FCC Part 15
EMI TEST REPORT

of

E.U.T. : DATA COLLETION TERMINAL

MODEL : PPT-120

FCC ID. : QWTPPT-120

for

APPLICANT : CHUNG-HSIN ELECTRIC & MACHINERY MFG. CORP.

ADDRESS : No. 25, Wen-Te Rd., Lo-Shan Village, Kwei Shan Hsiang, Taoyuan Hsien, Taiwan, R.O.C.

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-11-188-01

TEST REPORT CERTIFICATION

Applicant : CHUNG-HSIN ELECTRIC & MACHINERY MFG. CORP.
No. 25, Wen-Te Rd., Lo-Shan Village, Kwei Shan Hsiang, Taoyuan Hsien, Taiwan, R.O.C.

Manufacturer : CHUNG-HSIN ELECTRIC & MACHINERY MFG. CORP.
No. 25, Wen-Te Rd., Lo-Shan Village, Kwei Shan Hsiang, Taoyuan Hsien, Taiwan, R.O.C.

Description of EUT :

a) Type of EUT : DATA COLLETION TERMINAL

b) Trade Name : Mobia

c) Model No. : PPT-120

d) Power Supply : AC Adaptor (Model No.:A602-4.2)
Input: 100-240VAC,50/60Hz ; Output: 4.2VDC, 1A, 4.2W

Regulation Applied : FCC Rules and Regulations Part 15 Subpart B & C (2003)

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 : Jan. 05, 2004

Test Engineer : Andy Kuo

Approve & Authorized Signer : Win-Po Tsai

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

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1 GENERAL INFORMATION

1.1 Product Description

a) Type of EUT : DATA COLLETION TERMINAL
b) Trade Name : Mobia
c) Model No. : PPT-120
d) Power Supply : AC Adaptor (Model No.:A602-4.2)
Input: 100-240VAC,50/60Hz ; Output: 4.2VDC, 1A, 4.2W

1.2 Characteristics of Device

Features Class 1 Bluetooth wireless technology, with a transmission range of 100 meters; equipped with a standard IrDA interface and a standard UART interface; comes with a GUI operating system, an integrated browser, and a built-in barcode laser scanner engine and decoder that reads multiple types of 1D barcodes; a sophisticated pc-based development tool allows developers to easily create applications for their target industries.

1.3 Test Methodology

The DATA COLLETION TERMINAL designed with a transmitting method of Frequency Hopping spread spectrum, which operates at 2.4 GHz ISM band. The rated output power is 11.83dBm (15.2 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

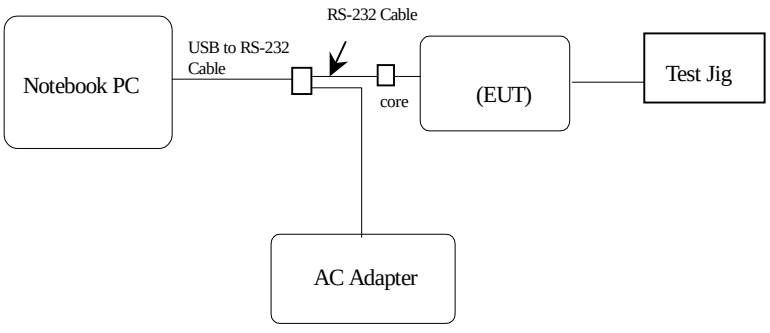
3.1 Justification

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 during the test. Notebook PC was used to control the RF channel under the hightest, middle and lowest frequency and transmit the maximun RF power. Customer would not use it. But never the less ancillary equipment can influence the test results..

3.2 Devices for Tested System

Device	Manufacture	Model	Cable Description
* DATA COLLETION TERMINAL	CHUNG-HSIN ELECTRIC & MACHINERY MFG. CORP.	PPT-120	1.6m, Unshielded RS232 Cable with core Adapter 1.9m
Notebook PC	ASUS	S1300	0.3m, Shielded USB to RS232 Cable Adapter 3.3m
Test Jig	----	----	0.1m, Unshielded Control Line

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

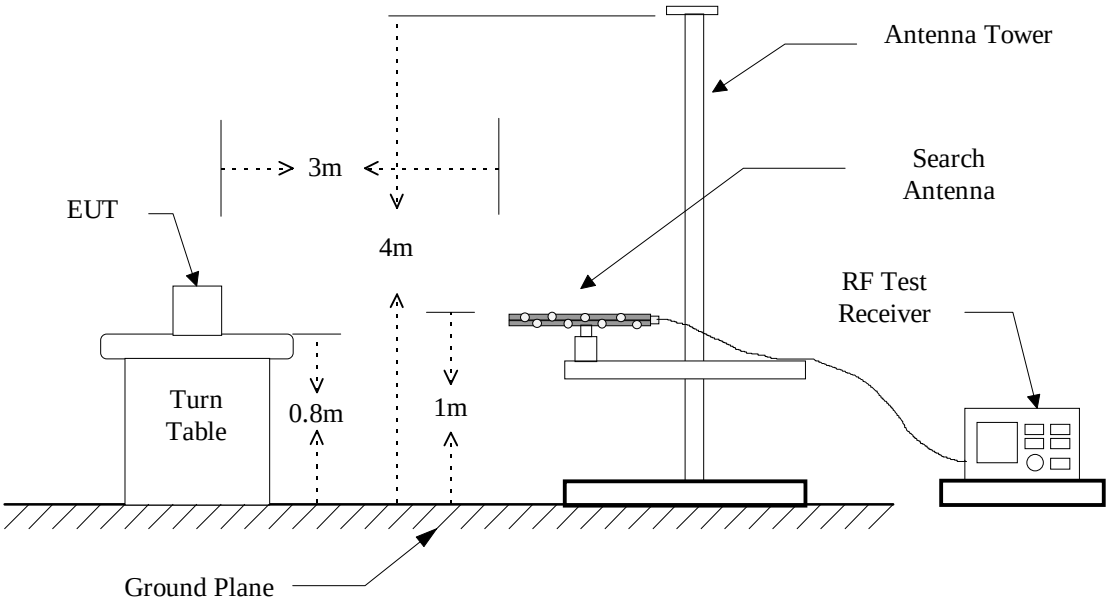
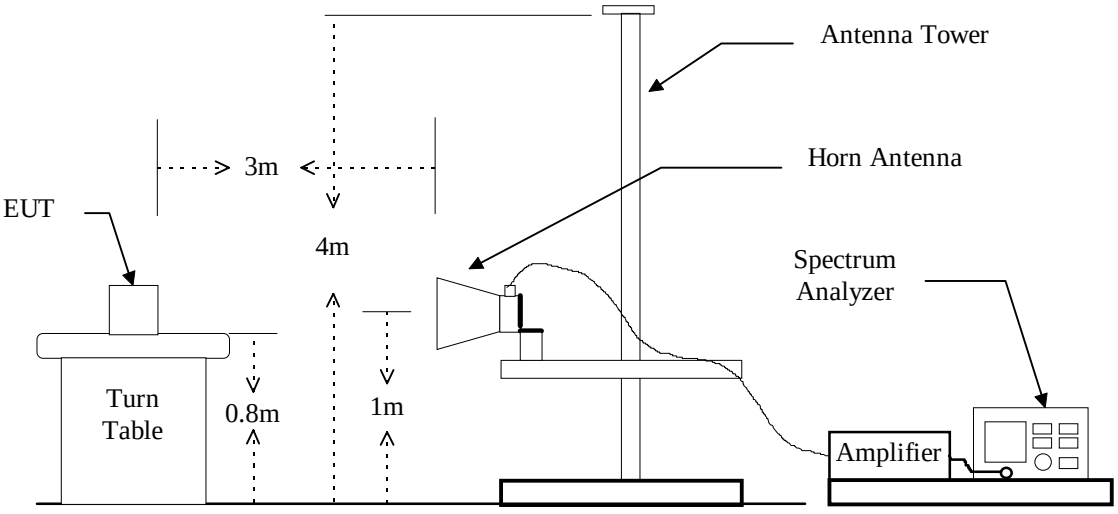


Figure 2 : Frequencies measured above 1 GHz configuration



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	08/27/2004
Horn Antenna	EMCO	3115	06/05/2004
LogBicone Antenna	Schwarzbeck	9160	10/28/2004
Horn Antenna	EMCO	3116	06/28/2004
Preamplifier	Hewlett-Packard	8449B	09/04/2004
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2004

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	300 kHz
	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 1

EUT azimuth : x axis
Operation Mode : Transmitting
Fundamental Frequency : 2402 MHz
Test Date : Jan. 03, 2004 Temperature : 19 ℃ Humidity : 70%

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 (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
4804.000	57.3	41.0	57.5	41.2	-4.6	52.9	36.6	74.0	54.0	-1.1	90	1.0
12010.000	---	---	---	---	2.9	---	---	74.0	54.0	---	---	---
19216.000	---	---	---	---	4.5	---	---	74.0	54.0	---	---	---

EUT azimuth : y axis

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 (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
4804.000	64.8	44.2	52.5	34.0	-4.6	60.2	36.6	74.0	54.0	-17.4	94	1.0
12010.000	---	---	---	---	2.9	---	---	74.0	54.0	---	---	---
19216.000	---	---	---	---	4.5	---	---	74.0	54.0	---	---	---

EUT azimuth : z axis

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 (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
4804.000	53.8	39.3	57.5	41.2	-4.6	52.9	36.6	74.0	54.0	-1.1	101	1.0
12010.000	---	---	---	---	2.9	---	---	74.0	54.0	---	---	---
19216.000	---	---	---	---	4.5	---	---	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 fundamental frequency and show the significant frequencies, other means the value is too low to be detected.
5. The estimated measurement uncertainty of the result measurement is:
   ±4.1dB(1GHz≦f≦18GHz)
   ±4.4dB(18GHz<f≦40GHz)

b) Channel 40

EUT azimuth : x axis
Operation Mode : Transmitting
Fundamental Frequency : 2441 MHz
Test Date : Jan. 03, 2004 Temperature : 19 ℃ Humidity : 70%

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 (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
4882.000	49.8	37.0	52.3	38.3	-4.6	47.7	33.7	74.0	54.0	-6.3	91	1.0
7323.000	50.7	26.2	50.7	35.3	-1.0	49.7	34.3	74.0	54.0	-4.3	90	1.0
12205.000	---	---	---	---	2.9	---	---	74.0	54.0	---	---	---
19528.000	---	---	---	---	4.5	---	---	74.0	54.0	---	---	---

EUT azimuth : y axis

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 (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
4882.000	60.2	41.7	46.0	34.2	-4.6	55.6	37.1	74.0	54.0	-16.9	90	1.0
7323.000	48.0	35.7	48.2	35.2	-1.0	47.2	34.7	74.0	54.0	-6.8	94	1.0
12205.000	---	---	---	---	2.9	---	---	74.0	54.0	---	---	---
19528.000	---	---	---	---	4.5	---	---	74.0	54.0	---	---	---

EUT azimuth : z axis

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 (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
4882.000	51.7	38.0	52.7	38.3	-4.6	48.1	33.7	74.0	54.0	-5.9	113	1.0
7323.000	53.0	39.0	50.7	37.0	-1.0	52.0	38.0	74.0	54.0	-2.0	110	1.0
12205.000	---	---	---	---	2.9	---	---	74.0	54.0	---	---	---
19528.000	---	---	---	---	4.5	---	---	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 fundamental frequency and show the significant frequencies, other means the value is too low to be detected.
5. The estimated measurement uncertainty of the result measurement is:
   ±4.1dB(1GHz≦f≦18GHz)
   ±4.4dB(18GHz<f≦40GHz)

c) Channel 79
EUT azimuth : x axis
Operation Mode : Transmitting
Fundamental Frequency : 2480 MHz
Test Date : Jan. 03, 2004 Temperature : 19 ℃ Humidity : 70%

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 (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
4960.000	48.8	35.3	52.3	38.3	-4.6	47.7	33.7	74.0	54.0	-6.3	89	1.0
7440.000	48.0	35.0	51.2	37.2	-1.0	50.2	36.2	74.0	54.0	-3.8	91	1.0
12400.000	---	---	---	---	2.9	---	---	74.0	54.0	---	---	---
19840.000	---	---	---	---	4.5	---	---	74.0	54.0	---	---	---
22320.000	---	---	---	---	1.3	---	---	74.0	54.0	---	---	---

EUT azimuth : y axis

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 (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
4960.000	49.2	36.3	52.3	38.7	-4.6	47.7	34.1	74.0	54.0	-6.3	93	1.0
7440.000	53.3	39.0	50.5	37.8	-1.0	52.3	38.0	74.0	54.0	-1.7	92	1.0
12400.000	---	---	---	---	2.9	---	---	74.0	54.0	---	---	---
19840.000	---	---	---	---	4.5	---	---	74.0	54.0	---	---	---
22320.000	---	---	---	---	1.3	---	---	74.0	54.0	---	---	---

EUT azimuth : z axis

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 (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
4960.000	55.7	39.8	48.5	35.2	-4.6	51.1	35.2	74.0	54.0	-2.9	106	1.0
7440.000	53.5	38.3	51.7	38.3	-1.0	52.5	37.3	74.0	54.0	-1.5	108	1.0
12400.000	---	---	---	---	2.9	---	---	74.0	54.0	---	---	---
19840.000	---	---	---	---	4.5	---	---	74.0	54.0	---	---	---
22320.000	---	---	---	---	1.3	---	---	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 fundamental frequency and show the significant frequencies, other means the value is too low to be detected.
5. The estimated measurement uncertainty of the result measurement is:
   ±4.1dB(1GHz≦f≦18GHz)
   ±4.4dB(18GHz<f≦40GHz)

4.4.2 Other Emission

A.below 1GHz

Operation Mode: Transmitting/ Receving Mode

Test Date : Dec. 11, 2003 Temperature : 19 ℃ Humidity : 67%

Emission Frequency	Meter Reading (dBuV)		CORR'd Factor	Results (dBuV/m)		Limit (3m)	Margins	Table Degree (deg)		Ant. High (m)	
(MHz)	HOR.	VERT.	(dB)	HOR.	VERT.	(dBuV/m)	(dB)	HOR.	VERT.	HOR.	VERT.
286.080	24.2#	24.3#	16.5	40.7#	40.8#	46.0	-5.2	96	112	1.0	1.0
305.480	25.3#	***	17.5	42.8#	***	46.0	-3.2	67	***	1.2	***
507.240	17.8#	***	22.3	40.1#	***	46.0	-5.9	86	***	1.0	***
572.230	***	16.1#	23.7	***	39.8#	46.0	-6.2	***	177	***	1.3
693.480	***	13.9#	26.6	***	40.5#	46.0	-5.5	***	95	***	1.1
708.030	14.3#	13.1#	26.6	40.9#	39.7#	46.0	-5.1	91	90	1.0	1.0
800.180	***	11.3	27.6	***	38.9	46.0	-7.1	***	244	***	1.4
868.080	13.0#	***	28.6	41.6#	***	46.0	-4.4	256	***	1.1	***
900.090	12.5#	11.1#	30.4	42.9#	41.5#	46.0	-3.1	172	156	1.0	1.0

Note :

1. The EUT is a hand-hold device. In order to get the worse data, EUT direction(X,Y,Z axes) were adjusted during the prescan measurement. For final measurement, EUT was set up under the maximum emission direction.
2. Remark "***" means that the emissions level is too low to be measured.
3. Remark "#" means the noise was low, so record the peak value.
4. Item "Margin" referred to Q.P. limit while there is only peak result.
5. The estimated measurement uncertainty of the result measurement is:
   ±4.6dB(30MHz≦f≦300MHz)
   ±4.4dB(300MHz≦f≦1GHz)

B.above 1GHz

The emission level is too low to be measured. Please see next pages for ploted datas.

4.5 Field Strength Calculation

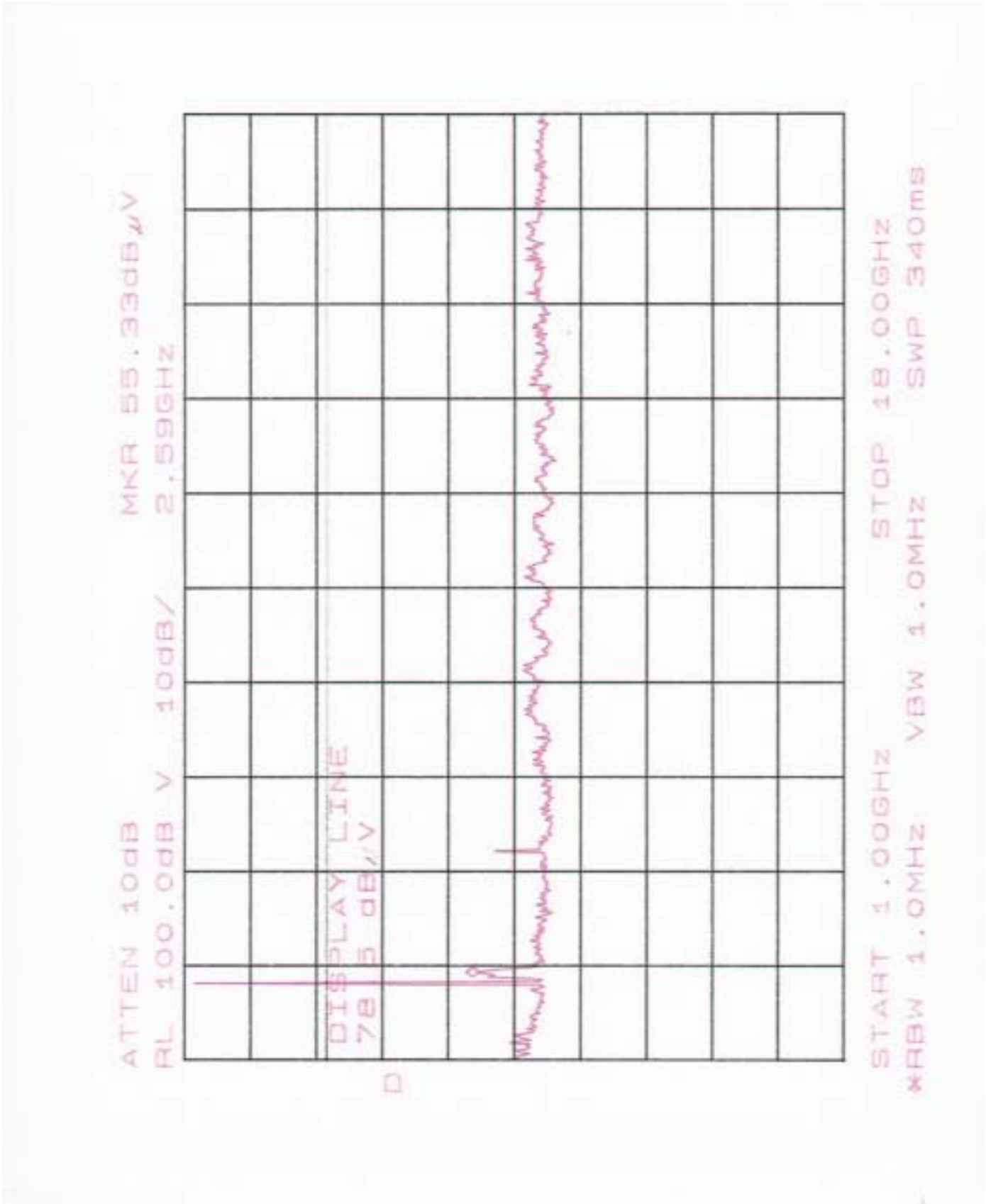
The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

Result = Reading + Corrected Factor

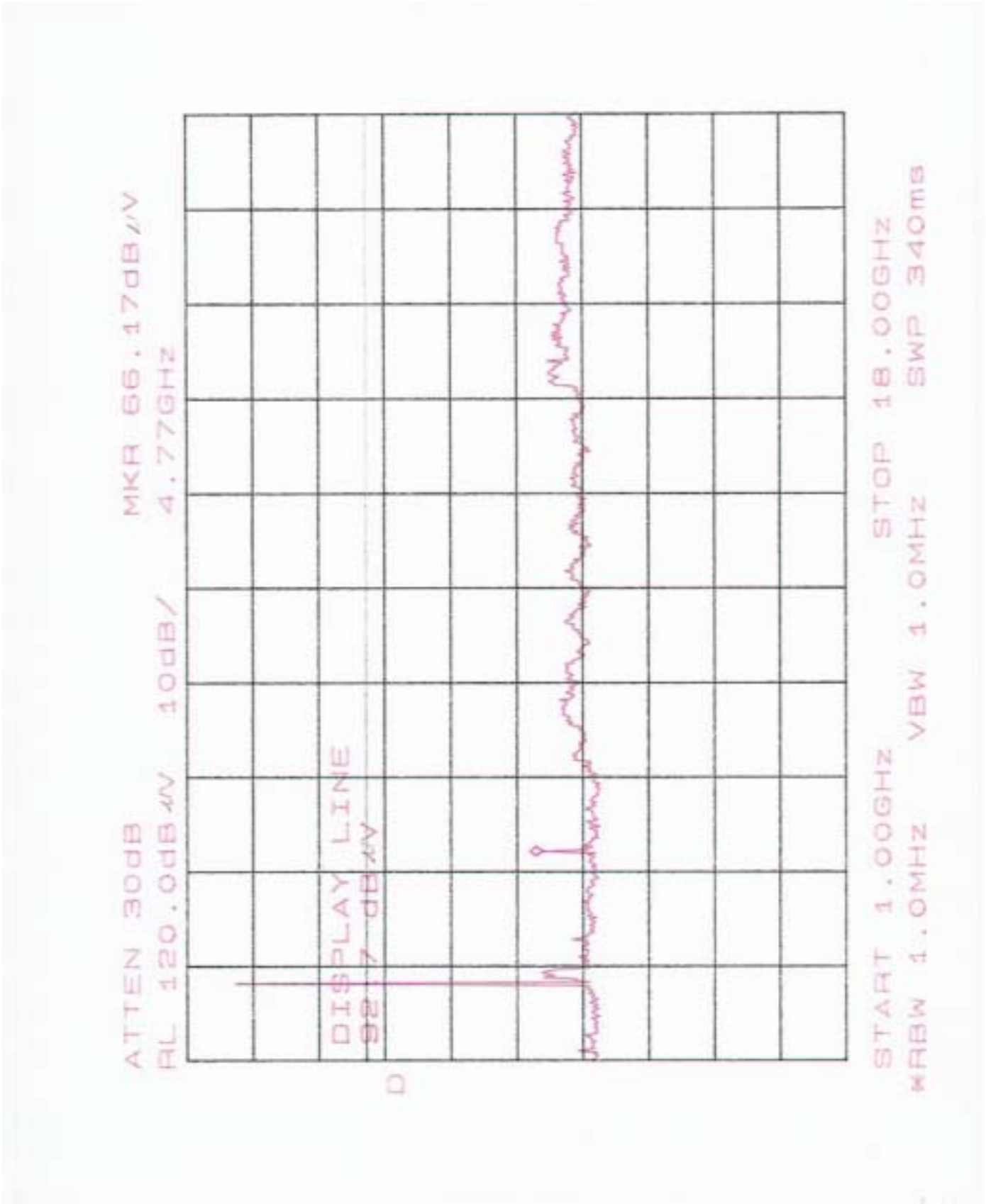
where

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

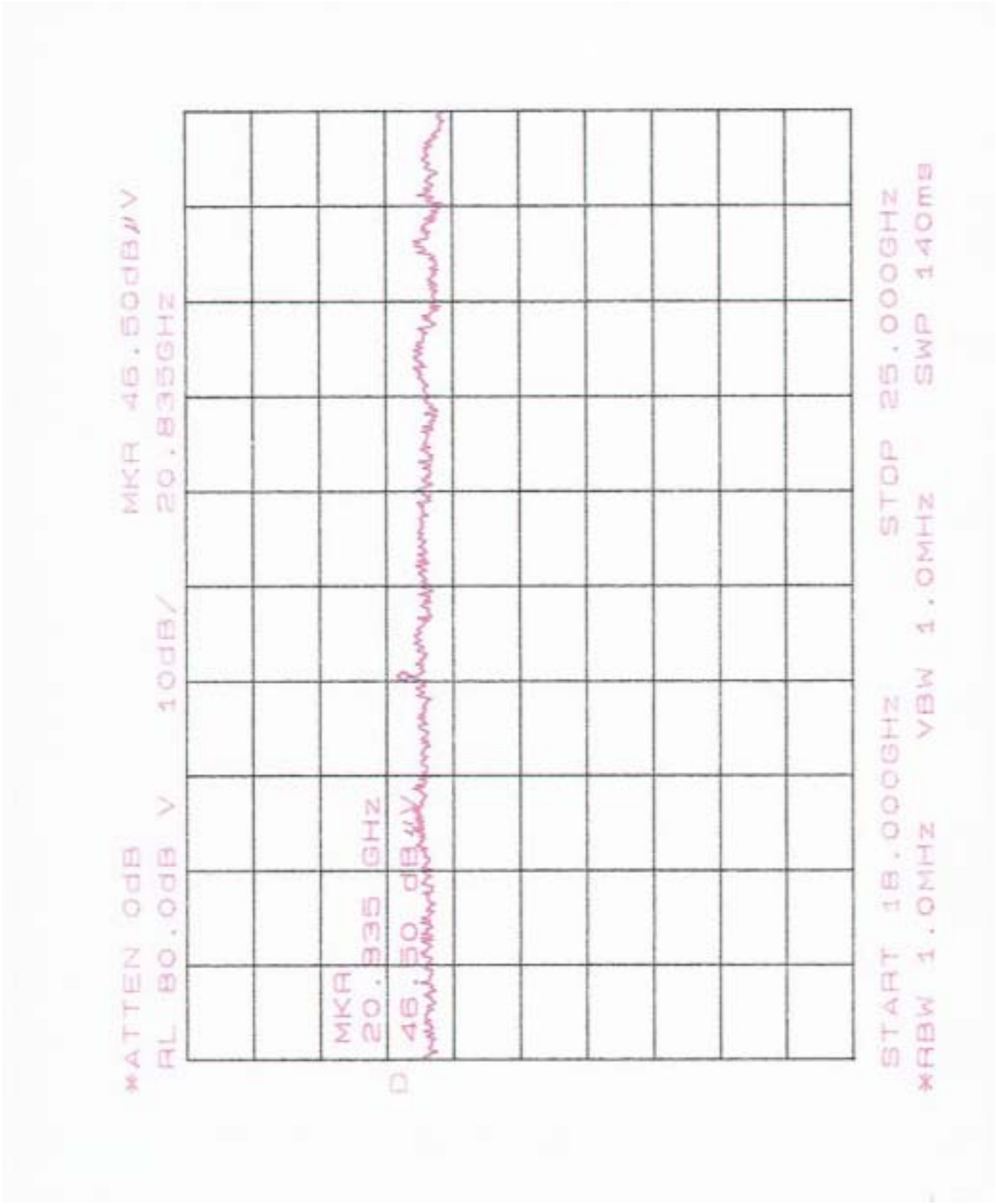
Horizontal


MKR 55.33dBµV
2.59GHz
ATTEN 10dB
RL 100.0dBµV 10dB/
DISPLAY LINE
78.5 dBµV
START 1.00GHz
*RBW 1.0MHz
VBW 1.0MHz
STOP 18.00GHz
SWP 340ms

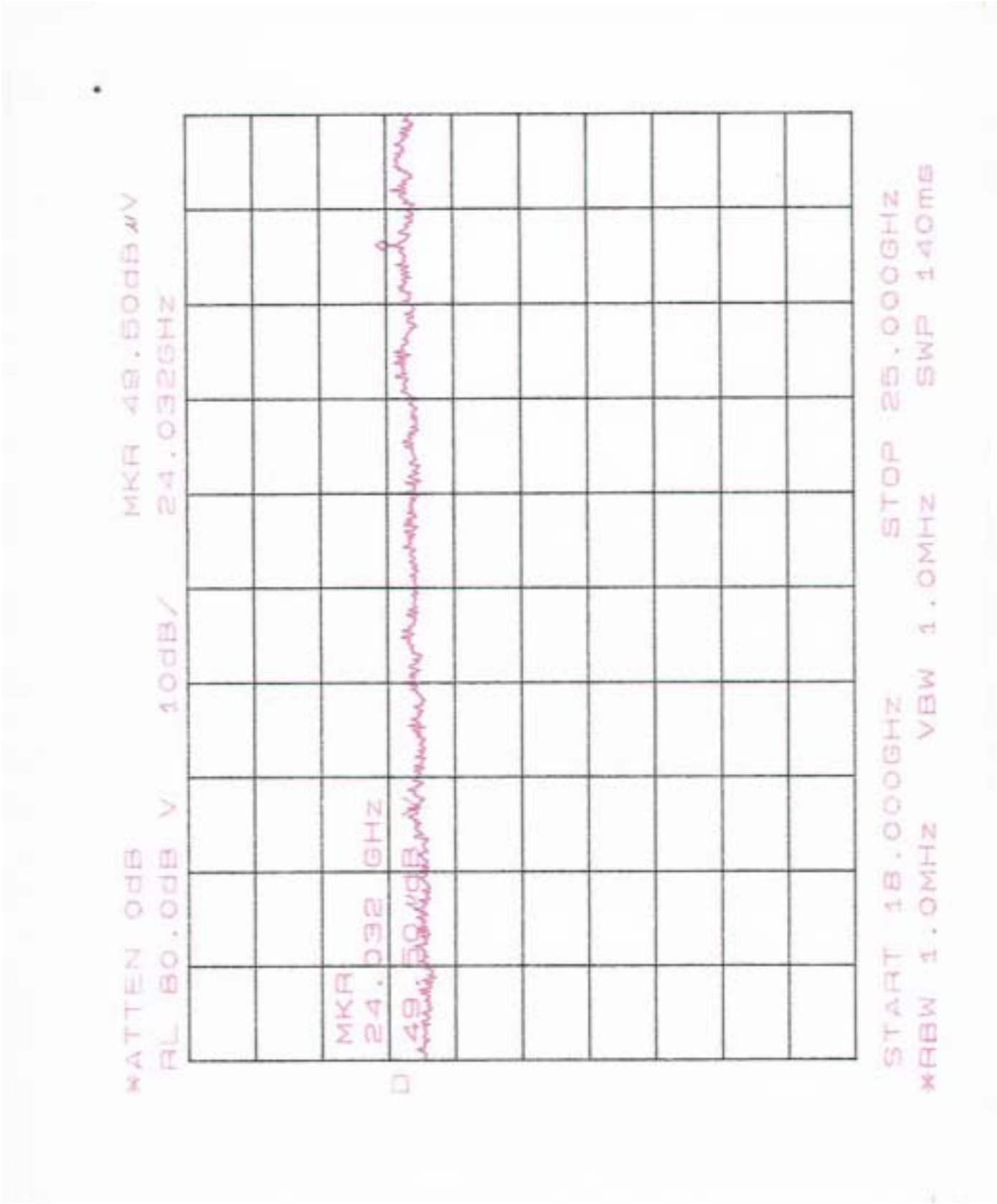
Vertical


MKR 66.17dBµV
4.77GHz
ATTEN 30dB
RL 120.0dBµV 10dB/
DISPLAY LINE
82.7 dBµV
START 1.00GHz
#RBW 1.0MHz
VBW 1.0MHz
STOP 18.00GHz
SWP 340ms

Horizontal


*ATTEN 0dB
RL 80.0dB V 10dB/
MKR 46.50dBµV
20.835GHz
MKR
20.835 GHz
46.50 dBµV
START 18.000GHz
*RBW 1.0MHz
VBW 1.0MHz
STOP 25.000GHz
SWP 140ms

Vertical


MKR 49.50dBµV
24.032GHz
10dB/
ATTEN 0dB
RL 80.0dB V
MKR
24.032 GHz
49.50dBµV
STOP 25.000GHz
SWP 140ms
VBW 1.0MHz
START 18.000GHz
RBW 1.0MHz

4.6 Photos of Radiation Measuring Setup

x axis

y axis

z axis

5 CONDUCTED EMISSION MEASUREMENT

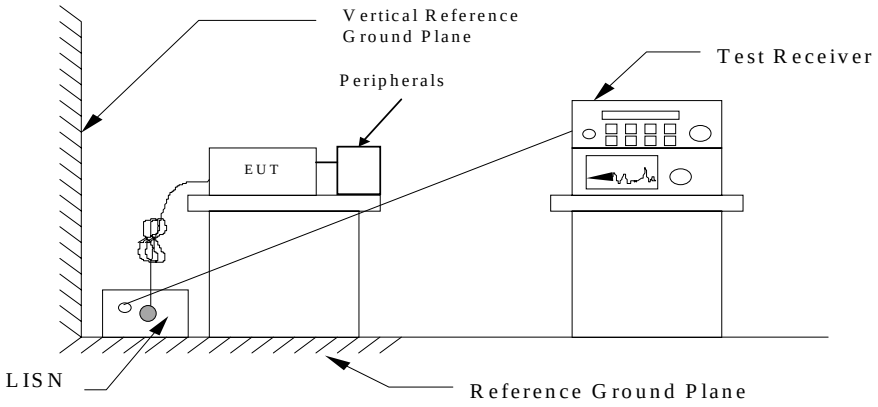
5.1 Applicable Standard

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

5.3.1

Temperature : 18 ℃
Humidity : 69%
Test Date : Jan. 02, 2004
Operation Mode : Hopping Mode

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	45.0#	47.4#	----	----	0.1	45.1#	47.5#	----	----	66.0	56.0	-18.5
0.193	50.9#	42.2#	----	----	0.1	51.0#	42.3#	----	----	63.8	53.8	-12.8
1.000	40.5#	39.5#	----	----	0.2	40.7#	39.7#	----	----	56.0	46.0	-15.3
1.785	40.3#	40.2#	----	----	0.2	40.5#	40.4#	----	----	56.0	46.0	-15.5
2.422	41.4#	42.2#	----	----	0.2	41.6#	42.4#	----	----	56.0	46.0	-13.6
2.574	41.3#	38.5#	----	----	0.2	41.5#	38.7#	----	----	56.0	46.0	-14.5
2.805	40.9#	40.7#	----	----	0.2	41.1#	40.9#	----	----	56.0	46.0	-14.9

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. “#” means the noise was low, so record the peak value.
4. 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.
5. The estimated measurement uncertainty of the result measurement is ± 3dB.

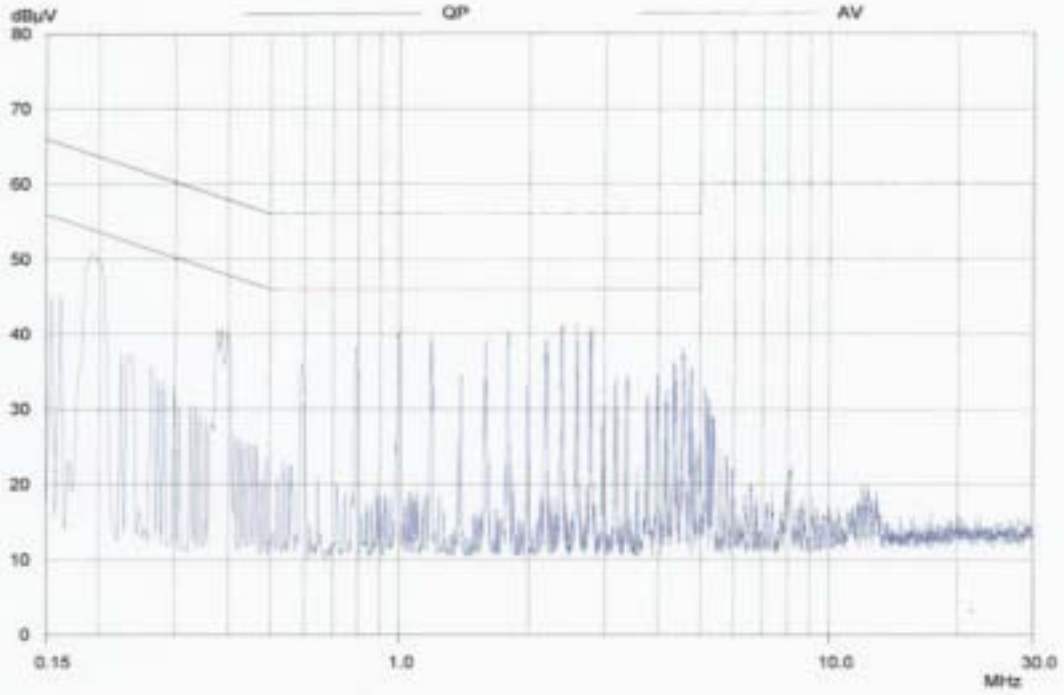
Conducted Emission Test

02 Jan 2004 13:26

PEAK VALUE

EUT:	BARCODE READER
Manuf:	
Op Cond:	HOPPING
Operator:	An
Test Spec:	FCC 15 B
Comment:	
	L1

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



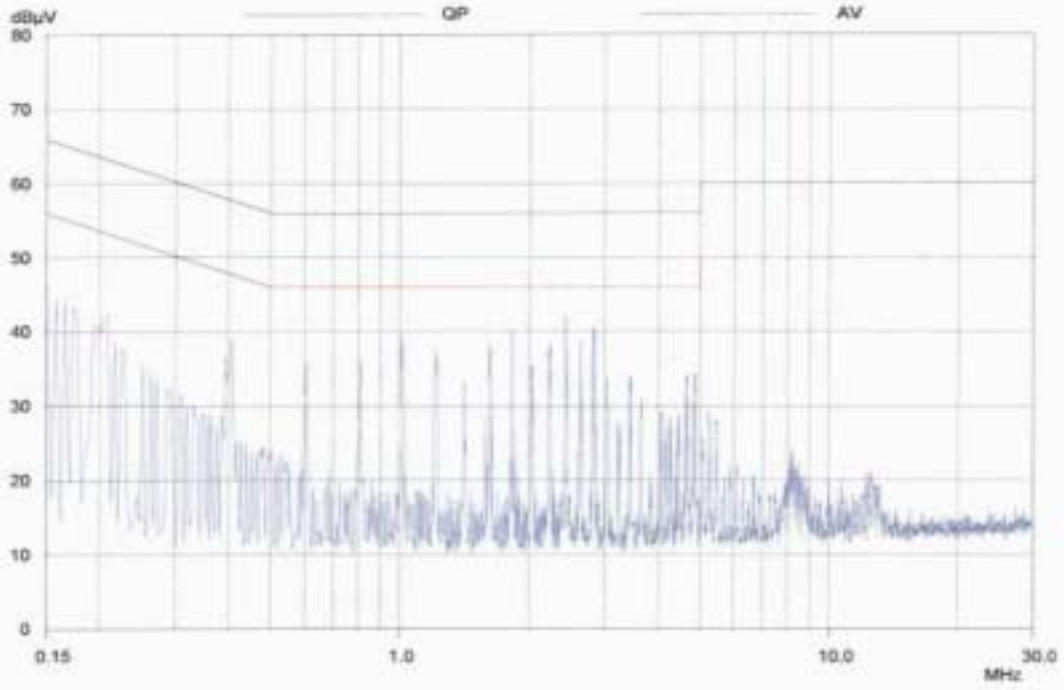
Conducted Emission Test

02 Jan 2004 13:29

PEAK VALUE

EUT:	BARCODE READER
Manuf:	
Op Cond:	HOPPING
Operator:	An.
Test Spec:	FCC 15 B
Comment:	
	L2

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



5.3.2

Temperature : 18 ℃
Humidity : 69%
Test Date : Jan. 02, 2004
Operation Mode : Charge Mode

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			
0.224	***	50.1#	----	----	0.1	***	50.2#	----	----	62.7	52.7	-12.5
0.435	37.4#	41.4#	----	----	0.1	37.5#	41.5#	----	----	57.2	47.2	-15.7
1.090	40.8#	42.2#	----	----	0.2	41.0#	42.4#	----	----	56.0	46.0	-13.6
1.313	40.3#	40.4#	----	----	0.2	40.5#	40.6#	----	----	56.0	46.0	-15.4
2.395	42.8#	44.4#	----	----	0.2	43.0#	44.6#	----	----	56.0	46.0	-11.4
2.402	40.1#	43.3#	----	----	0.2	40.3#	43.5#	----	----	56.0	46.0	-12.5
2.609	41.1#	41.3#	----	----	0.2	41.3#	41.5#	----	----	56.0	46.0	-14.5

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. “#” means the noise was low, so record the peak value.
4. 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.
5. The estimated measurement uncertainty of the result measurement is ± 3dB.

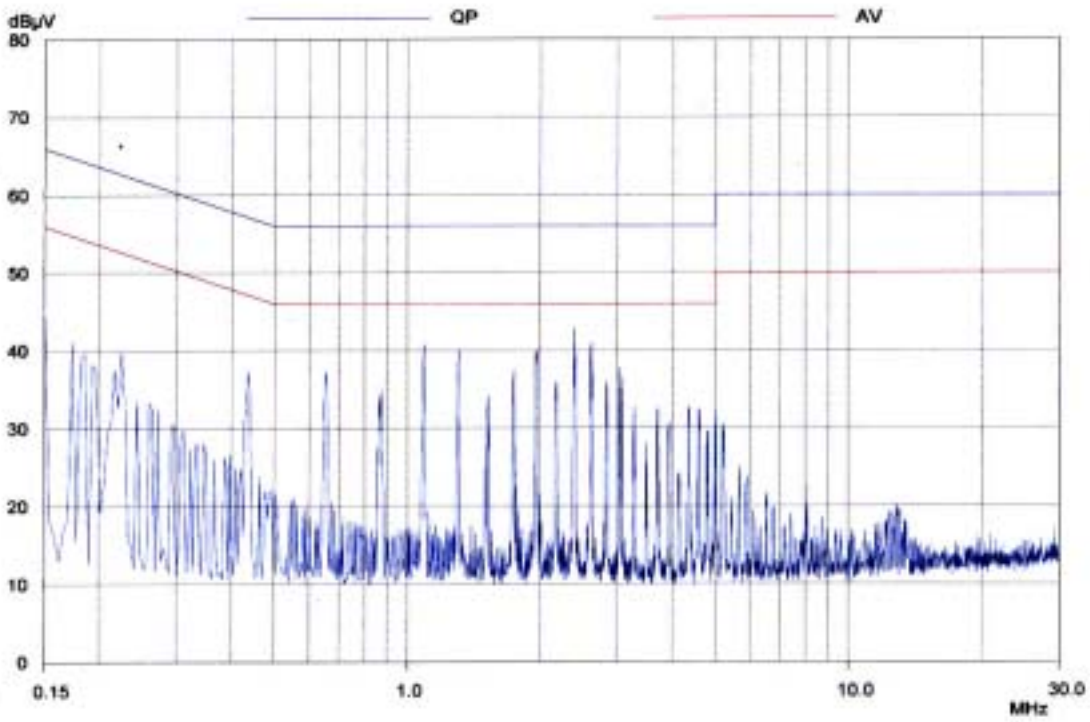
Conducted Emission Test

02 Jan 2004 13:14

PEAK VALUE

EUT:	BARCODE READER
Manuf:	
Op Cond:	CHARGING
Operator:	AR.
Test Spec:	FCC 15 B
Comment:	
	L1

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



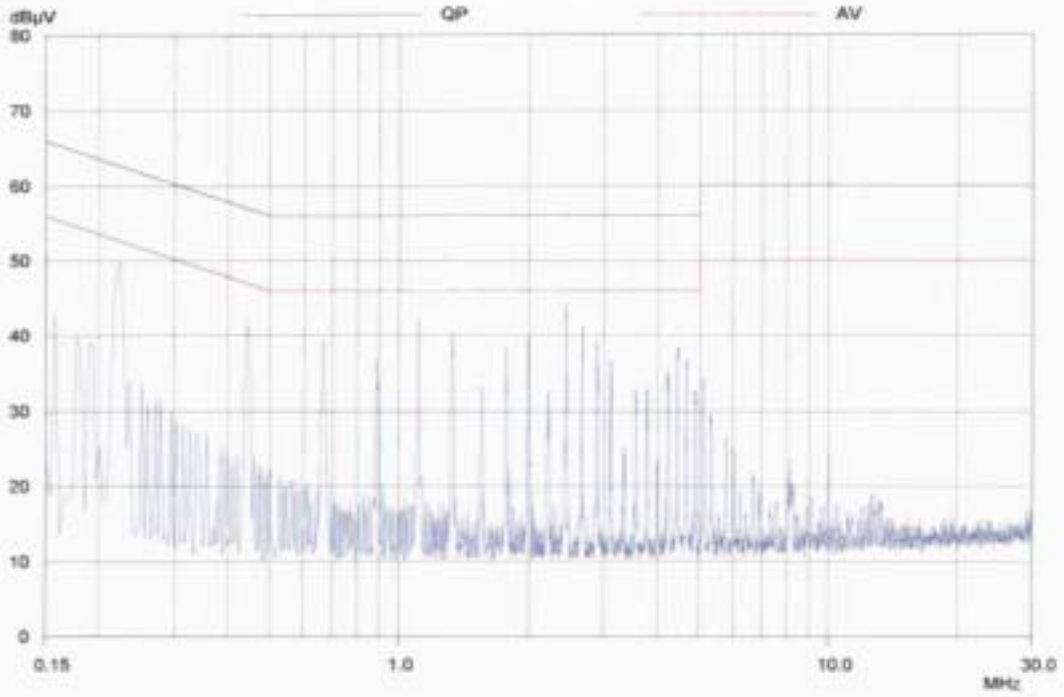
Conducted Emission Test

02 Jan 2004 13:18

PEAK VALUE

EUT:	BARCODE READER
Manuf:	
Op Cond:	CHARGING
Operator:	An.
Test Spec:	FCC 15 B
Comment:	
	L2

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 dB μ V is obtained, and LISN Factor is 0.1 dB, then the total of field strength is 22.6 dB μ V.

RESULT = 22.5 + 0.1 = 22.6 dB μ V
Level in μ V = Common Antilogarithm[(22.6 dB μ V)/20]
= 13.48 μ V

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, 2004
LISN	EMCO	3825	13057704-001	Nov. 02, 2004

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 Receving 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. The directional gain of antenna used for Receving is typical 2dBi.

7 20dB EMISSION BANDWIDTH MEASUREMENT

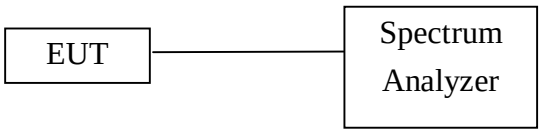
7.1 Standard Applicable

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	09/10/2004

7.4 Measurement Data

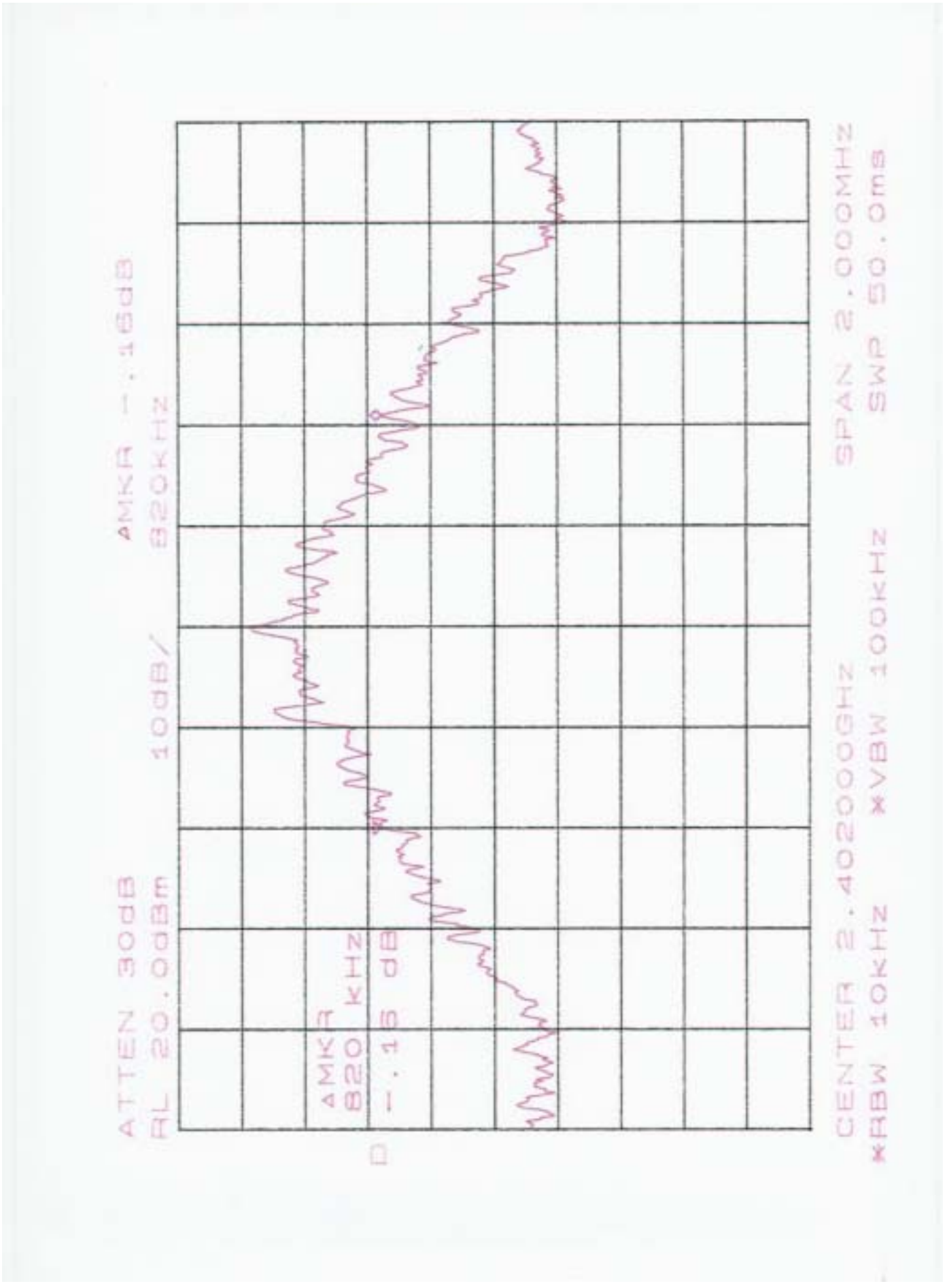
Test Date : Jan. 05, 2004 Temperature : 29 ℃ Humidity: 70%

a) Channel 01 : 20 dB Emission Bandwidth is 820 KHz
b) Channel 40 : 20 dB Emission Bandwidth is 823 KHz
c) Channel 79 : 20 dB Emission Bandwidth is 820 KHz

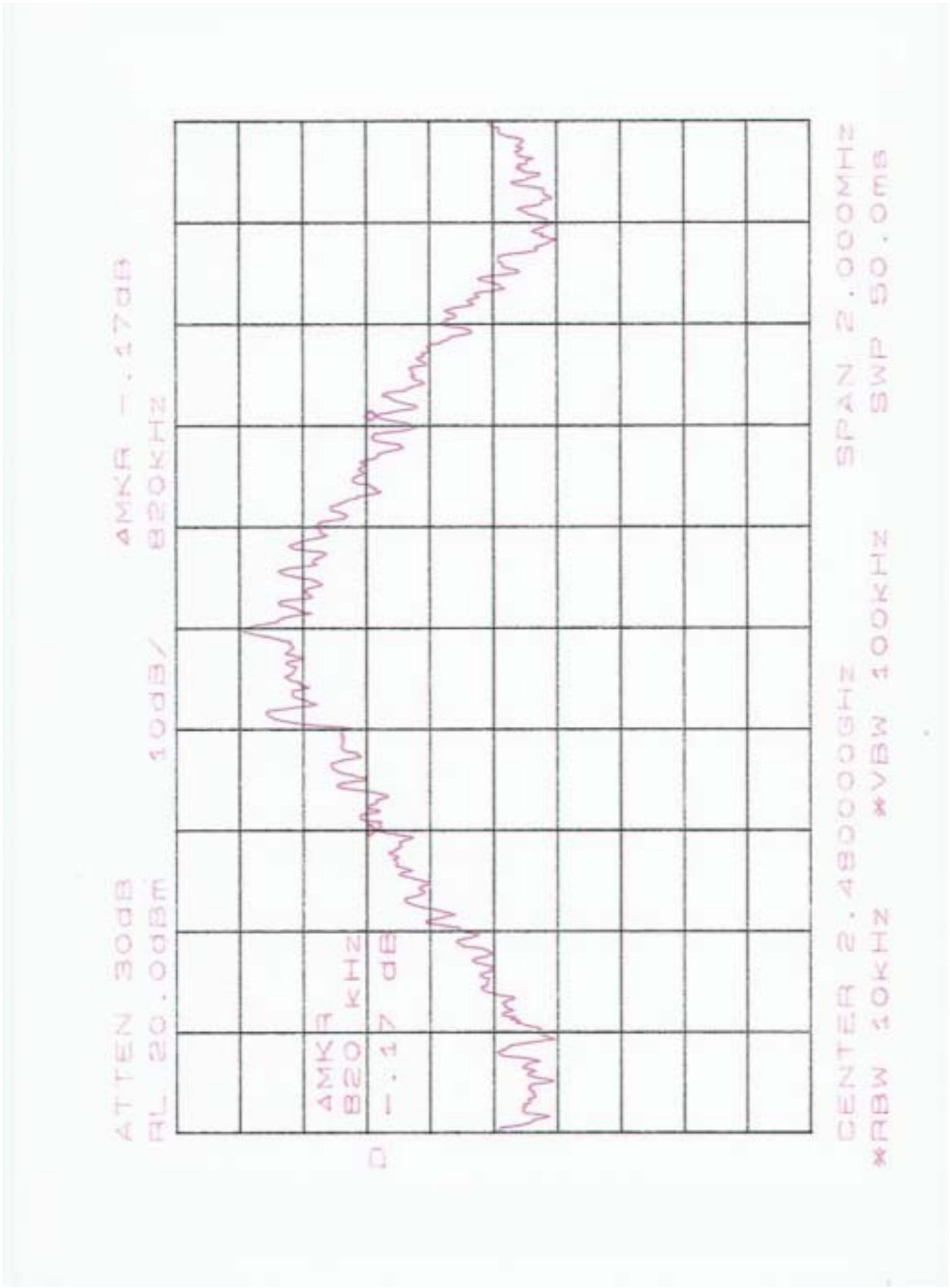
Note:

1.The estimated measurement uncertainty of the result measurement is:
:±1.5dB(1GHz≦f≦18GHz)

2.Please see next pages for ploted datas


ATTEN 30dB
RL 20.00Bm
10dB/
ΔMKR -.16dB
820kHz
ΔMKR
820 kHz
-.16 dB
CENTER 2.402000GHz
*RBW 10kHz
*VBW 100kHz
SPAN 2.000MHz
SWP 50.0ms


ATTEN 30dB
RL 20.0dBm
10dB/
AMKR -.34dB
823kHz
AMKR
823 kHz
-.34 dB
CENTER 2.441000GHz
*RBW 10kHz
*VBW 100kHz
SPAN 2.000MHz
SWP 50.0ms


ATTEN 30dB
RL 20.0dBm
10dB/
AMKR -.17dB
820KHz
AMKR 820 KHz
-.17 dB
1
CENTER 2.480000GHz
*RBW 10KHz
*VBW 100KHz
SPAN 2.000MHz
SWP 50.0ms

8 OUTPUT POWER MEASUREMENT

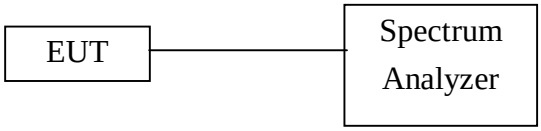
8.1 Standard Applicable

For frequency hopping system, according to 15.247(b), the maximum peak output power of the transmitter shall not exceed 1 Watt. If Receving 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	09/10/2004

8.4 Measurement Data

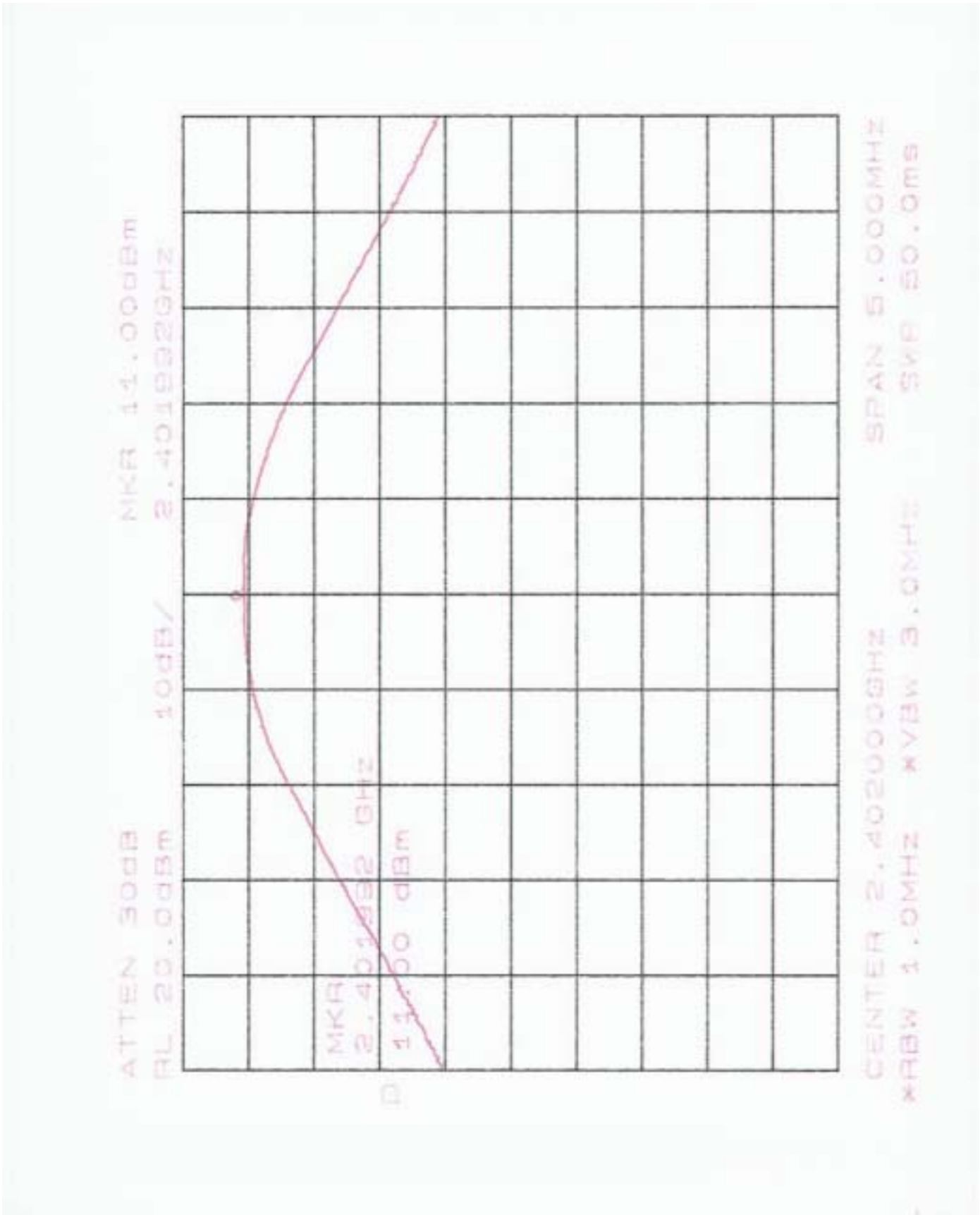
Test Date : Jan. 05, 2004 Temperature : 29 ℃ Humidity: 70%

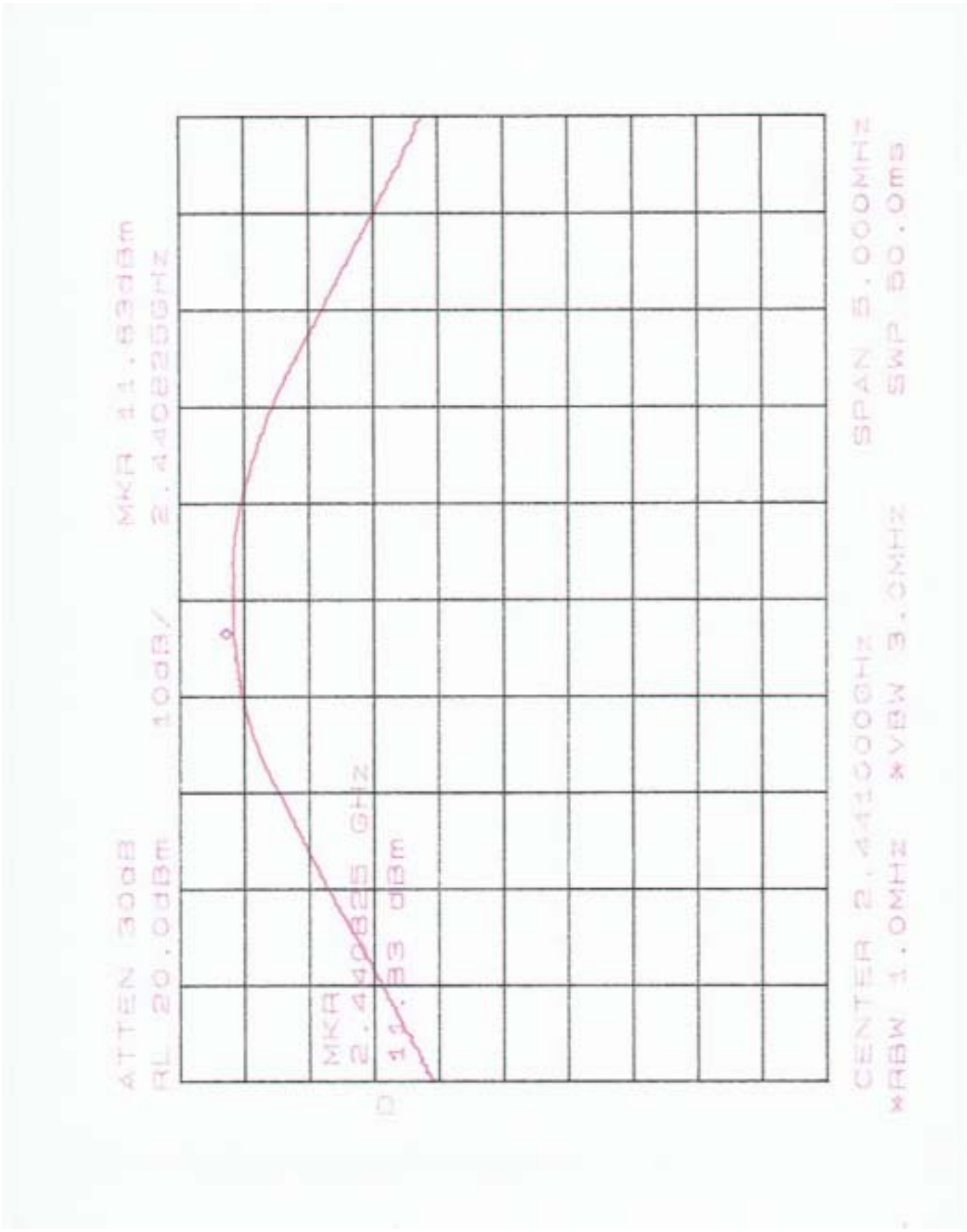
a) Channel 01 : Output Peak Power is 11.00dBm or 12.59 mW
b) Channel 40 : Output Peak Power is 11.83dBm or 15.20 mW
c) Channel 79 : Output Peak Power is 11.83dBm or 15.20 mW

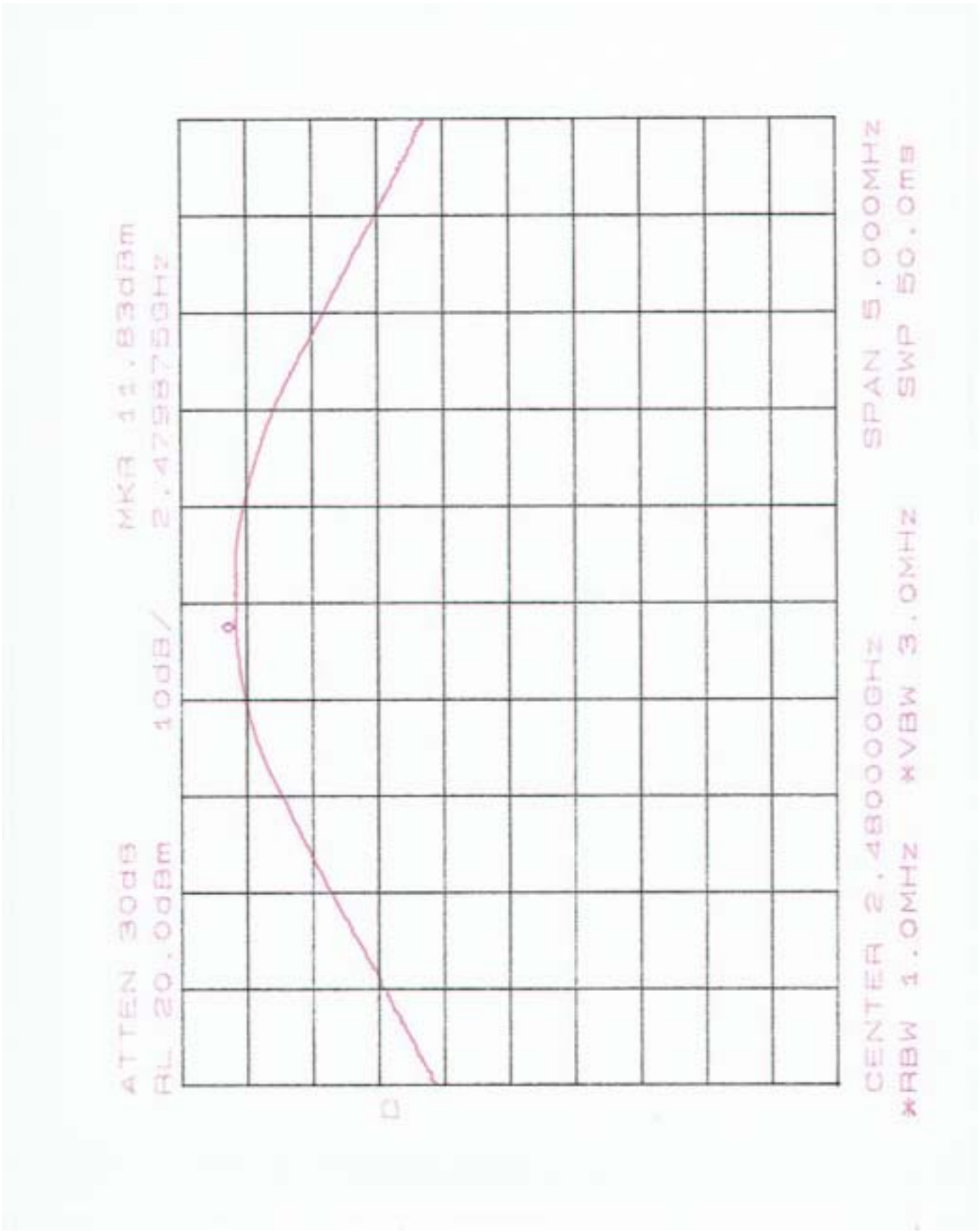
Note:

1.The estimated measurement uncertainty of the result measurement is:
:±1.5dB(1GHz≦f≦18GHz)

2.Please see next pages for ploted datas


MKR 11.000dBm
2.410000GHz
10dB/
ATTEN 30dB
RL 20.00dBm
MKR 2.410000GHz
11.00 dBm
CENTER 2.402000GHz
SPAN 5.000MHz
*RBW 1.0MHz
*VBW 3.0MHz
SWP 50.0ms


ATTEN 30dB
RL 20.00dBm
10dB/
MKR 11.83GHz
2.4402GHz
MKR
2.440GHz
11.83 dBm
CENTER 2.441000GHz
*RBW 1.0MHz
*VBW 3.0MHz
SPAN 5.000MHz
SWP 50.0ms


MKR 11.83dBm
2.479875GHz
ATTEN 30dB
RL 20.00dBm
10dB/
CENTER 2.480000GHz
*RBW 1.0MHz
*VBW 3.0MHz
SPAN 5.000MHz
SWP 50.0ms

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	09/10/2004

9.4 Measurement Data

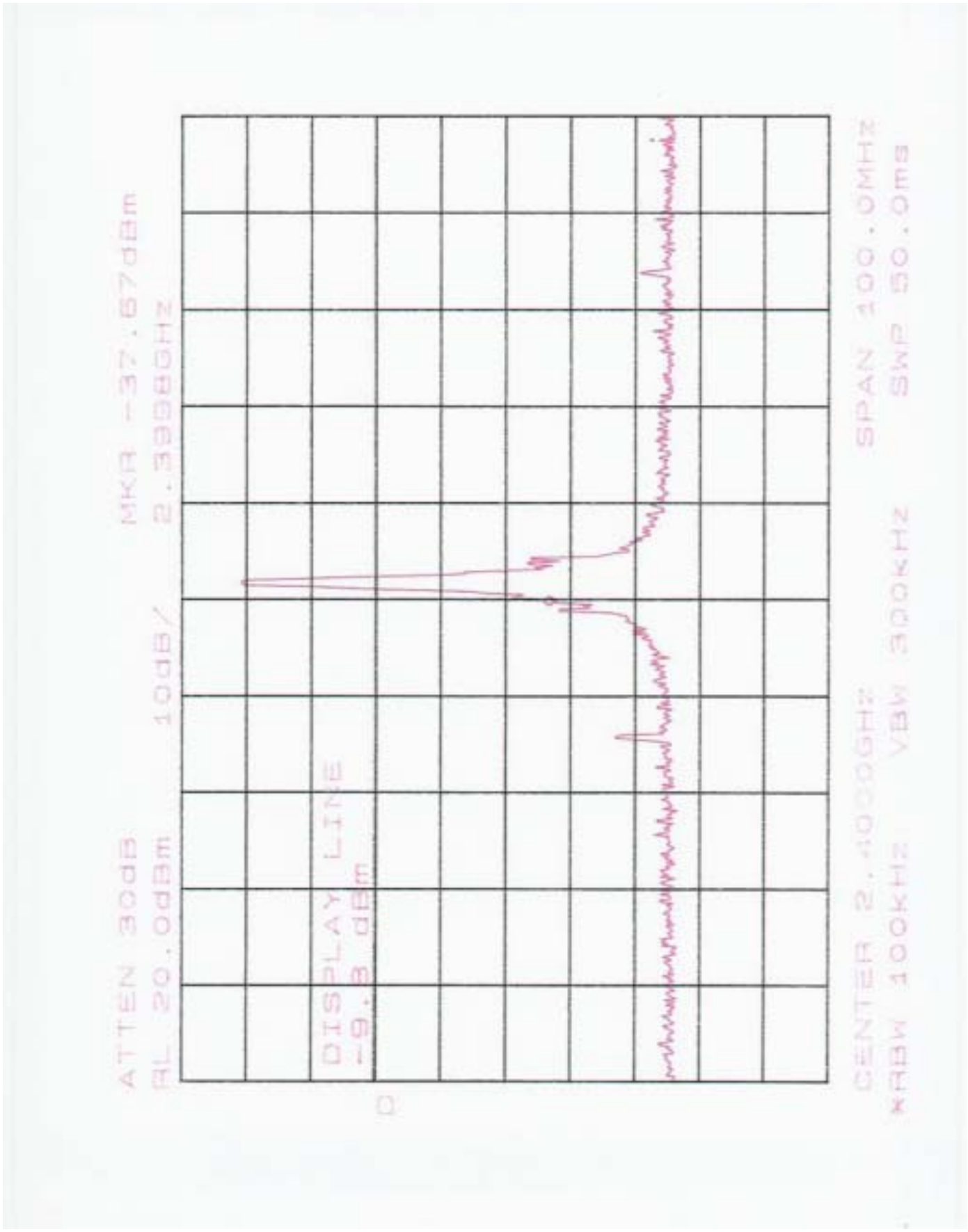
Test Date : Jan. 05, 2004 Temperature : 29 ℃ Humidity: 70%

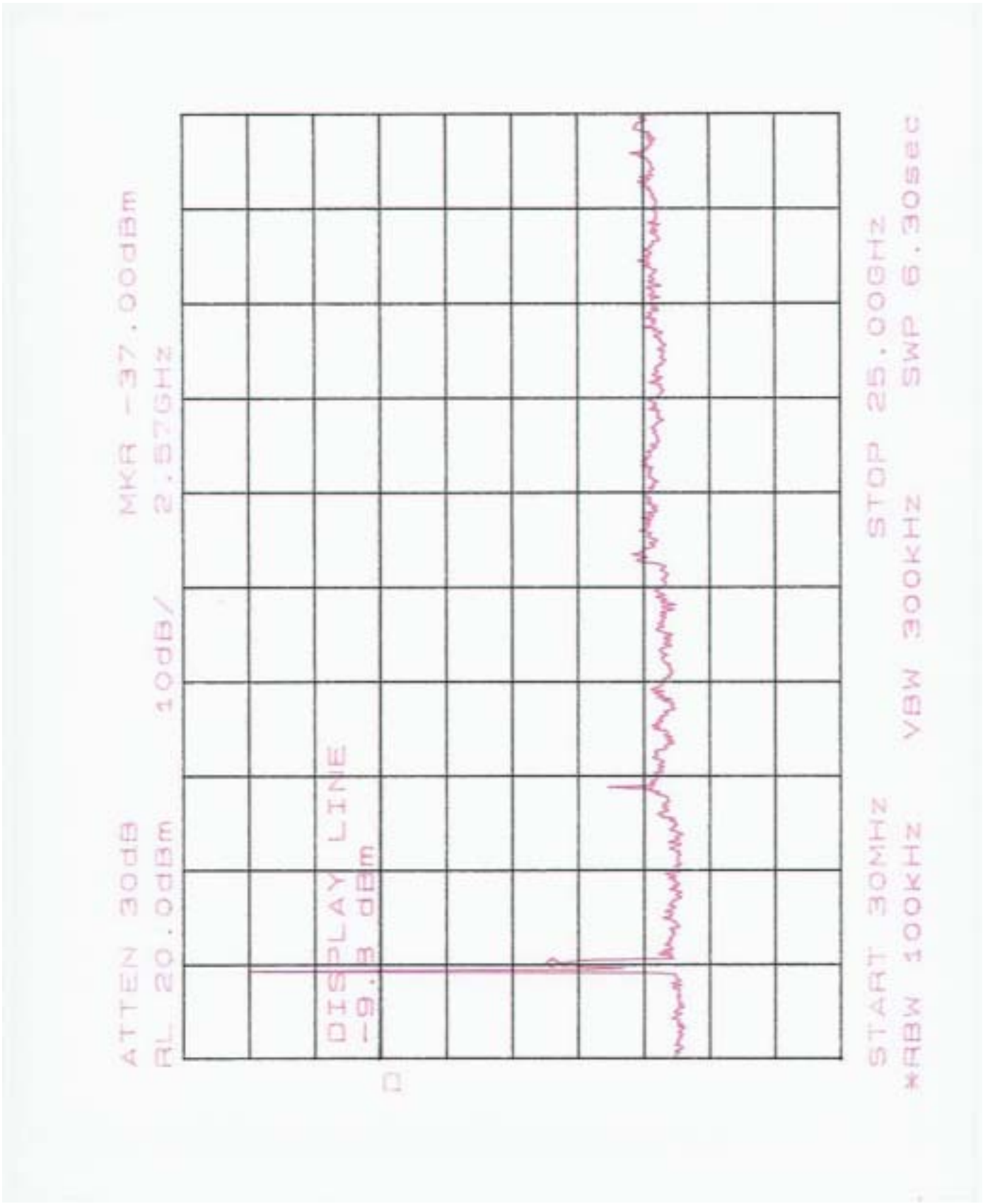
a) Lower Band Edge : maximum value is –37.67dBm that is attenuated more than 20dB
b) Upper Band Edge : maximum value is –41.50 dBm that is attenuated more than 20dB

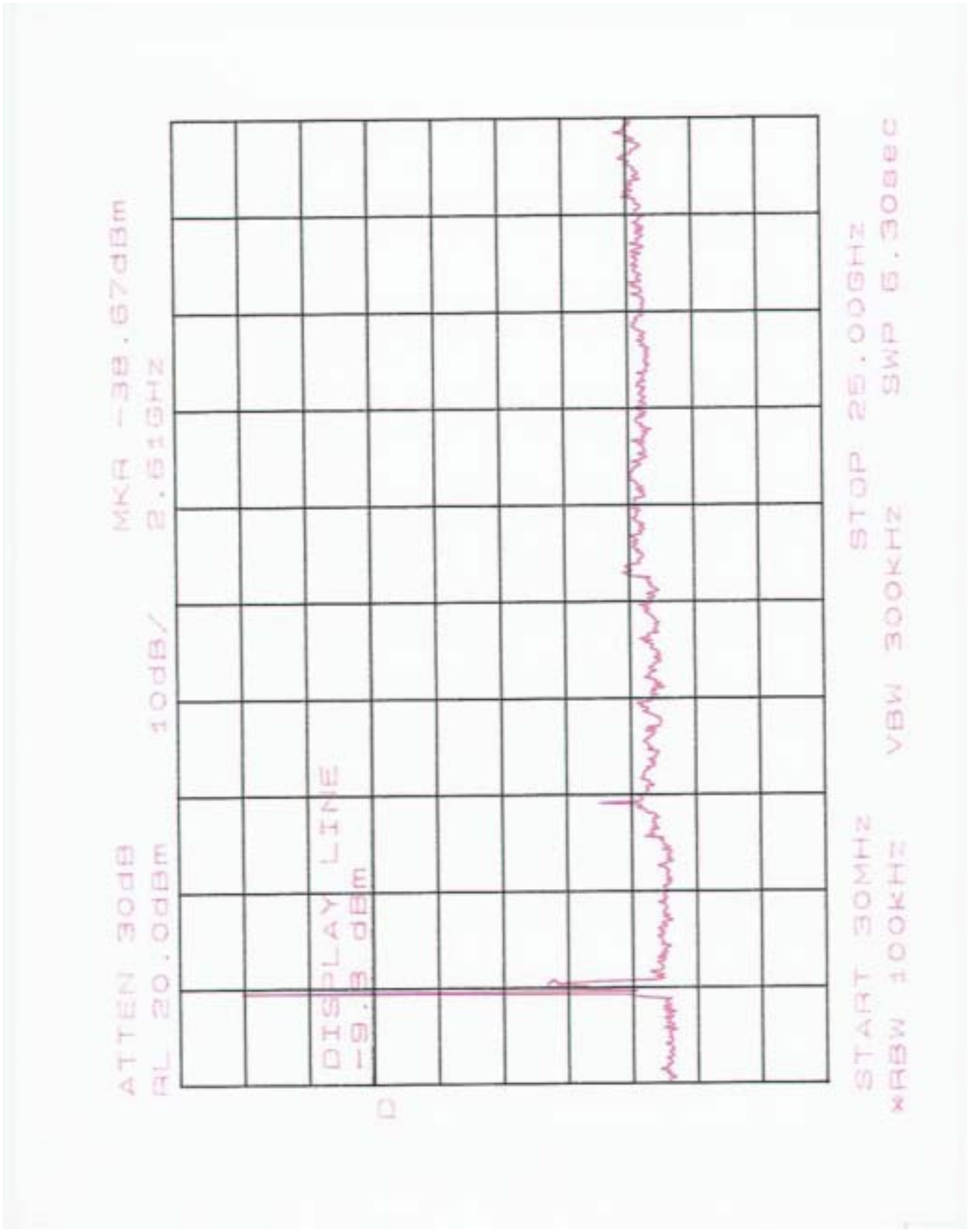
Note:

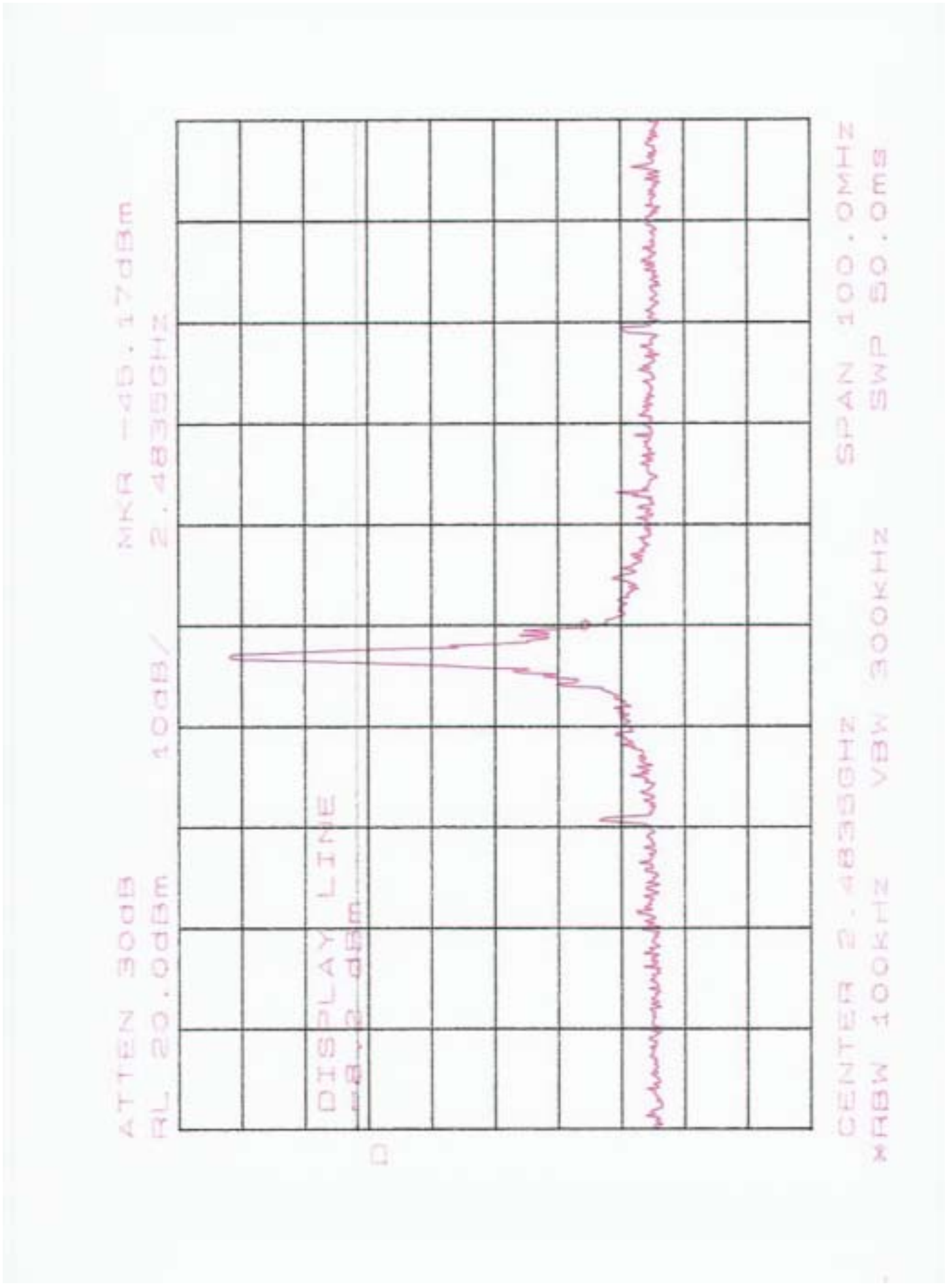
1.The estimated measurement uncertainty of the result measurement is:
:±1.5dB(1GHz≦f≦18GHz)

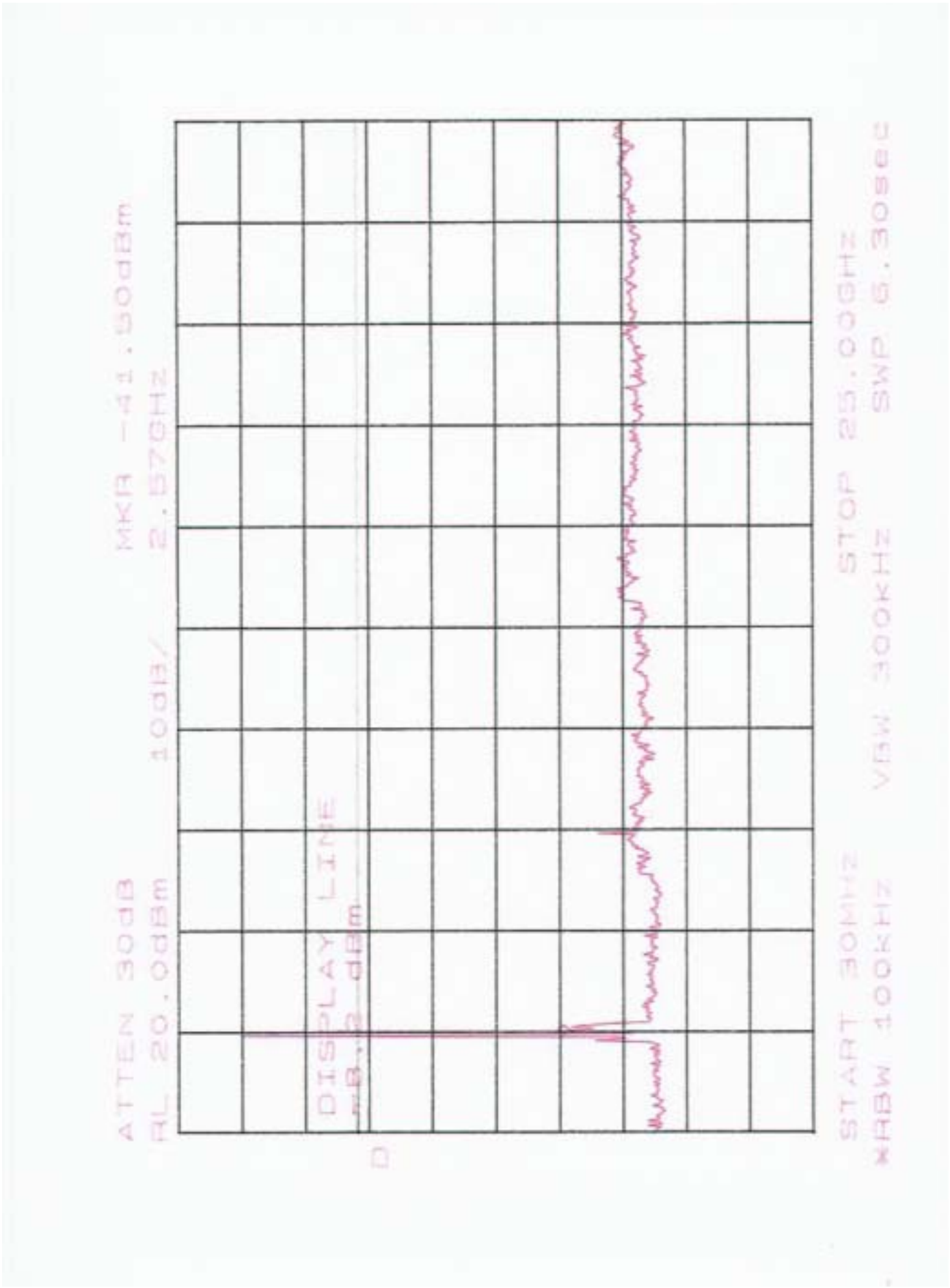
2.Please see next pages for ploted datas


MKR -37.67dBm
2.399880GHz
ATTEN 30dB
RL 20.0dBm
10dB/
DISPLAY LINE
-9.8 dBm
CENTER 2.400GHz
SPAN 100.0MHz
RBW 100kHz
VBW 300kHz
SWP 50.0ms


MKR -37.00dBm
2.57GHz
ATTEN 30dB
RL 20.0dBm
10dB/
DISPLAY LINE
-9.3 dBm
START 30MHz
*RBW 100KHz
VBW 300KHz
STOP 25.000MHz
SWP 6.30sec


MKR -38.67dBm
2.616GHz
ATTEN 30dB
RL 20.0dBm
10dB/
DISPLAY LINE
-19.3 dBm
STOP 25.000GHz
SWP 6.30sec
VBW 300KHz
START 30MHz
RBW 100KHz


ATTEN 30dB
RL 20.00dBm
10dB/
MKR -45.17dBm
2.4835GHz
DISPLAY LINE
-8.2 dBm
CENTER 2.4835GHz
MRBW 100KHz
VBW 300KHz
SPAN 100.0MHz
SWP 50.0ms


MKR -41.50dBm
2.857GHz
ATTEN 30dB
RL 20.0dBm
10dB/
DISPLAY LINE
-8.2 dBm
D
START 30MHz
#RBW 100kHz
VBW 300kHz
STOP 25.006GHz
SWP 6.30sec

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 1、40、79, 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	08/27/2004
Horn Antenna	EMCO	3115	06/05/2004
LogBicone Antenna	Schwarzbeck	9160	10/28/2004
Horn Antenna	EMCO	3116	06/28/2004
Preamplifier	Hewlett-Packard	8449B	09/04/2004
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2004

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 1

Operation Mode : Transmitting /Receving
Fundamental Frequency : 2402 MHz
Test Date : Jan. 03, 2004 Temperature : 19℃ Humidity: 70%

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 (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
2390.000	28.2	16.7	28.7	16.0	28.3	57.0	44.6	74.0	54.0	-9.4	90	1.0
2483.500	29.0	16.3	30.2	18.8	28.3	58.5	47.1	74.0	54.0	-6.9	90	1.0

b) Channel 40

Operation Mode : Transmitting / Receving
Fundamental Frequency : 2441MHz
Test Date : Jan. 03, 2004 Temperature : 19℃ Humidity: 70%

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 (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
2390.000	28.3	15.7	28.7	16.0	28.3	57.0	44.3	74.0	54.0	-9.7	90	1.0
2483.500	28.2	16.3	30.5	18.2	28.3	58.8	46.5	74.0	54.0	-7.5	90	1.0

c) Channel 79

Operation Mode : Transmitting / Receving
Fundamental Frequency : 2480 MHz
Test Date : Jan. 03, 2004 Temperature : 19℃ Humidity: 70%

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 (dBuV/m) Ave (H/V Max.)	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.	Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
2390.500	28.2	15.5	28.2	16.7	28.3	56.5	45.0	74.0	54.0	-9.0	90	1.0
2483.500	28.3	17.8	30.8	19.0	28.3	59.1	47.3	74.0	54.0	-6.7	90	1.0

Note:

The estimated measurement uncertainty of the result measurement is:
±4.1dB(1GHz≦f≦18GHz)

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

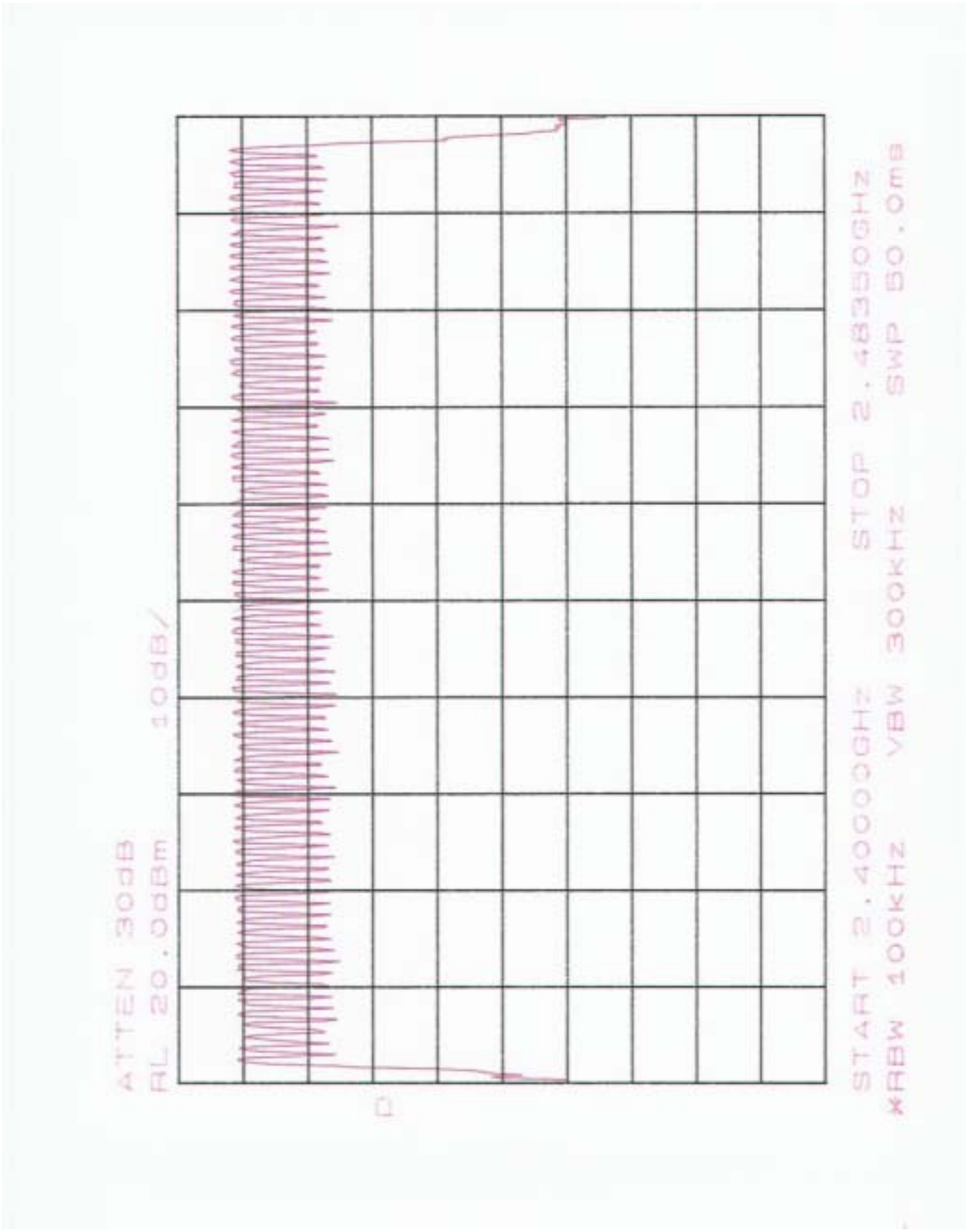
Equipment	Manufacturer	Model No.	Next Cal. Due
Plotter	Hewlett-Packard	7440A	N/A
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2004

11.4 Measurement Data

Test Date : Jan. 05, 2004 Temperature : 29 ℃ Humidity: 70%

Number of hopping channels = 79 channels

Note: Please see next pages for ploted datas


ATTEN 30dB
RL 20.00Bm
10dB/
START 2.400000GHz
#RBW 100kHz
VBW 300kHz
STOP 2.483500GHz
SWP 50.0ms

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	09/10/2004

12.4 Measurement Data

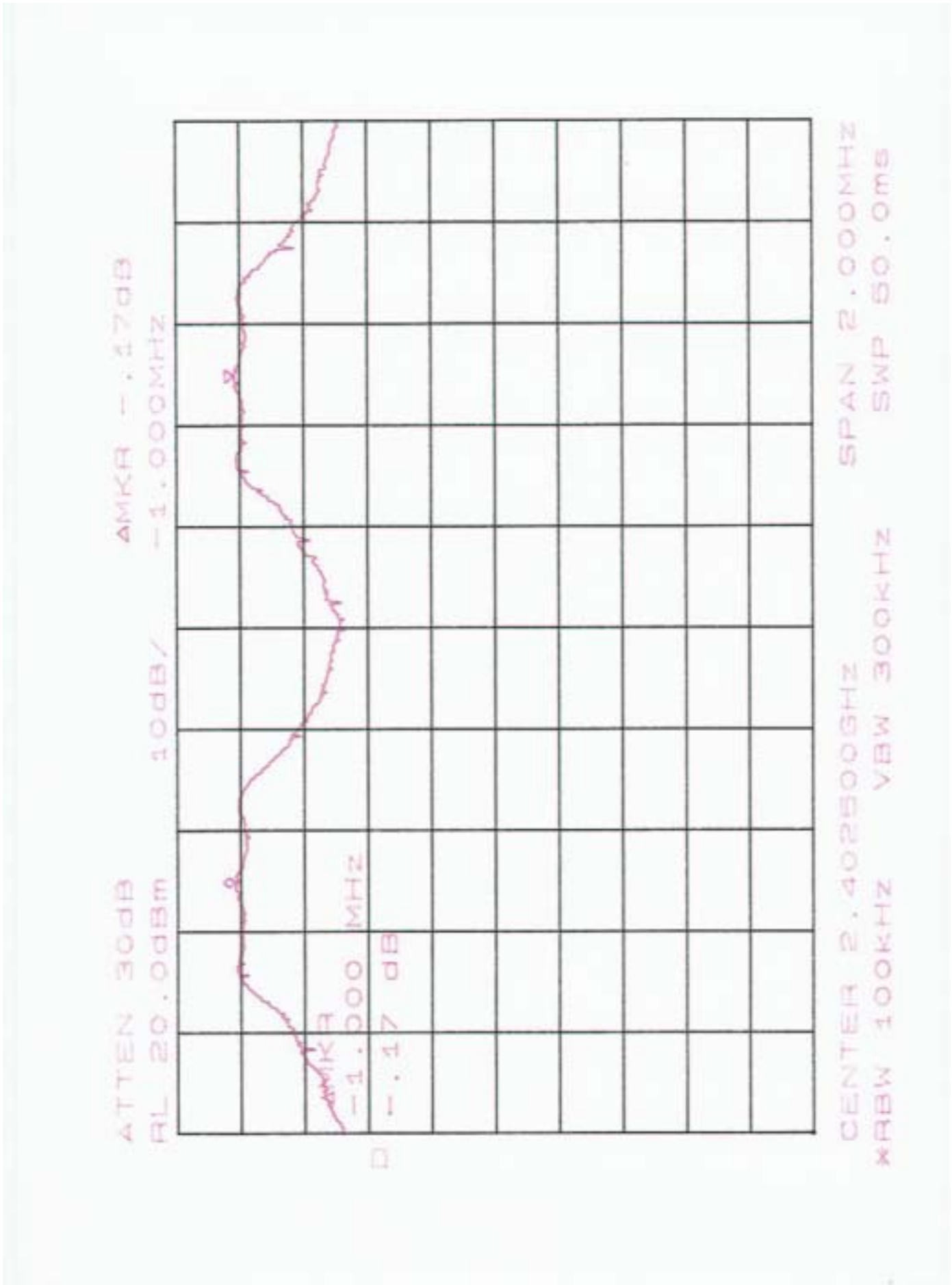
Test Date : Jan. 05, 2004 Temperature : 29 ℃ Humidity: 70%

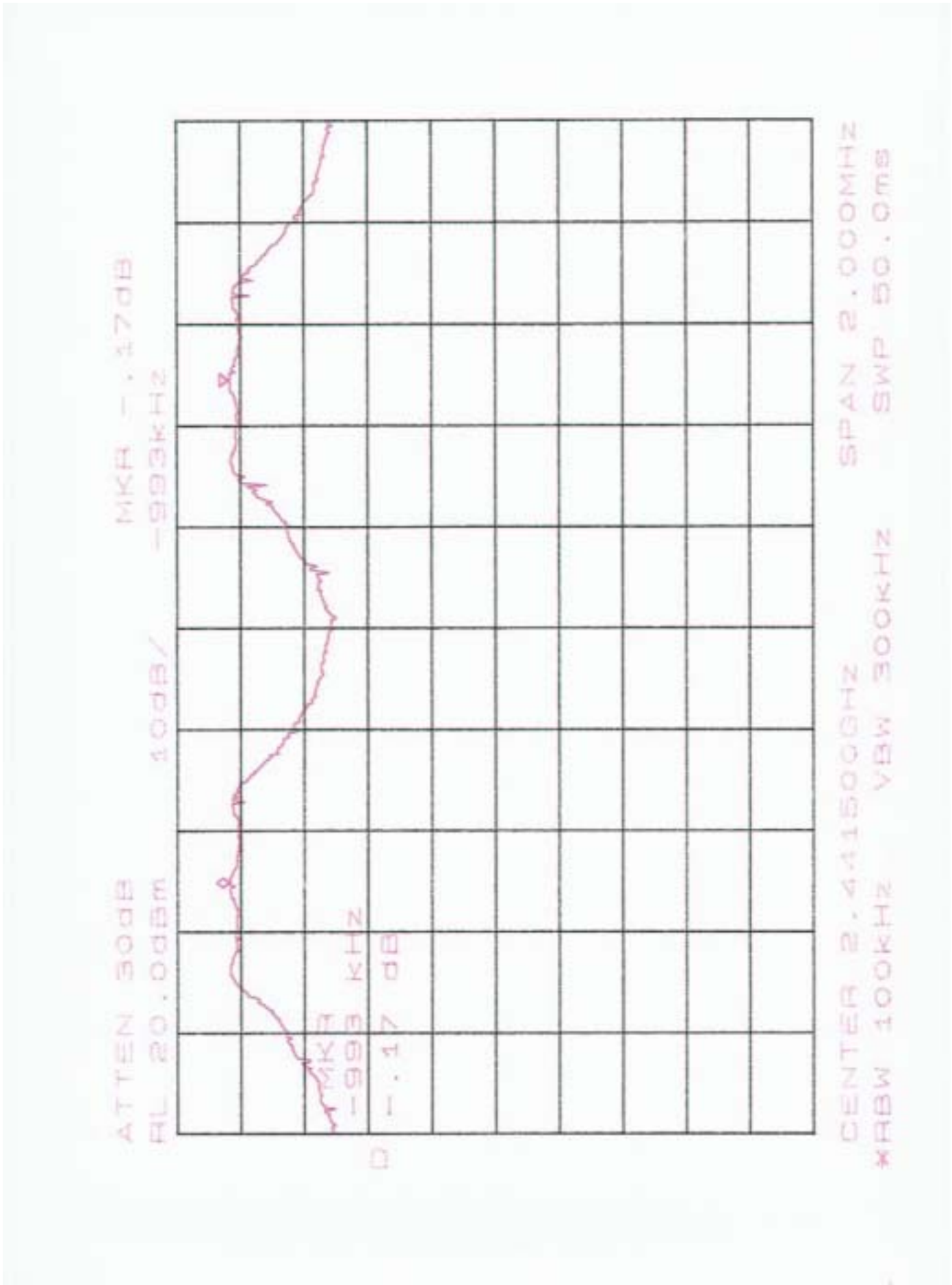
a) 2402MHz channel seperation is 1000kHz
b) 2441MHz channel seperation is 993kHz
c) 2480MHz channel seperation is 993kHz

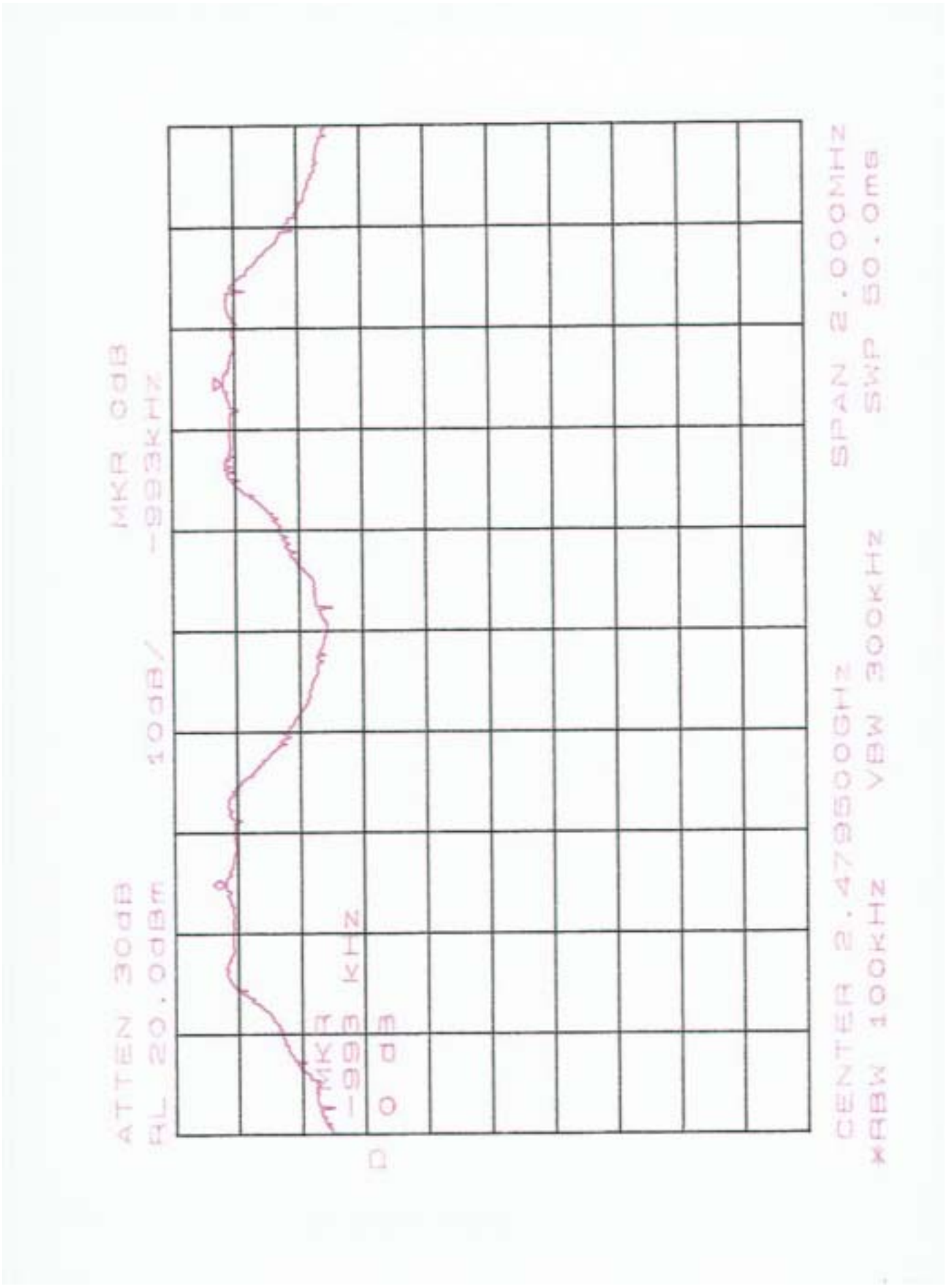
Note:

1.The estimated measurement uncertainty of the result measurement is:
:±1.5dB(1GHz≦f≦18GHz)

2.Please see next pages for ploted datas


ATTEN 30dB
RL 20.00dBm
10dB/
ΔMKR -.47dB
-1.000MHz
MKR -1.000 MHz
-1.47 dB
CENTER 2.402500GHz
SPAN 2.000MHz
VBW 300KHz
SWP 50.0ms
*RBW 100KHz


ATTEN 30dB
RL 20.00dBm
10dB/
MKR -998kHz
-1.47dB
MKR -998 kHz
-1.47 dB
CENTER 2.411500GHz
*RBW 100kHz
VBW 300kHz
SPAN 2.000MHz
SWP 50.0ms


ATTEN 30dB
RL 20.00dBm
10dB/
MKR 0dB
-993kHz
CENTER 2.479500GHz
SPAN 2.000MHz
RBW 100kHz
VBW 300kHz
SWP 50.0ms
MKR 1.996 MHz
0.00

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	09/10/2004

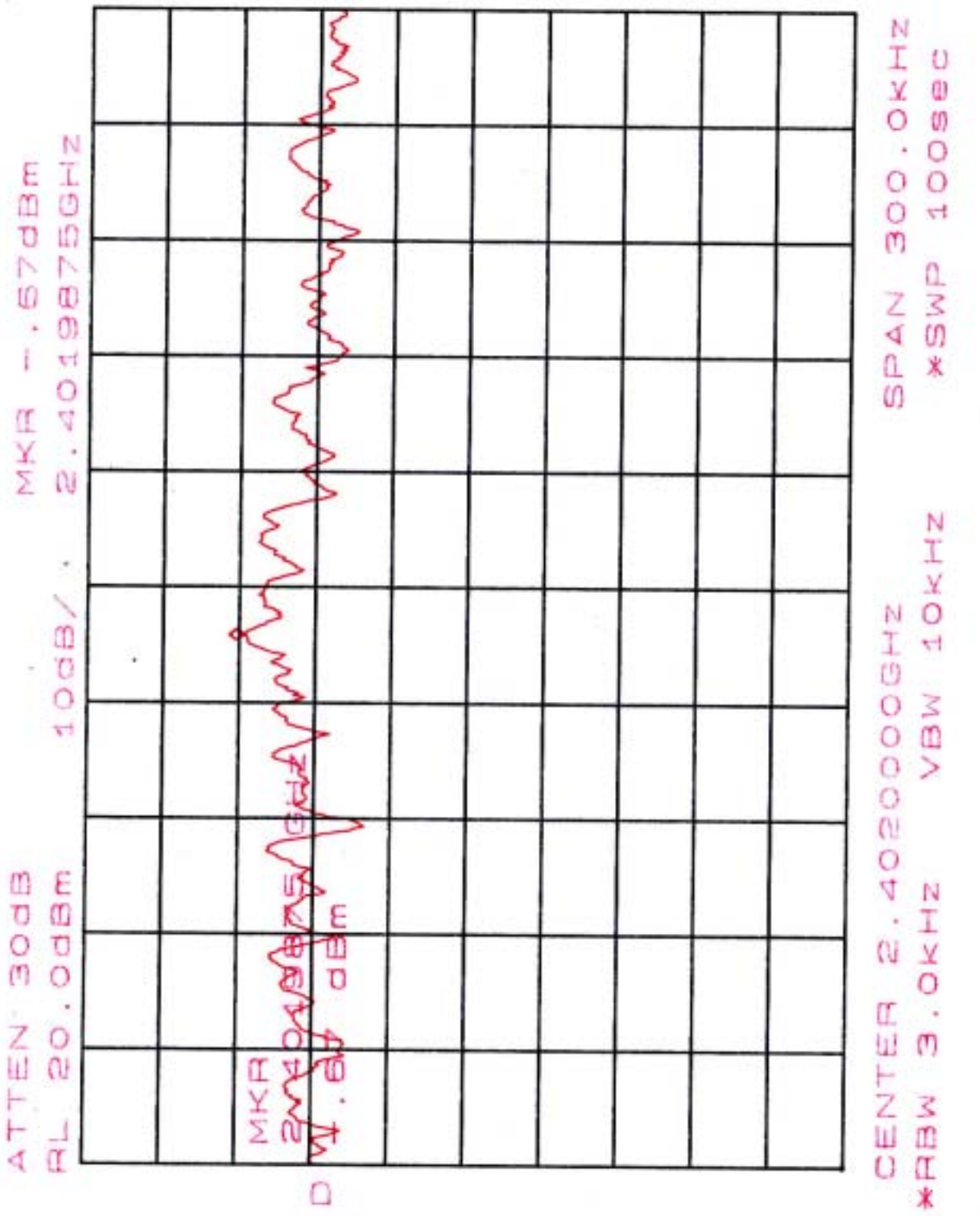
13.4 Measurement Data

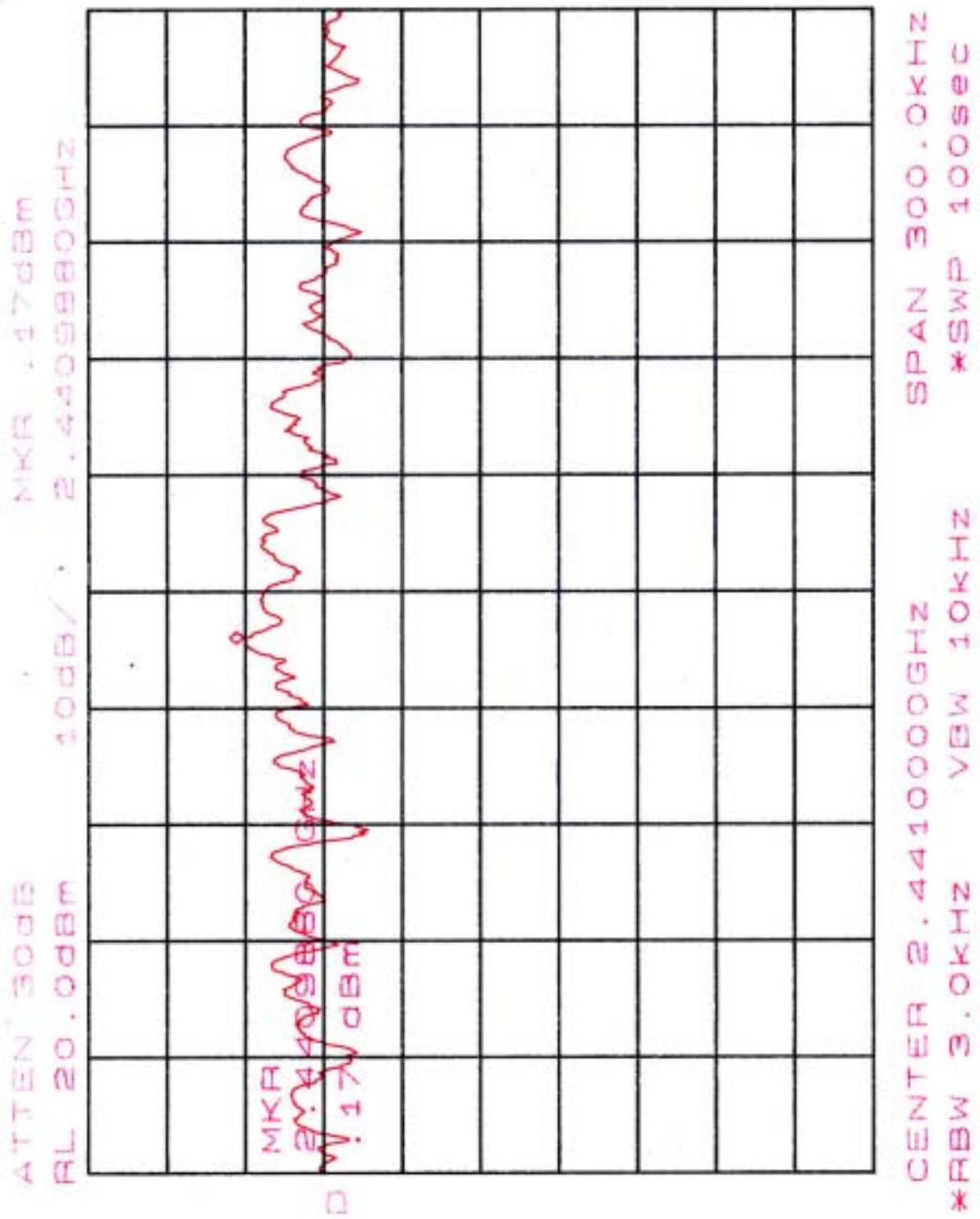
Test Date : Jan. 05, 2004 Temperature : 29 ℃ Humidity: 70

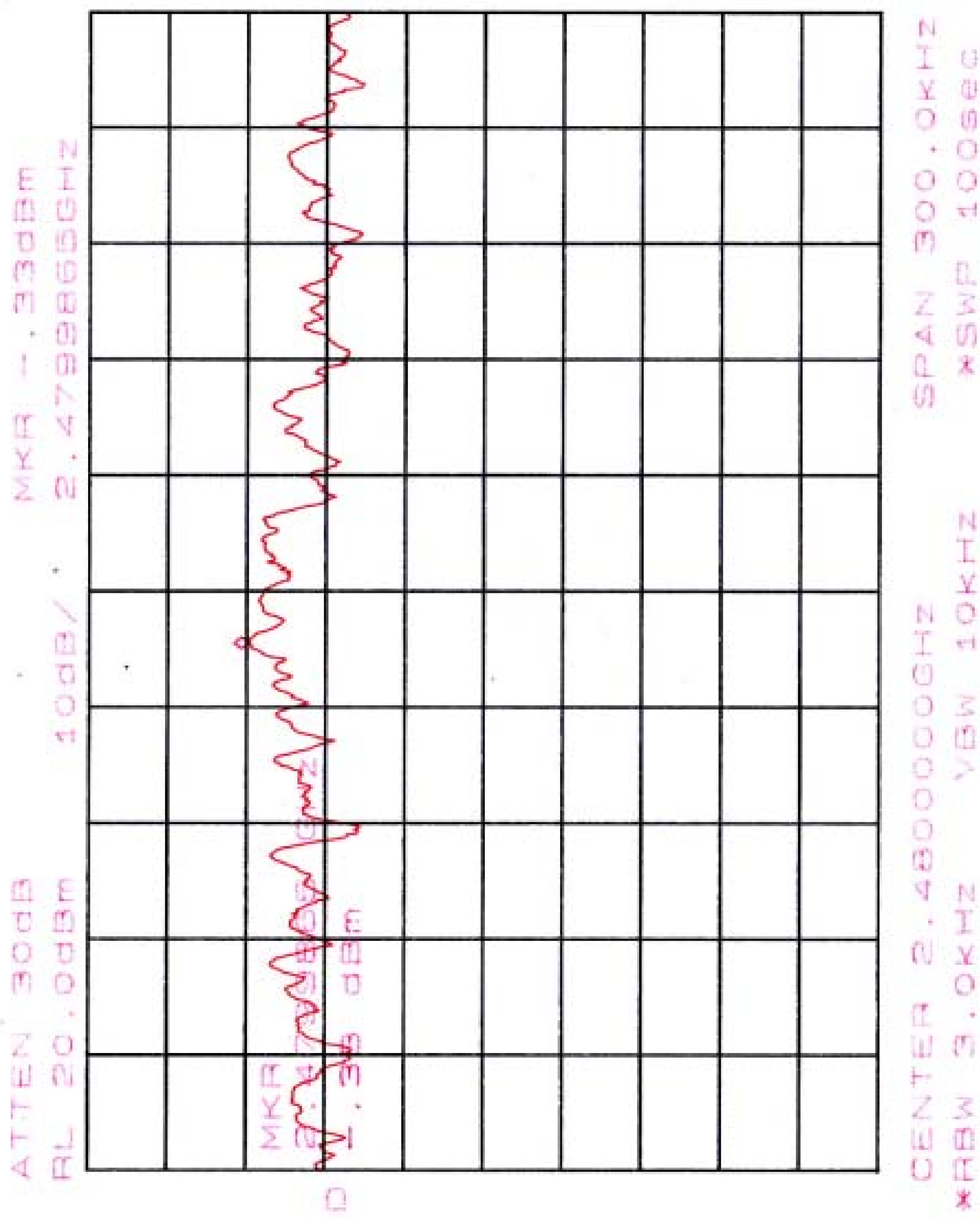
a) Channel 01 : Power Spectral Density is –0.67 dBm
b) Channel 40 : Power Spectral Density is 0.17 dBm
c) Channel 79 : Power Spectral Density is –0.33 dBm

Note:

1.The estimated measurement uncertainty of the result measurement is:
:±1.0dB(1GHz≦f≦18GHz)
2.Please see next pages for ploted datas


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -.57dBm
2.401987550HZ
SPAN 300.0KHZ
*SWP 100sec
CENTER 2.402000GHZ
VBW 10KHZ
*RBW 3.0KHZ


ATTEN 30dB
RL 20.0dBm
10dB/
MKR .17dBm
2.4410000GHz
MKR
2.4410000GHz
.17 dBm
CENTER 2.4410000GHz
*RBW 3.0KHz
VBW 10KHz
SPAN 300.0KHz
*SWP 100sec


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -.33dBm
2.479865GHz
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	09/10/2004

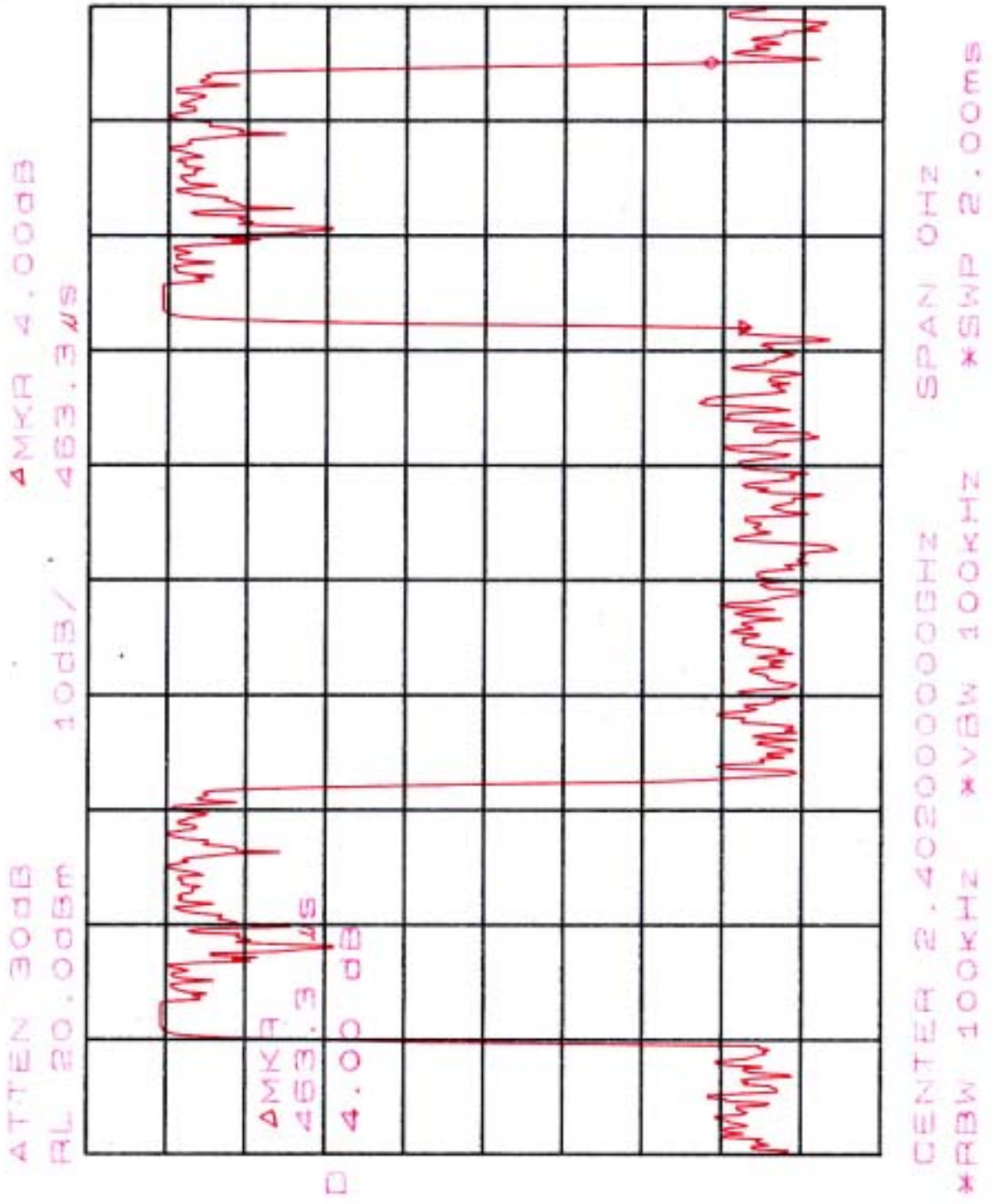
14.4 Measurement Data

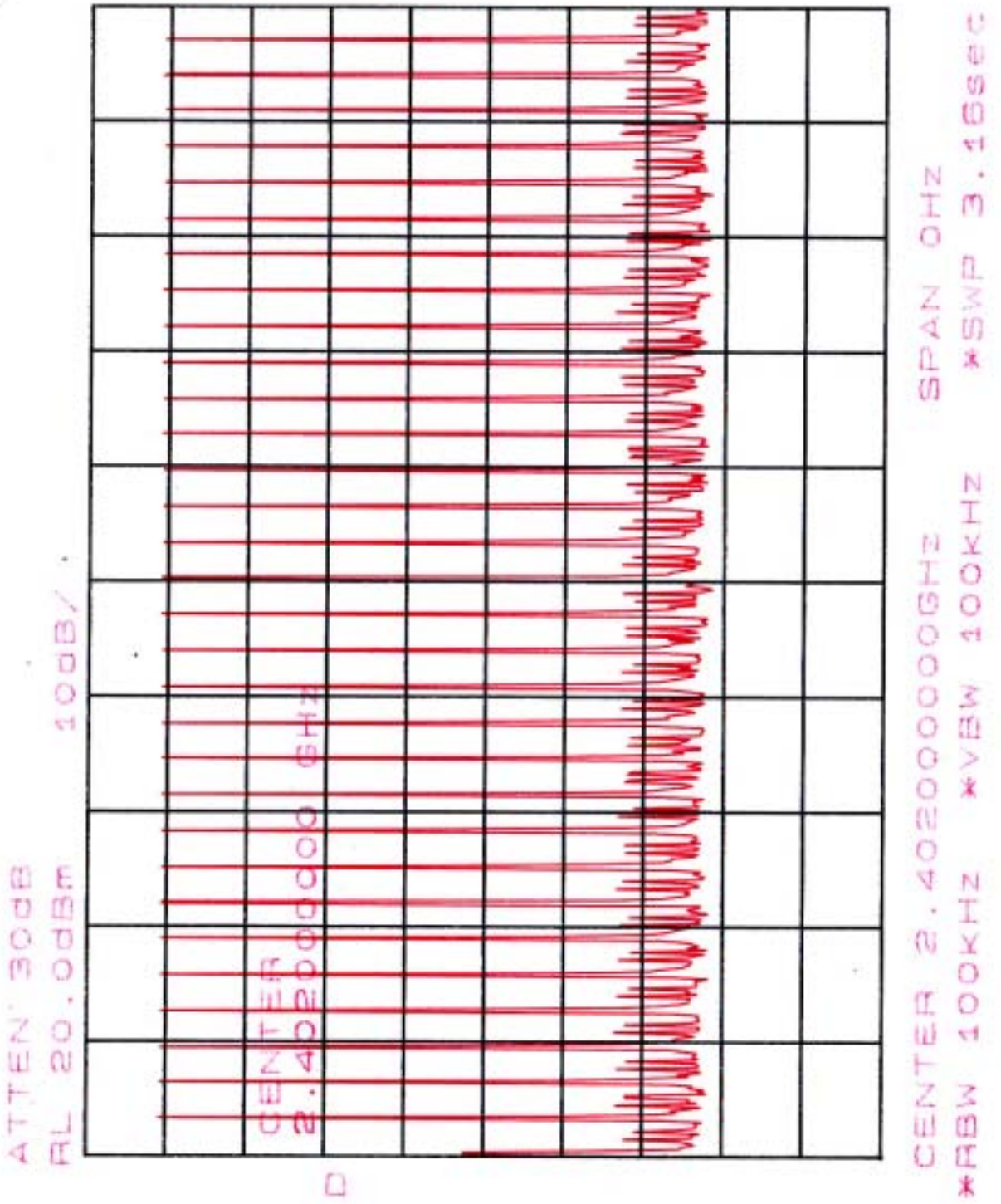
Test Date : Jan. 05, 2004 Temperature : 29 ℃ Humidity: 70

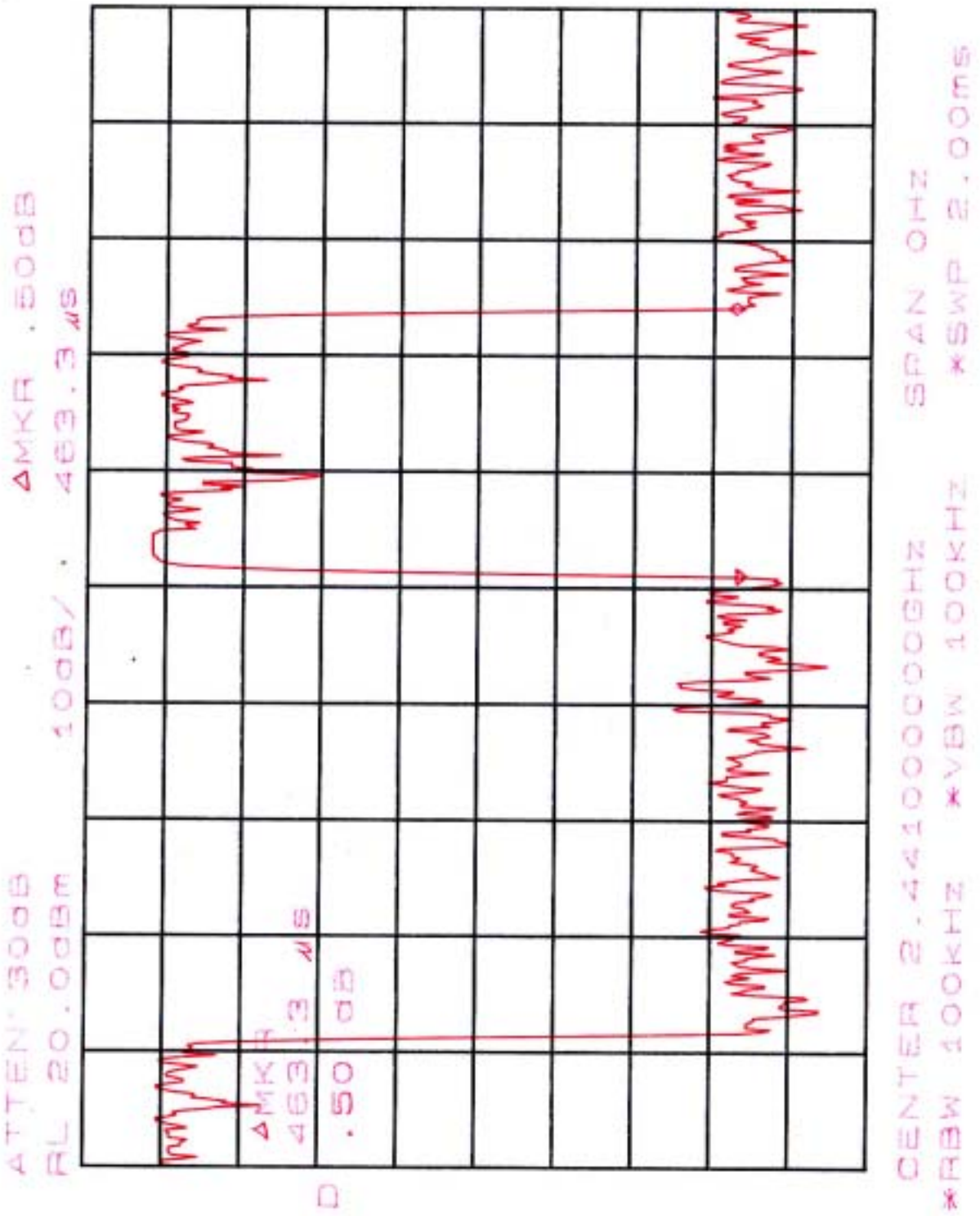
Test period=0.4(second/channel)×79 channel=31.6sec

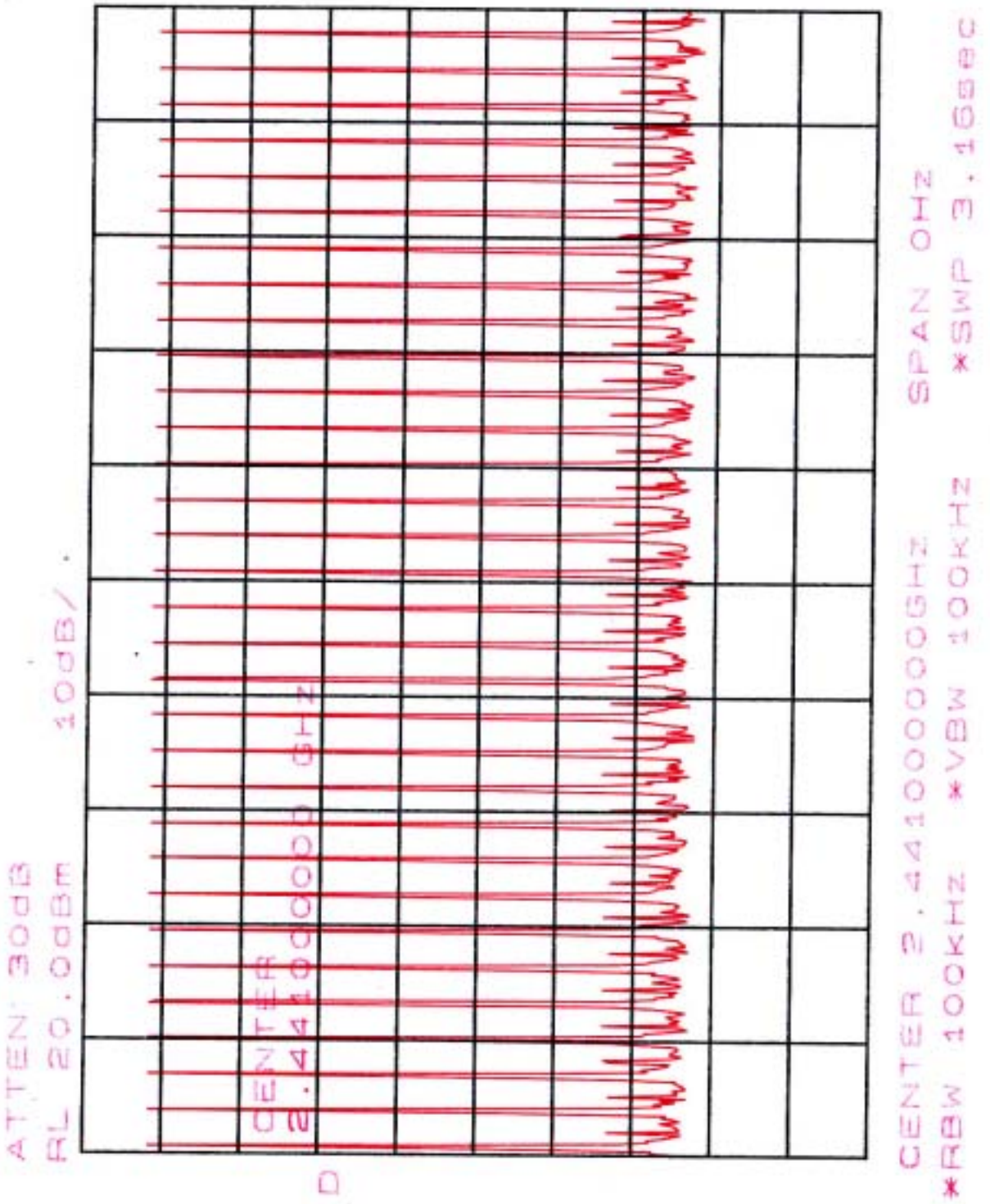
a) 2402MHz dwell time= 0.4633ms×32×10=149.216ms
b) 2441MHz dwell time= 0.4633ms×32×10=149.216ms
c) 2480MHz dwell time= 0.4667ms×32×10=149.344ms

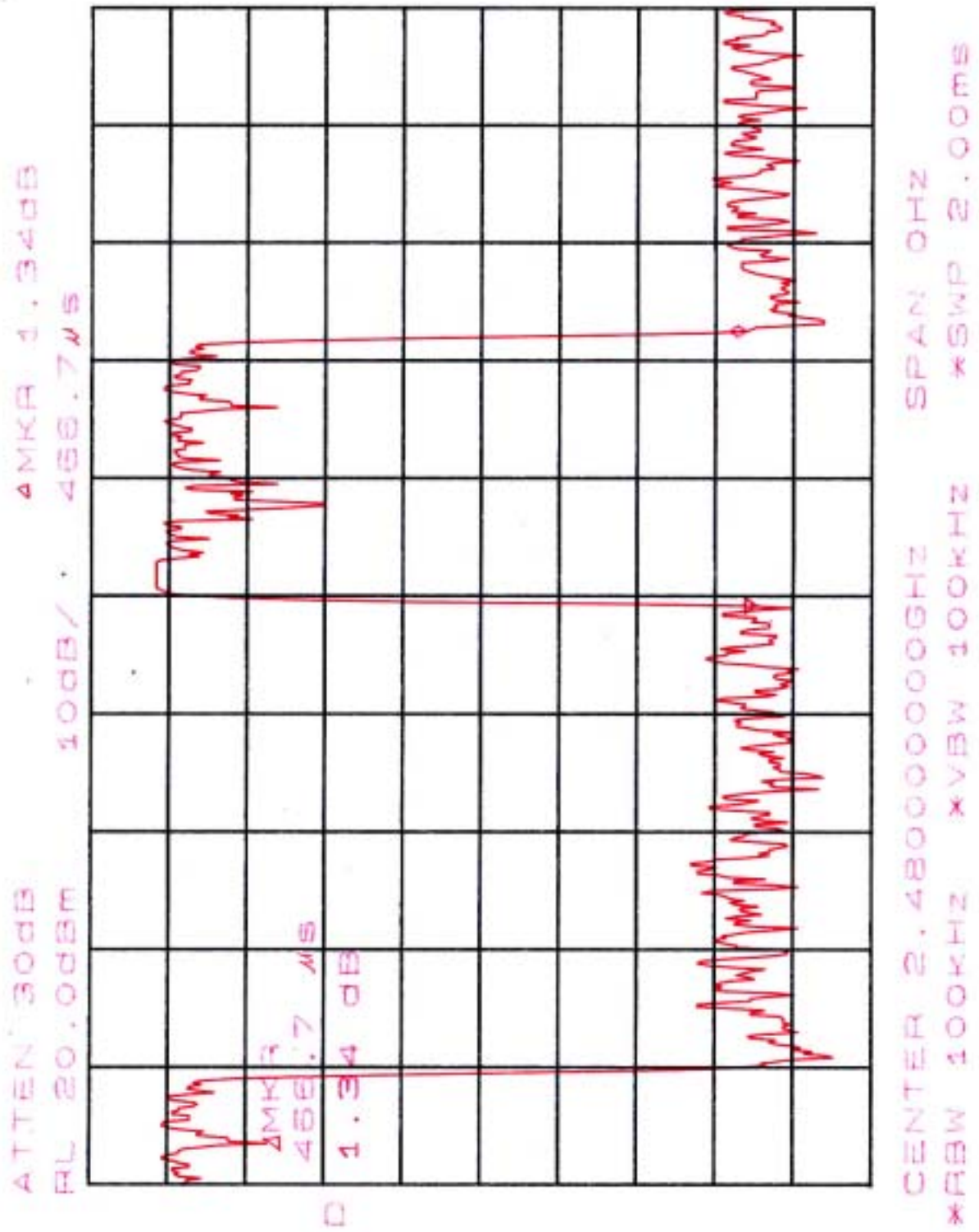
Note: Please see next pages for ploted datas

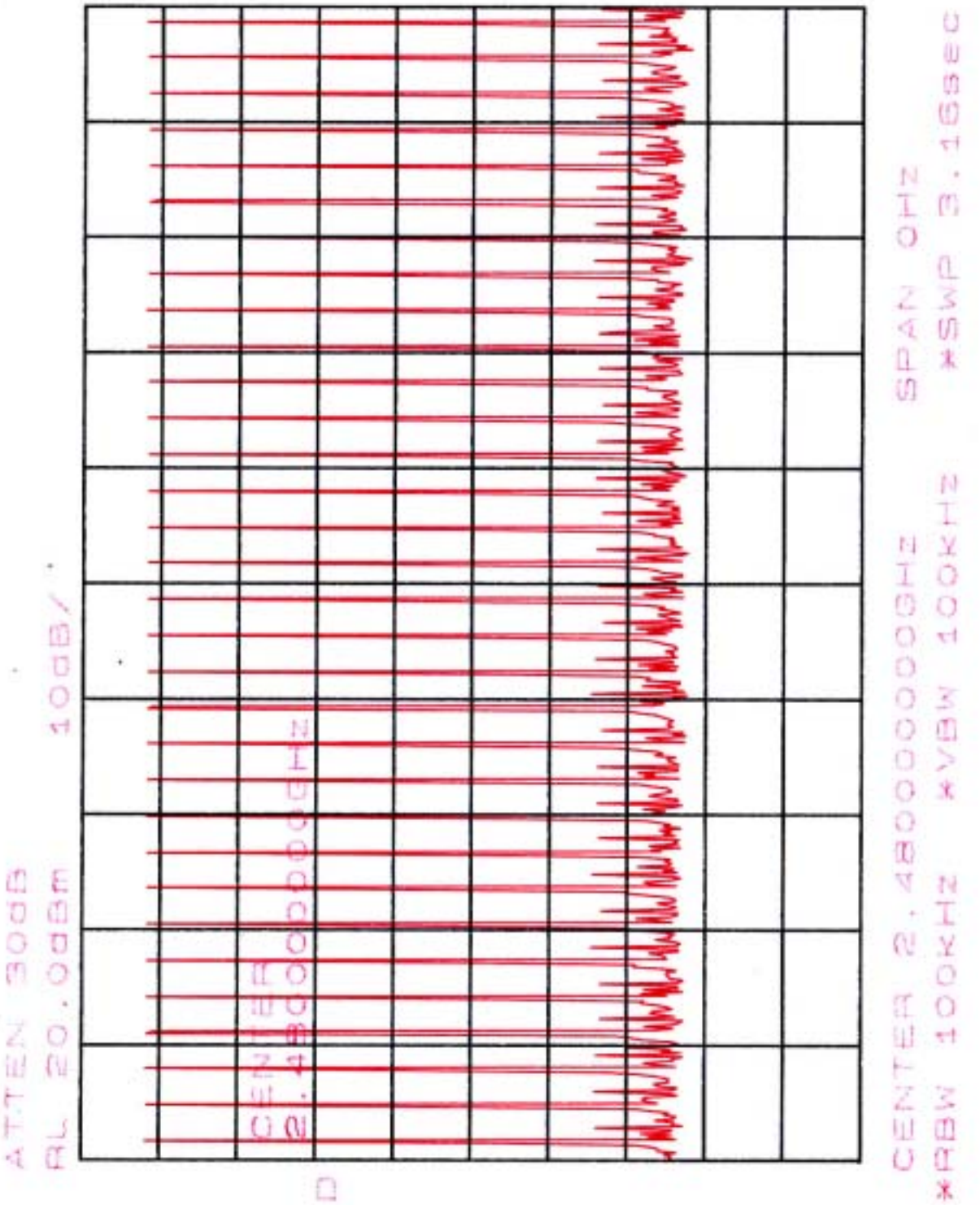

ATTEN 30dB
RL 20.00dBm
10dB/
ΔMKR 4.00dB
463.3μs
ΔMKR
463.3 μs
4.00 dB
CENTER 2.402000000GHz
SPAN 0Hz
*RBW 100KHz
*VBW 100KHz
*SWP 2.00ms


ATTEN 30dB
RL 20.0dBm
10dB/
CENTER 2.402000000 GHz
CENTER 2.402000000GHz
SPAN 0Hz
*SWP 3.16sec
*VBW 100KHz
*RBW 100KHz


ATTEN 30dB
RL 20.00dBm
10dB/
ΔMKR .50dB
463.3 µs
.50 dB
ΔMKR
463.3 µs
CENTER 2.441000000GHz
SPAN 10MHz
*RBW 100kHz
*VBW 100kHz
*SWP 2.00ms


ATTEN 30dB
RL 20.00dBm
10dB/
CENTER 2.441000000GHz
SPAN 10MHz
*SWP 3.16sec
CENTER 2.441000000GHz
*RBW 100kHz
*VBW 100kHz


ATTEN 30dB
RL 20.00dBm
10dB/
ΔMKR 1.34dB
466.7μs
ΔMKR 1.34dB
466.7μs
SPAN 0Hz
*SWP 2.00s
CENTER 2.480000000GHz
*RBW 100kHz
*VBW 100kHz


ATTEN 30dB
RL 20.00dBm
10dB/
CENTER 2.480000000GHz
SPAN 0Hz
*SWP 3.16sec
CENTER 2.480000000GHz
*VBW 100KHz
*RBW 100KHz