



International Certification Corp.

No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan Hsiang, Tao Yuan Hsien 333, Taiwan, R.O.C.

Tel: 886-3-271-8666

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Japan Test Report

Equipment : Bluetooth AT Data Module
Model No. : BTM431 (refer to item 1.1.1 for more details)
Brand Name : Laird
Applicant : Laird Technologies
Address : 11160 Thompson Ave. / Lenexa, Kansas /
66219 / USA
Standard : ARIB STD-T66 Ver 3.6
Received Date : Mar. 14, 2013
Tested Date : Mar. 27, 2013

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Approved & Reviewed by:

Gary Chang / Manager





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Release Record

Report No.	Version	Description	Issued Date
JR331401	Rev. 01	Initial issue	Apr. 09, 2013



Summary of Test Results

Ref. Std. Clause	Description	Result
3.2(2)(3)	Antenna Power / Tolerances for antenna power	Pass
3.2(4)	Frequency Tolerance	Pass
3.2(6)	Transmitter Spurious Emission	Pass
3.2(7)	Occupied Bandwidth	Pass
3.2(8)	Spreading Bandwidth	Pass
3.2(9)	Spreading Factor	Pass
3.2(11)	Dwell time	Pass
3.5(2)	Radio Interference Prevention Capability	Pass
3.3(1)	Receiver Spurious Emission	Pass



1 General Description

1.1 Information

1.1.1 Product Description

The following models are provided to this EUT.

Model Name	Difference
BTM411	CSR Unified Stack 2.1EDR
BTM431	CSR Unified Statck 2.0EDR
BTM421	CSR HCI Stack 2.1EDR
BTM441	CCL Interface Express Subsystem 2.1+EDR (point to point protocol)
BTM443	CCL Interface Express Subsystem 2.1+EDR (multipoint protocol)
BTM461	CCL Interface Express Subsystem 2.1+EDR (Apple profile)
✦ Hardware is the same on all of these modules. Only difference is the Bluetooth firmware installed.	
✦ The above models, model BTM431 was selected as a representative one for the final test and only its data was recorded in this report.	

1.1.2 Specification of the Equipment under Test (EUT)

Power Type	3.2Vdc from host
Type(s) of Modulation / Technology	FHSS / GFSK = 1Mbps, $\pi/4$ DQPSK = 2Mbps, 8DPSK = 3Mbps
Bluetooth Version	V2.1+EDR
Frequency Range (MHz)	2402 ~ 2480 MHz
Total Channel Number	79
HW Version	0050-00198Rev.1
SW Version	ITSE_00087_01, V11_28_1_0

1.1.3 Antenna Details

Ant. No.	Type	Brand	Model	Gain (dBi)	Connector	Remark
1	Chip	JOHANSON TECHNOLOGY	2450AT42B100	0	---	---
2	Chip	ACX	AT5020-E3R0HBAN	0	---	---

Note: Regarding to more detail antenna pattern and other information, please refer to Appendix B Antenna Report.



1.1.4 Antenna Power

Operating Mode	Rated Power (mW/MHz)	Measured Condcuted Power (mW/MHz)	Radiated Power (mW/MHz)
GFSK	0.042	0.04216	0.04216
8DPSK	0.032	0.03174	0.03174

Note : After pretest for 3 modulations , GFSK and 8DPSK has worse value than $\pi/4$ DQPSK.
Therefore, only select GFSK and 8DPSK to perform final test.

1.1.5 Channel List

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



1.1.6 Test Tool and Power Setting

Test Tool
BlueSuite 2.5.0

Power Setting			
Channel	Frequency (MHz)	GFSK	8DPSK
0	2402	56	95
39	2441	56	95
78	2480	56	95

Note : After pretest for 3 modulations , GFSK and 8DPSK has worse value than $\pi/4$ DQPSK. Therefore, only select GFSK and 8DPSK to perform final test.

1.1.7 Protection Method for High Frequency and Modulation Section

Protected Method	Description
Shielding Case	RF and Modulation components are covered with shielding case and this shielding case is soldered.

Photo





1.2 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV 40	101063	Feb. 18, 2013	Feb. 17, 2014
DC Power Source	G.W.	GPC-6030D	C671845	Jun. 19, 2012	Jun. 18, 2013
AC Power Source	G.W.	APS-9102	EL920581	Jul. 02, 2012	Jul. 01, 2013
Power Meter	Anritsu	ML2495A	1241002	Oct. 15, 2012	Oct. 14, 2013
Power Sensor	Anritsu	MA2411B	1027366	Oct. 24, 2012	Oct. 23, 2013
Signal Generator	R&S	SMB100A	175727	Jan. 14, 2013	Jan. 13, 2014
RF Cable-2m	HUBER+SUHNER	SUCOFLEX_104	MY16016/4	Dec. 25, 2012	Dec. 24, 2013
RF Cable-3m	HUBER+SUHNER	SUCOFLEX_104	MY16013/4	Dec. 25, 2012	Dec. 24, 2013

Note : RF cableseares calibrated by ICC. Other instruments are calibrated by ETC

1.3 Testing Applied Standards

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

ARIB STD-T66 Ver 3.6

MIC notice 88 Appendix 43

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor ($k=2$))

Measurement Uncertainty	
Parameters	Uncertainty
Frequency error	± 0.02 ppm
Bandwidth	± 44.076 Hz
Conducted power	± 0.551 dB
TX Conducted emission	± 2.687 dB
RX Conducted emission	± 3.148 dB
Time	± 0.12 ms



2 Test Configuration

2.1 Testing Location and Conditions

Test Site	Site Category	Ambient Condition	Tested By
TH01-WS	OVEN Room	21.6°C / 45%	Jack Li

2.2 Supporting Units

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E5420	DoC

2.3 The Worst Test Modes and Channel Details

Test item	Mode	Test channel
Antenna Power	GFSK, 8DPSK	0~78
Frequency Tolerance	Un-modulation	0 / 39 / 78
Transmitter Spurious Emission	GFSK, 8DPSK	0 / 39 / 78
Occupied Bandwidth	GFSK, 8DPSK	0~78
Spreading Bandwidth	GFSK, 8DPSK	0~78
Spreading Factor	GFSK, 8DPSK	0~78
Dwell time	GFSK, 8DPSK	0 / 39 / 78
Receiver Spurious Emission	GFSK, 8DPSK	0 / 39 / 78



3 Transmitter Test Results

3.1 Antenna Power

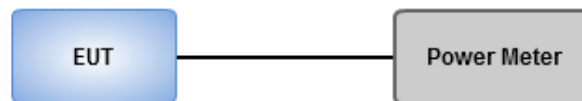
3.1.1 Limit of Antenna Power

Mode	Limit	Tolerance
1) FH, FH+DS, FH+OFDM	3 mW / MHz	+20 % , -80 %
2) OFDM(Narrow- bandwidht), DS	10 mW / MHz	
3) Other than 1) & 2)	10mW	
4) OFDM (Wide-band)	5 mW / MHz	

3.1.2 Test Procedures

1. Measure the total power by Power Meter in a state of hopping mode
2. Measure the burst ratio. Then calculate the real total power by burst ratio.
3. Calculate the mean power per 1MHz by dividing the total power by spread bandwidth
4. $\text{Output Power Density (mW/MHz)} = \text{Total Output Power (mW)} / \text{Burst Ratio} / \text{Spread Bandwidth (MHz)}$

3.1.3 Test Setup



3.1.4 Test Result of Maximum Transmit Power

Reference Documents	Test Items
Appendix A 19-BT-F1D	2.Test Results
	3. Antenna Power (Conducted Power)



3.2 Frequency Tolerance

3.2.1 Limit of Frequency Tolerance

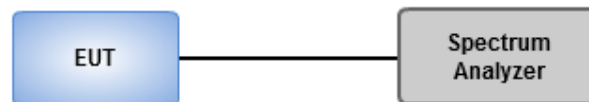
Frequency tolerance shall be +/- 50ppm.

3.2.2 Test Procedures

1. Set Span = 150kHz, RBW = 1kHz, VBW = 30kHz, Sweep time = Auto, detector = Peak.
2. Use Peak search function to find the max peak value and record this value (RF).
3. Calculate frequency tolerance by below formula
$$FT(ppm) = \{ (RF) - (MF) / (MF) \} \times 1000000$$

(FT: Frequency Tolerance, RF: Reading Frequency, MF: Measurement Frequency.)

3.2.3 Test Setup



3.2.4 Test Result of Frequency Tolerance

Reference Documents	Test Items
Appendix A 19-BT-F1D	2.Test Results



3.3 Occupied Bandwidth

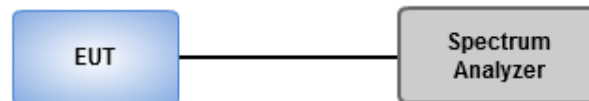
3.3.1 Limit of Occupied Bandwidth

Mode	Limit (MHz)
FH	83.5
FH+DS	83.5
FH+OFDM	83.5
OFDM(Narrow- bandwidth), DS	26
Others	26
OFDM (Wide-band)	38

3.3.2 Test Procedures

1. Set Span = 200MHz, RBW = VBW = 300kHz, detector = Peak, Sweep time = Auto.
2. Enable OBW function of spectrum analyzer to measure 99% bandwidth of total power.

3.3.3 Test Setup



3.3.4 Test Result of Occupied Bandwidth

Reference Documents	Test Items
Appendix A 19-BT-F1D	2.Test Results



3.4 Spreading Bandwidth and Factor

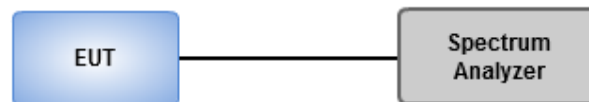
3.4.1 Limit of Spreading Bandwidth and Factor

Item	Limit
Spreading bandwidth	$\geq 500\text{kHz}$
Spreading factor for DSSS (operates at 2400~2483.5 MHz)	≥ 5
Spreading factor for DSSS (operates at 2471~2497 MHz)	≥ 10

3.4.2 Test Procedures

1. Set Span = 20MHz, RBW = VBW = 300kHz, detector = Peak, Sweep time = Auto.
2. Enable OBW (90%) function of spectrum analyzer to measure 90% bandwidth of total power.

3.4.3 Test Setup



3.4.4 Test Result of Spreading Bandwidth and Factor

Reference Documents	Test Items
Appendix A 19-BT-F1D	2. Test Results
	9. Spread Factor



3.5 Transmitter Spurious Emissions

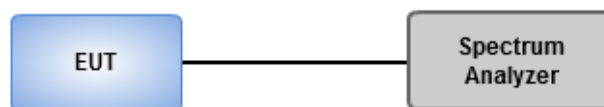
3.5.1 Limit of Transmitter Spurious Emissions

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 ($2483.5\text{MHz} < f \leq 2496.5\text{MHz}$).

3.5.2 Test Procedures

1. Set EUT to transmit at rated power and channel to perform test.
2. Set RBW = VBW = 1MHz, Detector type = Peak, Sweep time = Auto.
3. Following above setting of spectrum analyzer to measure spurious emission of 30~12750 MHz.

3.5.3 Test Setup



3.5.4 Test Result of Transmitter Spurious Emissions

Reference Documents	Test Items
Appendix A 19-BT-F1D	2. Test Results
	6. Unwanted Emission Intensity



3.6 Dwell time

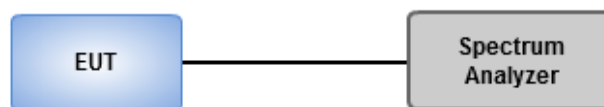
3.6.1 Limit of Dwell time

Limits	Shall be less than 0.4 second
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3.6.2 Test Procedures

1. Set EUT to transmit at rated power and channel to perform test.
2. Set RBW = VBW = 300kHz, Detector type = Peak, Span = Zero Span, Sweep time = 5 msec.
3. Use marker function to measure Burst on and off time.
4. Burst ratio = On Time / (On Time + Off time)

3.6.3 Test Setup



3.6.4 Test Result of Transmitter Spurious Emissions

Reference Documents	Test Items
Appendix A 19-BT-F1D	2. Test Results
	8. Hopping Frequency Dwell Time



3.7 Radio Interference Prevention Capability Measurement

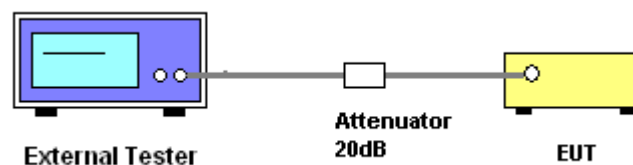
3.7.1 Limit

Limits	Identification code ≥ 48 bits
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3.7.2 Test Procedures

1. In the case that the EUT has the function of automatically transmitting the identification code: a. Transmit the predetermined identification codes from 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 from the counterpart. b. Check if communication is normal. c. Transmit the signals other than predetermined ID codes from the counterpart. d. Check if the EUT stops the transmission, or if it displays that identification codes are different from the predetermined ones
3. Use marker function to measure Burst on and off time.
4. Burst ratio = On Time / (On Time + Off time)

3.7.3 Test Setup



3.7.4 Test Result of Transmitter Spurious Emissions

Reference Documents	Test Items
Appendix A 19-BT-F1D	2.Test Results



4 Receiver Test Results

4.1 Receiver Spurious Emissions

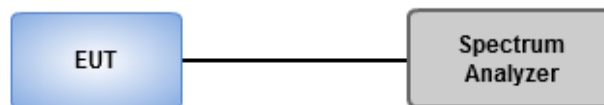
4.1.1 Limit of Receiver Spurious Emissions

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

4.1.2 Test Procedures

1. Set EUT to transmit at rated power and channel to perform test
2. Set RBW = VBW = 100kHz, detector = Peak, Sweep time = Auto for emission measurement below 1GHz.
3. Set RBW = VBW=1MHz, detector = Peak, Sweep time = Auto for emission measurement above 1GHz.

4.1.3 Test Setup



4.1.4 Test Result of Receiver Spurious Emissions

Reference Documents	Test Items
Appendix A 19-BT-F1D	2. Test Results
	7. Limitation of Collateral Emission of Receiver



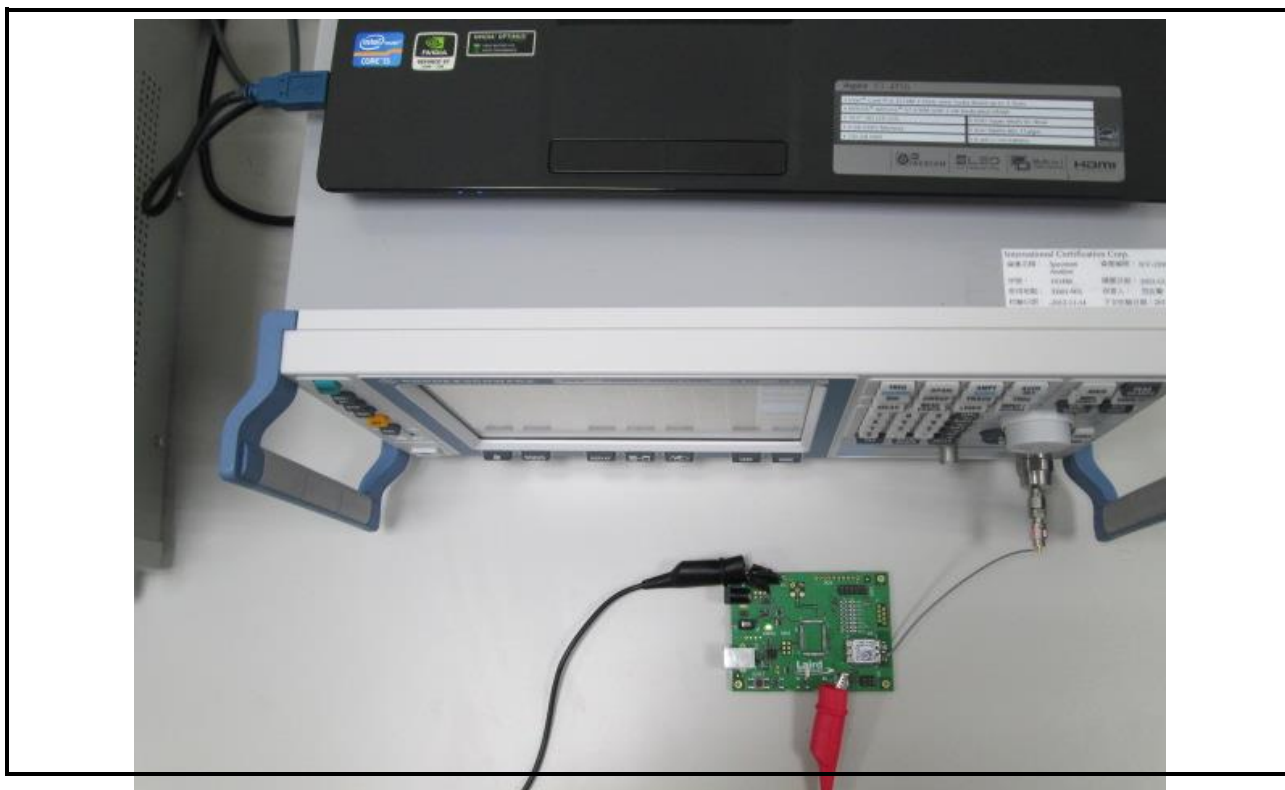
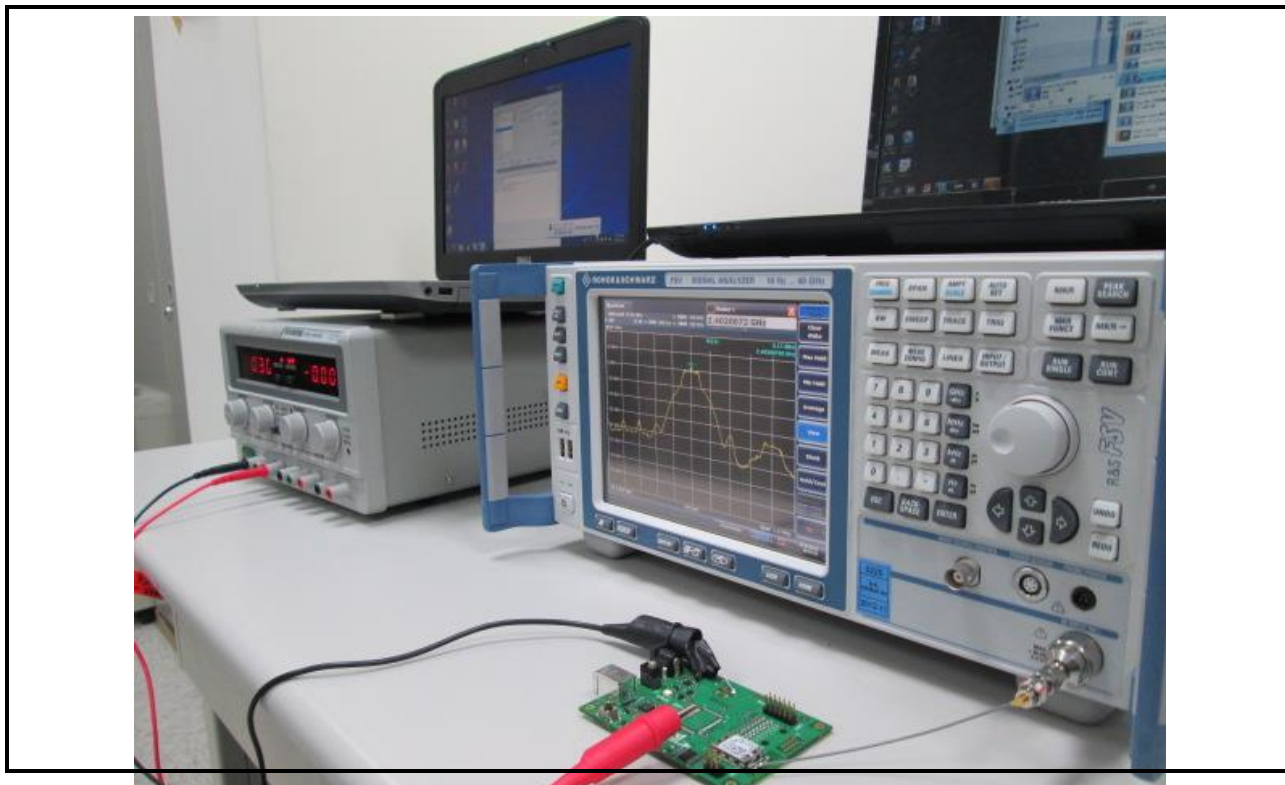
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5 Photographs of the Test Configuration



==END==

Appendix A 19-BT-F1D

1. General Information

Specified Radio Equipment	Class	Article 2 Paragraph 1 Item 19			Model	BTM431			Sporton No.	JR331401
	Type of Emission	F1D			Serial No.	NA			Test Date	2013/3/27
	Modulation Type	FHSS: GFSK			Antenna Power	0.042 mW/MHz			Test Location	ICC Lab.
	Frequency	2402~2480 MHz							Temp. / Humid.	21.6℃ / 45%
									Test Conducted By	Jack Li
									Name	Jack Li
									Department	Radio Service Group

2. Test Results

Testing for Electrical Specification	Test Voltage	V	Normal Voltage (3.2 V)			High Voltage + 10% (3.52V)			Low Voltage - 10% (2.88 V)			Remarks
	Test Frequency	MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	Low/Mid/High of test frequency range
	Measured Frequency	MHz	2402.0570	2441.0570	2480.0560	2402.0561	2441.0630	2480.0620	2402.0541	2441.0430	2480.0470	
	Frequency Error	ppm	23.73	23.35	22.58	23.36	25.81	25.00	22.52	17.62	18.95	Limit ≤ 50 ppm
	Occupied Bandwidth	MHz	78.99			78.99			78.99			Limit ≤ 83.5 MHz (RB/VB : 1MHz)
	Spread-spectrum Bandwidth	MHz	71.48			71.64			71.64			Spread Factor Limit ≥ 5 (DSSS and FHSS)
	Unwanted Emission Intensity (Power emission within 1MHz bandwidth)	※ 1 μW	0.00841	0.00671	0.00780	0.00877	0.00621	0.00767	0.01057	0.00650	0.00811	Limit ≤ 2.5 μW (-26 dBm)
		※ 2 μW	11.83042	0.00738	0.00746	11.85769	0.00689	0.00667	11.91242	0.00889	0.00746	Limit ≤ 25 μW (-16 dBm)
		※ 3 μW	0.00697	0.00745	0.01879	0.00710	0.00861	0.00644	0.00741	0.00914	0.00272	Limit ≤ 25 μW (-16 dBm)
		※ 4 μW	0.14825	0.07834	0.04055	0.13646	0.07145	0.04018	0.14289	0.09550	0.03467	Limit ≤ 2.5 μW (-26 dBm)
Testing for Radio Interference Prevention Function	Antenna Power (Conducted)	mW/MHz	0.042159			0.039801			0.039436			Limit ≤ 3 mW/MHz (4.77 dBm/MHz)
	Antenna Power Error	mW/MHz	0.000159			-0.002199			-0.002564			Limit ≤ 3 mW/MHz (4.77 dBm/MHz)
		%	0.38			-5.24			-6.10			Limit + 20% ~ - 80%
	Limitation of Collateral Emission of Receiver	※ 5 nW	0.0177	0.0158	0.0196	0.0158	0.0168	0.0168	0.0158	0.0170	0.0155	Limit ≤ 4 nW (-54 dBm)
		※ 6 nW	0.1875	0.1213	0.1268	0.1950	0.1151	0.1303	0.1871	0.1589	0.1291	Limit ≤ 20 nW (-47 dBm)
	Hopping Frequency Dwell Time	sec	0.3283	0.3283	0.3283	0.3283	0.3283	0.3283	0.3283	0.3283	0.3283	Limit ≤ 0.4 sec (In 0.4 sec × spreading rate)
	Radio Interference Prevention Function	ID Code	Good, MAC Address :00:16:a4:04:a2:a5									
	Carrier Sense	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR: Not Require

- ※ 1: Frequency Band 1 (30 MHz ≤ f ≤ 2387 MHz) ※ 4: Frequency Band 4 (2496.5 MHz ≤ f < 12.5 GHz)
 ※ 2: Frequency Band 2 (2387 MHz < f ≤ 2400 MHz) ※ 5: Frequency Band 5 (30 MHz ≤ f < 1000 MHz)
 ※ 3: Frequency Band 3 (2483.5 MHz ≤ f < 2496.5 MHz) ※ 6: Frequency Band 6 (1000 MHz ≤ f < 12.5 GHz)

3. Antenna Power (Conducted Power)

Testing for Electrical Specification	Test Voltage	V	Normal Voltage (3.2 V)		High Voltage + 10% (3.52V)		Low Voltage - 10% (2.88 V)		Remarks	
	Test Frequency	MHz	2402 ~ 2480		2402 ~ 2480		2402 ~ 2480			
	Power Meter Raw from EUT	dBm	4.20		3.95		3.91			
	Cable Loss	dB	0.16		0.16		0.16		Refer to Calibration Result	
	Duty Cycle Factor	dB	0.86		0.86		0.86		Duty Factor = $10 \times 10\text{Log}_{10}(1/\text{Duty Cycle})$	
	Spreading Bandwidth Factor	dB	-18.98		-18.98		-18.98		BW Factor = $10 \times 10\text{Log}_{10}(1/\text{Spreading BW})$	
	Antenna Power (Conducted)	dBm/MHz	-13.75		-14.00		-14.04		Limit $\leq 3 \text{ mW/MHz}$ (4.77 dBm/MHz)	
	Antenna Power (Conducted)	mW/MHz	0.04216		0.03980		0.03944			
	Antenna Power Error	mW	0.00016		-0.00220		-0.00256			
		%	0.38						Limit + 20% ~ - 80%	
Testing for Radio Interference Prevention Function	Transmitter ON _{Time}	msec			3.0783				RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz	
	Transmitter (ON+OFF) _{Time}	msec			3.7565					
	Transmitter Duty Cycle (DH5)	%			81.95%				Max TX on time mode	

4. Transmission Radiation Angle Width (This test item will not be applied to the EIRP power is lower than 6.91dBm/MHz)

No.	Antenna Power		Antenna			Cable			Total Gain D=B+C	EIRP F=A+D	Permitted Angle	Judgement	Remarks (Antenna Model)
	A	Type	Gain B (dBi)	3dB Beam-width Horizontal (Degree)	3dB Beam-width Vertical (Degree)	Model	Length (m)	Loss C (dB)					
1	-13.75	Chip	0.00						0.00	-13.75	360.00	Good	Model: 2450AT42B100 , AT5020-E3R0HBAN
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													

5. Transmission Antenna Gain (EIRP Power) (This test item will not be applied to the EIRP power is lower than 6.91dBm/MHz)

Antenna	Test Frequency		Output Level from Power Meter (Pt)		Cable Loss Between SG and Replacing Antenna (L)		Replacing Standard Antenna Gain (Gt)		EIRP Power Radiated Measurement EIRP = Pt - L + Gt		Remarks (Antenna Model)
	(MHz)		(dBm)		(dB)		(dBi)		(dBm)		
1											
1											
1											
2											
2											
2											
3											
3											
3											
4											
4											
4											

6. Unwanted Emission Intensity

Test Voltage	V	Normal Voltage (3.2 V)			High Voltage + 10% (3.52V)			Low Voltage - 10% (2.88 V)			Remarks
Test Frequency	MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	
Unwanted Emission Frequency	* 1 MHz	2387.00	2283.29	2231.43	2387.00	1585.62	1925.03	2377.57	1613.90	2250.29	RBW : 1 MHz ; VBW : 1 MHz
	* 2 MHz	2400.00	2392.43	2391.37	2400.00	2399.45	2388.30	2400.00	2392.90	2388.04	
	* 3 MHz	2484.31	2484.80	2483.50	2482.47	2491.56	2483.50	2494.84	2489.56	2483.55	
	* 4 MHz	4797.31	4877.33	7438.23	4797.31	4877.33	4957.36	4797.31	4877.33	3136.72	
Cable Loss	* 1 dB	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	
	* 2 dB	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	
	* 3 dB	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	
	* 4 dB	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	
Spectrum Raw	* 1 dBm	-50.91	-51.89	-51.24	-50.73	-52.23	-51.31	-49.92	-52.03	-51.07	
	* 2 dBm	-19.43	-51.48	-51.43	-19.42	-51.78	-51.92	-19.40	-50.67	-51.43	
	* 3 dBm	-51.73	-51.44	-33.94	-51.65	-50.81	-34.07	-51.46	-50.55	-34.11	
	* 4 dBm	-38.42	-41.19	-44.05	-38.78	-41.59	-44.09	-38.58	-40.33	-44.73	
Unwanted Emission Intensity	* 1 dBm	-50.75	-51.73	-51.08	-50.57	-52.07	-51.15	-49.76	-51.87	-50.91	Limit \leq 2.5 μ W (-26 dBm)
	* 2 dBm	-19.27	-51.32	-51.27	-19.26	-51.62	-51.76	-19.24	-50.51	-51.27	Limit \leq 25 μ W (-16 dBm)
	* 3 dBm	-51.57	-51.28	-33.78	-51.49	-50.65	-33.91	-51.30	-50.39	-33.95	Limit \leq 25 μ W (-16 dBm)
	* 4 dBm	-38.29	-41.06	-43.92	-38.65	-41.46	-43.92	-38.45	-40.20	-44.66	Limit \leq 2.5 μ W (-26 dBm)
Unwanted Emission Intensity	* 1 μ W	0.0084	0.0067	0.0078	0.0088	0.0062	0.0077	0.0106	0.0065	0.0081	Limit \leq 2.5 μ W (-26 dBm)
	* 2 μ W	11.8304	0.0074	0.0075	11.8577	0.0069	0.0067	11.9124	0.0089	0.0075	Limit \leq 25 μ W (-16 dBm)
	* 3 μ W	0.0070	0.0074	0.4188	0.0071	0.0086	0.4064	0.0074	0.0091	0.4027	Limit \leq 25 μ W (-16 dBm)
	* 4 μ W	0.1483	0.0783	0.0406	0.1365	0.0714	0.0402	0.1429	0.0955	0.0347	Limit \leq 2.5 μ W (-26 dBm)

* 1: Frequency Band 1 (30 MHz \leq f \leq 2387 MHz)* 4: Frequency Band 4 (2496.5 MHz \leq f < 12.5 GHz)* 2: Frequency Band 2 (2387 MHz < f \leq 2400 MHz)* 5: Frequency Band 5 (30 MHz \leq f < 1000 MHz)* 3: Frequency Band 3 (2483.5 MHz \leq f < 2496.5 MHz)* 6: Frequency Band 6 (1000 MHz \leq f < 12.5 GHz)

7. Limitation of Collateral Emission of Receiver

Test Voltage	V	Normal Voltage (3.2 V)			High Voltage + 10% (3.52V)			Low Voltage - 10% (2.88 V)			Remarks
Test Frequency	MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	
Spurious Emission Frequency	* 5 MHz	150.28	324.88	293.84	334.50	677.96	959.26	637.22	579.02	313.24	1st 30MHz~1000MHz:: Maximum emission and all emissions beyond 1/10 of the limitation must be indicated.
	* 5 MHz	-	-	-	-	-	-	-	-	-	2nd
	* 5 MHz	-	-	-	-	-	-	-	-	-	3rd
	* 6 MHz	2403.00	2426.00	2472.00	2403.00	2426.00	2472.00	2403.00	2426.00	2472.00	1st 1000MHz~ 12.5GHz:: Maximum emission and all emissions beyond 1/10 of the limitation must be indicated.
Cable Loss	* 6 MHz	-	-	-	-	-	-	-	-	-	2nd
	* 6 MHz	-	-	-	-	-	-	-	-	-	3rd
	* 5 dB	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	1st
	* 5 dB	-	-	-	-	-	-	-	-	-	2nd
Spectrum Raw	* 5 dB	-	-	-	-	-	-	-	-	-	3rd
	* 6 dB	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1st
	* 6 dB	-	-	-	-	-	-	-	-	-	2nd
	* 6 dB	-	-	-	-	-	-	-	-	-	3rd
Spurious Emission Intensity	* 5 dBm	-77.61	-78.11	-77.16	-78.11	-77.84	-77.84	-78.11	-77.79	-78.20	1st
	* 5 dBm	-	-	-	-	-	-	-	-	-	2nd
	* 5 dBm	-	-	-	-	-	-	-	-	-	3rd
	* 6 dBm	-77.52	-78.02	-77.07	-78.02	-77.75	-77.75	-78.02	-77.70	-78.11	1st Limit \leq 4 nW (-54 dBm)
Spurious Emission Intensity	* 6 dBm	-	-	-	-	-	-	-	-	-	2nd RBW : 100 kHz ; VBW : 100 kHz
	* 6 dBm	-	-	-	-	-	-	-	-	-	3rd
	* 5 dBm	-67.27	-69.16	-68.97	-67.10	-69.39	-68.85	-67.28	-67.99	-68.89	1st Limit \leq 20 nW (-47 dBm)
	* 6 dBm	-	-	-	-	-	-	-	-	-	2nd RBW : 1 MHz ; VBW : 1 MHz
Spurious Emission Intensity	* 6 dBm	-	-	-	-	-	-	-	-	-	3rd
	* 5 nW	0.0177	0.0158	0.0196	0.0158	0.0168	0.0168	0.0158	0.0170	0.0155	Total Emission Power
	* 5 nW	0.0177	0.0158	0.0196	0.0158	0.0168	0.0168	0.0158	0.0170	0.0155	1st Limit \leq 4 nW (-54 dBm)
	* 5 nW	-	-	-	-	-	-	-	-	-	2nd RBW : 100 kHz ; VBW : 100 kHz
Spurious Emission Intensity	* 6 nW	-	-	-	-	-	-	-	-	-	3rd
	* 6 nW	0.1875	0.1213	0.1268	0.1950	0.1151	0.1303	0.1871	0.1589	0.1291	Total Emission Power
	* 6 nW	-	-	-	-	-	-	-	-	-	1st Limit \leq 20 nW (-47 dBm)
	* 6 nW	-	-	-	-	-	-	-	-	-	2nd RBW : 1 MHz ; VBW : 1 MHz
Spurious Emission Intensity	* 6 nW	-	-	-	-	-	-	-	-	-	3rd

* 1: Frequency Band 1 (30 MHz \leq f \leq 2387 MHz)* 4: Frequency Band 4 (2496.5 MHz \leq f < 12.5 GHz)* 2: Frequency Band 2 (2387 MHz < f \leq 2400 MHz)* 5: Frequency Band 5 (30 MHz \leq f < 1000 MHz)* 3: Frequency Band 3 (2483.5 MHz \leq f < 2496.5 MHz)* 6: Frequency Band 6 (1000 MHz \leq f < 12.5 GHz)

8. Hopping Frequency Dwell Time

Test Voltage	V	Normal Voltage (3.2 V)			High Voltage + 10% (3.52V)			Low Voltage - 10% (2.88 V)			Remarks
Test Frequency	MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	
Pulse Duration	msec	3.0783	3.0783	3.0783	3.0783	3.0783	3.0783	3.0783	3.0783	3.0783	Limit \leq 0.4 sec (In 0.4 sec x spreading rate)
Measurement Time	sec	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	31.60	RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz
Dwell Time	sec	0.3283	0.3283	0.3283	0.3283	0.3283	0.3283	0.3283	0.3283	0.3283	The total sum of holding time at arbitrary frequencies within the time multiplied 0.4 sec by the spreading rate

9. Spread Factor

Test Voltage	V	Normal Voltage (3.2 V)			High Voltage + 10% (3.52V)			Low Voltage - 10% (2.88 V)			Remarks
Test Frequency	MHz	2402 ~ 2480			2402 ~ 2480			2402 ~ 2480			
Spread-Spectrum Bandwidth	MHz	78.99			78.99			78.99			
Modulation Rate	Mcps	1.000			1.000			1.000			
Spread Factor		78.99			78.99			78.99			Spread Factor Limit \geq 5 (DSSS and FHSS)

Appendix A 19-BT-F1D

					Sporton No.	JR331401
					Test Date	2013/3/27
					Test Location	ICC Lab.
1. General Information					Temp. / Humid.	21.6℃ / 45%
Specified Radio Equipment	Class	Article 2 Paragraph 1 Item 19	Model	BTM431	Test Conducted By	
	Type of Emission	G1D	Serial No.	NA	Name	
	Modulation Type	FHSS :8DPSK	Antenna Power	0.032 mW/MHz	Jack Li	
Frequency					Department	Radio Service Group

2. Test Results													
Testing for Electrical Specification	Test Voltage	V	Normal Voltage (3.2 V)			High Voltage + 10% (3.52V)			Low Voltage - 10% (2.88 V)			Remarks	
	Test Frequency	MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	Low/Mid/High of test frequency range	
	Measured Frequency	MHz	2401.9920	2440.9910	2479.9910	2401.9924	2440.9921	2479.9924	2401.9911	2440.9909	2479.9904		
	Frequency Error	ppm	-3.33	-3.69	-3.63	-3.16	-3.24	-3.06	-3.71	-3.73	-3.87	Limit ≤ 50 ppm	
	Occupied Bandwidth	MHz	79.16			79.16			79.16			Limit ≤ 83.5 MHz (RB/VB : 1MHz)	
	Spread-spectrum Bandwidth	MHz	71.64			71.64			71.64			Spread Factor Limit ≥ 5 (DSSS and FHSS)	
	Unwanted Emission Intensity (Power emission within 1MHz bandwidth)	※ 1	μW	0.01466	0.00650	0.00664	0.01675	0.00655	0.00668	0.01629	0.00611	0.00592	Limit ≤ 2.5 μW (-26 dBm)
		※ 2	μW	19.67886	0.00859	0.00855	19.54339	0.00942	0.00769	18.92344	0.00953	0.00753	Limit ≤ 25 μW (-16 dBm)
		※ 3	μW	0.00692	0.00780	0.73961	0.00687	0.00841	0.80353	0.00731	0.00805	0.72277	Limit ≤ 25 μW (-16 dBm)
		※ 4	μW	0.03133	0.02979	0.03126	0.03266	0.03148	0.02570	0.02999	0.03006	0.02606	Limit ≤ 2.5 μW (-26 dBm)
	Antenna Power (Conducted)	mW/MHz	0.031743			0.030736			0.027080			Limit ≤ 3 mW/MHz (4.77 dBm/MHz)	
	Antenna Power Error	mW/MHz	-0.000257			-0.001264			-0.004920				
		%	-0.80			-3.95			-15.38			Limit + 20% ~ - 80%	
	Limitation of Collateral Emission of Receiver	※ 5	nW	0.0160	0.0172	0.0189	0.0210	0.0174	0.0160	0.0159	0.0171	0.0150	Limit ≤ 4 nW (-54 dBm)
	※ 6	nW	0.1816	0.1202	0.1380	0.1871	0.1199	0.1845	0.2000	0.1230	0.1459	Limit ≤ 20 nW (-47 dBm)	
Hopping Frequency Dwell Time	sec	0.3003	0.3003	0.3003	0.3003	0.3003	0.3003	0.3003	0.3003	0.3003	0.3003	Limit ≤ 0.4 sec (In 0.4 sec × spreading rate)	
Radio Interference Prevention Function	ID Code	Good, MAC Address :00:16:a4:04:a2:a5											
	Carrier Sense	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR: Not Require	

- ※ 1: Frequency Band 1 (30 MHz ≤ f ≤ 2387 MHz)
- ※ 2: Frequency Band 2 (2387 MHz < f ≤ 2400 MHz)
- ※ 3: Frequency Band 3 (2483.5 MHz ≤ f < 2496.5 MHz)
- ※ 4: Frequency Band 4 (2496.5 MHz ≤ f < 12.5 GHz)
- ※ 5: Frequency Band 5 (30 MHz ≤ f < 1000 MHz)
- ※ 6: Frequency Band 6 (1000 MHz ≤ f < 12.5 GHz)

3. Antenna Power (Conducted Power)						
Testing for Electrical Specification	Test Voltage	V	Normal Voltage (3.2 V)	High Voltage + 10% (3.52V)	Low Voltage - 10% (2.88 V)	Remarks
	Test Frequency	MHz	2402 ~ 2480	2402 ~ 2480	2402 ~ 2480	
	Power Meter Raw from EUT	dBm	2.58	2.44	1.89	
	Cable Loss	dB	0.16	0.16	0.16	Refer to Calibration Result
	Duty Cycle Factor	dB	0.83	0.83	0.83	Duty Factor = $10 \times 10\text{Log}_{10}(1/\text{Duty Cycle})$
	Spreading Bandwidth Factor	dB	-18.55	-18.55	-18.55	BW Factor = $10 \times 10\text{Log}_{10}(1/\text{Spreading BW})$
	Antenna Power (Conducted)	dBm/MHz	-14.98	-15.12	-15.67	Limit $\leq 3 \text{ mW/MHz}$ (4.77 dBm/MHz)
	Antenna Power (Conducted)	mW/MHz	0.03174	0.03074	0.02708	
	Antenna Power Error	mW	-0.00026	-0.00126	-0.00492	
		%	-0.80	-3.95	-15.38	Limit + 20% ~ - 80%
	Tranmsitter ON _{Time}	msec	3.1043			RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz
	Tranmsitter (ON+OFF) _{Time}	msec	3.7565			
Tranmsitter Duty Cycle (DHS)	%	82.64%			Max TX on time mode	

4. Transmission Radiation Angle Width (This test item will not be applied to the EIRP power is lower than 6.91dBm/MHz)

No.	Antenna Power	Antenna				Cable			Tatal Gain D=B-C	EIRP F=A+D	Permitted Angle	Judgement	Remarks (Antenna Model)
	A (dBm/MHz)	Type	Gain B (dBi)	3dB Beam-width Horizontal (Degree)	3dB Beam-width Vertical (Degree)	Model	Length (m)	Loss C (dB)					
1	-14.98	Chip	0						0.00	-14.98	360.00	Good	Model: 2450AT42B100 , AT5020-E3R0HBAN
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													

5. Transmission Antenna Gain (EIRP Power) (This test item will not be applied to the EIRP power is lower than 6.91dBm/MHz)

Antenna	Test Frequency (MHz)	Output Level from Power Meter (Pt) (dBm)	Cable Loss Between SG and Replacing Antenna (L) (dB)	Replacing Standard Antenna Gain (Gt) (dBi)	EIRP Power Radiated Measurement EIRP = Pt – L + Gt (dBm)	Remarks (Antenna Model)
1						
1						
1						
2						
2						
2						
3						
3						
3						
4						
4						
4						

6. Unwanted Emission Intensity

Unwanted Emission Intensity	Test Voltage		V	Normal Voltage (3.2 V)			High Voltage + 10% (3.52V)			Low Voltage - 10% (2.88 V)			Remarks
	Test Frequency		MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	
	Unwanted Emission Frequency	※ 1	MHz	2387.00	2349.29	2354.00	2387.00	1736.47	2203.15	2387.00	2344.57	1312.21	RBW : 1 MHz ; VBW : 1 MHz
		※ 2	MHz	2400.00	2389.83	2390.56	2400.00	2387.91	2398.26	2400.00	2393.29	2389.63	
		※ 3	MHz	2494.78	2491.95	2483.50	2483.58	2490.62	2483.53	2494.78	2490.13	2483.50	
		※ 4	MHz	4797.31	3596.89	3096.71	4797.31	3056.70	3256.77	3276.77	3056.70	3136.72	
	Cable Loss	※ 1	dB	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	
		※ 2	dB	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	
		※ 3	dB	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	
		※ 4	dB	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	
	Spectrum Raw	※ 1	dBm	-48.50	-52.03	-51.94	-47.92	-52.00	-51.91	-48.04	-52.30	-52.44	
		※ 2	dBm	-17.22	-50.82	-50.84	-17.25	-50.42	-51.30	-17.39	-50.37	-51.39	
		※ 3	dBm	-51.76	-51.24	-31.47	-51.79	-50.91	-31.11	-51.52	-51.10	-31.57	
		※ 4	dBm	-45.17	-45.39	-45.18	-44.99	-45.15	-46.03	-45.36	-45.35	-45.97	
	Unwanted Emission Intensity	※ 1	dBm	-48.34	-51.87	-51.78	-47.76	-51.84	-51.75	-47.88	-52.14	-52.28	Limit ≤ 2.5 μW (-26 dBm)
		※ 2	dBm	-17.06	-50.66	-50.68	-17.09	-50.26	-51.14	-17.23	-50.21	-51.23	Limit ≤ 25 μW (-16 dBm)
		※ 3	dBm	-51.60	-51.08	-31.31	-51.63	-50.75	-30.95	-51.36	-50.94	-31.41	Limit ≤ 25 μW (-16 dBm)
		※ 4	dBm	-45.04	-45.26	-45.05	-44.86	-45.02	-45.90	-45.23	-45.22	-45.84	Limit ≤ 2.5 μW (-26 dBm)
	Unwanted Emission Intensity	※ 1	μW	0.0147	0.0065	0.0066	0.0167	0.0065	0.0067	0.0163	0.0061	0.0059	Limit ≤ 2.5 μW (-26 dBm)
		※ 2	μW	19.6789	0.0086	0.0086	19.5434	0.0094	0.0077	18.9234	0.0095	0.0075	Limit ≤ 25 μW (-16 dBm)
		※ 3	μW	0.0069	0.0078	0.7396	0.0069	0.0084	0.8035	0.0073	0.0081	0.7228	Limit ≤ 25 μW (-16 dBm)
		※ 4	μW	0.0313	0.0298	0.0313	0.0327	0.0315	0.0257	0.0300	0.0301	0.0261	Limit ≤ 2.5 μW (-26 dBm)

※ 1: Frequency Band 1 (30 MHz ≤ f ≤ 2387 MHz) ※ 4: Frequency Band 4 (2496.5 MHz ≤ f < 12.5 GHz)
※ 2: Frequency Band 2 (2387 MHz < f ≤ 2400 MHz) ※ 5: Frequency Band 5 (30 MHz ≤ f < 1000 MHz)
※ 3: Frequency Band 3 (2483.5 MHz ≤ f < 2496.5 MHz) ※ 6: Frequency Band 6 (1000 MHz ≤ f < 12.5 GHz)

7. Limitation of Collateral Emission of Receiver

Limitation of Collateral Emission	Test Voltage		V	Normal Voltage (3.2 V)			High Voltage + 10% (3.52V)			Low Voltage - 10% (2.88 V)			Remarks
	Test Frequency		MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	
	Spurious Emission Frequency	※ 5	MHz	468.44	825.40	390.84	978.66	648.86	456.80	557.68	111.48	709.00	1st 30MHz~1000MHz:: Maximum emission and all emissions beyond 1/10 of the limitation must be indicated. 2nd 3rd
		※ 5	MHz	-	-	-	-	-	-	-	-	-	
		※ 5	MHz	-	-	-	-	-	-	-	-	-	
		※ 6	MHz	2403.00	2426.00	2472.00	2403.00	2426.00	2472.00	2403.00	2426.00	2472.00	1st 1000MHz~12.5GHz:: Maximum emission and all emissions beyond 1/10 of the limitation must be indicated. 2nd 3rd
		※ 6	MHz	-	-	-	-	-	-	-	-	-	
		※ 6	MHz	-	-	-	-	-	-	-	-	-	
	Cable Loss	※ 5	dB	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	1st 2nd 3rd
		※ 5	dB	-	-	-	-	-	-	-	-	-	
		※ 5	dB	-	-	-	-	-	-	-	-	-	
		※ 6	dB	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1st 2nd 3rd
		※ 6	dB	-	-	-	-	-	-	-	-	-	
		※ 6	dB	-	-	-	-	-	-	-	-	-	
	Spectrum Raw	※ 5	dBm	-78.05	-77.74	-77.32	-76.86	-77.68	-78.04	-78.07	-77.76	-78.32	1st 2nd 3rd
		※ 5	dBm	-	-	-	-	-	-	-	-	-	
		※ 5	dBm	-	-	-	-	-	-	-	-	-	
		※ 6	dBm	-67.54	-69.33	-68.73	-67.41	-69.34	-67.47	-67.12	-69.23	-68.49	1st 2nd 3rd
		※ 6	dBm	-	-	-	-	-	-	-	-	-	
		※ 6	dBm	-	-	-	-	-	-	-	-	-	
	Spurious Emission Intensity	※ 5	dBm	-77.96	-77.65	-77.23	-76.77	-77.59	-77.95	-77.98	-77.67	-78.23	1st Limit ≤ 4 nW (-54 dBm) 2nd RBW : 100 kHz ; VBW : 100 kHz 3rd
		※ 5	dBm	-	-	-	-	-	-	-	-	-	
		※ 5	dBm	-	-	-	-	-	-	-	-	-	
		※ 6	dBm	-67.41	-69.20	-68.60	-67.28	-69.21	-67.34	-66.99	-69.10	-68.36	1st Limit ≤ 20 nW (-47 dBm) 2nd RBW : 1 MHz ; VBW : 1 MHz 3rd
		※ 6	dBm	-	-	-	-	-	-	-	-	-	
		※ 6	dBm	-	-	-	-	-	-	-	-	-	
	Spurious Emission Intensity	※ 5	nW	0.0160	0.0172	0.0189	0.0210	0.0174	0.0160	0.0159	0.0171	0.0150	Total Emission Power
		※ 5	nW	0.0160	0.0172	0.0189	0.0210	0.0174	0.0160	0.0159	0.0171	0.0150	1st Limit ≤ 4 nW (-54 dBm) 2nd RBW : 100 kHz ; VBW : 100 kHz 3rd
		※ 5	nW	-	-	-	-	-	-	-	-	-	
		※ 5	nW	-	-	-	-	-	-	-	-	-	
		※ 6	nW	0.1816	0.1202	0.1380	0.1871	0.1199	0.1845	0.2000	0.1230	0.1459	Total Emission Power
		※ 6	nW	0.1816	0.1202	0.1380	0.1871	0.1199	0.1845	0.2000	0.1230	0.1459	1st Limit ≤ 20 nW (-47 dBm) 2nd RBW : 1 MHz ; VBW : 1 MHz 3rd
		※ 6	nW	-	-	-	-	-	-	-	-	-	
		※ 6	nW	-	-	-	-	-	-	-	-	-	

※ 1: Frequency Band 1 (30 MHz ≤ f ≤ 2387 MHz) ※ 4: Frequency Band 4 (2496.5 MHz ≤ f < 12.5 GHz)
※ 2: Frequency Band 2 (2387 MHz < f ≤ 2400 MHz) ※ 5: Frequency Band 5 (30 MHz ≤ f < 1000 MHz)
※ 3: Frequency Band 3 (2483.5 MHz ≤ f < 2496.5 MHz) ※ 6: Frequency Band 6 (1000 MHz ≤ f < 12.5 GHz)

8. Hopping Frequency Dwell Time

DH5	Test Voltage		V	Normal Voltage (3.2 V)			High Voltage + 10% (3.52V)			Low Voltage - 10% (2.88 V)			Remarks
	Test Frequency		MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	Limit ≤ 0.4 sec (In 0.4 sec × spreading rate) RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz
	Pulse Duration		msec	3.1043	3.1043	3.1043	3.1043	3.1043	3.1043	3.1043	3.1043	3.1043	
	Measurement Time		sec	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	28.66	The total sum of holding time at arbitrary frequencies within the time multiplied 0.4 sec by the spreading rate
	Dwell Time		sec	0.3003	0.3003	0.3003	0.3003	0.3003	0.3003	0.3003	0.3003	0.3003	

9. Spread Factor

Spread Factor	Test Voltage		V	Normal Voltage (3.2 V)			High Voltage + 10% (3.52V)			Low Voltage - 10% (2.88 V)			Remarks
	Test Frequency		MHz	2402 ~ 2480			2402 ~ 2480			2402 ~ 2480			
	Spread-Spectrum Bandwidth		MHz	71.64			71.64			71.64			
	Modulation Rate		Mcps	3.000			3.000			3.000			
	Spread Factor			23.88			23.88			23.88			Spread Factor Limit ≥ 5 (DSSS and FHSS)