FCC TEST REPORT

for

47 CFR, Part 15, Subpart C

Equipment	:	Bluetooth CompactFlash Card
Model No.	:	PBTCF02C2CW
FCC ID	:	QQFPBTCF02C2CW
Filing Type	:	Certification
Applicant	:	**Windigo Systems** 2210 O'Toole Ave, Suite 200, San Jose, CA 95131, U.S.A.

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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: Dec. 31, 2002

■ No additional attachment.

☐ Additional attachment were issued as following record:

Attachment No.	Issue Date	Description

Certificate No. : F2N0613

CERTIFICATE OF COMPLIANCE

for

47 CFR, Part 15, Subpart C

Equipment	:	Bluetooth CompactFlash Card
Model No.	:	PBTCF02C2CW
FCC ID	:	QQFPBTCF02C2CW
Filing Type	:	Certification
Applicant	:	**Windigo Systems** 2210 O'Toole Ave., Suite 200, San Jose, CA 95131, U.S.A.

I **HEREBY** CERTIFY THAT:

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 - 1992** and the equipment under test was ***passed*** all test items required in FCC Part 15 subpart C, relative to the equipment under test. Testing was carried out on Nov. 18, 2002 at **SPORTON International Inc.** LAB.

K. J. Lin Dec. 31, 2002

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

Windigo Systems
2210, O'Toole Ave., Suite 200, San Jose, CA 95131, U.S.A.

1.2. Manufacturer

Wearnes Electronics (M) SDN. BHD
99, JALAN PARIT MASJID, 82000 PONTIAN JOHOR DARUL, TAKZIM MALAYSIA

1.3. Basic Description of Equipment under Test

Equipment	: Bluetooth CompactFlash Card
Model No.	: PBTCF02C2CW
Trade Name	: Windigo
Power Supply Type	: From PC

1.4. Feature of Equipment under Test

- RF Power Output : 4dBm
- Type of Modulation : GFSK
- Antenna（Type） : Integral (Build-In)
- Antenna Description : 2.4 GHZ Litmata SMD Bluetooth integrated low-profile, low-weight unit for automatic assembly antenna, size: 18.5 x 3.9x 1.0mm, Gain: 2 dBi
- Software: Blue Suit
- Channel Access Protocol: TDMA
- Channels of Operation: 79
- System Requirements: Windows CE 3.0 or later, Windows 98/SE, Windows ME, Windows NT, Windows 2000 or Windows XP, It is necessary to install the ActiveSync 3.1 or later on host PC and establish, a partnership between host PC and Pocket PC device before Pocket Monitor installation. Pleaser refer to ActiveSync and Pocket PC user manuals for more details regarding software installation.

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 associated with Notebook PC and peripherals pursuant to ANSI C63.4-1992 and configuration operated in a manner which tended to maximize its emission characteristics in a typical application.

b. The complete test system included GATEWAY PS2 Keyboard, LOGITECH USB Mouse, HP Printer, HITACHI Monitor and EUT for EMI test.

c. The EUT can operate on eleven channels from 2402.0MHz to 2483MHz. (as listed in section 1.4). According to 15.31(m), three channels (one near top, one near middle and one near bottom) were performed as following:
Mode 1: 2402MHz (Channel 00)
Mode 2: 2441MHz (Channel 39)
Mode 3: 2480MHz (Channel 78)

d. Frequency range investigated: conduction 450 KHz to 30 MHz, radiation 30 MHz to 24.83GHz.

2.2. Description of Test System

Support Unit 1. -- Monitor (HITACHI)

FCC ID	: N/A
Model No.	: CM823F
Power Supply Type	: Switching
Power Cord	: Shielded
Serial No.	: SP0026
Data Cable	: Shielded, 1.7m

Support Unit 2. -- USB Mouse (LOGITECH)

FCC ID	: N/A
Model No.	: M-BE58
Serial No.	: SP0108
Data Cable	: Shielded, 1.7m

Support Unit 3. -- Printer (HP)

FCC ID	: B94C2642X
Model No.	: DJ400
Power Supply Type	: Linear
Power Cord	: Non-Shielded
Serial No.	: SP0045
Data Cable	: Braided-Shielded, 1.35m

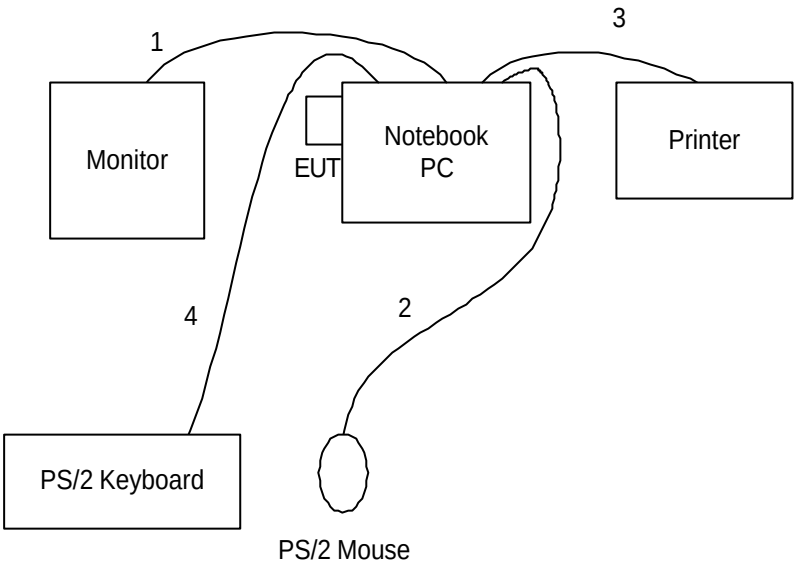
Support Unit 4. -- Notebook (DELL)

FCC ID	: N/A
Model No.	: PP01L
Power Supply Type	: Switching
Power Cord	: Non-Shielded
Serial No.	: 3F438A01
Data Cable	: Shielded
Remark	: This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

Support Unit 5. – Keyboard PS2 (GATEWAY)

FCC ID	: N/A
Model No.	: SK-9900U
Serial No.	: SP0020
Data Cable	: Shielded, 1.75m
Remark	: This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

2.3. Connection Diagram of Test System



1. The I/O cable is connected from PC to the support unit 1.
2. The I/O cable is connected from PC to the support unit 2.
3. The I/O cable is connected from PC to the support unit 3.
4. The I/O cable is connected from PC to the support unit 5

3. General Information of Test

3.1. Test Facility

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.	:	SH04

3.2. Test Voltage

115V/60Hz

3.3. Standard for Methods of Measurement

ANSI C63.4-1992

3.4. Test in Compliance with

FCC Part 15, Subpart C

3.5. Frequency Range Investigated

a. Conduction: from 150 kHz to 30 MHz
b. Radiation: from 30 MHz to 24.83GHz

3.6. Test Distance

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

3.7. Test Modes

The EUT can operate on eleven channels from 2402.0MHz to 2480.0MHz. (as listed in section 1.4) Above 1GHz, the EUT was tested on three different channels (Channel 00,39,78).

4. Report of Measurements and Examinations

4.1. List of Measurements and Examinations

FCC Rule	Description of Test	Result
15.107/15.207	Conducted Emission	Pass
15.247(a)(1)	Hopping Channel Separation	Pass
15.247(a)(1)(ii)	Number of Hopping Frequency Used	Pass
15.247(a)(1)(ii)	Hopping Channel Bandwidth	Pass
15.247(a)(1)(ii)	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
15.203	Antenna Requirement	Pass

4.2. Hopping Channel Separation

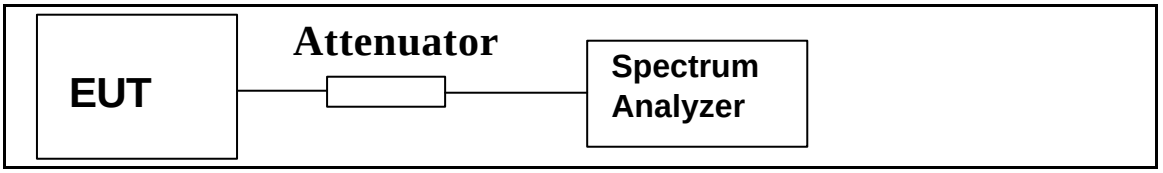
4.2.1. Measuring Instruments：

As described in chapter 6 of this test report.

4.2.2. 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 Separation is defined as the channel is separated with the next channel.

4.2.3. Test Setup Layout：

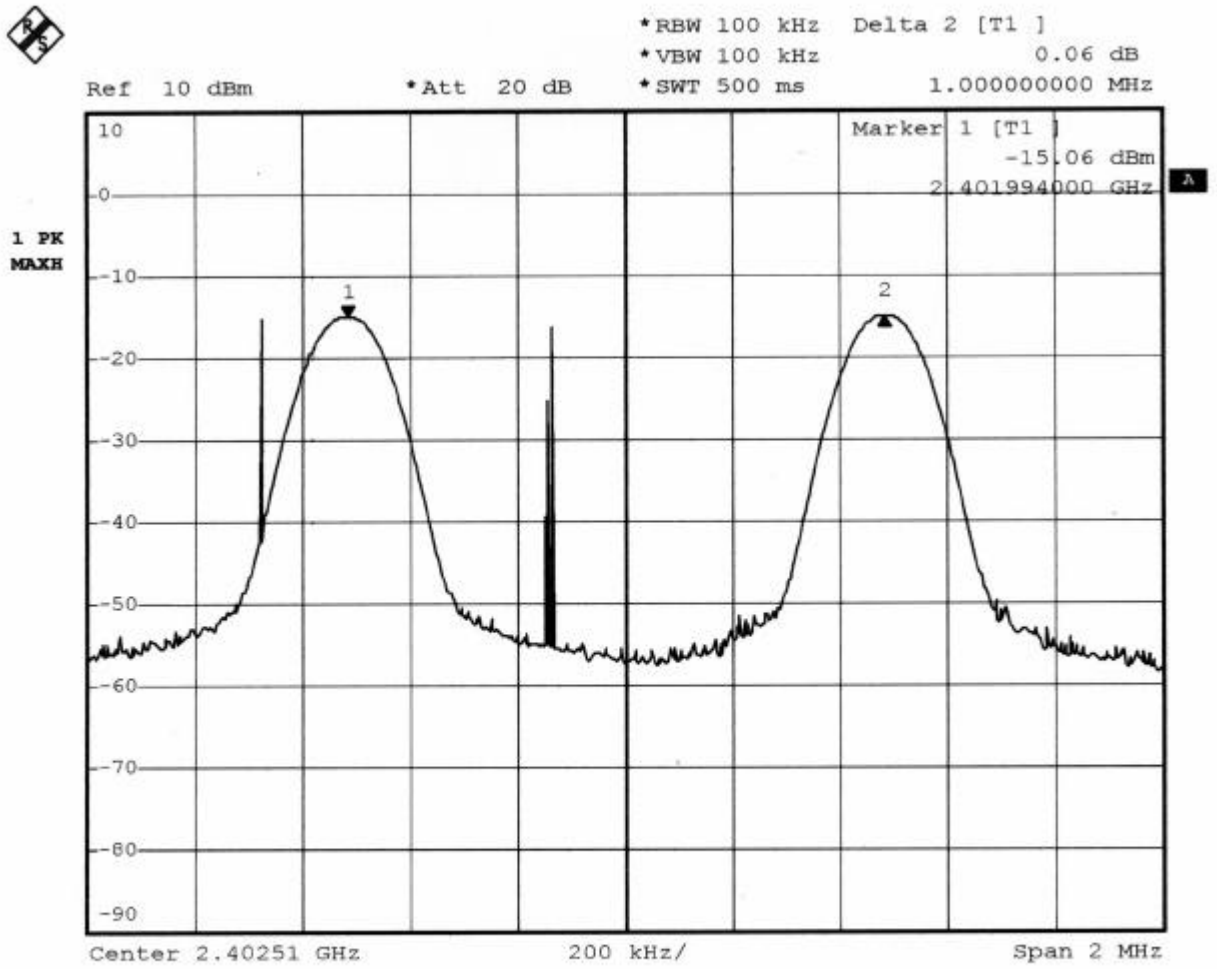


4.2.4. Test Result：The spectrum analyzer plots are attached as below

- Temperature: 25°C
- Relative Humidity: 53 %
- Duty cycle of the equipment during the test X ＝ 36%
-

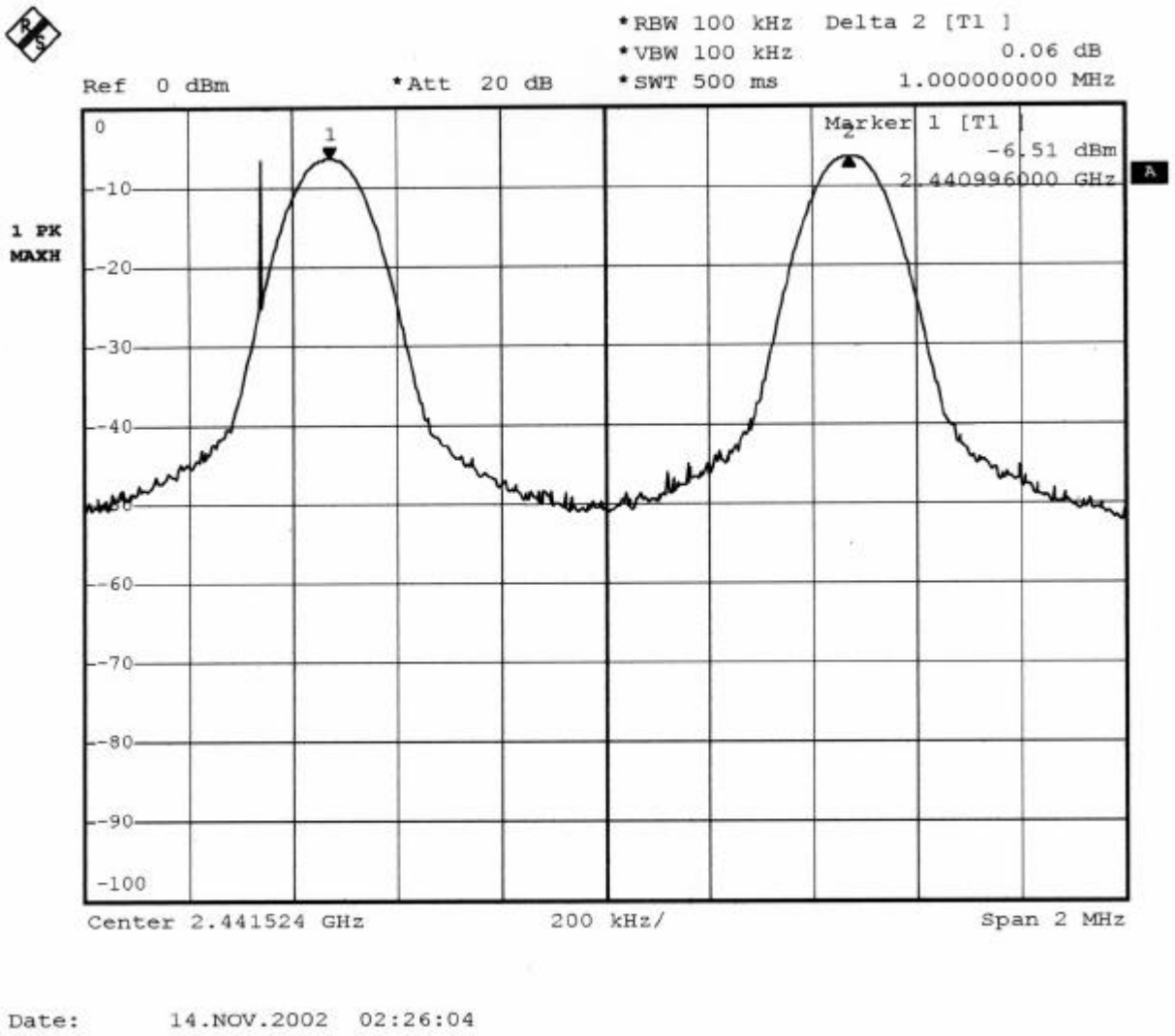
Channel	Frequency (MHz)	Hopping Channel Separation (KHz)	Limits (KHz)	Plot Ref. No.
00	2402	1000.00	25	1
39	2441	1000.00	25	2
78	2480	1000.00	25	3

Plot 1 (Channel 00) :

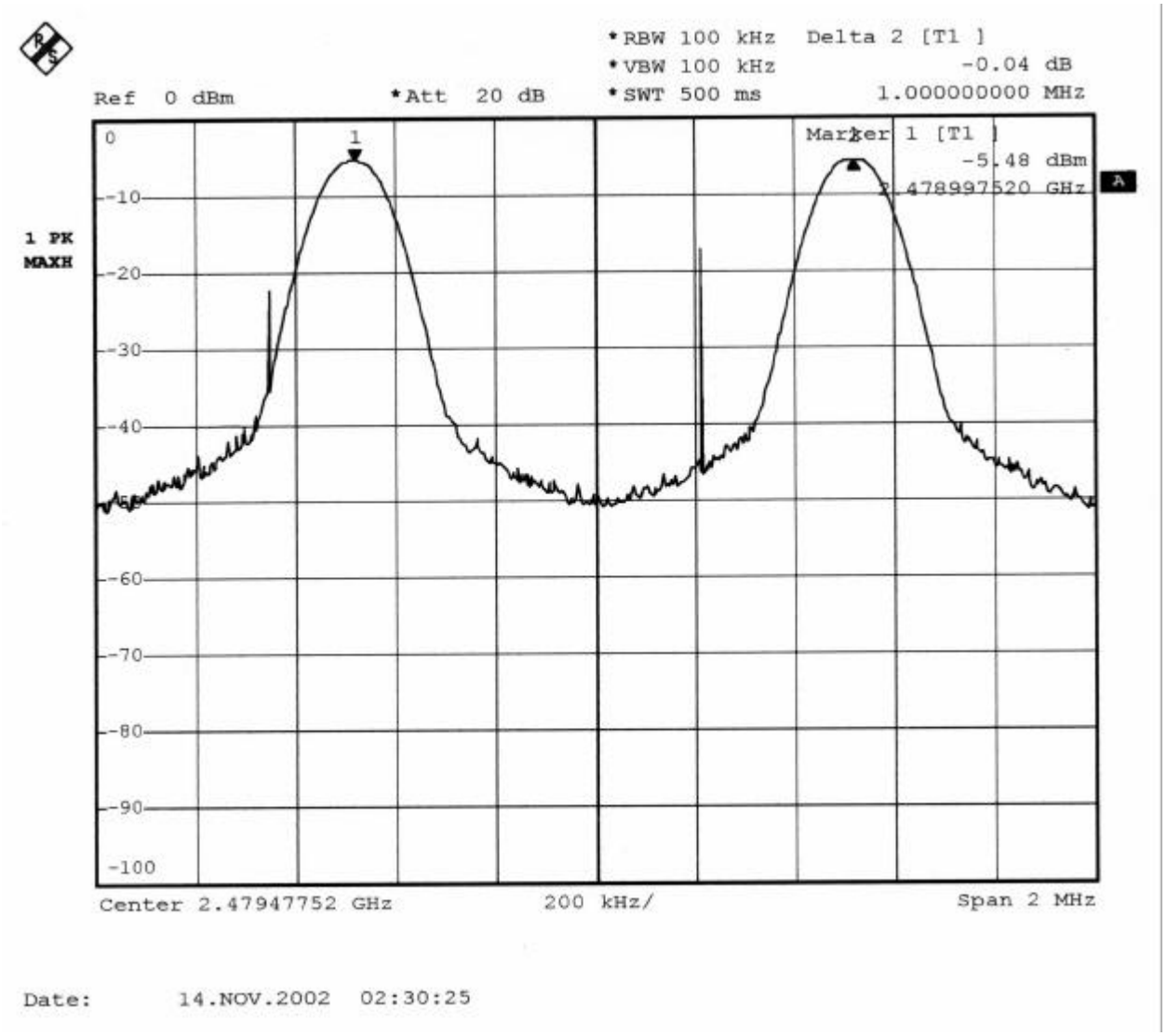


Date: 13.NOV.2002 05:04:44

Plot 2 (Channel 39) :



Plot 3 (Channel 78)：



4.2.5. 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.

4.3. Number of Hopping Frequency

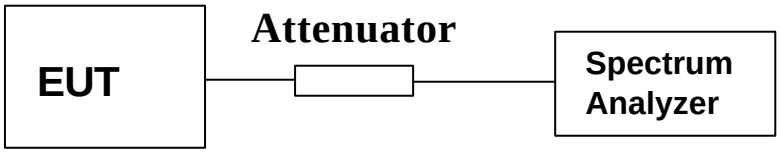
4.3.1. Measuring Instruments：

As described in chapter 6 of this test report.

4.3.2. 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.

4.3.3. Test Setup Layout：

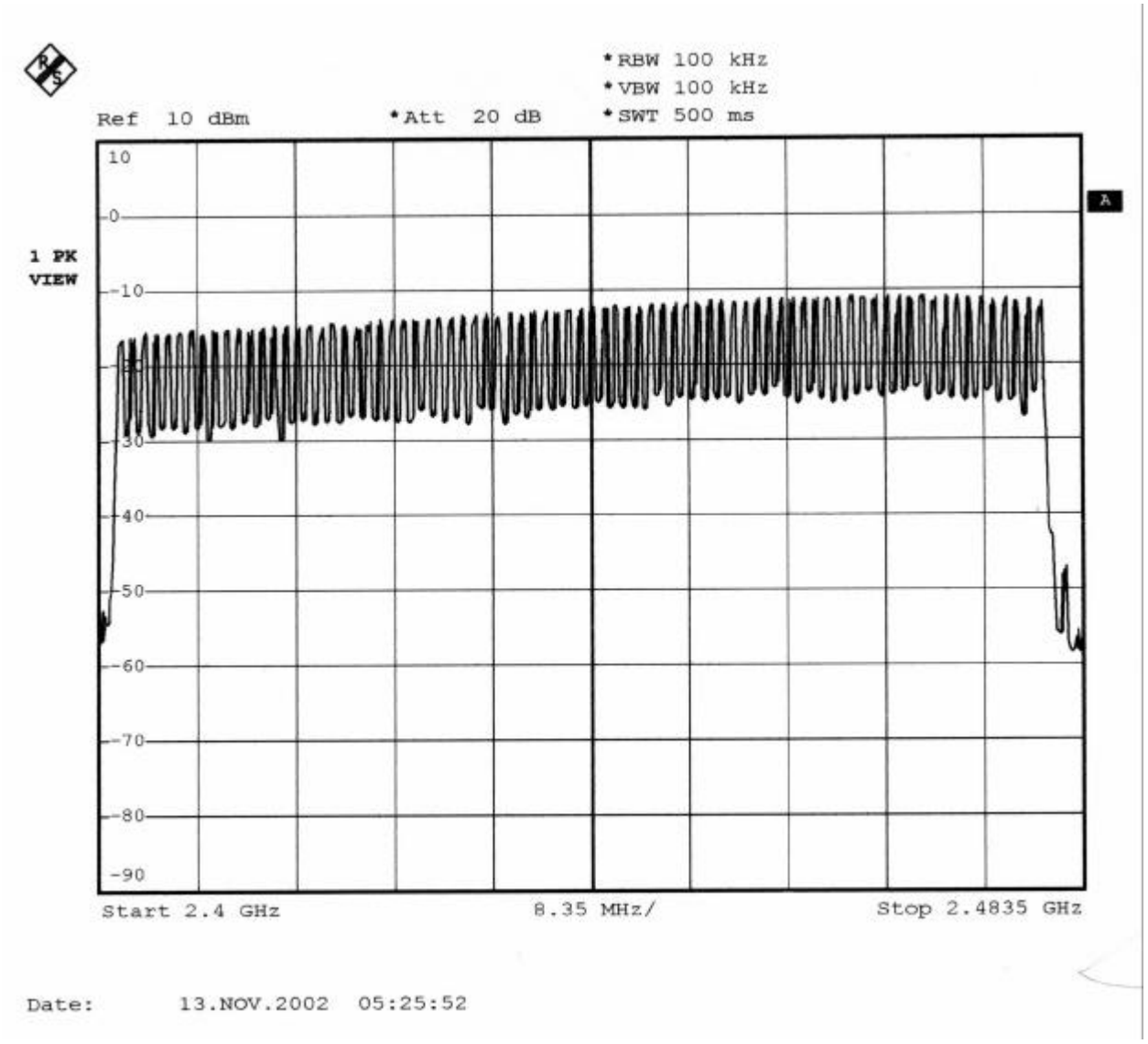


4.3.4. Test Result：See spectrum analyzer plots below

- Temperature: 25°C
- Relative Humidity: 53 %
- Duty cycle of the equipment during the test X ＝ 36%

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

Plot 1：


*RBW 100 kHz
*VBW 100 kHz
*SWT 500 ms
Ref 10 dBm
*Att 20 dB
1 PK
VIEW
A
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 2.4 GHz
8.35 MHz/
Stop 2.4835 GHz
Date: 13.NOV.2002 05:25:52

4.4. Hopping Channel Bandwidth

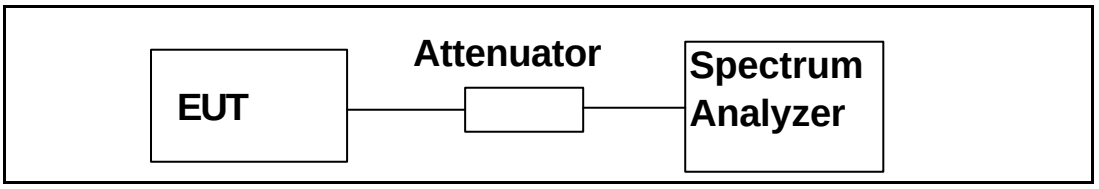
4.4.1. Measuring Instruments：

As described in chapter 6 of this test report.

4.4.2. 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.

4.4.3. Test Setup Layout：

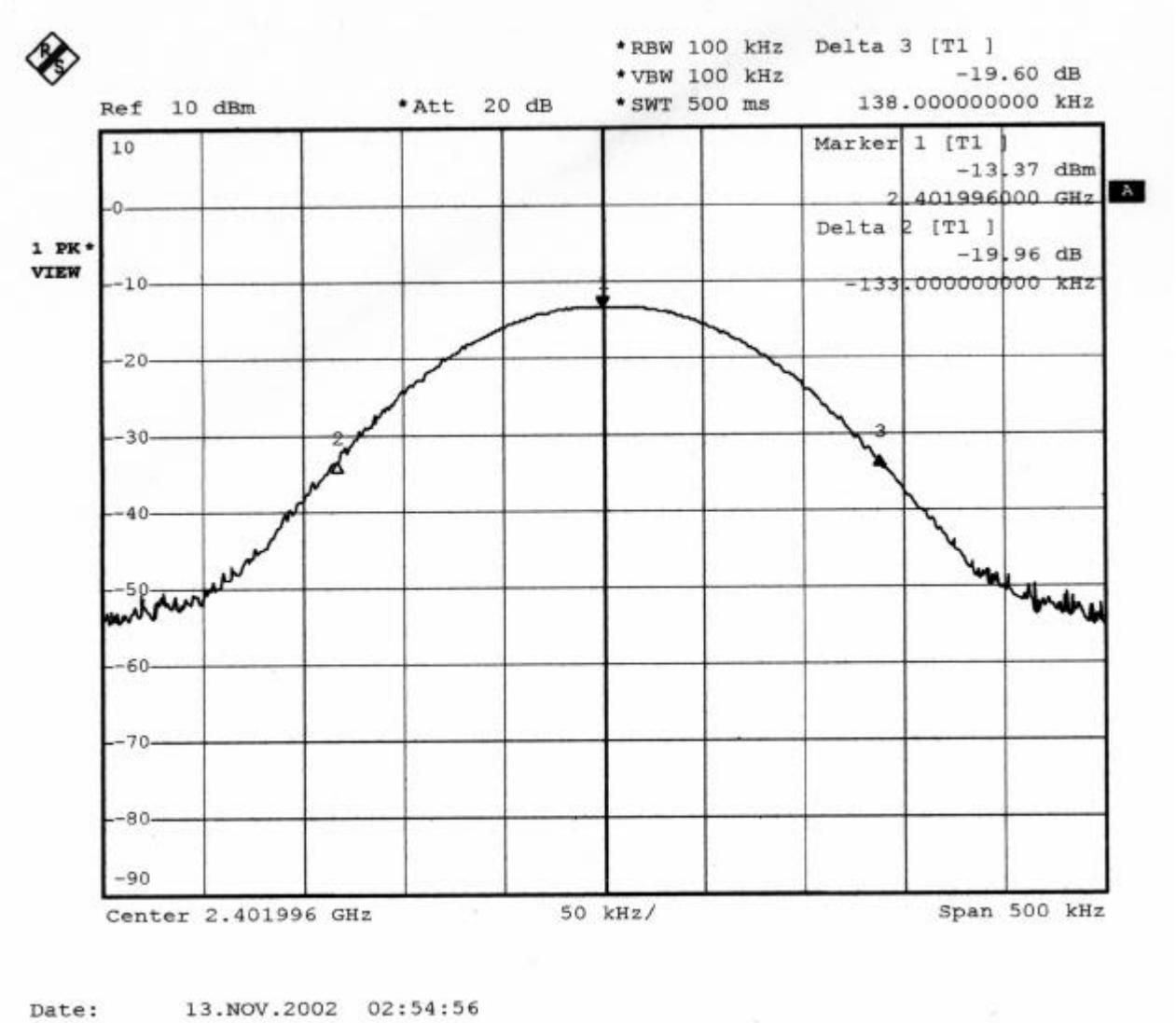


4.4.4. Test Result：See spectrum analyzer plots below

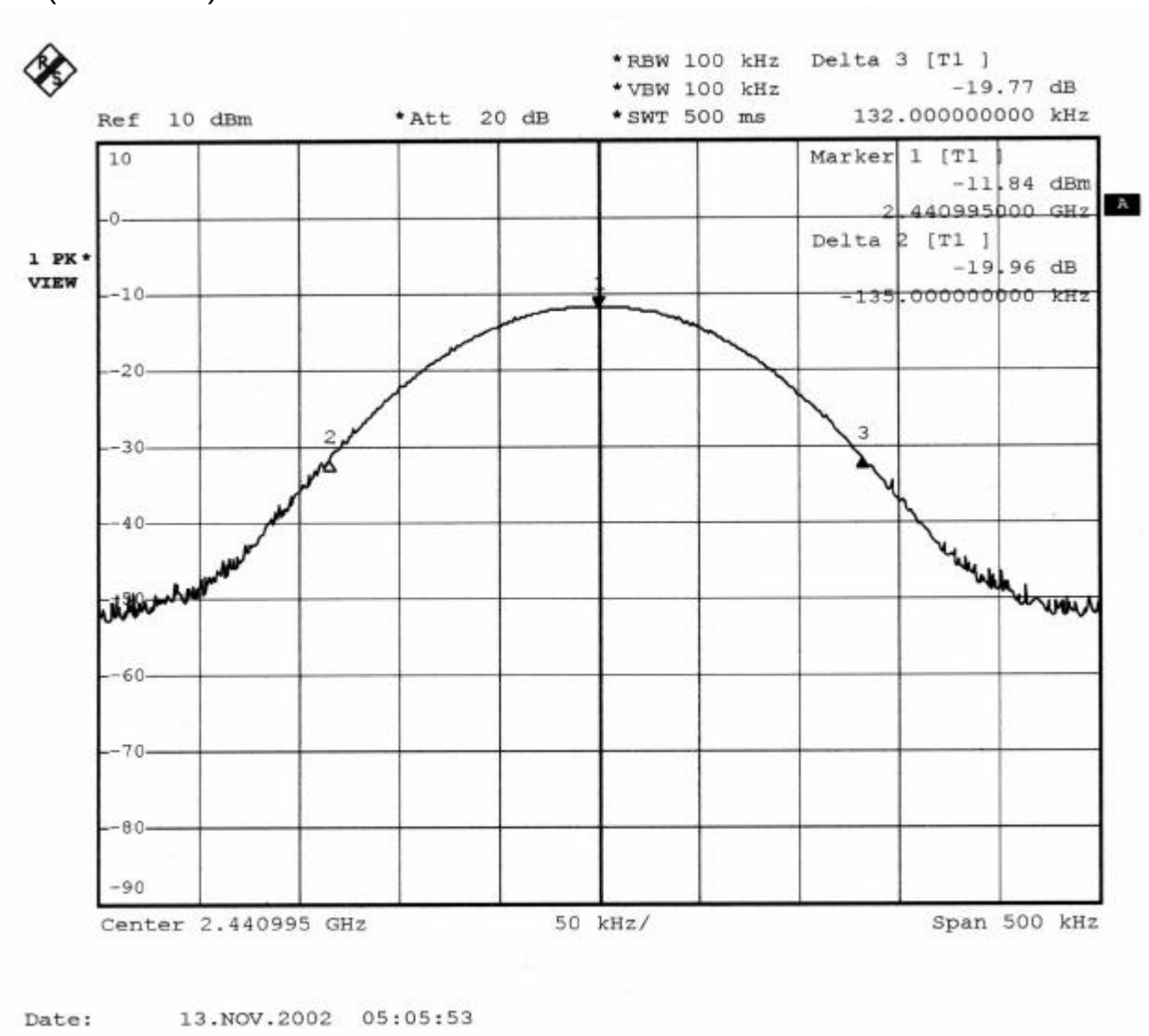
- Temperature: 25°C
- Relative Humidity: 53 %
- Duty cycle of the equipment during the test X ＝ 36%

Channel	Frequency (MHz)	Hopping Channel Bandwidth (KHz)	Limits (KHz)	Plot Ref. No.
00	2402	271.00	1000	1
39	2441	267.00	1000	2
78	2480	268.00	1000	3

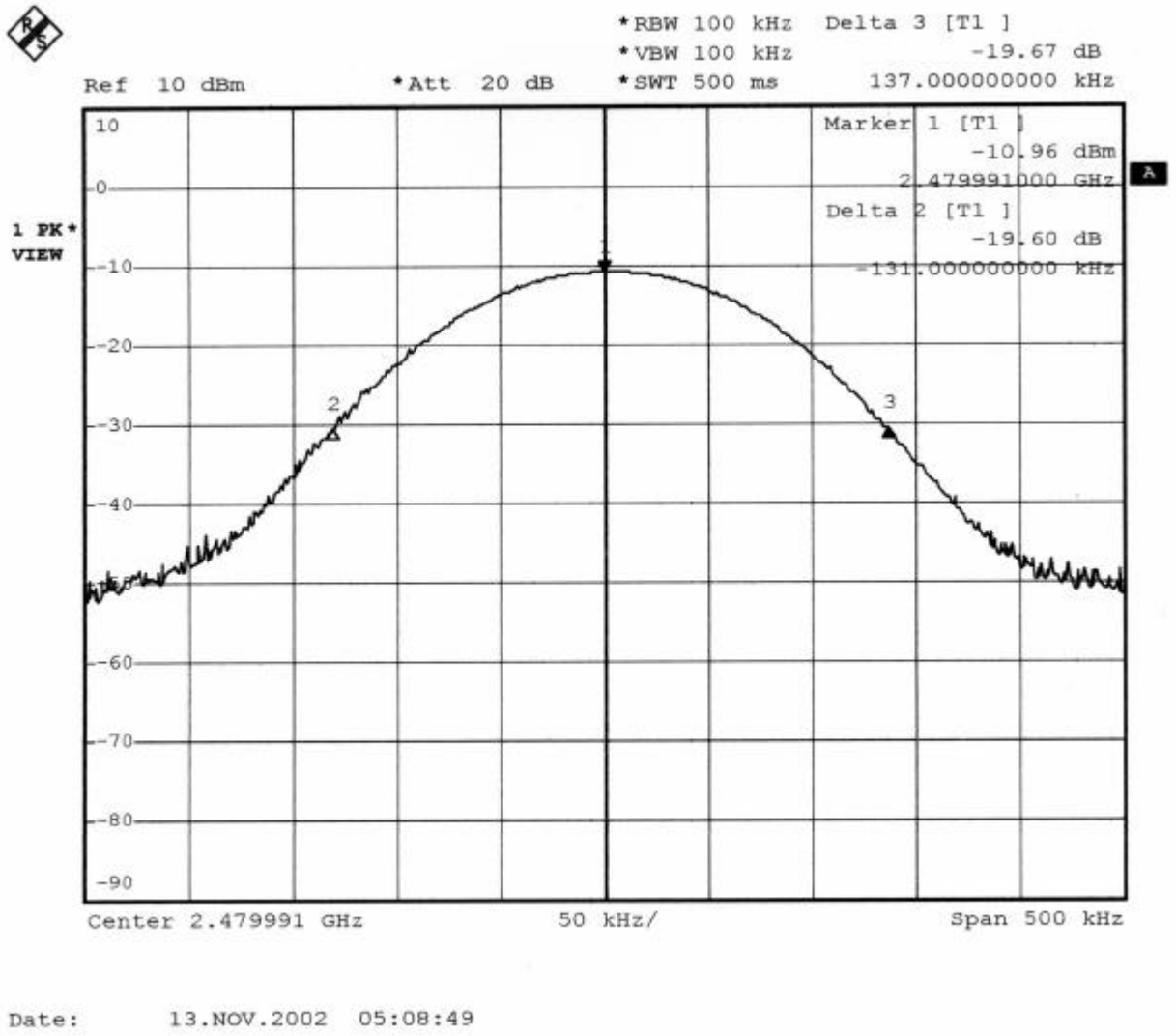
Plot 1 (Channel 00)



Plot 2 (Channel 39)



Plot 3 (Channel 78)



4.4.5. Test Configuration（EUT Operating Condition）：

Same as Section 4.2.5.

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

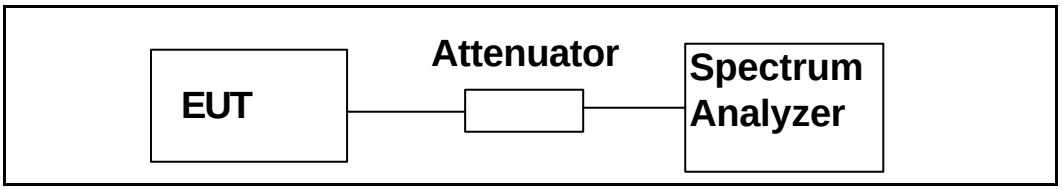
4.5.1. Measuring Instruments：

As described in chapter 6 of this test report.

4.5.2. 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. Set the center frequency on any frequency would be measure and set the frequency span to zero span.

4.5.3. Test Setup Layout：

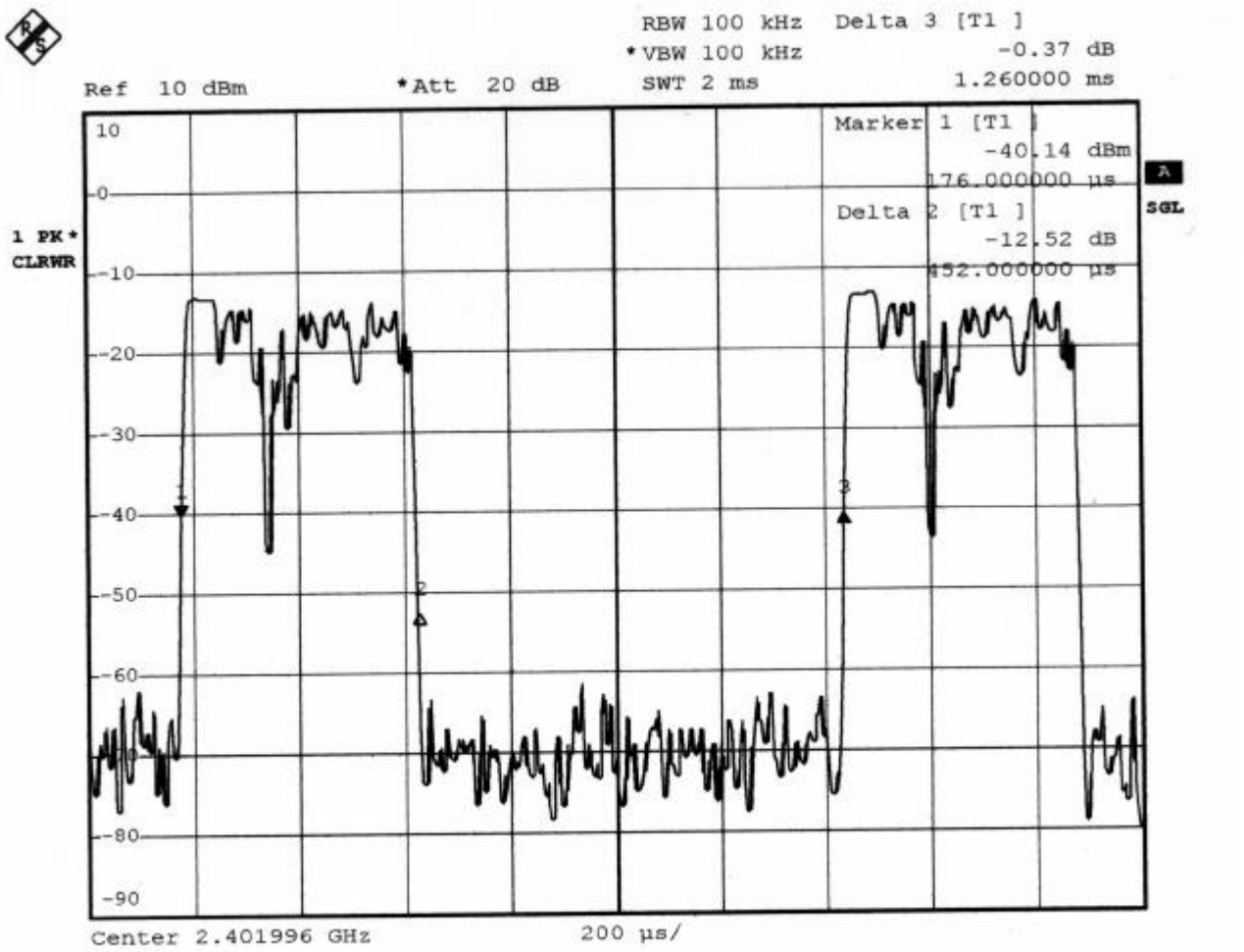


4.5.4. Test Result：See spectrum analyzer plots below

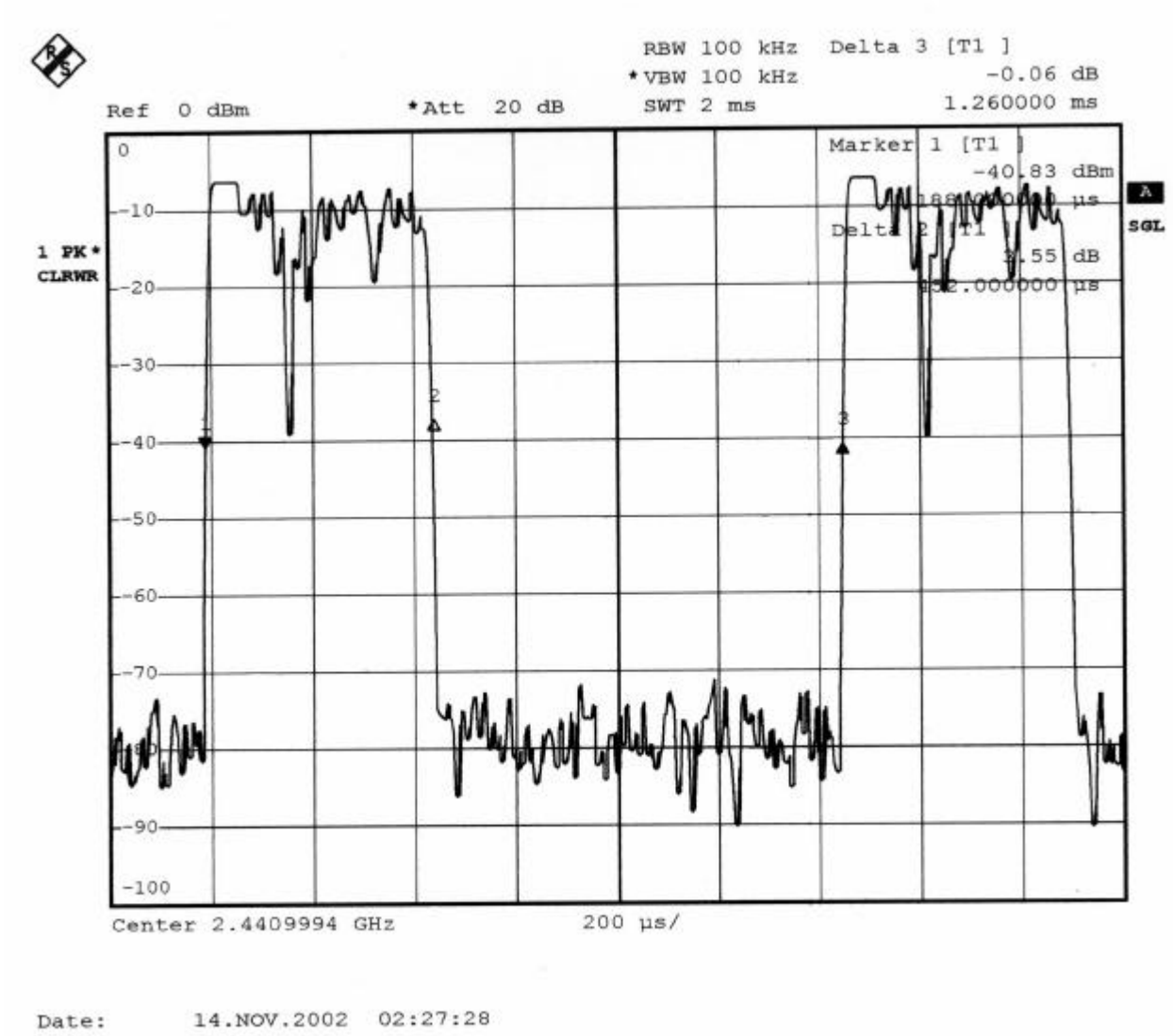
- Temperature: 25°C
- Relative Humidity: 53 %
- Duty cycle of the equipment during the test X ＝ 36%

Channel	Frequency (MHz)	Dwell Time (s)	Limits (s)	Plot Ref. No.
00	2402	0.136226643	0.4	1
39	2441	0.136226643	0.4	2
78	2480	0.137432188	0.4	3

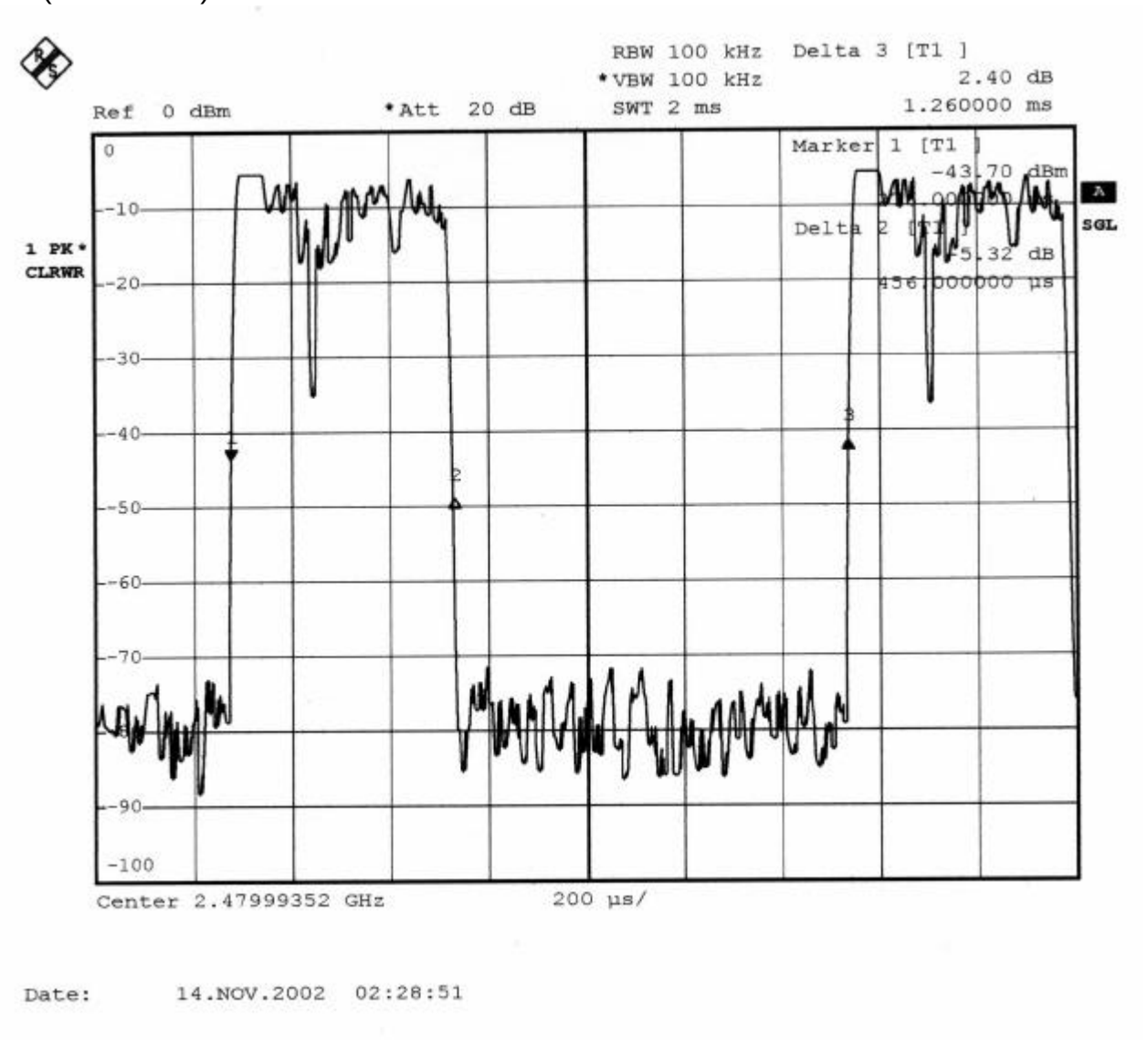
Plot 1 (Channel 00)



Plot 2 (Channel 39)



Plot 3 (Channel 78)



4.5.5. Test Configuration（EUT Operating Condition）：

Same as Section 4.2.5.

4.6. Output Power

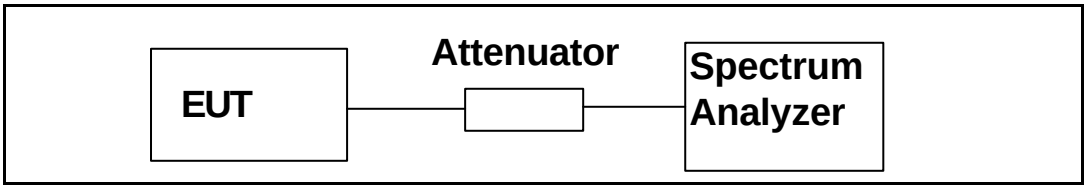
4.6.1. Measuring Instruments：

As described in chapter 6 of this test report.

4.6.2. 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 using 1MHz RBW and 1MHz VBW.
3. Use the channel power function of the spectrum analyzer to measured peak output power.
4. The channel bandwidth set 1MHz.

4.6.3. Test Setup Layout：



4.6.4. Test Result：See spectrum analyzer plots below

- Temperature: 25°C
- Relative Humidity: 53 %
- Duty cycle of the equipment during the test X ＝ 36%

Channel	Frequency (MHz)	Measured Output Power (mWatt)	Measured Output Power (dBm)	Limits (Watt/dBm)
00	2402	2.39	3.79	1W/30 dBm
39	2441	2.43	3.86	1W/30 dBm
78	2480	2.51	3.99	1W/30 dBm

4.6.5. Test Configuration（EUT Operating Condition）：

Same as Section 4.2.5.

4.7. 100KHz Bandwidth of Frequency Band Edges

4.7.1. Measuring Instruments：

As described in chapter 6 of this test report.

4.7.2. 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.

4.7.3. Test Result：

Test Result in lower band (Channel 00)： PASS

Test Result in higher band(Channel 78)： PASS

4.7.4. Note on Band edge Emission

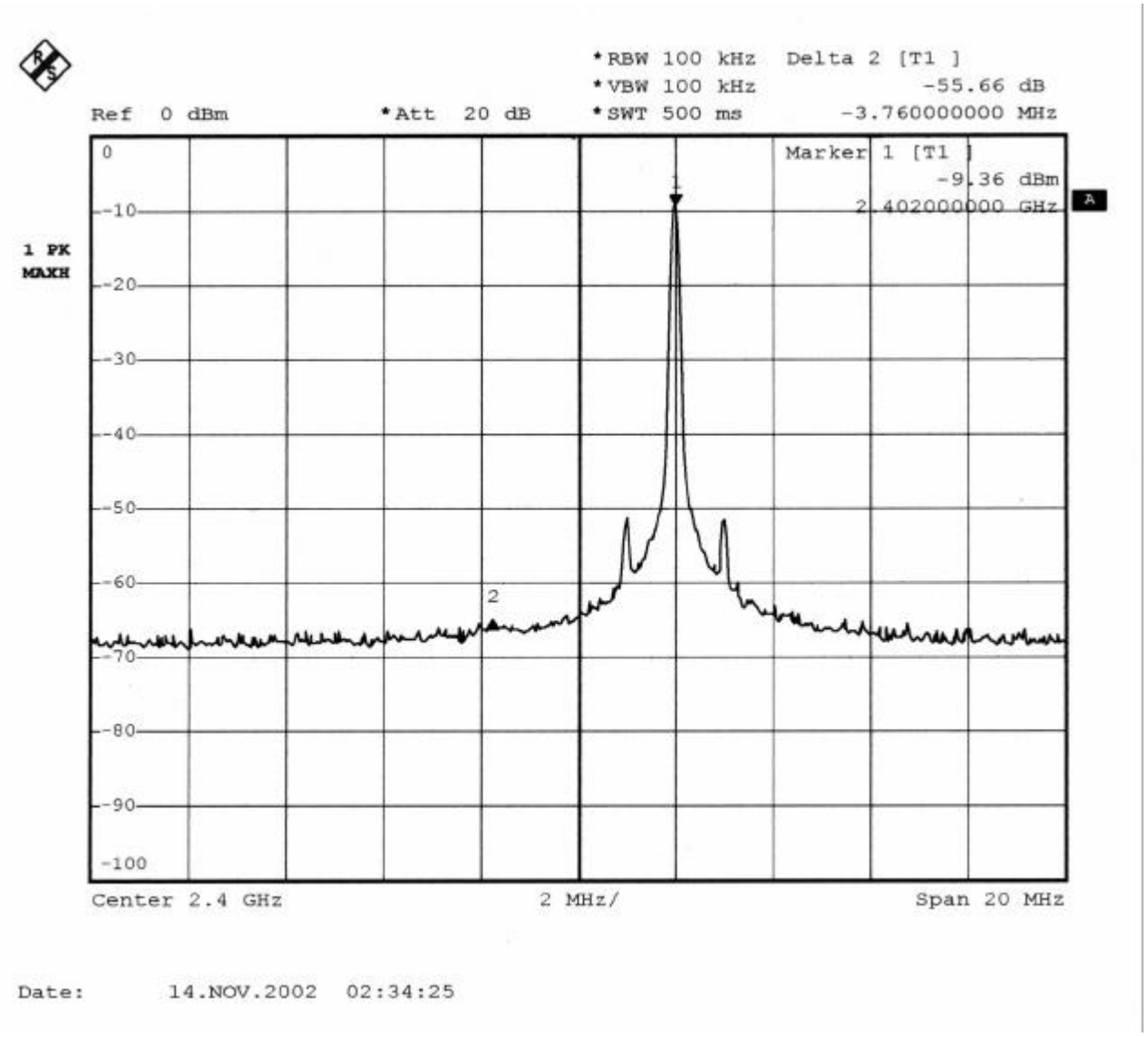
The band edge emission plot on page 37. shows 45.10dB delta between carrier maximum power and local maximum emission in the restricted band (2.4835GHz).

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)	Detector	Result
V	81.71	28.16	74.00	-45.84	Peak	Pass
V	69.95	16.40	54.00	-37.60	Average	Pass
H	79.83	26.28	74.00	-47.72	Peak	Pass
H	68.50	14.95	54.00	-34.05	Average	Pass

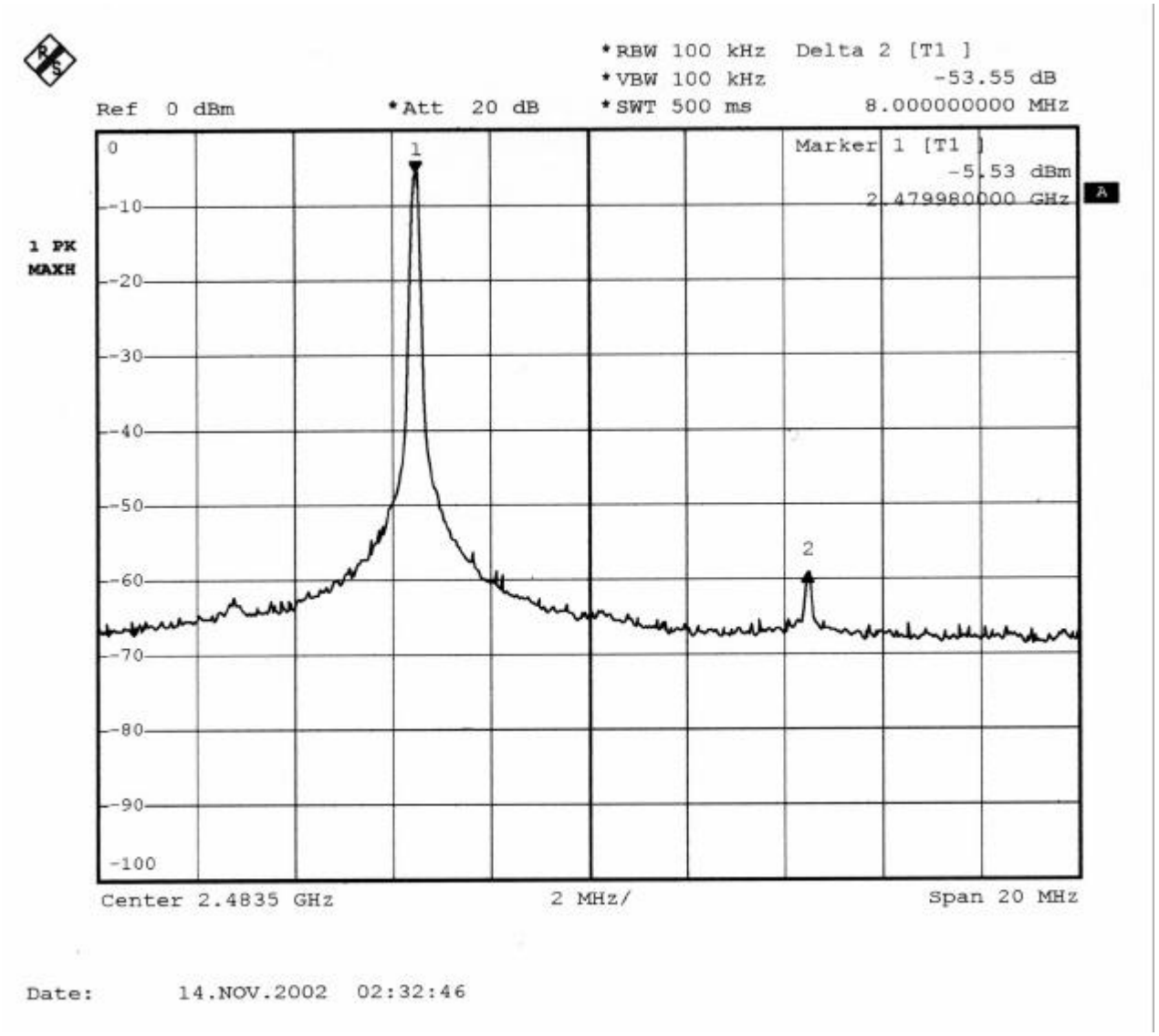
＊The maximum field strength in restricted band is the emission of carrier power strength subtract to the delta between carrier maximum power and local maximum emission in the restricted band.

The spectrum analyzer plots are attached as below：

Plot 1 (Channel 00)：



Plot 2 (Channel 78)：



Comments： All emissions in those 100kHz bandwidth are attenuated more then 20dB from the carrier.

4.7.5. 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.

4.8. 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 C63.4-1992 Section 3.1. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane as shown in section 4.5.3. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

4.8.1. Major Measuring Instruments：

Test Receiver	HP 8591EM
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

4.8.2. 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.

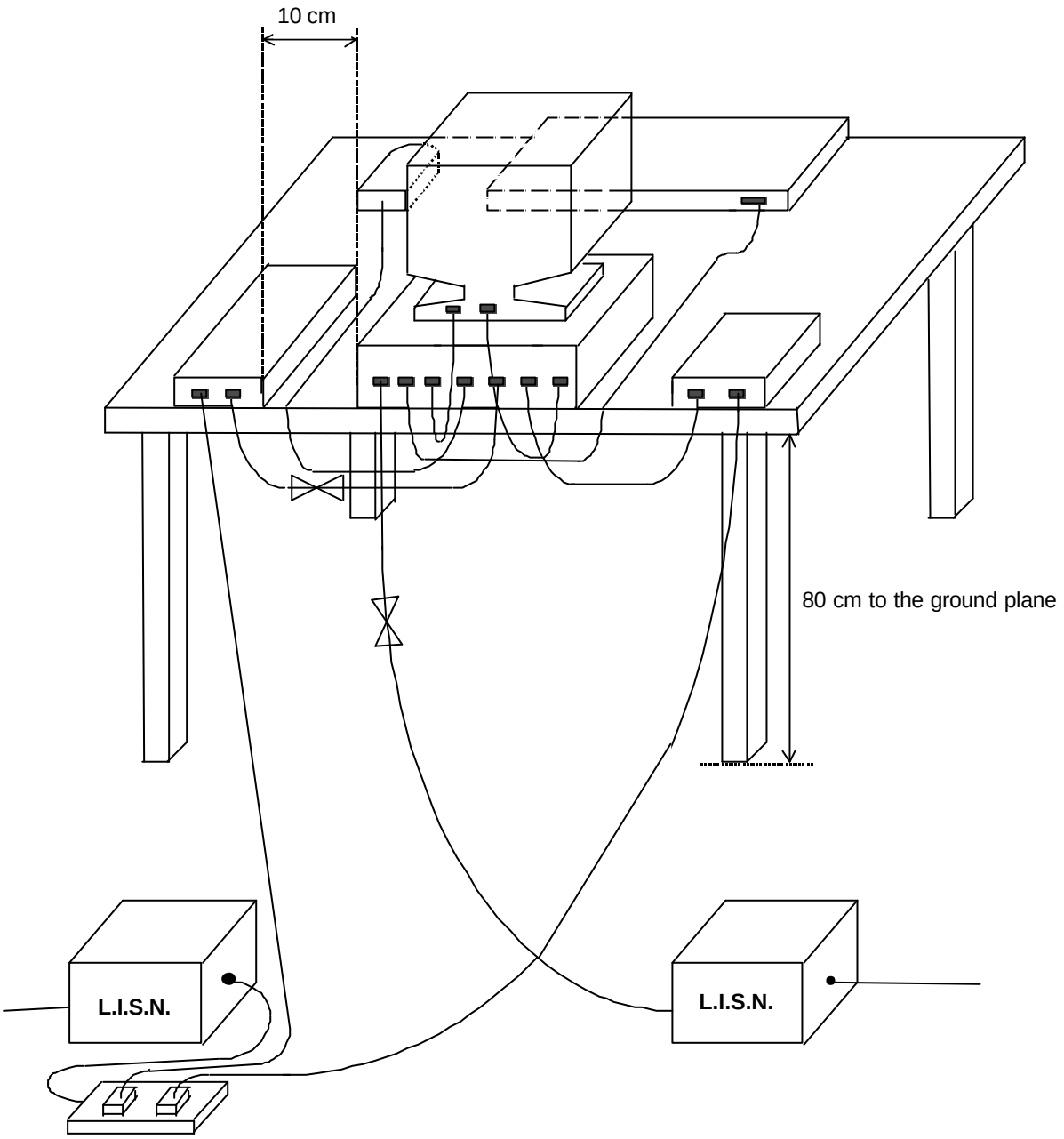
f. Both sides of AC line were checked for maximum conducted interference.

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.

i. If the emission level of the EUT in peak mode was 6 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 6 dB margin will be retested one by one using the quasi-peak method and reported.

4.8.3. Typical Test Setup Layout of Conducted Powerline：



4.8.4. Test Software：

1. EMCTEST Software
2. CSR Bluetooth TEST Software (Blue Suit)

4.8.5. Test Result of Conducted Emission：

- Test Mode: Mode 1 (CH00)
- 6dB Bandwidth: 10KHz
- Temperature: 29°C
- Relative Humidity: 54 %
- Test Date: Nov. 18, 2002

The Conducted Emission test was passed at minimum margin Line 0.184 MHz /52.52 dBuV.

Frequency	Line	Meter Reading		Limits		Margin	
	or	Q.P.	A.V.	Q.P.	A.V.	Q.P.	A.V.
(MHz)	Neutral	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)
0.184	Line	52.52	41.53	64.30	54.30	-11.78	-12.77
0.244	Line	45.48	33.99	61.96	51.96	-16.48	-17.97
0.307	Line	41.02	31.96	60.05	50.05	-19.03	-18.09
0.736	Line	33.50	24.76	56.00	46.00	-22.50	-21.24
1.104	Line	34.92	26.29	56.00	46.00	-21.08	-19.71
3.803	Line	35.19	28.95	56.00	46.00	-20.81	-17.05
0.184	Neutral	51.75	39.83	64.30	54.30	-12.55	-14.47
0.246	Neutral	44.87	35.75	61.89	51.89	-17.02	-16.14
0.308	Neutral	39.90	31.67	60.02	50.02	-20.12	-18.35
0.555	Neutral	34.79	29.10	56.00	46.00	-21.21	-16.90
0.862	Neutral	34.38	28.99	56.00	46.00	-21.62	-17.01
1.967	Neutral	30.21	24.66	56.00	46.00	-25.79	-21.34

Test Engineer: Andy

Andy Yang

- Test Mode: Mode 2 (CH39)
- 6dB Bandwidth: 10KHz
- Temperature: 29°C
- Relative Humidity: 54 %
- Test Date: Nov. 18, 2002

The Conducted Emission test was passed at minimum margin LINE 3.740 MHz / 33.69 dBuV.

Frequency	Line	Meter Reading		Limits		Margin	
	or	Q.P.	A.V.	Q.P.	A.V.	Q.P.	A.V.
(MHz)	Neutral	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)
0.182	Line	49.97	40.05	64.39	54.39	-14.42	-14.34
0.242	Line	41.90	34.91	62.03	52.03	-20.13	-17.12
0.604	Line	37.84	32.55	56.00	46.00	-18.16	-13.45
0.845	Line	38.79	33.01	56.00	46.00	-17.21	-12.99
1.149	Line	38.64	31.40	56.00	46.00	-17.36	-14.60
3.740	Line	38.38	33.69	56.00	46.00	-17.62	-12.31
0.182	Neutral	49.65	39.52	64.39	54.39	-14.74	-14.87
0.240	Neutral	41.84	31.18	62.10	52.10	-20.26	-20.92
0.301	Neutral	39.82	31.44	60.22	50.22	-20.40	-18.78
1.264	Neutral	37.50	28.06	56.00	46.00	-18.50	-17.94
1.445	Neutral	36.16	27.36	56.00	46.00	-19.84	-18.64
4.031	Neutral	38.56	32.62	56.00	46.00	-17.44	-13.38

Test Engineer: Andy

Andy Yang

- Test Mode: Mode 3 (CH78)
- 6dB Bandwidth: 10KHz
- Temperature: 29°C
- Relative Humidity: 54 %
- Test Date: Nov. 18, 2002

The Conducted Emission test was passed at minimum margin LINE 0.183 MHz / 51.51 dBuV.

Frequency (MHz)	Line or Neutral	Meter Reading Q.P. (dBuV)	Meter Reading A.V. (dBuV)	Limits Q.P. (dBuV)	Limits A.V. (dBuV)	Margin Q.P. (dB)	Margin A.V. (dB)
0.183	Line	51.51	40.71	64.35	54.35	-12.84	-13.64
0.244	Line	44.67	33.23	61.96	51.96	-17.29	-18.73
0.305	Line	40.29	31.39	60.11	50.11	-19.82	-18.72
0.732	Line	33.50	24.76	56.00	46.00	-22.50	-21.24
1.037	Line	33.54	24.76	56.00	46.00	-22.46	-21.24
3.969	Line	35.79	30.10	56.00	46.00	-20.21	-15.90
0.182	Neutral	50.61	40.18	64.39	54.39	-13.78	-14.21
0.243	Neutral	43.77	35.82	61.99	51.99	-18.22	-16.17
0.731	Neutral	36.84	31.78	56.00	46.00	-19.16	-14.22
0.974	Neutral	37.71	31.88	56.00	46.00	-18.29	-14.12
1.156	Neutral	37.24	30.74	56.00	46.00	-18.76	-15.26
4.017	Neutral	35.89	31.15	56.00	46.00	-20.11	-14.85

Test Engineer: Andy

Andy Yang

4.9. Test of Radiated Emission

Radiated emissions from 30 MHz to 24.83 GHz were measured with a bandwidth of 120 kHz according to the methods defines in ANSI C63.4-1992. The EUT was placed on a nonmetallic stand in the open-field site, 0.8 meter above the ground plane, as shown in section 4.6.3. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions.

4.9.1. Major Measuring Instruments

From 30MHz to 1GHz

- Amplifier (HP 8447D)

RF Gain	30 dB
Signal Input	100 KHz to 1.3 GHz

- Spectrum Analyzer (R&S FSP)

Attenuation	10 dB
Start Frequency	30 MHz
Stop Frequency	1000 MHz
Resolution Bandwidth	120 KHz
Signal Input	9 KHz to 7 GHz

Above 1GHz

- Spectrum analyzer (R&S FSP40)

Attenuation	10 dB
Start Frequency	1 GHz
Stop Frequency	24.83 GHz
Resolution Bandwidth	1 MHz
Video Bandwidth	1 MHz
Signal Input	9 KHz to 40 GHz

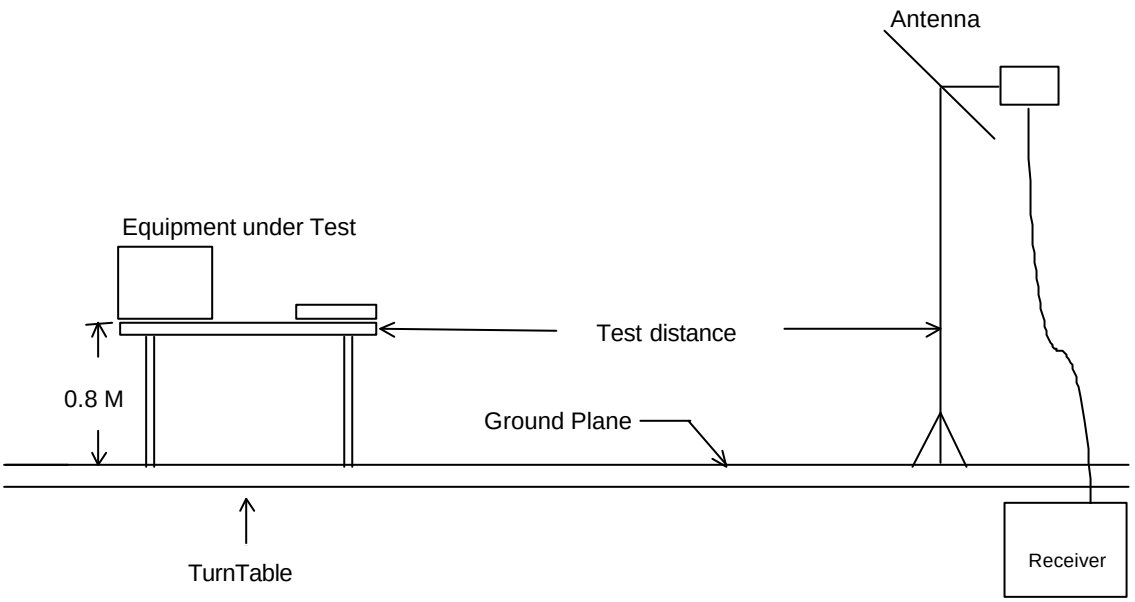
- Amplifier (MITEQ AFS44)

RF Gain	40 dB
Signal Input	100 MHz to 26.5GHz

4.9.2. 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.

4.9.3. Typical Test Setup Layout of Radiated Emission



4.9.4. Test Result of Radiated Emission

- Frequency Range: 30 - 24835 MHz
- Test Mode: Mode 1 (2402MHz)
- Test Distance: 3 M
- Temperature: 25°C
- Relative Humidity: 53 %
- Test Date: Nov. 12, 2002
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Antenna Factor + Cable Loss –Pre-Amp.+ Reading = Emission

The Radiated Emission test was passed at minimum margin:

467.300 MHz 42.95 dBuV/m (Vertical) Antenna Height 1 Meter, Turntable Degree 260 ^{o}.

Spurious Emission

Frequency	Polarity	Antenna Factor	Cable Loss	Reading	Limits		Emission Level		Margin	Detect
(MHz)		(dB/m)	(dB)	(dBuV)	(dBuV/m)	(uV/m)	(dBuV/m)	(uV/m)	(dB)	Mode
99.930	H	10.31	1.70	43.66	43.50	149.62	28.67	27.13	-14.38	Peak
195.780	H	8.36	2.33	53.65	43.50	149.62	37.73	77.00	-5.77	Peak
267.060	H	12.55	2.78	47.47	46.00	199.52	36.20	64.57	-9.80	Peak
300.000	H	13.00	2.90	52.91	46.00	199.52	42.21	128.97	-3.79	Peak
400.100	H	15.80	3.40	50.94	46.00	199.52	42.94	140.28	-3.06	Peak
467.300	H	16.81	3.64	50.04	46.00	199.52	42.95	140.44	-3.05	Peak
1198.000	H	25.91	3.59	39.95	74.00	5012.0	42.46	132.74	-31.54	Peak
1340.000	H	26.65	3.79	42.18	74.00	5012.0	45.61	190.77	-28.39	Peak
1454.000	H	27.08	3.96	40.18	74.00	5012.0	44.19	162.00	-29.81	Peak
1596.000	H	27.07	4.16	40.41	74.00	5012.0	44.59	169.63	-29.41	Peak
1844.000	H	28.61	4.50	44.77	74.00	5012.0	50.80	346.74	-23.20	Peak
99.930	V	10.31	1.70	47.61	43.50	149.62	32.62	42.76	-10.88	Peak
194.970	V	8.39	2.30	48.22	43.50	149.62	32.29	41.16	-11.21	Peak
260.580	V	13.04	2.72	45.91	46.00	199.52	35.07	56.70	-10.93	Peak
341.300	V	13.96	3.12	51.53	46.00	199.52	41.76	122.46	-4.24	Peak
391.000	V	15.37	3.40	45.30	46.00	199.52	36.92	70.15	-9.08	Peak
500.900	V	17.39	3.80	43.24	46.00	199.52	36.73	68.63	-9.27	Peak
1100.000	V	25.14	3.44	39.06	74.00	5012.0	40.66	107.90	-33.34	Peak
1198.000	V	25.91	3.59	40.93	74.00	5012.0	43.44	148.60	-30.56	Peak
1302.000	V	26.51	3.74	36.81	74.00	5012.0	40.05	100.58	-33.95	Peak
2006.000	V	31.08	4.72	38.31	74.00	5012.0	47.01	224.13	-26.99	Peak

Field strength of fundamental and harmonics

Frequency (MHz)	Polarity	Antenna Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Limits (dBuV/m)	Limits (uV/m)	Emission Level (dBuV/m)	Emission Level (uV/m)	Margin (dB)	Detect Mode
2404.000	H	30.19	5.19	71.99			80.21	10244.72		Peak
2404.000	H	30.19	5.19	60.57			68.79	2751.06		AV
2404.000	V	30.19	5.19	71.05			79.27	9193.90		Peak
2404.000	V	30.19	5.19	59.71			67.93	2491.72		AV

Test Engineer: Wayne Hsu

- Frequency Range: 30 - 24835 MHz
- Test Mode: Mode 2 (2441MHz)
- Test Distance: 3 M
- Temperature: 25°C
- Relative Humidity: 53 %
- Test Date: Nov. 12, 2002
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading: Antenna Factor + Cable Loss –Pre-Amp.+ Reading = Emission

The Radiated Emission test was passed at minimum margin:

399.400 MHz /42.32 dBuV/m (Vertical) Antenna Height 1 Meter, Turntable Degree 260 ^{o}.

Spurious Emission

Frequency	Polarity	Antenna Factor	Cable Loss	Reading	Limits		Emission Level		Margin	Detect
(MHz)		(dB/m)	(dB)	(dBuV)	(dBuV/m)	(uV/m)	(dBuV/m)	(uV/m)	(dB)	Mode
99.660	H	10.26	1.69	42.83	43.50	149.62	27.78	24.50	-15.72	Peak
149.970	H	8.39	2.30	52.97	43.50	149.62	37.04	71.12	-6.46	Peak
260.580	H	13.04	2.72	46.26	46.00	199.53	35.42	59.00	-10.58	Peak
341.300	H	13.96	3.12	49.32	46.00	199.53	39.55	94.95	-6.45	Peak
399.400	H	15.78	3.40	50.34	46.00	199.53	42.32	130.62	-3.68	Peak
500.900	H	17.39	3.80	43.84	46.00	199.53	37.33	73.54	-8.67	Peak
1220.000	H	26.08	3.62	38.77	74.00	5012.0	41.47	118.44	-32.53	Peak
1302.000	H	26.51	3.74	37.33	74.00	5012.0	40.57	106.78	-33.43	Peak
99.930	V	10.31	1.70	45.45	43.50	149.62	30.46	33.34	-13.04	Peak
194.970	V	8.39	2.30	49.74	43.50	149.62	33.81	49.03	-9.69	Peak
260.580	V	13.04	2.72	45.52	46.00	199.53	34.68	54.20	-11.32	Peak
341.300	V	13.96	3.12	50.27	46.00	199.53	40.50	105.93	-5.50	Peak
391.000	V	15.37	3.40	48.71	46.00	199.53	40.33	103.87	-5.67	Peak
500.900	V	17.39	3.80	48.71	46.00	199.53	41.90	124.45	-4.10	Peak
1302.000	V	26.51	3.74	37.61	74.00	5012.0	40.85	110.28	-33.15	Peak

Field Strength of fundamental and harmonics

Frequency (MHz)	Polarity	Antenna Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Limits (dBuV/m)	Limits (uV/m)	Emission Level (dBuV/m)	Emission Level (uV/m)	Margin (dB)	Detect Mode
2438.000	H	30.11	5.23	71.67			79.84	9817.48		Peak
2438.000	H	30.11	5.23	59.89			68.06	2529.30		AV
2438.000	V	30.11	5.23	72.49			80.66	10789.47		Peak
2438.000	V	30.11	5.23	61.74			69.91	3129.68		AV

Test Engineer: Wayne

Wayne Hsu

- Frequency Range: 30 - 24835 MHz
- Test Mode: Mode 3 (2480 MHz)
- Test Distance: 3 M
- Temperature: 25°C
- Relative Humidity: 53 %
- Test Date: Nov. 12, 2002
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Antenna Factor + Cable Loss –Pre-Amp.+ Reading = Emission

The Radiated Emission test was passed at minimum margin:

400.800 MHz /42.48 dBuV/m (Vertical) Antenna Height 1 Meter, Turntable Degree 260 ^{o}

Spurious Emission

Frequency	Polarity	Antenna Factor	Cable Loss	Reading	Limits		Emission Level		Margin	Detect
(MHz)		(dB/m)	(dB)	(dBuV)	(dBuV/m)	(uV/m)	(dBuV/m)	(uV/m)	(dB)	Mode
99.300	H	10.31	1.70	42.66	43.50	149.62	27.67	24.18	-15.83	Peak
194.970	H	8.39	2.30	52.95	43.50	149.62	37.02	70.96	-6.48	Peak
260.580	H	13.04	2.72	47.22	46.00	199.53	36.38	65.92	-9.62	Peak
360.200	H	14.42	3.30	50.69	46.00	199.53	41.45	118.17	-4.55	Peak
400.800	H	15.86	3.40	50.43	46.00	199.53	42.48	133.05	-3.52	Peak
534.500	H	18.15	3.87	45.85	46.00	199.53	40.07	100.81	-5.93	Peak
1238.000	H	26.23	3.64	37.24	74.00	5012.0	40.11	101.27	-33.89	Peak
99.660	V	10.26	1.69	45.93	43.50	149.62	30.88	35.00	-12.62	Peak
194.970	V	8.39	2.30	49.86	43.50	149.62	33.93	49.72	-9.57	Peak
260.580	V	13.04	2.72	49.32	43.50	149.62	38.48	83.95	-7.52	Peak
391.000	V	15.37	3.40	46.63	46.00	199.53	38.25	81.75	-7.75	Peak
500.200	V	17.39	3.80	45.20	46.00	199.53	38.69	86.00	-7.31	Peak
651.400	V	18.92	4.40	41.84	46.00	199.53	37.16	72.11	-8.84	Peak
1036.000	V	24.64	3.35	38.77	74.00	5012.0	39.79	97.61	-34.21	Peak
1302.000	V	26.51	3.74	37.62	74.00	5012.0	40.86	110.41	-33.14	Peak

Field strength of fundamental and harmonics

Frequency	Polarity	Antenna Factor	Cable Loss	Reading	Limits		Emission Level		Margin	Detect
(MHz)		(dB/m)	(dB)	(dBuV)	(dBuV/m)	(uV/m)	(dBuV/m)	(uV/m)	(dB)	Mode
2478.000	H	30.02	5.27	71.71			79.83	9806.18		Peak
2478.000	H	30.02	5.27	60.38			68.50	2660.73		AV
2478.000	V	30.02	5.27	73.59			81.71	12175.87		Peak
2478.000	V	30.02	5.27	61.83			69.95	3144.13		AV

Test Engineer: Wayne Hsu

4.10. Antenna Requirements

The EUT use an integral transmitting antenna, which is permitted as the system is intended for professional installation.

4.10.1. 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.

4.10.2. Antenna Connected Construction

The maximum Gain antenna used in this product is dipole antenna. All the antenna connector type is UFL. And the maximum Gain of these antennas is only 2dBi.

4.10.3. Notice

This device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter. End-users must be provided with specific operating instructions for satisfying RF exposure compliance.

5. EMI Suppression Component List

No EMI suppression components.

6. Antenna Factor & Cable Loss

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)
30	18.10	0.90
35	16.00	0.90
40	13.19	1.09
45	10.57	1.10
50	8.00	1.21
55	6.30	1.30
60	5.30	1.30
65	4.95	1.40
70	5.19	1.40
75	6.05	1.49
80	6.86	1.50
85	7.94	1.60
90	8.60	1.60
95	9.70	1.60
100	10.26	1.69
110	11.19	1.70
120	11.60	1.81
130	11.42	1.90
140	10.92	1.99
150	10.20	2.00
160	9.20	2.11
170	9.00	2.20
180	8.60	2.29
190	8.70	2.30
200	8.10	2.40
220	8.86	2.51
240	10.70	2.60
260	13.10	2.71
280	12.50	2.80
300	13.00	2.90
320	13.51	3.00
340	13.90	3.10
360	14.43	3.30
380	14.79	3.30
400	15.80	3.40
450	16.37	3.59
500	17.40	3.80
550	18.57	3.90
600	18.50	4.20
650	18.93	4.40
700	19.03	4.40
750	19.84	4.71
800	19.82	4.90
850	20.30	5.00
900	20.32	5.11
950	20.82	5.60
1000	21.20	5.50

7. List of Measuring Equipments Used

Reference Number	Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date
1	Spectrum Analyzer	R&S	FSP	838858/037	9KHz – 7GHz	Jan. 08, 2002
2	Amplifier	HP	8447D	2944A09072	100KHz – 1.3GHz	Oct. 21, 2002
3	Bilog Antenna	SCHAFFNER	CBL6112B	2687	30MHz –2GHz	Dec. 23, 2001
4	Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A
5	Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A
6	Horn Antenna	COM-POWER	AH-118	10094	1GHz – 18GHz	Apr. 09, 2002
7	Spectrum Analyzer	R&S	FSP40	100004/040	9KHZ~40GHZ	Aug. 07, 2002
8	Amplifier	MITEQ	AFS44	879981	100MHz~26.5GHz	Aug. 12, 2002
9	LISN	Rolf Heine	NNB-2/16Z	99041	50uH / 50 ohm	Mar. 26, 2002
10	LISN	KYORITSU	KNW-407	8-1010-15	50uH / 50 ohm	Nov. 26, 2002
11	Power Filter	CORCOM	MR12030	N/A	30A*2	N/A
12	Test Receiver	R&S	ESH3	893495/013	9 KHz - 30 MHz	Jul. 31, 2002
13	Spectrum Monitor	R&S	EZM	894987/011	9KHz – 1.3GHz	Jul. 31, 2002

※Calibration Interval of instruments listed above is one year.

8. 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

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

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