FCC Part 15
EMI TEST REPORT

of

E.U.T. : Bluetooth handsfree car kit
MODEL : CIRCLE1000
FCC ID. : QSO87111500328

for

APPLICANT : Hong Kong Communications Equipment Co., Ltd.

ADDRESS : 7/F, Communication Building, 55 Hennessy Road, Wanchai, Hong Kong.

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN
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Report Number : ET91S-12-157-04

TEST REPORT CERTIFICATION

Applicant	: Hong Kong Communications Equipment Co., Ltd. 7/F, Communication Building, 55 Hennessy Road, Wanchai, Hong Kong.
Manufacturer	: BIA TECHNOLOGY (SHENZHEN) Co. Hou Ting Village, Sha Jin Town, Bo An District, Shenzhen, PRC
Description of EUT	:
a) Type of EUT	: Bluetooth handsfree car kit
b) Trade Name	: CIRCLE
c) Model No.	: CIRCLE1000
d) Seriall No.	: ----
e) Power Supply	: DC 12V (Car Battery)
Regulation Applied	: FCC Rules and Regulations Part 15 Subpart B & C (2002)

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

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

Issued Date : Jan. 13, 2003

Test Engineer : Joe Hsieh

Approve & Authorized Signer : Win-Po Tsai

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

Table of Contents Page

1 GENERAL INFORMATION

1.1 Product Description

a) Type of EUT : Bluetooth handsfree car kit
b) Trade Name : CIRCLE
c) Model No. : CIRCLE1000
d) Power Supply : DC 12V (Car Battery)

1.2 Characteristics of Device

The CIRCLE Bluetooth Wireless Hands Free Car Kit CIRCLE1000 is a handsfree communications device built on bluetooth™ wireless technology which was designed and manufactured in accordance with Bluetooth specification v1.1. Bluetooth wireless technology is a global specification for personal area wireless connectivity to ensure communication compatibility worldwide. It was designed to connect Bluetooth equipped portable and stationary communication devices easily and without any cables.

1.3 Test Methodology

The Bluetooth handsfree car kit designed with a transmitting method of Frequency Hopping spread spectrum is for local area network operation, which operates at 2.4 GHz ISM band and data rate up to 1 Mbps. The rated output power is –0.5 dBm (0.89 mW).

1.4 Modifiction List of EUT

1) DC power input of EUT Line 1 series a wide band choke L4.
   L4(Erocore Co., Model:R6H0610A82R2)
2) DC power input of EUT Line 2 series a wide band choke L2.
   L2(Erocore Co., Model:R6H0610A82R5)
3) Near the Jack of earphone cable add a ferrite core with one turn.
   Ferrite core (Erocore Co., Model:FH0350B)
4) Near the Jack of microphone cable add a ferrite core with one turn.
   Ferrite core (Erocore Co., Model:FH0650B)
5) The R29 in the PCB change to bead.
   bead (King core Co., Model:FBM-10-201209-102)
6) The R30 in the PCB change to bead.
   bead (King core Co., Model:FBM-10-201209-102)

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) 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.

(2) 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.

(3) 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.

(4) 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.

(5) 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)

(6) Power Density

According to 15.247(d), for digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be grater then 8 dbm in any 3 kHz band during any time interval of continuous transmission.

2.3 Restricted Bands of Operation

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

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

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

2.4 Labeling Requirement

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

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

2.5 User Information

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

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

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

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

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

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

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

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

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

3. SYSTEM TEST CONFIGURATION

3.1 Justification

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

3.2 Devices for Tested System

Device	Manufacture	Model / FCC ID.	Cable Description
Bluetooth handsfree car kit *	BIA TECHNOLOGY (SHENZHEN) Co.	CIRCLE1000/ QSO87111500328	----
Earphone	----	----	1.6m, Unshielded cable
Microphone	----	----	1.6m, Unshielded cable
Speaker	----	----	0.2m, Unshielded cable
Battery (12V dc)	CSB	GP1272 F2	0.4m, Unshielded power cable
CD Player	Panasonic	SL-S120	1.8m, Unshielded cable 1.8m, Unshielded power cable / Adaptor

Remark "*" means equipment under test.

Note: The CD player is connected with the EUT and applied the 1kHz signals at the max.

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

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

Figure 1 : Frequencies measured below 1 GHz configuration

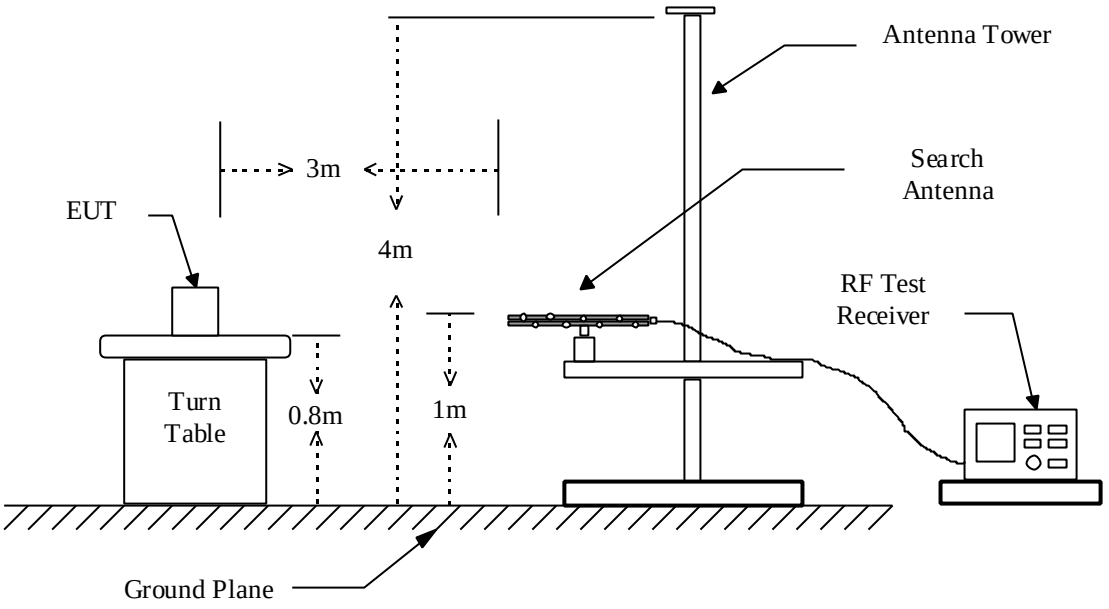
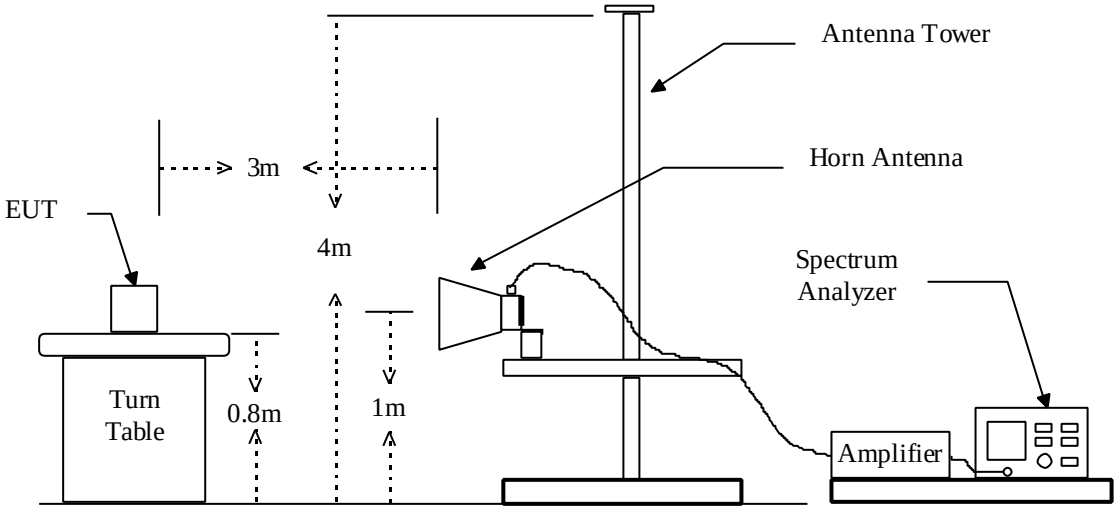


Figure 2 : Frequencies measured above 1 GHz configuration



4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement :

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

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

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10 Hz

4.4 Radiated Emission Data

4.4.1 RF Portion

a) Channel 0

Operation Mode : Receiving /Transmitting

Fundamental Frequency : 2402 MHz

Test Date : Jan. 10, 2003 Temperature : 15 ℃ Humidity : 75 %

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)
1201.390	46.5	35.7	47.5	38.4	-11.6	35.9	26.8	74.0	54.0	-27.2	240	1.0
3603.000	49.6	35.3	48.2	36.2	0.5	50.1	35.8	74.0	54.0	-18.2	55	1.5
4804.010	57.8	39.0	56.7	38.9	4.0	61.8	43.0	74.0	54.0	-11.0	225	1.5
7206.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
9608.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
12010.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14412.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
16814.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19216.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
21618.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24020.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark "---" means that the emissions level is too low to be measured.
3. Item "Margin" referred to Average limit while there is only peak result.
4. In order to get the worse data, X、Y、Z direction were adjusted during the data.
5. 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.

b) Channel 39

Operation Mode : Receiving / Transmitting

Fundamental Frequency : 2441 MHz

Test Date : Jan. 10, 2003 Temperature : 15 ℃ Humidity : 75 %

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)
1220.820	53.3	40.6	54.5	41.4	-11.6	42.9	29.8	74.0	54.0	-24.2	265	0
3661.600	51.6	37.8	51.3	37.5	0.7	52.3	38.5	74.0	54.0	-15.5	85	1.5
4881.930	56.0	37.3	51.7	36.4	4.2	60.2	41.5	74.0	54.0	-12.5	235	1.5
7323.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
9764.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
12205.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14646..000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
17087.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19528.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
21969.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24410.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark "---" means that the emissions level is too low to be measured.
3. Item "Margin" referred to Average limit while there is only peak result.
4. In order to get the worse data, X、Y、Z direction were adjusted during the data.
5. 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.

c) Channel 78

Operation Mode : Receiving / Transmitting

Fundamental Frequency : 2480 MHz

Test Date : Jan. 10, 2003 Temperature : 15 ℃ Humidity : 75 %

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)
1240.390	49.5	38.5	52.2	40.3	-11.4	40.8	28.9	74.0	54.0	-25.1	280	1.0
3720.000	49.2	36.3	47.1	34.7	0.8	50.1	37.1	74.0	54.0	-16.9	0	1.5
4960.030	50.8	37.5	48.5	36.1	4.3	55.1	41.8	74.0	54.0	-12.2	240	1.5
7440.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
9920.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
12400.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14880.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
17360.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19840.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
22320.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24800.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark "---" means that the emissions level is too low to be measured.
3. Item "Margin" referred to Average limit while there is only peak result.
4. In order to get the worse data, X、Y、Z direction were adjusted during the data.
5. 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.

4.4.2 Other Emission

a) Emission frequencies below 1 GHz

Test Date : Jan. 10, 2003 Temperature : 15 ℃ Humidity : 75 %

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)
41.226	H	8.6	11.1	19.7	40.0	-20.3	194	1.0
41.226	V	13.1	11.1	24.2	40.0	-15.8	215	1.0
71.789	H	19.0	9.2	28.2	43.5	-15.3	0	2.8
71.789	V	24.9	9.2	34.1	43.5	-9.4	360	1.0
128.000	H	15.5	10.6	26.1	43.5	-17.4	85	1.0
128.000	V	8.5	10.6	19.1	43.5	-24.4	0	1.0
172.065	H	14.8	11.6	26.4	43.5	-17.1	105	2.3
172.065	V	15.6	11.6	27.2	43.5	-16.3	285	1.0
368.700	H	13.5	19.0	32.5	46.0	-13.5	220	1.0
368.700	V	11.1	19.0	30.1	46.0	-15.9	182	1.0
393.310	H	12.5	20.6	33.1	46.0	-12.9	226	1.0
393.310	V	10.9	20.6	31.5	46.0	-14.5	360	1.0
417.926	H	13.0	20.6	33.6	46.0	-12.4	220	1.0
417.926	V	11.0	20.6	31.6	46.0	-14.4	35	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

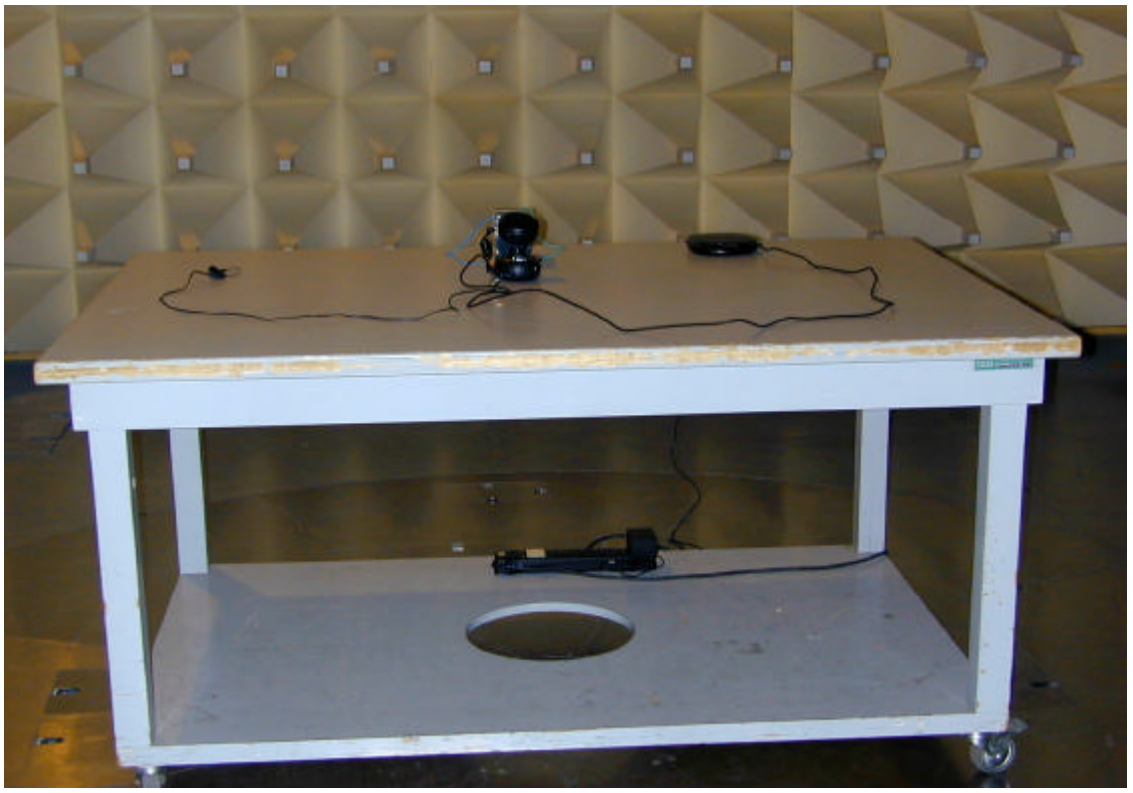
The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss (if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

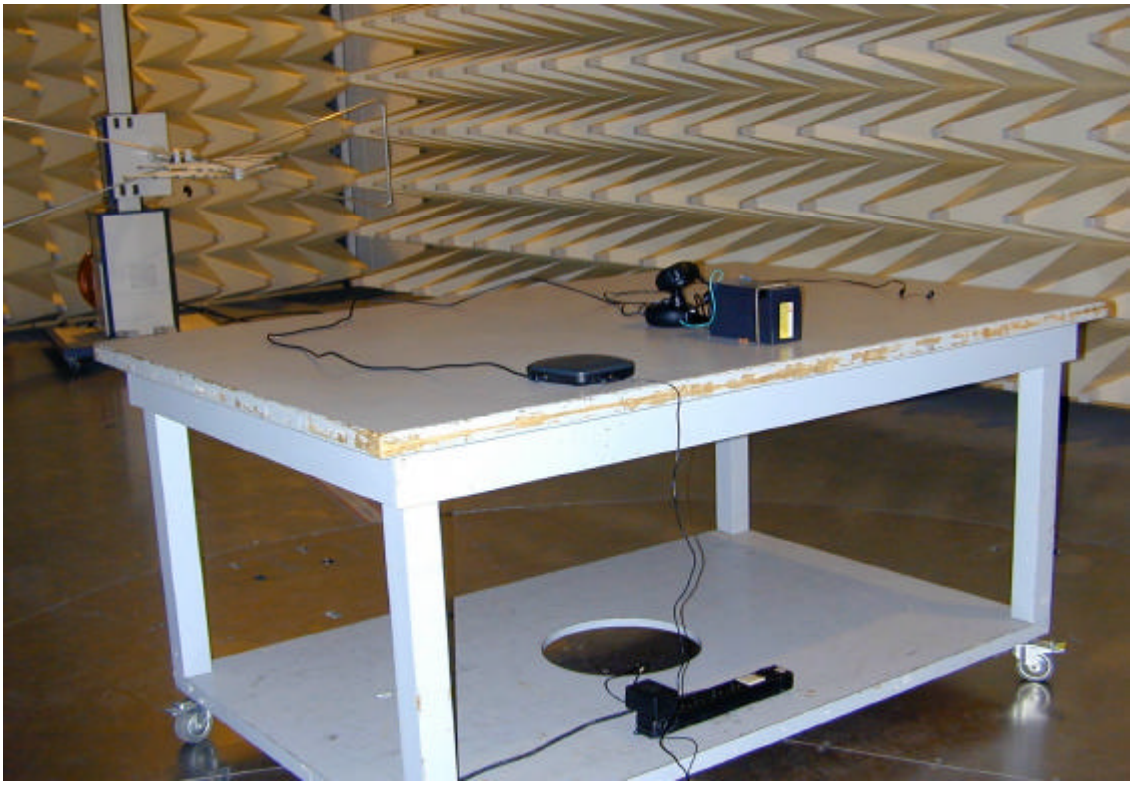
Result = Reading + Corrected Factor

where

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

4.6 Photos of Radiation Measuring Setup





5 20dB EMISSION BANDWIDTH MEASUREMENT

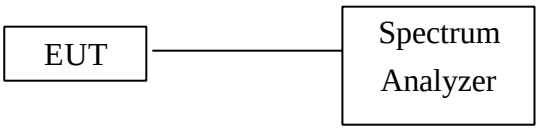
5.1 Standard Applicable

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.

5.2 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.



5.3 Measurement Equipment

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

5.4 Measurement Data

Test Date : Jan. 10, 2003 Temperature : 15 ℃ Humidity: 75%

a) Channel 0 : 20 dB Emission Bandwidth is 853 KHz
b) Channel 39 : 20 dB Emission Bandwidth is 853 KHz
c) Channel 78 : 20 dB Emission Bandwidth is 853 KHz

Note: Please see Appendix 1 for ploted datas

6 OUTPUT POWER MEASUREMENT

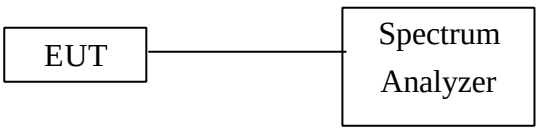
6.1 Standard Applicable

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

6.2 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.



6.3 Measurement Equipment

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

6.4 Measurement Data

Test Date : Jan. 10, 2003 Temperature : 15 ℃ Humidity: 75 %

a) Channel 0 : Output Peak Power is –0.5 dBm or **0.89** mW
b) Channel 39 : Output Peak Power is –0.85 dBm or **0.82** mW
c) Channel 78 : Output Peak Power is –1.48 dBm or **0.71** mW

Note: Please see Appendix 2 for ploted datas

7 100 kHz BANDWIDTH OF BAND EDGES MEASUREMENT

7.1 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.

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 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.

7.3 Measurement Equipment

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

7.4 Measurement Data

Test Date : Jan. 10, 2003 Temperature : 15 ℃ Humidity: 75%

a) Lower Band Edge : maximum value is –35.67 dBm that is attenuated more than 20dB
b) Upper Band Edge : maximum value is –34.83 dBm that is attenuated more than 20dB

Note: Please see Appendix 3 for ploted datas

8 RADIATED MEASUREMENT AT BANDEDGE WITH FUNDAMENTAL FREQUENCIES

8.1 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).

8.2 Measurement Procedure

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

8.3 Measuring Instrument

The following instrument are used for radiated emissions measurement :

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

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

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

8.4 Radiated Emission Data

a) Channel 0

Operation Mode : Receiving /Transmitting

Fundamental Frequency : 2402 MHz

Test Date : Jan. 10, 2003 Temperature : 15 ℃ Humidity : 75 %

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	40.5	---	39.5	---	-4.0	36.5	---	74.0	54.0	-37.5	127	1.0
2483.500	46.9	---	46.3	---	-3.3	43.6	---	74.0	54.0	-30.4	248	1.5

b) Channel 39

Operation Mode : Receiving / Transmitting

Fundamental Frequency : 2441MHz

Test Date : Jan. 10, 2003 Temperature : 15 ℃ Humidity : 75 %

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	41.0	---	40.6	---	-4.0	37.0	---	74.0	54.0	-37.0	103	1.0
2483.500	46.7	---	48.8	---	-3.3	45.5	---	74.0	54.0	-28.5	225	1.3

c) Channel 78

Operation Mode : Receiving / Transmitting

Fundamental Frequency : 2462 MHz

Test Date : Jan. 10, 2003 Temperature : 15 ℃ Humidity : 75 %

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	42.7	---	39.5	---	-4.0	38.7	---	74.0	54.0	-35.3	123	1.0
2483.500	53.0	---	51.1	---	-3.3	49.7	---	74.0	54.0	-24.3	255	1.5

9 RF Exposure Evaluation

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency radiation as specified in 1.1307(b) LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density(mW/cm^2)	Average Time (Minutes)
(A) Limits for Occupational/control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/Uncontrolled Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	1	30

F=Frequency in MHz

9.1 Friis Formula

Friis transmission formula: $Pd=(Pout*G)/(4*pi*r^2)$

Where
Pd=power density in mW/cm^2
Pout=output power to antenna in mW
G=gain of antenna in linear scale
Pi=3.1416
R=distance between observation point and center of the radiator in cm

Pd id the limit of MPE, 1 mW/cm^2. If we know the maximum gain of the antenna and the total power input to the antenn, through the calculation, we will know the distance where the MPE limit is reached.

9.2 EUT Operation condition

A software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

9.3 Test Result of RF Exposure Evaluation

Test Date : Jan. 10, 2003 Temperature : 18℃ Humidity: 79 %

Product: Bluetooh Hands free Car Kit
Test Item: RF Exposure Evaluation Data
Test site: No. 2 chamber
Test Mode: Normal Operation

9.3.1 Antenna Gain

Antenna Gain: The maximum Gain is 1.6dBi.

9.3.2 Output Power Into Antenna & RF Exposure Evaluation Distance

Channel	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Minimum allowable Distance ®From Skin(cm)
01	2402	-0.50	0.32
40	2441	-0.85	0.31
79	2480	-1.48	0.29

The distance r (4th column) calculated from the Friis transmission formula is far shorter than 20 cm separation requirement. So, RF exposure limit warning or SAR test are not required.

10 Power Density

10.1 Standard Applicable

For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be grater then 8 dbm in any 3 kHz band during any time interval of continuous transmission.

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 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 3 kHz and VBW to 3 kHz.
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.

10.3 Measurement Equipment

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

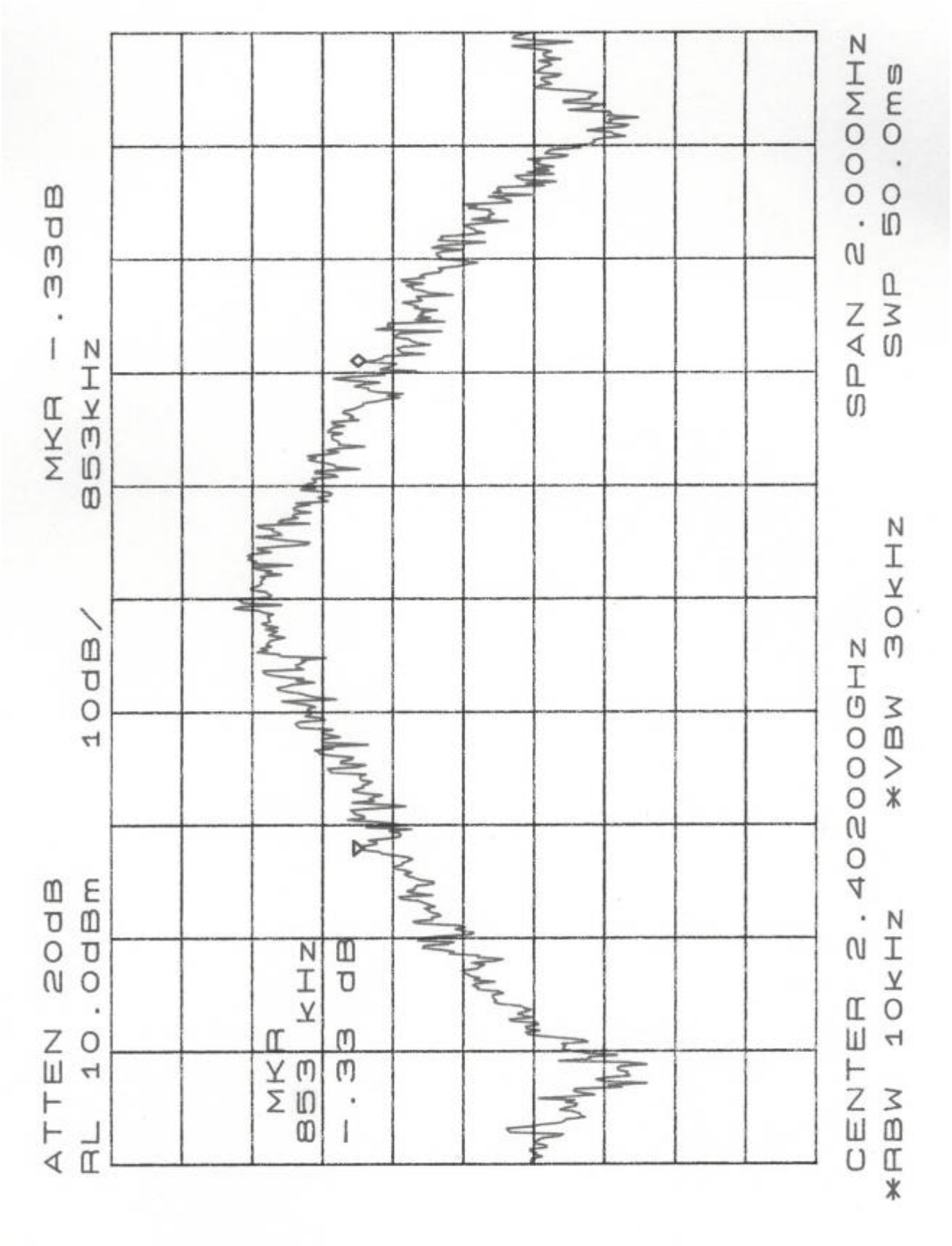
10.4 Measurement Data

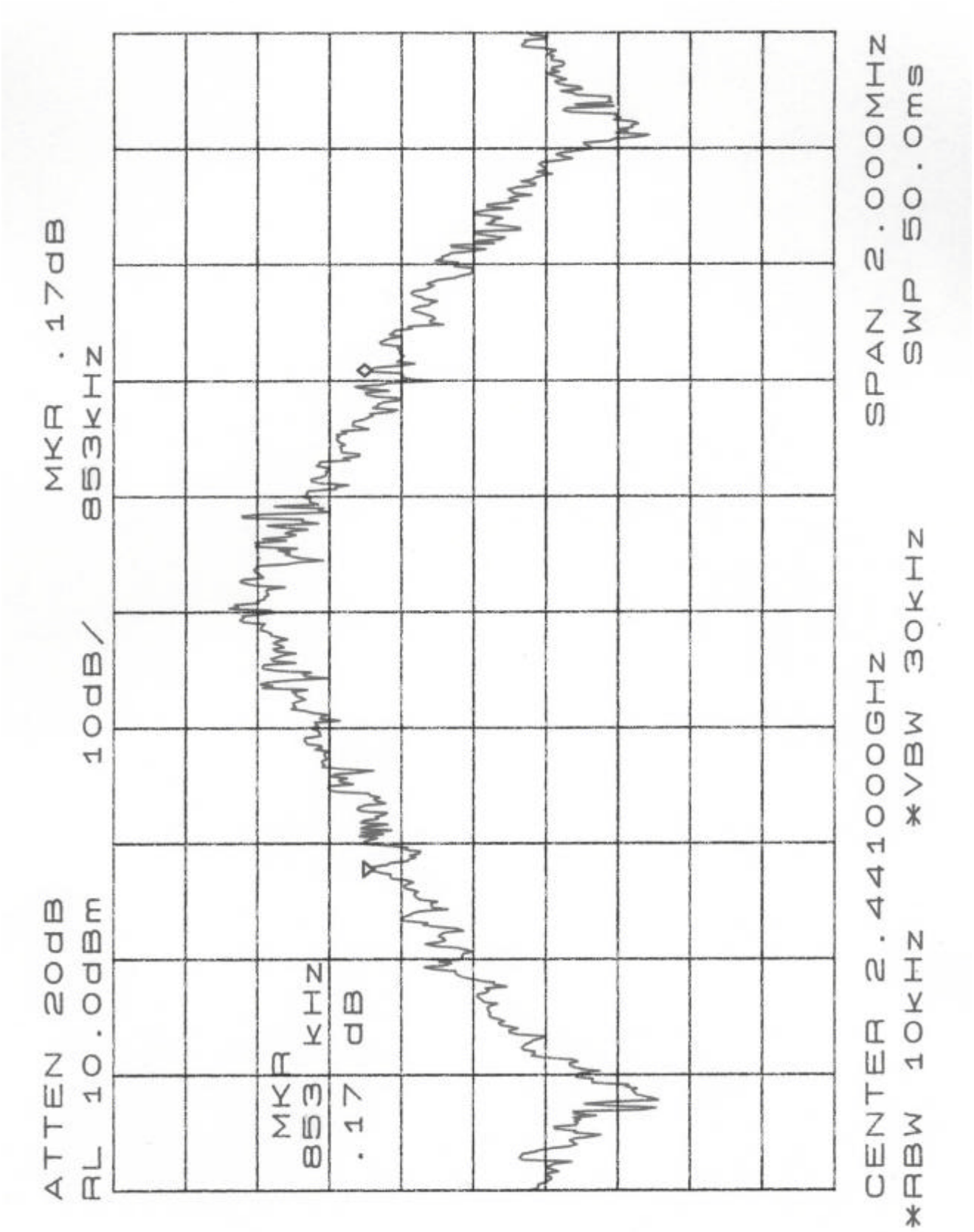
Test Date : Jan. 10, 2003 Temperature : 15 ℃ Humidity: 75 %

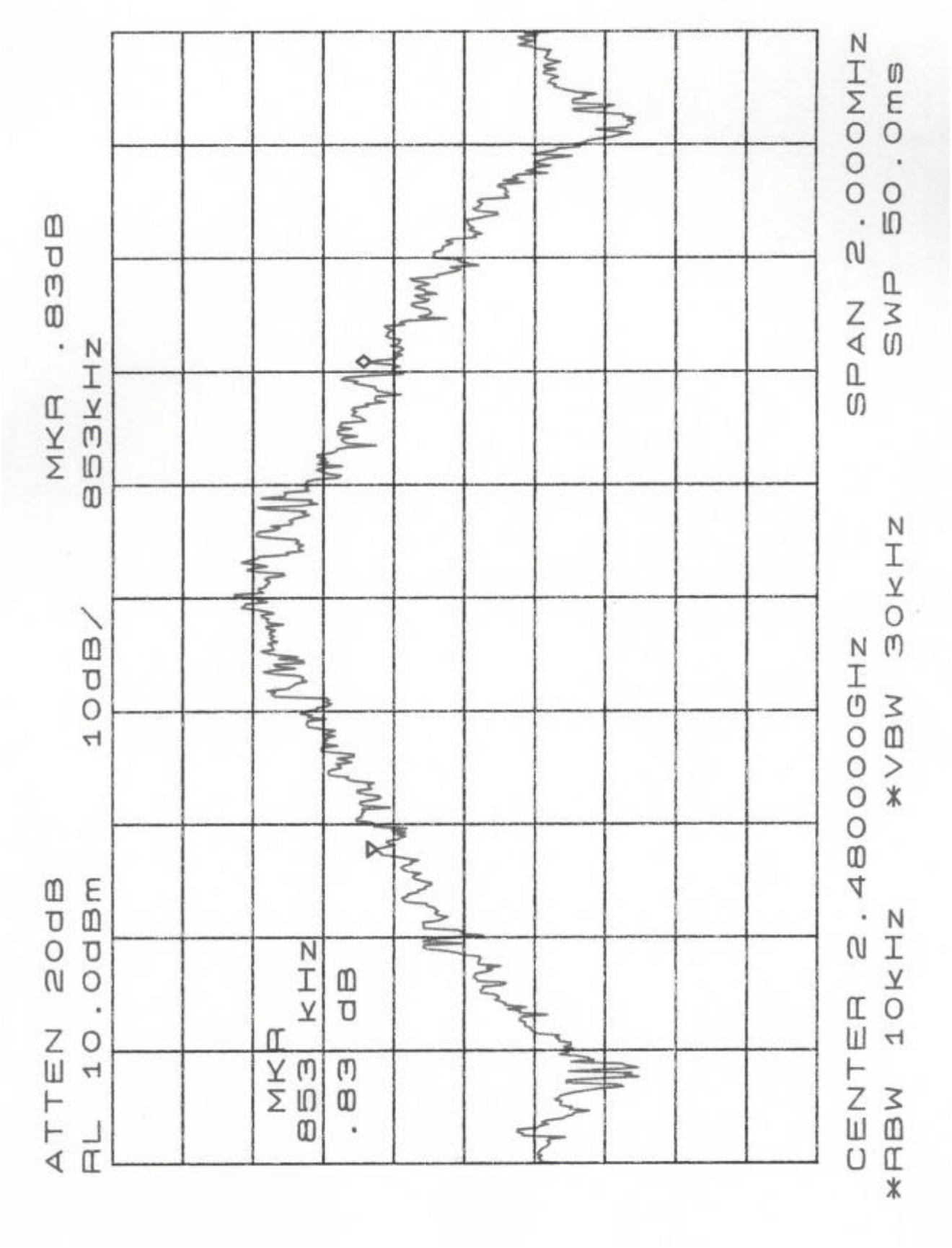
a) Channel 0 : Power Density is –15.50 dBm/3kHz.
b) Channel 39 : Power Density is –15.67 dBm/3kHz.
c) Channel 78 : Power Density is –16.17 dBm/3kHz.

Note: Please see Appendix 4 for ploted datas

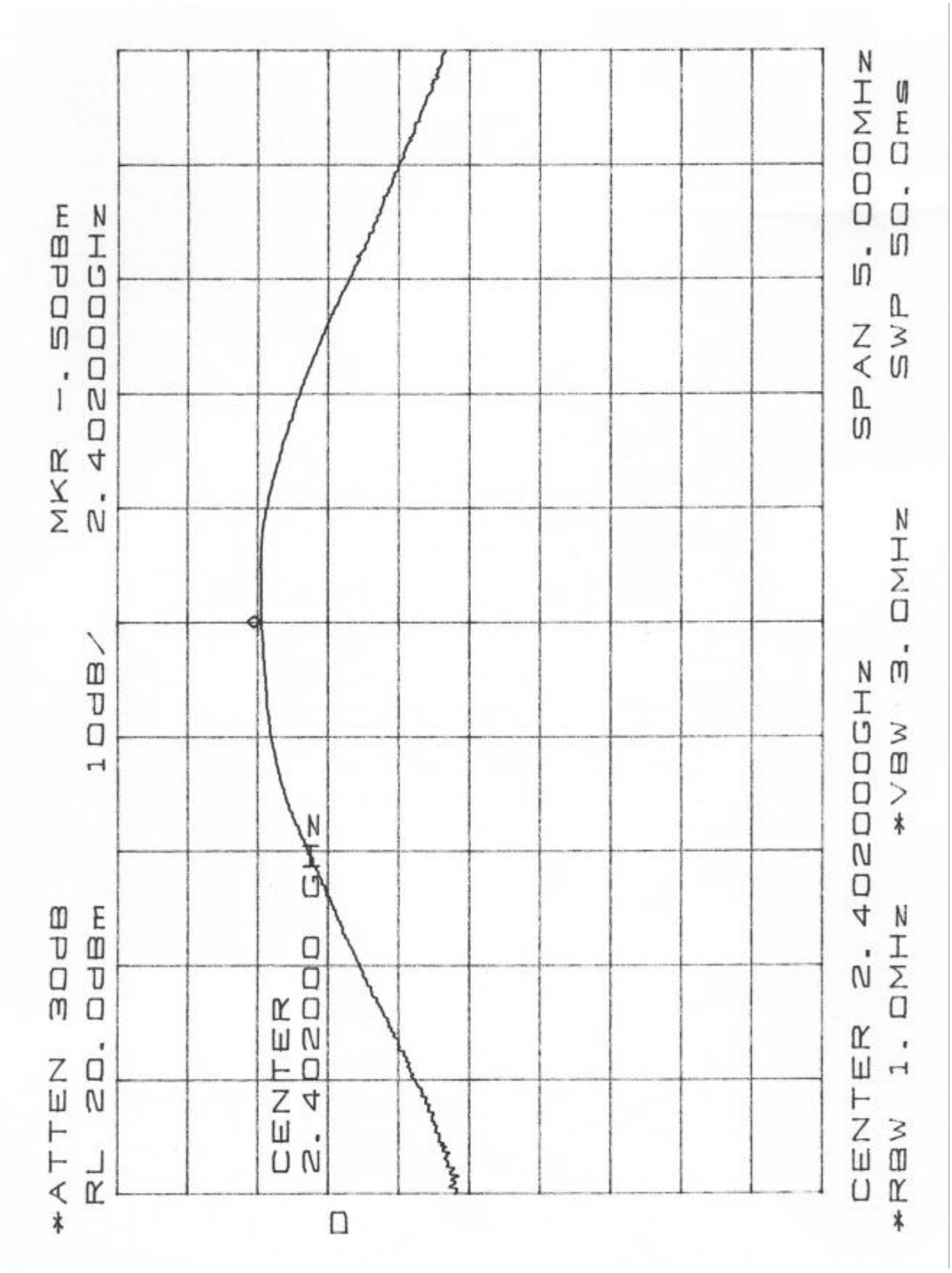
Appendix 1 : Ploted Datas of 20dB Bandwidth

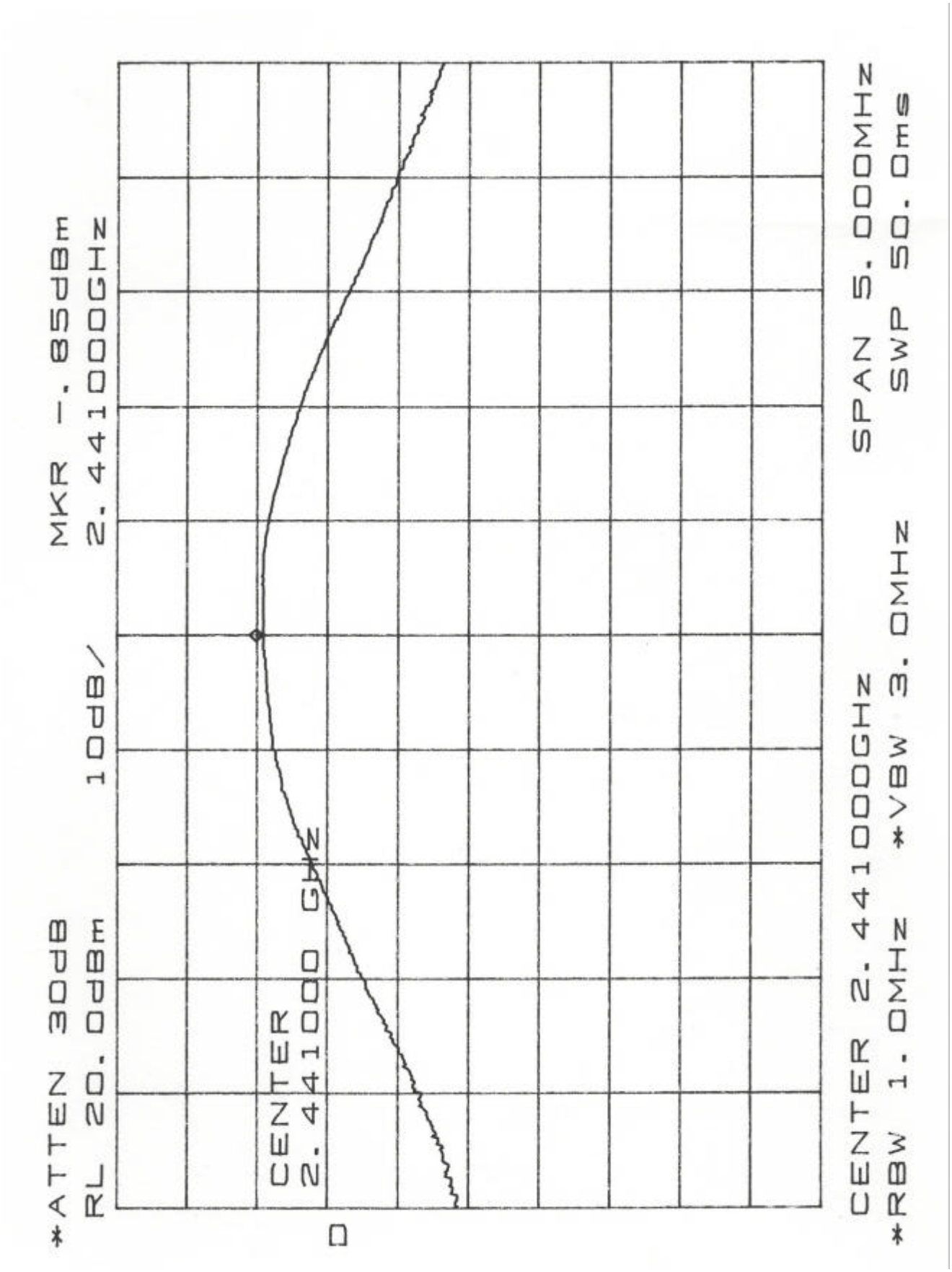

ATTEN 20dB
RL 10.0dBm
10dB/
MKR -.33dB
853kHz
MKR
853 kHz
-.33 dB
CENTER 2.402000GHz
SPAN 2.000MHz
*RBW 10kHz
*VBW 30kHz
SWP 50.0ms

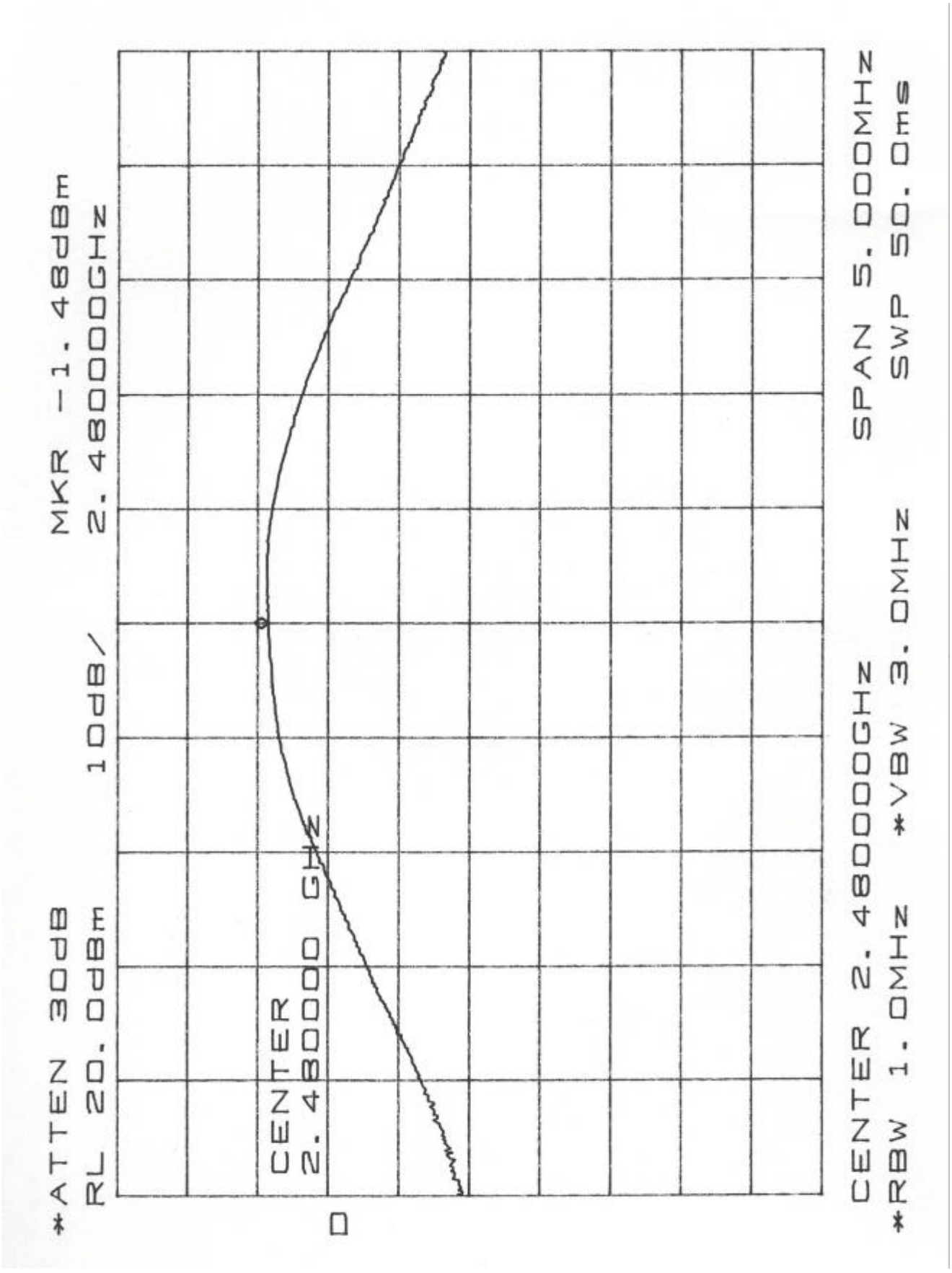

ATTEN 20dB
RL 10.0dBm
10dB/
MKR .17dB
853kHz
MKR
853 kHz
.17 dB
CENTER 2.441000GHz
SPAN 2.000MHz
*RBW 10kHz
*VBW 30kHz
SWP 50.0ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR .83dB
853KHz
MKR
853 kHz
.83 dB
CENTER 2.480000GHz
*RBW 10kHz
*VBW 30kHz
SPAN 2.000MHz
SWP 50.0ms

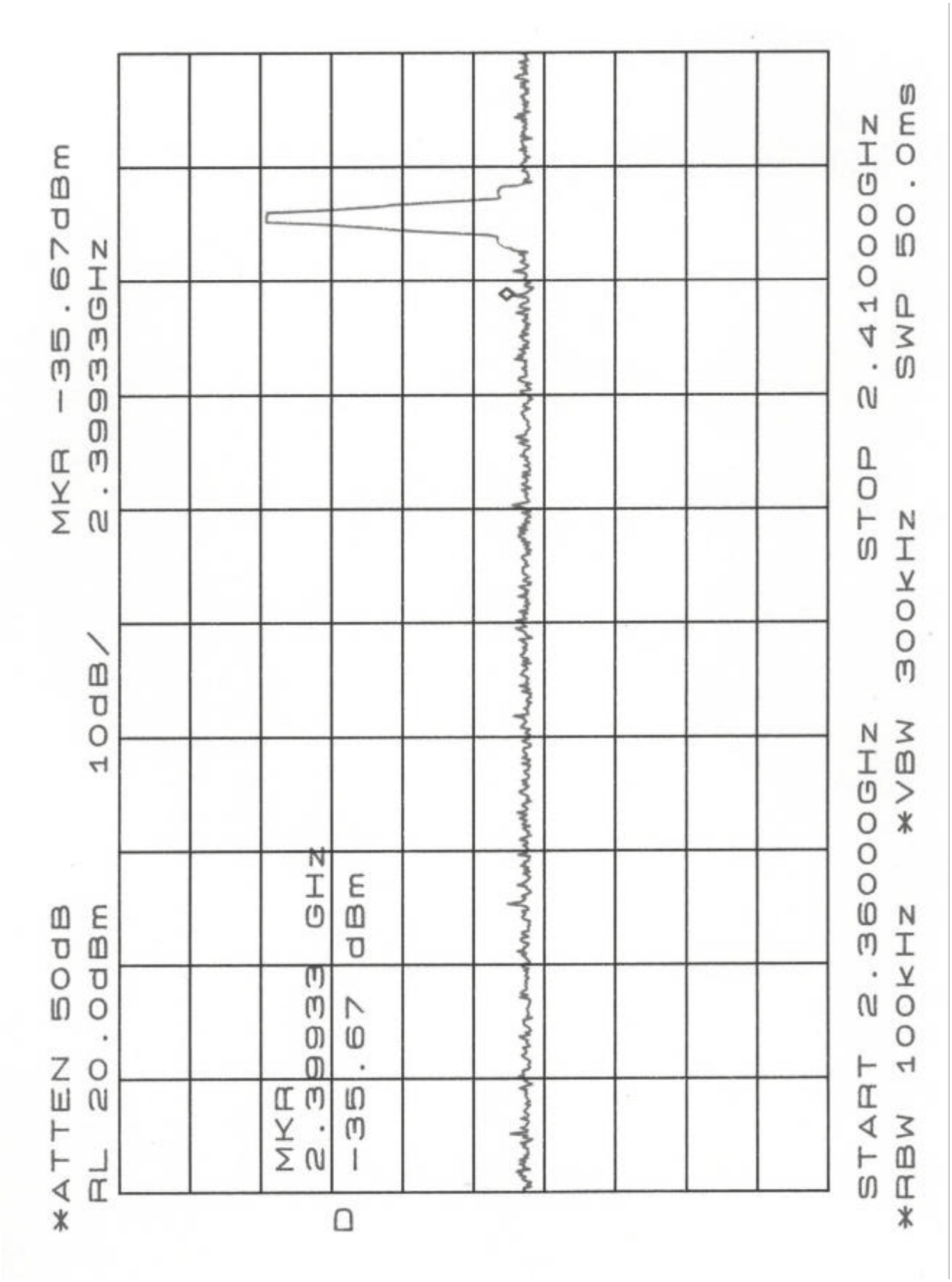
Appendix 2 : Ploted Datas of Output Peak Power

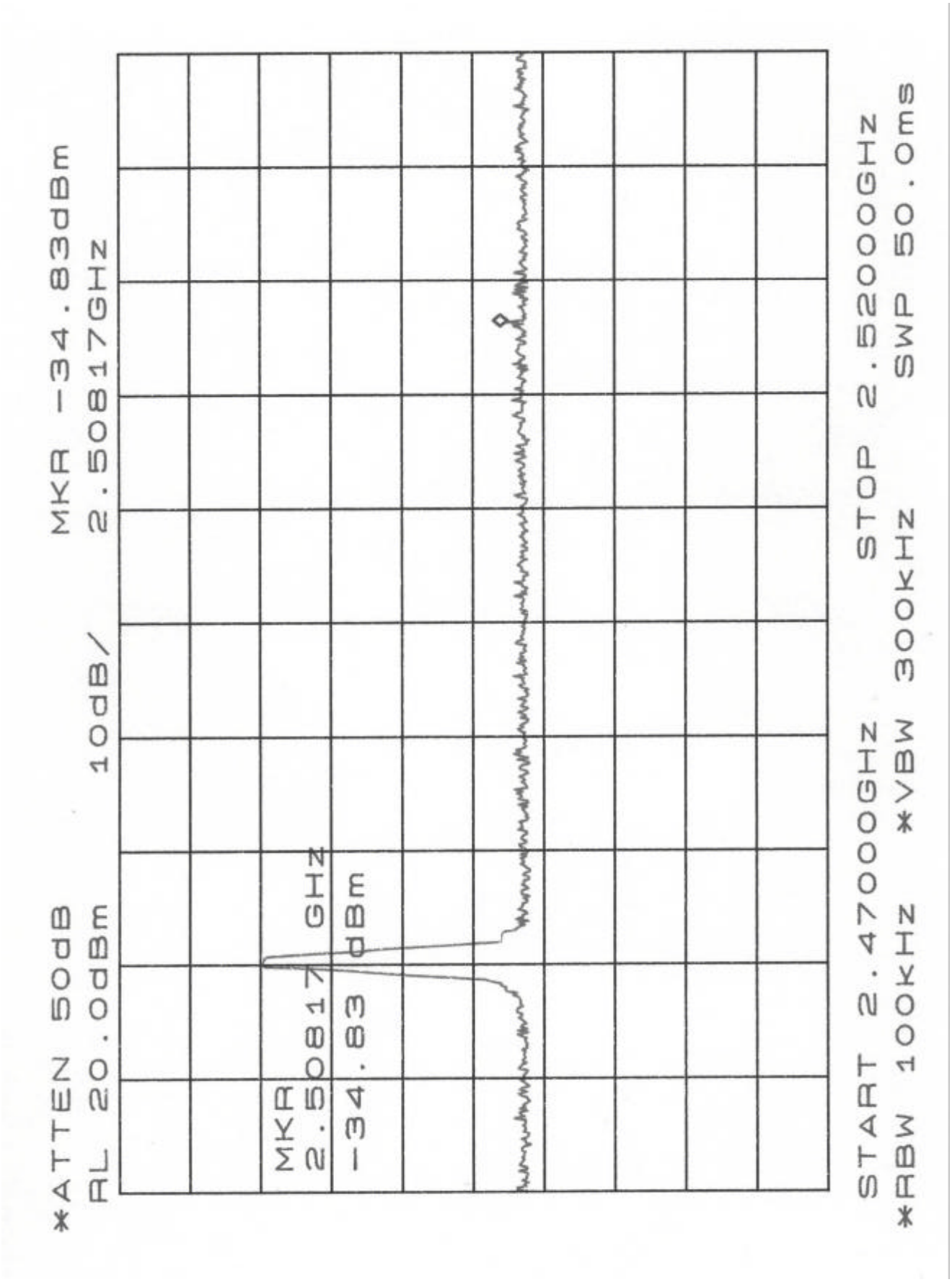

*ATTEN 30dB
RL 20.0dBm
10dB/
MKR -.50dBm
2.402000GHz
CENTER
2.402000 GHz
CENTER 2.402000GHz
*RBW 1.0MHz
*VBW 3.0MHz
SPAN 5.000MHz
SWP 50.0ms


*ATTEN 30dB
RL 20.0dBm
10dB/
MKR -.85dBm
2.441000GHz
CENTER
2.441000 GHz
CENTER 2.441000GHz
*RBW 1.0MHz
*VBW 3.0MHz
SPAN 5.000MHz
SWP 50.0ms

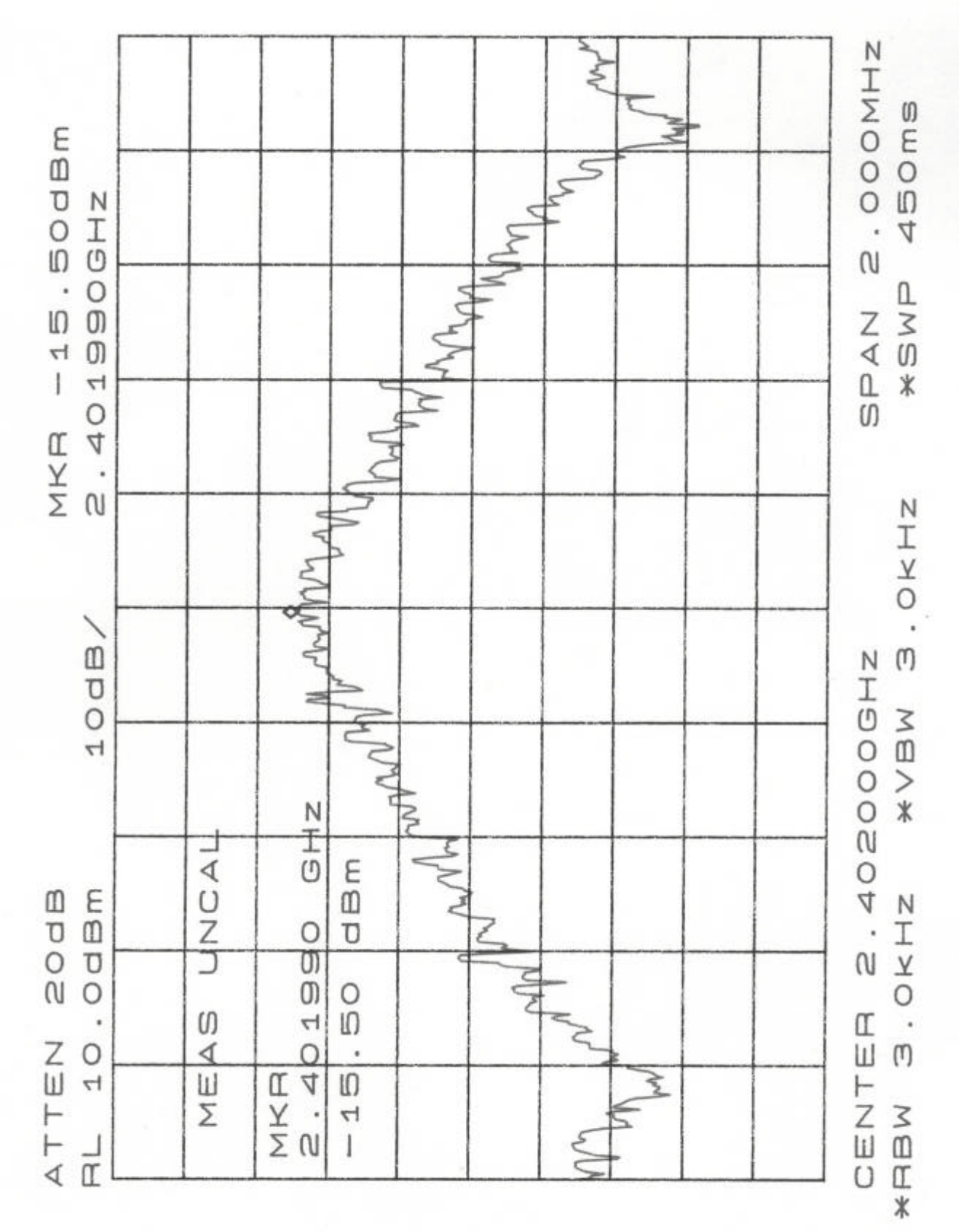

*ATTEN 30dB
RL 20.0dBm
10dB/
MKR -1.48dBm
2.480000GHz
CENTER
2.480000 GHz
SPAN 5.000MHz
SWP 50.0ms
CENTER 2.480000GHz
*RBW 1.0MHz
*VBW 3.0MHz

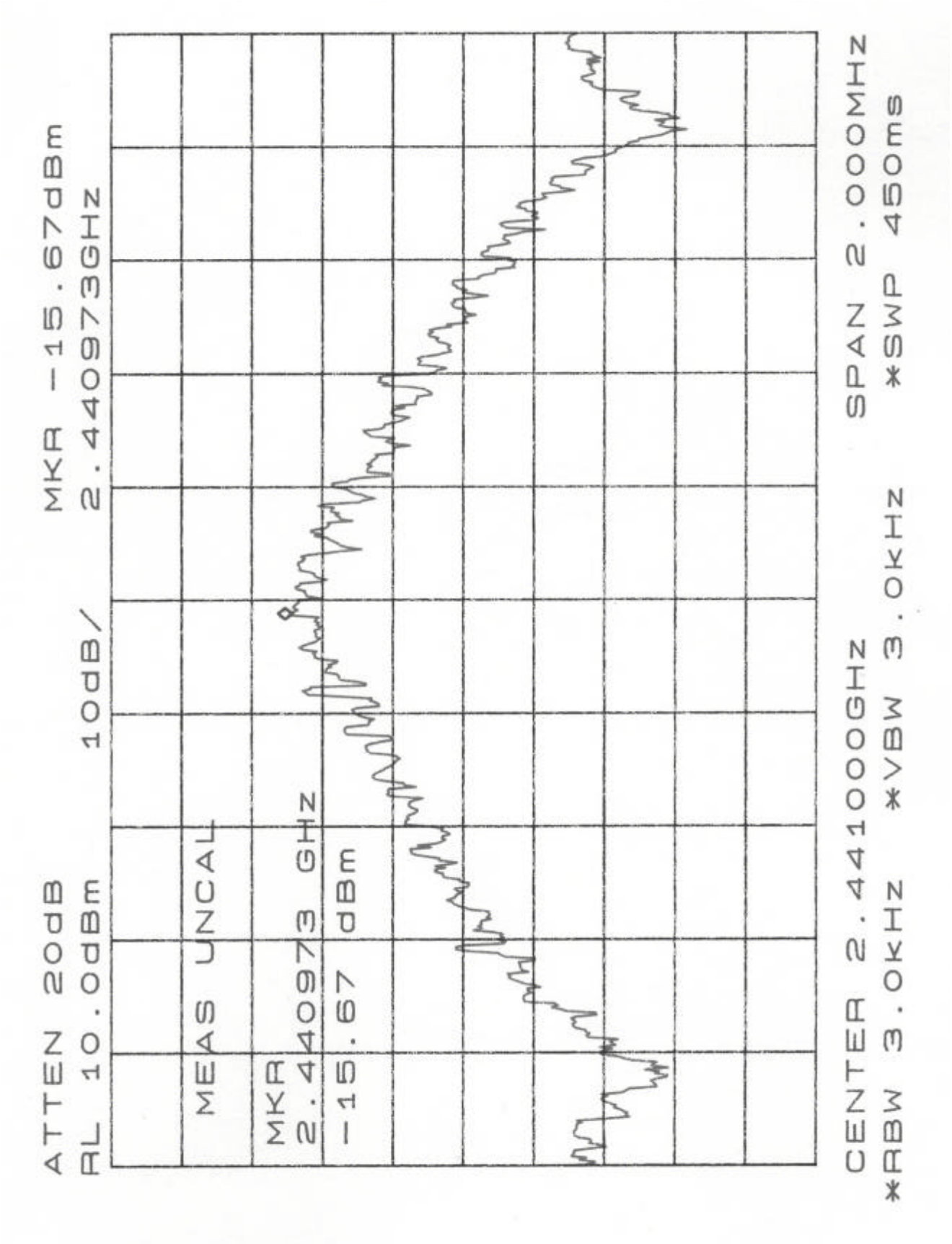
Appendix 3 : Ploted Datas of Band Edge Emission

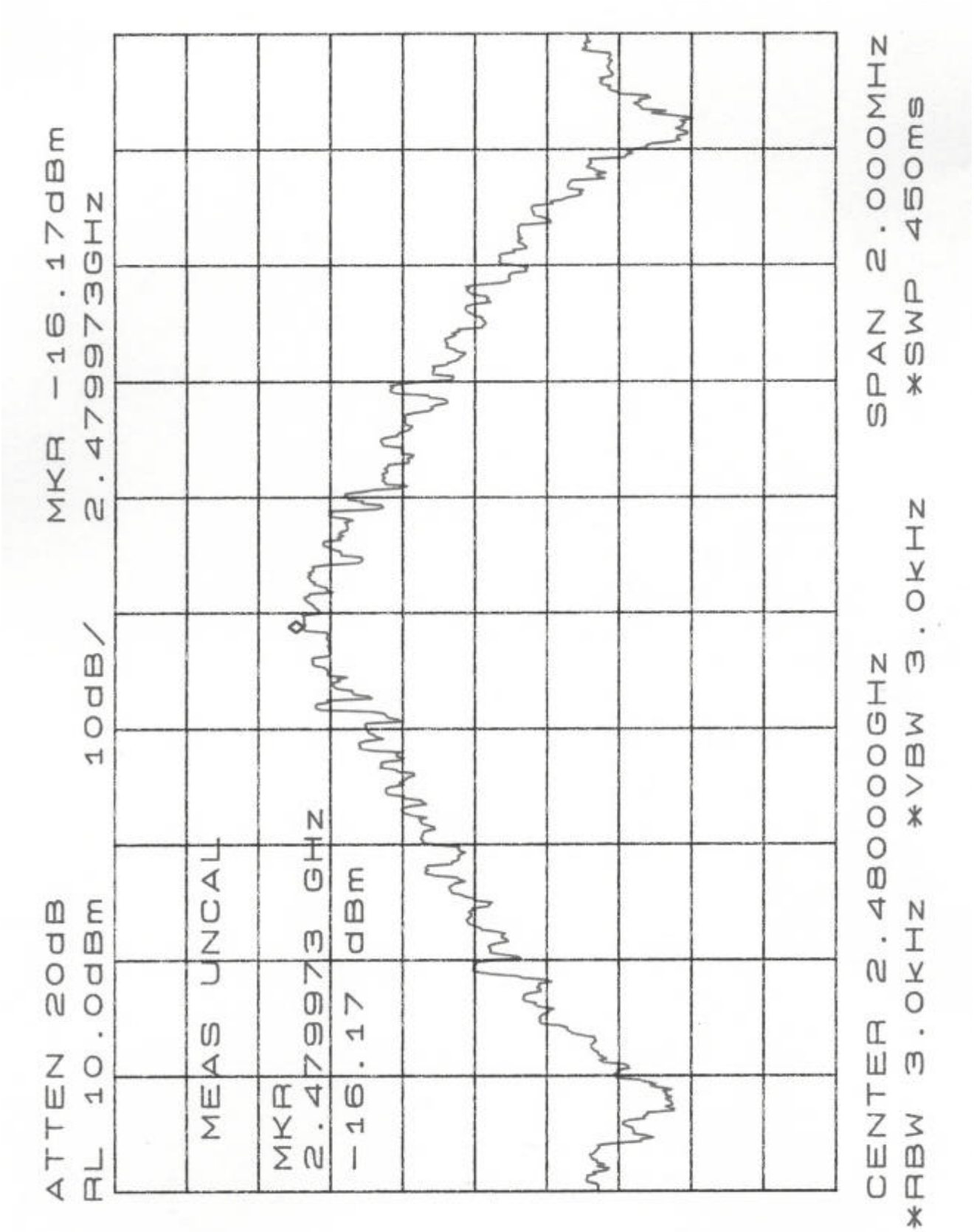

*ATTEN 50dB
RL 20.0dBm
10dB/
MKR -35.67dBm
2.39933GHz
MKR
2.39933 GHz
-35.67 dBm
D
START 2.36000GHz
*RBW 100KHz
*VBW 300KHz
STOP 2.41000GHz
SWP 50.0ms


*ATTEN 50dB
RL 20.0dBm
10dB/
MKR -34.83dBm
2.50817GHz
MKR
2.50817 GHz
-34.83 dBm
START 2.47000GHz
*RBW 100KHz
STOP 2.52000GHz
*VBW 300KHz
SWP 50.0ms

Appendix 4 : Ploted Datas of Power Density


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -15.50dBm
2.401990GHz
MEAS UNCAL
MKR
2.401990 GHz
-15.50 dBm
CENTER 2.402000GHz
SPAN 2.000MHz
*RBW 3.0KHz
*VBW 3.0KHz
*SWP 450ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -15.67dBm
2.440973GHz
MEAS UNCAL
MKR
2.440973 GHz
-15.67 dBm
CENTER 2.441000GHz
SPAN 2.000MHz
*RBW 3.0KHz
*VBW 3.0KHz
*SWP 450ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR -16.17dBm
2.479973GHz
MEAS UNCAL
MKR
2.479973 GHz
-16.17 dBm
CENTER 2.480000GHz
SPAN 2.000MHz
*RBW 3.0KHz
*VBW 3.0KHz
*SWP 450ms