RFI / EMI TEST REPORT

EUT Name	:	Portable MSR Reader with Rechargeable Battery with Bluetooth
Model No.	:	Mini400B
FCC ID.	:	WXAMini400B
Applicant	:	GIGA-TMS INC.
Address	:	8F, NO. 31, LANE 169, KANG-NING ST., HSI-CHIH, TAIPEI, TAIWAN, R. O. C.
Regulation	:	CFR 47, Part 15 Subpart C
Test Site	:	PEP Testing Laboratory
Test Engineer	:	IVAN HUANG
Test Date	:	APR. 20, 2009 – JUN. 11, 2009
Issued Date	:	JUN. 12, 2009
Report No.	:	E980411

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	:	**GIGA-TMS INC.**
PRODUCT	:	**Portable MSR Reader with Rechargeable Battery with Bluetooth**
FCC ID.	:	**WXAMini400B**
MODEL NO.	:	**Mini400B**

M. Y. TSUI / General Manager

PEP Testing Laboratory

Designation No.: TW1046

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TEL : 886-2-26021042 FAX : 886-2-26021045

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1. Product Information

EUT Name:	Portable MSR Reader with Rechargeable Battery with Bluetooth
Channel No. :	79 Channel
Frequency Range:	2.402GHz~2.480GHz
Modulation:	FHSS
Data Rate:	1MHz
Internal Crystal / Osc. :	8MHz
Power Rating:	DC 3.7V --- supplied by battery
Antenna Type:	Integral
Antenna Gain :	4 dBi (numeric 2.51)
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.

Mode	Operation Modes of EUT for Preliminary test
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.

After preliminary test, the worst-case test result was recorded and provided in the report.

Test step:

1. EUT connect with PC via controller, and set up on the table according to regulation.
2. Turning on the EUT and peripheral. Then execute EUT's main function and enable peripheral which is EUT connection.
3. Execute BlueTool program to choose test channel and make EUT transmit continuously.
4. Starting to test.

2.2 Test Software(s) Used

BlueTool: Through controller to control transmit frequency of EUT.

2.3 Modification(s)

N/A

3. Support Equipment Used

N/A

4. Measurement Result Summary

Modulation: FHSS

Test Item	Result
§15.247(b)(4) Antenna gain<6dBi	■Yes □No Read: 4 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: 732 kHz
§15.247(a)(1)(iii) Dwell Time Limit(t)<0.4(s)	□N/A ■Pass □Fail Read: 0.233 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: $0.003x10^{-3}$ W (H) Mid : $0.002x10^{-3}$ W (H) High: $0.002x10^{-3}$ 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~25GHz 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：Portable MSR Reader with Rechargeable Battery with Bluetooth		
b. EUT Model：Mini400B		
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	

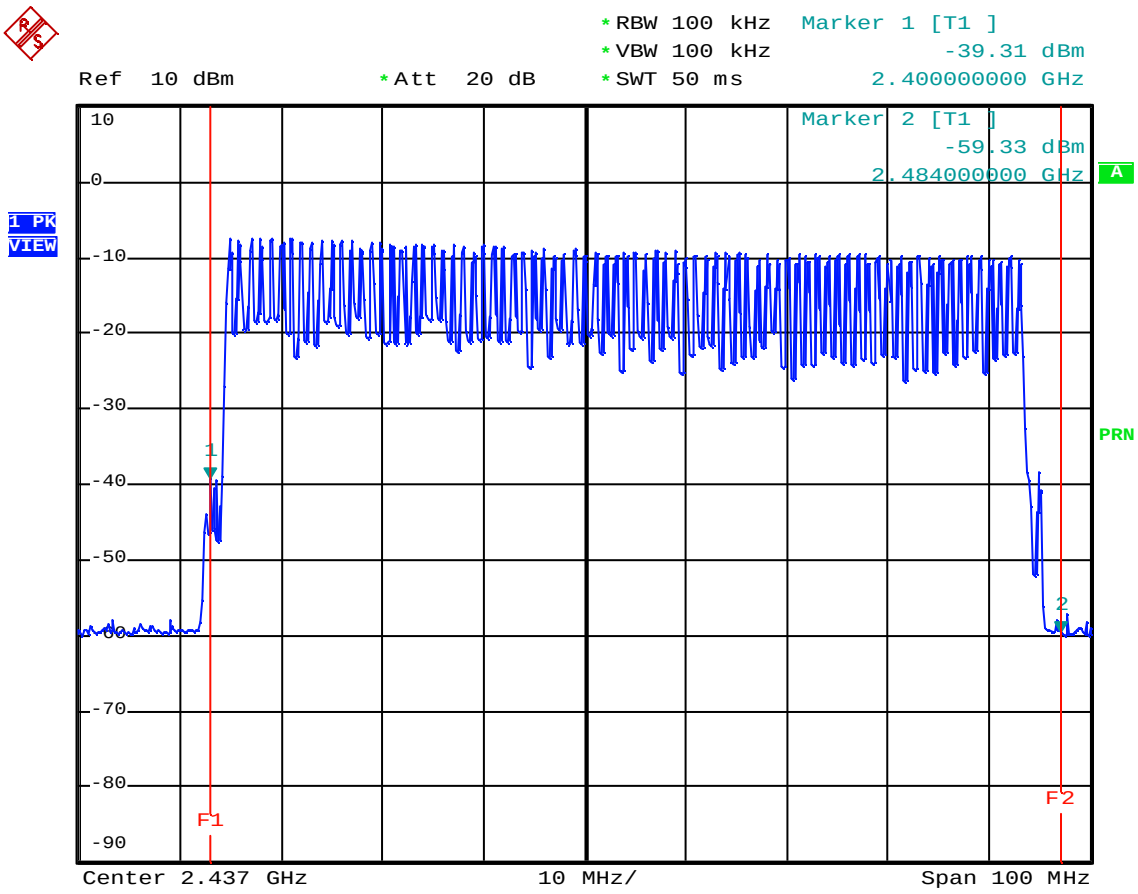
Frequency Range: 2.402 GHz to 2.480 GHz

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

2.402 GHz --- 2.480 GHz ■ Yes □ No

Typical Channel for testing:

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



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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.

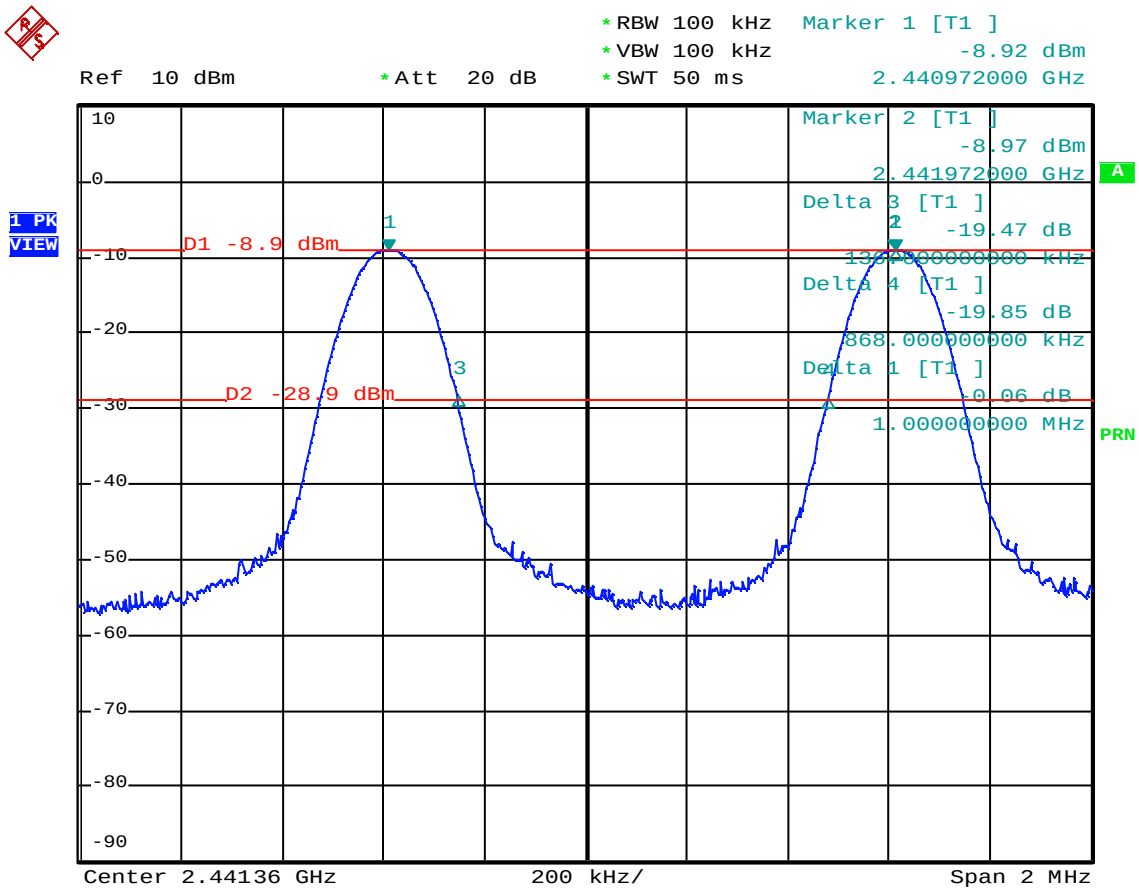
(2)Set the Spectrum as RBW=100KHz, VBW=100KHz

(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



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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.

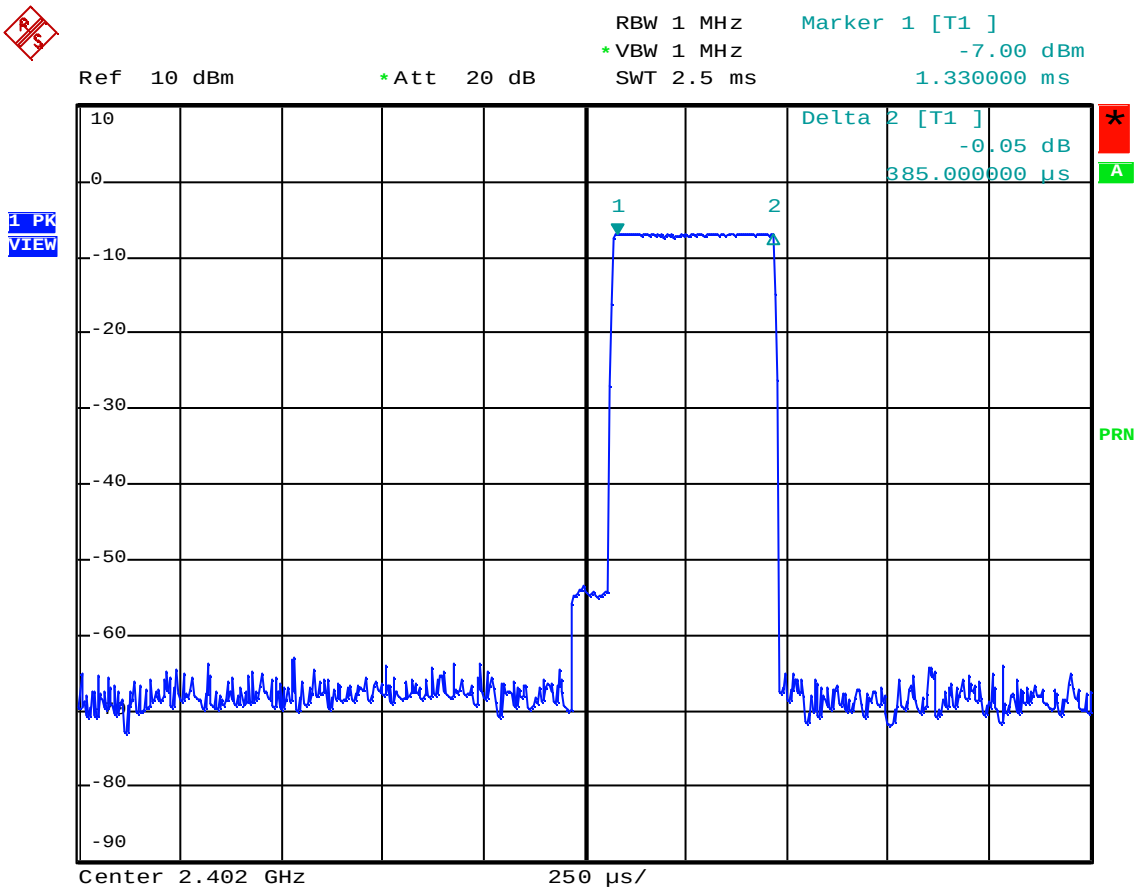
(2)Set the Spectrum as RBW=VBW=1MHz

(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 * 0.385 Sec = 0.233 Sec < 0.4 s

7.3 Spectrum Plot Data



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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 DA 00-705 (2000)" 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: **60** %

RBW = 3MHz

VBW = 3MHz

SWT = AUTO

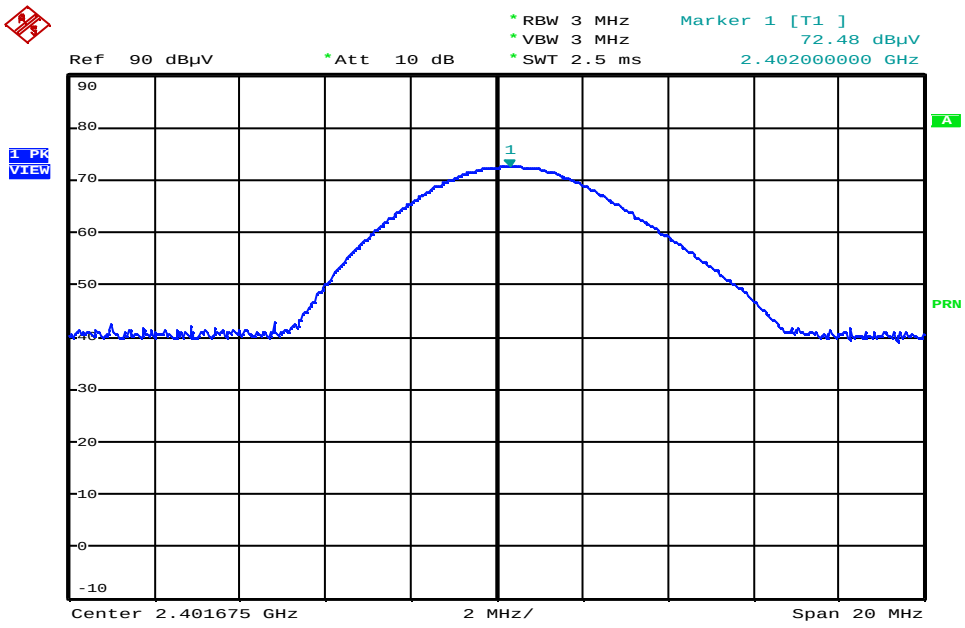
Test distance=3m

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	39.67	5.44	28.37	73.48	$4.72x10^{-3}$	$0.003x10^{-3}$	PASS
	V		37.86			71.67	$3.83x10^{-3}$	$0.002x10^{-3}$	PASS
40	H	2.441	38.61	5.52	28.38	72.51	$4.22x10^{-3}$	$0.002x10^{-3}$	PASS
	V		38.84			72.74	$4.34x10^{-3}$	$0.002x10^{-3}$	PASS
79	H	2.480	36.29	5.56	28.40	70.25	$3.25x10^{-3}$	$0.001x10^{-3}$	PASS
	V		38.12			72.08	$4.02x10^{-3}$	$0.002x10^{-3}$	PASS

8.3 Spectrum Plot Data

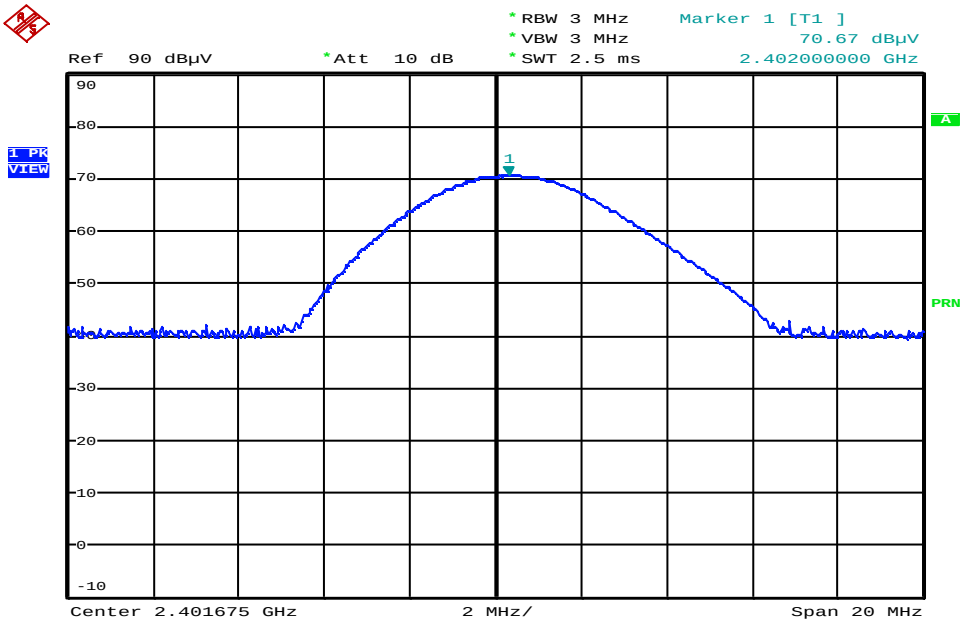
Channel : 1

Horizontal



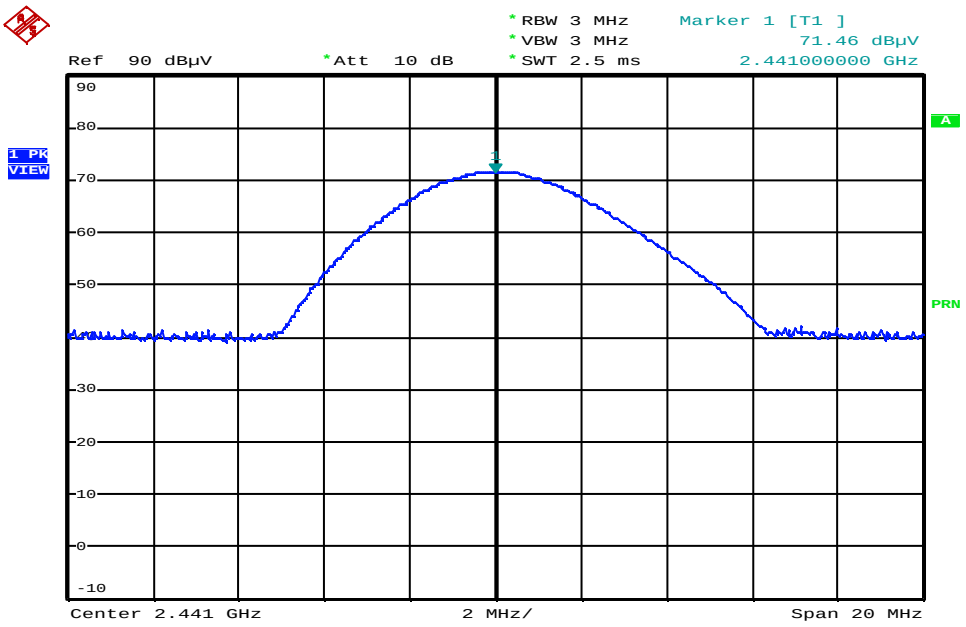
Date: 12.MAY.2009 15:03:07

Vertical



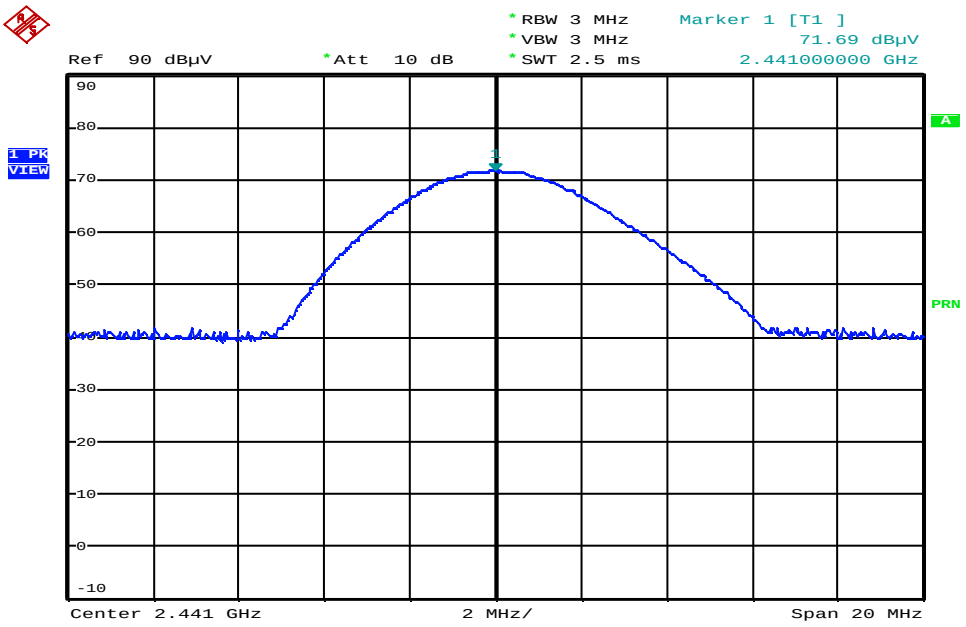
Channel : 40

Horizontal



Date: 12.MAY.2009 15:08:34

Vertical



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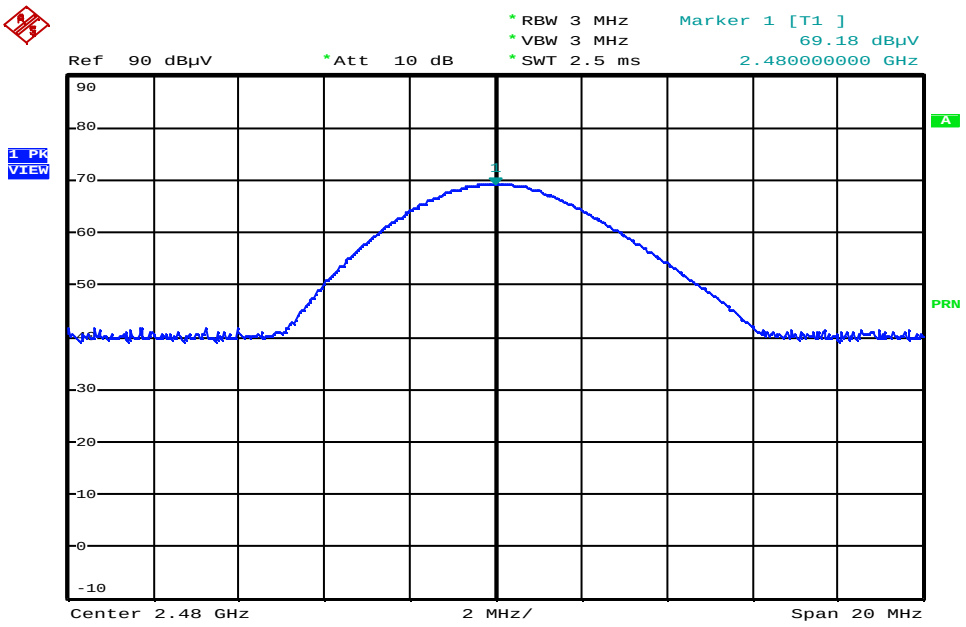
Channel : 79

Horizontal



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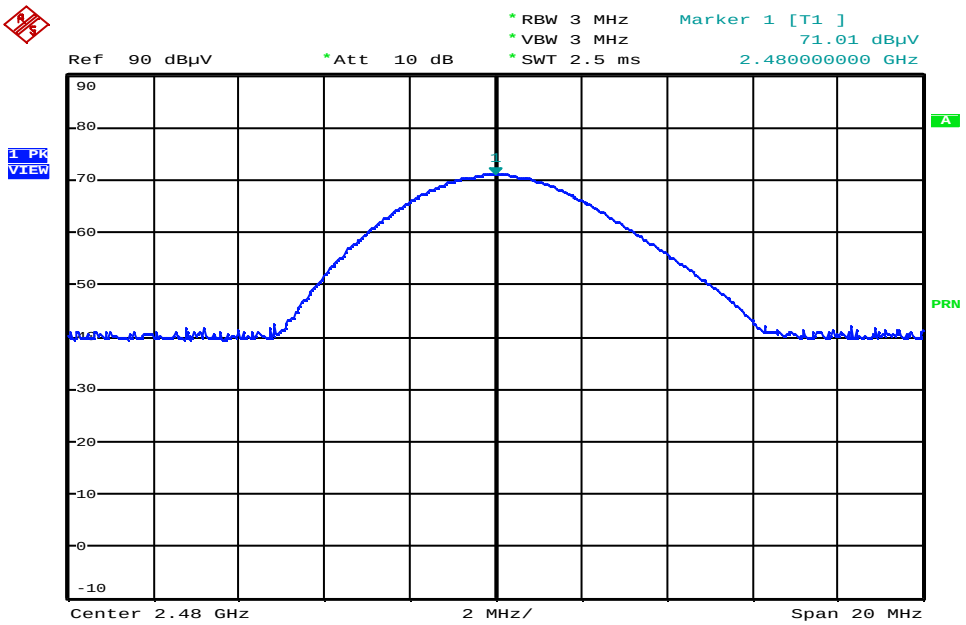
Vertical



Date: 12.MAY.2009 15:17:37

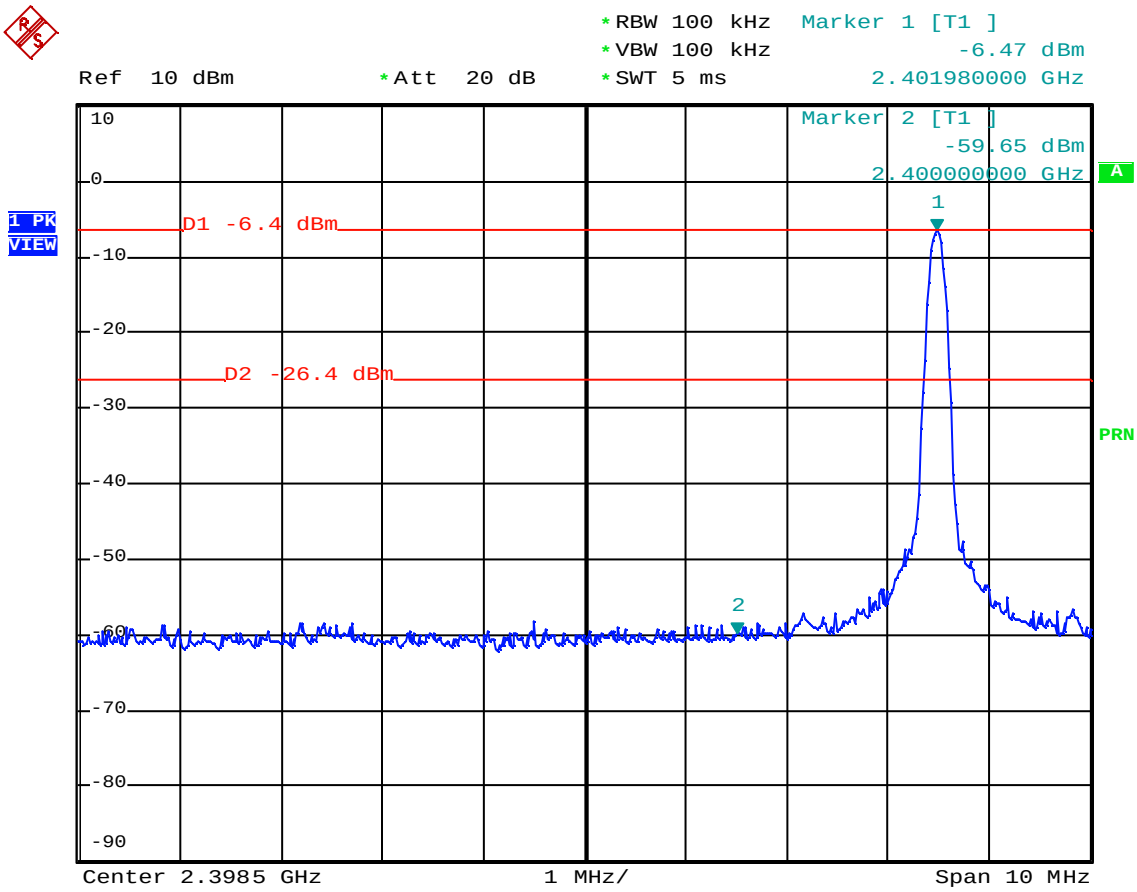
8.4 Test Setup Photo

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

9.1 Band Edge Measurement

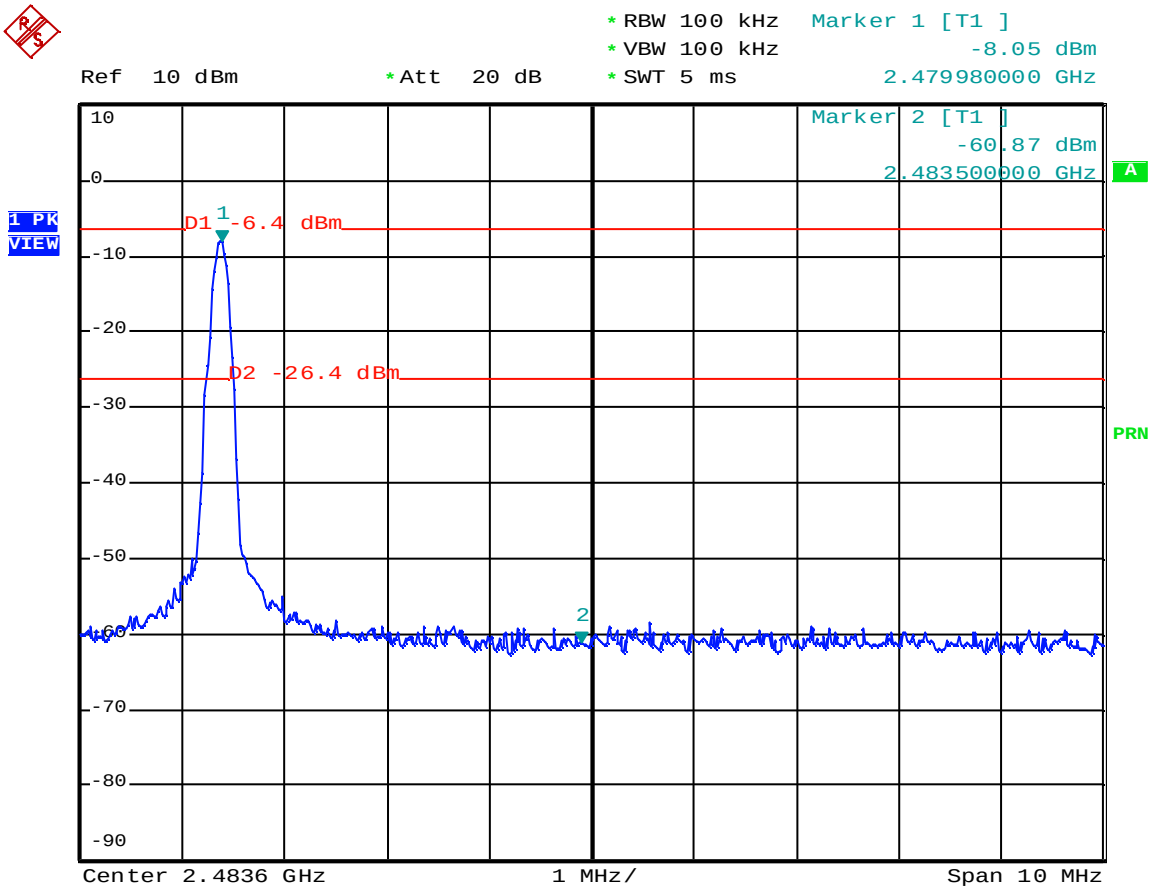
Channel: 1 Peak read: -6.47dBm, limit < -26.4dBm

Band-edges: 2.4GHz Peak read: -59.65dBm < -26.4dBm



Channel: 79 Peak read: -8.05dBm, limit < -26.4dBm

Band-edges: 2.4835GHz Peak read: -60.87dBm < -26.4dBm



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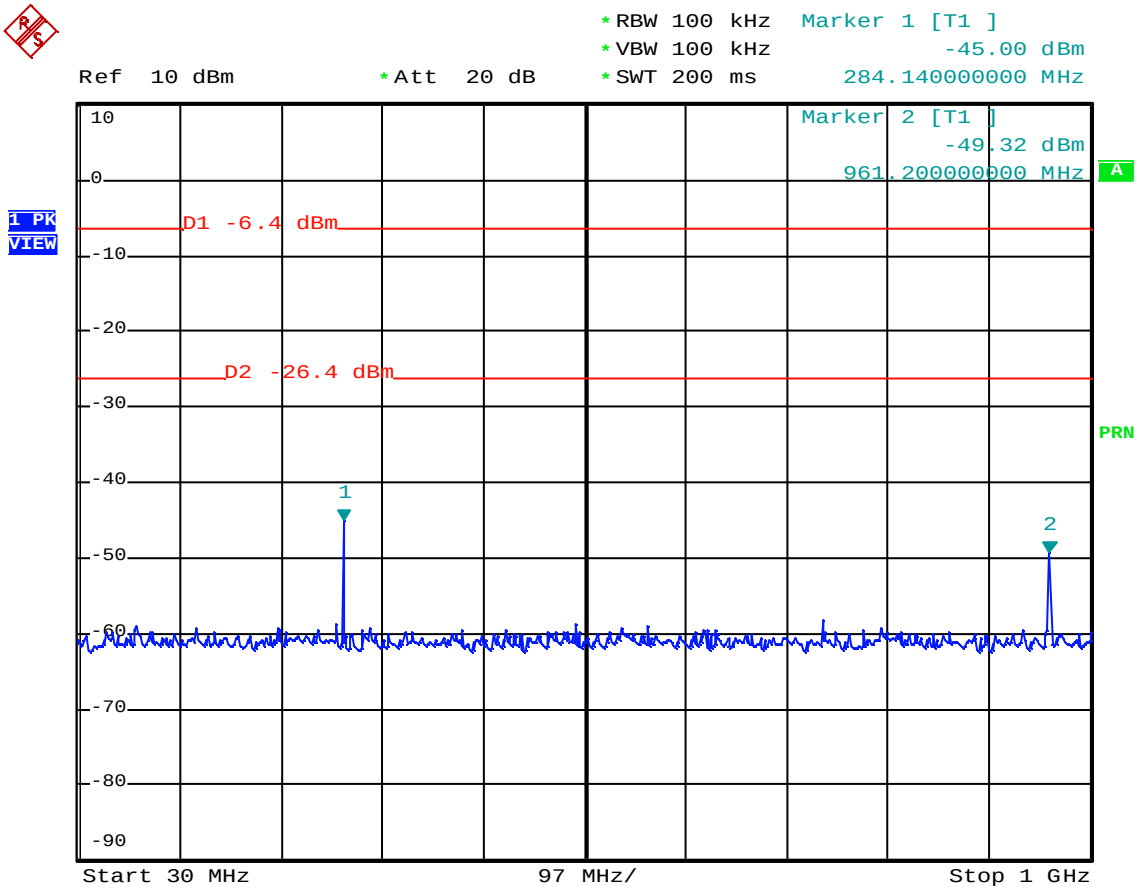
9.2 Spurious Emissions [Conducted]

Test Results:

Model No.	**: Mini400B**		
Frequency range	**: 30MHz to 1GHz**	**Detector**	**: Peak Value**
Temperature	**: 26 ℃**	**Humidity**	**: 60 %**

The highest value: 284.14MHz / -45.00dBm < -26.4dBm



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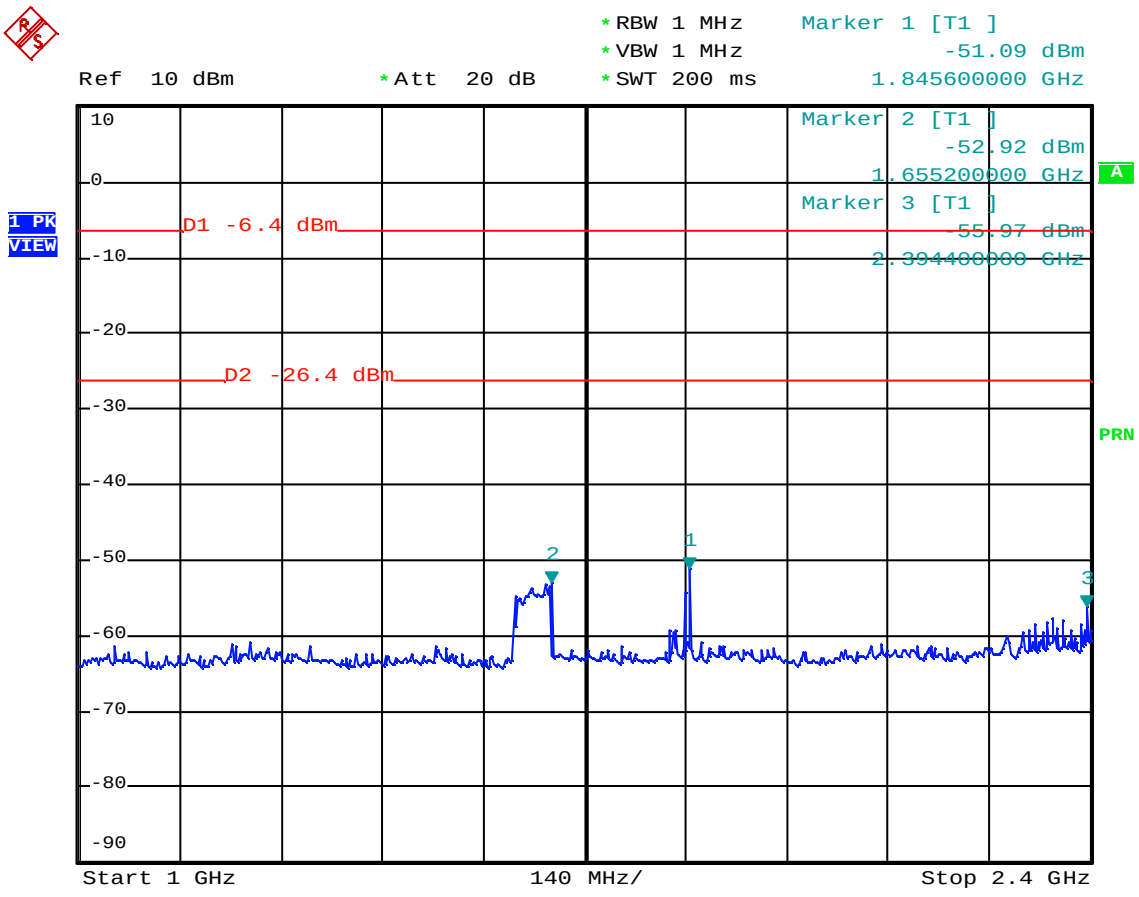
Test Results:

Model No.	**: Mini400B**		
Frequency range	**: 1GHz to 2.4GHz**	**Detector**	**: Peak Value**
Temperature	**: 26 ℃**	**Humidity**	**: 60 %**

The highest value: 1.846GHz / -51.09dBm < -26.4dBm

1.655GHz / -52.92dBm < -26.4dBm



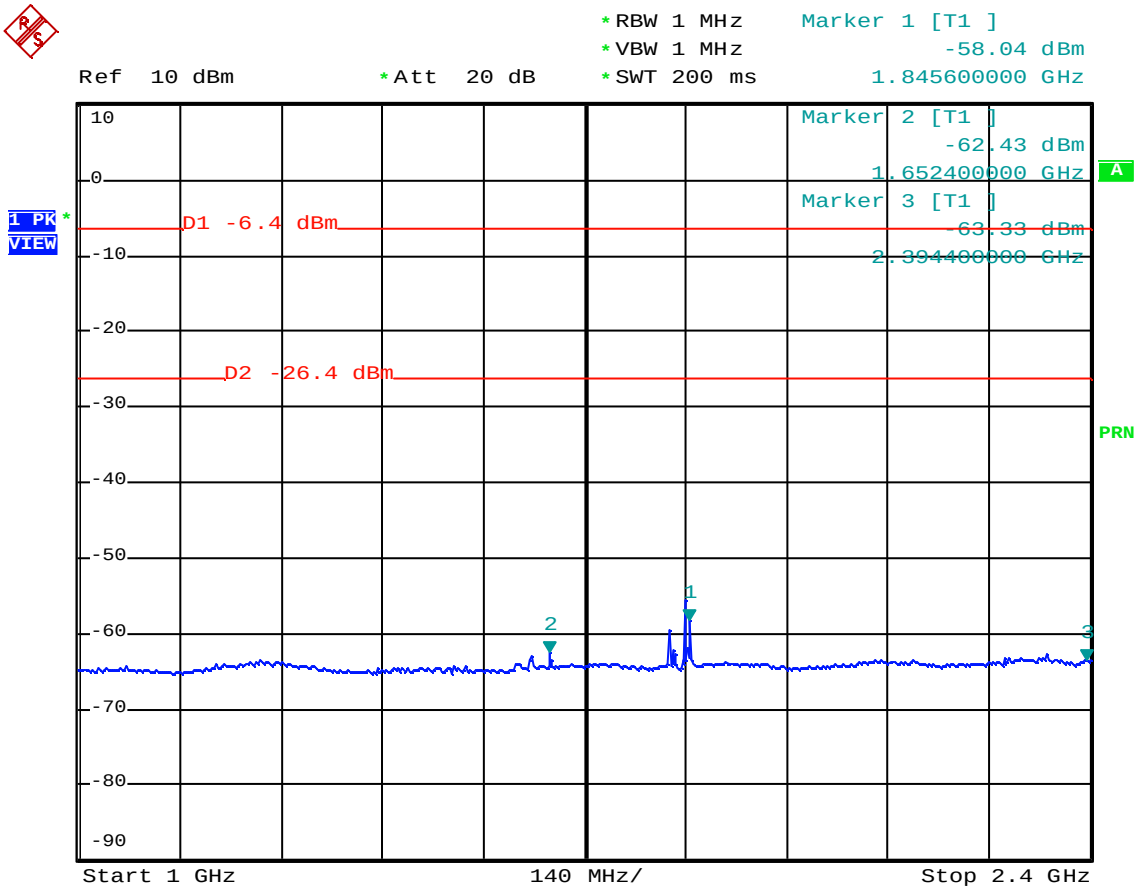
Date: 11.MAY.2009 19:46:08

Test Results:

Model No.	**: Mini400B**		
Frequency range	**: 1GHz to 2.4GHz**	**Detector**	**: Average Value**
Temperature	**: 26 ℃**	**Humidity**	**: 60 %**

The highest value: 1.846GHz / -58.04dBm < -26.4dBm

1.652GHz / -62.43dBm < -26.4dBm



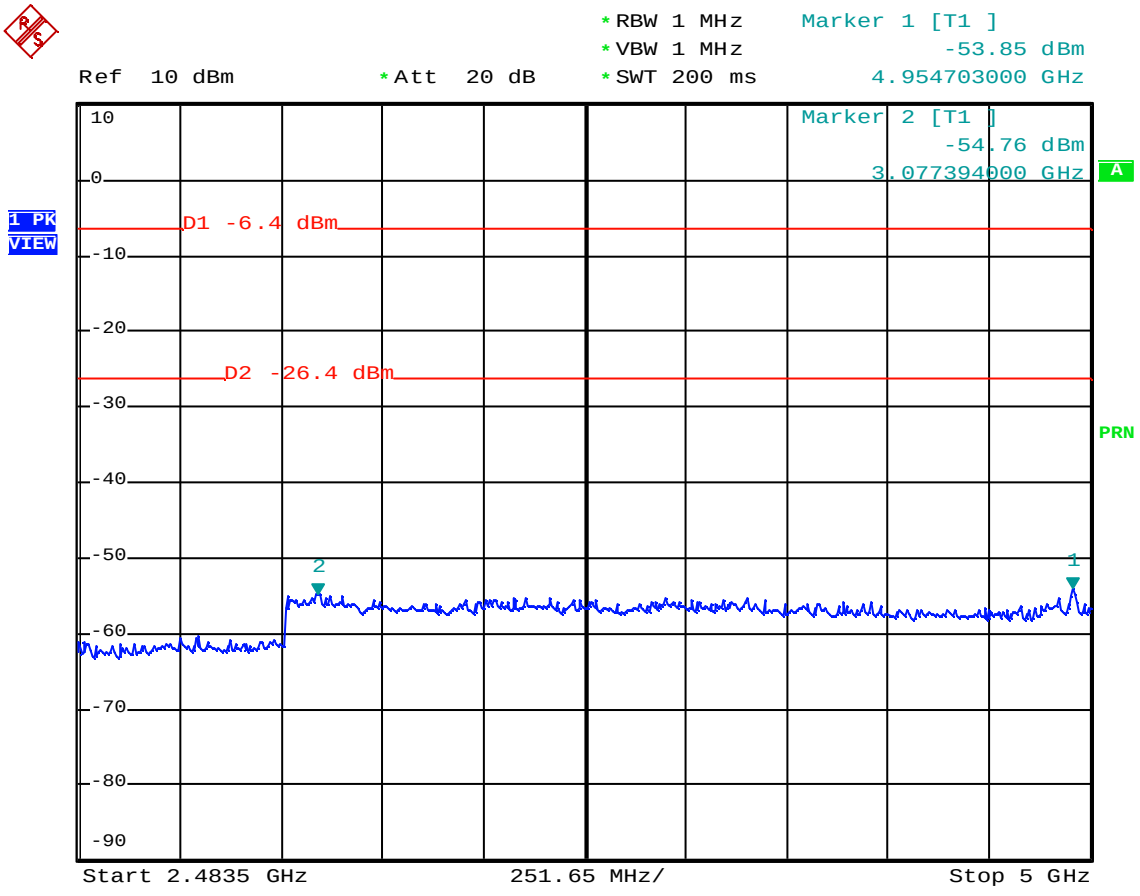
Date: 11.MAY.2009 19:50:26

Test Results:

Model No.	**: Mini400B**		
Frequency range	**: 2.4835GHz to 5GHz**	**Detector**	**: Peak Value**
Temperature	**: 26 ℃**	**Humidity**	**: 60 %**

The highest value: 4.955GHz / -53.85dBm < -26.4dBm

3.077GHz / -54.76dBm < -26.4dBm

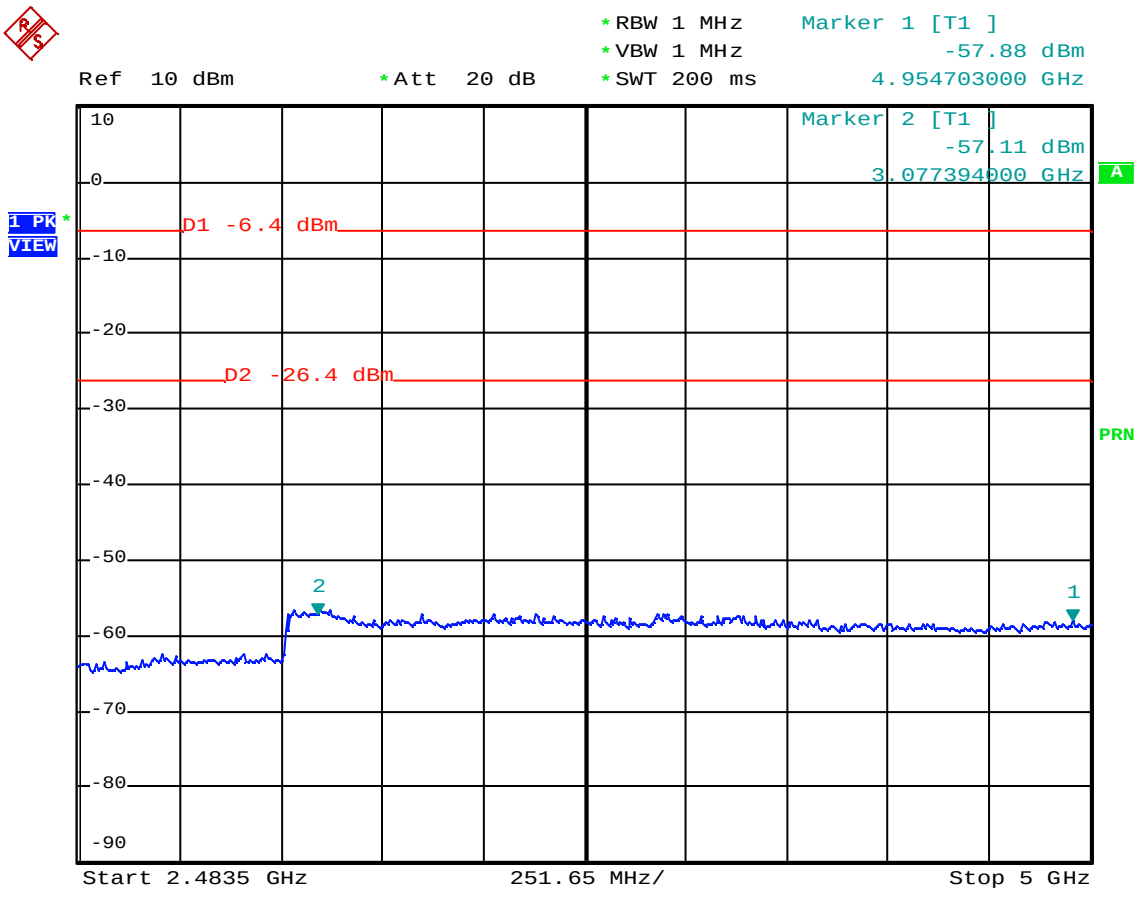


Test Results:

Model No.	**: Mini400B**		
Frequency range	**: 2.4835GHz to 5GHz**	**Detector**	**: Average Value**
Temperature	**: 26 ℃**	**Humidity**	**: 60 %**

The highest value: 3.077GHz / -57.11dBm < -26.4dBm

4.955GHz / -57.88dBm < -26.4dBm



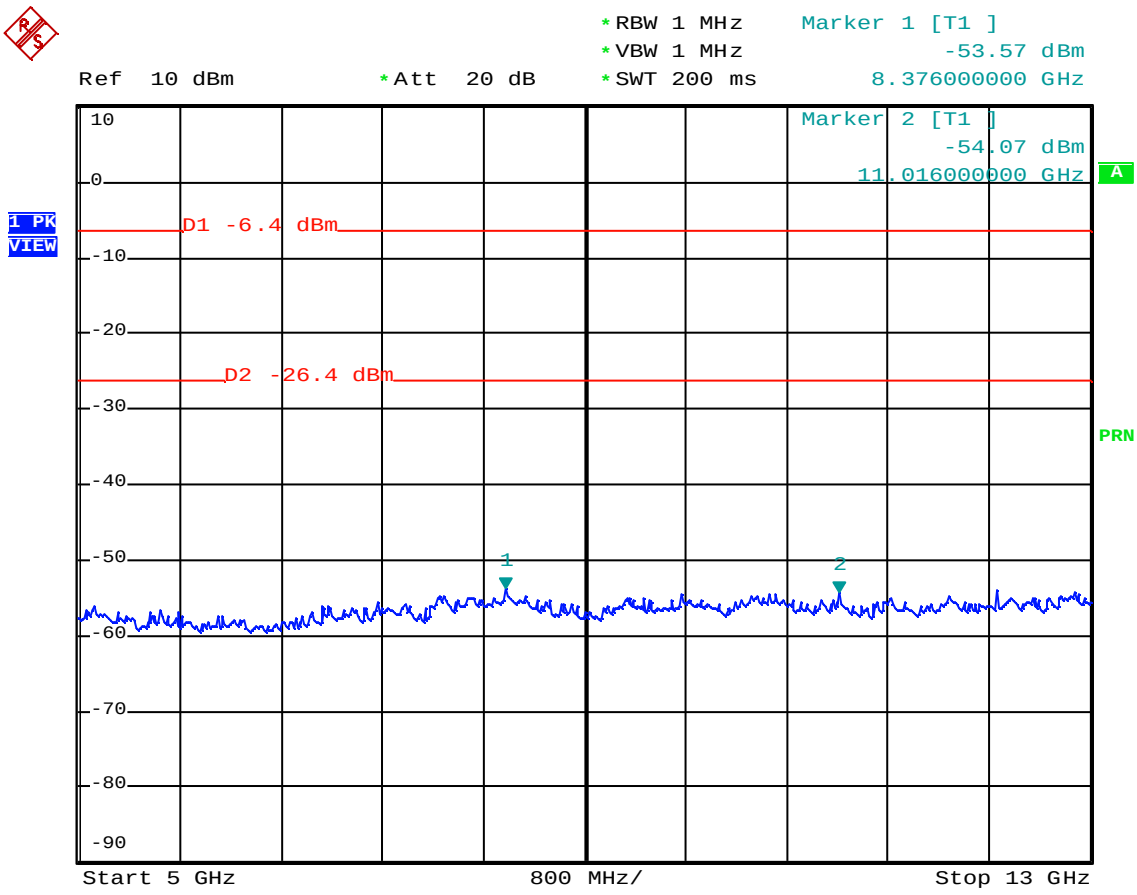
Date: 11.MAY.2009 19:52:56

Test Results:

Model No.	**: Mini400B**		
Frequency range	**: 5GHz to 13GHz**	**Detector**	**: Peak Value**
Temperature	**: 26 ℃**	**Humidity**	**: 60 %**

The highest value: 8.376GHz / -53.57dBm < -26.4dBm

11.016GHz / -54.07dBm < -26.4dBm



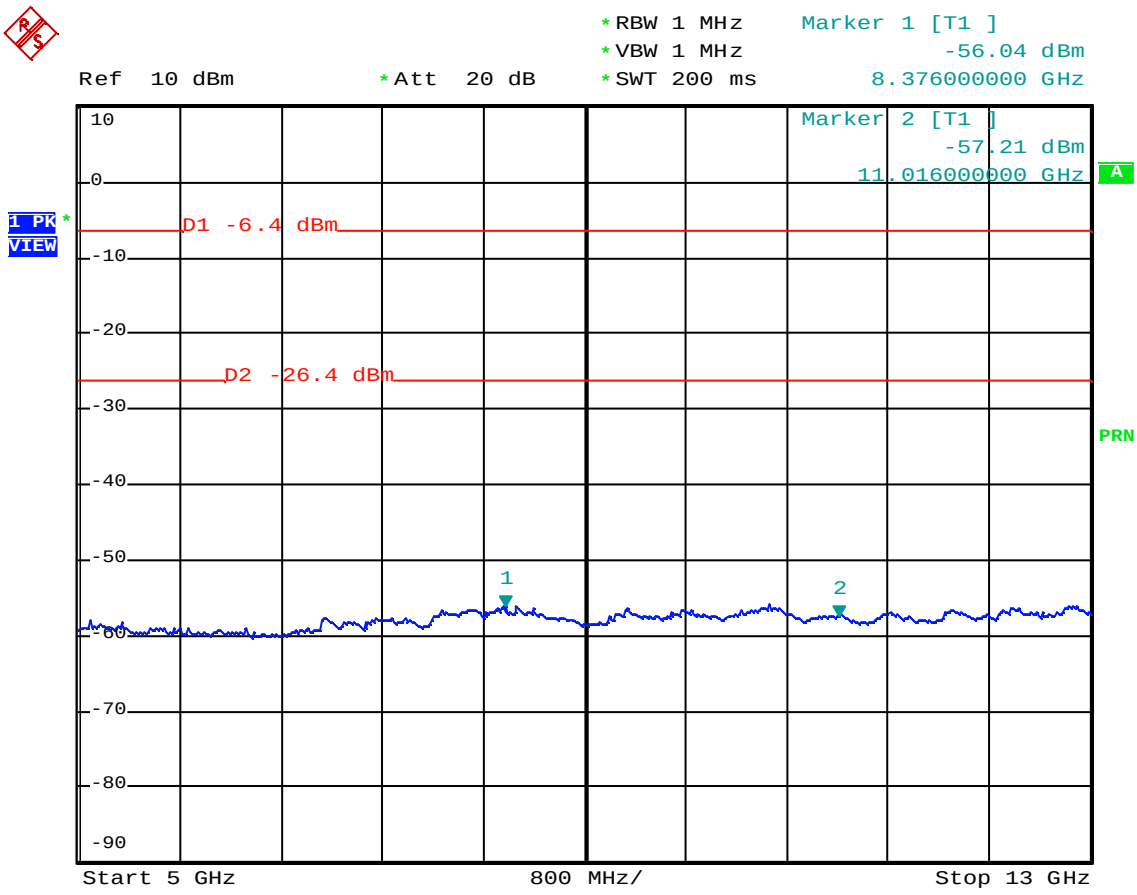
Date: 11.MAY.2009 19:55:51

Test Results:

Model No.	**: Mini400B**		
Frequency range	**: 5GHz to 13GHz**	**Detector**	**: Average Value**
Temperature	**: 26 ℃**	**Humidity**	**: 60 %**

The highest value: 8.376GHz / -56.04dBm < -26.4dBm

11.016GHz / -57.21dBm < -26.4dBm



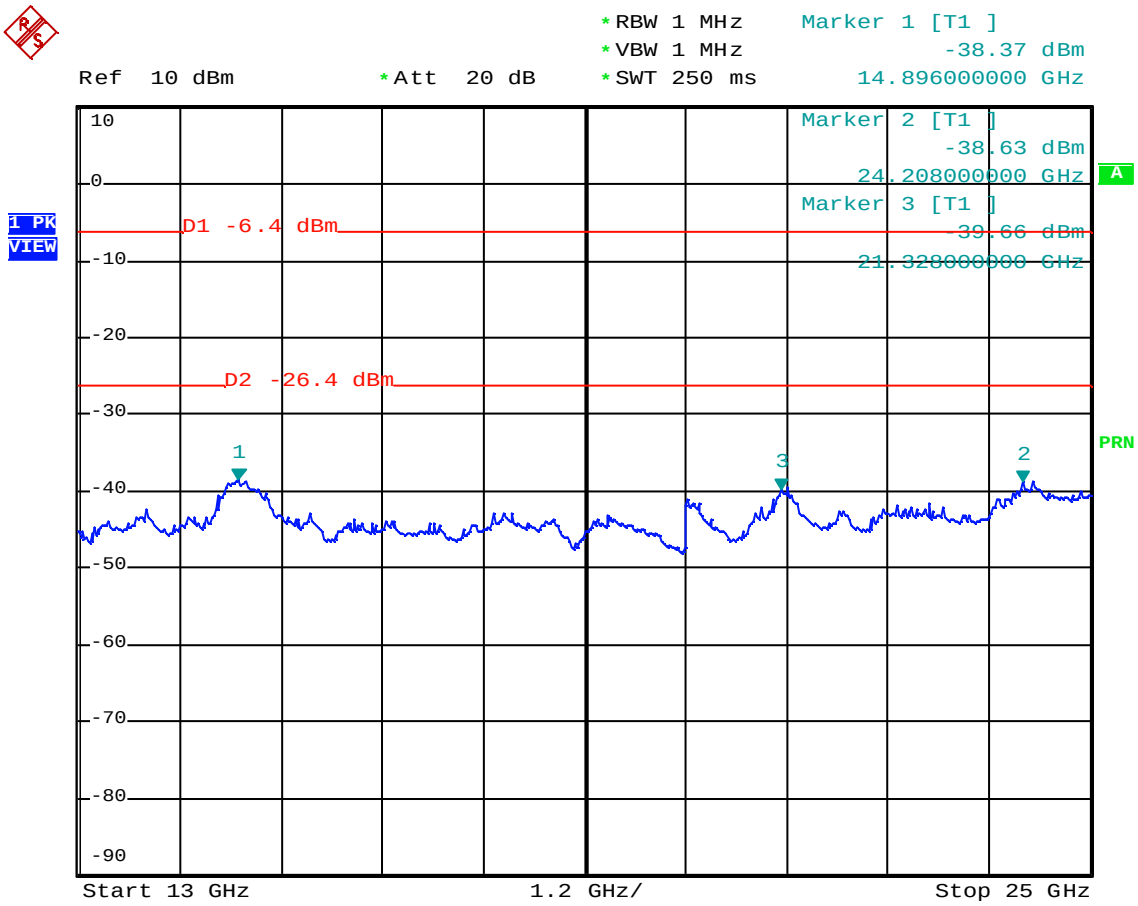
Date: 11.MAY.2009 19:56:27

Test Results:

Model No.	**: Mini400B**		
Frequency range	**: 13GHz to 25GHz**	**Detector**	**: Peak Value**
Temperature	**: 26 ℃**	**Humidity**	**: 60 %**

The highest value: 14.896GHz / -38.37dBm < -26.4dBm

24.208GHz / -38.63dBm < -26.4dBm



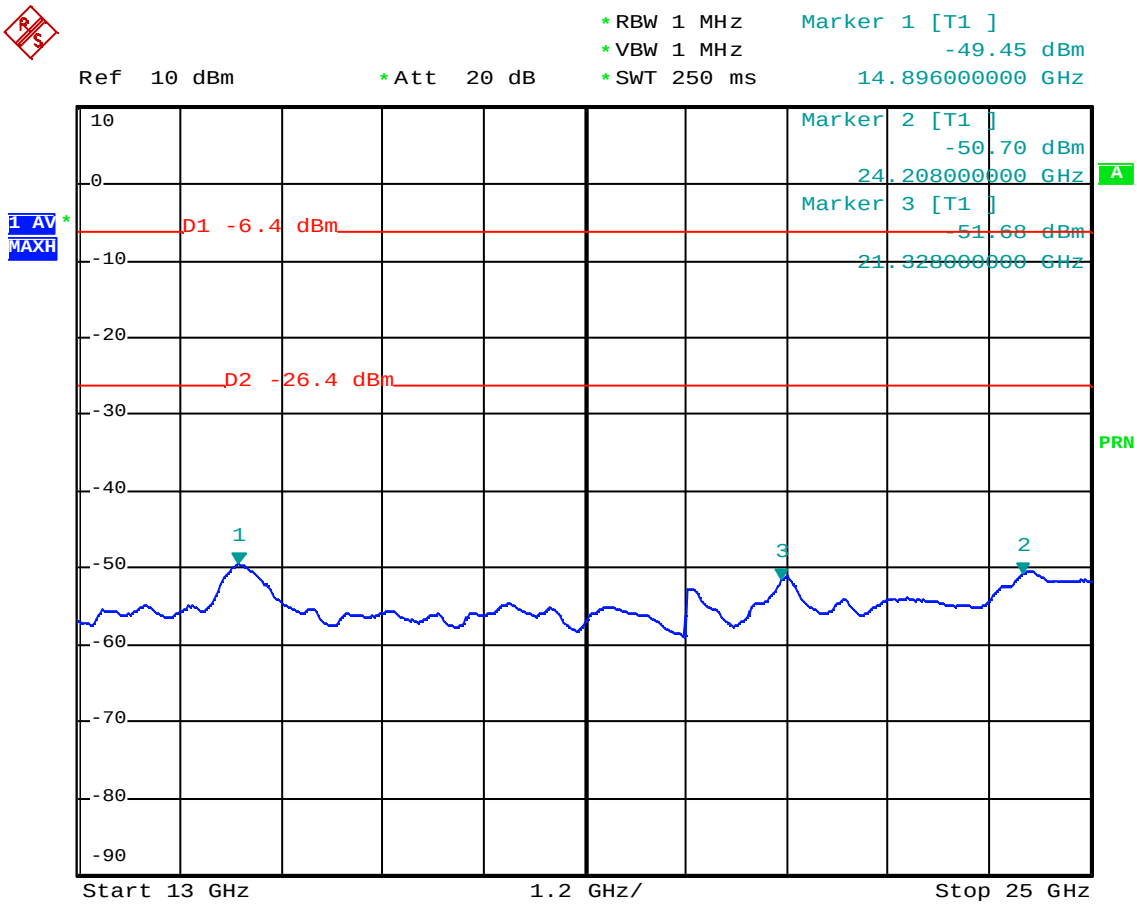
Date: 11.JUN.2009 11:16:23

Test Results:

Model No.	**: Mini400B**		
Frequency range	**: 13GHz to 25GHz**	**Detector**	**: Average Value**
Temperature	**: 26 ℃**	**Humidity**	**: 60 %**

The highest value: 14.896GHz / -49.45dBm < -26.4dBm

24.208GHz / -50.70dBm < -26.4dBm



Date: 11.JUN.2009 11:17:31

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~25GHz

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

Above 1GHz, RBW=1MHz

Temperature: **26** ℃ Humidity: **60** %

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
211.9	16.24	-64.36	80.60	31.45	8.07	2.03	25.31	Quasi-Peak
920.2	30.12	-50.48	80.60	29.14	20.60	4.33	23.95	Quasi-Peak
1652.4	44.36	-36.24	80.60	46.26	26.12	4.25	32.27	Peak
1652.4	34.15	-26.45	60.60	36.05	26.12	4.25	32.27	Average
			Restrict Band					
3927.9	48.81	-25.19	74.00	43.28	31.51	7.23	33.21	Peak
3927.9	45.29	- 8.71	54.00	39.76	31.51	7.23	33.21	Average
4854.0	49.00	-25.00	74.00	41.64	32.57	7.99	33.20	Peak
4854.0	46.32	- 7.68	54.00	38.96	32.57	7.99	33.20	Average
11968.0	61.19	-12.81	74.00	43.93	39.75	10.50	32.99	Peak
11968.0	48.61	- 5.39	54.00	31.35	39.75	10.50	32.99	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
200.1	16.67	-63.93	80.60	31.70	8.81	1.93	25.77	Quasi-Peak
830.6	31.38	-49.22	80.60	29.89	20.36	4.09	22.96	Quasi-Peak
2066.8	37.72	-42.88	80.60	37.03	28.23	4.93	32.47	Peak
2066.8	35.21	-25.39	60.60	34.52	28.23	4.93	32.47	Average
			Restrict Band					
4798.7	48.98	-25.02	74.00	41.59	32.44	7.95	33.20	Peak
4798.7	46.21	- 7.79	54.00	39.02	32.44	7.95	33.20	Average
9600.0	57.66	-16.34	74.00	40.84	39.60	9.92	32.70	Peak
9600.0	44.75	- 9.25	54.00	29.82	37.83	9.70	32.60	Average
12000.0	59.30	-14.70	74.00	42.10	39.70	10.50	33.00	Peak
12000.0	48.20	- 5.80	54.00	31.00	39.70	10.50	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

$$E\ (V/m) = \frac{\sqrt{30*P*G}}{d} \qquad \text{Power Density} = Pd\ (W/m^2) = \frac{E^2}{377}$$

Combine these two formulas can be changed to

$$Pd = \frac{30*P*G}{377*d^2}$$

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	2.51	0.003	0.0149	<1	PASS
40	2.51	0.002	0.0099	<1	PASS
79	2.51	0.002	0.0099	<1	PASS

11. List of Test Instruments

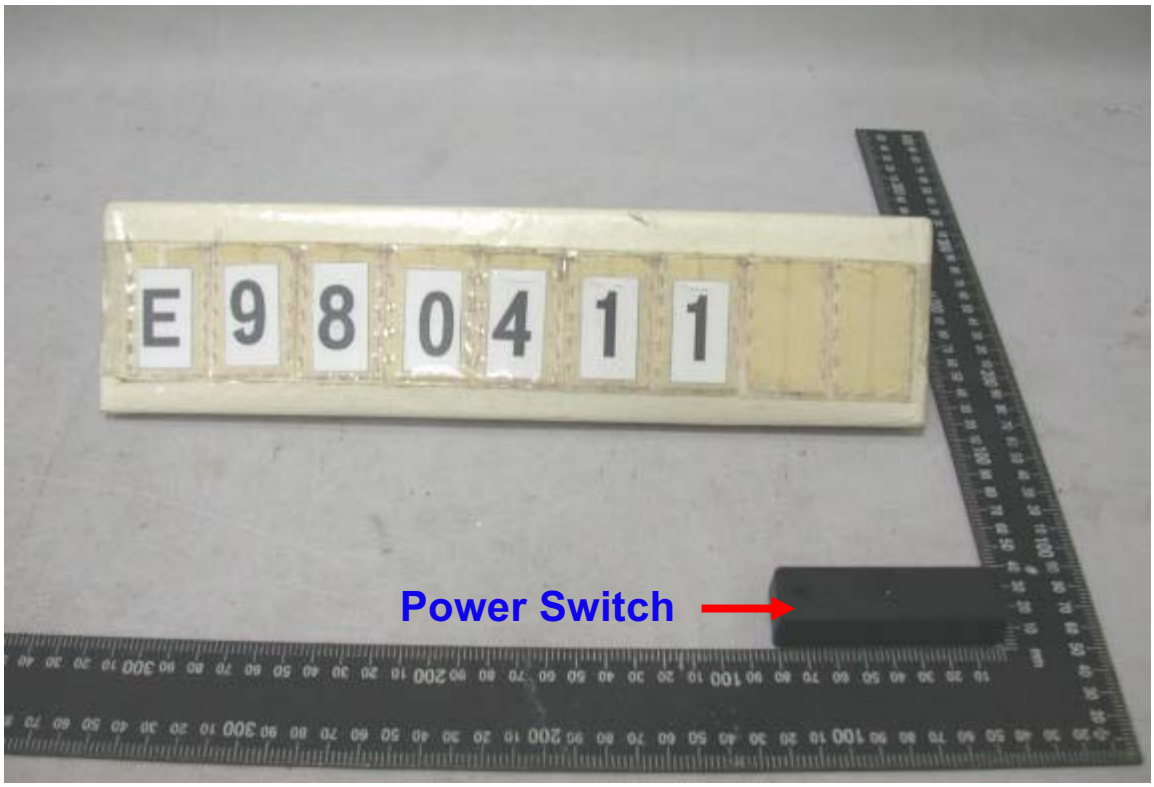
Test Site	Instrument	Manufacturer	Model No.	S/N	Next Cal. Date	Cal. Interval
Chamber (No. 1)	Spectrum Analyzer	ROHDE& SCHWARZ	FSP	830180/006	Nov. 16, 2009	1 Year
	30MHz~1GHz RF Cable	YEIDA WIRE CABLE	N/A	N/A	Jan. 18, 2010	1 Year
	1GHz~18GHz RF Cable	MITEQ	N/A	N/A	Sep. 22, 2009	1 Year
	Horn Antenna 1GHz~18GHz	COM-POWER	AH-118	10056	Mar. 12, 2010	1 Year
	Antenna	SCHWARZBECK	VULB 9161	4078	Jan. 16, 2010	1 Year
	Pre-Amplifier	Schaffner	CPA-9232	1028	Jan. 20, 2010	1 Year
	Preamplifier 1GHz~18GHz	MITEQ	28-5A	513015	Sep. 25, 2009	1 Year

12. EUT Photos

FCC ID. : WXAMini400B

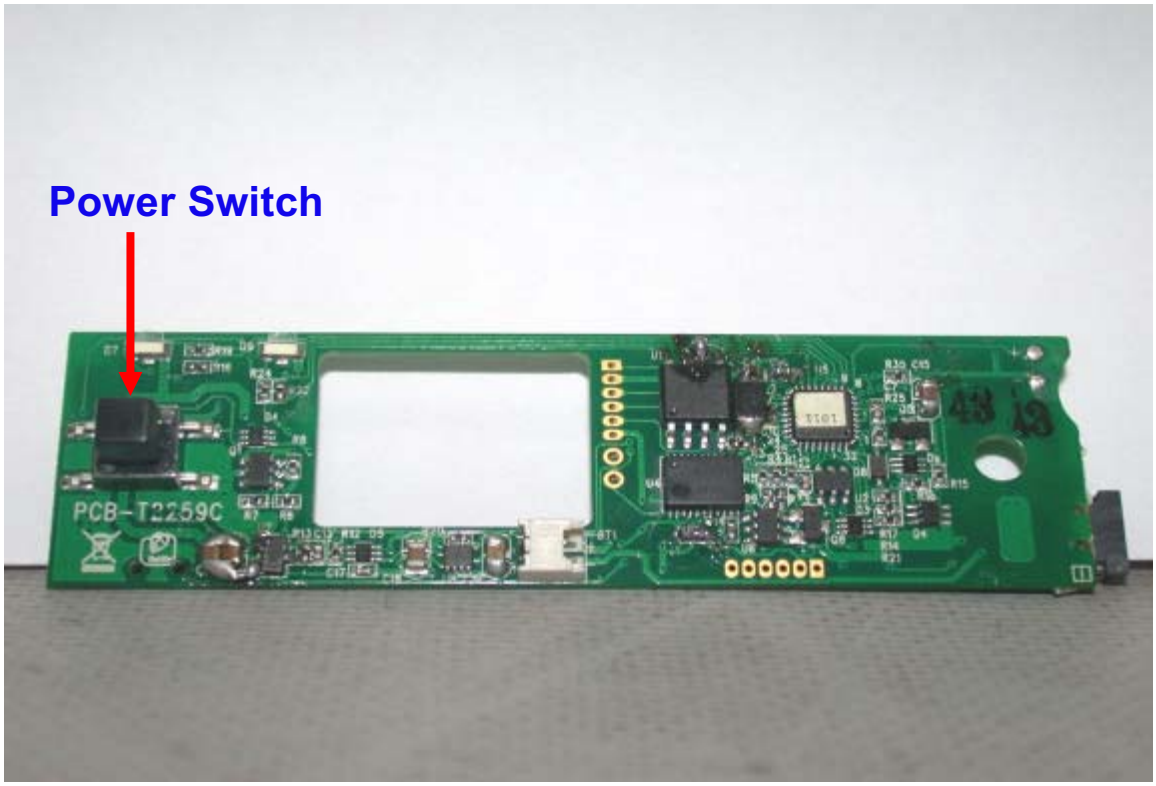
EUT FRONT VIEW

EUT REAR VIEW

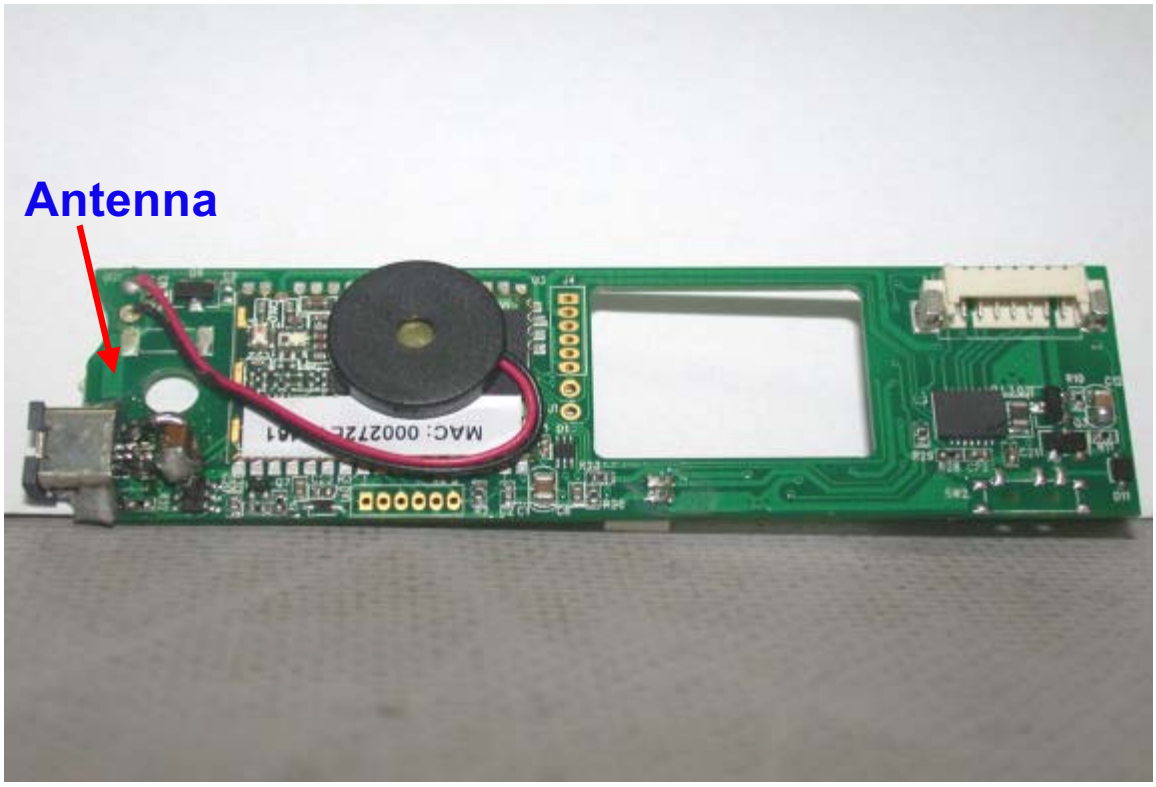


EUT INSIDE VIEW

EUT MAIN BOARD VIEW



EUT SOLDERING VIEW



EUT MODULE VIEW