

Japan Test Report

Equipment : Bluetooth Dual Mode UART AT featuring smartBASIC
Model No. : BT900-SC
Brand Name : Laird Technologies
Applicant : Laird Technologies
Address : 11160 Thompson Ave., Lenexa, Kansas 66219, USA
Standard : ARBI STD-T66 Ver. 3.6
Received Date : Apr. 28, 2014
Tested Date : May 13, 2014

Measurement was conducted by the following test method:
the test method of Ordinance Concerning Technical Regulations Conformity Certification etc. of Specified Radio Equipment in Annex 1, the Ministry of Internal Affairs and Communication notification in Annex "43" of Article 88, Paragraph 1 or the test method more than equivalent.

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
JR442806AD	Rev. 01	Initial issue	May 28, 2014

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	Interference prevention function	Pass
3.3(1)	Receiver Spurious Emission	Pass

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

Power Type	3.3Vdc from host.
Type(s) of Modulation / Technology	FHSS / GFSK = 1Mbps, $\pi/4$ DQPSK = 2Mbps, 8DPSK = 3Mbps
Bluetooth Version	V4.0
Frequency Range (MHz)	2402 ~ 2480 MHz
Total Channel Number	79
HW Version	BT900-A0
SW Version	9.x.y.z.

1.1.2 Antenna Details

Ant. No.	Type	Brand / Model	Gain (dBi)	Connector
1	PCB Dipole	Laird EBL2449A1-15UFL	2	UFL
2	Dipole	Nearson S181FL-L-RMM-2450S	2	UFL
3	Dipole	Laird MAF94190	2	UFL
4	Dipole	Laird WRR2400- IP04-B(MAF94019)	1.5	UFL

Note: Please refer to Appendix B for more details about antenna pattern and other information.

1.1.3 Antenna Power

Operating Mode	Rated Power (mW/MHz)	Measured Condcuted Power (mW/MHz)	Radiated Power (mW/MHz)
GFSK (non-AFH)	0.07	0.075	0.12
GFSK (AFH)	0.3	0.302	0.48
8DPSK (non-AFH)	0.03	0.036	0.06
8DPSK (AFH)	0.15	0.143	0.23

1.1.4 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		

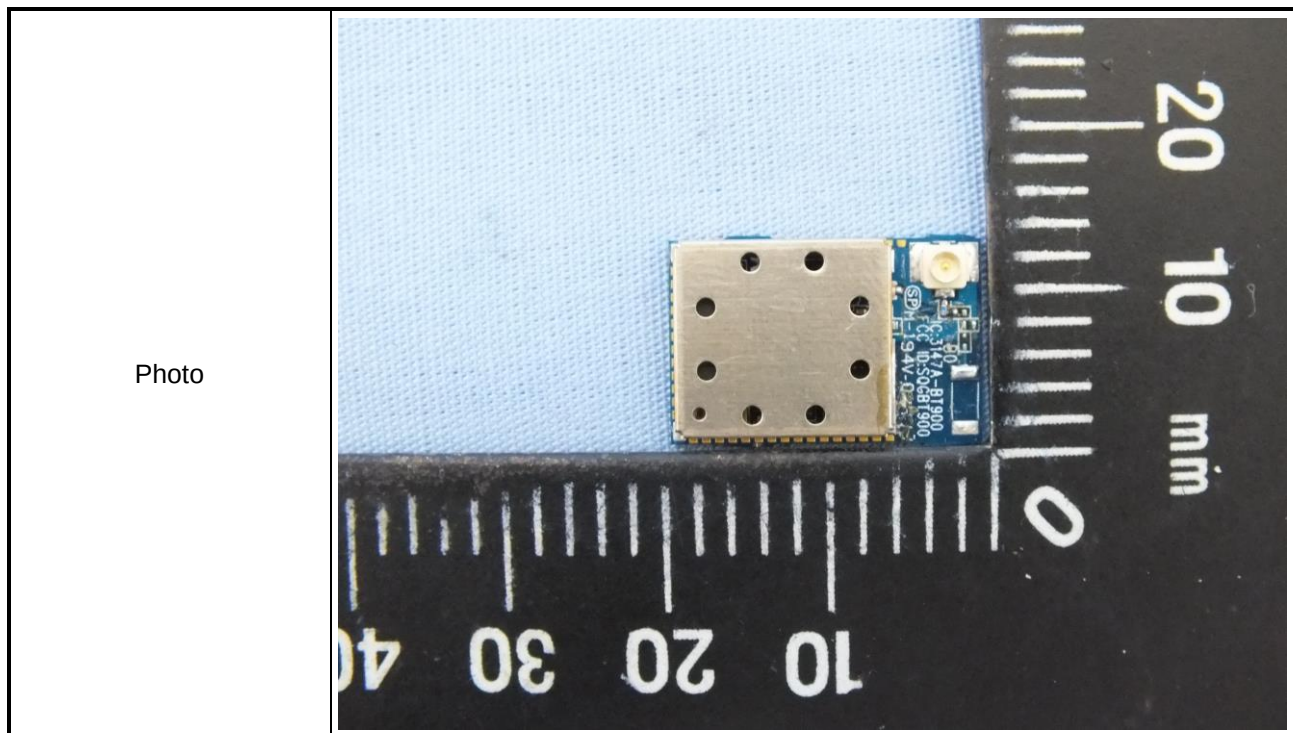
1.1.5 Test Tool and Power Setting

Test Tool
InstallBlueSuite V.2.5

Power Setting			
Channel	Frequency (MHz)	GFSK	8DPSK
0	2402	63	63
39	2441	63	63
78	2480	63	63

1.1.6 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.



1.2 Test Equipment and Calibration Data

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101063	Feb. 17, 2014	Feb. 16, 2015
Power Meter	Anritsu	ML2495A	1241002	Oct. 24, 2013	Oct. 23, 2014
Power Sensor	Anritsu	MA2411B	1207366	Oct. 24, 2013	Oct. 23, 2014
Signal Generator	R&S	SMB100A	175727	Jan. 07, 2014	Jan. 06, 2015
DC Power Source	G.W.	GPC-6030D	C671845	Jun. 21, 2013	Jun. 20, 2014
Note: Calibration Interval of instruments listed above is one year.					

1.3 Testing Applied Standards

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

ARBI STD-T66 Ver. 3.6

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 (Limit)	Uncertainty
Frequency error	±44.076 Hz	±33.988 Hz
Bandwidth	±44.076 Hz	±33.988 Hz
Conducted power	±0.551 dB	±0.537 dB
TX Conducted emission	±2.687 dB	±2.308 dB
RX Conducted emission	±3.148 dB	±2.525 dB

2 Test Configuration

2.1 Testing Location and Conditions

Test Site	Site Category	Ambient Condition	Tested By
TH01-WS	OVEN Room	21.6°C / 65%	Jack Li

2.2 Supporting Units

Support Unit	Brand	Model	FCC ID
-	-	-	-

2.3 The Worst Test Modes and Channel Details

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

3 Transmitter Test Results

3.1 Antenna Power

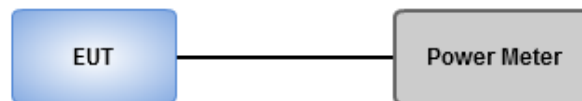
3.1.1 Limit of Antenna Power

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. Output Power Density (mW/MHz) = Total Output Power (mW) / Burst Ratio / 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

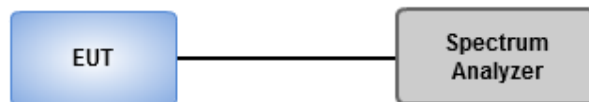
Frequency tolerance shall be +/- 50ppm.

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

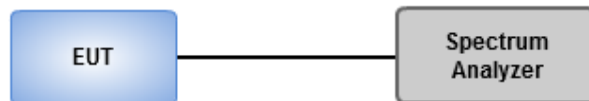
3.3.1 Limit of Occupied Bandwidth

Mode	Limit (MHz)
FH	83.5
FH+DS	83.5
FH+OFDM	83.5
OFDM(Narrow- bandwidht), 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

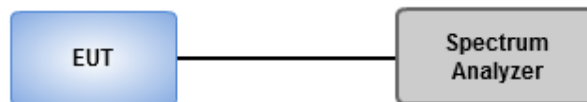
3.4.1 Limit of Spreading Bandwidth and Factor

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

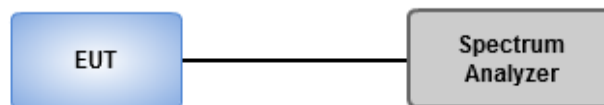
3.5.1 Limit of Transmitter Spurious Emissions

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

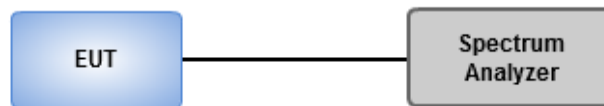
3.6.1 Limit of Dwell time

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 Interference prevention function

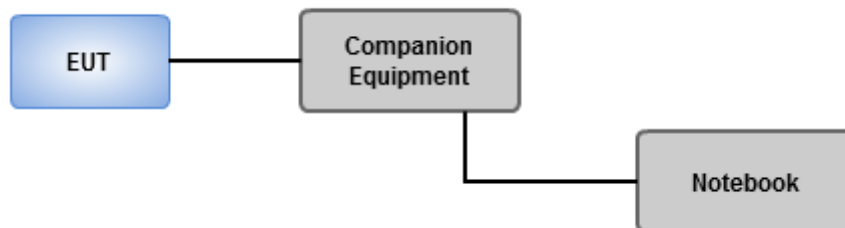
3.7.1 Limit of Interference Prevention Function

Limits
The identification code shall be 48 bits long

3.7.2 Test Procedures

1. Set EUT under operating mode and link up with companion equipment
2. Check communication status between EUT and companion equipment is normal
3. Confirm the MAC address of EUT

3.7.3 Test Setup



3.7.4 Test Result of Interference Prevention Function

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

4 Receiver Test Results

4.1 Receiver Spurious Emissions

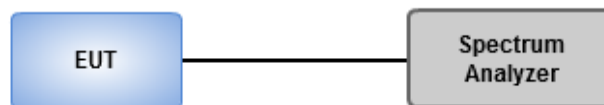
4.1.1 Limit of Receiver Spurious Emissions

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.

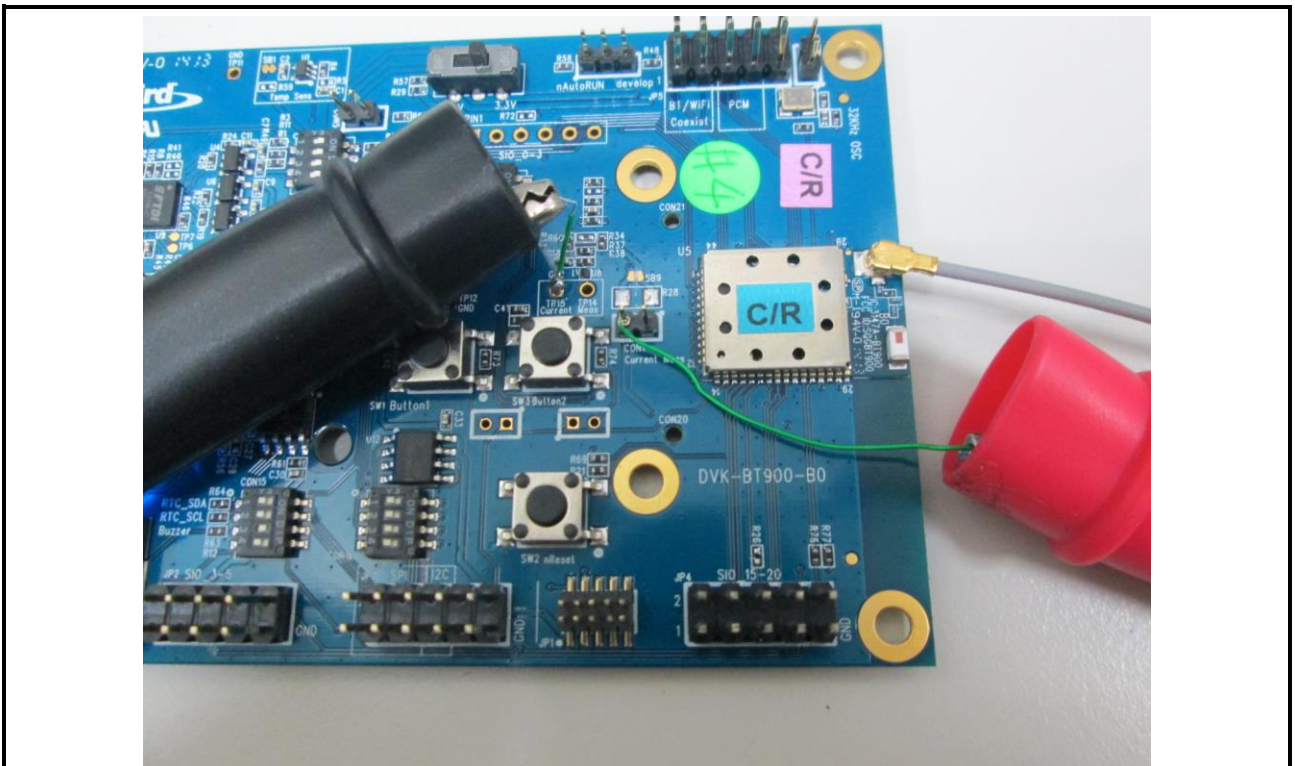
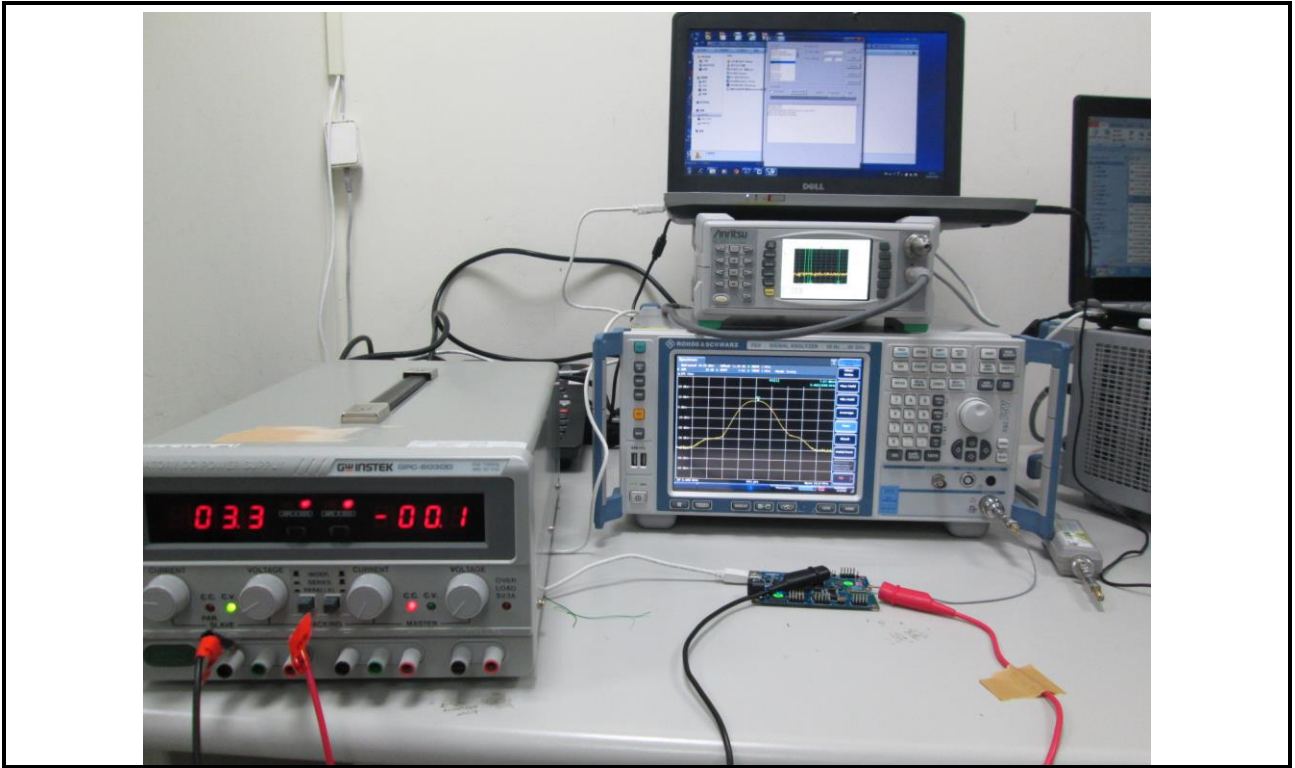
4.1.3 Test Setup



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

5 Photographs of the Test Configuration



6 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp, it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan Hsiang. Location map can be found on our website <http://www.icertifi.com.tw>.

Linkou

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Kwei Shan

Tel: 886-3-271-8666

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If you have any suggestion, please feel free to contact us as below information

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Email: ICC_Service@icertifi.com.tw

==END==

Appendix A 19-BT-F1D

						ICC No.	JR442806
						Test Date	2014/5/13
						Test Location	ICC Lab.
						Temp. / Humid.	21.6℃ / 65%
						Test Conducted By	
						Name	JACK
						Department	Radio Service Group
1. General Information							
Specified Radio Equipment	Class	Article 2 Paragraph 1 Item 19			BT900-SC		
	Type of Emission	F1D			NA		
	Modulation Type	FHSS: GFSK			0.07 mW/MHz		
	Frequency	2402 ~ 2480 MHz					

2. Test Results													
Testing for Electrical Specification	Test Voltage	V	Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks	
	Test Frequency	MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	Low/Mid/High of test frequency range	
	Measured Frequency	MHz	2401.9875	2440.9872	2479.9854	2401.9877	2440.9874	2479.9857	2401.9873	2440.9869	2479.9851		
	Frequency Error	ppm	-5.20	-5.24	-5.89	-5.12	-5.16	-5.77	-5.29	-5.37	-6.01	Limit ≤ 50 ppm	
	Occupied Bandwidth	MHz	78.79			78.79			78.79			Limit ≤ 83.5 MHz (RB/VB : 1MHz)	
	Spread-spectrum Bandwidth	MHz	71.30			71.30			71.30			Spread Factor Limit ≥ 5 (DSSS and FHSS)	
	Unwanted Emission Intensity (Power emission within 1MHz bandwidth)	※ 1	μW	0.01422	0.01439	0.01384	0.01486	0.01449	0.01871	0.01459	0.01611	0.01419	Limit ≤ 2.5 μW (-26 dBm)
		※ 2	μW	1.32434	0.01479	0.01503	1.47571	0.01406	0.01528	1.43219	0.01510	0.01340	Limit ≤ 25 μW (-16 dBm)
		※ 3	μW	0.01986	0.01892	0.27416	0.01419	0.02208	0.27164	0.01845	0.02080	0.26792	Limit ≤ 25 μW (-16 dBm)
		※ 4	μW	0.07047	0.06577	0.07129	0.08054	0.08395	0.06501	0.08414	0.06152	0.06823	Limit ≤ 2.5 μW (-26 dBm)
	Antenna Power (Conducted)	mW/MHz	0.073993			0.074506			0.073653			Limit ≤ 3 mW/MHz (4.77 dBm/MHz)	
	Antenna Power Error	mW/MHz	0.003993			0.004506			0.003653				
		%	5.70			6.44			5.22			Limit + 20% ~ - 80%	
	Limitation of Collateral Emission of Receiver	※ 5	nW	0.0029	0.0031	0.0030	0.0034	0.0028	0.0028	0.0028	0.0029	0.0038	Limit ≤ 4 nW (-54 dBm)
		※ 6	nW	0.0798	0.0731	0.0791	0.0899	0.0830	0.0839	0.0851	0.0942	0.0755	Limit ≤ 20 nW (-47 dBm)
	Hopping Frequency Dwell Time	sec	0.2844	0.2844	0.2844	0.2844	0.2844	0.2844	0.2844	0.2844	0.2844	0.2844	Limit ≤ 0.4 sec (In 0.4 sec × spreading rate)
	Radio Interference Prevention Function	ID Code	Good, MAC Address :00-02-5B-00-A5-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 (3.3V)		High Voltage (3.63V)		Low Voltage (2.97V)		Remarks	
	Test Frequency	MHz	2402 ~ 2480		2402 ~ 2480		2402 ~ 2480			
	Power Meter Raw from EUT	dBm	5.12		5.15		5.10			
	Cable Loss	dB	1.07		1.07		1.07		Refer to Calibration Result	
	Duty Cycle Factor	dB	1.03		1.03		1.03		Duty Factor = $10 \times 10\text{Log}_{10}(1/\text{Duty Cycle})$	
	Spreading Bandwidth Factor	dB	-18.53		-18.53		-18.53		BW Factor = $10 \times 10\text{Log}_{10}(1/\text{Spreading BW})$	
	Antenna Power (Conducted)	dBm/MHz	-11.31		-11.28		-11.33		Limit $\leq 3 \text{ mW/MHz}$ (4.77 dBm/MHz)	
	Antenna Power (Conducted)	mW/MHz	0.07399		0.07451		0.07365			
	Antenna Power Error	mW	0.00399		0.00451		0.00365			
		%	5.70		6.44		5.22		Limit + 20% ~ - 80%	
	Transmitter ON _{Time}	msec			2.9548				RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz	
	Transmitter (ON+OFF) _{Time}	msec			3.7478					
	Transmitter Duty Cycle (DHS)	%			78.84%				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	3dB Beam- width Horizontal (Degree)	3dB Beam- width Vertical (Degree)	Model	Length	Loss C					
	(dBm /MHz)		(dBi)				(m)	(dB)					
1	-11.28	PCB Dipole	2.00						2.00	-9.28	360.00	Good	EBL2449A1-15UFL
2	-11.28	Dipole	2.00						2.00	-9.28	360.00	Good	Nearson_(S181FL-L-RMM-2450S)
3	-11.28	Dipole	2.00						2.00	-9.28	360.00	Good	MAF94190
4	-11.28	Dipole	1.50						1.50	-9.78	360.00	Good	WRR2400-IP04-B_(MAF94019)
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						
2						
2						
3						
3						
3						
3						
4						
4						
4						
4						

6. Unwanted Emission Intensity

Verify	Test Voltage	V	Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks	
	Test Frequency	MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480		
	Unwanted Emission Frequency	※ 1	MHz	2323.90	2115.80	2341.00	2102.20	2337.50	2375.10	2149.90	2126.10	2088.50	RBW : 1 MHz ; VBW : 1 MHz
		※ 2	MHz	2399.99	2389.40	2391.13	2399.99	2388.27	2393.31	2399.99	2388.99	2394.61	
		※ 3	MHz	2495.93	2492.88	2483.51	2491.05	2492.48	2483.51	2494.78	2493.29	2483.51	
		※ 4	MHz	2561.50	9423.50	11783.50	12174.50	11653.50	11247.50	11899.50	11667.50	11189.50	
	Cable Loss	※ 1	dB	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	
		※ 2	dB	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	

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Unwanted Emission Inter	Cable Loss	※ 3	dB	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	
		※ 4	dB	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	
		※ 1	dBm	-49.54	-49.49	-49.66	-49.35	-49.46	-48.35	-49.43	-49.00	-49.55
		※ 2	dBm	-29.85	-49.37	-49.30	-29.38	-49.59	-49.23	-29.51	-49.28	-49.80
	Spectrum Raw	※ 3	dBm	-48.09	-48.30	-36.69	-49.55	-47.63	-36.73	-48.41	-47.89	-36.79
		※ 4	dBm	-43.65	-43.95	-43.60	-43.07	-42.89	-44.00	-42.88	-44.24	-43.79
		※ 1	dBm	-48.47	-48.42	-48.59	-48.28	-48.39	-47.28	-48.36	-47.93	-48.48
		※ 2	dBm	-28.78	-48.30	-48.23	-28.31	-48.52	-48.16	-28.44	-48.21	-48.73
	Unwanted Emission Intensity	※ 3	dBm	-47.02	-47.23	-35.62	-48.48	-46.56	-35.66	-47.34	-46.82	-35.72
		※ 4	dBm	-41.52	-41.82	-41.47	-40.94	-40.76	-41.87	-40.75	-42.11	-41.66
		※ 1	μW	0.0142	0.0144	0.0138	0.0149	0.0145	0.0187	0.0146	0.0161	0.0142
		※ 2	μW	1.3243	0.0148	0.0150	1.4757	0.0141	0.0153	1.4322	0.0151	0.0134
	Unwanted Emission Intensity	※ 3	μW	0.0199	0.0189	0.2742	0.0142	0.0221	0.2716	0.0185	0.0208	0.2679
		※ 4	μW	0.0705	0.0658	0.0713	0.0805	0.0839	0.0650	0.0841	0.0615	0.0682
												Limit ≤ 2.5 μW (-26 dBm)
												Limit ≤ 25 μW (-16 dBm)
												Limit ≤ 25 μW (-16 dBm)
												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

Test Voltage			V		Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks	
Test Frequency			MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480			
Spurious Emission Frequency	※ 5	MHz	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	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	12458.00	10528.00	7549.00	10861.00	11194.00	11194.00	11826.00	12475.00	7516.00	1st	1000MHz~12.5GHz:: Maximum emission and all emissions beyond 1/10 of the limitation must be indicated.		
	※ 6	MHz	-	-	-	-	-	-	-	-	-	2nd			
	※ 6	MHz	-	-	-	-	-	-	-	-	-	3rd			
Cable Loss	※ 5	dB	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	1st			
	※ 5	dB	-	-	-	-	-	-	-	-	-	2nd			
	※ 5	dB	-	-	-	-	-	-	-	-	-	3rd			
	※ 6	dB	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	1st			
	※ 6	dB	-	-	-	-	-	-	-	-	-	2nd			
	※ 6	dB	-	-	-	-	-	-	-	-	-	3rd			
Spectrum Raw	※ 5	dBm	-85.79	-85.53	-85.72	-85.17	-85.96	-86.00	-86.04	-85.82	-84.66	1st			
	※ 5	dBm	-	-	-	-	-	-	-	-	-	2nd			
	※ 5	dBm	-	-	-	-	-	-	-	-	-	3rd			
	※ 6	dBm	-73.11	-73.49	-73.15	-72.59	-72.94	-72.89	-72.83	-72.39	-73.35	1st			
	※ 6	dBm	-	-	-	-	-	-	-	-	-	2nd			
	※ 6	dBm	-	-	-	-	-	-	-	-	-	3rd			
Spurious Emission Intensity	※ 5	dBm	-85.31	-85.05	-85.24	-84.69	-85.48	-85.52	-85.56	-85.34	-84.18	1st	Limit ≦ 4 nW (-54 dBm) RBW : 100 kHz ; VBW : 100 kHz		
	※ 5	dBm	-	-	-	-	-	-	-	-	-	2nd			
	※ 5	dBm	-	-	-	-	-	-	-	-	-	3rd			
	※ 6	dBm	-70.98	-71.36	-71.02	-70.46	-70.81	-70.76	-70.70	-70.26	-71.22	1st	Limit ≦ 20 nW (-47 dBm) RBW : 1 MHz ; VBW : 1 MHz		
	※ 6	dBm	-	-	-	-	-	-	-	-	-	2nd			
	※ 6	dBm	-	-	-	-	-	-	-	-	-	3rd			
Spurious Emission Intensity	※ 5	nW	0.0029	0.0031	0.0030	0.0034	0.0028	0.0028	0.0028	0.0029	0.0038	Total Emission Power			
	※ 5	nW	0.0029	0.0031	0.0030	0.0034	0.0028	0.0028	0.0028	0.0029	0.0038	1st	Limit ≦ 4 nW (-54 dBm) RBW : 100 kHz ; VBW : 100 kHz		
	※ 5	nW	-	-	-	-	-	-	-	-	-	2nd			
	※ 5	nW	-	-	-	-	-	-	-	-	-	3rd			
	※ 6	nW	0.0798	0.0731	0.0791	0.0899	0.0830	0.0839	0.0851	0.0942	0.0755	Total Emission Power			
	※ 6	nW	0.0798	0.0731	0.0791	0.0899	0.0830	0.0839	0.0851	0.0942	0.0755	1st	Limit ≦ 20 nW (-47 dBm) RBW : 1 MHz ; VBW : 1 MHz		
	※ 6	nW	-	-	-	-	-	-	-	-	-	2nd			
	※ 6	nW	-	-	-	-	-	-	-	-	-	3rd			

※ 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 (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks	
	Test Frequency		MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	Limit ≤ 0.4 sec (In 0.4 sec × spreading rate)	
	Pulse Duration		msec	2.9548	2.9548	2.9548	2.9548	2.9548	2.9548	2.9548	2.9548	2.9548	RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz	
	Measurement Time		sec	28.52	28.52	28.52	28.52	28.52	28.52	28.52	28.52	28.52	The total sum of holding time at arbitrary frequencies within the time multiplied 0.4 sec by the spreading rate	
	Dwell Time		sec	0.2844	0.2844	0.2844	0.2844	0.2844	0.2844	0.2844	0.2844	0.2844		

9. Spread Factor

Spread Factor	Test Voltage		V	Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks	
	Test Frequency		MHz	2402 ~ 2480			2402 ~ 2480			2402 ~ 2480				
	Spread-Spectrum Bandwidth		MHz	71.30			71.30			71.30				
	Modulation Rate		Mcps	1.000			1.000			1.000				
	Spread Factor			71.2950			71.2950			71.2950			Spread Factor Limit ≥ 5 (DSSS and FHSS)	

Appendix C 19-BT-F1D

ICC No.	JR442806
Test Date	2014/5/13
Test Location	ICC Lab.
Temp. / Humid.	21.6°C / 65%
Test Conducted By	
Name	JACK
Department	Radio Service Group

1. General Information

Specified Radio Equipment	Class	Article 2 Paragraph 1 Item 19	Model	BT900-SC	Temp. / Humid.	21.6℃ / 65%	
	Type of Emission	F1D	Serial No.	NA	Test Conducted By		
	Modulation Type	FHSS: GFSK	Antenna Power	0.3	mW/MHz	Name	JACK
	Frequency	2402~2480 MHz (AFH mode)				Department	Radio Service Group

2. Test Results

Specification	Test Voltage	V	Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks
	Test Frequency	MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	Low/Mid/High of test frequency range
	Occupied Bandwidth	MHz	19.55			19.55			19.55			Limit ≤ 83.5 MHz (RB/VB : 1MHz)
	Spread-spectrum Bandwidth	MHz	17.57			17.57			17.57			Spread Factor Limit ≥ 5 (DSSS and FHSS)
	Antenna Power (Conducted)	mW/MHz	0.300177			0.302258			0.298798			Limit ≤ 3 mW/MHz (4.77 dBm/MHz)
	Antenna Power Error	mW/MHz	0.000177			0.002258			-0.001202			Limit + 20% ~ - 80%
		%	0.06			0.75			-0.40			
	Hopping Frequency Dwell Time	sec	0.2769	0.2769	0.2769	0.2769	0.2769	0.2769	0.2769	0.2769	0.2769	Limit ≤ 0.4 sec (In 0.4 sec × spreading rate)
	Radio Interference Prevention Function	ID Code	Good, MAC Address : 00-02-5B-00-A5-A5									
		Carrier Sense	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR: Not Require

3. Antenna Power (Conducted Power)

Testing for Electrical Specification	Test Voltage	V	Normal Voltage (3.3V)	High Voltage (3.63V)	Low Voltage (2.97V)	Remarks
	Test Frequency	MHz	2402 ~ 2480	2402 ~ 2480	2402 ~ 2480	
	Power Meter Raw from EUT	dBm	5.12	5.15	5.10	
	Cable Loss	dB	1.07	1.07	1.07	Refer to Calibration Result
	Duty Cycle Factor	dB	1.03	1.03	1.03	Duty Factor = $10 \times 10\text{Log}_{10}(1/\text{Duty Cycle})$
	Spreading Bandwidth Factor	dB	-12.45	-12.45	-12.45	BW Factor = $10 \times 10\text{Log}_{10}(1/\text{Spreading BW})$
	Antenna Power (Conducted)	dBm/MHz	-5.23	-5.20	-5.25	Limit $\leq 3 \text{ mW/MHz}$ (4.77 dBm/MHz)
	Antenna Power (Conducted)	mW/MHz	0.30018	0.30226	0.29880	
	Antenna Power Error	mW	0.00018	0.00226	-0.00120	
		%	0.06	0.75	-0.40	Limit + 20% ~ - 80%
Transmitter ON _{Time}	msec	2.9548			RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz	
Transmitter (ON+OFF) _{Time}	msec	3.7478				
Transmitter Duty Cycle (DH5)	%	78.84%			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	-5.20	PCB Dipole	2.00						2.00	-3.20	360.00	Good	EBL2449A1-15UFL
2	-5.20	Dipole	2.00						2.00	-3.20	360.00	Good	Nearson_(S181FL-L-RMM-2450S)
3	-5.20	Dipole	2.00						2.00	-3.20	360.00	Good	MAF94190
4	-5.20	Dipole	1.50						1.50	-3.70	360.00	Good	WRR2400-IP04-B_(MAF94019)
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)

8. Hopping Frequency Dwell Time

Test Voltage	V	Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks
Test Frequency	MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	Limit ≤ 0.4 sec (In 0.4 sec × spreading rate)
Pulse Duration	msec	2.9548	2.9548	2.9548	2.9548	2.9548	2.9548	2.9548	2.9548	2.9548	RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz
Measurement Time	sec	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	The total sum of holding time at arbitrary frequencies within the time multiplied 0.4 sec by the spreading rate
Dwell Time	sec	0.2769	0.2769	0.2769	0.2769	0.2769	0.2769	0.2769	0.2769	0.2769	

9. Spread Factor

Test Voltage	V	Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks
Test Frequency	MHz	2402 ~ 2480			2402 ~ 2480			2402 ~ 2480			
Spread-Spectrum Bandwidth	MHz	17.57			17.57			17.57			
Modulation Rate	Mcps	1.000			1.000			1.000			
Spread Factor		17.5740			17.5740			17.5740			Spread Factor Limit ≥ 5 (DSSS and FHSS)

Appendix A 19-BT-F1D

ICC No.	JR442806
Test Date	2014/5/13
Test Location	ICC Lab.
Temp. / Humid.	21.6℃ / 65%
Test Conducted By	
Name	JACK
Department	Radio Service Group

1. General Information

Specified Radio Equipment	Class	Article 2 Paragraph 1 Item 19	Model	BT900-SC	
	Type of Emission	F1D	Serial No.	NA	
	Modulation Type	FHSS: 8-DPSK	Antenna Power	0.03	mW/MHz
	Frequency	2402~2480 MHz			

2. Test Results

Testing for Electrical Specification	Test Voltage	V	Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks	
	Test Frequency	MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	Low/Mid/High of test frequency range	
	Measured Frequency	MHz	2401.9864	2440.9868	2479.9862	2401.9869	2440.9876	2479.9869	2401.9856	2440.9853	2479.9847		
	Frequency Error	ppm	-5.66	-5.41	-5.56	-5.45	-5.08	-5.28	-6.00	-6.02	-6.17	Limit ≤ 50 ppm	
	Occupied Bandwidth	MHz	78.91			78.91			78.79			Limit ≤ 83.5 MHz (RB/VB : 1MHz)	
	Spread-spectrum Bandwidth	MHz	71.17			71.05			70.93			Spread Factor Limit ≥ 5 (DSSS and FHSS)	
	Unwanted Emission Intensity (Power emission within 1MHz bandwidth)	※ 1	μW	0.01306	0.01795	0.01542	0.01175	0.01396	0.01227	0.01416	0.01230	0.01476	Limit ≤ 2.5 μW (-26 dBm)
		※ 2	μW	3.83707	0.01409	0.01406	3.91742	0.01327	0.01390	3.99945	0.01352	0.01355	Limit ≤ 25 μW (-16 dBm)
		※ 3	μW	0.01897	0.01963	0.06012	0.01567	0.01941	0.05370	0.01581	0.01778	0.06998	Limit ≤ 25 μW (-16 dBm)
		※ 4	μW	0.06412	0.06516	0.06223	0.07534	0.06486	0.06902	0.07295	0.07413	0.06427	Limit ≤ 2.5 μW (-26 dBm)
Antenna Power (Conducted)	mW/MHz	0.035041			0.035507			0.034838			Limit ≤ 3 mW/MHz (4.77 dBm/MHz)		
Antenna Power Error	mW/MHz	0.005041			0.005507			0.004838					
	%	16.80			18.36			16.13			Limit + 20% ~ - 80%		
Limitation of Collateral Emission of Receiver	※ 5	nW	0.0031	0.0029	0.0029	0.0029	0.0027	0.0027	0.0027	0.0031	0.0029	Limit ≤ 4 nW (-54 dBm)	
	※ 6	nW	0.0953	0.0793	0.0746	0.0863	0.0822	0.0863	0.0673	0.0836	0.0731	Limit ≤ 20 nW (-47 dBm)	
Hopping Frequency Dwell Time	sec	0.2786	0.2786	0.2786	0.2781	0.2781	0.2781	0.2777	0.2777	0.2777	Limit ≤ 0.4 sec (In 0.4 sec × spreading rate)		
Radio Interference Prevention Function	ID Code	Good, MAC Address : 00-02-5B-00-A5-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 (3.3V)	High Voltage (3.63V)	Low Voltage (2.97V)	Remarks
	Test Frequency	MHz	2402 ~ 2480	2402 ~ 2480	2402 ~ 2480	
	Power Meter Raw from EUT	dBm	1.80	1.85	1.76	
	Cable Loss	dB	1.07	1.07	1.07	Refer to Calibration Result
	Duty Cycle Factor	dB	1.10	1.10	1.10	Duty Factor = 10 × 10Log ₁₀ (1/Duty Cycle)
	Spreading Bandwidth Factor	dB	-18.52	-18.52	-18.51	BW Factor = 10 × 10Log ₁₀ (1/Spreading BW)
	Antenna Power (Conducted)	dBm/MHz	-14.55	-14.50	-14.58	Limit ≤ 3 mW/MHz (4.77 dBm/MHz)
	Antenna Power (Conducted)	mW/MHz	0.03504	0.03551	0.03484	
	Antenna Power Error	mW	0.00504	0.00551	0.00484	
		%	16.80	18.36	16.13	Limit + 20% ~ - 80%
	Transmitter ON _{Time}	msec	2.8991			RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz
	Transmitter (ON+OFF) _{Time}	msec	3.7339			
Transmitter Duty Cycle (3DH5)	%	77.64%			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			Total 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	-14.50	PCB Dipole	2.00						2.00	-12.50	360.00	Good	EBL2449A1-15UFL
2	-14.50	Dipole	2.00						2.00	-12.50	360.00	Good	Nearson (S181FL-L-RMM-2450S)
3	-14.50	Dipole	2.00						2.00	-12.50	360.00	Good	MAF94190
4	-14.50	Dipole	1.50						1.50	-13.00	360.00	Good	WRR2400-IP04-B (MAF94019)
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) (dB)	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

Test Voltage		V	Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks
Test Frequency		MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	
Unwanted Emission Frequency	※ 1	MHz	2102.20	2119.20	2071.50	2105.60	2197.70	2245.40	2153.30	2190.90	2095.40	RBW : 1 MHz ; VBW : 1 MHz
	※ 2	MHz	2399.99	2389.53	2390.02	2399.99	2393.39	2397.96	2399.99	2390.04	2390.83	
	※ 3	MHz	2494.14	2493.33	2483.50	2489.98	2492.75	2483.60	2489.15	2493.20	2483.53	
	※ 4	MHz	11696.50	7556.50	12391.50	11247.50	10552.50	7585.50	11899.50	10263.50	7020.50	
Cable Loss	※ 1	dB	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	
	※ 2	dB	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	
	※ 3	dB	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	

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Unwanted Emission Intensity	Spectrum Raw	※ 4	dB	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13		
		※ 1	dBm	-49.91	-48.53	-49.19	-50.37	-49.62	-50.18	-49.56	-50.17	-49.38	
		※ 2	dBm	-25.23	-49.58	-49.59	-25.14	-49.84	-49.64	-25.05	-49.76	-49.75	
		※ 3	dBm	-48.29	-48.14	-43.28	-49.12	-48.19	-43.77	-49.08	-48.57	-42.62	
		※ 4	dBm	-44.06	-43.99	-44.19	-43.36	-44.01	-43.74	-43.50	-43.43	-44.05	
	Unwanted Emission Intensity	※ 1	dBm	-48.84	-47.46	-48.12	-49.30	-48.55	-49.11	-48.49	-49.10	-48.31	Limit ≤ 2.5 μW (-26 dBm)
		※ 2	dBm	-24.16	-48.51	-48.52	-24.07	-48.77	-48.57	-23.98	-48.69	-48.68	Limit ≤ 25 μW (-16 dBm)
		※ 3	dBm	-47.22	-47.07	-42.21	-48.05	-47.12	-42.70	-48.01	-47.50	-41.55	Limit ≤ 25 μW (-16 dBm)
		※ 4	dBm	-41.93	-41.86	-42.06	-41.23	-41.88	-41.61	-41.37	-41.30	-41.92	Limit ≤ 2.5 μW (-26 dBm)
	Unwanted Emission Intensity	※ 1	μW	0.0131	0.0179	0.0154	0.0117	0.0140	0.0123	0.0142	0.0123	0.0148	Limit ≤ 2.5 μW (-26 dBm)
		※ 2	μW	3.8371	0.0141	0.0141	3.9174	0.0133	0.0139	3.9994	0.0135	0.0136	Limit ≤ 25 μW (-16 dBm)
		※ 3	μW	0.0190	0.0196	0.0601	0.0157	0.0194	0.0537	0.0158	0.0178	0.0700	Limit ≤ 25 μW (-16 dBm)
		※ 4	μW	0.0641	0.0652	0.0622	0.0753	0.0649	0.0690	0.0729	0.0741	0.0643	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 (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks	
	Test Frequency		MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480		
	Spurious Emission Frequency	※ 5	MHz	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	1st	30MHz~1000MHz:: Maximum emission and
		※ 5	MHz	-	-	-	-	-	-	-	-	-	2nd	all emissions beyond 1/10 of the limitation
		※ 5	MHz	-	-	-	-	-	-	-	-	-	3rd	must be indicated.
		※ 6	MHz	10528.00	7615.00	11177.00	11194.00	10528.00	7582.00	7565.00	7516.00	7499.00	1st	1000MHz~12.5GHz:: Maximum emission and
		※ 6	MHz	-	-	-	-	-	-	-	-	-	2nd	all emissions beyond 1/10 of the limitation
		※ 6	MHz	-	-	-	-	-	-	-	-	-	3rd	must be indicated.
	Cable Loss	※ 5	dB	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	1st	
		※ 5	dB	-	-	-	-	-	-	-	-	-	2nd	
		※ 5	dB	-	-	-	-	-	-	-	-	-	3rd	
		※ 6	dB	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	1st	
		※ 6	dB	-	-	-	-	-	-	-	-	-	2nd	
		※ 6	dB	-	-	-	-	-	-	-	-	-	3rd	
	Spectrum Raw	※ 5	dBm	-85.61	-85.89	-85.86	-85.92	-85.93	-86.13	-86.10	-85.51	-85.87	1st	
		※ 5	dBm	-	-	-	-	-	-	-	-	-	2nd	
		※ 5	dBm	-	-	-	-	-	-	-	-	-	3rd	
		※ 6	dBm	-72.34	-73.14	-73.40	-72.77	-72.98	-72.77	-73.85	-72.91	-73.49	1st	
		※ 6	dBm	-	-	-	-	-	-	-	-	-	2nd	
		※ 6	dBm	-	-	-	-	-	-	-	-	-	3rd	
	Spurious Emission Intensity	※ 5	dBm	-85.13	-85.41	-85.38	-85.44	-85.45	-85.65	-85.62	-85.03	-85.39	1st	Limit ≤ 4 nW (-54 dBm)
		※ 5	dBm	-	-	-	-	-	-	-	-	-	2nd	RBW : 100 kHz ; VBW : 100 kHz
		※ 5	dBm	-	-	-	-	-	-	-	-	-	3rd	
		※ 6	dBm	-70.21	-71.01	-71.27	-70.64	-70.85	-70.64	-71.72	-70.78	-71.36	1st	Limit ≤ 20 nW (-47 dBm)
		※ 6	dBm	-	-	-	-	-	-	-	-	-	2nd	RBW : 1 MHz ; VBW : 1 MHz
		※ 6	dBm	-	-	-	-	-	-	-	-	-	3rd	
	Spurious Emission Intensity	※ 5	nW	0.0031	0.0029	0.0029	0.0029	0.0029	0.0027	0.0027	0.0031	0.0029	Total Emission Power	
		※ 5	nW	0.0031	0.0029	0.0029	0.0029	0.0029	0.0027	0.0027	0.0031	0.0029	1st	Limit ≤ 4 nW (-54 dBm)
		※ 5	nW	-	-	-	-	-	-	-	-	-	2nd	RBW : 100 kHz ; VBW : 100 kHz
		※ 5	nW	-	-	-	-	-	-	-	-	-	3rd	
		※ 6	nW	0.0953	0.0793	0.0746	0.0863	0.0822	0.0863	0.0673	0.0836	0.0731	Total Emission Power	
		※ 6	nW	0.0953	0.0793	0.0746	0.0863	0.0822	0.0863	0.0673	0.0836	0.0731	1st	Limit ≤ 20 nW (-47 dBm)
		※ 6	nW	-	-	-	-	-	-	-	-	-	2nd	RBW : 1 MHz ; VBW : 1 MHz
		※ 6	nW	-	-	-	-	-	-	-	-	-	3rd	

- ※ 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

3DHF	Test Voltage		V	Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks	
	Test Frequency		MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	Limit ≤ 0.4 sec (In 0.4 sec × spreading rate)	
	Pulse Duration		msec	2.8991	2.8991	2.8991	2.8991	2.8991	2.8991	2.8991	2.8991	2.8991	RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz	
	Measurement Time		sec	28.47	28.47	28.47	28.42	28.42	28.42	28.37	28.37	28.37	The total sum of holding time at arbitrary frequencies	
	Dwell Time		sec	0.2786	0.2786	0.2786	0.2781	0.2781	0.2781	0.2777	0.2777	0.2777	within the time multiplied 0.4 sec by the spreading rate	

9. Spread Factor

Spread Factor	Test Voltage		V	Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks	
	Test Frequency		MHz	2402 ~ 2480			2402 ~ 2480			2402 ~ 2480				
	Spread-Spectrum Bandwidth		MHz	71.17			71.05			70.93				
	Modulation Rate		Mcps	3.000			3.000			3.000				
	Spread Factor			23.7247			23.6843			23.6440			Spread Factor Limit ≥ 5 (DSSS and FHSS)	

Appendix C 19-BT-F1D

ICC No.	JR442806
Test Date	2014/5/13
Test Location	ICC Lab.
Temp. / Humid.	21.6°C / 65%
Test Conducted By	
Name	JACK
Department	Radio Service Group

1. General Information

Specified Radio Equipment	Class	Article 2 Paragraph 1 Item 19	Model	BT900-SC		Temp. / Humid.	21.6℃ / 65%	
	Type of Emission	F1D	Serial No.	NA		Test Conducted By		
	Modulation Type	FHSS: 8-DPSK		Antenna Power	0.15	mW/MHz	Name	JACK
	Frequency	2402~2480 MHz (AFH mode)					Department	Radio Service Group

2. Test Results

Test Voltage	V	Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks
Test Frequency	MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	Low/Mid/High of test frequency range
Occupied Bandwidth	MHz	19.77			19.74			17.74			Limit ≤ 83.5 MHz (RB/VB : 1MHz)
Spread-spectrum Bandwidth	MHz	17.67			17.67			17.67			Spread Factor Limit ≥ 5 (DSSS and FHSS)
Antenna Power (Conducted)	mW/MHz	0.141144			0.142779			0.139850			Limit ≤ 3 mW/MHz (4.77 dBm/MHz)
Antenna Power Error	mW/MHz	-0.008856			-0.007221			-0.010150			Limit + 20% ~ - 80%
	%	-5.90			-4.81			-6.77			
Hopping Frequency Dwell Time	sec	0.2732	0.2732	0.2732	0.2732	0.2732	0.2732	0.2732	0.2732	0.2732	Limit ≤ 0.4 sec (In 0.4 sec × spreading rate)
Radio Interference Prevention Function	ID Code	Good, MAC Address : 00-02-5B-00-A5-A5									NR: Not Require
	Carrier Sense	NR	NR	NR	NR	NR	NR	NR	NR	NR	

3. Antenna Power (Conducted Power)

Testing for Electrical Specification	Test Voltage	V	Normal Voltage (3.3V)		High Voltage (3.63V)		Low Voltage (2.97V)		Remarks	
	Test Frequency	MHz	2402 ~ 2480		2402 ~ 2480		2402 ~ 2480			
	Power Meter Raw from EUT	dBm	1.80		1.85		1.76			
	Cable Loss	dB	1.07		1.07		1.07		Refer to Calibration Result	
	Duty Cycle Factor	dB	1.10		1.10		1.10		Duty Factor = 10 × 10Log ₁₀ (1/Duty Cycle)	
	Spreading Bandwidth Factor	dB	-12.47		-12.47		-12.47		BW Factor = 10 × 10Log ₁₀ (1/Spreading BW)	
	Antenna Power (Conducted)	dBm/MHz	-8.50		-8.45		-8.54		Limit ≤ 3 mW/MHz (4.77 dBm/MHz)	
	Antenna Power (Conducted)	mW/MHz	0.14114		0.14278		0.13985			
	Antenna Power Error	mW	-0.00886		-0.00722		-0.01015			
		%	-5.90		-4.81		-6.77		Limit + 20% ~ - 80%	
	Transmitter ON _{Time}	msec			2.8991				RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz	
	Transmitter (ON+OFF) _{Time}	msec			3.7339					
Transmitter Duty Cycle (3DH5)	%			77.64%				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			Total 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	-8.45	PCB Dipole	2.00						2.00	-6.45	360.00	Good	EBL2449A1-15UFL
2	-8.45	Dipole	2.00						2.00	-6.45	360.00	Good	Nearson_(S181FL-L-RMM-2450S)
3	-8.45	Dipole	2.00						2.00	-6.45	360.00	Good	MAF94190
4	-8.45	Dipole	1.50						1.50	-6.95	360.00	Good	WRR2400-IP04-B_(MAF94019)
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)

8. Hopping Frequency Dwell Time

Test Voltage	V	Normal Voltage (3.3V)			High Voltage (3.63V)			Low Voltage (2.97V)			Remarks
Test Frequency	MHz	2402	2441	2480	2402	2441	2480	2402	2441	2480	Limit ≤ 0.4 sec (In 0.4 sec × spreading rate)
Pulse Duration	msec	2.8991	2.8991	2.8991	2.8991	2.8991	2.8991	2.8991	2.8991	2.8991	RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz
Measurement Time	sec	7.07	7.07	7.07	7.07	7.07	7.07	7.07	7.07	7.07	The total sum of holding time at arbitrary frequencies within the time multiplied 0.4 sec by the spreading rate
Dwell Time	sec	0.2732	0.2732	0.2732	0.2732	0.2732	0.2732	0.2732	0.2732	0.2732	

9. Spread Factor

Spread Factor	Test Voltage	V	Normal Voltage (3.3V)	High Voltage (3.63V)	Low Voltage (2.97V)	Remarks
	Test Frequency	MHz	2402 ~ 2480	2402 ~ 2480	2402 ~ 2480	
	Spread-Spectrum Bandwidth	MHz	17.67	17.67	17.67	
	Modulation Rate	Mcps	3.000	3.000	3.000	
	Spread Factor		5.8900	5.8900	5.8900	Spread Factor Limit ≥ 5 (DSSS and FHSS)

Calibration Result

1. Linearity Check

SG Output (dBm)	Spectrum Raw (dBm)	Power Meter Raw (dBm)	Remark
0	-0.69	-0.85	• SG Test Frequency : 2450 MHz • RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz • ATT(30dB) ; Ref : 20 dBm
-5	-5.6	-5.76	
-10	-10.59	-10.74	
0	-1.35	-1.96	• SG Test Frequency : 5250 MHz • RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz • ATT(30dB) ; Ref : 20 dBm
-5	-6.34	-6.89	
-10	-11.25	-11.88	

2. Frequency Accuracy Confirmation

SG Output (dBm)	Spectrum Raw (MHz)	Frequency Error (ppm)	Remark
2450	2450.0012	0.4898	• SG Output : 0dBm • RBW : 30 kHz ; VBW : 30 kHz ; SP : 300kHz • Limit $\leq$ 10% of frequency error limits
5250	5250.0036	0.6857	

3. Cable Loss

SG Output (MHz)	Power Meter Raw Without Cable (dBm)	Power Meter Raw With Cable (dBm)	Cable Loss (dB)	Remark
1000	-0.23	-0.71	0.48	• SG Output : 0dBm
2450	-0.87	-1.94	1.07	
5250	-1.67	-3.24	1.57	
12500	-3.69	-5.82	2.13	
26000	-7.55	-11.35	3.80	

4. Power Measurement System Loss (EUT Output to IF Output of Spectrum)

SG Output (MHz)	Spectrum Raw (dBm)	Power Meter Raw With Cable form IF (dBm)	System Path Loss EUT to IF (dB)	Remark
2450	-1.03	-20.58	19.71	• SG : 0 dBm • RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz • ATT(30dB) ; Ref : 20 dBm
5250	-5.39	-25.09	23.42	

Appendix B. Antenna Information



The evolution of technology has brought the need to communicate everywhere and at all times without being confined to one space. Laird Technologies' internal wireless device antennas feature wide bandwidth to enhance the performance and application of portable wireless devices based on standards such as 802.11 and Bluetooth®. The antennas are specifically designed to be embedded inside devices for aesthetically pleasing integration with high durability.

FEATURES



- Versatile and easy to use antenna for 2.4 to 2.5 GHz Bluetooth® and IEEE 802.11 devices
- Designed for easy connection to radio cards
- Utilizes patented PCB Microsphere technology
- Has a ground plane incorporated into the resonator structure, therefore no additional ground plane is required to radiate efficiently
- Conformance to European RoHS Directive 2002/95/EC

MARKETS

- WiMAX

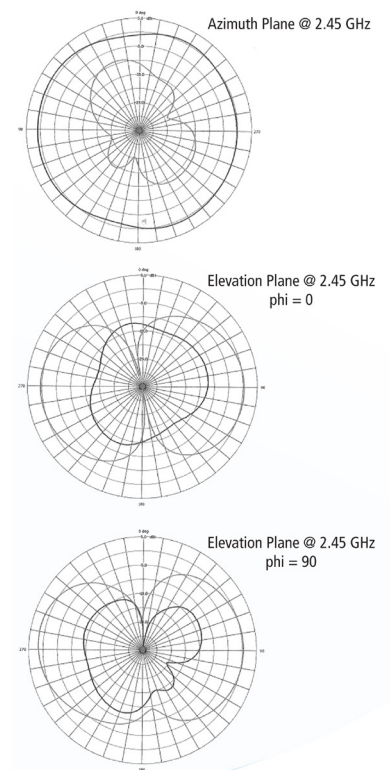
SPECIFICATIONS

PARAMETER	PERFORMANCE
Frequency range	2.4-2.5 GHz
Gain	2.0 dBi
Polarization	Linear
Impedance	50 ohms
VSWR	<2.0:1
Dimensions (L x W x H)	1.88 in x .5 in x .032 in
Weight	2 g

CABLE & CONNECTOR

PART #	CABLE TYPE	CABLE LENGTH	CONNECTOR
MAF94045	ø 1.13	100 mm	IPEX MHF
MAF94102	RG178	100mm	Flying lead
MAF94243	ø 1.13	203mm	IPEX MHF
MAF94452	ø 1.13	50mm	IPEX MHF
MAF95088	ø 1.13	165mm	IPEX MHF
EBL2449A1-15UFL	ø 1.13	150mm	IPEX MHF

ANTENNA PATTERNS



P/N S181FL-L-RMM-2450S

Alternative Connectors

.Straight MMCX Plug

P/N: S181FL-L-MM-2450S

ECN

Date

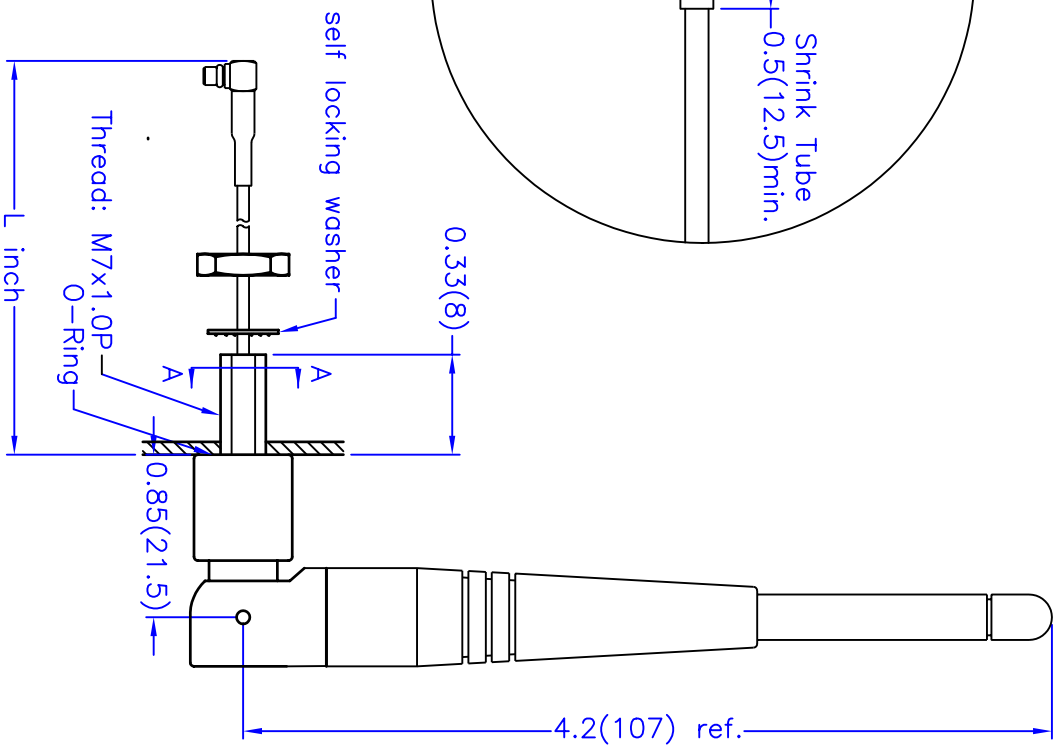
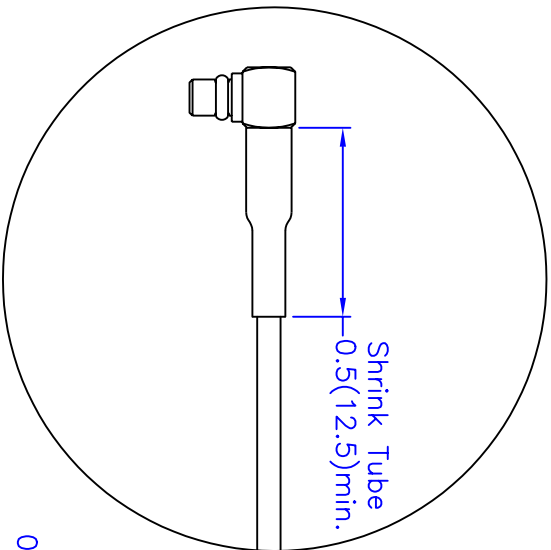
Description

5/30/02

change mounting thread/hole
from round to double D-cut

6/15/02

Supersede P/N
S181FL-L-RMM-2450S-DR



A-A view-Thread cross-section

0.236(6.0)



Electrical Properties:

Frequency Range: 2.4~2.5 GHz
Impedance: 50Ω nominal
VSWR: <2.0:1
Gain: *2.0 dBi
Radiation: Omni
Polarization: Vertical
*Gain is measured under no flying lead.

Mechanical Properties:

Cable: M17/93-RG178; Harbour Industries
Cable Length: Standard length L=5 inches.
or to be specified.
Connector: R/A MMCX Plug(male);
Nearson 25-03M-TGG
Material:
Overmold: Polyurethane(Black); BASF
Swivel: Polyurethane(Black); BASF and
Polycarbonate(Black); Bayer
Operation Temp.: -20°C to +65°C
Storage Temp.: -30°C to +75°C

TITLE		DATE	SHEET
2.4GHz Fixed Mount Swivel Antenna – 181 Model			1 of 2
UNIT	DWG. NO. S181FL-L-RMM-2450S		
in.(mm)			
SCALE			
None			

NEARSON

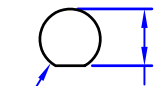
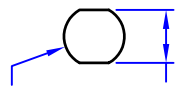
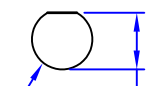
NEARSON

Alternative Connectors

.Straight MMCX Plug

P/N: S181FL-L-MM-2450S

ECN	Date	Description
	5/30/02	change mounting thread/hole from round to double D-cut
	6/15/02	Supersede P/N S181FL-L-RMM-2450S-DR

 round $\phi 7.0^{+0.1}_{-0.0} \text{ mm}$	 right D-cut $6.5^{+0.1}_{-0.0} \text{ mm}$ $\phi 7.0^{+0.1}_{-0.0} \text{ mm}$
 double D-cut $6.0^{+0.1}_{-0.0} \text{ mm}$ $\phi 7.0^{+0.1}_{-0.0} \text{ mm}$	 left D-cut $6.5^{+0.1}_{-0.0} \text{ mm}$ $\phi 7.0^{+0.1}_{-0.0} \text{ mm}$

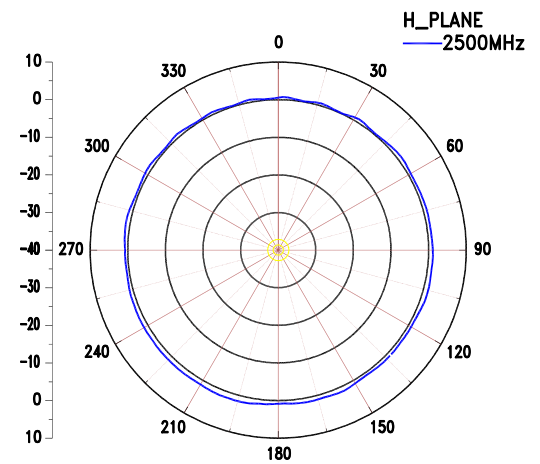
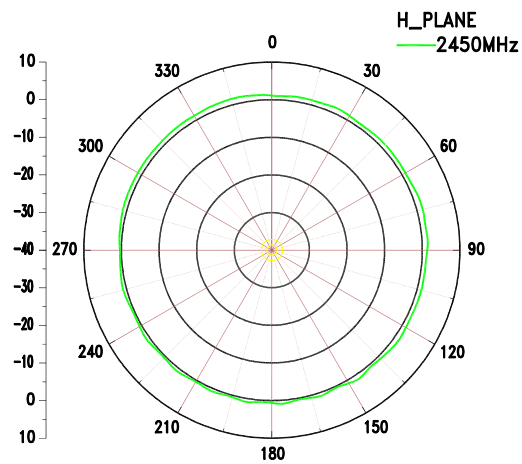
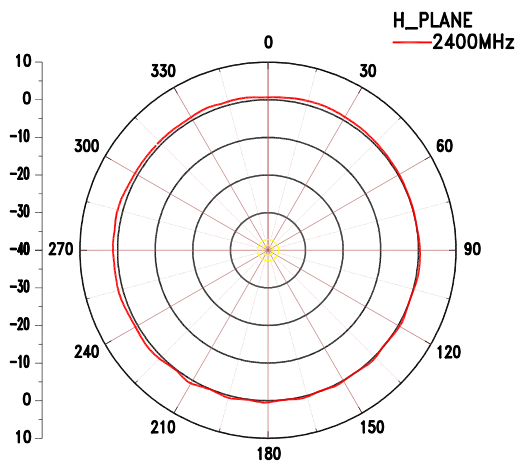
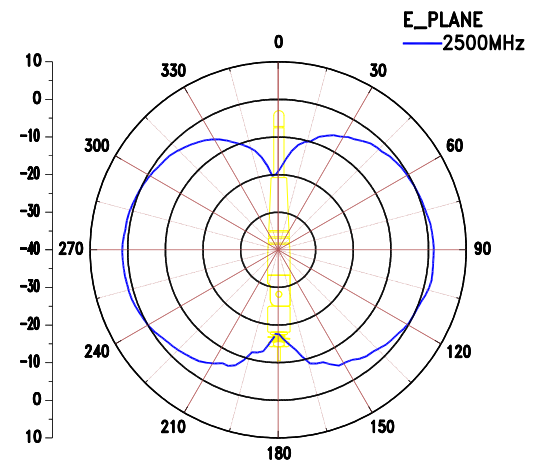
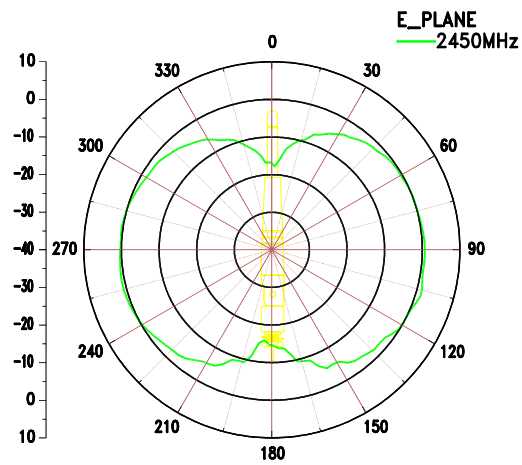
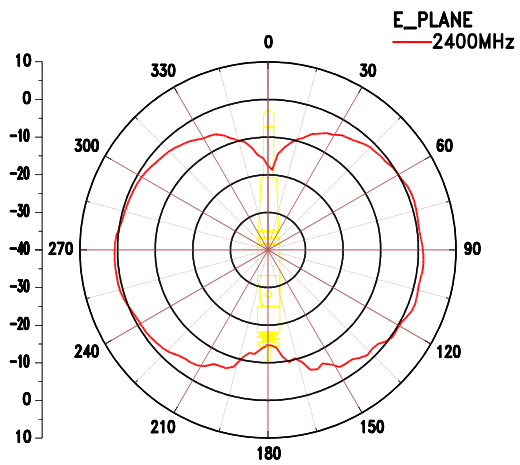
Recommended Mounting-Hole Dimensions

L (inch)	Attenuation (dB)
3"	0.20 dB
4"	0.27 dB
5"	0.33 dB
6"	0.40 dB
8"	0.53 dB
10"	0.66 dB
12"	0.79 dB

Flying Lead Cable Length v.s. Attenuation Table
Standard M17/93-RG178 Cable Measured @ 2.4GHz

TITLE	2.4GHz Fixed Mount Swivel Antenna — 181 Model	DATE	SHEET
UNIT	DWG. NO. S181FL-L-RMM-2450S		2 of 2
in.(mm)			
SCALE			
None			

NEARSON



DiPole ComAer 2.4: WCR

External Wireless Device Antenna



Today's work and lifestyles require us to communicate anytime, anywhere whether on the move or sitting still. Bluetooth® and 802.11 standards make wireless connections to computer networks and other devices possible, while at the same time enabling freedom of movement.

Laird's practical and rugged external wireless device antennas are designed to fit into the portable devices used in office, industrial and home environments. The antennas feature flexible elements and many are 1/2-wave coaxial dipole design for reduced ground dependence and improved performance.

FEATURES



- 1/2-wave coaxial dipole
- Flexible element
- Snap-in
- Clutch allows 360° rotation
- FCC Part 15 compliant polarized connector

MARKETS

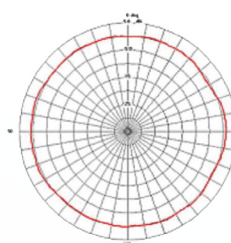
- Bluetooth® devices
- IEEE 802.11b/g devices

SPECIFICATIONS

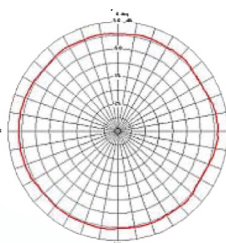
PARAMETER	PERFORMANCE
Frequency range	2.4-2.5 GHz
Gain	Peak: 2.0 dBi
Polarization	Vertical
Impedance	50 ohms
VSWR	1.5:1 max at resonance
Power Rating	50 watts
Dimensions (Length)	7.6 cm (90° Bent) or 10.8 cm (180°)
Temperature Range	-40° to +80°
Drop Test	1M

PART #	CABLE TYPE	CABLE LENGTH	CONNECTOR	KITTED W/SLEEVE
MAF94015	RG178	100	Flying Lead	Yes
MAF94017	RG178	100	IPEX MHF	Yes
MAF94190	ø 1.13	150	IPEX MHF	No
MAF94360	RG178	254	PEX MHF	No

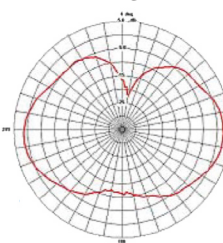
Antenna Bent @ 90°
Azimuth, 2.45 GHz



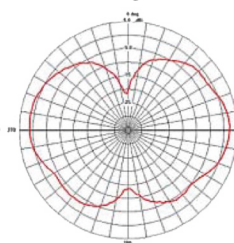
Antenna Bent @ 180°
Azimuth, 2.45 GHz



Elevation, phi=0
2.45 GHz



Elevation, phi=0
2.45 GHz



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External Two-Way Radio Antenna



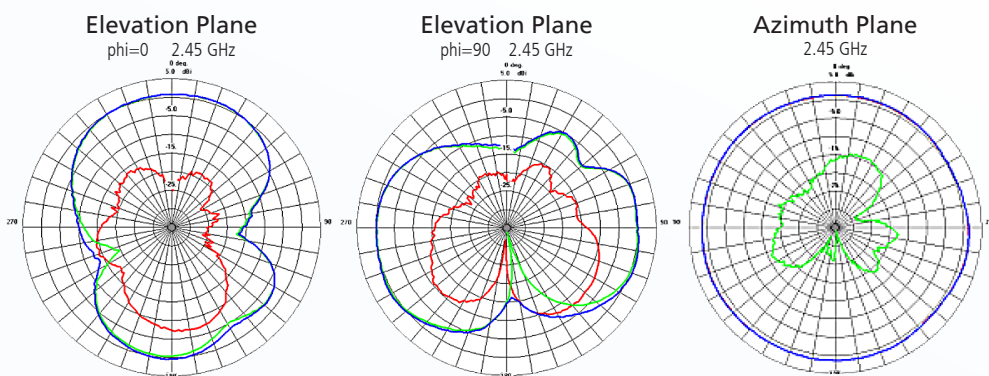
FEATURES

- Covers 802.11b for all U.S., European, and Japanese WLAN applications
- Center fed coaxial dipole with a coaxial cable pigtail

PARAMETER	SPECIFICATION
Frequency	2.4-2.5 GHz
Gain	1.5 dBi (2.45 GHz)
Polarization	Vertical, Omni-directional
Nominal Impedance	50 ohms
VSWR	2:1 max
Size (Length)	10.9 cm (180°) or 8.8 cm (90°)

FREQUENCIES AND CONNECTORS

MODEL #	PART #	COLOR	RG-178 CABLE	CONNECTOR
WRR2400- IP04-B	MAF94019	Black	100 mm	IPEX U.FL
WRR2400- IP04-G	MAF94048	Gray	100 mm	IPEX U.FL
WRR2400- FL04-B	MAF94027	Black	100 mm	Flying Lead
WRR2400- FL04-G	MAF94047	Gray	100 mm	Flying Lead



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