FCC Part 15
EMI TEST REPORT

of

E.U.T. : Bluetooth wireless USB Adapter

MODEL : BT2000.C-USB

FCC ID. : RK3-USBBT03

for

APPLICANT : AmbiCom Technology, Inc.

ADDRESS : 4F, No, 6, Lane 345, Yangguang St., Nei Hu Dist., Taipei 114 Taiwan

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN
NO. 8 LANE 29, WENMIMG ROAD,
LOSHAN TSUN, KWEISHAN HSIANG,
TAOYUAN, TAIWAN, R.O.C.

Tel:(03)3280026#570~576
Fax:(03)3276188

Report Number : ET92S-10-199-01

TEST REPORT CERTIFICATION

Applicant : AmbiCom Technology, Inc.
4F, No, 6, Lane 345, Yangguang St., Nei Hu Dist., Taipei 114 Taiwan

Manufacturer : Formosa Teletek Corporation
358, Huaya 2nd Rd., Gueishan Shiang, Taoyuan, Taiwan

Description of EUT :

a) Type of EUT : Bluetooth wireless USB Adapter

b) Trade Name : AmbiCom

c) Model No. : BT2000.C-USB

d) Power Supply : DC 5V (PROVIDED BY NOTEBOOK PC ASUS / A1300)

Regulation Applied : FCC Rules and Regulations Part 15 Subpart B & C (2002)

I HEREBY CERTIFY THAT: The data shown in this report were made in accordance with the procedures given in ANSI C63.4, and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Note: 1. The result of the testing report relate only to the item tested.
2. The testing report shall not be reproduced expect in full, without the written approval of ETC.

Issued Date : May 28, 2003

Test Engineer : Anderson

Approve & Authorized Signer : Win-Po Tsai

Signature
Win-Po Tsai
Manager of EMC Testing Department I
Electronics Testing Center, Taiwan

Table of Contents Page

1 GENERAL INFORMATION 1

1.1 Product Description 1
1.2 Characteristics of Device 1
1.3 Test Methodology 1
1.4 Modifiction List of EUT 1
1.5 Test Facility 1

2 PROVISIONS APPLICABLE 2

2.1 Definition 2
2.2 Requirement for Compliance 3
2.3 Restricted Bands of Operation 5
2.4 Labeling Requirement 5
2.5 User Information 6

3. SYSTEM TEST CONFIGURATION 7

3.1 Justification 7
3.2 Devices for Tested System 7

4 RADIATED EMISSION MEASUREMENT 8

4.1 Applicable Standard 8
4.2 Measurement Procedure 8
4.3 Measuring Instrument 10
4.4 Radiated Emission Data 11
4.4.1 RF Portion 11
4.4.2 Other Emission（30M~25G） 14
4.5 Field Strength Calculation 14
4.6 Photos of Radiation Measuring Setup 17

5 CONDUCTED EMISSION MEASUREMENT 18

5.1 Applicable Standard 18
5.2 Measurement Procedure 18
5.3 Conducted Emission Data 19
5.4 Result Data Calculation 28
5.5 Conducted Measurement Equipment 28
5.6 Photos of Conduction Measuring Setup 29

6 ANTENNA REQUIREMENT 30

6.1 Standard Applicable 30
6.2 Antenna Construction and Directional Gain 30

7 20dB EMISSION BANDWIDTH MEASUREMENT 31

7.1 Standard Applicable 31
7.2 Measurement Procedure 31
7.3 Measurement Equipment 31
7.4 Measurement Data 32

8 OUTPUT POWER MEASUREMENT 36

8.1 Standard Applicable 36
8.2 Measurement Procedure 36
8.3 Measurement Equipment 36
8.4 Measurement Data 37

9 100 KHZ BANDWIDTH OF BAND EDGES MEASUREMENT 41

9.1 Standard Applicable.....41
9.2 Measurement Procedure 41
9.3 Measurement Equipment 41
9.4 Measurement Data 42

10 RADIATED MEASUREMENT AT BANDEDGE WITH FUNDAMENTAL FREQUENCIES 48

10.1 Standard Applicable.....48
10.2 Measurement Procedure 48
10.3 Measuring Instrument 49
10.4 Radiated Emission Data.....50

11 NUMBER OF HOPPING CHANNELS 51

11.1 Standard Applicable.....51
11.2 Measurement Procedure 51
11.3 Measurement Equipment 51
11.4 Measurement Data 51

12 CHANNEL CARRIER FREQUENCIES SEPERATION 53

12.1 Standard Applicable.....53
12.2 Measurement Procedure 53
12.3 Measurement Equipment 53
12.4 Measurement Data 54

13 POWER SPECTRAL DENSITY 58

13.1 Standard Applicable.....58
13.2 Measurement Procedure 58
13.3 Measurement Equipment 58
13.4 Measurement Data 59

14 DWELL TIME.....63

14.1 Standard Applicable.....63
14.2 Measurement Procedure 63
14.3 Measurement Equipment 63
14.4 Measurement Data 64

1 GENERAL INFORMATION

1.1 Product Description

a) Type of EUT : Bluetooth wireless USB Adapter
b) Trade Name : AmbiCom
c) Model No. : BT2000.C-USB
d) Power Supply : DC 5V (PROVIDED BY NOTEBOOK PC ASUS / A1300)

1.2 Characteristics of Device

The Bluetooth wireless USB Adapter is a plug-in device for PC or notebook or other USB host device Bluetooth running under Microsoft platform. This device enables your PC or notebook point to multi-point friendly connecting with other bluetooth devices, such as PDA, mobile phone.

1.3 Test Methodology

The Bluetooth wireless USB Adapter designed with a transmitting method of Frequency Hopping spread spectrum, which operates at 2.4 GHz ISM band and data rate up to 11 Mbps. The rated output power is –9.26 dBm (0.119 mW).

1.4 Modifiction List of EUT

No modifications were required. (That is the EUT complied with the requirements as tested.)

1.5 Test Facility

The semi-anechoic chamber and conducted measurement facility used to collect the radiated and conducted data are located inside the Building at No.8, Lane 29, Wen-ming Road, Lo-shan Tsun, Kweishan Hsiang, Taoyuan, Taiwan, R.O.C.
This site has been accreditation as a FCC filing site.

2 PROVISIONS APPLICABLE

2.1 Definition

Unintentional radiator:
A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

Class A Digital Device:
A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

Class B Digital Device :
A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business of industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

Intentional radiator:
A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Requirement for Compliance

(1) Conducted Emission Requirement

For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following:

Frequency MHz	Quasi Peak dBμV	Average dBμV
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

*Decreases with the logarithm of the frequency.

For intentional device, according to § 15.207(a) Line Conducted Emission Limits is same as above table.

(2) Radiated Emission Requirement

For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency MHz	Distance Meters	Radiated dBμV/m	Radiated μV/m
30 - 88	3	40.0	100
88 - 216	3	43.5	150
216 - 960	3	46.0	200
above 960	3	54.0	500

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

(3) Antenna Requirement

For intentional device, according to § 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.

(4) 20dB Bandwidth Requirement

For frequency hopping systems, according to 15.247(a)(1), hopping channel carrier frequencies seperated by a minimum of 25kHz or the 20dB bandwidth of hopping channel, whichever is greater.

(5) Output Power Requirement

For frequency hopping systems, according to 15.247(1), operating in the 2400-2483.5MHz band employing at least 75 hopping channels. The maximum peak output power of the transmitter shall not exceed 1 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(6) 100 kHz Bandwidth of Frequency Band Edges Requirement

According to 15.247(c), if any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in § 15.209(a), whichever results in the lesser attenuation.

(7) Number of Hopping Channels

According to 15.247(b)(1), for frequency hopping systems, operating in the 2400-2483.5MHz band employing at least 75 hopping channels.

(8) Channel Carrier Frequencies Seperation

According to 15.247(a)(1)(iii), the frequency hopping systems shall have hopping channel carrier frequencies seperated by minimum of 25kHz or the 20dB bandwidth of hopping channel, whichever is greater.

(9) Dwell Time

According to 15.247(a)(1)(iii), frequency hopping system in the 2400-2483.5MHz band employing at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 second multiplied by the number of hopping channels employed.

(10) RF Exposure Evaluation

According to 15.247(b)(5), system operating under the provisions of this section(15.247) shall operated in a manner that ensures that the public is not exposed to radio frequency levels in excess of the commission guidelines, 1.1307(b)(1)

2.3 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.25
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio / TV technician for help.

3. SYSTEM TEST CONFIGURATION

3.1 Justification

For the purposes of this test report ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But never the less Ancillary Equipment can influence the test results..

3.2 Devices for Tested System

Device	Manufacture	Model	Cable Description
Notebook PC	ASUS	A1300	1.8m, Unshielded Power Line (Adaptor LITEON/PA-1530-01)

Remark "*" means equipment under test.

4 RADIATED EMISSION MEASUREMENT

4.1 Applicable Standard

For unintentional radiator, the radiated emission shall comply with § 15.109(a).

For intentional radiators, according to § 15.247 (a), operation under this provision is limited to frequency hopping and frequency hopping spread spectrum, and the out band emission shall be comply with § 15.247 (c)

4.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively.
2. For emission frequencies measured below 1 GHz, it is performed in a semi-anechoic chamber to determine the accurate frequencies of higher emissions. For emission frequencies measured above 1 GHz, a pre-scan be performed with a 1 meter measuring distance before final test.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

   Note : A band pass filter was used to avoid pre-amplifier saturated when measure TX operation mode in frequency band above 1 GHz.
5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the datarate, placement of ANT. cables associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration

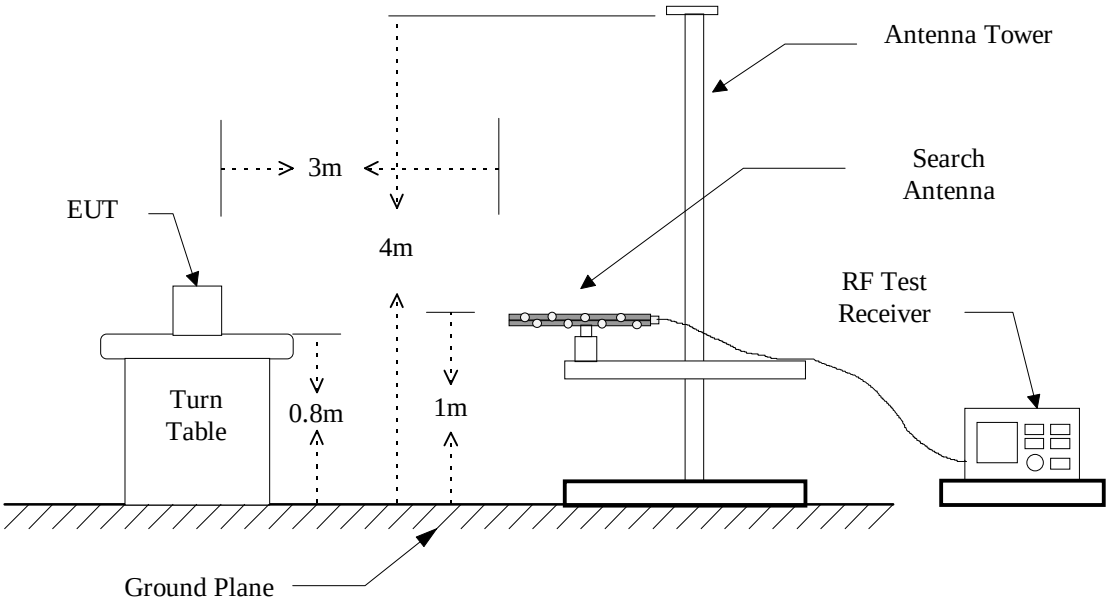
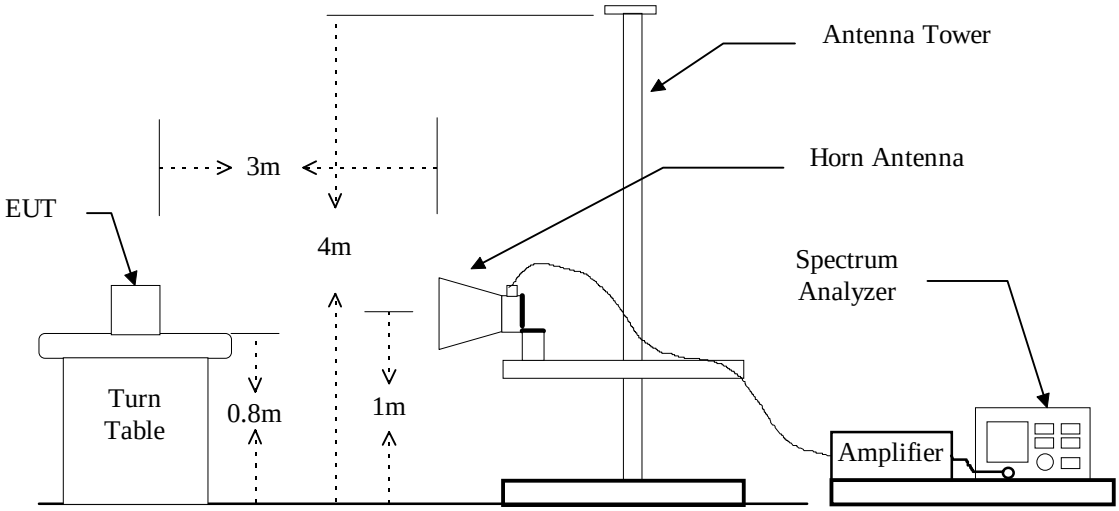


Figure 2 : Frequencies measured above 1 GHz configuration



4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

Equipment	**Manufacturer**	**Model No.**	**Next Cal. Due**
EMI Test Receiver	Hewlett-Packard	8546A	08/27/2003
Horn Antenna	EMCO	3115	06/05/2003
LogBicone Antenna	Schwarzbeck	9160	10/28/2003
Horn Antenna	EMCO	3116	06/28/2003
Preamplifier	Hewlett-Packard	8449B	09/04/2003
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2003

Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	300KHz
	Spectrum Analyzer	Peak	120 kHz	300 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10 Hz

4.4 Radiated Emission Data

4.4.1 RF Portion

a) Channel 0

Operation Mode : Receiving /Transmitting

Fundamental Frequency : 2402 MHz

Test Date : May 23, 2003 Temperature : 24 ℃ Humidity : 65 %

Frequency (MHz)	Reading (dBuV) H Peak	Reading (dBuV) H Ave	Reading (dBuV) V Peak	Reading (dBuV) V Ave	Factor (dB) Corr.	Result @3m (dBuV/m) Peak (H/V Max.)	Result @3m (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
1201.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
3603.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
4804.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
7206.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
9608.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
12010.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14412.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
16814.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19216.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
21618.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24020.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark “---” means that the emissions level is too low to be measured.
3. Item “Margin” referred to Average limit while there is only peak result.
4. The radiation emissions have been measured to beyond the tenth harmonic of the fundamenta frequency and show the significant frequencies, other means the value is too low to be detected.

b) Channel 39

Operation Mode : Receiving / Transmitting

Fundamental Frequency : 2441 MHz

Test Date : May 23, 2003 Temperature : 24 ℃ Humidity : 69 %

Frequency (MHz)	Reading (dBuV) H Peak	Reading (dBuV) H Ave	Reading (dBuV) V Peak	Reading (dBuV) V Ave	Factor (dB) Corr.	Result @3m (dBuV/m) Peak (H/V Max.)	Result @3m (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
1220.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
3660.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
4888.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
7320.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
9760.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
12200.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14640.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
17080.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19520.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
21960.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24400.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark “---” means that the emissions level is too low to be measured.
3. Item “Margin” referred to Average limit while there is only peak result.
4. The radiation emissions have been measured to beyond the tenth harmonic of the fundamenta frequency and show the significant frequencies, other means the value is too low to be detected.

c) Channel 78

Operation Mode : Receiving / Transmitting

Fundamental Frequency : 2480 MHz

Test Date : May 23, 2003 Temperature : 24 ℃ Humidity : 65 %

Frequency (MHz)	Reading (dBuV) H Peak	Reading (dBuV) H Ave	Reading (dBuV) V Peak	Reading (dBuV) V Ave	Factor (dB) Corr.	Result @3m (dBuV/m) Peak (H/V Max.)	Result @3m (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
1240.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
3720.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
4960.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
7440.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
9920.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
12400.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14880.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
17360.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19840.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
22320.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24800.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark “---” means that the emissions level is too low to be measured.
3. Item “Margin” referred to Average limit while there is only peak result.
4. The radiation emissions have been measured to beyond the tenth harmonic of the fundamenta frequency and show the significant frequencies, other means the value is too low to be detected.

4.4.2 Other Emission（30M~25G）

Operation Mode: Receiving / Transmitting Mode

Test Date : May 23, 2003 Temperature : 24 ℃ Humidity : 65 %

Frequency (MHz)	Ant-Pol H/V	Meter Reading (dBuV)	Corrected Factor (dB)	Result @3m (dBuV/m)	Limit @3m (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (m)
70.740	V	27.9	9.2	37.1	40.0	-2.9	118.0	1.0
85.290	H	28.0	10.1	38.1	40.0	-1.9	125.0	1.1
135.730	H	25.0	10.6	35.6	43.5	-7.9	118.0	1.1
135.730	V	25.3	10.6	35.9	43.5	-7.6	118.0	1.0
148.340	H	24.4	12.5	36.9	43.5	-6.6	198.0	1.0
245.340	H	24.1	14.5	38.6	46.0	-7.4	125.0	1.0
245.340	V	21.2	14.5	35.7	46.0	-10.3	118.0	1.0
264.740	H	26.2	15.6	41.8	46.0	-4.2	190.0	1.2
264.740	V	24.0	15.6	39.6	46.0	-6.4	120.0	1.0
407.330	H	23.8	20.6	44.4	46.0	-1.6	125.0	1.2
407.330	V	19.9	20.6	40.5	46.0	-5.5	120.0	1.0
460.680	H	20.0	21.3	41.3	46.0	-4.7	120.0	1.0
460.680	V	18.0	21.3	39.3	46.0	-6.7	118.0	1.0

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark “---” means that the emissions level is too low to be measured.
3. Item “Margin” referred to Average limit while there is only peak result.

4.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

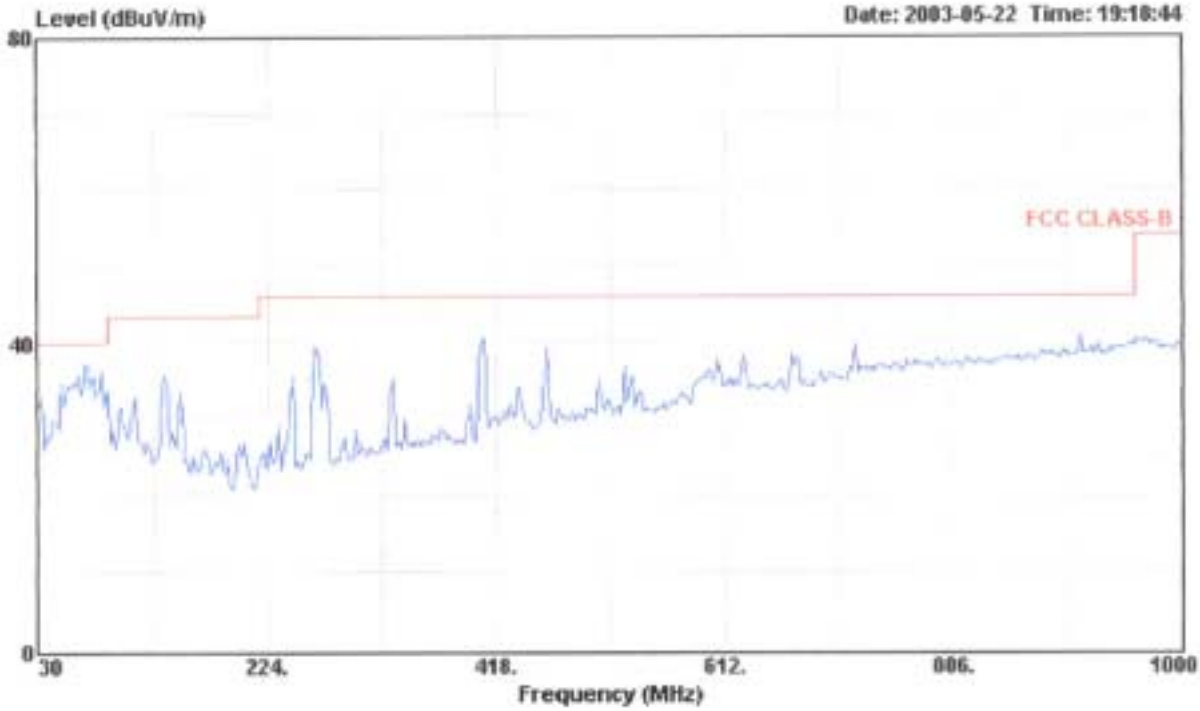
Result = Reading + Corrected Factor

where

Corrected Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Amplifier Gain

ETC EMC DEPARTMENT

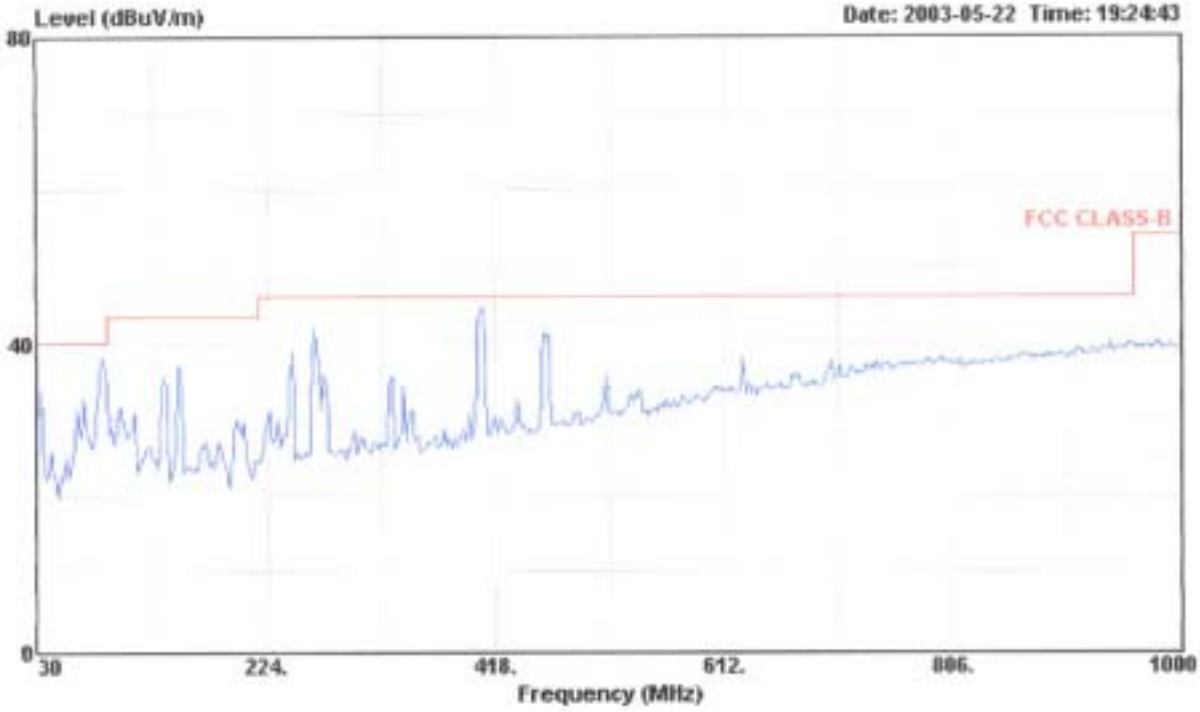
Data#: 697 File#: C:\Program Files\e3\anderson EMI



Site : M00 site
Condition : FCC CLASS-B 3m VERTICAL
EUT : Bluetooth USB
MODEL NO. BT2000.C-USB
Memo Bluetooth wireless USB Adapter

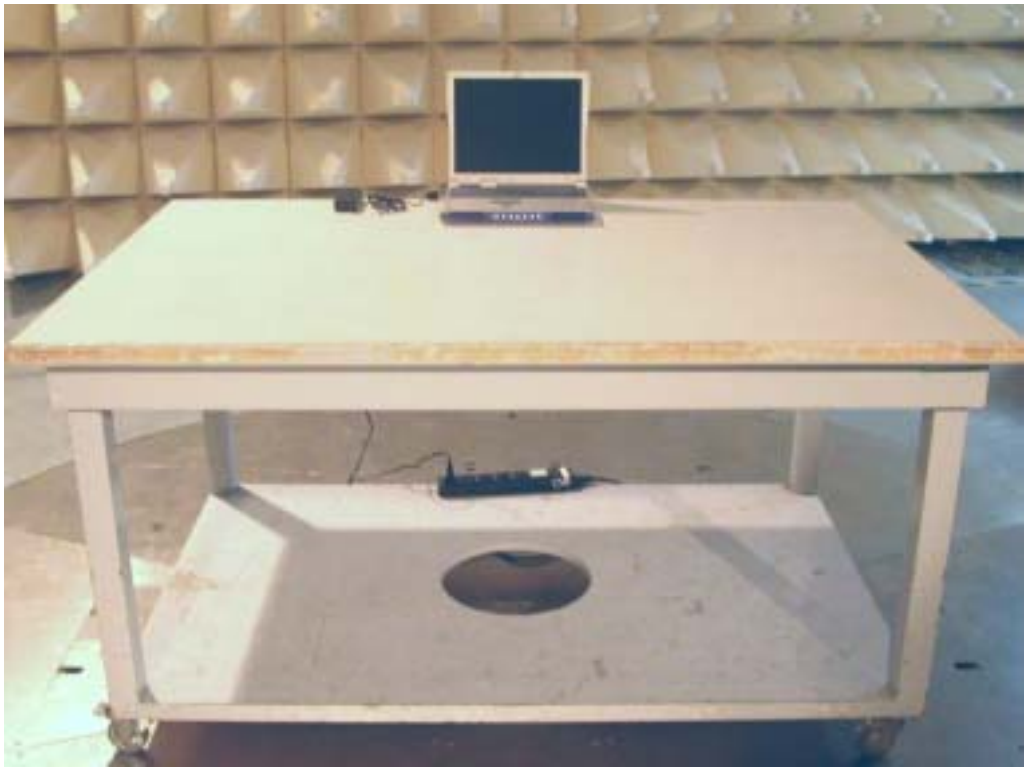
ETC EMC DEPARTMENT

Data#: 698 File#: C:\Program Files\e3\anderson EMI



Site : M00 site
Condition : FCC CLASS-B 3m HORIZONTAL
EUT : Bluetooth USB
MODEL NO. BT2000.C-USB
Memo Bluetooth wireless USB Adapter

4.6 Photos of Radiation Measuring Setup



5 CONDUCTED EMISSION MEASUREMENT

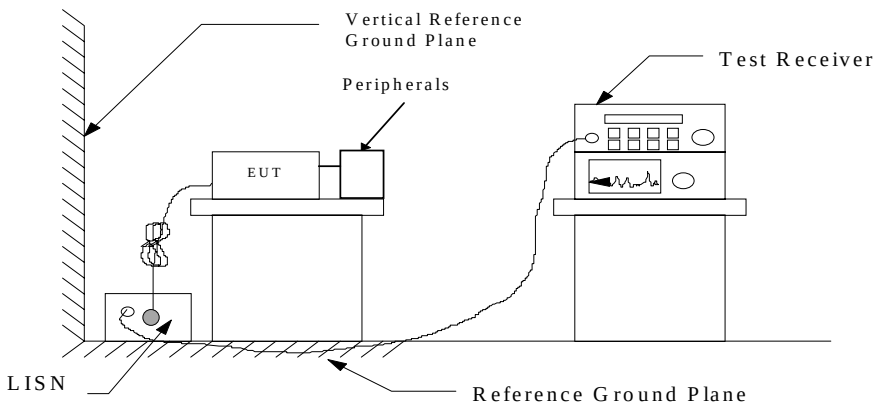
5.1 Applicable Standard

For unintentional digital devices, Line Conducted Emission Limits are in accordance to § 15.107(a) . And according to § 15.107(e), an alternative to the conducted limits is CISPR 22.

5.2 Measurement Procedure

1. Setup the configuration per figure 3.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 4 to 8 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then record the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 3 : Conducted emissions measurement configuration



5.3 Conducted Emission Data

Temperature : 24 ℃
Humidity : 65 %
Test Date : May 23, 2003
Operation Mode : CH 0

Freq. (MHz)	Meter Reading (dBuV)				Factor (dB)	Result (dBuV)				Limit (dBuV)		Margins (dB)
	Q.P Value		AVG. Value			Q.P Value		AVG. Value		Q.P Value	AVG. Value	Q.P. or AVG.
	L1	L2	L1	L2		L1	L2	L1	L2			
0.150	***	44.2	----	----	0.1	***	44.3	----	----	66.0	56.0	-21.7
0.205	38.6	***	----	----	0.1	38.7	***	----	----	63.4	53.4	-24.7
0.341	40.2	***	----	----	0.1	40.3	***	----	----	59.2	49.2	-18.9
0.478	***	34.6	----	----	0.1	***	34.7	----	----	56.4	46.4	-21.7
1.777	32.3	***	----	----	0.2	32.5	***	----	----	56.0	46.0	-23.5
2.184	***	31.9	----	----	0.2	***	32.1	----	----	56.0	46.0	-23.9
3.554	33.7	***	----	----	0.2	33.9	***	----	----	56.0	46.0	-22.1
4.914	***	34.0	----	----	0.2	***	34.2	----	----	56.0	46.0	-21.8
14.000	***	39.9	----	----	0.4	***	40.3	----	----	60.0	50.0	-19.7
15.250	39.9	***	----	----	0.4	40.3	***	----	----	60.0	50.0	-19.7
20.891	***	39.9	----	----	0.5	***	40.4	----	----	60.0	50.0	-19.6
21.300	40.5	***	----	----	0.5	41.0	***	----	----	60.0	50.0	-19.0

Note:

1. The full frequency range scanning test data is shown in next two pages.
2. “***” means the value was too low to be measured.
3. If the data table appeared symbol of "----" means the Q.P. value is under the limit for AVG. so, the AVG. value doesn't need to be measured.
4. The estimated measurement uncertainty of the result measurement is ± 3dB.

Temperature : 24 ℃
Humidity : 65 %
Test Date : May 23, 2003
Operation Mode : CH 39

Freq. (MHz)	**Meter Reading** (dBuV)				**Factor** (dB)	**Result** (dBuV)				**Limit** (dBuV)		**Margins** (dB)
	Q.P Value		AVG. Value			Q.P Value		AVG. Value		Q.P Value	AVG. Value	Q.P. or AVG.
	L1	L2	L1	L2		L1	L2	L1	L2			
0.150	46.7	***	----	----	0.1	46.8	***	----	----	66.0	56.0	-19.2
0.150	***	44.7	----	----	0.1	***	44.8	----	----	66.0	56.0	-21.2
0.177	***	42.4	----	----	0.1	***	42.5	----	----	64.6	54.6	-22.1
0.345	35.1	***	----	----	0.1	35.2	***	----	----	59.1	49.1	-23.9
2.867	***	32.5	----	----	0.2	***	32.7	----	----	56.0	46.0	-23.3
3.074	32.9	***	----	----	0.2	33.1	***	----	----	56.0	46.0	-22.9
4.914	***	33.9	----	----	0.2	***	34.1	----	----	56.0	46.0	-21.9
5.129	37.3	***	----	----	0.2	37.5	***	----	----	60.0	50.0	-22.5
14.551	***	40.4	----	----	0.4	***	40.8	----	----	60.0	50.0	-19.2
15.383	40.2	***	----	----	0.4	40.6	***	----	----	60.0	50.0	-19.4
20.891	***	40.6	----	----	0.5	***	41.1	----	----	60.0	50.0	-18.9
21.199	40.4	***	----	----	0.5	40.9	***	----	----	60.0	50.0	-19.1

Note:

1. The full frequency range scanning test data is shown in next two pages.
2. “***” means the value was too low to be measured.
3. If the data table appeared symbol of "----" means the Q.P. value is under the limit for AVG. so, the AVG. value doesn't need to be measured.
4. The estimated measurement uncertainty of the result measurement is ± 3dB.

Temperature : 24 ℃
Humidity : 65 %
Test Date : May 23, 2003
Operation Mode : CH 78

Freq. (MHz)	Meter Reading (dBuV)				Factor (dB)	Result (dBuV)				Limit (dBuV)		Margins (dB)
	Q.P Value		AVG. Value			Q.P Value		AVG. Value		Q.P Value	AVG. Value	Q.P. or AVG.
	L1	L2	L1	L2		L1	L2	L1	L2			
0.150	46.3	***	----	----	0.1	46.4	***	----	----	66.0	56.0	-19.6
0.200	***	41.2	----	----	0.1	***	41.3	----	----	63.6	53.6	-22.3
0.267	42.9	***	----	----	0.1	43.0	***	----	----	61.2	51.2	-18.2
0.957	***	31.7	----	----	0.1	***	31.8	----	----	56.0	46.0	-24.2
2.391	***	32.0	----	----	0.2	***	32.2	----	----	56.0	46.0	-23.8
2.527	32.3	***	----	----	0.2	32.5	***	----	----	56.0	46.0	-23.5
4.984	***	35.5	----	----	0.2	***	35.7	----	----	56.0	46.0	-20.3
4.988	35.9	***	----	----	0.2	36.1	***	----	----	56.0	46.0	-19.9
14.894	***	39.5	----	----	0.4	***	39.9	----	----	60.0	50.0	-20.1
15.109	40.0	***	----	----	0.4	40.4	***	----	----	60.0	50.0	-19.6
20.734	***	40.5	----	----	0.5	***	41.0	----	----	60.0	50.0	-19.0
20.781	40.6	***	----	----	0.5	41.1	***	----	----	60.0	50.0	-18.9

Note:

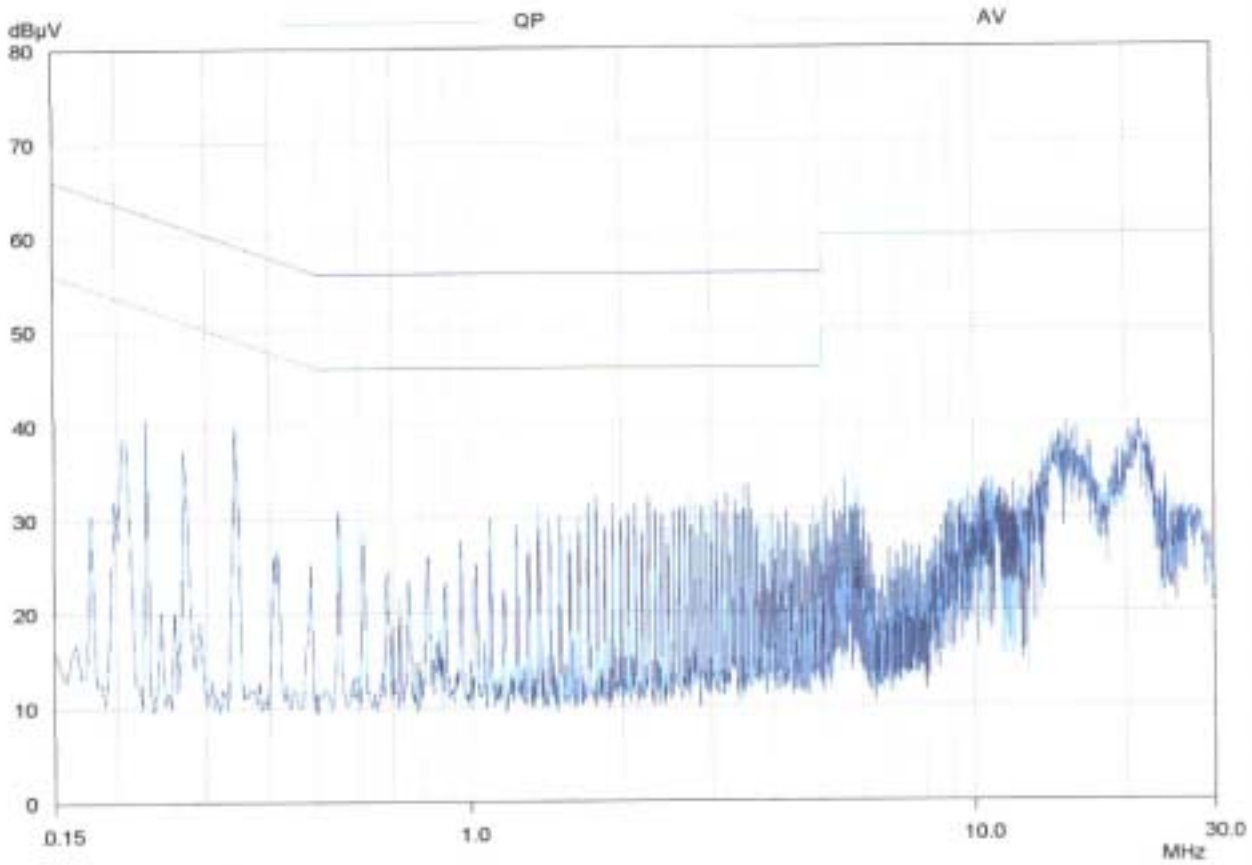
1. The full frequency range scanning test data is shown in next two pages.
2. “***” means the value was too low to be measured.
3. If the data table appeared symbol of "----" means the Q.P. value is under the limit for AVG. so, the AVG. value doesn't need to be measured.
4. The estimated measurement uncertainty of the result measurement is ± 3dB.

Conducted Emission Test

Peak Value

EUT:	Bluetooth wireless USB Adapter (BT2000.C-USB)
Manuf:	FORMOSA TELETEK CO.
Op Cond:	CH0
Operator:	Anderson
Test Spec:	FCC PART15 B
Comment:	L TX+RX
Result File:	audio.dat : New Measurement

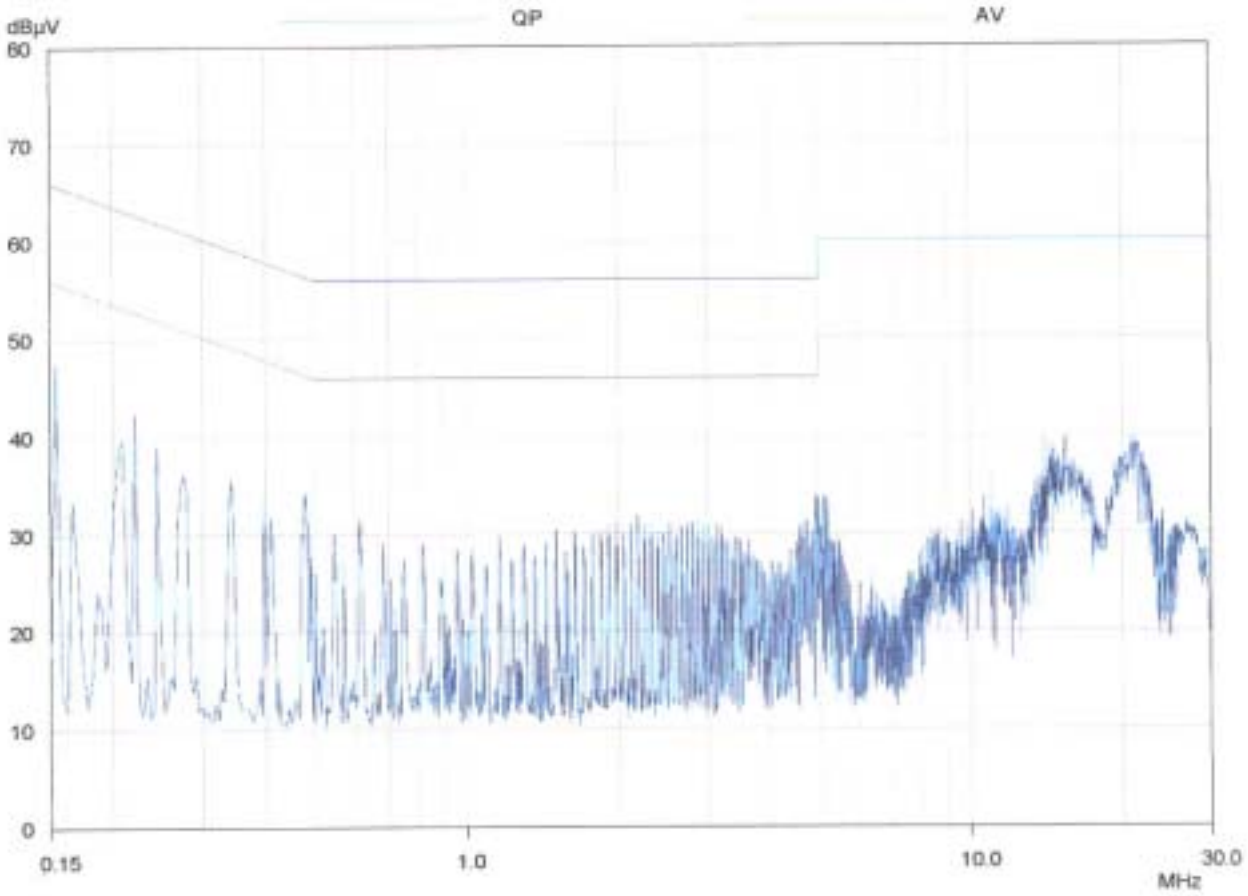
Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	8
	Acc Margin:	25 dB



Conducted Emission Test
Peak Value

EUT:	Bluetooth wireless USB Adapter (BT2000.C-USB)
Manuf:	
Op Cond:	CH0
Operator:	Anderson
Test Spec:	FCC PART15 B
Comment:	N
	TX+RX
Result File:	audio.dat : New Measurement

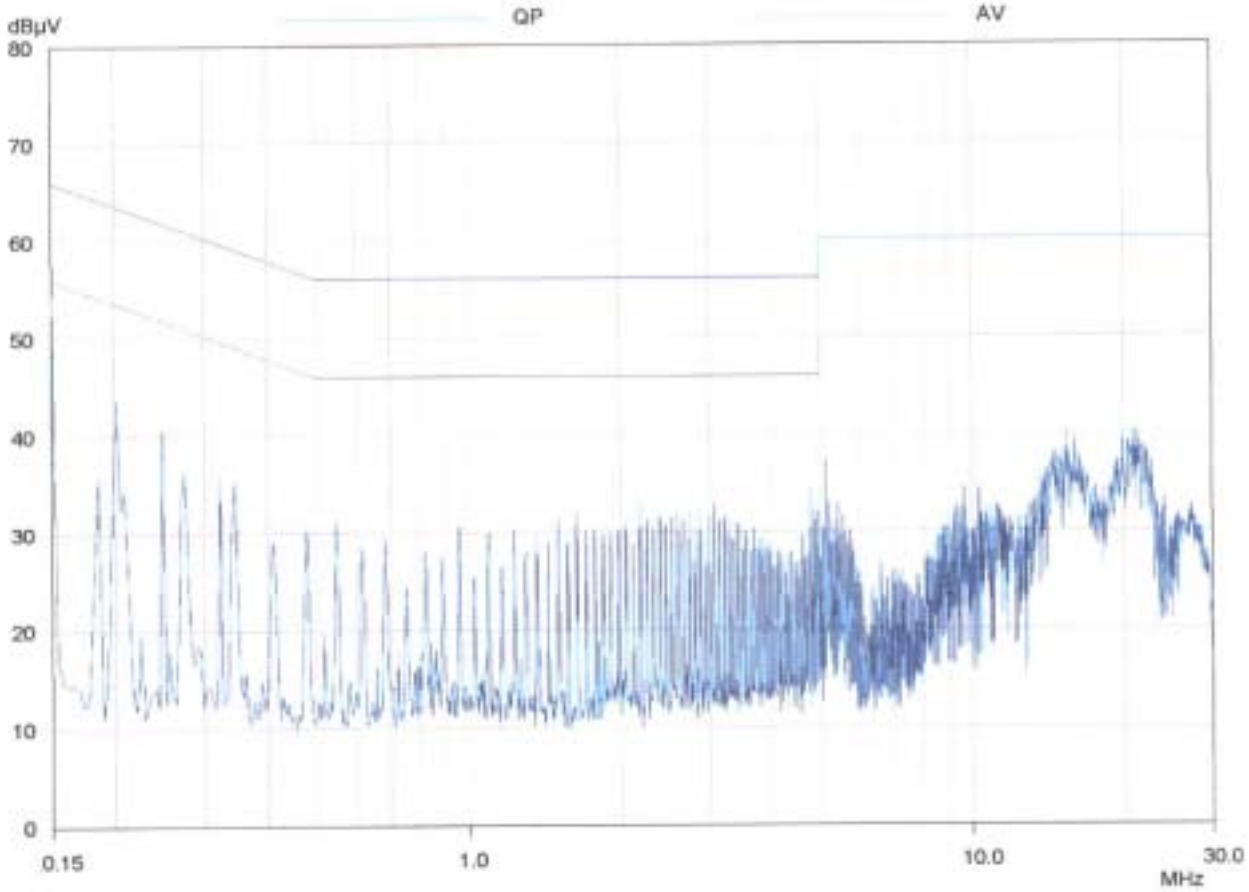
Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	8
	Acc Margin:	25 dB



Conducted Emission Test
Peak Value

EUT:	Bluetooth wireless USB Adapter (BT2000.C-USB)
Manuf:	
Op Cond:	CH39
Operator:	Anderson
Test Spec:	FCC PART15 B
Comment:	L
	TX+RX
Result File:	audio.dat : New Measurement

Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	8
	Acc Margin:	25 dB

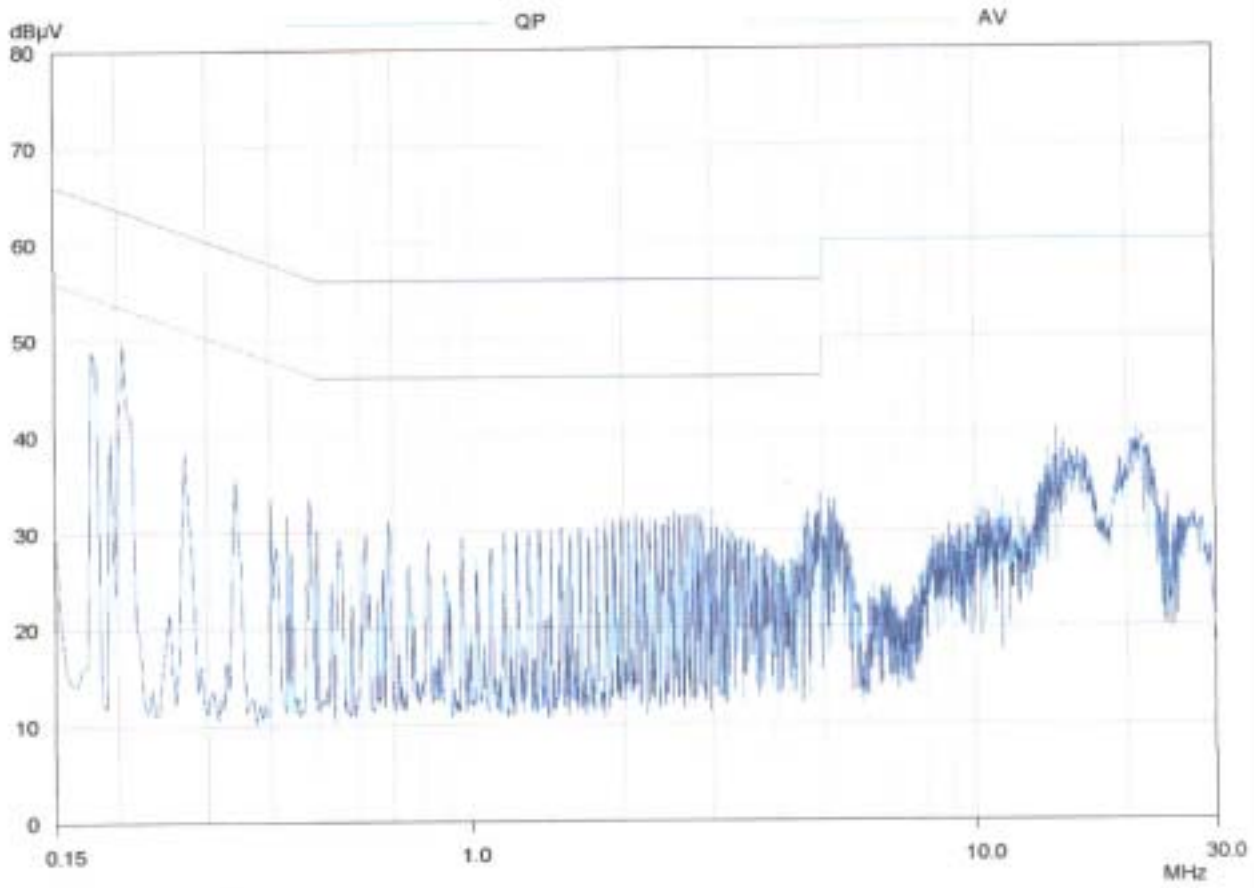


Conducted Emission Test

Peak Value

EUT:	Bluetooth wireless USB Adapter (BT2000.C-USB)
Manuf:	
Op Cond:	CH39
Operator:	Anderson
Test Spec:	FCC PART15 B
Comment:	N
	TX+RX
Result File:	audio.dat : New Measurement

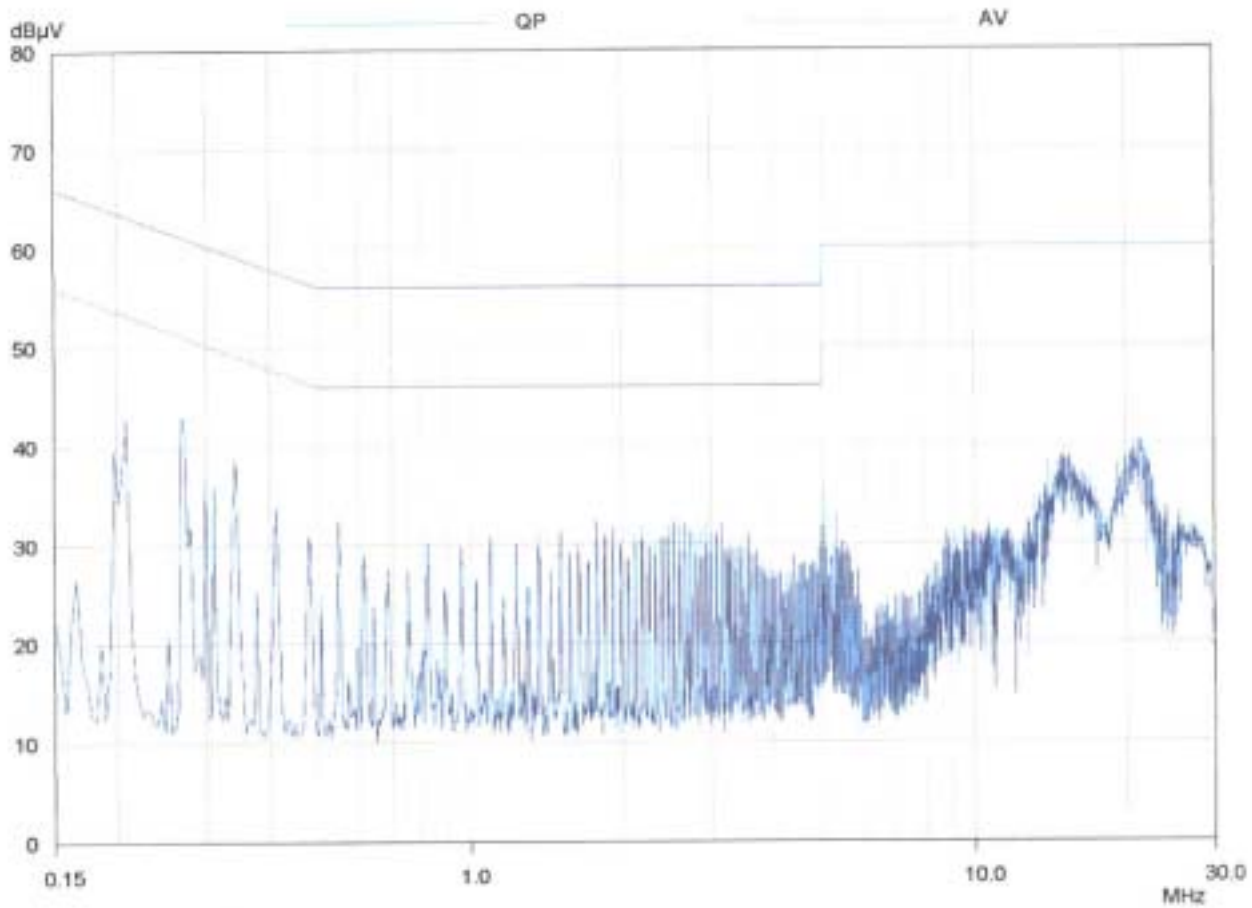
Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	8
	Acc Margin:	25 dB



Conducted Emission Test
Peak Value

EUT:	Bluetooth wireless USB Adapter (BT2000.C-USB)
Manuf:	
Op Cond:	CH78
Operator:	Anderson
Test Spec:	FCC PART15 B
Comment:	L
	TX+RX
Result File:	audio.dat : New Measurement

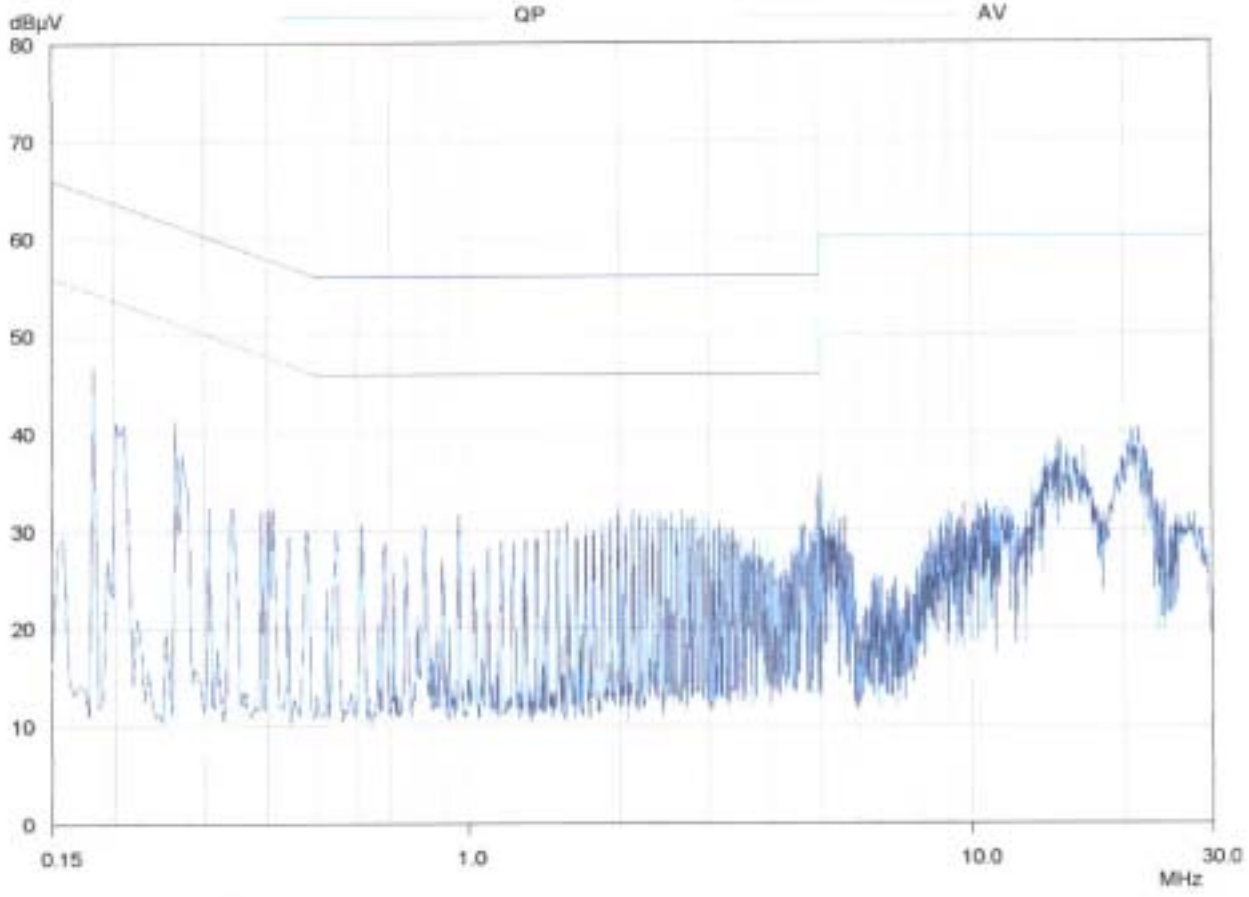
Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	8
	Acc Margin:	25 dB



Conducted Emission Test
Peak Value

EUT:	Bluetooth wireless USB Adapter (BT2000.C-USB)
Manuf:	
Op Cond:	CH78
Operator:	Anderson
Test Spec:	FCC PART15 B
Comment:	N
	TX+RX
Result File:	audio.dat : New Measurement

Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	8
	Acc Margin:	25 dB



5.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

RESULT = READING + LISN FACTOR

Assume a receiver reading of 22.5 dBμV is obtained, and LISN Factor is 0.1 dB, then the total of field strength is 22.6 dBμV.

RESULT = 22.5 + 0.1 = 22.6 dBμV
Level in μV = Common Antilogarithm[(22.6 dBμV)/20]
= 13.48 μV

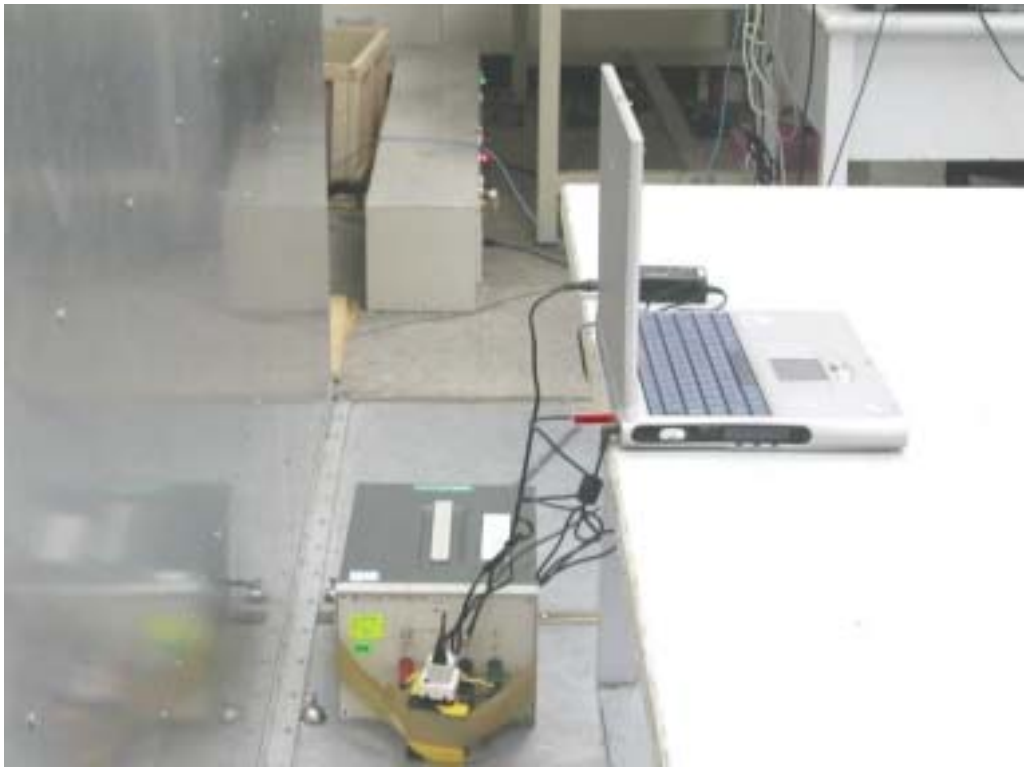
5.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test .

Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
EMI Test Receiver	R&S	ESCS30	13054409-001	Sep. 23, 2003
LISN	EMCO	3825	13057704-001	Nov. 02, 2003

Note: The standards used to perform this calibration are traceable to NML/ROC and NIST/USA.

5.6 Photos of Conduction Measuring Setup



6 ANTENNA REQUIREMENT

6.1 Standard Applicable

For intentional device, according to § 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 § 15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.2 Antenna Construction and Directional Gain

Highly efficient special antennas fix on the PCB. The directional gain of antenna used for transmitting is typical 2.5dBi (Max) and the details Please refer to antenna construction.

7 20dB EMISSION BANDWIDTH MEASUREMENT

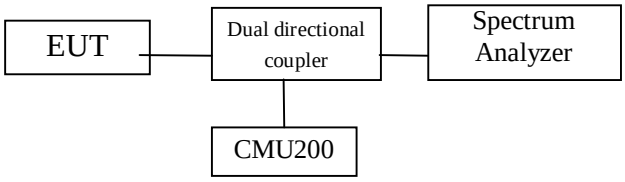
7.1 Standard Applicable

According to 15.247(a)(1), for frequency hopping systems, hopping channel carrier frequencies seperated by a minimum of 25kHz or the 20dB bandwidth of hopping channel, whichever is greater.

7.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Figure 4: Emission bandwidth measurement configuration.



7.3 Measurement Equipment

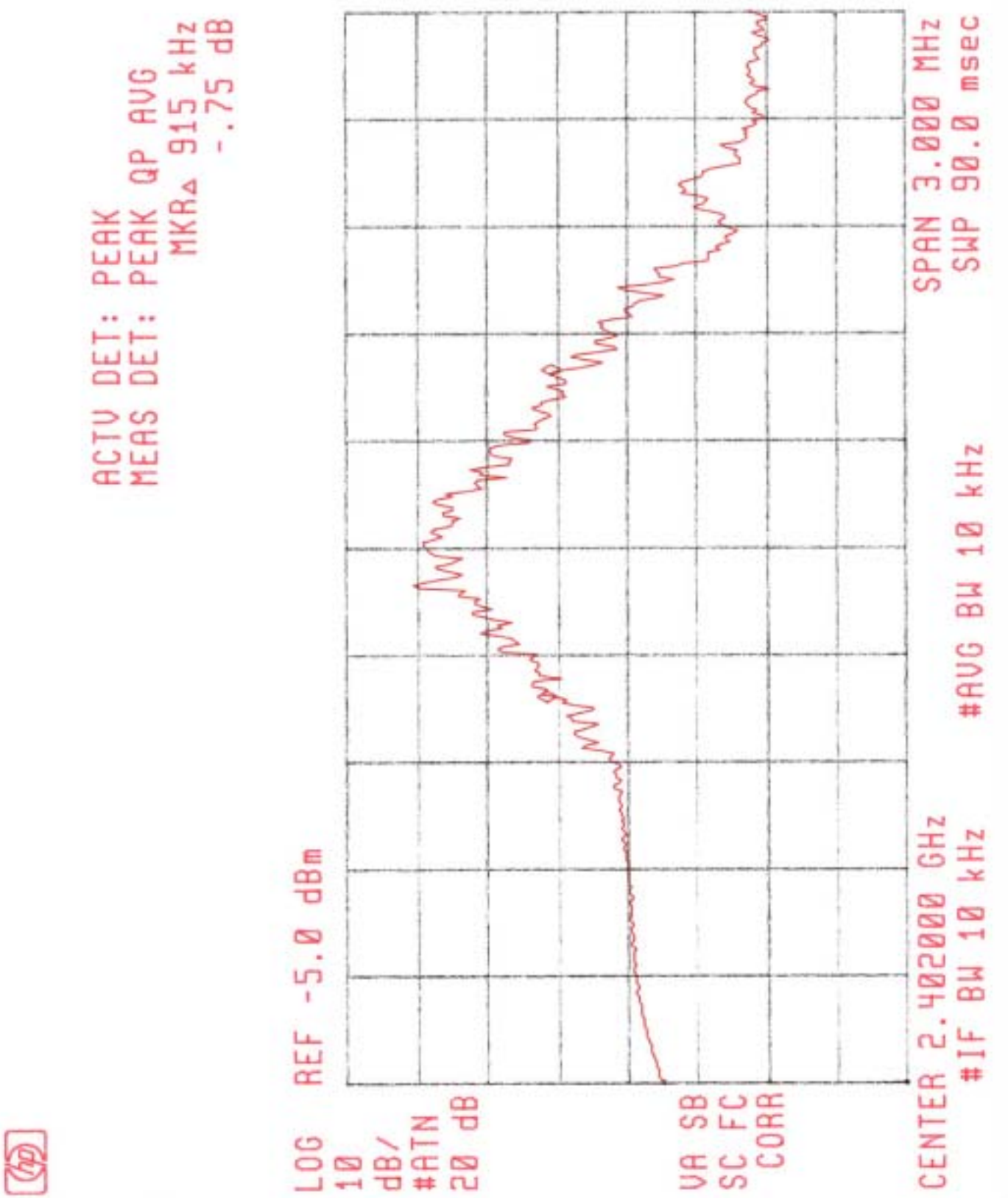
Equipment	Manufacturer	Model No.	Next Cal. Due
Plotter	Hewlett-Packard	7550A	N/A
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2003
Universal Radio Communication Tester	Rohde and Schwarz	CMU200	06/25/2003
Dual Directional Coupler	Agilent	778D	03/13/2004

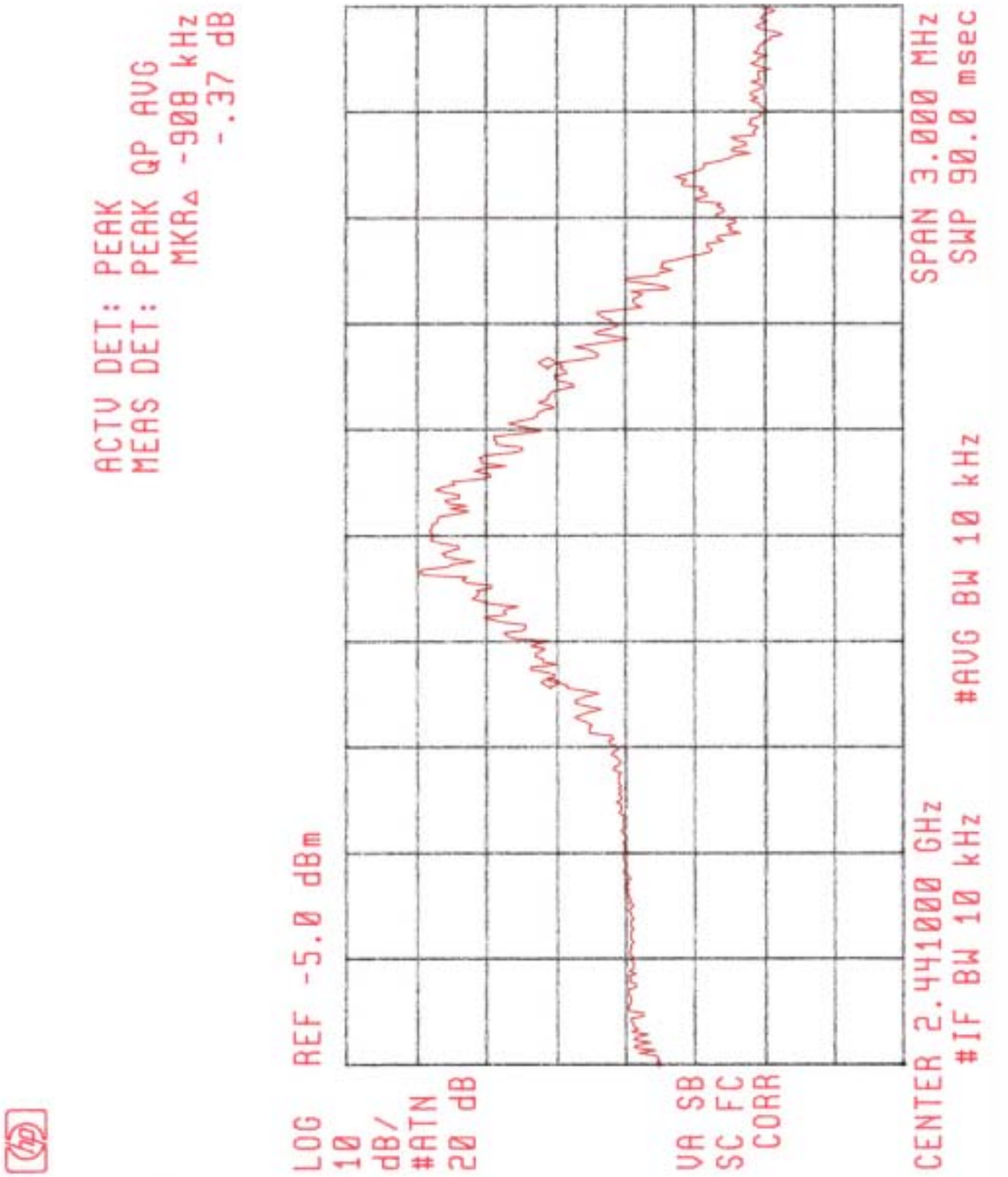
7.4 Measurement Data

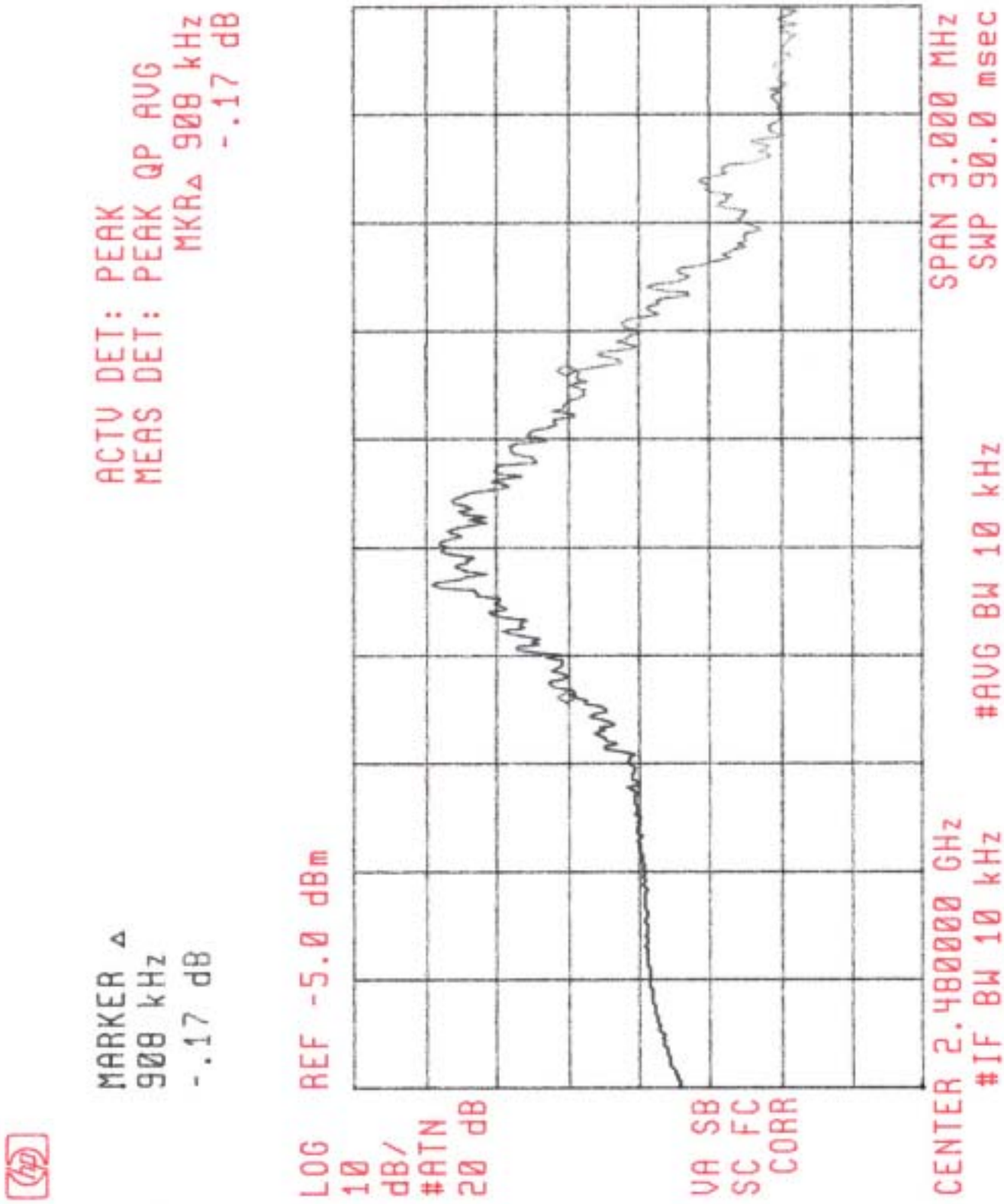
Test Date : May 23, 2003 Temperature : 24 ℃ Humidity: 65%

a) Channel 0 : 20 dB Emission Bandwidth is 915 KHz
b) Channel 39 : 20 dB Emission Bandwidth is 908 KHz
c) Channel 78 : 20 dB Emission Bandwidth is 908 KHz

Note: Please see Appendix 1 for ploted datas


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR∆ 915 kHz
-.75 dB
LOG REF -5.0 dBm
10
dB/
#ATN
20 dB
VA SB
SC FC
CORR
CENTER 2.402000 GHz
#IF BW 10 kHz
#AVG BW 10 kHz
SPAN 3.000 MHz
SWP 90.0 msec


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR△ -908 kHz
-.37 dB
LOG
10
dB/
#ATN
20 dB
REF -5.0 dBm
VA SB
SC FC
CORR
CENTER 2.441000 GHz
#IF BW 10 kHz
SPAN 3.000 MHz
SWP 90.0 msec
#AVG BW 10 kHz


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR△ 908 kHz
-.17 dB
MARKER △
908 kHz
-.17 dB
LOG REF -5.0 dBm
10
dB/
#ATN
20 dB
VA SB
SC FC
CORR
CENTER 2.480000 GHz
#IF BW 10 kHz
#AVG BW 10 kHz
SPAN 3.000 MHz
SWP 90.0 msec

8 OUTPUT POWER MEASUREMENT

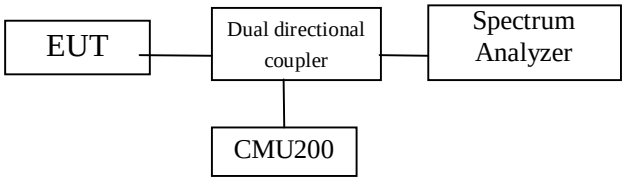
8.1 Standard Applicable

For frequency hopping system, according to 15.247(b), the maximum peak output power of the transmitter shall not exceed 1 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz and VBW to 3 MHz.
4. Measure the highest amplitude appearing on spectral display and record the level to calculate result data.
5. Repeat above procedures until all frequencies measured were complete.

Figure 5: Output power and measurement configuration.



8.3 Measurement Equipment

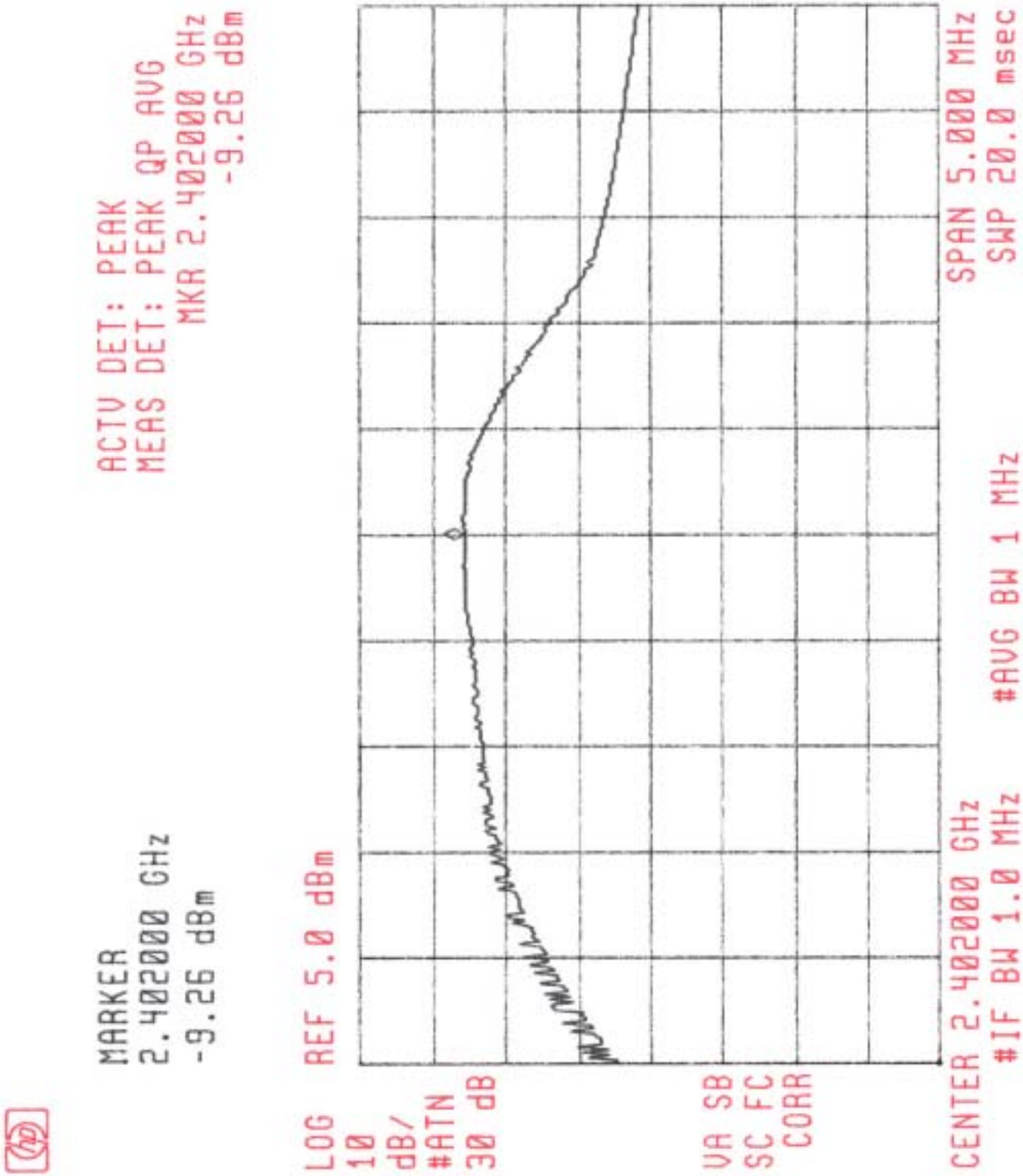
Equipment	Manufacturer	Model No.	Next Cal. Due
Plotter	Hewlett-Packard	7550A	N/A
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2003
Universal Radio Communication Tester	Rohde and Schwarz	CMU200	06/25/2003
Dual Directional Coupler	Agilent	778D	03/13/2004

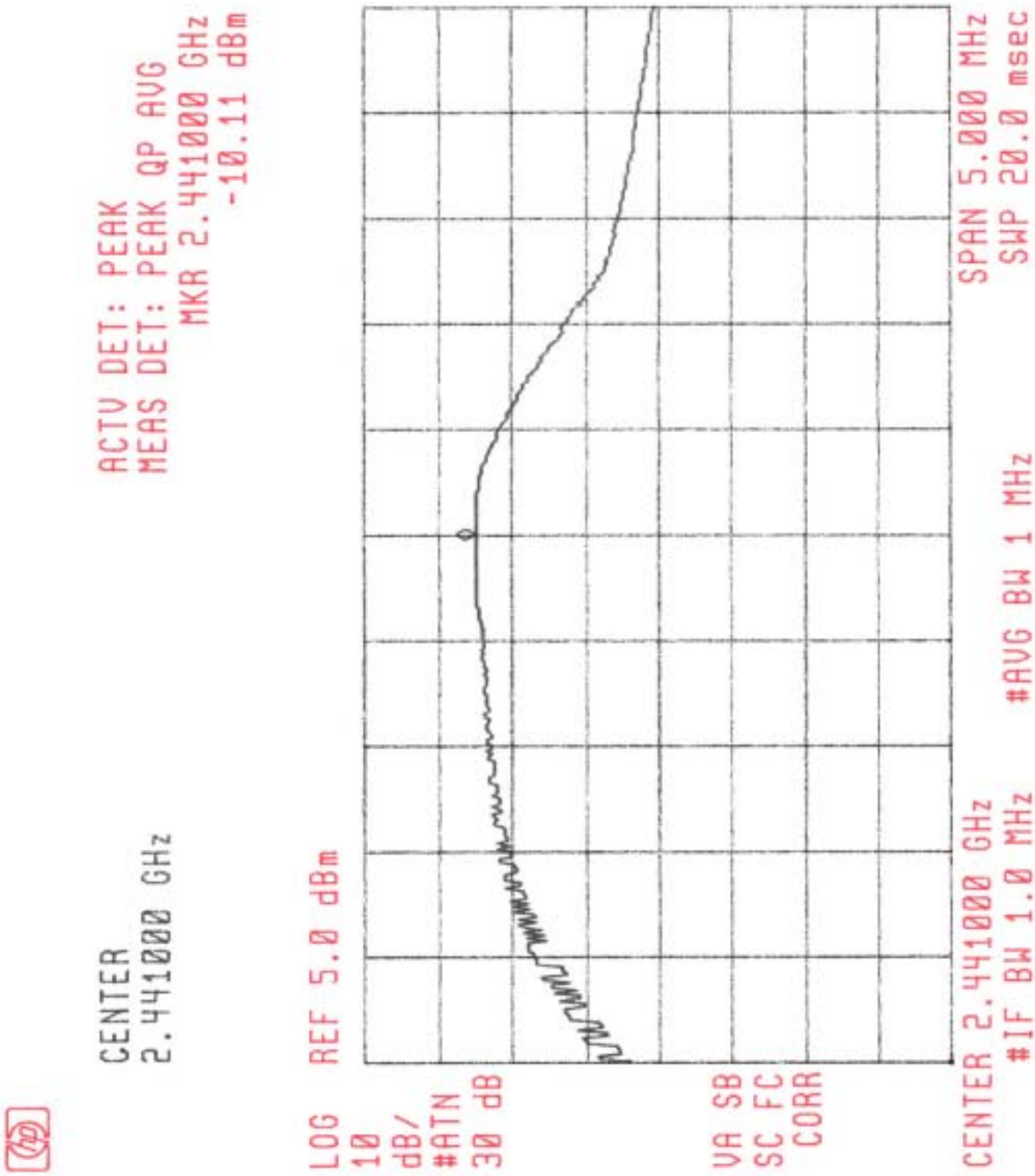
8.4 Measurement Data

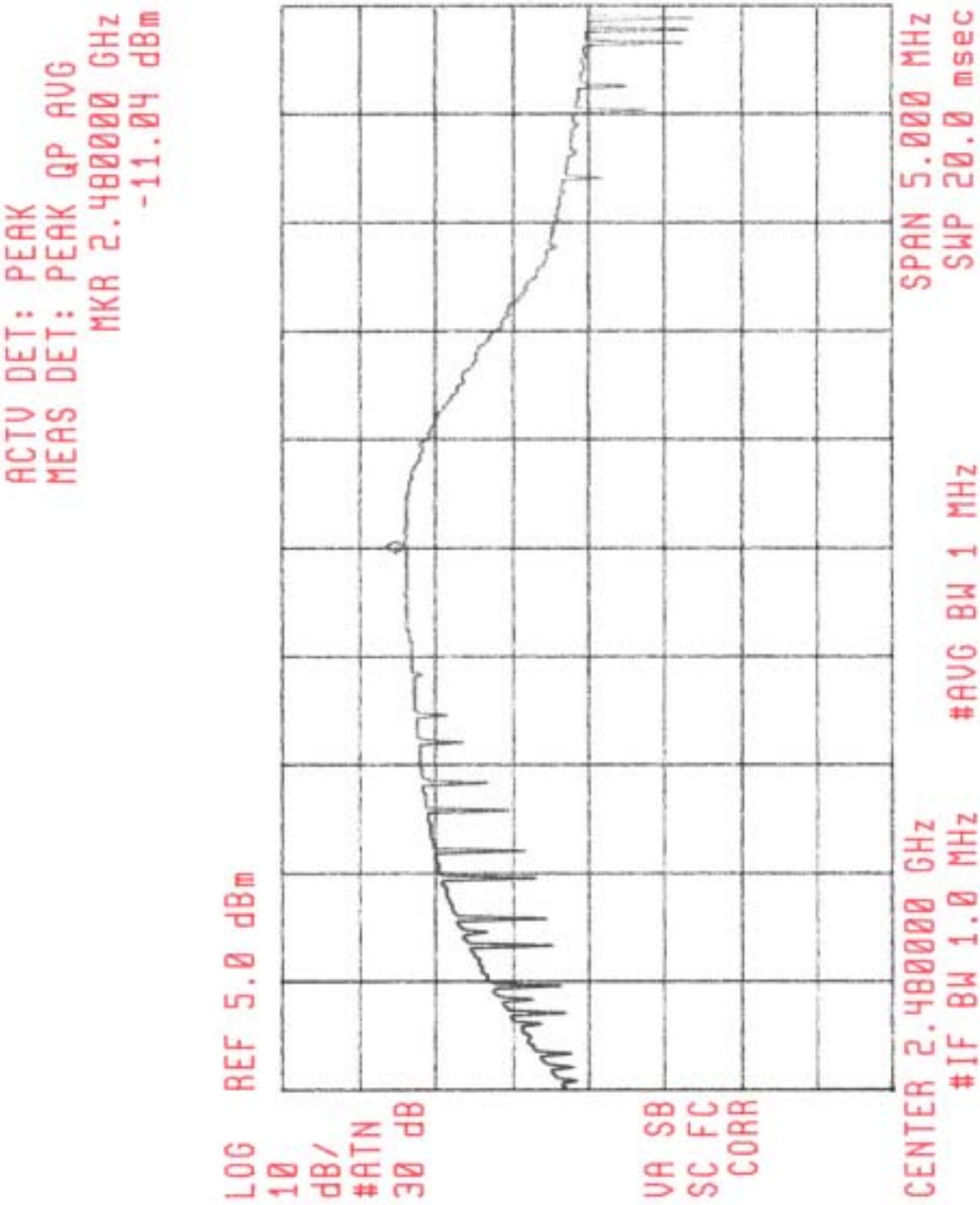
Test Date : May 23, 2003 Temperature : 24 ℃ Humidity: 65 %

a) Channel 0 : Output Peak Power is –9.26 dBm or **0.119** mW
b) Channel 39 : Output Peak Power is –10.11 dBm or **0.097** mW
c) Channel 78 : Output Peak Power is –11.04 dBm or **0.079** mW

Note: Please see Appendix 2 for ploted datas


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.402000 GHz
-9.26 dBm
MARKER
2.402000 GHz
-9.26 dBm
LOG REF 5.0 dBm
10
dB/
#ATN
30 dB
VA SB
SC FC
CORR
CENTER 2.402000 GHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 5.000 MHz
SWP 20.0 msec


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.441000 GHz
-10.11 dBm
CENTER
2.441000 GHz
REF 5.0 dBm
LOG
10
dB/
#ATN
30 dB
VA SB
SC FC
CORR
CENTER 2.441000 GHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 5.000 MHz
SWP 20.0 msec


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.480000 GHz
-11.04 dBm
LOG REF 5.0 dBm
10
dB/
#ATN
30 dB
VA SB
SC FC
CORR
CENTER 2.480000 GHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 5.000 MHz
SWP 20.0 msec

9 100 kHz BANDWIDTH OF BAND EDGES MEASUREMENT

9.1 Standard Applicable

According to 15.247(c), if any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in § 15.209(a), whichever results in the lesser attenuation.

9.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

9.3 Measurement Equipment

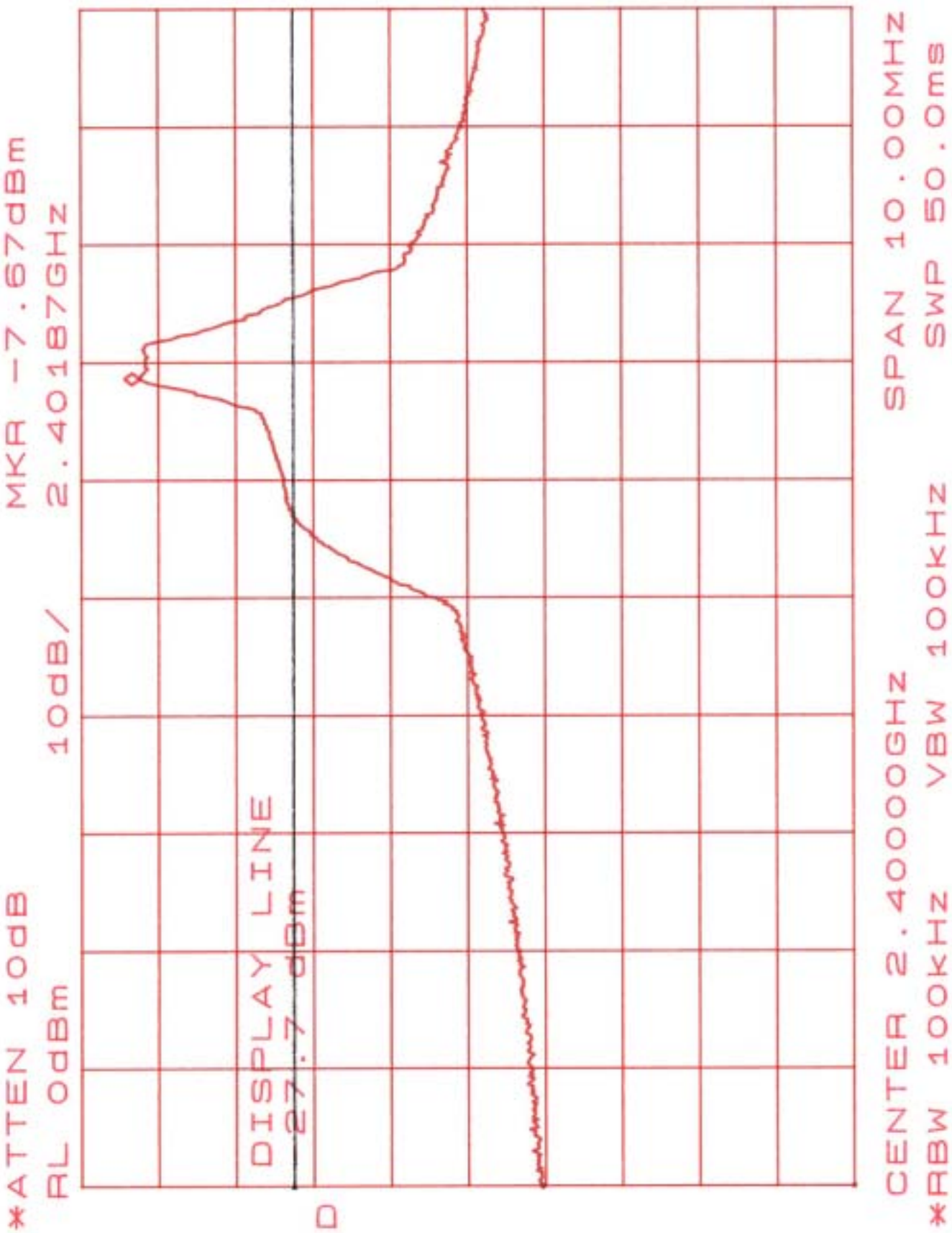
Equipment	Manufacturer	Model No.	Next Cal. Due
Plotter	Hewlett-Packard	7550A	N/A
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2003
Universal Radio Communication Tester	Rohde and Schwarz	CMU200	06/25/2003
Dual Directional Coupler	Agilent	778D	03/13/2004

9.4 Measurement Data

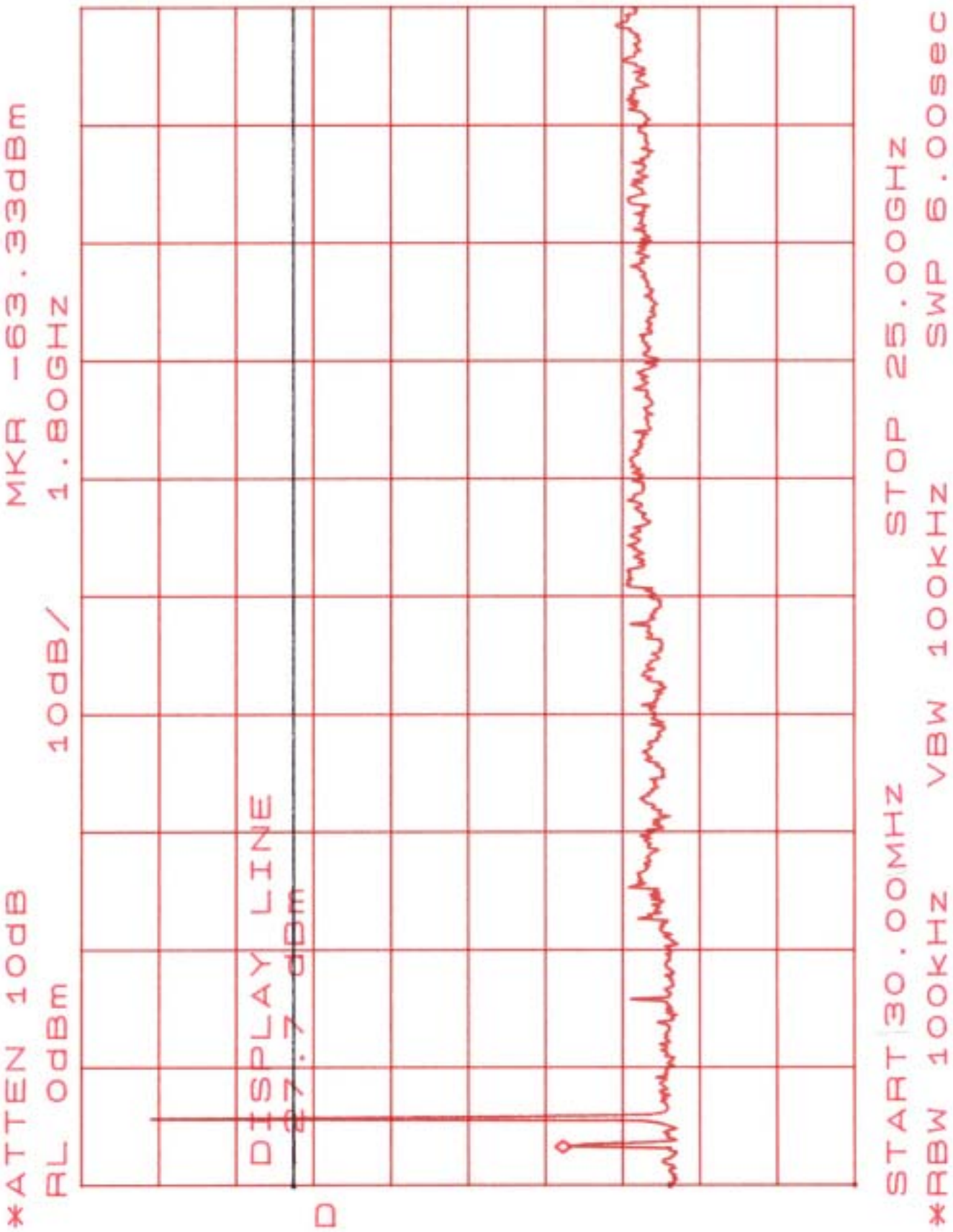
Test Date : May 23, 2003 Temperature : 24 ℃ Humidity: 65%

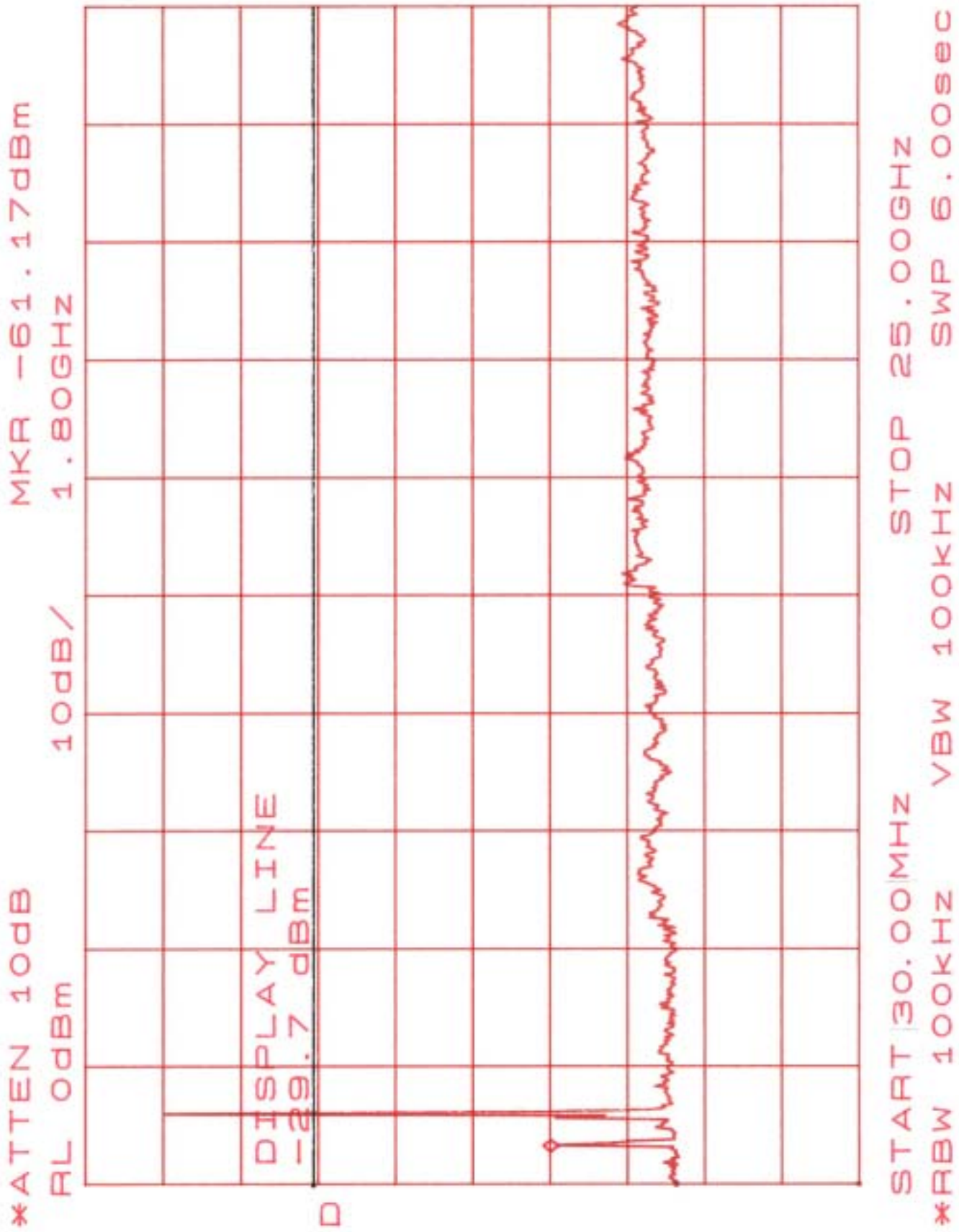
a) Lower Band Edge : maximum value is –46.02dBm that is attenuated more than 20dB
b) Upper Band Edge : maximum value is –56.27 dBm that is attenuated more than 20dB

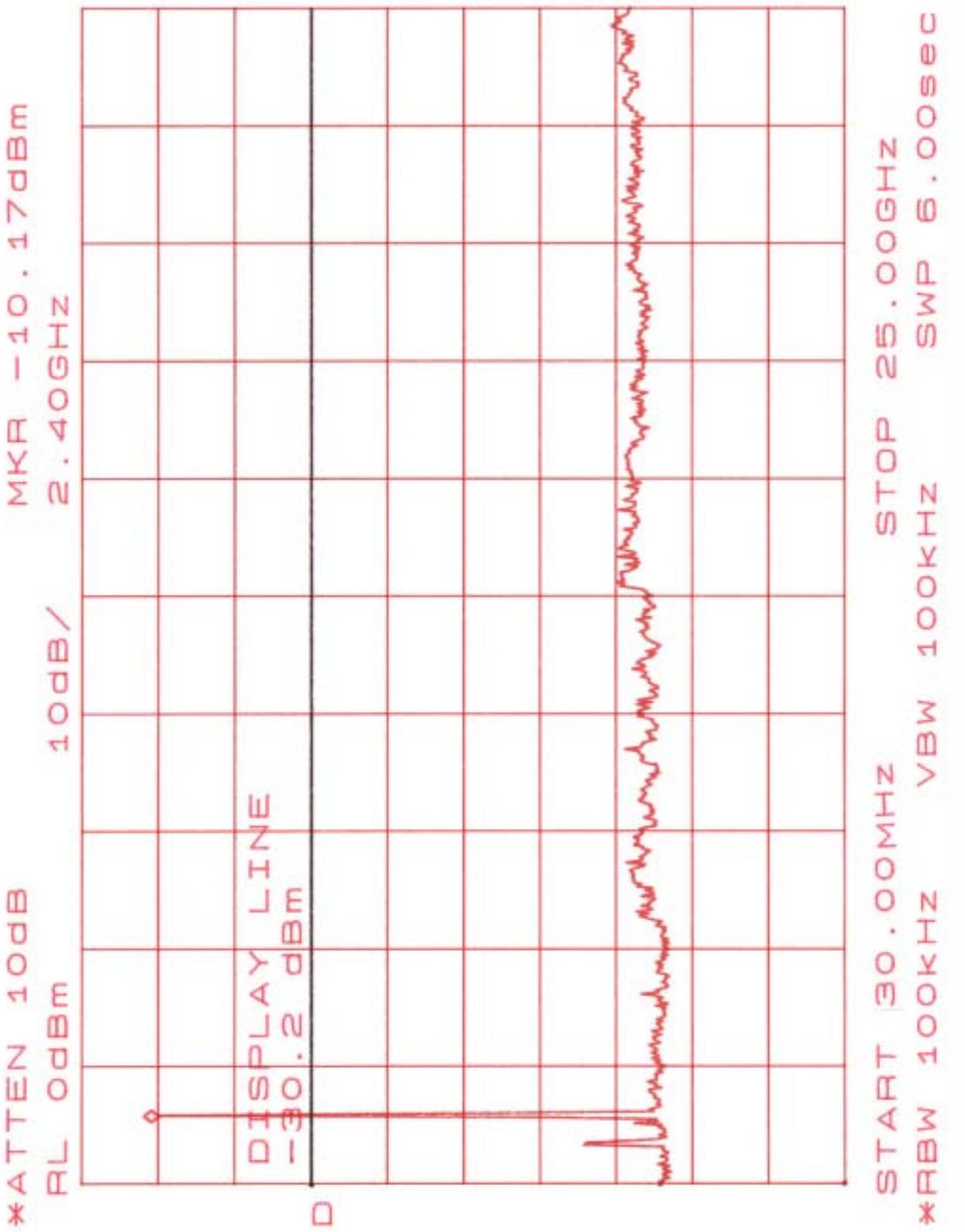
Note: Please see Appendix 3 for ploted datas


*ATTEN 10dB
RL 0dBm
10dB/
MKR -7.67dBm
2.40187GHz
DISPLAY LINE
27.7 dBm
D
CENTER 2.40000GHz
*RBW 100kHz
VBW 100kHz
SPAN 10.00MHz
SWP 50.0ms

*ATTEN 20dB
RL -5.0dBm
10dB/
MKR -9.67dBm
2.47992GHz
DISPLAY LINE
-29.7 dBm
CENTER 2.48350GHz
*RBW 100kHz
VBW 100kHz
SPAN 10.00MHz
SWP 50.0ms


*ATTEN 10dB
RL 0dBm
10dB/
MKR -63.33dBm
1.80GHz
DISPLAY LINE
27.7 dBm
D
STOP 25.00GHz
SWP 6.00sec
START 30.00MHz
VBW 100kHz
*RBW 100kHz


*ATTEN 10dB
RL 0dBm
10dB/
MKR -61.17dBm
1.80GHz
DISPLAY LINE
-29.7 dBm
D
START 30.00MHz
*RBW 100kHz
VBW 100kHz
STOP 25.00GHz
SWP 6.00sec


*ATTEN 10dB
RL 0dBm
10dB/
MKR -10.17dBm
2.40GHz
DISPLAY LINE
-30.2 dBm
D
*RBW 100kHz
START 30.00MHz
VBW 100kHz
STOP 25.00GHz
SWP 6.00sec

10 RADIATED MEASUREMENT AT BANDEDGE WITH FUNDAMENTAL FREQUENCIES

10.1 Standard Applicable

According to 15.247(c), radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

10.2 Measurement Procedure

1. Setup the configuration per figure 2 for 2.39GHz and 2.4835GHz measured.
2. Set the spectrum analyzer on 1MHz resolution bandwidth for each frequency measured.
3. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position th highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0º to 360º with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.
4. Repeat step 3 until all frequencies need to be measured were complete.
5. Repeat step 4 with search antenna in vertical polarized orientations.
6. Measurement applied to channel 0、39、78, recorded the result.

10.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

Equipment	Manufacturer	Model No.	Next Cal. Due
EMI Test Receiver	Hewlett-Packard	8546A	08/27/2003
Horn Antenna	EMCO	3115	06/05/2003
LogBicone Antenna	Schwarzbeck	9160	10/28/2003
Horn Antenna	EMCO	3116	06/28/2003
Preamplifier	Hewlett-Packard	8449B	09/04/2003
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2003
Universal Radio Communication Tester	Rohde and Schwarz	CMU200	06/25/2003
Dual Directional Coupler	Agilent	778D	03/13/2004

Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
2390 & 2483.5	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10 Hz

10.4 Radiated Emission Data

a) Channel 0

Operation Mode : Receiving /Transmitting

Fundamental Frequency : 2402 MHz

Test Date : May 23, 2003 Temperature : 24 ℃ Humidity : 65 %

Frequency (MHz)	Reading (dBuV) H Peak	H Ave	V Peak	V Ave	Factor (dB) Corr.	Result @3m (dBuV/m) Peak (H/V Max.)	Result @3m Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m Ave.	Margin (dB) (H/V Max)	Table Deg. (Deg.)	Ant. High (m)
2390.000	50.3	---	50.8	---	-2.1	48.7	---	74.0	54.0	-5.3	180	1.0
2483.500	59.0	---	56.0	49.3	-1.7	57.3	47.6	74.0	54.0	-6.4	0	1.0

b) Channel 39

Operation Mode : Receiving / Transmitting

Fundamental Frequency : 2441MHz

Test Date : May 23, 2003 Temperature : 24 ℃ Humidity : 65 %

Frequency (MHz)	Reading (dBuV) H Peak	H Ave	V Peak	V Ave	Factor (dB) Corr.	Result @3m (dBuV/m) Peak (H/V Max.)	Result @3m Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m Ave.	Margin (dB) (H/V Max)	Table Deg. (Deg.)	Ant. High (m)
2383.000	50.2	---	50.3	---	-2.1	48.2	---	74.0	54.0	-5.8	180	1.0
2483.500	58.7	---	56.2	48.8	-1.7	56.0	47.1	74.0	54.0	-6.9	360	1.0

c) Channel 78

Operation Mode : Receiving / Transmitting

Fundamental Frequency : 2480 MHz

Test Date : May 23, 2003 Temperature : 24 ℃ Humidity : 65 %

Frequency (MHz)	Reading (dBuV) H Peak	H Ave	V Peak	V Ave	Factor (dB) Corr.	Result @3m (dBuV/m) Peak (H/V Max.)	Result @3m Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m Ave.	Margin (dB) (H/V Max)	Table Deg. (Deg.)	Ant. High (m)
2390.000	50.4	---	51.0	---	-2.1	48.9	---	74.0	54.0	-5.1	180	1.0
2483.500	58.7	---	56.0	49.1	-1.7	57.0	47.4	74.0	54.0	-6.6	0	1.0

11 NUMBER OF HOPPING CHANNELS

11.1 Standard Applicable

According to 15.247(b)(1), for frequency hopping systems, operating in the 2400-2483.5MHz band employing at least 75 hopping channels

11.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set EUT to hopping operating mode and set spectrum analyzer miximum to measure the number of hopping channels.

11.3 Measurement Equipment

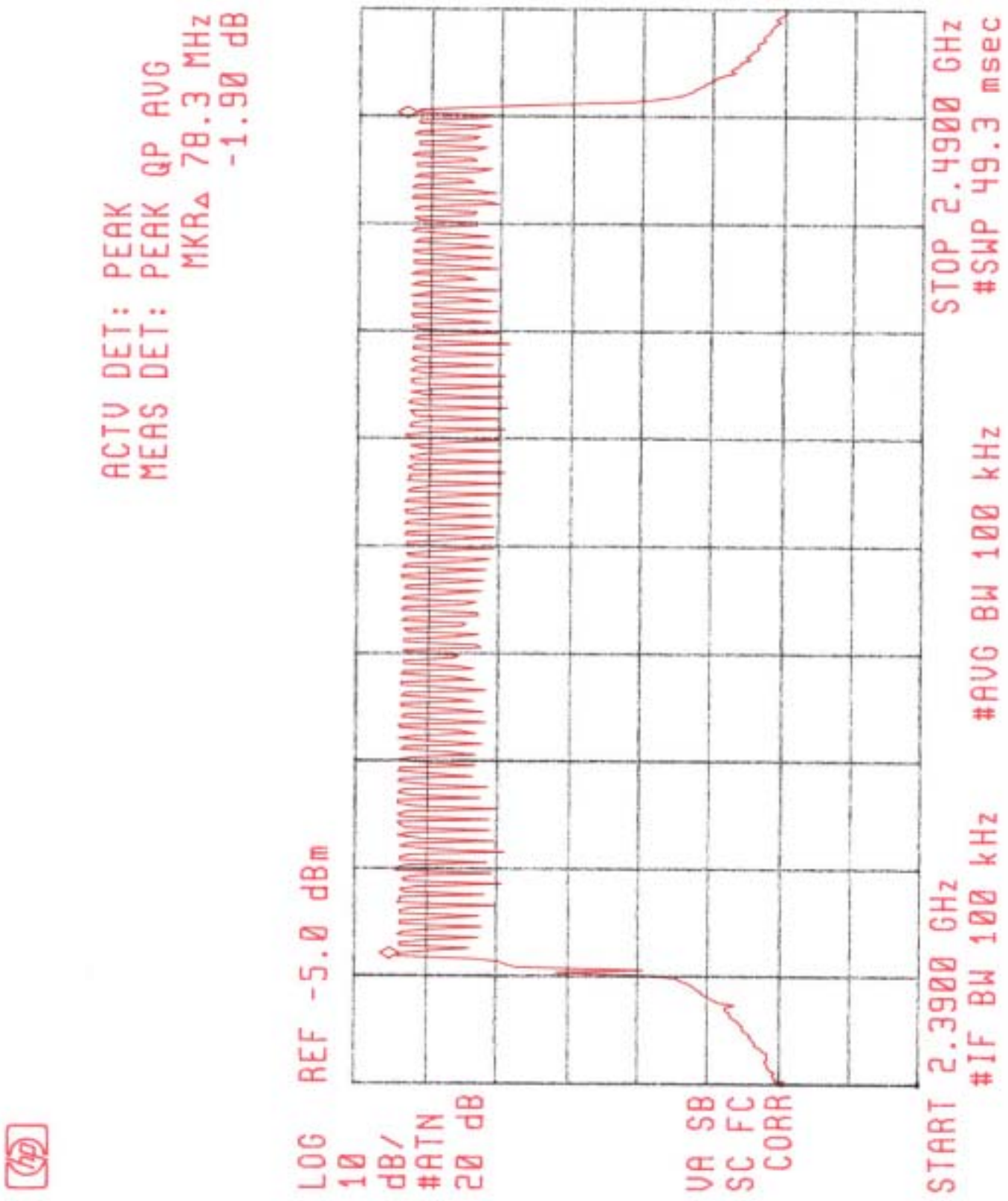
Equipment	Manufacturer	Model No.	Next Cal. Due
Plotter	Hewlett-Packard	7440A	N/A
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2003

11.4 Measurement Data

Test Date : May 23, 2003 Temperature : 24℃ Humidity: 65 %

Number of hopping channels = 79 channels

Note: Please see Appendix 4 for ploted datas


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR∆ 78.3 MHz
-1.90 dB
LOG
10
dB/
#ATN
20 dB
REF -5.0 dBm
VA SB
SC FC
CORR
START 2.3900 GHz
#IF BW 100 kHz
#AVG BW 100 kHz
STOP 2.4900 GHz
#SWP 49.3 msec

12 CHANNEL CARRIER FREQUENCIES SEPERATION

12.1 Standard Applicable

According to 15.247(a)(1), the frequency hopping system shall have hopping channel carrier frequencies seperated by minimum of 25kHz or the 20dB bandwidth of hopping channel, whichever is greater.

12.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measurement frequency within its operating ragne and make sure the instrument is operated in its linear range.
3. Set spectrum analyzer maximum hold to measure channel carrier frequency , then adjust channel carrier frequency to adjacent channel.
4. Repeat above procedure until all measured frequencies were complete.

12.3 Measurement Equipment

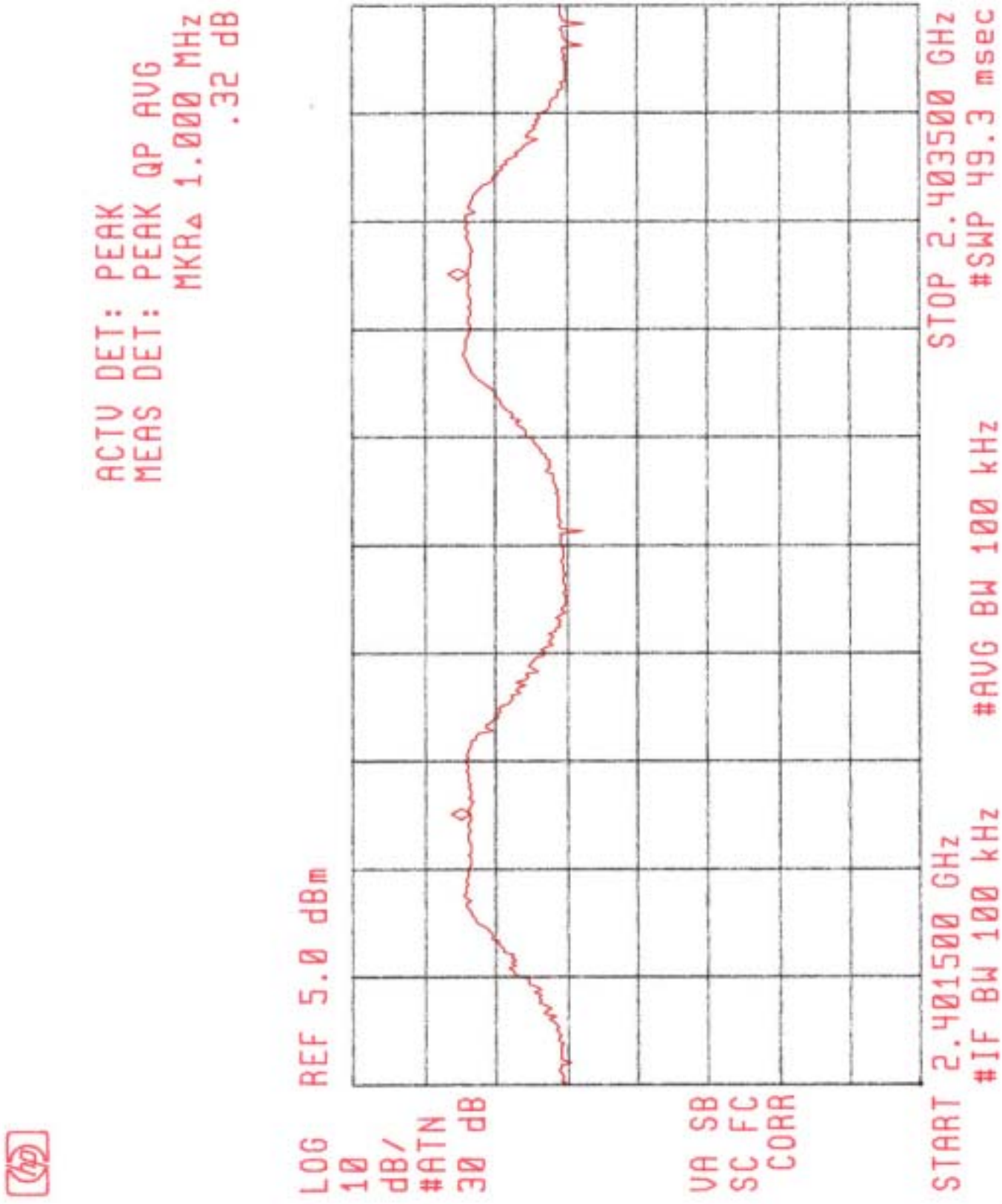
Equipment	Manufacturer	Model No.	Next Cal. Due
Plotter	Hewlett-Packard	7550A	N/A
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2003

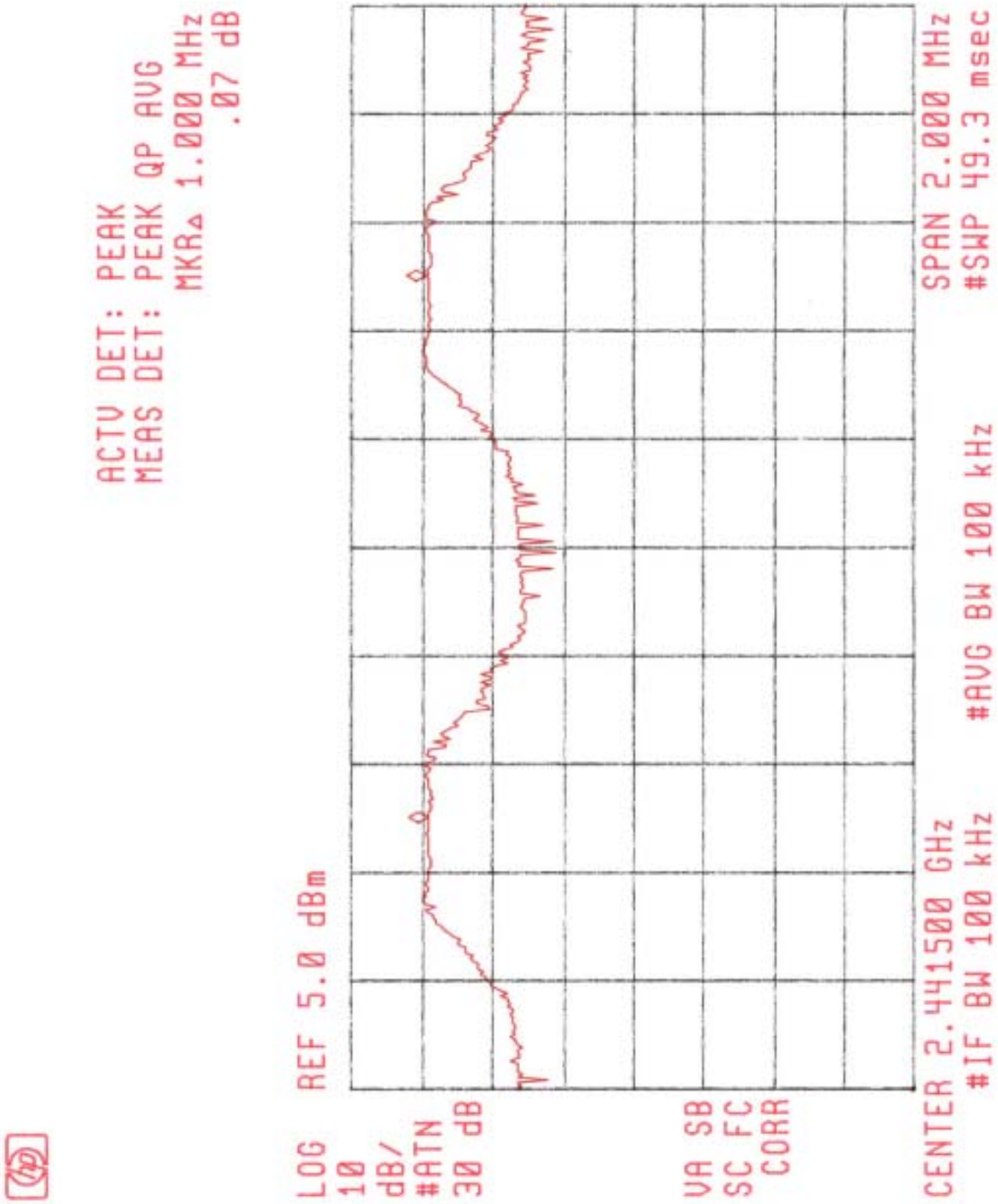
12.4 Measurement Data

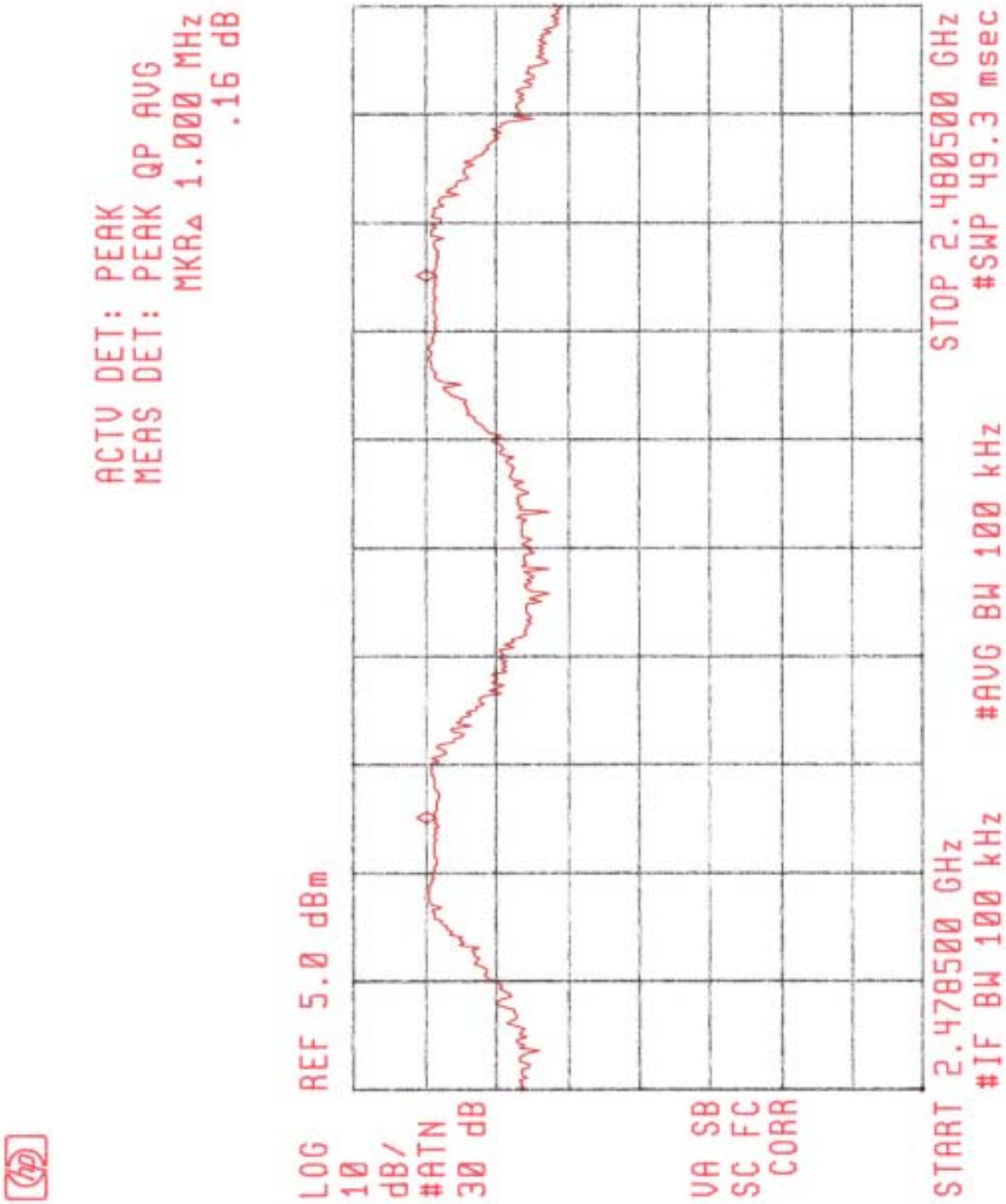
Test Date : May 23, 2003 Temperature : 24℃ Humidity: 65 %

a) 2402MHz channel seperation is 1MHz
b) 2441MHz channel seperation is 1MHz
c) 2480MHz channel seperation is 1MHz

Note: Please see Appendix 5 for ploted datas


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR△ 1.000 MHz
.32 dB
LOG REF 5.0 dBm
10
dB/
#ATN
30 dB
VA SB
SC FC
CORR
START 2.401500 GHz
#IF BW 100 kHz
#AVG BW 100 kHz
STOP 2.403500 GHz
#SWP 49.3 msec


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 1.000 MHz
.07 dB
LOG
10
dB/
#ATN
30 dB
REF 5.0 dBm
VA SB
SC FC
CORR
CENTER 2.441500 GHz
#IF BW 100 kHz
#AVG BW 100 kHz
SPAN 2.000 MHz
#SWP 49.3 msec


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR△ 1.000 MHz
.16 dB
LOG REF 5.0 dBm
10
dB/
#ATN
30 dB
VA SB
SC FC
CORR
START 2.478500 GHz
#IF BW 100 kHz
#AVG BW 100 kHz
STOP 2.480500 GHz
#SWP 49.3 msec

13 POWER SPECTRAL DENSITY

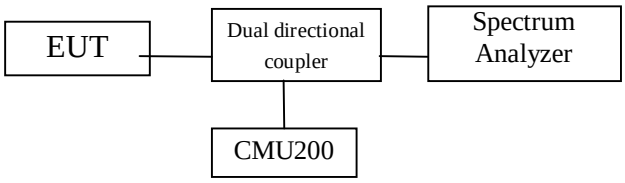
13.1 Standard Applicable

For frequency hopping system, according to 15.247(d), for digitally modulated, the peak power speceral density conducted from the intentional radiator to the antenna shall not be greater them 8dBm in any 3kHz band furing any time interral of continuous transmission.

13.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 3kHz, VBW to 30 kHz, sweep 300kHz and sweep time 100 sec.
4. Measure the highest amplitude appearing on spectral display and record the level to calculate result data.
5. Repeat above procedures until all frequencies measured were complete.

Figure 5: Output power and measurement configuration.



13.3 Measurement Equipment

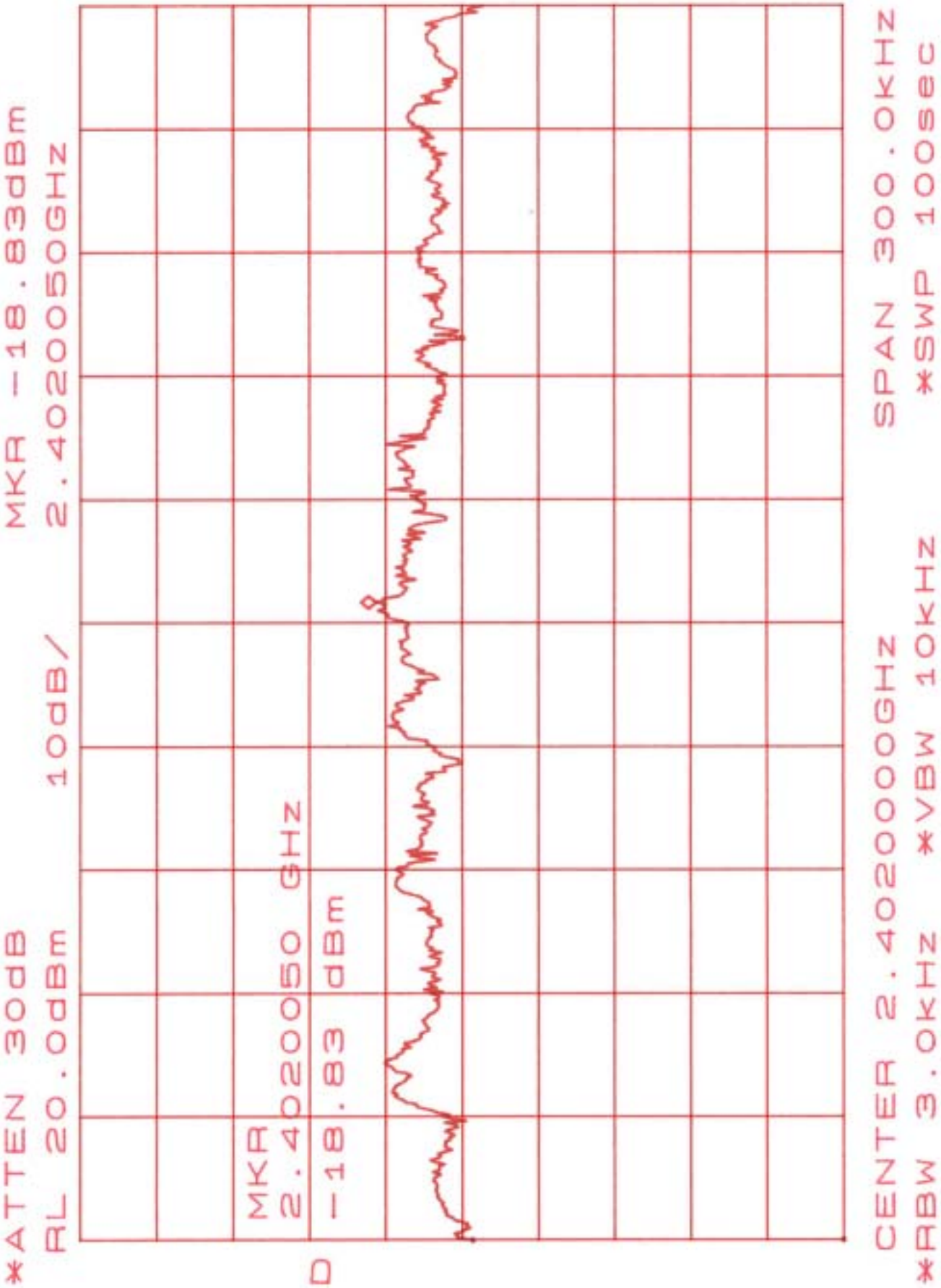
Equipment	Manufacturer	Model No.	Next Cal. Due
Plotter	Hewlett-Packard	7550A	N/A
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2003
Universal Radio Communication Tester	Rohde and Schwarz	CMU200	06/25/2003
Dual Directional Coupler	Agilent	778D	03/13/2004

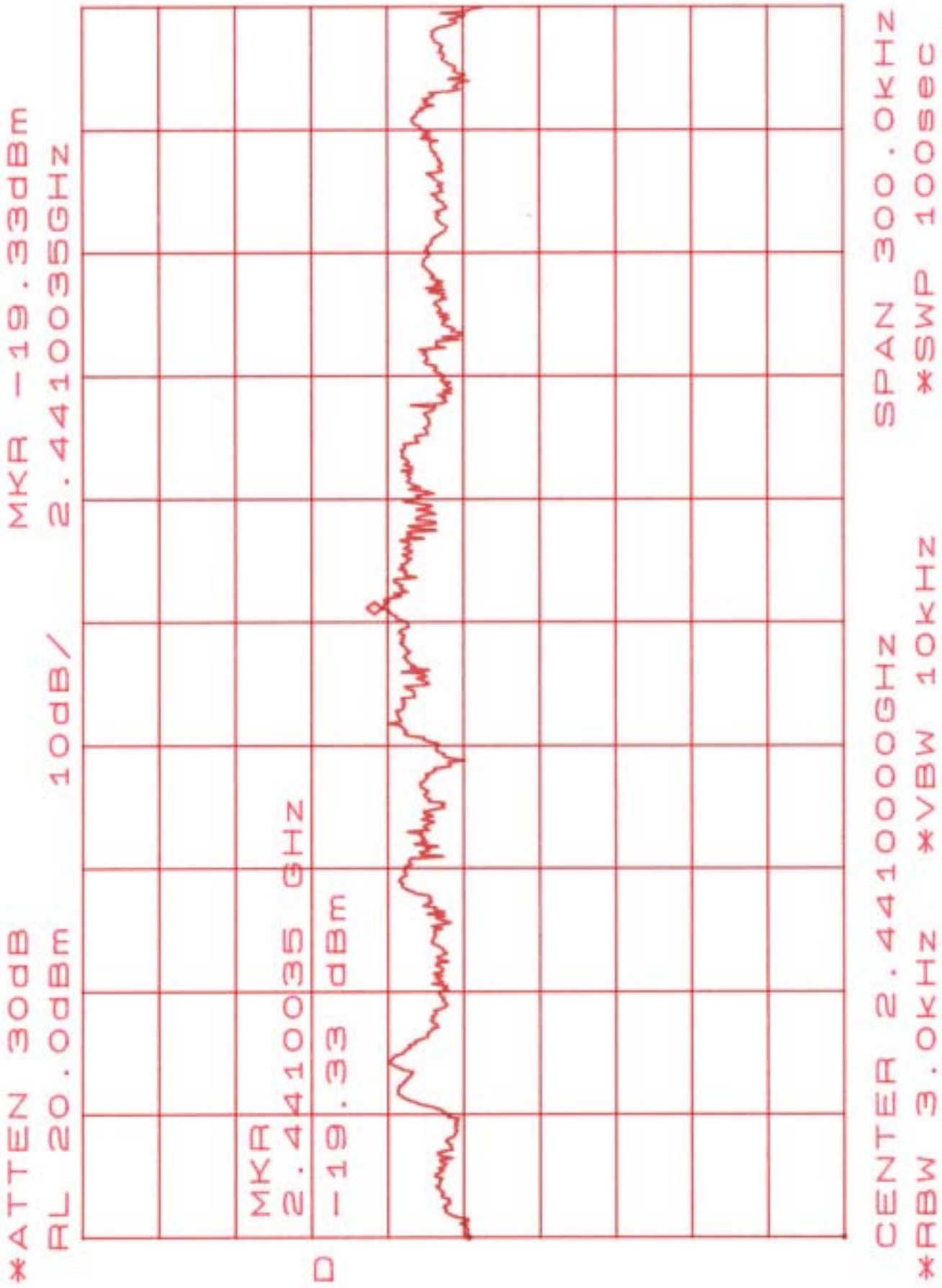
13.4 Measurement Data

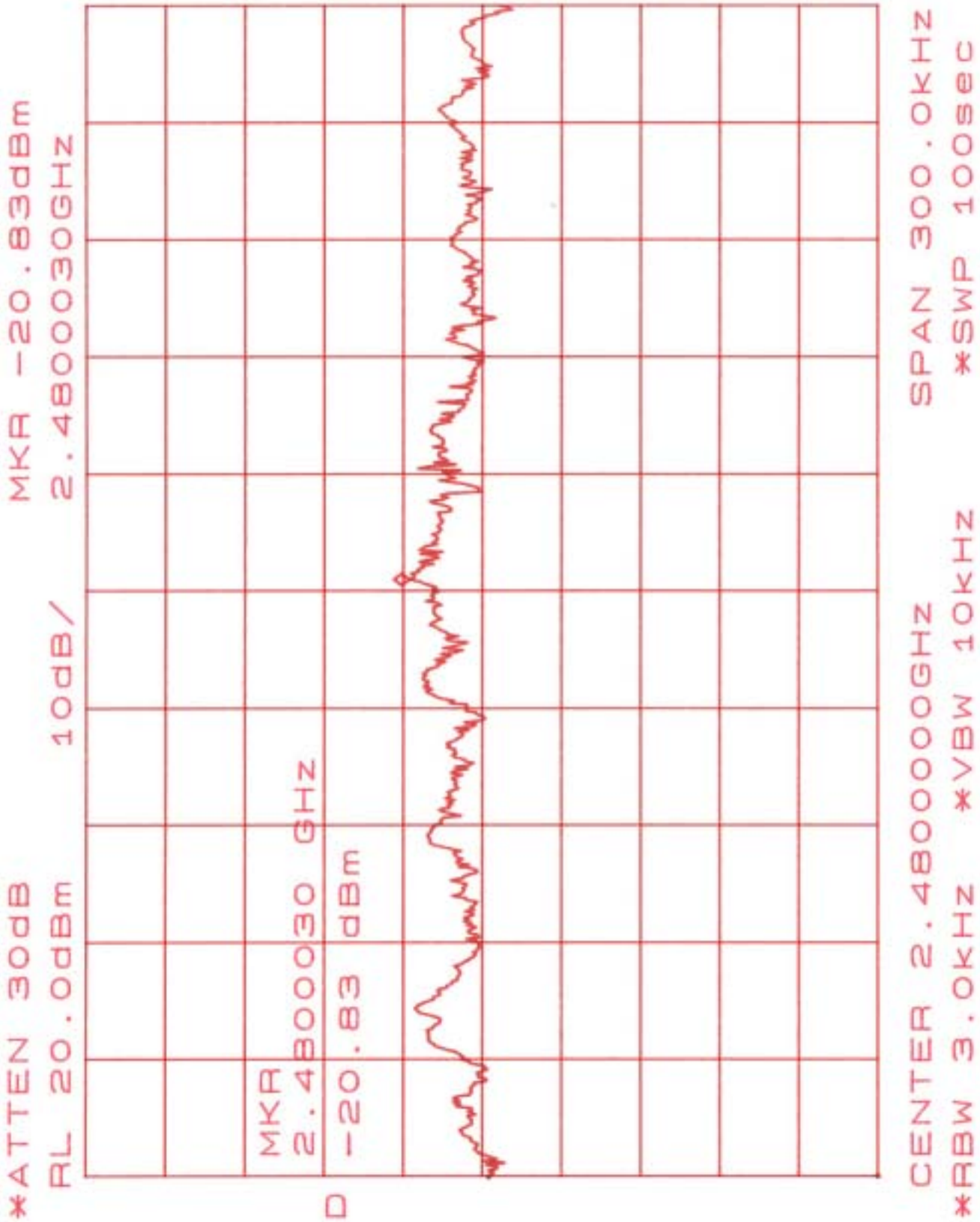
Test Date : May 23, 2003 Temperature : 24 ℃ Humidity: 65 %

a) Channel 0 : Power Spectral Density is –18.83 dBm
b) Channel 39 : Power Spectral Density is –19.33 dBm
c) Channel 78 : Power Spectral Density is –20.83 dBm

Note: Please see next pages for ploted datas


*ATTEN 30dB
RL 20.0dBm
10dB/
MKR -18.83dBm
2.402005GHz
MKR
2.402005 GHz
-18.83 dBm
D
CENTER 2.402000GHz
*RBW 3.0kHz
*VBW 10kHz
SPAN 300.0kHz
*SWP 100sec


*ATTEN 30dB
RL 20.0dBm
10dB/
MKR -19.33dBm
2.441003 5GHz
MKR
2.441003 5 GHz
-19.33 dBm
D
CENTER 2.441000GHz
*RBW 3.0kHz
*VBW 10kHz
SPAN 300.0kHz
*SWP 100sec


*ATTEN 30dB
RL 20.0dBm
10dB/
MKR -20.83dBm
2.480030GHz
MKR
2.480030 GHz
-20.83 dBm
D
CENTER 2.480000GHz
*RBW 3.0kHz
*VBW 10kHz
SPAN 300.0kHz
*SWP 100sec

14 DWELL TIME

14.1 Standard Applicable

According to 15.247(a)(1)(iii), frequency hopping system in the 2400-2483.5MHz band employing at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 second multiplied by the number of hopping channels employed.

14.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5.

14.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Plotter	Hewlett-Packard	7550A	N/A
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2003

14.4 Measurement Data

Test Date : May 23, 2003 Temperature : 24℃ Humidity: 65 %

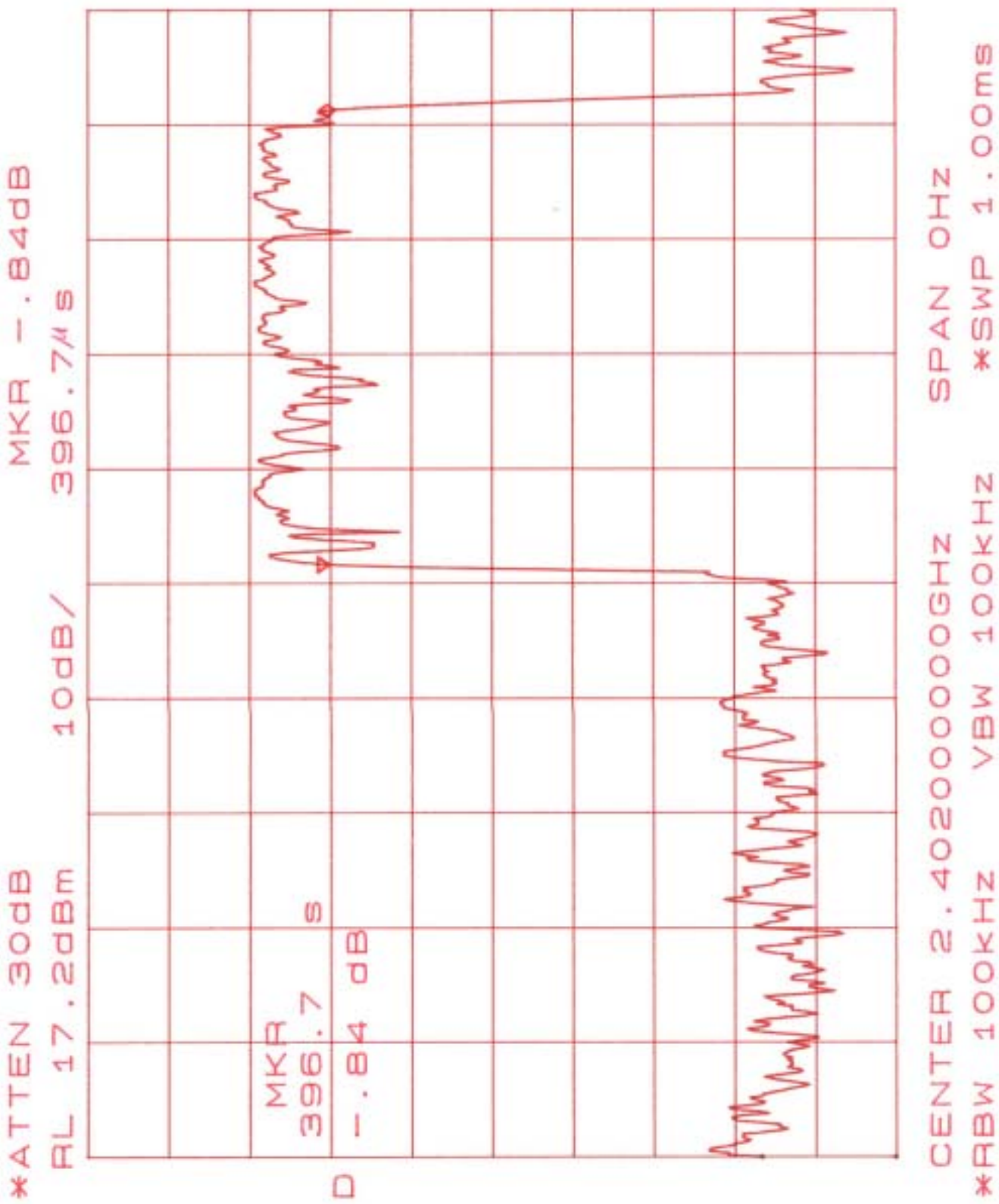
Test period=0.4(second/channel)$\times$79 channel=31.6sec

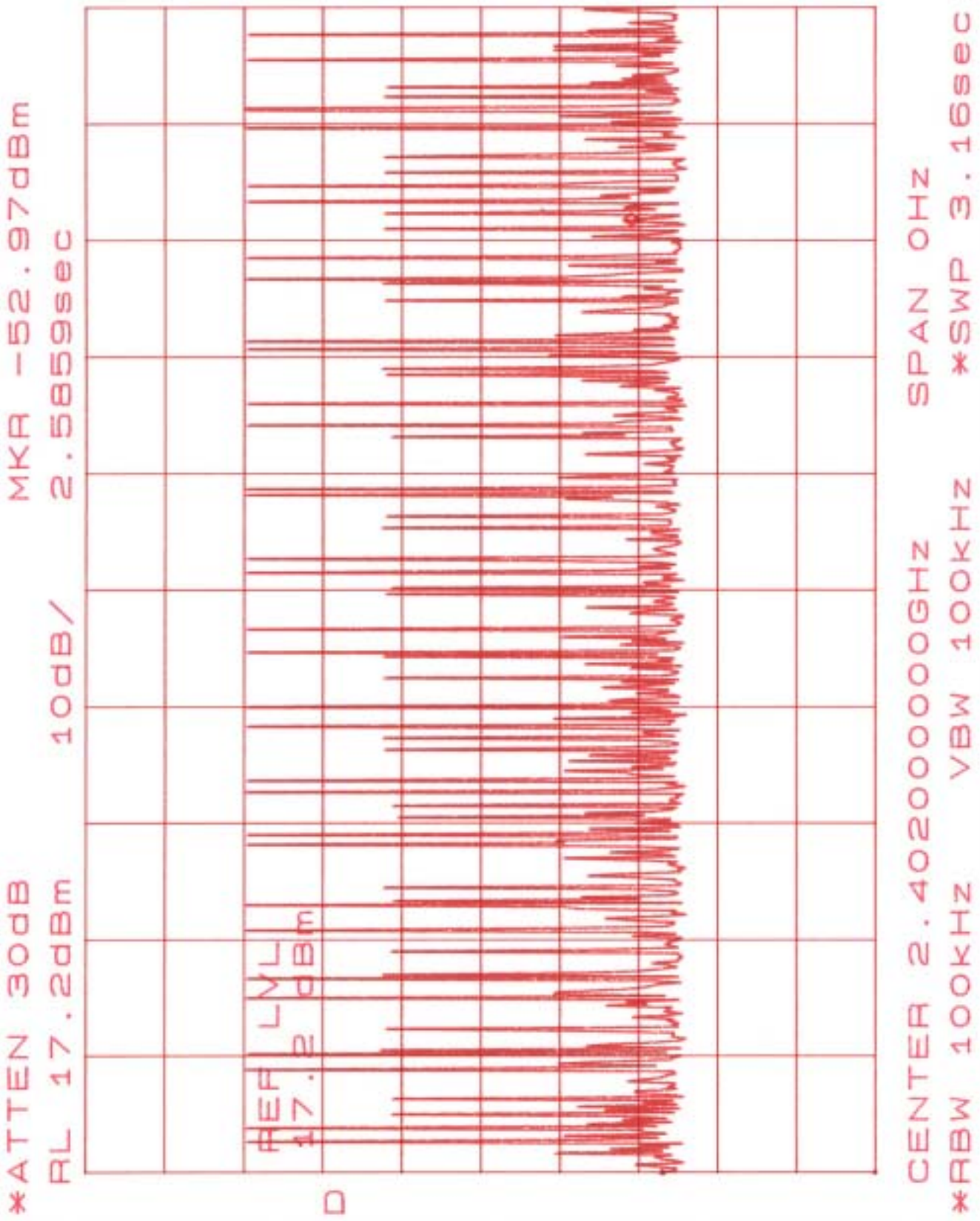
a) 2402MHz dwell time= $0.3967\text{ms} \times \frac{32}{3.16} \times 31.6 = 126.94\text{ms}$

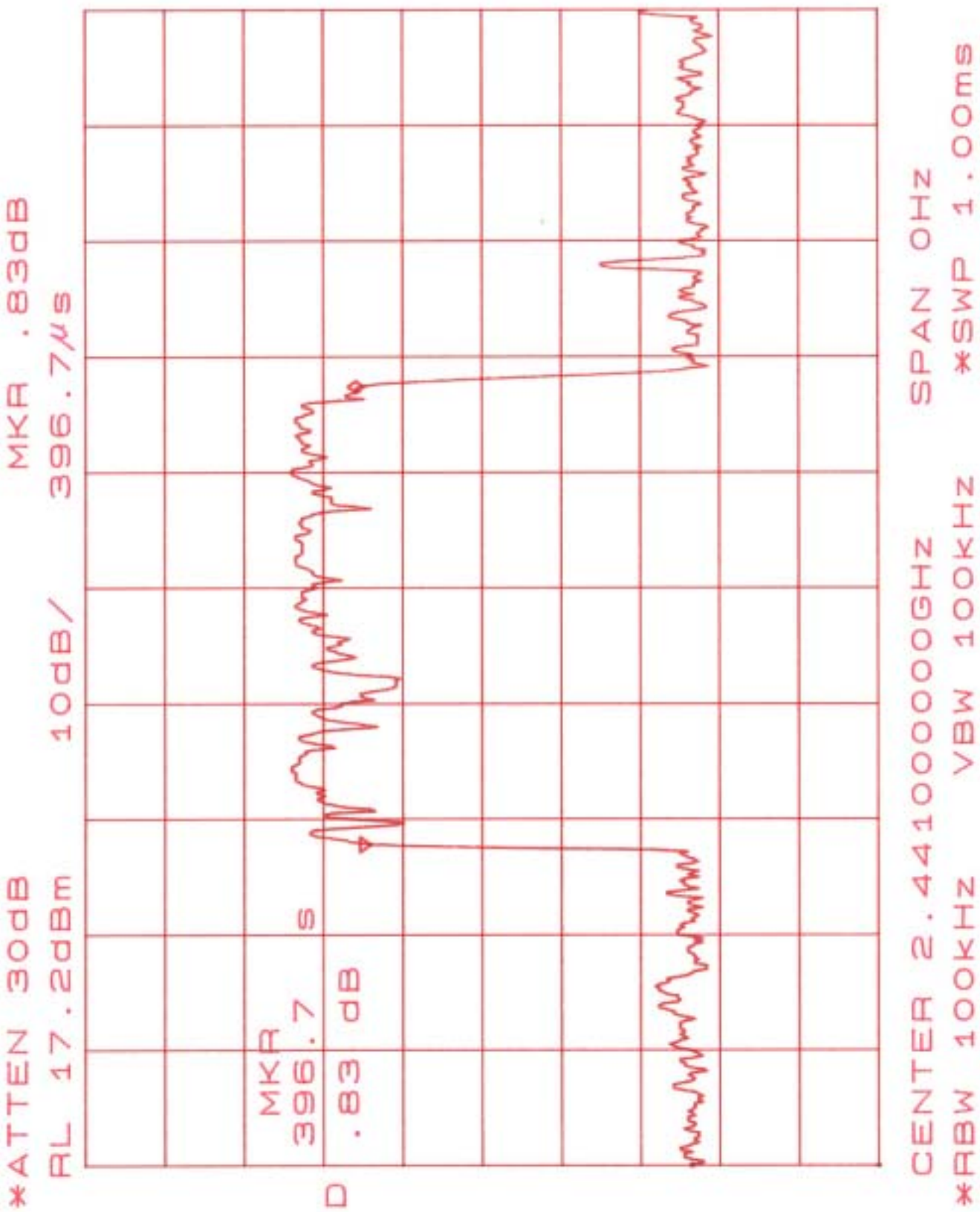
b) 2441MHz dwell time= $0.3967\text{ms} \times \frac{33}{3.16} \times 31.6 = 130.91\text{ms}$

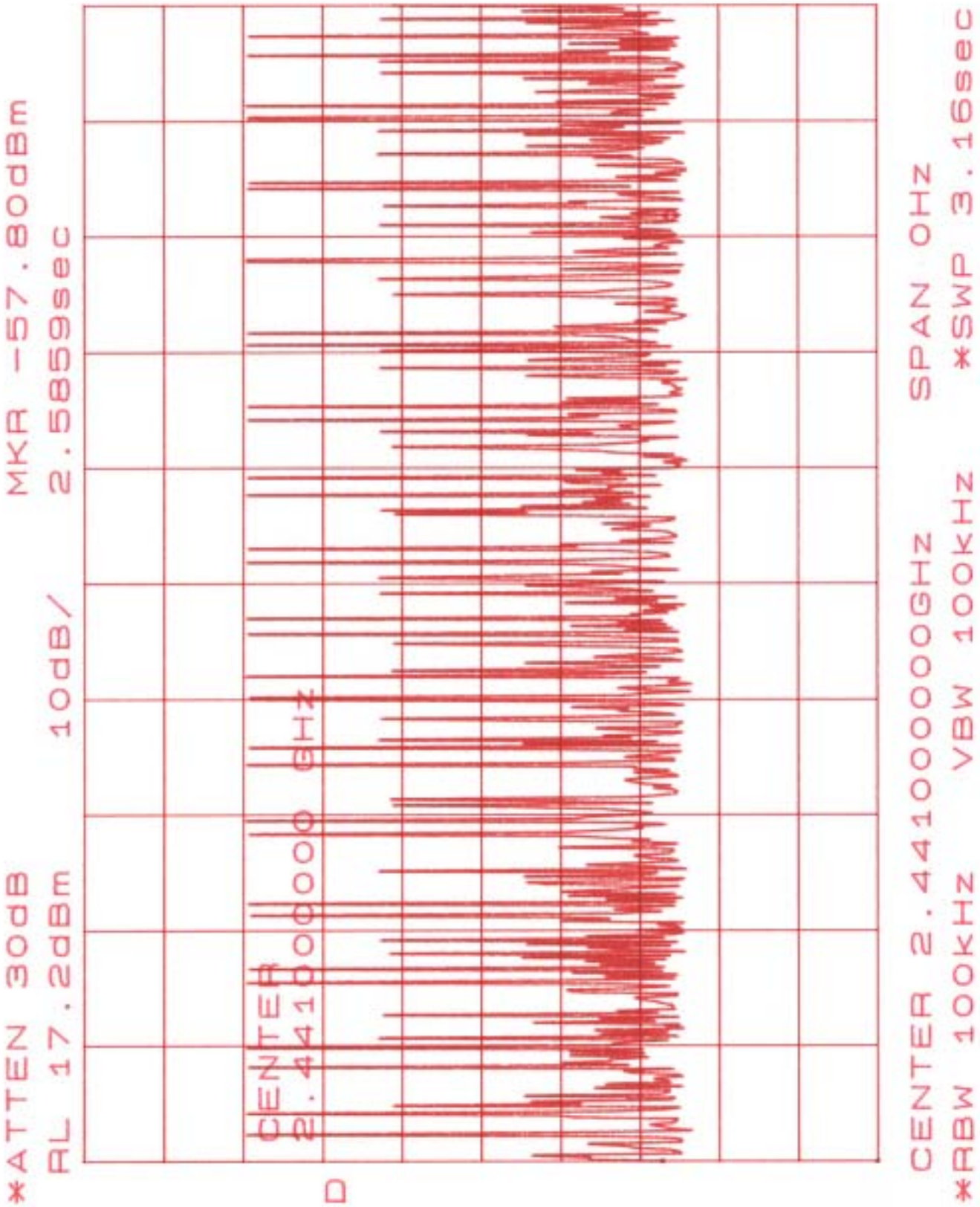
c) 2480MHz dwell time= $0.3983\text{ms} \times \frac{32}{3.16} \times 31.6 = 127.46\text{ms}$

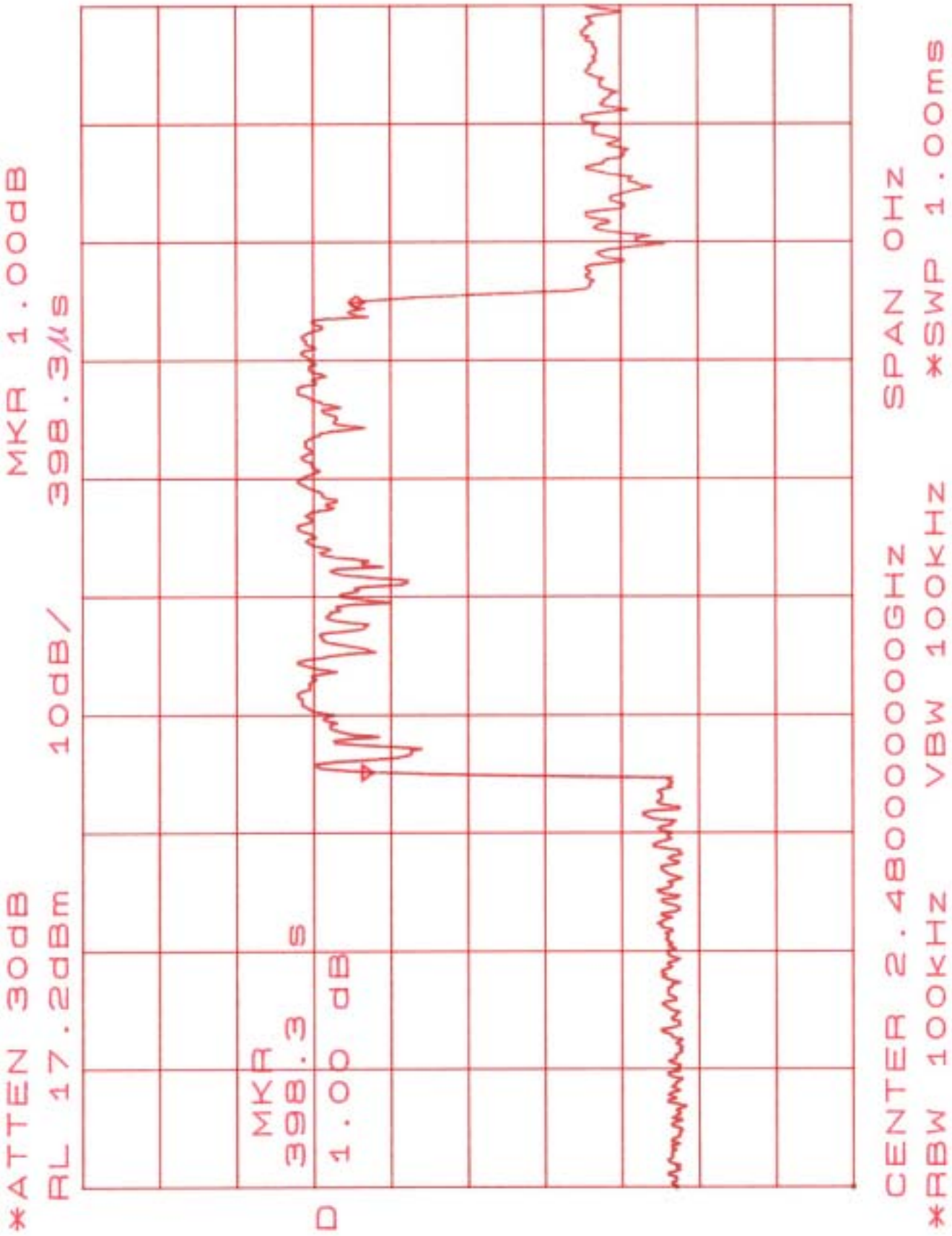
Note: Please see Appendix 6 for ploted datas

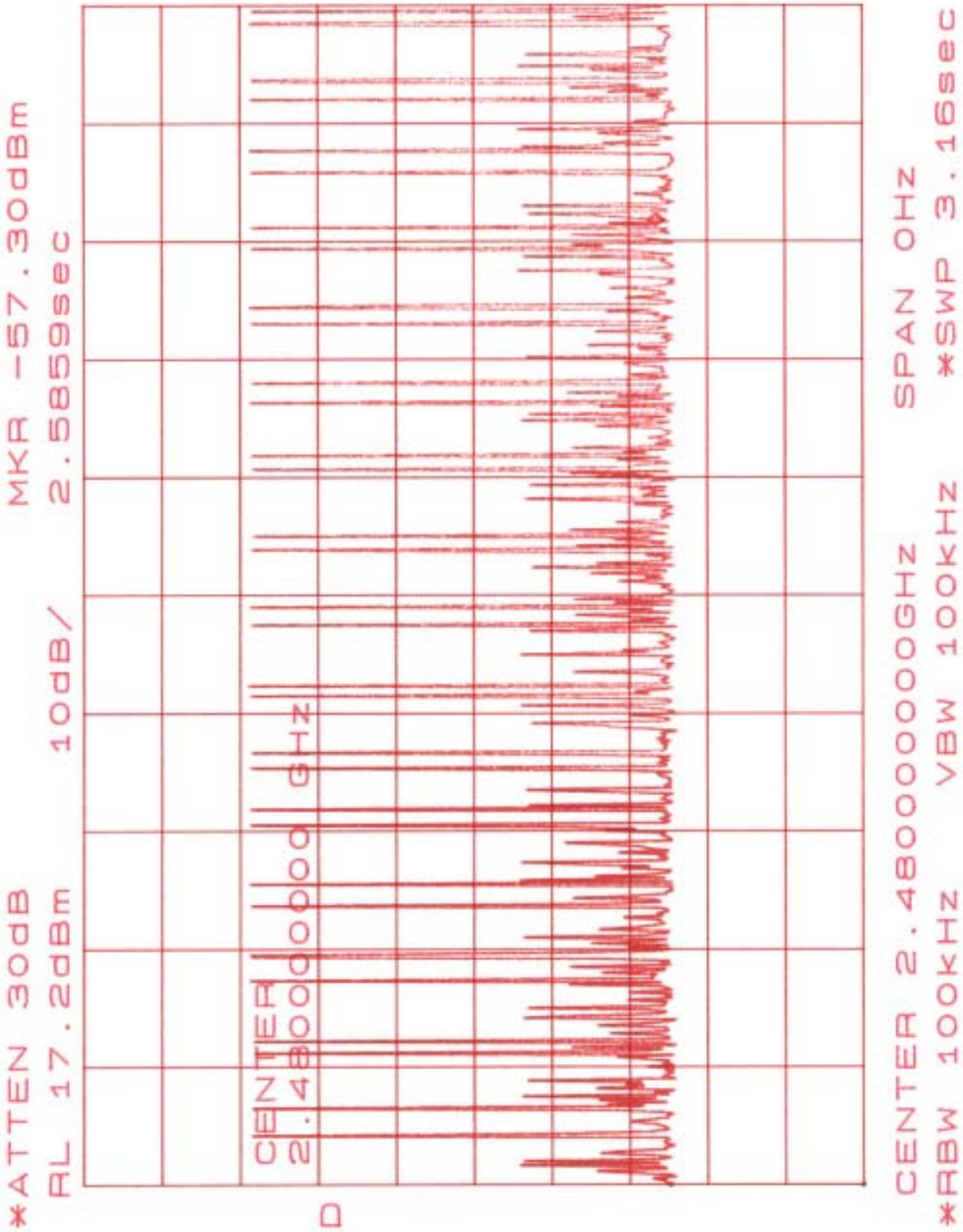

*ATTEN 30dB
RL 17.2dBm
10dB/
MKR -.84dB
396.7μs
MKR
396.7 s
-.84 dB
D
CENTER 2.402000000GHz
*RBW 100kHz
VBW 100kHz
SPAN 0Hz
*SWP 1.00ms


*ATTEN 30dB
RL 17.2dBm
10dB/
MKR -52.97dBm
2.58859sec
REF LVL
17.2 dBm
D
CENTER 2.402000000GHz
SPAN 0Hz
*RBW 100kHz
VBW 100kHz
*SWP 3.16sec


*ATTEN 30dB
RL 17.2dBm
10dB/
MKR .83dB
396.7μs
MKR
396.7 s
.83 dB
D
CENTER 2.441000000GHz
SPAN 0Hz
*RBW 100kHz
VBW 100kHz
*SWP 1.00ms


*ATTEN 30dB
RL 17.2dBm
10dB/
MKR -57.80dBm
2.58859sec
CENTER
2.441000000 GHz
D
CENTER 2.441000000GHz
*RBW 100kHz
VBW 100kHz
SPAN 0Hz
*SWP 3.16sec


*ATTEN 30dB
RL 17.2dBm
10dB/
MKR 1.00dB
398.3µs
MKR
398.3 s
1.00 dB
D
CENTER 2.480000000GHz
*RBW 100kHz
VBW 100kHz
SPAN 0Hz
*SWP 1.00ms


*ATTEN 30dB
RL 17.2dBm
10dB/
MKR -57.30dBm
2.58859sec
CENTER
2.480000000 GHZ
CENTER 2.480000000GHZ
*RBW 100KHZ
VBW 100KHZ
SPAN 0HZ
*SWP 3.16sec