FCC Part 15
EMI TEST REPORT

of

E.U.T. : 802.11b mini-pci wireless lan card

MODEL : WM1

FCC ID. : HFSWM100

for

APPLICANT : Quanta Computer Inc.

ADDRESS : No. 188, Wen Hwa 2nd Rd., Kuei Shan Hsiang, Tao Yuan Shien, Taiwan, R.O.C.

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN
NO. 8 LANE 29, WENMIMG ROAD,
LOSHAN TSUN, KWEISHAN HSIANG,
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Report Number : ET90S-11-032

TEST REPORT CERTIFICATION

Applicant	: Quanta Computer Inc. No. 188, Wen Hwa 2nd Rd., Kuei Shan Hsiang, Tao Yuan Shien, Taiwan, R.O.C.
Manufacturer	: Quanta Computer Inc. No. 188, Wen Hwa 2nd Rd., Kuei Shan Hsiang, Tao Yuan Shien, Taiwan, R.O.C.
Description of EUT	:
a) Type of EUT	: 802.11b mini-pci wireless lan card
b) Trade Name	: Quanta
c) Model No.	: WM1
d) Power Supply	: Adaptor:I/P:100~240Vac 50/60Hz; O/P:3.3V, Tx:380MA, Rx:215MA, Tx:1.245W, Rx:0.7095W
Regulation Applied	: FCC Rules and Regulations Part 15 Subpart B & C (1999)

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 : Dec. 05, 2001

Test Engineer : Ric Hu

Approve & Authorized Signer : Win-Po Tsai

Win-Po Tsai, Manager, NVLAP Signatory
EMC Dept. I of ELECTRONICS
TESTING CENTER, TAIWAN

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1 GENERAL INFORMATION

1.1 Product Description

a) Type of EUT : 802.11b mini-pci wireless lan card
b) Trade Name : Quanta
c) Model No. : WM1
d) Power Supply : Adaptor:I/P:100~240Vac 50/60Hz;
O/P:3.3V, Tx:380MA, Rx:215MA,
Tx:1.245W, Rx:0.7095W

1.2 Characteristics of Device

- Fully IEEE 802.11b and Wi-Fi compatible
- Seamless roaming under 802.11b WLAN intrastructure
- Support 11M/5.5M/2M/1M automatically fall back functionality
- WEP 40/64/128 bits encryption provided
- User-friendly installation, just plug and play
- Provide Web-based configuration utility and window-based diagnostic tools
- Good receiving sensitivity and block free design

1.3 Test Methodology

The 802.11b mini-pci wireless lan card designed with a transmitting method of direct sequence spread spectrum is for local area network operation, which operates at 2.4 GHz ISM band and data rate up to 11 Mbps. The rated output power is 19.9 dBm (97.7 mW).

1.4 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	Emissions V	Emissions dBV
0.45 - 30.0	250	48.0

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 dBV/m	Radiated V/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) Bandwidth Requirement

For direct sequence system, according to 15.247(a)(2), the minimum 6dB bandwidth shall be at least 500 kHz.

(5) Output Power Requirement

For direct sequence 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.

(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) Power Density Requirement

According to 15.247(d), for direct sequence systems, the transmitted power density averaged over any 1 second interval shall not be greater than 8 dBm in any 3 kHz bandwidth within these bands.

(8) Processing Gain Requirement

According to 15.247(e), the processing gain of a direct sequence system shall be at least 10 dB. The processing gain shall be determined from the ratio in dB of the signal to noise ratio with the system spreading code turned off to the signal to noise ratio with the system spreading code turned on, as measured at the demodulated output of the receiver.

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 both radiated and conducted emissions, EUT was extended from notebook PC. The notebook PC put in an aluminum box and shielded it.

3.2 Devices for Tested System

Device	Manufacture	Model / FCC ID.	Cable Description
802.11b mini-pci wireless lan card *	Quanta Computer Inc.	WM1 HFSWM100	----

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 direct sequence 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 360with 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 and changed ANT.1 ~ANT.4 to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration

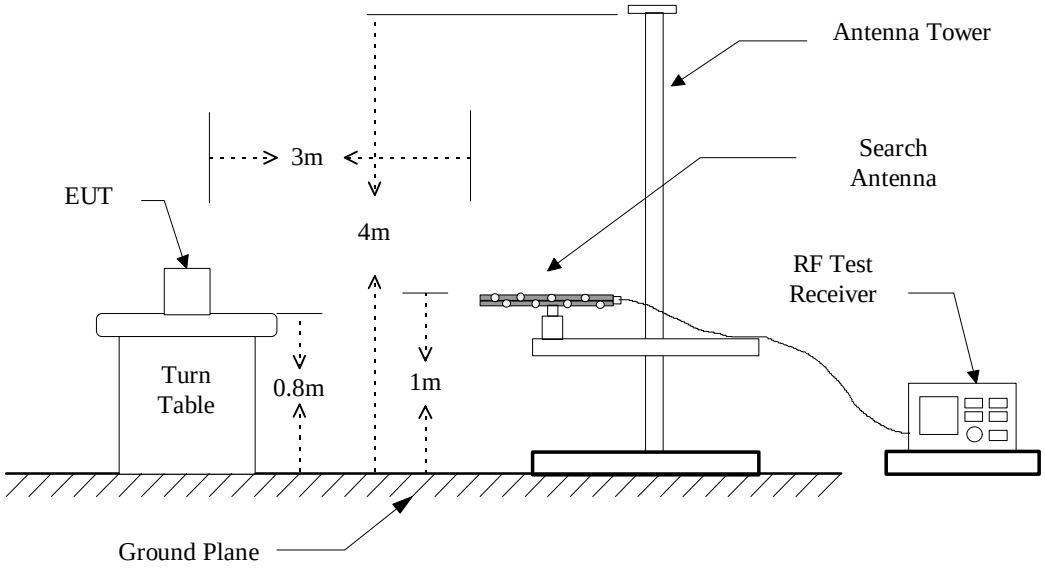
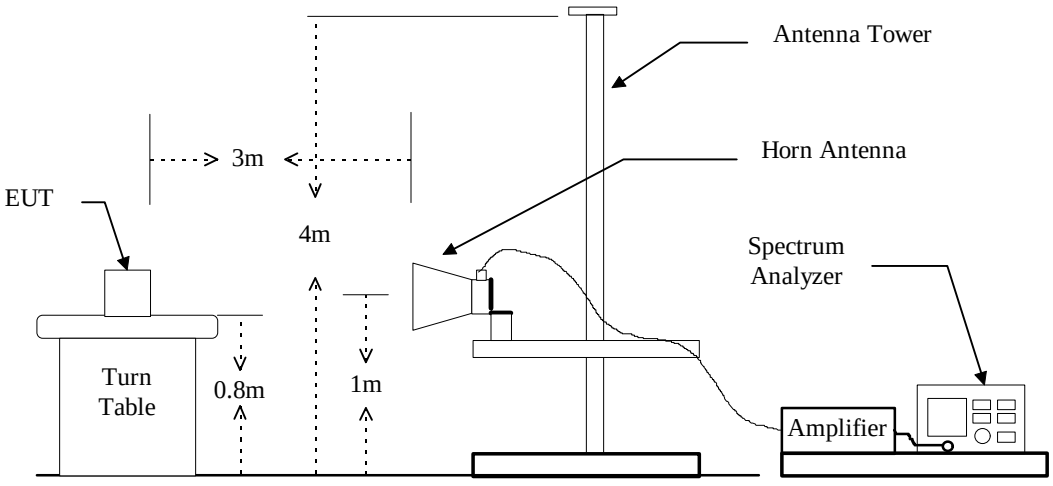


Figure 2 : Frequencies measured above 1 GHz configuration



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	01/31/2002
Horn Antenna	EMCO	3115	05/09/2002
LogBicone Antenna	Schwarzbeck	9160	10/18/2002
Horn Antenna	EMCO	3116	06/28/2002
Preamplifier	Hewlett-Packard	8449B	08/30/2002
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2002

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	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	300 Hz

4.4 Radiated Emission Data

4.4.1 RF Portion

a) Channel 1

Operation Mode : Receiving /Transmitting

Fundamental Frequency : 2412 MHz (Local Frequency : 2038 MHz)

Test Date : Dec. 03, 2001 Temperature : 23 Humidity : 65 %

Frequency	Reading (dBuV)				Factor	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin	Table Deg.	Ant. High
	H		V		(dB)	Peak	Ave	Peak	Ave.	(dB)	(Deg.)	(m)
(MHz)	Peak	Ave	Peak	Ave	Corr.							
2038.000	61.2	47.2	64.5	56.5	-3.3	61.2	53.2	74.0	54.0	-0.8	305	1.0
4076.000	---	---	---	---	9.8	---	---	74.0	54.0	---	---	---
6114.000	---	---	---	---	12.5	---	---	74.0	54.0	---	---	---
8152.000	---	---	---	---	17.3	---	---	74.0	54.0	---	---	---
10190.000	---	---	---	---	18.3	---	---	74.0	54.0	---	---	---
4824.000	47.2	33.7	51.2	35.3	11.5	62.7	46.8	74.0	54.0	-7.2	78	1.3
7236.000	---	---	---	---	15.1	---	---	74.0	54.0	---	---	---
9648.000	---	---	---	---	17.7	---	---	74.0	54.0	---	---	---
12060.000	---	---	---	---	22.9	---	---	74.0	54.0	---	---	---
14472.000	---	---	---	---	25.6	---	---	74.0	54.0	---	---	---
16884.000	---	---	---	---	25.6	---	---	74.0	54.0	---	---	---
19296.000	---	---	---	---	31.0	---	---	74.0	54.0	---	---	---
21708.000	---	---	---	---	31.4	---	---	74.0	54.0	---	---	---
24120.000	---	---	---	---	30.7	---	---	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.

b) Channel 6

Operation Mode : Receiving / Transmitting

Fundamental Frequency : 2437 MHz (Local Frequency : 2063 MHz)

Test Date : Dec. 03, 2001 Temperature : 23 Humidity : 65 %

Frequency	Reading (dBuV)				Factor	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin	Table Deg.	Ant. High
	H		V		(dB)	Peak	Ave	Peak	Ave.	(dB)	(Deg.)	
(MHz)	Peak	Ave	Peak	Ave	Corr.							(m)
2063.000	58.8	***	63.8	56.0	-3.2	60.6	52.8	74.0	54.0	-1.2	309	1.0
4126.000	---	---	---	---	9.9	---	---	74.0	54.0	---	---	---
6189.000	---	---	---	---	12.6	---	---	74.0	54.0	---	---	---
8252.000	---	---	---	---	17.2	---	---	74.0	54.0	---	---	---
10315.000	---	---	---	---	18.5	---	---	74.0	54.0	---	---	---
4874.000	47.3	34.2	53.0	38.2	11.6	64.6	49.8	74.0	54.0	-4.2	20	1.0
7311.000	---	---	---	---	15.1	---	---	74.0	54.0	---	---	---
9748.000	---	---	---	---	17.8	---	---	74.0	54.0	---	---	---
12185.000	---	---	---	---	22.1	---	---	74.0	54.0	---	---	---
14622.000	---	---	---	---	25.6	---	---	74.0	54.0	---	---	---
17059.000	---	---	---	---	25.7	---	---	74.0	54.0	---	---	---
19496.000	---	---	---	---	31.1	---	---	74.0	54.0	---	---	---
21933.000	---	---	---	---	31.4	---	---	74.0	54.0	---	---	---
24370.000	---	---	---	---	30.5	---	---	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.

c) Channel 11

Operation Mode : Receiving / Transmitting

Fundamental Frequency : 2462 MHz (Local Frequency : 2088 MHz)

Test Date : Dec. 03, 2001 Temperature : 23 Humidity : 65 %

Frequency	Reading (dBuV)				Factor	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin	Table Deg.	Ant. High
	H		V		(dB)	Peak	Ave	Peak	Ave.	(dB)	(Deg.)	
(MHz)	Peak	Ave	Peak	Ave	Corr.							(m)
2088.000	59.3	42.0	64.0	56.0	-3.1	60.9	52.9	74.0	54.0	-1.1	310	1.0
4176.000	---	---	---	---	10.0	---	---	74.0	54.0	---	---	---
6264.000	---	---	---	---	12.8	---	---	74.0	54.0	---	---	---
8352.000	---	---	---	---	17.4	---	---	74.0	54.0	---	---	---
10440.000	---	---	---	---	18.9	---	---	74.0	54.0	---	---	---
4924.000	49.3	34.0	52.5	36.5	11.7	64.2	48.2	74.0	54.0	-5.8	285	1.0
7386.000	---	---	---	---	15.2	---	---	74.0	54.0	---	---	---
9848.000	---	---	---	---	17.9	---	---	74.0	54.0	---	---	---
12310.000	---	---	---	---	22.1	---	---	74.0	54.0	---	---	---
14772.000	---	---	---	---	25.7	---	---	74.0	54.0	---	---	---
17234.000	---	---	---	---	25.7	---	---	74.0	54.0	---	---	---
19696.000	---	---	---	---	31.2	---	---	74.0	54.0	---	---	---
22158.000	---	---	---	---	31.5	---	---	74.0	54.0	---	---	---
24620.000	---	---	---	---	31.0	---	---	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.

4.4.2 Other Emission

a) Emission frequencies below 1 GHz

Test Date : Dec. 05, 2001 Temperature : 23 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)
31.940	V	2.0	24.9	26.9	40.0	-13.1	280	1.0
96.930	H	29.8	9.4	39.2	43.5	-4.3	145	1.0
444.190	H	20.3	21.3	41.6	46.0	-4.4	200	1.2
444.190	V	12.4	21.3	33.7	46.0	-12.3	300	1.0
465.530	H	21.1	21.3	42.4	46.0	-3.6	360	1.1
478.140	H	18.8	22.3	41.1	46.0	-4.9	240	1.0
478.140	V	12.2	22.3	34.5	46.0	-11.5	270	1.1
512.090	H	19.8	22.3	42.1	46.0	-3.9	325	1.0
512.090	V	14.0	22.3	36.3	46.0	-9.7	320	1.0
521.790	H	20.9	22.3	43.2	46.0	-2.8	310	1.4
521.790	V	14.1	22.3	36.4	46.0	-9.6	230	1.0
555.740	V	11.5	23.7	35.2	46.0	-10.8	175	1.0

b) Emission frequencies above 1 GHz

Radiated emission frequencies above 1 GHz to 5 GHz were too low to be measured with a pre-amplifier of 35 dB.

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:

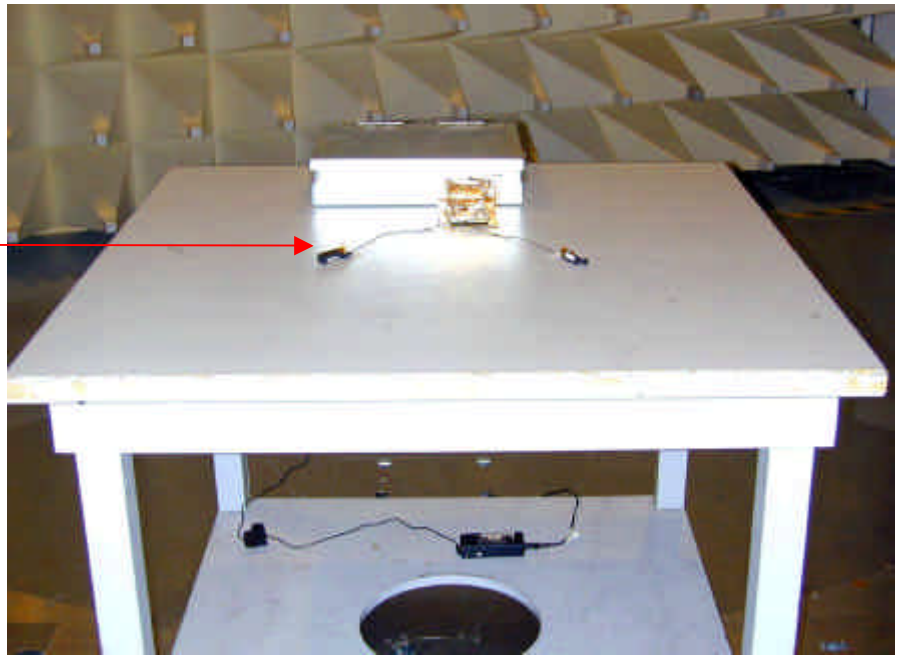
Result = Reading + Corrected Factor

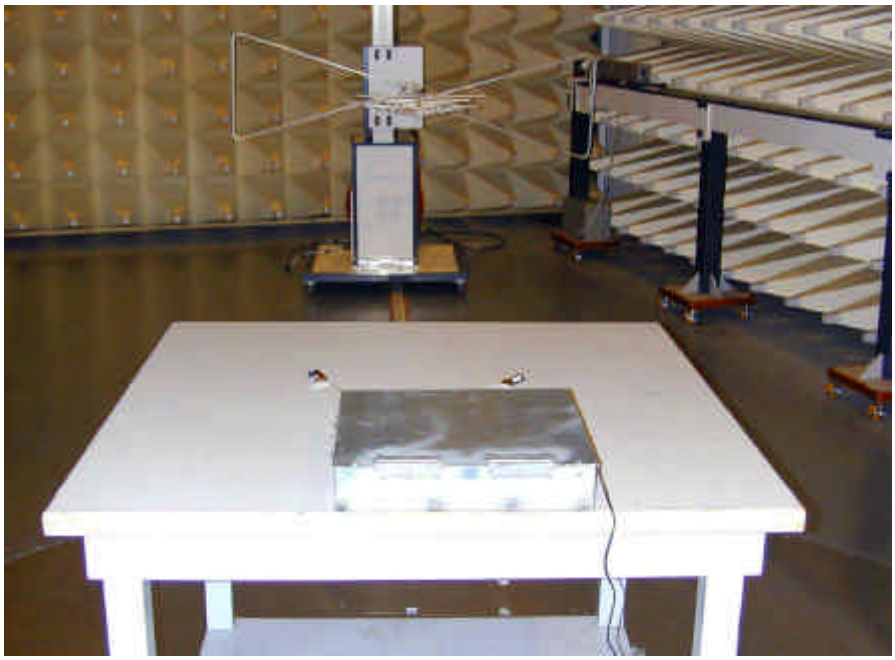
where

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

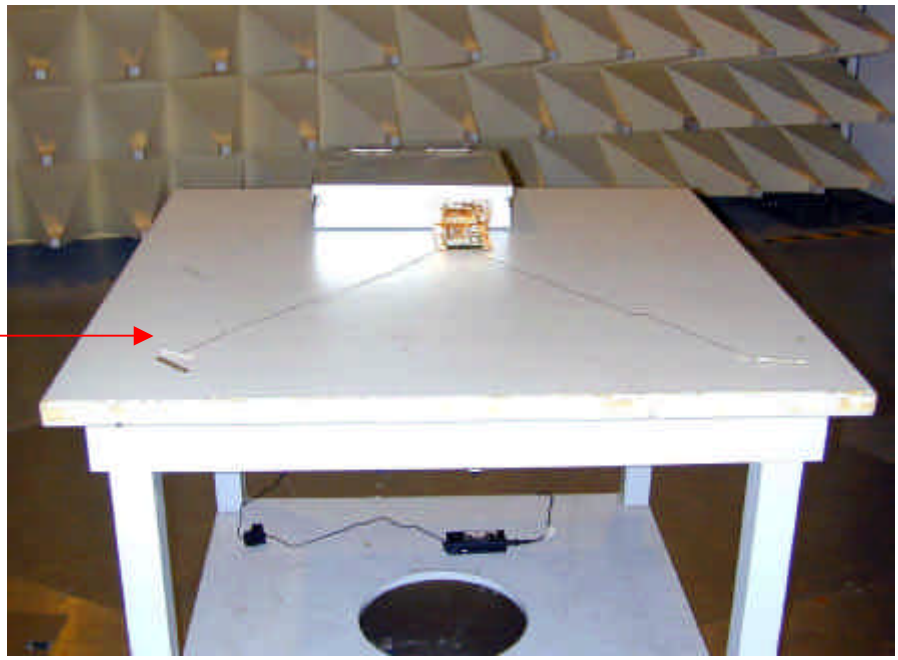
4.6 Photos of Radiation Measuring Setup

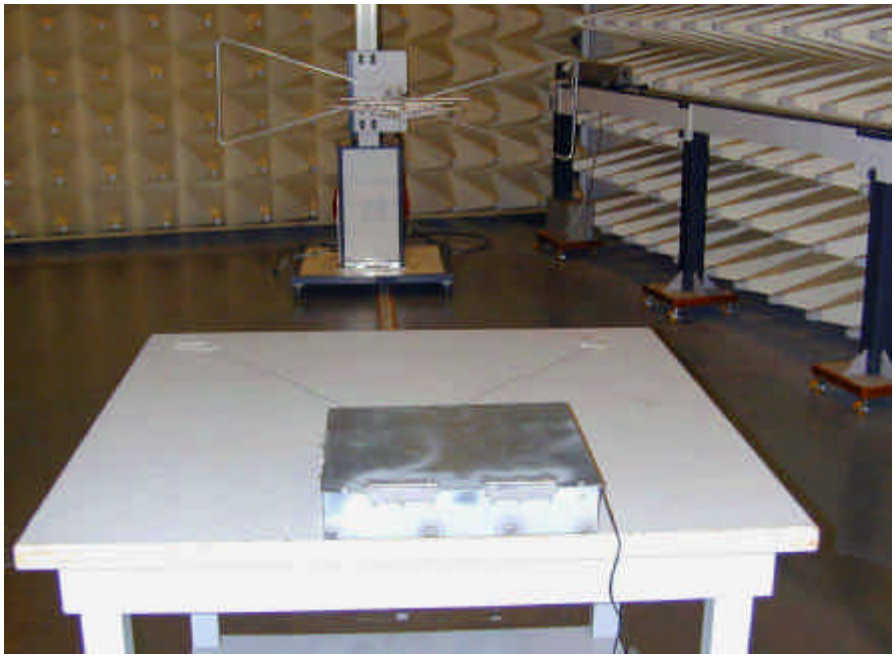
ANT. 1





ANT. 2





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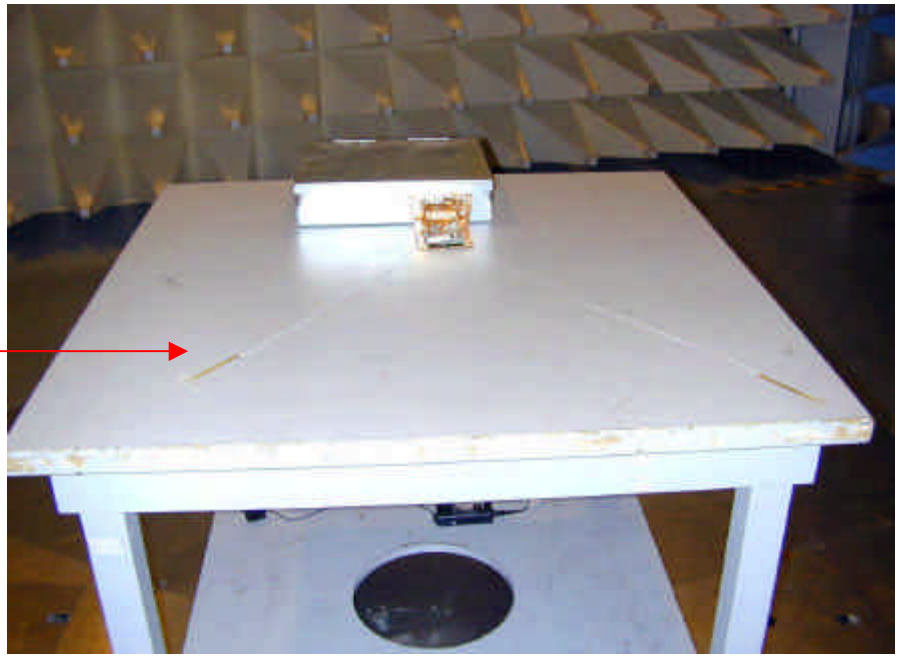
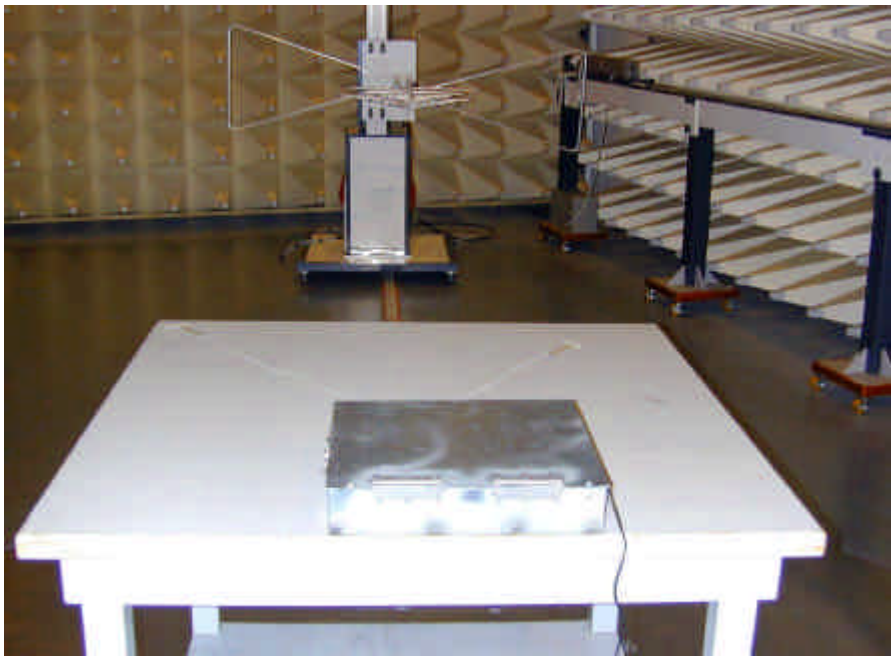
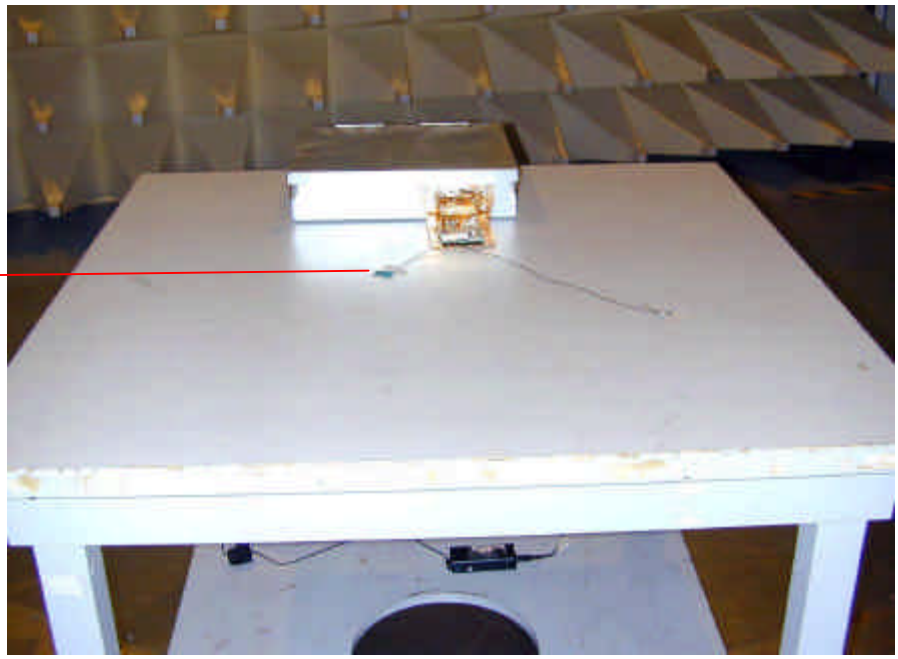
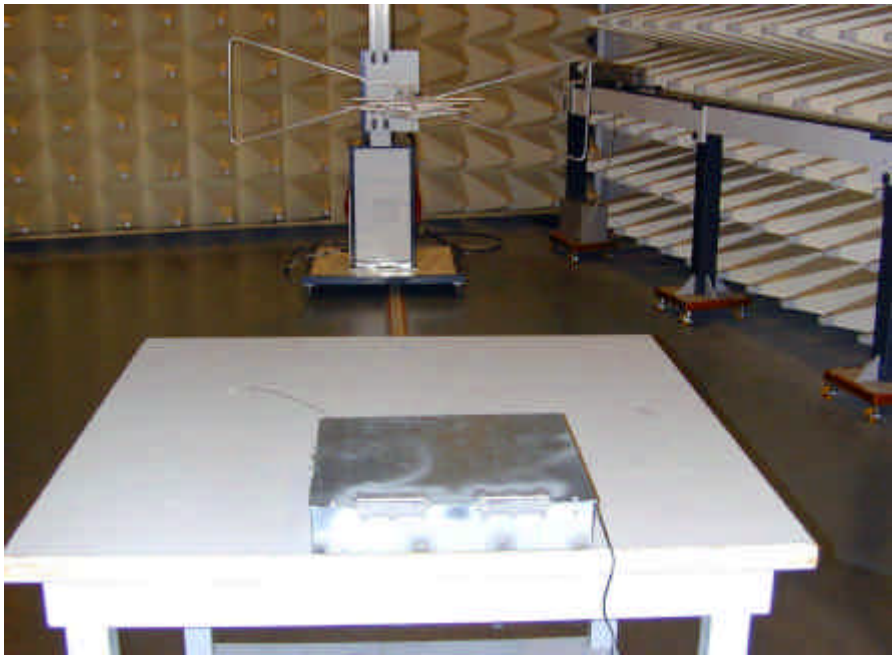




ANT. 4





5 CONDUCTED EMISSION MEASUREMENT

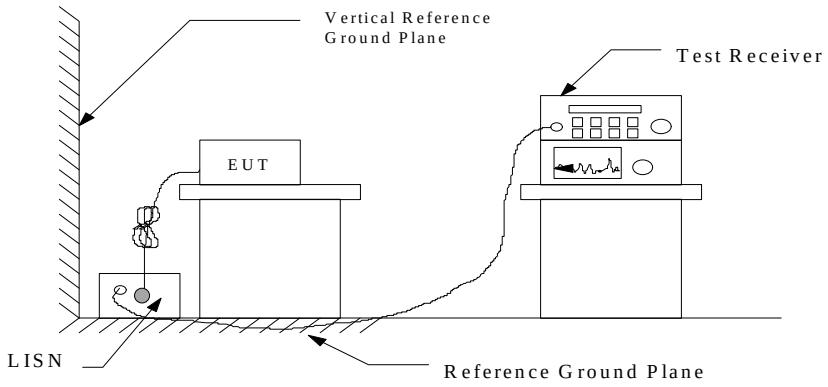
5.1 Standard Applicable

For unintentional and intentional device, Line Conducted Emission Limits are in accordance to 15.107(a) and 15.207(a) respectively. Both Limits are identical specification.

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 6 or 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 three 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

a) Channel 1

Operation Mode : Transmitting / Receiving
Test Date : Dec. 05, 2001 Temperature : 22 Humidity: 66 %

Frequency	Reading (dBuV)		Factor	Result (dBuV)		Limit	Margin
(MHz)	L1	L2	(dB)	L1	L2	(dBuV)	(dB)
0.505	29.1#	29.3#	0.1	29.2#	29.4#	48.0	-18.6
0.563	27.6#	26.8#	0.1	27.7#	26.9#	48.0	-20.3
0.942	***	27.9#	0.1	***	28.0#	48.0	-20.0
1.980	29.0#	***	0.2	29.2#	***	48.0	-18.8
4.648	***	27.9#	0.2	***	28.1#	48.0	-19.9
6.691	29.3#	***	0.2	29.5#	***	48.0	-18.5
27.207	***	30.4#	0.5	***	30.9#	48.0	-17.1
27.344	30.7#	***	0.5	31.2#	***	48.0	-16.8
28.684	31.2#	***	0.5	31.7#	***	48.0	-16.3
29.345	***	31.5#	0.5	***	32.0#	48.0	-16.0

b) Channel 6

Operation Mode : Transmitting / Receiving
Test Date : Dec. 05, 2001 Temperature : 22 Humidity: 66 %

Frequency	Reading (dBuV)		Factor	Result (dBuV)		Limit	Margin
(MHz)	L1	L2	(dB)	L1	L2	(dBuV)	(dB)
0.505	27.5#	28.1#	0.1	27.6#	28.2#	48.0	-19.8
0.563	***	26.7#	0.1	***	26.8#	48.0	-21.2
0.692	24.3#	***	0.1	24.4#	***	48.0	-23.6
1.004	***	26.3#	0.2	***	26.5#	48.0	-21.5
1.695	25.6#	***	0.2	25.8#	***	48.0	-22.2
3.457	27.1#	***	0.2	27.3#	***	48.0	-20.7
4.715	***	28.3#	0.2	***	28.5#	48.0	-19.5
4.965	28.0#	***	0.2	28.2#	***	48.0	-19.8
27.238	***	26.4#	0.5	***	26.9#	48.0	-21.1
27.777	31.4#	***	0.5	31.9#	***	48.0	-16.1

c) Channel 11

Operation Mode : Transmitting / Receiving
Test Date : Dec. 05, 2001 Temperature : 22 Humidity: 66 %

Frequency	Reading (dBuV)		Factor	Result (dBuV)		Limit	Margin
(MHz)	L1	L2	(dB)	L1	L2	(dBuV)	(dB)
0.505	28.9#	26.6#	0.1	29.0#	26.7#	48.0	-19.0
0.563	26.0#	26.3#	0.1	26.1#	26.4#	48.0	-21.6
1.008	***	28.0#	0.2	***	28.2#	48.0	-19.8
2.230	***	27.4#	0.2	***	27.6#	48.0	-20.4
2.891	26.1#	***	0.2	26.3#	***	48.0	-21.7
4.652	27.8#	***	0.2	28.0#	***	48.0	-20.0
5.344	27.3#	***	0.2	27.5#	***	48.0	-20.5
27.102	***	27.4#	0.5	***	27.9#	48.0	-20.2
28.824	***	27.6#	0.5	***	28.1#	48.0	-19.9
28.953	27.0#	***	0.5	27.5#	***	48.0	-20.5

1)① If the data table appeared symbol of "***" means the value was too low to be measured.
② 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.
③ If the data table appeared symbol of “#“ means the noise was low, so record the peak value.

Note : Please see appendix 1 for Ploted Datas

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 (Included Cable Loss)

Assume a receiver reading of 22.5 dBV is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dBV.

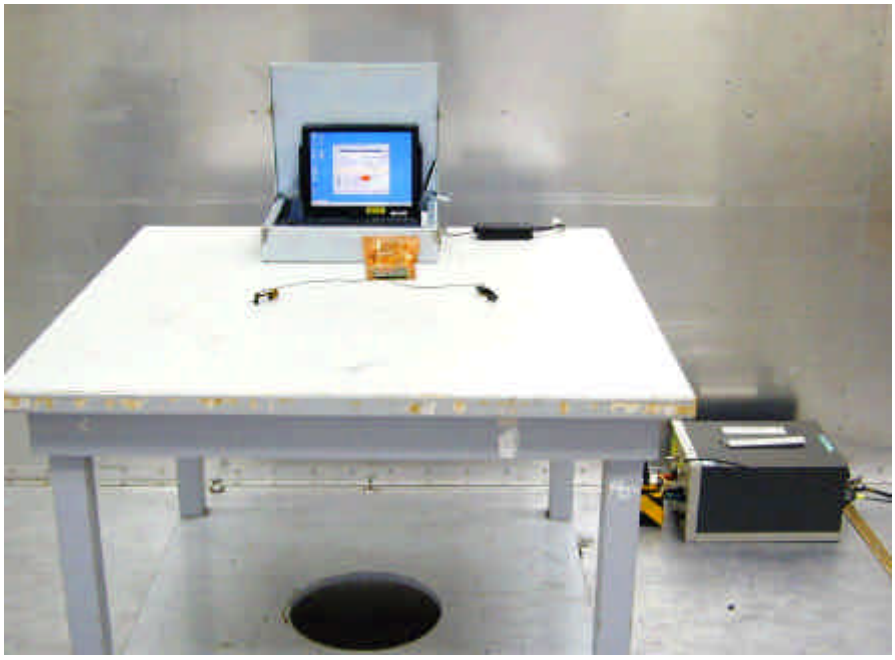
RESULT = 22.5 + 0.1 = 22.6 dBV
Level in V = Common Antilogarithm[(22.6 dBV)/20]
= 13.48 V

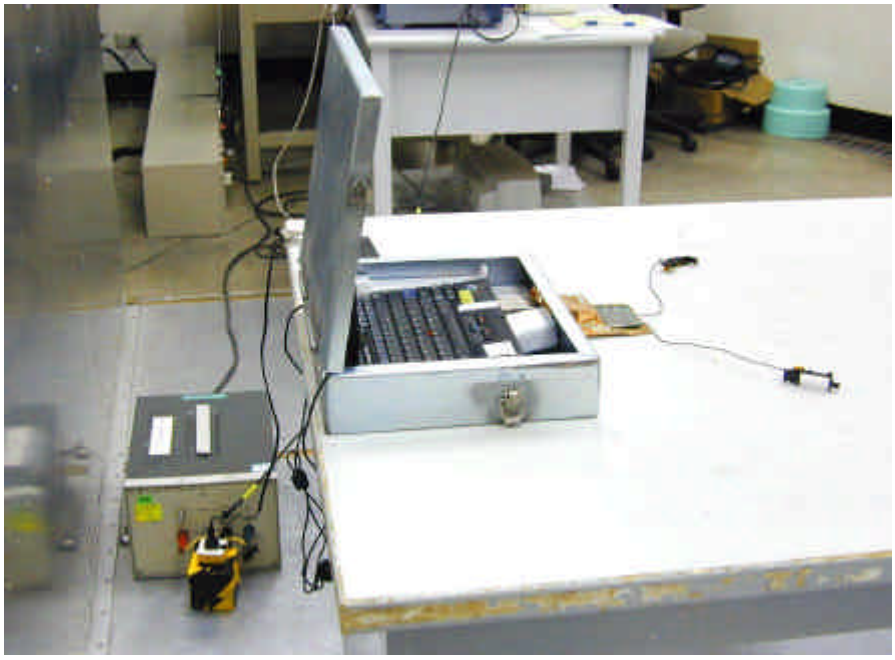
5.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test .

Equipment	Manufacturer	Model No.	Next Cal. Due
RF Test Receiver	Rohde and Schwarz	ESCS30	09/18/2002
Line Impedance Stabilization network	EMCO	3825	10/27/2002

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

The antenna terminal of this unit is designed with a female HIROSE Connector. Please see constraction Photos Of Exhibit B for details.

The directional gain of antenna used for transmitting is Peak 2dBi, Typical 0.5~1.5dBi and the details antenna construction please see ***Appendix 2***.

7 EMISSION BANDWIDTH MEASUREMENT

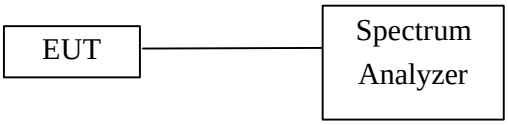
7.1 Standard Applicable

According to 15.247(a)(2), for direct sequence system, the minimum 6dB bandwidth shall be at least 500 kHz.

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 6 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	7440A	N/A
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2002

7.4 Measurement Data

Test Date : Dec. 04, 2001 Temperature : 20 Humidity: 65 %

a) Channel 01 : 6 dB Emission Bandwidth is 11.17 MHz
b) Channel 06 : 6 dB Emission Bandwidth is 9.17 MHz
c) Channel 11 : 6 dB Emission Bandwidth is 9.00 MHz

Note: Please see Appendix 3 for ploted datas

8 OUTPUT POWER MEASUREMENT

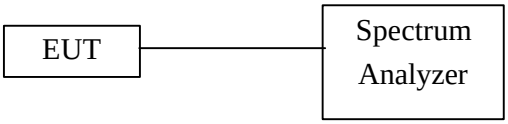
8.1 Standard Applicable

For direct sequence 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 2 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	7440A	N/A
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2002

8.4 Measurement Data

Test Date : Dec. 04, 2001 Temperature : 20 Humidity: 65 %

a) Channel 01 : Output Peak Power is 19.9 dBm or **97.7** mW
b) Channel 06 : Output Peak Power is 19.8 dBm or **95.5** mW
c) Channel 11 : Output Peak Power is 19.3 dBm or **85.1** mW

Note: Please see Appendix 4 for ploted datas

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	7440A	N/A
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2002

9.4 Measurement Data

Test Date : Dec. 04, 2001 Temperature : 20 Humidity: 65 %

a) Lower Band Edge : maximum value is –26.0 dBm that is attenuated more than 20dB
b) Upper Band Edge : maximum value is –48.7 dBm that is attenuated more than 20dB

Note: Please see Appendix 5 for ploted datas

10 POWER DENSITY MEASUREMENT

10.1 Standard Applicable

According to 15.247(d), for direct sequence systems, the transmitted power density averaged over any 1 second interval shall not be greater than 8 dBm in any 3 kHz bandwidth within these bands.

10.2 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 any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of spectrum analyzer on highest level appearing on spectral display within a 300 kHz frequency span.
4. Set the spectrum analyzer on a 3 kHz resolution bandwidth and 10 kHz video bandwidth as well as max. hold function, then record the measurement result.
5. Repeat above procedures until all measured frequencies were complete.

10.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Plotter	Hewlett-Packard	7440A	N/A
Spectrum Analyzer	Hewlett-Packard	8564EC	09/10/2002

10.4 Measurement Data

Test Date : Dec. 04, 2001 Temperature : 20 Humidity: 65 %

a) Channel 01 : Maximun Power Density of 3 kHz Bandwidth is –8.7 dBm
b) Channel 06 : Maximun Power Density of 3 kHz Bandwidth is –8.5 dBm
c) Channel 11 : Maximun Power Density of 3 kHz Bandwidth is –9.3 dBm

Note: Please see Appendix 6 for ploted datas

11 PROCESSING GAIN MEASUREMENT

11.1 Standard Applicable

According to 15.247(e), the processing gain of a direct sequence system shall be at least 10 dB. The processing gain shall be determined from the ratio in dB of the signal to noise ratio with the system spreading code turned off to the signal to noise ratio with the system spreading code turned on, as measured at the demodulated output of the receiver.

11.2 Measurement Description

The processing gain measurement is based upon the CW jamming margin method suggested in the FCC document entitled "GUIDANCE ON MEASUREMENTS FOR DIRECT SEQENCE SPREAD SPECTRUM SYSTEMS, 54597, July 12,1995"

The test consists of stepping a CW signal generator in 50KHz increment across pass band of each three channels within 2400 – 2483 MHz band. This CW signal represents the jamming signal. The selected three channels are as followings:

Channel 01: centered at 2412 MHz

Channel 06: centered at 2437 MHz

Channel 11: centered at 2462 MHz

These three channels represents the Low, Mid and High frequency bands of the EUT, respectively. And, the processing gain of the EUT determined for these bands should be representative of the entire band.

(1). Measurement Configuration

The measurement configuration (draw in next page) is according to FCC document 54797,page3.

(2) Derivation of the Processing Gain

(a) The Processing Gain (Gp) is calculated according to the following equations:

Gp=(S/N)o + Mj + Lsys …..(4-1)…. Refer to FCC document 54797 Page3

Where Mj = J/S ratio (dB)

Lsys =System losses (assumed to be 2 dB)

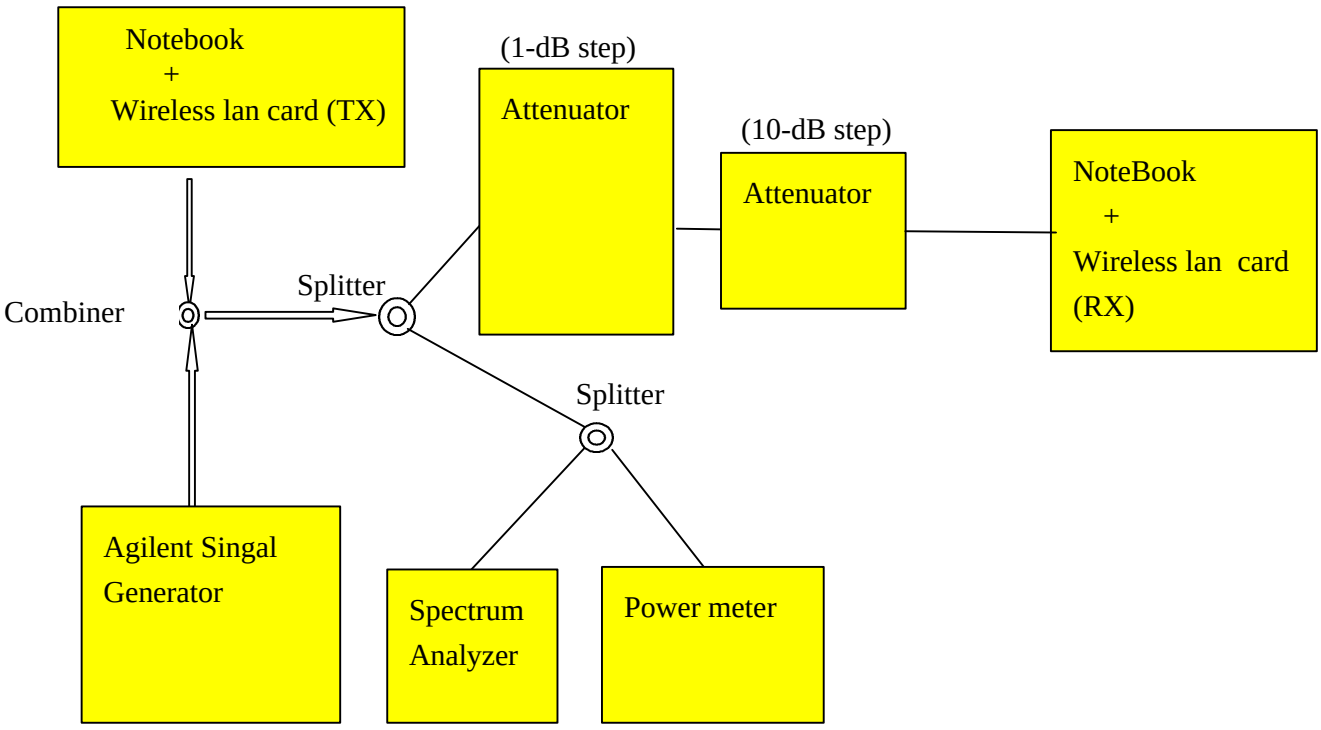
(S/N)o = the required signal to noise ratio at the receiver output for a given received signal quality

Therefore, from equation (4-1)

Gp=16.4 + J/S +2 (dB) = 18.4 + J/S (dB)…..(4-2)

(3) Test Results

The tested data are listed in the following pages. After discarding the worst 20% of the J/S ratio data points, the lowest remaining J/S ratio is used to determine the processing gain (PG), according to the derivative equation (4/2), of each tested channel.



11.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Agilent	E4407B	06/11/2002
Signal Generator	Agilent	E4433B	06/07/2002
Power Meter	Agilent	E4417A	06/11/2002
Attenuator	Agilent	8496A	06/08/2002
Attenuator	Agilent	8494A	06/09/2002
Combiner/Splitter	Merrimac	PMD-24M-6G	N/A

11.4 Measurement Data

Test Date : Dec. 14, 2001 Temperature : 20 Humidity: 67 %

The processing gain is greater then 10 dB, please see Appendix 7 for details.

Data Rate = 11Mbps
For channel 1, PG =12.1 (2412 MHz)
channel 6, PG =12.1 (2437 MHz)
channel 11, PG =12.1 (2462 MHz)

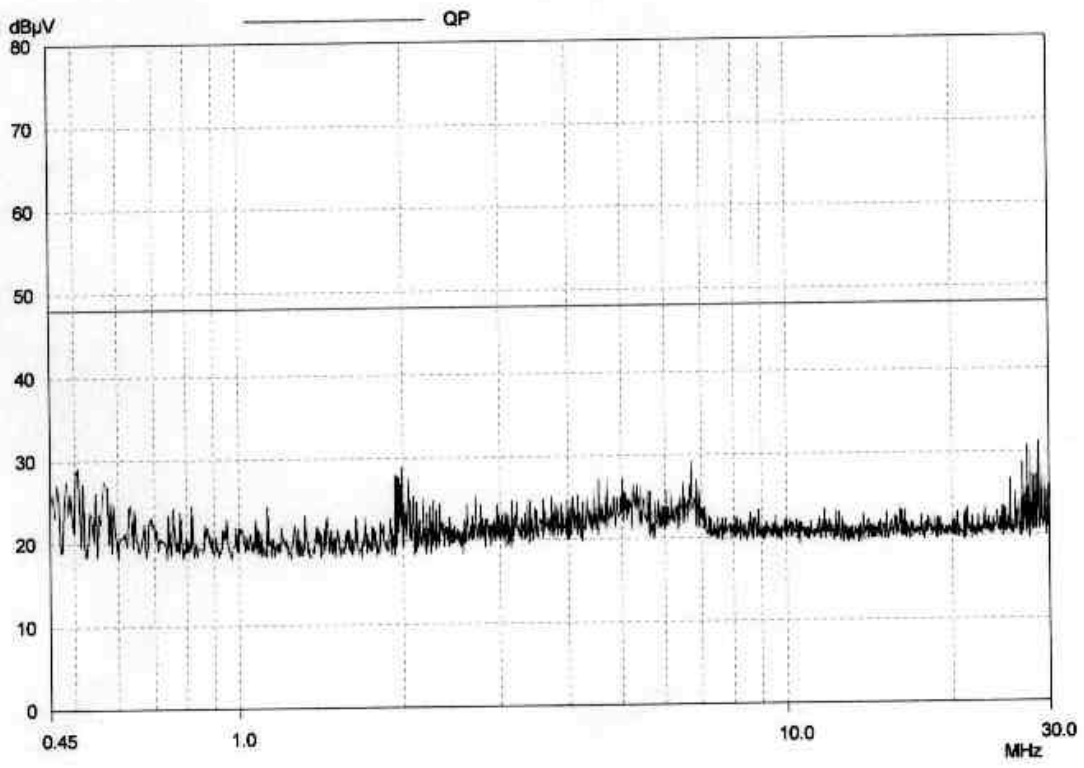
In these three channels, the processing-gain values of EUT are all greater than 10dB, which satisfies §15.247(e).

Appendix 1 : Ploted Datas of Power Line Conducted Emissions

Conducted Emission
Peak Value

EUT:	Wireless LAN Mini PCI Card
Manuf:	
Op Cond:	CH1 Datarate 11Mbps
Operator:	Rick Hu
Test Spec:	FCC Class B
Comment:	L1

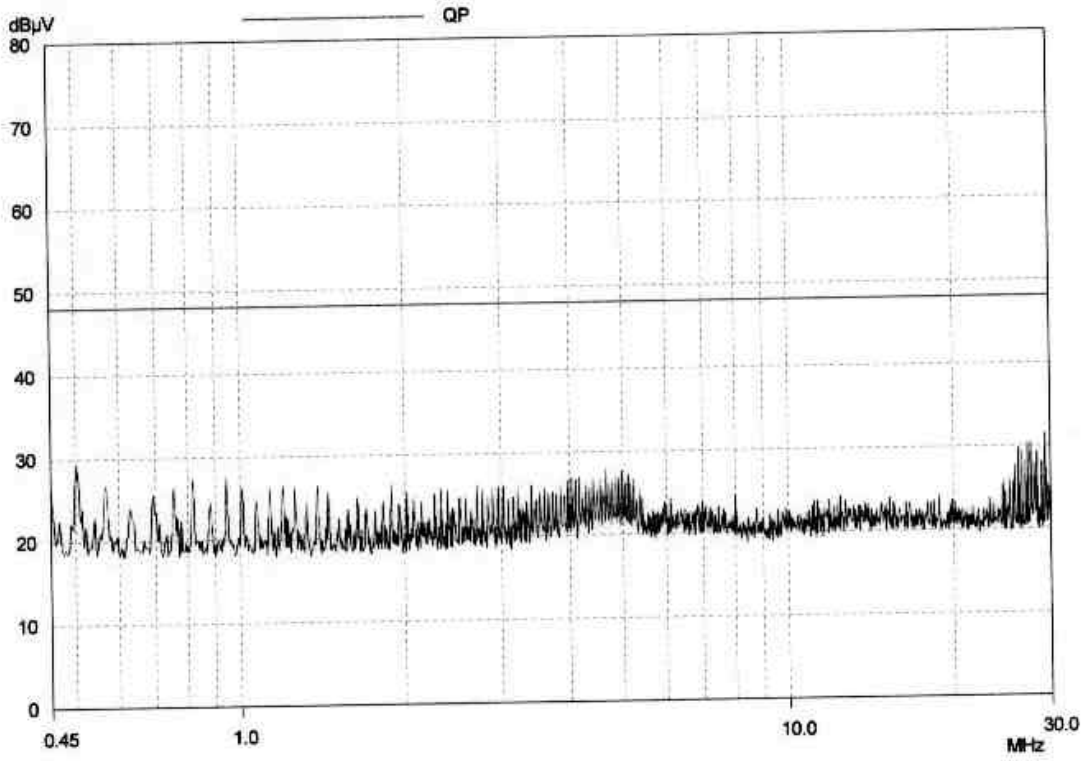
Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	8
	Acc Margin:	10 dB



Conducted Emission
Peak Value

EUT:	Wireless LAN Mini PCI Card
Manuf:	
Op Cond:	CH1 Datarate 11Mbps
Operator:	Rick Hu
Test Spec:	FCC Class B
Comment:	L2

Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	8
	Acc Margin:	10 dB

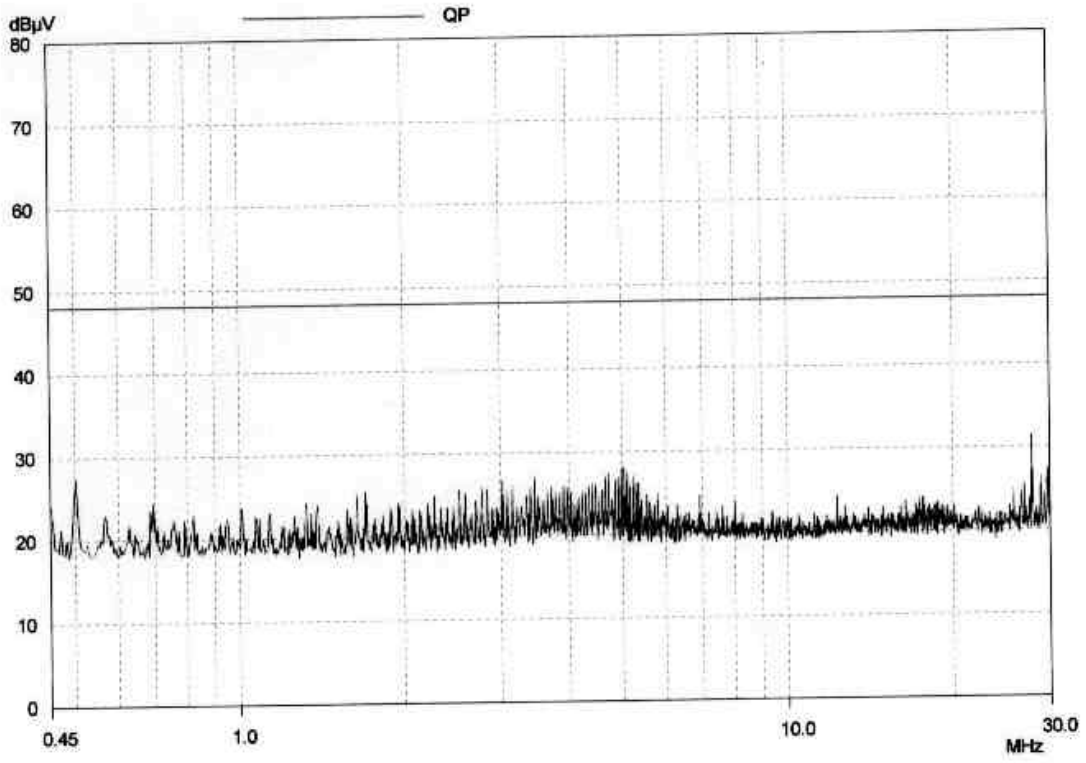


Conducted Emission

Peak Value

EUT:	Wireless LAN Mini PCI Card
Manuf:	
Op Cond:	CH6 Datarate 11Mbps
Operator:	Rick Hu
Test Spec:	FCC Class B
Comment:	L1

Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	8
	Acc Margin:	10 dB

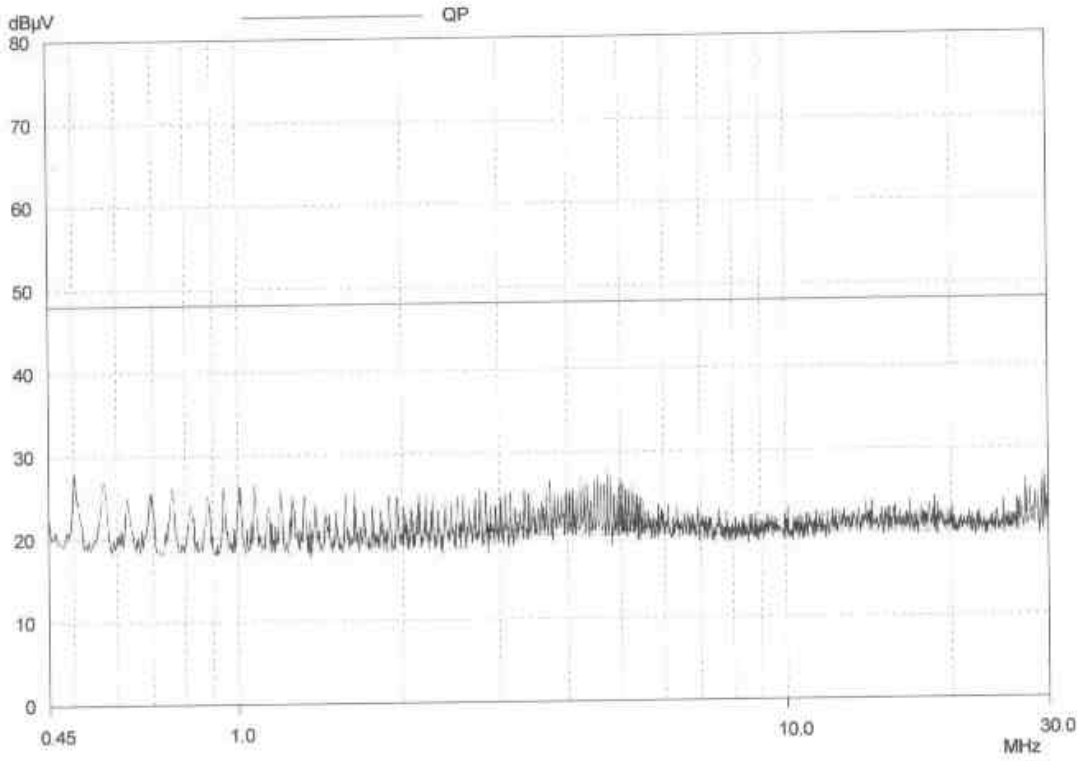


Conducted Emission

Peak Value

EUT:	Wireless LAN Mini PCI Card
Manuf:	
Op Cond:	CH6 Datarate 11Mbps
Operator:	Rick Hu
Test Spec:	FCC Class B
Comment:	L2

Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	8
	Acc Margin:	10 dB

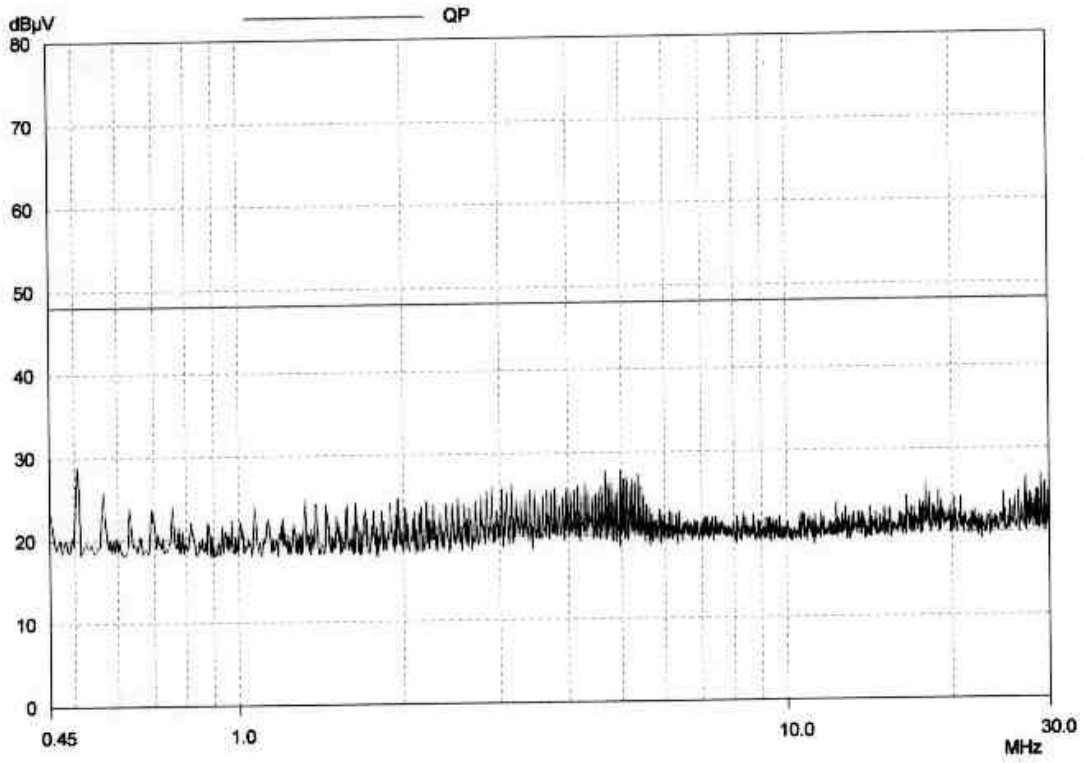


Conducted Emission

Peak Value

EUT:	Wireless LAN Mini PCI Card
Manuf:	
Op Cond:	CH11 Datarate 11Mbps
Operator:	Rick Hu
Test Spec:	FCC Class B
Comment:	L1

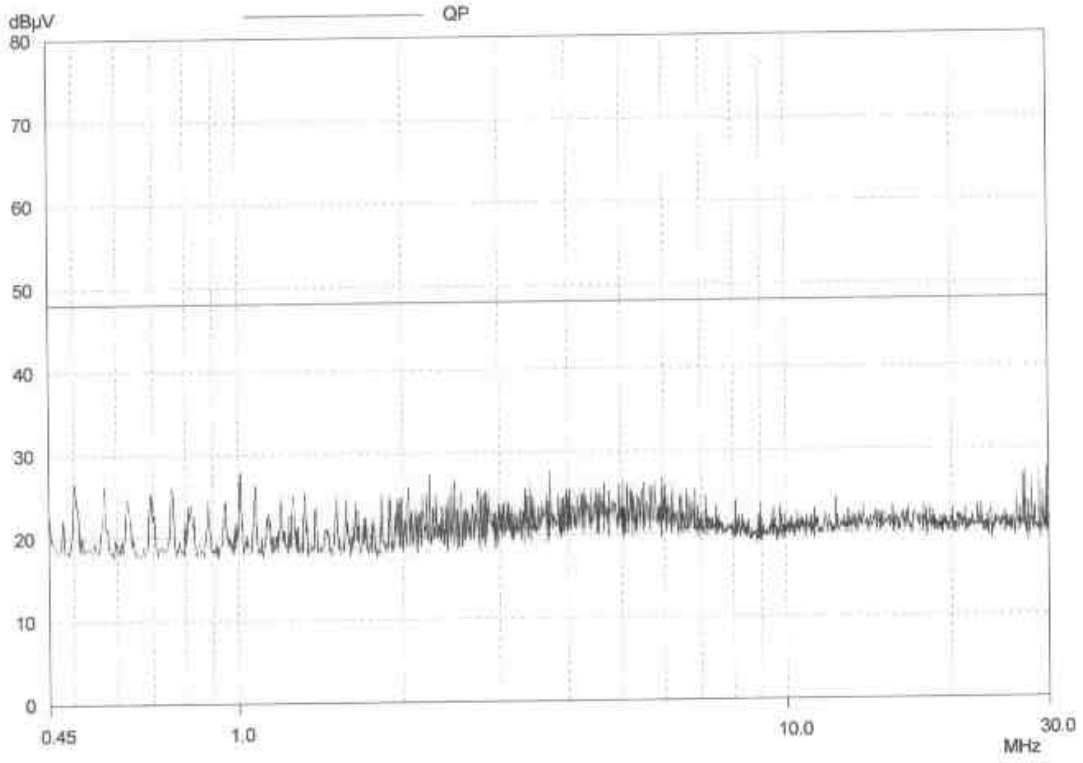
Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	8
	Acc Margin:	10 dB



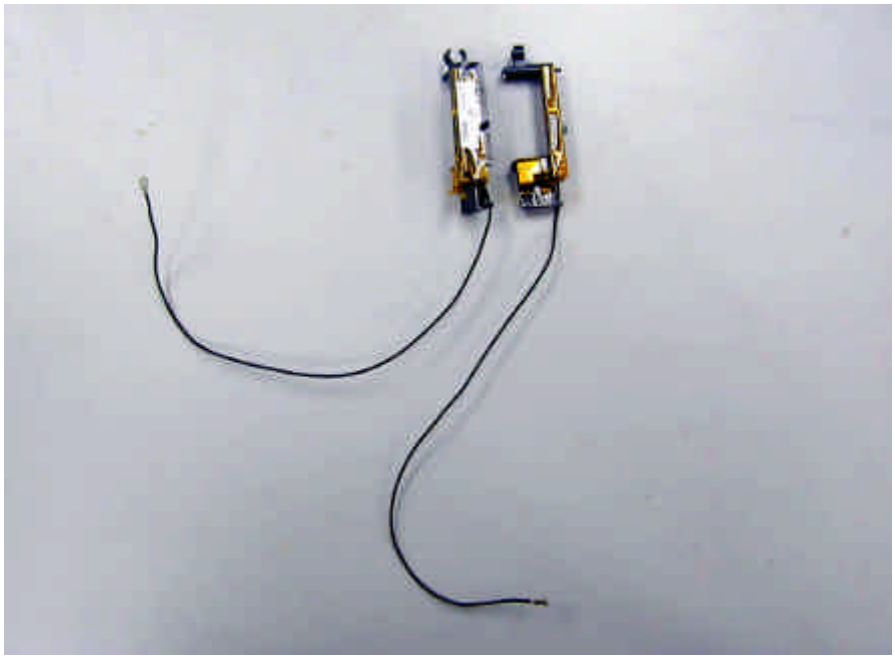
Conducted Emission
Peak Value

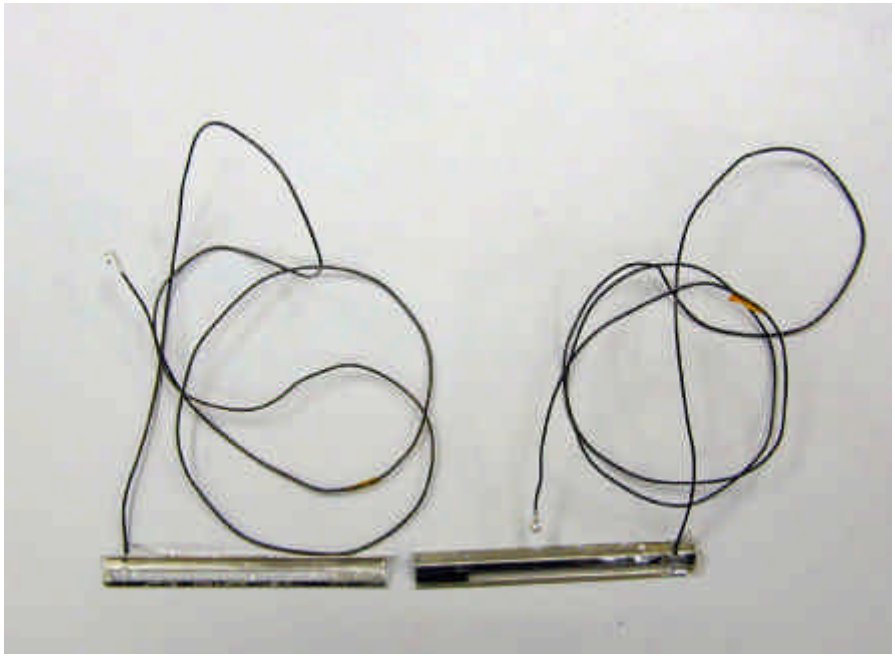
EUT:	Wireless LAN Mini PCI Card
Manuf:	
Op Cond:	CH11 Datarate 11Mbps
Operator:	Rick Hu
Test Spec:	FCC Class B
Comment:	L2

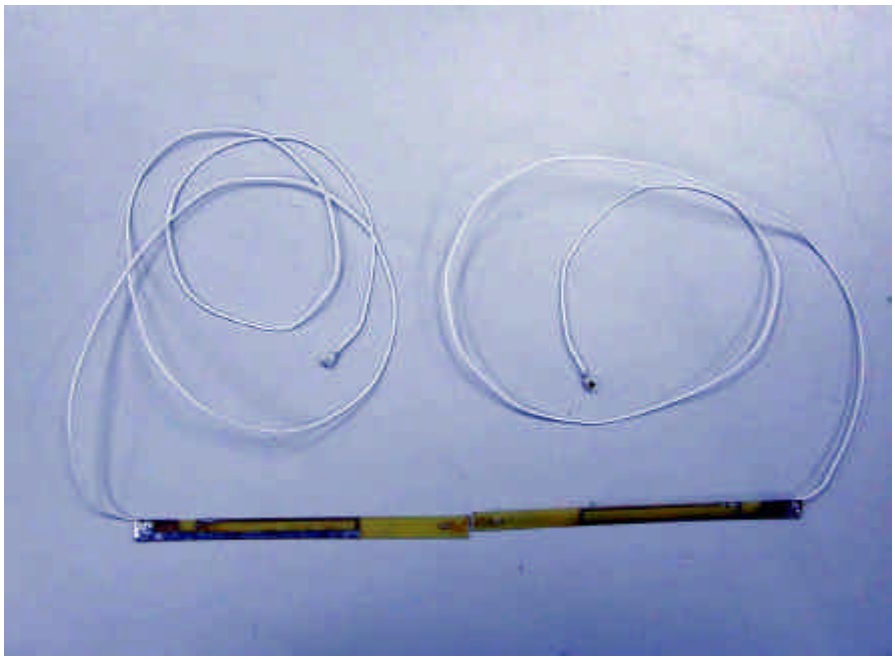
Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	8
	Acc Margin:	10 dB

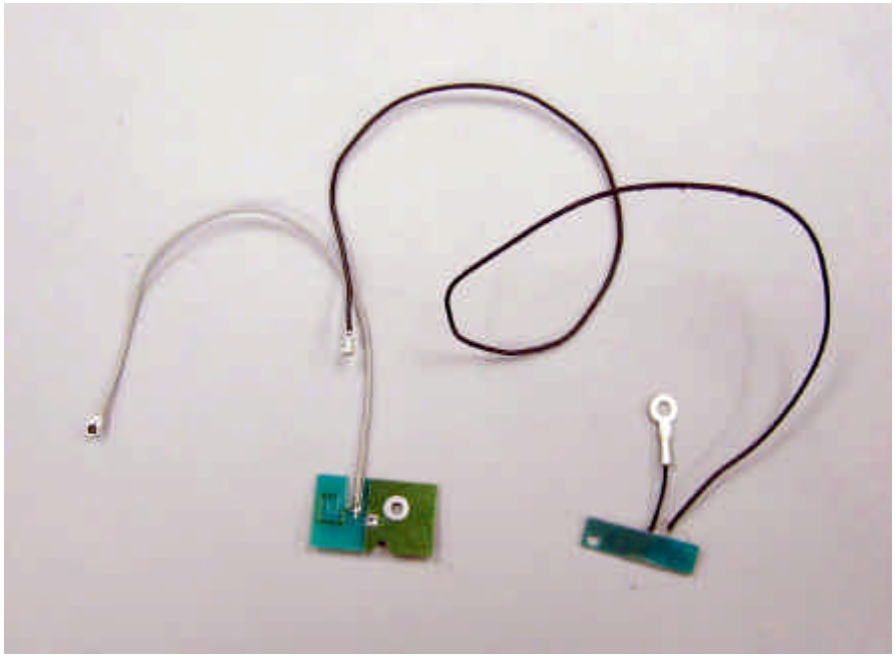


Appendix 2 : Engineering Graph of Antenna Construction

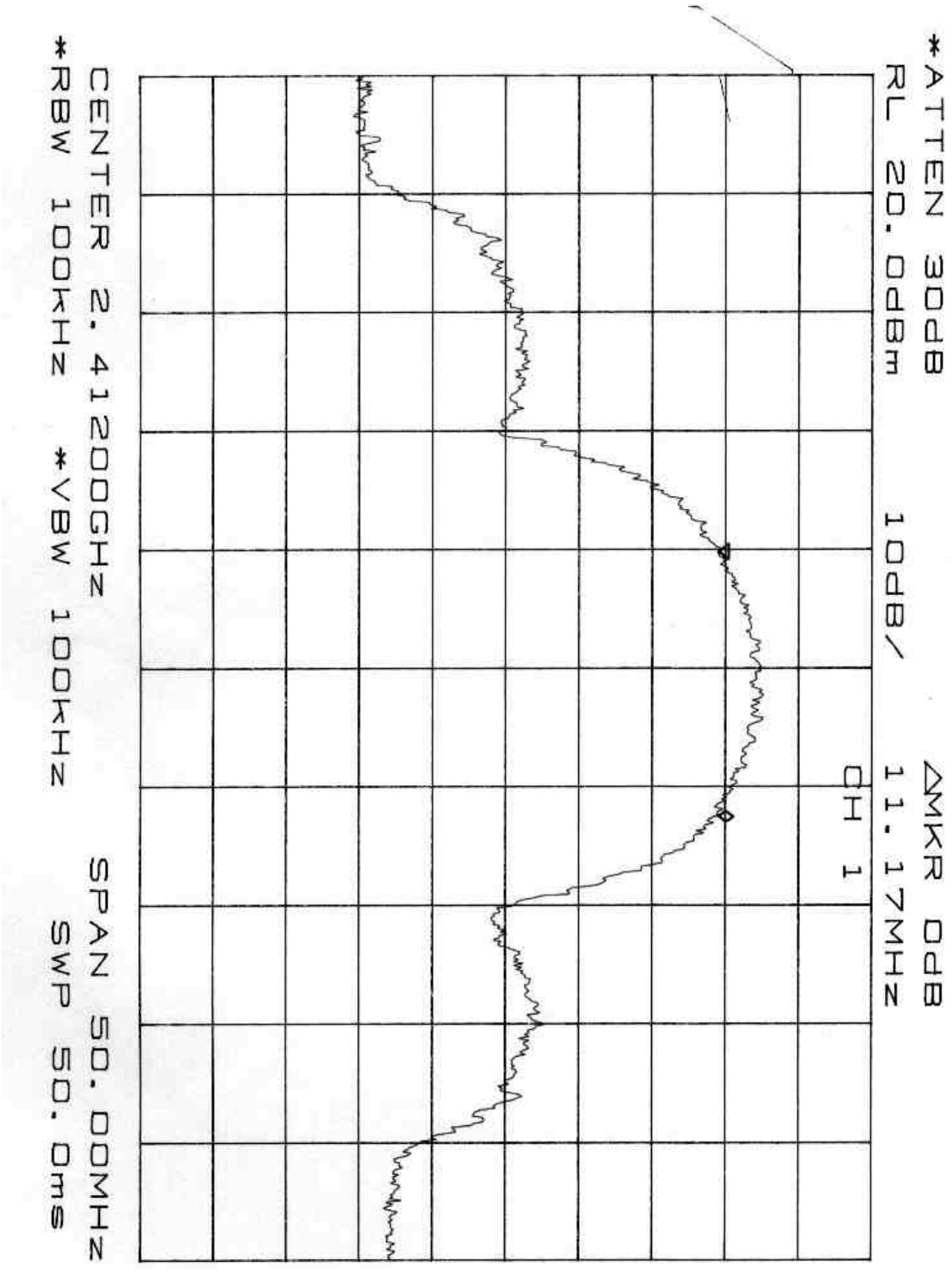


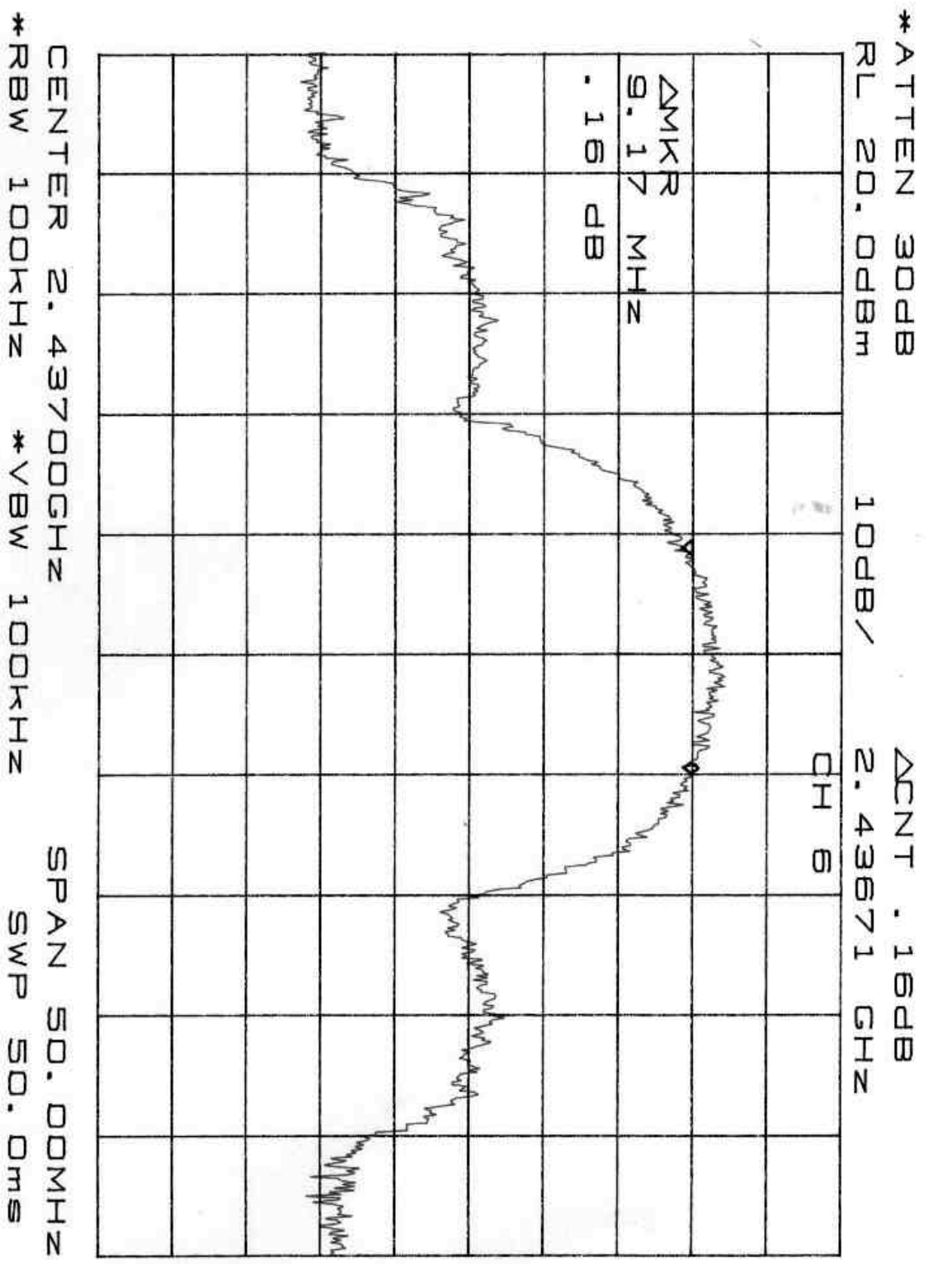


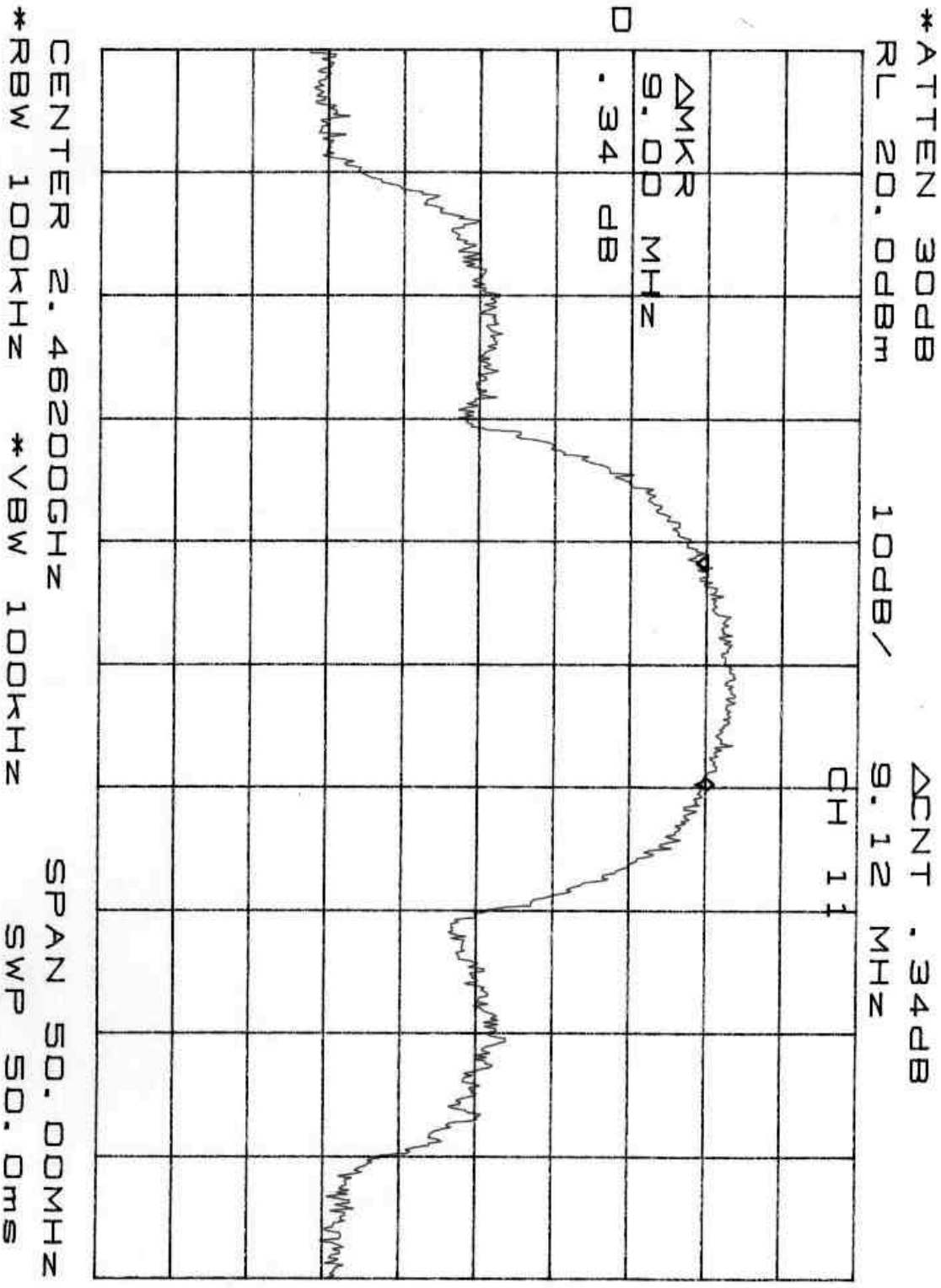




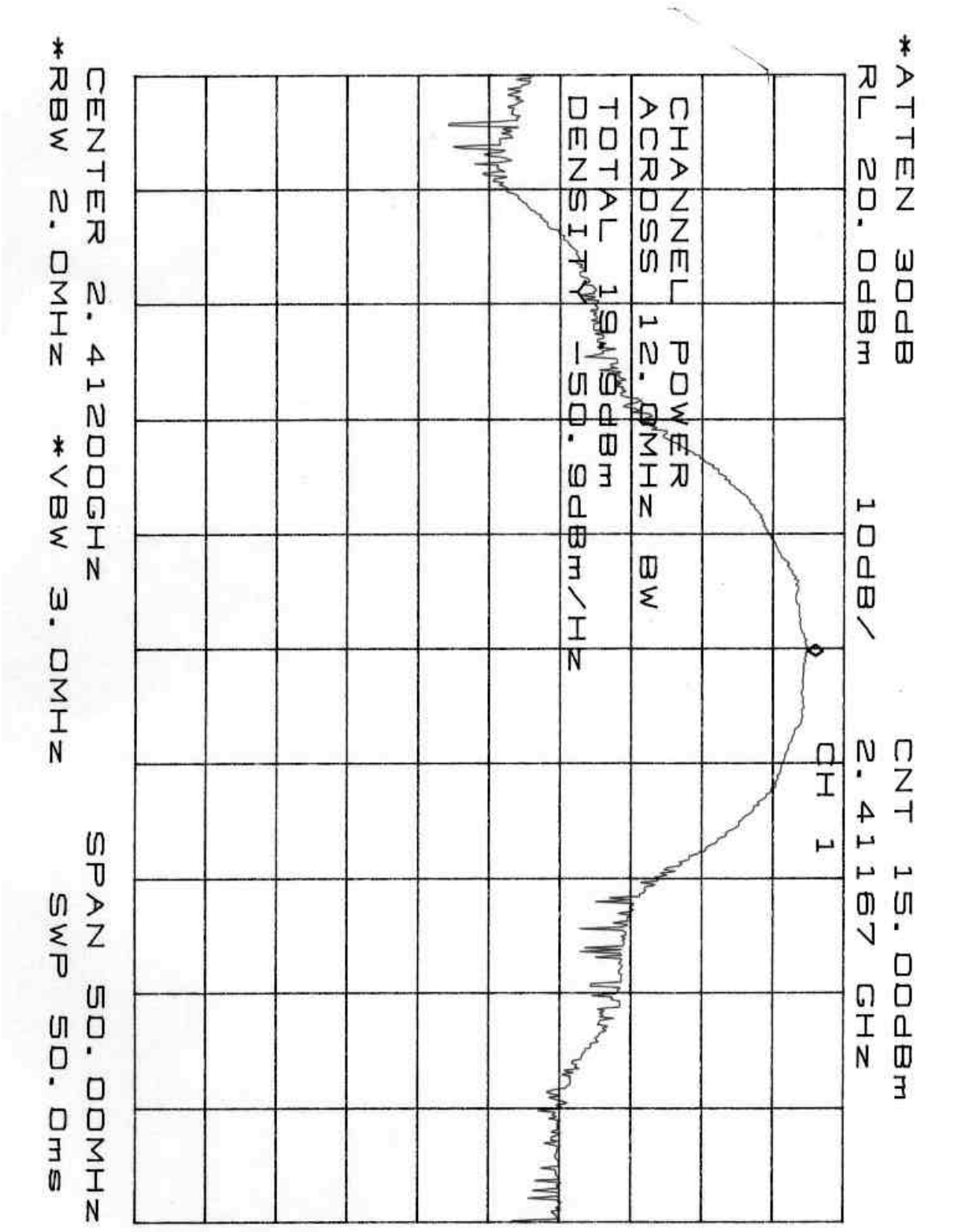
Appendix 3 : Ploted Datas of Emissions Bandwidth

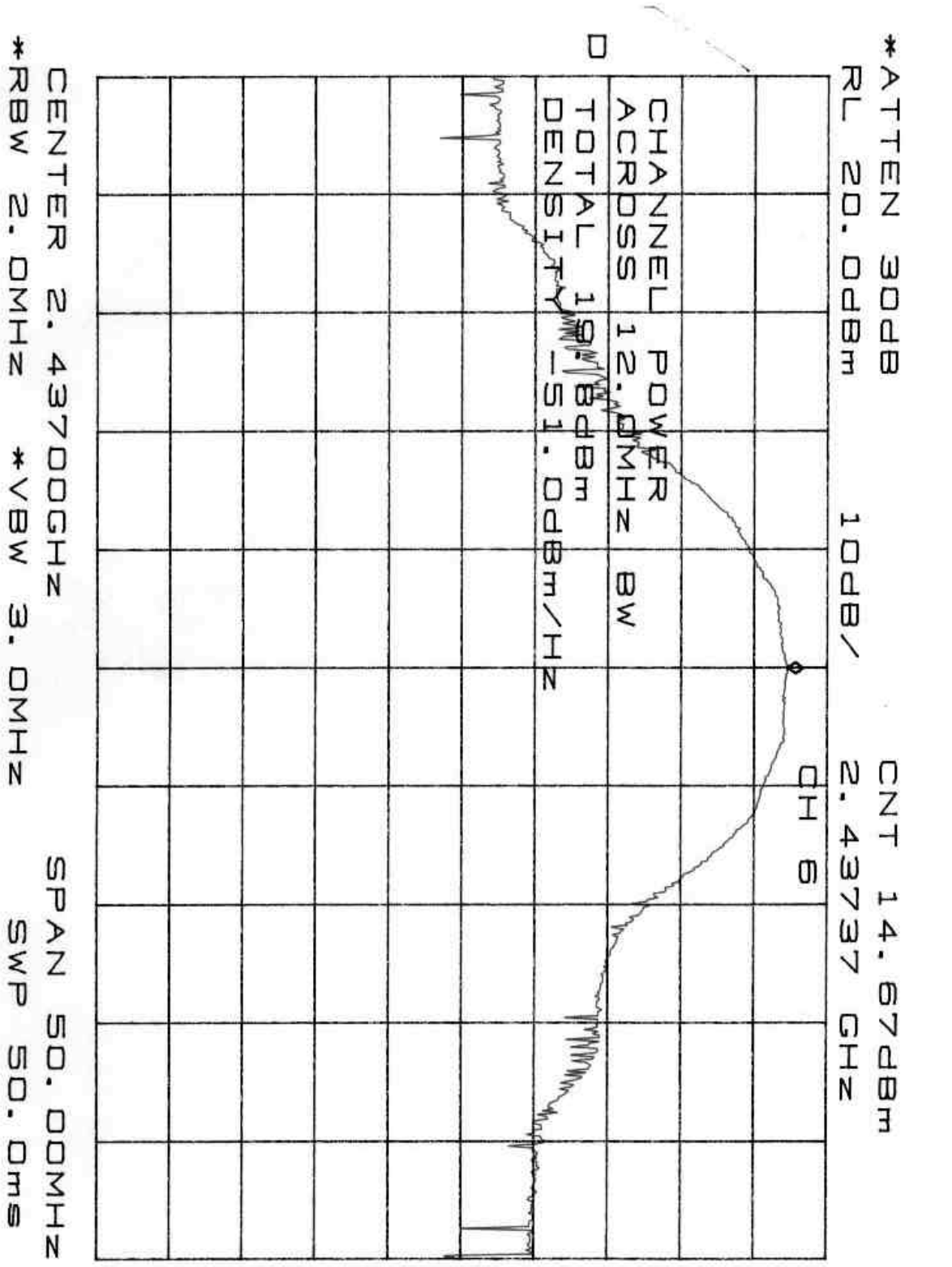

*ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR 0dB
11.17MHz
CH 1
CENTER 2.412000GHz
SPAN 50.00MHz
*RBW 100kHz
*VBW 100kHz
SWP 50.0ms

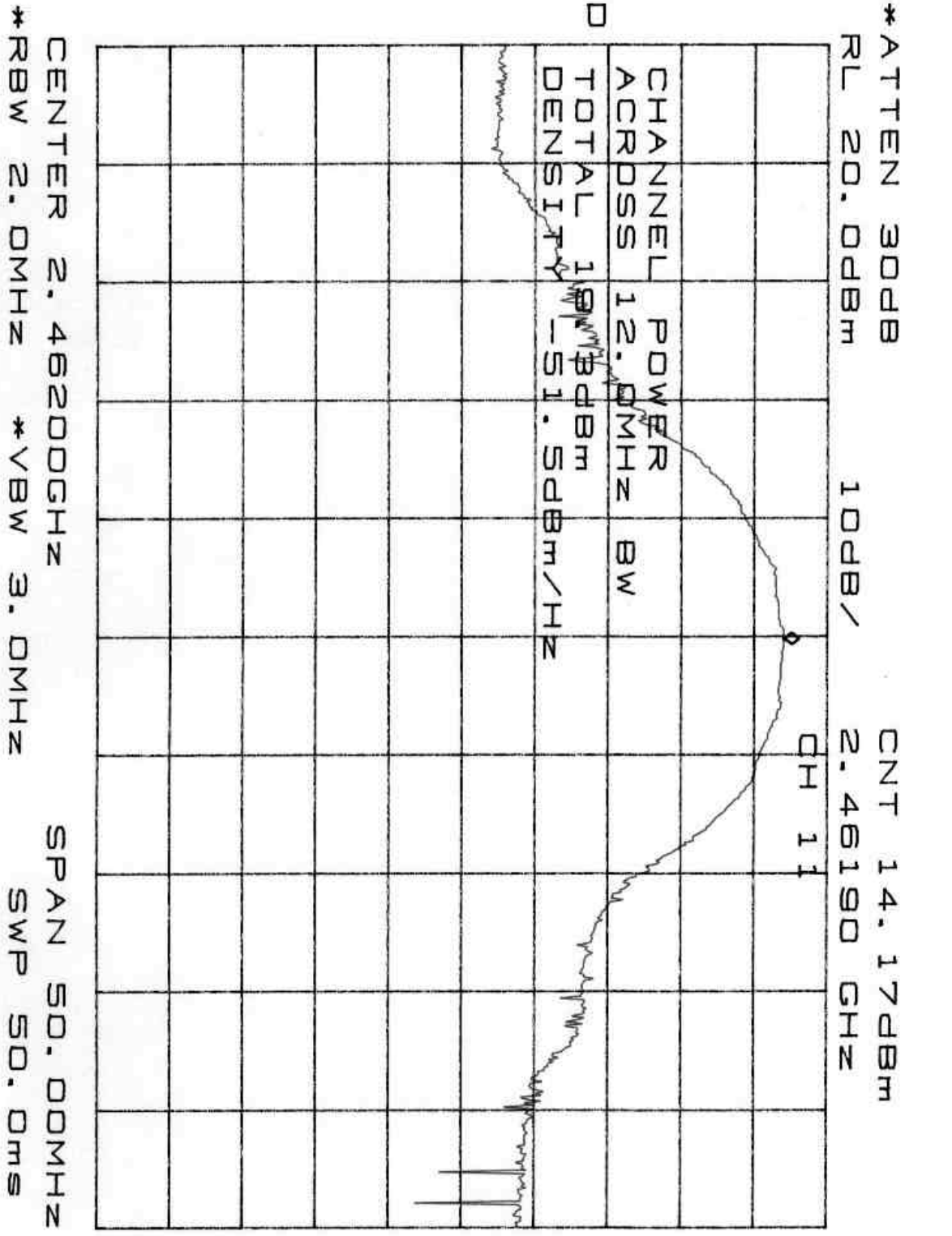

*ATTEN 30dB
RL 20.0dBm
10dB/
ΔCNT .16dB
2.43671 GHz
ΔMKR
9.17 MHz
.16 dB
CH 6
CENTER 2.437000GHz
*RBW 100KHz
*VBW 100KHz
SPAN 50.00MHz
SWP 50.0ms


*ATTEN 30dB
RL 20.0dBm
10dB/
ΔCNT .34dB
9.12 MHz
CH 11
ΔMKR
9.00 MHz
.34 dB
D
CENTER 2.462000GHz
SPAN 50.00MHz
*RBW 100KHz
*VBW 100KHz
SWP 50.0ms

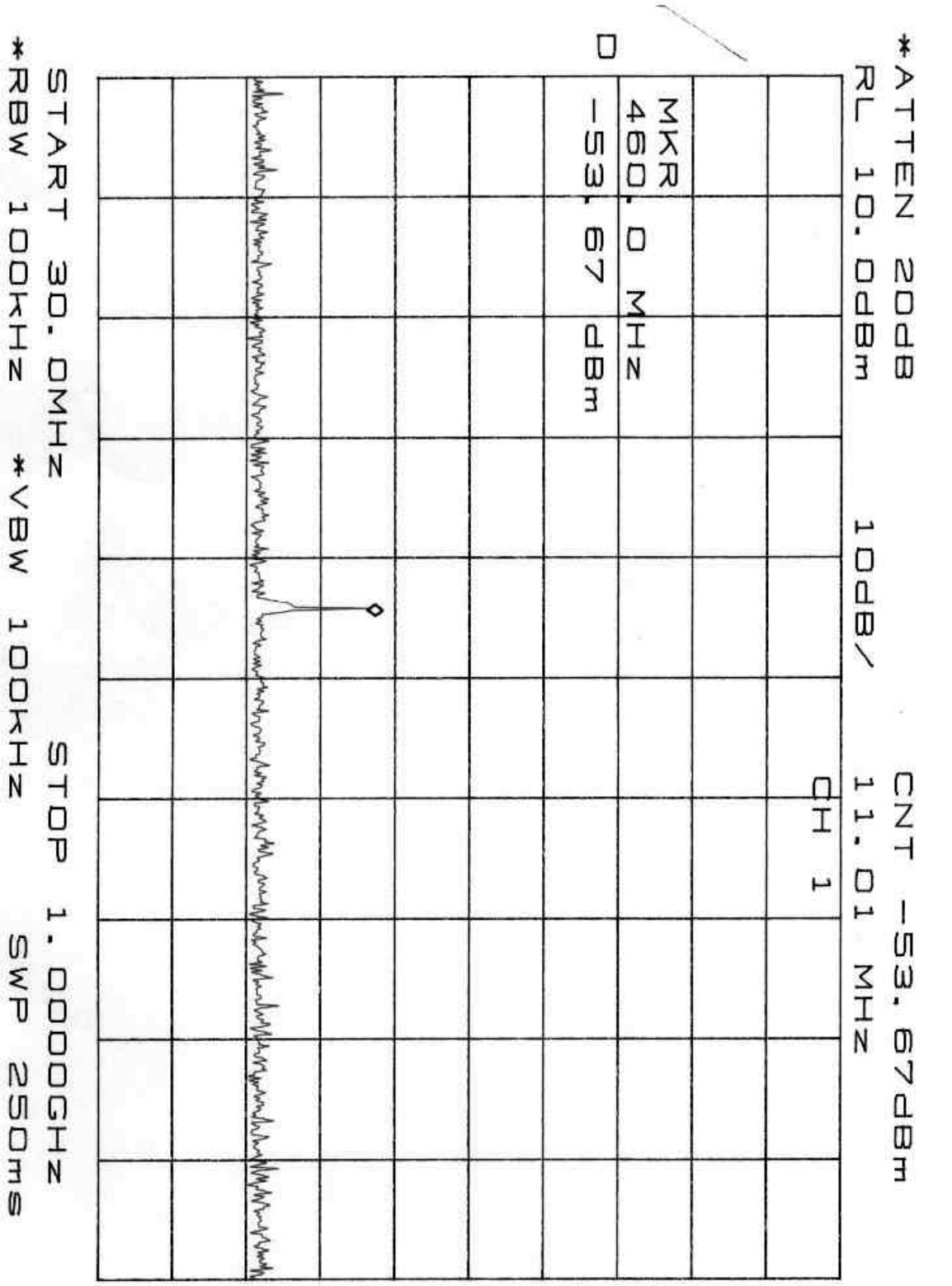
Appendix 4 : Ploted Datas of Output Peak Power

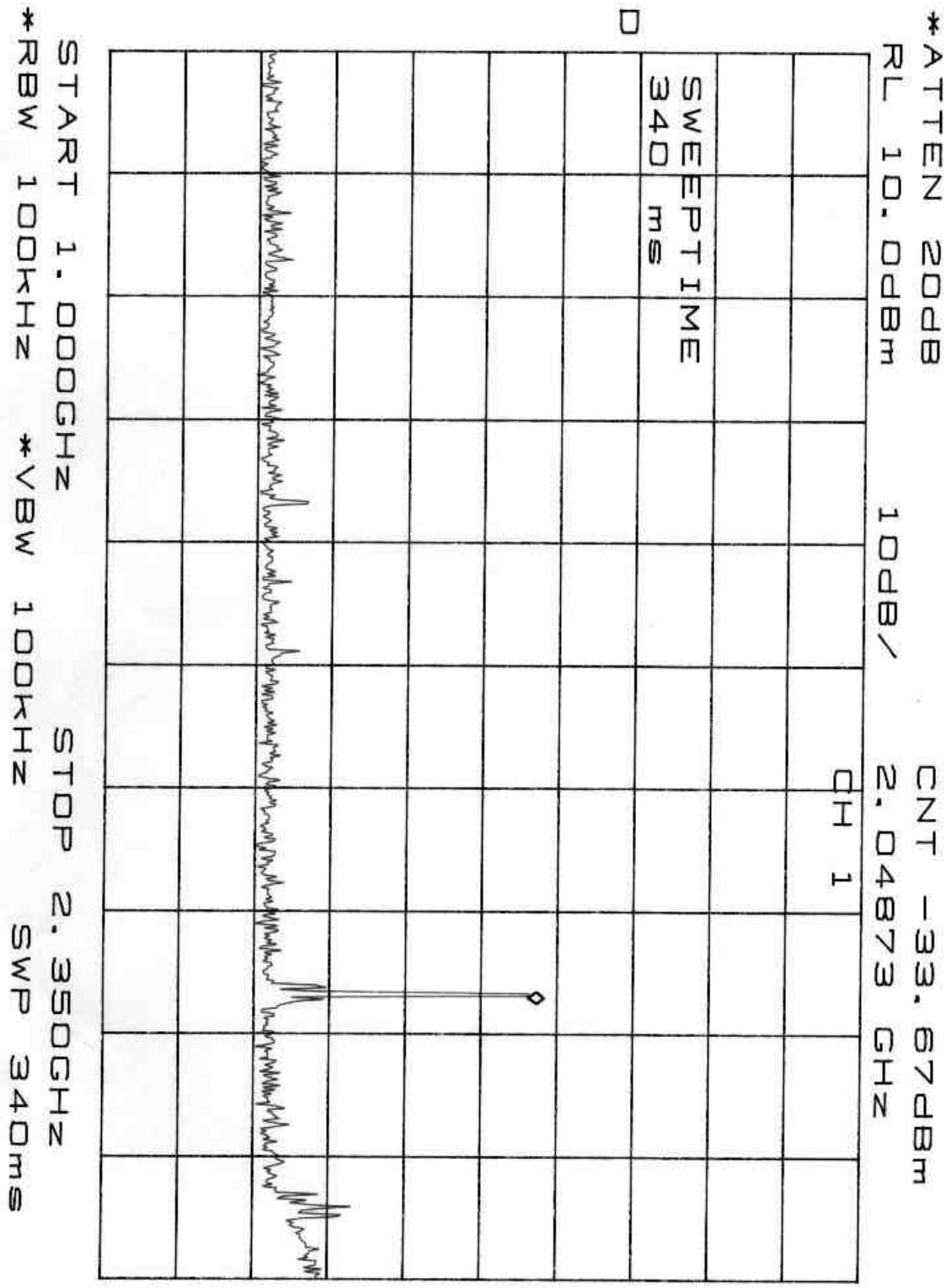

*ATTEN 30dB
RL 20.0dBm
10dB/
CNT 15.00dBm
2.41167 GHz
CH 1
CHANNEL POWER
ACROSS 12.0MHz BW
TOTAL 19.58dBm
DENSITY -50.98dBm/Hz
CENTER 2.412000GHz
SPAN 50.00MHz
*RBW 2.0MHz
*VBW 3.0MHz
SWP 50.0ms

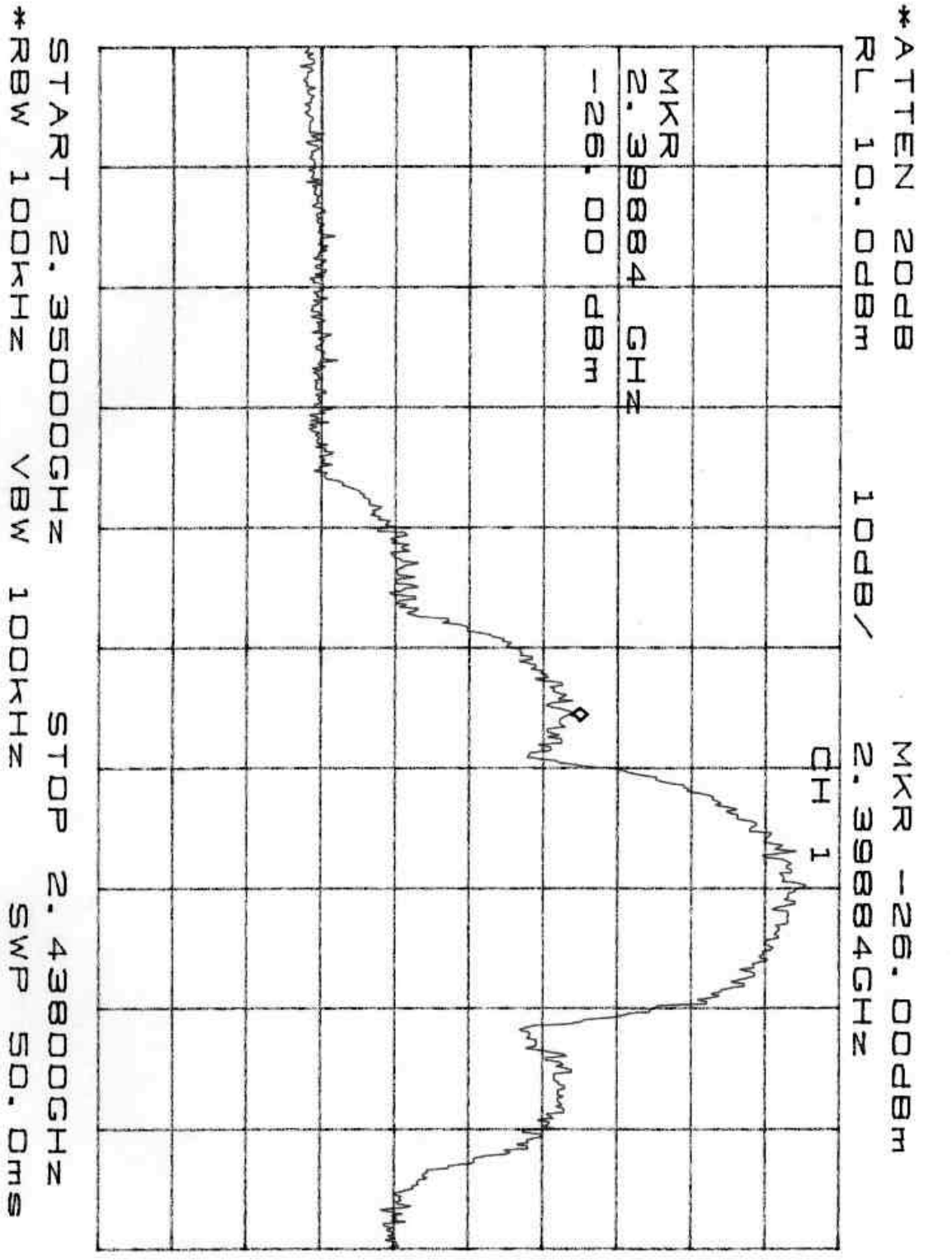

*ATTEN 30dB
RL 20.0dBm
10dB/
CNT 14.67dBm
2.43737 GHz
CH 6
CHANNEL POWER
ACROSS 12.0MHz BW
TOTAL 19.8dBm
DENSITY -51.0dBm/Hz
CENTER 2.437000GHz
SPAN 50.00MHz
*RBW 2.0MHz
*VBW 3.0MHz
SWP 50.0ms

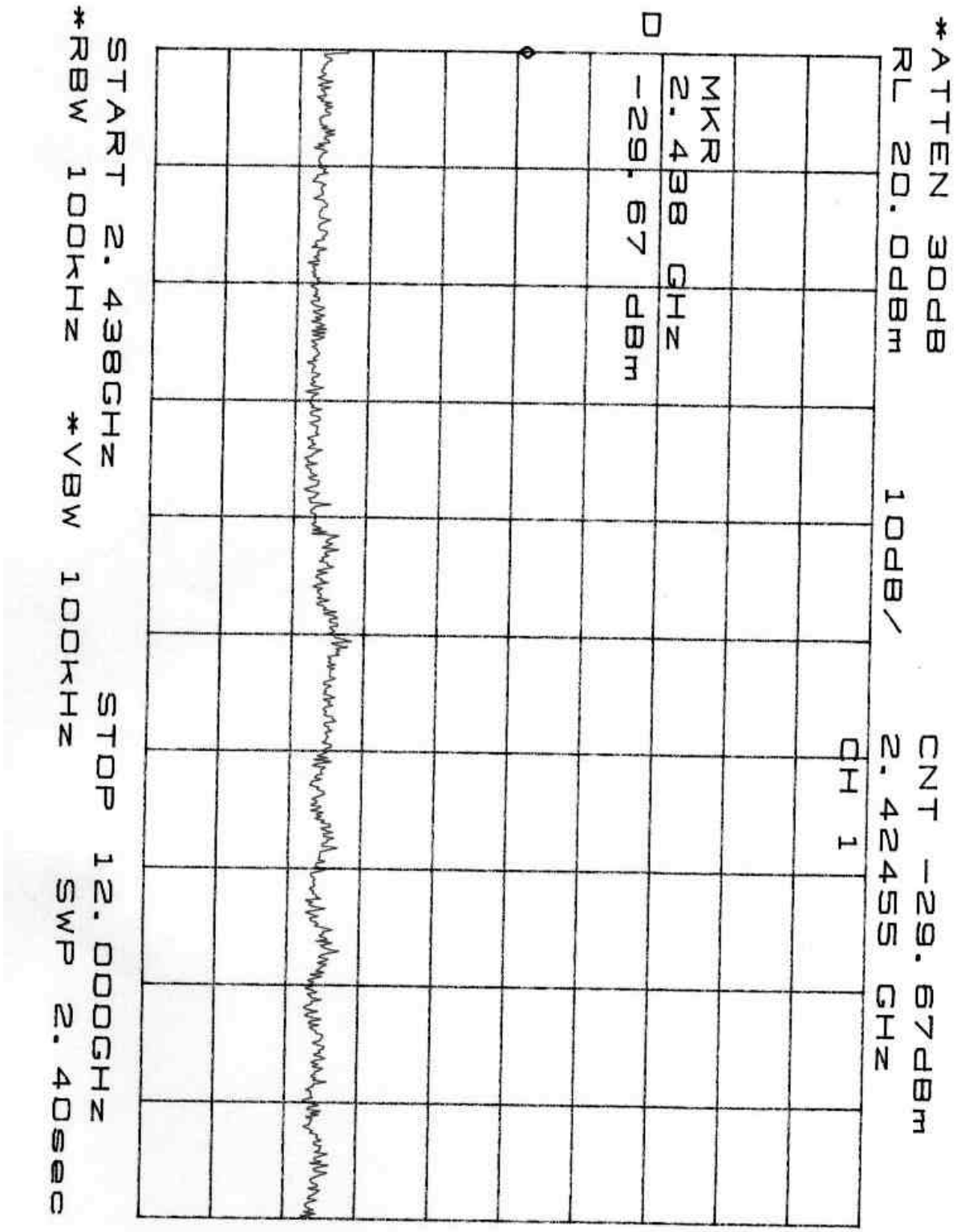

*ATTEN 30dB
RL 20.0dBm
10dB/
CNT 14.17dBm
2.46190 GHz
CH 11
CHANNEL POWER
ACROSS 12.0MHz BW
TOTAL 19.8dBm
DENSITY -51.5dBm/Hz
CENTER 2.462000GHz
*RBW 2.0MHz
*VBW 3.0MHz
SPAN 50.00MHz
SWP 50.0ms

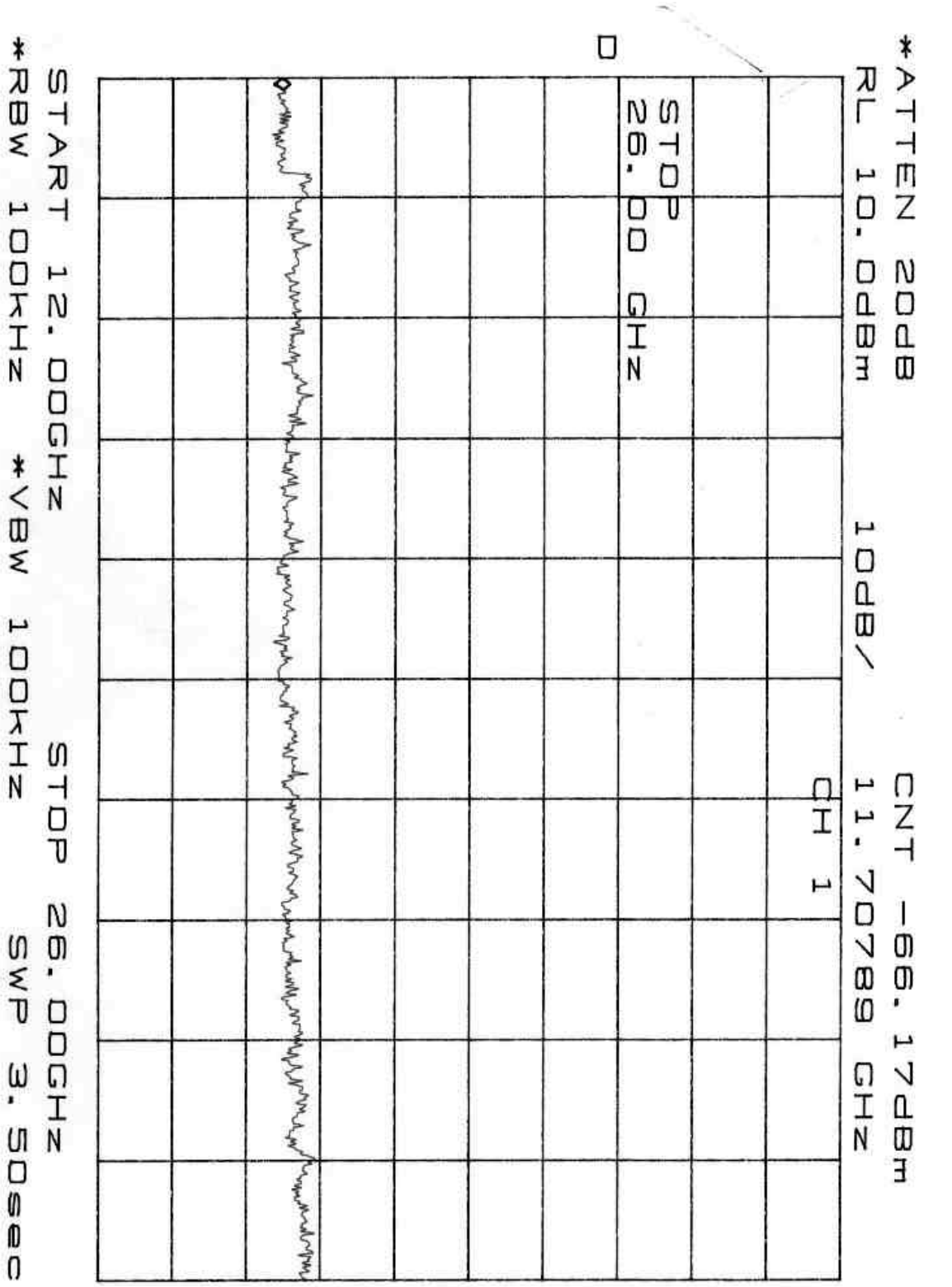
Appendix 5 : Ploted Datas of Band Edge Emission

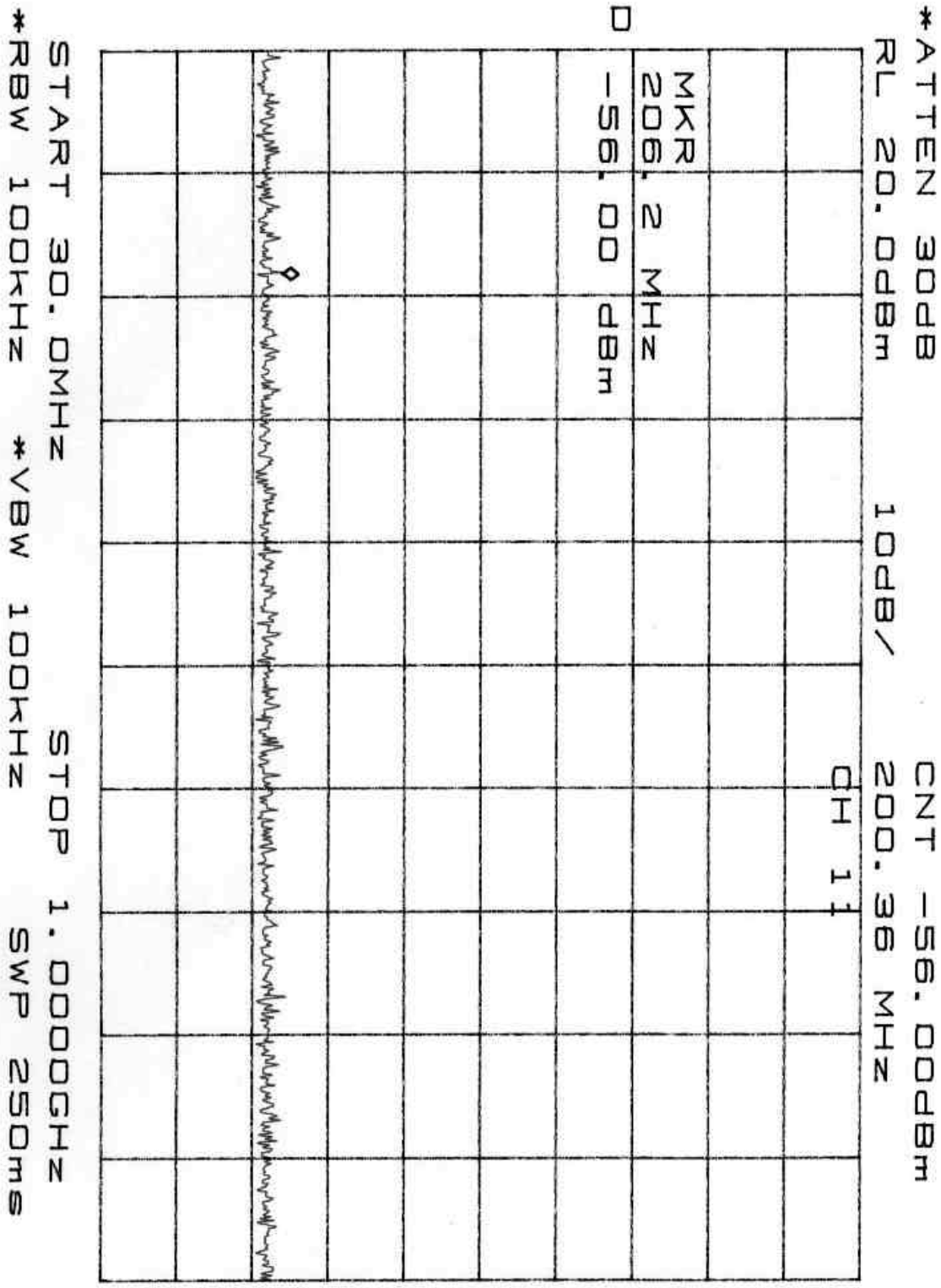

*ATTEN 20dB
RL 10.0dBm
10dB/
CNT -53.67dBm
11.01 MHz
CH 1
MKR
460.0 MHz
-53.67 dBm
D
START 30.0MHz
*RBW 100kHz
*VBW 100kHz
STOP 1.00000GHz
SWP 250ms

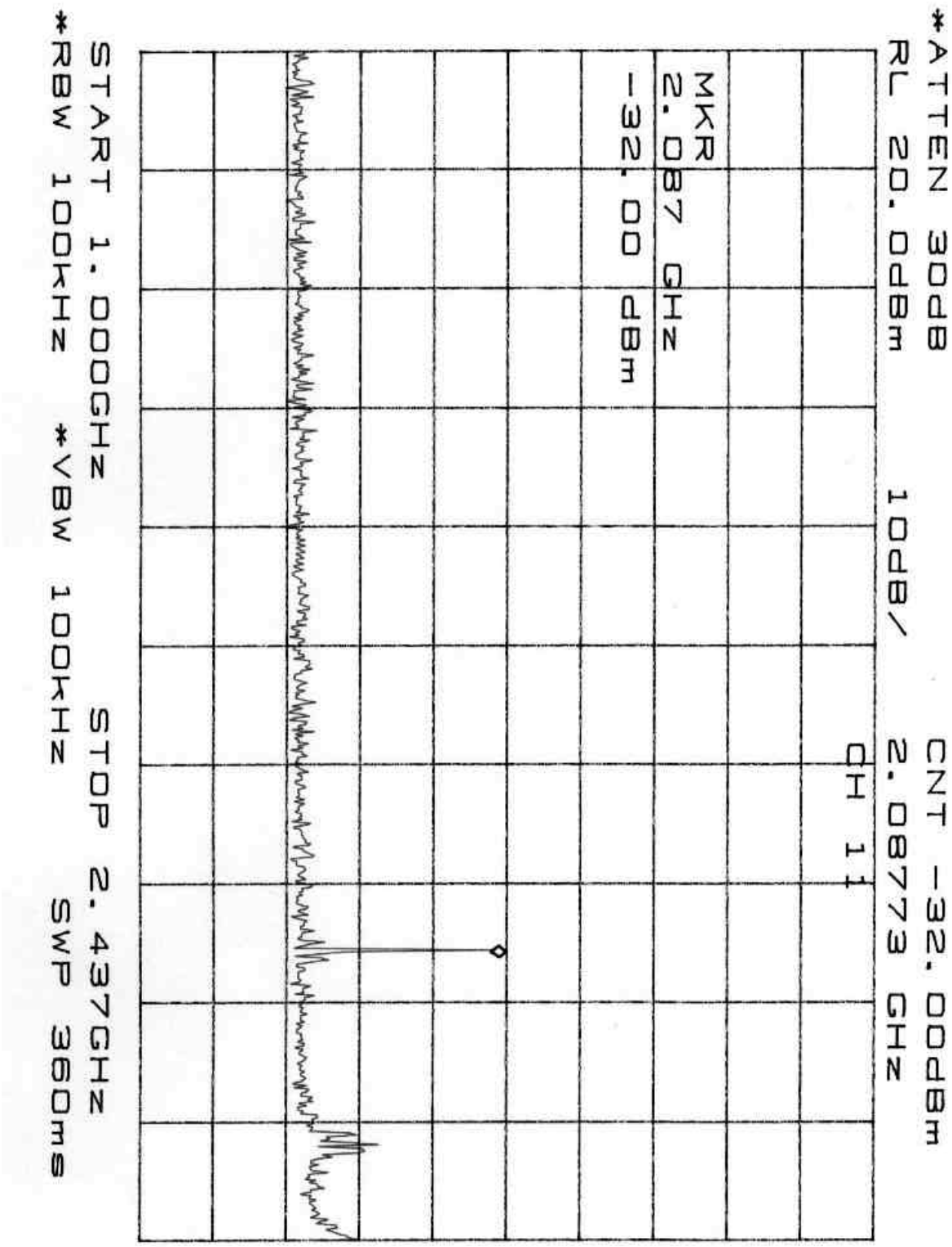

*ATTEN 20dB
RL 10.0dBm
10dB/
CNT -33.67dBm
2.04873 GHz
CH 1
SWEEPTIME
340 ms
D
START 1.000GHz
STOP 2.350GHz
*RBW 100kHz
*VBW 100kHz
SWP 340ms

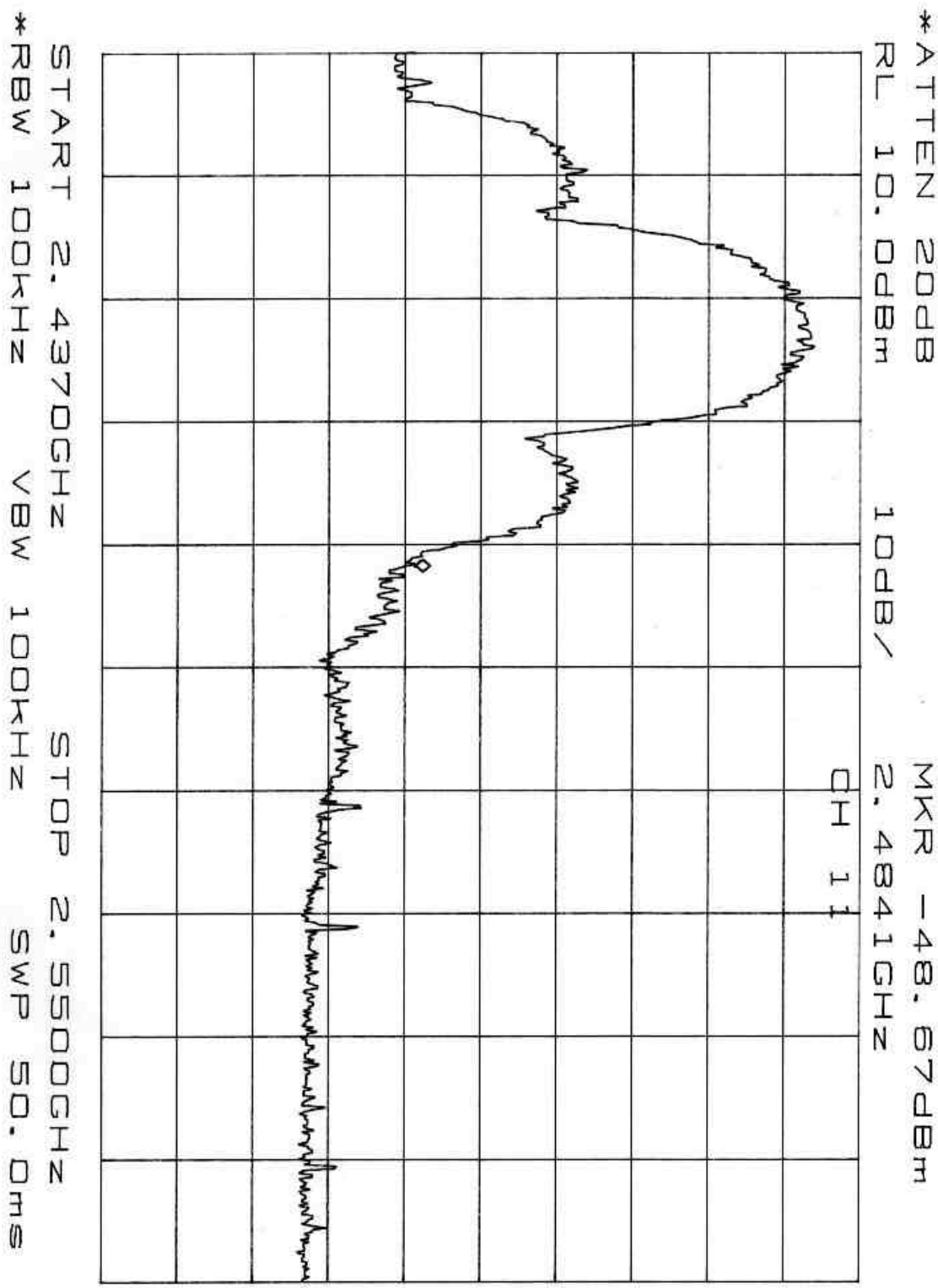

*ATTEN 20dB
RL 10.00dBm
10dB/
MKR -26.00dBm
2.39884GHz
CH 1
MKR
2.39884 GHz
-26.00 dBm
START 2.350000GHz
STOP 2.438000GHz
*RBW 100kHz
VBW 100kHz
SWP 50.0ms

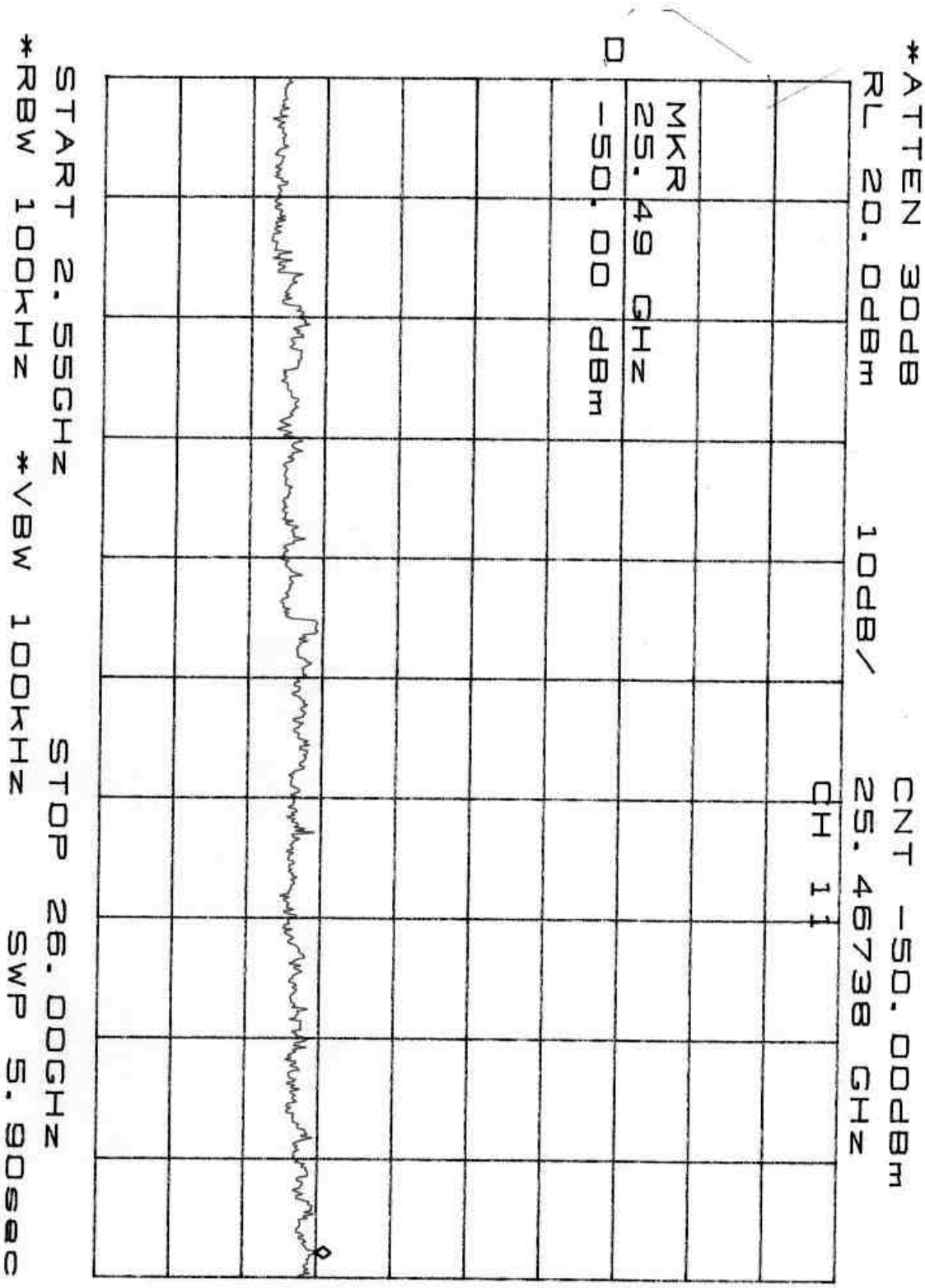

*ATTEN 30dB
RL 20.0dBm
10dB/
CNT -29.67dBm
2.42455 GHz
CH 1
MKR
2.488 GHz
-29.67 dBm
D
START 2.438GHz
*RBW 100kHz
*VBW 100kHz
STOP 12.000GHz
SWP 2.40sec


*ATTEN 20dB
RL 10.0dBm
10dB/
CNT -66.17dBm
11.70789 GHz
CH 1
STOP
26.00 GHz
D
START 12.000GHz
*RBW 100kHz
*VBW 100kHz
STOP 26.000GHz
SWP 3.50sec

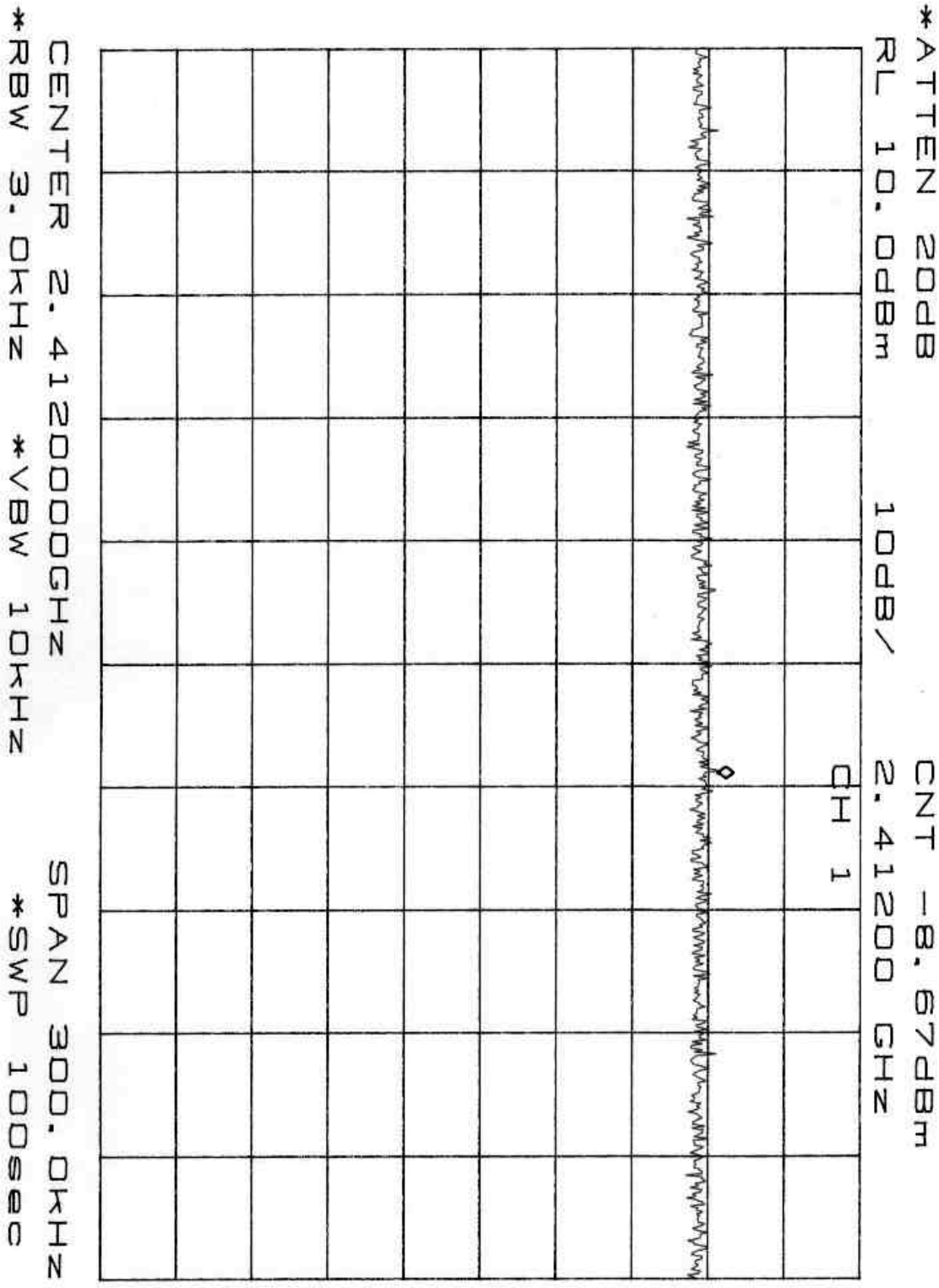

*ATTEN 30dB
RL 20.0dBm
10dB/
CNT -56.00dBm
200.36 MHz
CH 11
MKR
206.2 MHz
-56.00 dBm
D
D
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
*VBW 100kHz
SWP 250ms

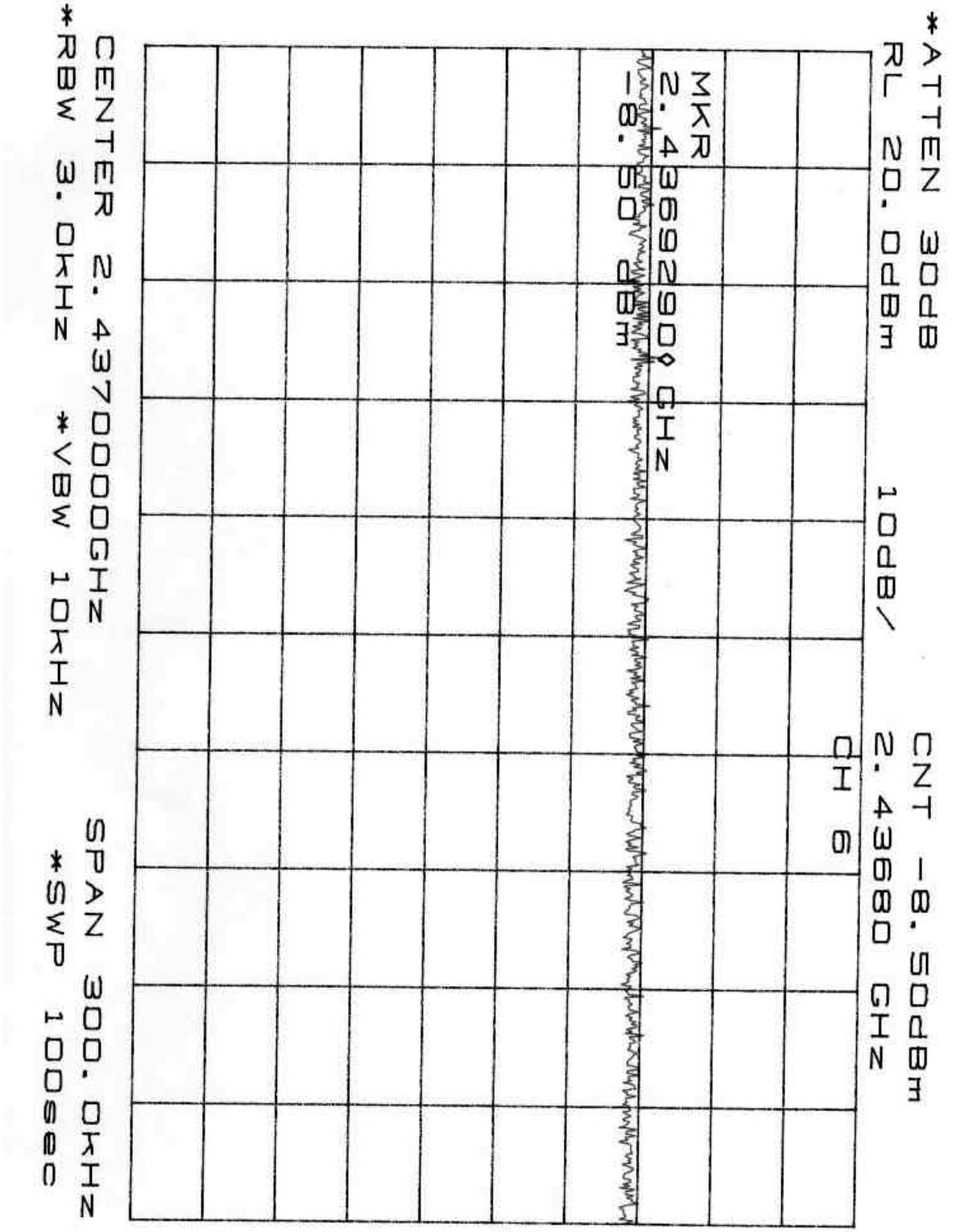

*ATTEN 30dB
RL 20.00dBm
10dB/
CNT -32.00dBm
2.08773 GHz
CH 11
MKR
2.087 GHz
-32.00 dBm
START 1.000GHz
STOP 2.437GHz
*RBW 100kHz
*VBW 100kHz
SWP 360ms

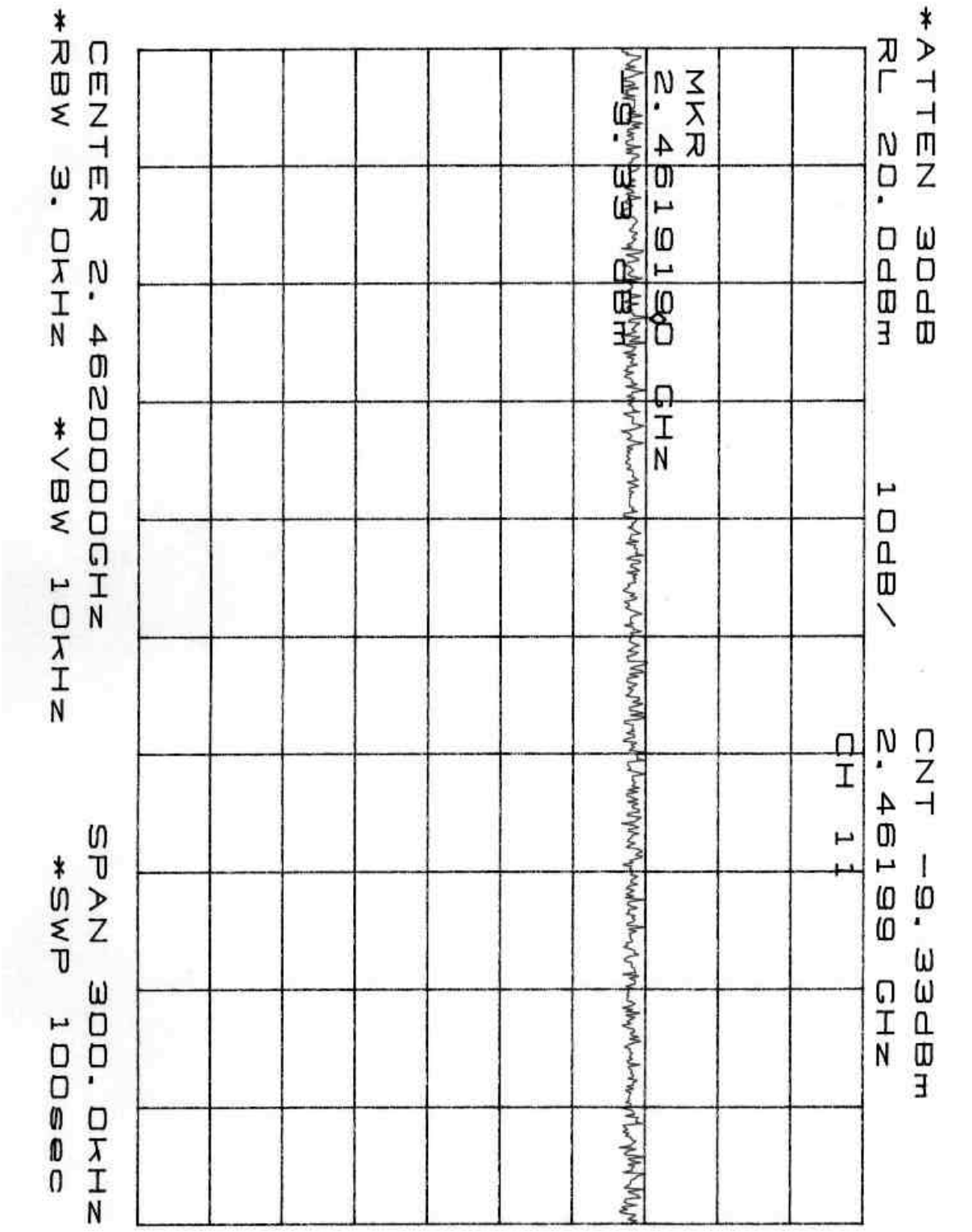

*ATTEN 20dB
RL 10.0dBm
10dB/
MKR -48.67dBm
2.4841GHz
CH 11
START 2.4370GHz
*RBW 100kHz
VBW 100kHz
STOP 2.5500GHz
SWP 50.0ms


*ATTEN 30dB
RL 20.0dBm
10dB/
CNT -50.000dBm
25.46738 GHz
CH 11
MKR
25.49 GHz
-50.00 dBm
D
START 2.55GHz
STOP 26.00GHz
*RBW 100kHz
*VBW 100kHz
SWP 5.90sec

Appendix 6 : Ploted Datas of Power Density


*ATTEN 20dB
RL 10.0dBm
10dB/
CNT -8.67dBm
2.41200 GHz
CH 1
CENTER 2.412000GHz
*RBW 3.0kHz
*VBW 10kHz
SPAN 300.0kHz
*SWP 100sec


*ATTEN 30dB
RL 20.0dBm
10dB/
CNT -8.50dBm
2.43680 GHz
CH 6
MKR
2.4369290 GHz
-8.50 dBm
CENTER 2.4370000GHz
*RBW 3.0KHz
*VBW 10KHz
SPAN 300.0KHz
*SWP 100sec


*ATTEN 30dB
RL 20.0dBm
10dB/
CNT -9.33dBm
2.46199 GHz
CH 11
MKR
2.461990 GHz
-9.33 dBm
CENTER 2.462000GHz
SPAN 300.0kHz
*RBW 3.0kHz
*VBW 10kHz
*SWP 100sec