JAPAN RADIO TEST REPORT

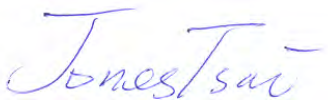
BLUETOOTH

Product Name	:	**Google Nest Wifi Add-on point**
Model Name	:	**H2E**
Applicant	:	**Google LLC 1600 Amphitheatre Parkway, Mountain View, California, 94043 USA**
Type Emissions	:	**78M1F1D(BR); 78M4G1D(EDR); 19M5F1D(BR_AFH); 20M0G1D(EDR_AFH); 1M07F1D(LE_1M)**
Declaration Output Power	:	**0.20 mW/MHz (BR); 0.20 mW/MHz (EDR); 0.80 mW/MHz (BR_AFH); 0.80 mW/MHz (EDR_AFH); 7.80 mW (LE_1M)**
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 Jun. 06, 2019 and testing was started from Jun. 06, 2019 and completed on Jul. 17, 2019. We, SPORTON INTERNATIONAL INC., 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 report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.



Reviewed by: Jones Tsai

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

Table of Contents

History of this test report

Report No.	Version	Description	Issued Date
JR960638A	01	Initial issue of report	Aug. 20, 2019

Summary of Test Result

Report Clause	Test Items	Result (PASS/FAIL)
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

Reviewed by: Louis Wu

Report Producer: Wii Chang

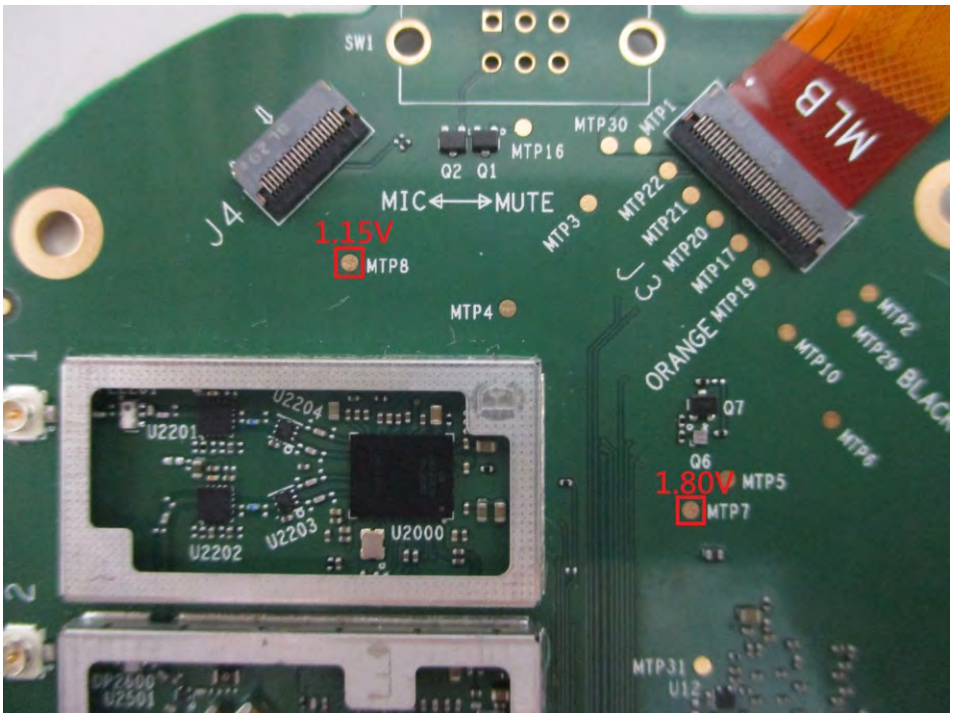
1 General Description

1.1 Feature of Equipment Under Test

Product Feature & Specification		
Product Name	Google Nest Wifi Add-on point	
Model Name	H2E	
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 LE	40
Channel Spacing	BR/EDR/AFH Mode	1MHz
	Other : BT LE	2MHz
Declaration RF Output Power	0.20 mW/MHz (BR) ; 0.20 mW/MHz (EDR) ; 0.80 mW/MHz (BR_AFH) ; 0.80 mW/MHz (EDR_AFH) ; 7.80 mW (LE_1M)	
Antenna Power (E.I.R.P)	-5.49 dBm/MHz (BR) -5.49 dBm/MHz (EDR) 0.53 dBm/MHz (BR_AFH) 0.53 dBm/MHz (EDR_AFH) 10.42 dBm (LE_1M)	
Modulation	■ GFSK ■ π/4-DQPSK ■ 8-DPSK ☐ Other : FSK	
Power Source[NOTE]	■ Commercial power	AC 100 ~ 240V
	■ External Power Source	DC 14V, 1.1A
	☐ Lithium battery	DC 3.7V
	☐ 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 14 **Vdc (Nominal)**	Power Supply voltage 15.4 **Vdc (+10%)**	Power Supply voltage 12.6 **Vdc (-10%)**
1.15	1.15	1.15
1.80	1.80	1.80
Measurement point		



Antenna Information		
Main Antenna	**Antenna Type :** PIFA	**Antenna Gain :** 1.5 dBi

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

1.2 Modification of EUT

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

1.3 Testing Site

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978
Test Site No.	**Sporton Site No.:** TH02-HY

Test Items	Uncertainty	Remark
Occupied Channel Bandwidth	±3.27%	Confidence 95%
RF output power, conducted	±0.55 dB	Confidence 95%
Frequency Tolerance	±5.3 Hz	Confidence 95%
Unwanted Emission	±1.38 dB	Confidence 95%
Temperature	±0.8 °C	Confidence 95%
Humidity	±3 %	Confidence 95%

1.4 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.

1.5 Ancillary Equipment List

None.

2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Channel (LE Channel)	Frequency (MHz)	Channel (LE Channel)	Frequency (MHz)	Channel (LE 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

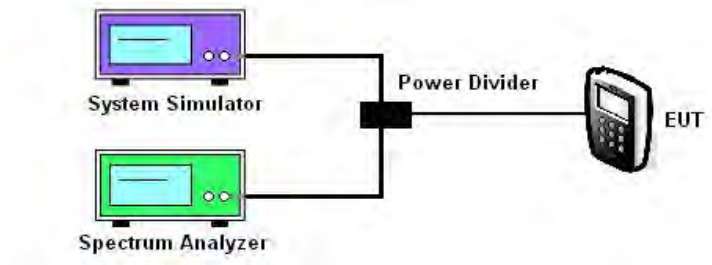
3.1.2 Measuring Instruments

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-fc)/fc×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)

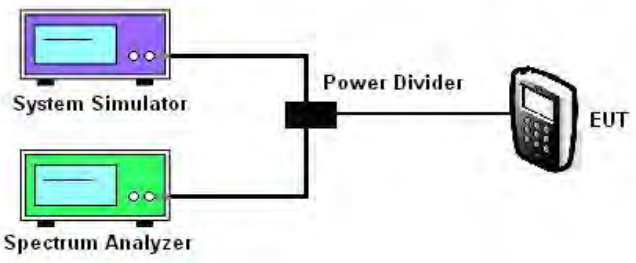
3.2.2 Measuring Instruments

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)

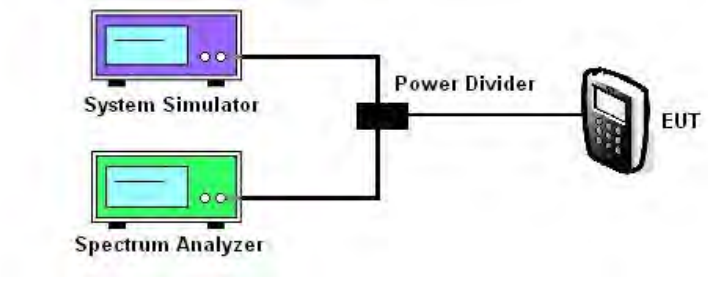
3.3.2 Measuring Instruments

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:

Test method 1:

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.

Test method 2:

i. Peak search by use setting of SA is following as:
Span = 2 time of occupied bandwidth
RBW =1MHz / VBW = 3 time of RBW
Sweep Mode: Continuous sweep
Detect mode = Positive peak / Trace mode = Max hold.
Mark the peak value

ii. Measure maximum average power per MHz by use setting of SA is following as:

Center frequency = frequency of peak value

Span = 0Hz

RBW =1MHz / VBW = RBW

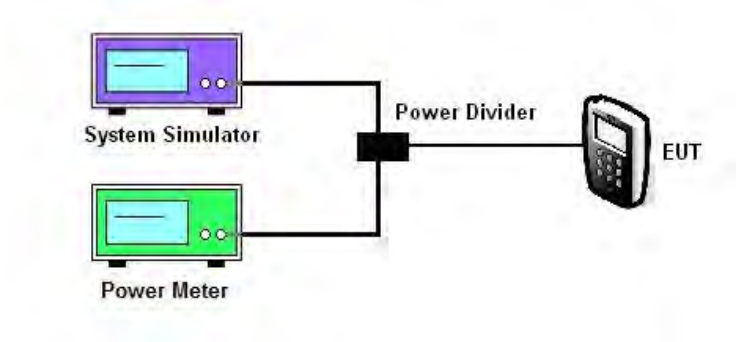
Sweep Mode: Continuous sweep

Detect mode = Sample / Trace mode = Max hold.

Calculated the mean power value

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)

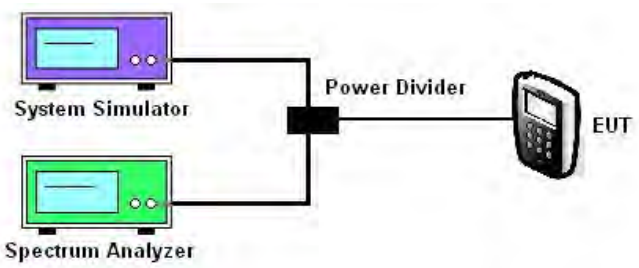
3.5.2 Measuring Instruments

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

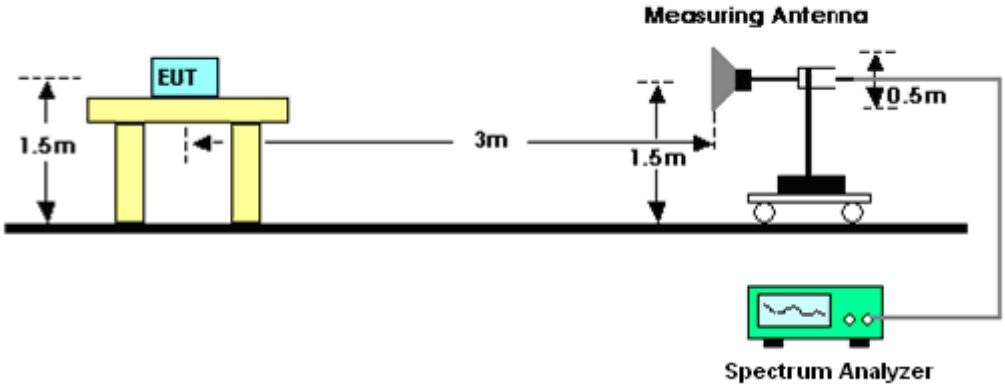
See list of measuring instruments of this test report.

3.6.3 Test Procedures

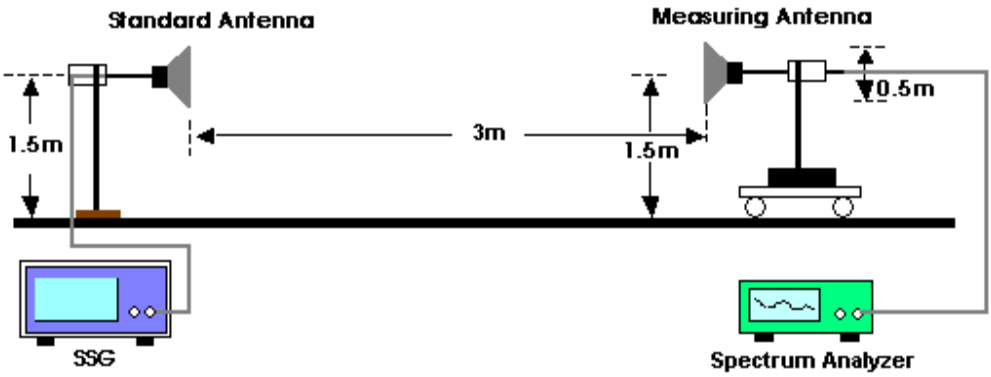
1. Set EUT ad measuring antenna at the same height and roughly facing each other.
2. Move the measuring antenna height up and down within ± 50cm of EUT height and swing it to find the maximum output of the measuring antenna. The output level at the spectrum analyzer is read as “E“.
3. Remove the EUT 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.	

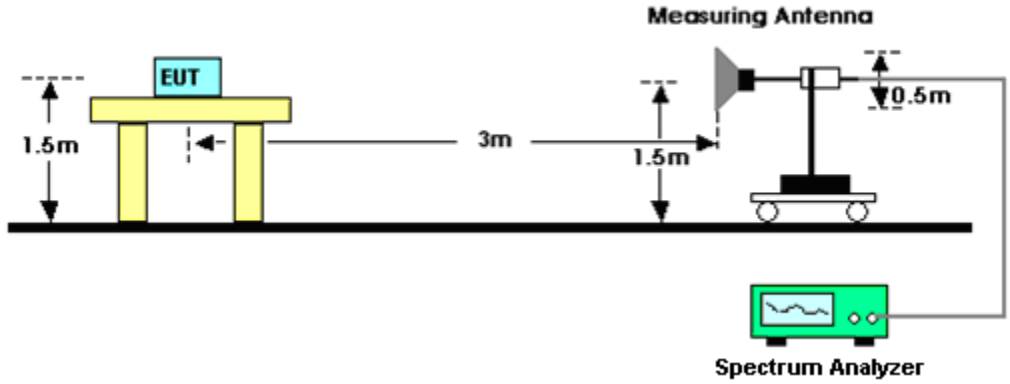
3.7.2 Measuring Instruments

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

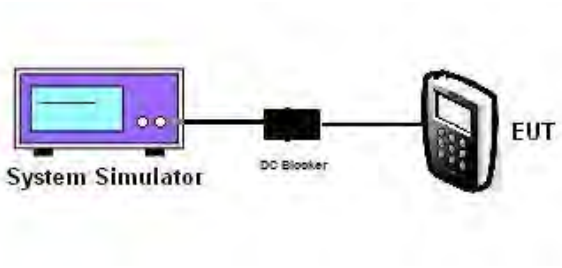
3.8.2 Measuring Instruments

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

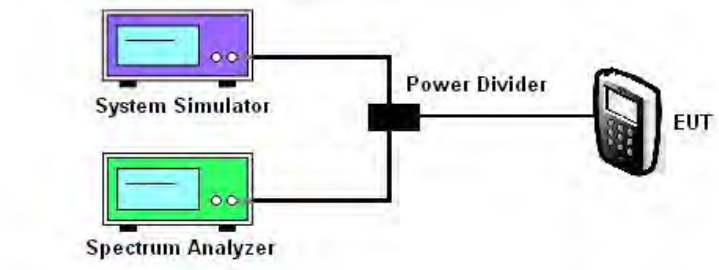
3.9.2 Measuring Instruments

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

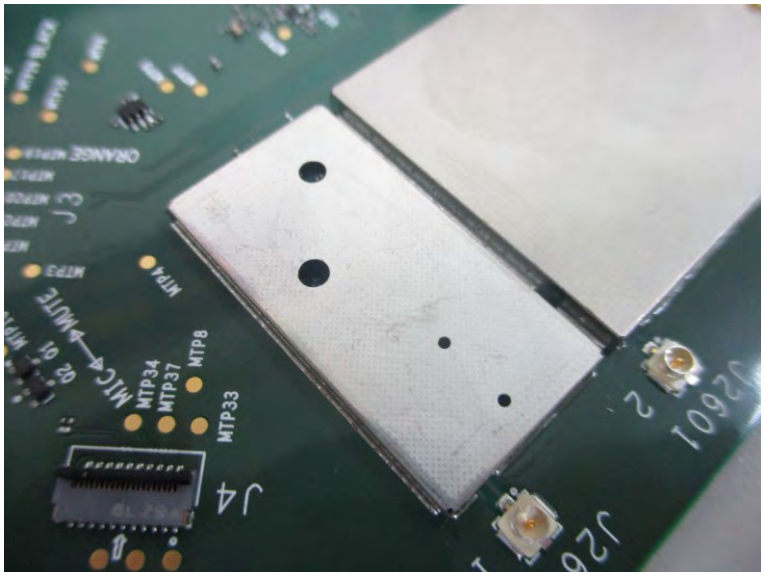
3.10.1 Limit

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.	Calibration Date	Test Periods	Due Date	Calibration Body	Calibration Method
Spectrum Analyzer	Rohde & Schwarz	FSV 40	101408	Jul. 30, 2018	Jun. 06, 2019~ Jul. 17, 2019	Jul. 29, 2019	Rohde & Schwarz	C
BT Base Station	Rohde & Schwarz	CBT	101136	Sep. 26, 2018	Jun. 06, 2019~ Jul. 17, 2019	Sep. 25, 2019	ETC , R.O.C	C
Power Sensor	DARE	RPR3006W	16I00054SNO12	Dec. 27, 2018	Jun. 06, 2019~ Jul. 17, 2019	Dec. 26, 2019	ETC, R.O.C	C
Programmable Power Supply	GW Instek	PSS-2005	EL890094	Oct. 02, 2018	Jun. 06, 2019~ Jul. 17, 2019	Oct. 01, 2019	GW Instek	C
Multimeter	YFE	YF-303	1317563	Jan. 15, 2019	Jun. 06, 2019~ Jul. 17, 2019	Jan. 14, 2020	ETC , R.O.C	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 Engineering Center, Intertek Japan K.K., Keysight Technologies, Inc～.

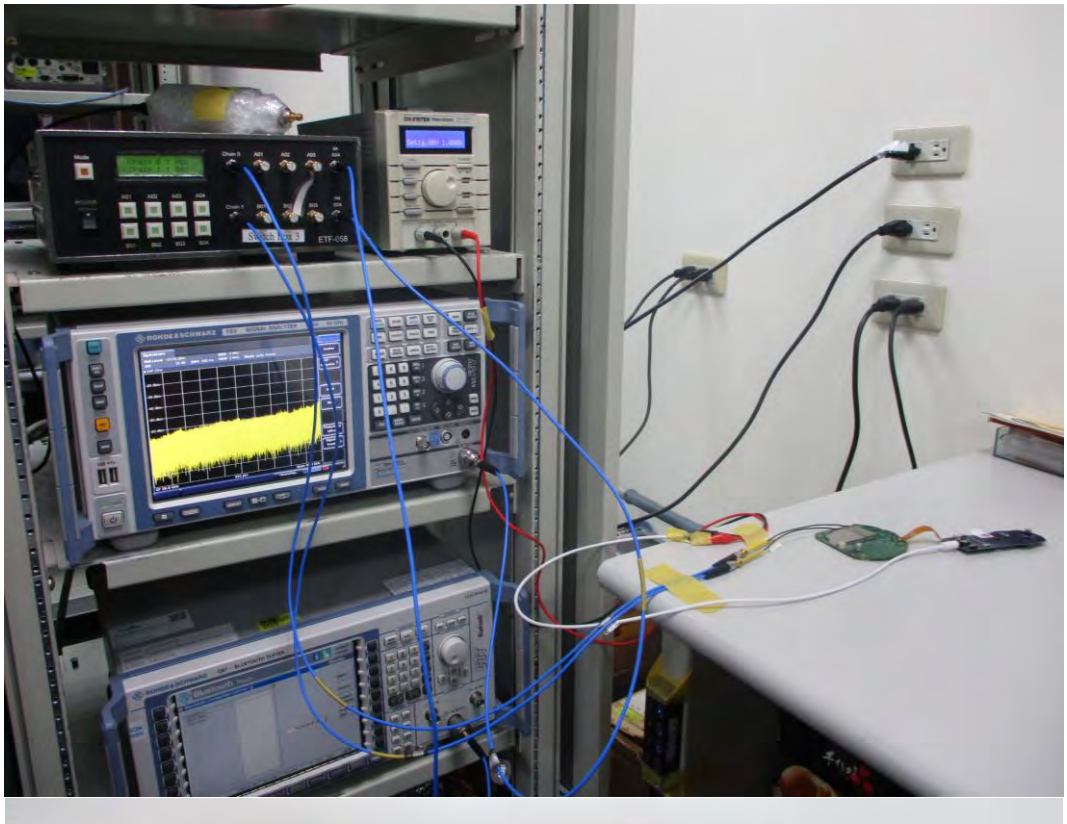
b)：Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992)～Japan Calibration Service System～

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

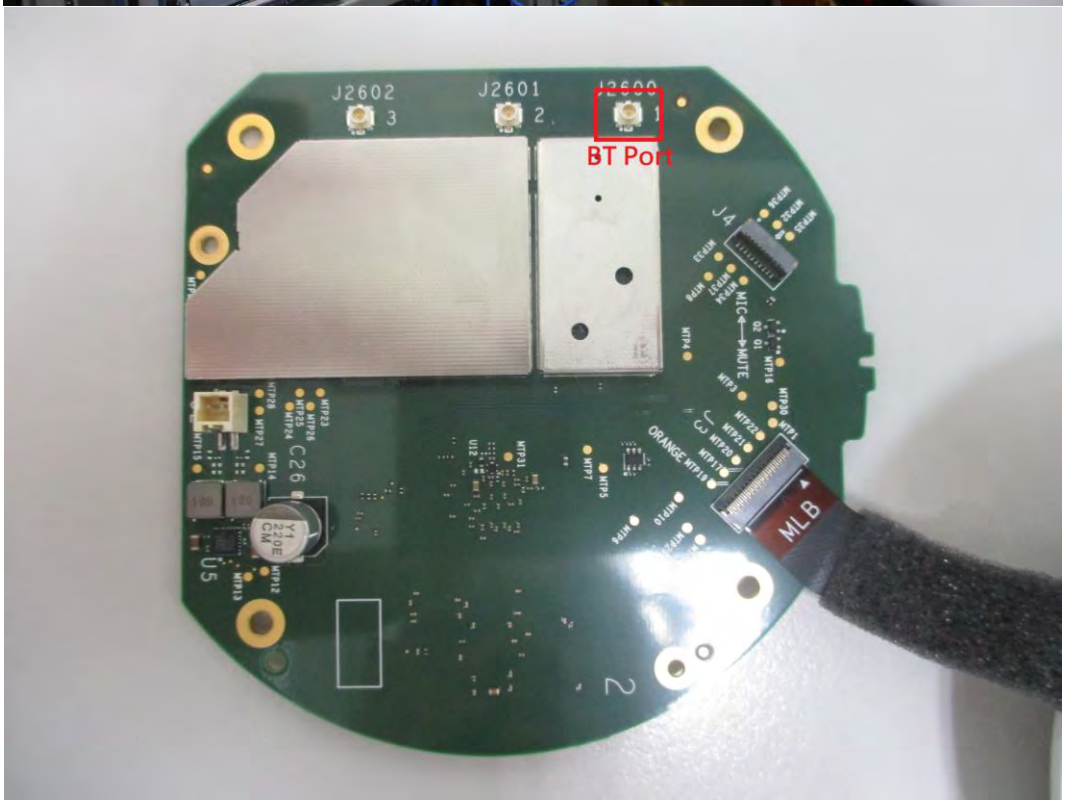
(1)～ TELEC Engineering Center, Intertek Japan K.K., Keysight Technologies, Inc～.

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	23~25 °C
	Humidity	50~55 %
Test Engineer	Ethan Lin	

Modulatoin Type :	GFSK
Type Emissions :	78M1F1D

Declaration Output Power	0.20	mW/MHz
Declaration Output Power	-6.99	dBm/MHz
Antenna Power (E.I.R.P)	-5.49	dBm/MHz
Input Power Voltage	14.000	Vdc

Path Loss		24.60	dB
Burst	ON TIME	0.377	msec
	OFF TIME	0.870	msec
	Ratio	30.23	%
Packet Type (Mode)		DH1	mode

Antenna Information:

Antenna Model	Antenna Type	Gain(dBi)
Refer to antenna report	PIFA	1.50

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	2479.994		-----	-----	-----	
Frequency Tolerance	ppm	-1.207	-1.188	-2.339	±50	**PASS**	**PASS**	**PASS**	

Occupied Bandwidth	MHz	78.15	83.5	**PASS**		
Spread Bandwidth	MHz	71.49	0.5	**PASS**		
RF Output Power	mW/MHz	0.180		-----	-----	-----
RF Output Power Tolerance	%	-9.90	-80~+20	**PASS**		
Output Power (With burst ratio)	dBm	11.10		-----	-----	-----

Unwanted Emission Intensity	Under 2387MHz	µW/MHz	0.02735	0.02377	0.02529	2.5	**PASS**	**PASS**	**PASS**	
		MHz	870.760	960.961	987.828		-----	-----	-----	
	2387MHz - 2400MHz	µW/MHz	0.81658	0.00460	0.00479	25	**PASS**	**PASS**	**PASS**	
		MHz	2399.997	2389.193	2389.946		-----	-----	-----	
	2483.5MHz - 2496.5MHz	µW/MHz	0.00528	0.00522	0.01127	25	**PASS**	**PASS**	**PASS**	
		MHz	2484.335	2489.292	2483.562		-----	-----	-----	
	2496.5MHz - 12.5GHz	µW/MHz	0.04266	0.04150	0.04539	2.5	**PASS**	**PASS**	**PASS**	
		MHz	10043.886	10029.883	10492.998		-----	-----	-----	
Limitation of Collateral Emission of Receiver	Under 1GHz	nW	0.002	0.002	0.002	4	**PASS**	**PASS**	**PASS**	
		MHz	972.115	957.858	975.316		-----	-----	-----	
	1 -12.5GHz	nW	0.023	0.025	0.024	20	**PASS**	**PASS**	**PASS**	
		MHz	11731.960	10658.716	10053.100		-----	-----	-----	

Spread Factor	-----	71.49	5	**PASS**	
Dwell Time	mSec	242.85	400	**PASS**	DH5
Radio Interference Prevention Capability	-----	good		**PASS**	

2. TEST RESULTS DATA
BLUETOOTH - EDR

Environment of Test Room	Temperature	23~25 °C
	Humidity	50~55 %
Test Engineer	Ethan Lin	

Modulatoin Type :	8DPSK
Type Emissions :	78M4G1D

Declaration Output Power	0.20	mW/MHz
Declaration Output Power	-6.99	dBm/MHz
Antenna Power (E.I.R.P)	-5.49	dBm/MHz
Input Power Voltage	14.000	Vdc

Path Loss		24.60	dB
Burst	ON TIME	0.384	msec
	OFF TIME	0.870	msec
	Ratio	30.64	%
Packet Type (Mode)		3-DH1	mode

Antenna Information:

Antenna Model	Antenna Type	Gain(dBi)
Refer to antenna report	PIFA	1.50

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	2401.968	2440.971	2479.968		-----	-----	-----	
Frequency Tolerance		ppm	-13.260	-11.860	-12.843	±50	**PASS**	**PASS**	**PASS**	
Occupied Bandwidth		MHz	78.44			83.5	**PASS**			
Spread Bandwidth		MHz	71.49			0.5	**PASS**			
RF Output Power		mW/MHz	0.099				-----	-----	-----	
RF Output Power Tolerance		%	-50.49			-80~+20	**PASS**			
Output Power (With burst ratio)		dBm	8.50				-----	-----	-----	
Unwanted Emission Intensity	Under 2387MHz	µW/MHz	0.02564	0.02884	0.02858	2.5	**PASS**	**PASS**	**PASS**	
		MHz	713.927	236.929	987.537		-----	-----	-----	
	2387MHz - 2400MHz	µW/MHz	3.01995	0.00490	0.00475	25	**PASS**	**PASS**	**PASS**	
		MHz	2399.990	2394.286	2392.798		-----	-----	-----	
	2483.5MHz - 2496.5MHz	µW/MHz	0.00548	0.00509	0.00902	25	**PASS**	**PASS**	**PASS**	
		MHz	2493.339	2492.859	2484.068		-----	-----	-----	
	2496.5MHz - 12.5GHz	µW/MHz	0.04018	0.05433	0.03926	2.5	**PASS**	**PASS**	**PASS**	
		MHz	10052.888	12392.473	12371.468		-----	-----	-----	
Limitation of Collateral Emission of Receiver	Under 1GHz	nW	0.002	0.002	0.002	4	**PASS**	**PASS**	**PASS**	
		MHz	953.493	329.846	970.563		-----	-----	-----	
	1 -12.5GHz	nW	0.024	0.028	0.025	20	**PASS**	**PASS**	**PASS**	
		MHz	10124.010	11162.757	10655.841		-----	-----	-----	
Spread Factor		-----	71.49			5	**PASS**			
Dwell Time		mSec	268.89			400	**PASS**			3DH5
Radio Interference Prevention Capability		-----	good				**PASS**			

3. TEST RESULTS DATA
BLUETOOTH - AFH_BR

Environment of Test Room	Temperature	23~25 °C
	Humidity	50~55 %
Test Engineer	Ethan Lin	

Modulatoin Type :	GFSK
Type Emissions :	19M5F1D

Declaration Output Power	0.80	mW/MHz
Declaration Output Power	-0.97	dBm/MHz
Antenna Power (E.I.R.P)	0.53	dBm/MHz
Input Power Voltage	14.000	Vdc

Path Loss		24.60	dB
Burst	ON TIME	0.377	msec
	OFF TIME	0.870	msec
	Ratio	30.23	%
Packet Type (Mode)		DH1	mode

Antenna Information:

Antenna Model	Antenna Type	Gain(dBi)
Refer to antenna report	PIFA	1.50

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	2402.020	2410.994	2421.020		-----	-----	-----	
Frequency Tolerance		ppm	8.430	-2.406	8.364	±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	0.701				-----	-----	-----	
RF Output Power Tolerance		%	-12.38			-80~+20	**PASS**			
Output Power (With burst ratio)		dBm	11.10				-----	-----	-----	
Unwanted Emission Intensity	Under 2387MHz	µW/MHz	0.02786	0.02535	0.02366	2.5	PASS	**PASS**	PASS	
		MHz	968.915	936.423	944.085		-----	-----	-----	
	2387-2400MHz	µW/MHz	0.81846	0.00526	0.00494	25	PASS	**PASS**	PASS	
		MHz	2399.990	2397.660	2389.870		-----	-----	-----	
	2483.5-2496.5MHz	µW/MHz	0.00509	0.00513	0.00512	25	PASS	**PASS**	PASS	
		MHz	2492.820	2484.800	2487.840		-----	-----	-----	
	2496.5MHz - 12.5GHz	µW/MHz	0.04603	0.04111	0.04345	2.5	PASS	**PASS**	PASS	
		MHz	12399.470	12411.480	12485.500		-----	-----	-----	
Limitation of Collateral Emission of Receiver	Under 1GHz	nW	0.002	0.002	0.002	4	PASS	**PASS**	PASS	
		MHz	974.734	803.546	997.3328		-----	-----	-----	
	1 -12.5GHz	nW	0.025	0.024	0.024	20	PASS	**PASS**	PASS	
		MHz	10492.940	11138.800	10488.150		-----	-----	-----	
Spread Factor		-----	18.38			5	**PASS**			
Dwell Time		mSec	242.85			400	**PASS**			DH5
Radio Interference Prevention Capability		-----	good				**PASS**			

4. TEST RESULTS DATA
BLUETOOTH - AFH EDR

Environment of Test Room	Temperature	23~25 °C
	Humidity	50~55 %
Test Engineer	Ethan Lin	

Modulatoin Type :	8DPSK
Type Emissions :	20M0G1D

Declaration Output Power	0.80	mW/MHz
Declaration Output Power	-0.97	dBm/MHz
Antenna Power (E.I.R.P)	0.53	dBm/MHz
Input Power Voltage	14.000	Vdc

Path Loss		24.60	dB
Burst	ON TIME	0.384	msec
	OFF TIME	0.870	msec
	Ratio	30.64	%
Packet Type (Mode)		3DH1	mode

Antenna Information:

Antenna Model	Antenna Type	Gain(dBi)
Refer to antenna report	PIFA	1.50

4.1. 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	2401.968	2410.968	2420.968		-----	-----	-----	
Frequency Tolerance		ppm	-13.260	-13.210	-13.156	±50	**PASS**	**PASS**	**PASS**	
Occupied Bandwidth		MHz	19.97			83.5	**PASS**			
Spread Bandwidth		MHz	18.45			0.5	**PASS**			
RF Output Power		mW/MHz	0.384				-----	-----	-----	
RF Output Power Tolerance		%	-52.04			-80~+20	**PASS**			
Output Power (With burst ratio)		dBm	8.50				-----	-----	-----	
Unwanted Emission Intensity	Under 2387MHz	µW/MHz	0.03155	0.02449	0.02636	2.5	PASS	**PASS**	PASS	
		MHz	916.928	991.804	493.565		-----	-----	-----	
	2387-2400MHz	µW/MHz	2.90402	0.00502	0.00522	25	PASS	**PASS**	PASS	
		MHz	2399.984	2396.826	2397.294		-----	-----	-----	
	2483.5-2496.5MHz	µW/MHz	0.00490	0.00509	0.00527	25	PASS	**PASS**	PASS	
		MHz	2492.839	2491.975	2489.688		-----	-----	-----	
	2496.5MHz - 12.5GHz	µW/MHz	0.04083	0.04276	0.04217	2.5	PASS	**PASS**	PASS	
		MHz	10549.012	11696.299	11160.165		-----	-----	-----	
Limitation of Collateral Emission of Receiver	Under 1GHz	nW	0.002	0.002	0.002	4	PASS	**PASS**	PASS	
		MHz	986.567	508.308	811.4024		-----	-----	-----	
	1 -12.5GHz	nW	0.022	0.024	0.023	20	PASS	**PASS**	PASS	
		MHz	11175.215	10498.688	11738.668		-----	-----	-----	
Spread Factor		-----	18.45			5	**PASS**			
Dwell Time		mSec	268.89			400	**PASS**			3DH5
Radio Interference Prevention Capability		-----	good				**PASS**			

5. TEST RESULTS DATA
BLUETOOTH - LE

Environment of Test Room	Temperature	23~25 °C
	Humidity	50~55 %
Test Engineer	Ethan Lin	

Modulatoin Type :	GFSK
Type Emissions :	1M07F1D

Declaration Output Power	7.80	mW
Declaration Output Power	8.92	dBm
Antenna Power (E.I.R.P)	10.42	dBm
Input Power Voltage	14.000	Vdc

Path Loss		24.60	dB
Burst	ON TIME	0.406	msec
	OFF TIME	0.220	msec
	Ratio	64.81	%
Packet Type (Mode)		Low Energy	mode

Antenna Information:

Antenna Model	Antenna Type	Gain(dBi)
Refer to antenna report	PIFA	1.50

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	2402.000	2439.997	2479.997		-----	-----	-----	
Frequency Tolerance	ppm	0.000	-1.189	-1.169	-50≦x≦+50	**PASS**	**PASS**	**PASS**	

Occupied Bandwidth	MHz	1.07	1.07	1.07	26	**PASS**
Spreading Bandwidth	MHz		N/A		0.5	**N/A**
RF Output Power	mW	7.762	7.244	6.607	10mW	-----
RF Output Power Tolerance	%	-0.48	-7.12	-15.30	-80≦x≦+20	**PASS**
Output Power (With burst ratio)	dBm	8.90	8.60	8.20	10dBm	-----

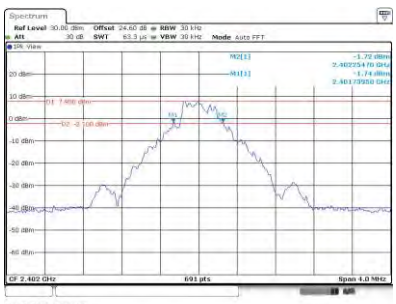
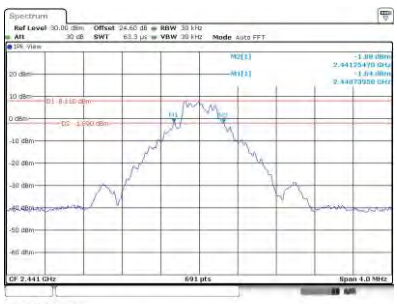
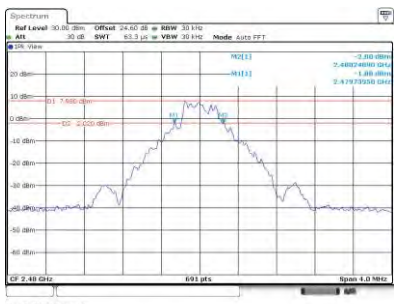
Unwanted Emission Intensity	Under 2387MHz	µW/MHz	0.03396	0.03162	0.02972	2.5	**PASS**	**PASS**	**PASS**	
		MHz	982.687	882.399	322.571		-----	-----	-----	
	2387MHz - 2400MHz	µW/MHz	1.19674	0.00518	0.00552	25	**PASS**	**PASS**	**PASS**	
		MHz	2399.990	2388.705	2395.339		-----	-----	-----	
	2483.5MHz - 2496.5MHz	µW/MHz	0.00556	0.00568	0.01135	25	**PASS**	**PASS**	**PASS**	
		MHz	2489.305	2483.607	2483.516		-----	-----	-----	
	2496.5MHz - 12.5GHz	µW/MHz	0.03622	0.03908	0.03459	2.5	**PASS**	**PASS**	**PASS**	
		MHz	12299.450	6891.098	6974.119		-----	-----	-----	
Limitation of Collateral Emission of Receiver	Under 1GHz	nW	0.002	0.002	0.002	4	**PASS**	**PASS**	**PASS**	
		MHz	917.704	947.286	957.179		-----	-----	-----	
	1 -12.5GHz	nW	0.026	0.024	0.025	20	**PASS**	**PASS**	**PASS**	
		MHz	10329.077	10105.804	11187.672		-----	-----	-----	

Spread Factor	-----	N/A	5	**N/A**
Dwell Time	mSec	N/A	400	**N/A**
Radio Interference Prevention Capability	-----	good		**PASS**

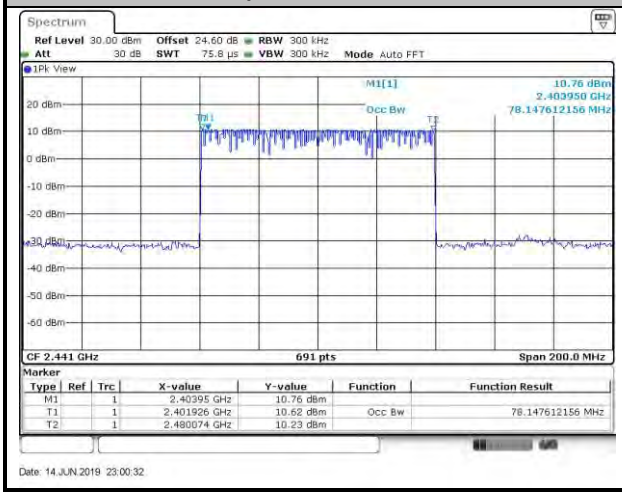
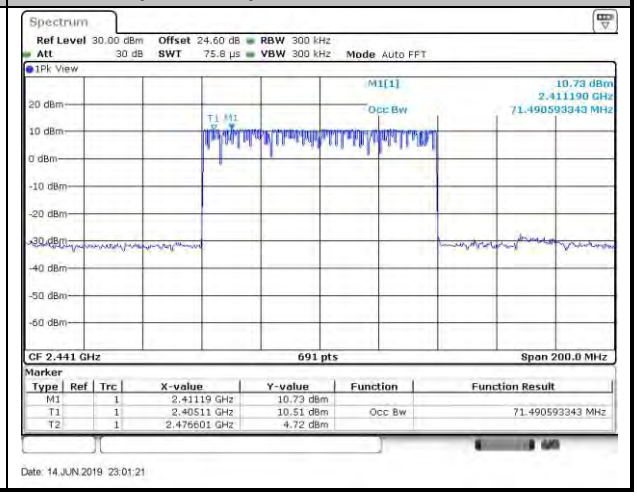
Appendix C. Test Plots

C.1. BR (Basic Rate)

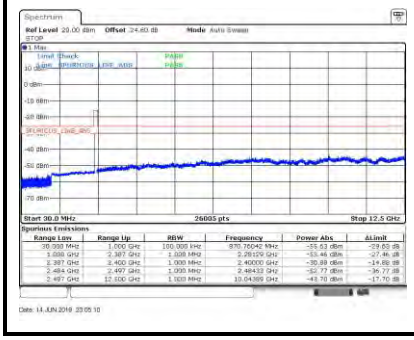
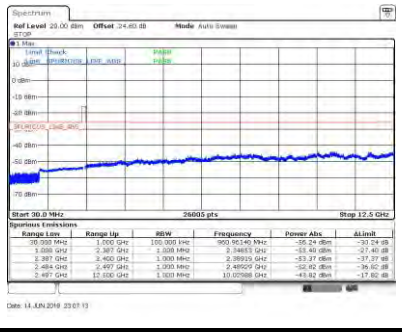
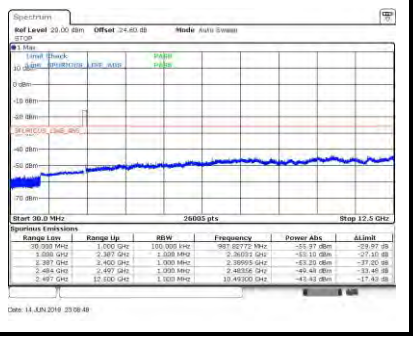
C.1.1. Frequency Tolerance

Low Channel	Middle Channel	High Channel
		

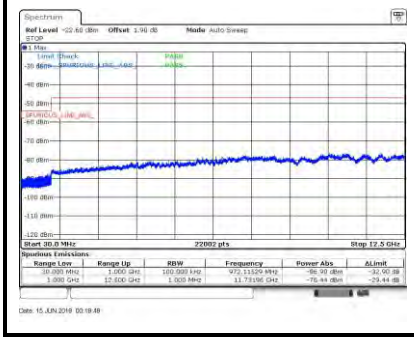
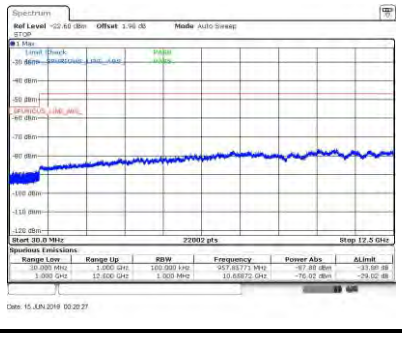
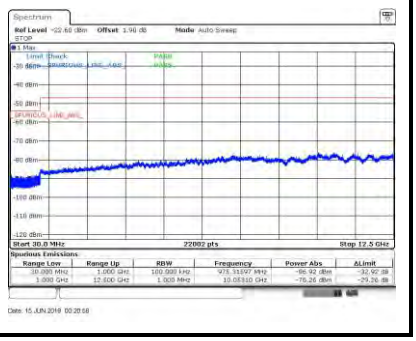
C.1.2. Occupied Bandwidth and Spread-spectrum Bandwidth

Occupied Bandwidth	Spread-spectrum Bandwidth
	

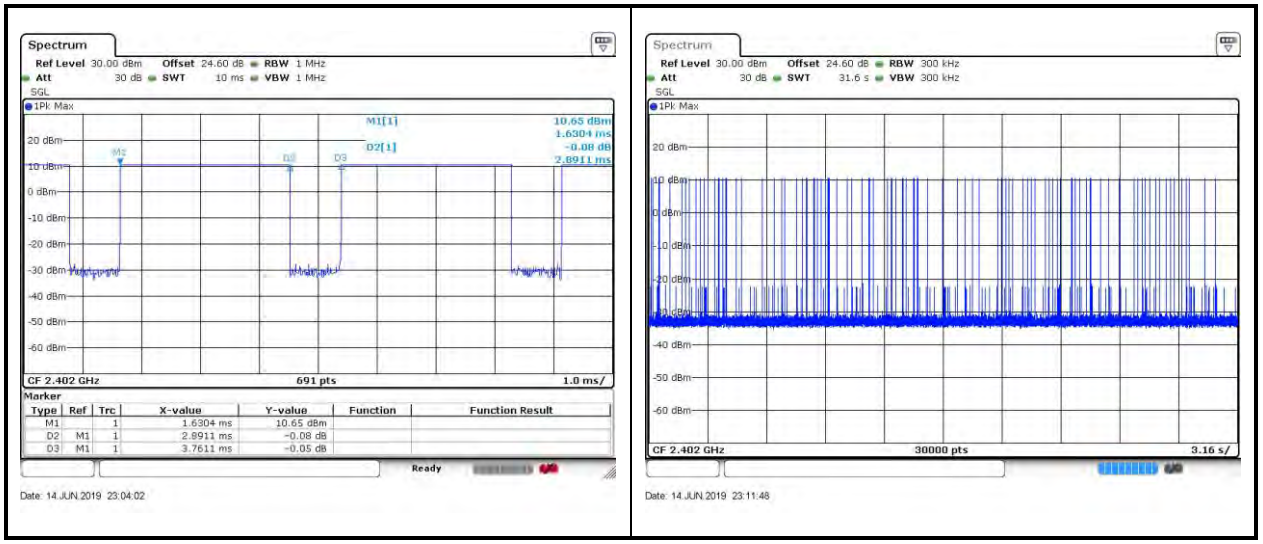
C.1.3. Unwanted Emission Intensity

Low Channel	Middle Channel	High Channel
		

C.1.4. Limitation of Collateral Emission of Receiver

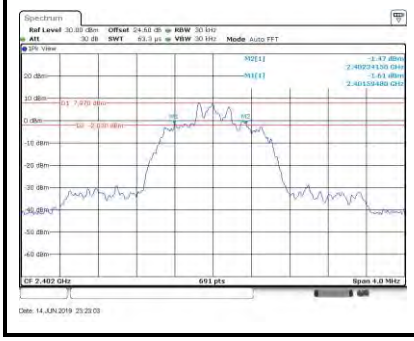
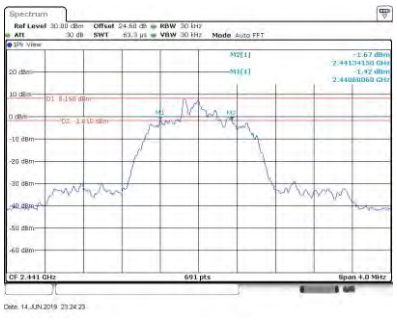
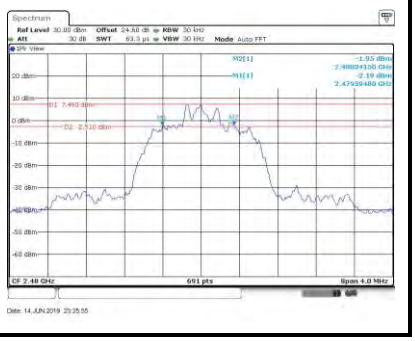
Low Channel	Middle Channel	High Channel
		

C.1.5. Hopping Frequency Dwell Time

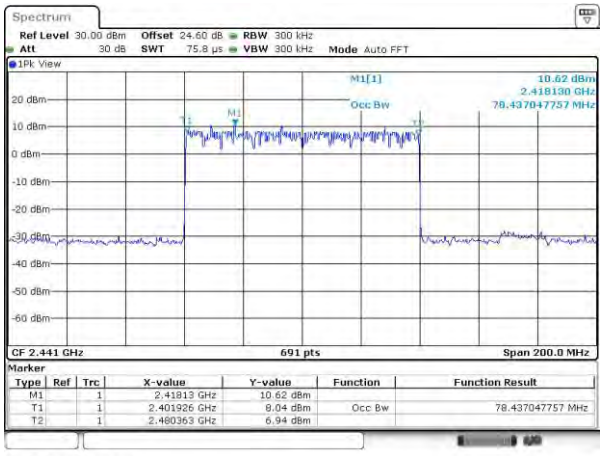
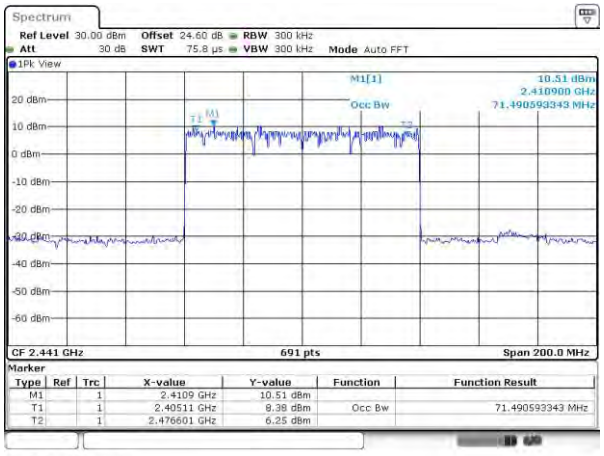


C.2. EDR (Enhanced Data Rate)

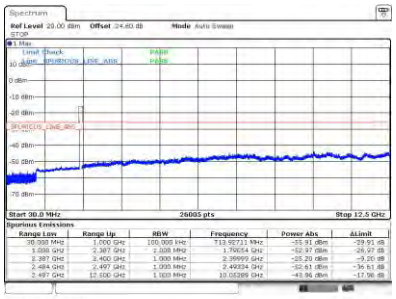
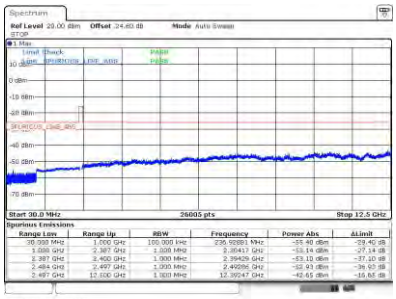
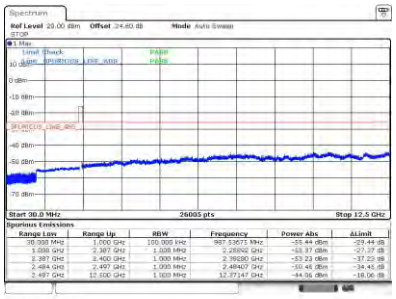
C.2.1. Frequency Tolerance

Low Channel	Middle Channel	High Channel
		

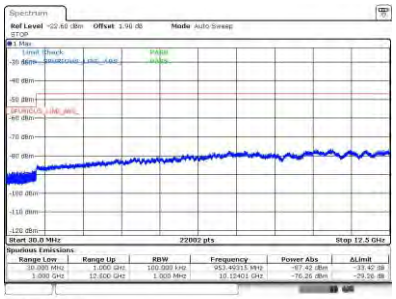
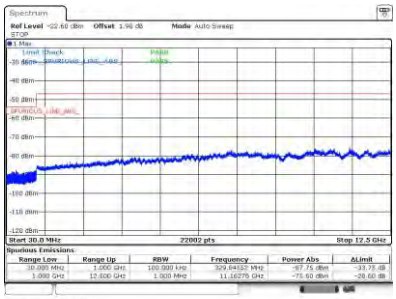
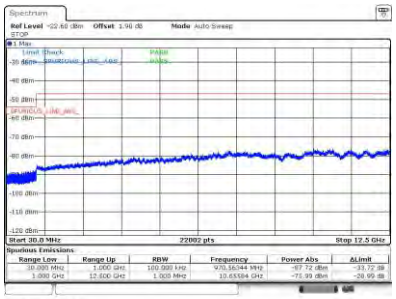
C.2.2. Occupied Bandwidth and Spread-spectrum Bandwidth

Occupied Bandwidth	Spread-spectrum Bandwidth
	

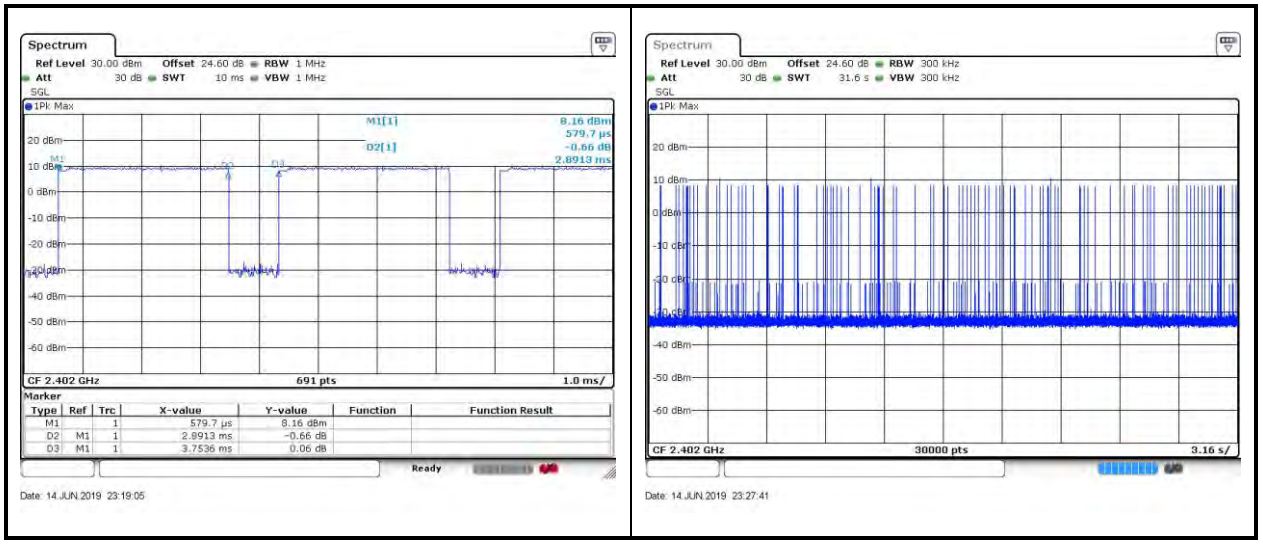
C.2.3. Unwanted Emission Intensity

Low Channel	Middle Channel	High Channel
		

C.2.4. Limitation of Collateral Emission of Receiver

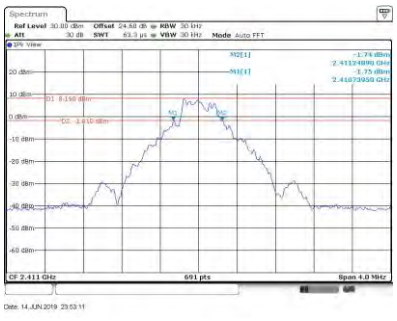
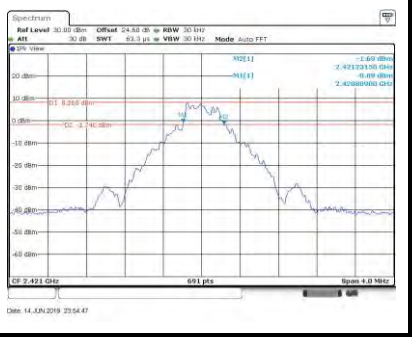
Low Channel	Middle Channel	High Channel
		

C.2.5. Hopping Frequency Dwell Time

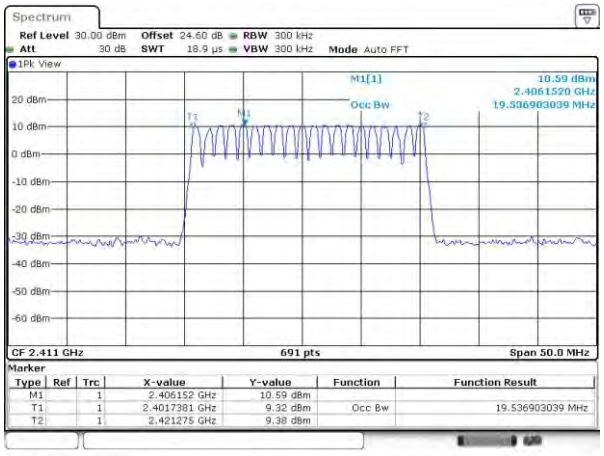
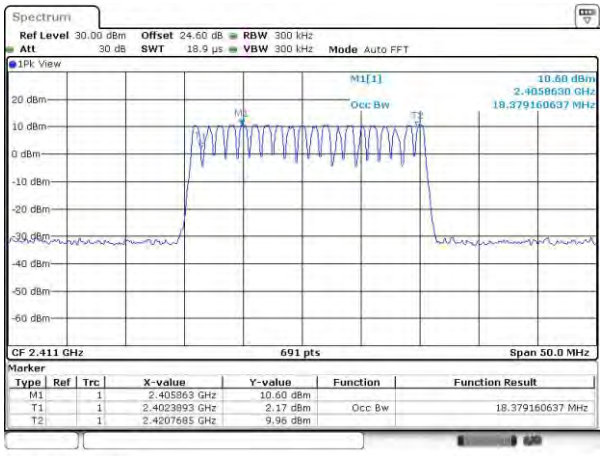


C.3. BR_AFH (Adaptive Frequency Hopping)

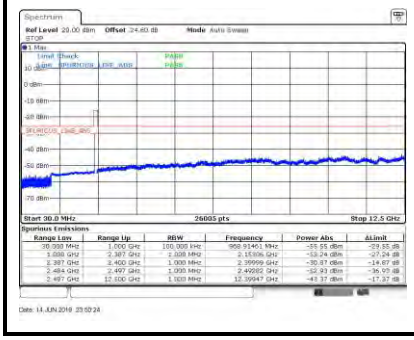
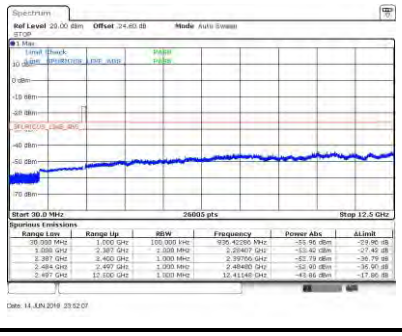
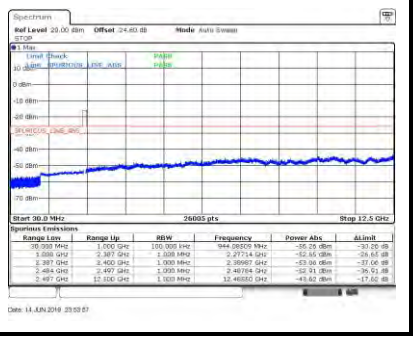
C.3.1. Frequency Tolerance

Low Channel	Middle Channel	High Channel
		

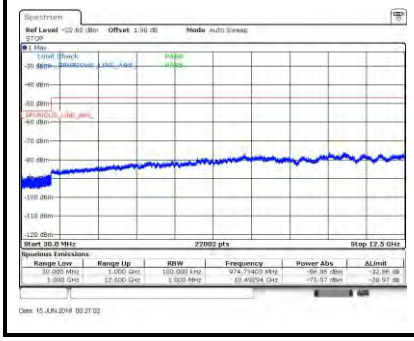
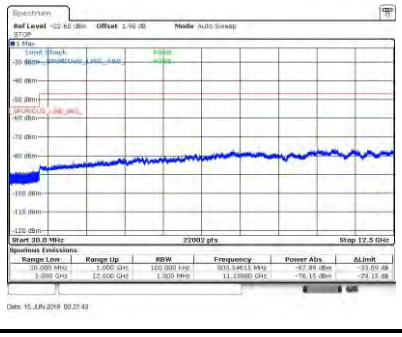
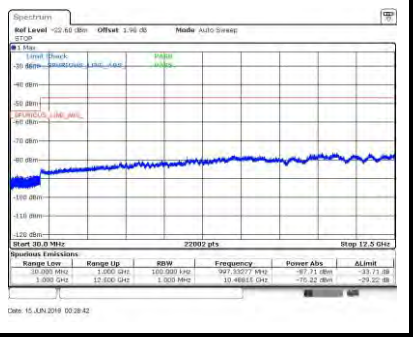
C.3.2. Occupied Bandwidth and Spread-spectrum Bandwidth

Occupied Bandwidth	Spread-spectrum Bandwidth
	

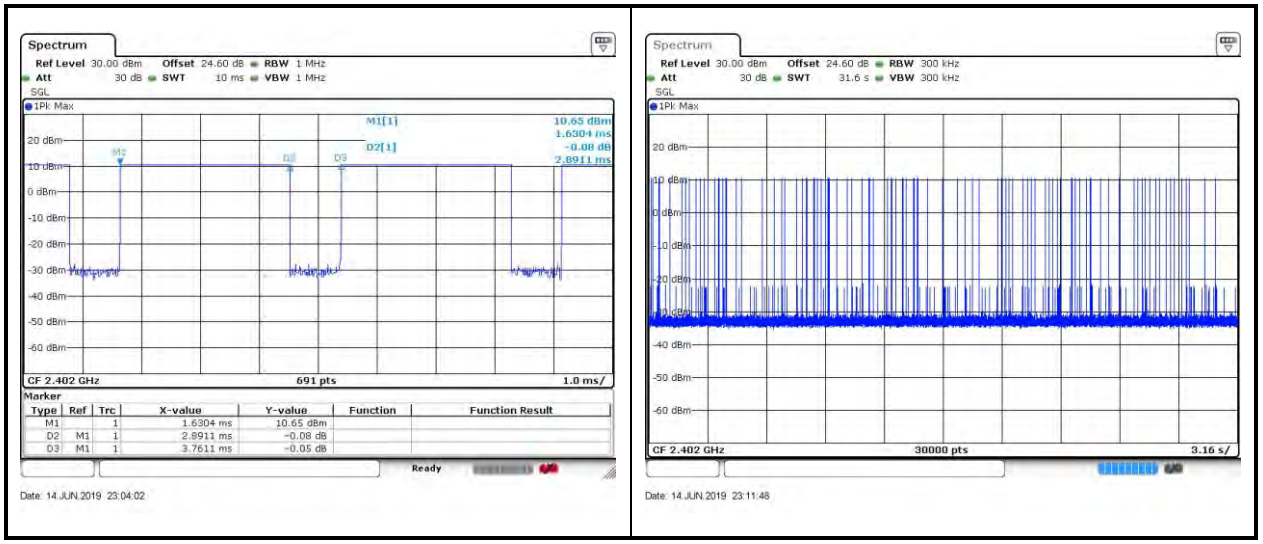
C.3.3. Unwanted Emission Intensity

Low Channel	Middle Channel	High Channel
		

C.3.4. Limitation of Collateral Emission of Receiver

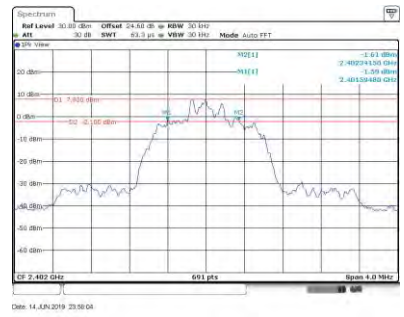
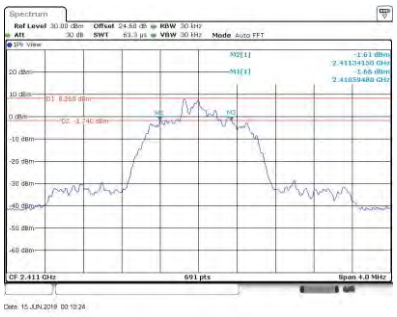
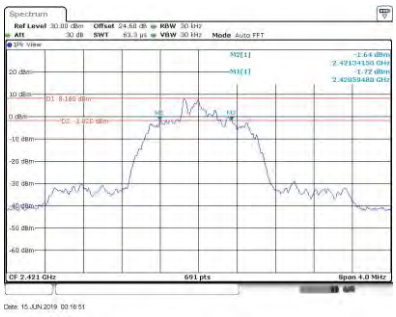
Low Channel	Middle Channel	High Channel
		

C.3.5. Hopping Frequency Dwell Time

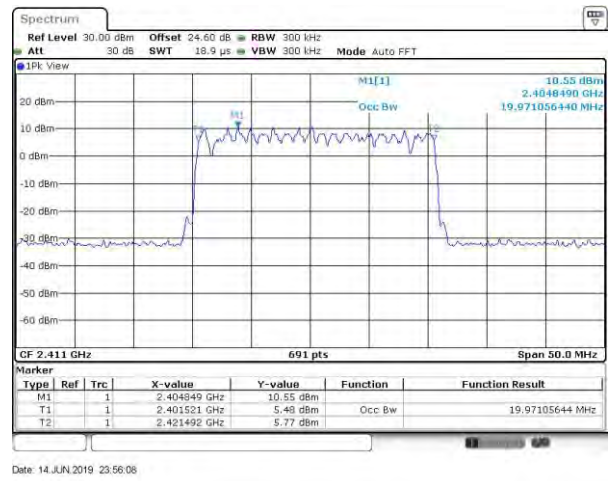
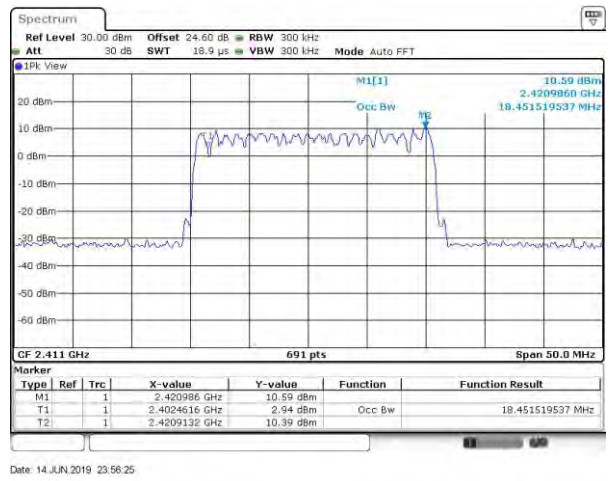


C.4. EDR_AFH (Adaptive Frequency Hopping)

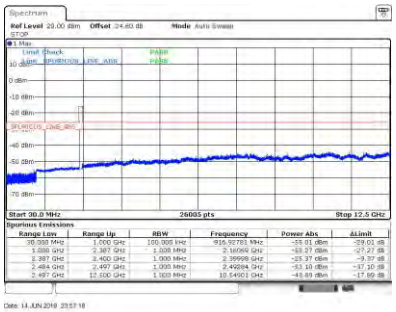
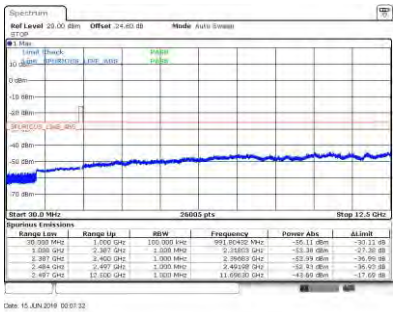
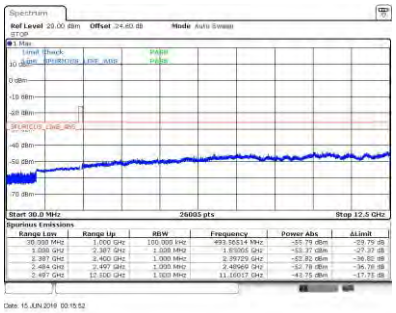
C.4.1. Frequency Tolerance

Low Channel	Middle Channel	High Channel
		

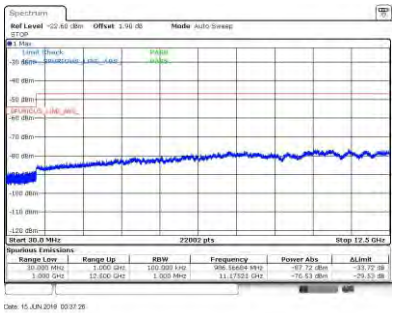
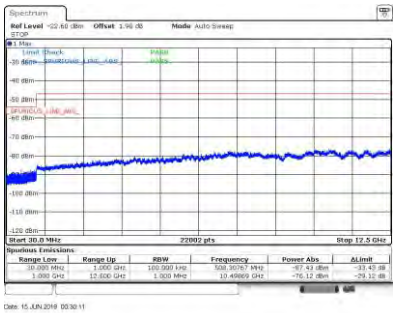
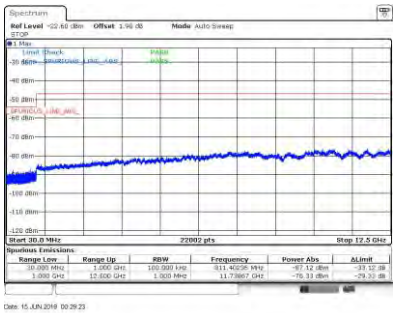
C.4.2. Occupied Bandwidth and Spread-spectrum Bandwidth

Occupied Bandwidth	Spread-spectrum Bandwidth
	

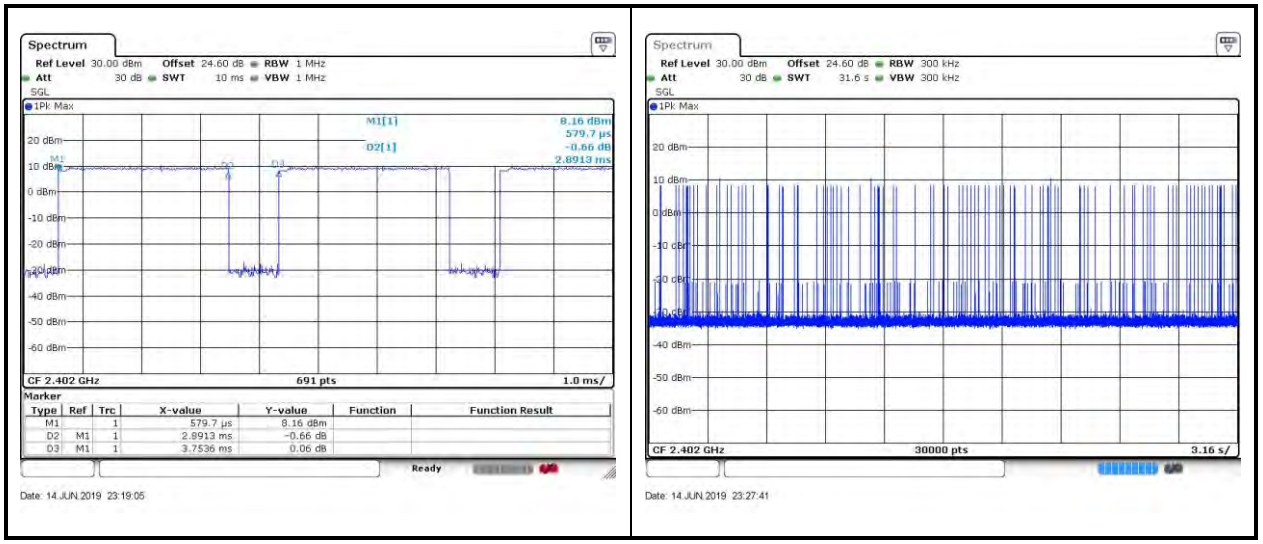
C.4.3. Unwanted Emission Intensity

Low Channel	Middle Channel	High Channel
		

C.4.4. Limitation of Collateral Emission of Receiver

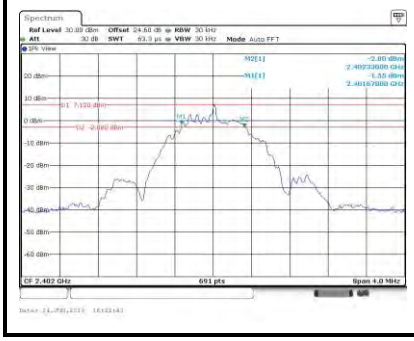
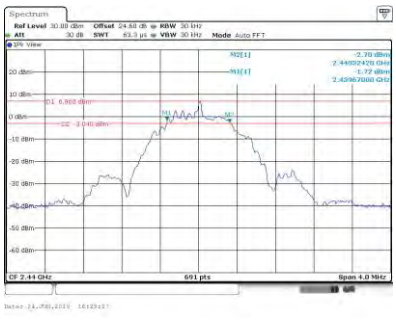
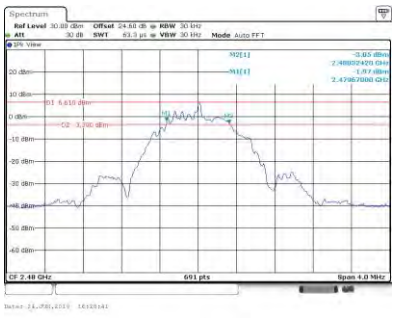
Low Channel	Middle Channel	High Channel
		

C.4.5. Hopping Frequency Dwell Time

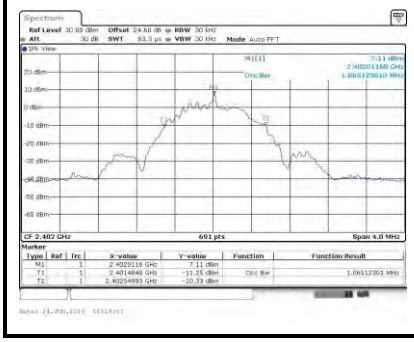
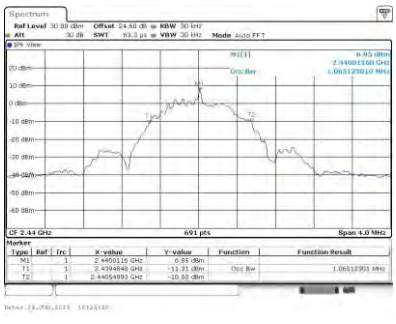
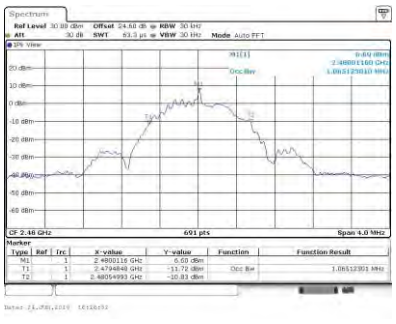


C.5. LE_1M (Low Energy)

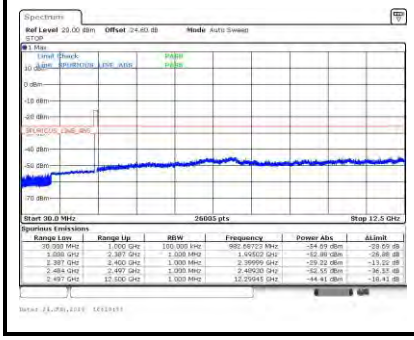
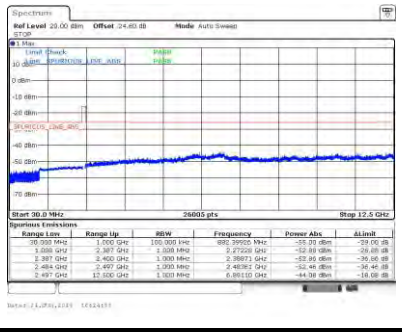
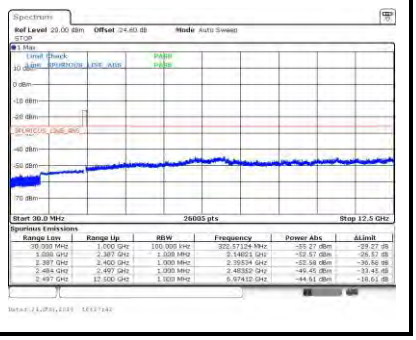
C.5.1. Frequency Tolerance

Low Channel	Middle Channel	High Channel
		

C.5.2. Occupied Bandwidth

Low Channel	Middle Channel	High Channel
		

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