

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



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Release Record

Report No.	Version	Description	Issued Date
JR490301-01AE	Rev. 01	Initial issue	Aug. 10, 2015
JR490301-01AE	Rev. 02	Appendix A data modified.	Sep. 02, 2015

Summary of Test Results

Ref. Std. Clause	Description	Result
3.2(2)(3)	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
3.3(1)	Receiver Emission	Pass
3.4.1	Interference prevention function	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
Frequency Range (MHz)	2402 ~ 2480 MHz
Total Channel Number	40
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)	Measured Conducted Power (mW)	Radiated Power (mW)
LE	7.5	7.295	8.185

1.1.6 Channel List

Frequency band (MHz)				2400~2483.5			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
37	2402	9	2422	18	2442	28	2462
0	2404	10	2424	19	2444	29	2464
1	2406	38	2426	20	2446	30	2466
2	2408	11	2428	21	2448	31	2468
3	2410	12	2430	22	2450	32	2470
4	2412	13	2432	23	2452	33	2472
5	2414	14	2434	24	2454	34	2474
6	2416	15	2436	25	2456	35	2476
7	2418	16	2438	26	2458	36	2478
8	2420	17	2440	27	2460	39	2480

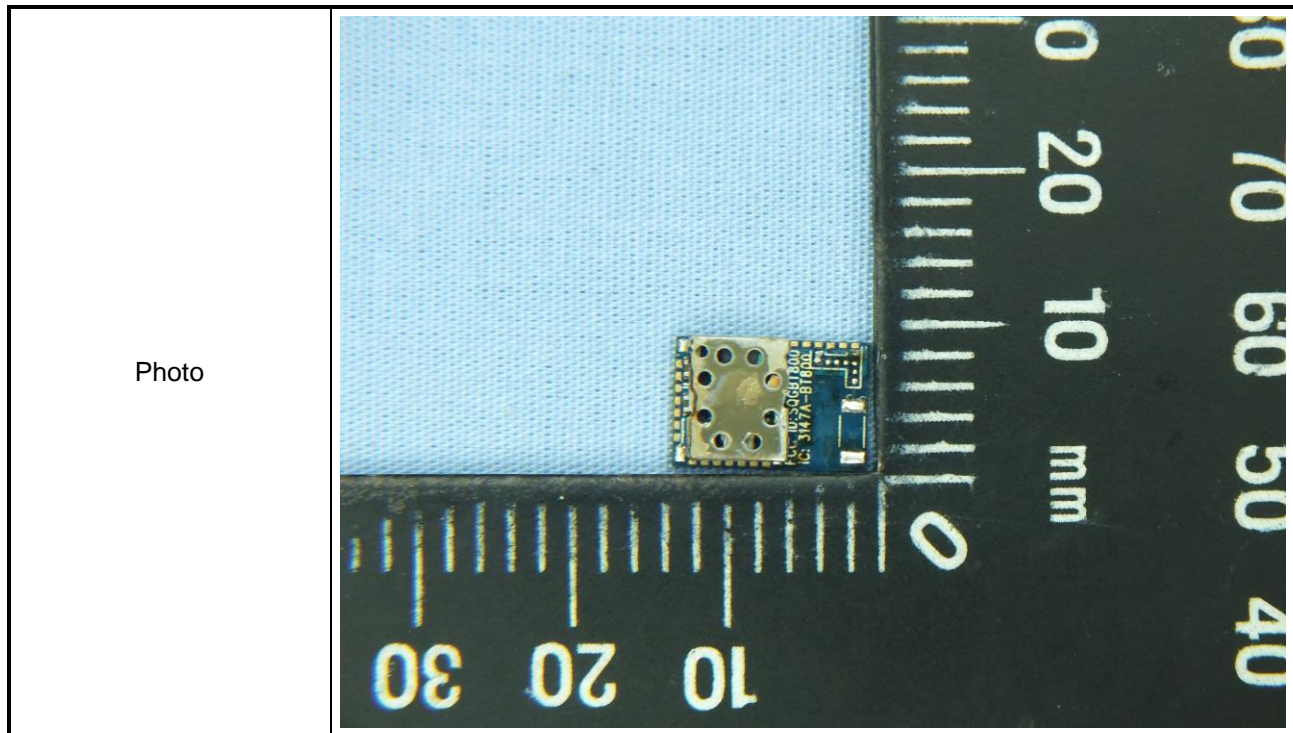
1.1.7 Test Tool and Power Setting

Test Tool
BlueTest3 version CSR 2.5.0

Modulation Mode	Test Frequency (MHz)		
	2402	2440	2480
GFSK/1Mbps	Default	Default	Default

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 Frequency (MHz)
Antenna Power Frequency Tolerance Transmitter Spurious Emission Occupied Bandwidth Spreading Bandwidth Collateral Emission of Receiver Spreading Factor Interference prevention function	BT LE	2402 / 2440 / 2480

3 Transmitter Test Results

3.1 Antenna Power

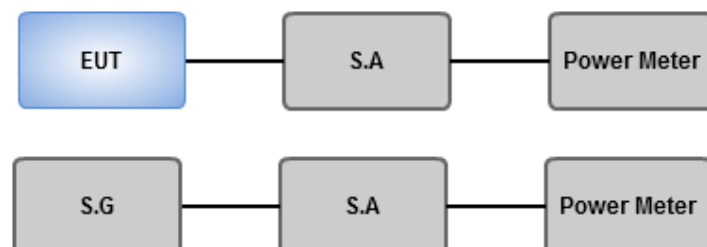
3.1.1 Limit of Antenna Power

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. A power meter is connected on the IF output port of the spectrum analyzer. Adjust the spectrum analyzer to have the center frequency the same with the measured carrier. RBW=VBW=1MHz, detector mode is positive peak. Turn off the averaging function and use zero span.
2. The calibrating signal power shall be reduced to 0 dBm and it shall be verified that the power meter reading also reduces by 10 dB. Connect the equipment to be measured. Using the following settings of the spectrum analyzer in combination with "max hold" function, find the frequency of highest power output in the power envelope: center frequency equal to operating frequency; RBW & VBW: 1 MHz; detector mode: positive peak; averaging: off; span: 3 times the spectrum width; amplitude: adjust for middle of the instrument's range. The frequency found shall be recorded.
3. Set the center frequency of the spectrum analyzer to the found frequency and switch to zero span. The power meter indicates the measured power density "E". Remove the EUT and put the replacing standard signal generator (SSG). Set the standard signal generator (SSG) at same frequency and transmit on, then set SSG output power at Pt to give the equivalent output level of "E".
4. Calculate antenna power density by the formula below $PD = Pt + 10 \cdot \log(1/x)$.
x: The duty cycle of the EUT in continuously transmitting mode.
Pt: Output power of the SSG.
5. Antenna Power Error is definition that actual measure antenna power tolerance between + 20% to - 80% power range that base on manufacturer declare the conducted power density.

3.1.3 Test Setup



3.1.4 Test Result of Maximum Transmit Power

Reference Documents	Test Mode	Test Items
Appendix A 19-LE	LE	1. Test Results 2. Antenna Power (Conducted Power)

3.2 Frequency Tolerance

3.2.1 Limit of Frequency Tolerance

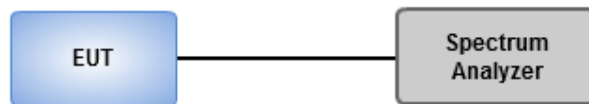
Frequency tolerance shall be +/- 50ppm.

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 Mode	Test Items
Appendix A 19-LE	LE	1.Test Results

3.3 Occupied Bandwidth

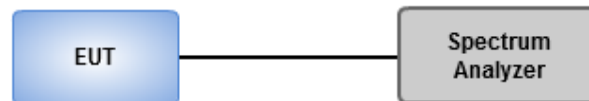
3.3.1 Limit of Occupied Bandwidth

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 = 40MHz, RBW = VBW = 300kHz, detector = Peak, Sweep time = Auto.
2. Enable OBW function of spectrum analyzer to measure OBW and capture test plot.

3.3.3 Test Setup



3.3.4 Test Result of Occupied Bandwidth

Reference Documents	Test Mode	Test Items
Appendix A 19-LE	LE	1.Test Results

3.4 Spreading Bandwidth and Factor

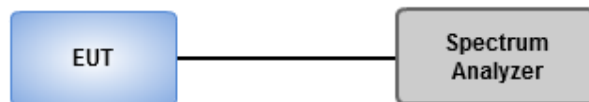
3.4.1 Limit of Spreading Bandwidth and Factor

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 OBW (90%) and capture test plot.

3.4.3 Test Setup



3.4.4 Test Result of Spreading Bandwidth and Factor

Reference Documents	Test Mode	Test Items
Appendix A 19-LE	LE	1.Test Results

3.5 Transmitter Spurious Emissions

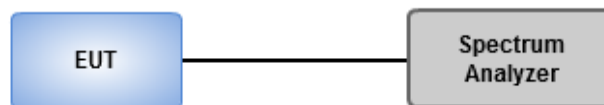
3.5.1 Limit of Transmitter Spurious Emissions

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 Mode	Test Items
Appendix A 19-LE	LE	1. Test Results 5. Unwanted Emission Intensity

3.6 Interference prevention function

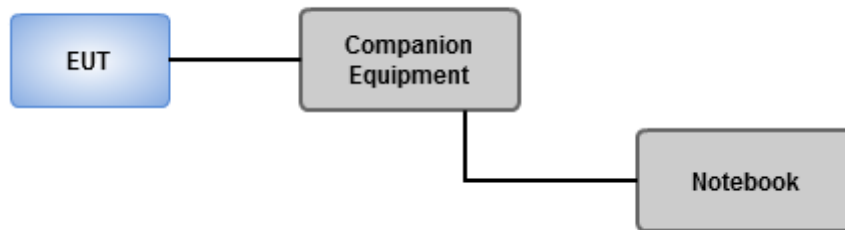
3.6.1 Limit of Interference Prevention Function

Limits
The identification code shall be 48 bits long

3.6.2 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

3.6.3 Test Setup



3.6.4 Test Result of Interference Prevention Function

Reference Documents	Test Mode	Test Items
Appendix A 19-LE	LE	1.Test Results

4 Receiver Test Results

4.1 Receiver Spurious Emissions

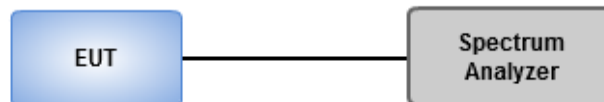
4.1.1 Limit of Receiver Spurious Emissions

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.

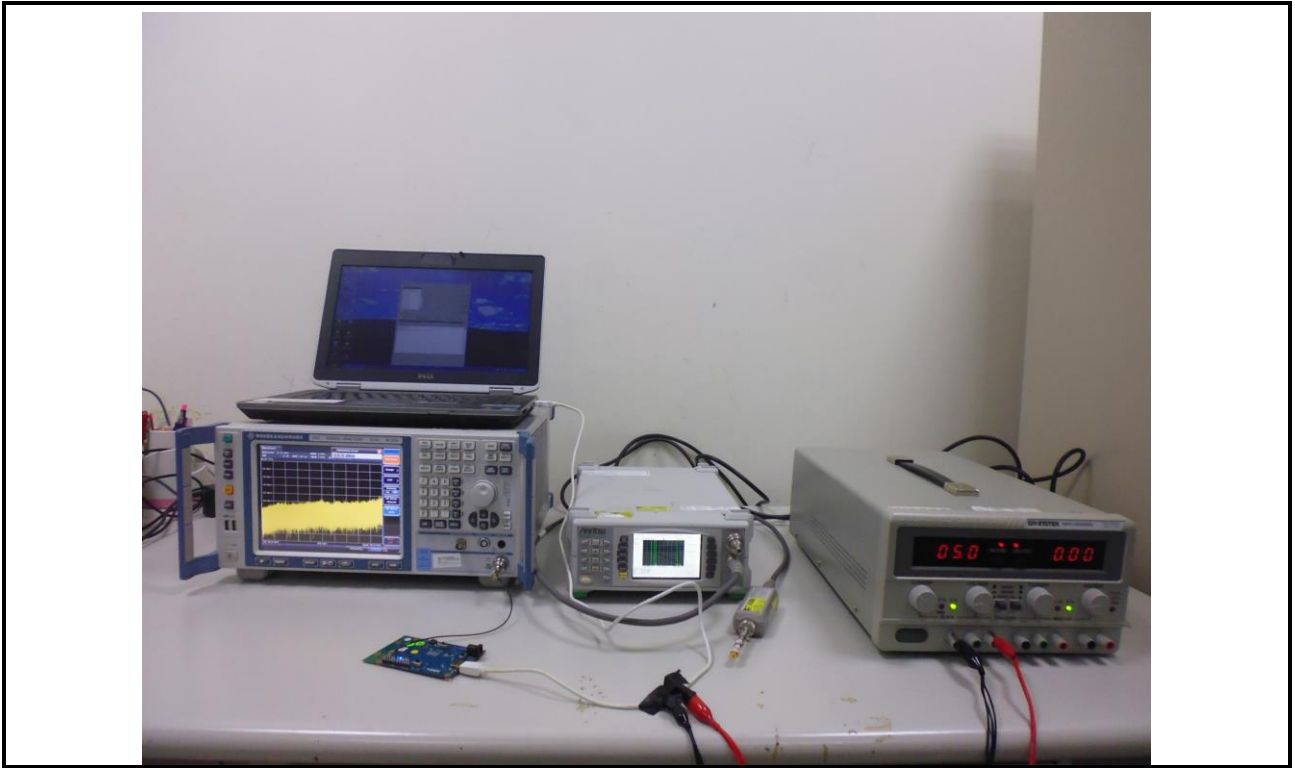
4.1.3 Test Setup



4.1.4 Test Result of Receiver Spurious Emissions

Reference Documents	Test Mode	Test Items
Appendix A 19-LE	LE	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>.

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Kwei Shan Site II

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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

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==END==

Test Voltage	V	Normal Voltage (5V)			Remarks	
Test Frequency	MHz	2402	2440	2480	Low/Mid/High of test frequency range	
Measured Frequency	MHz	2401.9915	2439.9910	2479.9890		
Frequency Error	ppm	-3.54	-3.69	-4.44	Limit ≤ 50 ppm	
Occupied Bandwidth	MHz	1.25	1.25	1.25	Limit ≤ 26 MHz (RB/VB : 300kHz)	
Spread-spectrum Bandwidth	MHz	0.84	0.84	0.84		
Unwanted Emission Intensity (Power emission within 1MHz bandwidth)	※ 1	μW	0.0010	0.0012	0.0009	Limit ≤ 0.25 μW (-36 dBm)
	※ 2	μW	0.0176	0.0224	0.0181	Limit ≤ 2.5 μW (-26 dBm)
	※ 3	μW	2.8576	0.0036	0.0023	Limit ≤ 25 μW (-16 dBm)
	※ 4	μW	0.0029	0.0056	0.0342	Limit ≤ 25 μW (-16 dBm)
	※ 5	μW	0.0659	0.0659	0.1009	Limit ≤ 2.5 μW (-26 dBm)
Antenna Power (Measured Power)	mW	4.074	5.623	7.295	Limit ≤ 10 mW (10 dBm)	
Antenna Power (Rated Power)	mW	7.5				
Antenna Power Error	mW	-3.426	-1.877	-0.205		
	%	-45.68	-25.02	-2.74	Limit + 20% ~ - 80%	
Limitation of Collateral	※ 6	nW	0.0218	0.0097	0.0390	Limit ≤ 4 nW (-54 dBm)
Emission of Receiver	※ 7	nW	0.0627	0.0662	0.0776	Limit ≤ 20 nW (-47 dBm)
Hopping Frequency Dwell Time	sec	-	-	-	Limit ≤ 0.4 sec (In 0.4 sec x 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	

Test Voltage	
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Testing for Electrical Specification	Test Voltage	V	Normal Voltage (5V)			Remarks
	Test Frequency	MHz	2402	2440	2480	
	Power Meter Form EUT	dBm	2.91	4.31	5.44	
	Cable loss	dB	1.49	1.49	1.49	Refer to Calibration Result
	Transmitter Duty Cycle Factor	dB	1.70	1.70	1.70	Duty Factor = $10 \times 10\text{Log}_{10}(1/\text{Duty Cycle})$
	Antenna Power (Conducted)	dBm	6.100	7.500	8.630	Limit $\leq 10\text{ mW}$ (10 dBm)
	Antenna Power (Conducted)	mW	4.074	5.623	7.295	
	Antenna Power Error	mW	-3.426	-1.877	-0.205	
		%	-45.68	-25.02	-2.74	Limit + 20% ~ - 80%
	Transmitter ON _{Time}	msec	0.4420			RBW : 1 MHz ; VBW : 1 MHz ; SP : 0Hz
Transmitter (ON+OFF) _{Time}	msec	0.6536				
Transmitter Duty Cycle	%	67.63%				

[illegible]

Antenna	Test Frequency (MHz)	Output Level from SG (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						

Test Voltage		V	Normal Voltage (5V)			Remarks
Unwanted Emission Frequency	Test Frequency	MHz	2402	2440	2480	
	※ 1	MHz	854.70	858.90	774.70	RBW : 100 kHz ; VBW : 100 kHz
	※ 2	MHz	2355.90	2335.80	2315.70	
	※ 3	MHz	2399.99	2388.21	2395.95	RBW : 1 MHz ; VBW : 1 MHz
	※ 4	MHz	2494.48	2492.52	2483.51	
	※ 5	MHz	7874.50	7845.50	7874.50	
	※ 1	dB	0.88	0.88	0.88	
	※ 2	dB	1.49	1.49	1.49	
	※ 3	dB	1.49	1.49	1.49	
	※ 4	dB	1.49	1.49	1.49	
Spectrum Raw	※ 5	dB	1.76	1.76	1.76	
	※ 1	dBm	-61.08	-60.07	-61.31	
	※ 2	dBm	-49.03	-47.99	-48.91	
	※ 3	dBm	-26.92	-26.92	-27.95	
	※ 4	dBm	-56.94	-53.99	-36.25	

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Unwanted Emission Intensity	※ 5	dBm	-43.57	-43.57	-41.72	
	※ 1	dBm	-60.20	-59.19	-60.43	Limit $\leq 0.25 \mu W$ (-36 dBm)
	※ 2	dBm	-47.54	-46.50	-47.42	Limit $\leq 2.5 \mu W$ (-26 dBm)
	※ 3	dBm	-25.44	-54.48	-56.46	Limit $\leq 25 \mu W$ (-16 dBm)
	※ 4	dBm	-55.45	-52.50	-34.76	Limit $\leq 25 \mu W$ (-16 dBm)
	※ 5	dBm	-41.81	-41.81	-39.96	Limit $\leq 2.5 \mu W$ (-26 dBm)
	※ 1	μW	0.0010	0.0012	0.0009	Limit $\leq 0.25 \mu W$ (-36 dBm)
	※ 2	μW	0.0176	0.0224	0.0181	Limit $\leq 2.5 \mu W$ (-26 dBm)
	※ 3	μW	2.8576	0.0036	0.0023	Limit $\leq 25 \mu W$ (-16 dBm)
	※ 4	μW	0.0029	0.0056	0.3342	Limit $\leq 25 \mu W$ (-16 dBm)
Unwanted Emission Intensity	※ 5	μW	0.0659	0.0659	0.1009	Limit $\leq 2.5 \mu W$ (-26 dBm)

※ 1: Frequency Band 1 (30 MHz $\leq f \leq$ 2387 MHz)

※ 2: Frequency Band 2 (2387 MHz $< f \leq$ 2400 MHz)

※ 3: Frequency Band 3 (2483.5 MHz $\leq f <$ 2496.5 MHz)

※ 4: Frequency Band 4 (2496.5 MHz $\leq f <$ 12.5 GHz)

※ 5: Frequency Band 5 (30 MHz $\leq f <$ 1000 MHz)

※ 6: Frequency Band 6 (1000 MHz $\leq f <$ 12.5 GHz)

6. Limitation of Collateral Emission of Receiver

Test Voltage		V	Normal Voltage (5V)			Remarks	
Test Frequency		MHz	2402	2440	2480		
Spurious Emission Frequency	※ 6	MHz	99.50	766.30	99.50	1st	30MHz~1000MHz:: Maximum emission and all emissions beyond 1/10 of the limitation must be indicated.
	※ 6	MHz	-	-	-	2nd	
	※ 6	MHz	-	-	-	3rd	
	※ 7	MHz	7865.00	7848.00	7865.00	1st	1000MHz~12.5GHz:: Maximum emission and all emissions beyond 1/10 of the limitation must be indicated.
	※ 7	MHz	-	-	-	2nd	
	※ 7	MHz	-	-	-	3rd	
Cable Loss	※ 6	dB	0.88	0.88	0.88	1st	
	※ 6	dB	-	-	-	2nd	
	※ 6	dB	-	-	-	3rd	
	※ 7	dB	1.76	1.76	1.76	1st	
	※ 7	dB	-	-	-	2nd	
	※ 7	dB	-	-	-	3rd	
Spectrum Raw	※ 6	dBm	-77.49	-81.00	-74.97	1st	
	※ 6	dBm	-	-	-	2nd	
	※ 6	dBm	-	-	-	3rd	
	※ 7	dBm	-73.79	-73.55	-72.86	1st	
	※ 7	dBm	-	-	-	2nd	
	※ 7	dBm	-	-	-	3rd	
Spurious Emission Intensity	※ 6	dBm	-76.61	-80.12	-74.09	1st	Limit ≤ 4 nW (-54 dBm) RBW : 100 kHz ; VBW : 100 kHz
	※ 6	dBm	-	-	-	2nd	
	※ 6	dBm	-	-	-	3rd	
	※ 7	dBm	-72.03	-71.79	-71.10	1st	Limit ≤ 20 nW (-47 dBm) RBW : 1 MHz ; VBW : 1 MHz
	※ 7	dBm	-	-	-	2nd	
	※ 7	dBm	-	-	-	3rd	
Spurious Emission Intensity	※ 6	nW	0.0218	0.0097	0.0390	Total Emission Power	
	※ 6	nW	0.0218	0.0097	0.0390	1st	Limit ≤ 4 nW (-54 dBm) RBW : 100 kHz ; VBW : 100 kHz
	※ 6	nW	-	-	-	2nd	
	※ 6	nW	-	-	-	3rd	
	※ 7	nW	0.0627	0.0662	0.0776	Total Emission Power	
	※ 7	nW	0.0627	0.0662	0.0776	1st	Limit ≤ 20 nW (-47 dBm) RBW : 1 MHz ; VBW : 1 MHz
	※ 7	nW	-	-	-	2nd	
	※ 7	nW	-	-	-	3rd	

※ 1: Frequency Band 1 (30 MHz $\leq f \leq$ 2387 MHz)

※ 2: Frequency Band 2 (2387 MHz $< f \leq$ 2400 MHz)

※ 3: Frequency Band 3 (2483.5 MHz $\leq f <$ 2496.5 MHz)

※ 4: Frequency Band 4 (2496.5 MHz $\leq f <$ 12.5 GHz)

※ 5: Frequency Band 5 (30 MHz $\leq f <$ 1000 MHz)

※ 6: Frequency Band 6 (1000 MHz $\leq f <$ 12.5 GHz)

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

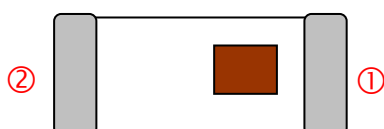
Q'ty/Reel (pcs) : 3,000pcs
 Operating Temperature Range : -40 ~ +85 °C
 Storage Temperature Range : +5 ~ +35 °C, Humidity 45~75%RH
 Storage Period : 12 months max.
 Power Capacity : 2W max.

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		

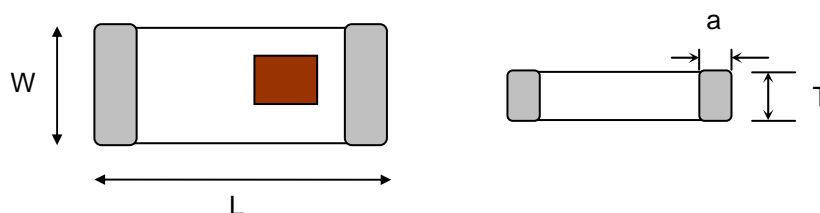
Terminal Configuration



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

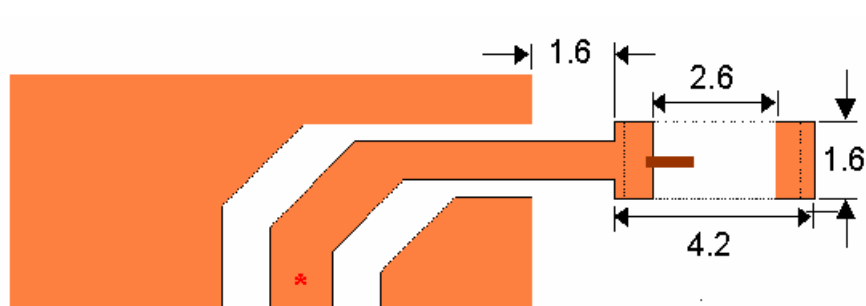
Dimensions and Recommended PC Board Pattern

Unit : mm

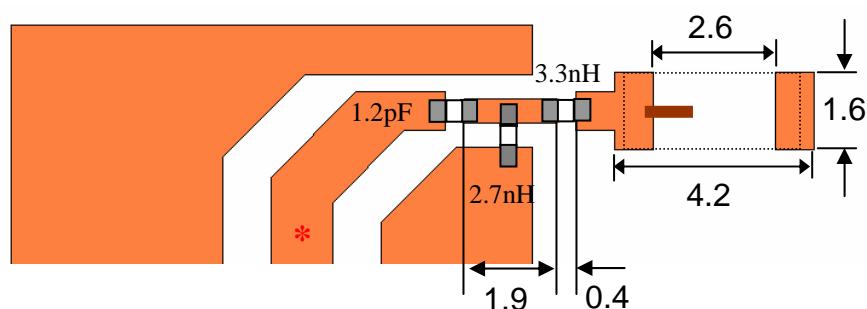


Mark	L	W	T	a
Dimensions	3.2±0.2	1.6±0.2	1.3+ 0.1/-0.2	0.5±0.3

(a) Without Matching Circuits



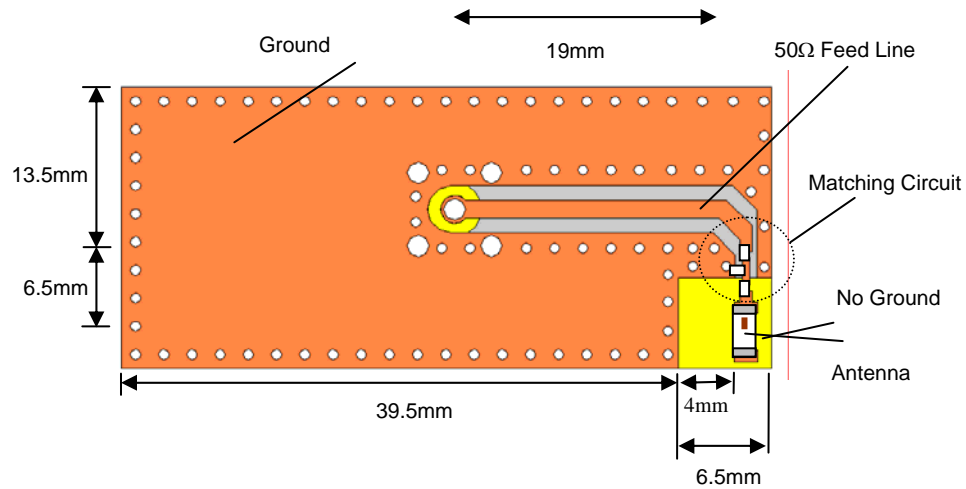
(b) With Matching Circuits



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

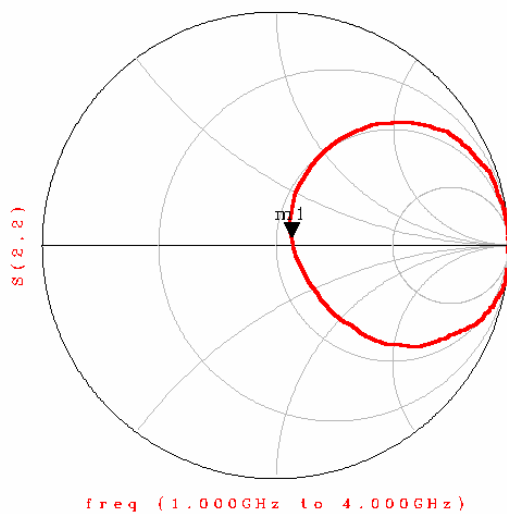
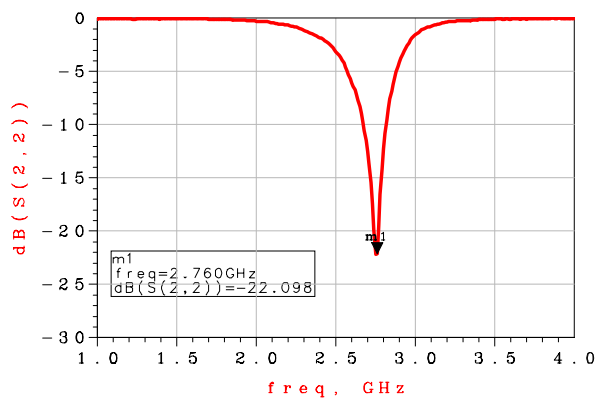
Typical Electrical Characteristics (T=25°C)

❖ Test Board

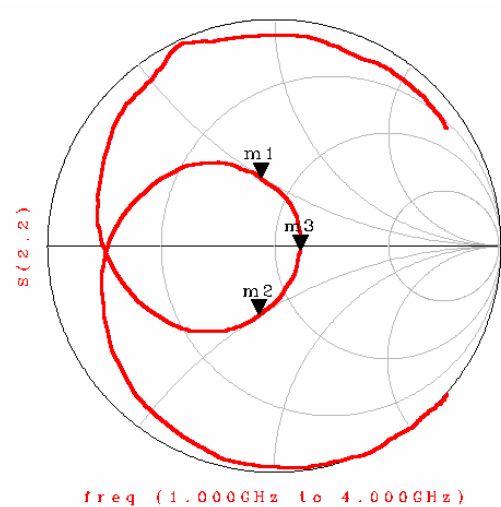
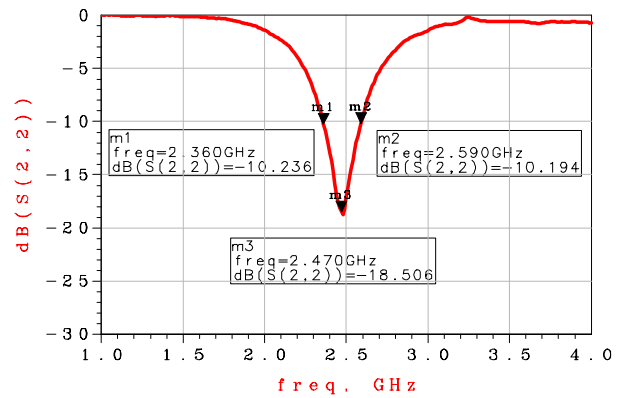


❖ Return Loss

(a) Without Matching Circuits

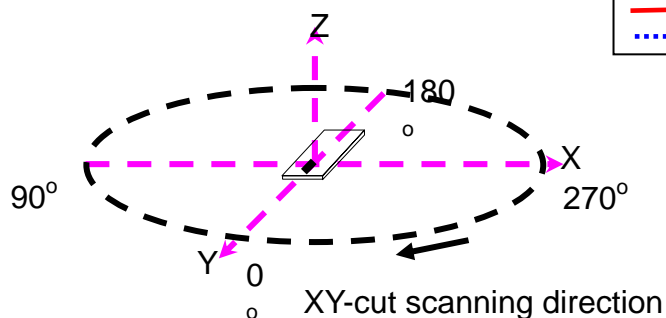


(b) With Matching Circuits

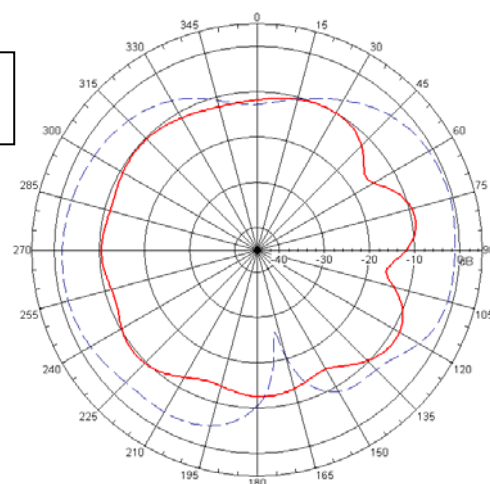


Radiation Patterns

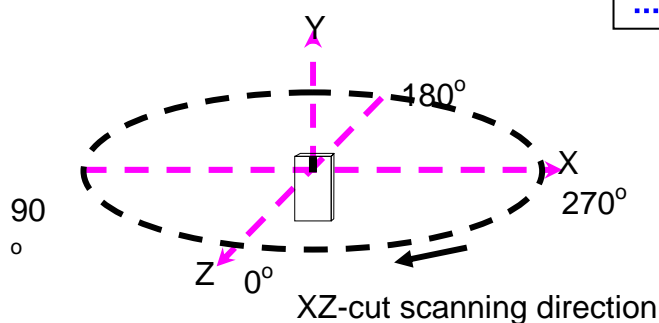
XY-V/XY-H



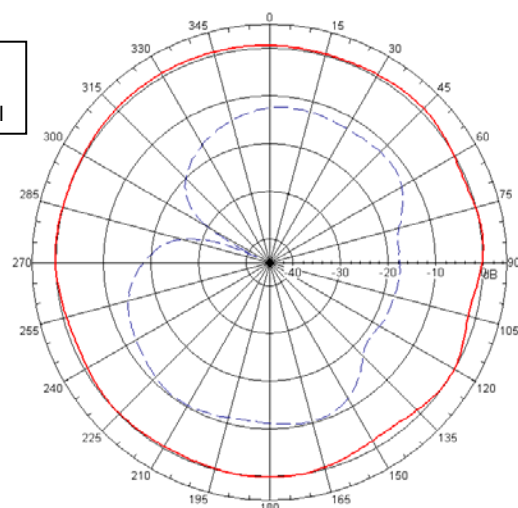
XY cut @2.45GHz
— Vertical
- - - Horizontal



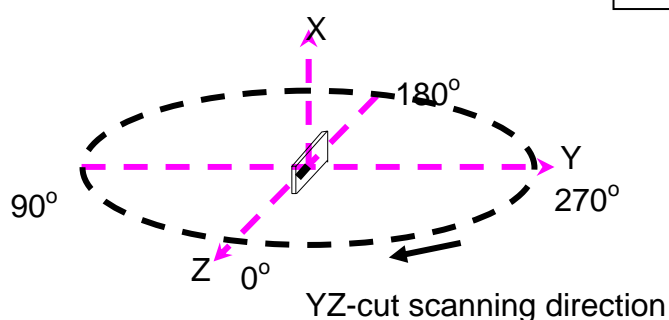
XZ-V/XZ-H



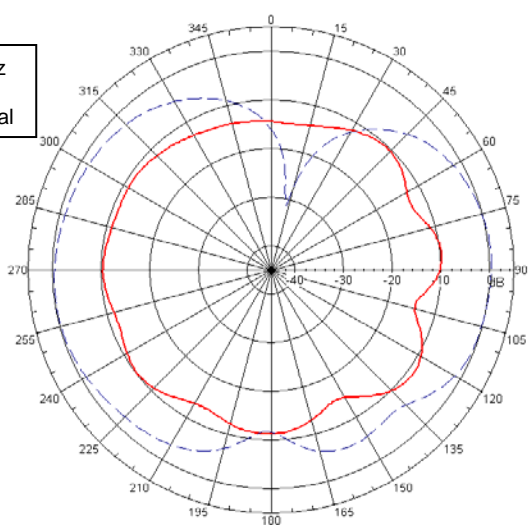
XZ cut @2.45GHz
— Vertical
- - - Horizontal



YZ-V/YZ-H



YZ cut @2.45GHz
— Vertical
- - - Horizontal



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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

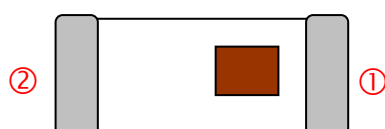
Q'ty/Reel (pcs) : 3,000pcs
 Operating Temperature Range : -40 ~ +85 °C
 Storage Temperature Range : +5 ~ +35 °C, Humidity 45~75%RH
 Storage Period : 12 months max.
 Power Capacity : 2W max.

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		

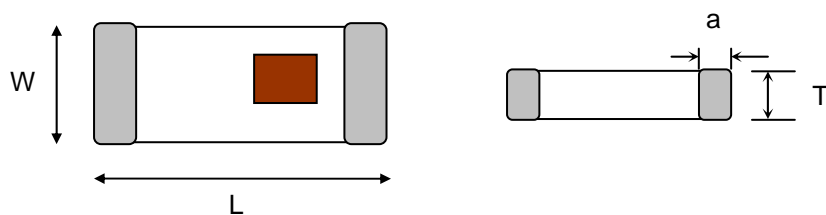
Terminal Configuration



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

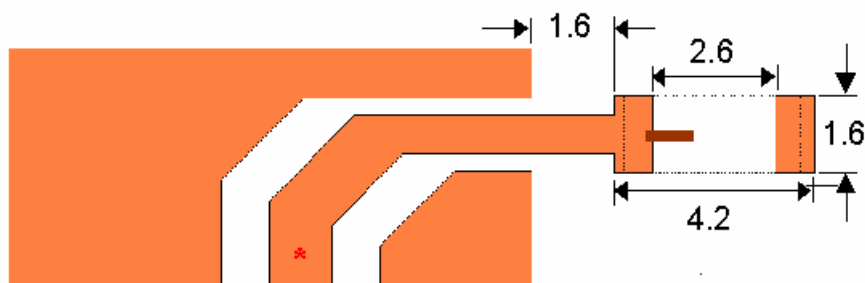
Dimensions and Recommended PC Board Pattern

Unit : mm

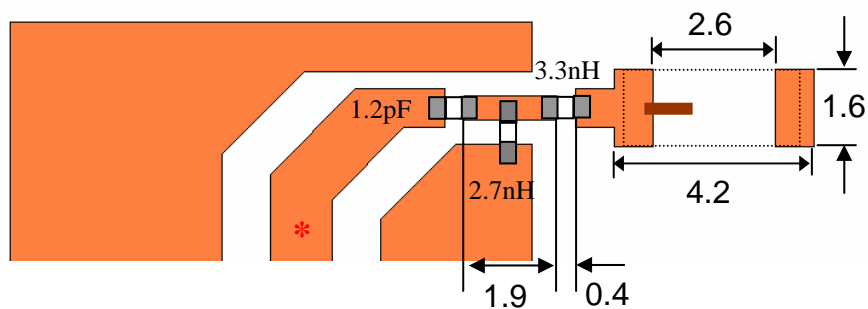


Mark	L	W	T	a
Dimensions	3.2±0.2	1.6±0.2	1.3+ 0.1/-0.2	0.5±0.3

(a) Without Matching Circuits



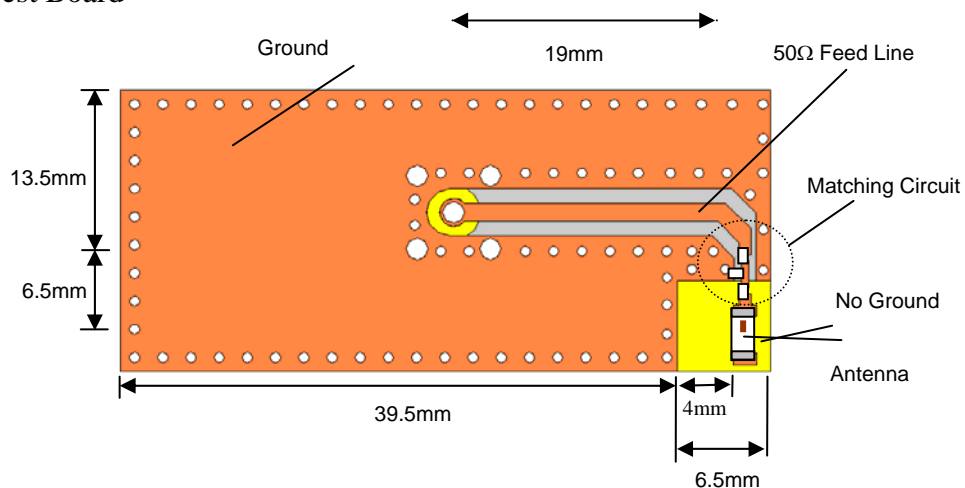
(b) With Matching Circuits



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

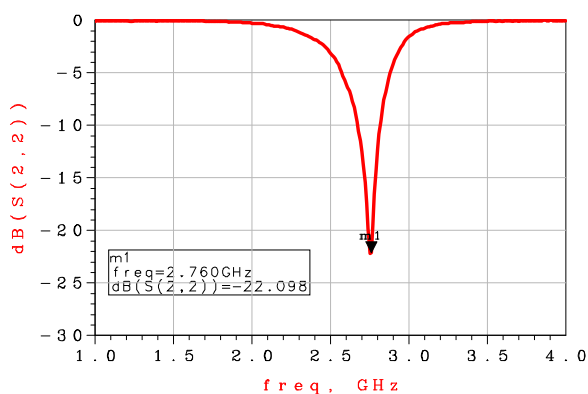
Typical Electrical Characteristics (T=25°C)

❖ Test Board

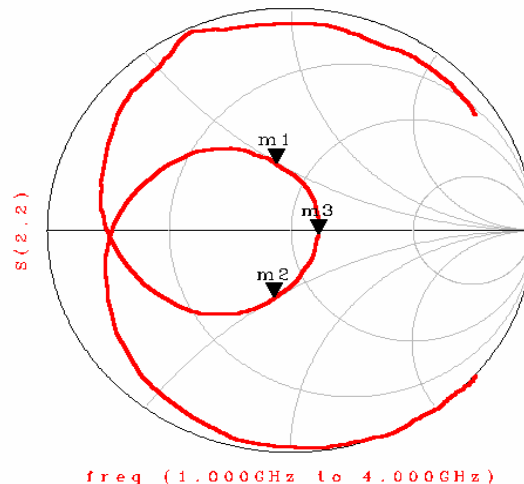
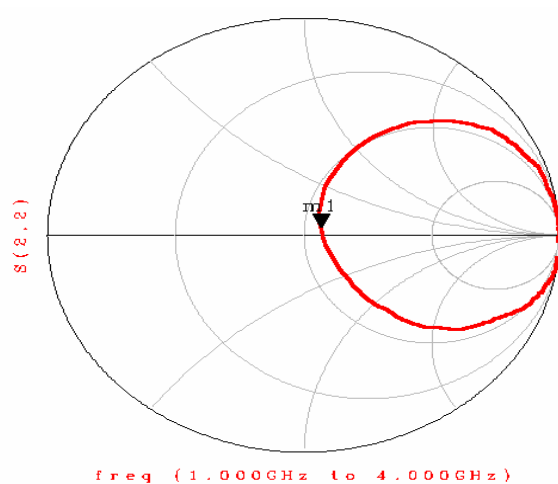
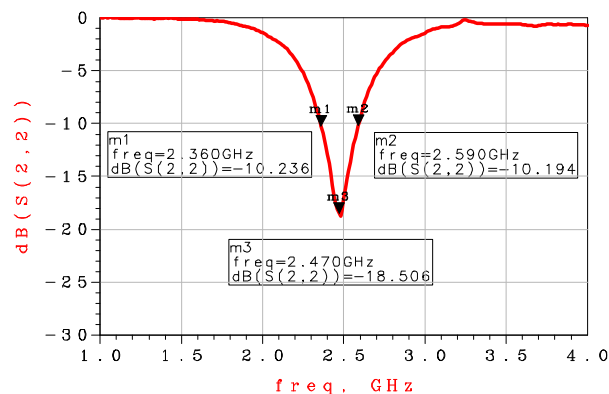


❖ Return Loss

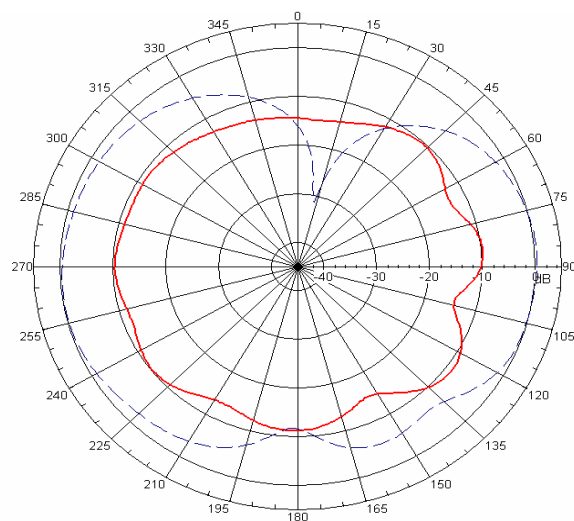
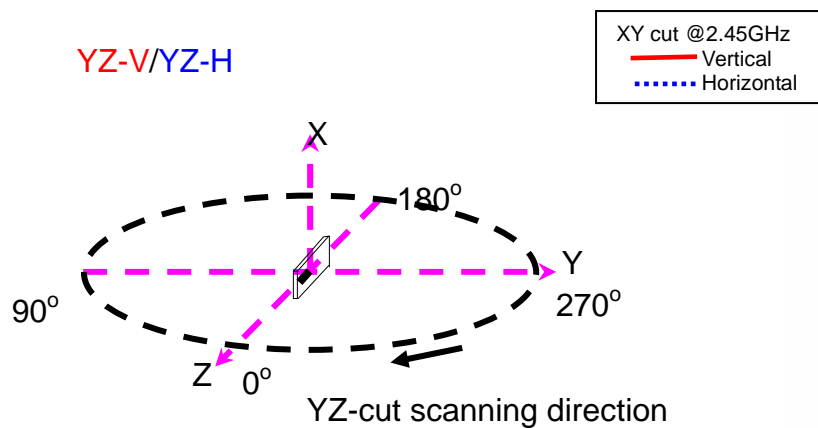
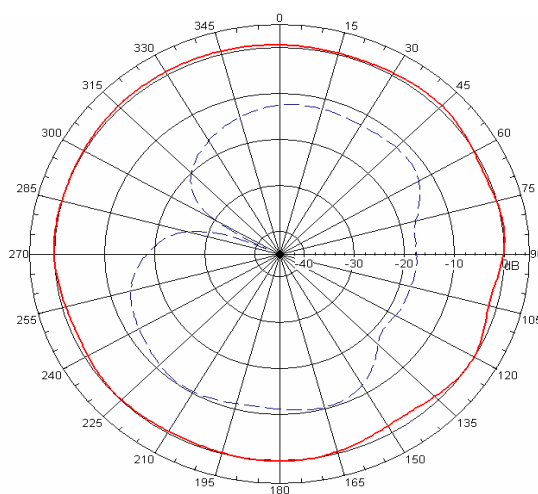
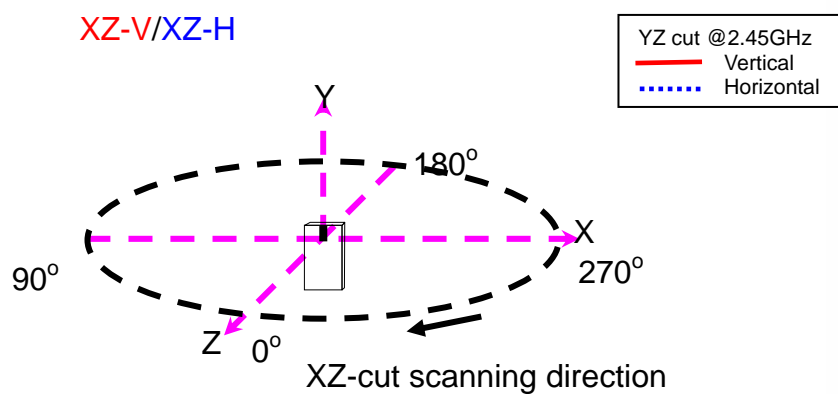
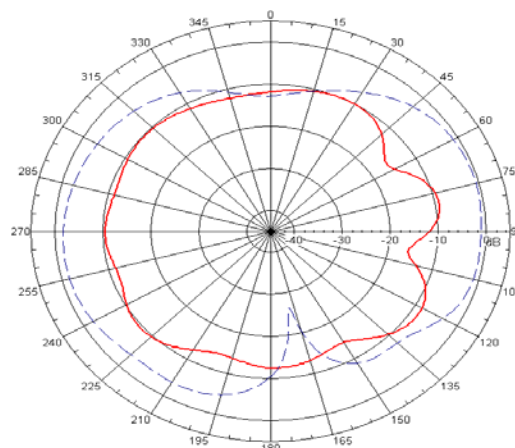
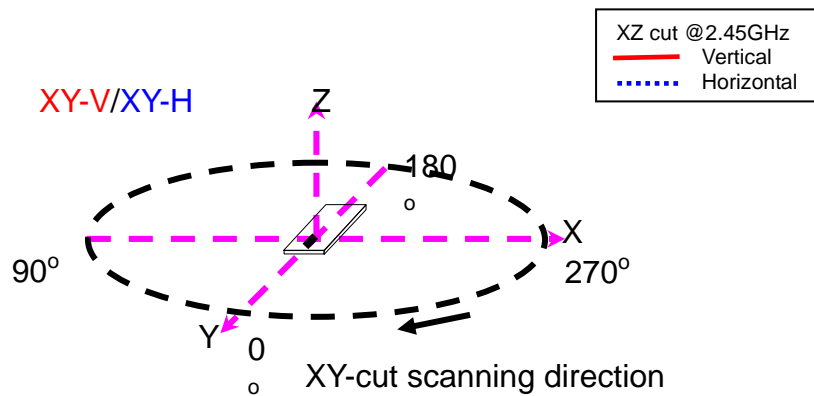
(a) Without Matching Circuits



(b) With Matching Circuits

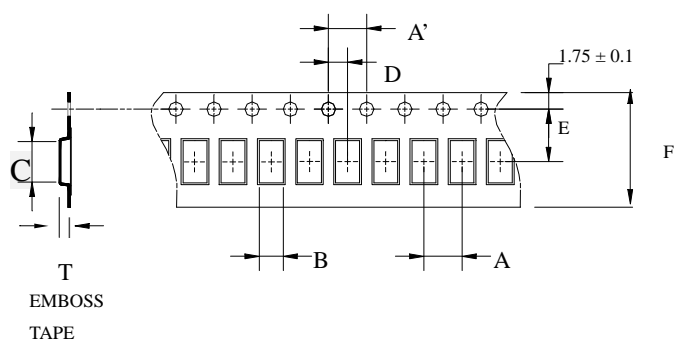


Radiation Patterns



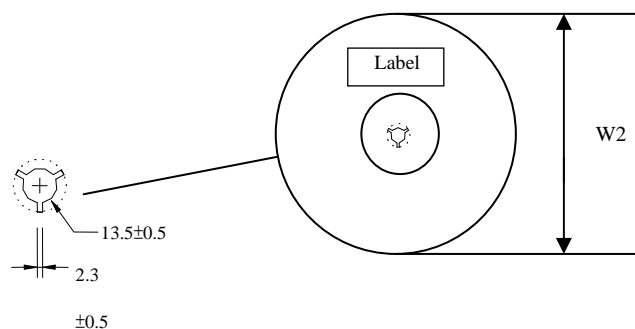
Taping Specifications

❖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)

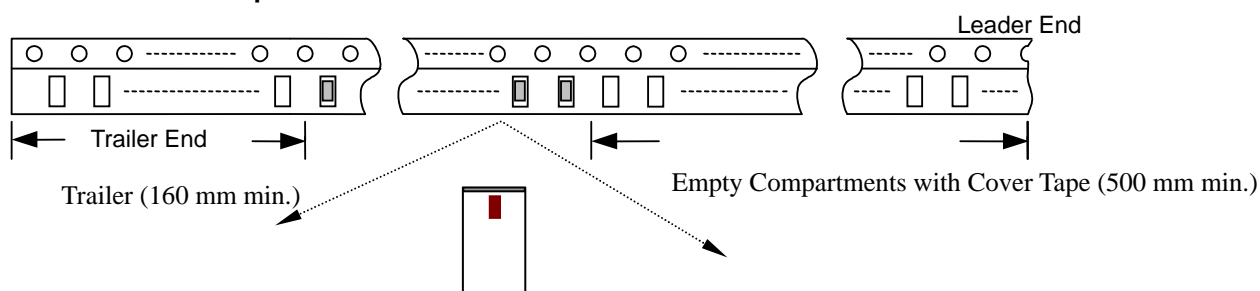
❖Reel Dimensions (Unit: mm)



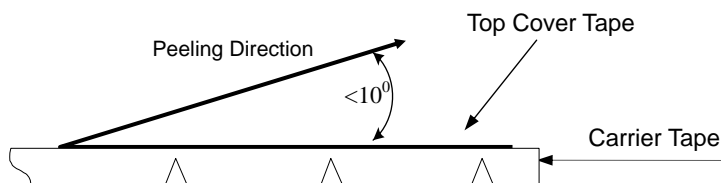
Label: Customer's Name,
ACX P/N, Q'ty, Date,
ACX Corp.

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 .

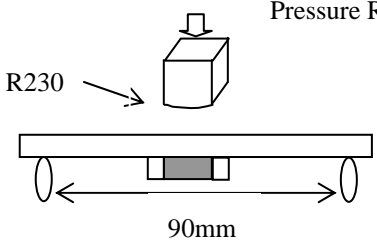
❖ **Storage Conditions**

- (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.

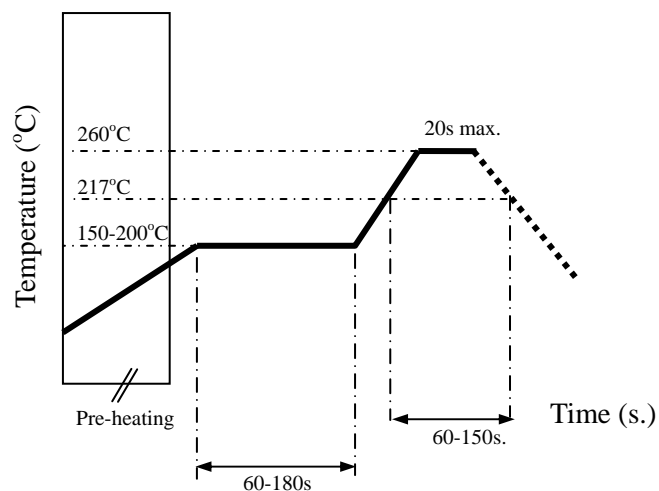
Mechanical & Environmental Characteristics

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

Soldering Conditions

❖ Typical Soldering Profile for Lead-free Process

Reflow Soldering :



Notes

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