

Japan Test Report

Equipment : BTv4.0 Dual Mode USB HCI Module
BTv4.0 Dual Mode USB HCI Module – External
Antenna variant

Model No. : BT800
BT800-ST
(Please refer to section 1.1.1 for more details.)

Brand Name : Laird Technologies

Applicant : Laird Technologies

Address : 11160 Thompson Ave. / Lenexa, Kansas /
66219 / USA

Standard : ARIB STD-T66 Ver. 3.7

Received Date : Jul. 29, 2015

Tested Date : Jul. 29, 2015

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



Table of Contents

1	GENERAL DESCRIPTION	5
1.1	Information.....	5
1.2	Test Equipment and Calibration Data	8
1.3	Testing Applied Standards	8
1.4	Measurement Uncertainty	8
2	TEST CONFIGURATION	9
2.1	Testing Location and Conditions	9
2.2	Supporting Units	9
2.3	The Worst Test Modes and Channel Details	9
3	TRANSMITTER TEST RESULTS.....	10
3.1	Antenna Power	10
3.2	Frequency Tolerance	11
3.3	Occupied Bandwidth	12
3.4	Spreading Bandwidth and Factor	13
3.5	Transmitter Spurious Emissions.....	14
3.6	Dwell time	15
3.7	Interference prevention function.....	16
4	RECEIVER TEST RESULTS	17
4.1	Receiver Spurious Emissions.....	17
5	PHOTOGRAPHS OF THE TEST CONFIGURATION	18
6	TEST LABORATORY INFORMATION	19
APPENDIX A. TEST RESULTS.....		A1
APPENDIX B. ANTENNA INFORMATION.....		B1

Release Record

Report No.	Version	Description	Issued Date
JR490301-01AD	Rev. 01	Initial issue	Aug. 10, 2015
JR490301-01AD	Rev. 02	Appendix A data modified.	Sep. 02, 2015
JR490301-01AD	Rev. 03	Rated power modified (page 5)	Sep. 07, 2015

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

1 General Description

1.1 Information

1.1.1 Product Details

The following models are provided to this EUT.

Model Name	Product Name	Description
BT800	BTv4.0 Dual Mode USB HCI Module	mounted with chipset antenna
BT800-ST	BTv4.0 Dual Mode USB HCI Module – External Antenna variant	connected to external antenna

1.1.2 Specification of the Equipment under Test (EUT)

Power Type	5Vdc 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	1.0
SW Version	A4

1.1.3 Accessories

N/A

1.1.4 Antenna Details

Ant. No.	Brand	Model	Type	Connector	Antenna Gain (dBi)	Remark
1	ACX	AT3216-B2R7HAA_3216	chip	N/A	0.5	For BT800
2	ACX	AT3216-B2R7HAA	chip	UFL	0.5	For BT800-ST

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

1.1.5 Antenna Power

Operating Mode	Rated Power (mW/MHz)	Measured Conducted Power (mW/MHz)	Radiated Power (mW/MHz)
GFSK (non-AFH)	0.1	0.102	0.11
GFSK (AFH)	0.4	0.411	0.46
8DPSK (non-AFH)	0.1	0.070	0.08
8DPSK (AFH)	0.3	0.285	0.32

1.1.6 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		

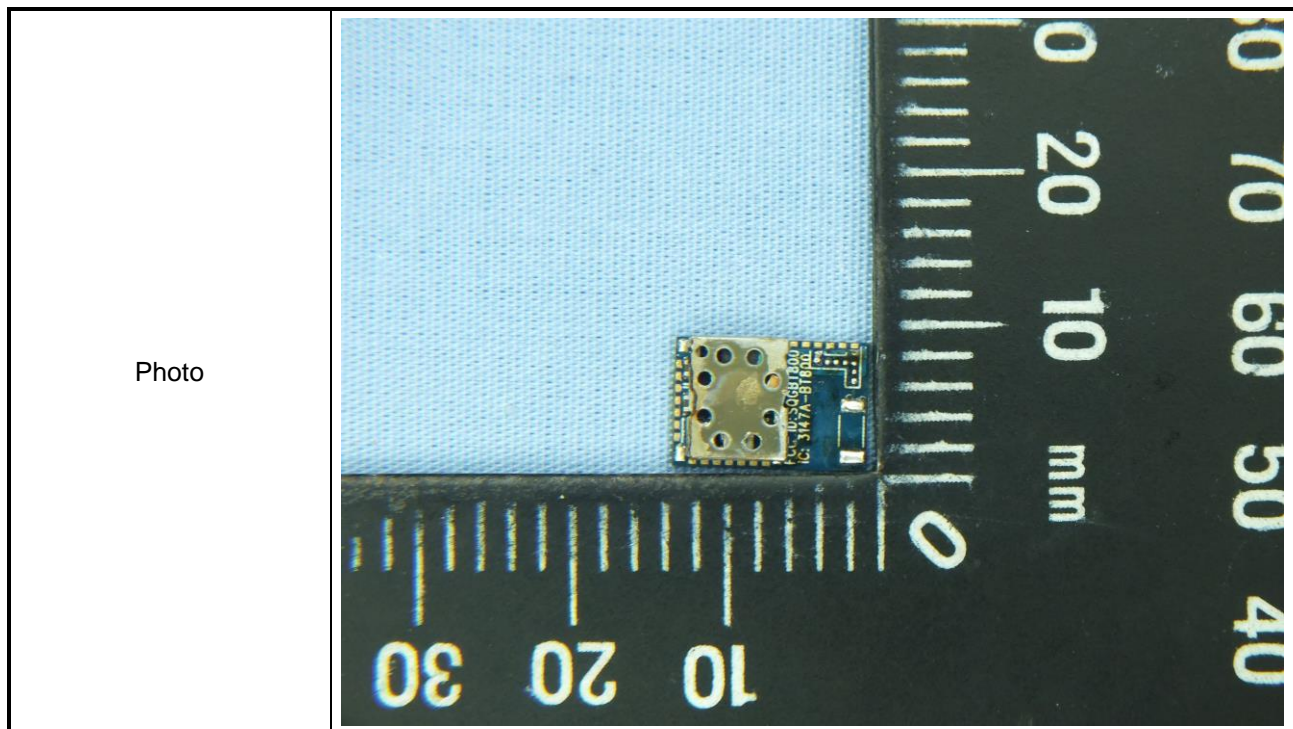
1.1.7 Test Tool and Power Setting

Test Tool
BlueTest3 version CSR 2.5.0

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

1.1.8 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	101486	Oct. 13, 2014	Oct. 12, 2015
Power Meter	Anritsu	ML2495A	1241002	Sep. 29, 2014	Sep. 28, 2015
Power Sensor	Anritsu	MA2411B	1207366	Sep. 29, 2014	Sep. 28, 2015
Signal Generator	R&S	SMB100A	175727	Oct. 08, 2014	Oct. 07, 2015
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Measurement Software	Agilent	EN RF test	1.140904	NA	NA
Note 1: Calibration Interval of instruments listed above is one year. Note 2: Above instruments are calibrated by Electronics Testing Center					

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. 3.7

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	±33.988 Hz
Bandwidth	±33.988 Hz
Conducted power	±0.537 dB
TX Conducted emission	±2.308 dB
RX Conducted emission	±2.525 dB

2 Test Configuration

2.1 Testing Location and Conditions

Test Site	Site Category	Ambient Condition	Tested By
TH01-WS	OVEN Room	26°C / 61%	Allen Yu

2.2 Supporting Units

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E5420	---
DC Power Supply	GWINSTEK	GPC-60300	---

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

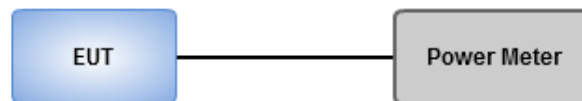
3.1.1 Limit of Antenna Power

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	1. Test Results
	2. Antenna Power (Conducted Power)

3.2 Frequency Tolerance

3.2.1 Limit of Frequency Tolerance

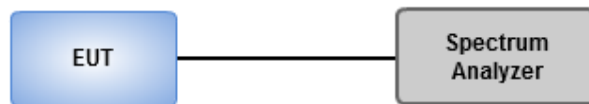
Frequency tolerance shall be +/- 50ppm.

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	1.Test Results

3.3 Occupied Bandwidth

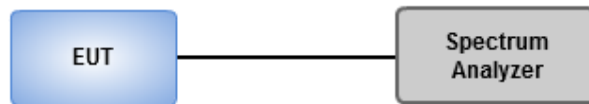
3.3.1 Limit of Occupied Bandwidth

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	1.Test Results

3.4 Spreading Bandwidth and Factor

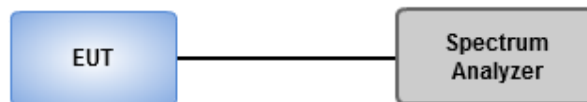
3.4.1 Limit of Spreading Bandwidth and Factor

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	1. Test Results
	8. Spread Factor

3.5 Transmitter Spurious Emissions

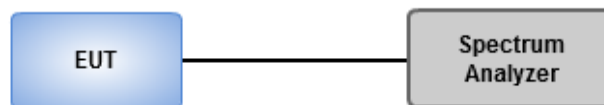
3.5.1 Limit of Transmitter Spurious Emissions

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	1. Test Results
	5. Unwanted Emission Intensity

3.6 Dwell time

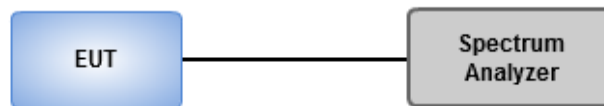
3.6.1 Limit of Dwell time

Limits	Shall be less than 0.4 second
---------------	-------------------------------

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	1. Test Results
	7. Hopping Frequency Dwell Time

3.7 Interference prevention function

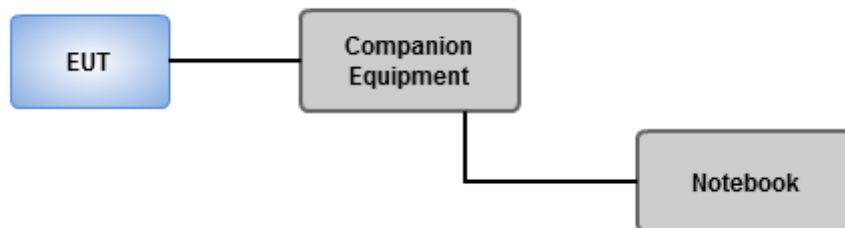
3.7.1 Limit of Interference Prevention Function

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	1. Test Results

4 Receiver Test Results

4.1 Receiver Spurious Emissions

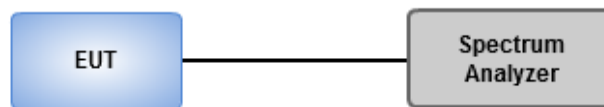
4.1.1 Limit of Receiver Spurious Emissions

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.

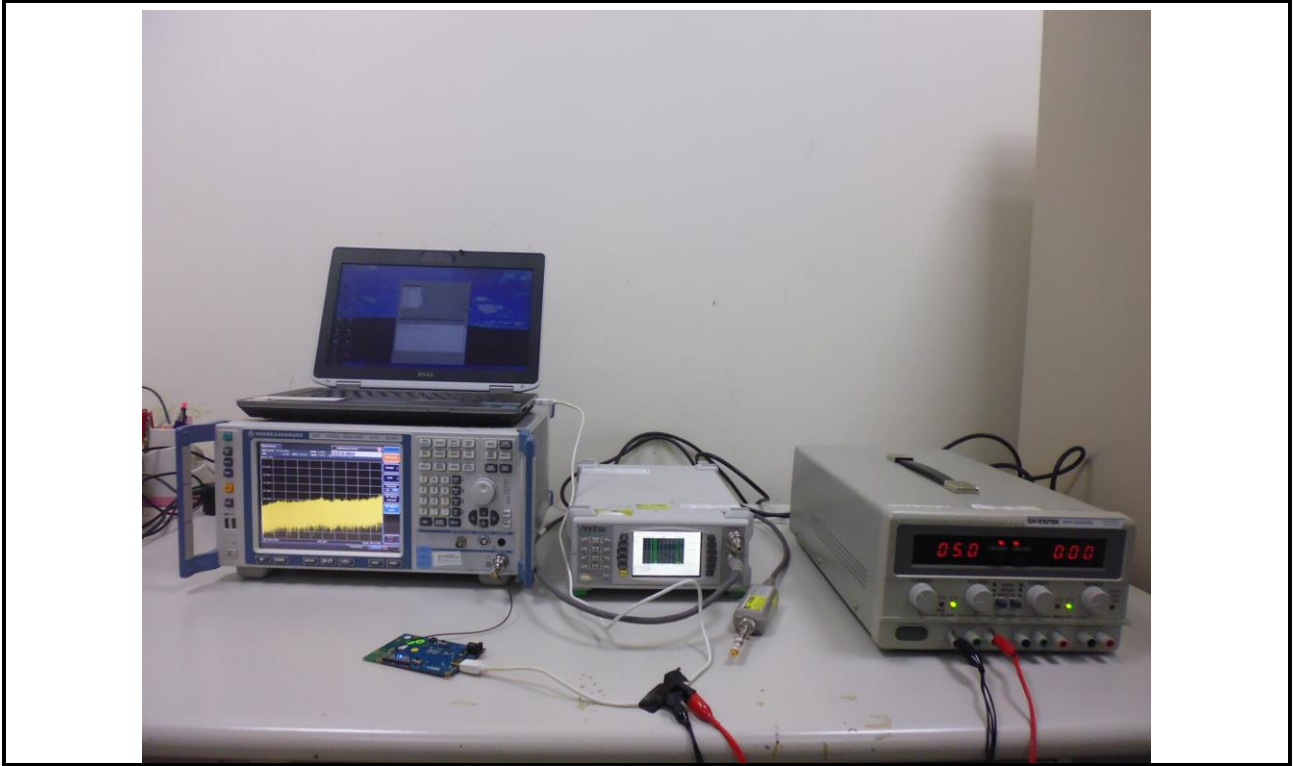
4.1.3 Test Setup



4.1.4 Test Result of Receiver Spurious Emissions

Reference Documents	Test Items
Appendix A 19-BT-F1D	1. Test Results
	6. 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

Tel: 886-2-2601-1640

No. 30-2, Ding Fwu Tsuen, Lin
Kou District, New Taipei City,
Taiwan, R.O.C.

Kwei Shan

Tel: 886-3-271-8666

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

Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd
St., Kwei Shan Hsiang, Tao Yuan
Hsien 333, Taiwan, R.O.C.

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

Tel: 886-3-271-8666

Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

==END==

Test Voltage		V	Normal Voltage (5V)			Remarks	
Testing for Electrical Specification	Test Frequency	MHz	2402	2441	2480	Low/Mid/High of test frequency range	
	Measured Frequency	MHz	2401.9918	2440.9913	2479.9894		
	Frequency Error	ppm	-3.41	-3.56	-4.27	Limit ≤ 50 ppm	
	Occupied Bandwidth	MHz		79.14		Limit ≤ 83.5 MHz (RB/VB : 1MHz)	
	Spread-spectrum Bandwidth	MHz		71.77		Spread Factor Limit ≥ 5 (DSSS and FHSS)	
	Unwanted Emission Intensity (Power emission within 1MHz bandwidth)	※ 1	μ W	0.0009			Limit ≤ 0.25 μ W (-36 dBm)
		※ 2	μ W	0.0157			Limit ≤ 2.5 μ W (-26 dBm)
		※ 3	μ W	8.1470			Limit ≤ 25 μ W (-16 dBm)
		※ 4	μ W	0.3945			Limit ≤ 25 μ W (-16 dBm)
		※ 5	μ W	0.0863			Limit ≤ 2.5 μ W (-26 dBm)
Antenna Power (Measured Power)	mW/MHz	0.102			Limit ≤ 3 mW/MHz (4.77 dBm/MHz)		
Antenna Power (Rated Power)	mW/MHz	0.10					
Antenna Power Error	mW/MHz	0.002					
	%	1.64			Limit + 20% ~ - 80%		
Limitation of Collateral Emission of Receiver	※ 6	nW	0.0108	0.0095	0.0103	Limit ≤ 4 nW (-54 dBm)	
	※ 7	nW	0.1652	0.0824	0.0881	Limit ≤ 20 nW (-47 dBm)	
Hopping Frequency Dwell Time	sec	0.2872	0.2859	0.2859	Limit ≤ 0.4 sec (In 0.4 sec \times spreading rate)		
Radio Interference Prevention Function	ID Code	Good, MAC Address :00-16-A4-08-FE-2E					
	Carrier Sense	NR	NR	NR	NR: Not Require		

2. Antenna Power (Conducted Power)

Test Voltage	V	Normal Voltage (5V)	Remarks
Test Frequency	MHz	2402 ~ 2480	
Power Meter Raw from EUT	dBm	6.11	
Cable Loss	dB	1.49	Refer to Calibration Result
Duty Cycle Factor	dB	1.03	Duty Factor = $10 \times 10\log_{10}(1/\text{Duty Cycle})$
Spreading Bandwidth Factor	dB	-18.56	BW Factor = $10 \times 10\log_{10}(1/\text{Spreading BW})$
Antenna Power (Conducted)	dBm/MHz	-9.93	Limit $\leq 3 \text{ mW/MHz}$ (4.77 dBm/MHz)
Antenna Power (Conducted)	mW/MHz	0.10164	
Antenna Power Error	mW	0.00164	
	%	1.64	Limit + 20% ~ - 80%
Transmitter ON _{Time}	msec	2.9638	RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz
Transmitter (ON+OFF) _{Time}	msec	3.7551	
Transmitter Duty Cycle (DH5)	%	78.93%	Max TX on time mode

[illegible]

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						

Test Voltage	V	Normal Voltage (5V)	Remarks
Test Frequency	MHz	Hopping	
※ 1	MHz	661.00	RBW : 100 kHz ; VBW : 100kHz
※ 2	MHz	1906.30	RBW : 1 MHz ; VBW : 1 MHz
※ 3	MHz	2399.97	
※ 4	MHz	2483.51	
※ 5	MHz	8844.50	
※ 1	dB	0.88	
※ 2	dB	1.49	
※ 3	dB	1.49	
※ 4	dB	1.49	
※ 5	dB	1.76	
※ 1	dBm	-61.26	
※ 2	dBm	-49.53	
※ 3	dBm	-22.38	
※ 4	dBm	-35.53	
※ 5	dBm	-42.40	
※ 1	dBm	-60.38	Limit ≤ 0.25 μW (-36 dBm)
※ 2	dBm	-48.04	Limit ≤ 2.5 μW (-26 dBm)
※ 3	dBm	-20.89	Limit ≤ 25 μW (-16 dBm)
※ 4	dBm	-34.04	Limit ≤ 25 μW (-16 dBm)
※ 5	dBm	-40.64	Limit ≤ 2.5 μW (-26 dBm)
※ 1	μW	0.0009	Limit ≤ 0.25 μW (-36 dBm)
※ 2	μW	0.0157	Limit ≤ 2.5 μW (-26 dBm)
※ 3	μW	8.1470	Limit ≤ 25 μW (-16 dBm)
※ 4	μW	0.3945	Limit ≤ 25 μW (-16 dBm)

International Certification Corp.				
	※ 5	μW	0.0863	Limit ≦ 2.5 μW (-26 dBm)

- ※ 1: Frequency Band 1 (30 MHz ≦ f ≦ 1000 MHz)
- ※ 2: Frequency Band 2 (1000 MHz < f ≦ 2387 MHz)
- ※ 3: Frequency Band 3 (2387 MHz < f ≦ 2400 MHz)
- ※ 4: Frequency Band 4 (2483.5 MHz ≦ f < 2496.5 MHz)
- ※ 5: Frequency Band 5 (2496.5 MHz ≦ f < 12.5 GHz)
- ※ 6: Frequency Band 6 (30 MHz ≦ f < 1000 MHz)
- ※ 7: Frequency Band 7 (1000 MHz ≦ f < 12.5 GHz)

6. Limitation of Collateral Emission of Receiver

Limitation of Collateral Emission	Test Voltage		V	Normal Voltage (5V)			Remarks
	Test Frequency		MHz	2402	2441	2480	
	Spurious Emission Frequency	※ 6	MHz	904.20	947.40	659.60	30MHz～1000MHz:: Maximum emission and all emissions beyond 1/10 of the limitation must be indicated
		※ 6	MHz	-	-	-	
		※ 6	MHz	-	-	-	
		※ 7	MHz	10295.00	7865.00	7882.00	1000MHz～12.5GHz::
		※ 7	MHz	-	-	-	Maximum emission and all emissions beyond 1/10 of the limitation must be indicated
		※ 7	MHz	-	-	-	
	Cable Loss	※ 6	dB	1.09	1.09	1.09	
		※ 6	dB	-	-	-	
		※ 6	dB	-	-	-	
		※ 7	dB	5.68	1.76	1.76	
		※ 7	dB	-	-	-	
		※ 7	dB	-	-	-	
	Spectrum Raw	※ 6	dBm	-80.77	-81.30	-80.96	
		※ 6	dBm	-	-	-	
		※ 6	dBm	-	-	-	
		※ 7	dBm	-73.50	-72.60	-74.12	
		※ 7	dBm	-	-	-	
		※ 7	dBm	-	-	-	
	Spurious Emission Intensity	※ 6	dBm	-79.68	-80.21	-79.87	Limit ≦ 4 nW (-54 dBm)
		※ 6	dBm	-	-	-	RBW : 100 kHz ; VBW : 100 kHz
		※ 6	dBm	-	-	-	
		※ 7	dBm	-67.82	-70.84	-72.36	Limit ≦ 20 nW (-47 dBm)
		※ 7	dBm	-	-	-	RBW : 1 MHz ; VBW : 1 MHz
		※ 7	dBm	-	-	-	
	Spurious Emission Intensity	※ 6	nW	0.0108	0.0095	0.0103	Total Emission Power
		※ 6	nW	0.0108	0.0095	0.0103	Limit ≦ 4 nW (-54 dBm)
		※ 6	nW	-	-	-	RBW : 100 kHz ; VBW : 100 kHz
		※ 6	nW	-	-	-	
		※ 7	nW	0.1652	0.0824	0.0581	Total Emission Power
		※ 7	nW	0.1652	0.0824	0.0581	Limit ≦ 20 nW (-47 dBm)
		※ 7	nW				RBW : 1 MHz ; VBW : 1 MHz
		※ 7	nW				

- ※ 1: Frequency Band 1 (30 MHz ≦ f ≦ 1000 MHz)
- ※ 2: Frequency Band 2 (1000 MHz < f ≦ 2387 MHz)
- ※ 3: Frequency Band 3 (2387 MHz < f ≦ 2400 MHz)
- ※ 4: Frequency Band 4 (2483.5 MHz ≦ f < 2496.5 MHz)
- ※ 5: Frequency Band 5 (2496.5 MHz ≦ f < 12.5 GHz)
- ※ 6: Frequency Band 6 (30 MHz ≦ f < 1000 MHz)
- ※ 7: Frequency Band 7 (1000 MHz ≦ f < 12.5 GHz)

7. Hopping Frequency Dwell Time

DH5	Test Voltage		V	Normal Voltage (5V)			Remarks
	Test Frequency		MHz	2402	2441	2480	Limit ≧ 0.4 sec (In 0.4 sec × spreading rate)
	Pulse Duration		msec	2.9638	2.9500	2.9500	RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz
	Measurement Time		sec	28.71	28.71	28.71	The total sum of holding time at arbitrary frequencies within the time multiplied 0.4 sec by the spreading rate
	Dwell Time		sec	0.2872	0.2859	0.2859	

8. Spread Factor

Spread Factor	Test Voltage		V	Normal Voltage (5V)			Remarks
	Test Frequency		MHz	2402 ~ 2480			
	Spread-Spectrum Bandwidth		MHz	71.77			
	Modulation Rate		Mcps	1.000			
	Spread Factor			71.7700			Spread Factor Limit ≧ 5 (DSSS and FHSS)

Test Voltage	V	Normal Voltage (5V)	Remarks
Test Frequency	MHz	Hopping	
Unwanted Emission Frequency	※ 1	MHz	995.10
	※ 2	MHz	2363.80
	※ 3	MHz	2399.99
	※ 4	MHz	2483.51
	※ 5	MHz	7874.50
Cable Loss	※ 1	dB	0.88
	※ 2	dB	1.49
	※ 3	dB	1.49
	※ 4	dB	1.49
	※ 5	dB	1.76
Spectrum Raw	※ 1	dBm	-60.61
	※ 2	dBm	-49.30
	※ 3	dBm	-19.18
	※ 4	dBm	-33.22
	※ 5	dBm	-43.61
Unwanted Emission Intensity	※ 1	dBm	-59.73
	※ 2	dBm	-47.81
	※ 3	dBm	-17.69
	※ 4	dBm	-31.73
	※ 5	dBm	-41.85
	※ 1	μW	0.0011
	※ 2	μW	0.0166

International Certification Corp.

Unwanted Emission Intensity	※ 3	μW	17.0216	Limit \leq 25 μW (-16 dBm)
	※ 4	μW	0.6714	Limit \leq 25 μW (-16 dBm)
	※ 5	μW	0.0653	Limit \leq 2.5 μW (-26 dBm)

- ※ 1: Frequency Band 1 (30 MHz \leq f \leq 1000 MHz)
- ※ 2: Frequency Band 2 (1000 MHz < f \leq 2387 MHz)
- ※ 3: Frequency Band 3 (2387 MHz < f \leq 2400 MHz)
- ※ 4: Frequency Band 4 (2483.5 MHz \leq f < 2496.5 MHz)
- ※ 5: Frequency Band 5 (2496.5 MHz \leq f < 12.5 GHz)
- ※ 6: Frequency Band 6 (30 MHz \leq f < 1000 MHz)
- ※ 7: Frequency Band 7 (1000 MHz \leq f < 12.5 GHz)

6. Limitation of Collateral Emission of Receiver

Limitation of Collateral Emission	Test Voltage		V	Normal Voltage (5V)			Remarks	
	Test Frequency		MHz	2402	2441	2480		
	Spurious Emission Frequency	※ 6	MHz	989.50	762.10	926.30	1st	30MHz~1000MHz::
		※ 6	MHz	-	-	-	2nd	Maximum emission and all
		※ 6	MHz	-	-	-	3rd	emissions beyond 1/10 of the
		※ 7	MHz	8847.00	8830.00	10528.00	1st	1000MHz~12.5GHz::
		※ 7	MHz	-	-	-	2nd	Maximum emission and all
		※ 7	MHz	-	-	-	3rd	emissions beyond 1/10 of the
		※ 7	MHz	-	-	-	3rd	limitation must be indicated
		※ 6	dB	0.88	0.88	0.88	1st	
		※ 6	dB	-	-	-	2nd	
	Cable Loss	※ 6	dB	-	-	-	3rd	
		※ 6	dB	-	-	-	3rd	
		※ 7	dB	1.76	1.76	5.68	1st	
		※ 7	dB	-	-	-	2nd	
		※ 7	dB	-	-	-	3rd	
	Spectrum Raw	※ 6	dBm	-80.41	-80.53	-80.79	1st	
		※ 6	dBm	-	-	-	2nd	
		※ 6	dBm	-	-	-	3rd	
		※ 7	dBm	-73.14	-74.09	-73.67	1st	
		※ 7	dBm	-	-	-	2nd	
		※ 7	dBm	-	-	-	3rd	
	Spurious Emission Intensity	※ 6	dBm	-79.53	-79.65	-79.91	1st	Limit \leq 4 nW (-54 dBm)
		※ 6	dBm	-	-	-	2nd	RBW : 100 kHz ; VBW : 100
		※ 6	dBm	-	-	-	3rd	kHz
		※ 7	dBm	-71.38	-72.33	-67.99	1st	Limit \leq 20 nW (-47 dBm)
		※ 7	dBm	-	-	-	2nd	RBW : 1 MHz ; VBW : 1 MHz
		※ 7	dBm	-	-	-	3rd	
		※ 7	dBm	-	-	-	3rd	
	Spurious Emission Intensity	※ 6	nW	0.0111	0.0108	0.0102	Total Emission Power	
		※ 6	nW	0.0111	0.0108	0.0102	1st	Limit \leq 4 nW (-54 dBm)
		※ 6	nW	-	-	-	2nd	RBW : 100 kHz ; VBW : 100
		※ 6	nW	-	-	-	3rd	kHz
		※ 7	nW	0.0728	0.0585	0.1589	Total Emission Power	
		※ 7	nW	0.0728	0.0585	0.1589	1st	Limit \leq 20 nW (-47 dBm)
		※ 7	nW	-	-	-	2nd	RBW : 1 MHz ; VBW : 1 MHz
		※ 7	nW	-	-	-	3rd	
		※ 7	nW	-	-	-	3rd	

- ※ 1: Frequency Band 1 (30 MHz \leq f \leq 1000 MHz)
- ※ 2: Frequency Band 2 (1000 MHz < f \leq 2387 MHz)
- ※ 3: Frequency Band 3 (2387 MHz < f \leq 2400 MHz)
- ※ 4: Frequency Band 4 (2483.5 MHz \leq f < 2496.5 MHz)
- ※ 5: Frequency Band 5 (2496.5 MHz \leq f < 12.5 GHz)
- ※ 6: Frequency Band 6 (30 MHz \leq f < 1000 MHz)
- ※ 7: Frequency Band 7 (1000 MHz \leq f < 12.5 GHz)

7. Hopping Frequency Dwell Time

30Hz5	Test Voltage		V	Normal Voltage (5V)			Remarks	
	Test Frequency		MHz	2402	2441	2480	Limit \leq 0.4 sec (In 0.4 sec x spreading rate)	
	Pulse Duration		msec	2.9783	2.9500	2.9500	RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz	
	Measurement Time		sec	28.81	28.81	28.81	The total sum of holding time at arbitrary frequencies within the time multiplied 0.4 sec by the spreading rate	
	Dwell Time		sec	0.2896	0.2869	0.2869		

8. Spread Factor

Spread Factor	Test Voltage		V	Normal Voltage (5V)			Remarks	
	Test Frequency		MHz	2402 ~ 2480				
	Spread-Spectrum Bandwidth		MHz	72.02				
	Modulation Rate		Mcps	3.000				
	Spread Factor			24.0067			Spread Factor Limit \geq 5 (DSSS and FHSS)	

Testing for Electrical Specification	Test Voltage	V	Normal Voltage (5V)			Remarks
	Test Frequency	MHz	2402	2441	2480	Low/Mid/High of test frequency range
	Occupied Bandwidth	MHz	19.70			Limit \leq 83.5 MHz (RB/VB : 1MHz)
	Spread-spectrum Bandwidth	MHz	17.3			Spread Factor Limit \leq 5 (DS-SS and FHSS)
	Antenna Power (Measured Power)	mW/MHz	0.111426			Limit \leq 3 mW/MHz (4.77 dBm/MHz)
	Antenna Power (Rated Power)	mW/MHz	0.40			
	Antenna Power Error	mW/MHz	0.011426			
		%	2.86			Limit + 20% ~ - 80%
	Hopping Frequency Dwell Time	sec	0.2803	0.2790	0.2790	Limit \leq 0.4 sec (In 0.4 sec \times spreading rate)
	Radio Interference Prevention Function	ID Code	Good, MAC Address : 00-16-A4-08-FE-2E			
	Carrier Sense	NR	NR	NR	NR: Not Require	

Testing for Electrical Specification	Test Voltage	V	Normal Voltage (5V)	Remarks
	Test Frequency	MHz	2402 ~ 2480	
	Power Meter Raw from EUT	dBm	6.11	
	Cable Loss	dB	1.49	Refer to Calibration Result
	Duty Cycle Factor	dB	1.03	Duty Factor = $10 \times 10\text{Log}_{10}(1/\text{Duty Cycle})$
	Spreading Bandwidth Factor	dB	-12.49	BW Factor = $10 \times 10\text{Log}_{10}(1/\text{Spreading BW})$
	Antenna Power (Conducted)	dBm/MHz	-3.86	Limit $\leq 3 \text{ mW/MHz}$ (4.77 dBm/MHz)
	Antenna Power (Conducted)	mW/MHz	0.41143	
Antenna Power Error				
	%	2.86		Limit + 20% ~ - 80%
Transmitter ON _{Time}	msec	2.9638		RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz
Transmitter (ON+OFF) _{Time}	msec	3.7551		
Transmitter Duty Cycle (DHS)	%	78.93%		Max TX on time mode

[illegible]

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						

Test Voltage		Normal Voltage (5V)			Remarks	
DH5	Test Frequency	MHz	2402	2441	2480	Limit ≤ 0.4 sec (In 0.4 sec \times spreading rate) RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz
	Pulse Duration	msec	2.9638	2.9500	2.9500	The total sum of holding time at arbitrary frequencies within the time multiplied 0.4 sec by the spreading rate
	Measurement Time	sec	7.09	7.09	7.09	
	Dwell Time	sec	0.2803	0.2790	0.2790	

Spread Factor	V	Normal Voltage (5V)	Remarks
Test Voltage	MHz	2402 ~ 2480	
Test Frequency	MHz	17.73	
Spread-Spectrum Bandwidth	Mbps	1.000	
Modulation Rate		17.7300	Spread Factor Limit ≥ 5 (DSSS and FHSS)
Spread Factor			

Testing for Electrical Specification	Test Voltage	V	Normal Voltage (5V)			Remarks
	Test Frequency	MHz	2402	2441	2480	Low/Mid/High of test frequency range
	Occupied Bandwidth	MHz	19.80			Limit \leq 83.5 MHz (RB/VB : 1MHz)
	Spread-spectrum Bandwidth	MHz	17.70			Spread Factor Limit \geq 5 (DSSS and FHSS)
	Antenna Power (Measured Power)	mW/MHz	0.28577			Limit \leq 3 mW/MHz (4.77 dBm/MHz)
	Antenna Power (Rated Power)	mW/MHz	0.30			
	Antenna Power Error	mW/MHz	-0.014223			
		%	-4.74			Limit + 20% - - 80%
	Hopping Frequency Dwell Time	sec	0.2812	0.2785	0.2785	Limit \leq 0.4 sec (In 0.4 sec \times spreading rate)
	Radio Interference Prevention Function	ID Code	Good, MAC Address: 00-16-A4-08-FE-2E			
	Carrier Sense	NR	NR	NR	NR: Not Require	

Testing for Electrical Specification	Test Voltage	V	Normal Voltage (5 V)	Remarks
	Test Frequency	MHz	2402 ~ 2480	
	Power Meter Raw from EUT	dBm	4.54	
	Cable Loss	dB	1.49	Refer to Calibration Result
	Duty Cycle Factor	dB	1.01	Duty Factor = $10 \times 10\log_{10}(1/\text{Duty Cycle})$
	Spreading Bandwidth Factor	dB	-12.48	BW Factor = $10 \times 10\log_{10}(1/\text{Spreading BW})$
	Antenna Power (Conducted)	dBm/MHz	-5.44	Limit ≤ 3 mW/MHz (4.77 dBm/MHz)
	Antenna Power (Conducted)	mW/MHz	0.28578	
	Antenna Power Error	mW	-0.01422	
		%	-4.74	Limit + 20% ~ - 80%
Transmitter ON _{Time}	msec	2.9783	RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz	
Transmitter (ON+OFF) _{Time}	msec	3.7551		
Transmitter Duty Cycle (3DH5)	%	79.31%	Max TX on time mode	

[illegible]

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						

3DH5	Test Voltage	V	Normal Voltage (5 V)			Remarks
	Test Frequency	MHz	2402	2441	2480	Limit ≤ 0.4 sec (In 0.4 sec \times spreading rate) RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz The total sum of holding time at arbitrary frequencies within the time multiplied 0.4 sec by the spreading rate
	Pulse Duration	msec	2.9783	2.9500	2.9500	
	Measurement Time	sec	7.08	7.08	7.08	
	Dwell Time	sec	0.2812	0.2785	0.2785	

Spread Factor	Test Voltage	V	Normal Voltage (5 V)	Remarks
	Test Frequency	MHz	2402 ~ 2480	
	Spread-Spectrum Bandwidth	MHz	17.70	
	Modulation Rate	Mcps	3.000	
	Spread Factor		5.9000	Spread Factor Limit ≥ 5 (DSSS and FHSS)

Power Supply Voltage Fluctuation Test

Voltage Fluctuation Test	Normal Voltage	High Voltage	Low Voltage
Input DC Power	5	5.5	4.5
Output DC Power	3.3	3.3	3.3
Voltage Variation (%)	-	0.000000	0.000000

Note: Voltage Variation (%) = (Output High or Low Voltage - Output Normal Voltage)/Output Normal Voltage X 100

During the input supply voltage to the EUT from the external power source is varied by +/- 10%, if output voltage had been confirmed that the fluctuation of power supply to the RF circuit of EUT (excluding power source) is equal to or less than +/- 1%. Exempt extremely high and low supply voltage condition tests, EUT only operated in normal voltage to test all regulations.

Calibration Result

1. Linearity Check

SG Output (dBm)	Spectrum Raw (dBm)	Power Meter Raw (dBm)	Remark
0	-1.3	-0.93	<ul style="list-style-type: none"> • SG Test Frequency : 2450 MHz • RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz • ATT(30dB) ; Ref : 20 dBm
-5	-6.34	-5.88	
-10	-11.17	-10.84	
0	-1.64	-1.66	<ul style="list-style-type: none"> • SG Test Frequency : 5250 MHz • RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz • ATT(30dB) ; Ref : 20 dBm
-5	-6.6	-6.62	
-10	-11.48	-11.58	

2. Frequency Accuracy Confirmation

SG Output (dBm)	Spectrum Raw (MHz)	Frequency Error (ppm)	Remark
2450	2450.0002	0.0816	<ul style="list-style-type: none"> • SG Output : 0dBm • RBW : 30 kHz ; VBW : 30 kHz ; SP : 300kHz • Limit \leq 10% of frequency error limits
5250	5250.0012	0.2286	

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	-1.11	0.88	• SG Output : 0dBm
2450	-0.87	-2.36	1.49	
5250	-1.67	-3.43	1.76	
12500	-3.69	-9.37	5.68	
26000	-5.55	-19.13	13.58	

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	<ul style="list-style-type: none"> • SG : 0 dBm • RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz • ATT(30dB) ; Ref : 20 dBm
5250	-5.39	-22.01	20.34	

Appendix B. Antenna Information

AT3216 Series

Multilayer Chip Antenna

Features

- ❖ Monolithic SMD with small, low-profile and light-weight type.
- ❖ Wide bandwidth

Applications

- ❖ Bluetooth/Wireless LAN/Home RF
- ❖ ISM band 2.4GHz applications



Specifications

Part Number	Frequency Range (MHz)	Peak Gain (XZ-V)	Average Gain (XZ-V)	VSWR	Impedance
AT3216 -B2R7HAA	2400 ~ 2500	0.5 dBi typ.	-0.5 dBi typ.	2 max.	50 Ω

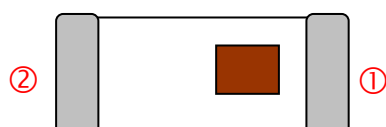
Q'ty/Reel (pcs) : 3,000pcs
 Operating Temperature Range : -40 ~ +85 °C
 Storage Temperature Range : +5 ~ +35 °C, Humidity 45~75%RH
 Storage Period : 12 months max.
 Power Capacity : 2W max.

Part Number

AT 3216 - B 2R7 HAA □ □
 ① ② ③ ④ ⑤ ⑥ ⑦

① Type	AT : Antenna	② Dimensions (L x W)	3.2x 1.6 mm
③ Material Code	B	④ Frequency Range	2R7=2700MHz
⑤ Specification Code	HAA	⑥ Packaging	T: Tape & Reel B: Bulk
⑦ Soldering	=lead-containing /LF=lead-free		

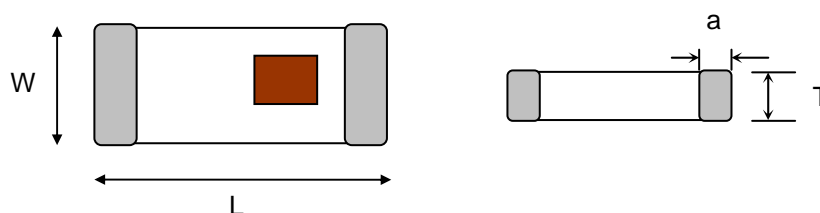
Terminal Configuration



No.	Terminal Name	No.	Terminal Name
①	Feeding Point	②	NC

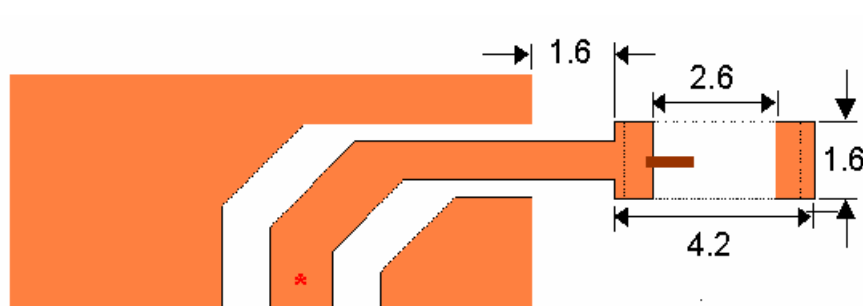
Dimensions and Recommended PC Board Pattern

Unit : mm

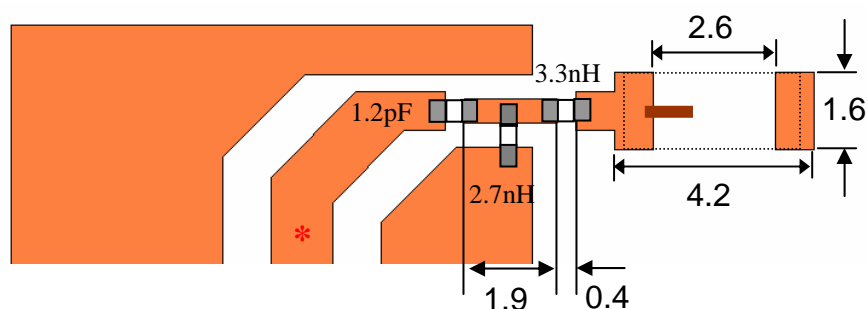


Mark	L	W	T	a
Dimensions	3.2±0.2	1.6±0.2	1.3+ 0.1/-0.2	0.5±0.3

(a) Without Matching Circuits



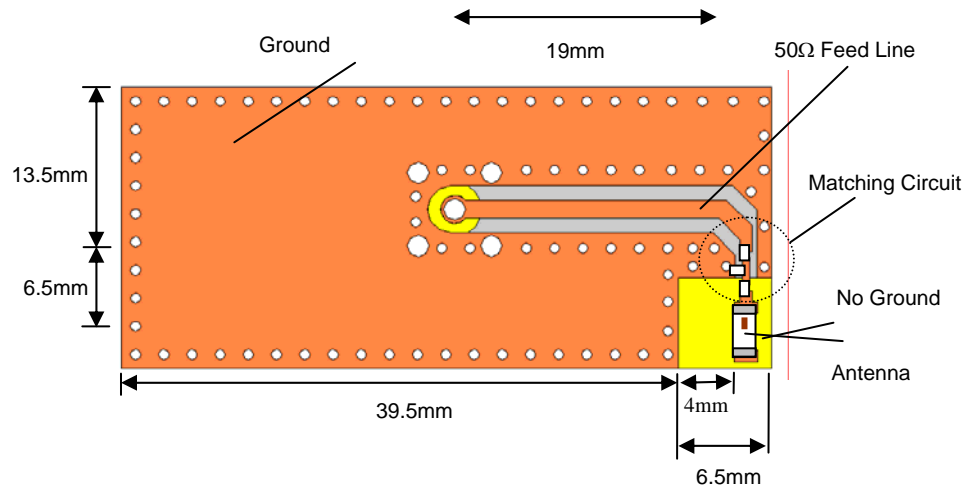
(b) With Matching Circuits



*Line width should be designed to match 50Ω characteristic impedance, depending on PCB material and thickness.

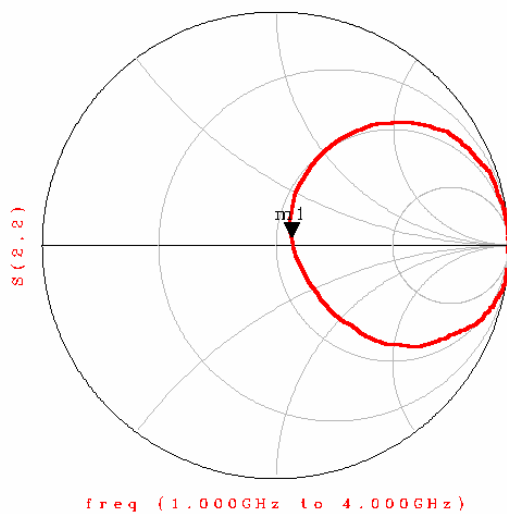
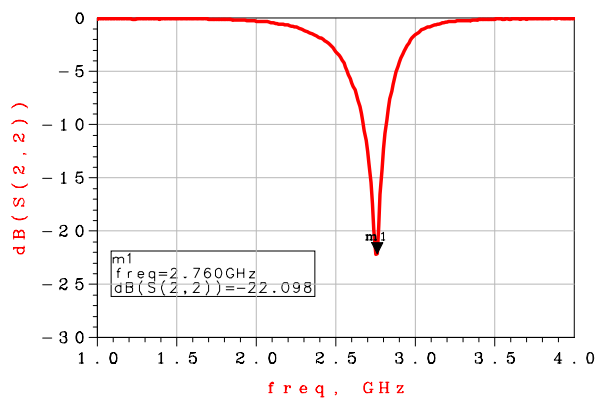
Typical Electrical Characteristics (T=25°C)

❖ Test Board

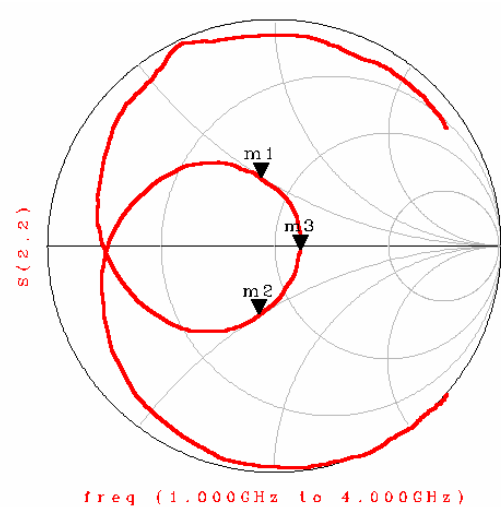
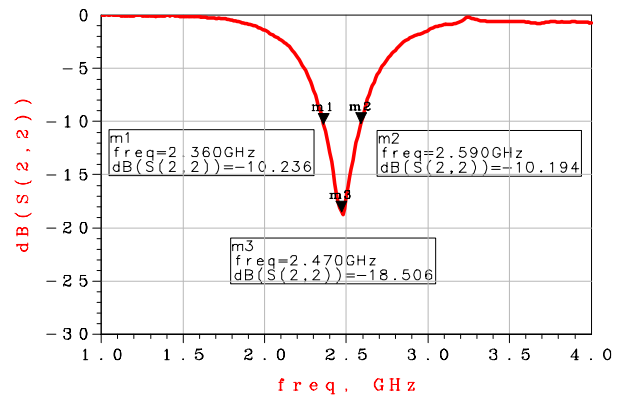


❖ Return Loss

(a) Without Matching Circuits

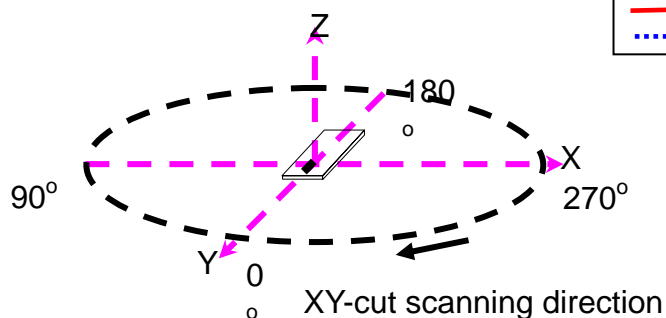


(b) With Matching Circuits

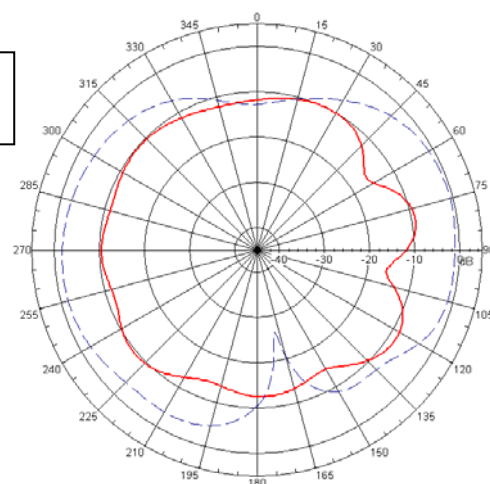


Radiation Patterns

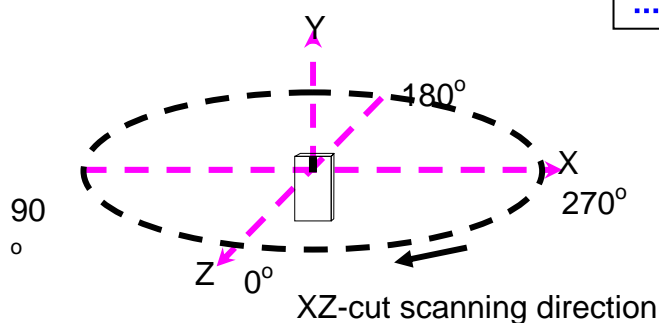
XY-V/XY-H



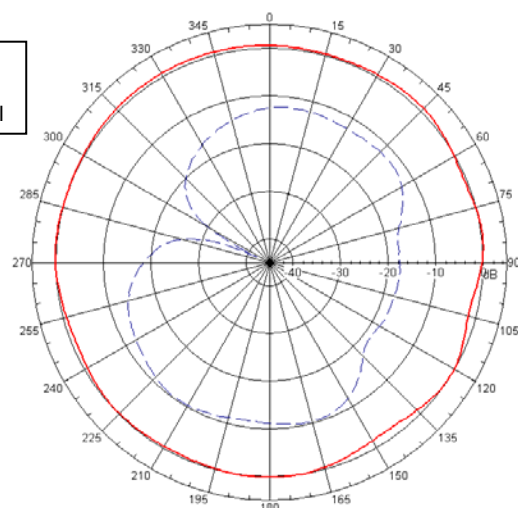
XY cut @2.45GHz
— Vertical
- - - Horizontal



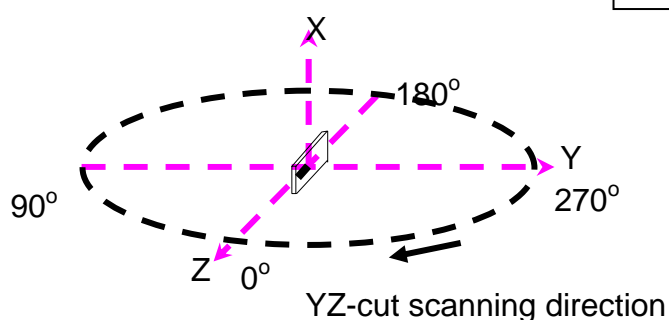
XZ-V/XZ-H



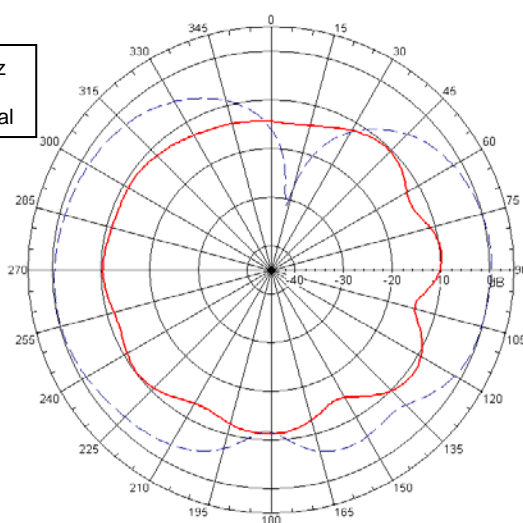
XZ cut @2.45GHz
— Vertical
- - - Horizontal



YZ-V/YZ-H



YZ cut @2.45GHz
— Vertical
- - - Horizontal



Advanced Ceramic X Corp.

16 Tzu Chiang Road, Hsinchu Industrial District Hsinchu Hsien 303, Taiwan

TEL:886-3-5987008 FAX:886-3-5987001

E-mail: acx@acxc.com.tw <http://www.acxc.com.tw>

AT3216 Series

Multilayer Chip Antenna

Features

- ❖ Monolithic SMD with small, low-profile and light-weight type.
- ❖ Wide bandwidth
- ❖ RoHS compliant



Applications

- ❖ Bluetooth/Wireless LAN/Home RF
- ❖ ISM band 2.4GHz applications

Specifications

Part Number	Operating Frequency (MHz)	Peak Gain (XZ-V)	Average Gain (XZ-V)	VSWR	Impedance
AT3216 -B2R7HAA_	2400 ~ 2500	0.5 dBi typ.	-0.5 dBi typ.	2 max.	50 Ω

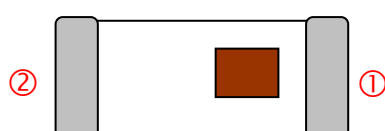
Q'ty/Reel (pcs) : 3,000pcs
 Operating Temperature Range : -40 ~ +85 °C
 Storage Temperature Range : +5 ~ +35 °C, Humidity 45~75%RH
 Storage Period : 12 months max.
 Power Capacity : 2W max.

Part Number

AT 3216 - B 2R7 HAA □ □
 ① ② ③ ④ ⑤ ⑥ ⑦

① Type	AT : Antenna	② Dimensions (L × W)	3.2× 1.6 mm
③ Material Code	B	④ Initial center frequency	2R7=2700MHz
⑤ Specification Code	HAA	⑥ Packaging	T: Tape & Reel B: Bulk
⑦ Soldering	/LF=lead-free		

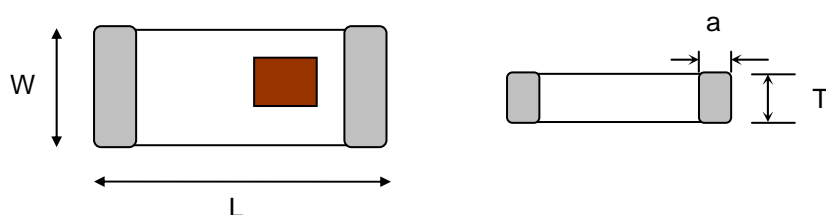
Terminal Configuration



No.	Terminal Name	No.	Terminal Name
①	Feeding Point	②	NC

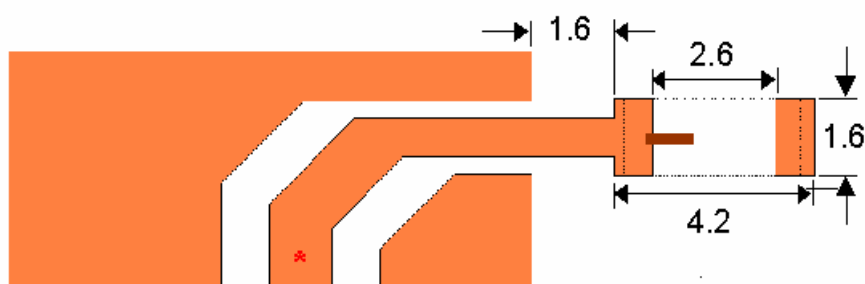
Dimensions and Recommended PC Board Pattern

Unit : mm

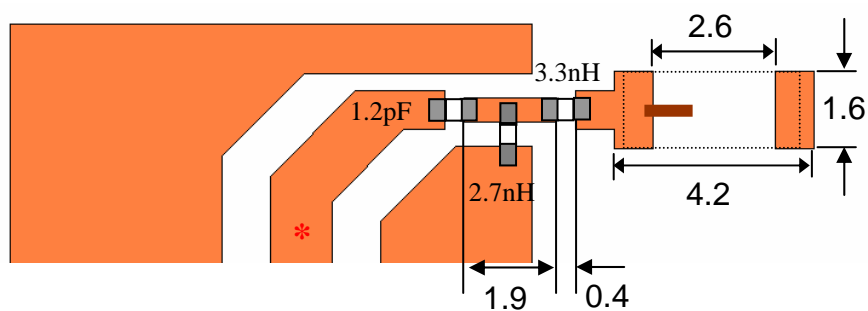


Mark	L	W	T	a
Dimensions	3.2±0.2	1.6±0.2	1.3+ 0.1/-0.2	0.5±0.3

(a) Without Matching Circuits



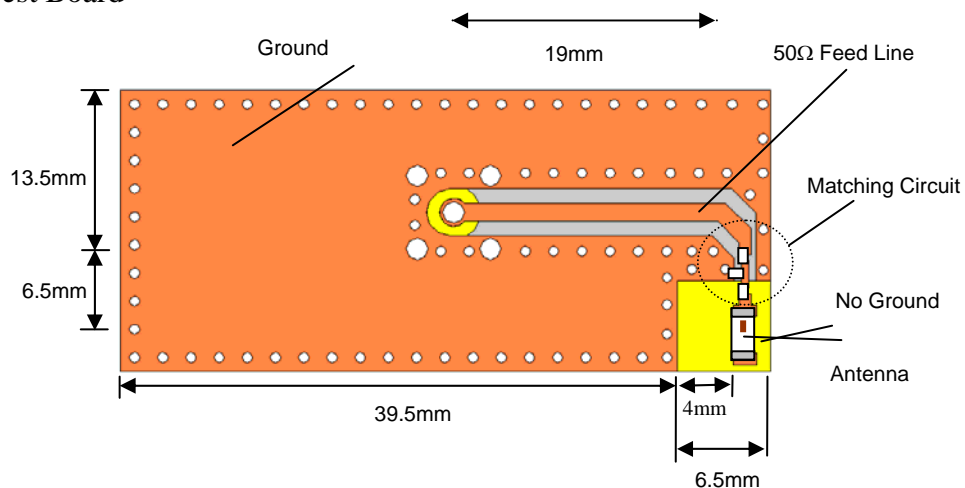
(b) With Matching Circuits



*Line width should be designed to match 50Ω characteristic impedance, depending on PCB material and thickness.

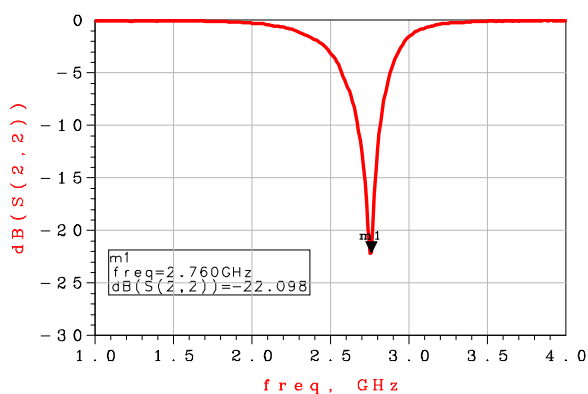
Typical Electrical Characteristics (T=25°C)

❖ Test Board

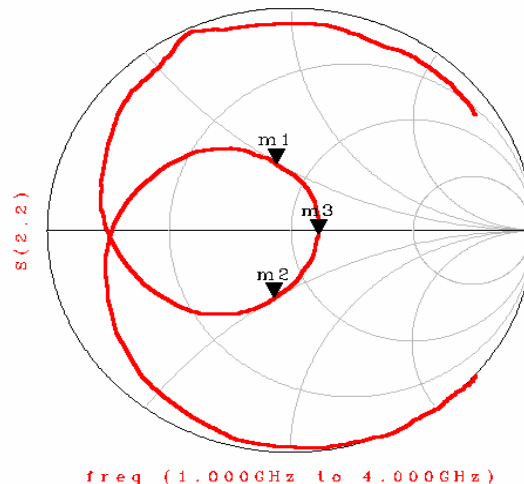
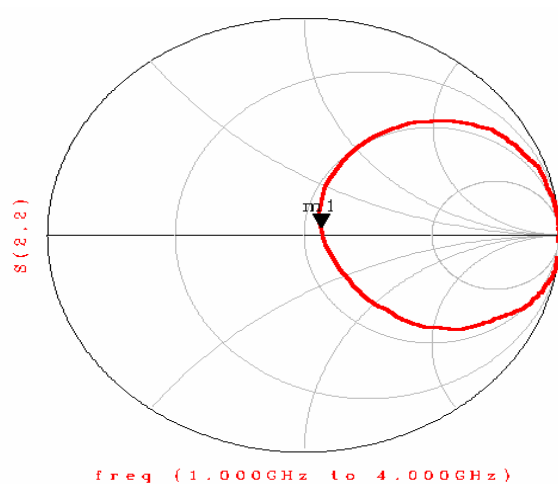
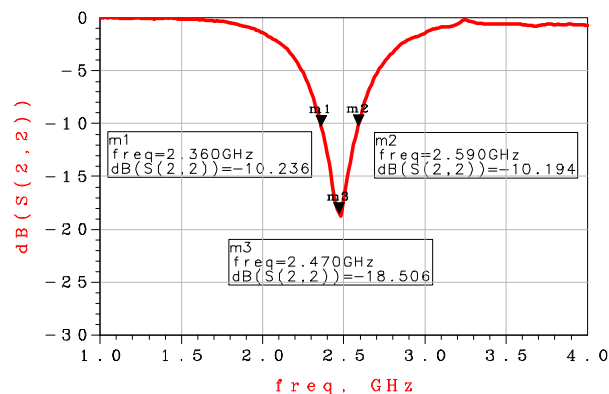


❖ Return Loss

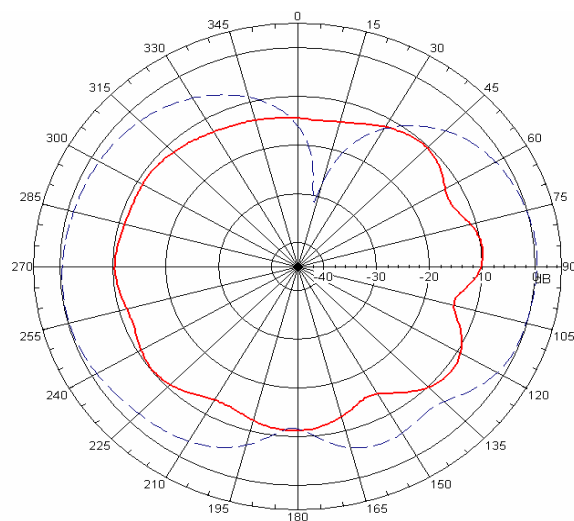
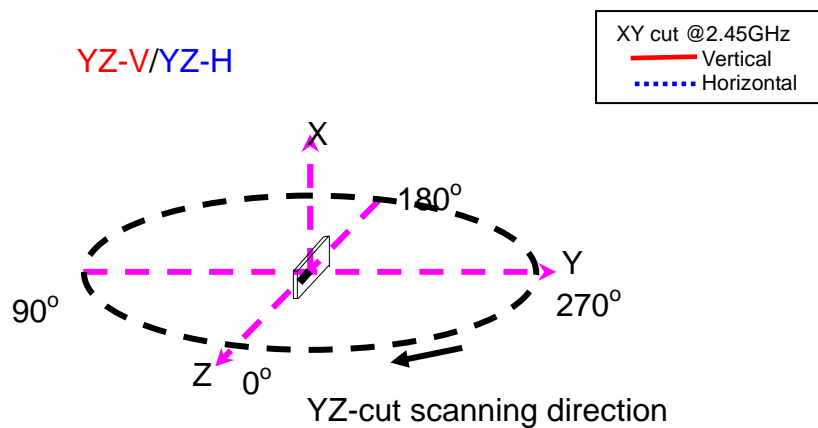
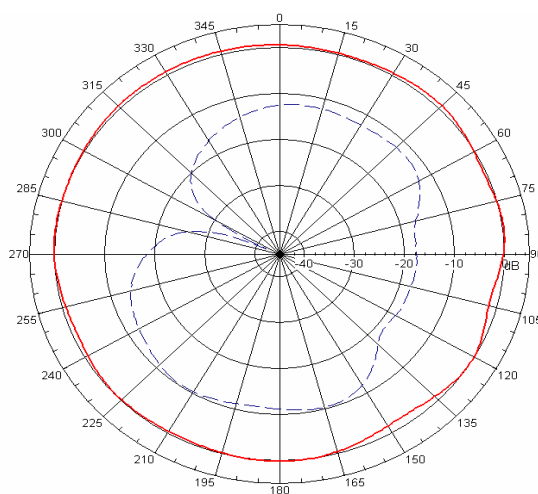
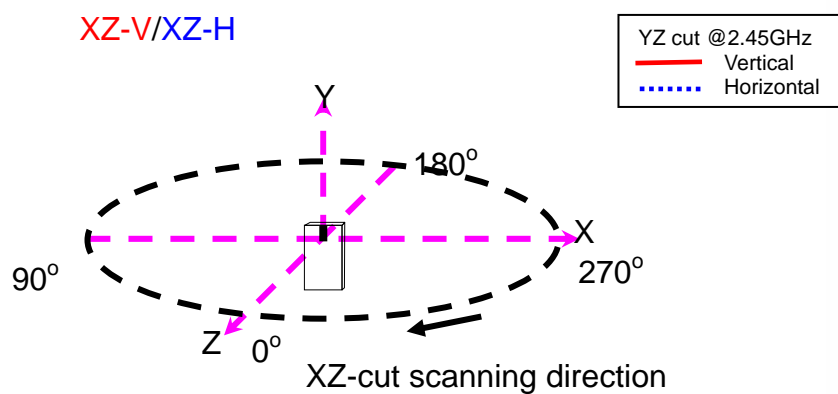
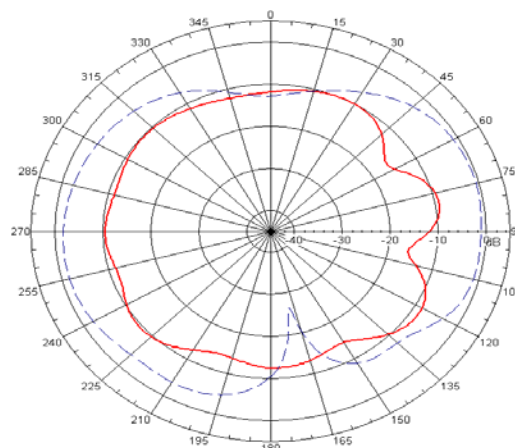
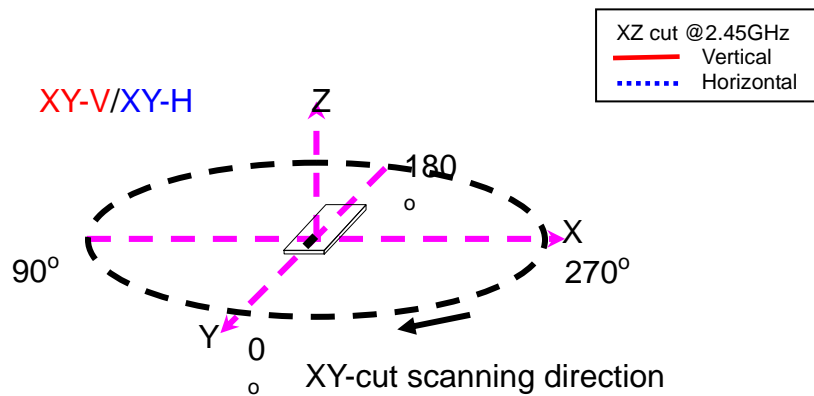
(a) Without Matching Circuits



(b) With Matching Circuits

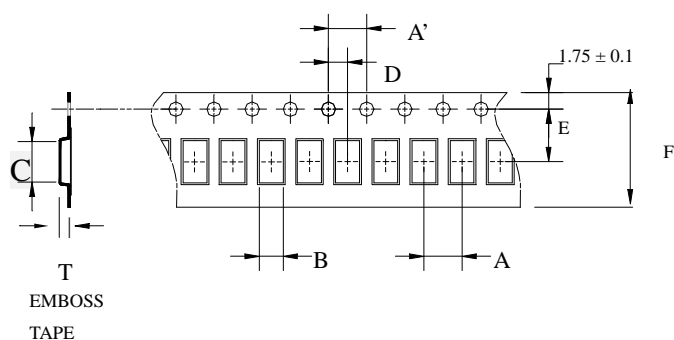


Radiation Patterns



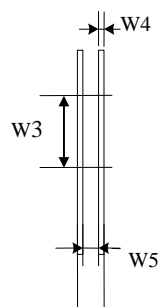
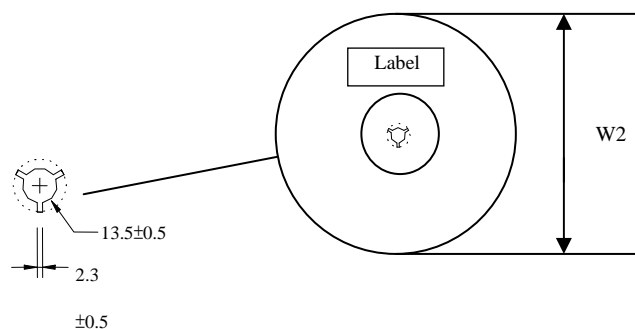
Taping Specifications

❖Tape & Reel Dimensions (Unit: mm) vs. Quantity (pcs)



Type	A	A'	B	C	D	E	F	T	Quantity/per reel	Tape material
AT3216	4.0±0.1	4.0±0.05	1.88±0.1	3.5±0.1	2.0±0.05	3.5±0.05	8.00±0.1	1.27±0.1	3,000pcs	Plastic (Embossed)

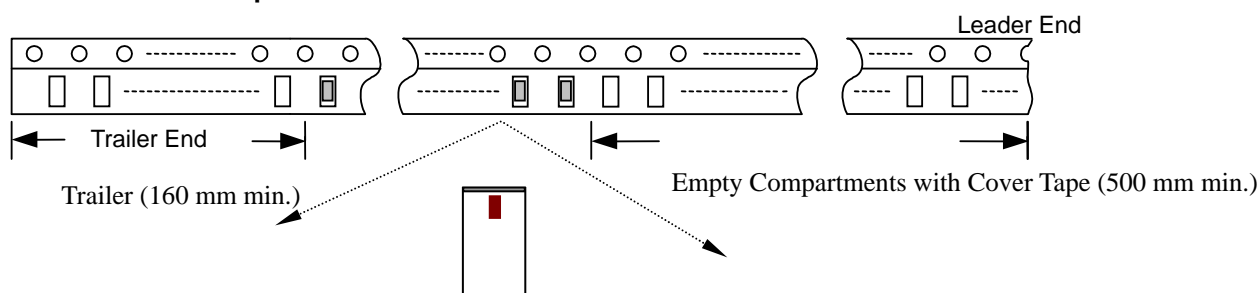
❖Reel Dimensions (Unit: mm)



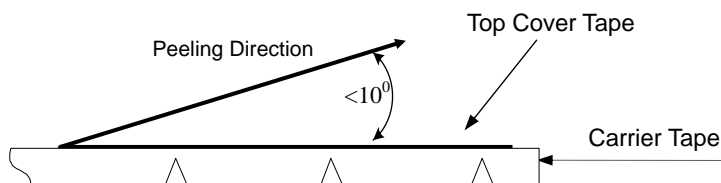
Label: Customer's Name,
ACX P/N, Q'ty, Date,
ACX Corp.

Type	W2	W3	W4	W5
AT3216	178±1	60±1	1.4±0.2	17±0.5

❖Leader and Trailer Tape



❖ **Peel-off Force**



Peel-off force should be in the range of 0.1 – 0.6 N at a peel-off speed of 300 ± 10 mm/min .

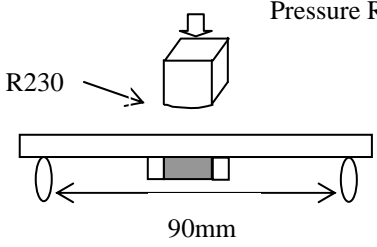
❖ **Storage Conditions**

- (1) Temperature: 15 ~35°C , relative humidity (RH): 45~75%.
- (2) Non-corrosive environment

Notes

❖ The contents of this data sheet are subject to change without notice. Please confirm the specifications and delivery conditions when placing your order.

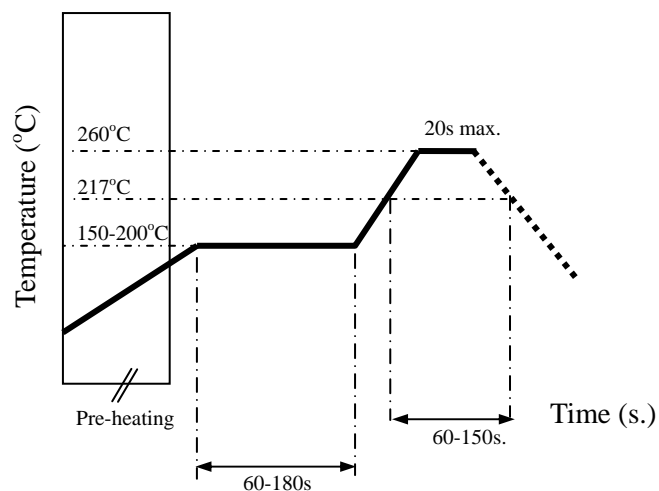
Mechanical & Environmental Characteristics

Item	Requirements	Procedure
Solderability	<ol style="list-style-type: none"> 1. No apparent damage 2. More than 95% of the terminal electrode shall be covered with new solder 	<ol style="list-style-type: none"> 1. Preheat: $120 \pm 5^{\circ}\text{C}$ 2. Solder: $245 \pm 5^{\circ}\text{C}$ for 5 ± 1 sec
Soldering strength (Termination Adhesion)	<ol style="list-style-type: none"> 1. 1kg minimum 	<ol style="list-style-type: none"> 1. Solder specimen onto test jig. 2. Apply push force at 0.5mm/s until electrode pads are peeled off or ceramic are broken. Pushing force is applied to longitude direction
Deflection (Substrate Bending)	<ol style="list-style-type: none"> 1. No apparent damage 	<ol style="list-style-type: none"> 1. Solder specimen onto test jig (FR4, 0.8mm) using the recommend soldering profile. 2. Apply a bending force of 2mm deflection 
Heat/Humidity Resistance	<ol style="list-style-type: none"> 1. No apparent damage 2. Fulfill the electrical specification after test 	<ol style="list-style-type: none"> 1. Temperature: $85 \pm 2^{\circ}\text{C}$ 2. Humidity: 90% ~ 95% RH 3. Duration: 1000 ± 48hrs 4. Recovery: 1-2hrs
Thermal shock (Temperature Cycle)	<ol style="list-style-type: none"> 1. No apparent damage 2. Fulfill the electrical specification after test 	<ol style="list-style-type: none"> 1. One cycle/step 1 : $125 \pm 5^{\circ}\text{C}$ for 30 min step 2 : $-40 \pm 5^{\circ}\text{C}$ for 30 min 2. No of cycles : 100 3. Recovery: 1-2 hrs
Low Temperature Resistance	<ol style="list-style-type: none"> 1. No apparent damage 2. Fulfill the electrical specification after test 	<ol style="list-style-type: none"> 1. Temperature: $-40^{\circ} \pm 5^{\circ}\text{C}$ 2. Duration: 500 ± 24hrs 3. Recovery: 1-2hrs

Soldering Conditions

❖ Typical Soldering Profile for Lead-free Process

Reflow Soldering :



Notes

❖ The contents of this data sheet are subject to change without notice. Please confirm the specifications and delivery conditions when placing your order.

Advanced Ceramic X Corp.

16 Tzu Chiang Road, Hsinchu Industrial District Hsinchu Hsien 303, Taiwan

TEL:886-3-5987008 FAX:886-3-5987001

E-mail: acx@acxc.com.tw

<http://www.acxc.com.tw>