



JAPAN RADIO TEST REPORT

Low Energy

Product Name : Wireless Remote
Model Name : L5B83G
Applicant : Bluff Arches Cay LLC
6991 East Camelback Rd., SuiteD-300
Scottsdale, Arizona, 85251
Type Emissions : 1M16F1D (LE_1M)
2M10F1D (LE_2M)
Declaration : 2 mW (LE_1M)
Output Power : 2 mW (LE_2M)
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 Apr. 30, 2020 and testing was started from Jun. 23, 2020 and completed on Jun. 23, 2020. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, 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. 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.)



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History of This Test Report

Report No.	Version	Description	Issued Date
JR050121	01	Initial issue of report	Jul. 17, 2020



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	NA
3.10	Construction Protection Confirmation	Pass

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: William Chen

Report Producer: Yimin Ho



1 General Description

1.1 Feature of Equipment Under Test

Product Feature & Specification	
Product Name	Wireless Remote
Model Name	L5B83G
Support Category / Frequency Range	Article 2-1-19 / 2400MHz ~ 2483.5MHz
Type of Modulation	<input type="checkbox"/> Direct Spreading (DS) <input type="checkbox"/> Orthogonal frequency-division multiplexing (OFDM) <input type="checkbox"/> Frequency Hopping (FH) <input checked="" type="checkbox"/> Other : GFSK
Number of Channels	BR/EDR Mode NA
	AFH Mode NA
	Other : Low Energy 40
Channel Spacing	BR/EDR/AFH Mode NA
	Other : Low Energy 2MHz
Declaration RF Output Power	2 mW (LE_1M) 2 mW (LE_2M)
Antenna Power (E.I.R.P)	7.59 dBm (LE_1M) 7.59 dBm (LE_2M)
Modulation	<input checked="" type="checkbox"/> GFSK <input type="checkbox"/> $\pi/4$ -DQPSK <input type="checkbox"/> 8-DPSK <input type="checkbox"/> Other : FSK
Power Source <small>NOTE</small>	<input type="checkbox"/> Commercial power AC 100 ~ 240V
	<input type="checkbox"/> External Power Source DC 5V, 2.0A
	<input type="checkbox"/> Lithium battery DC 3.7V
	<input checked="" type="checkbox"/> UM battery DC 3V

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

Power Supply voltage 3.000 Vdc (Nominal)	Power Supply voltage 3.300 Vdc (+10%)	Power Supply voltage 2.700 Vdc (-10%)
3.395	3.395	3.395
Measurement point		
		

Antenna Information		
Main Antenna	Antenna Type : PCB Inverted F type	Antenna Gain : 4.58 dBi

Remark: The above EUT's information was declared by manufacturer.

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. EMC & Wireless Communications Laboratory
Test Site Location	No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-3273456 / FAX: +886-3-3284978
Test Site No.	Sporton Site No.: TH05-HY

Test Items	Uncertainty	Remark
Occupied Channel Bandwidth	$\pm 3.27\%$	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:

- All test items were verified and recorded according to the standards and without any deviation during the test.
- 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	2402	14	2430	28	2458
1	2404	15	2432	29	2460
2	2406	16	2434	30	2462
3	2408	17	2436	31	2464
4	2410	18	2438	32	2466
5	2412	19	2440	33	2468
6	2414	20	2442	34	2470
7	2416	21	2444	35	2472
8	2418	22	2446	36	2474
9	2420	23	2448	37	2476
10	2422	24	2450	38	2478
11	2424	25	2452	39	2480
12	2426	26	2454		
13	2428	27	2456		

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	$\leq \pm 50\text{ppm}$

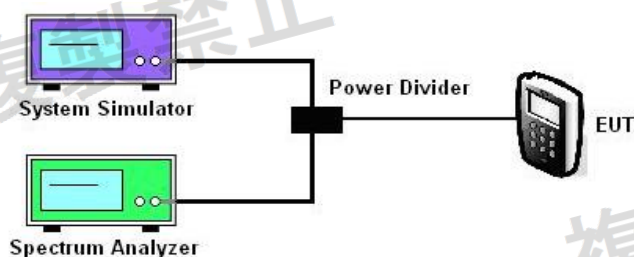
3.1.2 Measuring Instruments

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 $(f - f_c)/f_c \times 10^6 \text{ ppm}$ and the limit is less than $\pm 50\text{ppm}$.

3.1.4 Test Setup



3.1.5 Test Result of Frequency Tolerance

Please refer to Appendix A.

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

3.2.1 Limit

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

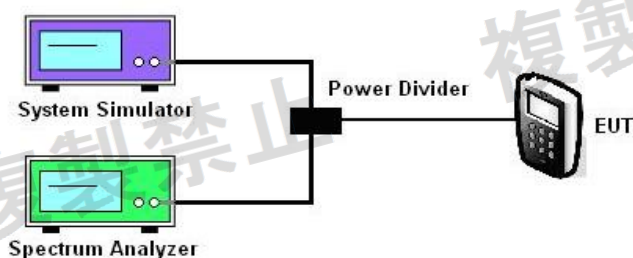
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Test Procedures

- Setting of SA is following as: RBW \leq 3% of bandwidth / VBW = RBW / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold.
- 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).
- SA set to 90% of occupied bandwidth to measure Spread Spectrum Bandwidth and must greater than 500kHz.
- Spread Spectrum Factor = Spread Spectrum Bandwidth / modulation rate of EUT.
- 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 A.

3.3 Unwanted Emission Intensity Measurement

3.3.1 Limit

Item	Limits
Tx Spurious Emission	$\leq 2.5 \mu\text{W}$ ($2387\text{MHz} > f ; 2496.5\text{MHz} < f$)
	$\leq 25 \mu\text{W}$ ($2387\text{MHz} \leq f < 2400\text{MHz}$) and ($2483.5\text{MHz} < f \leq 2496.5\text{MHz}$)

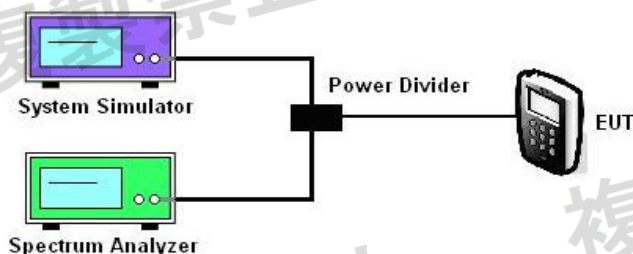
3.3.2 Measuring Instruments

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 2.5 μW .
5. SA adjusted to start frequency 2387MHz and stop frequency 2400MHz. Then to mark peak reading value + cable loss shall be less than 25 μW .
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 25 μW .
7. SA adjusted to start frequency 2496.5MHz and stop frequency 12500MHz Then to mark peak reading value + cable loss shall be less than 2.5 μW .
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 A.

3.4 RF Output Power / Tolerance

3.4.1 Limit

Item	Limits
Antenna Power Density	$\leq 3\text{mW/MHz}$ (FH form 2400 ~ 2483.5MHz)
	$\leq 10\text{mW/MHz}$ (OFDM,DS from 2400 ~ 2483.5MHz)
	$\leq 10\text{mW}$ (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 + $10 \log_{10} (1/\text{Duty Cycle})$ dB + $10 \log_{10} (1/\text{Spread Bandwidth})$ 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

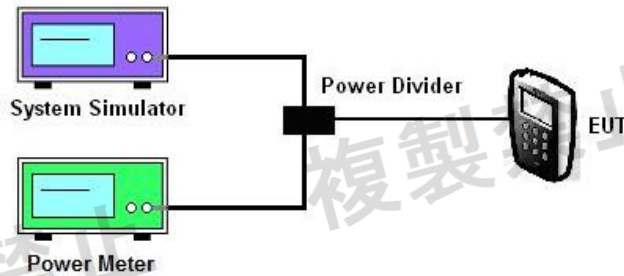
Sweep Mode: Continuous sweep

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 A.

3.5 Limitation of Collateral Emission of Receiver Measurement

3.5.1 Limit

Item	Limits	
Rx Spurious Emission	$\leq 4\text{nW}$	($f < 1\text{GHz}$)
	$\leq 20\text{nW}$	($1\text{GHz} \leq f$)

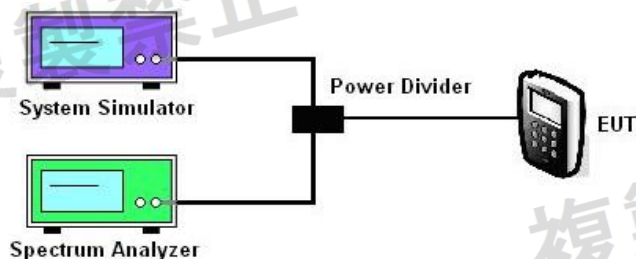
3.5.2 Measuring Instruments

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 $f < 1\text{GHz}$, 2nW for $f \geq 1\text{GHz}$), 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 A.

3.6 Transmission Antenna Gain (EIRP Antenna Power) Measurement

3.6.1 Limit

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

3.6.2 Measuring Instruments

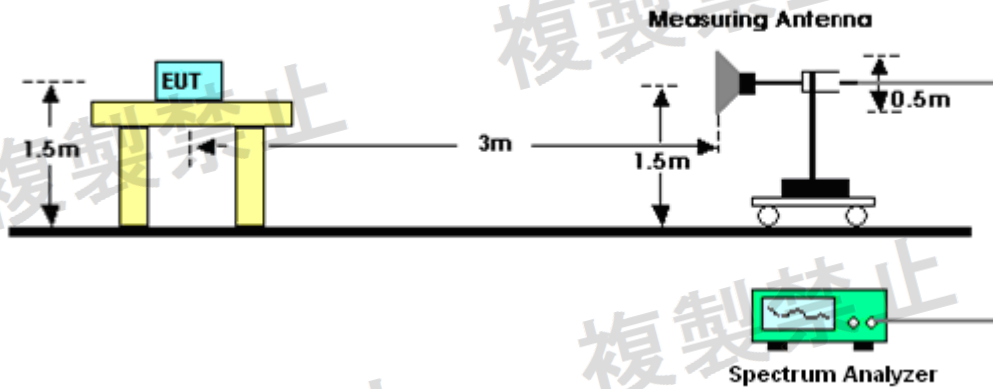
See list of measuring instruments of this test report.

3.6.3 Test Procedures

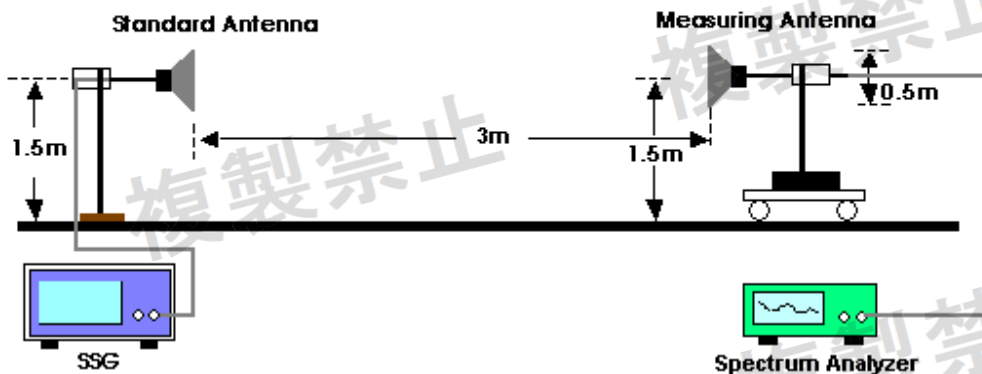
1. Set EUT ad measuring antenna at the same height and roughly facing each other.
2. Move the measuring antenna height up and down within $\pm 50\text{cm}$ of EUT height and swing it to find the maximum output of the measuring antenna. The output level at the spectrum analyzer is read as "E".
3. Remove 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 $\pm 50\text{cm}$ 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 ($\pm 1\text{dB}$). Record the Pt.
7. Calculate EIRP by the formula below $\text{EIRP} = \text{Gt} - \text{L} + \text{Pt}$.
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 A. 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 Beam-width) Measurement

3.7.1 Limit

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

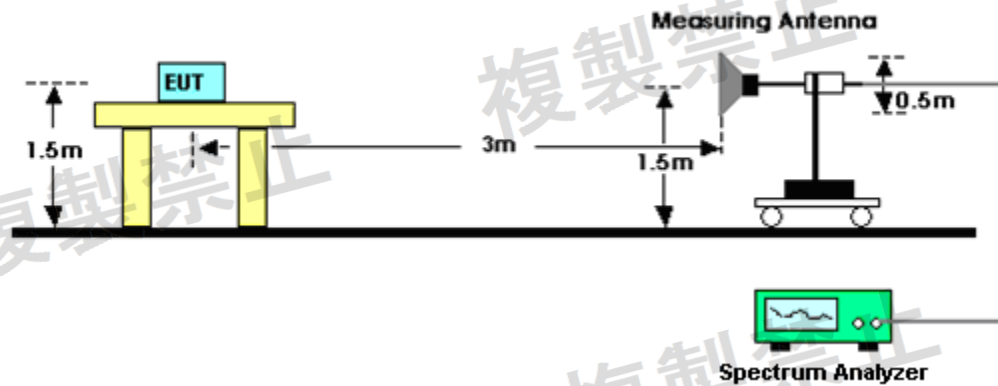
3.7.2 Measuring Instruments

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 $\pm 50\text{cm}$ 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 $A = 1$).
 $A = \{\text{EIRP Power [mW]} / 16.36 \text{ for DS, OFDM}\}$ or
 $A = \{\text{EIRP Power [mW]} / 4.9 \text{ for FH}\}$

3.7.4 Test Setup



3.7.5 Test Result of Transmission Radiation Angle Width (3dB Beam-width)

Please refer to Appendix A.

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 12.14 dBm/MHz.

3.8 Radio Interference Prevention Capability Measurement

3.8.1 Limit

Item	Limits
Identification code	≥ 48 bits

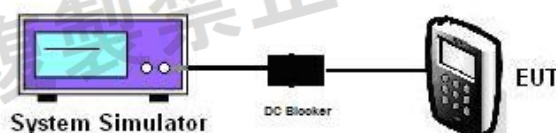
3.8.2 Measuring Instruments

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 A.

3.9 Hopping Frequency Dwell Time Measurement

3.9.1 Limit

Item	Limits
Hopping Freq. Dwell Time	≤ 0.4 seconds

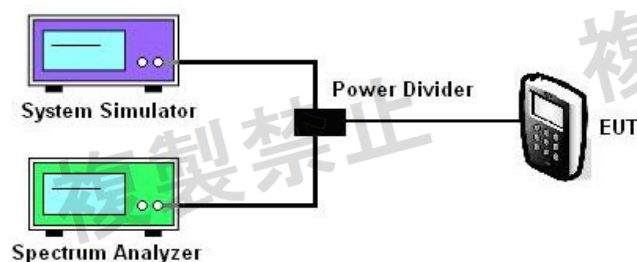
3.9.2 Measuring Instruments

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

Not Applicable.

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

<input type="checkbox"/>	Sealed with special screws.
<input type="checkbox"/>	Plastic chassis is being welded using ultrasonic waves.
<input type="checkbox"/>	Chassis is glued using a special adhesive.
<input type="checkbox"/>	Metal covers are spot-fused.
<input checked="" type="checkbox"/>	Cover is specially interlocked.
<input type="checkbox"/>	RF and Modulation components are covered with shielding case and this shielding case is soldered.
<input type="checkbox"/>	Shield case is welded at RF and modulation parts, and ID-ROM is welded using the BGA Method.
<input type="checkbox"/>	Shield case is welded at RF and modulation parts, and ID-ROM is glued at its lead with a special adhesive.
<input type="checkbox"/>	Shield case is welded at RF and modulation parts, and ID-ROM is glued with a non-transparent laminating agent.
<input type="checkbox"/>	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	Aug. 13, 2019	Jun. 23, 2020	Aug. 12, 2020	Rohde & Schwarz	C
Power Sensor	DARE	RPR3006W	17I00015SNO37	Dec. 04, 2019	Jun. 23, 2020	Dec. 04, 2020	ETC, R.O.C	C
Programmable Power Supply	GW Instek	PSS-2005	EL890094	Oct. 09, 2019	Jun. 23, 2020	Oct. 08, 2020	GW Instek	C
Multimeter	GW Instek	GDM-461	GUT210214	Feb. 06, 2020	Jun. 23, 2020	Feb. 05, 2021	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. Test Results

Please refer to the following pages for test results.

1. TEST RESULTS DATA BLUETOOTH - LE 1M

Environment of Test Room	Temperature	23.9 °C
	Humidity	53.3 %
Test Engineer	Derek Hsu	

Modulation Type :	GFSK
Type Emissions :	1M16F1D

Declaration Output Power	2.000	mW
Declaration Output Power	3.01	dBm
Antenna Power (E.I.R.P.)	7.59	dBm
Input Power Voltage	3.000	Vdc

Path Loss		1.90	dB
Burst	ON TIME	0.391	msec
	OFF TIME	0.232	msec
	Ratio	62.79	%
Packet Type (Mode)		Low Energy	mode

Antenna Information:

Antenna Model	Antenna Type	Gain(dBi)
Refer to antenna report	PCB Inverted F type	4.58

1.1. 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	2401.954	2439.954	2479.948		-----	-----	-----	
Frequency Tolerance	ppm	-19.276	-18.975	-21.008	$-50 \leq x \leq +50$	PASS	PASS	PASS	

Occupied Bandwidth	MHz	1.16	1.13	1.14	26	PASS	
Spreading Bandwidth	MHz	N/A			0.5	N/A	
RF Output Power	mW	1.950	1.820	1.738	10mW	-----	
RF Output Power Tolerance	%	-2.51	-9.01	-13.11	$-80 \leq x \leq +20$	PASS	
Output Power (With burst ratio)	dBm	2.90	2.60	2.40	10dBm	-----	

Unwanted Emission Intensity	Under 2387MHz	μ W/MHz	0.00035	0.00056	0.00028	2.5	PASS	PASS	PASS	
		MHz	2385.267	746.419	2273.669		-----	-----	-----	
	2387MHz - 2400MHz	μ W/MHz	1.78649	0.00020	0.00015	25	PASS	PASS	PASS	
		MHz	2399.984	2397.736	2392.824		-----	-----	-----	
	2483.5MHz - 2496.5MHz	μ W/MHz	0.00016	0.00017	0.00558	25	PASS	PASS	PASS	
		MHz	2494.392	2488.116	2484.283		-----	-----	-----	
	2496.5MHz - 12.5GHz	μ W/MHz	0.01479	0.01459	0.01148	2.5	PASS	PASS	PASS	
		MHz	9606.777	9758.815	9918.855		-----	-----	-----	
Limitation of Collateral Emission of Receiver	Under 1GHz	nW	0.019	0.032	0.025	4	PASS	PASS	PASS	
		MHz	943.988	951.262	729.737		-----	-----	-----	
	1 -12.5GHz	nW	0.693	0.480	0.938	20	PASS	PASS	PASS	
		MHz	2461.816	9747.417	2463.732		-----	-----	-----	

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

2. TEST RESULTS DATA

BLUETOOTH - LE 2M

Environment of Test Room	Temperature	23.9 °C
	Humidity	53.3 %
Test Engineer	Derek Hsu	

Modulation Type :	GFSK
Type Emissions :	2M10F1D

Declaration Output Power	2.000	mW
Declaration Output Power	3.01	dBm
Antenna Power (E.I.R.P.)	7.59	dBm
Input Power Voltage	3.000	Vdc

Path Loss		1.90	dB
Burst	ON TIME	0.206	msec
	OFF TIME	0.420	msec
	Ratio	32.87	%
Packet Type (Mode)		Low Energy	mode

Antenna Information:

Antenna Model	Antenna Type	Gain(dBi)
Refer to antenna report	PCB Inverted F type	4.58

2.1. 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	2439.913	2479.913		-----	-----	-----	
Frequency Tolerance	ppm	-6.016	-35.574	-35.000	$-50 \leq x \leq +50$	PASS	PASS	PASS	

Occupied Bandwidth	MHz	2.10	2.08	2.08	26	PASS			
Spreading Bandwidth	MHz	N/A			0.5	N/A			
RF Output Power	mW	1.905	1.820	1.738	10mW	-----			
RF Output Power Tolerance	%	-4.73	-9.01	-13.11	$-80 \leq x \leq +20$	PASS			
Output Power (With burst ratio)	dBm	2.80	2.60	2.40	10dBm	-----			

Unwanted Emission Intensity	Under 2387MHz	μ W/MHz	0.00030	0.00025	0.00021	2.5	PASS	PASS	PASS	
		MHz	951.262	2129.494	729.349		-----	-----	-----	
	2387MHz - 2400MHz	μ W/MHz	14.45440	0.00016	0.00018	25	PASS	PASS	PASS	
		MHz	2399.990	2391.252	2388.900		-----	-----	-----	
	2483.5MHz - 2496.5MHz	μ W/MHz	0.00015	0.00018	0.01047	25	PASS	PASS	PASS	
		MHz	2487.239	2485.101	2483.536		-----	-----	-----	
	2496.5MHz - 12.5GHz	μ W/MHz	0.01225	0.01242	0.00741	2.5	PASS	PASS	PASS	
		MHz	9609.778	9759.815	9919.855		-----	-----	-----	
Limitation of Collateral Emission of Receiver	Under 1GHz	nW	0.022	0.038	0.022	4	PASS	PASS	PASS	
		MHz	951.165	746.807	621.398		-----	-----	-----	
	1 -12.5GHz	nW	0.481	0.468	1.062	20	PASS	PASS	PASS	
		MHz	2463.732	9739.751	2458.941		-----	-----	-----	

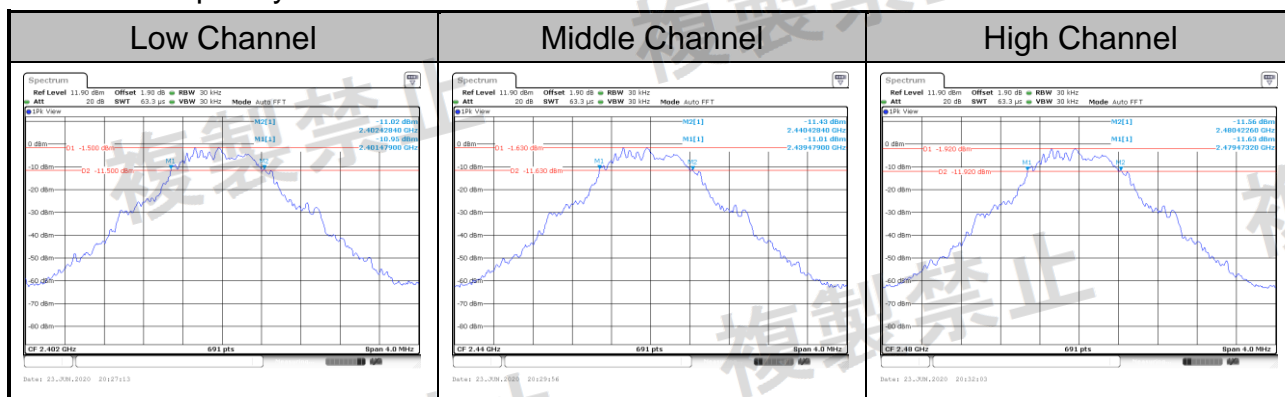
Spread Factor	-----	N/A			5	N/A			
Dwell Time	mSec	N/A			400	N/A			
Radio Interference Prevention Capability	-----	good				PASS			



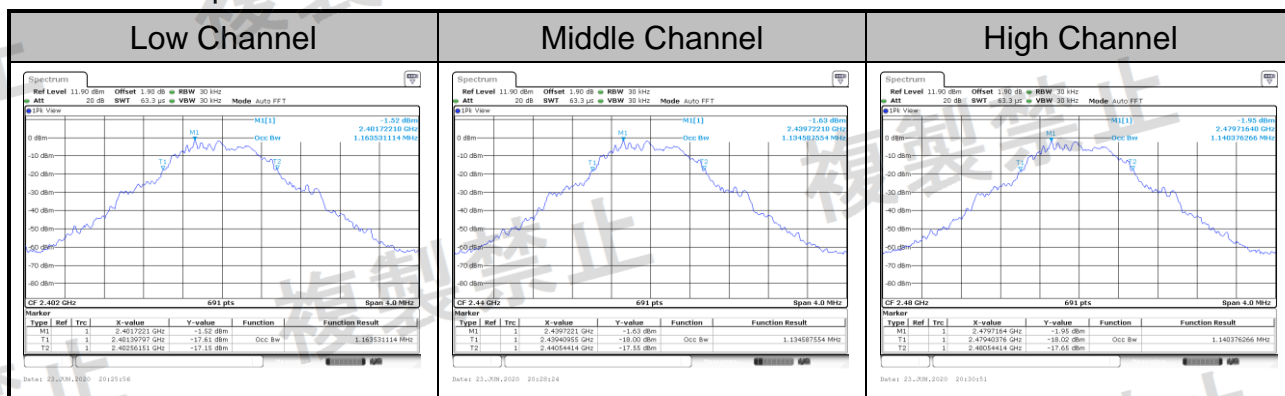
Appendix B. Test Plots

B.1. LE_1M (Low Energy)

B.1.1. Frequency Tolerance

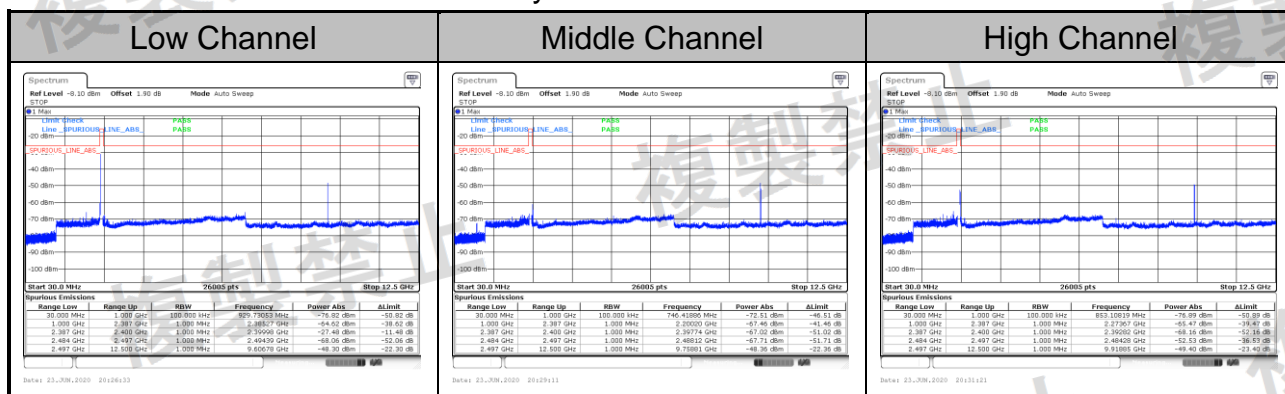


B.1.2. Occupied Bandwidth

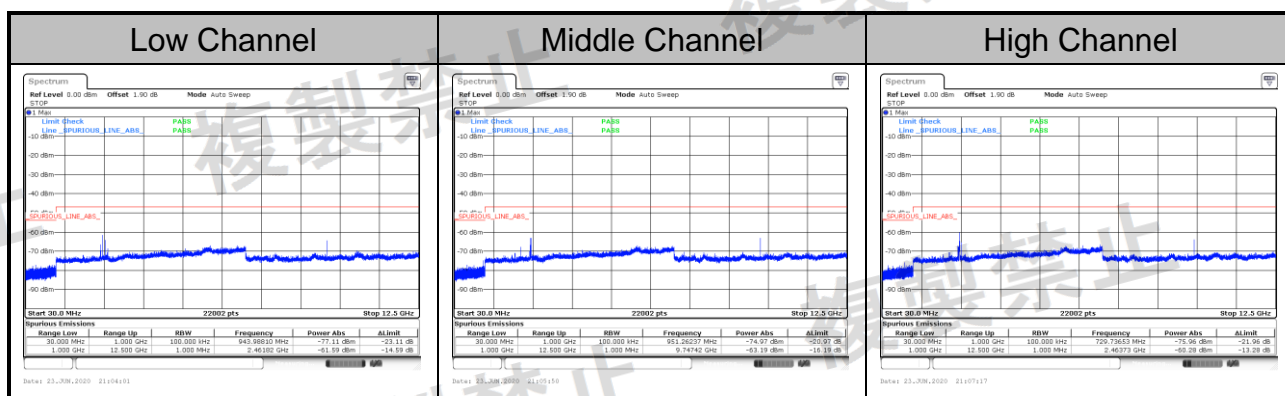




B.1.3. Unwanted Emission Intensity



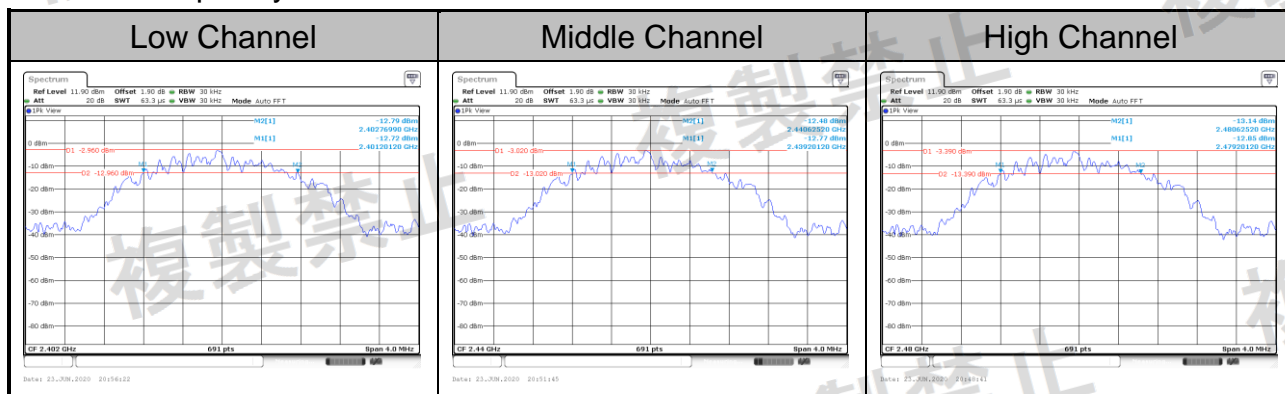
B.1.4. Limitation of Collateral Emission of Receiver



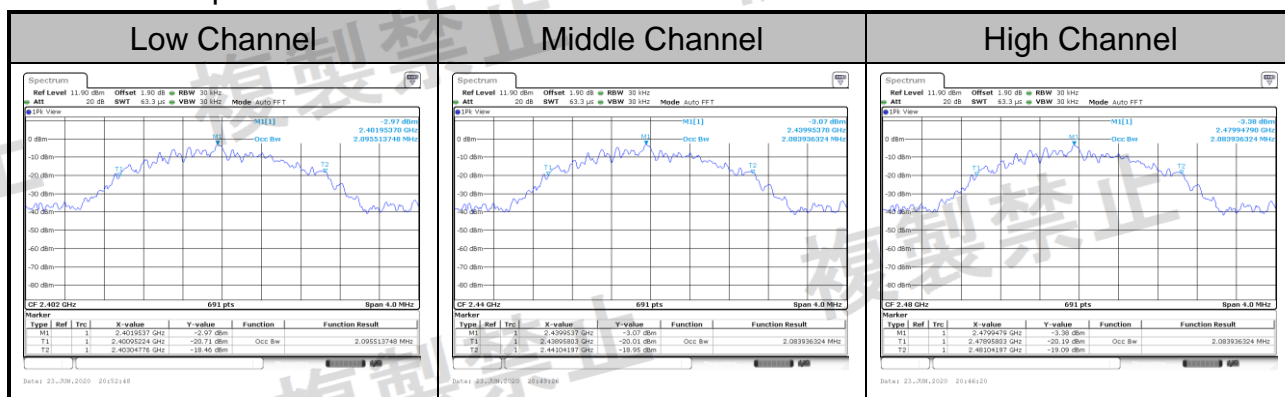


B.2. LE_2M (Low Energy)

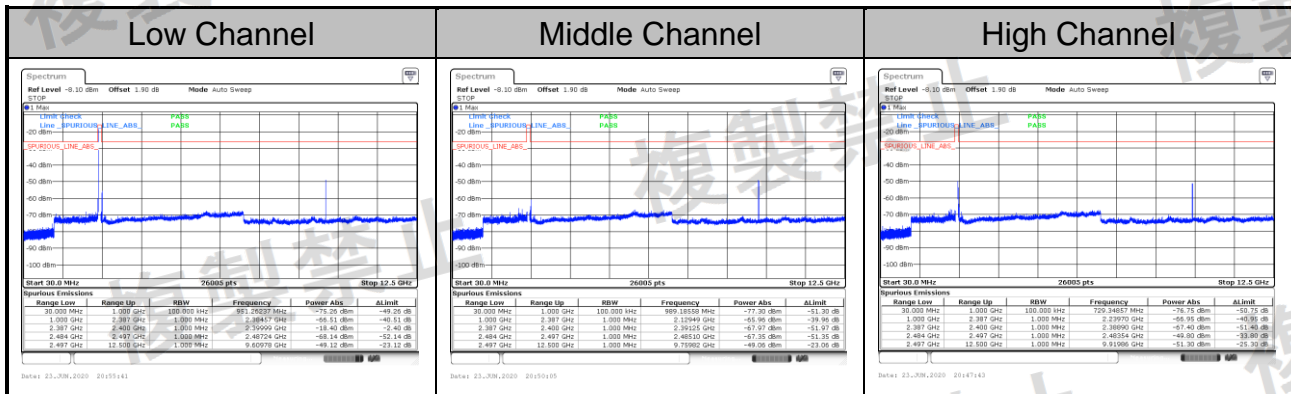
B.2.1. Frequency Tolerance



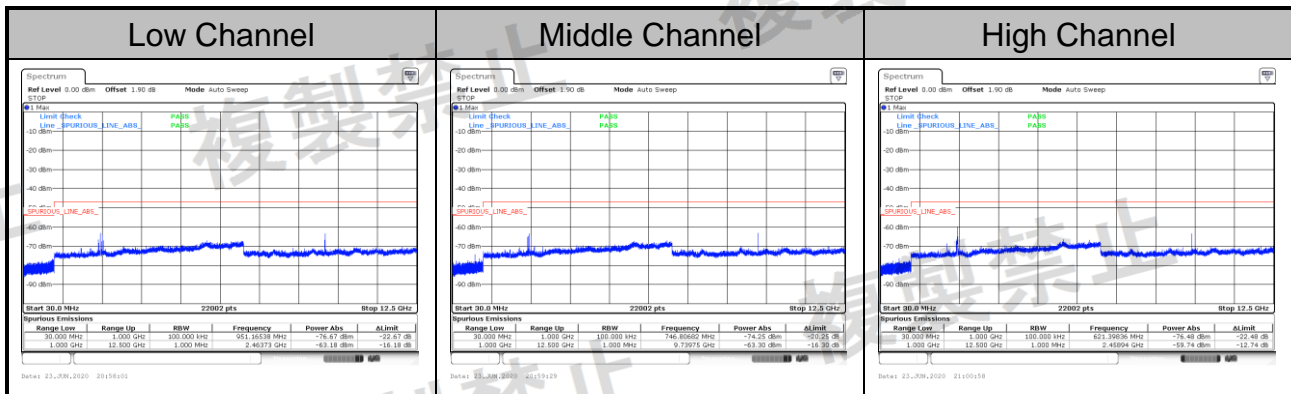
B.2.2. Occupied Bandwidth



B.2.3. Unwanted Emission Intensity



B.2.4. Limitation of Collateral Emission of Receiver



—THE END—