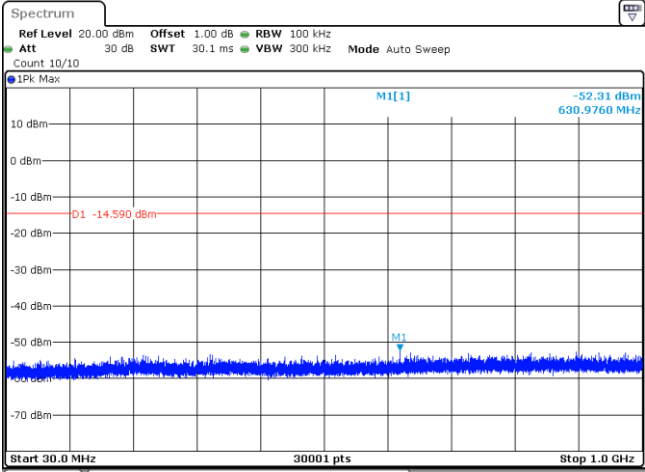
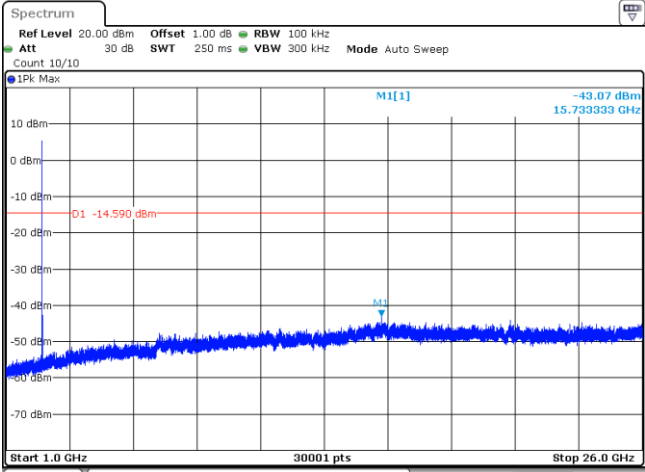
TEST MODE:

Please refer to the clause 3.3

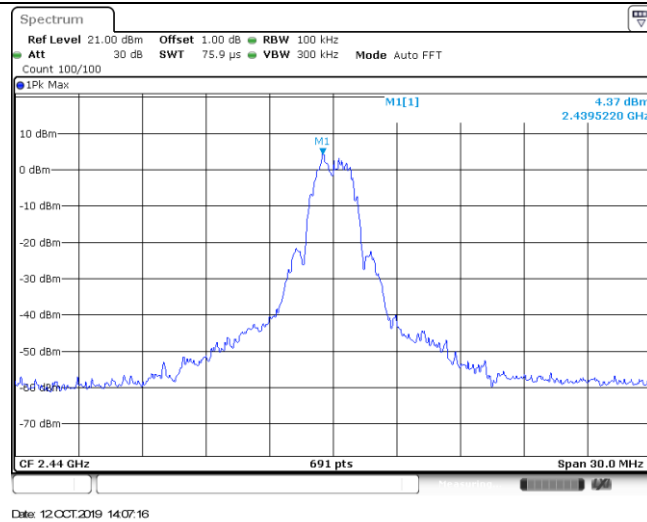
TEST RESULTS

☒ Passed ☐ Not Applicable

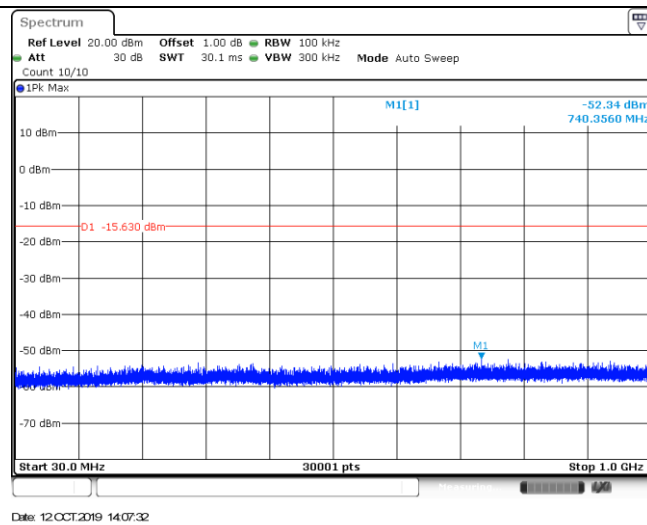
Test Item:	Band edge
CH00	Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 227.5 μs VBW 300 kHz Mode Auto FFT Count 300/300 1Pk Max <

Test Item:	SE
CH00 Reference level	 Spectrum Ref Level 21.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 75.9 μs VBW 300 kHz Mode Auto FFT Count 100/100 IPk Max M1[1] 5.41 dBm 2.4050430 GHz CF 2.405 GHz 691 pts Span 30.0 MHz Date: 12 OCT 2019 14:12:00
CH00 30MHz~1000MHz	 Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 30.1 ms VBW 300 kHz Mode Auto Sweep Count 10/10 IPk Max M1[1] -52.31 dBm 630.9760 MHz D1 -14.590 dBm Start 30.0 MHz 30001 pts Stop 1.0 GHz Date: 12 OCT 2019 14:12:15
CH00 1GHz~26GHz	 Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep Count 10/10 IPk Max M1[1] -43.07 dBm 15.733333 GHz D1 -14.590 dBm Start 1.0 GHz 30001 pts Stop 26.0 GHz Date: 12 OCT 2019 14:13:36

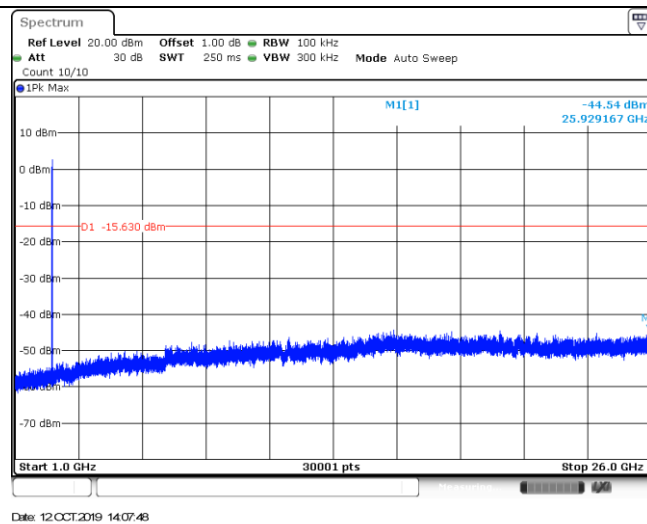
CH19
Reference level



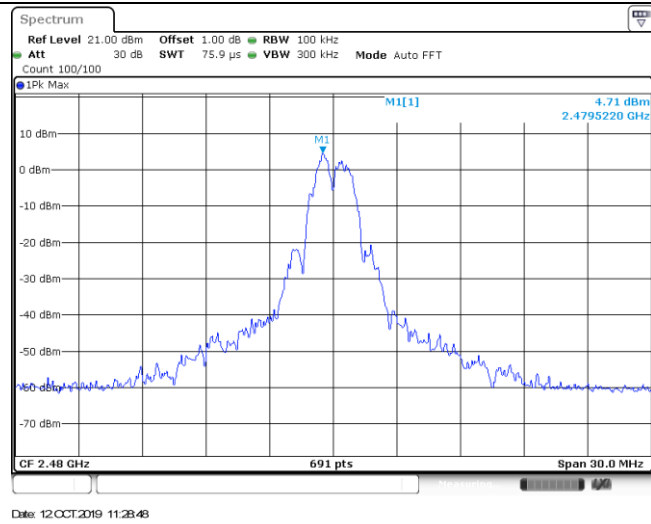
CH19
30MHz~1000MHz



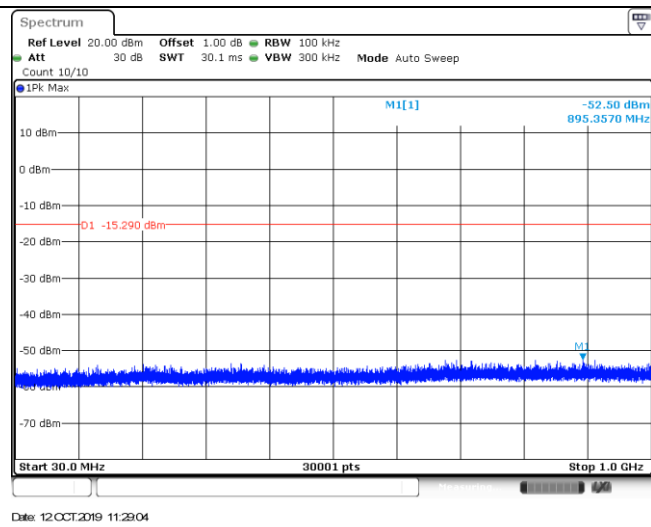
CH19
1GHz~26GHz



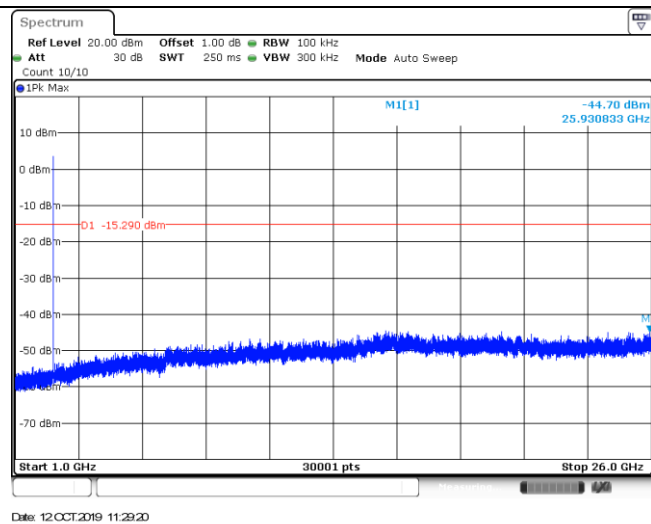
CH39
Reference level



CH39
30MHz~1000MHz



CH39
1GHz~26GHz



5.8. Spurious Emissions (radiated)

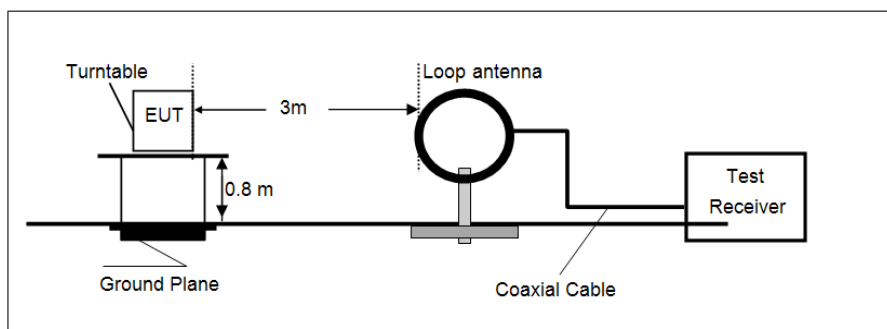
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

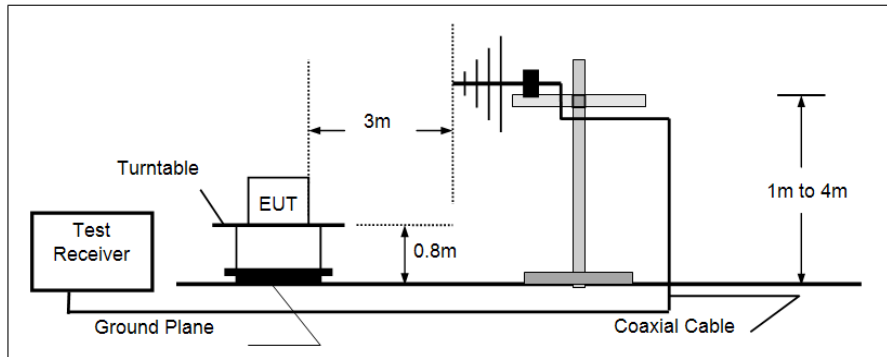
Frequency	Limit (dBuV/m @3m)	Value
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

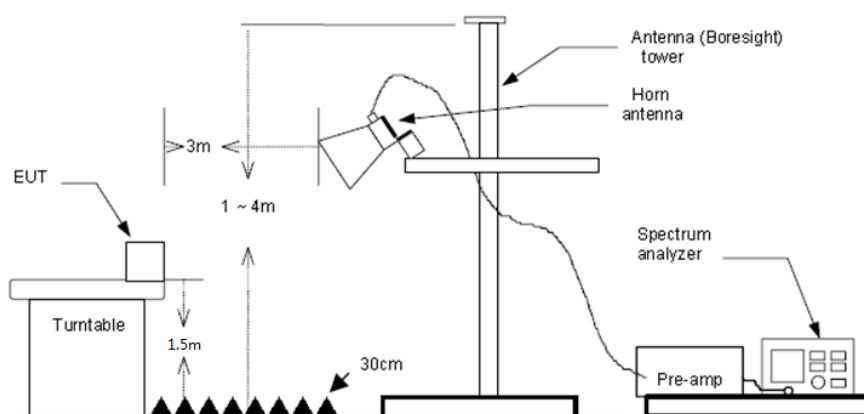
- 9 kHz ~ 30 MHz



- 30 MHz ~ 1 GHz



- Above 1 GHz



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Below 1 GHz:
RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
 - (3) From 1 GHz to 10th harmonic:
RBW=1MHz, VBW=3MHz Peak detector for Peak value.
RBW=1MHz, VBW=3MHz RMS detector for Average value.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Note:

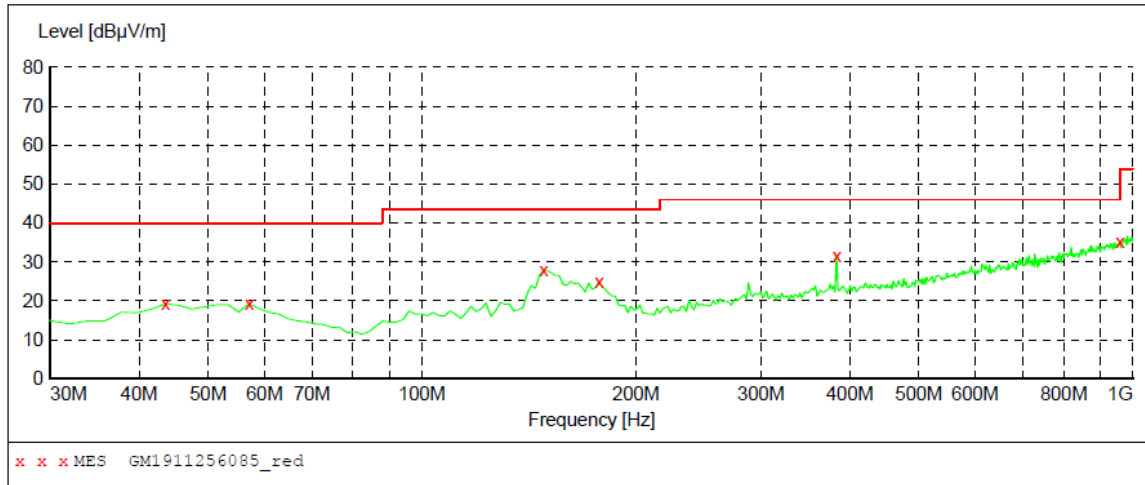
- 1) Above 1GHz Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
 - 2) The emission levels of other frequencies are very lower than the limit and not show in test report.
- **9 kHz ~ 30 MHz**
The EUT was pre-scanned the frequency band (9 kHz ~ 30 MHz), found the radiated level lower than the limit, so don't show on the report.
- **30 MHz ~ 1000 MHz**
Have pre-scan all modulation mode, found the BT-BLE mode CH39 which it was worst case, so only the worst case's data on the test report.

➤ 30 MHz ~ 1 GHz

Smart Panel(4 inch screen)

Polarization:

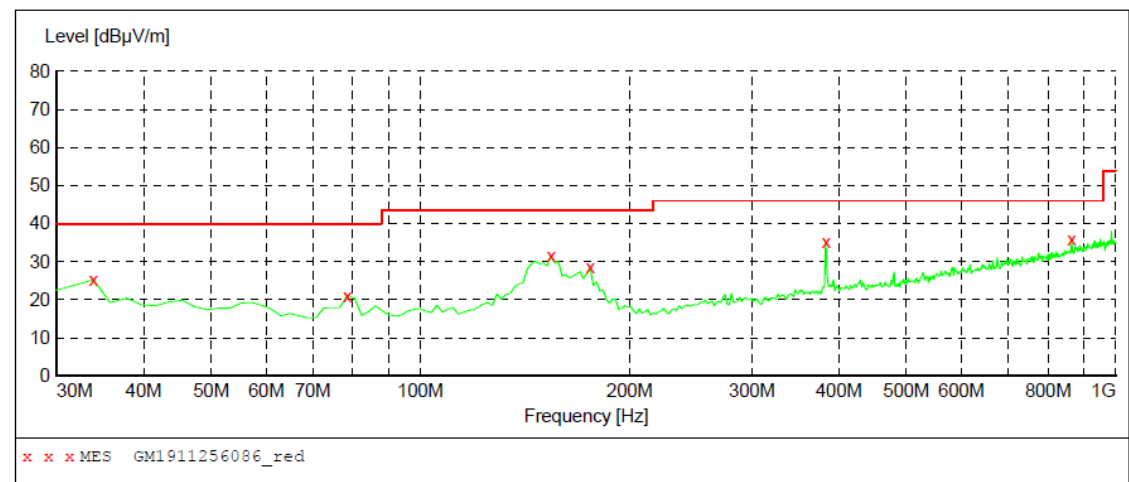
Horizontal



Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
43.580000	19.20	-8.7	40.0	20.8	QP	300.0	228.00	HORIZONTAL
57.160000	19.30	-8.7	40.0	20.7	QP	100.0	239.00	HORIZONTAL
148.340000	27.80	-13.4	43.5	15.7	QP	100.0	189.00	HORIZONTAL
177.440000	24.90	-12.2	43.5	18.6	QP	100.0	0.00	HORIZONTAL
383.080000	31.60	-4.3	46.0	14.4	QP	100.0	239.00	HORIZONTAL
959.260000	35.30	8.4	46.0	10.7	QP	100.0	341.00	HORIZONTAL

Polarization:

Vertical

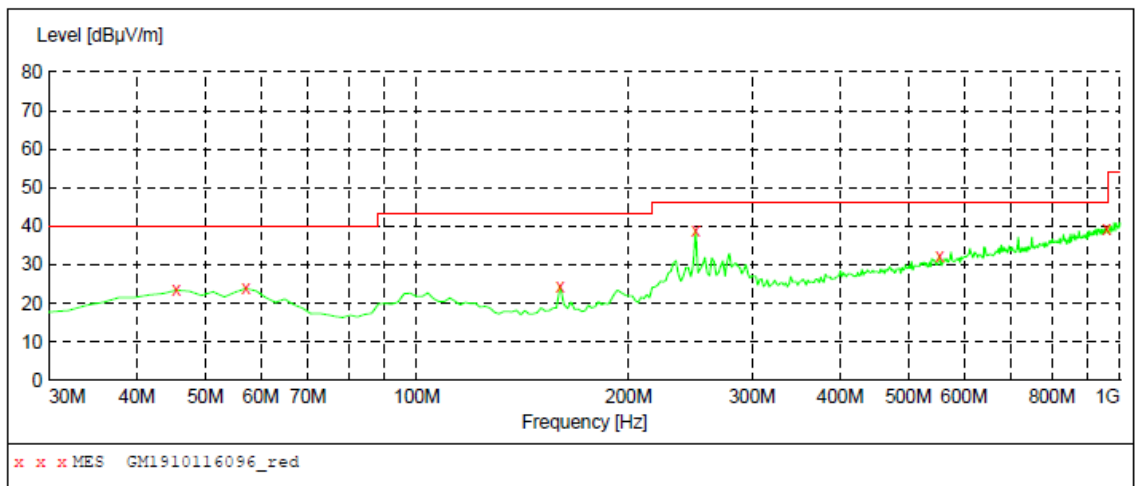


Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
33.880000	25.30	-12.1	40.0	14.7	QP	100.0	296.00	VERTICAL
78.500000	21.00	-15.1	40.0	19.0	QP	100.0	194.00	VERTICAL
154.160000	31.50	-13.1	43.5	12.0	QP	100.0	335.00	VERTICAL
175.500000	28.40	-12.3	43.5	15.1	QP	100.0	335.00	VERTICAL
383.080000	35.20	-4.3	46.0	10.8	QP	100.0	257.00	VERTICAL
864.200000	36.00	6.6	46.0	10.0	QP	100.0	245.00	VERTICAL

Wireless Gateway

Polarization:

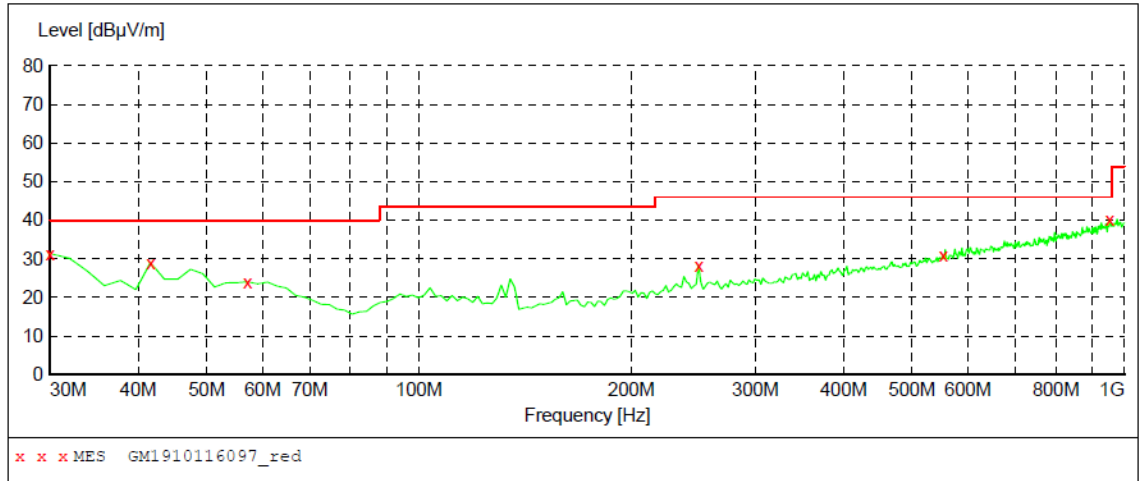
Horizontal



Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
45.520000	23.40	-4.4	40.0	16.6	QP	300.0	336.00	HORIZONTAL
57.160000	23.90	-4.7	40.0	16.1	QP	100.0	171.00	HORIZONTAL
159.980000	24.60	-8.7	43.5	18.9	QP	100.0	114.00	HORIZONTAL
249.220000	39.10	-4.2	46.0	6.9	QP	100.0	286.00	HORIZONTAL
553.800000	32.30	4.2	46.0	13.7	QP	300.0	190.00	HORIZONTAL
955.380000	39.50	12.3	46.0	6.5	QP	300.0	305.00	HORIZONTAL

Polarization:

Vertical

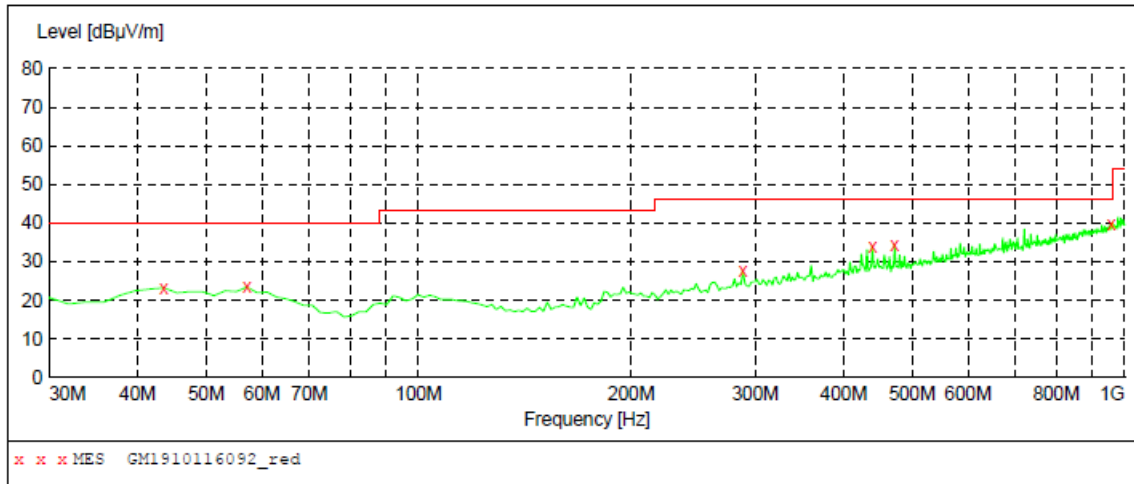


Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	31.30	-8.8	40.0	8.7	QP	100.0	0.00	VERTICAL
41.640000	29.00	-5.2	40.0	11.0	QP	100.0	268.00	VERTICAL
57.160000	24.00	-4.7	40.0	16.0	QP	100.0	35.00	VERTICAL
249.220000	28.30	-4.2	46.0	17.7	QP	100.0	207.00	VERTICAL
553.800000	30.80	4.2	46.0	15.2	QP	100.0	253.00	VERTICAL
953.440000	40.10	12.2	46.0	5.9	QP	100.0	268.00	VERTICAL

Smart Panel (Intelligent Key Control)

Polarization:

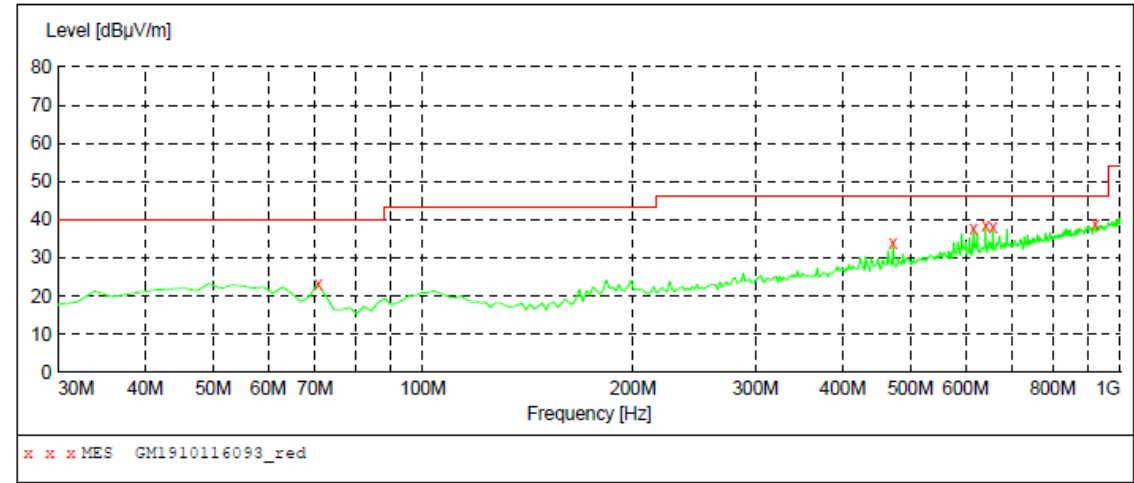
Horizontal



Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
43.580000	23.30	-4.7	40.0	16.7	QP	100.0	237.00	HORIZONTAL
57.160000	23.50	-4.7	40.0	16.5	QP	100.0	319.00	HORIZONTAL
288.020000	27.50	-2.7	46.0	18.5	QP	100.0	84.00	HORIZONTAL
439.340000	34.00	1.4	46.0	12.0	QP	100.0	272.00	HORIZONTAL
472.320000	34.30	1.8	46.0	11.7	QP	100.0	63.00	HORIZONTAL
955.380000	39.60	12.3	46.0	6.4	QP	100.0	212.00	HORIZONTAL

Polarization:

Vertical

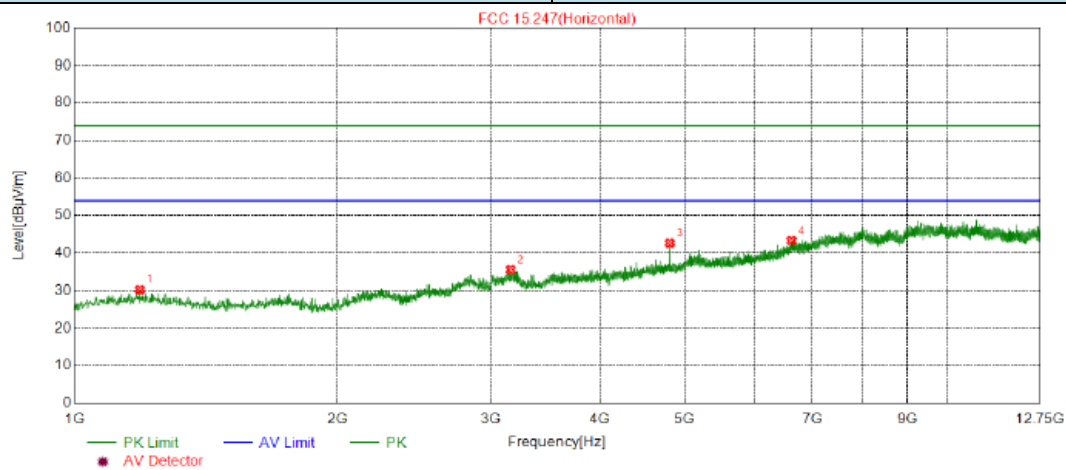


Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
70.740000	23.30	-9.1	40.0	16.7	QP	100.0	11.00	VERTICAL
472.320000	33.90	1.8	46.0	12.1	QP	100.0	47.00	VERTICAL
615.880000	37.70	5.9	46.0	8.3	QP	100.0	199.00	VERTICAL
641.100000	38.40	6.3	46.0	7.6	QP	100.0	255.00	VERTICAL
656.620000	38.00	6.6	46.0	8.0	QP	100.0	271.00	VERTICAL
920.460000	38.90	11.6	46.0	7.1	QP	100.0	26.00	VERTICAL

➤ 1 GHz ~ 25 GHz

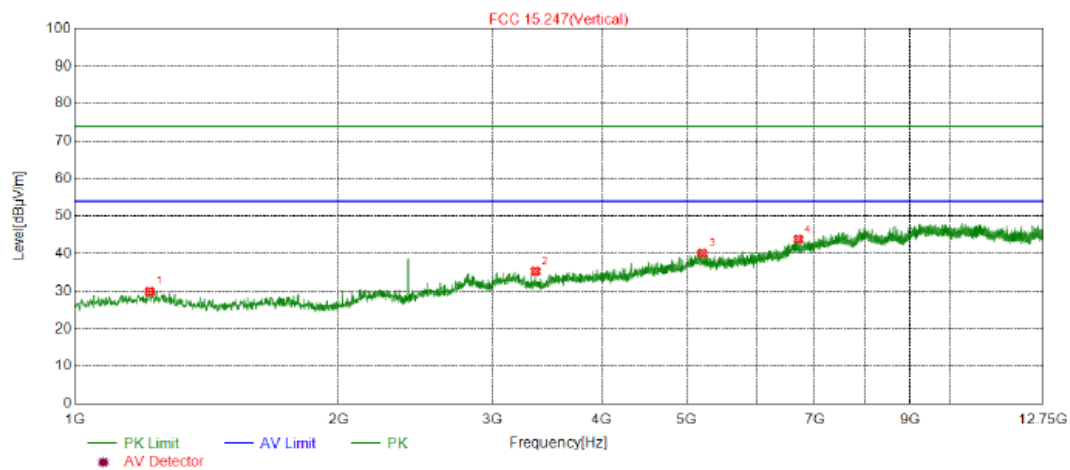
Test channel

CH01



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	1188.000	36.25	-5.96	30.29	74.00	43.71	Horizontal	PK
2	3159.062	35.00	0.63	35.63	74.00	38.37	Horizontal	PK
3	4808.468	35.67	7.06	42.73	74.00	31.27	Horizontal	PK
4	6626.781	30.12	13.24	43.36	74.00	30.64	Horizontal	PK

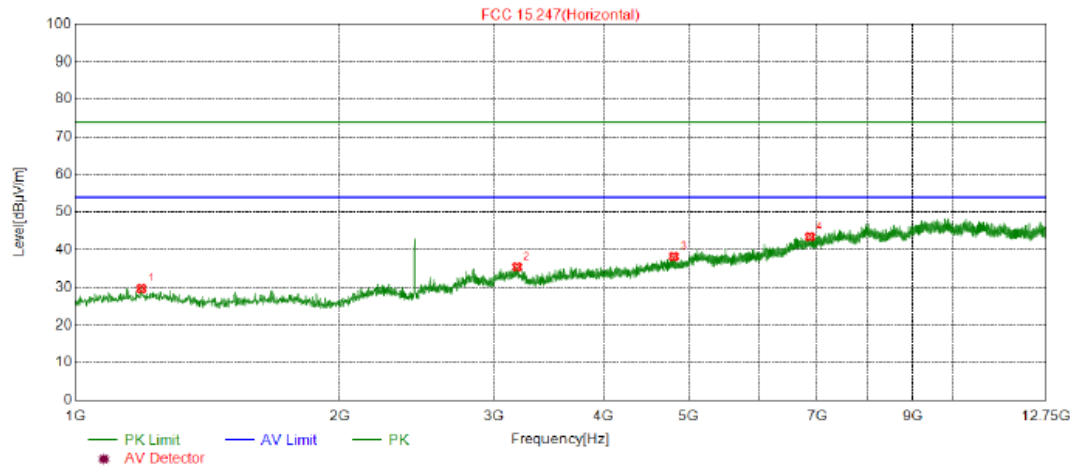


Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	1217.375	35.74	-5.78	29.96	74.00	44.04	Vertical	PK
2	3360.281	35.53	-0.23	35.30	74.00	38.70	Vertical	PK
3	5207.968	31.25	8.94	40.19	74.00	33.81	Vertical	PK
4	6706.093	30.42	13.45	43.87	74.00	30.13	Vertical	PK

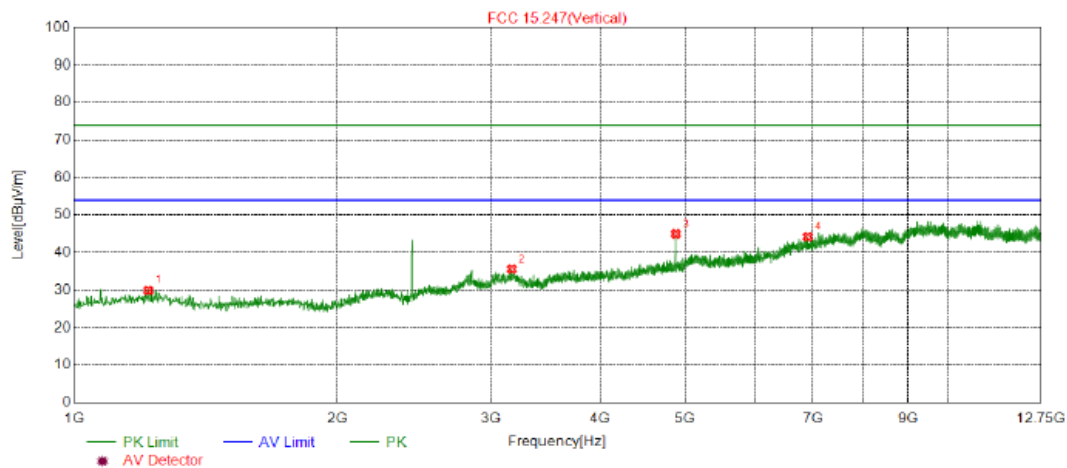
Test channel

CH08



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	1189.468	35.69	-5.94	29.75	74.00	44.25	Horizontal	PK
2	3185.500	34.72	0.76	35.48	74.00	38.52	Horizontal	PK
3	4808.468	31.22	7.06	38.28	74.00	35.72	Horizontal	PK
4	6870.593	29.62	13.84	43.46	74.00	30.54	Horizontal	PK

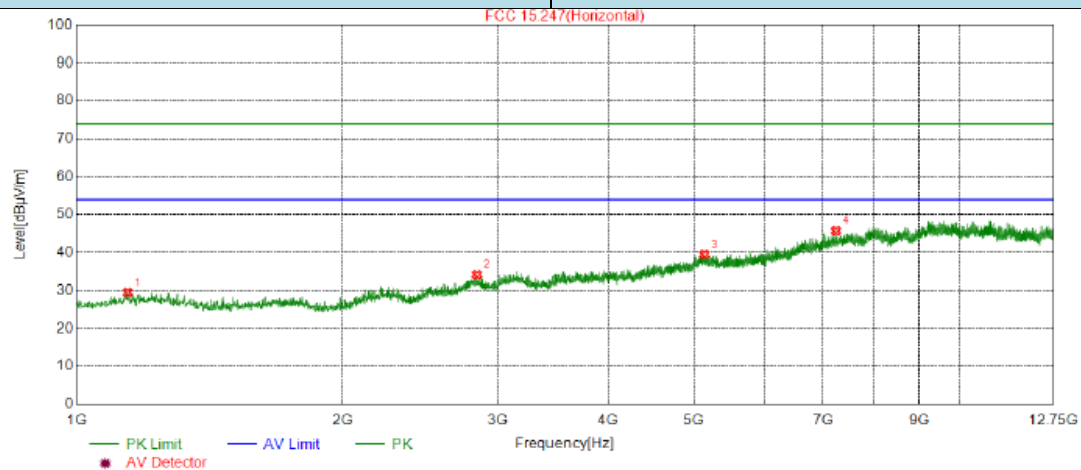


Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	1215.906	35.76	-5.79	29.97	74.00	44.03	Vertical	PK
2	3167.875	34.96	0.67	35.63	74.00	38.37	Vertical	PK
3	4881.906	37.85	7.16	45.01	74.00	28.99	Vertical	PK
4	6910.250	30.14	14.11	44.25	74.00	29.75	Vertical	PK

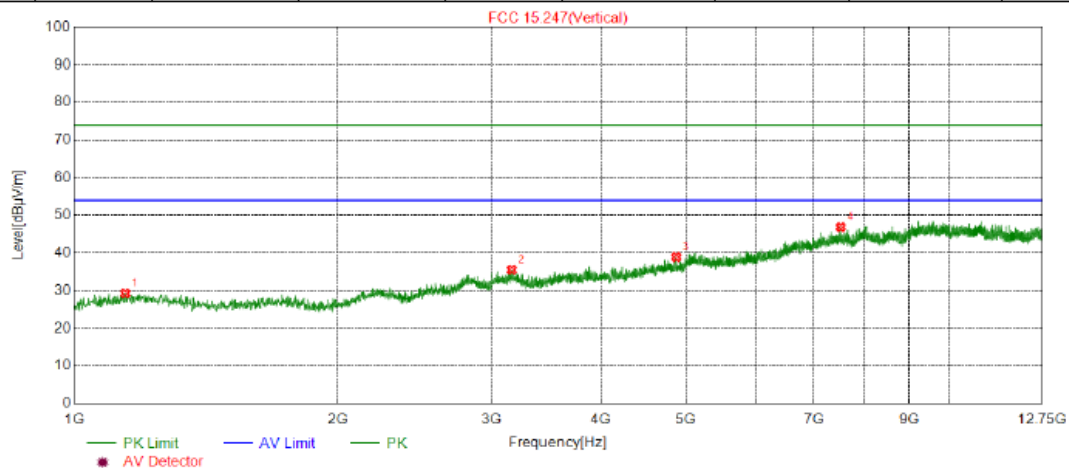
Test channel

CH16



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	1142.468	35.91	-6.44	29.47	74.00	44.53	Horizontal	PK
2	2840.343	32.79	1.43	34.22	74.00	39.78	Horizontal	PK
3	5140.406	30.67	8.87	39.54	74.00	34.46	Horizontal	PK
4	7242.187	30.74	15.02	45.76	74.00	28.24	Horizontal	PK



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	1143.937	35.70	-6.42	29.28	74.00	44.72	Vertical	PK
2	3162.000	34.90	0.64	35.54	74.00	38.46	Vertical	PK
3	4876.031	31.78	7.15	38.93	74.00	35.07	Vertical	PK
4	7513.906	31.45	15.47	46.92	74.00	27.08	Vertical	PK

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The peak level is lower than average limit (54 dBμV/m), this data is too weak for the instrument to test.
3. The emission levels of other frequencies are very lower than the limit and not shown in the test report.

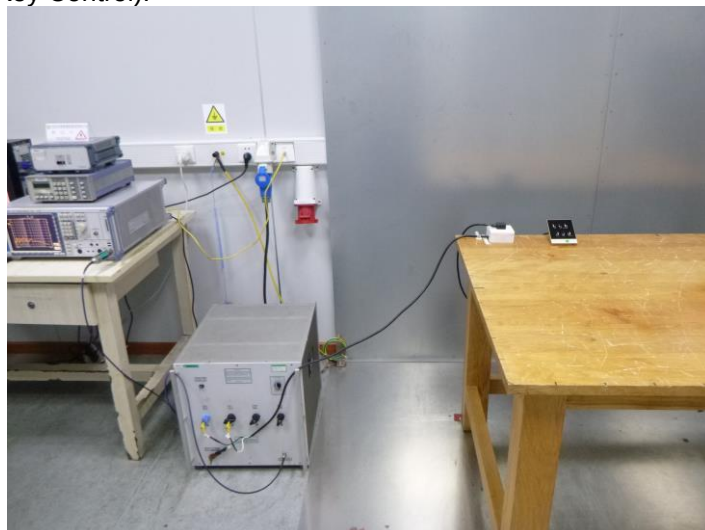
6. TEST SETUP PHOTOS

Conducted Emissions(AC Mains)

Wireless Gateway:



Smart Panel (Intelligent Key Control):



Smart Panel(4 inch screen):



Radiated Emissions(30M-1GHz)

Wireless Gateway:



Smart Panel (Intelligent Key Control):



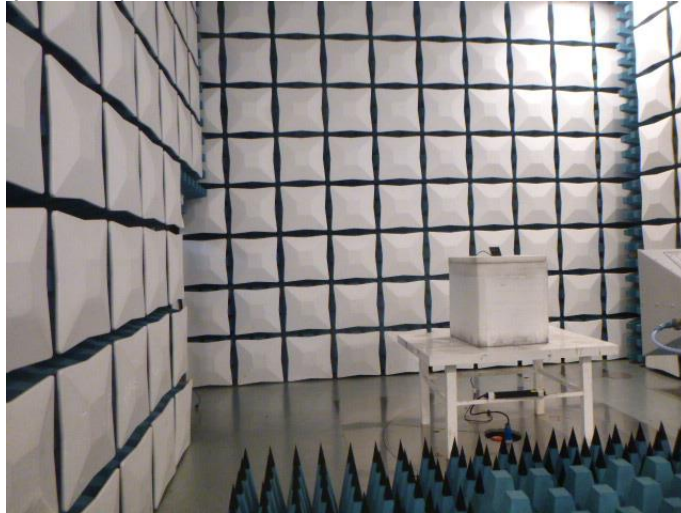
Smart Panel(4 inch screen):



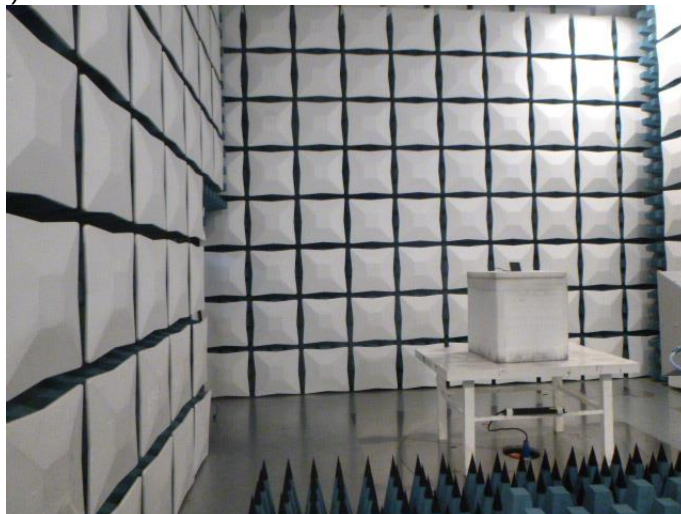
Radiated Emissions(Above 1GHz)
Wireless Gateway:



Smart Panel (Intelligent Key Control):

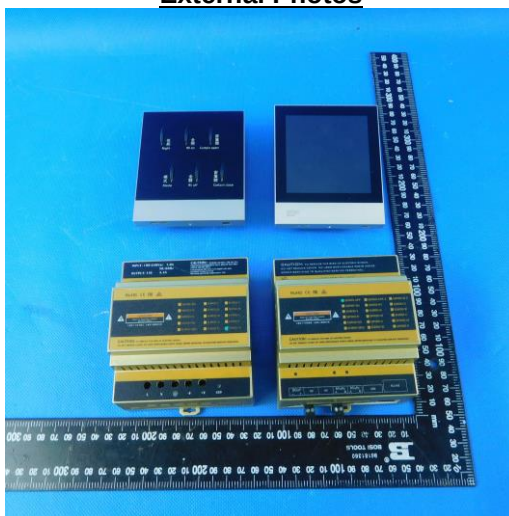


Smart Panel(4 inch screen):

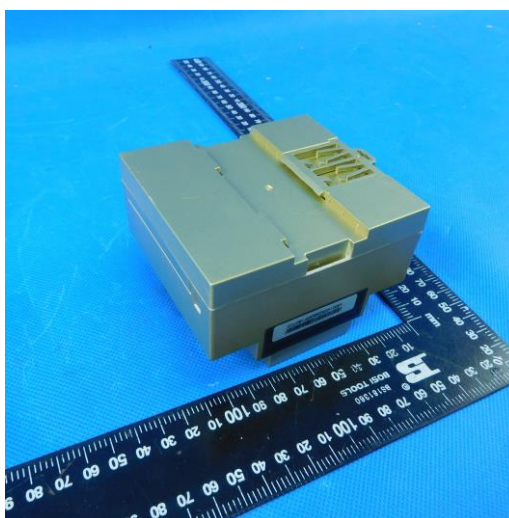
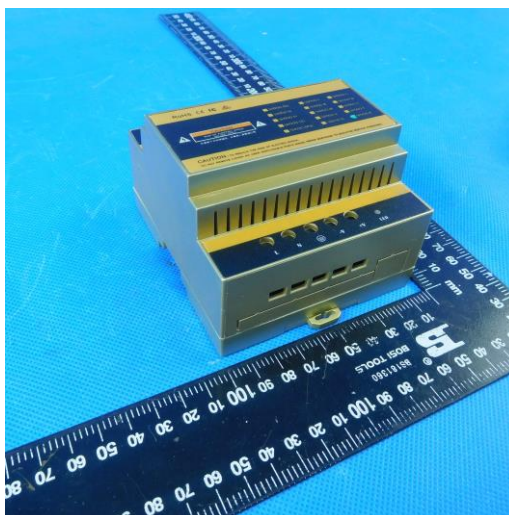


7. EXTERNAL AND INTERNAL PHOTOS

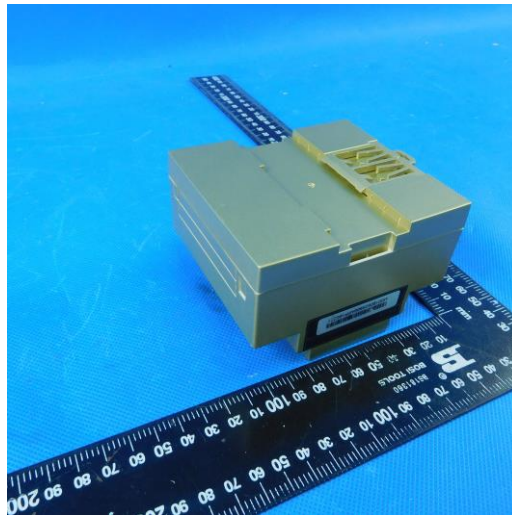
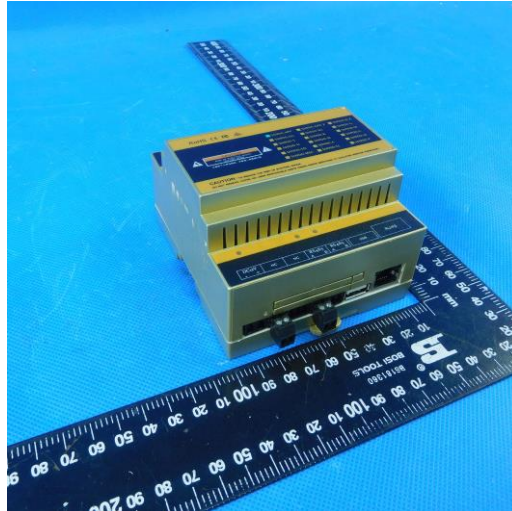
External Photos



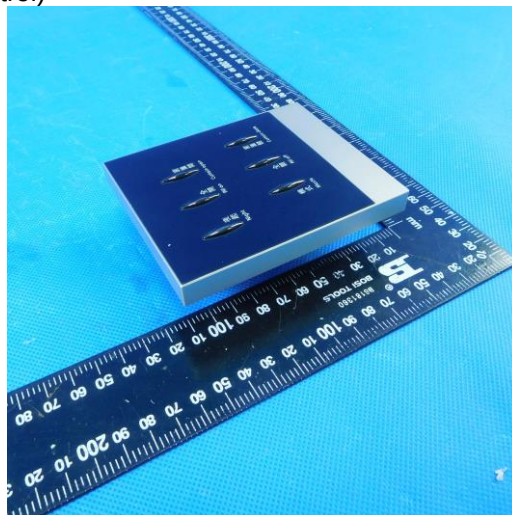
Power Supply

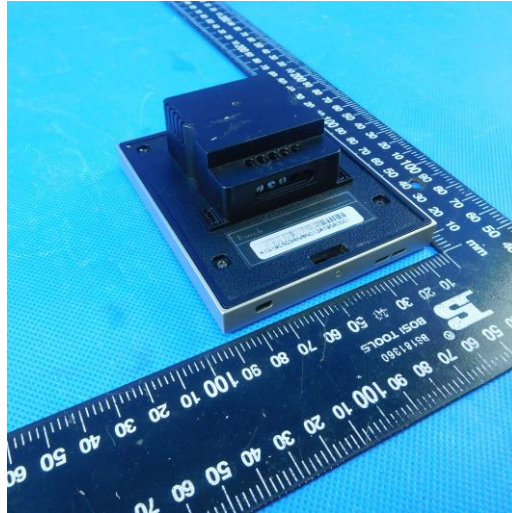


Wireless Gateway

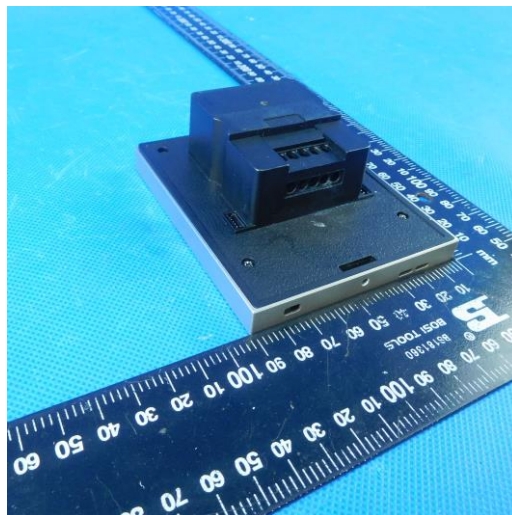
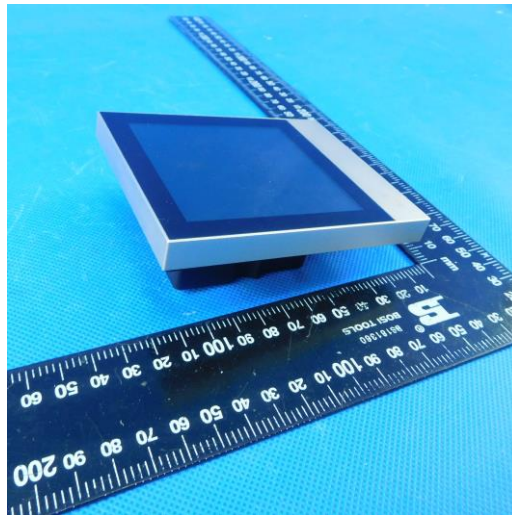


Smart Panel (Intelligent Key Control)



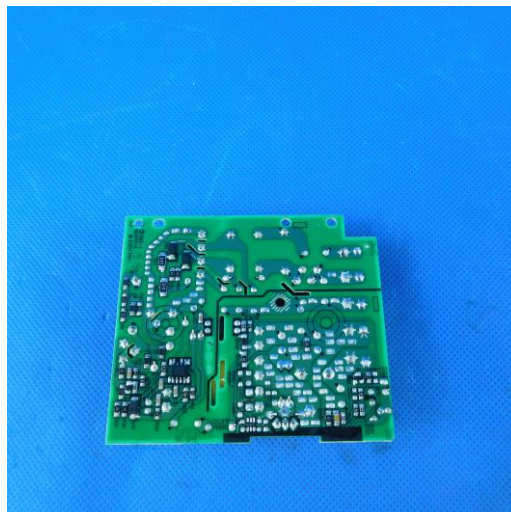
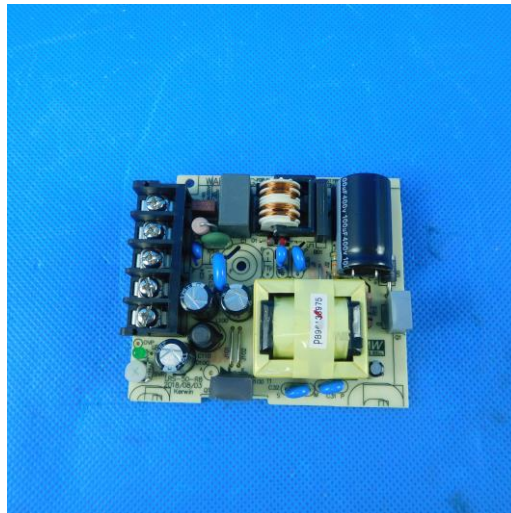
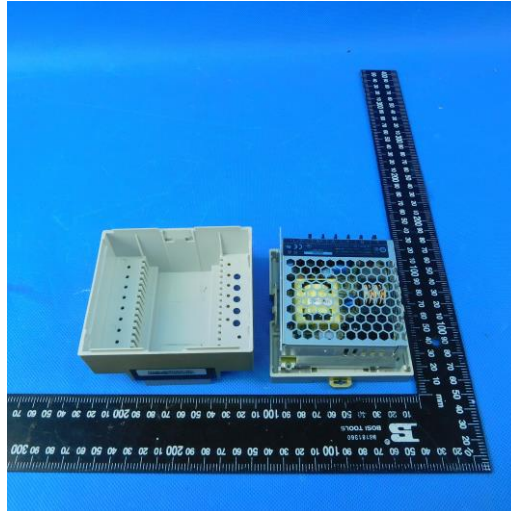


Smart Panel(4 inch screen)

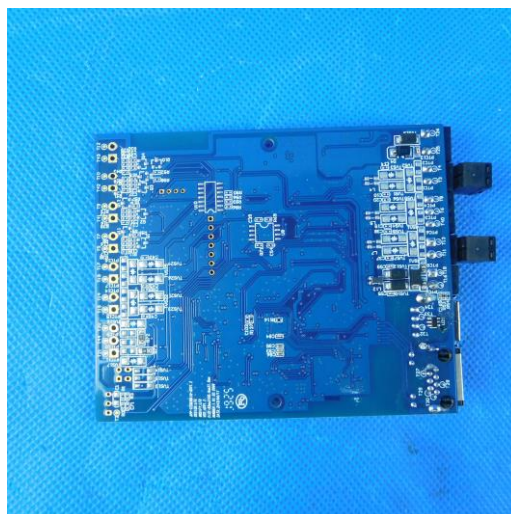
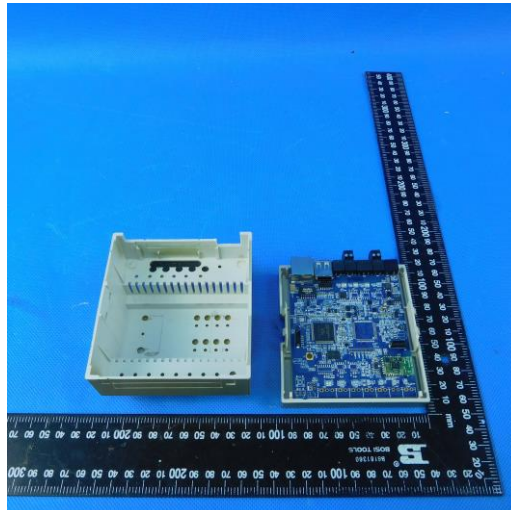


Internal Photos

Power Supply



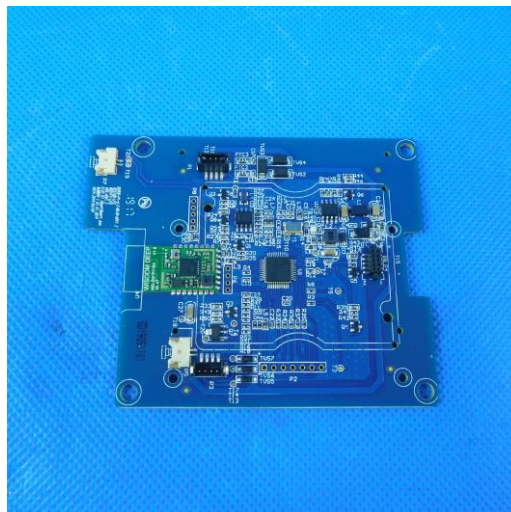
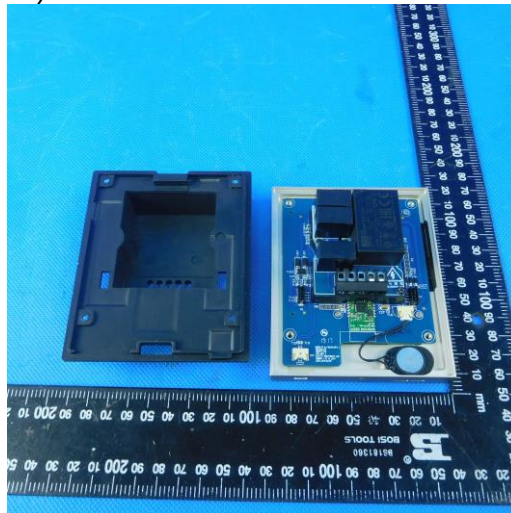
Wireless Gateway

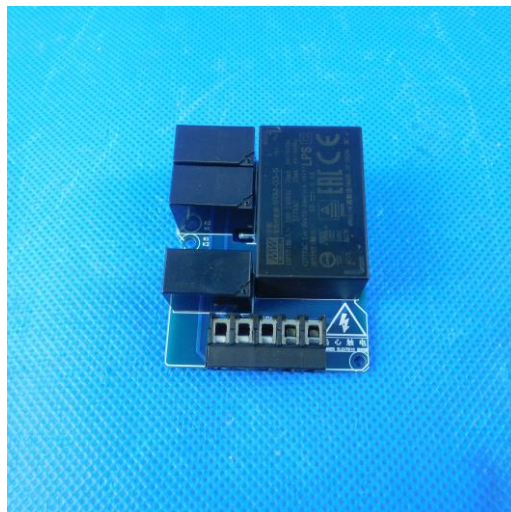
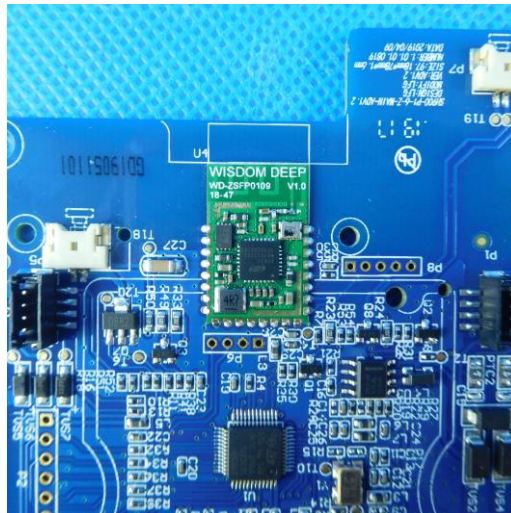
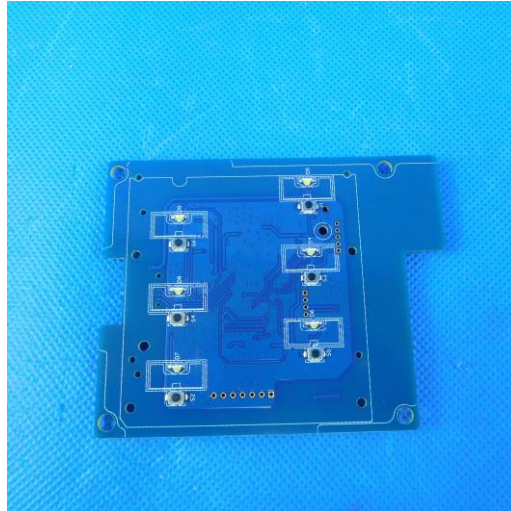


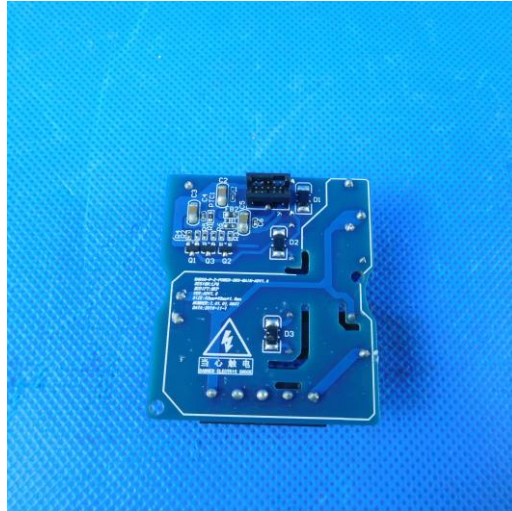


RF Antenna

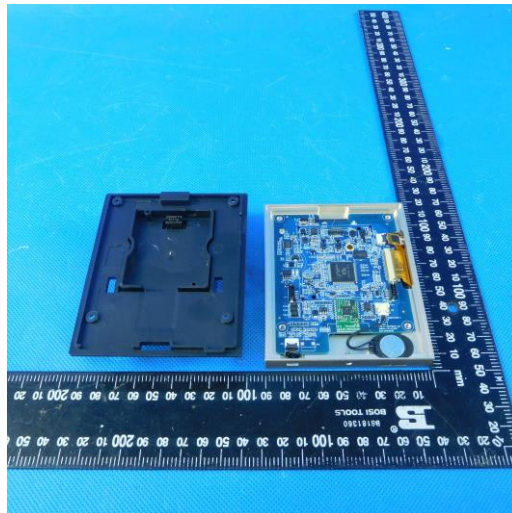
Smart Panel (Intelligent Key Control)

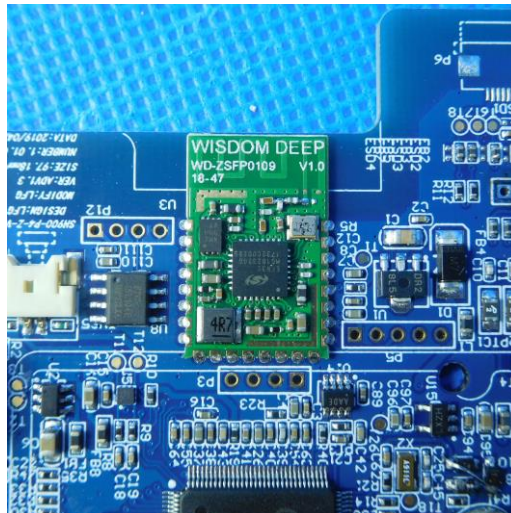
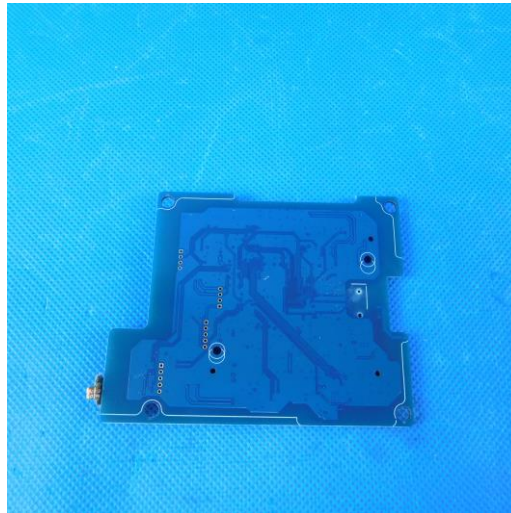


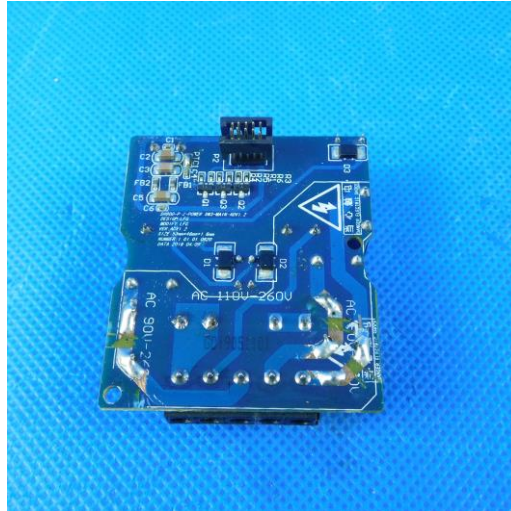




Smart Panel(4 inch screen)







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