TEST REPORT

Report No. ..... :	**CHTEW19120239**
Project No……:	**SHT1912063003EW**
FCC ID..... :	**2AJ9T-HBLBM**
Applicant's name..... :	**ZKTECO CO., LTD.**
Address.....:	No.26, Pingshan 188 Industry zone, Tangxia Town, Dongguan City, Guangdong Province, China 523728
Manufacturer.....:	ZKTECO CO., LTD.
Address.....:	No.26, Pingshan 188 Industry zone, Tangxia Town, Dongguan City, Guangdong Province, China 523728
Test item description ..... :	**Hybrid Biometric Lock**
Trade Mark .....:	-
Model/Type reference.....:	HBL100B
Listed Model(s) .....:	HBL200B
Standard ..... :	**FCC CFR Title 47 Part 15 Subpart C Section 15.247**
Date of receipt of test sample……...:	Dec.20,2019
Date of testing……..:	Dec.20,2019 ~ Dec.30,2019
Date of issue……....:	Dec.31,2019
Result..... ……..:	**PASS**

Report Verification:

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Testing Laboratory Name ..... :	**Shenzhen Huatongwei International Inspection Co., Ltd.**
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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	2019-12-31	Original

2. TEST DESCRIPTION

Report clause	Test Items	Standard Requirement	Result
5.1	Antenna Requirement	15.203/15.247(c)	PASS
5.2	AC Conducted Emission	15.207	PASS
5.3	Peak Output Power	15.247(b)(3)	PASS
5.4	Power Spectral Density	15.247(e)	PASS
5.5	6dB Bandwidth	15.247(a)(2)	PASS
5.6	99% Occupied Bandwidth	-	PASS*1
5.7	Duty cycle	-	PASS*1
5.8	Conducted Band Edge and Spurious Emission	15.247(d)/15.205	PASS
5.9	Radiated Band Edge Emission	15.205/15.209	PASS
5.10	Radiated Spurious Emission	15.247(d)/15.205/15.209	PASS

Note:

– The measurement uncertainty is not included in the test result.

– *1: No requirement on standard, only report these test data.

3. SUMMARY

3.1. Client Information

Applicant:	ZKTECO CO., LTD.
Address:	No.26, Pingshan 188 Industry zone, Tangxia Town, Dongguan City, Guangdong Province, China 523728
Manufacturer:	ZKTECO CO., LTD.
Address:	No.26, Pingshan 188 Industry zone, Tangxia Town, Dongguan City, Guangdong Province, China 523728

3.2. Product Description

Name of EUT:	Hybrid Biometric Lock
Trade Mark:	-
Model No.:	HBL100B
Listed Model(s):	HBL200B
Power supply:	DC 7.4V
Hardware version:	V1.5
Software version:	V 19.0919.1702

3.3. Radio Specification Description

Bluetooth version:	V4.0
Support function*2:	BLE
Modulation:	GFSK
Operation frequency:	2402MHz~2480MHz
Channel number:	39
Channel separation:	2MHz
Antenna type:	PCB Antenna
Antenna gain:	2.2dBi

Note:

*2: only show the RF function associated with this report.

3.4. Testing Laboratory Information

Laboratory Name	Shenzhen Huatongwei International Inspection Co., Ltd.	
Laboratory Location	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China	
Qualifications	Type	Accreditation Number
	CNAS	L1225
	A2LA	3902.01
	FCC	762235
	Canada	5377A

4. TEST CONFIGURATION

4.1. Test frequency list

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

Channel	Frequency (MHz)
00	**2402**
01	2404
⋮	⋮
19	**2440**
⋮	⋮
38	2478
39	**2480**

4.2. Test mode

For RF test items
The engineering test program was provided and enabled to make EUT continuous transmit.
For Radiated spurious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data Recorded in the report.

4.3. Support unit used in test configuration and system

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

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

Whether support unit is used?					
✓ No					
Item	Equipement	Trade Name	Model No.	FCC ID	Power cord
1					
2					

4.4. Testing environmental condition

Type	Requirement	Actual
Temperature:	15~35°C	25°C
Relative Humidity:	25~75%	50%
Air Pressure:	860~1060mbar	1000mbar

4.5. Measurement uncertainty

Test Item	Measurement Uncertainty
AC Conducted Emission (150kHz~30MHz)	3.02 dB
Radiated Emission (30MHz~1000MHz	4.90 dB
Radiated Emissions (1GHz~25GHz)	4.96 dB
Peak Output Power	0.51 dB
Power Spectral Density	0.51 dB
Conducted Spurious Emission	0.51 dB
6dB Bandwidth	70 Hz

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

4.6. Equipment Used during the Test

● Conducted Emission							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Shielded Room	Albatross projects	HTWE0114	N/A	N/A	2018/09/28	2023/09/27
●	EMI Test Receiver	R&S	HTWE0111	ESCI	101247	2019/10/26	2020/10/25
●	Artificial Mains	SCHWARZBECK	HTWE0113	NNLK 8121	573	2019/10/23	2020/10/22
●	Pulse Limiter	R&S	HTWE0033	ESH3-Z2	100499	2019/10/23	2020/10/22
●	RF Connection Cable	HUBER+SUHNER	HTWE0113-02	ENVIROFLEX_142	EF-NM-BNCM-2M	2019/10/23	2020/10/22
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Radiated emission-6th test site							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0127	SAC-3m-02	C11121	2018/09/30	2021/09/29
●	EMI Test Receiver	R&S	HTWE0099	ESCI	100900	2019/10/26	2020/10/25
●	Loop Antenna	R&S	HTWE0170	HFH2-Z2	100020	2018/04/02	2021/04/01
●	Ultra-Broadband Antenna	SCHWARZBECK	HTWE0119	VULB9163	546	2017/04/05	2020/04/04
●	Pre-Amplifer	SCHWARZBECK	HTWE0295	BBV 9742	N/A	2019/11/14	2020/11/13
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-01	N/A	N/A	2019/08/21	2020/08/20
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-02	SUCOFLEX 104	501184/4	2019/05/27	2020/05/26
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Radiated emission-7th test site							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0122	SAC-3m-01	N/A	2018/09/27	2021/09/26
●	Spectrum Analyzer	R&S	HTWE0098	FSP40	100597	2019/10/26	2020/10/25
●	Horn Antenna	SCHWARZBECK	HTWE0126	9120D	1011	2017/04/01	2020/03/31
●	Horn Antenna	SCHWARZBECK	HTWE0103	BBHA9170	25841	2017/03/27	2020/03/26
●	Broadband Horn Antenna	SCHWARZBECK	HTWE0103	BBHA9170	BBHA9170472	2018/10/11	2021/10/11
●	Pre-amplifier	CD	HTWE0071	PAP-0102	12004	2019/11/14	2020/11/13
●	Broadband Pre-amplifier	SCHWARZBECK	HTWE0201	BBV 9718	9718-248	2019/05/23	2020/05/22
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-01	6m 18GHz S Serisa	N/A	2019/05/10	2020/05/09
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-02	6m 3GHz RG Serisa	N/A	2019/05/10	2020/05/09
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-03	6m 3GHz RG Serisa	N/A	2019/05/10	2020/05/09
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-04	6m 3GHz RG Serisa	N/A	2019/05/10	2020/05/09
●	RF Connection Cable	HUBER+SUHNER	HTWE0121-01	6m 18GHz S Serisa	N/A	2019/05/10	2020/05/09
●	Test Software	Audix	N/A	E3	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	2019/10/26	2020/10/25
●	Spectrum Analyzer	Agilent	N9020A	MY50510187	2019/10/26	2020/10/25
●	Power Meter	Anritsu	ML249A	N/A	2019/10/26	2020/10/25
○	Radio communication tester	R&S	CMW500	137688-Lv	2019/10/26	2020/10/25

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.

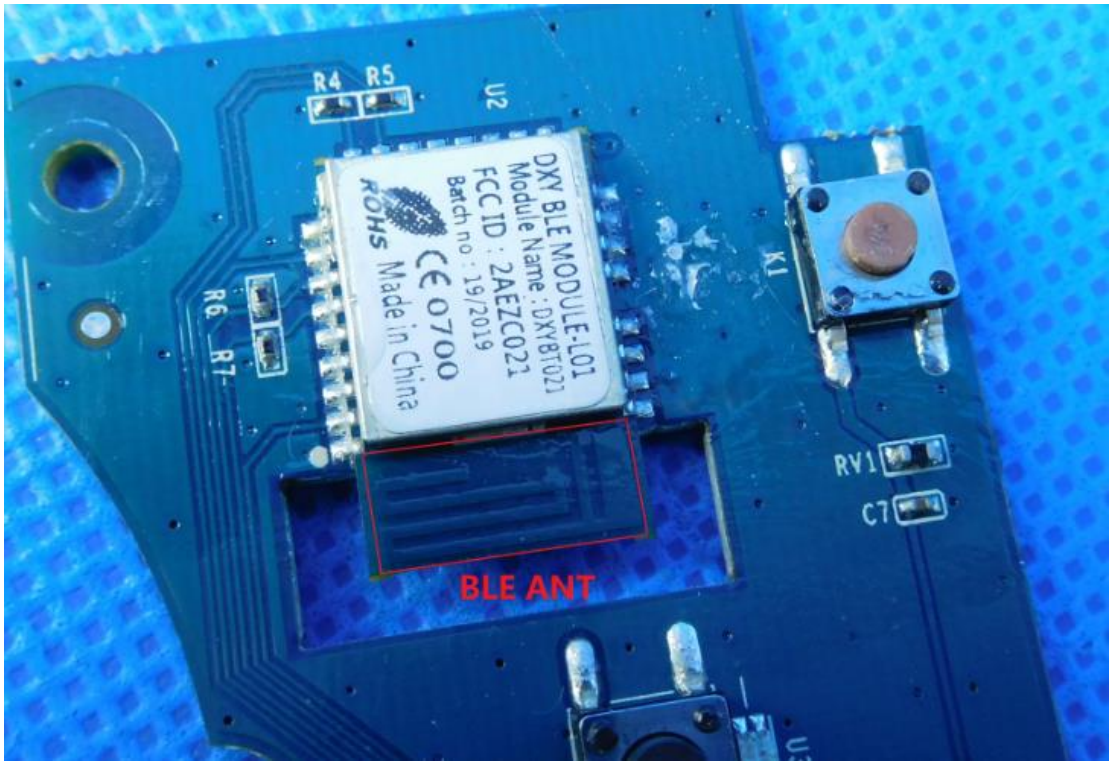
FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(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 RESULT

☒ **Passed** ☐ **Not Applicable**

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



5.2. AC Conducted Emission

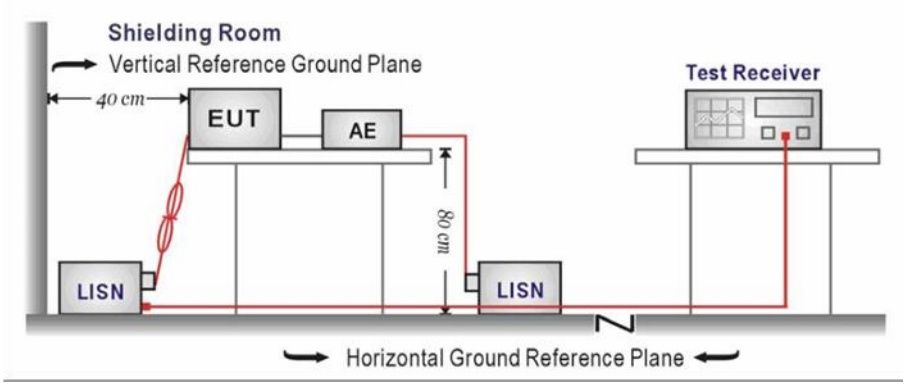
LIMIT

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 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.

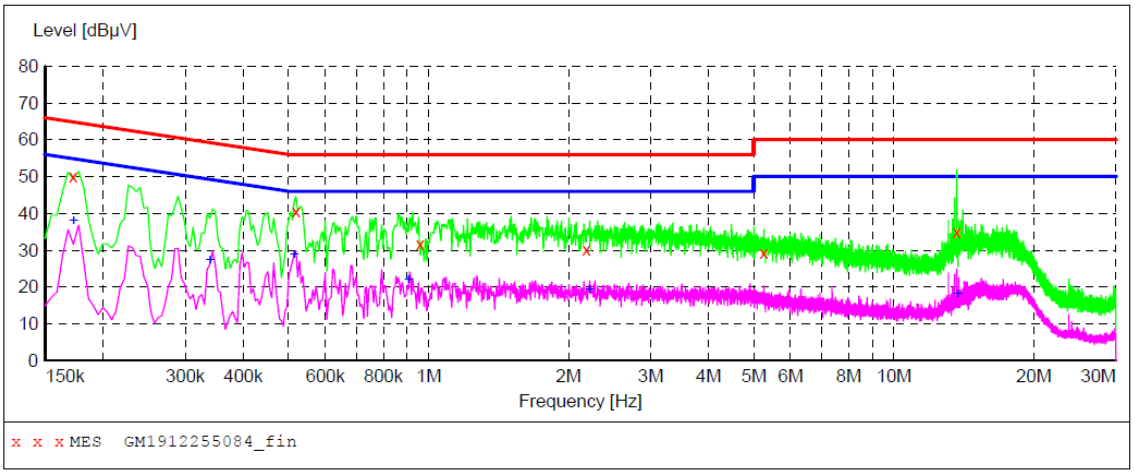
TEST MODE:

Please refer to the clause 4.2

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

Test Line:	L



MEASUREMENT RESULT: "GM1912255084_fin"

12/25/2019 6:41PM

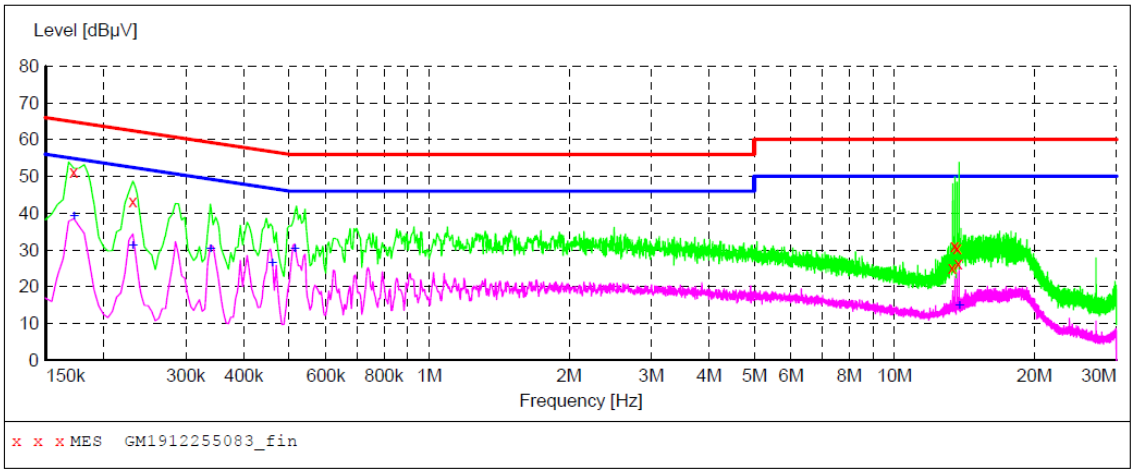
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.172500	50.00	10.1	65	14.8	QP	L1	GND
0.519000	40.60	10.1	56	15.4	QP	L1	GND
0.960000	31.60	10.1	56	24.4	QP	L1	GND
2.184000	30.30	10.1	56	25.7	QP	L1	GND
5.257500	29.40	10.2	60	30.6	QP	L1	GND
13.663500	34.80	10.2	60	25.2	QP	L1	GND

MEASUREMENT RESULT: "GM1912255084_fin2"

12/25/2019 6:41PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.172500	38.00	10.1	55	16.8	AV	L1	GND
0.339000	27.10	10.1	49	22.1	AV	L1	GND
0.514500	28.60	10.1	46	17.4	AV	L1	GND
0.906000	22.00	10.1	46	24.0	AV	L1	GND
2.215500	19.30	10.1	46	26.7	AV	L1	GND
13.681500	17.90	10.2	50	32.1	AV	L1	GND

Test Line:	N



MEASUREMENT RESULT: "GM1912255083_fin"

12/25/2019 6:38PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.172500	51.10	10.1	65	13.7	QP	N	GND
0.231000	43.10	10.1	62	19.3	QP	N	GND
13.321500	25.30	10.2	60	34.7	QP	N	GND
13.474500	31.20	10.2	60	28.8	QP	N	GND
13.650000	30.50	10.2	60	29.5	QP	N	GND
13.726500	26.30	10.2	60	33.7	QP	N	GND

MEASUREMENT RESULT: "GM1912255083_fin2"

12/25/2019 6:38PM

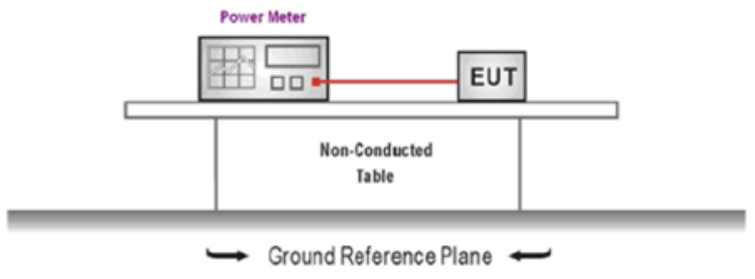
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.172500	39.10	10.1	55	15.7	AV	N	GND
0.231000	31.10	10.1	52	21.3	AV	N	GND
0.339000	30.20	10.1	49	19.0	AV	N	GND
0.460500	26.30	10.1	47	20.4	AV	N	GND
0.514500	30.10	10.1	46	15.9	AV	N	GND
13.789500	14.90	10.2	50	35.1	AV	N	GND

5.3. Peak Output Power

LIMIT

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

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was tested according to ANSI C63.10 and KDB 558074 D01 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 4.2

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

Please refer to appendix A on the appendix report

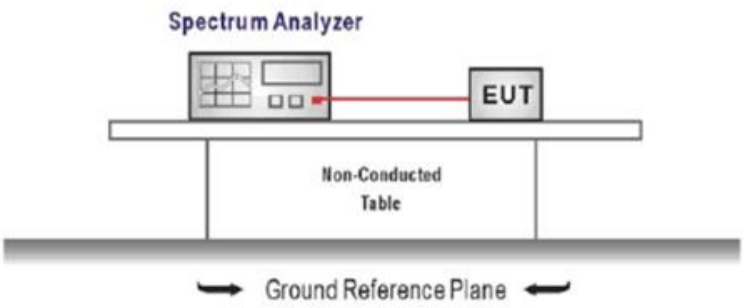
5.4. Power Spectral Density

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 8dBm 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 4.2

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

Please refer to appendix B on the appendix report

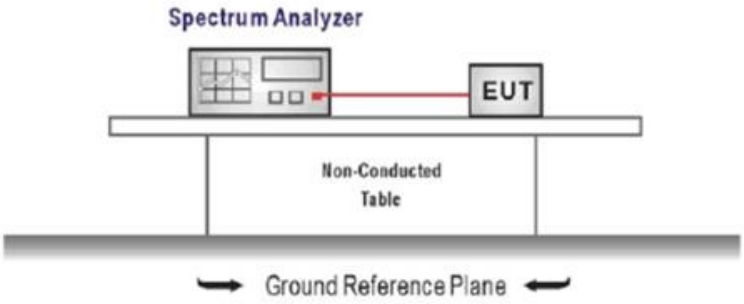
5.5. 6dB bandwidth

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 4.2

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

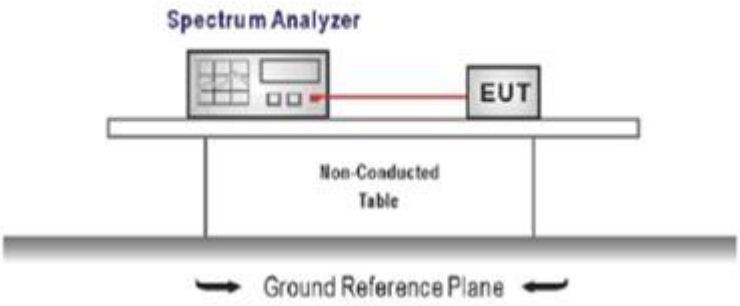
Please refer to appendix C on the appendix report

5.6. 99% Occupied Bandwidth

LIMIT

N/A

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 andthe spectrum analyzer).
   Center Frequency =channel center frequency
   Span≥1.5 x OBW
   RBW = 1%~5%OBW
   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.

TEST MODE:

Please refer to the clause 4.2

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

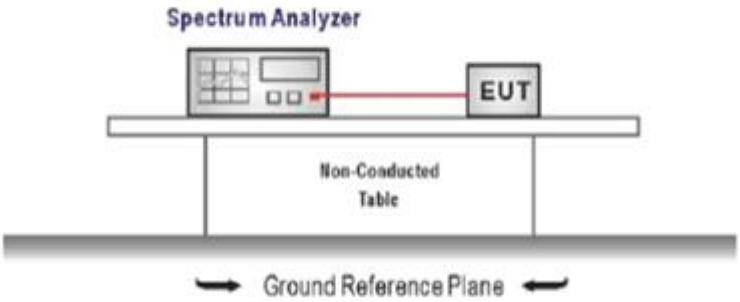
Please refer to appendix D on the appendix report

5.7. Duty Cycle

LIMIT

N/A

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span=zero span, Frequency=centered channel, RBW= 1 MHz, VBW ≥ RBW
   Sweep=as necessary to capture the entire dwell time,
   Detector function = peak, Trigger mode
4. Measure and record the duty cycle data

TEST MODE:

Please refer to the clause 4.2

TEST Data

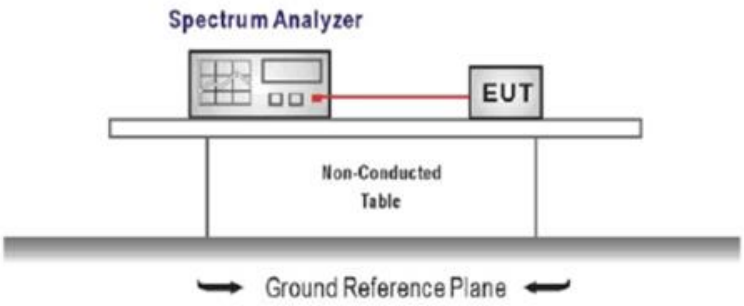
Please refer to appendix E on the appendix report

5.8. Conducted Band edge and Spurious Emission

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section15.247 (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 4.2

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST Data

Please refer to appendix F on the appendix report

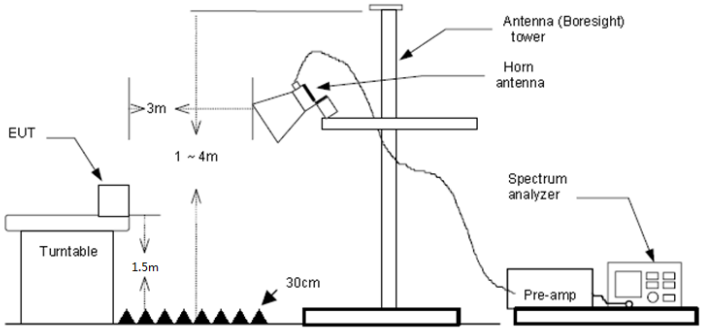
5.9. Radiated Band edge Emission

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 .
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 waspositioned 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. Thisis repeated for both horizontal and vertical polarization of the antenna. In order to find themaximum emission, all of the interface cables were manipulated according to ANSI C63.10 on radiated measurement.
5. Use the following spectrum analyzer settings:
   a) Span shall wide enough to fully capture the emission being measured
   b) Set RBW=100kHz for <1GHz, VBW=3*RBW, Sweep time=auto, Detector=peak, Trace=max hold
   c) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement

      For average measurement:
      – VBW=10Hz, When duty cycle is no less than 98 percent
      – VBW≥1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation, so refer to this clasue 5.6 duty cycle.

TEST MODE:

Please refer to the clause 4.2

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

Note:

1) Level= Reading + Factor; Factor =Antenna Factor+ Cable Loss- Preamp Factor
2) Margin = Limit – Level
3) Average measurement was not performed if peak level is lower than average limit(54 dBuV/m).

Test channel	CH00	Polarity	Horizontal

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2310.000	35.75	-2.34	33.41	74.00	40.59	Horizontal	PK
2	2390.010	35.66	-2.41	33.25	74.00	40.75	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	34.47	-2.34	32.13	54.00	21.87	Horizontal	AV
2	2390.010	34.69	-2.41	32.28	54.00	21.72	Horizontal	AV

Test channel	CH00	Polarity	Vertical

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2310.000	34.77	-2.34	32.43	74.00	41.57	Vertical	PK
2	2390.010	34.64	-2.41	32.23	74.00	41.77	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	33.43	-2.34	31.09	54.00	22.91	Vertical	AV
2	2390.010	33.45	-2.41	31.04	54.00	22.96	Vertical	AV

Test channel	CH39	Polarity	Horizontal

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2483.501	26.05	-2.15	23.90	74.00	50.10	Horizontal	PK
2	2500.000	26.42	-2.10	24.32	74.00	49.68	Horizontal	PK

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2483.501	25.64	-2.15	23.49	54.00	30.51	Horizontal	AV
2	2500.000	25.37	-2.10	23.27	54.00	30.73	Horizontal	AV

Test channel	CH39	Polarity	Vertical

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2483.501	26.31	-2.15	24.16	74.00	49.84	Vertical	PK
2	2500.000	25.91	-2.10	23.81	74.00	50.19	Vertical	PK

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	2483.501	25.16	-2.15	23.01	54.00	30.99	Vertical	AV
2	2500.000	25.17	-2.10	23.07	54.00	30.93	Vertical	AV

5.10. Radiated Spurious Emission

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

Frequency	Limit (dBuV/m)	Value
0.009 MHz ~0.49 MHz	2400/F(kHz) @300m	Quasi-peak
0.49 MHz ~ 1.705 MHz	24000/F(kHz) @30m	Quasi-peak
1.705 MHz ~30 MHz	30 @30m	Quasi-peak

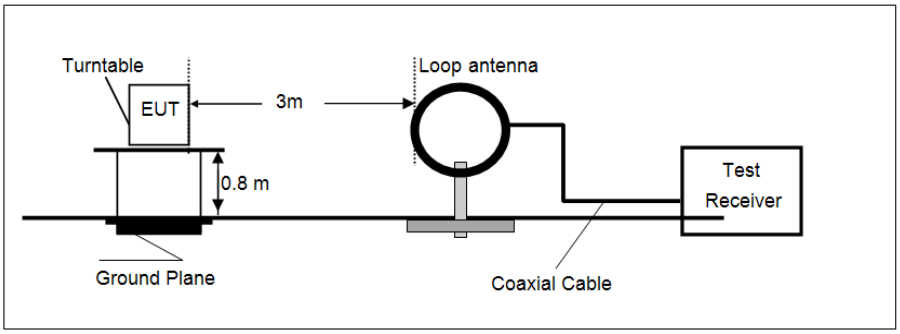
Note: Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3)= Limit dBuV/m @300m +80,

Limit dBuV/m @3m = Limit dBuV/m @30m +40*log(30/3)= Limit dBuV/m @30m + 40.

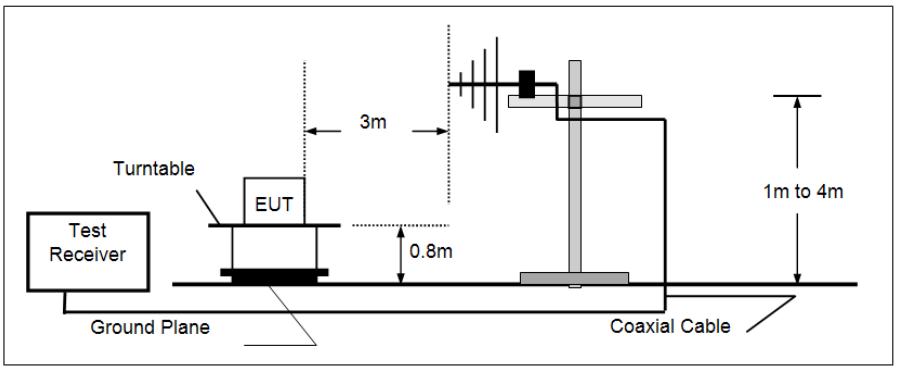
Frequency	Limit (dBuV/m @3m)	Value
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

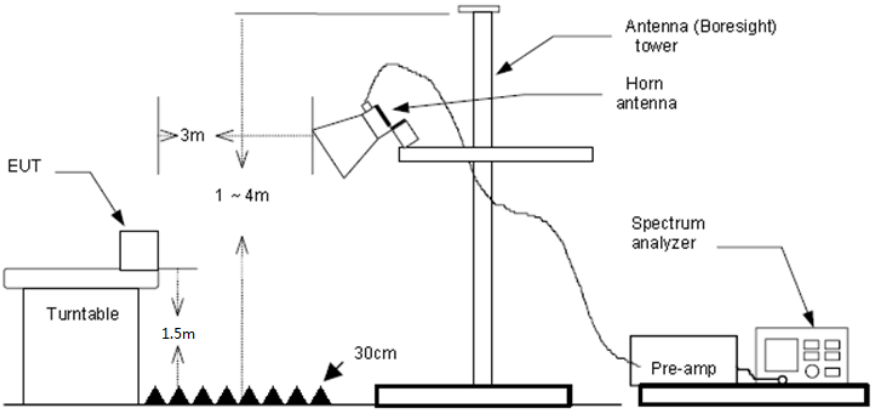
- 9 kHz ~ 30 MHz



- 30 MHz ~ 1 GHz



- Above 1 GHz



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10 .
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
   a) Span shall wide enough to fully capture the emission being measured;
   b) 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.
   c) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement
      For average measurement:
      – VBW=10Hz, When duty cycle is no less than 98 percent
      – VBW≥1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation, so refer to this clasue 5.6 duty cycle.

TEST MODE:

Please refer to the clause 4.2

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

Note:

1) Level= Reading + Factor/Transd; Factor/Transd =Antenna Factor+ Cable Loss- Preamp Factor
2) Margin = Limit – Level
3) Average measurement was not performed if peak level is lower than average limit(54 dBuV/m) for above 1GHz.

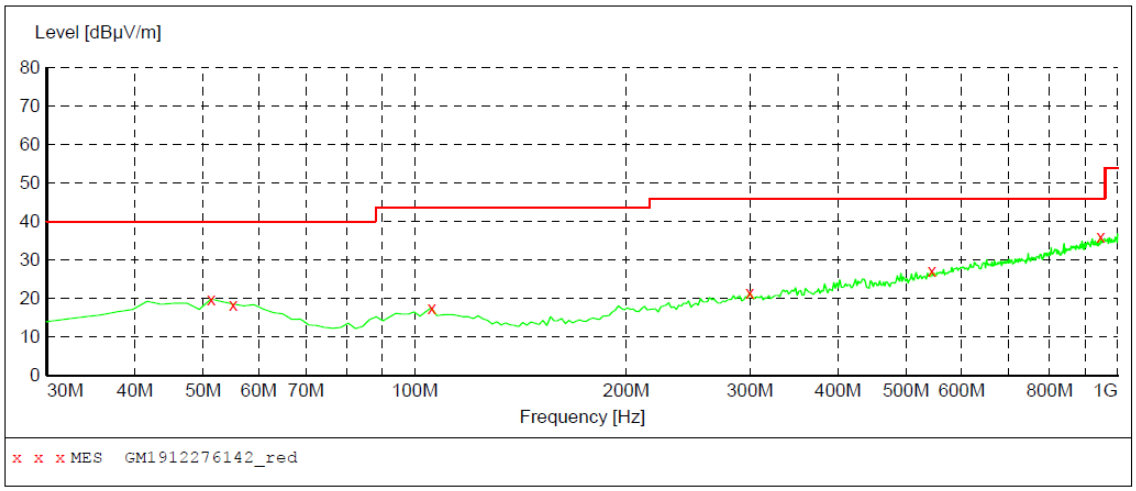
TEST DATA FOR 9 kHz ~ 30 MHz

The EUT was pre-scanned this frequency band, found the radiated level 20dB lower than the limit, so don't show data on this report.

TEST DATA FOR 30 MHz ~ 1000 MHz

Have pre-scan all test channel, found CH39 which it was worst case, so only show the worst case's data on this report.

Polarization:	Horizontal

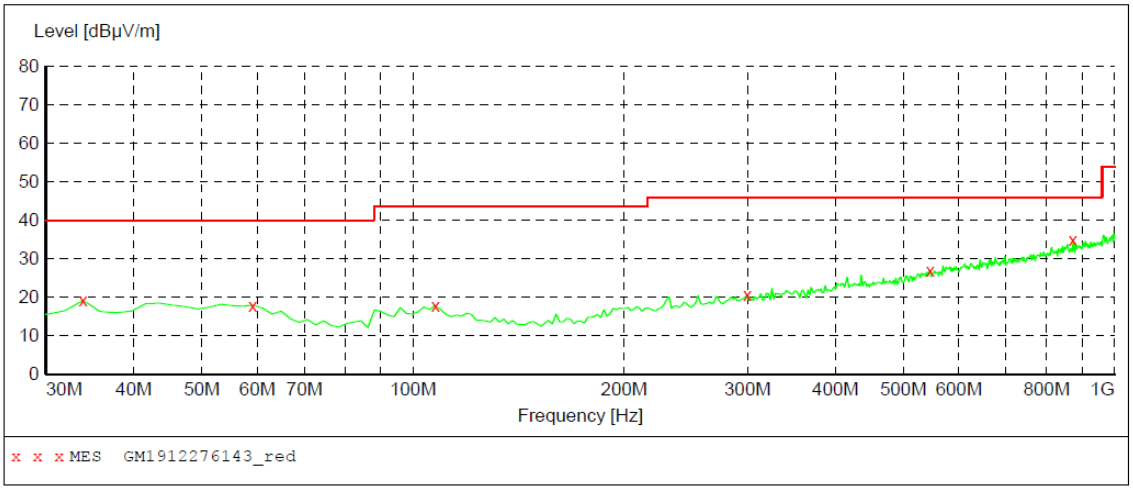


MEASUREMENT RESULT: "GM1912276142_red"

12/28/2019 12:38AM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
51.340000	19.90	-8.8	40.0	20.1	QP	300.0	274.00	HORIZONTAL
55.220000	18.50	-8.4	40.0	21.5	QP	100.0	150.00	HORIZONTAL
105.660000	17.60	-10.3	43.5	25.9	QP	300.0	274.00	HORIZONTAL
299.660000	21.60	-6.4	46.0	24.4	QP	300.0	245.00	HORIZONTAL
544.100000	27.10	0.0	46.0	18.9	QP	300.0	297.00	HORIZONTAL
945.680000	36.00	8.1	46.0	10.0	QP	100.0	248.00	HORIZONTAL

Polarization:	Vertical



MEASUREMENT RESULT: "GM1912276143_red"

12/28/2019 12:41AM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
33.880000	19.20	-12.1	40.0	20.8	QP	100.0	355.00	VERTICAL
59.100000	17.90	-9.1	40.0	22.1	QP	100.0	318.00	VERTICAL
107.600000	17.90	-10.4	43.5	25.6	QP	100.0	183.00	VERTICAL
299.660000	20.70	-6.4	46.0	25.3	QP	100.0	347.00	VERTICAL
546.040000	26.90	0.1	46.0	19.1	QP	100.0	195.00	VERTICAL
871.960000	35.00	6.8	46.0	11.0	QP	100.0	360.00	VERTICAL

TEST DATA FOR 1 GHz ~ 25 GHz

Test channel	CH00

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	1198.281	34.07	-5.85	28.22	74.00	45.78	Horizontal	PK
2	3162.000	32.46	0.64	33.10	74.00	40.90	Horizontal	PK
3	4804.062	39.79	7.06	46.85	74.00	27.15	Horizontal	PK
4	9606.875	38.44	17.11	55.55	74.00	18.45	Horizontal	PK
5	9606.875	31.76	17.11	48.87	54.00	5.13	Horizontal	AV

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	1249.687	34.25	-5.70	28.55	74.00	45.45	Vertical	PK
2	3110.593	33.52	0.38	33.90	74.00	40.10	Vertical	PK
3	4802.593	33.82	7.05	40.87	74.00	33.13	Vertical	PK
4	9609.812	33.69	17.11	50.80	74.00	23.20	Vertical	PK

Test channel	CH19

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	1227.656	34.36	-5.76	28.60	74.00	45.40	Horizontal	PK
2	3150.250	32.78	0.58	33.36	74.00	40.64	Horizontal	PK
3	4880.437	40.21	7.15	47.36	74.00	26.64	Horizontal	PK
4	9759.625	33.23	17.21	50.44	54.00	3.56	Horizontal	AV
5	9761.093	38.20	17.21	55.41	74.00	18.59	Horizontal	PK

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	1098.406	34.71	-6.90	27.81	74.00	46.19	Vertical	PK
2	3206.062	32.61	0.77	33.38	74.00	40.62	Vertical	PK
3	4880.437	33.22	7.15	40.37	74.00	33.63	Vertical	PK
4	7522.718	30.30	15.51	45.81	74.00	28.19	Vertical	PK

Test channel	CH39

Suspected Data List

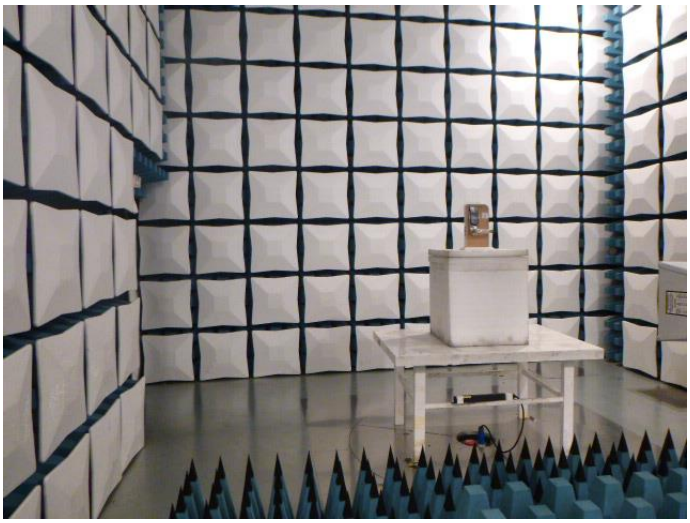
NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	1217.375	34.81	-5.78	29.03	74.00	44.97	Horizontal	PK
2	3192.843	33.11	0.80	33.91	74.00	40.09	Horizontal	PK
3	4959.750	37.51	7.58	45.09	74.00	28.91	Horizontal	PK
4	9919.718	36.97	17.28	54.25	74.00	19.75	Horizontal	PK
5	9919.718	31.63	17.28	48.91	54.00	5.09	Horizontal	AV

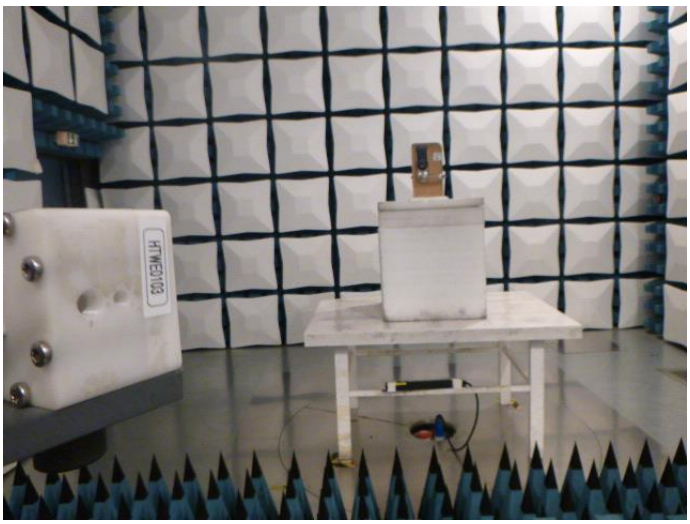
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector
1	1227.656	34.48	-5.76	28.72	74.00	45.28	Vertical	PK
2	3167.875	32.89	0.67	33.56	74.00	40.44	Vertical	PK
3	4959.750	33.18	7.58	40.76	74.00	33.24	Vertical	PK
4	9919.718	33.48	17.28	50.76	74.00	23.24	Vertical	PK

6. TEST SETUP PHOTOS

Radiated Emission

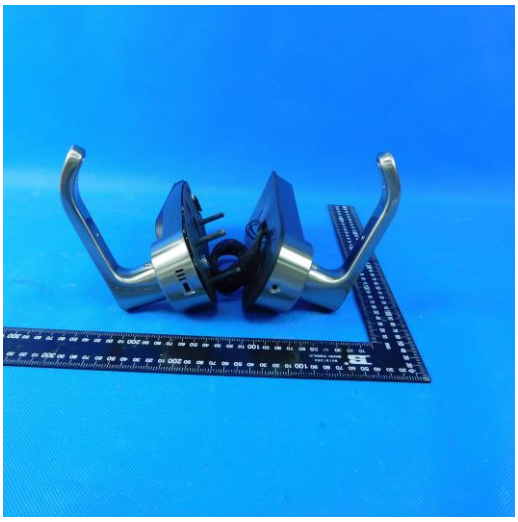


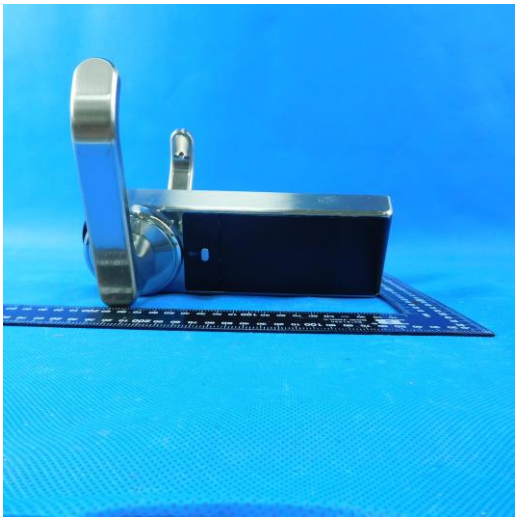


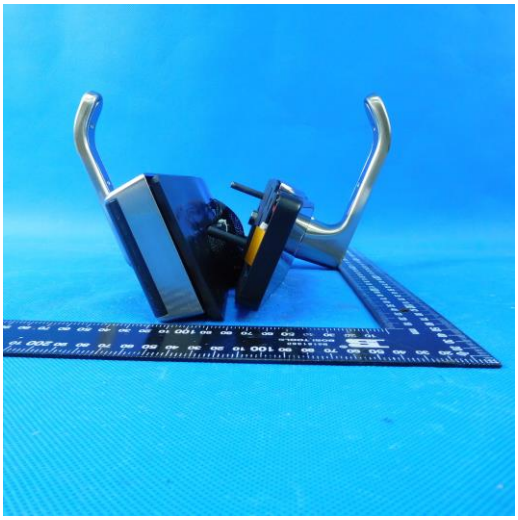
AC Conducted Emission

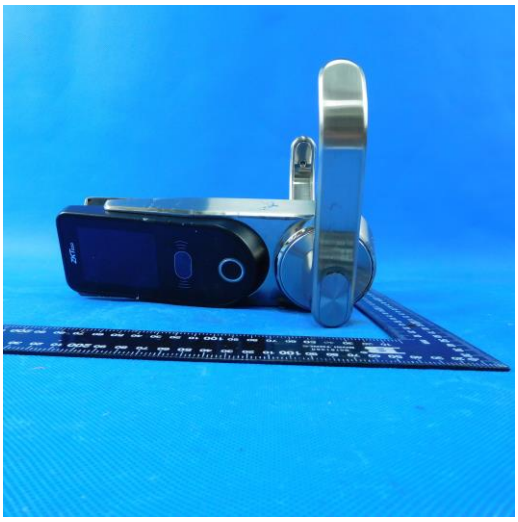
7. EXTERANAL AND INTERNAL PHOTOS

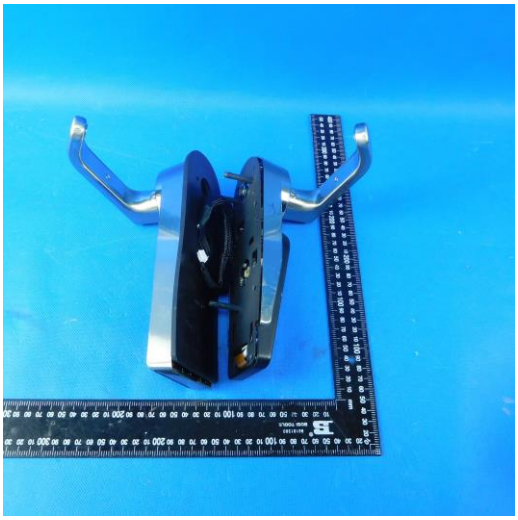
External Photos

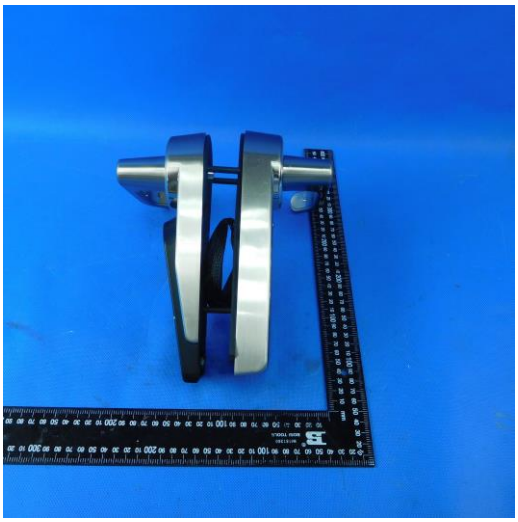


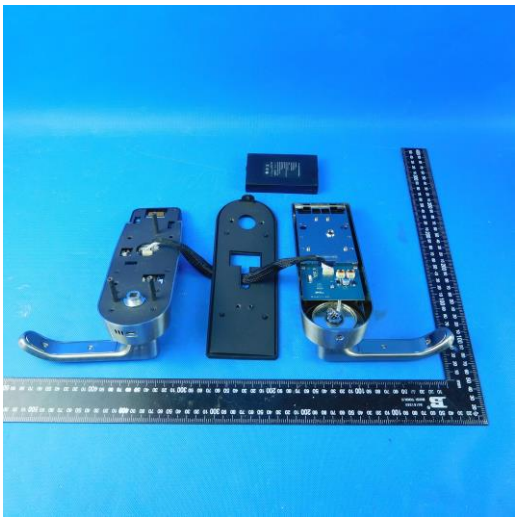


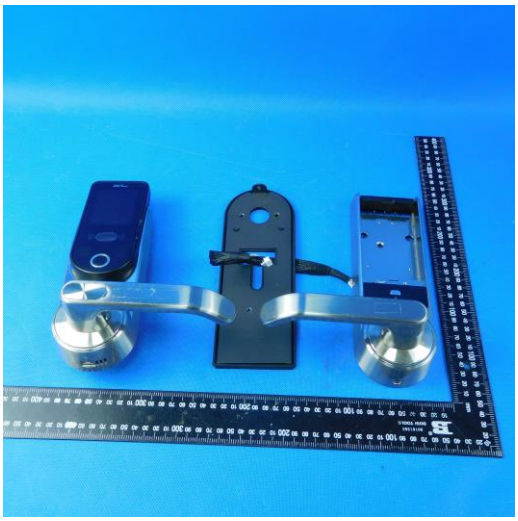


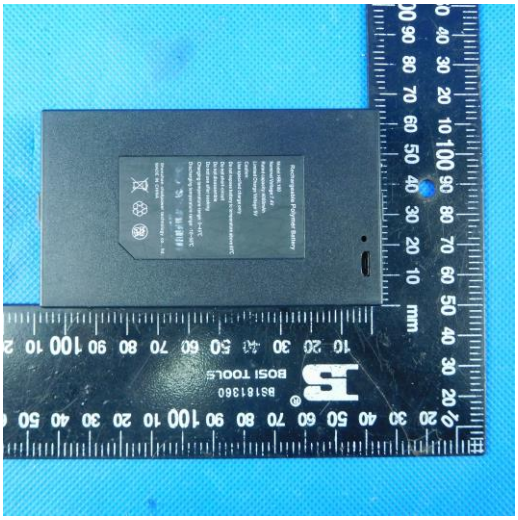


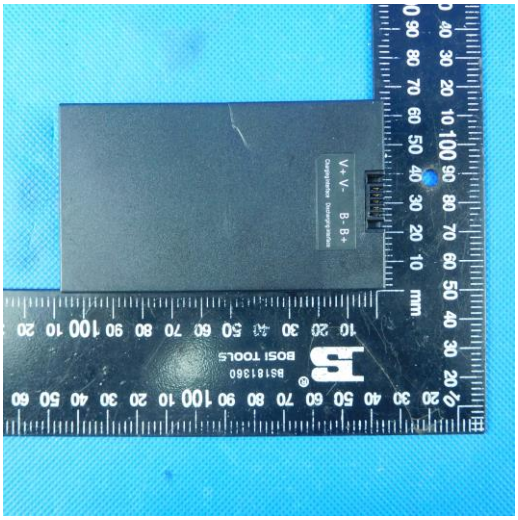






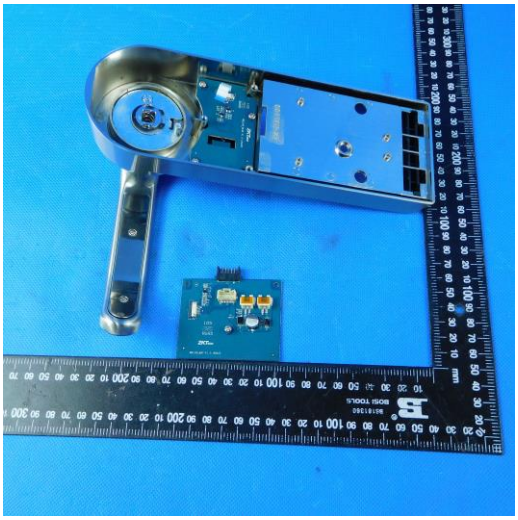


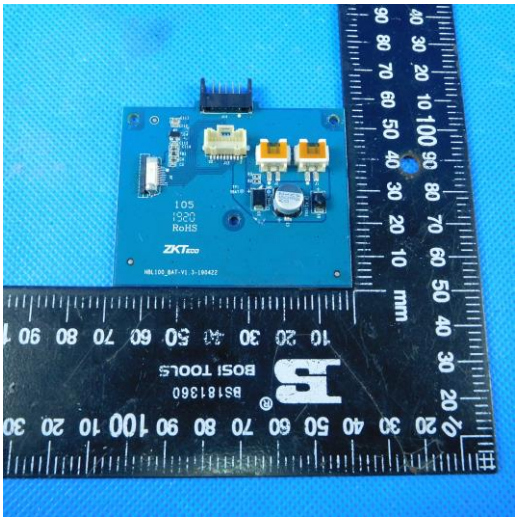

Rechargeable Polymer Battery
BOSI TOOLS
mm

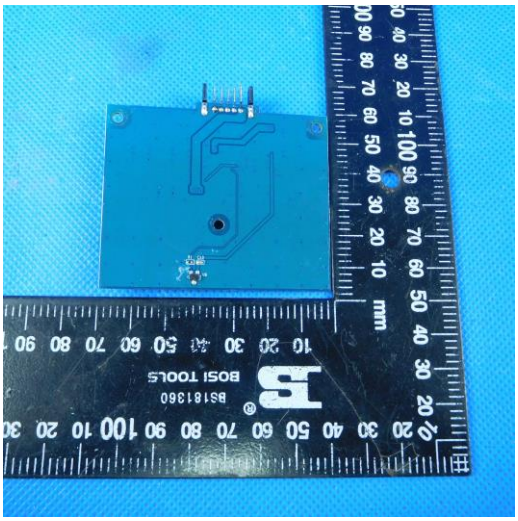

V+ V-
B- B+
BOSI TOOLS
mm

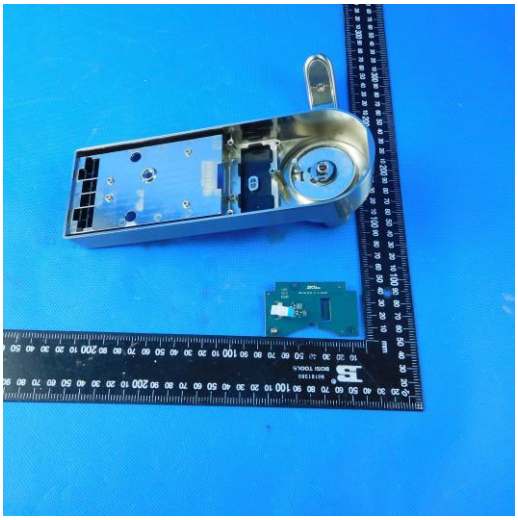
Rechargeable Polymer Battery
Model:HBL100
Nominal Voltage:7.4V
Rated capacity:4000mAh
Limited Charge Voltage:5V
Caution:
Use specified charge only
Do not expose battery to temperature above 60℃
Do not short-circuit
Do not disassemble
Do not use after soaking
Charging temperature range: 0~45℃
Discharging temperature range: -10~55℃
Shenzhen choipower technology co., ltd.
MADE IN CHINA

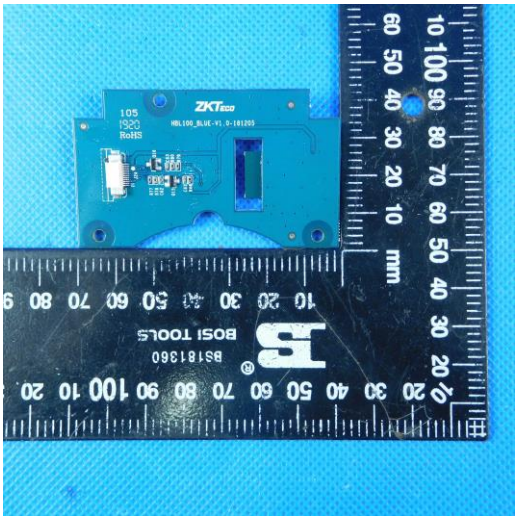
Internal Photos







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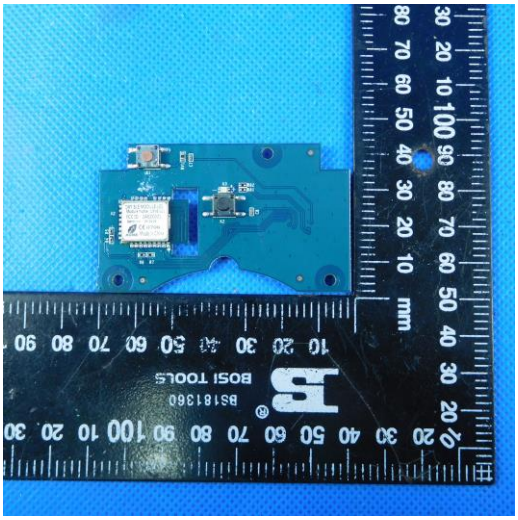
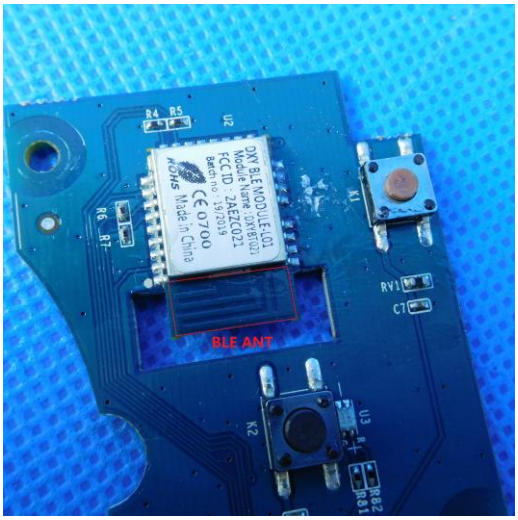
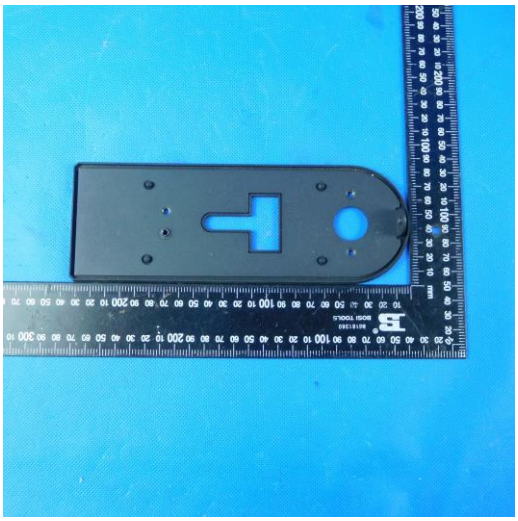
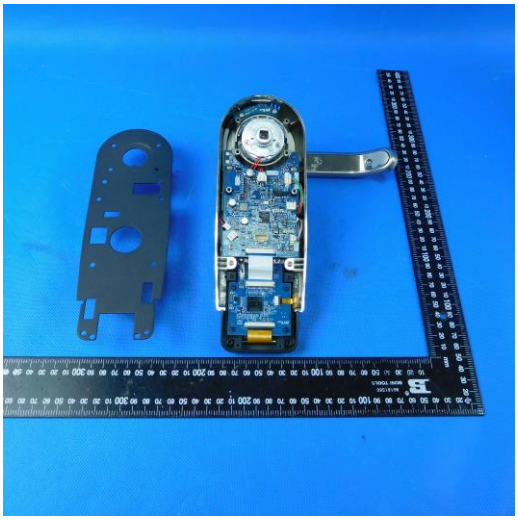
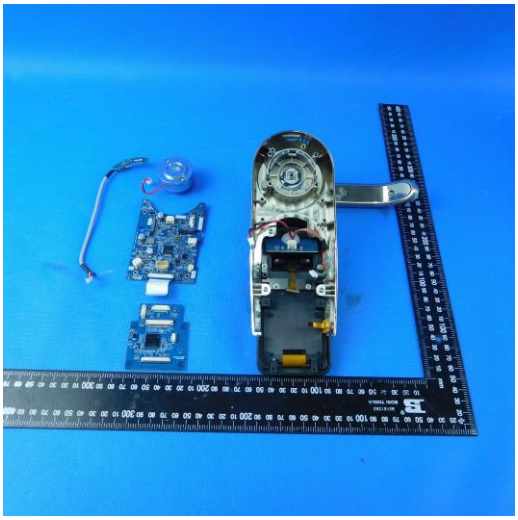
105
1920
RoHS
BOSI TOOLS
BS181360
mm

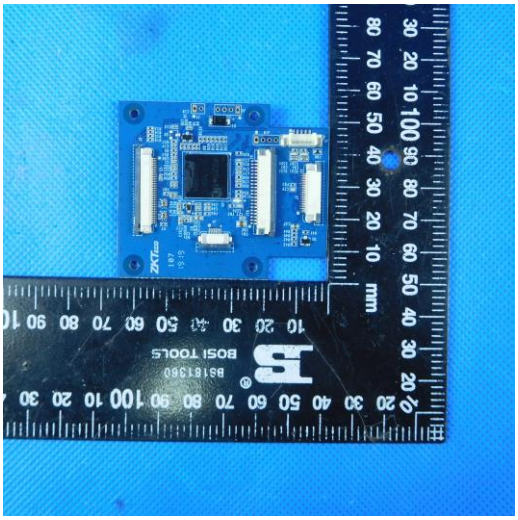

BOSI TOOLS
BS181360
mm

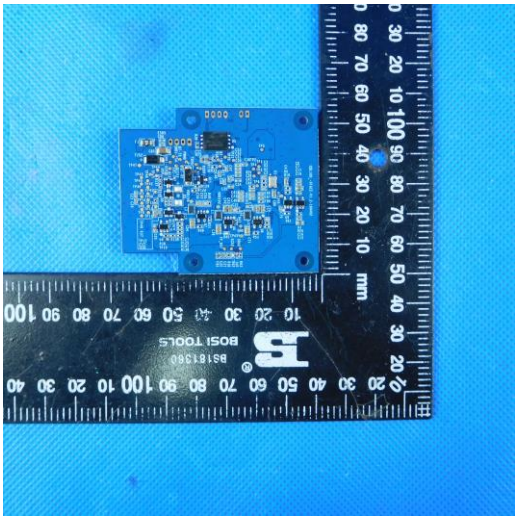

BLE ANT

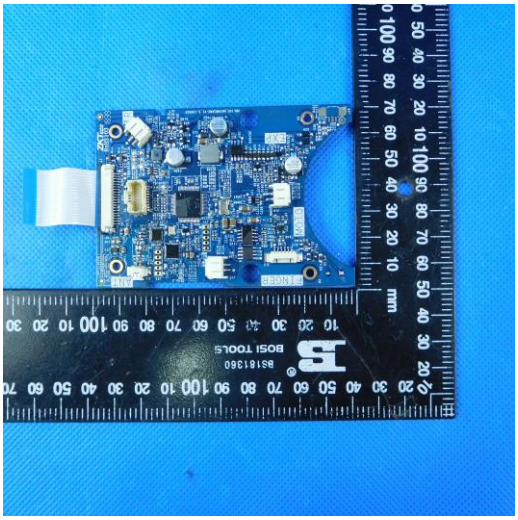


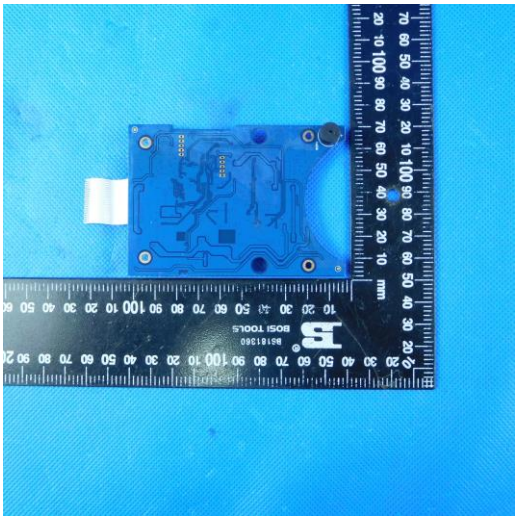


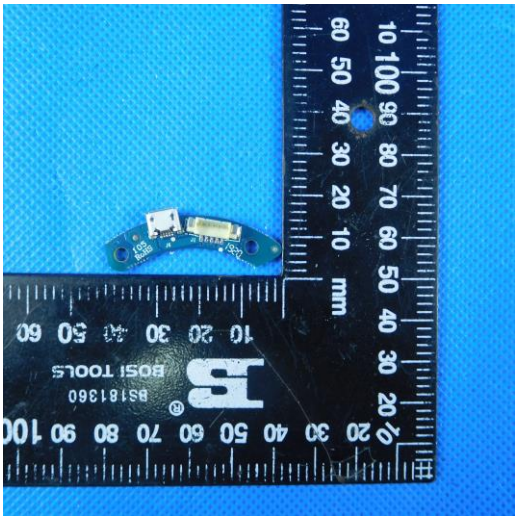


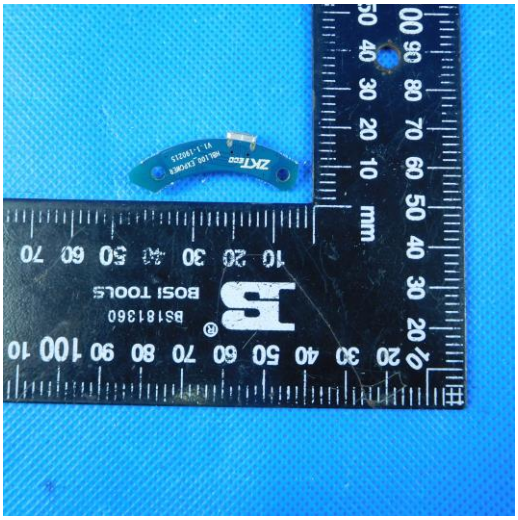


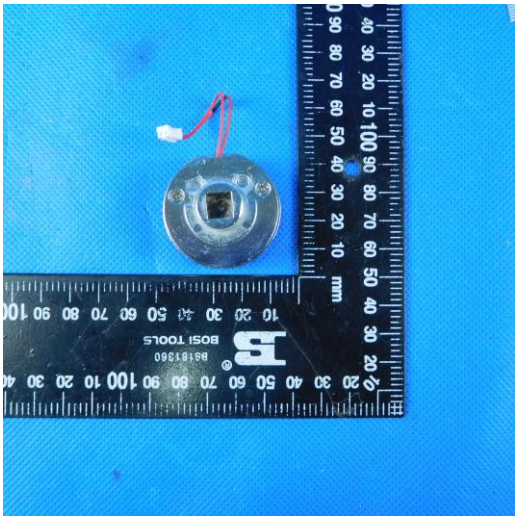


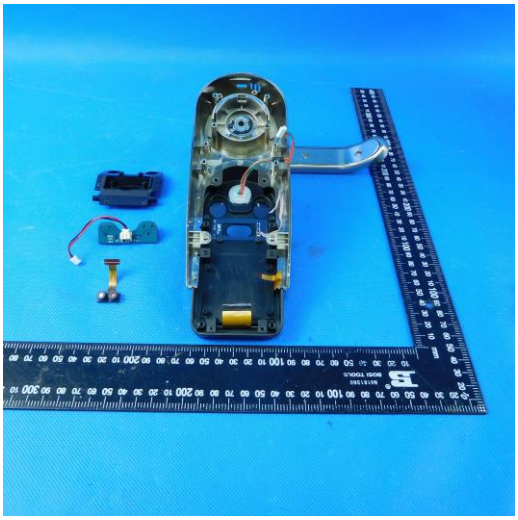


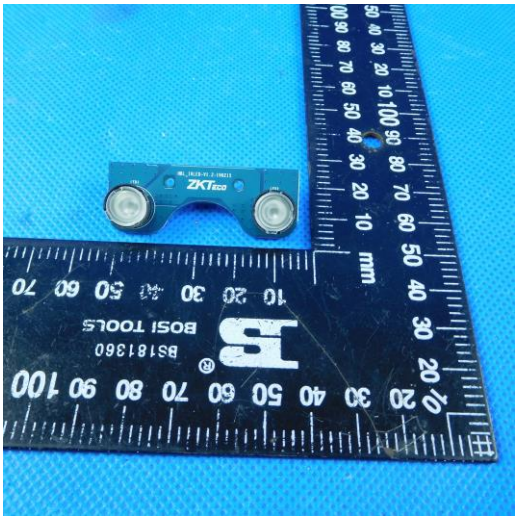





ZKTeco
BS181360
BOSI TOOLS


BS181360
BOSI TOOLS

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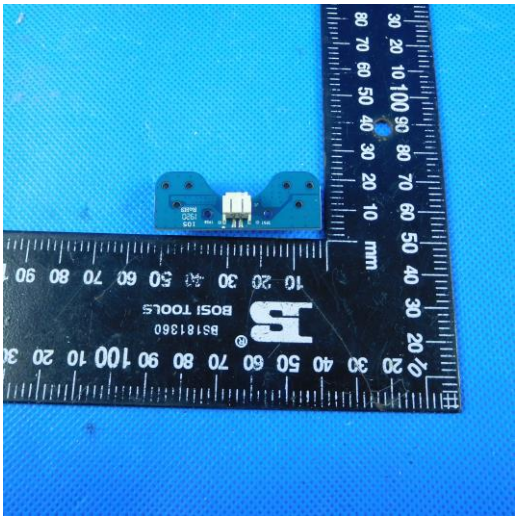
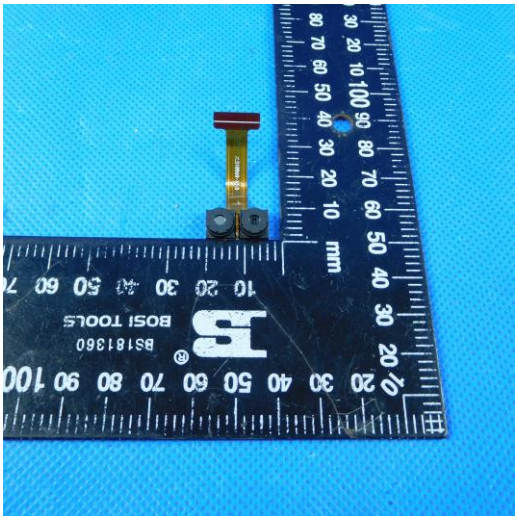
BOSI TOOLS
BS181360


BOSI TOOLS
BS181360


BOSI TOOLS
BS181360

8. APPENDIX REPORT

APPENDIX REPORT

Project No.	SHT1912063003EW	Radio Specification	Bluetooth BLE
Test sample No.	YPHT19120630003	Model No.	HBL100B
Start test date	2019/12/24	Finish date	2019/12/24
Temperature	25°C	Humidity	50%
Test Engineer	Ximing Huang	Auditor	William.wang

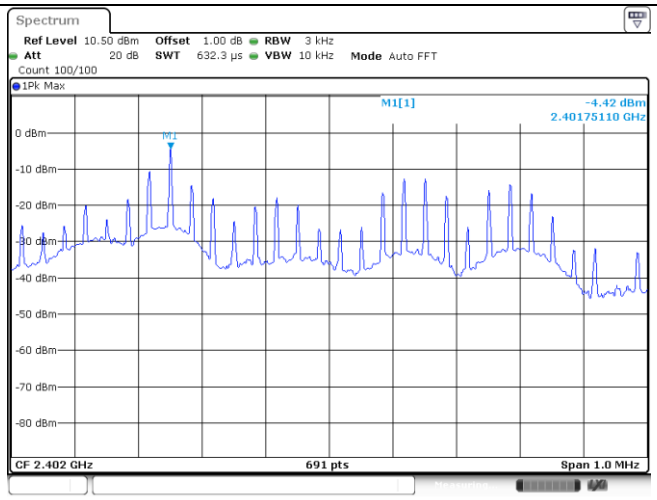
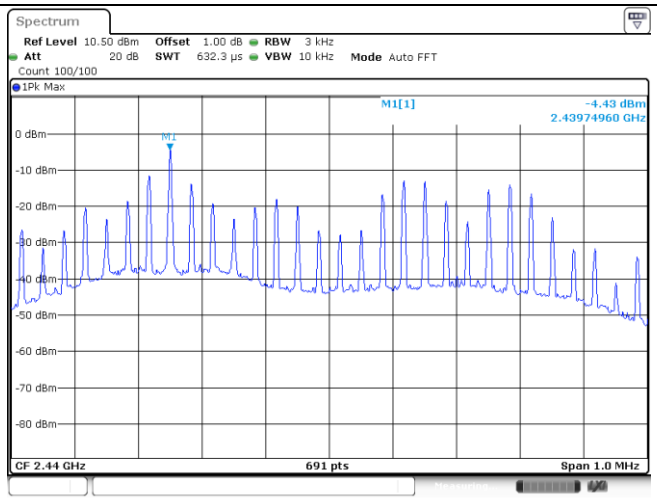
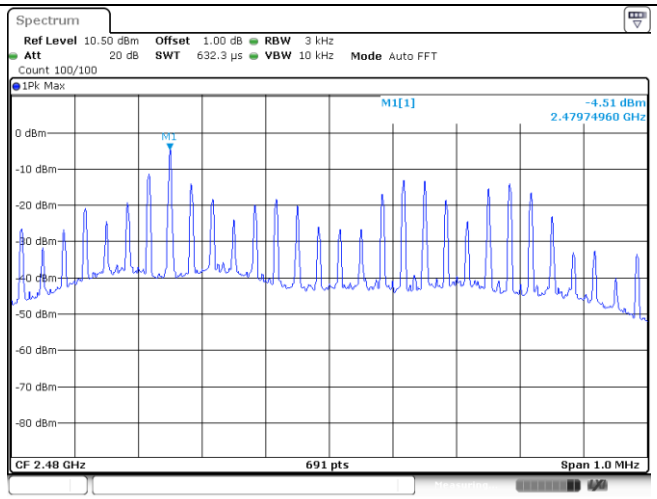
Appendix clause	Test item	Result
A	Peak Output Power	PASS
B	Power Spectral Density	PASS
C	6 dB Bandwidth	PASS
D	99% Occupied Bandwidth	PASS
E	Duty cycle	PASS
F	Band edge and Spurious Emissions (conducted)	PASS

Appendix A：Peak Output Power

Type	Channel	Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
BT-BLE	00	-1.10	-1.15	≤30.00	Pass
	19	-1.19	-1.21		
	39	-1.23	-1.25		

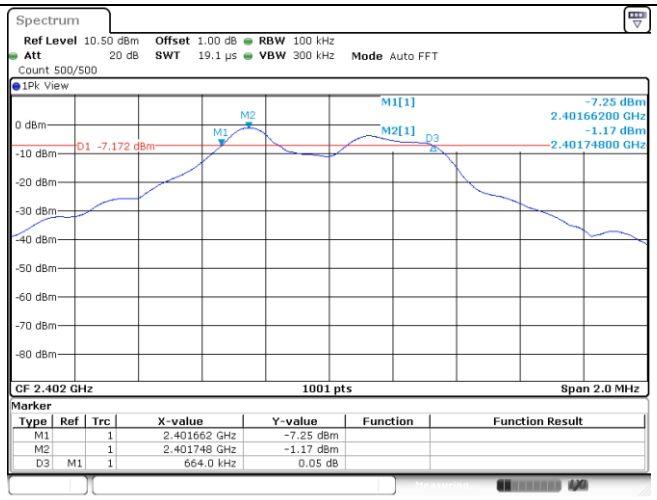
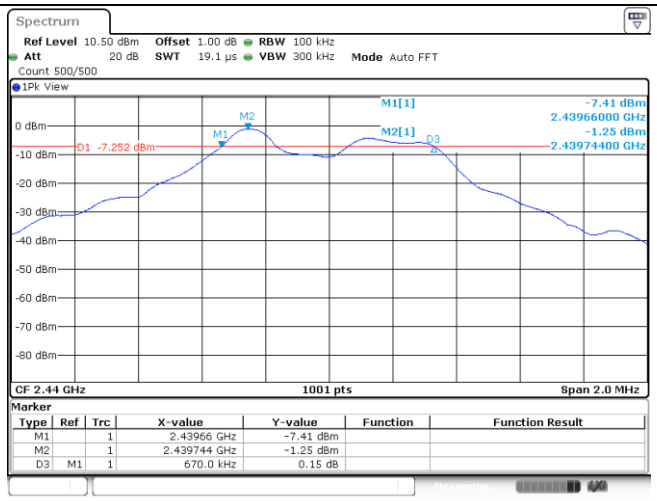
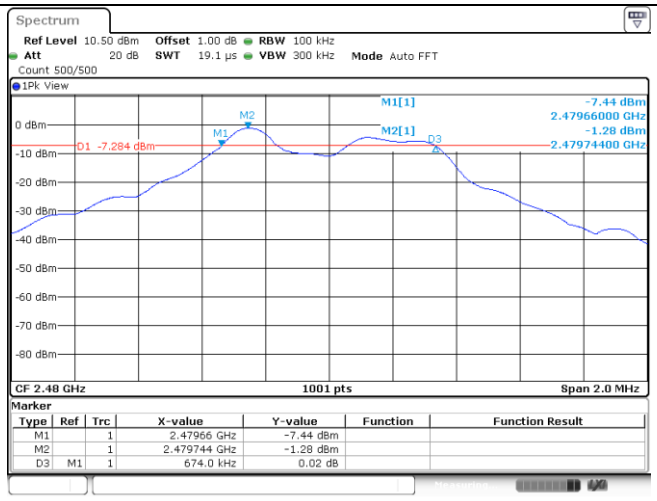
Appendix B：Power Spectral Density

Type	Channel	Power Spectral Density(dBm/3KHz)	Limit (dBm/3KHz)	Result
BT-BLE	00	-4.42	≤8.00	Pass
	19	-4.43		
	39	-4.51		

CH00	 Date: 24.DEC.2019 16:45:03
CH19	 Date: 24.DEC.2019 16:48:08
CH39	 Date: 24.DEC.2019 16:49:39

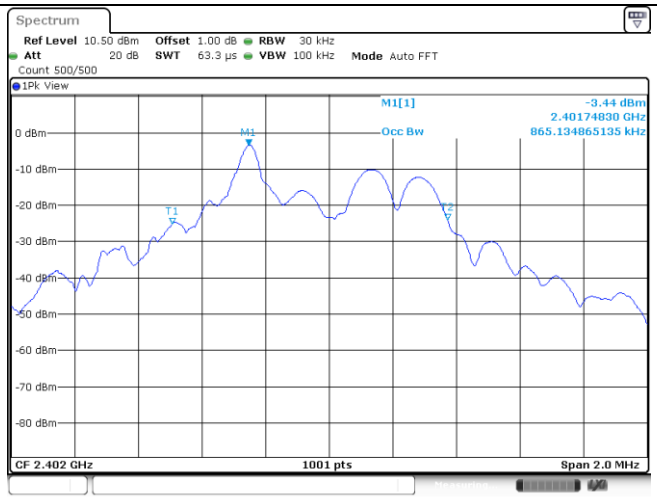
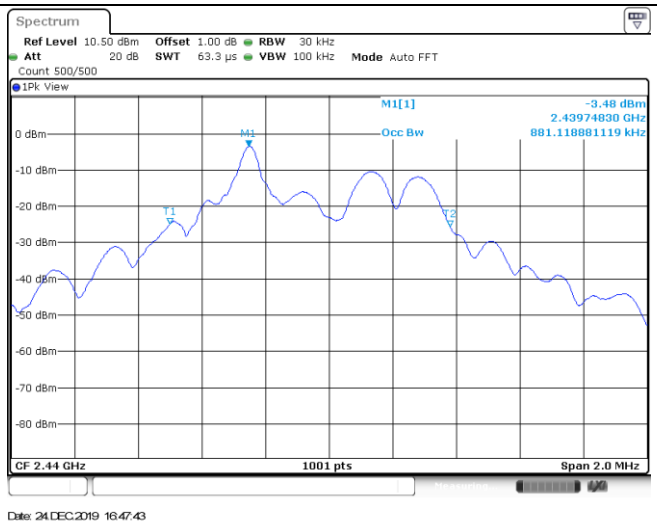
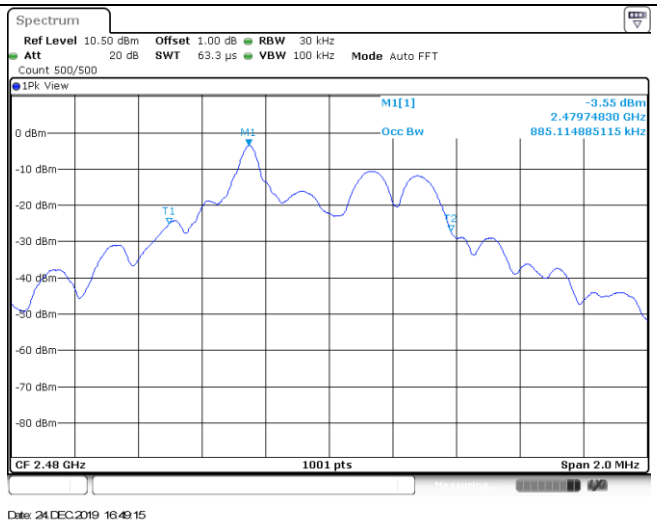
Appendix C：6dB bandwidth

Type	Channel	6dB Bandwidth(kHz)	Limit (kHz)	Result
BT-BLE	00	664.00	≥500	Pass
	19	670.00		
	39	674.00		

CH00	
CH19	
CH39	

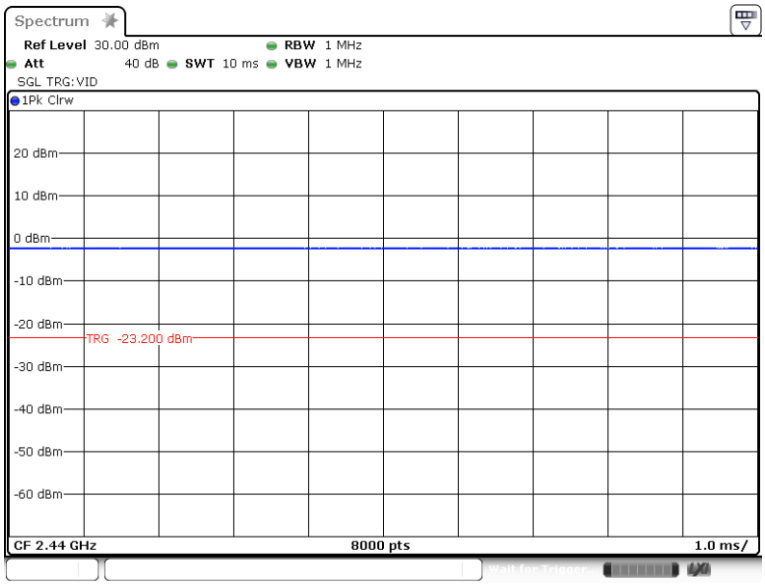
Appendix D：99% Occupied Bandwidth

Type	Channel	99% Occupied Bandwidth(MHz)	Limit (kHz)	Result
BT-BLE	00	0.87	-	Pass
	19	0.88		
	39	0.89		

CH00	
CH19	
CH39	

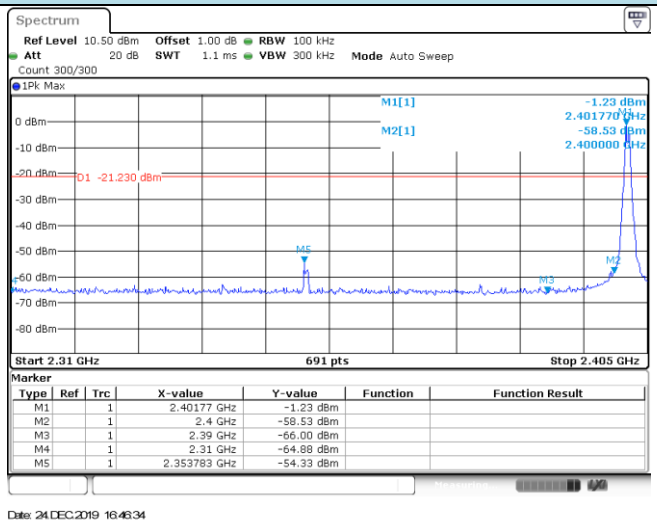
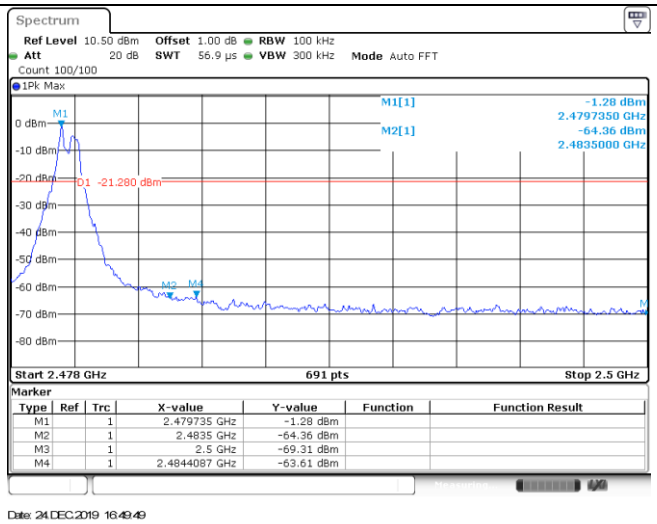
Appendix E：Duty cycle

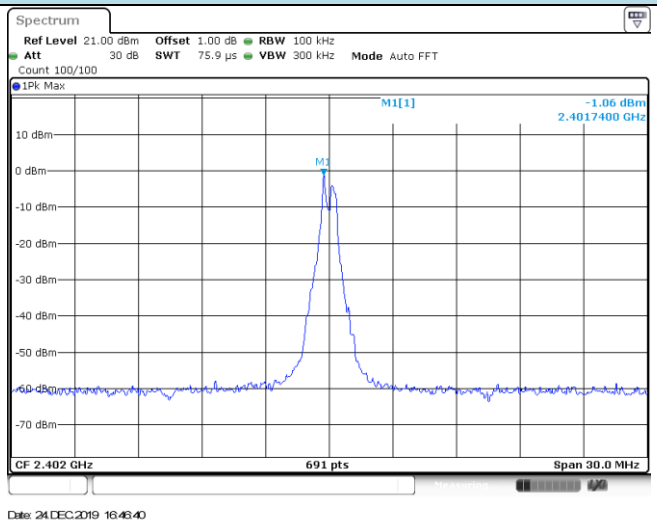
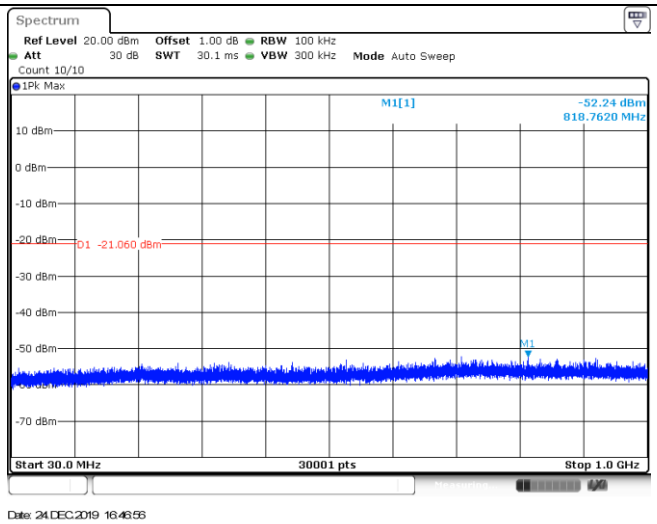
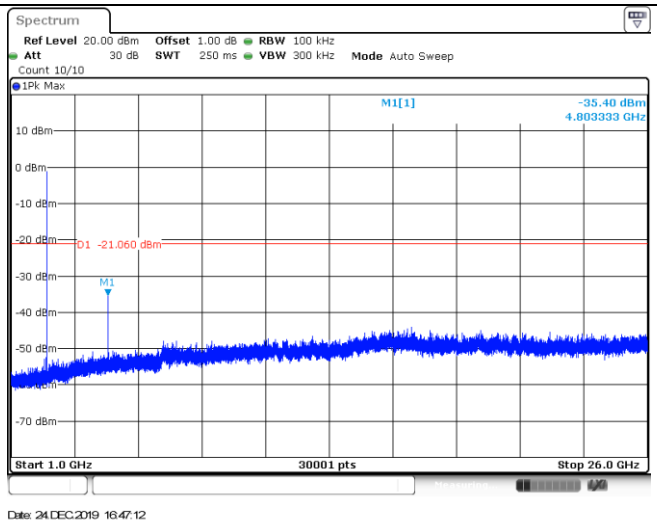
Test Frequency（MHz）	$T_{on\ time}$ for single burst (ms)	T_{period} (ms)	Duty cycle	$1/T_{on\ time}$ (kHz)
2440	---	---	100%	1.0

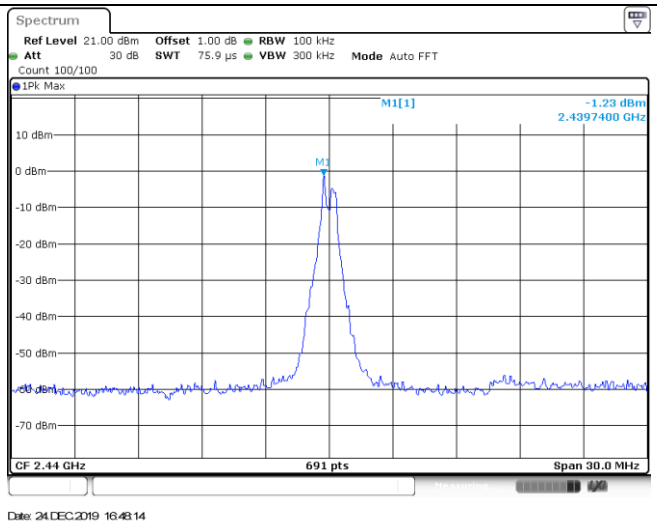
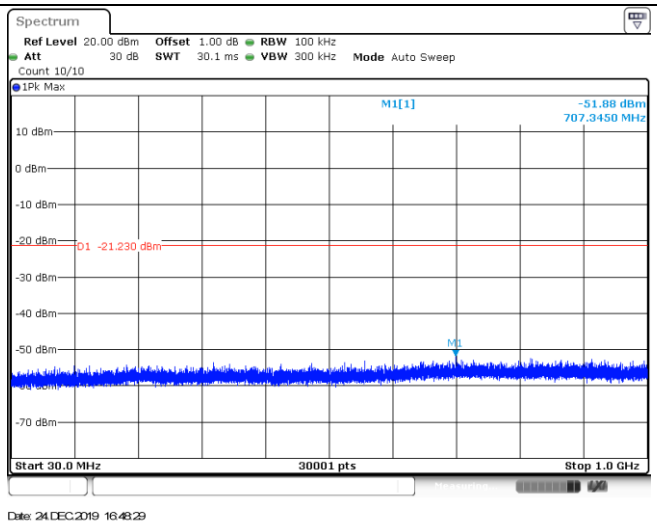
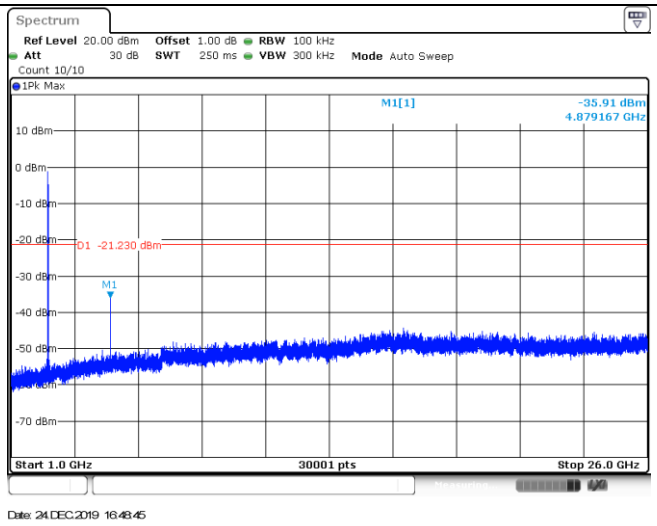


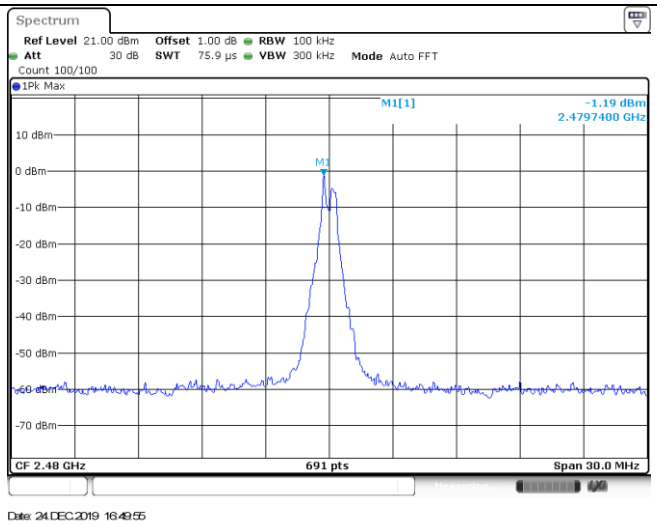
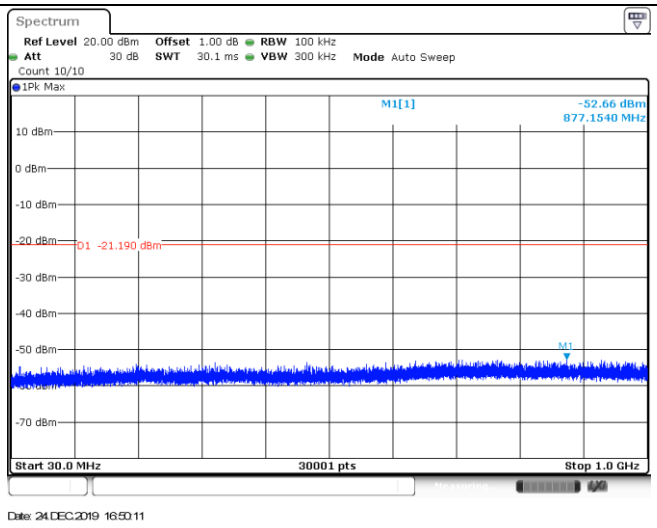
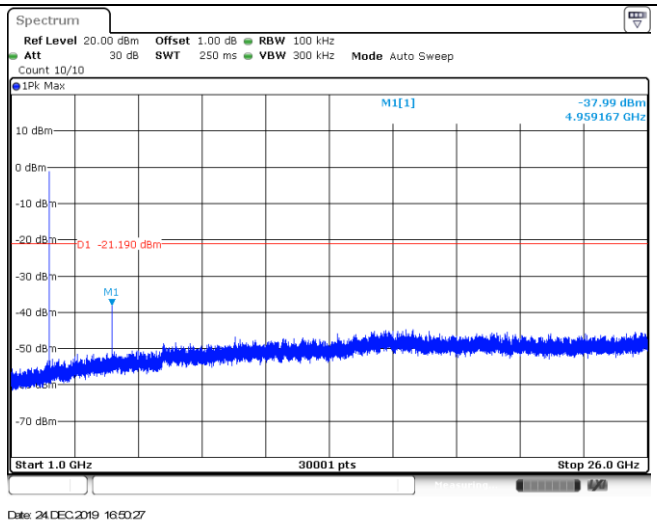
Date: 24.DEC.2019 16:51:57

Appendix F：Band edge and Spurious Emissions (conducted)

Test Item:	Band edge
CH00	
CH39	

Test Item:	SE
CH00 Reference level	
CH00 30MHz~1000MHz	
CH00 1GHz~26GHz	

CH19 Reference level	
CH19 30MHz~1000MHz	
CH19 1GHz~26GHz	

CH39 Reference level	
CH39 30MHz~1000MHz	
CH39 1GHz~26GHz	

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