FCC Part 15
EMI TEST REPORT

of

E.U.T. : WL PCI

MODEL : NW630

FCC ID. : IOU0630S01

for

APPLICANT : NATIONAL DATACOMM CORPORATION

ADDRESS : 2F, NO. 28, INDUSTRY EAST 9TH ROAD, SCIENCE PARK, HSIN-CHU, 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)3280026-32
Fax:(03)3280034

Report Number : ET88R-04-044-01

TEST REPORT CERTIFICATION

Applicant	: NATIONAL DATACOMM CORPORATION 2F, NO. 28, INDUSTRY EAST 9TH ROAD, SCIENCE PARK, HSIN-CHU, TAIWAN, R.O.C.
Manufacturer	: NATIONAL DATACOMM CORPORATION 2F, NO. 28, INDUSTRY EAST 9TH ROAD, SCIENCE PARK, HSIN-CHU, TAIWAN, R.O.C.
Description of EUT	:
a) Type of EUT	: WL PCI
b) Trade Name	: NDC
c) Model No.	: NW630
d) Power Supply	: From PC
Regulation Applied	: FCC Rules and Regulations Part 15 Subpart B & C (1997)

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 relates only to the item tested.
2. The testing report shall not be reproduced expect in full, without the written approval of ETC.

Issued Date : APR. 23, 1999

Test Engineer : Chin Cheng Yeh
(Chin Cheng Yeh)

Approve & Authorized Signer : Will Yauo
Will Yauo, Supervisor
EMI Test Site of ELECTRONICS
TESTING CENTER, TAIWAN

Table of Contents

Page

1 GENERAL INFORMATION

1.1 Product Description

a) Type of EUT : WL PCI
b) Trade Name : NDC
c) Model No. : NW630
d) Power Supply : From PC

1.2 Characteristics of Device

The WL PCI designed with a transmitting method of frquency hopping spread spectrum is for local area network operation, which operates at 2.4 GHz ISM band and data rate up to 2Mbps. The on-air protocol and radio characteristic conform to the IEEE 802.11 stabdard (frequency hopping). It nominal rated output power is 20 dBm.

1.3 Test Methodology

For WL PCI, both conducted and radiated emissions were performed according to the procedures illustrated in ANSI C63.4(1992) and for processing gain measurement is according to FCC Public Notice. Other required measurements were illustrated in separate sections of this test report for details.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at No.34, Lin 5, Ding Fu Tsun, Linkou Hsiang, Taipei Hsien, Taiwan, R.O.C.
This site has been fully described in a report submitted to your office, and accepted in a letter dated Feb. 10 , 1997.

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 μV	Emissions dBμV
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 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) Hopping Channel Separation

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

(5) Number of Hopping frequencies used

According to 15.247(a)(1)(ii), for frequency hopping system operating in the 2400-2483.5 MHz and 5725-5850 MHz bands shall use at least 75 hopping frequencies.

(6) Hopping Channel Bandwidth

According to 15.247(a)(1)(ii), for frequency hopping system operating in the 2400-2483.5 MHz and 5725-5850 MHz bands, the maximum 20 dB bandwidth of the hopping channel is 1MHz.

(7) Dwell Time of each frequency within a 30-second period

According to 15.247(a)(1)(ii), for frequency hopping system operating in the 2400-2483.5 MHz and 5725-5850 MHz bands, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 30-second period.

(8) 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.

(9) 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.

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	3360-4400	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 below 1 GHz, the system was configured for testing in a typical fashion as a customer would normally use it. The peripherals other than EUT were connected in normally standing by situation. Measurement was performed under the condition that a computer program was exercised to simulate data communication of EUT, and the transmission rate was set to maximum allowed by EUT. Three highest emissions were verified with varying placement of the transmitting antenna connected to EUT to maximize the emission from EUT.

For conducted emissions, only measured on TX and RX operation, for the digital circuits portion also function normally whenever TX or RX is operated. For radiated emissions, whichever RF channel is operated, the digital circuits' function identically. As the reason, measurement of radiated emissions from digital circuits is only performed with channel 11 by transmitting mode.

3.2 Devices for Tested System

Device	Manufacture	Model / FCC ID.	Cable Description
WL PCI *	NATIONAL DATACOMM CORPORATION	NW630 IOU0630S01	1.0m Shielded Cable
PC	Hewlett-Packard	VECTRA VE SERIES 2 HCJVECTRAVL5	1.8m AC Power Cord
Monitor	NEC	JC-1743UMA A3DJC-1743UMA	1.5m Shielded Cable 1.8m AC Power Cord

Remark "*" means equipment under test.

Devices for tested system, continued

Device	Manufacture	Model / FCC ID.	Description
Printer	Hewlett-Packard	2225C+ DSI6XU2225	1.2m Shielded Cable Adapter cord 1.9m
Modem	Team Technology	1200AT EF56A5 1200AT	Shielded cable 1.5m Adapter cord 1.9m
PS2 Mouse	Hewlett-Packard	M-S34 DZL211029	Shielded cable 1.8m

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 5 and 6 for frequencies measured below and above 1 GHz respectively.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also 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 placement of cables associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration

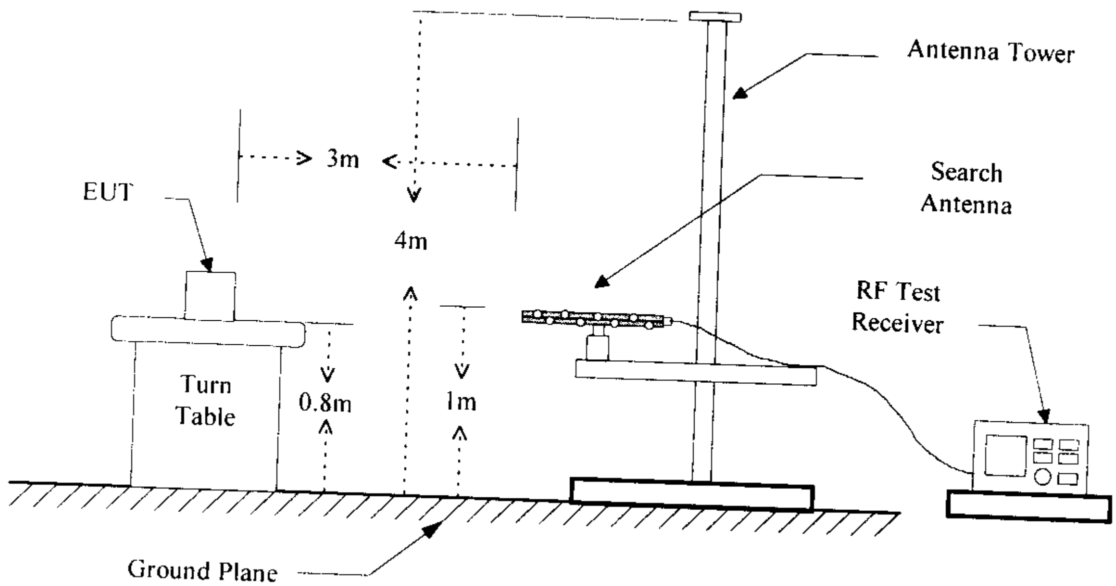
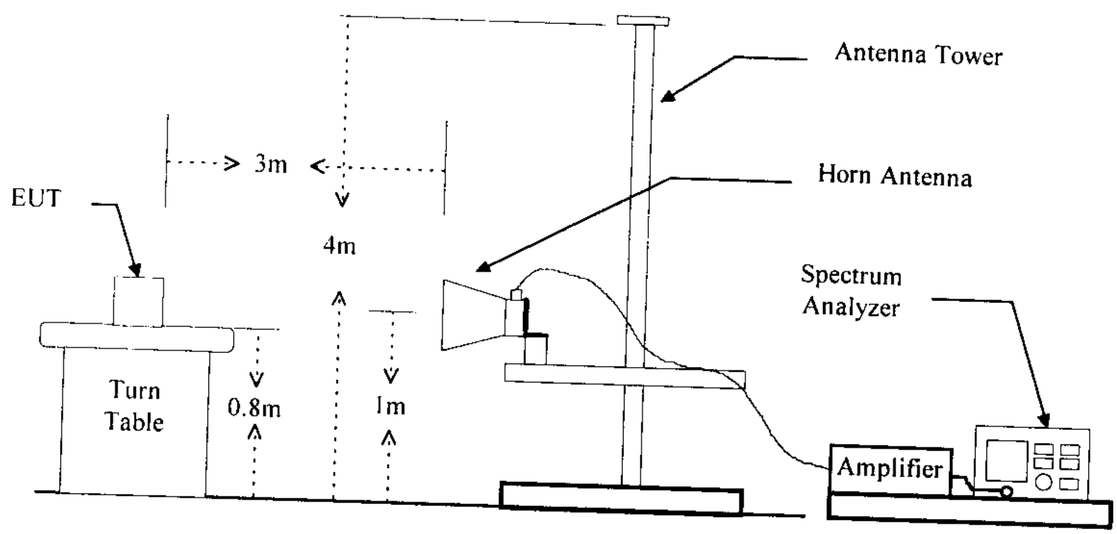


Figure 2 : Frequencies measured above 1 GHz configuration



4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement :

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Hewlett-Packard	8568B	12/02/1999
Pre-selector	Hewlett-Packard	85685A	12/07/1999
Quasi Peak Detector	Hewlett-Packard	85650A	12/02/1999
Spectrum Analyzer	Adventest	R3271	08/24/1999
RF Test Receiver	Rohde & Schwarz	ESVS 30	01/10/2000
Horn Antenna	EMCO	3115	08/22/1999
Horn Antenna	EMCO	3116	05/07/1999
Log periodic Antenna	EMCO	3146	09/15/1999
Biconical Antenna	EMCO	3110	09/15/1999
Preamplifier	Hewlett-Packard	8449B	06/17/1999
Preamplifier	Hewlett-Packard	8447D	11/30/1999

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

Operation Mode : Transmitting

Fundamental Frequency : 2402 MHz

Test Date : APR. 15, 1999 Temperature : 25 ℃ Humidity : 65%

Frequency (MHz)	Reading (dBuV) @3m H Peak	H Ave	V Peak	V Ave	Factor (dB) Corr.	Result @3m (dBuV/m) Peak	Result Ave	Limit @3m (dBuV/m) Peak	Limit Ave.	Margin (dB)
*1962.030	50.1	---	51.0	---	-4.8	46.2	---	74.0	54.0	-7.8
*3924.220	---	---	---	---	1.7	---	---	74.0	54.0	---
*5886.035	---	---	---	---	4.5	---	---	74.0	54.0	---
*7848.062	---	---	---	---	6.3	---	---	74.0	54.0	---
*4804.050	39.3	---	39.8	---	2.5	42.3	---	74.0	54.0	-11.7
*7206.420	42.0	---	43.6	---	5.7	47.7	---	74.0	54.0	-6.3
*9608.700	41.2	---	40.8	---	7.2	48.4	---	74.0	54.0	-5.6
12010.066	---	---	---	---	9.2	---	---	74.0	54.0	---
14412.000	---	---	---	---	11.5	---	---	74.0	54.0	---
16814.000	---	---	---	---	11.8	---	---	74.0	54.0	---
19216.000	---	---	---	---	8.9	---	---	74.0	54.0	---
21618.000	---	---	---	---	9.7	---	---	74.0	54.0	---
24020.000	---	---	---	---	10.3	---	---	74.0	54.0	---

Note :

1. Remark "*" means that the emission frequency is produced from local oscillator.
2. Remark "---" means that the emission level is too low to be measured (a pre-amplifier of about 35 dB is used).
3. Margins are derived from Peak or Average whichever is lower. If there is only peak value in Result field, the Margin is also referred to average limits.

Operation Mode : Transmitting

Fundamental Frequency : 2442 MHz

Test Date : APR. 15, 1999 Temperature : 25 ℃ Humidity : 65%

Frequency (MHz)	Reading (dBuV) @3m H Peak	H Ave	V Peak	V Ave	Factor (dB) Corr.	Result @3m (dBuV/m) Peak	Result Ave	Limit @3m (dBuV/m) Peak	Limit Ave.	Margin (dB)
*2002.000	50.2	---	51.6	---	-4.6	47.0	---	74.0	54.0	-7.0
*4004.000	---	---	---	---	2.0	---	---	74.0	54.0	---
*6006.000	---	---	---	---	4.5	---	---	74.0	54.0	---
*8008.000	---	---	---	---	6.4	---	---	74.0	54.0	---
*10010.000	---	---	---	---	7.4	---	---	74.0	54.0	---
4884.000	40.7	---	41.1	---	2.7	43.8	---	74.0	54.0	-10.2
7326.000	42.4	---	41.9	---	5.9	48.3	---	74.0	54.0	-5.7
9768.000	40.2	---	40.2	---	7.3	47.5	---	74.0	54.0	-6.5
12210.000	---	---	---	---	9.3	---	---	74.0	54.0	---
14652.000	---	---	---	---	11.6	---	---	74.0	54.0	---
17094.000	---	---	---	---	13.4	---	---	74.0	54.0	---
19536.000	---	---	---	---	8.5	---	---	74.0	54.0	---
21978.000	---	---	---	---	9.9	---	---	74.0	54.0	---
24420.000	---	---	---	---	10.7	---	---	74.0	54.0	---

Note :

1. Remark "*" means that the emission frequency is produced from local oscillator.
2. Remark "---" means that the emission level is too low to be measured (a pre-amplifier of about 35 dB is used).
3. Margins are derived from Peak or Average whichever is lower. If there is only peak value in Result field, the Margin is also referred to average limits.

Operation Mode : Transmitting

Fundamental Frequency : 2480 MHz

Test Date : APR. 15, 1999 Temperature : 25 ℃ Humidity : 65%

Frequency (MHz)	Reading (dBuV) @3m H Peak	H Ave	V Peak	V Ave	Factor (dB) Corr.	Result @3m (dBuV/m) Peak	Ave	Limit @3m (dBuV/m) Peak	Ave.	Margin (dB)
*2040.000	49.9	---	50.8	---	-4.4	46.4	---	74.0	54.0	-7.6
*4080.000	---	---	---	---	2.0	---	---	74.0	54.0	---
*6120.000	---	---	---	---	4.5	---	---	74.0	54.0	---
*8160.000	---	---	---	---	6.5	---	---	74.0	54.0	---
*10200.000	---	---	---	---	7.6	---	---	74.0	54.0	---
4960.012	40.6	---	40.5	---	2.8	43.4	---	74.0	54.0	-10.6
7440.220	42.9	---	40.6	---	6.1	49.0	---	74.0	54.0	-5.0
9920.032	43.9	---	44.8	---	7.4	52.1	---	74.0	54.0	-1.9
12400.042	---	---	---	---	9.4	---	---	74.0	54.0	---
14880.052	---	---	---	---	11.5	---	---	74.0	54.0	---
17360.062	---	---	---	---	15.2	---	---	74.0	54.0	---
19840.072	---	---	---	---	8.6	---	---	74.0	54.0	---
22320.082	---	---	---	---	10.2	---	---	74.0	54.0	---
24800.092	---	---	---	---	11.0	---	---	74.0	54.0	---

Note :

1. Remark "*" means that the emission frequency is produced from local oscillator.
2. Remark "--" means that the emission level is too low to be measured (a pre-amplifier of about 35 dB is used).
3. Margins are derived from Peak or Average whichever is lower. If there is only peak value in Result field, the Margin is also referred to average limits.

4.4.2 Digital Portion

a) Emission frequencies below 1 GHz

Operation Mode : Hopping
Test Date : APR. 19, 1999 Temperature : 20 ℃ Humidity : 50 %

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)
132.693	V	52.5	-11.3	41.2	43.5	-2.3	180	1.50
144.086	V	45.3	-10.5	34.8	43.5	-8.7	180	1.50
208.050	H	47.0	-6.6	40.4	43.5	-3.1	90	1.50
257.786	H	40.7	-3.9	36.8	46.0	-9.2	90	1.50
265.710	H	44.9	-3.7	41.2	46.0	-4.8	90	1.00
298.471	H	43.6	-1.0	42.6	46.0	-3.4	90	1.00
364.807	H	49.8	-7.8	42.0	46.0	-4.0	90	1.00
464.279	H	45.4	-5.0	40.4	46.0	-5.6	180	1.00

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

5 CONDUCTED EMISSION MEASUREMENT

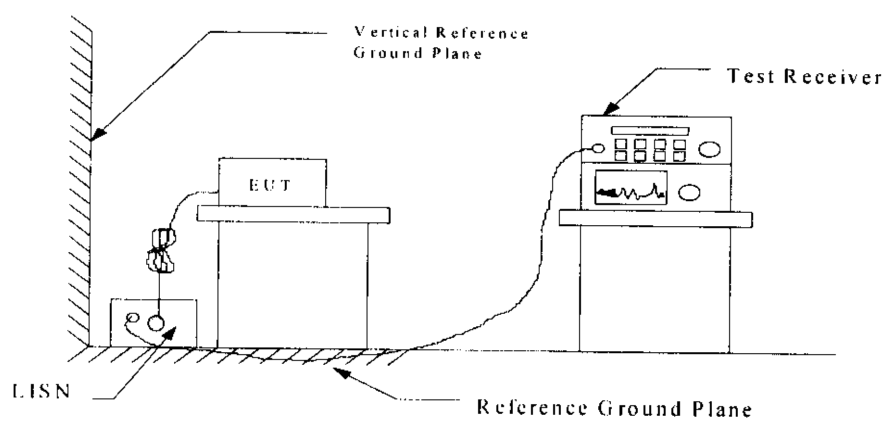
5.1 Standard Applicable

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 2

Operation Mode : Transmitting
Test Date : APR. 15, 1999 Temperature : 20 ℃ Humidity: 50 %

Frequency	Reading (dBuV)		Factor	Result (dBuV)		Limit	Margin
(MHz)	Va	Vb	(dB)	Va	Vb	(dBuV)	(dB)
0.489	34.0	29.0	0.2	34.2	29.2	48.0	-13.8
0.694	33.4	28.6	0.2	33.6	28.8	48.0	-14.4
0.906	33.0	27.8	0.3	33.3	28.1	48.0	-14.7
1.182	32.4	28.2	0.3	32.7	28.5	48.0	-15.3
11.964	37.4	34.8	0.6	38.0	35.4	48.0	-10.0
23.979	30.4	30.0	1.0	31.4	31.0	48.0	-16.6

b) Channel 40

Operation Mode : Transmitting
Test Date : APR. 15, 1999 Temperature : 20 ℃ Humidity: 50 %

Frequency	Reading (dBuV)		Factor	Result (dBuV)		Limit	Margin
(MHz)	Va	Vb	(dB)	Va	Vb	(dBuV)	(dB)
0.489	34.0	29.1	0.2	34.2	29.3	48.0	-13.8
0.694	33.4	28.7	0.2	33.6	28.9	48.0	-14.4
0.906	33.0	27.9	0.3	33.3	28.2	48.0	-14.7
1.181	32.4	28.2	0.3	32.7	28.5	48.0	-15.3
11.965	37.5	34.8	0.6	38.1	35.4	48.0	-9.9
23.980	30.5	30.0	1.0	31.5	31.0	48.0	-16.5

c) Channel 80

Operation Mode : Transmitting
Test Date : APR. 15, 1999 Temperature : 23 ℃ Humidity: 50 %

Frequency	Reading (dBuV)		Factor	Result (dBuV)		Limit	Margin
(MHz)	Va	Vb	(dB)	Va	Vb	(dBuV)	(dB)
0.489	34.0	29.0	0.2	34.2	29.2	48.0	-13.8
0.694	33.3	28.6	0.2	33.5	28.8	48.0	-14.5
0.906	33.0	27.9	0.3	33.3	28.2	48.0	-14.7
1.182	32.3	28.2	0.3	32.6	28.5	48.0	-15.4
11.965	37.4	34.8	0.6	38.0	35.4	48.0	-10.0
23.980	30.4	30.0	1.0	31.4	31.0	48.0	-16.6

Note : Please see appendix 1 for Plotted Data

5.4 Result Data Calculation

The result data is calculated by adding the Factor (including LISN insertion loss and cable loss) to the measured reading. The basic equation with a sample calculation is as follows:

RESULT = READING + FACTOR

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	ESH3	01/10/2000
Spectrum Monitor	Rohde and Schwarz	EZM	N.C.R.
Line Impedance Stabilization network	Kyoritsu	KNW-407	11/30/1999
Plotter	Hewlett-Packard	7440A	N/A
Shielded Room	Riken		N.C.R.

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 Connected Construction

The directional gain of antenna used for transmitting is 0dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. The antenna of this device is connected with a reversed type of SMA Connector, that is the male type with a whole and the femle type with a pin. Please see constraction Photos Of Exhibit B for details.

7 HOPPING CHANNEL SEPARATION

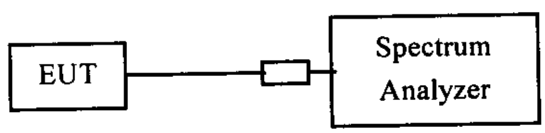
7.1 Standard Applicable

According to 15.247(a)(1), frequency hopping system shall have, hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the 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 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
5. 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
Spectrum Analyzer	Hewlett-Packard	84125C	07/02/1999
Plotter	Hewlett-Packard	7440A	N/A

7.4 Measurement Data

Test Date : APR. 15, 1999 Temperature : 20 ℃ Humidity: 50 %

a) Channel 02 : Adjacent Hopping Channel Separation is 1000kHz
b) Channel 42 : Adjacent Hopping Channel Separation is 997kHz
c) Channel 80 : Adjacent Hopping Channel Separation is 1000kHz

Note: Please see Appendix 2 for Plotted Data

8 NUMBER OF HOPPING FREQUENCY USED

8.1 Standard Applicable

According to 15.247(a)(1)(ii), for frequency hopping system operating in the 2400-2483.5 MHz and 5725-5850 MHz bands shall use at least 75 hopping frequencies.

8.2 Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. 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 the SA on MaxHold Mode, and then keep the EUT in hoppping mode. Record all the siganls from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

8.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Hewlett-Packard	84125C	07/02/1999
Attenuator	Weinschel Engineering	1	N/A

8.4 Measurement Data

Test Date : APR. 15, 1999 Temperature : 20 ℃ Humidity: 50 %

There are 79 hopping frequencies in a hopping sequence.

Note: Please see Appendix 3 for Plotted Data

9 CHANNEL BANDWIDTH

9.1 Standard Applicable

According to 15.247(a)(1)(ii), for frequency hopping system operating in the 2400-2483.5 MHz and 5725-5850 MHz bands, the maximum 20dB bandwidth of the hopping channel is 1MHz.

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 4 without connection to measurement instrument. 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.

9.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Hewlett-Packard	84125C	07/02/1999
Attenuator	Weinschel Engineering	1	N/A

9.4 Measurement Data

Test Date : APR. 15, 1999 Temperature : 20 ℃ Humidity: 50 %

a) Channel 02 : Channel Bandwidth is 983kHz
b) Channel 42 : Channel Bandwidth is 987kHz
c) Channel 80 : Channel Bandwidth is 923kHz

Note: Please see Appendix 4 for Plotted Data

10 DWELL TIME ON EACH CHANNEL

10.1 Standard Applicable

According to 15.247(a)(1)(ii), for frequency hopping system operating in the 2400-2483.5 MHz and 5725-5850 MHz bands, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 30-second period.

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 4 without connection to measurement instrument. 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. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.

10.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Hewlett-Packard	84125C	07/02/1999
Attenuator	Weinschel Engineering	1	N/A

10.4 Measurement Data

Test Date : APR. 15, 1999 Temperature : 20 ℃ Humidity: 50 %

a) Channel 02 : the dwell time is $191.7 \times 2 = 383.4$ ms
b) Channel 42 : the dwell time is $191.7 \times 2 = 383.4$ ms
c) Channel 80 : the dwell time is $191.7 \times 2 = 383.4$ ms

In normal operation, for there is a empty cycle time of 13.9 ms, therefore the total hopping duration time between two transmission for each channel is $205.6 \times 79 = 16.25$ s. And there are only two transmissions in a 30-second period.

Note: Please see Appendix 5 for plotted data

11 OUTPUT POWER MEASUREMENT

11.1 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.

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 4 without connection to measurement instrument. 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 1 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.

11.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Hewlett-Packard	84125C	07/02/1999
Attenuator	Weinschel Engineering	1	N/A

11.4 Measurement Data

Test Date : APR. 15, 1999 Temperature : 20 ℃ Humidity: 50 %

a) Channel 02 : Output Peak Power is 19.83 dBm or **96.16** mW
b) Channel 42 : Output Peak Power is 19.67 dBm or **92.68** mW
c) Channel 80 : Output Peak Power is 19.33 dBm or **85.70** mW

Note: Please see Appendix 6 for Plotted Data

12 100 kHz BANDWIDTH OF BAND EDGES MEASUREMENT

12.1 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.

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 4 without connection to measurement instrument. 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 300 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.

12.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Hewlett-Packard	84125C	07/02/1999
Plotter	Hewlett-Packard	7440A	N/A

12.4 Measurement Data

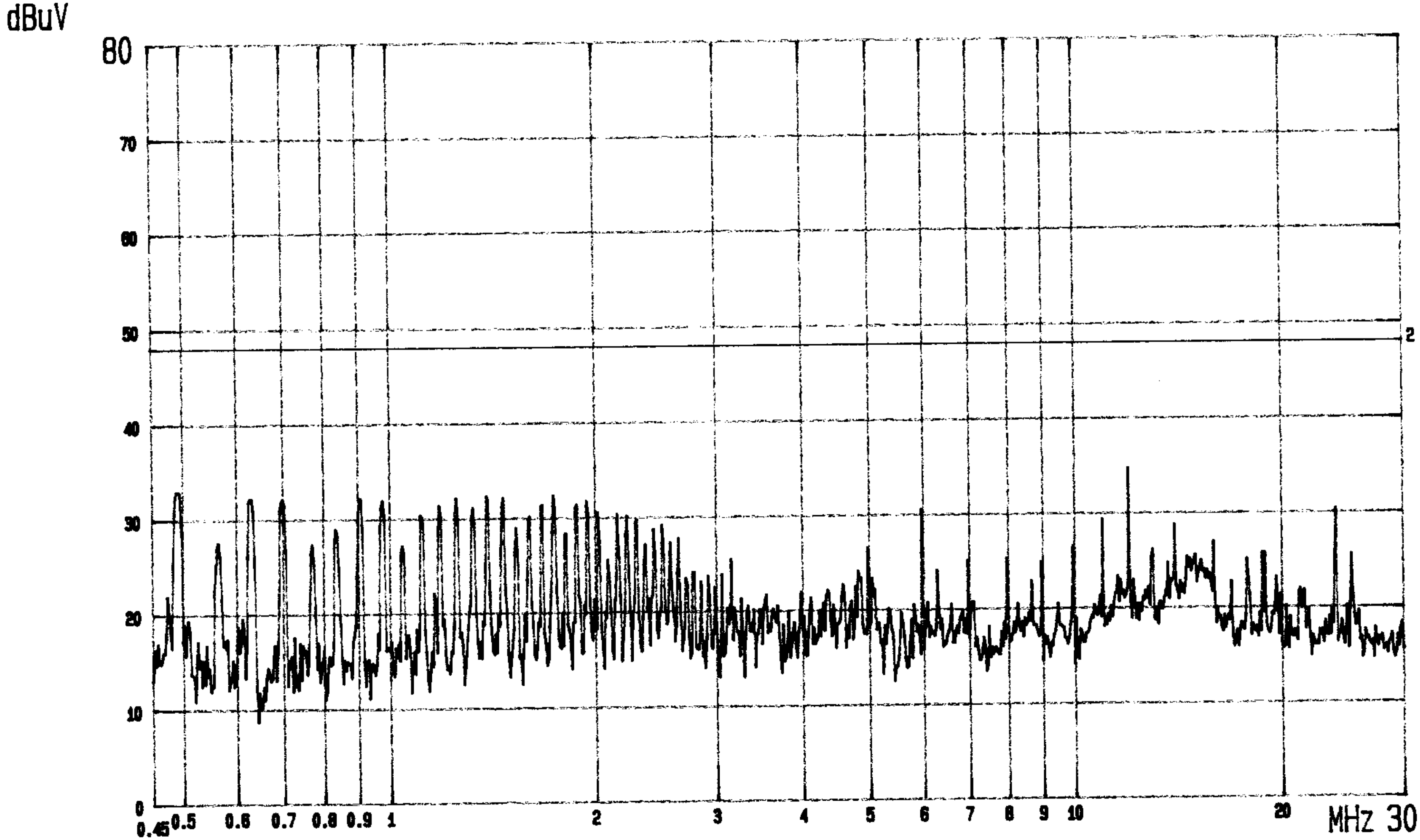
Test Date : APR. 15, 1999 Temperature : 20 ℃ Humidity: 50 %

a) Lower Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 50dB from the carrier.

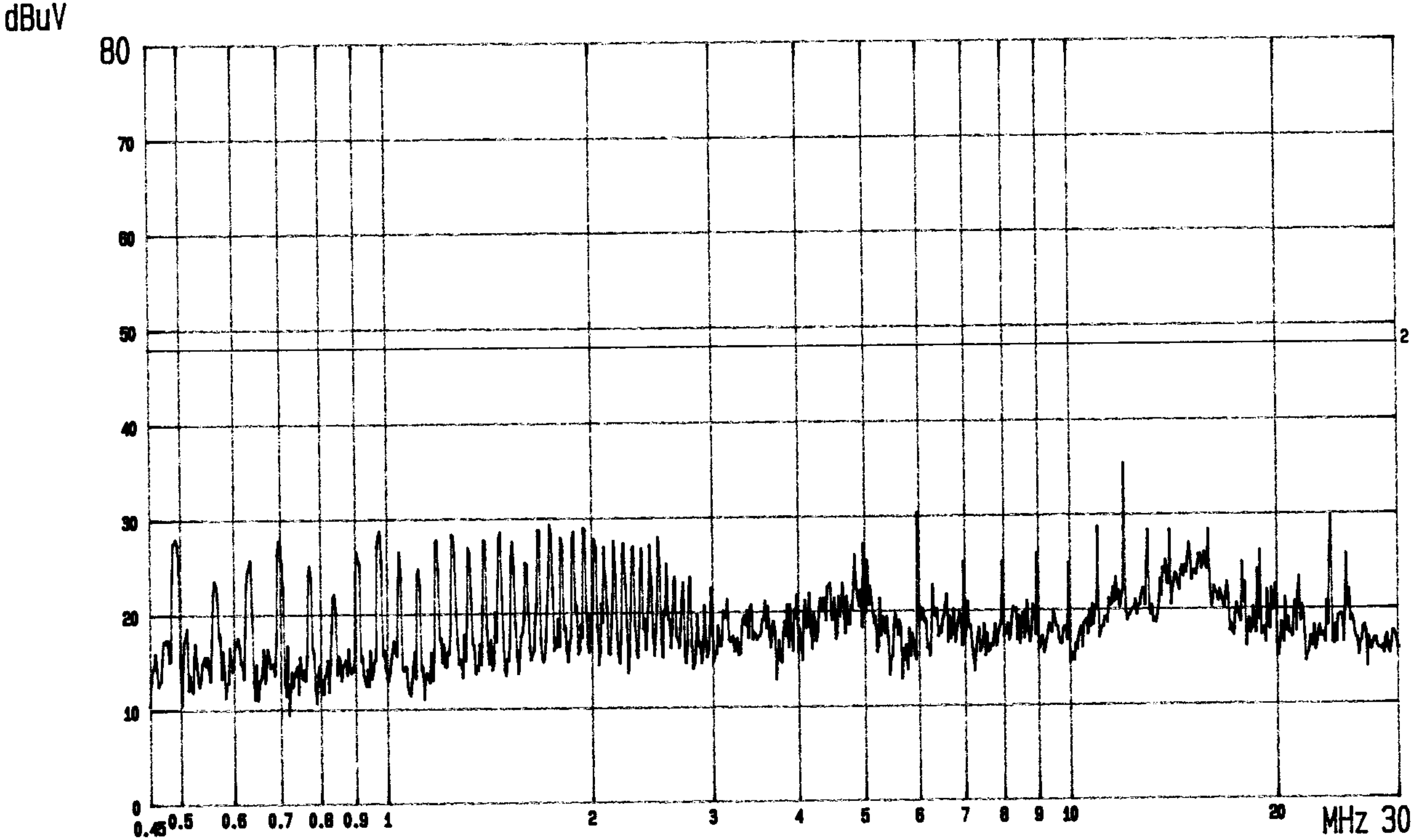
b) Upper Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 50dB from the carrier.

Note: Please see Appendix 7 for Plotted Data

Appendix 1 : Plotted Data of Power Line Conducted Emissions



CONDUCTED EMISSION TEST | EUT: WL PCI CARD | 2: QP., | CLASS B LIMIT
MODEL: | MODE: 2402MHz | LISN: N | ETC EMI LAB.

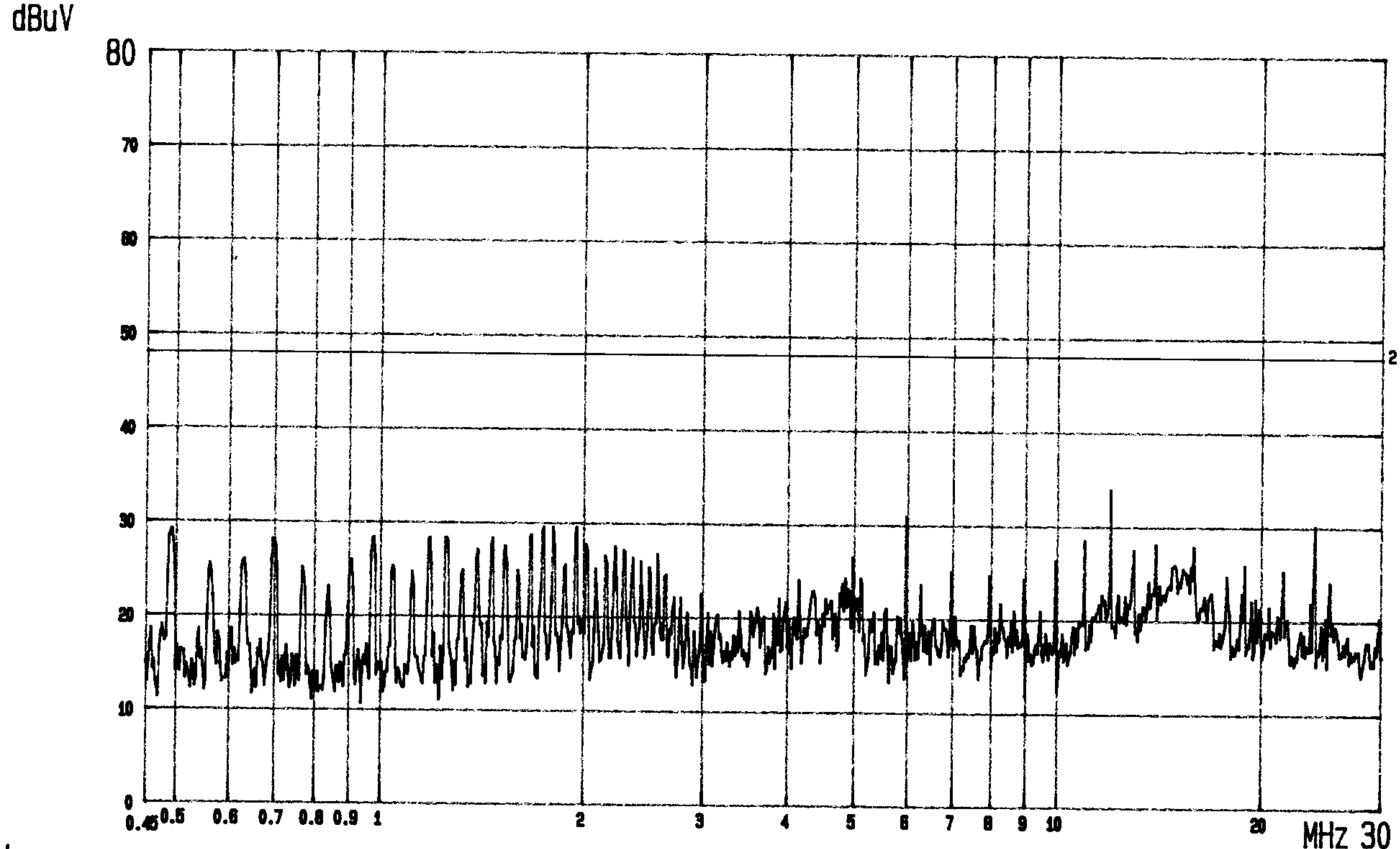


CONDUCTED EMISSION TEST
MODEL:

EUT: WL PCI CARD
MODE: 2402MHz

2: QP.,
LISN: L1

CLASS B LIMIT
ETC EMI LAB.

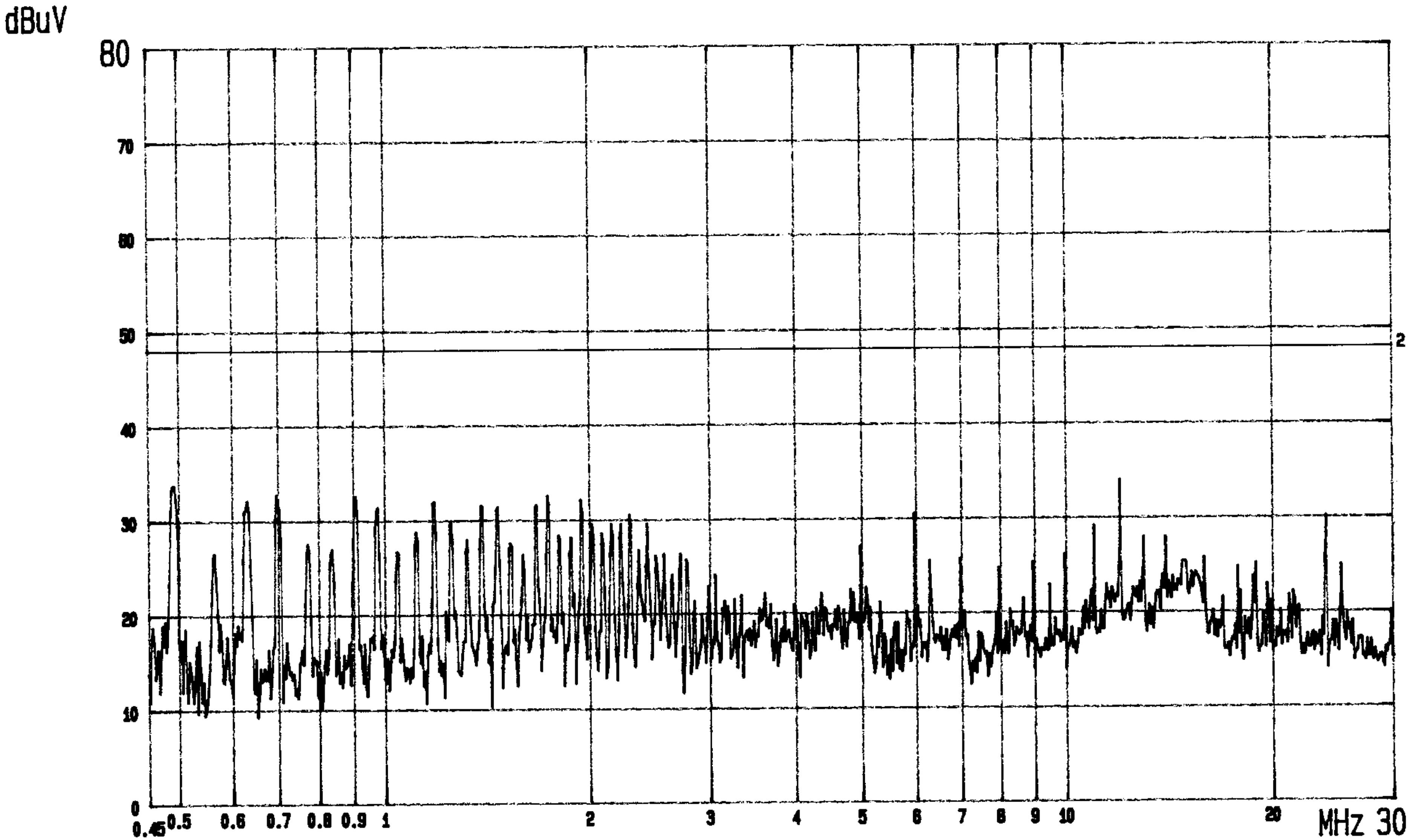


|---
CONDUCTED EMISSION TEST
MODEL:

EUT: WL PCI CARD
MODE: 2442MHz

2: QP.,
LISN: N

CLASS B LIMIT
ETC EMI LAB.

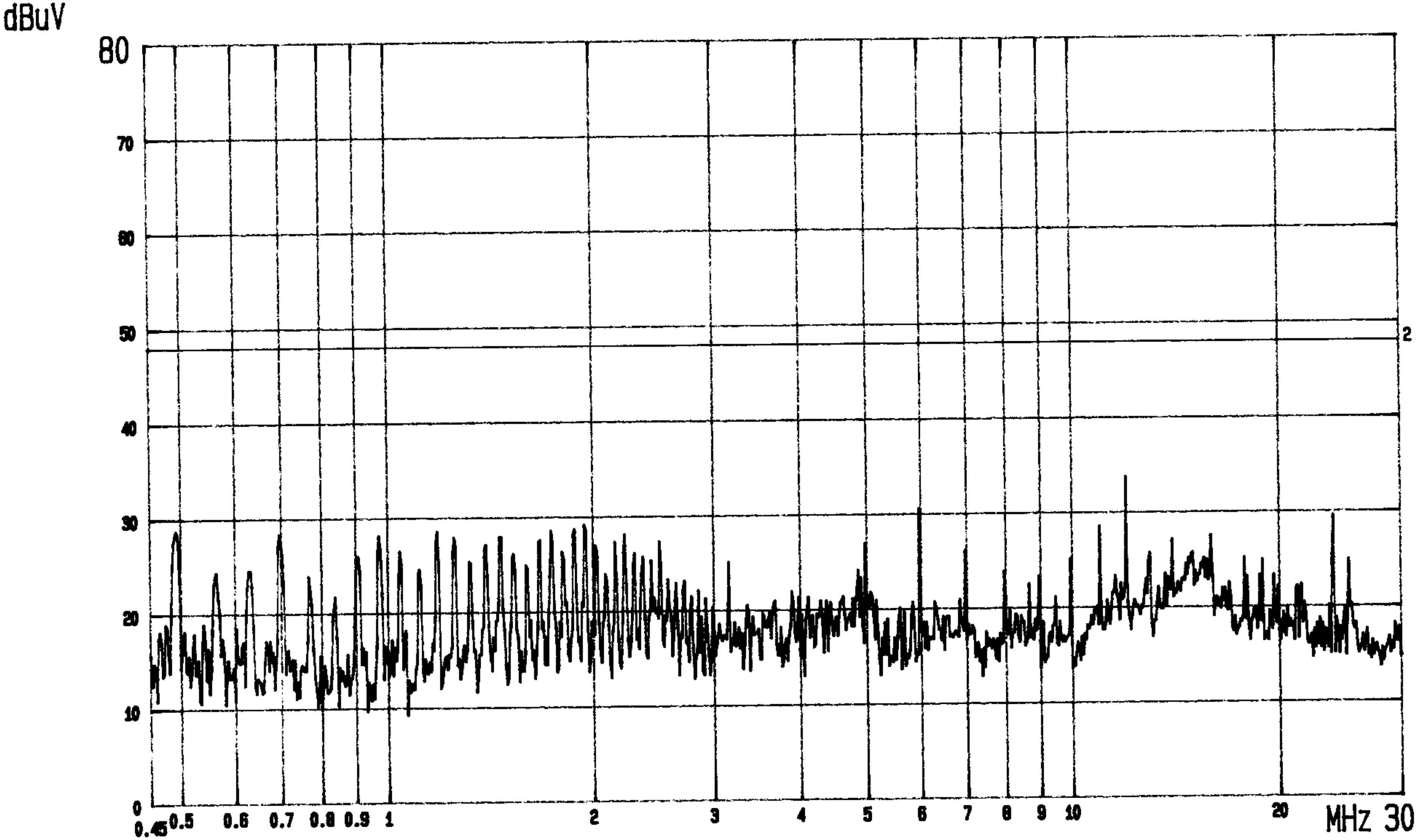


CONDUCTED EMISSION TEST
MODEL:

EUT: WL PCI CARD
MODE: 2442MHz

2: QP.,
LISN: L1

CLASS B LIMIT
ETC EMI LAB.

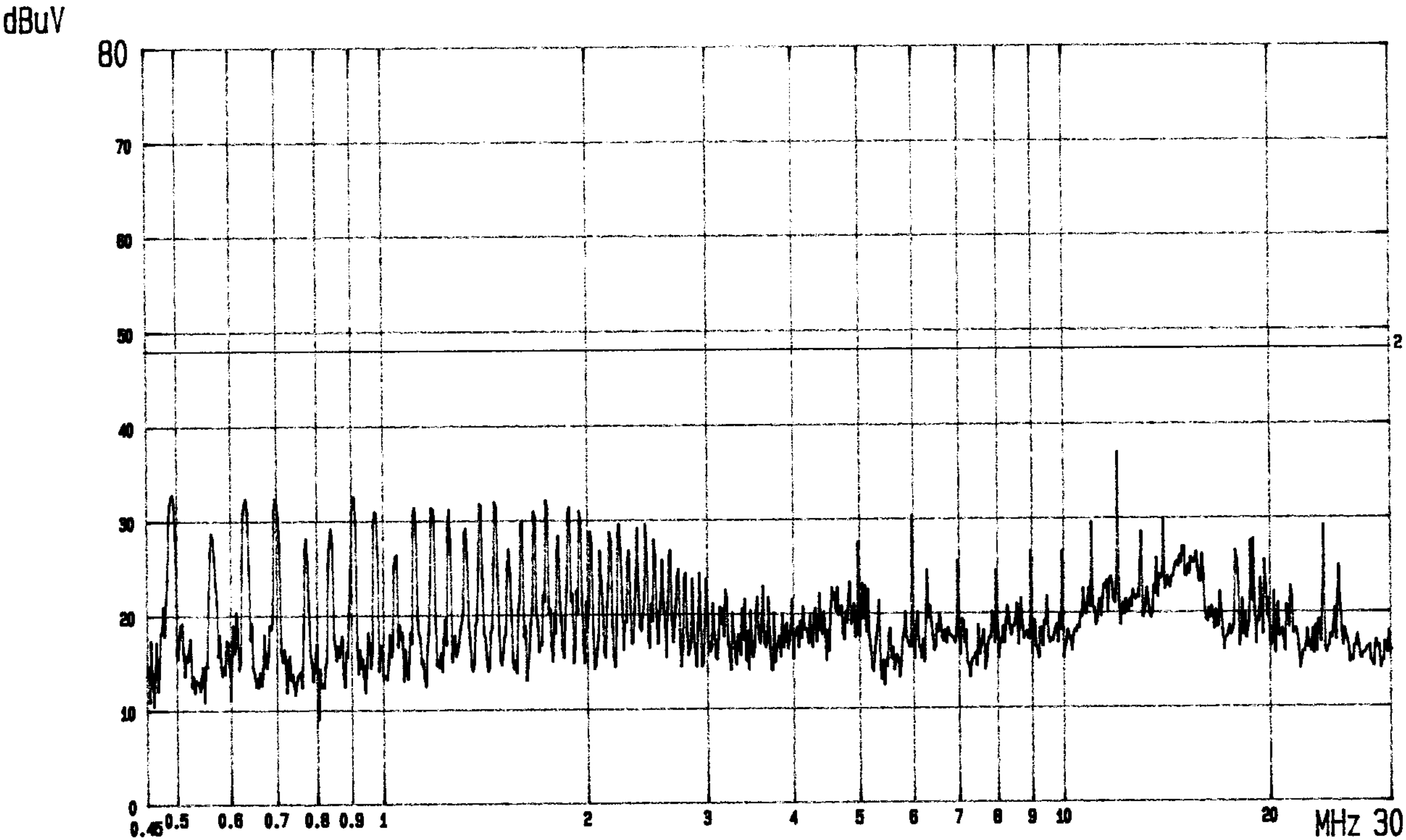


CONDUCTED EMISSION TEST
MODEL:

EUT: WL PCI CARD
MODE: 2480MHz

2: QP.,
LISN: L1

CLASS B LIMIT
ETC EMI LAB.



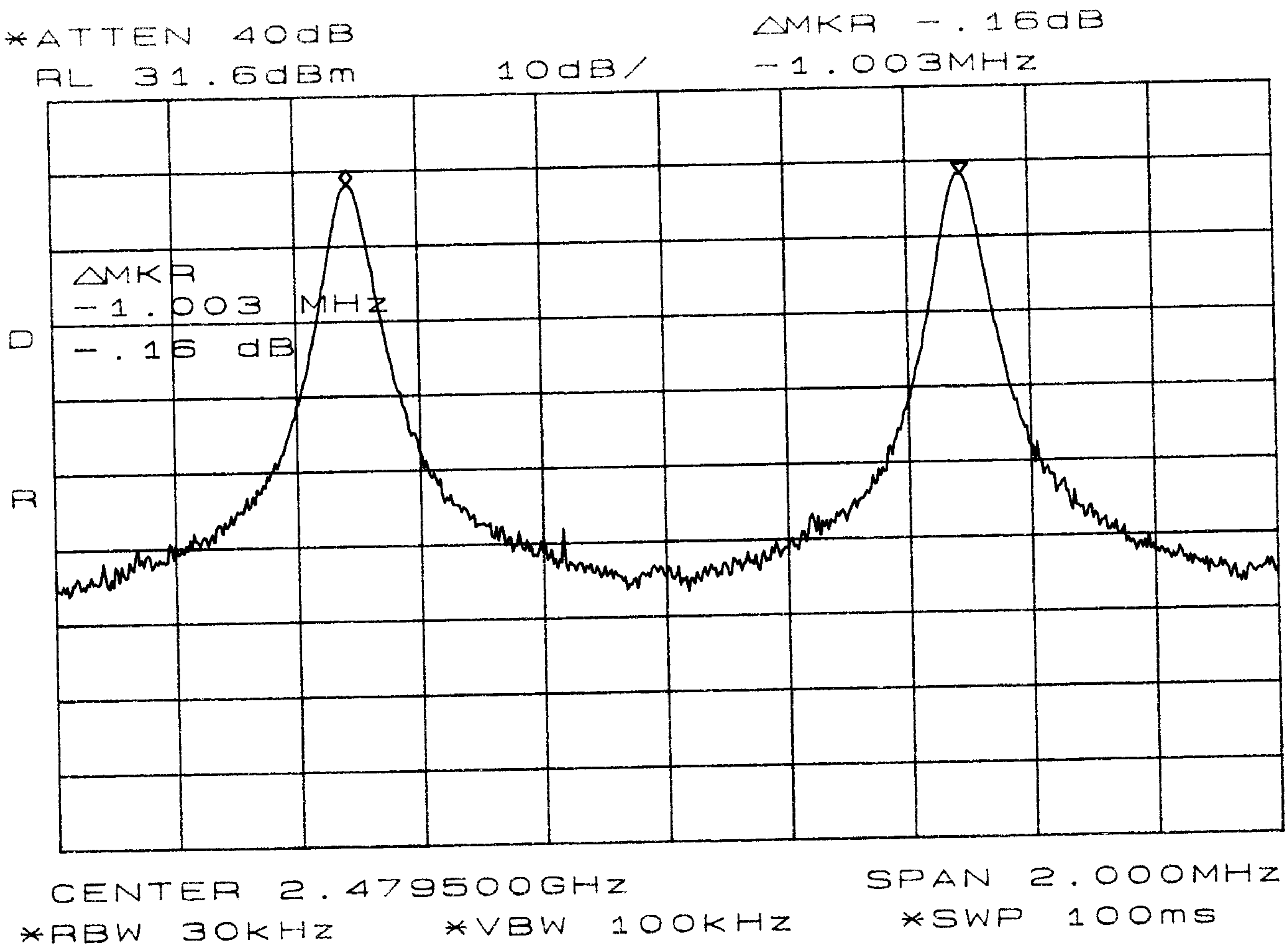
|---
CONDUCTED EMISSION TEST
MODEL:

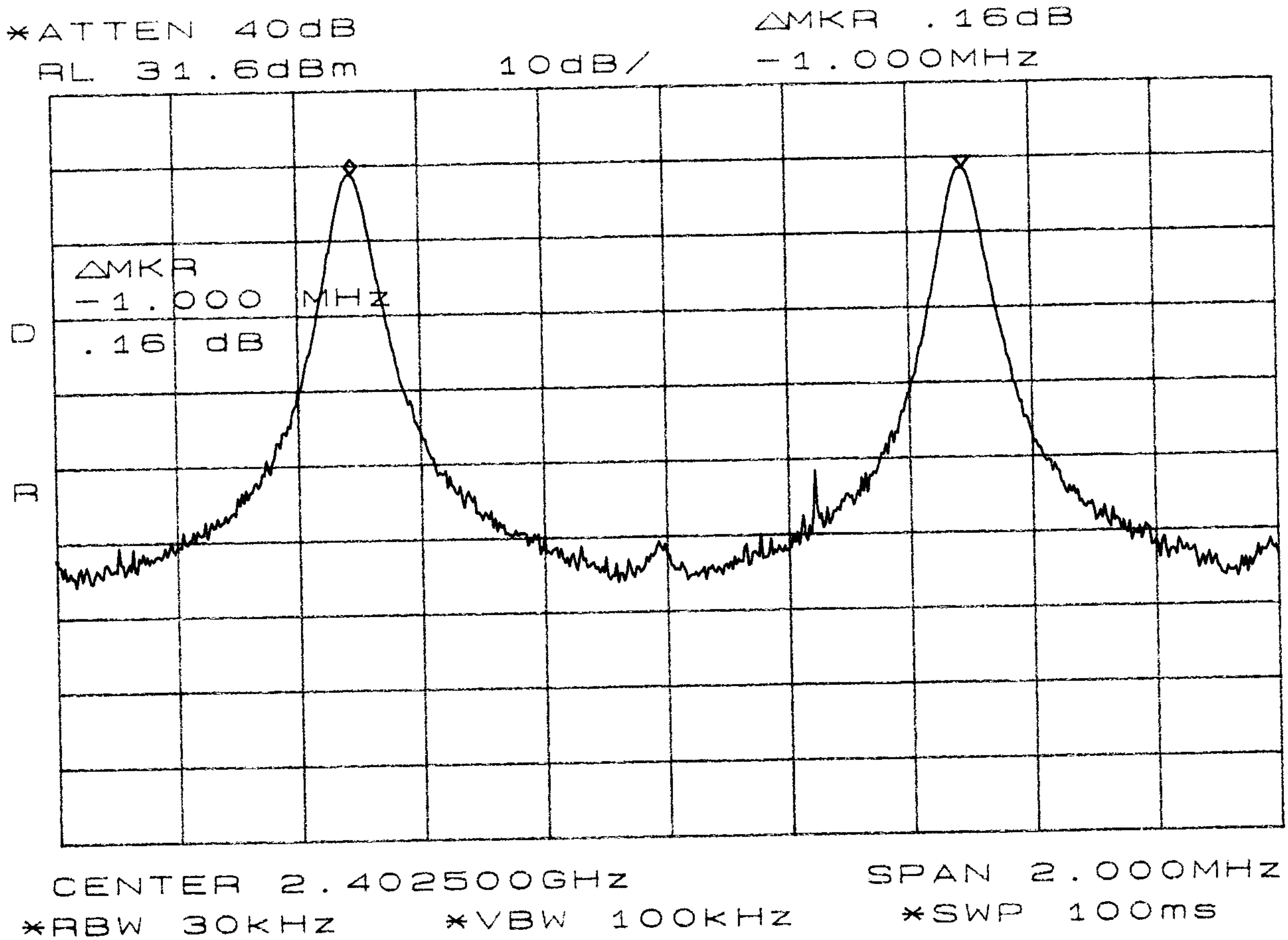
EUT: WL PCI CARD
MODE: 2480MHz

2: QP.,
LISN: N

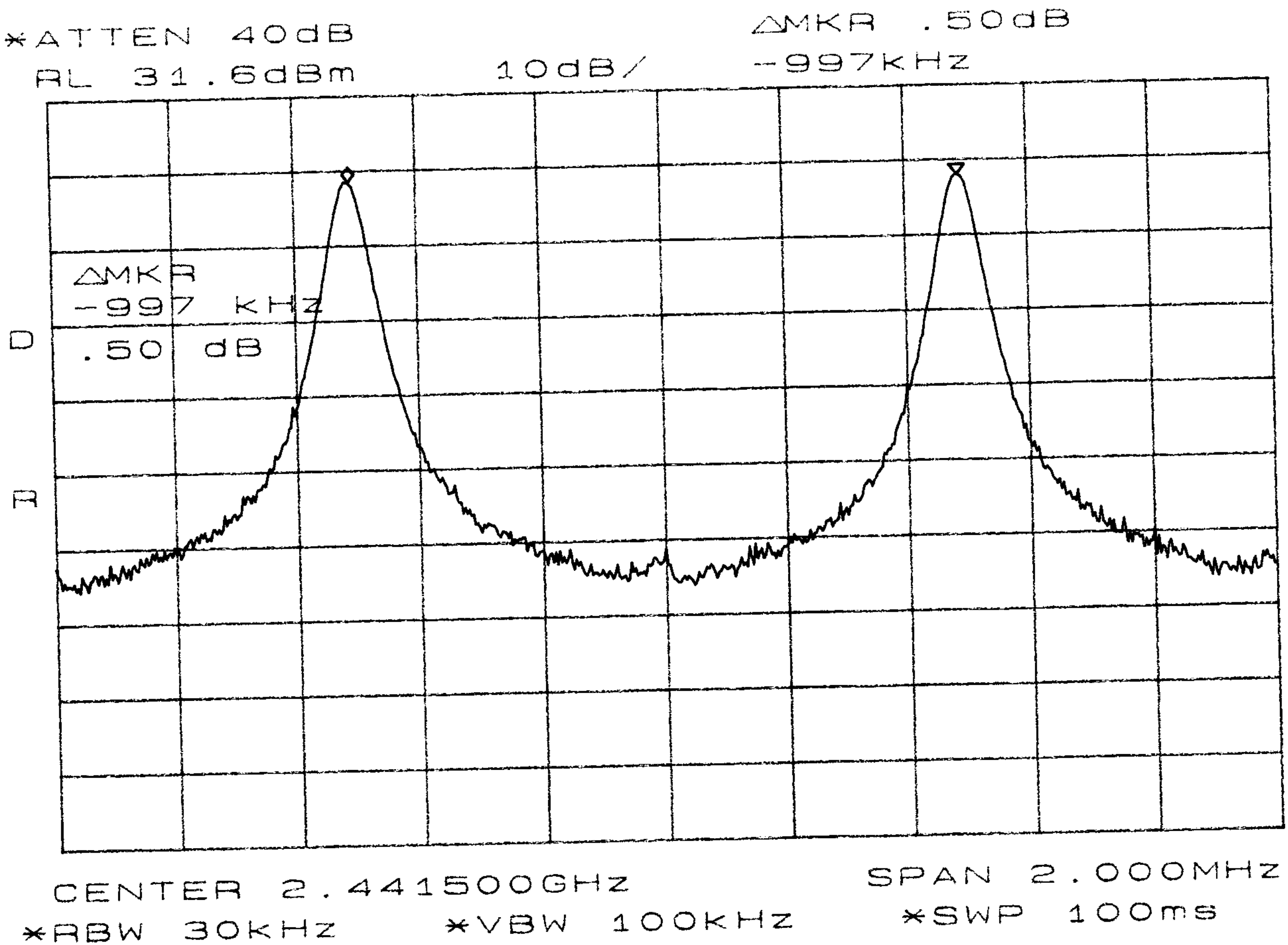
CLASS B LIMIT
ETC EMI LAB.

Appendix 2 : Plotted Data for Separation of Adjacent Channel


*ATTEN 40dB
RL 31.6dBm
10dB/
ΔMKR -.16dB
-1.003MHz
ΔMKR
-1.003 MHz
-.16 dB
D
R
CENTER 2.479500GHz
*RBW 30KHz
*VBW 100KHz
SPAN 2.000MHz
*SWP 100ms

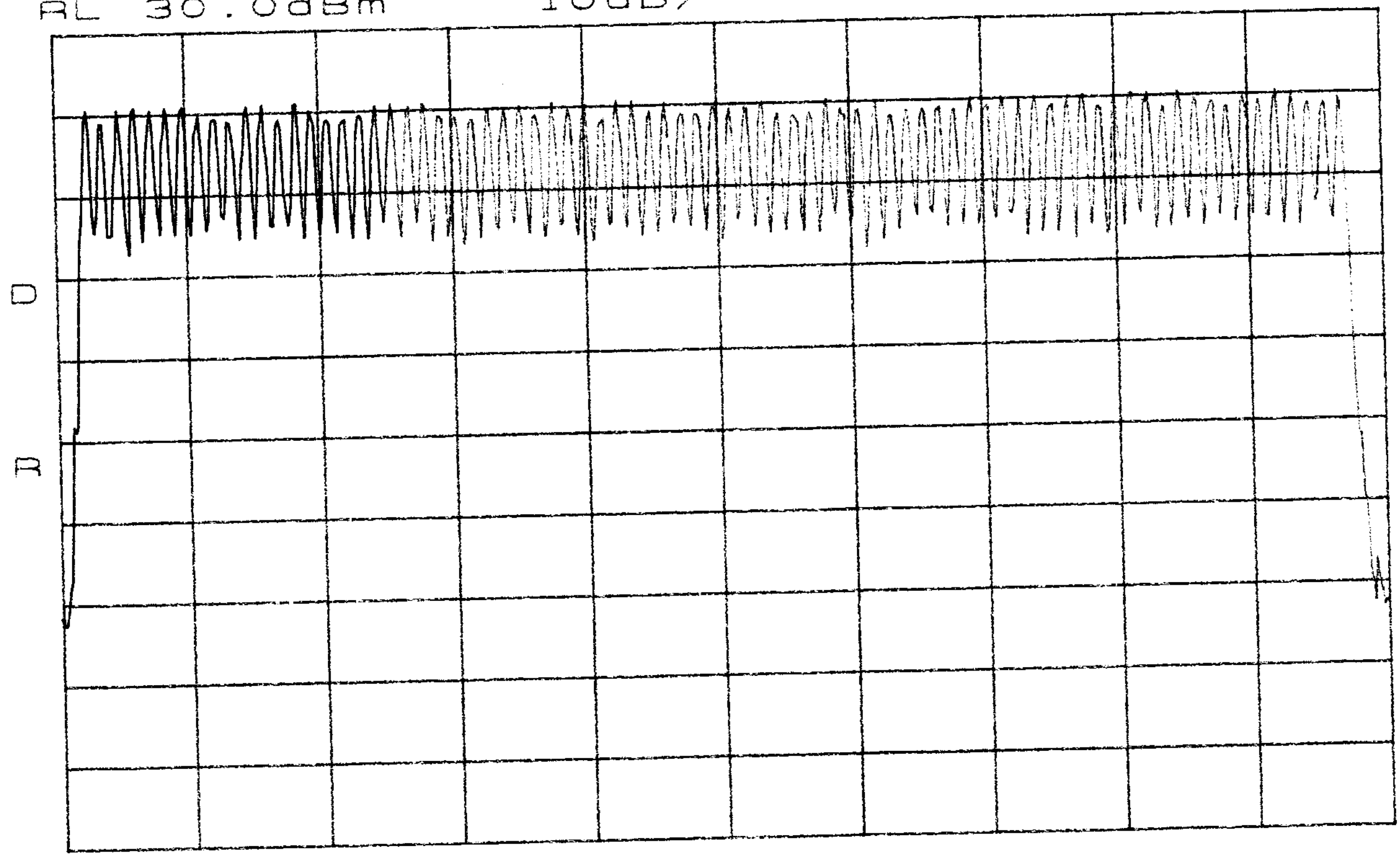


*ATTEN 40dB
RL 31.6dBm
10dB/
ΔMKR .16dB
-1.000MHz
ΔMKR
-1.000 MHz
.16 dB
D
R
CENTER 2.402500GHz
*RBW 30kHz
*VBW 100kHz
SPAN 2.000MHz
*SWP 100ms


*ATTEN 40dB
RL 31.6dBm
10dB/
ΔMKR .50dB
-997kHz
ΔMKR
-997 kHz
.50 dB
D
R
CENTER 2.441500GHz
*RBW 30kHz
*VBW 100kHz
SPAN 2.000MHz
*SWP 100ms

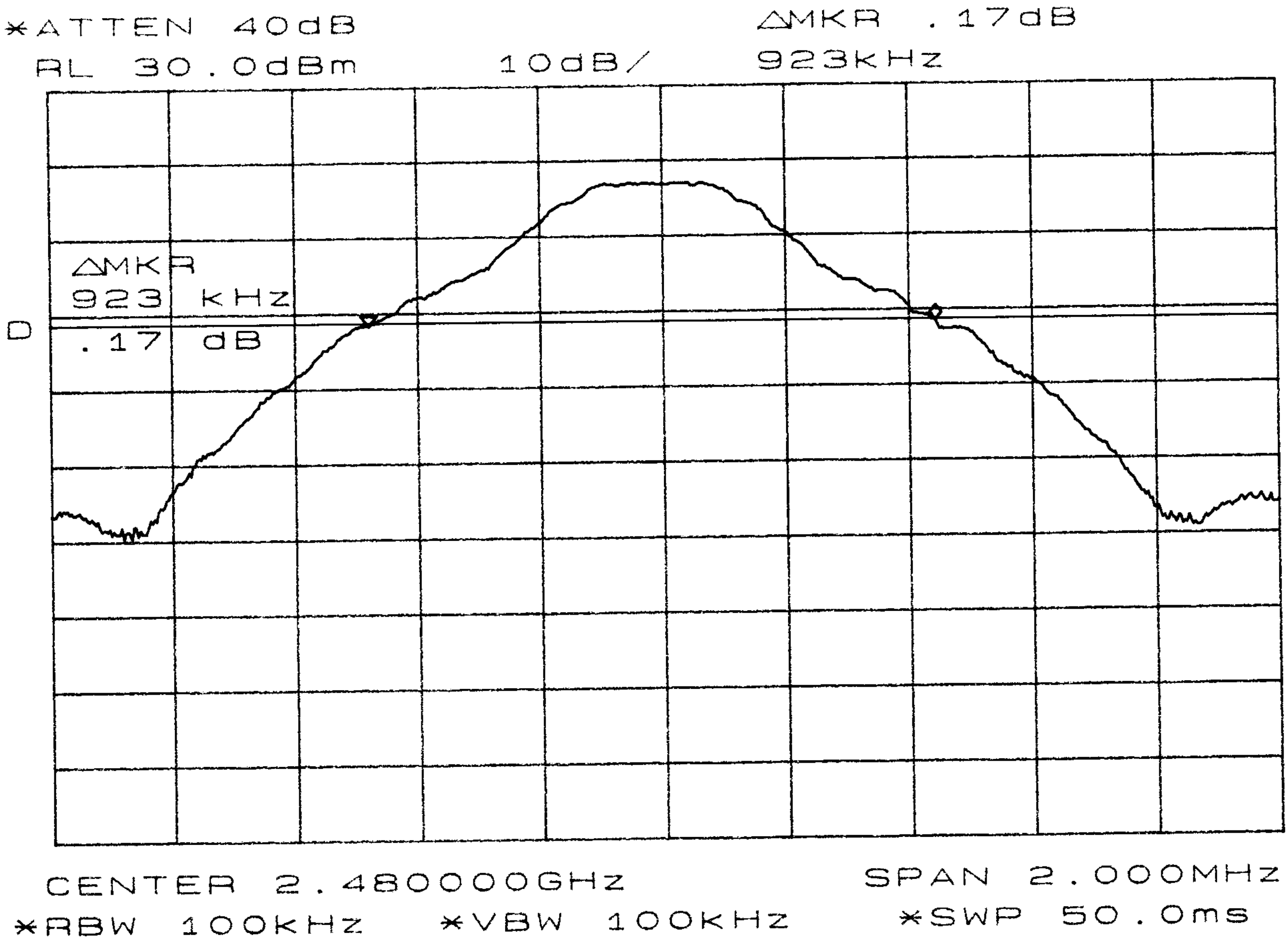
Appendix 3 : Plotted Data for Total Used Hopping Frequencies

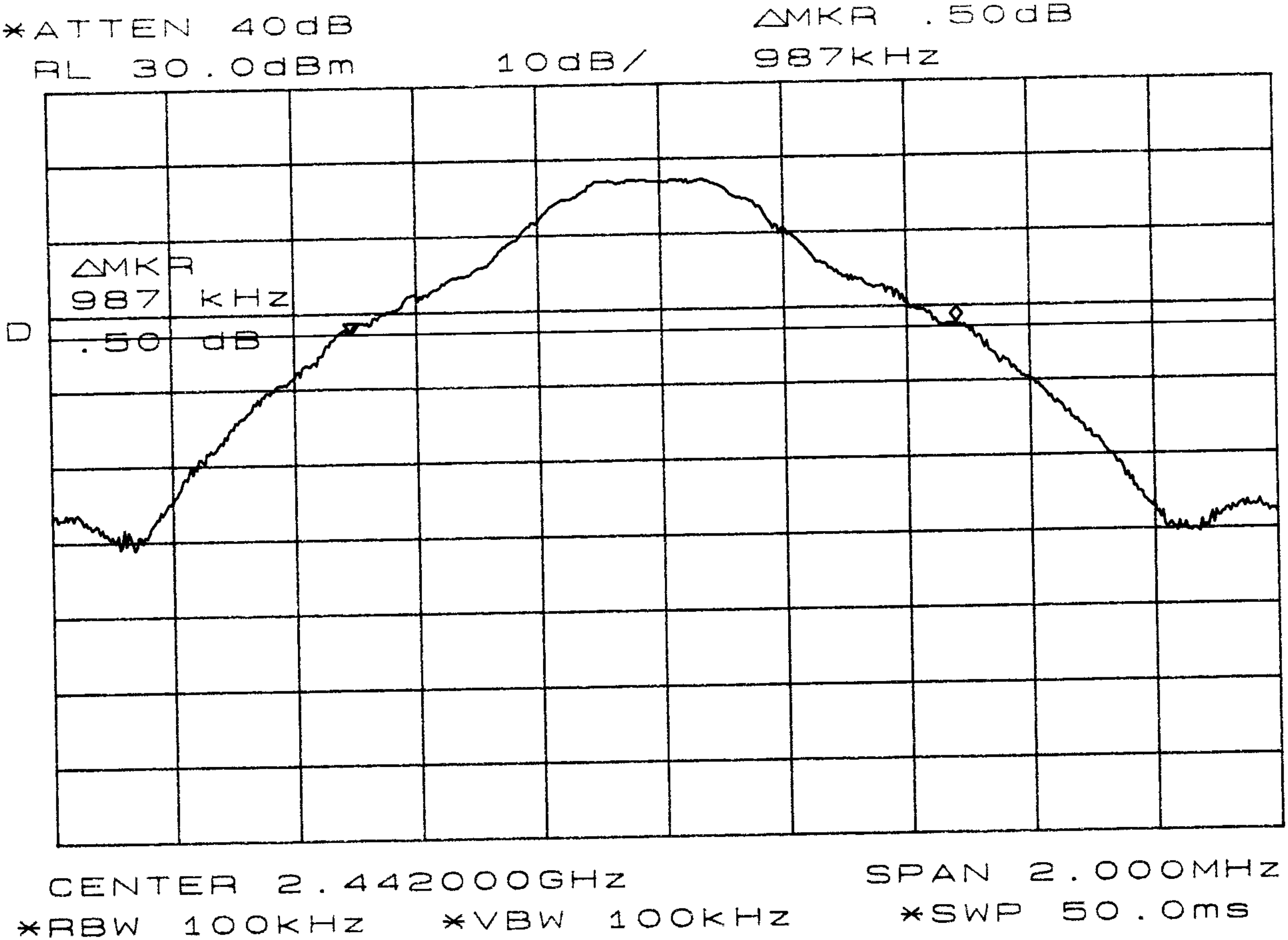
*ATTEN 40dB
RL 30.0dBm 10dB/

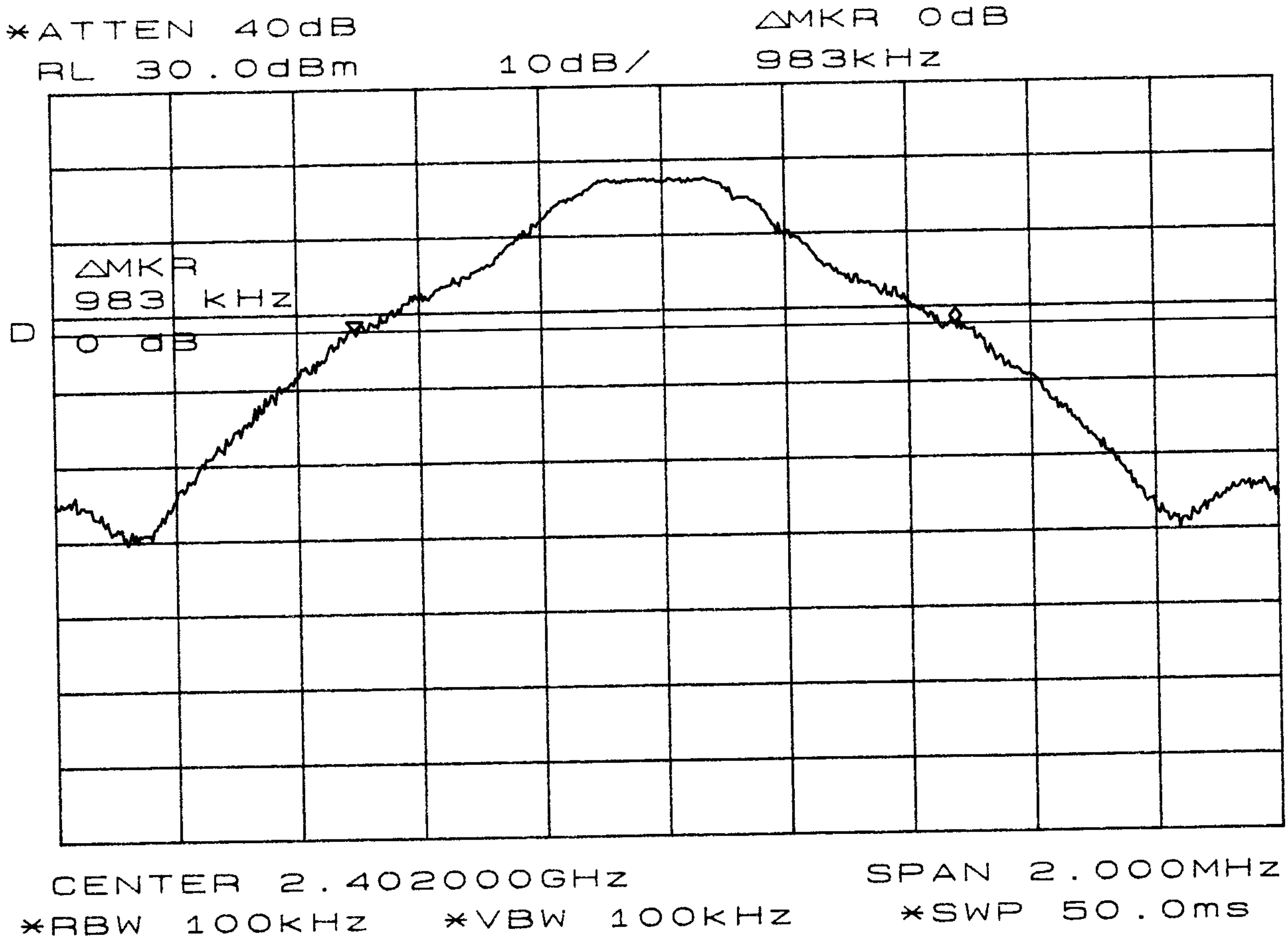


START 2.40000GHz STOP 2.48350GHz
*RBW 100kHz *VBW 100kHz *SWP 50.0ms

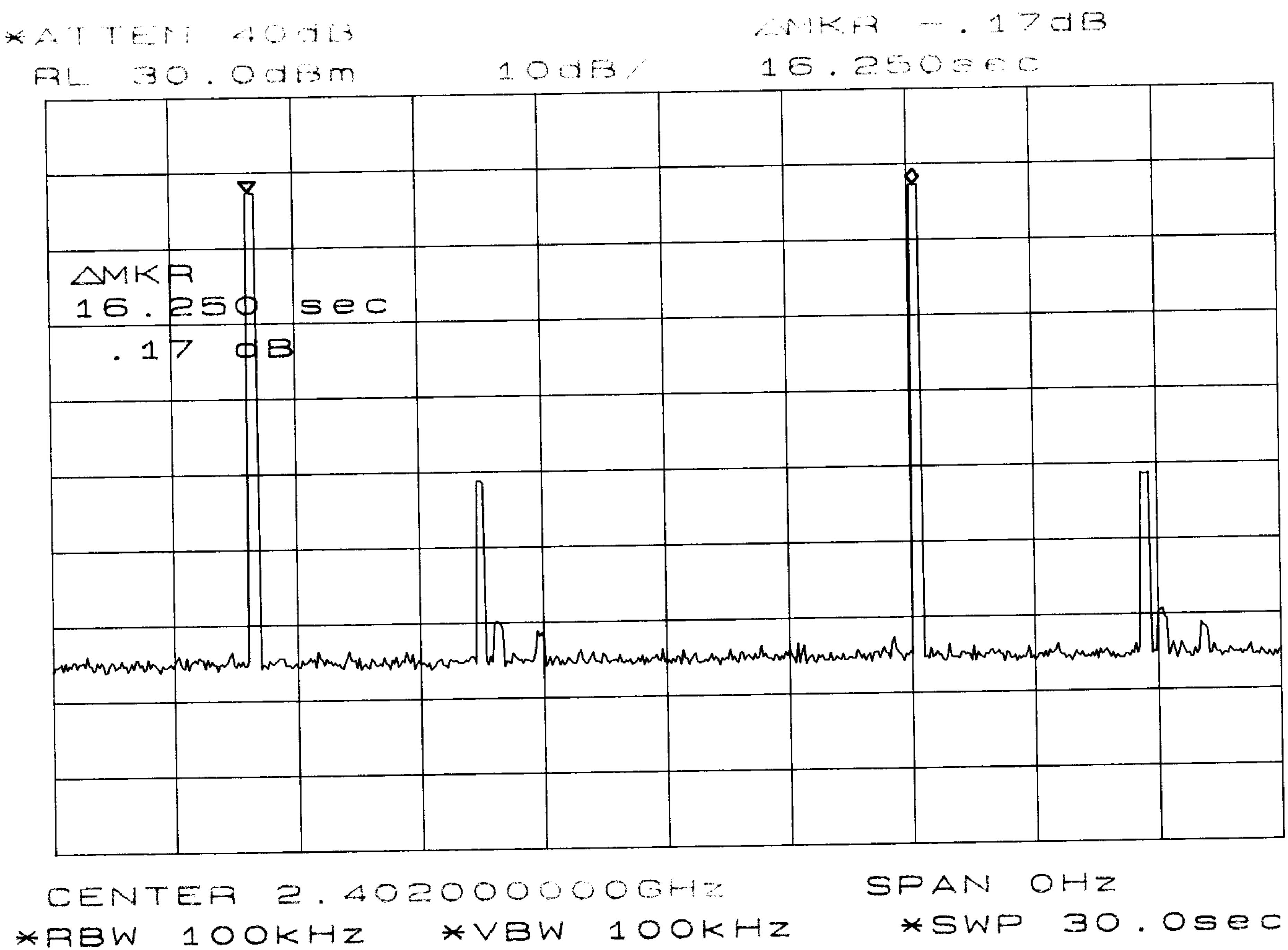
Appendix 4 : Plotted Data for Channel Bandwidth


*ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR .17dB
923kHz
ΔMKR
923 kHz
.17 dB
D
CENTER 2.480000GHz
SPAN 2.000MHz
*RBW 100kHz
*VBW 100kHz
*SWP 50.0ms

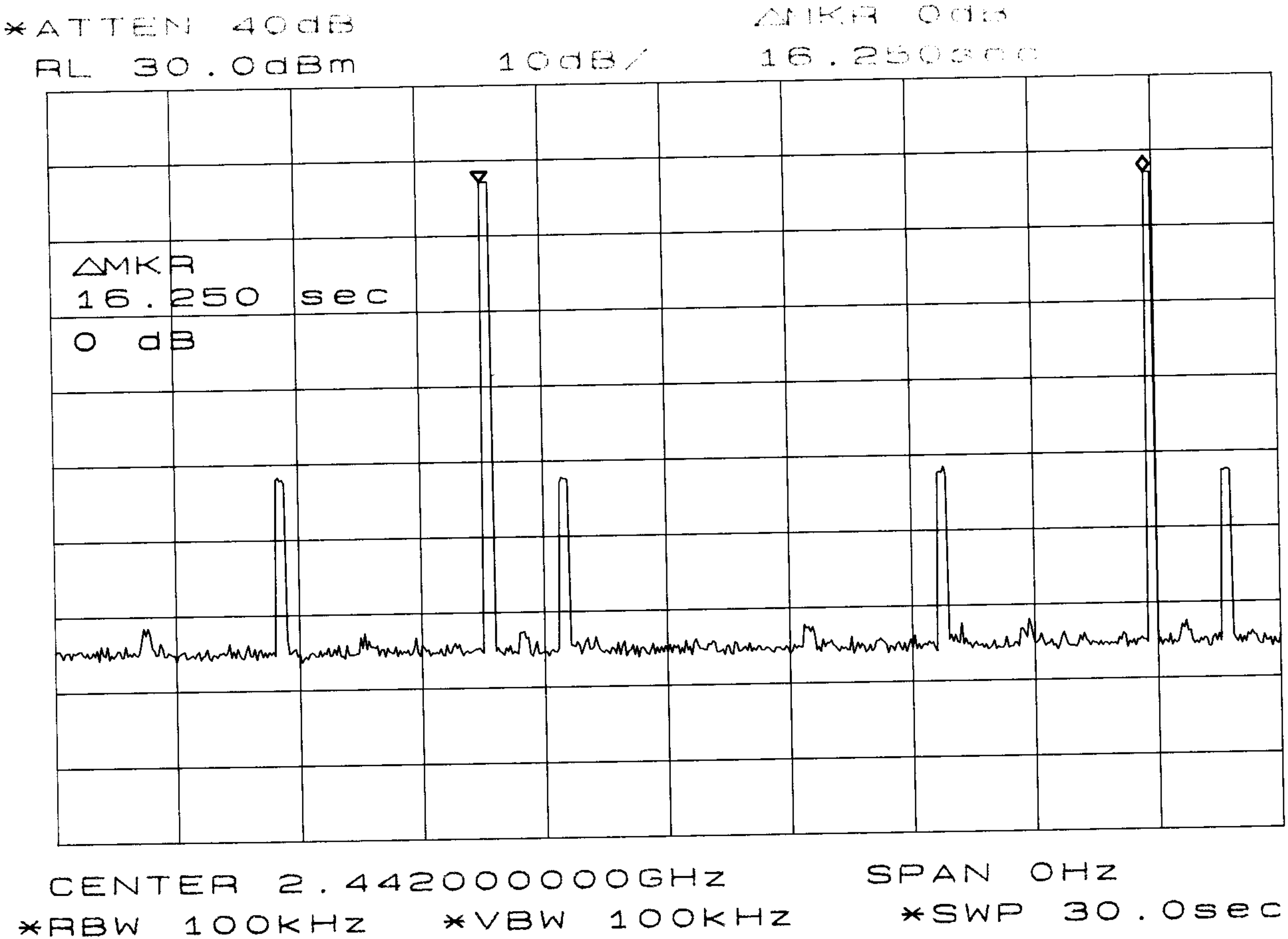

*ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR .50dB
987kHz
ΔMKR
987 kHz
.50 dB
D
CENTER 2.442000GHz
*RBW 100kHz
*VBW 100kHz
SPAN 2.000MHz
*SWP 50.0ms


*ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR 0dB
983kHz
ΔMKR
983 kHz
0 dB
D
CENTER 2.402000GHz
*RBW 100kHz
*VBW 100kHz
SPAN 2.000MHz
*SWP 50.0ms

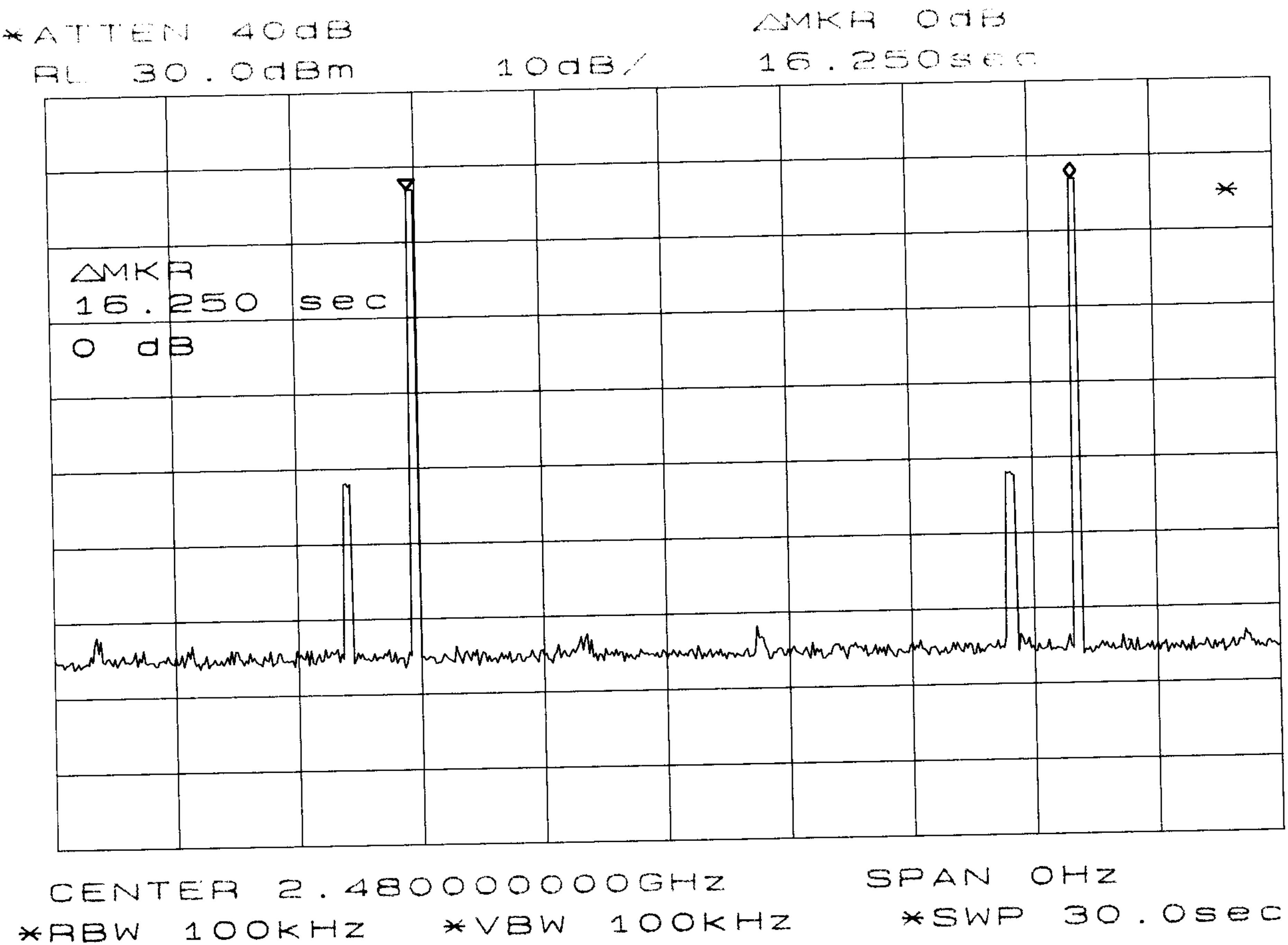
Appendix 5 : Plotted Data for Channel Dwell Time

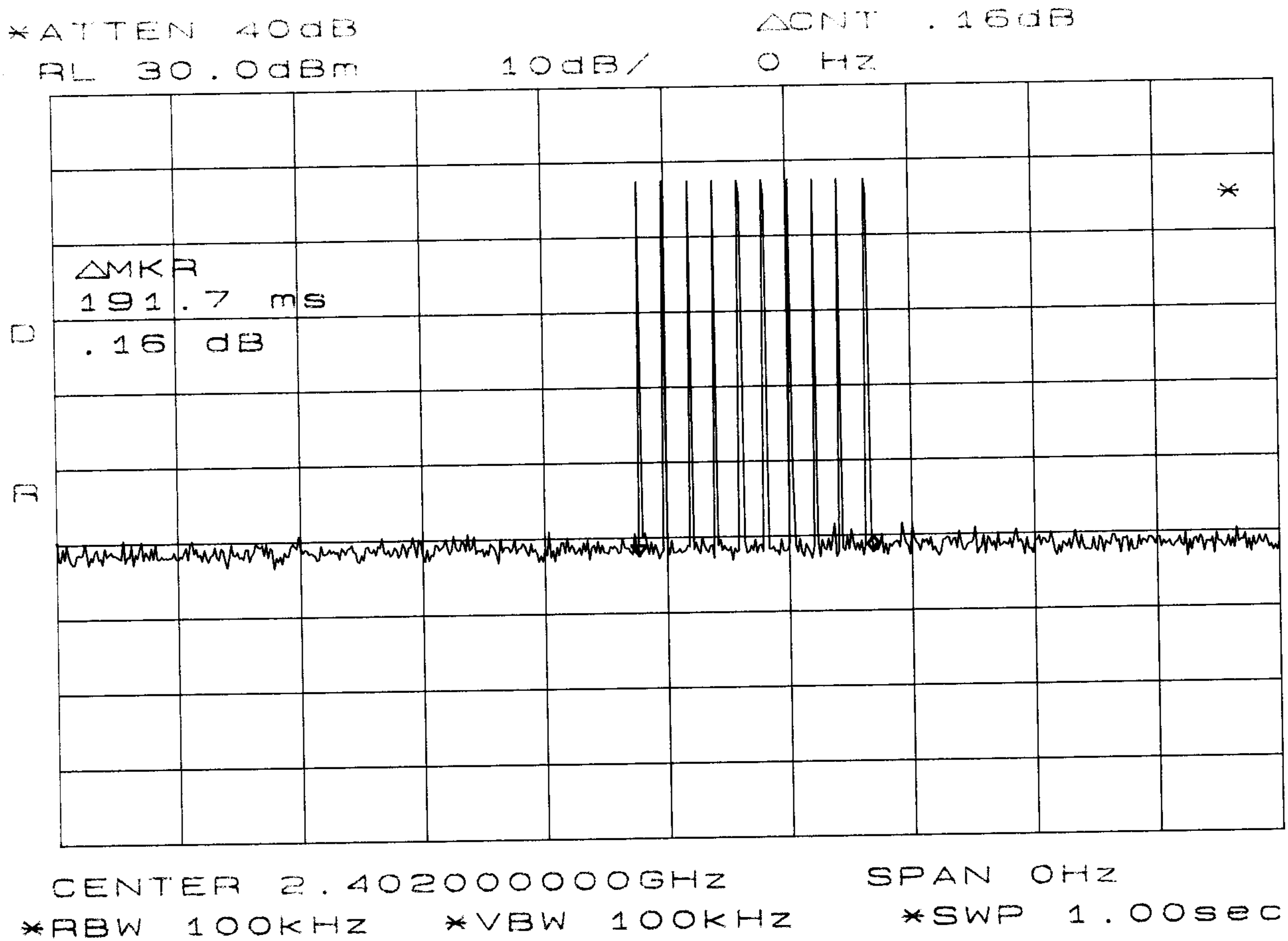


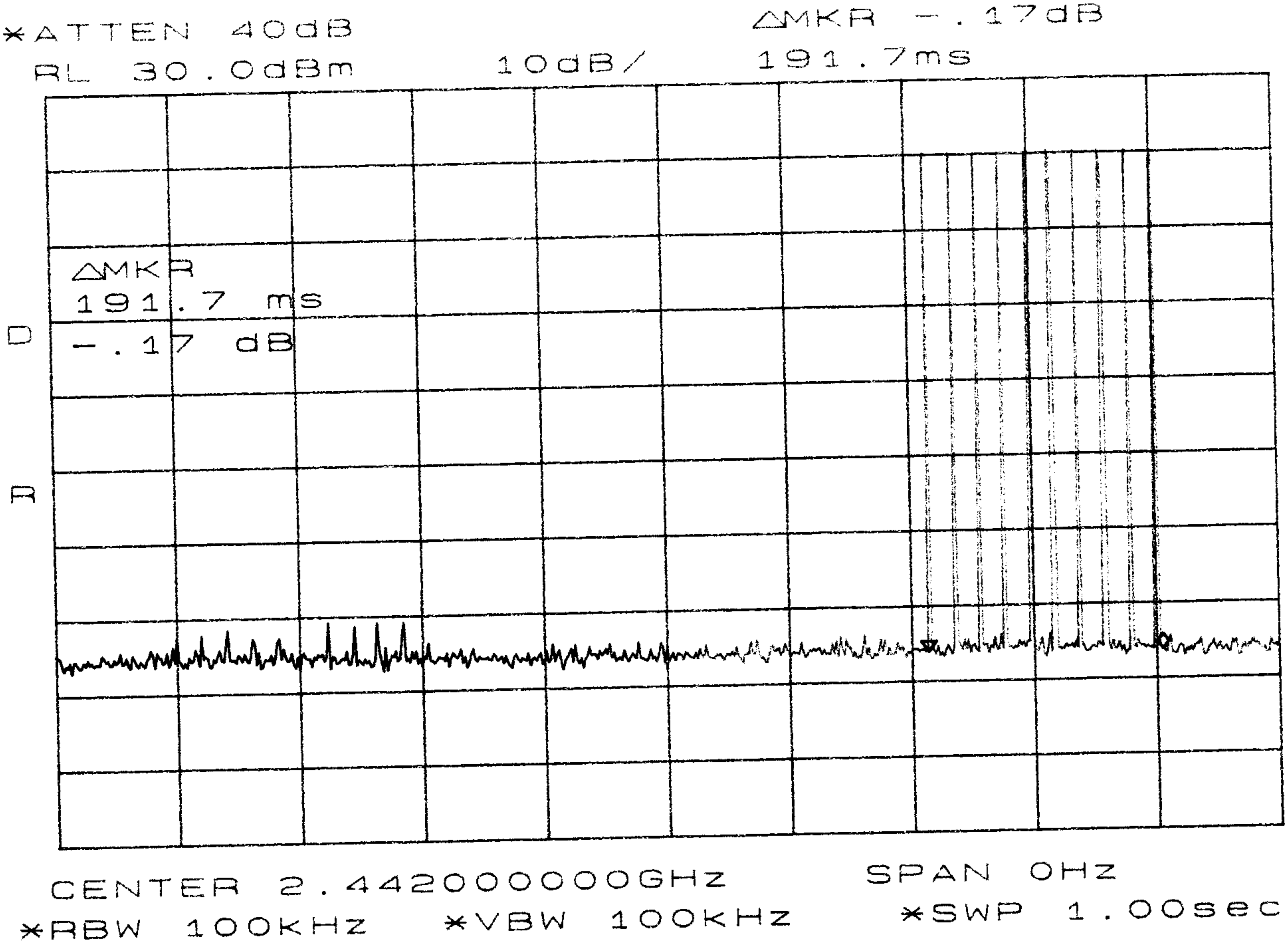
*ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -.17dB
16.250sec
ΔMKR
16.250 sec
.17 dB
CENTER 2.402000000GHz
SPAN 0Hz
*RBW 100kHz
*VBW 100kHz
*SWP 30.0sec

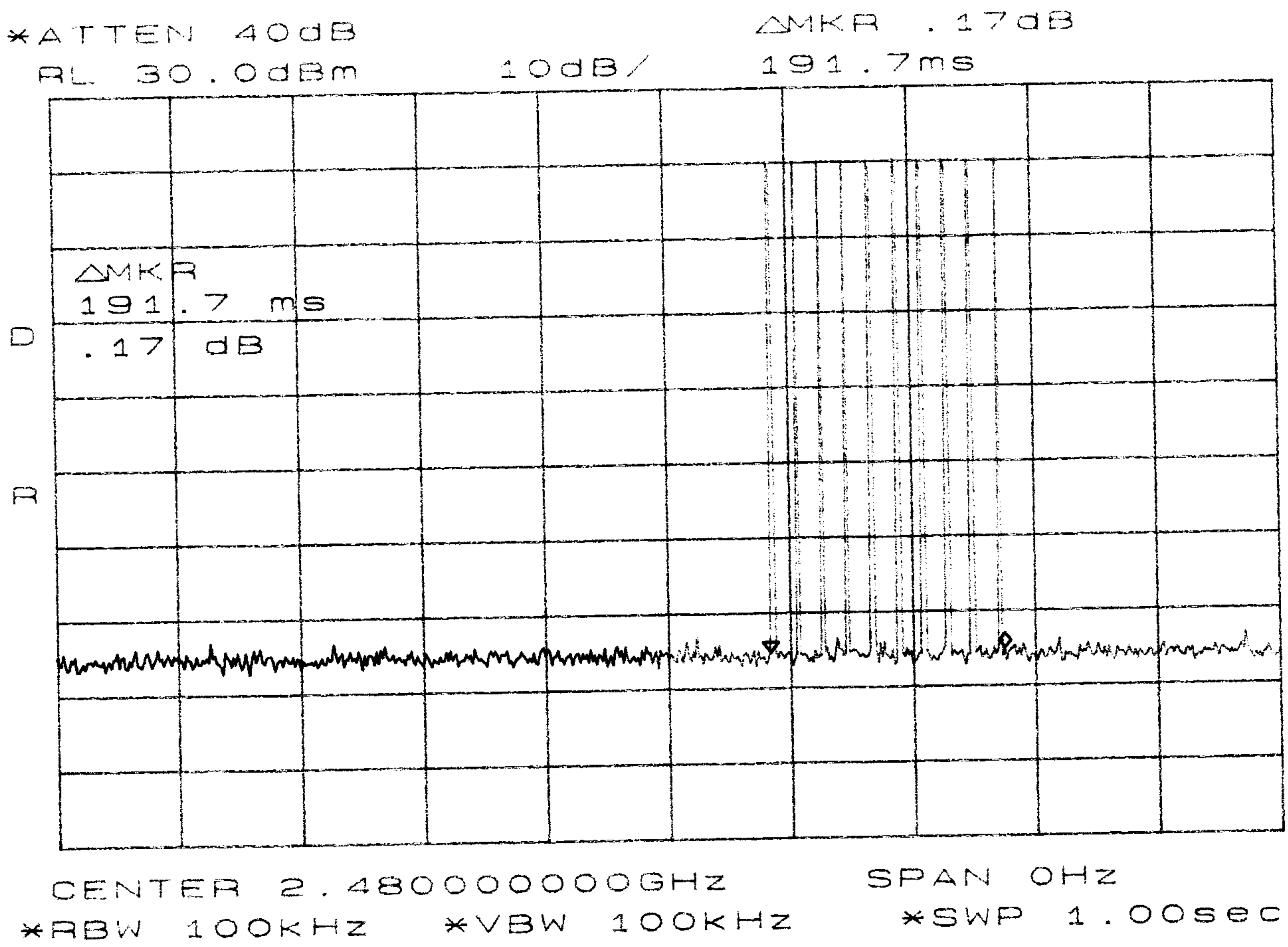


*ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR 0dB
16.250sec
ΔMKR
16.250 sec
0 dB
CENTER 2.4420000000GHz
SPAN 0Hz
*RBW 100KHz
*VBW 100KHz
*SWP 30.0sec

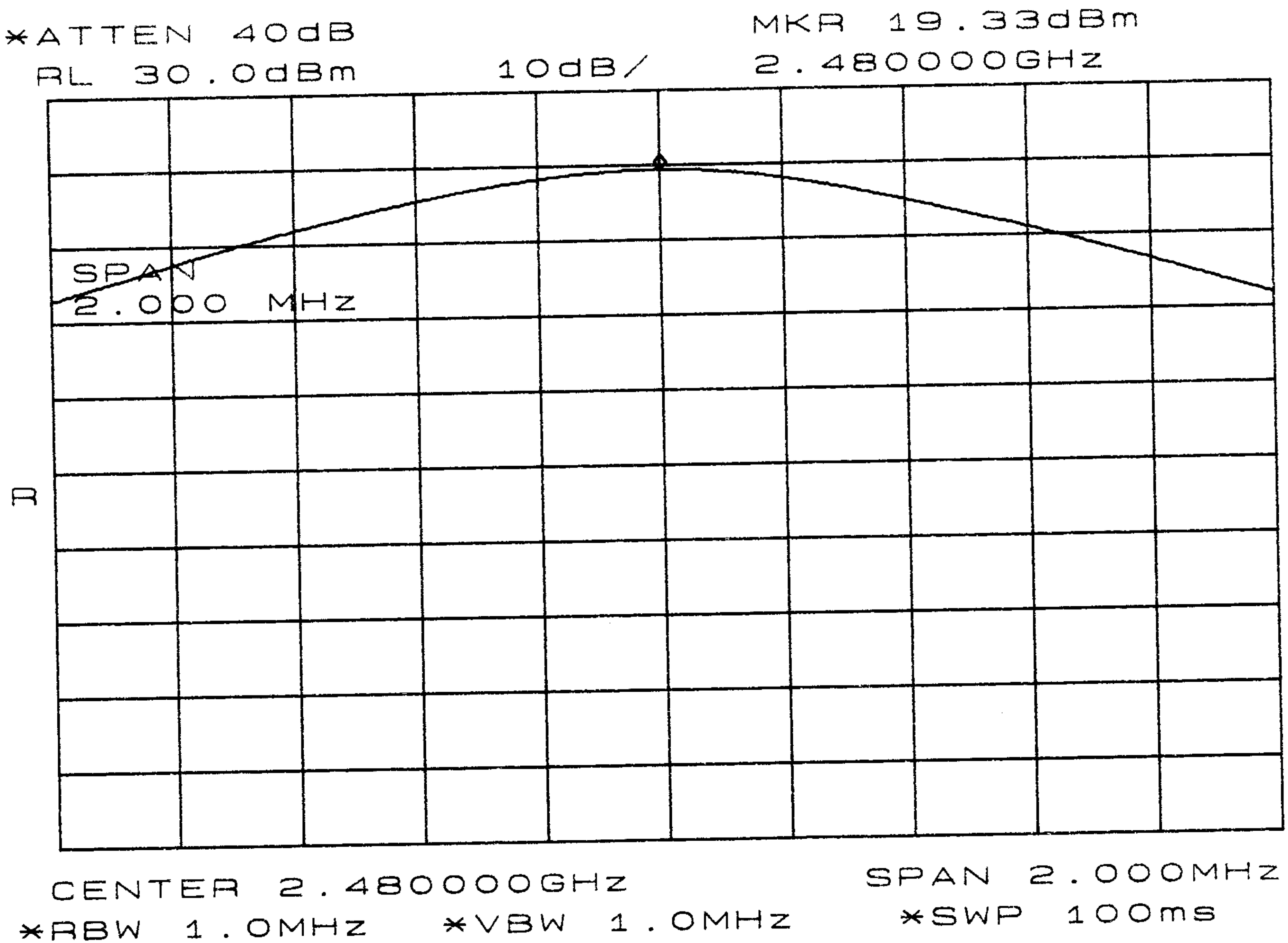

*ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR 0dB
16.250sec
ΔMKR
16.250 sec
0 dB
CENTER 2.480000000GHz
*RBW 100kHz
*VBW 100kHz
SPAN 0Hz
*SWP 30.0sec

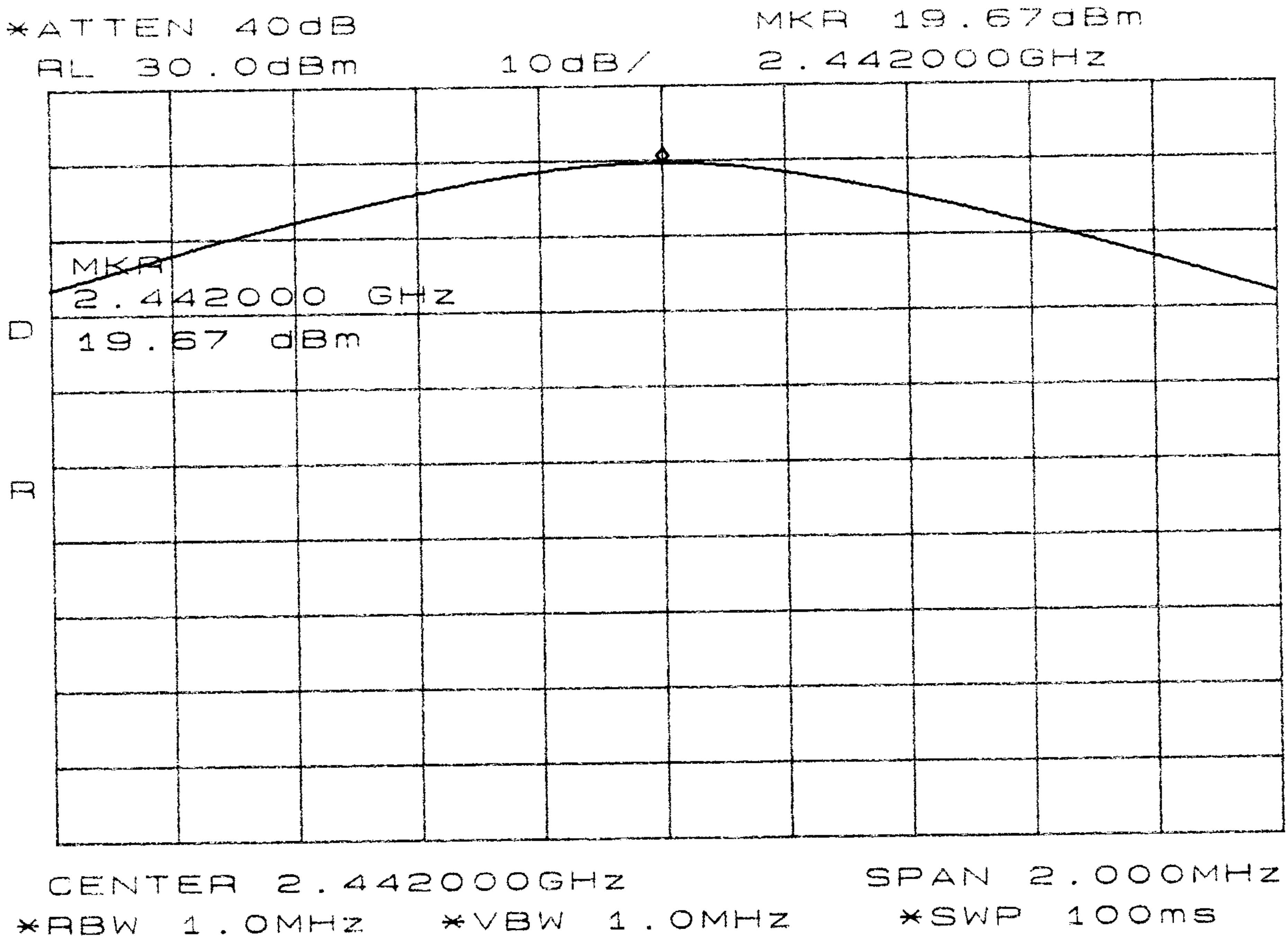

*ATTEN 40dB
RL 30.0dBm
10dB/
ΔCNT .16dB
0 Hz
ΔMKR
191.7 ms
.16 dB
D
R
CENTER 2.402000000GHz
SPAN 0Hz
*RBW 100kHz
*VBW 100kHz
*SWP 1.00sec

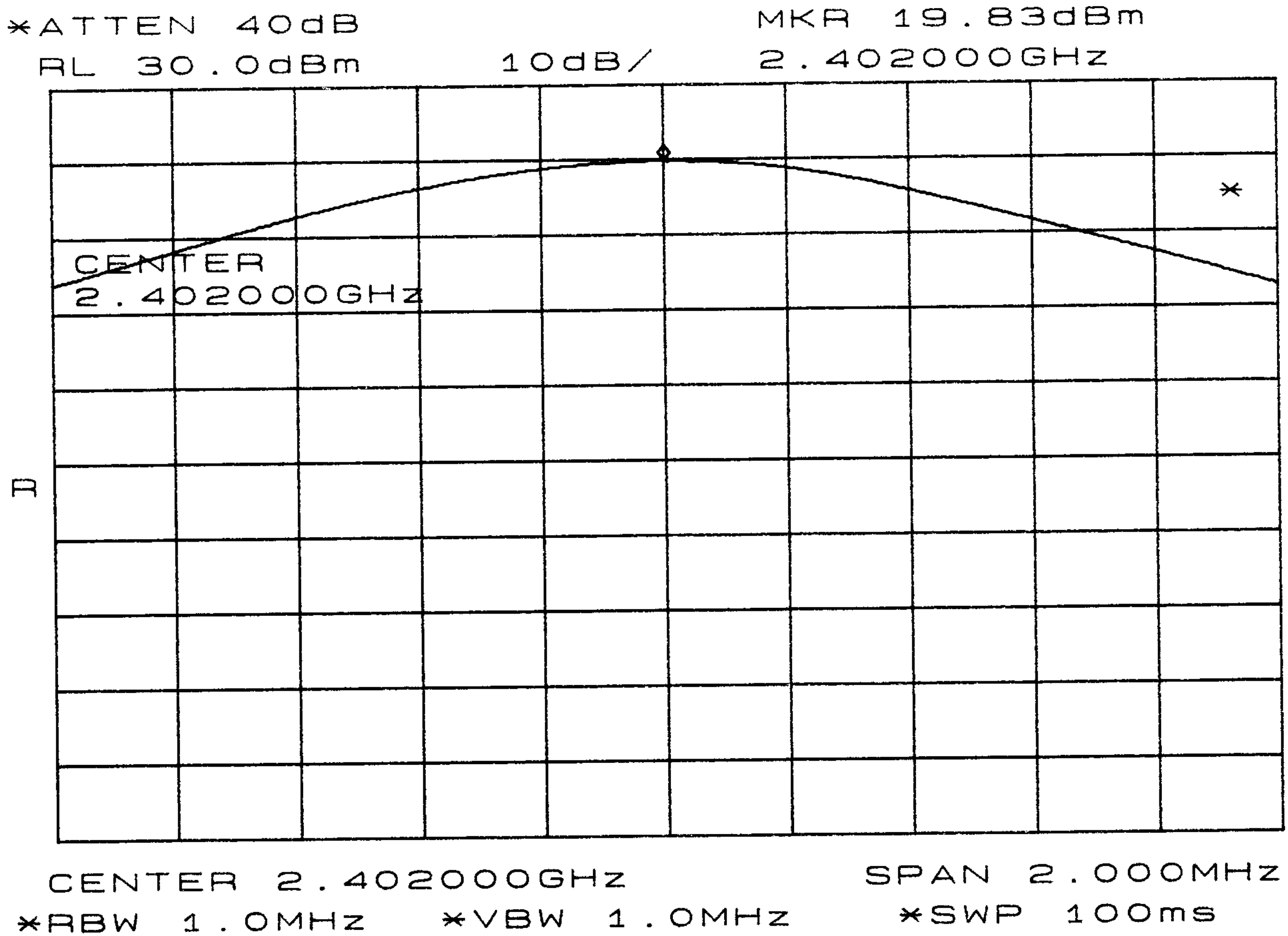

*ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -.17dB
191.7ms
ΔMKR
191.7 ms
-.17 dB
D
R
CENTER 2.4420000000GHz
SPAN 0Hz
*RBW 100KHz
*VBW 100KHz
*SWP 1.00sec


*ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR .17dB
191.7ms
ΔMKR
191.7 ms
.17 dB
D
R
CENTER 2.480000000GHz
SPAN 0Hz
*RBW 100KHz
*VBW 100KHz
*SWP 1.00sec

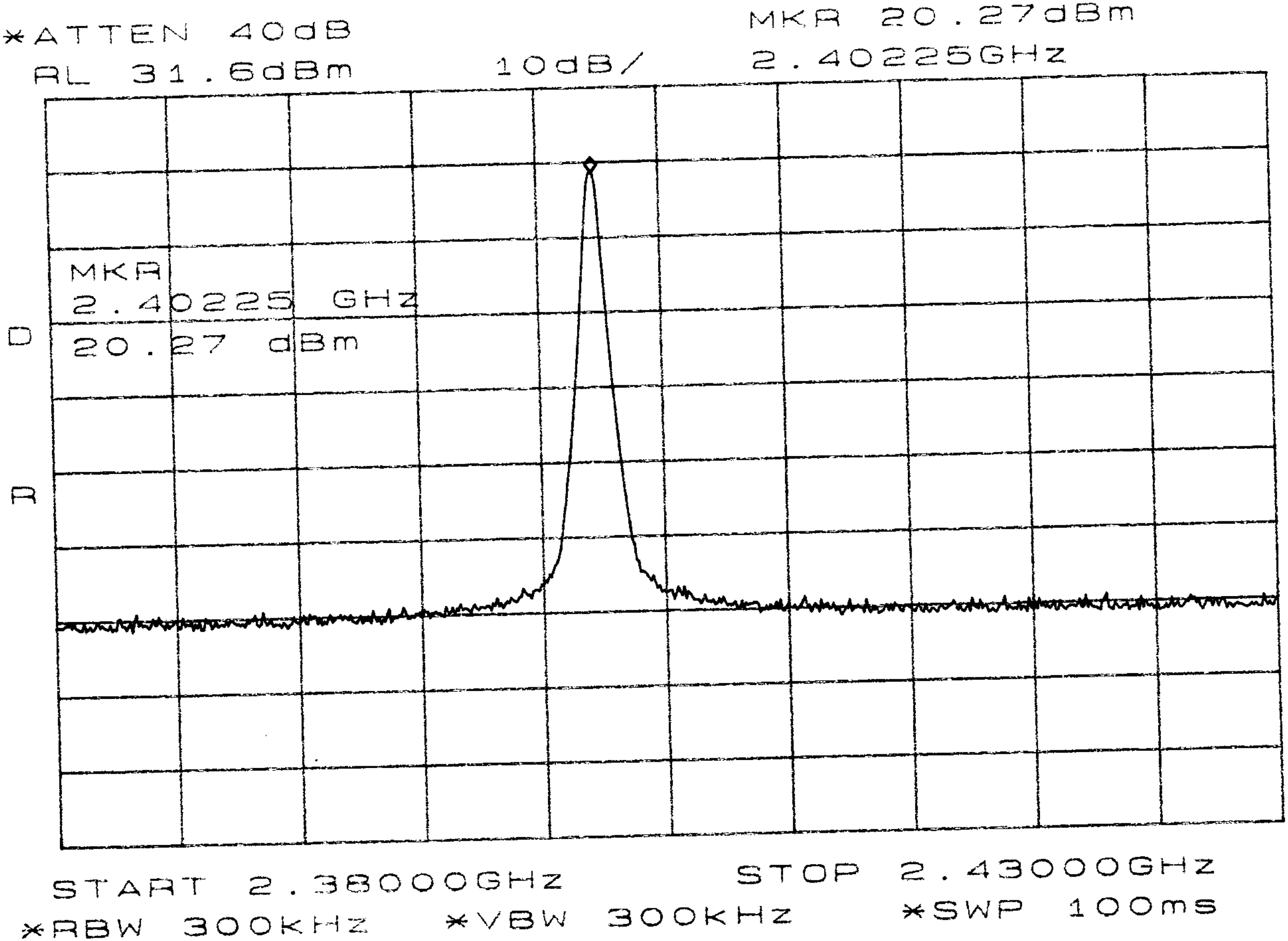
Appendix 6 : Plotted Data for Output Peak Power


*ATTEN 40dB
RL 30.0dBm
10dB/
MKR 19.33dBm
2.480000GHz
SPAN
2.000 MHz
R
CENTER 2.480000GHz
SPAN 2.000MHz
*RBW 1.0MHz
*VBW 1.0MHz
*SWP 100ms

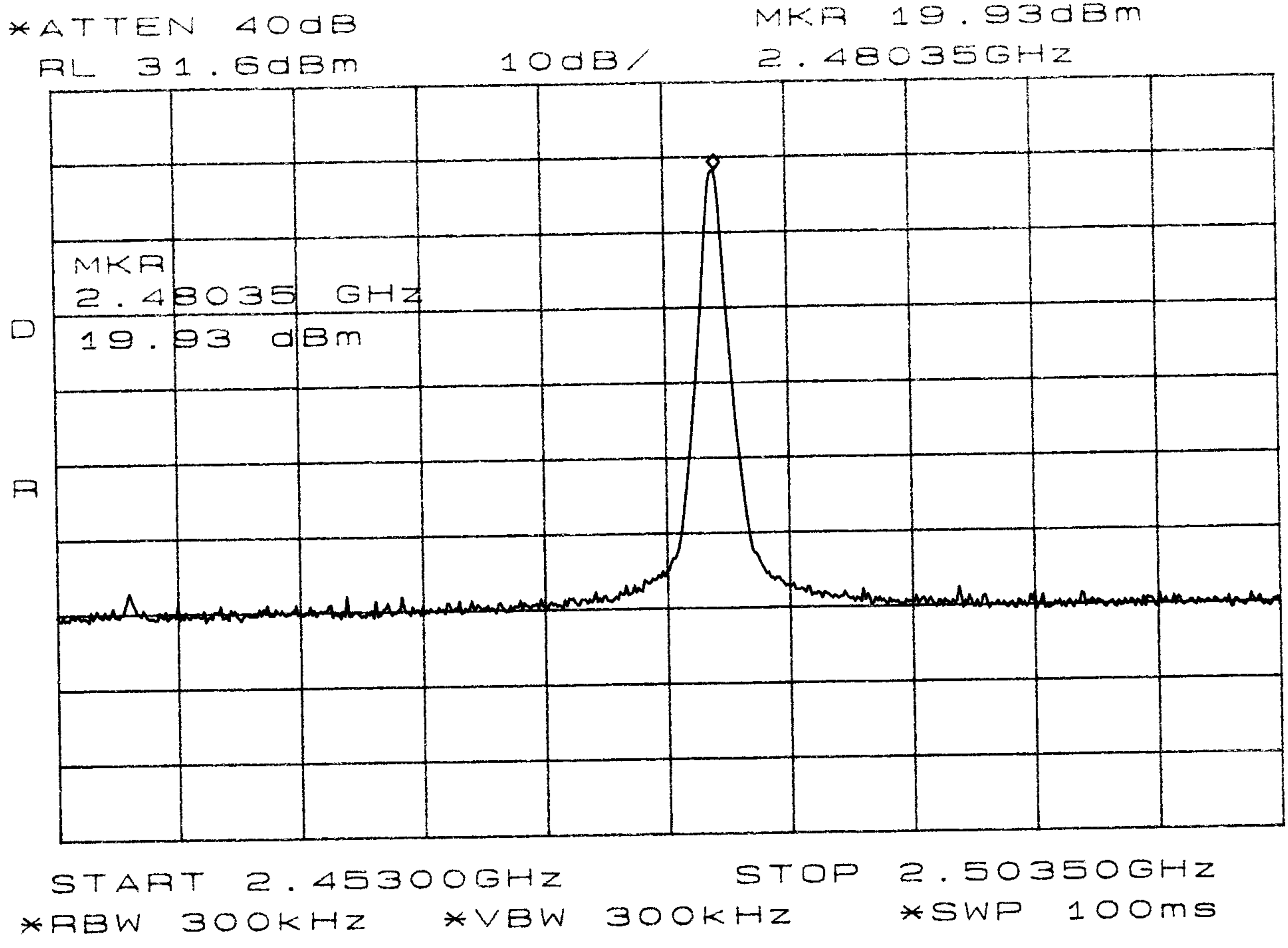

*ATTEN 40dB
RL 30.0dBm
10dB/
MKR 19.67dBm
2.442000GHz
MKR
2.442000 GHz
19.67 dBm
D
R
CENTER 2.442000GHz
*RBW 1.0MHz
*VBW 1.0MHz
SPAN 2.000MHz
*SWP 100ms


*ATTEN 40dB
RL 30.0dBm
10dB/
MKR 19.83dBm
2.402000GHz
CENTER
2.402000GHz
R
CENTER 2.402000GHz
SPAN 2.000MHz
*RBW 1.0MHz
*VBW 1.0MHz
*SWP 100ms

Appendix 7 : Plotted Data for 100 kHz Bandwidth from Band Edge



*ATTEN 40dB
RL 31.6dBm
10dB/
MKR 20.27dBm
2.40225GHz
MKR
2.40225 GHz
20.27 dBm
D
R
START 2.38000GHz
STOP 2.43000GHz
*RBW 300KHZ
*VBW 300KHZ
*SWP 100ms


*ATTEN 40dB
RL 31.6dBm
10dB/
MKR 19.93dBm
2.48035GHz
MKR
2.48035 GHz
19.93 dBm
D
R
START 2.45300GHz
STOP 2.50350GHz
*RBW 300kHz
*VBW 300kHz
*SWP 100ms