JAPAN Radio Test Report

Bluetooth

APPLICANT	:	Lenovo(Shanghai) Electronics Technology Co., Ltd.
PRODUNCT NAME	:	Portable Tablet Computer
BRAND NAME	:	Lenovo
MODEL NAME	:	Lenovo TB-8705F
TYPE EMISSIONS	:	78M1F1D(BR); 78M7G1D(EDR); 19M5F1D(BR_AFH); 926KF1D(4.2 LE) ; 1M87F1D(5.0 LE)
DECLARATION OUTPUT POWER	:	0.120 mW/MHz (BR/EDR); 0.480 mW/MHz (BR_AFH); 1.300 mW (4.2 LE); 1.300 mW (5.0 LE)
STANDARD	:	Article 49-20 and the relevant articles of the Ordinance Regulating Radio Equipment
TEST PROCEDURE	:	MIC Notice No.88 Appendix No.43

The product sample received on Aug. 12, 2019 and completely tested on Aug. 28, 2019. We, Sporton International Inc. (KunShan), would like to declare that the tested sample has been evaluated in accordance with the procedures given in MIC Notice No.88 Appendix No.43 and shown to be compliant with the applicable technical standards. Article 2 Paragraph 1 Item 19 of the Certificate Ordinance of the Radio Law indicates the classification of the specified radio equipment.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (KunShan), the test report shall not be reproduced except in full.

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Approved by: Jones Tsai / Manager

Sporton International Inc. (KunShan)
No.1098, Pengxi North Road, Kunshan Economic Development Zone, Jiangsu province, China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
JR981201A	Rev. 01	Initial issue of report	Sep. 27, 2019

SUMMARY OF TEST RESULT

Report Section	Description	Result
3.1	Frequency Tolerance	Pass
3.2	Occupied Bandwidth and Spread-spectrum Bandwidth / Spread Factor	Pass
3.3	Unwanted Emission Intensity	Pass
3.4	RF Output Power / Tolerance	Pass
3.5	Limitation of Collateral Emission of Receiver	Pass
3.6	Transmission Antenna Gain (EIRP Antenna Power)	NA
3.7	Transmission Radiation Angle Width (3dB Beam width)	NA
3.8	Radio Interference Prevention Capability	Pass
3.9	Hopping Frequency Dwell Time	Pass
3.10	Construction Protection Confirmation	Pass

1 General Description

1.1 Applicant

Lenovo(Shanghai) Electronics Technology Co., Ltd.
Section 304-305, Building No. 4, # 222, Meiyue Road, China (Shanghai) Pilot Free Trade Zone

1.2 Manufacturer

Lenovo PC HK Limited
23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong, P.R.CHINA

1.3 Feature of Equipment Under Test

Product Feature & Specification		
Product Name	Portable Tablet Computer	
Brand Name	Lenovo	
Model Name	Lenovo TB-8705F	
Support Category / Frequency Range	Article 2-1-19 / 2400MHz ~ 2483.5MHz	
Type of Modulation	☐ Direct Spreading (DS) ☐ Orthogonal frequency-division multiplexing (OFDM) ■ Frequency Hopping (FH) ■ Other :GFSK	
Number of Channels	BR/EDR Mode	79
	AFH Mode	20
	Other : BT 4.2/5.0	40
Channel Spacing	BR/EDR/AFH Mode	1MHz
	Other : BT 4.2/5.0	2MHz
Declaration RF Output Power	0.120 mW/MHz (BR/EDR mode) ; 0.480 mW/MHz (BR_AFH mode) ; 1.300 mW (4.2 LE mode) ; 1.300 mW (5.0 LE mode)	
Antenna Power (E.I.R.P)	-12.63 dBm/MHz (BR/EDR mode) -6.61 dBm/MHz (BR_AFH mode) -2.28 dBm (4.2 LE mode) -2.28 dBm (5.0 LE mode)	
Modulation	■ GFSK ■ π/4-DQPSK ■ 8-DPSK ☐ Other : FSK	
Power Source[NOTE]	■ Commercial power	AC 100 ~ 240V
	■ External Power Source	DC 5V, 2A
	■ Lithium battery	DC 3.86V, 5000mAh
	☐ UM battery	DC 1.2V

NOTE: When EUT be operated at ±10% from the normal supply voltage, the supply voltage of RF part was varied within ±1%. All test cases were done under the normal supply voltage.

Power Supply voltage 3.86 Vdc (Nominal)	Power Supply voltage 4.246 Vdc (+10%)	Power Supply voltage 3.474 Vdc (-10%)
1.8	1.8	1.8
3.3	3.3	3.3

Measurement point

Antenna Information			
Brand Name :	N/A	**Model Name :**	N/A
Antenna Type :	Monopole	**Antenna Gain :**	-3.42 dBi

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Modification of EUT

No modifications are made to the EUT during all test items.

1.5 Testing Site

Test Site	Sporton International Inc. (KunShan) Mobile Communications Laboratory
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone, Jiangsu province, China TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958
Test Site No.	**Sporton Site No.:** TH01-KS

Test Items	Uncertainty	Remark
Occupied Channel Bandwidth	±101.5 kHz	Confidence 95%
RF output power, conducted	±0.68 dB	Confidence 95%
Frequency Tolerance	±101.5 kHz	Confidence 95%
Power density, conducted	±0.46 dB	Confidence 95%
Temperature	±0.8 °C	Confidence 95%
Humidity	±3 %	Confidence 95%
Time	±0.33 %	Confidence 95%

1.6 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- Article 49-20 and the relevant articles of the Ordinance Regulating Radio Equipment

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The measurement was implemented in accordance with MIC Notice No. 88 Appendix No. 43.

1.7 Ancillary Equipment List

None.

2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Channel (LE Channel)	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0 (0)	2402	27	2429	54 (27)	2456
1	2403	28 (14)	2430	55	2457
2 (1)	2404	29	2431	56 (28)	2458
3	2405	30 (15)	2432	57	2459
4 (2)	2406	31	2433	58 (29)	2460
5	2407	32 (16)	2434	59	2461
6 (3)	2408	33	2435	60 (30)	2462
7	2409	34 (17)	2436	61	2463
8 (4)	2410	35	2437	62 (31)	2464
9	2411	36 (18)	2438	63	2465
10 (5)	2412	37	2439	64 (32)	2466
11	2413	38 (19)	2440	65	2467
12 (6)	2414	39	2441	66 (33)	2468
13	2415	40 (20)	2442	67	2469
14 (7)	2416	41	2443	68 (34)	2470
15	2417	42 (21)	2444	69	2471
16 (8)	2418	43	2445	70 (35)	2472
17	2419	44 (22)	2446	71	2473
18 (9)	2420	45	2447	72 (36)	2474
19	2421	46 (23)	2448	73	2475
20 (10)	2422	47	2449	74 (37)	2476
21	2423	48 (24)	2450	75	2477
22 (11)	2424	49	2451	76 (38)	2478
23	2425	50 (25)	2452	77	2479
24 (12)	2426	51	2453	78 (39)	2480
25	2427	52 (26)	2454	-	-
26 (13)	2428	53	2455	-	-

2.2 EUT Operation Test Setup

The equipment under test (EUT) was linked with Bluetooth simulator or operated by commands in order to make the EUT into the engineering modes for transmitting, receiving signals continuously, and hopping mode.

3 Test Result

3.1 Frequency Tolerance Measurement

3.1.1 Limit

Item	Limits
Frequency Tolerance	≦ ±50ppm

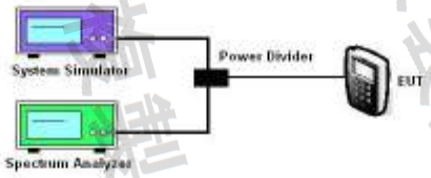
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 Test Procedure

1. Frequency accuracy of instrument shall be less than 10% of limits tolerance (5ppm).
2. Three testing methods
   a. Measure frequency tolerance by the system simulator.
   b. CW Tone method
      i. Setting of SA is following as: RBW:1kHz / VBW:30kHz.
      ii. Maker Max. level to get measuring frequency f.
   c. 10dB down method
      i. Setting of SA is following as: RBW:30kHz / VBW: 30kHz / Trace: MaxHold
      ii. Display line Level = Max. level – 10dB to place two markers, highest(fH) and lowest(fL) frequency
      iii. Determine measuring frequency f = (fH-fL)/2
3. The frequency tolerance test case is directly measured using the frequency accuracy function of Bluetooth tester or spectrum analyzer. Then the frequency error formula is $(f\text{-}fc)/fc \times 10^6$ ppm and the limit is less than ±50ppm.

3.1.4 Test Setup



3.1.5 Test Result of Frequency Tolerance

Please refer to Appendix B.

3.2 Occupied Bandwidth and Spread-spectrum Bandwidth / Spread Factor Measurement

3.2.1 Limit

Item	Limits
Occupied Band Width	≦ 83.5MHz (FH) ≦ 26MHz (OFDM, DS and Others)
Spreading Bandwidth	≧ 500 kHz (FH, DS)

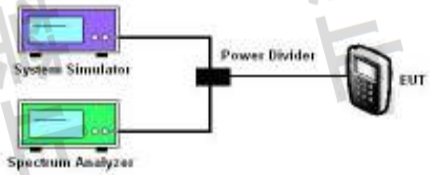
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Test Procedures

1. Setting of SA is following as: RBW =< 3% of bandwidth / VBW = RBW / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold.
2. EUT have transmitted each modulation signal and fixed channelize (For DSSS or OFDM Device) or continuous maximum power of hopping mode (For FHSS Device). SA set to 99% of occupied bandwidth to measure occupied bandwidth. The limit is less than 26MHz (For DSSS or OFDM Device) or 83.5MHz (For FHSS Device).
3. SA set to 90% of occupied bandwidth to measure Spread Spectrum Bandwidth and must greater than 500kHz.
4. Spread Spectrum Factor = Spread Spectrum Bandwidth / modulation rate of EUT.
5. Spread Spectrum Factor limit is greater than 5.

3.2.4 Test Setup



3.2.5 Test Result of Occupied Bandwidth and Spread-spectrum Bandwidth / Spread Factor Measurement

Please refer to Appendix B.

3.3 Unwanted Emission Intensity Measurement

3.3.1 Limit

Item	Limits
Tx Spurious Emission	≦ 2.5 μW (2387MHz＞f ; 2496.5MHz＜f)
	≦ 25 μW (2387MHz≦f＜2400MHz) and (2483.5MHz＜f≦2496.5MHz)

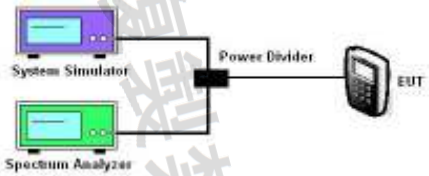
3.3.2 Measuring Instruments

See list of measuring instruments of this test report.

3.3.3 Test Procedures

1. EUT have transmitted the maximum power and fixed channelize.
2. Setting of SA is following as: RBW:1MHz / VBW:1MHz above 1GHz, Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold.
3. Setting of SA is following as: RBW:100KHz / VBW:100KHz under 1GHz, Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold.
4. Setting of SA is following as 30MHz and stop frequency 2387MHz Then to mark peak reading value + cable loss shall be less than 2.5μW.
5. SA adjusted to start frequency 2387MHz and stop frequency 2400MHz. Then to mark peak reading value + cable loss shall be less than 25μW.
6. SA adjusted to start frequency 2483.5MHz and stop frequency 2496.5MHz Then to mark peak reading value + cable loss shall be less than 25μW.
7. SA adjusted to start frequency 2496.5MHz and stop frequency 12500MHz Then to mark peak reading value + cable loss shall be less than 2.5μW.
8. If the Result_Value is over the requirement, take total sum of 1MHz band centered at the spur frequency like ACLP measurement as Result_Value.

3.3.4 Test Setup



3.3.5 Test Result of Unwanted Emission Intensity

Please refer to Appendix B.

3.4 RF Output Power / Tolerance

3.4.1 Limit

Item	Limits	
Antenna Power Density	≦ 3mW/MHz	(FH form 2400~2483.5MHz)
	≦ 10mW/MHz	(OFDM,DS from 2400~2483.5MHz)
	≦ 10mW	(Other from 2400~2483.5MHz)
Antenna Power Error	+20%, -80% (Base on manufacturer declare antenna power density)	

3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

3.4.3 Test Procedures

1. EUT have transmitted continuous maximum power on hopping mode (For FHSS Device).
2. Frequency hopping system or combined systems of direct spread and frequency hopping:

i. Connect the high frequency power meter to the output of the attenuator and measure the total power (without bandwidth limitation)

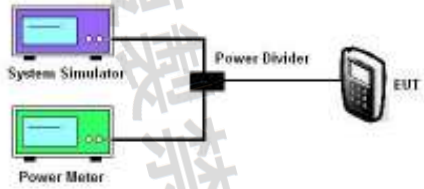
ii. Divide the total power by the spread bandwidth to find the “average” power per MHz.
The average power per MHz is equal to the power meter value dBm + cable loss dB + 10 $\log_{10}$ (1/ Duty Cycle) dB + 10 $\log_{10}$ (1/ Spread Bandwidth) dB.

iii. Confirm that frequency distribution of the hopping frequencies is homogeneous according to the supporting data.
If frequency distribution of the frequencies is not homogeneous, consider other measurement or correction methods based on the supporting data.

iv. Set the antenna power as follows:
- Continuous waves: value in ii.

3. Antenna RF Output Power Tolerance is definition that actual measure antenna power tolerance between + 20% to - 80% power range that manufacturer declare the conducted power density.

3.4.4 Test Setup



3.4.5 Test Result of RF Output Power / Tolerance

Please refer to Appendix B.

3.5 Limitation of Collateral Emission of Receiver Measurement

3.5.1 Limit

Item	Limits	
Rx Spurious Emission	≦ 4nW	(f ＜ 1GHz)
	≦ 20nW	(1GHz ≦ f)

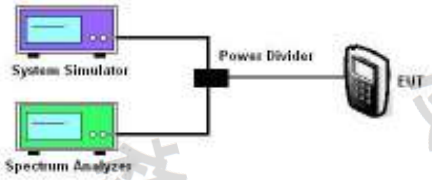
3.5.2 Measuring Instruments

See list of measuring instruments of this test report.

3.5.3 Test Procedures

1. EUT have the continuous reception mode and fixed only one channelize.
2. SA set RBW: 100KHz and VBW: 100KHz. Then adjust to start frequency 30MHz and stop frequency 1GHz. Search to mark peak reading value + cable loss shall be less than 4nW.
3. SA set RBW: 1MHz and VBW: 1MHz. Then adjust to start frequency 1000MHz and stop frequency 12.5GHz. Search to mark peak reading value + cable loss shall be less than 20nW.
4. If power level of lower emissions are more than 1/10 of limit (.0.4nW for f＜1GHz, 2nW for f≧ 1GHz), all those are to be indicated in the 2nd and 3rd lines. If others are 1/10 or less more of the limit, no necessary to be indicated.

3.5.4 Test Setup



3.5.5 Test Result of Limitation of Collateral Emission of Receiver

Please refer to Appendix B.

3.6 Transmission Antenna Gain (EIRP Antenna Power) Measurement

3.6.1 Limit

Item	Limits	
EIRP Power Density	≦ 6.91dBm/MHz	(FH form 2400~2483.5MHz)
	≦ 12.14dBm/MHz	(OFDM,DS from 2400~2483.5MHz)
	≦ 12.14dBm	(Other from 2400~2483.5MHz)
Remark: This test item will not be applied to EIRP power of EUT is lower than 12.14dBm/MHz.		

3.6.2 Measuring Instruments

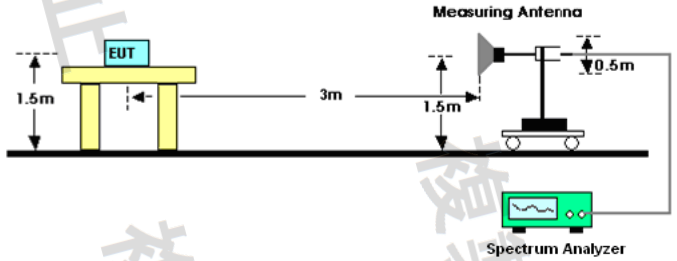
See list of measuring instruments of this test report.

3.6.3 Test Procedures

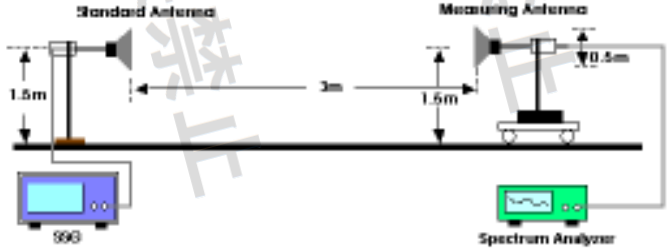
1. Set EUT ad measuring antenna at the same height and roughly facing each other.
2. Move the measuring antenna height up and down within ± 50cm of EUT height and swing it to find the maximum output of the measuring antenna. The output level at the spectrum analyzer is read as “E“.
3. Remove the EUT from the turn table and put the replacing antenna facing to measuring antenna at same height. Set the standard signal generator (SSG) at same frequency and transmit on then receive the signal.
4. Swing the replacing antenna give a maximum receiving level.
5. Move the measuring antenna height up and down within ± 50cm of replacing antenna height and swing it to find the maximum receiving level.
6. Set SSG output power at Pt to give the equivalent output level of “E” or calculate Pt with SSG output which gives the nearest of “E” and difference (± 1dB). Record the Pt.
7. Calculate EIRP by the formula below EIRP = Gt – L + Pt.
   Gt: gain of replacing antenna (dBi)
   L: feeder loss between SSG and replacing antenna
   Pt: Output power of the SSG
8. If the antenna for the EUT has circular polarization, sum of V-field and H-field will be result if measuring antenna is linear polarization.

3.6.4 Test Setup

<For EUT radiation measurement>



<For standard antenna measurement>



3.6.5 Test Result of Transmission Antenna Gain (EIRP Antenna Power)

Please refer to Appendix B. For the antenna gain, please refer to antenna test report.

Remark: This test item will not be applied to EIRP power of EUT is lower than 12.14dBm/MHz.

3.7 Transmission Radiation Angle Width (3dB Beamwidth) Measurement

3.7.1 Limit

Item	Limits
3dB antenna beamwidth	360/A (If A < 1; then A = 1) A = {EIRP Power [mW] / 16.36 for DS, OFDM} or A = {EIRP Power [mW] / 4.9 for FH}
Remark: This test item will not be applied to EIRP power of EUT is lower than 12.14dBm/MHz.	

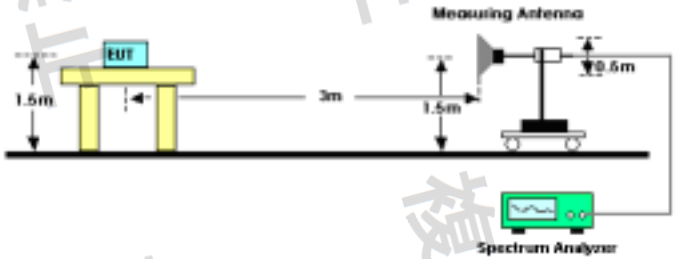
3.7.2 Measuring Instruments

See list of measuring instruments of this test report.

3.7.3 Test Procedures

1. Set EUT and measuring antenna at the same height and roughly facing each other.
2. Set spectrum analyzer with condition in section 3.7.2 and tune reference level to observe receiving signal position.
3. Rotate directions of the EUT horizontally and vertically to find the maximum receiving power.
4. Move the measuring antenna height up and down within ± 50cm of EUT height and swing it to find the maximum output of measuring antenna. The output level at the spectrum analyzer is read as “E”.
5. Calculate permitted radiation angle in horizontal and vertical using EIRP measured in another test method.
6. Calculate 3dB antenna beam width by the formula below 360/A (If A<1; then A=1).
   A = {EIRP Power [mW] / 16.36 for DS, OFDM} or
   A = {EIRP Power [mW] / 4.9 for FH}

3.7.4 Test Setup



3.7.5 Test Result of Transmission Radiation Angle Width (3dB Beamwidth)

Please refer to Appendix B.

For the antenna gain, please refer to antenna test report.

Remark: This test item will not be applied to EIRP power of EUT is lower than 12.14dBm/MHz.

3.8 Radio Interference Prevention Capability Measurement

3.8.1 Limit

Item	Limits
Identification code	≧ 48 bits

3.8.2 Measuring Instruments

See list of measuring instruments of this test report.

3.8.3 Test Procedures

1. In the case that the EUT has the function of automatically transmitting the identification code: a. Transmit the predetermined identification codes form EUT. b. Check the transmitted identification codes with the demodulator.
2. In the case of receiving the identification code: a. Transmit the predetermined identification codes form the counterpart. b . Check if communication is normal. c. Transmit the signals other than predetermined ID codes form the counterpart. d. check if the EUT stops the transmission, or if it displays that identification codes are different from the predetermined ones.

3.8.4 Test Setup

3.8.5 Test Result of Radio Interference Prevention Capability

Please refer to Appendix B.

3.9 Hopping Frequency Dwell Time Measurement

3.9.1 Limit

Item	Limits
Hopping Freq. Dwell Time	≦ 0.4 seconds

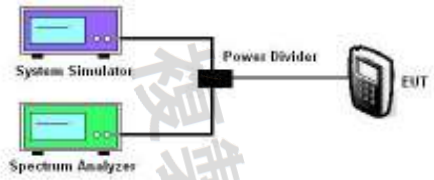
3.9.2 Measuring Instruments

See list of measuring instruments of this test report.

3.9.3 Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
3. Use a video trigger with the trigger level set to enable triggering only on full pulses.
4. Sweep Time is more than once pulse time.
5. Set the center frequency on any frequency would be measured and set the frequency span to zero span.
6. Measure the maximum time duration of one single pulse.
7. Set the EUT in continuous transmitting for each supported maximum packet format.
8. Measure the maximum time duration of one single pulse.
9. Use the marker-delta function to calculate the dwell time.
10. Dwell Time = Total Number of channels x 0.4(s) x Average Hopping Channel x package transfer time
11. Average Hopping Channel = Total Number of hopping / sweep time

3.9.4 Test Setup



3.9.5 Test Result of Hopping Frequency Dwell Time

Please refer to Appendix B.

3.10 Construction Protection Confirmation Method

3.10.1 Limit

The high-frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

3.10.2 Confirmation Method

☐	Sealed with special screws.
☐	Plastic chassis is being welded using ultrasonic waves.
☐	Chassis is glued using a special adhesive.
☐	Metal covers are spot-fused.
☐	Cover is specially interlocked.
■	RF and Modulation components are covered with shielding case and this shielding case is soldered.
☐	Shield case is welded at RF and modulation parts, and ID-ROM is welded using the BGA Method.
☐	Shield case is welded at RF and modulation parts, and ID-ROM is glued at its lead with a special adhesive.
☐	Shield case is welded at RF and modulation parts, and ID-ROM is glued with a non-transparent laminating agent.
☐	Other :

3.10.3 The Photos of Construction Protection

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Periods of Test	Due Date	Calibration Body	Calibration Method
Spectrum Analyzer	R&S	FSV30	101338	10Hz~30GHz	Apr. 16, 2019	Aug. 20, 2019~ Aug. 28, 2019	Apr. 15, 2020	CEPREI Calibration and Testing Center	C
Pulse Power Senor	Anritsu	ML2495A	1339163	300MHz~40GHz	Nov. 19, 2018	Aug. 20, 2019~ Aug. 28, 2019	Nov. 18, 2019	CEPREI Calibration and Testing Center	C
Power Meter	Anritsu	ML2495A	1435004	50MHz Bandwidth	Nov. 19, 2018	Aug. 20, 2019~ Aug. 28, 2019	Nov. 18, 2019	CEPREI Calibration and Testing Center	C
Bluetooth Tester	R&S	CBT	100783	Max input Power +27dBm	Aug. 02, 2019	Aug. 20, 2019~ Aug. 28, 2019	Aug. 01, 2020	CEPREI Calibration and Testing Center	C
DC Power Supply	GW INSTEK	GPD-2303S	GEO861339	Max 31	Oct. 12, 2018	Aug. 20, 2019~ Aug. 28, 2019	Oct. 11, 2019	CEPREI Calibration and Testing Center	C
Multi-meter	YFE	YF-303	YF-303-01	-	Apr. 17, 2019	Aug. 20, 2019~ Aug. 28, 2019	Apr. 16, 2020	CEPREI Calibration and Testing Center	C

Note: Above test equipment was used and kept valid calibration period during test.

Calibration Method :

a) : Calibration conducted by the National Institute of Information and Communications Technology～ NICT～ or a designated calibration agency under Article 102-18 paragraph

(1) TELEC Engeneering Center, Intertek Japan K.K., Keysight Technologies, Inc～.

b) : Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992)～Japan Calibration Service Syste～

c) : Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph

(1)～ TELEC Engeneering Center, Intertek Japan K.K., Keysight Technologies, Inc～.

Appendix A. Setup Photographs

Front View

Near View

Appendix B. Test Results

Please refer to the following pages for test results.

1. TEST RESULTS DATA
BLUETOOTH - BR

Environment of Test Room	Temperature	21-24 °C
	Humidity	49-51 %
Test Engineer	Aly Cao	

Modulatoin Type :	GFSK
Type Emissions :	78M1F1D

Declaration Output Power	0.120	mW/MHz
Declaration Output Power	-9.21	dBm/MHz
Antenna Power (E.I.R.P)	-12.63	dBm/MHz
Input Power Voltage	3.860	Vdc

Path Loss		5.50	dB
Burst	ON TIME	2.884	msec
	OFF TIME	0.875	msec
	Ratio	76.72	%
Packet Type (Mode)		DH5	mode

Antenna Information:

Antenna Model	Antenna Type	Gain(dBi)
Refer to antenna report	Monopole	-3.42

1.1. Test Results (Normal Voltage)

Measurement Frequency	MHz	2402	2441	2480	Limit	Result			Note
Channel Number	Ch.	0	39	78		0	39	78	
Reading Frequency	MHz	2401.997	2440.997	2479.997		----	----	----	
Frequency Tolerance	ppm	-1.207	-1.188	-1.169	±50	PASS	PASS	PASS	

Occupied Bandwidth	MHz	78.15			83.5	PASS	
Spread Bandwidth	MHz	72.36			0.5	PASS	
RF Output Power	mW/MHz	0.100				---- ---- ----	
RF Output Power Tolerance	%	-16.57			-80~+20	PASS	
Output Power (With burst ratio	dBm	8.60				---- ---- ----	

Unwanted Emission Intensity	Under 2387MHz	µW/MHz	0.00618	0.00108	0.00184	2.5	PASS	PASS	PASS
		MHz	1749.645	1748.259	1750.339		----	----	----
	2387MHz - 2400MHz	µW/MHz	0.57148	0.00060	0.00049	25	PASS	PASS	PASS
		MHz	2399.990	2396.250	2396.976		----	----	----
	2483.5MHz - 2496.5MHz	µW/MHz	0.00057	0.00074	0.00773	25	PASS	PASS	PASS
		MHz	2484.692	2485.075	2485.238		----	----	----
	2496.5MHz - 12.5GHz	µW/MHz	0.01026	0.01312	0.01064	2.5	PASS	PASS	PASS
		MHz	4804.577	4882.596	4960.616		----	----	----
Limitation of Collateral Emission of Receiver	Under 1GHz	nW	0.047	0.053	0.052	4	PASS	PASS	PASS
		MHz	978.032	944.182	977.062		----	----	----
	1 -12.5GHz	nW	0.514	0.495	0.512	20	PASS	PASS	PASS
		MHz	6543.017	6302.500	6743.290		----	----	----

Spread Factor	----	72.36	5	PASS
Dwell Time	mSec	279.49	400	PASS
Radio Interference Prevention Capability	----	good		PASS

2. TEST RESULTS DATA
BLUETOOTH - EDR

Environment of Test Room	Temperature	21-24 °C
	Humidity	49-51 %
Test Engineer	Aly Cao	

Modulatoin Type :	8DPSK
Type Emissions :	78M7G1D

Declaration Output Power	0.120 mW/MHz
Declaration Output Power	-9.21 dBm/MHz
Antenna Power (E.I.R.P)	-12.63 dBm/MHz
Input Power Voltage	3.860 Vdc

Path Loss		5.50	dB
Burst	ON TIME	2.886	msec
	OFF TIME	0.867	msec
	Ratio	76.90	%
Packet Type (Mode)		3-DH5	mode

Antenna Information:

Antenna Model	Antenna Type	Gain(dBi)
Refer to antenna report	Monopole	-3.42

2.1. Test Results (Normal Voltage)

Measurement Frequency		MHz	2402	2441	2480	Limit	Result			Note
Channel Number		Ch.	0	39	78		0	39	78	
Reading Frequency		MHz	2402.012	2440.991	2479.991		----	----	----	
Frequency Tolerance		ppm	4.829	-3.564	-3.508	±50	PASS	PASS	PASS	
Occupied Bandwidth		MHz	78.73			83.5	PASS			
Spread Bandwidth		MHz	73.23			0.5	PASS			
RF Output Power		mW/MHz	0.061				----	----	----	
RF Output Power Tolerance		%	-48.93			-80~+20	PASS			
Output Power (With burst ratio		dBm	6.52				----	----	----	
Unwanted Emission Intensity	Under 2387MHz	µW/MHz	0.00435	0.00146	0.00515	2.5	PASS	PASS	PASS	
		MHz	1751.720	1749.645	1752.418		----	----	----	
	2387MHz - 2400MHz	µW/MHz	2.34963	0.00050	0.00046	25	PASS	PASS	PASS	
		MHz	2399.990	2397.554	2389.492		----	----	----	
	2483.5MHz - 2496.5MHz	µW/MHz	0.00049	0.00063	0.00441	25	PASS	PASS	PASS	
		MHz	2483.850	2485.283	2483.776		----	----	----	
	2496.5MHz - 12.5GHz	µW/MHz	0.00543	0.00759	0.00804	2.5	PASS	PASS	PASS	
		MHz	4804.580	4882.596	4960.616		----	----	----	
Limitation of Collateral Emission of Receiver	Under 1GHz	nW	0.062	0.054	0.072	4	PASS	PASS	PASS	
		MHz	841.954	919.062	884.921		----	----	----	
	1 -12.5GHz	nW	0.755	0.649	0.718	20	PASS	PASS	PASS	
		MHz	6373.410	5880.860	6696.340		----	----	----	
Spread Factor		----	73.23			5	PASS			
Dwell Time		mSec	240.11			400	PASS			3DH5
Radio Interference Prevention Capability		----	good				PASS			

3. TEST RESULTS DATA
BLUETOOTH - AFH_BR

Environment of Test Room	Temperature	21-24 °C
	Humidity	49-51 %
Test Engineer	Aly Cao	

Modulatoin Type :	GFSK
Type Emissions :	19M5F1D

Declaration Output Power	0.480 mW/MHz
Declaration Output Power	-3.19 dBm/MHz
Antenna Power (E.I.R.P)	-6.61 dBm/MHz
Input Power Voltage	3.860 Vdc

Path Loss		5.50	dB
Burst	ON TIME	2.884	msec
	OFF TIME	0.875	msec
	Ratio	76.72	%
Packet Type (Mode)		DH5	mode

Antenna Information:

Antenna Model	Antenna Type	Gain(dBi)
Refer to antenna report	Monopole	-3.42

3.1. Test Results (Normal Voltage)

Measurement Frequency		MHz	2402	2411	2421	Limit	Result			Note
Channel Number		Ch.	0	9	19		0	9	19	
Reading Frequency		MHz	2401.997	2410.997	2420.994		----	----	----	
Frequency Tolerance		ppm	-1.207	-1.203	-2.375	±50	PASS	PASS	PASS	
Occupied Bandwidth		MHz	19.54			83.5	PASS			
Spread Bandwidth		MHz	18.38			0.5	PASS			
RF Output Power		mW/MHz	0.394				----	----	----	
RF Output Power Tolerance		%	-17.88			-80~+20	PASS			
Output Power (With burst ratio		dBm	8.60				----	----	----	
Unwanted Emission Intensity	Under 2387MHz	µW/MHz	0.00133	0.00047	0.00061	2.5	PASS	PASS	PASS	
		MHz	1757.270	1762.815	1746.873		----	----	----	
	2387-2400MHz	µW/MHz	0.58076	0.00098	0.00078	25	PASS	PASS	PASS	
		MHz	2399.990	2399.367	2399.613		----	----	----	
	2483.5-2496.5MHz	µW/MHz	0.00046	0.00054	0.00057	25	PASS	PASS	PASS	
		MHz	2483.672	2486.810	2486.388		----	----	----	
	2496.5MHz - 12.5GHz	µW/MHz	0.00995	0.00682	0.00693	2.5	PASS	PASS	PASS	
		MHz	4804.577	4822.581	4842.586		----	----	----	
Limitation of Collateral Emission of Receiver	Under 1GHz	nW	0.059	0.055	0.052	4	PASS	PASS	PASS	
		MHz	936.714	974.928	899.4696		----	----	----	
	1 -12.5GHz	nW	0.743	0.796	1.059	20	PASS	PASS	PASS	
		MHz	6784.500	6931.110	1764.210		----	----	----	
Spread Factor		----	18.38			5	PASS			
Dwell Time		mSec	71.53			400	PASS			
Radio Interference Prevention Capability		----	good				PASS			

4. TEST RESULTS DATA
BLUETOOTH - LE

Environment of Test Room	Temperature	21~24 °C
	Humidity	51~55 %
Test Engineer	Asa Cheng	

Modulatoin Type :	GFSK
Type Emissions :	926KF1D

Declaration Output Power	1.300	mW
Declaration Output Power	1.14	dBm
Antenna Power (E.I.R.P)	-2.28	dBm
Input Power Voltage	3.860	Vdc

Path Loss		5.50	dB
Burst	ON TIME	0.383	msec
	OFF TIME	0.243	msec
	Ratio	61.11	%
Packet Type (Mode)		Low Energy	mode

Antenna Information:

Antenna Model	Antenna Type	Gain(dBi)
Refer to antenna report	Monopole	-3.42

4.1. Test Results (Normal Voltage)

Measurement Frequency		MHz	2402	2440	2480	Limit	Result			Note
Channel Number		Ch.	0	19	39		0	19	39	
Reading Frequency		MHz	2401.997	2439.997	2479.997		----	----	----	
Frequency Tolerance		ppm	-1.207	-1.189	-1.169	-50≦x≦+50	PASS	PASS	PASS	
Occupied Bandwidth		MHz	0.93	0.93	0.93	26	PASS			
Spreading Bandwidth		MHz	N/A			0.5	N/A			
RF Output Power		mW	1.169	1.191	1.175		----			
RF Output Power Tolerance		%	-10.04	-8.37	-9.62	-80≦x≦+20	PASS			
Output Power (With burst ratio		dBm	0.68	0.76	0.70		----			
Unwanted Emission Intensity	Under 2387MHz	µW/MHz	0.01663	0.01807	0.01910	2.5	PASS	PASS	PASS	
		MHz	931.864	339.254	766.593		----	----	----	
	2387MHz - 2400MHz	µW/MHz	0.25527	0.01033	0.01148	25	PASS	PASS	PASS	
		MHz	2399.997	2393.773	2391.700		----	----	----	
	2483.5MHz - 2496.5MHz	µW/MHz	0.01033	0.00920	0.01074	25	PASS	PASS	PASS	
		MHz	2495.178	2489.519	2494.574		----	----	----	
	2496.5MHz - 12.5GHz	µW/MHz	0.01730	0.01687	0.01738	2.5	PASS	PASS	PASS	
		MHz	6838.085	6850.088	6613.029		----	----	----	
Limitation of Collateral Emission of Receiver	Under 1GHz	nW	0.050	0.046	0.041	4	PASS	PASS	PASS	
		MHz	880.944	973.861	676.877		----	----	----	
	1 -12.5GHz	nW	0.427	0.456	0.460	20	PASS	PASS	PASS	
		MHz	6417.486	6796.000	6800.787		----	----	----	
Spread Factor		----	N/A			5	N/A			
Dwell Time		mSec	N/A			400	N/A			
Radio Interference Prevention Capability		----	good				PASS			

5. TEST RESULTS DATA
BLUETOOTH - LE

Environment of Test Room	Temperature	21~24 °C
	Humidity	51~55 %
Test Engineer	Asa Cheng	

Modulatoin Type :	GFSK
Type Emissions :	1M87F1D

Declaration Output Power	1.300	mW
Declaration Output Power	1.14	dBm
Antenna Power (E.I.R.P)	-2.28	dBm
Input Power Voltage	3.860	Vdc

Path Loss		5.50	dB
Burst	ON TIME	1.071	msec
	OFF TIME	0.801	msec
	Ratio	57.20	%
Packet Type (Mode)		Low Energy	mode

Antenna Information:

Antenna Model	Antenna Type	Gain(dBi)
Refer to antenna report	Monopole	-3.42

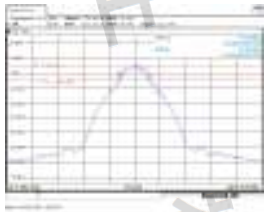
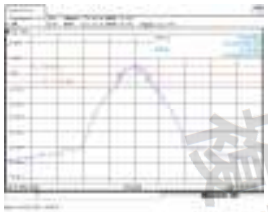
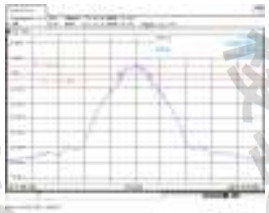
5.1. Test Results (Normal Voltage)

Measurement Frequency		MHz	2402	2440	2480	Limit	Result			Note
Channel Number		Ch.	0	19	39		0	19	39	
Reading Frequency		MHz	2401.986	2439.986	2479.986		----	----	----	
Frequency Tolerance		ppm	-6.037	-5.943	-5.847	-50≦x≦+50	PASS	PASS	PASS	
Occupied Bandwidth		MHz	1.87	1.87	1.87	26	PASS			
Spreading Bandwidth		MHz	N/A			0.5	N/A			
RF Output Power		mW	1.197	1.216	1.189		----			
RF Output Power Tolerance		%	-7.94	-6.45	-8.58	-80≦x≦+20	PASS			
Output Power (With burst ratio		dBm	0.78	0.85	0.75		----			
Unwanted Emission Intensity	Under 2387MHz	µW/MHz	0.01510	0.01603	0.01589	2.5	PASS	PASS	PASS	
		MHz	378.535	923.426	956.888		----	----	----	
	2387MHz - 2400MHz	µW/MHz	1.68267	0.01069	0.00940	25	PASS	PASS	PASS	
		MHz	2399.997	2392.396	2391.122		----	----	----	
	2483.5MHz - 2496.5MHz	µW/MHz	0.01067	0.01030	0.01119	25	PASS	PASS	PASS	
		MHz	2494.307	2486.947	2487.375		----	----	----	
	2496.5MHz - 12.5GHz	µW/MHz	0.01738	0.01786	0.01905	2.5	PASS	PASS	PASS	
		MHz	6995.124	6825.082	6992.124		----	----	----	
Limitation of Collateral Emission of Receiver	Under 1GHz	nW	0.060	0.048	0.046	4	PASS	PASS	PASS	
		MHz	976.189	895.202	896.948		----	----	----	
	1 -12.5GHz	nW	0.378	0.475	0.454	20	PASS	PASS	PASS	
		MHz	6506.604	6235.418	6873.614		----	----	----	
Spread Factor		----	N/A			5	N/A			
Dwell Time		mSec	N/A			400	N/A			
Radio Interference Prevention Capability		----	good				PASS			

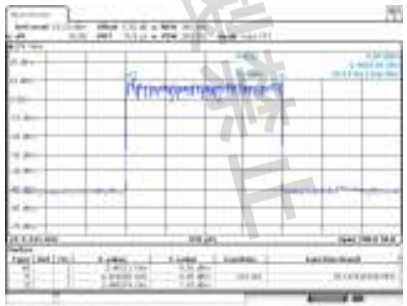
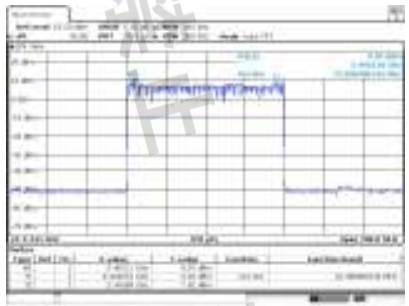
Appendix C. Test Plots

C.1. BR (Basic Rate)

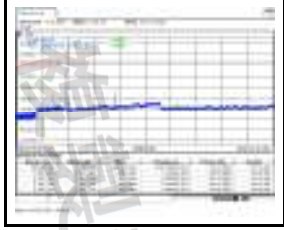
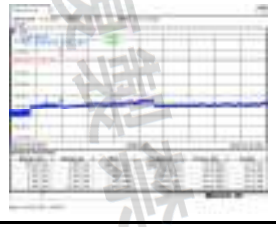
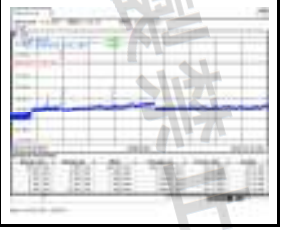
C.1.1. Frequency Tolerance

Low Channel	Middle Channel	High Channel
		

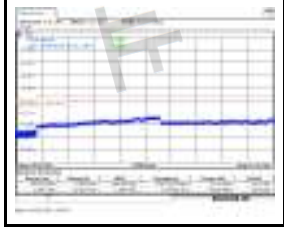
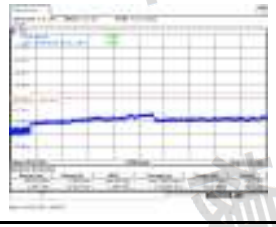
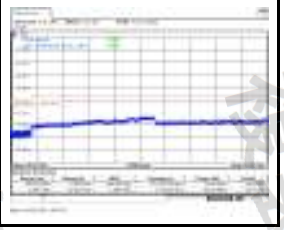
C.1.2. Occupied Bandwidth and Spread-spectrum Bandwidth

Occupied Bandwidth	Spread-spectrum Bandwidth
	

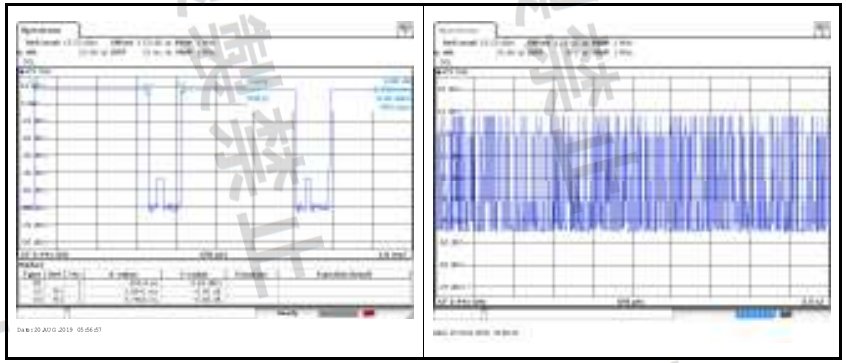
C.1.3. Unwanted Emission Intensity

Low Channel	Middle Channel	High Channel
		

C.1.4. Limitation of Collateral Emission of Receiver

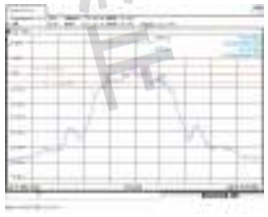
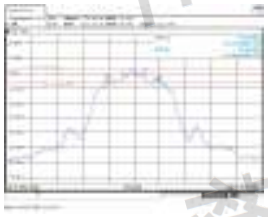
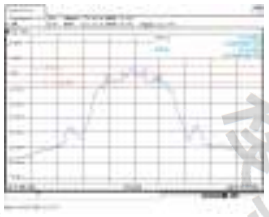
Low Channel	Middle Channel	High Channel
		

C.1.5. Hopping Frequency Dwell Time

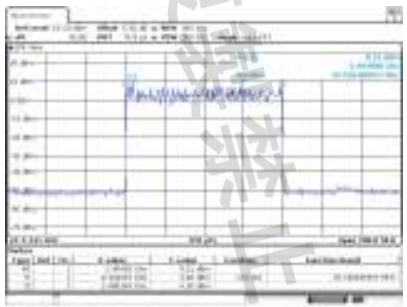


C.2. EDR (Enhanced Data Rate)

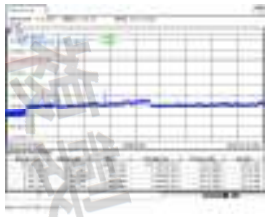
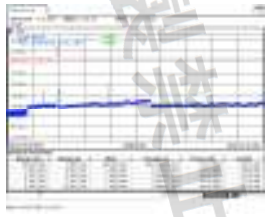
C.2.1. Frequency Tolerance

Low Channel	Middle Channel	High Channel
		

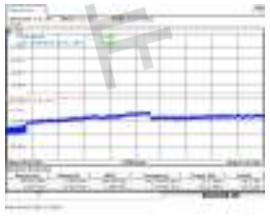
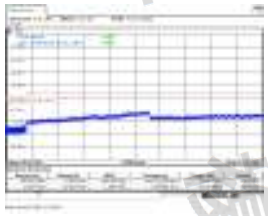
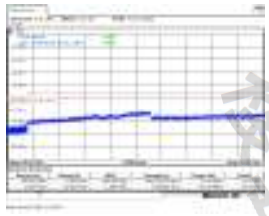
C.2.2. Occupied Bandwidth and Spread-spectrum Bandwidth

Occupied Bandwidth	Spread-spectrum Bandwidth
	

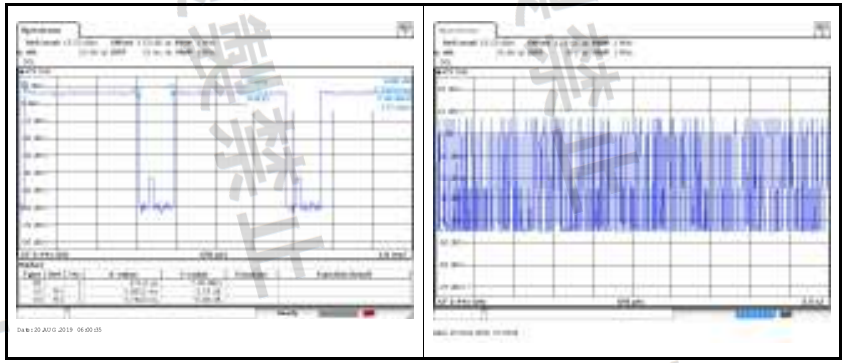
C.2.3. Unwanted Emission Intensity

Low Channel	Middle Channel	High Channel
		

C.2.4. Limitation of Collateral Emission of Receiver

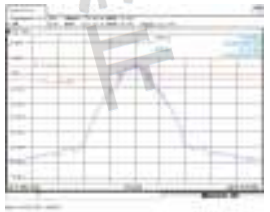
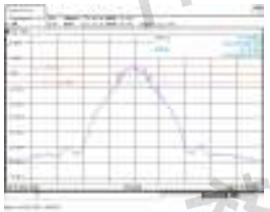
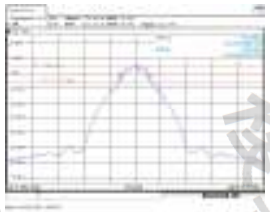
Low Channel	Middle Channel	High Channel
		

C.2.5. Hopping Frequency Dwell Time



C.3. AFH (Adaptive Frequency Hopping)

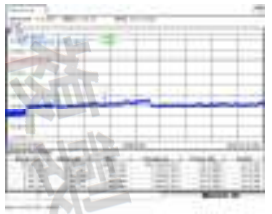
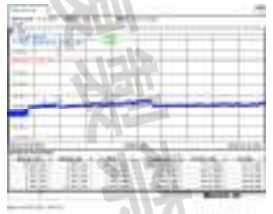
C.3.1. Frequency Tolerance

Low Channel	Middle Channel	High Channel
		

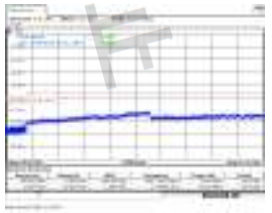
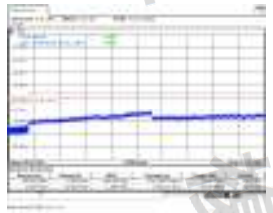
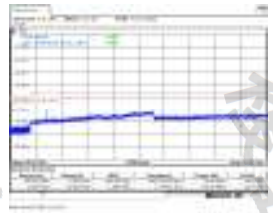
C.3.2. Occupied Bandwidth and Spread-spectrum Bandwidth

Occupied Bandwidth	Spread-spectrum Bandwidth
	

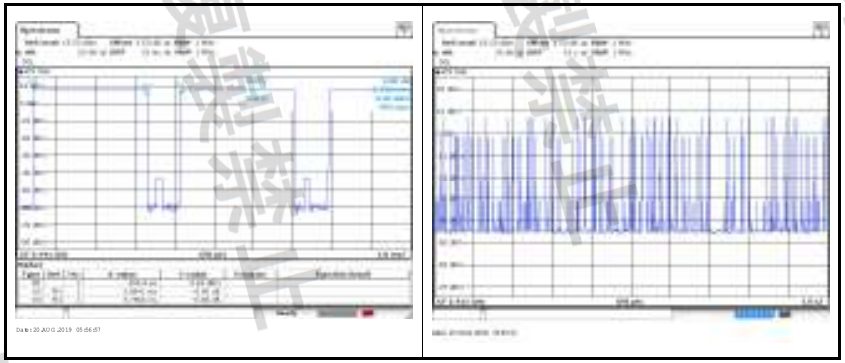
C.3.3. Unwanted Emission Intensity

Low Channel	Middle Channel	High Channel
		

C.3.4. Limitation of Collateral Emission of Receiver

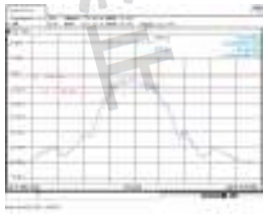
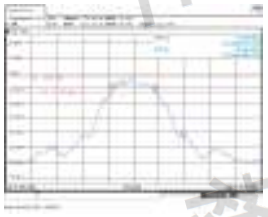
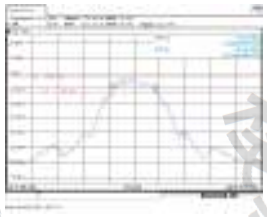
Low Channel	Middle Channel	High Channel
		

C.3.5. Hopping Frequency Dwell Time

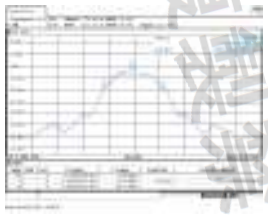
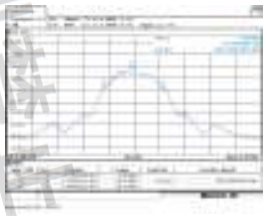


C.4. LE v4.2 (Low Energy)

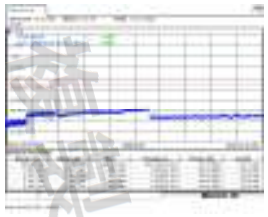
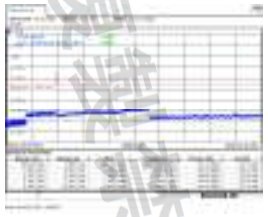
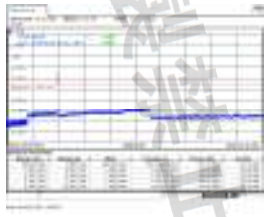
C.4.1. Frequency Tolerance

Low Channel	Middle Channel	High Channel
		

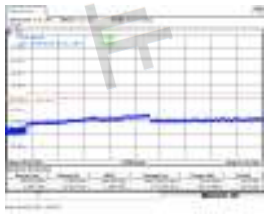
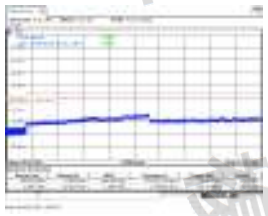
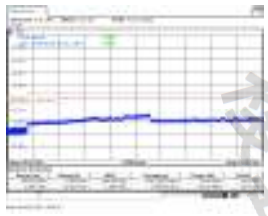
C.4.2. Occupied Bandwidth

Low Channel	Middle Channel	High Channel
		

C.4.3. Unwanted Emission Intensity

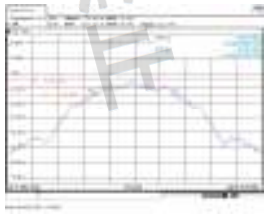
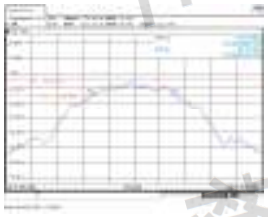
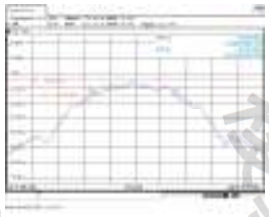
Low Channel	Middle Channel	High Channel
		

C.4.4. Limitation of Collateral Emission of Receiver

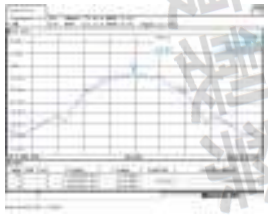
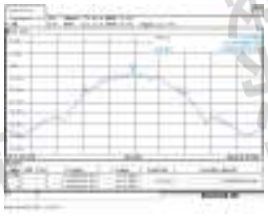
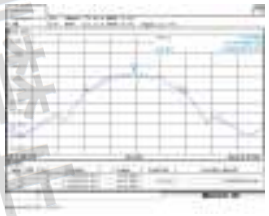
Low Channel	Middle Channel	High Channel
		

C.5. LE v5.0 (Low Energy)

C.5.1. Frequency Tolerance

Low Channel	Middle Channel	High Channel
		

C.5.2. Occupied Bandwidth

Low Channel	Middle Channel	High Channel
		

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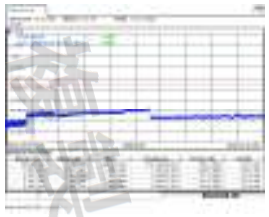
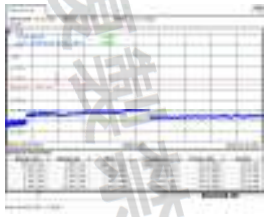
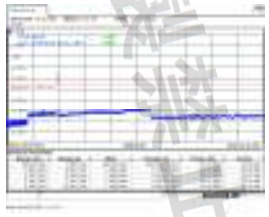
C.5.3. Unwanted Emission Intensity

Low Channel	Middle Channel	High Channel
		

C.5.4. Limitation of Collateral Emission of Receiver

Low Channel	Middle Channel	High Channel