

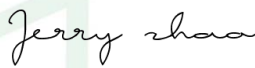





TEST REPORT

Report No. : **CHTEW19070090** Report verification : 
Project No. : **SHT1906086402EW**
FCC ID..... : **2ATWHWNK-19TOM1**
Applicant's name..... : **New Wanaka Limited**
 Address..... : 857,No.1,Suzhou Street,Haidian District,Beijing, China
 Manufacturer..... : MEDELI Musical Instrument (Zhuhai) CO.,LTD
 Address..... : Medeli Instrument Zone, 2 Shuang Lin East Road, Dalinshan Area, Liangang Industrial Zone, Jinwan District, Zhuhai, China
Test item description : **Keyboard Air**
 Trade Mark : -
 Model/Type reference..... : TOM
 Listed Model(s) : -
Standard : **FCC CFR Title 47 Part 15 Subpart C Section 15.247**
 Date of receipt of test sample..... : Jun.28, 2019
 Date of testing..... : Jun.28, 2019- Jul.18, 2019
 Date of issue..... : Jul.19, 2019
Result..... : **PASS**

Compiled by
 (Position+Printed name+Signature) : File administrators Echo Wei 
 Supervised by
 (Position+Printed name+Signature) : Project Engineer Jerry Zhao 
 Approved by
 (Position+Printed name+Signature) : RF Manager Hans Hu 

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 v05r01](#): 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	2019-07-19	Original

2. TEST DESCRIPTION

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

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

3. SUMMARY

3.1. Client Information

Applicant:	New Wanaka Limited
Address:	857, No.1, Suzhou Street, Haidian District, Beijing, China
Manufacturer:	MEDELI Musical Instrument (Zhuhai) CO., LTD
Address:	Medeli Instrument Zone, 2 Shuang Lin East Road, Dalinshan Area, Liangang Industrial Zone, Jinwan District, Zhuhai, China

3.2. Product Description

Name of EUT:	Keyboard Air
Trade Mark:	-
Model No.:	TOM
Listed Model(s):	-
Power supply:	DC 12V
Adapter information:	INPUT: 100-240Va.c., 50/60Hz, 0.4A Max OUTPUT: 12Vd.c., 1000mA
Hardware version:	-
Software version:	-
Bluetooth	
Version:	Supported BT4.0+BLE
Modulation:	GFSK
Operation frequency:	2402MHz~2480MHz
Channel number:	40
Channel separation:	2MHz
Antenna type:	Integral antenna
Antenna gain:	2.5 dBi

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)
00	2402
01	2404
⋮	⋮
19	2440
⋮	⋮
38	2478
39	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	2018/09/28	2019/09/27
●	RF Connection Cable	HUBER+SUHNER	SUCOFLEX104	501184/4	2018/09/28	2019/09/27
●	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	2019/09/28
○	Radio communication tester	R&S	CMW500	137688-Lv	2018/09/29	2019/09/28
○	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.

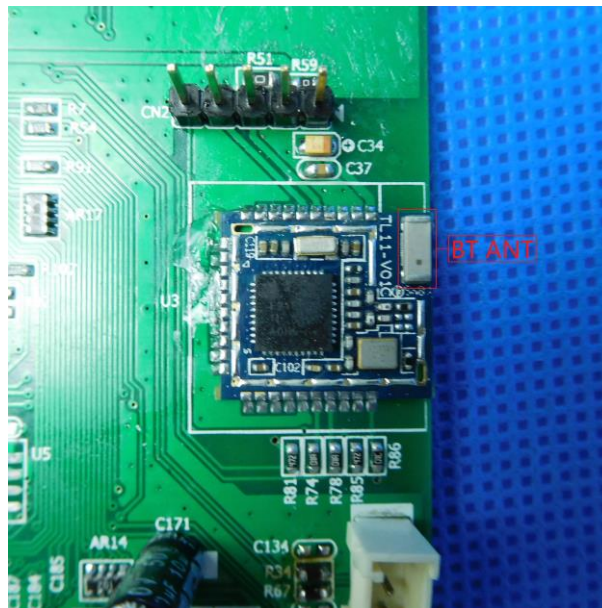
FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(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)

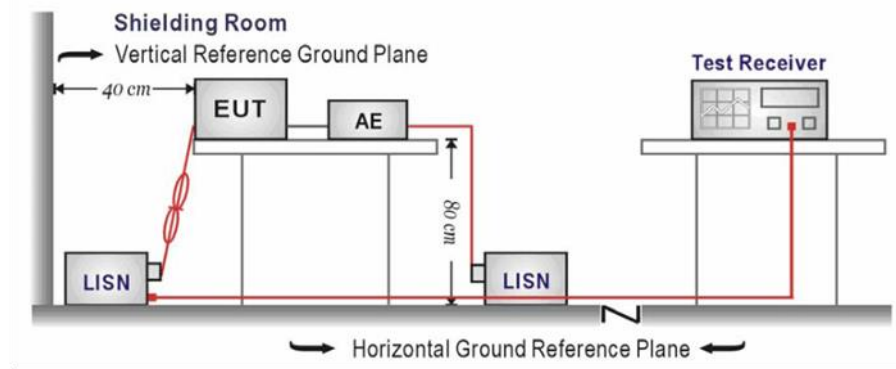
LIMIT

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

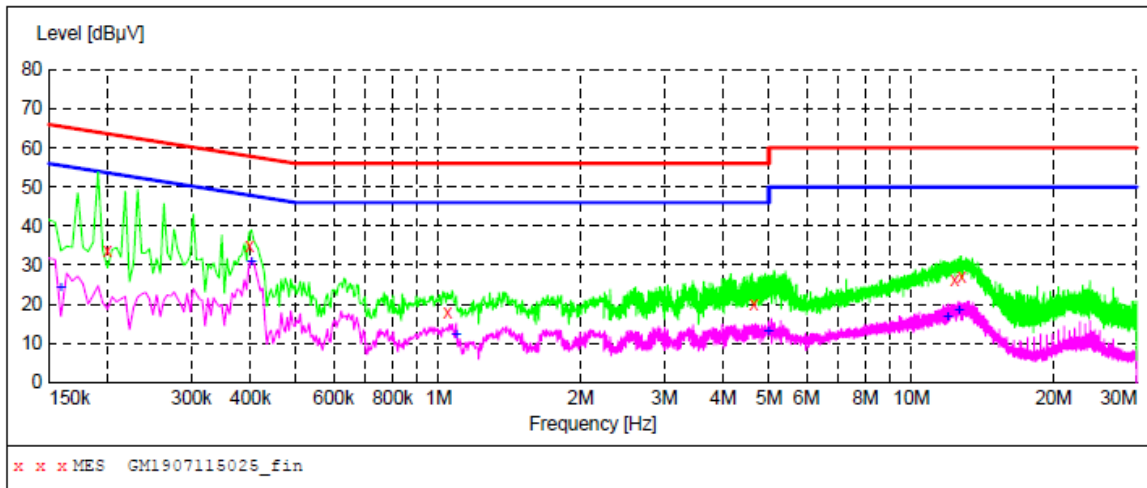
Passed Not Applicable

Note:

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

Test Line:

L



MEASUREMENT RESULT: "GM1907115025_fin"

7/11/2019 2:01PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.199500	33.50	9.9	64	30.1	QP	L1	GND
0.397500	35.10	9.9	58	22.8	QP	L1	GND
1.045500	17.90	9.9	56	38.1	QP	L1	GND
4.636500	19.90	9.9	56	36.1	QP	L1	GND
12.367500	26.40	10.1	60	33.6	QP	L1	GND
12.790500	26.90	10.1	60	33.1	QP	L1	GND

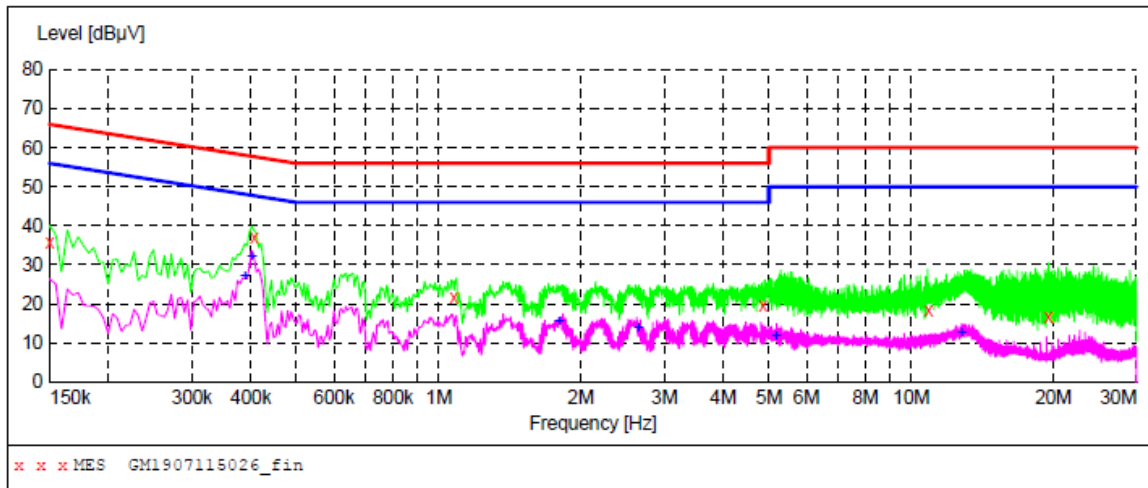
MEASUREMENT RESULT: "GM1907115025_fin2"

7/11/2019 2:01PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.159000	24.30	9.9	56	31.2	AV	L1	GND
0.402000	30.90	9.9	48	16.9	AV	L1	GND
1.090500	12.00	9.9	46	34.0	AV	L1	GND
4.983000	13.00	10.0	46	33.0	AV	L1	GND
11.931000	16.80	10.1	50	33.2	AV	L1	GND
12.619500	18.20	10.1	50	31.8	AV	L1	GND

Test Line:

N



MEASUREMENT RESULT: "GM1907115026_fin"

7/11/2019 2:04PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.150000	35.60	9.9	66	30.4	QP	N	GND
0.406500	37.20	9.9	58	20.5	QP	N	GND
1.077000	21.80	9.9	56	34.2	QP	N	GND
4.861500	19.50	10.0	56	36.5	QP	N	GND
10.869000	18.20	10.1	60	41.8	QP	N	GND
19.536000	16.50	10.2	60	43.5	QP	N	GND

MEASUREMENT RESULT: "GM1907115026_fin2"

7/11/2019 2:04PM

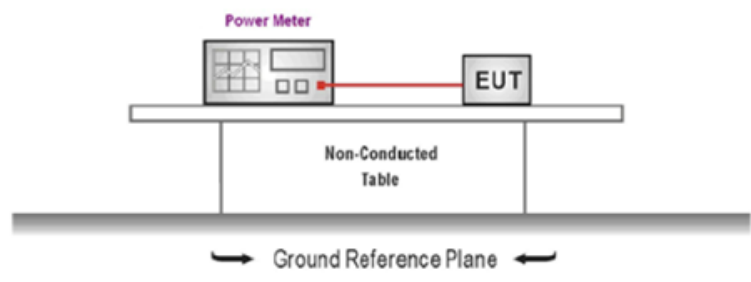
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.388500	26.90	9.9	48	21.2	AV	N	GND
0.402000	31.90	9.9	48	15.9	AV	N	GND
1.797000	15.60	9.9	46	30.4	AV	N	GND
2.643000	14.00	9.9	46	32.0	AV	N	GND
5.172000	11.70	10.0	50	38.3	AV	N	GND
12.795000	12.50	10.1	50	37.5	AV	N	GND

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
BT-BLE	00	-1.92	≤30.00	Pass
	19	-2.02		
	39	-2.71		

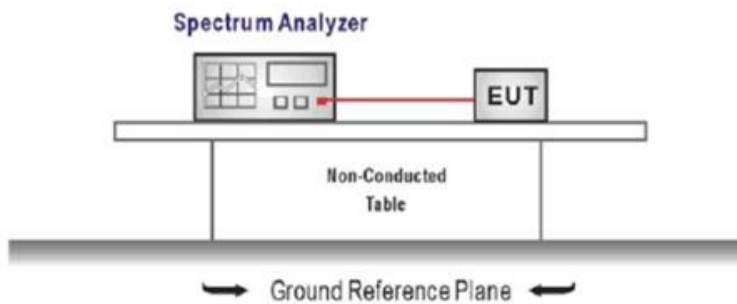
5.4. Power Spectral Density

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 kHz ≤ 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 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
BT-BLE	00	-16.22	≤8.00	Pass
	19	-16.28		
	39	-16.99		

Test plot as follows:

CH00	<p>Spectrum</p> <p>Ref Level 10.50 dBm Offset 1.00 dB RBW 3 kHz Att 20 dB SWT 632.3 μs VBW 10 kHz Mode Auto FFT Count 100/100</p> <p>1Pk Max</p> <p>M1[1] -16.22 dBm 2.40199280 GHz</p> <p>CF 2.402 GHz 691 pts Span 1.0 MHz</p> <p>Date: 12/20/2019 13:28:18</p>
CH19	<p>Spectrum</p> <p>Ref Level 10.50 dBm Offset 1.00 dB RBW 3 kHz Att 20 dB SWT 632.3 μs VBW 10 kHz Mode Auto FFT Count 100/100</p> <p>1Pk Max</p> <p>M1[1] -16.28 dBm 2.43999280 GHz</p> <p>CF 2.44 GHz 691 pts Span 1.0 MHz</p> <p>Date: 12/20/2019 13:31:02</p>
CH39	<p>Spectrum</p> <p>Ref Level 10.50 dBm Offset 1.00 dB RBW 3 kHz Att 20 dB SWT 632.3 μs VBW 10 kHz Mode Auto FFT Count 100/100</p> <p>1Pk Max</p> <p>M1[1] -16.99 dBm 2.47999280 GHz</p> <p>CF 2.48 GHz 691 pts Span 1.0 MHz</p> <p>Date: 12/20/2019 13:32:50</p>

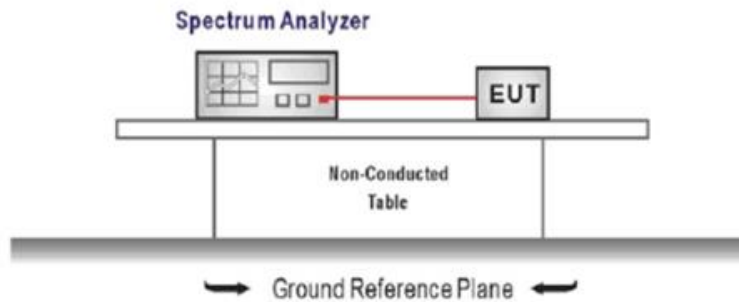
5.5. 6dB bandwidth

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

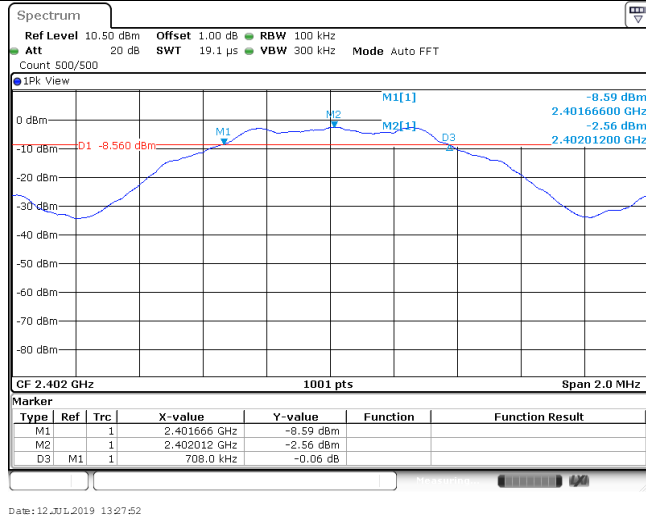
TEST RESULTS

Passed Not Applicable

Type	Channel	6dB Bandwidth(MHz)	Limit (kHz)	Result
BT-BLE	00	0.71	≥500	Pass
	19	0.70		
	39	0.71		

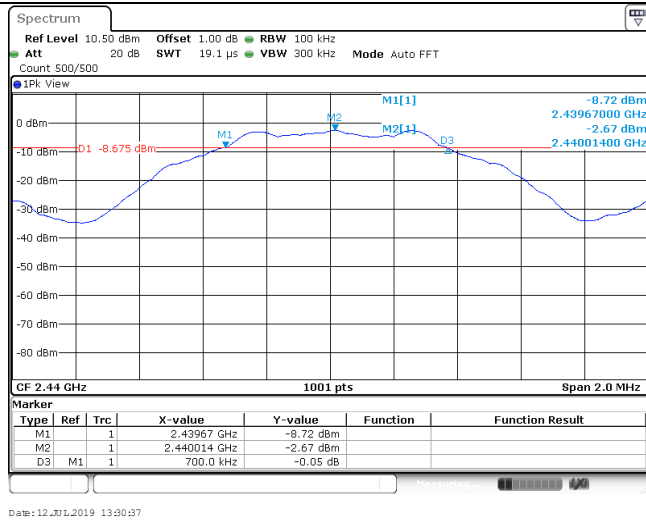
Test plot as follows:

CH00



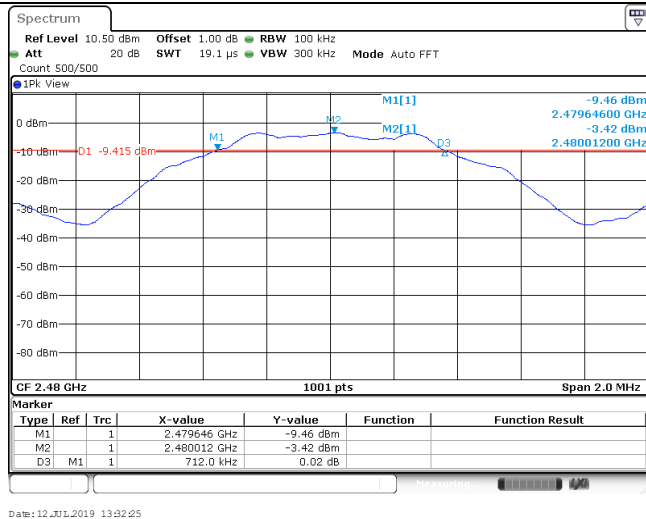
Date: 12/01/2019 13:27:52

CH19



Date: 12/01/2019 13:30:37

CH39



Date: 12/01/2019 13:32:25

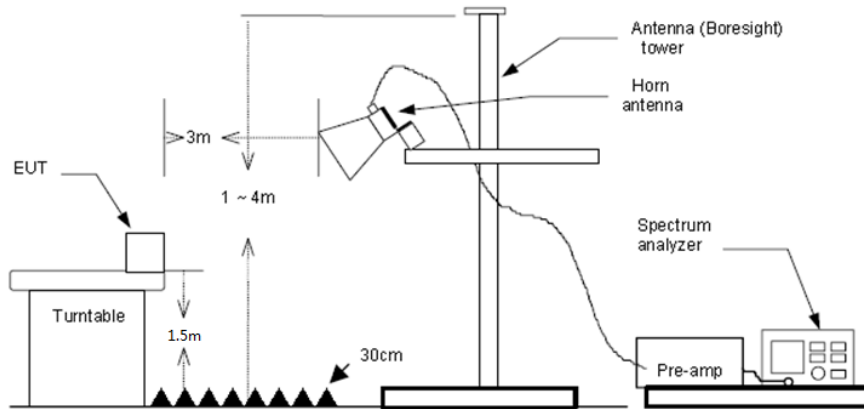
5.6. Restricted band

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				CH00			
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
2310.0000	52.50	-2.34	50.16	74.00	23.84	Horizontal	PK
2390.0008	52.55	-2.41	50.14	74.00	23.86	Horizontal	PK
2310.0000	45.80	-2.34	43.46	54.00	10.54	Horizontal	AV
2390.0008	46.31	-2.41	43.90	54.00	10.10	Horizontal	AV
2310.0000	53.82	-2.34	51.48	74.00	22.52	Vertical	PK
2390.0008	52.45	-2.41	50.04	74.00	23.96	Vertical	PK
2310.0000	46.75	-2.34	44.41	54.00	9.59	Vertical	AV
2390.0008	45.47	-2.41	43.06	54.00	10.94	Vertical	AV

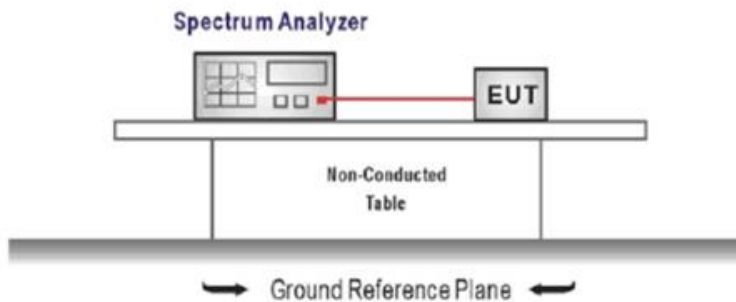
Test channel				CH39			
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
2483.5000	52.89	-2.15	50.74	74.00	23.26	Horizontal	PK
2500.0000	51.75	-2.10	49.65	74.00	24.35	Horizontal	PK
2483.5000	44.44	-2.15	42.29	54.00	11.71	Horizontal	AV
2500.0000	45.20	-2.10	43.10	54.00	10.90	Horizontal	AV
2483.5000	52.80	-2.15	50.65	74.00	23.35	Vertical	PK
2500.0000	52.38	-2.10	50.28	74.00	23.72	Vertical	PK
2483.5000	46.08	-2.15	43.93	54.00	10.07	Vertical	AV
2500.0000	46.26	-2.10	44.16	54.00	9.84	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 ≥ 3 x 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.

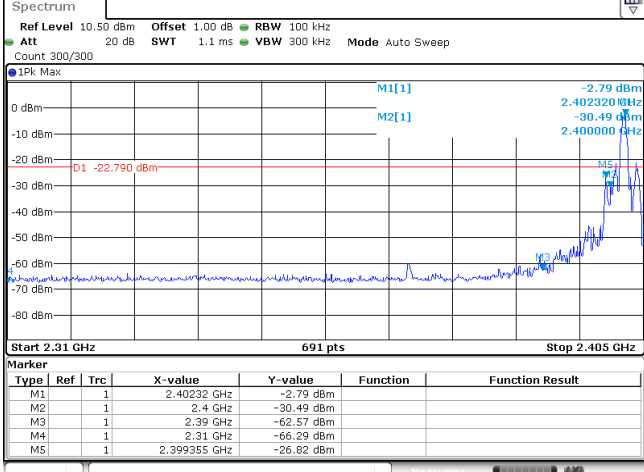
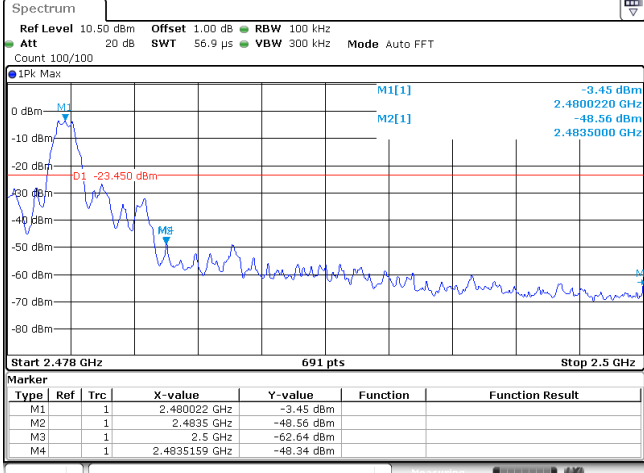
3. Emission level measurement
Set the center frequency and span to encompass frequency range to be measured
RBW = 100 kHz, VBW ≥ 3 x RBW
Detector = peak, Sweep time = auto couple, Trace mode = max hold
Allow trace to fully stabilize
Use the peak marker function to determine the maximum amplitude level.
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.

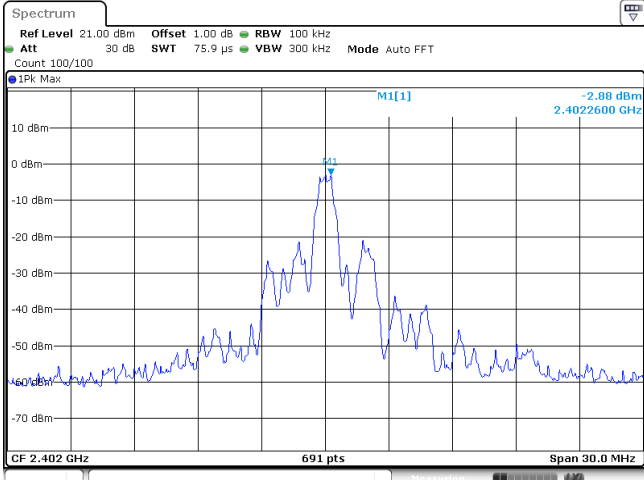
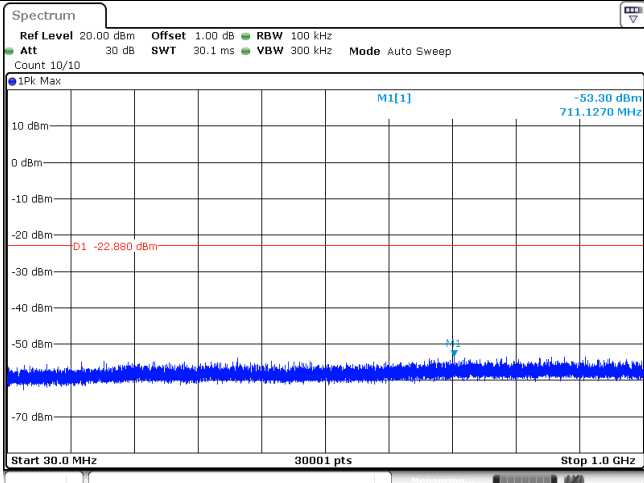
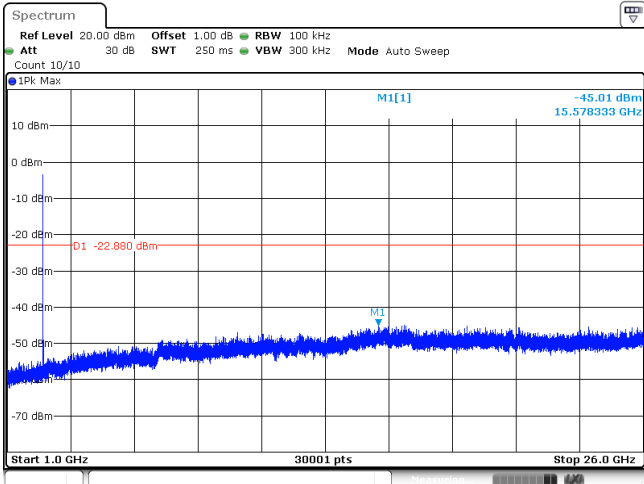
TEST MODE:

Please refer to the clause 3.3

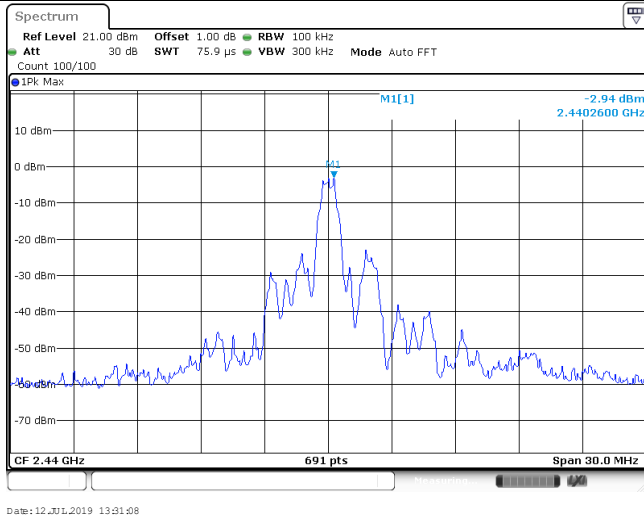
TEST RESULTS

Passed Not Applicable

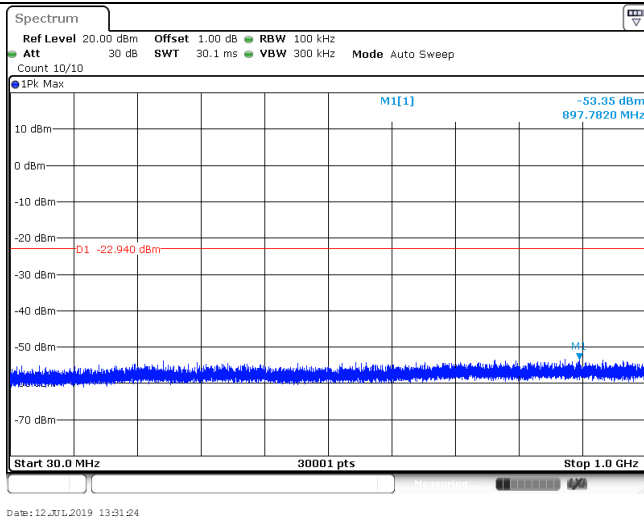
Test Item:	Band edge																																										
<p style="text-align: center;">CH00</p>	 <p>Marker Table:</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td>2.40232 GHz</td> <td>-2.79 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.4 GHz</td> <td>-30.49 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.39 GHz</td> <td>-62.57 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.31 GHz</td> <td>-66.29 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td>2.399355 GHz</td> <td>-26.82 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 12 JUL 2019 13:28:55</p>	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.40232 GHz	-2.79 dBm			M2	1		2.4 GHz	-30.49 dBm			M3	1		2.39 GHz	-62.57 dBm			M4	1		2.31 GHz	-66.29 dBm			M5	1		2.399355 GHz	-26.82 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																					
M1	1		2.40232 GHz	-2.79 dBm																																							
M2	1		2.4 GHz	-30.49 dBm																																							
M3	1		2.39 GHz	-62.57 dBm																																							
M4	1		2.31 GHz	-66.29 dBm																																							
M5	1		2.399355 GHz	-26.82 dBm																																							
<p style="text-align: center;">CH39</p>	 <p>Marker Table:</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td>2.480022 GHz</td> <td>-3.45 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.4835 GHz</td> <td>-48.56 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.5 GHz</td> <td>-62.64 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.4835159 GHz</td> <td>-48.34 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 12 JUL 2019 13:33:00</p>	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.480022 GHz	-3.45 dBm			M2	1		2.4835 GHz	-48.56 dBm			M3	1		2.5 GHz	-62.64 dBm			M4	1		2.4835159 GHz	-48.34 dBm									
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																					
M1	1		2.480022 GHz	-3.45 dBm																																							
M2	1		2.4835 GHz	-48.56 dBm																																							
M3	1		2.5 GHz	-62.64 dBm																																							
M4	1		2.4835159 GHz	-48.34 dBm																																							

Test Item:	SE
CH00 Reference level	 <p>Spectrum</p> <p>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</p> <p>IPK Max</p> <p>M1[1] -2.88 dBm 2.4022600 GHz</p> <p>CF 2.402 GHz 691 pts Span 30.0 MHz</p> <p>Date: 12 JUL 2019 13:29:04</p>
CH00 30MHz~1000MHz	 <p>Spectrum</p> <p>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</p> <p>IPK Max</p> <p>M1[1] -53.30 dBm 711.1270 MHz</p> <p>D1 -22.880 dBm</p> <p>Start 30.0 MHz 30001 pts Stop 1.0 GHz</p> <p>Date: 12 JUL 2019 13:29:42</p>
CH00 1GHz~26GHz	 <p>Spectrum</p> <p>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</p> <p>IPK Max</p> <p>M1[1] -45.01 dBm 15.578333 GHz</p> <p>D1 -22.880 dBm</p> <p>Start 1.0 GHz 30001 pts Stop 26.0 GHz</p> <p>Date: 12 JUL 2019 13:29:58</p>

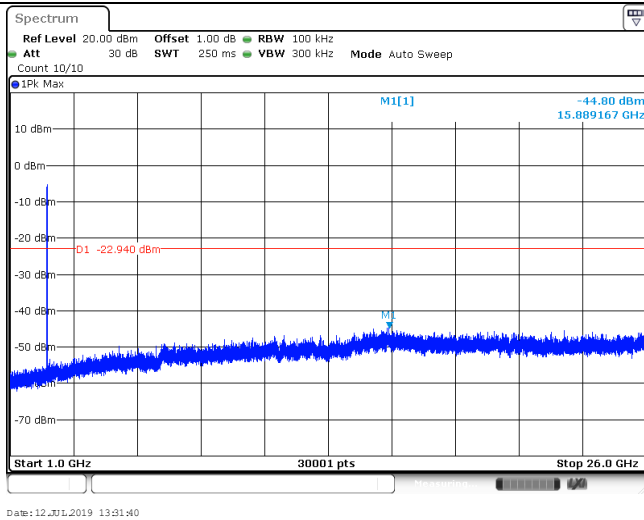
CH19
Reference level



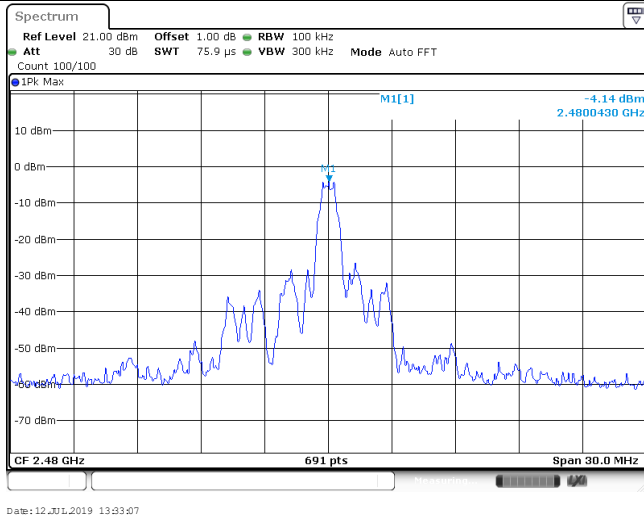
CH19
30MHz~1000MHz



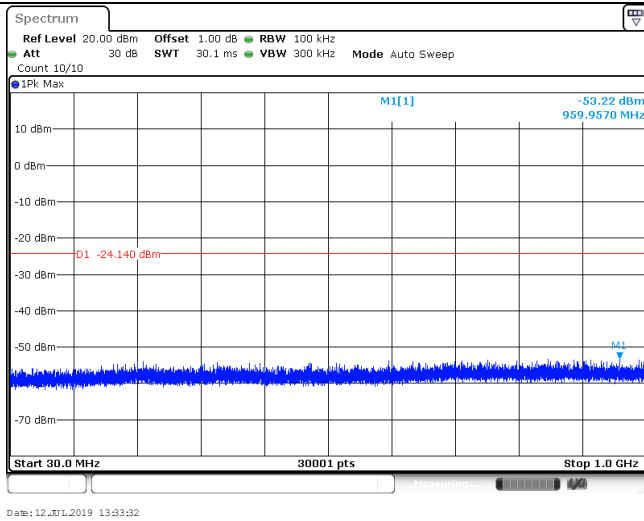
CH19
1GHz~26GHz



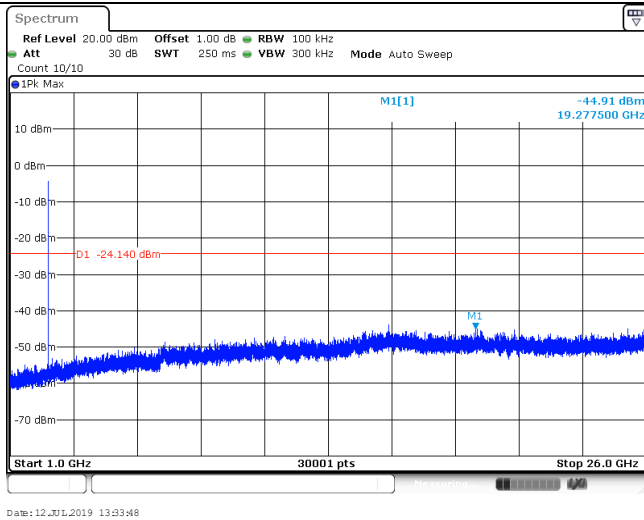
CH39
Reference level



CH39
30MHz~1000MHz



CH39
1GHz~26GHz



5.8. Spurious Emissions (radiated)

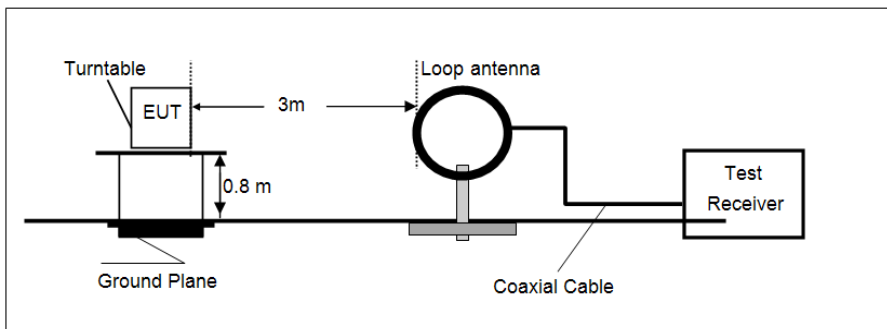
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

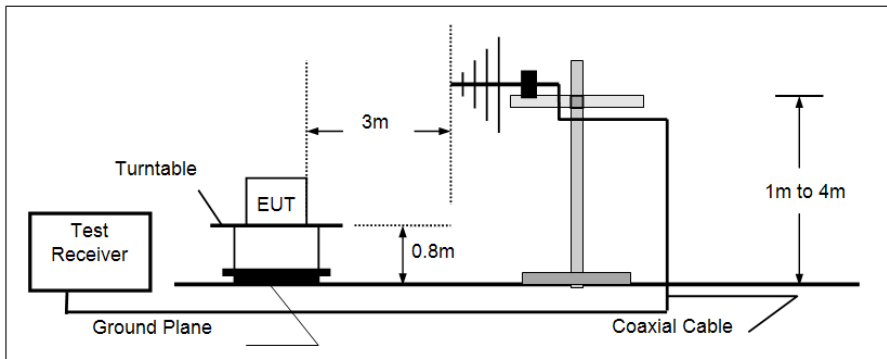
Frequency	Limit (dBuV/m @3m)	Value
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

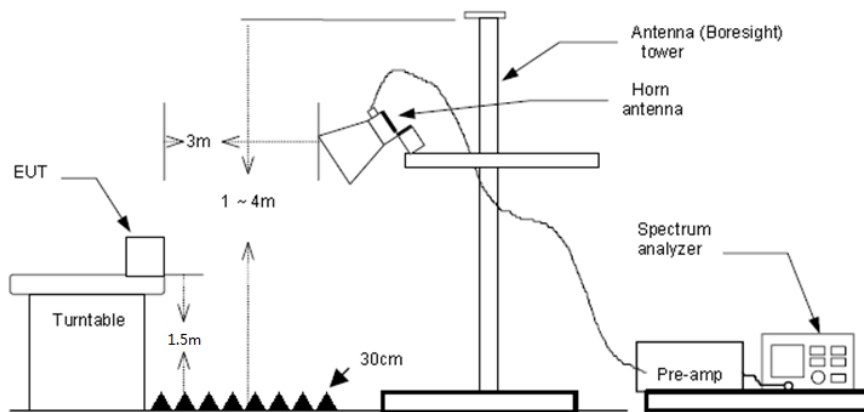
- 9 kHz ~ 30 MHz



- 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

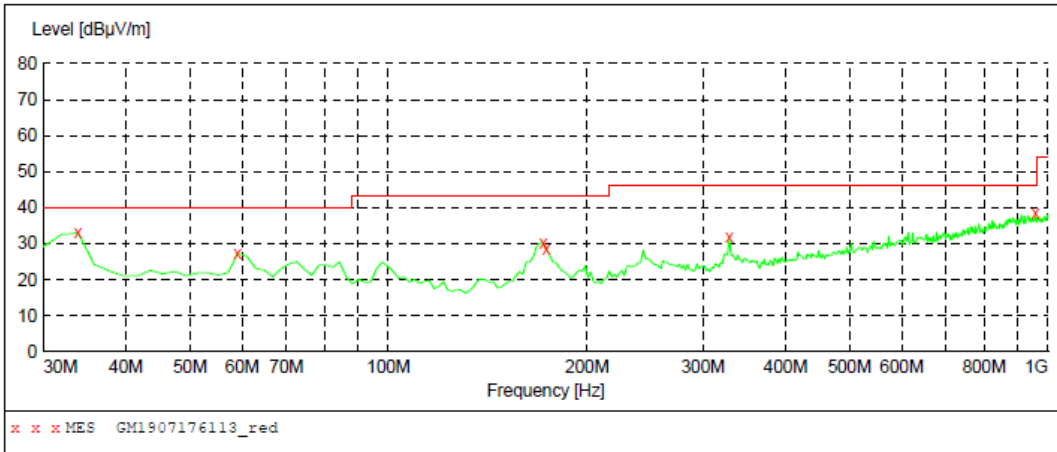
Passed **Not Applicable**

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

Polarization: Vertical

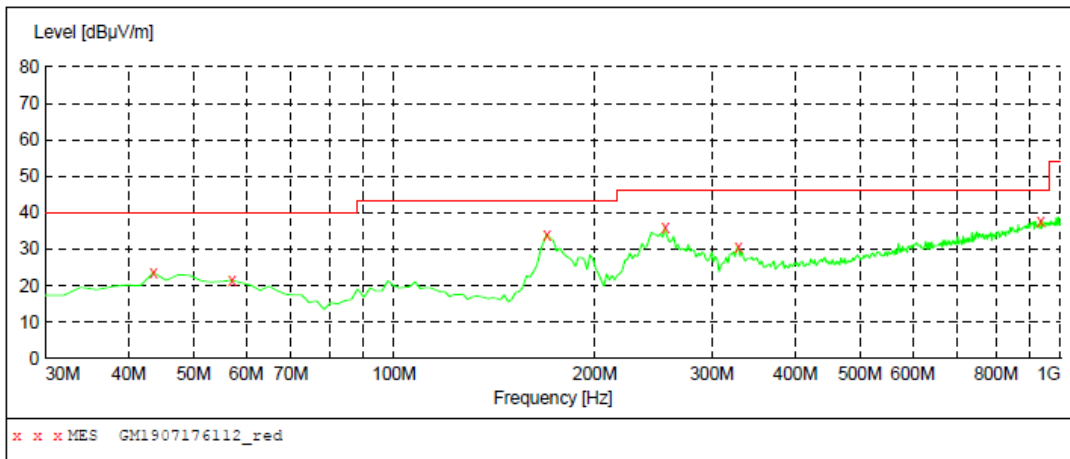


MEASUREMENT RESULT: "GM1907176113_red"

7/17/2019 7:59PM

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
33.880000	33.00	-8.7	40.0	7.0	QP	100.0	75.00	VERTICAL
59.100000	27.20	-5.9	40.0	12.8	QP	100.0	90.00	VERTICAL
171.620000	30.30	-9.1	43.5	13.2	QP	100.0	227.00	VERTICAL
173.560000	28.60	-9.0	43.5	14.9	QP	100.0	209.00	VERTICAL
328.760000	31.70	-2.6	46.0	14.3	QP	100.0	209.00	VERTICAL
957.320000	38.60	10.9	46.0	7.4	QP	100.0	352.00	VERTICAL

Polarization: Horizontal



MEASUREMENT RESULT: "GM1907176112_red"

7/17/2019 7:56PM

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
43.580000	23.60	-5.2	40.0	16.4	QP	100.0	122.00	HORIZONTAL
57.160000	21.50	-5.5	40.0	18.5	QP	100.0	53.00	HORIZONTAL
169.680000	34.10	-9.2	43.5	9.4	QP	100.0	337.00	HORIZONTAL
255.040000	35.80	-4.5	46.0	10.2	QP	100.0	191.00	HORIZONTAL
328.760000	30.60	-2.6	46.0	15.4	QP	100.0	204.00	HORIZONTAL
934.040000	37.80	10.8	46.0	8.2	QP	100.0	122.00	HORIZONTAL

➤ 1 GHz ~ 25 GHz

Test channel				CH00			
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
1660.9375	40.26	-6.17	34.09	74.00	39.91	Horizontal	PK
3192.8438	33.46	0.80	34.26	74.00	39.74	Horizontal	PK
5042.0000	29.92	8.25	38.17	74.00	35.83	Horizontal	PK
7071.8125	30.52	15.36	45.88	74.00	28.12	Horizontal	PK
1631.5625	39.63	-6.22	33.41	74.00	40.59	Vertical	PK
2784.5313	32.12	1.86	33.98	74.00	40.02	Vertical	PK
3994.7813	33.97	3.00	36.97	74.00	37.03	Vertical	PK
4808.4688	34.13	7.06	41.19	74.00	32.81	Vertical	PK

Test channel				CH19			
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
1329.0000	37.65	-5.57	32.08	74.00	41.92	Horizontal	PK
2655.2813	35.87	-0.27	35.60	74.00	38.40	Horizontal	PK
4153.4063	31.88	3.55	35.43	74.00	38.57	Horizontal	PK
6058.3750	30.74	10.61	41.35	74.00	32.65	Horizontal	PK
1151.2813	44.53	-6.35	38.18	74.00	35.82	Vertical	PK
1536.0938	40.77	-5.86	34.91	74.00	39.09	Vertical	PK
3867.0000	32.29	2.45	34.74	74.00	39.26	Vertical	PK
5949.6875	30.36	10.22	40.58	74.00	33.42	Vertical	PK

Test channel				CH39			
Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Polarity	Detector
1151.2813	42.38	-6.35	36.03	74.00	37.97	Horizontal	PK
1659.4688	44.02	-6.17	37.85	74.00	36.15	Horizontal	PK
3562.9688	32.09	1.30	33.39	74.00	40.61	Horizontal	PK
5138.9375	31.22	8.87	40.09	74.00	33.91	Horizontal	PK
1151.2813	43.79	-6.35	37.44	74.00	36.56	Vertical	PK
1660.9375	44.45	-6.17	38.28	74.00	35.72	Vertical	PK
4958.2813	34.78	7.57	42.35	74.00	31.65	Vertical	PK
7751.8438	30.11	17.36	47.47	74.00	26.53	Vertical	PK

Remark:

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

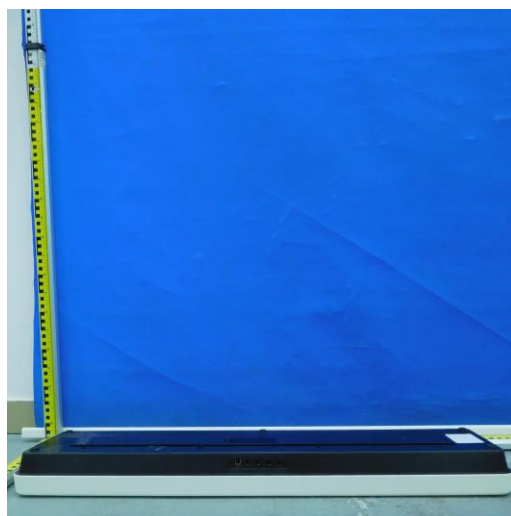
6. TEST SETUP PHOTOS

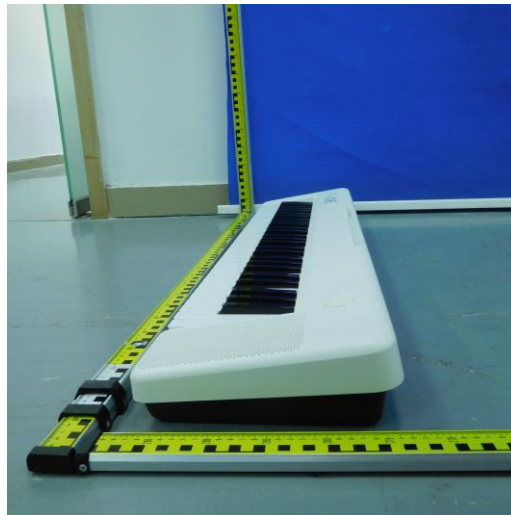
Radiated Emissions

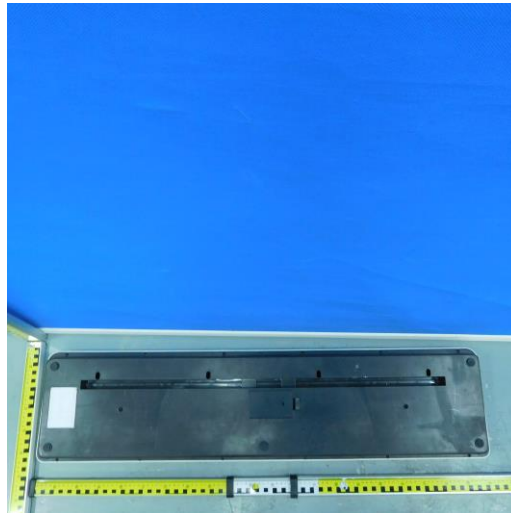


7. EXTERANAL AND INTERNAL PHOTOS

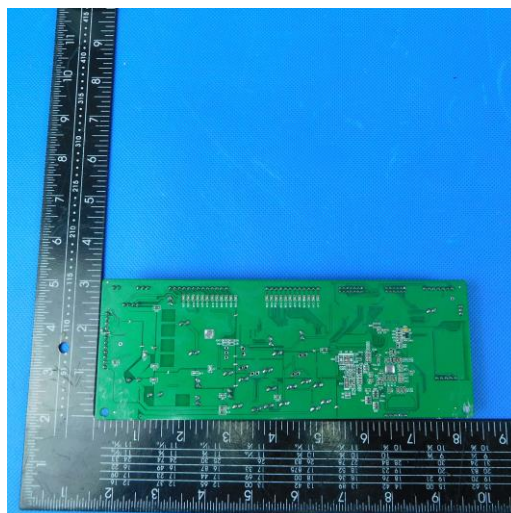
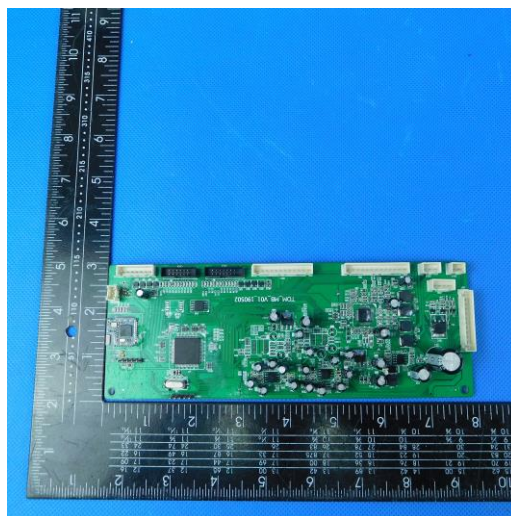
External Photos

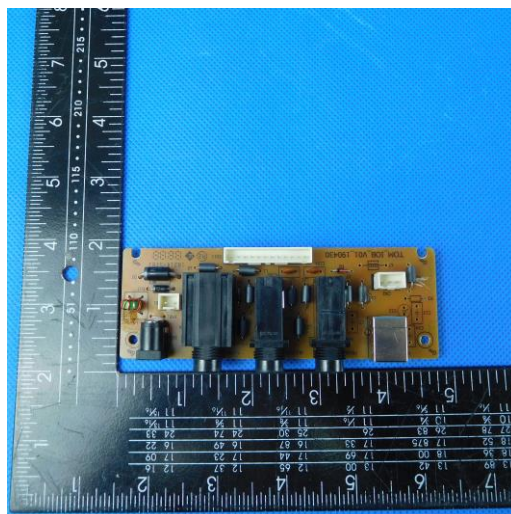
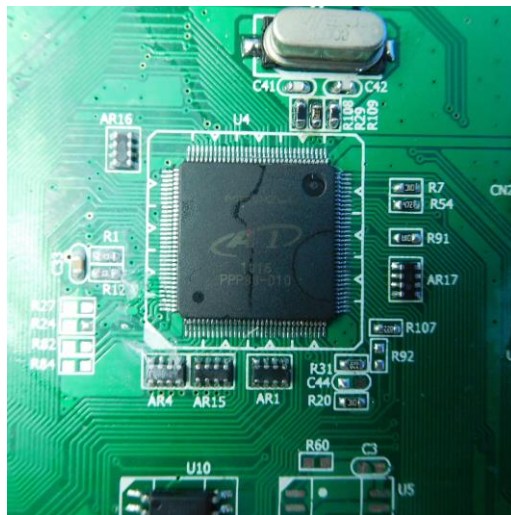
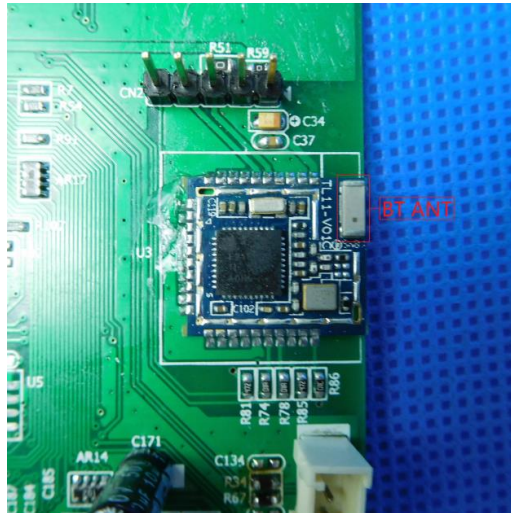


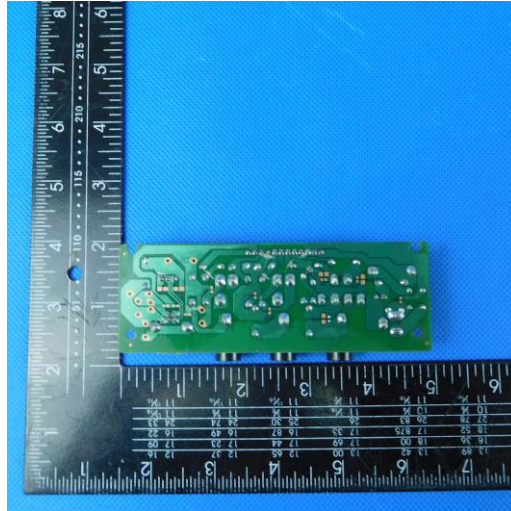




Internal Photos







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