FCC TEST REPORT

for

47 CFR Part 15 Subpart C

Equipment : Bluetooth headset

Model No. : BA-2010-H

FCC ID. : K7SF8T060xHDST

Filing Type : Certification

Applicant : **BELKIN CORPORATION**
West Walnut Street Compton CA 90220-5221

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SPORTON International Inc.

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

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History of this test report

Original Report Issue Date: Jan. 19, 2004

■ No additional attachment.

□ Additional attachment were issued as following record:

Attachment No.	Issue Date	Description

Certificate No. : F3D0107

CERTIFICATE OF COMPLIANCE

for

47 CFR Part 15 Subpart C

Equipment : Bluetooth headset

Model No. : BA-2010-H

FCC ID. : K7SF8T060xHDST

Filing Type : Certification

Applicant : **BELKIN CORPORATION**
501 West Walnut Street Compton CA 90220-5221

I **HEREBY** CERTIFY THAT :

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 - 2001** and the equipment under test was ***passed*** all test items required in 47 CFR Part 15 subpart C, relative to the equipment under test. Testing was carried out on Dec. 09, 2003 at **SPORTON International Inc.** LAB.

K. J. Lin
Manager

SPORTON International Inc.
6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

1. General Description of Equipment under Test

1.1. Applicant

BELKIN CORPORATION
501 West Walunt Street Compton CA 90220-5221

1.2. Manufacturer

Same as 1.1

1.3. Basic Description of Equipment under Test

Equipment	: Bluetooth headset
Model No.	: BA-2010-H
FCC ID	: K7SF8T060xHDST
Trade Name	: BELKIN
Power Supply Type	: Linear
AC Power Input	: Wall-Mount, 2pin
DC Power Input	:Non-Shielded 1.8m, 2pin

1.4. Feature of Equipment under Test

	Headset
1. Type of Modulation	GFSK
2. Number of Channels	79
3. Frequency Band	2402MHz~2480MHz
4. Carrier Frequency of each channel	f=2042+kMHz,k=0,…,78
5. Bandwidth of each channel	1MHz
6. Maximum Output Power to Antenna	0.27dBm
7. Antenna Type	Ceramic Antenna
8. Function Type	Transceiver
9. Power Rating (DC/AC, Voltage)	5V
10. Duty Cycle	100%
11. Temperature Range (Operating)	-10 to 50

Channel	Frequency	Channel	Frequency
00	2402	40	2442
01	2403	41	2443
02	2404	42	2444
03	2405	43	2445
04	2406	44	2446
05	2407	45	2447
06	2408	46	2448
07	2409	47	2449
08	2410	48	2450
09	2411	49	2451
10	2412	50	2452
11	2413	51	2453
12	2414	52	2454
13	2415	53	2455
14	2416	54	2456
15	2417	55	2457
16	2418	56	2458
17	2419	57	2459
18	2420	58	2460
19	2421	59	2461
20	2422	60	2462
21	2423	61	2463
22	2424	62	2464
23	2425	63	2465
24	2426	64	2466
25	2427	65	2467
26	2428	66	2468
27	2429	67	2469
28	2430	68	2470
29	2431	69	2471
30	2432	70	2472
31	2433	71	2473
32	2434	72	2474
33	2435	73	2475
34	2436	74	2476
35	2437	75	2477
36	2438	76	2478
37	2439	77	2479
38	2440	78	2480
39	2441		

2. Test Configuration of Equipment under Test

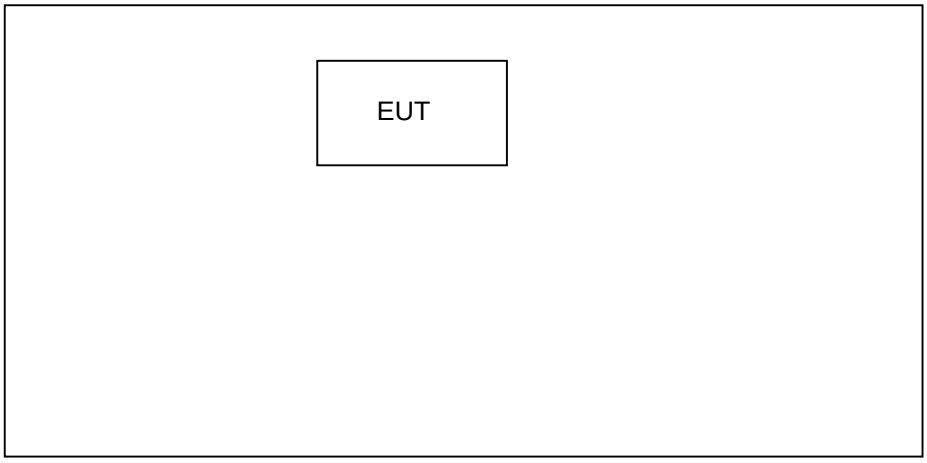
2.1. Test Manner

a. The EUT has been tested stand alone and peripherals pursuant to ANSI C63.4-2001 and configuration operated in a manner, which tended to maximize its emission characteristics in a typical application.
b. For 15.247(g), during data transmission, the carrier frequency is repeatly switched on 79 hopping frequencies, any 2 hopping frequencies will not be available on the spectrum simultaneously. So, this device can be taken as true frequeny hopping device.
c. Frequency range investigated: conduction 150 KHz to 30 MHz, radiation 30 MHz to 25000MHz.

2.2. Description of Test System

The EUT was tested alone. No support device is needed for testing.

2.3. Connection Diagram of Test System



3. Test Software

During testing, the EUT kept transmitting signals at fixed frequency.

4. General Information of Test

Test Site Location	:	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiag, Tao Yuan Hsien, Taiwan, R.O.C. TEL : 886-3-327-3456 FAX : 886-3-318-0055
Test Site No	:	CO01-HY, 03CH03-HY

4.1. Test Voltage

110V/60Hz, DC 5V

4.2. Standard for Methods of Measurement

ANSI C63.4-2001 for conducted power line test and radiated emission test.

4.3. Test in Compliance with

47 CFR Part 15 Subpart C

4.4. Frequency Range Investigated

a. Conduction: from 150 kHz to 30 MHz
b. Radiation: from 30 MHz to 25000 MHz

4.5. Test Distance

The test distance of radiated emission from antenna to EUT is 3 M.

5. Report of Measurements and Examinations

5.1. List of Measurements and Examinations

FCC Rule	Description of Test	Result
15.247(a)(2)	Hopping Channel Bandwidth	Pass
15.247(a)(1)	Hopping Channel Separation	Pass
15.247(a)(1)	Number of Hopping Frequency Used	Pass
15.247(a)(1)	Dwell Time of Each Frequency within a 30 Second Period	Pass
15.247(b)	Output Power	Pass
15.247(c)	100KHz Bandwidth of Frequency Band Edges	Pass
15.207	Conducted Emission	Pass
15.209	Radiated Emission	Pass
15.203	Antenna Requirement	Pass

5.2. Hopping Channel Separation

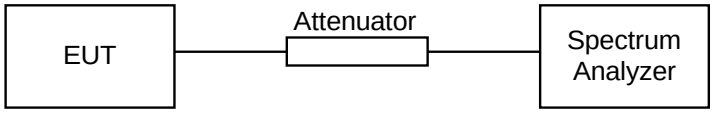
5.2.1. Measuring Instruments：

As described in chapter 10 of this test report.

5.2.2. Test Procedure：

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 30KHz and VBW to 100KHz.
3. The Hopping Channel Separation is defined as the channel is separated with the next channel.

5.2.3. Test Setup Layout：



5.2.4. Test Result：The spectrum analyzer plots are attached as below

- Temperature: 25.5°C
- Relative Humidity: 55 %
- Duty cycle of the equipment during the test X ＝ 100%

Channel	Frequency (MHz)	Hopping Channel Separation (KHz)	Limits (KHz)	Plot Ref. No.
00	2402	1000.0000	0.2650	1
39	2441	1000.0000	0.2640	2
78	2480	1000.0000	0.2660	3

Limits: min fo 25KHz ro 20dB bandwidth , which is greater.

5.2.5. Test Configuration（EUT Operating Condition）：

The software provided by client to enable the EUT under transmission condition.
The EUT have its hopping function enabled.

5.3. Number of Hopping Frequency

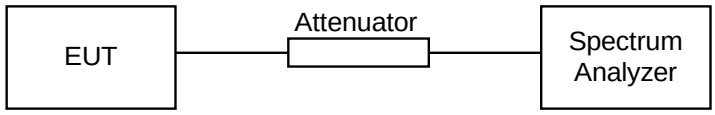
5.3.1. Measuring Instruments：

As described in chapter 10 of this test report.

5.3.2. Test Procedure：

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.
3. The number of hopping frequency used is defined as the device has the numbers of total channel.

5.3.3. Test Setup Layout：



5.3.4. Test Result：See spectrum analyzer plots below

- Temperature: 25.5°C
- Relative Humidity: 55 %
- Duty cycle of the equipment during the test X ＝ 100%

Number of Hopping Frequency (Channel)	Limits (Channel)	Plot Ref. No.
79	75	1

5.3.5. Test Configuration（EUT Operating Condition）：

The software provided by client to enable the EUT under transmission condition.
The EUT have its hopping function enabled.

5.4. Hopping Channel Bandwidth

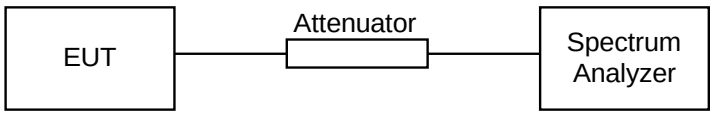
5.4.1 Measuring Instruments：

As described in chapter 10 of this test report.

5.4.2 Test Procedure：

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.
3. The Hopping Channel bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

5.4.3 Test Setup Layout：



5.4.4 Test Result：See spectrum analyzer plots below

- Temperature: 25.5°C
- Relative Humidity: 55 %
- Duty cycle of the equipment during the test X ＝ 100%

Channel	Frequency (MHz)	Hopping Channel Bandwidth (MHz)	Limits (MHz)	Plot Ref. No.
00	2402	0.2650	1.0	1
39	2441	0.2640	1.0	2
78	2480	0.2660	1.0	3

5.4.5 Test Configuration（EUT Operating Condition）：

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies respectively.

5.5 Dwell Time of Each Frequency within a 30 Seconds Period

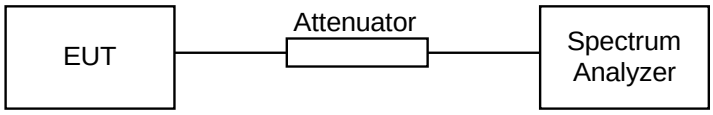
5.5.1 Measuring Instruments：

As described in chapter 10 of this test report.

5.5.2 Test Procedure：

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
3. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
4. The calculate = 30*(1600/79)*t (ie: t = the time duration of one single pulse)

5.5.3 Test Setup Layout：



5.5.4 Test Result：See spectrum analyzer plots below

- Temperature: 25.5°C
- Relative Humidity: 55 %
- Duty cycle of the equipment during the test X ＝ 100%

Channel	Frequency (MHz)	Dwell Time (s)	Limits (s)	Plot Ref. No.
00	2402	0.272202532	0.4	1
39	2441	0.270987342	0.4	2
78	2480	0.272202532	0.4	3

5.5.5 Test Configuration（EUT Operating Condition）：

Same as Section 5.2.5.

5.6 Output Power

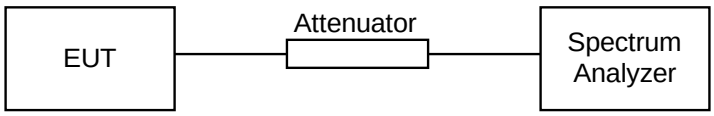
5.6.1 Measuring Instruments：

As described in chapter 10 of this test report.

5.6.2 Test Procedure：

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. The center frequency of the spectrum analyzer was set to the fundamental frequency and set RBW to 1MHz and VBW to 1MHz.

5.6.3 Test Setup Layout：



5.6.4 Test Result：See spectrum analyzer plots below

- Temperature: 25.5°C
- Relative Humidity: 55 %
- Duty cycle of the equipment during the test X ＝ 100%

Channel	Frequency (MHz)	Measured Output Power (dBm)	Measured Output Power (mWatt)	Limits (Watt/dBm)
00	2402	0.27	2.238721139	1W/30 dBm
39	2441	0.09	1.945360082	1W/30 dBm
78	2480	-1.36	1.422328787	1W/30 dBm

5.6.5 Test Configuration（EUT Operating Condition）：

Same as Section 5.4.5.

5.7 100KHz Bandwidth of Frequency Band Edges

5.7.1 Measuring Instruments：

As described in chapter 10 of this test report.

5.7.2 Test Procedure：

1. The transmitter output was connected to the spectrum analyzer via a low lose cable.
2. Set both RBW and VBW of spectrum analyzer to 100KHz with convenient frequency span including 100 KHz bandwidth from band edge.
3. The band edges was measured and recorded.

5.7.3 Test Result：

Test Result in lower band (Channel 00)： PASS

Test Result in higher band(Channel 78)： PASS

5.7.4 Note on Band edge Emission

The band edge emission plot on appendix B page B14. shows 55.82dB delta between carrier maximum power and local maximum emission in the restricted band (2386.033MHz).

CH	The emission of carrier power strength (dB μV/m)	The maximum field strength in restrict band (dB μV/m)	Limit (dB μV/m)	Margin (dB)	Result
00	67.12	11.30	74.00	-62.70	Average

The band edge emission plot on appendix B page B15. shows 46.72dB delta between carrier maximum power and local maximum emission in the restricted band (2485.300MHz).

Polarity	The emission of carrier power strength (dB μV/m)	The maximum field strength in restrict band (dB μV/m)	Limit (dB μV/m)	Margin (dB)	Result
78	75.87	29.15	74.00	-44.85	Average

＊The maximum field strength in restricted band is the emission of carrier power strength subtract to the delta between carrier maximum power and local maximum emission in the restricted band.

5.7.5 Test Configuration（EUT Operating Condition）：

The software provided by client to enable the EUT under transmission condition continuously at lowest, and highest channel frequencies respectively.

5.8 Test of Conducted Emission

Conducted Emissions were measured from 150 KHz to 30 MHz with a bandwidth of 9 KHz and return leads of the EUT according to the methods defined in ANSI C63.4-2001 Section 3.1. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

5.8.1 Major Measuring Instruments：

• Test Receiver	(R&S ESCS 30)
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 KHz

5.8.2 Test Procedures：

a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
c. All the support units are connect to the other LISN.
d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
e. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
f. Both sides of AC line were checked for maximum conducted interference.
g. The frequency range from 150 KHz to 30 MHz was searched.
h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

5.8.3 Test Result of Conducted Emission：

- CH 00 / 2402MHz
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 25.5°C
- Relative Humidity: 55 %

Line

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.162	16.21	-49.16	65.37	16.07	0.10	0.04	QP
2	0.162	14.88	-40.49	55.37	14.74	0.10	0.04	Average
3	0.203	8.72	-54.77	63.49	8.59	0.10	0.03	QP
4	0.203	4.46	-49.03	53.49	4.33	0.10	0.03	Average
5	0.379	9.09	-49.21	58.30	8.93	0.10	0.06	QP
6	0.379	4.92	-43.38	48.30	4.76	0.10	0.06	Average
7	0.963	7.90	-48.10	56.00	7.76	0.10	0.04	QP
8	0.963	3.76	-42.24	46.00	3.62	0.10	0.04	Average
9	1.730	8.66	-47.34	56.00	8.49	0.10	0.07	QP
10	1.730	4.57	-41.43	46.00	4.40	0.10	0.07	Average
11	7.850	11.27	-48.73	60.00	10.86	0.17	0.24	QP
12	7.850	7.01	-42.99	50.00	6.60	0.17	0.24	Average

Neutral

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.162	16.21	-49.16	65.37	16.07	0.10	0.04	QP
2	0.162	14.88	-40.49	55.37	14.74	0.10	0.04	Average
3	0.203	8.72	-54.77	63.49	8.59	0.10	0.03	QP
4	0.203	4.46	-49.03	53.49	4.33	0.10	0.03	Average
5	0.379	9.09	-49.21	58.30	8.93	0.10	0.06	QP
6	0.379	4.92	-43.38	48.30	4.76	0.10	0.06	Average
7	0.963	7.90	-48.10	56.00	7.76	0.10	0.04	QP
8	0.963	3.76	-42.24	46.00	3.62	0.10	0.04	Average
9	1.730	8.66	-47.34	56.00	8.49	0.10	0.07	QP
10	1.730	4.57	-41.43	46.00	4.40	0.10	0.07	Average
11	7.850	11.27	-48.73	60.00	10.86	0.17	0.24	QP
12	7.850	7.01	-42.99	50.00	6.60	0.17	0.24	Average

- CH 39 / 2441MHz
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 25.5°C
- Relative Humidity: 55 %

Line

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.160	16.62	-48.84	65.46	16.48	0.10	0.04	QP
2	0.160	15.03	-40.43	55.46	14.89	0.10	0.04	Average
3	0.213	8.45	-54.64	63.09	8.32	0.10	0.03	QP
4	0.213	4.45	-48.64	53.09	4.32	0.10	0.03	Average
5	0.379	9.01	-49.29	58.30	8.85	0.10	0.06	QP
6	0.379	4.85	-43.45	48.30	4.69	0.10	0.06	Average
7	0.963	7.90	-48.10	56.00	7.76	0.10	0.04	QP
8	0.963	3.84	-42.16	46.00	3.70	0.10	0.04	Average
9	1.730	9.00	-47.00	56.00	8.83	0.10	0.07	QP
10	1.730	4.42	-41.58	46.00	4.25	0.10	0.07	Average
11	5.170	9.33	-50.67	60.00	9.02	0.13	0.18	QP
12	5.170	5.01	-44.99	50.00	4.70	0.13	0.18	Average

Neutral

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.162	15.89	-49.47	65.36	15.75	0.10	0.04	QP
2	0.162	14.23	-41.13	55.36	14.09	0.10	0.04	Average
3	0.179	7.19	-47.34	54.53	7.05	0.10	0.04	Average
4	0.179	11.15	-53.38	64.53	11.01	0.10	0.04	QP
5	0.272	5.86	-45.20	51.06	5.72	0.10	0.04	Average
6	0.272	9.97	-51.09	61.06	9.83	0.10	0.04	QP
7	1.030	7.92	-48.08	56.00	7.78	0.10	0.04	QP
8	1.030	3.88	-42.12	46.00	3.74	0.10	0.04	Average
9	1.670	4.19	-41.81	46.00	4.02	0.10	0.07	Average
10	1.670	8.39	-47.61	56.00	8.22	0.10	0.07	QP
11	4.620	5.06	-40.94	46.00	4.70	0.20	0.16	Average
12	4.620	9.02	-46.98	56.00	8.66	0.20	0.16	QP

- CH 78 / 2480MHz
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 25.5°C
- Relative Humidity: 55 %

Line

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.159	16.45	-49.07	65.52	16.31	0.10	0.04	QP
2	0.159	14.69	-40.83	55.52	14.55	0.10	0.04	Average
3	0.252	4.16	-47.53	51.69	4.02	0.10	0.04	Average
4	0.252	8.20	-53.49	61.69	8.06	0.10	0.04	QP
5	0.779	4.05	-41.95	46.00	3.90	0.10	0.05	Average
6	0.779	7.83	-48.17	56.00	7.68	0.10	0.05	QP
7	1.640	8.89	-47.11	56.00	8.72	0.10	0.07	QP
8	1.640	4.56	-41.44	46.00	4.39	0.10	0.07	Average
9	2.460	4.33	-41.67	46.00	4.13	0.10	0.10	Average
10	2.460	8.24	-47.76	56.00	8.04	0.10	0.10	QP
11	4.140	8.87	-47.13	56.00	8.63	0.10	0.14	QP
12	4.140	4.64	-41.36	46.00	4.40	0.10	0.14	Average

Neutral

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.159	16.45	-49.07	65.52	16.31	0.10	0.04	QP
2	0.159	14.69	-40.83	55.52	14.55	0.10	0.04	Average
3	0.252	4.16	-47.53	51.69	4.02	0.10	0.04	Average
4	0.252	8.20	-53.49	61.69	8.06	0.10	0.04	QP
5	0.779	4.05	-41.95	46.00	3.90	0.10	0.05	Average
6	0.779	7.83	-48.17	56.00	7.68	0.10	0.05	QP
7	1.640	8.89	-47.11	56.00	8.72	0.10	0.07	QP
8	1.640	4.56	-41.44	46.00	4.39	0.10	0.07	Average
9	2.460	4.33	-41.67	46.00	4.13	0.10	0.10	Average
10	2.460	8.24	-47.76	56.00	8.04	0.10	0.10	QP
11	4.140	8.87	-47.13	56.00	8.63	0.10	0.14	QP
12	4.140	4.64	-41.36	46.00	4.40	0.10	0.14	Average

Test Engineer: 

John Huang

5.8.4 Photographs of Conducted Emission Test Configuration

- The photographs show the configuration that generates the maximum emission.

FRONT VIEW

REAR VIEW

SIDE VIEW

5.9 Test of Radiated Emission

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defines in ANSI C63.4-2001. The EUT was placed on a nonmetallic stand, 0.8 meter above the ground plane, as shown in section 5.9.3. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions

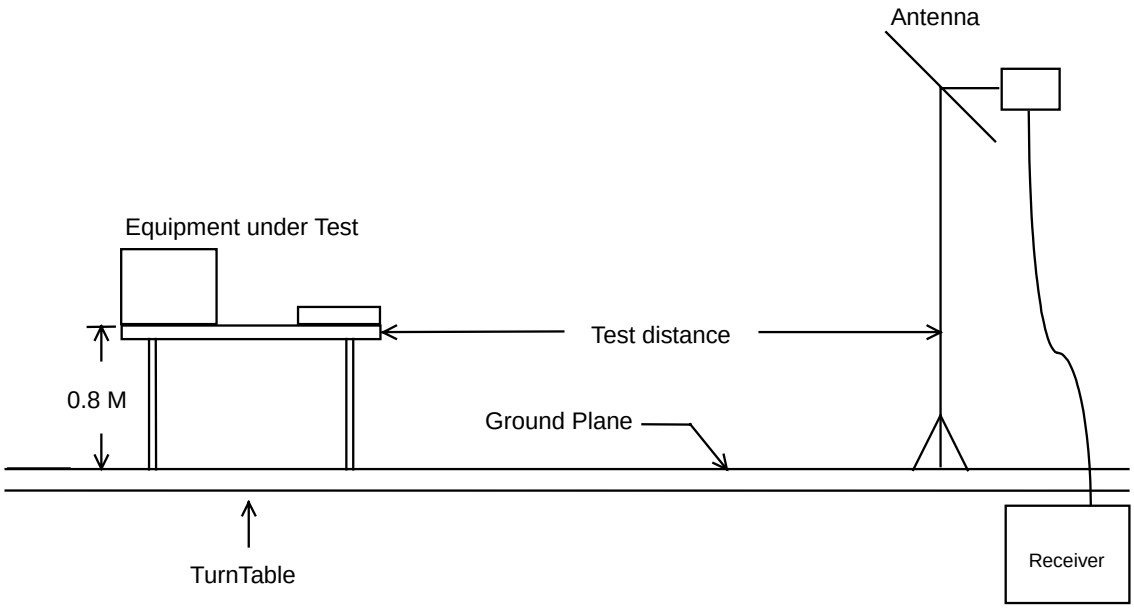
5.9.1 Major Measuring Instruments

● Amplifier	(MITEQ AFS44)
RF Gain	40 dB
Signal Input	100 MHz to 26.5 GHz
● Amplifier	(HP 8447D)
RF Gain	30 dB
Signal Input	100 KHz to 1.3 GHz
● Spectrum analyzer	(R&S FSP40)
Attenuation	10 dB
Start Frequency	1 GHz
Stop Frequency	25 GHz
Resolution Bandwidth	1 MHz
Video Bandwidth	1 MHz
Signal Input	9 KHz to 40 GHz
● Test Receiver	(SCHAFFNER SCR3501)
Resolution Bandwidth	120 KHz
Frequency Band	9 K – 1 GHz
Quasi-Peak Detector	ON for Quasi-Peak Mode
	OFF for Peak Mode

5.9.2 Test Procedures

1. The EUT was placed on a rotatable table top 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
5. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

5.9.3 Typical Test Setup Layout of Radiated Emission



5.9.4 Test Result of Radiated Emission

- CH 00 / 2402 MHz
- Temperature: 27 °C
- Relative Humidity: 63 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

■ Spurious Emission

Horizontal

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	98.340	20.85	-22.65	43.50	37.37	9.65	1.73	27.90	Peak	---	---
2	105.140	21.54	-21.96	43.50	37.52	10.13	1.78	27.89	Peak	---	---
3	159.030	23.07	-20.43	43.50	36.04	12.65	2.16	27.78	Peak	---	---
1	336.000	27.85	-18.15	46.00	37.03	15.12	3.18	27.48	Peak	---	---
2	528.000	28.50	-17.50	46.00	35.52	17.59	4.12	28.73	Peak	---	---
3	566.400	27.93	-18.07	46.00	34.29	18.17	4.24	28.77	Peak	---	---

Vertical

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	30.000	27.10	-12.90	40.00	39.76	14.47	0.92	28.05	Peak	100	108
2	37.820	23.40	-16.60	40.00	38.17	12.19	1.07	28.03	Peak	---	---
3	125.710	25.65	-17.85	43.50	40.75	11.03	1.72	27.85	Peak	---	---
1	528.000	29.79	-16.21	46.00	36.81	17.59	4.12	28.73	Peak	---	---
2	566.400	26.92	-19.08	46.00	33.28	18.17	4.24	28.77	Peak	---	---
3	672.000	30.95	-15.05	46.00	35.80	19.23	4.65	28.73	Peak	---	---

➢ For 5GHz ~ 25GHz

Remark: Frequency from 5000MHz to 25000MHz, the emission emitted by the EUT is too low to be measured.

5.9.5 Test Result of Radiated Emission

- CH 00 / 2402 MHz
- Temperature: 27 °C
- Relative Humidity: 63 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

■ Spurious Emission

Horizontal

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1198.000	43.90	-30.10	74.00	55.37	24.60	4.24	40.31	Peak	---	---
2	1198.000	32.08	-21.92	54.00	43.55	24.60	4.24	40.31	Average	---	---
3 X	2398.000	62.61			69.33	28.22	6.21	41.15	Average	---	---
4 X	2398.000	82.63			89.35	28.22	6.21	41.15	Peak	---	---

Vertical

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1198.000	38.98	-35.02	74.00	50.45	24.60	4.24	40.31	Peak	---	---
2	1198.000	28.68	-25.32	54.00	40.15	24.60	4.24	40.31	Average	---	---
3 X	2404.000	67.12			73.83	28.23	6.21	41.15	Average	---	---
4 X	2404.000	86.47			93.18	28.23	6.21	41.15	Peak	---	---
1	4804.000	50.72	-23.28	74.00	50.98	33.03	9.05	42.34	Peak	---	---
2	4804.000	37.73	-16.27	54.00	37.99	33.03	9.05	42.34	Average	---	---

Remark : X : Fundamental Frequency

Test Engineer: Steve

Steve Chen

- CH 39 / 2441 MHz
- Temperature: 27 °C
- Relative Humidity: 63 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

■ Spurious Emission

Horizontal

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	98.340	21.31	-22.19	43.50	37.83	9.65	1.73	27.90	Peak	---	---
2	105.310	21.20	-22.30	43.50	37.17	10.14	1.78	27.89	Peak	---	---
3	159.030	23.25	-20.25	43.50	36.22	12.65	2.16	27.78	Peak	---	---
1	336.000	27.90	-18.10	46.00	37.08	15.12	3.18	27.48	Peak	---	---
2	528.000	29.53	-16.47	46.00	36.55	17.59	4.12	28.73	Peak	---	---
3	566.400	28.74	-17.26	46.00	35.10	18.17	4.24	28.77	Peak	---	---

Vertical

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	30.000	28.06	-11.94	40.00	40.72	14.47	0.92	28.05	Peak	100	125
2	124.350	25.89	-17.61	43.50	41.05	10.93	1.76	27.85	Peak	---	---
3	135.910	25.20	-18.30	43.50	39.48	11.59	1.96	27.83	Peak	---	---
1	528.000	29.99	-16.01	46.00	37.01	17.59	4.12	28.73	Peak	---	---
2	624.000	26.74	-19.26	46.00	32.27	18.89	4.36	28.78	Peak	---	---
3	672.000	29.61	-16.39	46.00	34.46	19.23	4.65	28.73	Peak	---	---

➢ For 5GHz ~ 25GHz

Remark: Frequency from 5000MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

- CH 39 / 2441 MHz
- Temperature: 27 °C
- Relative Humidity: 63 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

■ Spurious Emission

Horizontal

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1220.000	43.13	-30.87	74.00	54.54	24.65	4.27	40.33	Peak	---	---
2	1220.000	30.79	-23.21	54.00	42.20	24.65	4.27	40.33	Average	---	---
3 X	2438.000	76.45			83.06	28.30	6.26	41.17	Peak	---	---
4 X	2438.000	57.45			64.06	28.30	6.26	41.17	Average	---	---

Vertical

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1220.000	38.80	-35.20	74.00	50.21	24.65	4.27	40.33	Peak	---	---
2	1220.000	28.71	-25.29	54.00	40.12	24.65	4.27	40.33	Average	---	---
3 X	2438.000	84.49			91.10	28.30	6.26	41.17	Peak	---	---
4 X	2438.000	64.76			71.37	28.30	6.26	41.17	Average	---	---

Remark : X : Fundamental Frequency

Test Engineer: Steve

Steve Chen

- CH 78 / 2480 MHz
- Temperature: 27 °C
- Relative Humidity: 63 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

■ Spurious Emission

Horizontal

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	98.340	21.30	-22.20	43.50	37.82	9.65	1.73	27.90	Peak	---	---
2	104.460	21.75	-21.75	43.50	37.78	10.08	1.78	27.89	Peak	---	---
3	157.670	23.16	-20.34	43.50	36.17	12.61	2.16	27.78	Peak	---	---
1	336.000	27.85	-18.15	46.00	37.03	15.12	3.18	27.48	Peak	---	---
2	528.000	28.43	-17.57	46.00	35.45	17.59	4.12	28.73	Peak	---	---
3	569.600	28.32	-17.68	46.00	34.60	18.25	4.24	28.77	Peak	---	---

Vertical

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	31.700	26.59	-13.41	40.00	39.87	13.78	0.98	28.04	Peak	100	121
2	39.860	24.45	-15.55	40.00	39.57	11.74	1.16	28.02	Peak	---	---
3	125.540	25.49	-18.01	43.50	40.60	11.02	1.72	27.85	Peak	---	---
1	528.000	29.44	-16.56	46.00	36.46	17.59	4.12	28.73	Peak	---	---
2	672.000	29.95	-16.05	46.00	34.80	19.23	4.65	28.73	Peak	---	---
3	777.600	27.34	-18.66	46.00	30.91	20.21	5.00	28.78	Peak	---	---

➢ For 5GHz ~ 25GHz

Remark: Frequency from 5000MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

- CH 78 / 2480 MHz
- Temperature: 27 °C
- Relative Humidity: 63 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

■ Spurious Emission

Horizontal

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1238.000	44.31	-29.69	74.00	55.66	24.70	4.30	40.35	Peak	---	---
2	1238.000	32.36	-21.64	54.00	43.71	24.70	4.30	40.35	Average	---	---
3 X	2478.000	75.87			82.37	28.38	6.31	41.19	Peak	---	---
4 X	2478.000	57.05			63.55	28.38	6.31	41.19	Average	---	---

Vertical

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1238.000	39.24	-34.76	74.00	50.59	24.70	4.30	40.35	Peak	---	---
2	1238.000	29.27	-24.73	54.00	40.62	24.70	4.30	40.35	Average	---	---
3 X	2478.000	79.23			85.73	28.38	6.31	41.19	Peak	---	---
4 X	2478.000	58.97			65.47	28.38	6.31	41.19	Average	---	---

Remark : X : Fundamental Frequency

Test Engineer: Steve

Steve Chen

5.9.6 Photographs of Radiated Emission Test Configuration

- The photographs show the configuration that generates the maximum emission.

FRONT VIEW

REAR VIEW

6 EMI Suppression Component List

No EMI suppression components.

7 Antenna Requirements

The EUT use a ceramic antenna without connector. It is considered meet antenna requirement of FCC.

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

8 RF Exposure

FCC Rules and Regulations Part 1.1307,1.1310,2.1091,2.1093:

RF Exposure Compliance

Limit For Maximum Permissible Exposure (MPE)

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

F=frequency in MHz *Plane-wave equivalent power density

MPE Calculations

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

E＝Electric field (V/m)

P＝Peak output power (mW)

G＝Antenna numeric gain (numeric)

d＝Separation distance (m)

Because the EUT is belong to General Population/ Uncontrolled Exposure. So the Limit of Power Density is 10 W/m^2. We can change the formula to:

$$d = \sqrt{\frac{30 \times P \times G}{377}}$$

Channel NO.	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated RF Exposure Separation Distance (cm)	Minimum RF Exposure Separation Distance (cm)
Channel 00	2.00	1.58	0.27	1.064143018	0.53	20
Channel 39	2.00	1.58	0.09	1.020939484	0.50	20
Channel 78	2.00	1.58	-1.36	0.731139083	0.42	20

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation. Proposed RF exposure safety information to include in User's Manual.

9 Antenna Factor & Cable Loss

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)	Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)
30	15.35	0.92	1000	24.10	1.92
35	13.23	1.05	2000	27.40	2.65
40	11.11	1.08	3000	30.00	2.85
45	8.58	1.15	4000	32.60	4.07
50	6.47	1.39	5000	33.40	4.20
55	5.83	1.63	6000	34.20	4.70
60	5.18	1.30	7000	35.30	5.22
65	4.81	1.36	8000	36.90	5.72
70	4.43	1.43	9000	38.10	6.07
75	5.17	1.48	10000	39.00	6.72
80	5.91	1.53	11000	38.60	6.84
85	7.33	1.61	12000	39.50	7.08
90	8.74	1.69	13000	39.30	7.61
95	9.08	1.67	14000	41.60	7.75
100	9.36	1.76	15000	40.60	7.58
110	9.65	1.80	16000	37.20	8.05
120	9.97	1.90	17000	40.20	8.28
130	10.51	1.61	18000	36.70	8.26
140	10.32	2.14	19000	37.60	8.70
150	9.42	2.16	20000	37.30	9.15
160	8.09	2.16	21000	37.00	9.50
170	7.43	1.99	22000	38.00	10.02
180	7.60	2.39	23000	38.70	10.18
190	7.43	2.38	24000	38.60	10.02
200	7.26	2.46	25000	38.90	10.27
220	9.11	2.59			
240	10.88	2.68			
260	11.75	2.91			
280	11.55	2.92			
300	11.36	2.99			
320	12.03	3.03			
340	12.69	3.22			
360	13.33	3.28			
380	14.00	3.80			
400	14.63	3.80			
450	15.33	3.70			
500	16.03	3.93			
550	16.59	4.23			
600	17.29	4.15			
650	17.64	4.57			
700	18.00	4.73			
750	18.40	4.87			
800	18.79	4.99			
850	19.11	5.05			
900	19.42	5.28			
950	19.59	5.50			
1000	19.75	5.62			

10 List of Measuring Equipments Used

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMC Receiver	R&S	ESCS 30	100132	9 KHz – 2.75 GHz	Jun. 12, 2003	Conduction (CO01-HY)
LISN	MessTec	NNB-2/16Z	2001-008	9 KHz – 30 MHz	Apr. 29, 2003	Conduction (CO01-HY)
LISN (Support Unit)	MessTec	NNB-2/16Z	2001-009	9 KHz – 30 MHz	Apr. 29, 2003	Conduction (CO01-HY)
EMI Filter	LINDGREN	LRE-2060	1004	< 450 Hz	N/A	Conduction (CO01-HY)
EMI Filter	LINDGREN	N6006	201052	0 ~ 60 Hz	N/A	Conduction (CO01-HY)
RF Cable-CON	Suhner Switzerland	RG223/U	CB029	9KHz~30MHz	Jan. 07, 2003	Conduction (CO01-HY)
50 ohm BNC type Terminal	NOBLE	50ohm	TM013	50 ohm	Apr. 24, 2003	Conduction (CO01-HY)
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz~1GHz 3m	Jun. 21, 2003	Radiation (03CH03-HY)
Spectrum analyzer	R&S	FSP40	100004	9KHZ~40GHz	Aug. 23, 2003	Radiation (03CH03-HY)
Amplifier	HP	8447D	2944A09072	100KHz – 1.3GHz	Nov. 05, 2003	Radiation (03CH03-HY)
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz~1GHz	Jan. 02, 2003	Radiation (03CH03-HY)
Amplifier	MITEQ	AFS44	879981	100MHz~26.5GHz	Jul. 23, 2003	Radiation (03CH03-HY)
Horn Antenna	COM-POWER	3115	6741	1GHz – 18GHz	Apr. 08, 2003	Radiation (03CH03-HY)
Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A	Radiation (03CH03-HY)
Horn Antenna	Schwarzbeck	BBHA9170	154	15GHz~40GHz	Jun. 02, 2003	Radiation (03CH03-HY)
RF Cable-HIGH	Jye Bao	RG142	CB030-HIGH	1GHz~29.5GHz	Mar. 14, 2003	Radiation (03CH03-HY)
RF Cable-HIGH	Jye Bao	RG142	CB030-HIGH	1GHz~29.5GHz	Mar. 14, 2003	Radiation (03CH03-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Spectrum analyzer	R&S	FSP7	838858/014	9KHZ~7GHZ	Sep. 03, 2003	Conducted
Power meter	R&S	NRVS	100444	DC~40GHz	May 28, 2003	Conducted
Power sensor	R&S	NRV-Z55	100049	DC~40GHz	May 28, 2003	Conducted
Power Sensor	R&S	NRV-Z32	100057	30MHz-6GHz	May 28, 2003	Conducted
AC power source	HPC	HPA-500W	HPA-9100024	AC 0~300V	May 27, 2003	Conducted
AC power source	G.W.	GPC-6030D	C671845	DC 1V~60V	Nov. 06, 2003	Conducted
Temp. and Humidity Chamber	KSON	THS-C3L	612	N/A	Oct. 01, 2003	Conducted
RF CABLE-1m	Jye Bao	RG142	CB034-1m	20MHz~7GHz	Jan. 01, 2003	Conducted
RF CABLE-2m	Jye Bao	RG142	CB035-2m	20MHz~1GHz	Jan. 01, 2003	Conducted

※ Calibration Interval of instruments listed above is one year.

11 Uncertainty of Test Site

Uncertainty of Radiated Emission Measurement

Contribution	Probability Distribution	3m
Antenna factor calibration	normal(k=2)	±1
cable loss calibration	normal(k=2)	±0.3
RCV/SPA specification	rectangular	±2
Antenna Directivity	rectangular	±3
Antenna Factor V.S. Height	rectangular	±2
Antenna Factor Interpolation for Frequency	rectangular	±0.25
site imperfection	rectangular	±2
Mismatch Receiver VSWR Γ1=0.09 Antenna VSWR Γ2=0.67 Uncertainty=20log(1-Γ1*Γ2)	U-shaped	±0.54
combined standard uncertainty Ue(y)	normal	±2.7
Measuring uncertainty for a level of confidence of 95% U=2Ue(y)	normal (k=2)	±5.4

$U=\sqrt{\{(1/2)^2+(0.3/2)^2+(2^2+0.5^2+2^2+0.25^2+2^2)/3+(0.54)^2/2\}}=2.2$ for 10m test distance

$U=\sqrt{\{(1/2)^2+(0.3/2)^2+(2^2+3^2+2^2+0.25^2+2^2)/3+(0.54)^2/2\}}=2.7$ for 3m test distance

Uncertainty of Conducted Emission Measurement

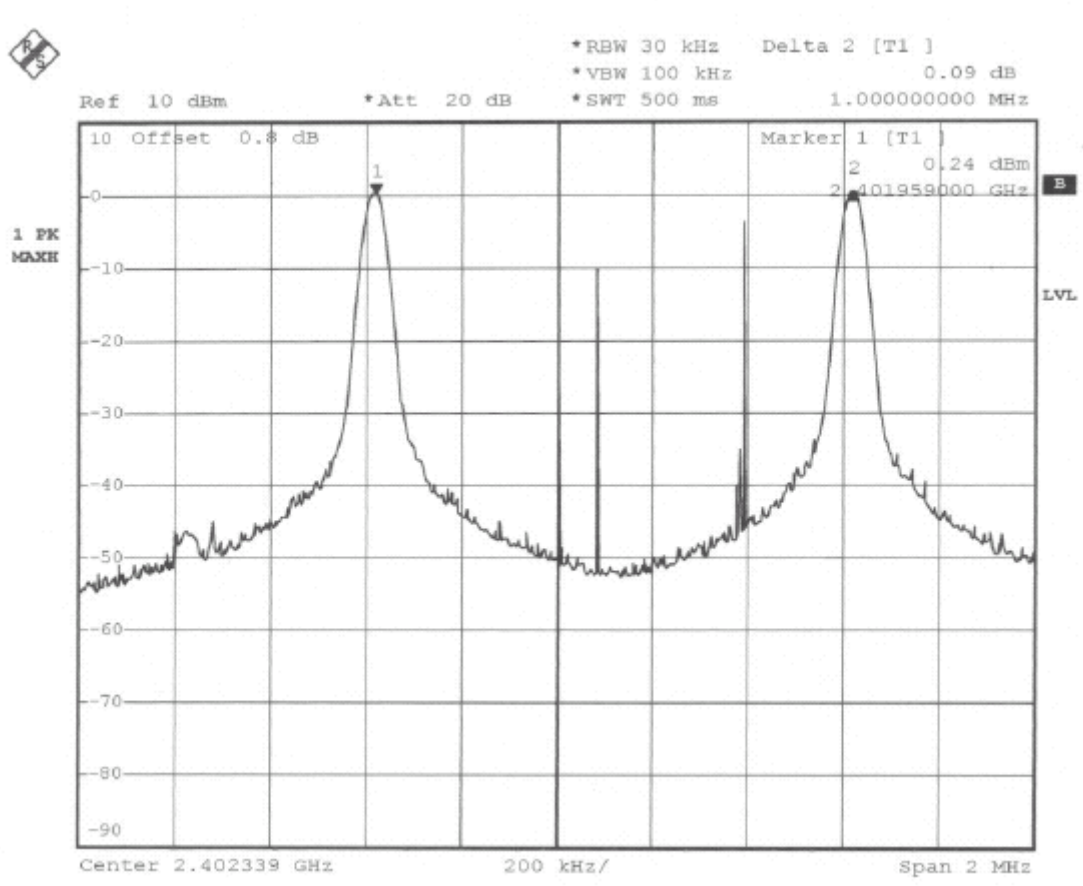
Contribution	Probability Distribution	150KHz – 30MHz
Cable and I/P attenuator calibration	normal(k=2)	±0.3
RCV/SPA specification	rectangular	±2
LISN coupling specification	rectangular	±1.5
Transducer factor frequency interpolation	rectangular	±0.2
Mismatch Receiver VSWR Γ1=0.09 LISN VSWR Γ2=0.33 Uncertainty=20log(1-Γ1*Γ2)	U-shaped	0.2
combined standard uncertainty Ue(y)	normal	±1.66
Measuring uncertainty for a level of confidence of 95% U=2Ue(y)	normal (k=2)	±3.32

$U=\sqrt{\{(0.3/2)^2+(2^2+1.5^2+0.2^2)/3+(0.2)^2/2\}}=1.66$

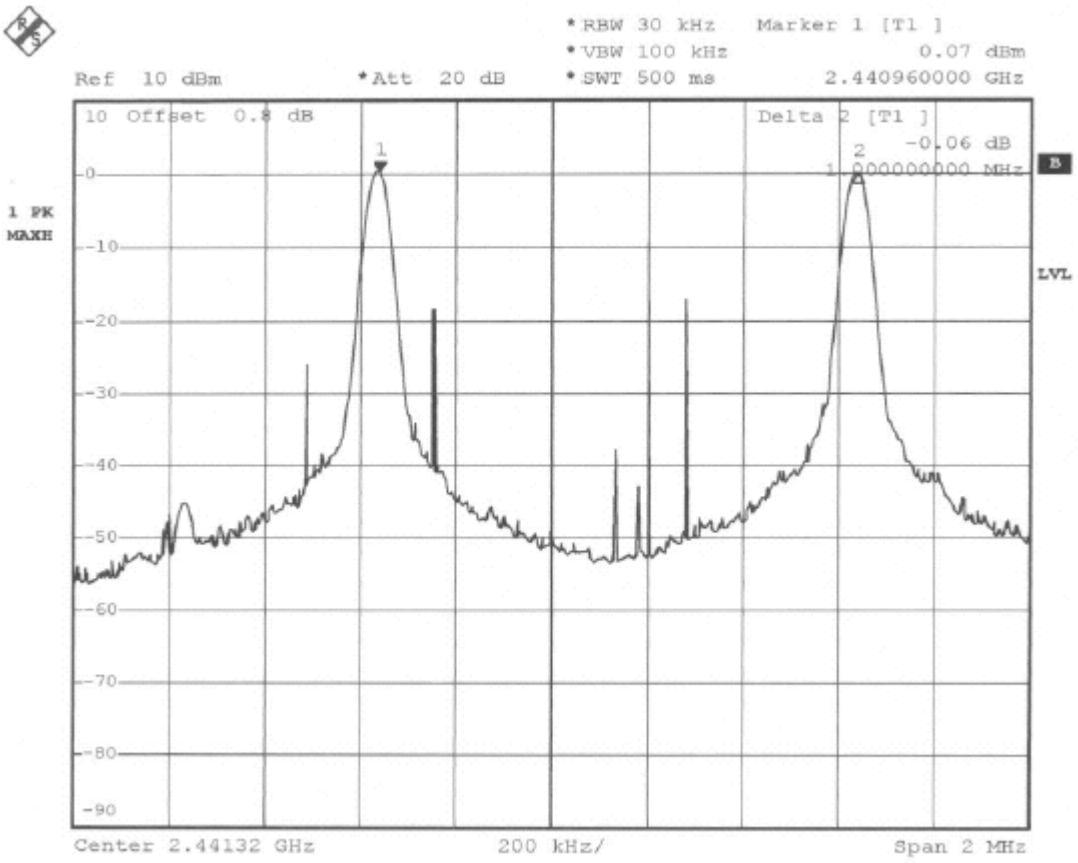
APPENDIX B. Test Pattern

1.1. Hopping Channel Separation

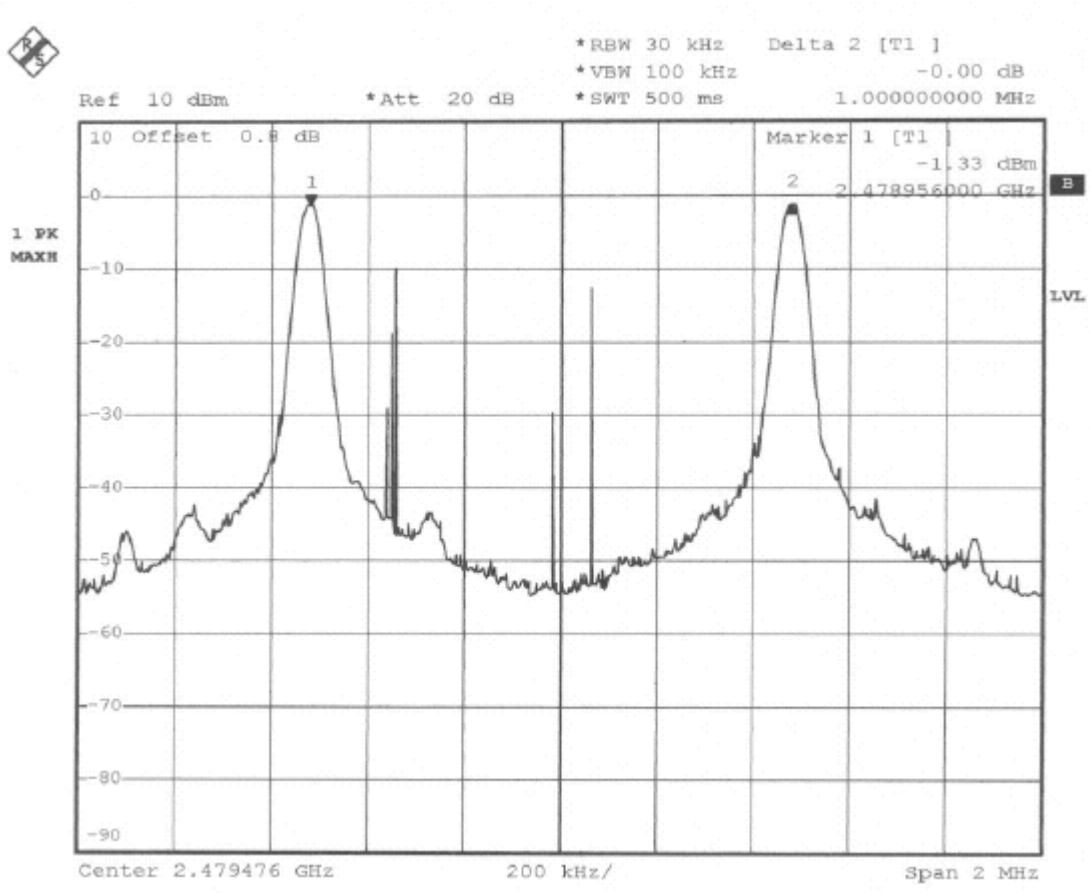
Plot1(Channel 00)：



Plot2(Channel 39)：



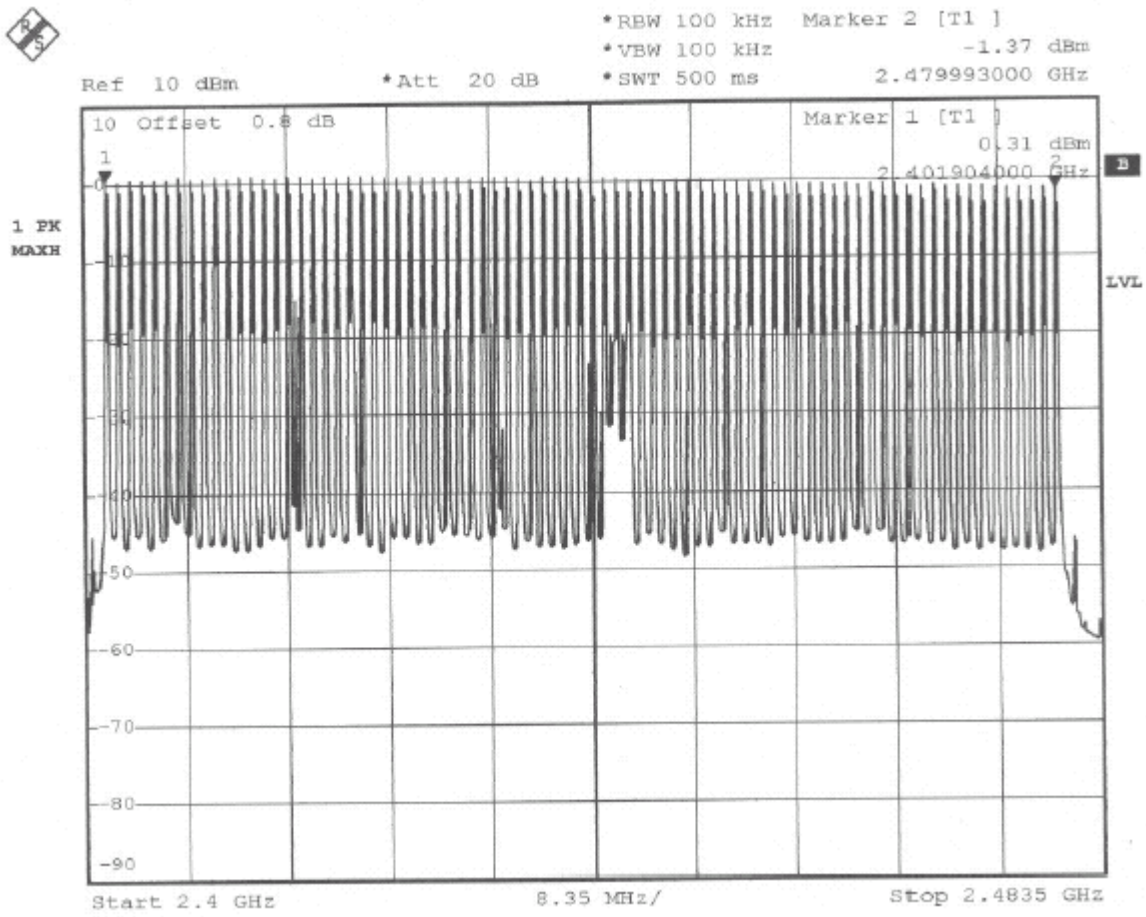
Plot3(Channel 78)：



Comments：6dB Emission bandwidth>500kHz

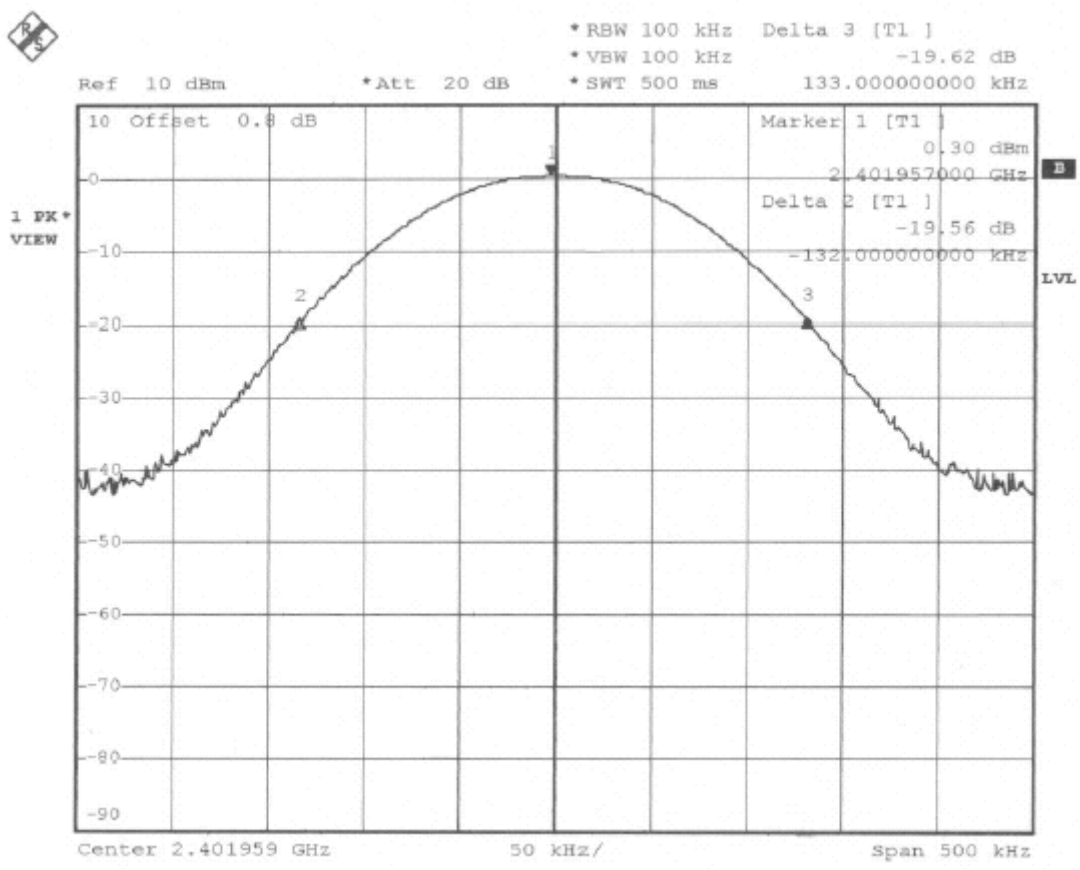
1.2. Number of Hopping Frequency

Plot1:

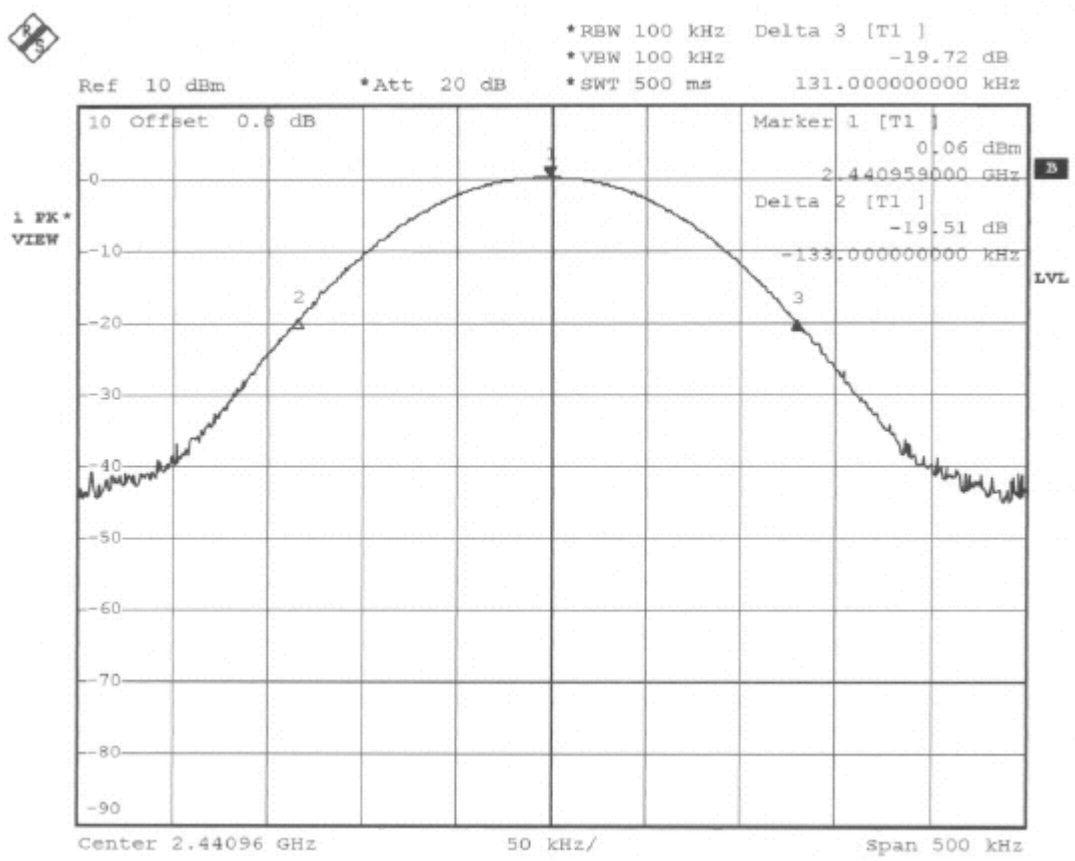


1.3. Hopping Channel Bandwidth

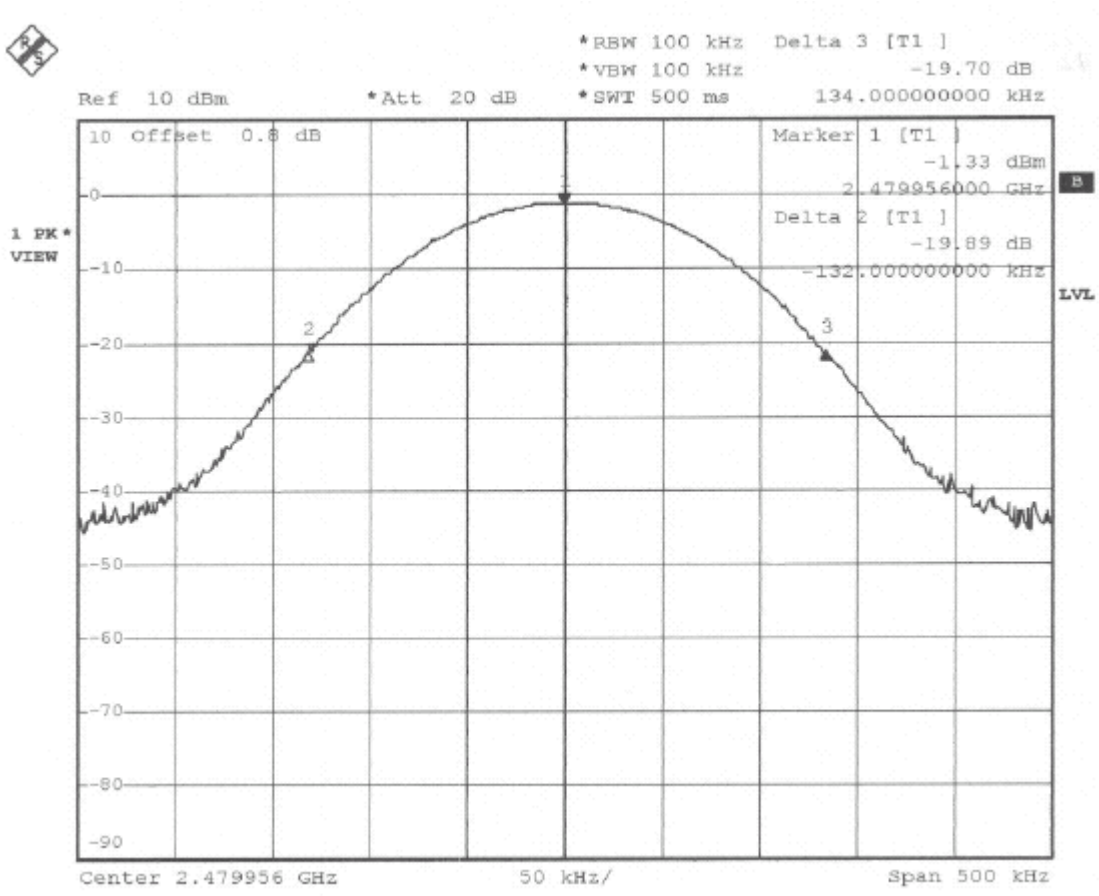
Plot1 (Channel 00)：



Plot2 (Channel 39)：



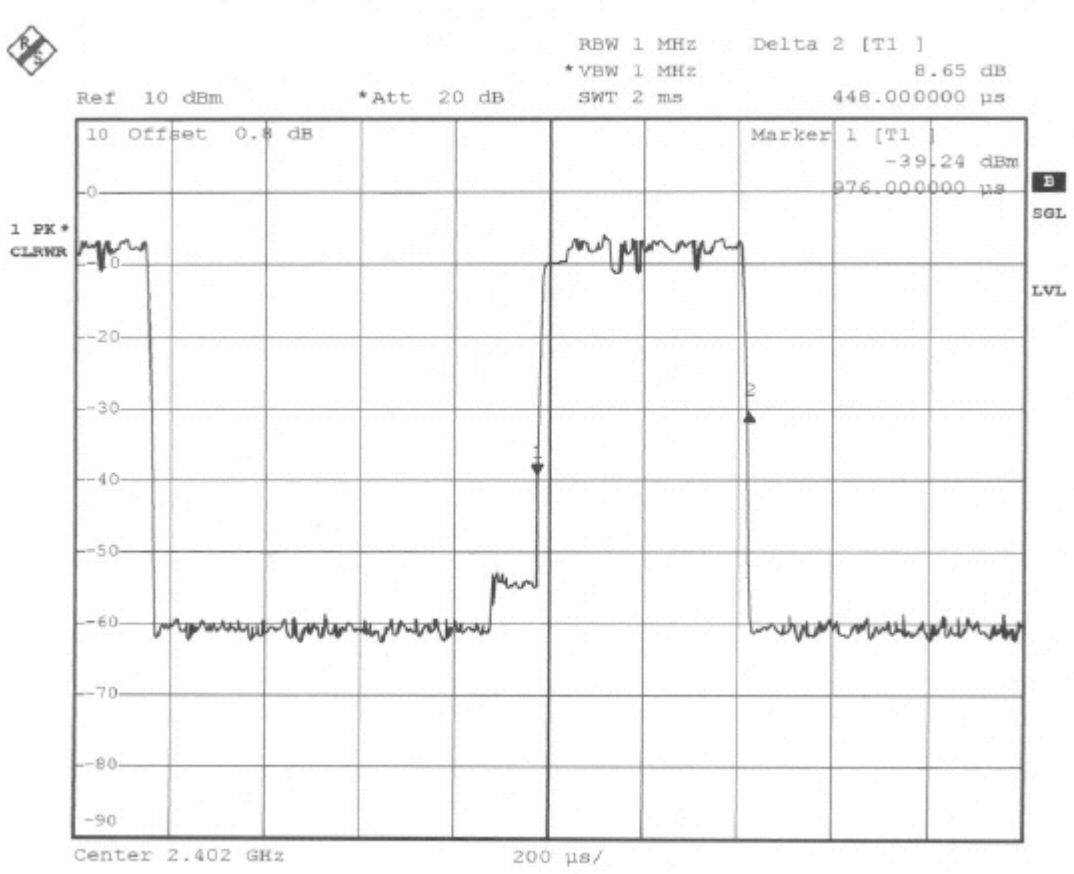
Plot3 (Channel 78)：



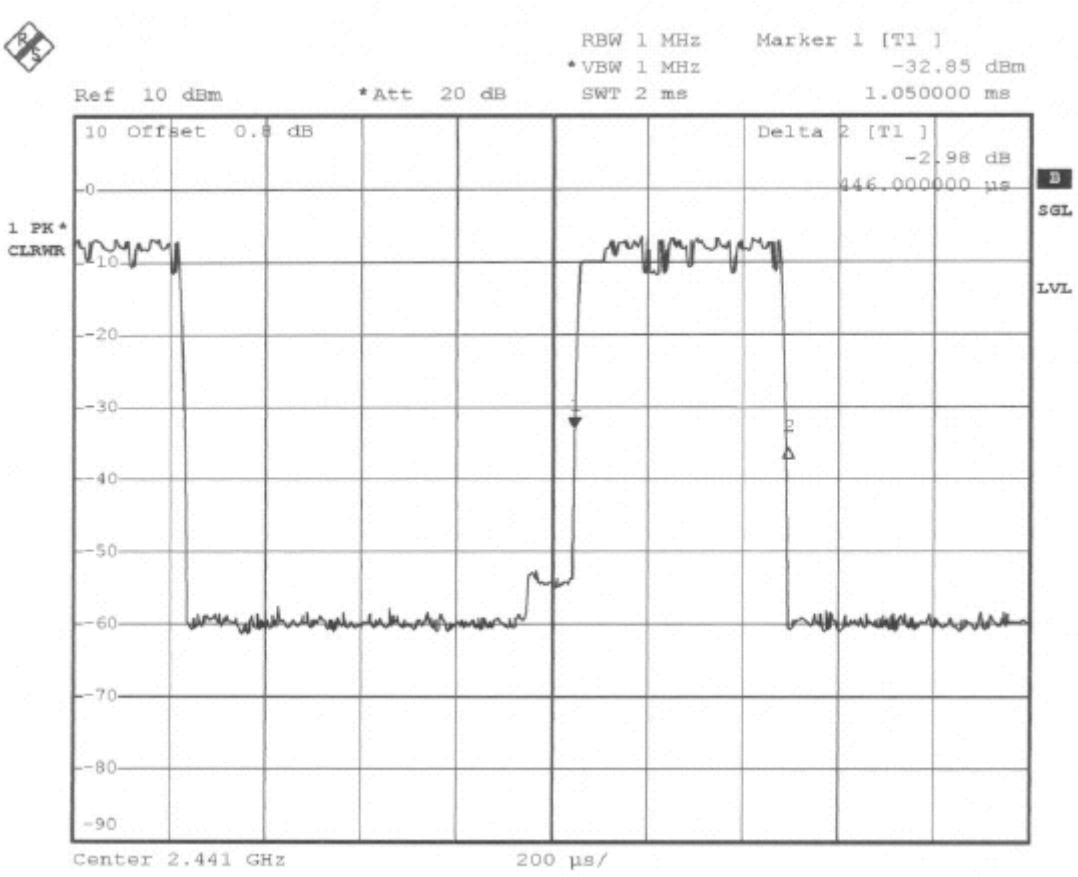
Comments： All emissions in any 100kHz bandwidth outside the band edge are attenuated more then 20dB from the carrier.

1.4. Dwell Time of Each Frequency within a 30 Seconds Period

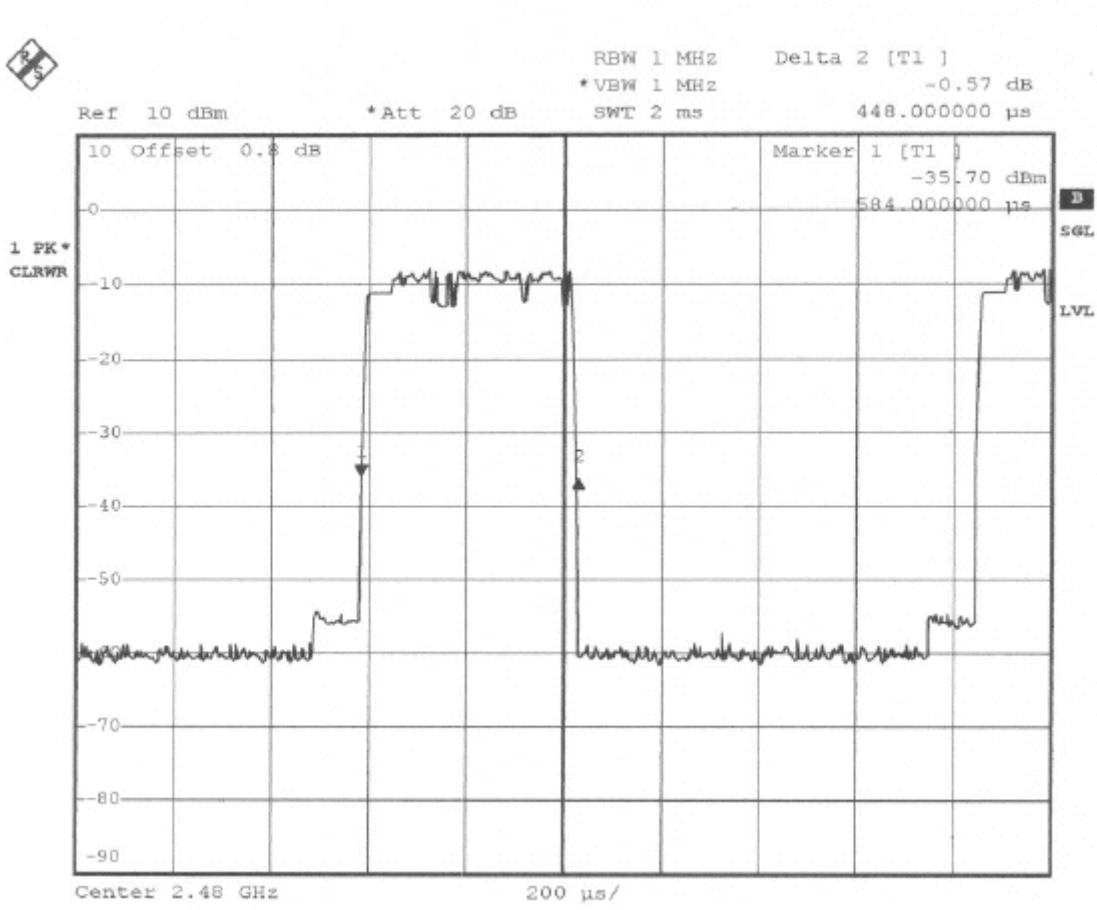
Plot1 (Channel 00)：



Plot2 (Channel 39)：

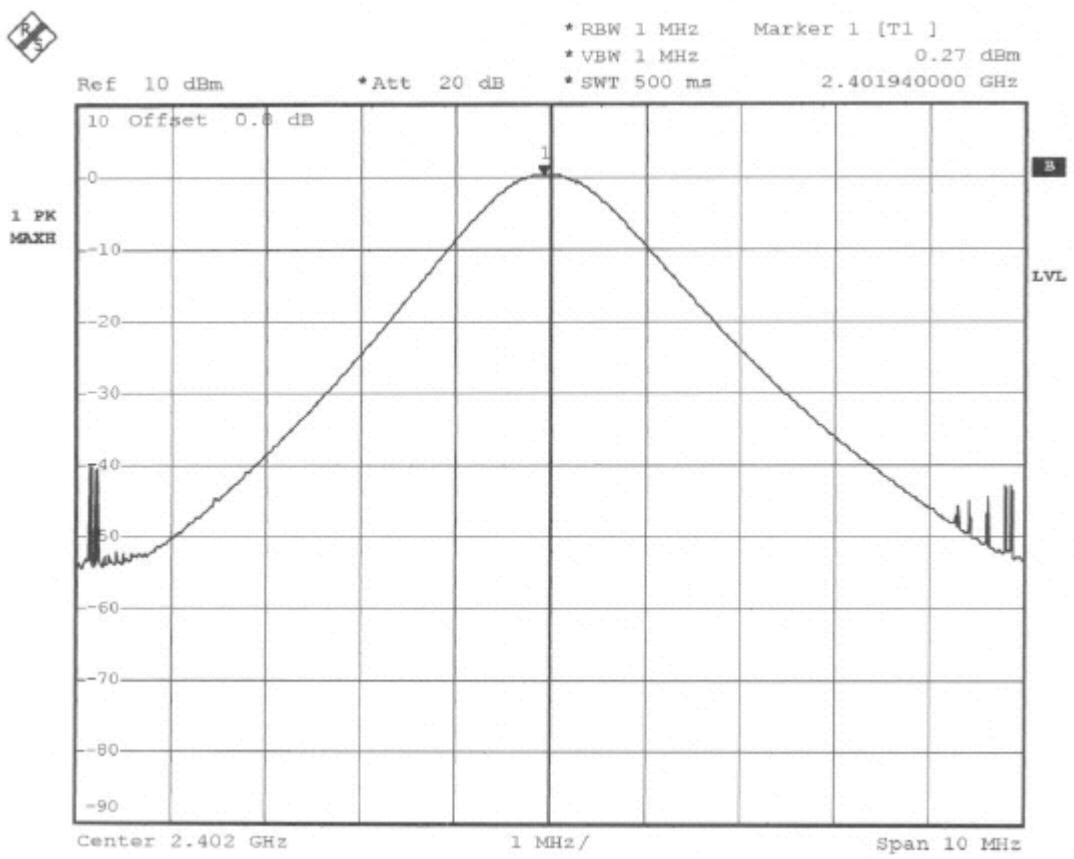


Plot3 (Channel 78)：

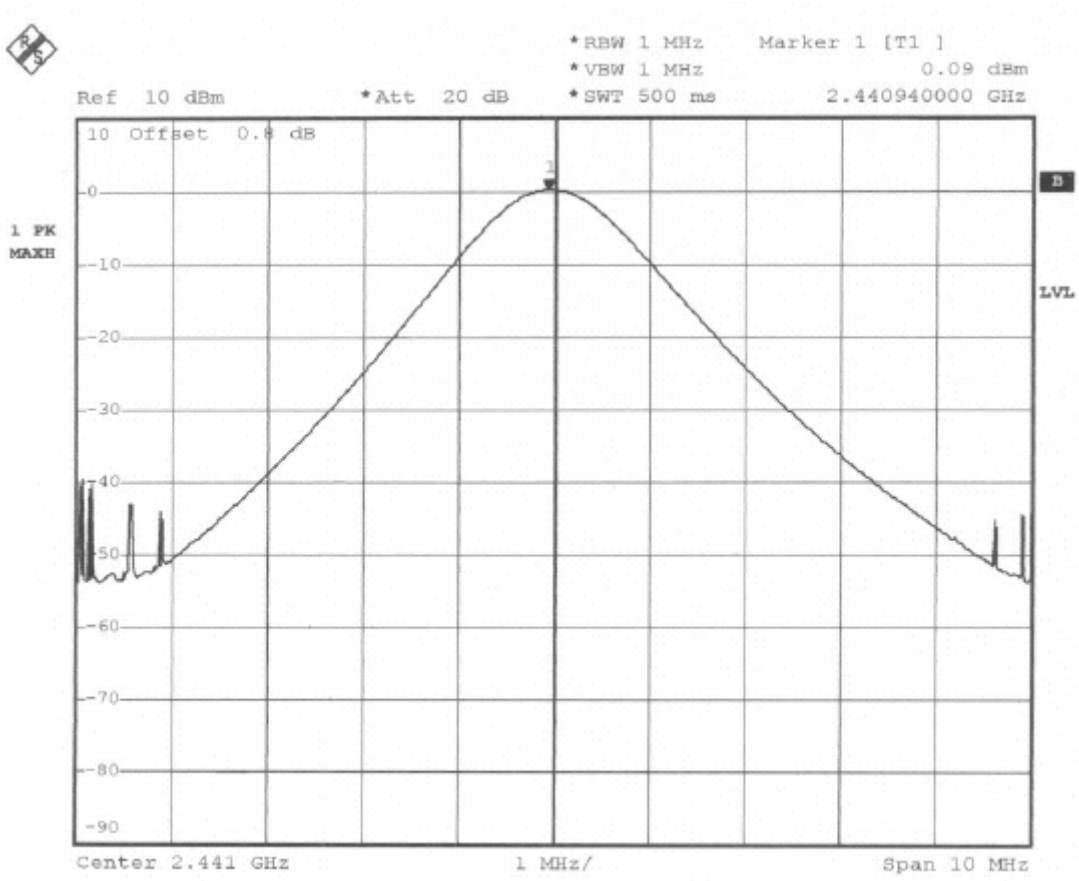


1.5. Output Power

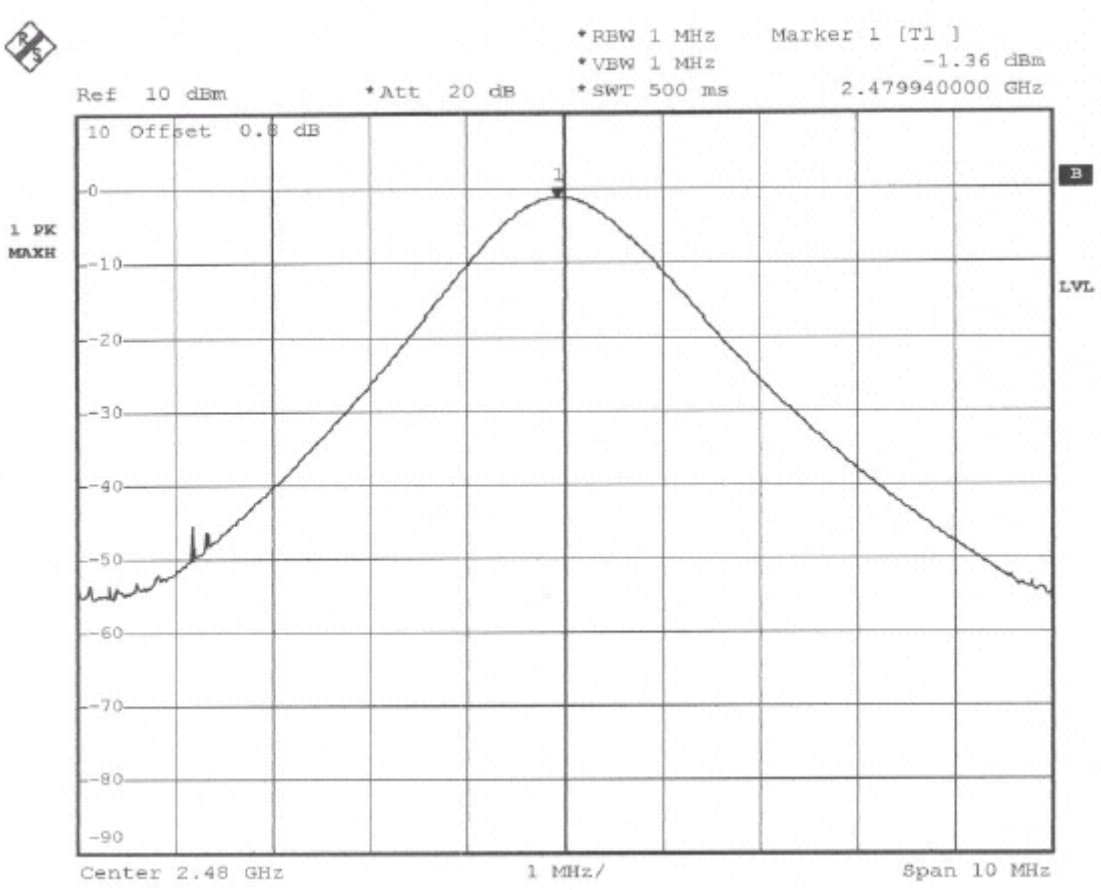
Plot1 (Channel 00)：



Plot2 (Channel 39)：

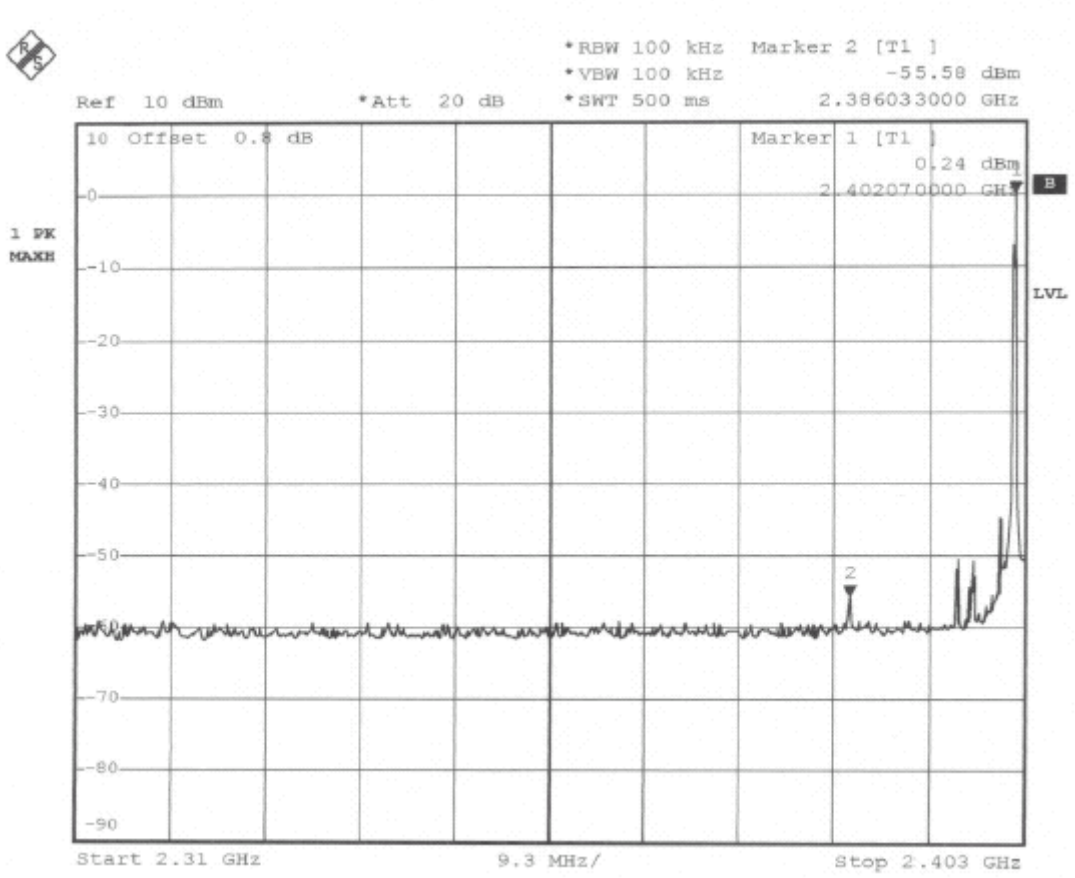


Plot3 (Channel 78)：



1.6. 100KHz Bandwidth of Frequency Band Edges

Plot1 (Channel 00)：



Plot2 (Channel 78)：