

RFI / EMI TEST REPORT

EUT Name	: Bluetooth Keyboard
Model No.	: PSK-8052, PSK-8052AL, PSK-8152, PSK-8152AL, ASK-8052, ASK-8052AL, ASK-8152, ASK-8152AL, KSK-8020 MAC-BT, BTKEY, SKB-BTMAC2BK, SKB-BTMAC2W
FCC ID.	: RAC8052A01
Applicant	: PRECISION SQUARED TECHNOLOGY CORPORATION
Address	: 5F-7, NO. 2, JIAN BA ROAD, CHUNG HO CITY, TAIPEI HSIENG, TAIWAN, R. O. C.
Regulation	: CFR 47, Part 15 Subpart C
Test Site	: PEP Testing Laboratory
Test Engineer	: IVAN HUANG
Test Date	: OCT. 13, 2008 – OCT 15, 2008
Issued Date	: OCT. 31, 2008
Report No.	: E970267

VERIFICATION

WE HEREBY VERIFY THAT :

The EUT listed below has completed RFI testing by PEP Testing Laboratory and it does comply with the limitation of FCC Part 15 subpart C, Section 15.247 limitations.

The tested configurations and the facility comply with the radiated and AC line conducted test site criteria in ANSI C63. 4- 2003.

Any data in this RFI report is “ **reference** ” only.

APPLICANT : PRECISION SQUARED TECHNOLOGY CORPORATION

PRODUCT : Bluetooth Keyboard

FCC ID. : RAC8052A01

MODEL NO. : PSK-8052, PSK-8052AL, PSK-8152, PSK-8152AL, ASK-8052,
ASK-8052AL, ASK-8152, ASK-8152AL, KSK-8020 MAC-BT,
BTKEY, SKB-BTMAC2BK, SKB-BTMAC2W



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1. Product Information

EUT Name:	Bluetooth Keyboard
Model Number:	The appearance of top cover of PSK-8052 is plastic and PSK-8152 is aluminum. All models have identical electrical design and construction except that they are different in model number for marketing purpose.
Channel No. :	79 Channel
Frequency Range:	2.4GHz~2.4835GHz
Modulation:	FHSS
Data Rate:	1MHz
Internal Crystal / Osc. :	24MHz
Power Rating:	DC 3V --- supplied by battery
Antenna Type:	Integral
Antenna Gain :	0.5 dBi (numeric 1.12)
Case:	ABS

2. General Information

2.1 Test Mode and Procedure

Test Channel: As required by FCC Part15, Section 15.31(m) measurements on intentional radiators or receiver should be performed at three frequencies for operating frequency over 10MHz, one near top, one near middle and one near bottom.

Due to the support channels are 79 channels, the selected three frequencies for testing would be 2.402GHz near top for CH LOW, 2.441GHz near middle for CH MID and 2.480GHz near bottom for CH HIGH.

Test Mode	Channel setting and Operating condition
Channel Low Mode (2402MHz)	Using controller that is customer provides to control EUT test under Channel Low frequency and transmit continuously.
Channel Mid Mode (2441MHz)	Using controller that is customer provides to control EUT test under Channel Mid frequency and transmit continuously.
Channel High Mode (2480MHz)	Using controller that is customer provides to control EUT test under Channel High frequency and transmit continuously.

Test Procedure:

1. Putting the EUT on the platform and turning on the EUT (on/off button on the bottom of the EUT).
2. Setting test channel described as "Channel setting and operating condition", and testing channel by channel.
3. For the maximum conducted output power measurement, we followed Part 15 Subpart 15.247, Measurement of Digital Transmission Systems "Alternative Test Procedure (1).
4. For the spurious emission test based on ANSI C63.4(2003), at the frequency where below 1GHz used quasi-peak detector mode; where above 1GHz used the peak and average detector mode. IF the peak value may be under average limit, the average mode will not be performed.
5. In this RFI test report, we provided the worst case conducted emission test data or/and radiated emission test data. The entire testing data was recorded and provided in this report.

2.2 Test Software(s) Used

BoueTool: Through controller to control transmit frequency of EUT.

2.3 Modification(s)

N/A

3. Support Equipment Used

Personal Computer (PC4)	CPU : Intel P4 3.06GHz FCC ID : Declaration of Conformity(DoC) Manufacturer : ACER Model Number : Aspire T650 Power Supply : Switching Power Cord : Non-Shielded, Detachable, 1.8m Data Cable : N/A
Modem (MOD1)	FCC ID : IFAXDM1414 Manufacturer : ACEEX Model Number : 1414 Power Supply : Linear, 9Vac O/P Power Cable : Non-Shielded , Detachable,1.7m Data Cable : 1 > Shielded , Detachable,1m 2 > Back Shell : Metal
LCD (LCD1 17")	FCC ID : Declaration of Conformity(DoC) Manufacturer : MiTAC Model Number : LC51 Power Supply : Switching Power Cord : Non-Shielded, Detachable, 1.8m Data Cable : 1 > Shielded , Detachable,1.2m 2 > Back Shell : Metal
Printer (PRN1)	FCC ID : B94C2642X Manufacturer : Hewlett-Packard Model Number : C2642E Power Supply : Linear, 30Vdc O/P Power Cable : Non-Shielded , Detachable,1.8m Data Cable : 1 > Shielded , Detachable,1.2m 2 > Back Shell : Metal
Mouse (MOUS/1 PS/2)	FCC ID : DZL211106 Manufacturer : LOGITECH Model Number : M-S43 Power Supply : +5Vdc from PS2 of PC Power Cord : N/A Data Cable : 1 > Shielded , Non-detachable,1.8m 2 > Back Shell : Metal

4. Measurement Result Summary

Modulation: FHSS

Test Item	Result
§15.247(b)(4) Antenna gain<6dBi	☒ Yes ☐ No Read: <u>0.5</u> dBi
Channel Listing	☒ Ok
§15.247(a)(1) Hopping Channel Frequency Separated Limit>25KHz or -20dB Bandwidth, whichever is greater	☐ N/A ☒ Pass ☐ Fail Read: <u>1000</u> kHz
§15.247(a)(1)(iii) Dwell Time Limit(t)<0.4(s)	☐ N/A ☒ Pass ☐ Fail Read: <u>0.176</u> s
§15.247(a)(2) -6dB Bandwidth Limit>500KHz	☒ N/A ☐ Pass ☐ Fail Read: _____ kHz
§15.247(b)(2) Maximum peak radiated output power Non-overlapping channel>75 Limit<1 Watt	☐ N/A ☒ Pass ☐ Fail Low: <u>0.348*10⁻³</u> W (H) Mid : <u>0.348*10⁻³</u> W (H) High: <u>0.276*10⁻³</u> W (H)
§15.247(b)(3) Maximum peak conducted output power Limit<1 Watt	☒ N/A ☐ Pass ☐ Fail Read: _____ W
§15.247(d) 100KHz outside band test (i) Band edge measurement (ii) 30MHz~24GHz spurious emission	☒ Pass ☐ Fail
§15.247(e) The power spectral density Limit<8dBm (in 3KHz)	☒ N/A ☐ Pass ☐ Fail Read: _____ dBm
§15.247(e)(i) MPE calculation	☒ Pass ☐ Fail

5. Channel Listing

a. EUT Type : Bluetooth Keyboard		
b. EUT Model : PSK-8052		
c. TX Channel No. : 79		
Channel 01: 2402 MHz	Channel 28: 2429 MHz	Channel 55: 2456 MHz
Channel 02: 2403 MHz	Channel 29: 2430 MHz	Channel 56: 2457 MHz
Channel 03: 2404 MHz	Channel 30: 2431 MHz	Channel 57: 2458 MHz
Channel 04: 2405 MHz	Channel 31: 2432 MHz	Channel 58: 2459 MHz
Channel 05: 2406 MHz	Channel 32: 2433 MHz	Channel 59: 2460 MHz
Channel 06: 2407 MHz	Channel 33: 2434 MHz	Channel 60: 2461 MHz
Channel 07: 2408 MHz	Channel 34: 2435 MHz	Channel 61: 2462 MHz
Channel 08: 2409 MHz	Channel 35: 2436 MHz	Channel 62: 2463 MHz
Channel 09: 2410 MHz	Channel 36: 2437 MHz	Channel 63: 2464 MHz
Channel 10: 2411 MHz	Channel 37: 2438 MHz	Channel 64: 2465 MHz
Channel 11: 2412 MHz	Channel 38: 2439 MHz	Channel 65: 2466 MHz
Channel 12: 2413 MHz	Channel 39: 2440 MHz	Channel 66: 2467 MHz
Channel 13: 2414 MHz	Channel 40: 2441 MHz	Channel 67: 2468 MHz
Channel 14: 2415 MHz	Channel 41: 2442 MHz	Channel 68: 2469 MHz
Channel 15: 2416 MHz	Channel 42: 2443 MHz	Channel 69: 2470 MHz
Channel 16: 2417 MHz	Channel 43: 2444 MHz	Channel 70: 2471 MHz
Channel 17: 2418 MHz	Channel 44: 2445 MHz	Channel 71: 2472 MHz
Channel 18: 2419 MHz	Channel 45: 2446 MHz	Channel 72: 2473 MHz
Channel 19: 2420 MHz	Channel 46: 2447 MHz	Channel 73: 2474 MHz
Channel 20: 2421 MHz	Channel 47: 2448 MHz	Channel 74: 2475 MHz
Channel 21: 2422 MHz	Channel 48: 2449 MHz	Channel 75: 2476 MHz
Channel 22: 2423 MHz	Channel 49: 2450 MHz	Channel 76: 2477 MHz
Channel 23: 2424 MHz	Channel 50: 2451 MHz	Channel 77: 2478 MHz
Channel 24: 2425 MHz	Channel 51: 2452 MHz	Channel 78: 2479 MHz
Channel 25: 2426 MHz	Channel 52: 2453 MHz	Channel 79: 2480 MHz
Channel 26: 2427 MHz	Channel 53: 2454 MHz	
Channel 27: 2428 MHz	Channel 54: 2455 MHz	

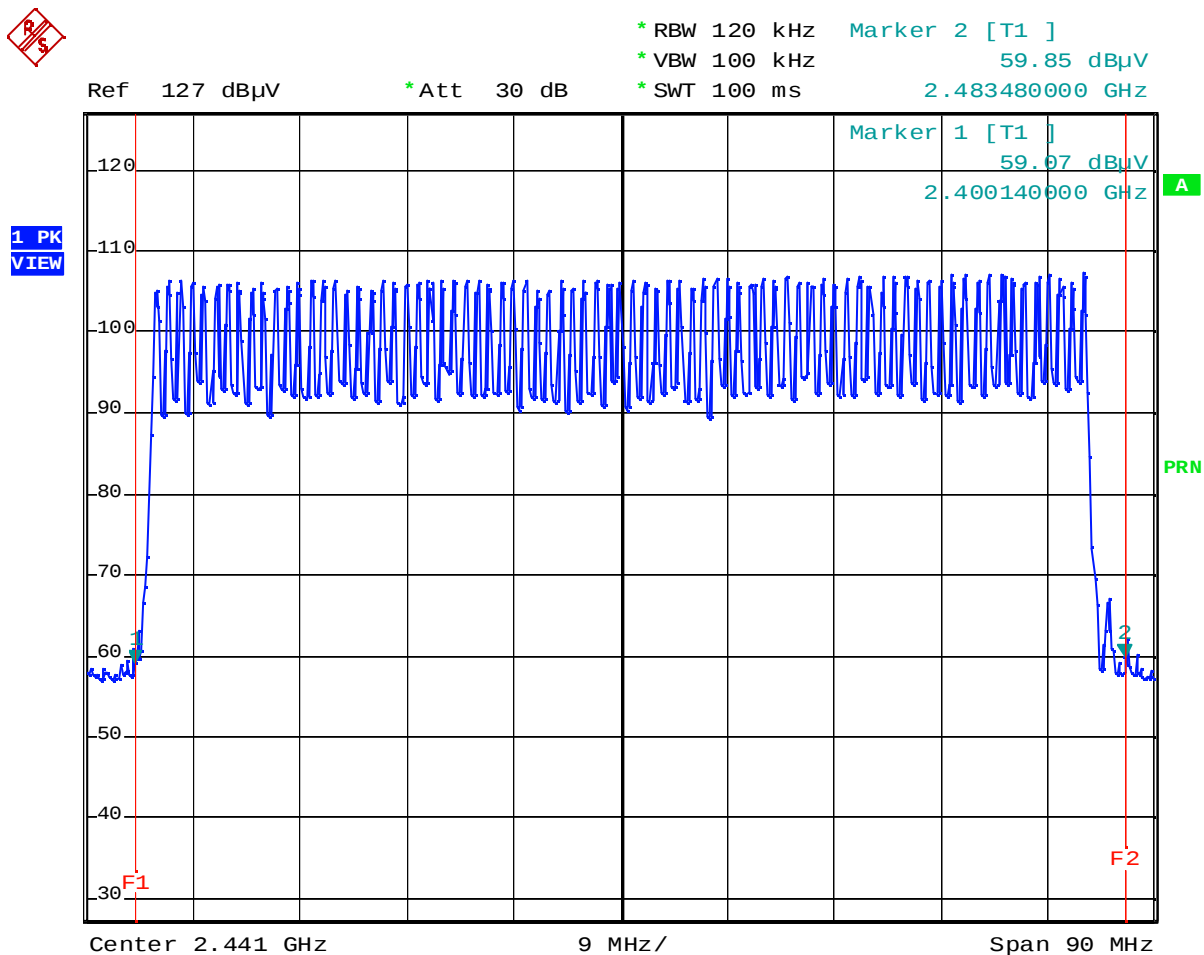
Frequency Range: 2.4 GHz to 2.4834 GHz

Note: All channels located in the frequency range as below:

2.4 GHz --- 2.4835 GHz ☒ Yes ☐ No

Typical Channel for testing:

Channel	Channel Number	Frequency (GHz)
LOW	1	2.402
MID	40	2.441
HIGH	79	2.480



6. §15.247(a)(1): Hopping Channel Frequency Separation

Limit > 25KHz or -20dB Bandwidth, whichever is greater

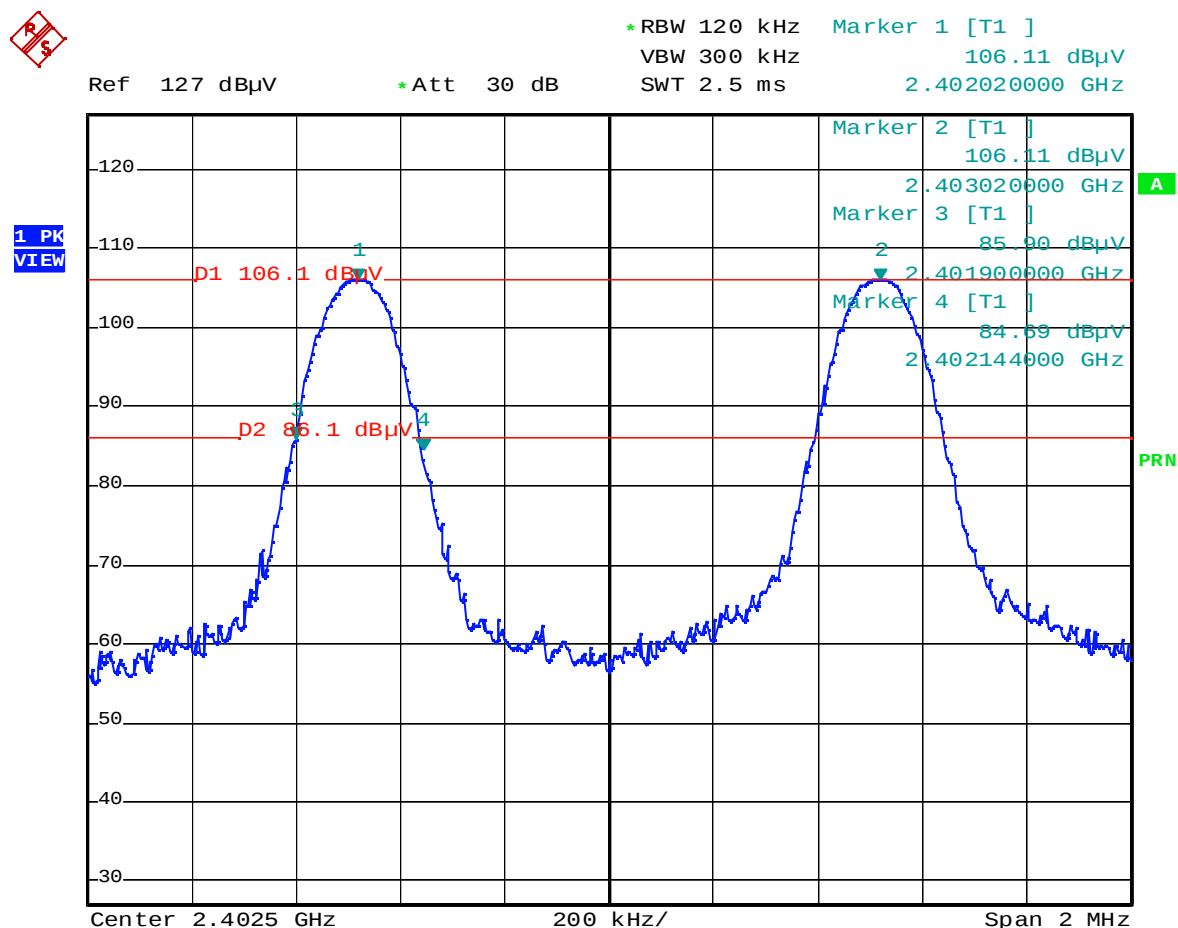
6.1 Test Procedure

- (1)The Hopping Channel Frequency Separation was measured in max hold analyzer mode with span wide enough to capture the peaks of two adjacent channels.
- (2)Set the Spectrum as RBW=120KHz, VBW=300KHz
- (3)6.3 Spectrum Plot Data show the Frequency Separation test results.

6.2 Test Result of Frequency Separation

	Measured Separation (KHz)	Separation at -20dB (KHz)	Limit (KHz)	Test Result
Channel Separation	1000	732	25	PASS

6.3 Spectrum Plot Data



7. §15.247(a)(1): Time of Occupancy (Dwell Time)

Limit (t) <0.4(s)

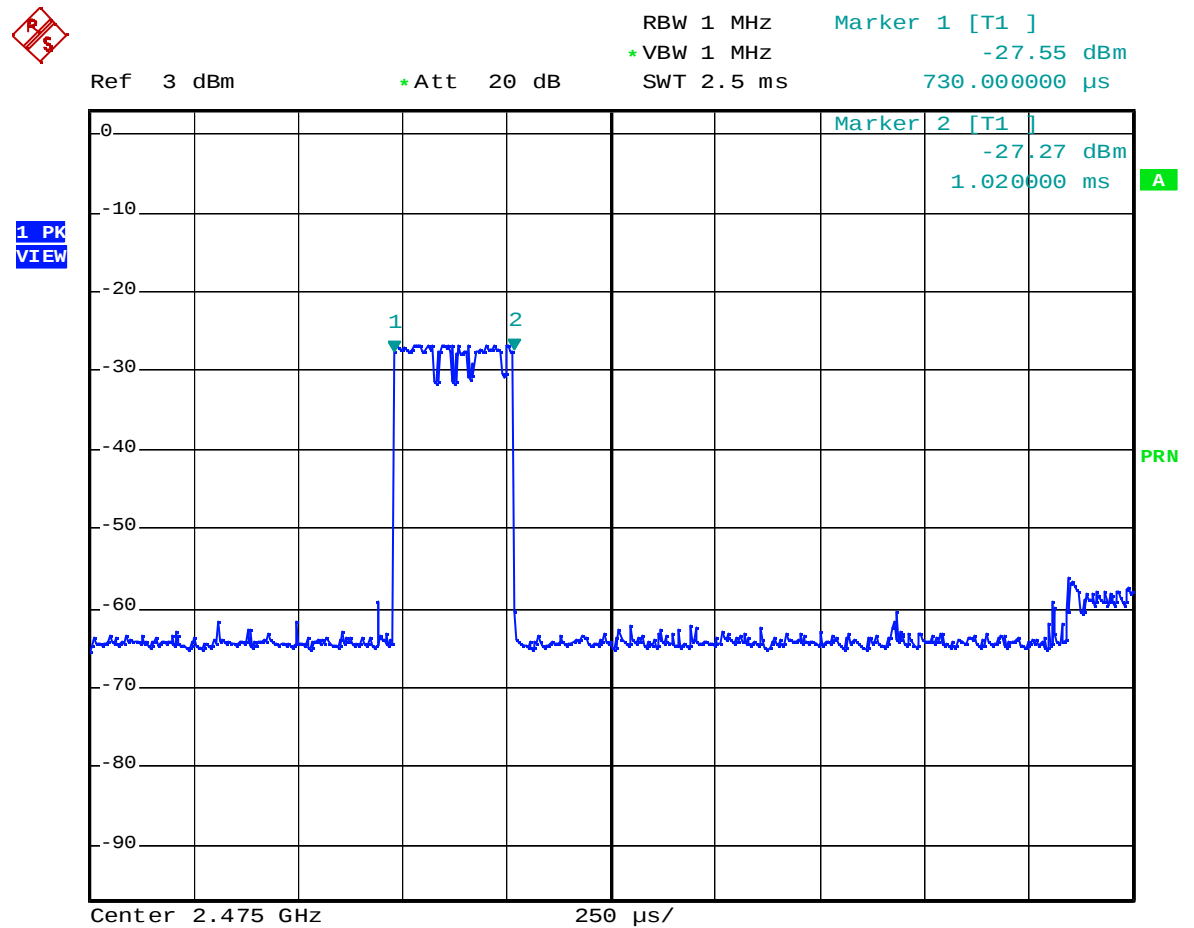
7.1 Test Procedure

- (1)The Time of Occupancy was measured in “max hold” analyzer mode with zero span and different sweep time to calculate the Time of Occupancy.
- (2)Set the Spectrum as RBW=VBW=1MHz
- (3)7.3 Spectrum Plot Data show the Time of Occupancy test results.

7.2 Test Result of Dwell Time

Dwell Time= $30(1600/79)*t=30*20.25*0.29$ Sec = 0.176 Sec < 0.4s

7.3 Spectrum Plot Data



8. §15.247(b)(2): Maximum Peak Radiated Output Power

Non-overlapping channel >75, Limit <1 Watt

8.1 Testing Description

- (A) The testing procedures followed "Measurement of Digital Transmission Systems Operating under Section 15.247 (2005)" Alternative Test Procedure (1)

ALTERNATIVE TEST PROCEDURES

If antenna conducted tests cannot be performed on this device, radiated tests to show compliance with the various conducted requirements of Section 15.247 are acceptable. As stated previously, a pre-amp must be used in making the following measurements.

- (1) Calculate the transmitter's peak power using the following equation:

Where:

E = the measured maximum field strength in V/m.

Set the RBW > 6dB bandwidth of the emission or use a peak power meter.

$$P = (E \times d)^2 / (30 \times G)$$

G = the numeric gain of the transmitting antenna over an isotropic radiator.

d = the distance in meters from which the field strength was measured.

P = the power in watts for which you are solving:

- (B) Three channels were tested: CH LOW, CH MID AND CH HIGH Measurements were taken by using both horizontal and vertical antenna polarization, and the receiving antenna was raised between 1m and 4m to find the worst emission levels.

8.2 Test Result of Fundamental Emissions

Temperature: 26 Humidity: 52 %

RBW = 3MHz

VBW = 3MHz

SWT = AUTO

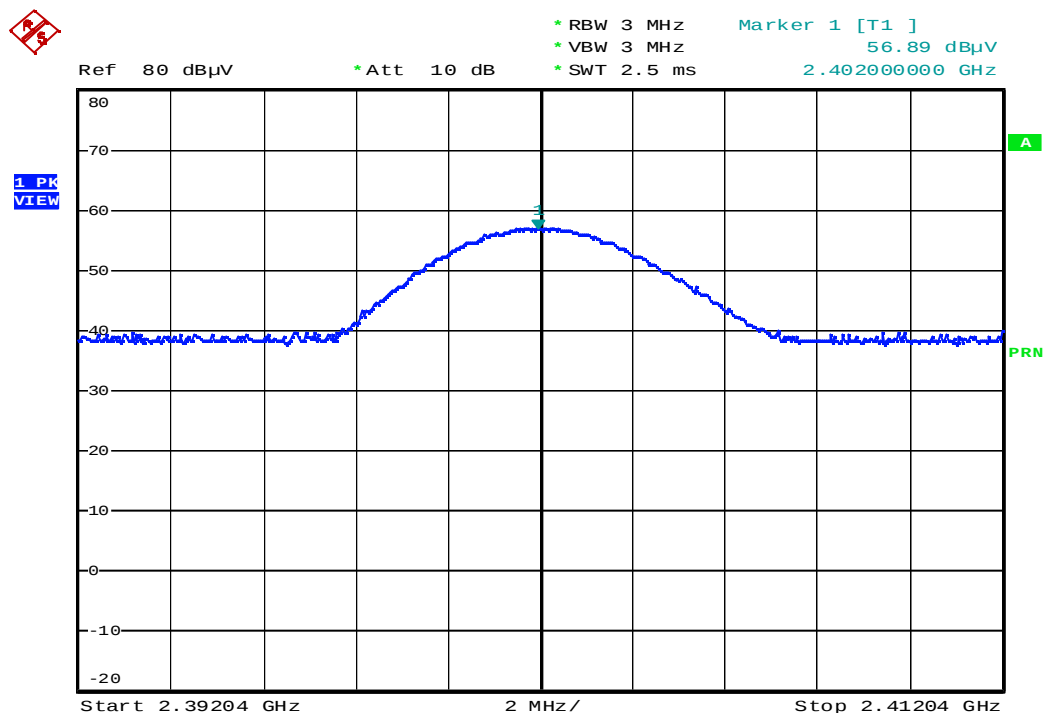
Test distance=3m

Channel	A.P.	Frequency (GHz)	S.A. Read (dBμV/m)	C. L. (dB)	A. F. (dB)	E (dBμV/m)	E (V/m)	P (W)	Test Result
1	H	2.402	56.89	5.43	28.46	90.78	36.06×10^{-3}	0.348×10^{-3}	PASS
	V		53.15			87.04	22.49×10^{-3}	0.135×10^{-3}	PASS
9	H	2.441	57.09	5.52	28.53	91.14	36.06×10^{-3}	0.348×10^{-3}	PASS
	V		54.45			88.5	26.61×10^{-3}	0.189×10^{-3}	PASS
16	H	2.480	55.98	5.57	28.58	90.13	32.1×10^{-3}	0.276×10^{-3}	PASS
	V		55.52			89.67	30.44×10^{-3}	0.248×10^{-3}	PASS

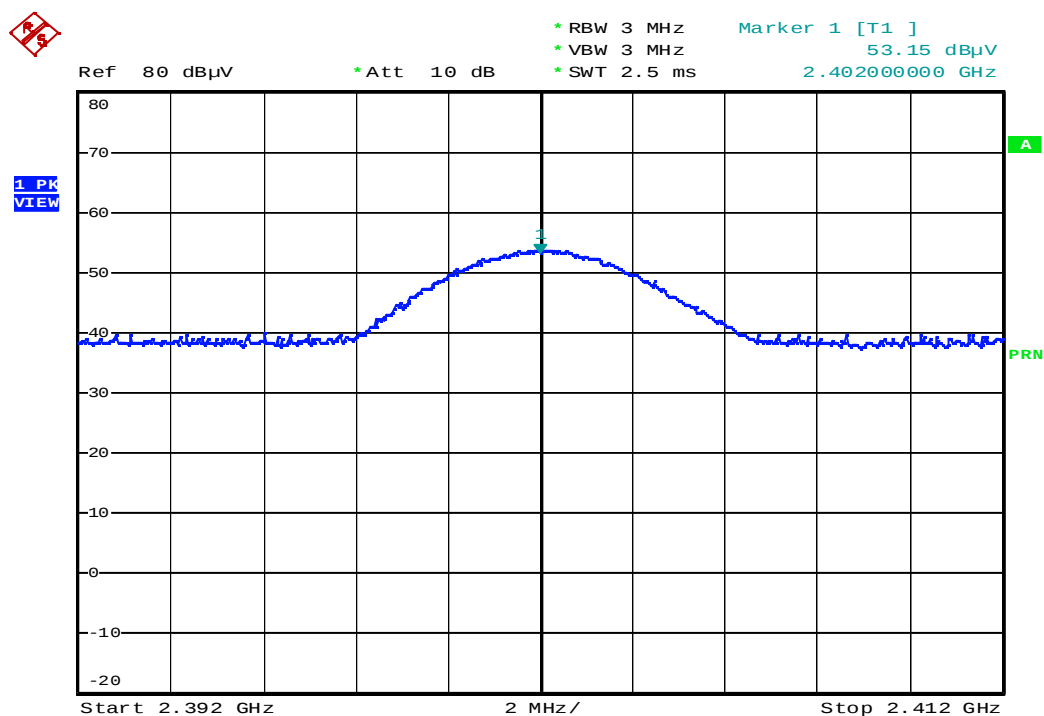
8.3 Spectrum Plot Data

Channel : 1

Horizontal

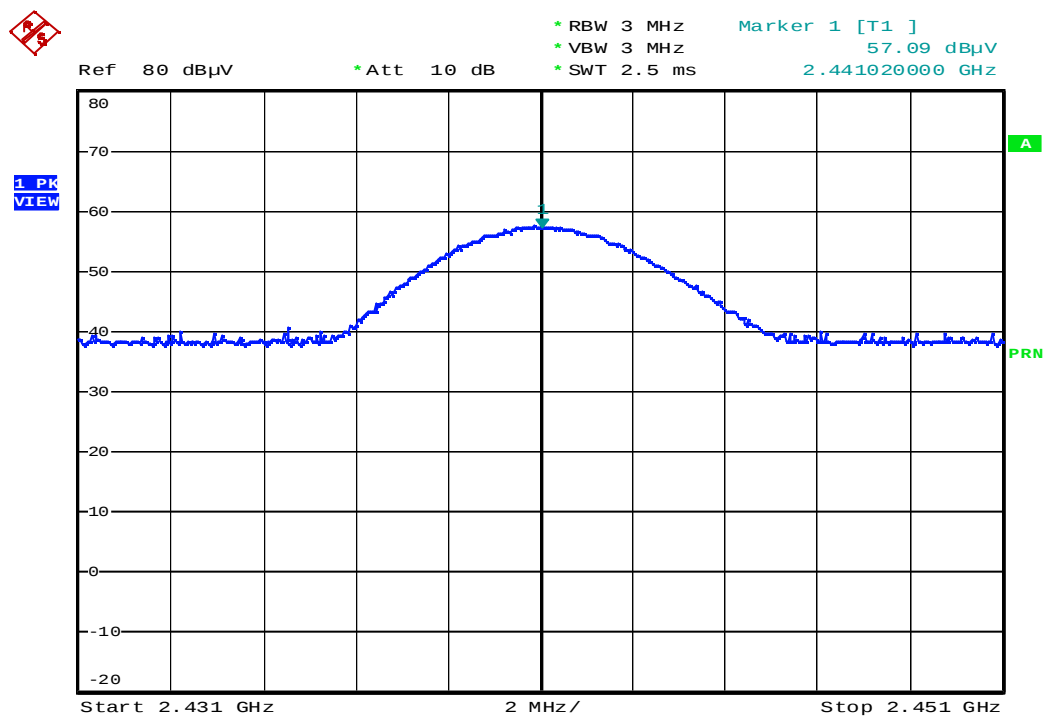


Vertical

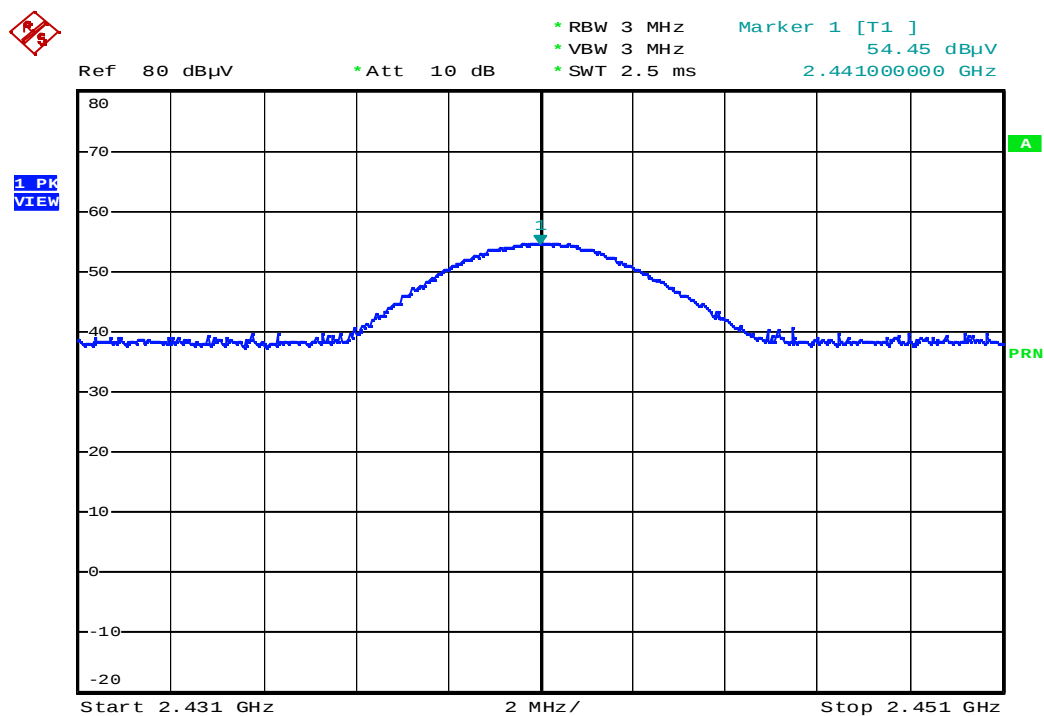


Channel : 40

Horizontal

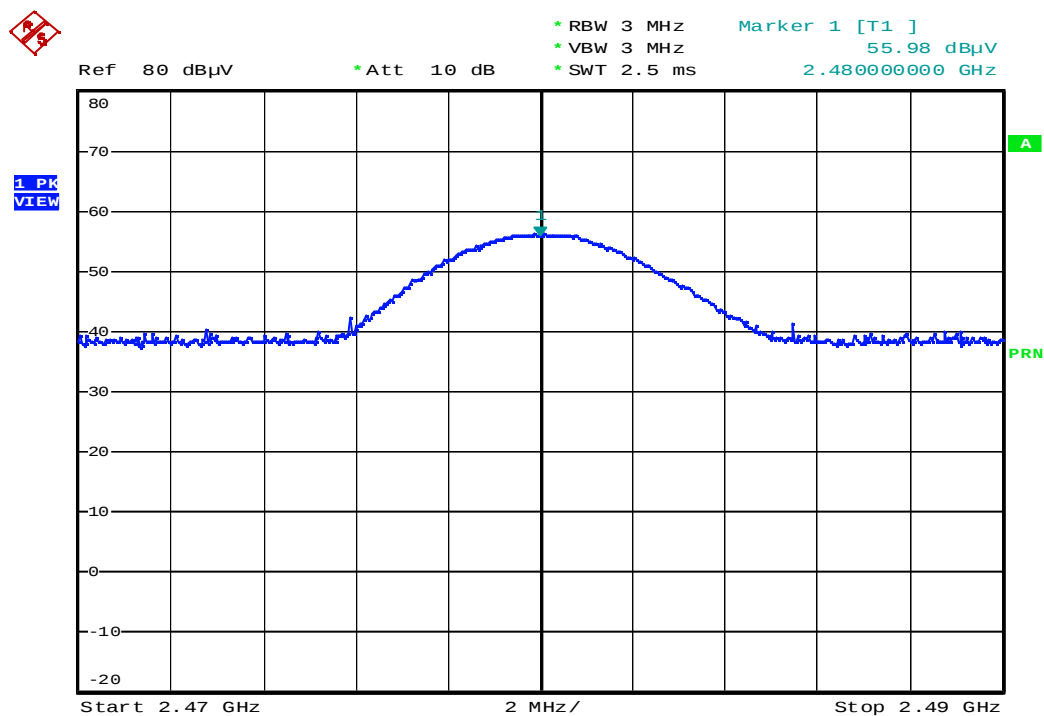


Vertical

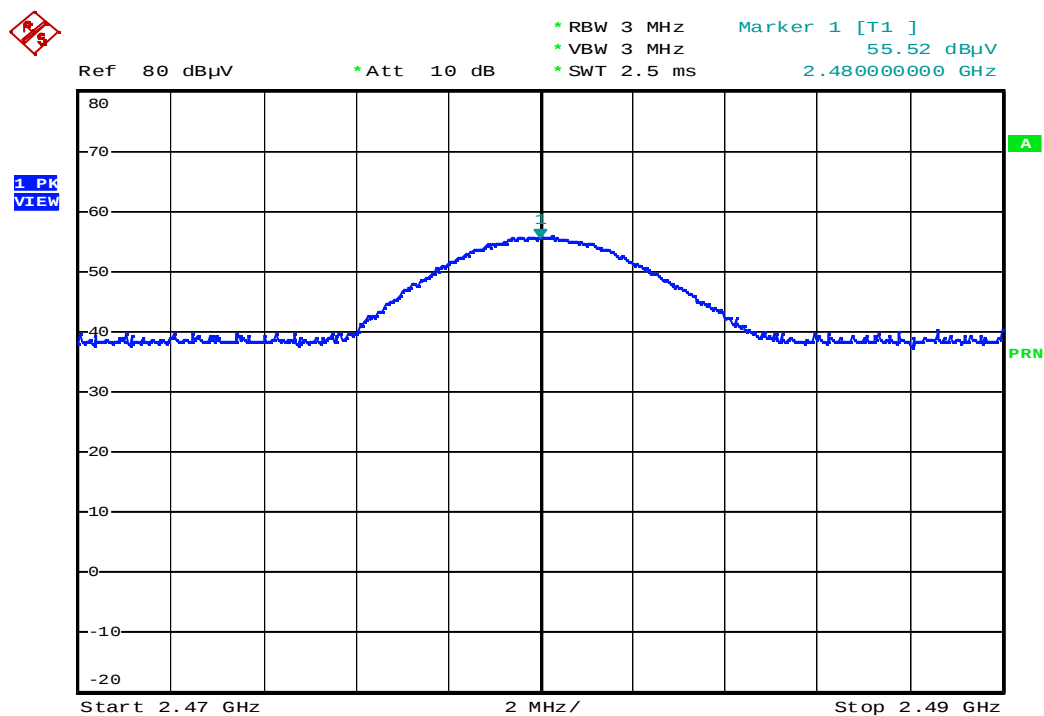


Channel : 79

Horizontal



Vertical



8.4 Test Setup Photo

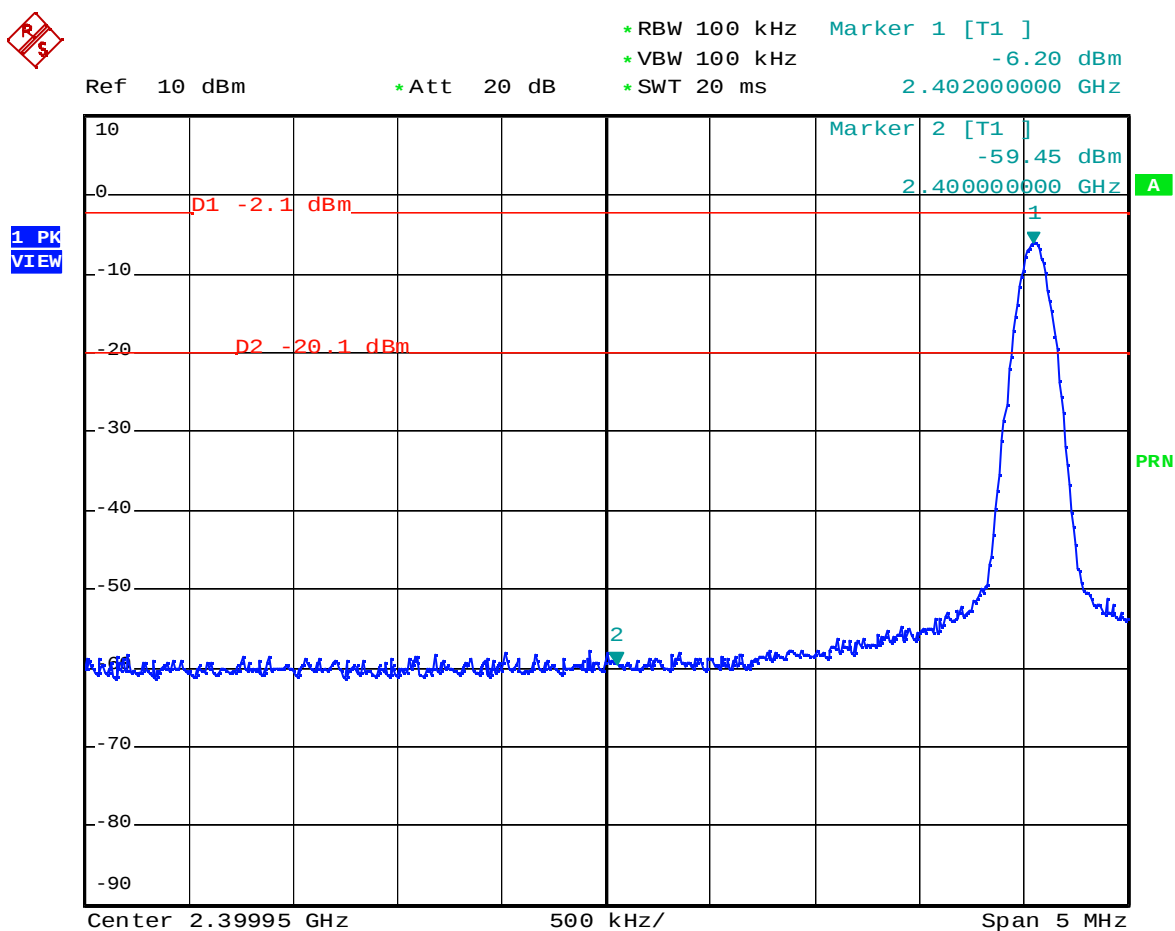


9. §15.247(d): 100KHz Outside Band Test

9.1 Band Edge Measurement

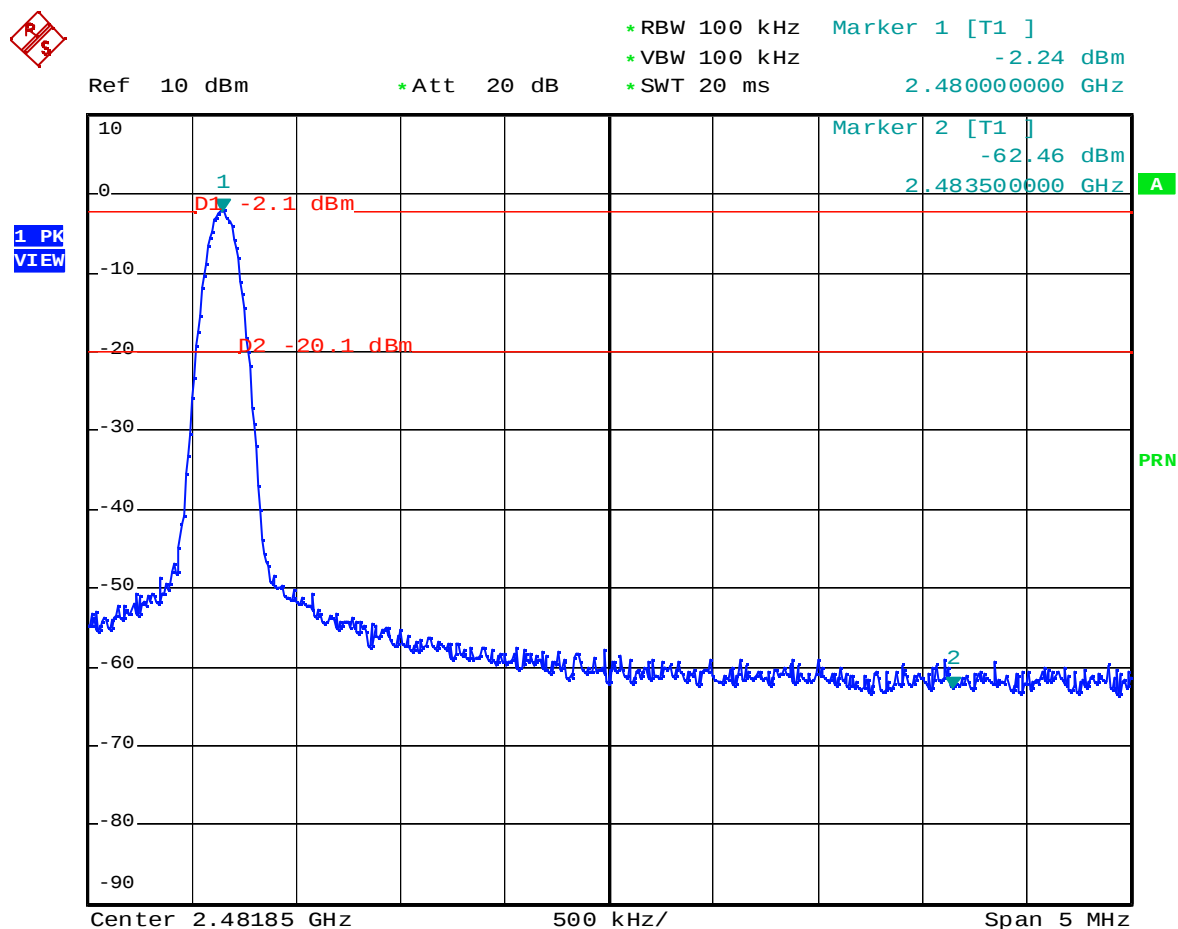
Channel: 1 Peak read: -6.20dBm, limit < -20.1dBm

Band-edges: 2.4GHz Peak read: -59.45dBm < -20.1dBm



Channel: 79 Peak read: -2.24dBm, limit < -20.1dBm

Band-edges: 2.4835GHz Peak read: -62.46dBm < -20.1dBm

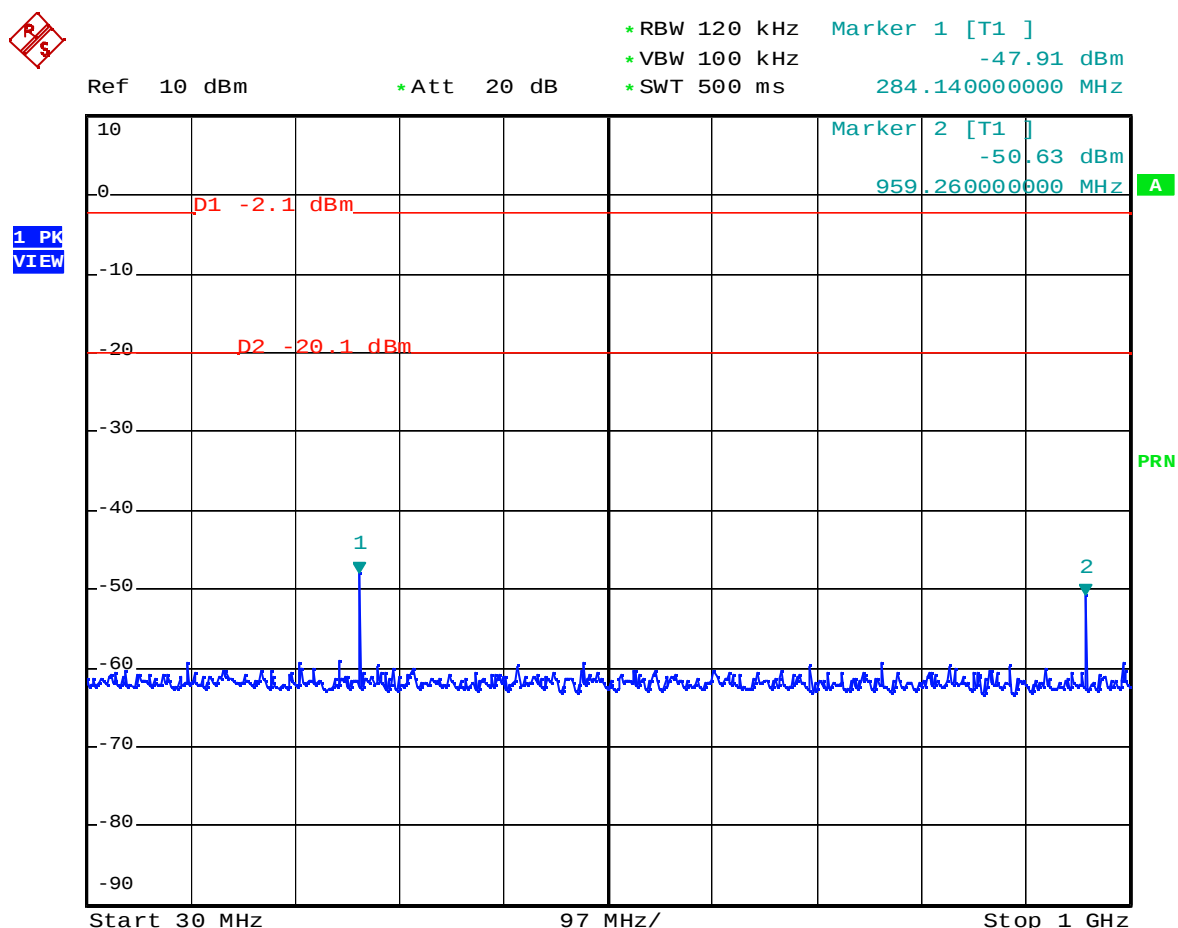


9.2 Spurious Emissions [Conducted]

Test Results:

Model No.	: PSK-8052	Detector	: Quasi-Peak Value
Frequency range	: 30MHz to 1GHz	Humidity	: 52 %
Temperature	: 26		

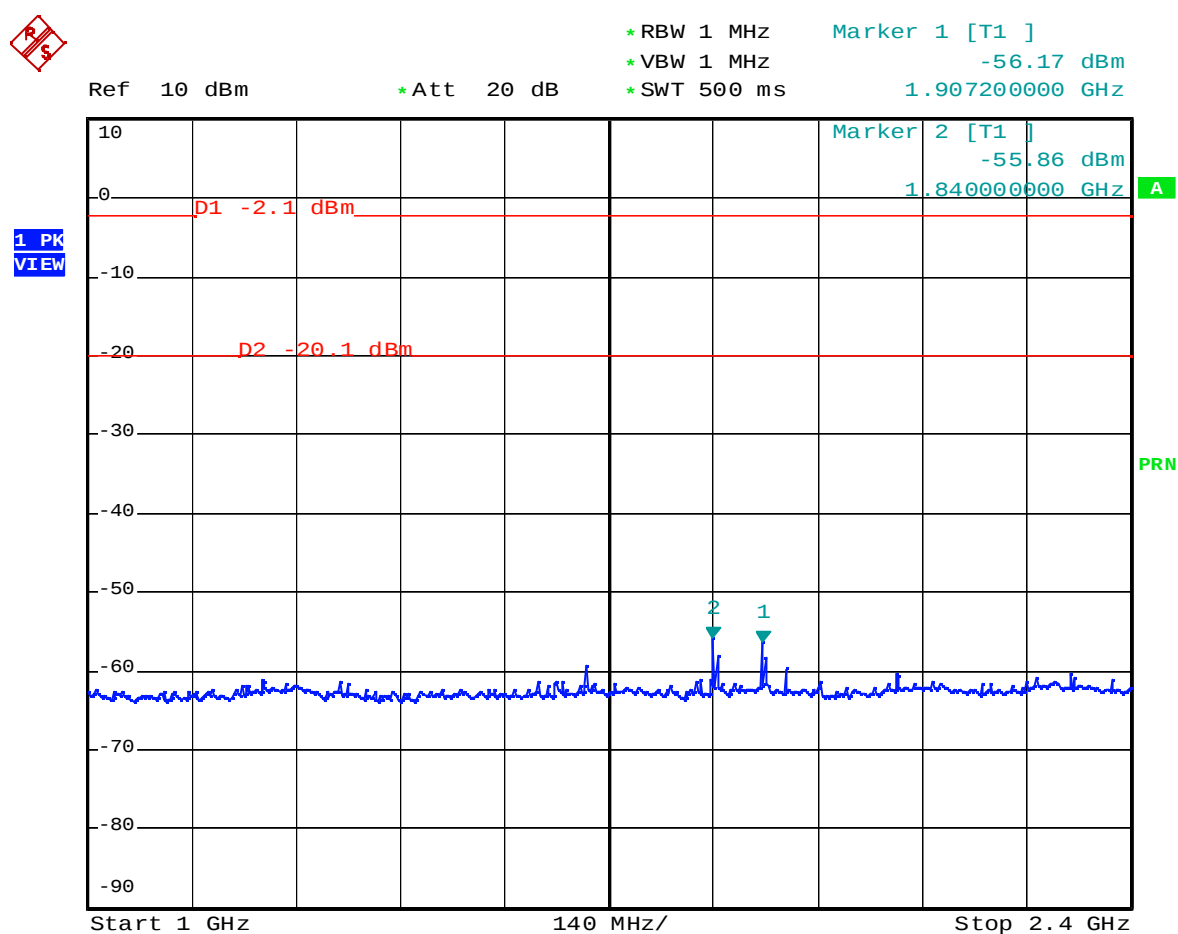
The highest value: 284.14MHz / -47.91dBm < -20.1dBm



Test Results:

Model No.	: PSK-8052	Detector	: Quasi-Peak Value
Frequency range	: 1GHz to 2.4GHz	Humidity	: 52 %
Temperature	: 26		

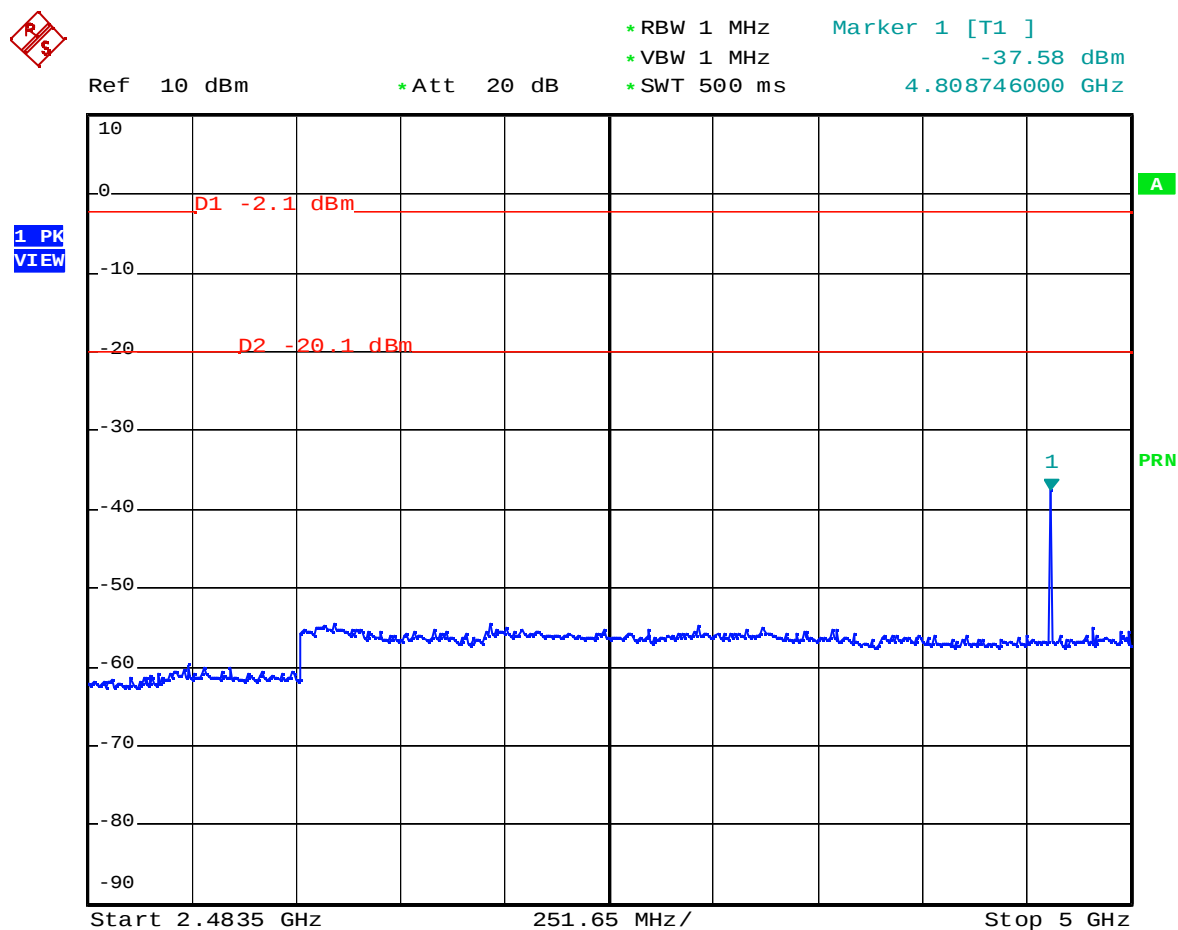
The highest value: 1.84GHz / -55.86dBm < -20.1dBm



Test Results:

Model No.	: PSK-8052	Detector	: Quasi-Peak Value
Frequency range	: 2.4835GHz to 5GHz	Humidity	: 52 %
Temperature	: 26		

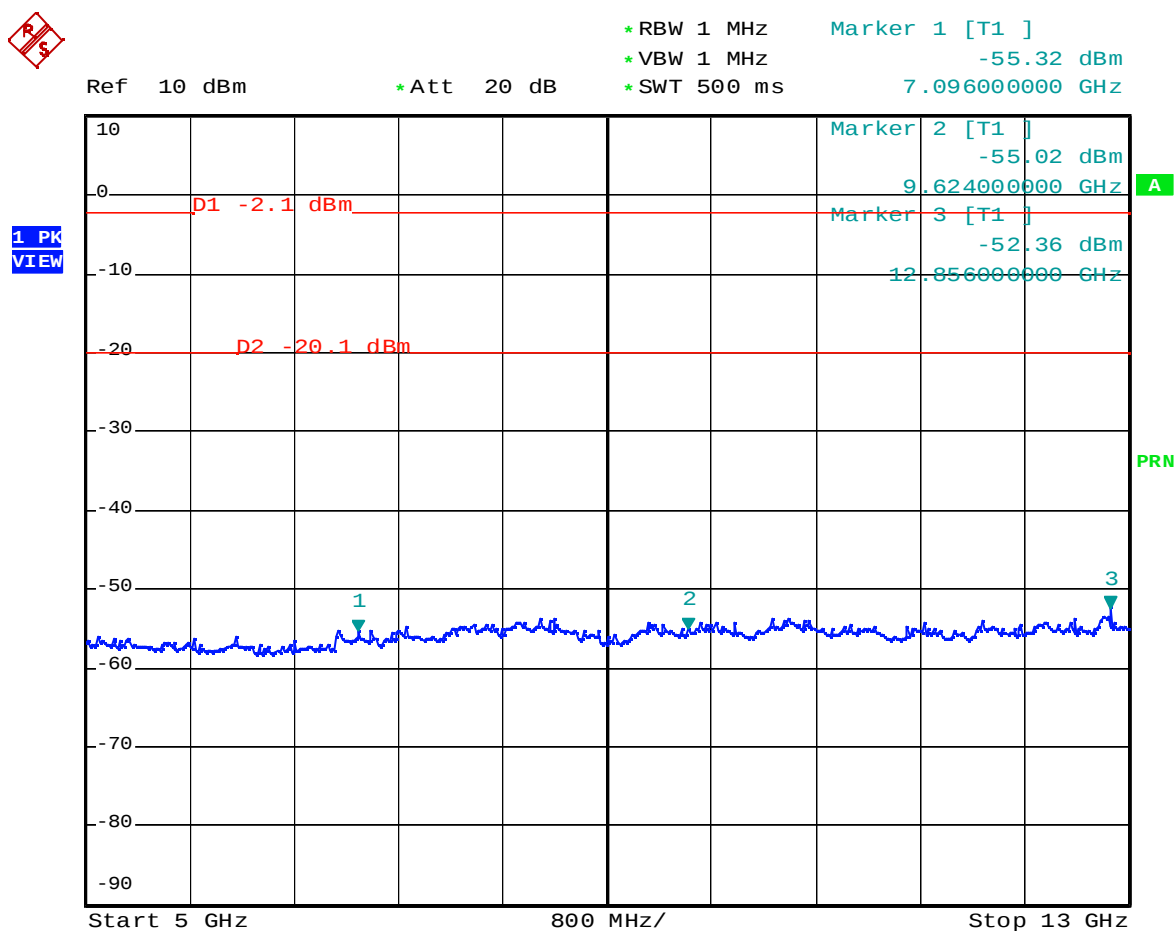
The highest value: 4.808GHz / -37.58dBm < -20.1dBm



Test Results:

Model No.	: PSK-8052	Detector	: Quasi-Peak Value
Frequency range	: 5GHz to 13GHz	Humidity	: 52 %
Temperature	: 26		

The highest value: 12.856GHz / -52.36dBm < -20.1dBm



9.3 Spurious Emissions [Radiated]

Test method:

According to ANSI C63.4 (2003) paragraph 10.1.8.2, we indicate three highest spurious and three restrict band emission relative to the limit, as result.

When we performed “Spurious Radiated Emission”, the EUT was under continuous transmitting condition. It means the channel will transmit energy channel by channel, sequentially. Then the worst case data can be detected, we don't set F_L , F_M , F_H under test.

To avoid the pre-amplifier saturation by fundamental frequency, we added a “natch filter” (bandwidth from 2.4GHz to 2.4835GHz) between receiving antenna RF output and pre-amplifier's RF input to bypass fundamental frequency , and only detected spurious emission.

Test result:

Measurement Range: 30MHz~24GHz

Resolution Bandwidth: 30MHz~1GHz, RBW=120KHz

Above 1GHz, RBW=1MHz

Temperature: 26 Humidity: 52 %

Antenna polarization: HORIZONTAL ; Test distance : 3m ;

Freq. (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Detector Mode
850.6	29.64	-57.26	86.90	25.08	21.75	4.81	22.00	Quasi-Peak
7230.0	43.44	-43.46	86.90	29.46	37.89	9.09	33.00	Peak
9595.0	46.83	-40.07	86.90	30.41	39.50	9.92	33.00	Peak

Restrict Band

2268.4	43.29	-10.71	54.00	42.76	28.29	5.24	33.00	Peak
4886.7	51.15	- 2.85	54.00	43.02	33.11	8.02	33.00	Peak
12046.0	48.20	- 5.80	54.00	30.84	39.85	10.51	33.00	Average

Antenna polarization: VERTICAL ; Test distance : 3m ;

Freq. (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Detector Mode
928.2	29.91	-56.99	86.90	23.76	23.07	5.08	22.00	Quasi-Peak
7195.0	43.69	-43.21	86.90	29.68	37.93	9.08	33.00	Peak
9670.0	47.05	-39.85	86.90	30.55	39.57	9.93	33.00	Peak

Restrict Band

2269.8	39.41	-14.59	54.00	38.88	28.29	5.24	33.00	Peak
4783.5	48.61	- 5.39	54.00	40.97	32.71	7.93	33.00	Peak
12034.0	47.60	- 6.40	54.00	30.26	39.83	10.51	33.00	Average

Note: If the Peak level under Average limit, the Average detector will not be perform.

9.4 Test Setup Photo



10. §15.247(e)(i): Maximum Permissible Exposure (MPE)

10.1 MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \cdot P \cdot G}}{d}$$

$$\text{Power Density} = P_d \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

Combine these two formulas can be changed to

$$P_d = \frac{30 \cdot P \cdot G}{377 \cdot d^2}$$

Note:

1. "E" means Electric field (V/m)
2. "P" means Peak RF output power (W)
3. "G" means EUT Antenna numeric gain (numeric)
4. "d" means the minimum mobile separation distance is 0.2m between radiator and human body.

10.2 Calculated Result and Limit

Channel	Antenna Gain (numeric)	Peak Output Power (mW)	Power Density(S) (mW / cm ²)	Limit of Power Density(S) (mW / cm ²)	Test Result
1	1.12	0.348	0.077*10 ⁻³	<1	PASS
40	1.12	0.348	0.077*10 ⁻³	<1	PASS
79	1.12	0.276	0.061*10 ⁻³	<1	PASS

11. List of Test Instruments

Test Site	Instrument	Manufacturer	Model No.	S/N	Next Cal. Date	Cal. Interval
Chamber (No. 3)	Spectrum Analyzer	ROHDE & SCHWARZ	FSP30	100157	Sep. 01, 2009	1 Year
	30MHz~1GHz RF Cable	YEIDA WIRE CABLE	NO.3	N/A	Jan. 01, 2009	1 Year
	1GHz~26.5GHz RF Cable	MITEQ	N/A	N/A	Sep. 28, 2010	2 Years
	Horn Antenna 1GHz~18GHz	COM-POWER	AH-826	10056	Aug. 20, 2009	2 Years
	Horn Antenna 18GHz~26GHz	COM-POWER	AH-118	081000	Oct. 02, 2010	2 Years
	SCHWARZBECK Antenna	SCHWARZBECK	VULB9161	4078	July 19, 2009	1 Year
	Schaffner Pre-Amplifier	Schaffner	CPA-9232	1028	Jan. 01, 2009	1 Year
	Preamplifier 1GHz~18GHz	MITEQ	28-5A	513015	Sep. 29, 2009	1 Year
	Preamplifier 18GHz~26GHz	MITEQ	30-5A	808329	May 15, 2009	1 Year

12. EUT Photos

FCC ID : RAC8052A01

EUT FRONT VIEW



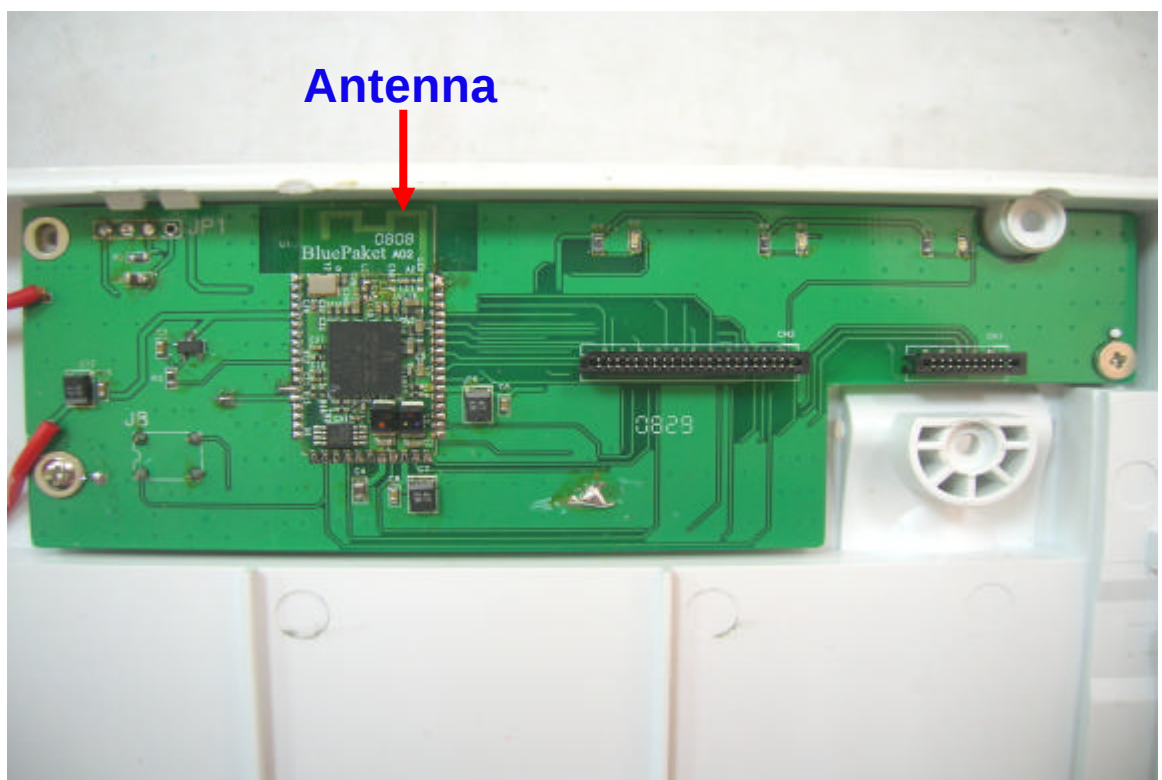
EUT REAR VIEW



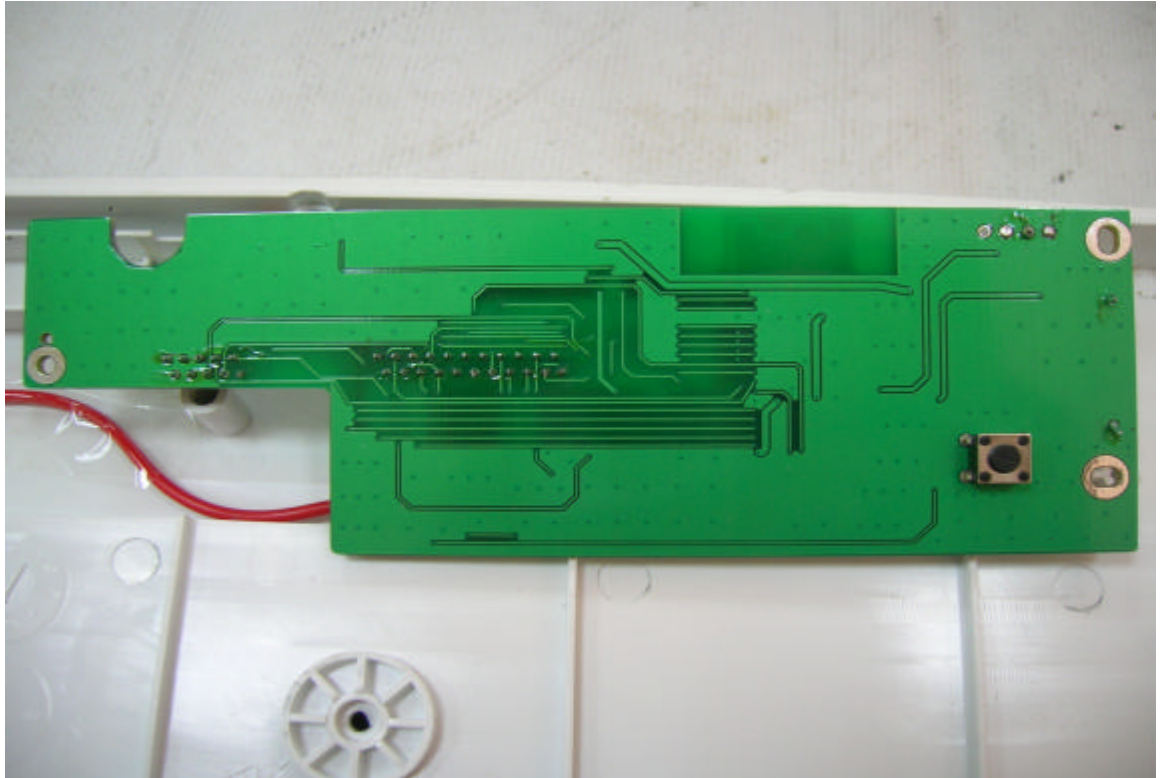
EUT INSIDE VIEW



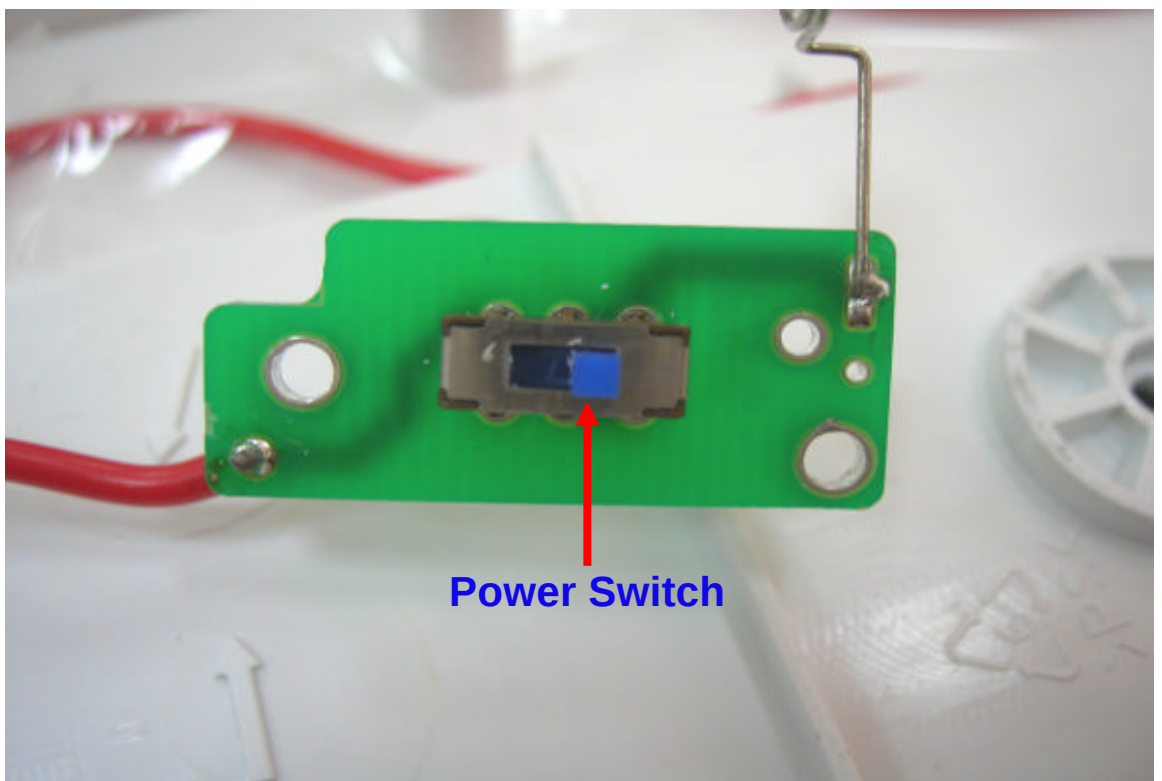
EUT MAIN BOARD VIEW



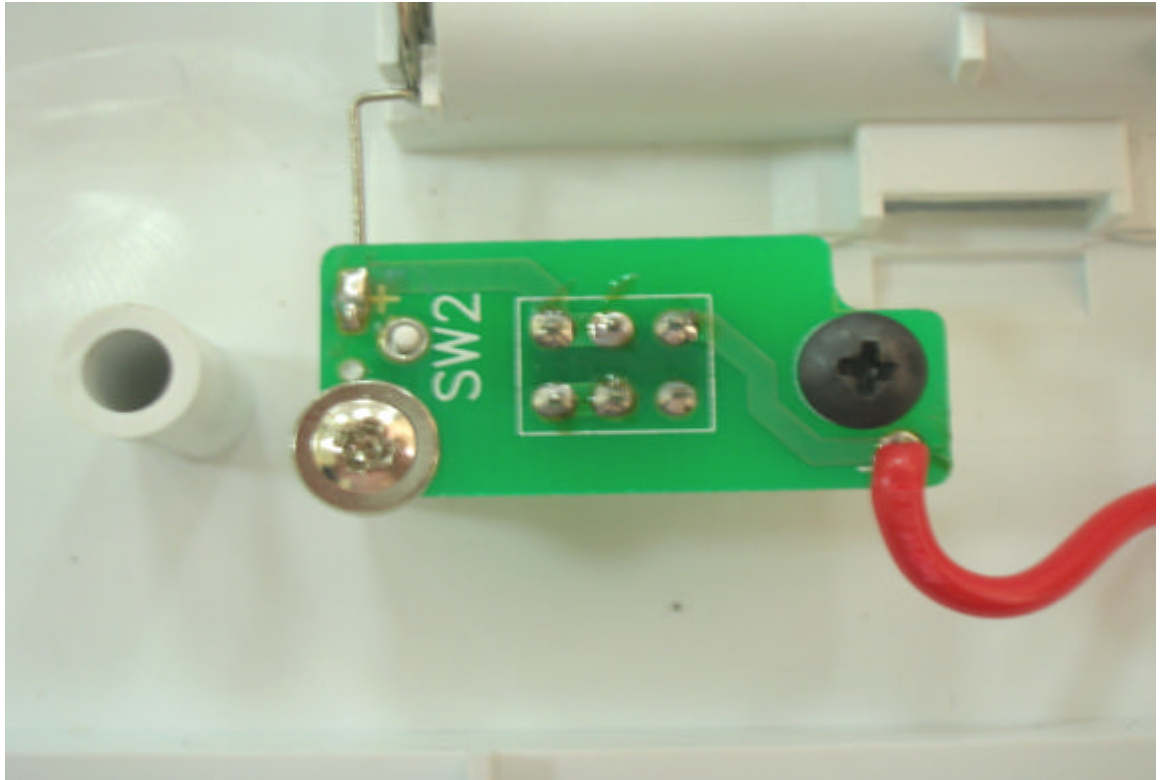
EUT SOLDERING VIEW



EUT COMPONENT VIEW



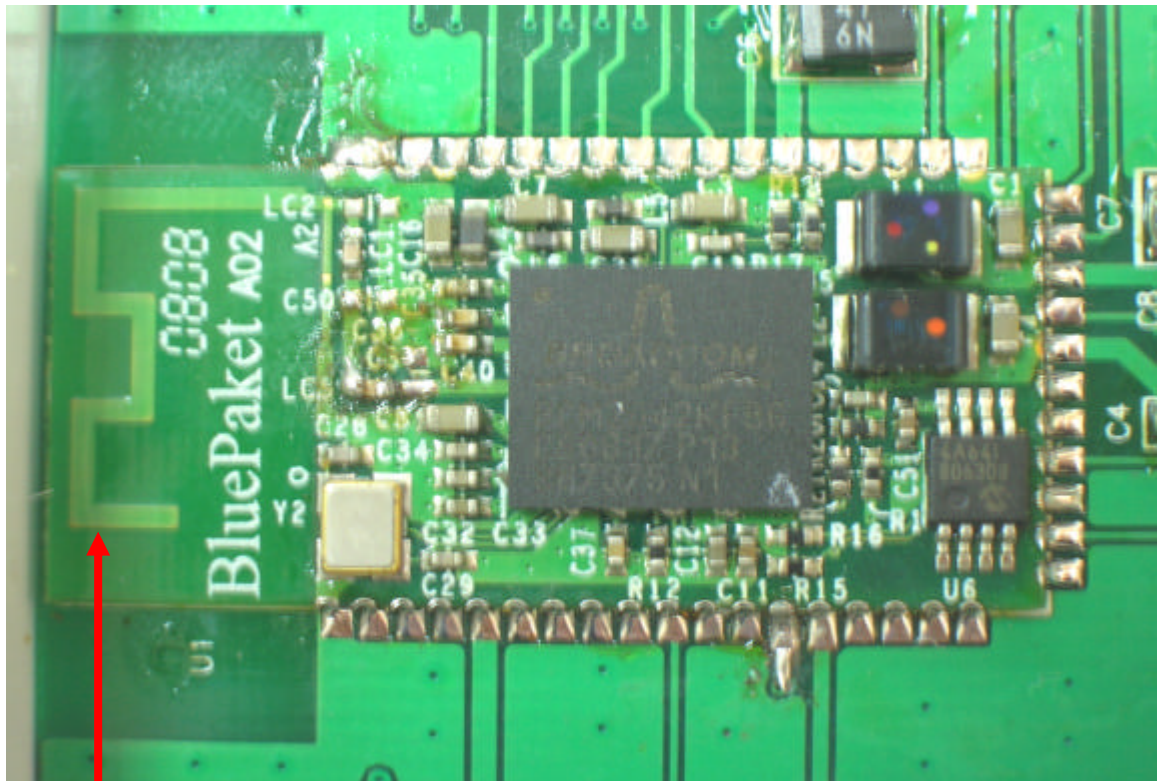
EUT SOLDERING VIEW



EUT COMPONENT VIEW



EUT MODULE VIEW



FCC ID : RAC8052A01

EUT FRONT VIEW



EUT REAR VIEW

