FCC CERTIFICATION REPORT

for

Symbol Technologies, Inc.

FCC ID: H9PWWC1046

1.0 Introduction

This report has been prepared on behalf of Symbol Technologies, Inc. to support the attached Application for Equipment Authorization. The test and application are submitted for an Intentional Radiator under Section 15.249 of the FCC Rules and Regulations. The Equipment Under Test was the Symbol Technologies, Inc. WWC 1046 Dual Transmitter.

All measurements herein were performed according to the 1992 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and field Strength Instrumentation. Calibration checks are made periodically to verify proper performance of the measuring instrumentation.

All measurements are performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code 200066-0) as an independent test laboratory.

The results of this test report relate only to the item tested. This report shall not be used to claim product endorsement by NVLAP or any agency of the US Government.

1.1 Summary

The Symbol Technologies, Inc. WWC 1046 Dual Transmitter complies with the limits for an Intentional Radiator under Section 15.249.

2.0 Description of Equipment Under Test (EUT)

The Symbol Technologies, Inc. WWC 1046 Dual Transmitter controls all functions of a Symbol Technologies' Wearable Scanning System (WSS). The battery powered system is an infrared scanner used for data collection and consists of a ring scanner and wearable wrist computer (WWC). The WWC provides the user interface to the system, scanner control, and radio communication link. The WWC 1046 contains a 2.4 GHz spread spectrum transmitter PCMCIA card used to communicate with a remote PC that collects the data from the WSS. The unit also contains a second short range radio transmitter that operates at 926 MHz and is used to provide wireless printing capability for the system.

The WWC is already FCC approved, FCC ID: H9PWWC1049, with a 916.5 MHz low power transmitter and 2.4 GHz spread spectrum transmitter. This application is for the WWC 1046 which contains the 926 MHz low power transmitter and the same 2.4 GHz spread spectrum transmitter as the already FCC approved unit, FCC ID: H9PWWC1049. The two units are identical except for the transmit frequency of the low power transmitter. Data for the 2.4 GHz spread spectrum transmitter is provided from the previously approved application, FCC ID: H9PWWC1049, since the layout and placement for this transmitter is the same as the previous unit.

The digital portion of the unit was FCC verified during testing of the original WWC and this portion of the unit was not changed.

2.1 On-board Oscillators

The Symbol Technologies, Inc. WWC 1046 Dual Transmitter contains an FCC approved Spectrum 24 Wireless LAN PCMCIA card, FCC ID: H9PLA2400, for the 2.4 GHz spread spectrum transmitter and a RF Monolithics ASH transmitter for the 926 MHz low power transmitter. The digital section of the unit the unit contains a 16 MHz and 32.768 kHz oscillator.

3.0 Test Configuration

To complete the test configuration required by the FCC, the system was powered on and tested in all three orthogonal planes.

3.1 Testing Algorithm

The transmitter was turned on and continuously transmitting. Worst case emissions are recorded in the data tables.

3.2 Conducted Emissions Testing

Conducted emissions testing is not required since the EUT is battery powered.

3.3 Radiated Emissions Testing

The EUT was then placed on an 80 cm high 1 x 1.5 meters non-conductive motorized turntable for radiated testing on a 3 meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Biconical log periodic and horn broadband antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

The output from the antenna was connected, via a preselector or preamplifier, to the input of the spectrum analyzer. The detector function was set to quasi-peak for frequencies below 1000 MHz and peak for frequencies above 1000 MHz. For frequencies below 1000 MHz, the measurement bandwidth on the spectrum analyzer system was set to at least 120 kHz, with all post-detector filtering no less than 10 times the measurement bandwidth. For frequencies above 1000 MHz, the resolution bandwidth on the spectrum analyzer system was set to 1 MHz and the video bandwidth on the spectrum analyzer system was set to 1 MHz for peak measurements.

3.3.1 Radiated Data Reduction and Reporting

To convert the raw spectrum analyzer radiated data into a form that can be compared with the FCC limits, it is necessary to account for various calibration factors that are supplied with the antennas and other measurement accessories. These factors are grouped into a composite antenna factor (AFc) and are supplied in the AFc column of Table 1. The AFc in dB/m is algebraically added to the Spectrum Analyzer Voltage in dbμV to obtain the Radiated Electric Field in dBμV/m.

Only peak measurements were taken above 1 GHz and compared to the average limit. Quasi-peak measurements were taken for emissions below 1 GHz.

Example:

Spectrum Analyzer Voltage:	VdBμV
Composite Antenna Factor:	AFcdB/m
Electric Field:	EdBμV/m = VdBμV + AFcdB/m
To convert to linear units:	EμV/m = antilog (EdBμV/m/20)

Data is recorded in Table 1.

Table 1

Radiated Emissions Test Per 15.249

CLIENT: Symbol Technologies, Inc.
FCC ID: H9PWWC1046
DATE: 4/9/98
BY: Steve Koster
JOB #: 4497X

FREQ MHz	POL H/V	Azimuth Degree	Ant Height m	SA LEVEL (QP) dBuV	AFc dB/m	E-FIELD dBuV/m	E-FIELD uV/m	LIMIT uV/m	MARGIN dB	
168.01	V	135.00	1.0	7.6	11.2	18.8	8.7	150.0	-24.7	
926.00	H	225.00	1.0	47.9	28.5	76.4	6590.2	50000.0	-17.6	
				Peak						
1000.00	H	0.00	1.0	33.5	-16.2	17.3	7.3	500.0	-36.7	*
1852.13	V	180.00	1.0	35.9	-6.9	29.0	28.2	500.0	-25.0	
2778.00	H	0.00	1.0	33.9	-13.5	20.4	10.5	500.0	-33.6	*
3704.25	H	225.00	1.0	34.7	-6.0	28.7	27.2	500.0	-25.3	
4630.32	H	225.00	1.0	34.7	-4.5	30.2	32.4	500.0	-23.8	
7408.00	H	0.00	1.0	32.0	4.0	36.0	63.2	500.0	-18.0	*
8334.00	H	0.00	1.0	32.6	4.8	37.4	74.1	500.0	-16.6	*

*** No emissions from the EUT were detected at these frequencies. Ambient levels were recorded.**

Table 2

System Under Test

FCC ID: H9PWWC1046

EUT: Symbol Technologies, Inc. WWC 1046 Dual Transmitter; FCC ID: H9PWWC1046; S/N: ALPH0582

Table 3

Measurement Equipment Used

The following equipment is used to perform measurements:

Hewlett-Packard Spectrum Analyzer: HP 8568B

Hewlett-Packard Spectrum Analyzer: HP 8593A

Hewlett-Packard Quasi-Peak Adapter: HP 85650A

Hewlett-Packard Preselector: HP 85685A

Hewlett-Packard Preamplifier: HP 8449B

Antenna Research Associates, Inc. Biconical Log Periodic Antenna: LPB-2520

Antenna Research Associates Horn Antenna: DRG-118/A

Solar 50 Ω/50 μH Line Impedance Stabilization Network

Washington Laboratories Portable Antenna Mast

AH Systems, Inc. Motorized Turntable

RG-214 semi-rigid coaxial cable

RG-223 double-shielded coaxial cable

EXHIBIT 1

EUT PHOTOGRAPHS

EXHIBIT 2

MAXIMUM RADIATED EMISSIONS CONFIGURATION

Technical Description

2.4 GHz Spread Spectrum Transmitter

2.1.3 Radio Section

The radio portion of uses a frequency hopping spread spectrum method over an extended range of 2.4 to 2.5 GHz, with actual operating frequency bands depending on various countries' regulations. The FH channels are 1 MHz wide, with nominal channel centers at the 1 MHz increments and hop dwell times up to a maximum of 400 msec. The radio transmits and receives at 1 Mbps using a binary GFSK modulation with BT=0.5 and minimum deviation of 160 KHz (h=0.32).

The radio portion is designed in two versions. The first version is a minimum cost 100 mW transmit power radio with a stuffing option for antenna diversity. The second is a higher power version scaleable from 250 mW to 500 mW, with antenna diversity included. Antenna diversity improves performance in multipath environments by constantly testing and using the best of two nearly independent propagation paths. Diversity is only used for receiving; the transmit path is hardwired to a single antenna.

The radio is designed with two synthesizers, a frequency hopped and a fixed frequency synthesizer. The radio uses a upconversion transmitter with a 371 MHz IF and a (fc -371) MHz LO to produce the output signal at fc. The output of the fixed frequency synthesizer is divided down with two different modulus values to provide different frequencies for transmit IF and receiver second LO. The receiver uses a 5.888 MHz second IF for FM demodulation.

In transmit mode, transmit data is filtered by a 3-pole Bessel low pass filter with 3 dB bandwidth of 0.5 MHz and summed with the fixed frequency synthesizer loop error at the input of the VCO. Compensation is used to reduce data bias tracking within the loop.

In receive mode, the received signal is input into an FM demodulator which has two output signals. The RSSI output of the FM demodulator is routed to an A/D with a parallel interface to Crux. DC offset at the baseband output of the demodulator is removed with a switchable time constant RC filter. The bias compensated signal is then sliced into a bi-level signal and input into Crux. Crux performs a carrier sense algorithm, recovers the symbol timing, and converts the signal into bits. Upon detection of the start frame delimiter, Crux sends a signal back to the radio to switch the RC time constant from fast to slow.

The receiver uses a SAW band-pass filter at the IF frequency. The SAW 3 dB bandwidth is 1 MHz. A low-pass filter after demodulation also limits the bandwidth to approximately 1 MHz.

2.1.4 Hopping Pattern

The hopping pattern for USA FCC 15.247 and Europe ETSI 300-328 is a pseudo-random sequence which selects one of 79, 1 MHz channels centered from 2402 to 2480 MHz.

Each channel is evenly utilized by selecting each channel once and only once in each cycle, and using identical dwells at each channel.

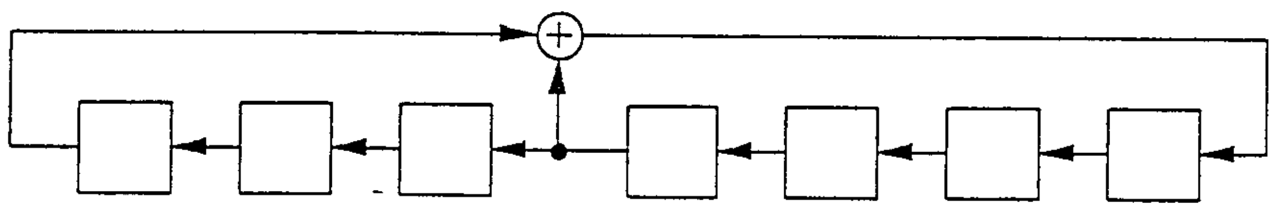
The Spectrum 24 network communicates by half duplex. A transmitter and receiver must and do follow the same hop pattern in synchronization. In this way a unit which wishes to transmit to a receiver which is part of the same association will find on any hop that the potential receivers are also on the same hop at the same time and are following the same sequence.

Each channel is evenly utilized by selecting each channel once and only once in each cycle, and using identical dwells at each channel. The hop pattern does not reset (recycle) until the hop pattern has been completed.

Each channel is equally used by the hop pattern and dwell time operation and each unit is a transceiver with receiver and transmitter following the hop pattern together. The data presented to the transceiver is random and on average evenly distributed in time. The evenly distributed data presented to the transmitter together with the equally distributed channel utilization by the hop pattern and dwell time produce on the average each frequency equally used by the transmitter.

The beacons and any other transmission (or receive) always follow the pseudorandom hopping pattern.

The hopping pattern is based on a pseudo-random sequence generated by a linear shift register with taps corresponding to the irreducible polynomial $x^7 + x^4 + 1$ as shown in the figure below.



The contents of the registers form 7-bit words with values from 1 to 127. The irreducible polynomial produces a maximal length sequence which mean that each value from 1 to 127 occurs once and only once in each cycle. Values less than 2 and greater than 80 are eliminated, leaving 79 values from 2 through 80 which corresponds to the frequencies 2402 through 2480.

A set of 78 hopping patterns are derived by permutations of the basic pseudo-random sequence. The permutations are derived by a sequential incrementing with modulo wrap-around through the basic pseudo-random sequence with an incremental delta from 1 to

78. Because the number of channels (79) in the hopping set is a prime number, a sequential incrementing through the base pseudo-random sequence using a delta from 1 to 78 will produce a unique sequence that is equally pseudo-random and evenly utilized as the basic pseudo-random sequence.

The basic pseudo-random sequence and the first 8 permutations with deltas of 2 to 9 are shown in the tables below. A delta of 1 reproduces the basic pseudo-random sequence. The values in all columns including the index are between 2 and 80 for a total of 79 channels, and each sequence begins at the same channel as a point of reference.

Index	Basic PRN Sequence	Delta= 2	Delta= 3	Delta= 4	Delta= 5	Delta= 6	Delta= 7	Delta= 8	Delta= 9
2	67	67	67	67	67	67	67	67	67
3	7	14	29	59	60	75	22	44	50
4	14	59	75	44	73	36	16	64	4
5	29	75	50	36	32	4	34	19	24
6	59	44	36	64	17	19	49	46	48
7	60	73	32	17	38	11	54	12	53
8	75	36	4	19	11	48	51	78	52
9	22	16	34	49	54	51	28	33	47
10	44	64	19	46	12	78	33	62	27
11	50	4	24	48	53	52	47	27	14
12	73	17	11	12	57	21	70	7	18
13	18	68	58	26	80	74	31	50	17
14	36	19	48	78	21	27	60	2	69
15	72	76	6	30	37	63	36	38	3
16	16	49	51	33	70	60	8	58	39
17	32	11	53	21	71	18	76	25	33
18	64	46	78	62	7	2	58	28	37
19	2	45	79	40	75	9	12	66	56
20	4	48	52	27	18	69	39	37	59
21	8	3	66	15	64	54	52	55	72
22	17	12	21	7	34	25	42	14	68
23	34	51	47	60	76	39	40	73	23
24	68	26	74	50	23	61	71	4	12
25	9	41	35	72	48	10	29	76	28
26	19	78	27	2	25	37	73	45	5
27	38	57	71	34	41	13	2	51	20
28	76	30	63	38	79	31	19	57	15
29	24	52	14	69	33	59	23	5	75
30	49	33	60	58	42	73	3	74	32
31	69	5	44	65	74	64	53	56	19
32	11	21	18	25	13	68	30	29	58
33	23	43	16	53	15	49	10	18	51
34	46	62	2	28	14	45	74	8	79
35	58	74	17	61	22	12	55	24	21
36	45	40	9	66	36	41	7	54	35
37	54	70	76	42	2	30	44	77	63
38	48	27	69	37	68	5	32	79	44
39	65	56	46	35	24	62	68	10	2
40	3	15	54	55	46	70	69	20	76
41	6	63	3	31	65	15	48	71	54
42	12	7	25	14	51	29	77	59	26
43	25	29	26	75	39	50	57	36	61
44	51	60	39	73	30	32	66	17	43
45	77	22	57	16	66	34	62	49	13
46	26	50	61	4	43	24	13	48	7
47	53	18	33	68	20	58	63	26	73
48	41	72	10	76	27	6	75	30	8
49	39	32	43	11	31	53	72	21	49
50	78	2	37	45	29	79	17	40	65
51	28	8	40	3	44	66	24	15	41

Index	Basic PRN Sequence	Delta= 2	Delta= 3	Delta= 4	Delta= 5	Delta= 6	Delta= 7	Delta= 8	Delta= 9
52	57	34	13	51	72	47	45	60	80
53	79	9	56	41	4	35	25	72	62
54	30	38	31	57	9	71	78	34	55
55	61	24	7	52	49	14	80	69	29
56	52	69	59	5	58	44	43	65	36
57	80	23	22	43	3	16	35	53	34
58	33	58	73	74	77	17	15	61	11
59	66	54	72	70	78	76	59	42	6
60	5	65	64	56	61	46	18	35	78
61	10	6	8	63	5	3	4	31	66
62	21	25	68	29	47	26	38	75	74
63	42	77	38	22	40	57	46	16	71
64	43	53	49	18	55	33	6	68	60
65	47	39	23	32	63	43	41	11	16
66	62	28	45	8	59	40	61	3	9
67	37	79	65	9	50	56	21	41	46
68	74	61	12	24	16	7	20	52	25
69	20	80	77	23	8	22	56	43	57
70	40	66	41	54	19	72	14	70	10
71	35	10	28	6	69	8	50	63	40
72	70	42	30	77	45	38	64	22	31
73	13	47	80	39	6	23	9	32	22
74	27	37	5	79	26	65	11	9	64
75	55	20	42	80	28	77	65	23	38
76	56	35	62	10	52	28	26	6	45
77	71	13	20	47	10	80	79	39	77
78	15	55	70	20	62	42	5	80	30
79	31	71	55	13	35	20	37	47	42
80	63	31	15	71	56	55	27	13	70

2.1.5 Power Conservation

There are two methods of power conservation used in to maximize battery life. The first is at the MAC level where provisions are made for portable units to go to a "sleep" mode and periodically "awake" to check if they have any waiting messages. This requires a time synchronization with all of the terminals within a Basic Service Set. FH networks also require hop frequency synchronization, and both requirements are met by the same provision.

The second method is at the PHY level where sections of the radio are powered up separately only as needed and turned off as soon as possible.

3. Interface Definition

3.1 External Interfaces

3.1.1 Physical Interface

PCMCIA type II standard interface as specified in PCMCIA Card Services Specification.

3.1.2 Logical Interface

Uses I/O and memory interface

18 bit address

8 bit data

3.1.3 Antenna/RF Interface

3.1.3.1 Antenna Connector

Connector type:	Proprietary
Number of connectors:	2
Impedance:	50 ohms

3.1.3.2 Channel Frequencies

Frequency range:	2400 to 2500 MHz programmable for different country regulations
Number of channels:	100 programmable in 1 MHz steps for different country regulations

3.1.3.3 Modulation Format

Modulation type:	Binary GFSK, Gaussian filter BT = 0.5
Peak frequency deviation:	167 kHz, +/-7 kHz

4. Performance Requirements and Objectives

4.1 General

Frequency range:	2400 to 2500 MHz programmable for different country regulations
Number of channels:	100 programmable in 1 MHz steps for different country regulations
Minimum hopping rate:	2.5 hops/sec (per FCC part 15.247)
Hopping sequence:	IEEE P802.11
Maximum data bias:	+32/-32 bits over all packet lengths
Maximum data run length:	41 bits of consecutive 1's or 0's

4.2 Transmit Performance

Transmit power level:	Model chosen based on country regulation and cost
Low power version:	100 mW
Mid power version:	230 mW
High power version:	500 mW

Maximum radiated EIRP	FCC regulations part 15.247 in US ETS 300-328 in Europe RCR STD-33 in Japan
Center frequency tolerance:	± 25 ppm
Modulation:	Binary GFSK, Gaussian filter BT = 0.5
Modulator baseline wandering:	_ 20% of nominal peak deviation
Occupied 20 dB bandwidth:	_ 1 MHz

Integrated power in 1 MHz bandwidth relative to total transmit power centered at:

f_c ± 2 MHz	_ -45 dBc
f_c ± 3 MHz	_ -60 dBc
In-band spurs	_ -50 dBc (802.11 FH & DS PHY are both -55 dBc)
Out-of-band emissions	FCC regulations part 15.247, 15.209 in US, ETSI 300 - 328 in Europe, and RCR STD-33 in Japan

4.3 Receive Performance

Sensitivity:	_10^{-3} BER @ -85 dBm (min signal level)
Maximum useable input level:	_10^{-3} BER @ -10 dBm (1 W @ 1 meter)
Center frequency acceptance range:	+/- 25 ppm
Alternate channel selectivity:	_ 45 dB for desired signal at 2 dB above minimum signal level and interfering signal _2 channels away

4.4 Timing Requirements

WLAN Adapter State Transition Times

Off to Idle	1 ms
Idle to Standby	8 ms
Transmit to Receive	<20 µs
Receive to Transmit	<20 µs

Note: transition times do not include hop frequency synchronization with the access point or ad hoc peers.

Hop frequency transition time	<225 µs

4.5 Power Requirements

Estimates of the average current draw (in mA) versus power conservation state are shown in Figure 6-1.

State Name:	Sleep	Idle	Standby 1	Standby 2	Receive	Transmit 100 mW	Transmit 560 mW
Sleep registers	6	0.05	0.05	0.05	0.05	0.05	0.05
20 MHz	off	4	4	4	4	4	4
CPU, arrays, memory	off	30	100	100	130	130	130
Fixed (slow) synth	off	off	62	62	62	62	62
Hopping (fast) synth; FM demod; negative bias	off	off	off	48	48	48	48
Receiver	off	off	off	off	36	off	off
Transmitter (100 mW)	off	off	off	off	off	125	350
Total Current Draw mA	6	36	168	216	282	371	596

Figure 4.5- Power Conservation State Definition and Power Dissipation Estimates

2.0 General Information

Applicant:	Symbol Technologies, Inc. 2145 Hamilton Avenue San Jose, CA 95125
Contact Person:	Ray Martino, Jr.
Equipment Under Test:	Sirius WLAN Adapter Card
Model Number:	LA2400
Serial Number:	Pre Production Prototype 002
FCC ID Number:	H9PLA24005AZL
Report Number:	B1072495
Date of Test:	July 24 - 28, 1995
Manufacturer:	Symbol Technologies, Inc.
Type of Test:	FCC part 15, Subpart B, 15.247 (Certification)
requency Range:	450 kHz to 30 MHz - Line Conducted Emissions 30 MHz to 1000 MHz - Radiated Emissions 2400 MHz to 24.5 GHz - part 15.247

Summary

Pass/Fail: Passed

Line Conducted Test:

The EUT was placed in a screen room and connected to a LISN of primary AC Power. All other associated peripherals and support equipment was connected to a separate power source. The highest emission observed was **-35.5 dB** below the applicable limit. All emissions observed were below the FCC, Class A limit.

Radiated Test:

The EUT was placed on a 3 meter open field test site. The highest emission observed was **-10.6 dB** below the applicable limit. All emissions observed were below the FCC, Class A limit.

15.247 Operation within the 2400 - 2483.5 MHz band:
The EUT met all the requirements. See attached data and plots.

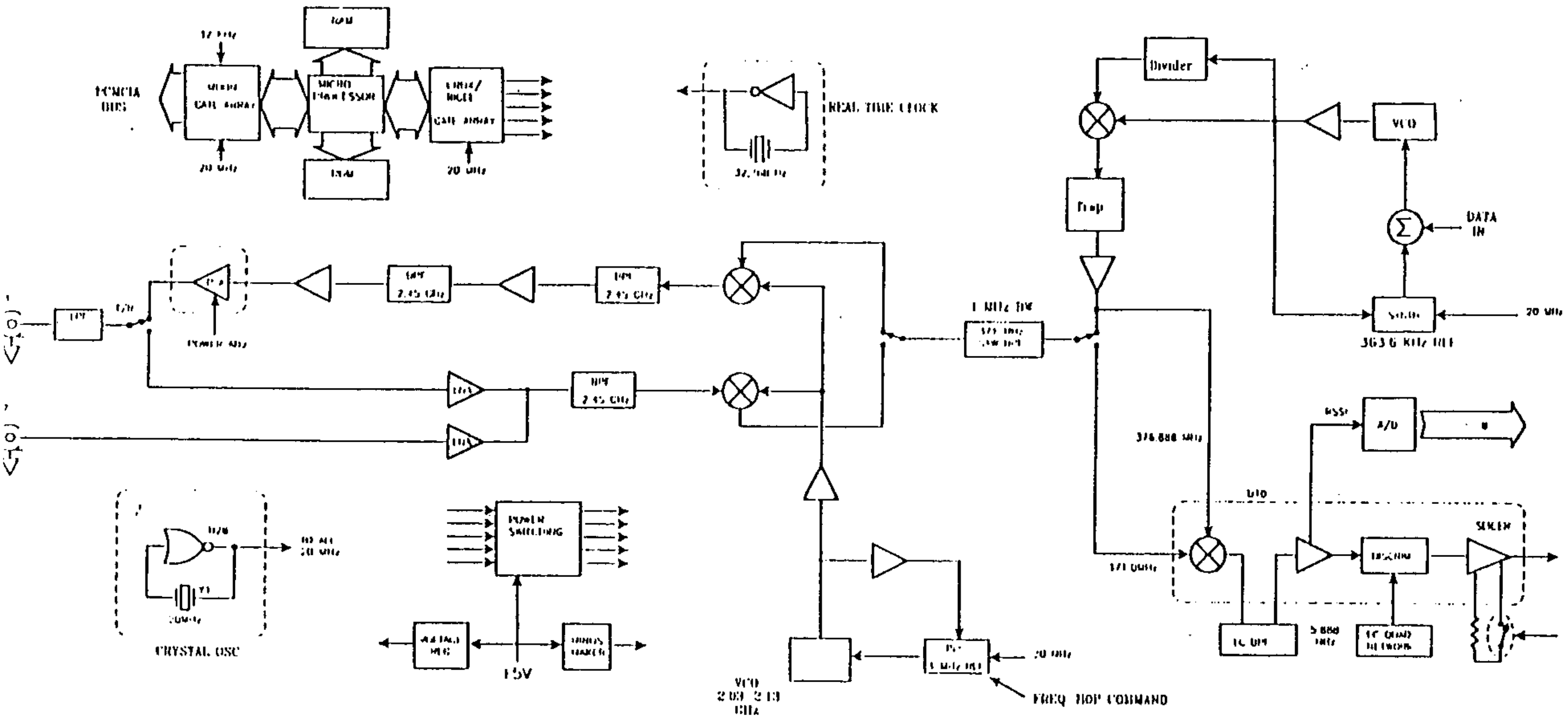


Figure 2.1.3. Radio Section Block Diagram

FCC ID: H9PWWC1049

3.0 Test Facility

Name: Electronic Compliance Laboratories

Location: 1249 Birchwood Drive
Sunnyvale, CA 94089

Site Filing: A site description is on file at the Federal Communications Commission
P.O. Box 429
Columbia, MD 21045

Types of Sites: Open Field Radiated and Indoor (Screen Room).
Line Conducted: All sites are constructed and calibrated to meet ANSI C63.4-1994 requirements.

4.0 Test Equipment Settings

Parameter	Line Conducted Emissions	Radiated Emissions
Bandwidth	9 kHz	120 kHz
*Detector Mode	Peak	Peak

*(Unless otherwise specified)

Units of Measurement

Measurements of radiated emissions are reported in terms of micro volts per meter or in dBμV/m, at a specified distance. The indicated readings on the spectrum analyzer are converted to micro volts per meter or to dBμV/m by use of appropriate conversion factors. Measurements of conducted interference are reported in terms of microvolts, or dBμV.

5.0 Antennas

Antenna Type	Frequency Range
Biconical	25 to 300 MHz
Log Periodic	300 to 1000 MHz
Horn Double Ridge	1 to 24 GHz
Horn Parabolic	4.9 to 10 GHz
Horn Polarad	4.7 to 7.74 GHz
Horn Polarad	8.3 to 10 GHz

Correction Factors: Programmed into the software.
Antenna Height: Varied from 1 to 4 meters above the ground plane.
Polarization: Vertical/Horizontal

The antenna used at the time the data was taken is indicated on each data page. The correction factors and antenna polarization are noted on the data pages.

5.1 Test Equipment

The following list contains equipment used at EC Laboratories, Inc. for compliance testing. The equipment conforms to the American National Standard Specifications for Electromagnetic Interference and Field Strength Instrumentation from 10 kHz to 1000 MHz.

Description	Manufacturer	S/N	Model Number	Cal. Due Date
EMI Receiver	HP	3325A00137	Model 8546A	7/11/95
EMI Receiver	HP	3137A01183	Model 8563A	7/11/95
Pre-Amp	EM	243	BPA1000	7/11/95
Pre-Amp	HP	3008A00527	8449B	7/11/95
LISN	EM	2532	ANS-25/2	As needed
Plotter	HP	2644V00365	7470A	N/A

EM = ElectroMetrics
HP = Hewlett Packard

The calibration of the measuring instruments, including any accessories that may effect such calibration, are checked frequently to assure their accuracy. Adjustments are made and correction factors applied in accordance with instructions contained in the manual for the measuring instrument.

6.0 Data Reporting Format

The measurement results are expressed in accordance with FCC Part-15, Subpart B Class B limits, where applicable, are presented in tabular or graphical form.

6.1 Operating Conditions

The EUT was operated at the specified load conditions (mechanical and/or electrical) for which it was designed.

6.2 Conditions of the EUT

The EUT was operated for a sufficient period of time to approximate normal operating conditions.

6.3 Test Configuration

The equipment under test was configured and operated in a manner which tends to maximize its emission characteristics in a typical application. Power and signal distribution, ground, interconnecting cabling and physical placement of equipment were simulating the typical application and usage in so far as practicable. The EUT was furnished with rated voltage as specified by the manufacturer in the individual equipment's power requirements.

6.4 Test Platform

The EUT was placed on a wooden table having a height of 1 meter above the test site ground plane.

6.5 Maximization of Emissions

The test platform was rotated 360 degrees along with the moving of cabling and/or equipment's in order to determine the maximum level of emissions.

6.6 Temperature

The ambient temperature of the testing location was within the range of 10 to 40 deg. C (50 to 104 Deg. F).

7.0 Detector Functions

On any frequency or frequencies below or equal to 1000 MHz, the limits shown below are based n measuring equipment employing a CISPR quasi-peak detector function and related measurement ,andwidths.

On any frequency or frequencies above 1000 MHz, the radiated limits shown below are based on the use of measuring equipment employing an average detector function.

EC Laboratories uses the Peak detection mode for normal testing and initial screening of the EUT. The Peak detection mode will produce a measurement value that is always greater than, or equal to, the quasi-peak or average detection mode. Whenever the measurement value is 6 dB below the applicable limit or greater, the appropriate detector function will be employed and recorded.

7.1 Frequency Range of Investigation

The spectrum was investigated up to the frequency specified in the following table according to the highest clock frequency generated in the device.

Highest Frequency Used (Clock)	Upper Limit of Range Measured
Below 1.705 MHz	30 MHz
1.705 to 108 MHz	1000 MHz
108 to 500 MHz	2000 MHz
500 to 1000 MHz	5000 MHz
Above 1000 MHz	5th Harmonic or 40 GHz (Whichever is Lower)

8.0 FCC Class Types

Class A Digital Device

A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

Class B Digital Device

A digital device that is marketed for use in a residential environment notwithstanding use in a commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B 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 devices a Class B digital device, regardless of its intended use.
(Code of Federal Regulations, 47, Part 15, Subpart A, Sect. H&I)
(CFR 47, Parts 0 TO 19, Revised as of October 1,1990)

9.0 FCC Limits

9.1 Conducted Emission Limits

For a digital device that is designed to be connected to the public utility (AC)power line, the radio frequency voltage that is conducted back into the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed the limits in the following table for the appropriate class. Compliance shall be based on the measurement of the Radio Frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Frequency (MHz)	Class A Limit (μV)	Class A Limit (dBμV)	Class B Limit (μV)	Class B Limit (dBμV)
0.45 to 1.705	1000	60.0	250	48.0
1.705 to 30.0	3000	69.5	250	48.0

9.2 Radiated Emission Limits

The field strength of radiated emissions for a Class A Digital Device, when measured at a distance of 10 meters, shall not exceed the limits given in the table below. The lower limit applies at the band edge.

The field strength of radiated emissions for a Class B Digital Device, when measured at a distance of 3 meters, shall not exceed the limits given in the table below. The lower limit applies at the band edge.

Frequency (MHz)	Class A (3m) Limit (μV/m)	Class A (3m) Limit (dBμV/m)	Class A (10m) Limit (μV/m)	Class A (10m) Limit (dBμV/m)	Class B (3m) Limit (μV/m)	Class B (3m) Limit (dBμV/m)
30-88	300	49.6	90	39.1	100	40.0
88-216	500	54.0	150	43.5	150	43.5
216-960	700	56.0	210	46.4	200	46.0
Above 960	1000	60.0	300	49.5	500	54.0

10.0 Test Methods

10.1 Line Conducted Emissions Test Procedure

.. EUT and any other equipment and cables were placed on a wood table one meter above a ground screen.
2. The EUT's Input Power line cord was connected to a Line Impedance Stabilization Network (LISN) under the table.
3. All other (Non-EUT) equipment received power from a separate AC Power Source. The LISN assembly has two monitoring points: Line 1 (AC-Hot) and Line 2 (AC-Neutral). Each monitoring point was scanned by the measuring equipment (the other point was terminated in 50 ohms) over the frequency range of 450 kHz to 30 MHz for conducted emissions.
4. When an emission is found, the following takes place:
   a. The emission levels are maximized by equipment/cable placement.
   b. Frequency and emission level data are entered into computer in dBm.
   c. The monitoring point (Line 1 or 2) is entered into the computer.
   d. The computer converts dBm to micro volts and uses a look-up table to find cable losses (in dB) at that frequency, calculates a corrected emission level, and compares the corrected emission level to the appropriate limit. The data is then printed out in tabular form.

An example of the printout and definitions follows below.

11.0 Line Conducted Emissions Test Example

	Site			FCC Limit		EUT Level (L1)	
Freq	Raw	CF	Corr'd	A	B	A	B
(MHz)	(dBm)	(dB)	(dBμV)	(dBμV)		(dB)	
1.85	-57	15.0	65.0	69.5	48.0	-4.5	+17

Freq. = Frequency of emission in MHz
Raw dBm = Reading at Spectrum Analyzer (uncorrected)
Site CF = Correction factor for cable loss
Corr'd dBμV = Corrected emission level in dBμV
FCC Limit A/B = Conducted Emission level limit in dBμV
EUT Level A* = Emission relative to the FCC Class A Limit
EUT Level B* = Emission relative to the FCC Class B Limit

Note = L1 is AC-Hot, L2 is AC-Neutral
QP is a Quasi-Peak value

*A negative value indicates that the emission is below (or meets) the limit and a positive value indicates that the emission is above (or exceeds) the limit.

12.0 Radiated Emissions Test Procedure

1. EUT and any other equipment and cables used with the EUT were placed on a wood table one meter above a ground screen.
2. The EUT receives the normal AC Power at the base of the table.
3. All equipment and cables are placed in a manner which tends to maximize their emission characteristics in a typical application.
4. The table was rotated 360 degrees to determine the maximum radial emissions.
5. The antenna was varied in height between 1 meter and 4 meters above the ground plane to determine the maximum emissions. Various antennas are used during the test in both the vertical and horizontal polarization.
6. The Spectrum Analyzer is scanned from 30 MHz to 1000 MHz for emissions. The applicable spectrum analyzer settings are:
    a. Resolution Bandwidth = 100 kHz,
    b. Normal Detector Mode = Peak (The Quasi-Peak is used when the emissions are near, or over the limit).
7. When an emission is found and maximized, the following actions are performed:
    a. The emission frequency is entered into the computer.
    b. The emission level is read from the spectrum analyzer in dBm and entered into the computer.
    c. The antenna polarization is entered into the computer.
    d. The computer converts the level in dBm to dBµV and uses lookup tables to determine the coax cable loss, antenna factor, and pre-amp gain. A site correction factor is calculated for that particular frequency, and the data is printed out in tabular form.

13.0 Radiated Test Example

	Site			FCC Limit		EUT Level (QP)	
Freq	Raw	CF	Corr'd	A	B	A	B
(MHz)	(dBm)	(dB)	(dBµV)	(dBµV)		(dB)	
65.4	-58	-14.5	34.5	39.1	40.0	-4.6	-5.5

Freq. = Frequency of emission in MHz.
Raw dBm = Reading at Spectrum Analyzer (uncorrected)
Site CF = Correction Factor for coax/antenna/preamp for that frequency. Note that a negative CF is the result of the gain of the preamp.
Corr'd dBµV = Corrected emission level in dBµV
FCC Limit A/B = Limit in dBµV as stated in Part-15, Subpart B
EUT Level A = Emission level relative to the FCC Class A limit. A negative value indicates that the emission is below the limit and a positive value indicates the emission is above (or over) the limit.
EUT Level B = Emission level relative to the FCC Class B. A negative value indicates that the emission is below the limit . Whereas a positive value indicates the emission is above (or over) the limit.

Note = V/H is the antenna polarization (Vertical or Horizontal), QP indicates the Quasi-Peak value.

14.0 Labeling Requirements

LABEL REQUIREMENTS, Class B Certified Digital Device

A CLASS B Digital Device subject to Certification by the FCC shall bear the following statement in a conspicuous location on the device.

(Name of Grantee)
FCC ID:
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.

The label is to be located in a "conspicuous location". This is any location readily visible to the user of the device without the use of tools.

The label is to be permanently attached to the equipment in such a manner that the label can normally be expected to remain fastened and legible during the equipment's expected useful life.

Where the device is constructed in two or more sections connected by wires and marketed together, the statement specified in this section is required to be affixed only to the main control unit.

When the device is so small or for such use that it is not practicable to place the statement specified above on it, this required information shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier must be displayed on the device.

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 user's operation manual.

NOTE: This equipment has been tested and found to comply with the limits for Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio and 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:

- Re-orient 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 which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.
- For systems incorporating several digital devices, the statement shown above, needs to be contained only in the instruction manual for the main control unit.
- Where special accessories, such as shielded cables, are required in order to meet FCC emission limits, appropriate instructions regarding the need to use such accessories must be contained in the operator's manual.

- The operators manual must caution the user that changes or modifications not expressly approved by the manufacturer could void their right to operate the equipment.

- The above radio interference statement is to be bound in the same manner as the operators manual. A loose-leaf insert page in a bound manual would not meet this requirement.

15.0 Summary of Measurements

<u>Summary of Measurements for a Spread-Spectrum System, 2400 - 2500 MHz</u>

<u>CFR Title 47, Part 15.247</u>

Manufacturer: Symbol Technologies, Inc.
2145 Hamilton Avenue
San Jose, CA 95125
408/369-2646
408/446-4630 Fax

Contact: Ray Martino, Jr.

FCC ID: H9PLA24005AZL

Test Report Number: B1072495

The Symbol Technologies, Inc. Sirius WLAN Adapter card uses a frequency hopping spread-spectrum (FHSS) system transceiver operating in the 2400-2483.5 MHz band. The Sirius WLAN Adapter card transmits and receives at 1 Mbps using binary GFSK modulation with BT=0.5 and a minimum deviation of 160 kHz (h=0.32). See Theory of Operation (Attachment A).

<u>15.247 (a) (1) Frequency Hopping Systems</u>

The Symbol Technologies, Inc. Sirius WLAN Adapter card uses 79 programmable channels in 1 MHz wide. Frequencies of operation are 2401 to 2482 MHz inclusive. The hopping frequencies are selected from a pseudo random list of hopping frequencies generated by a shift-register. On average, each frequency is used equally. See plots titled "HOPPING CHANNEL BANDWIDTH" in Appendix B. Please refer to attached document entitled "<u>Theory of Operation</u>", which is in Attachment A.

<u>15.247 (a) (1) (ii) Utilization of Channels, 20 dB Channel Bandwidth, Average Time of Occupancy</u>

The Sirius WLAN Adapter card uses 79 channels, which meets the required minimum of 75. Refer to plot entitled "Channel Utilization".

The maximum 20 dB bandwidth of the hopping channel is less than 1 MHz, as shown in the three plots labeled "Channel Bandwidth". Three separate measurements were taken for this test as shown in the table below. During this test, the EUT was placed in continuous transmit mode and set to one of the three tested frequencies.

Portion of Band	Channel Number	Frequency, MHz	20 dB Bandwidth, MHz
Low	01	2402.0	0.97
Middle	41	2440.0	0.96
High	82	2480.0	0.98

The average time of occupancy on any given channel in a 30 second period is 0.369 seconds, which is less than the maximum permitted time of 0.4 seconds. Refer to "<u>Theory of Operation</u>", which is in Attachment A.

15.247 (b) Maximum Peak Output Power

The spectrum analyzer plots entitled "Symbol Sirius WLAN Adapter" shows the maximum peak output power of the transmitter to be +27.0 dBm, or 500 milliwatts. Maximum permitted is 1.0 Watts, or +30 dBm. The EUT was placed in continuous transmit mode and set to a single frequency (the hopping function disabled) for each of the three measurements shown in the table below. The EUT was tested at the bottom, middle, and top of the band. The output signal was fed directly into an HP 435B Power meter with no external attenuation.

Frequency, MHz	Reading, dBm	Cable Loss, dB	Corrected Reading, dBm / mW
2402.0	+26.0	N/A*	+26.0 dBm / 398.1 mW
2440.0	+26.5	N/A*	+26.5 dBm / 446.7 mW
2480.0	+27.0	N/A*	+27.0 dBm / 500 mW

*Note there is no cable loss, a special connector directly at the power sensor head fits directly into the antenna connector.

15.247 (c) Out Of Band Emissions (Not Falling within Restricted Bands)

The EUT was placed in normal (hopping) mode and set to transmit continuously. The spectrum analyzer was placed in MAX HOLD mode. Out of band emissions are better than 20 dB (in power) below the highest in-band emission. The three plots described in the table below show the EUT's emissions remain inside the 2400 - 2483.5 MHz band during operation.

A special test program ran during this. The program was set to transmit to each of the hopping channels sequentially, the total time approximately 10 seconds. The frequencies outside the operating bands were swept at a much faster rate on MAX HOLD for 20 seconds. No emissions within the 20 dB of the transmitter's fundamentals were located.

Plot Title	Frequency Range of Plot, MHz	Purpose of Plot
Channel Utilization Out of Band Emissions	2400.0 - 2483.5	Show use of 79 channels & out of band emissions down by 20 dB
Out Of Band Emissions - Lower Band Edge 1	20 - 975 MHz	Show emissions are better than 20 dB down
Out of Band Emissions - Lower Band Edge 2	975 MHz - 2.4 GHz	Show emissions are better than 20 dB down
Out of Band Emissions - Upper Band Edge	2.484 - 6.509 GHz 6.4 - 24.8 GHz	Show emissions are better than 20 dB down

15.205 Restricted Bands - Emissions Within Restricted Bands

The EUT was placed on a wooden table resting on a turntable. The wooden table was approximately 1 meter above the ground plane of the 3 meter test site.

The plot entitled "Restricted Band 2500 MHz" shows a maximum uncorrected reading and shows all emissions are greater than 20 dB below the specification requirements for the restricted band.

15.207 AC Line Conducted Emissions

RFD line conducted levels for emissions in the 0.450 to 30.0 MHz band must not exceed 250µV when measured with a line impedance stabilization network. Attached data show emissions are below the 48 'BµV/m limit, with the worst case emission being 35.5 dB below this limit.

15.203 Antenna Requirement

The LA 2400 PCMCIA wireless LAN card is normally attached to its antenna via a coaxial connector. The coaxial connector is manufactured by Murata Erie Corp only. The Murata Erie part number is MM3325-2505. The mating connector with coaxial cable is part number MXYH62XXLLLL (where LLLL denotes length ex: 100 mm = 100, 500 mm = 500, 1000 = 1001,). Drawings of these connectors are attached. The other end of the coaxial cable is usually attached to a polarized BNC connector. The polarized BNC connector is similar to a regular BNC type connector but it is made unique by swapping the inner conductor sex. These connectors can be purchased by the manufacturer, M/A-COM Inc. A drawing of this connector is attached. In some cases the coax cable is directly soldered to the antenna. The following antennas are options for antennas for the LA 2400 PCMCIA wireless LAN card:

1) Surface Mount Box Shaped Antenna. Made by Tecom Industries part number 505042C. This antenna is 0 dBi omni-directional in azimuth plane. It is 2.5 x 2.5 x .75 inches and mounts with Velcro. The antenna is attached to coaxial cable terminated in the polarized BNC connector. A drawing of this antenna is attached.

2) Collinear Omni-directional Pole shaped. Made by Cushcraft Signals Corp. part number S2403BE. This antenna is 5.4 dBi, 9 inches tall, with coaxial cable terminated in the polarized BNC connector. This antenna has a dipole style pattern. A drawing is attached.

3) Dipole Rubber Duck. Made by Centurion corp. part number EXR-2.4-BNCP and Cushcraft Signals Corp part number RBN2400XSR. These antennas are 2.4 dBi and have dipole style pattern. The polarized BNC connector is molded into the antenna. A drawing of this antenna is attached.

4) An antenna can be attached directly to the PCMCIA card without a coaxial connector. This antenna Symbol calls an End Cap Antenna. When using the end cap antenna a pin connector is used. The pin connector manufactured by Samtek Corp. part number HTMS-15-01-F-S on the PCMCIA card mating to the socket SLM-15-01-F-S on the antenna. This antenna is less than 0 dBi in all planes. The antenna is manufactured by Symbol. A drawings of the end antenna and connector are attached.

5) IBM Dipole made by IBM part number 25H3851. The antenna is a dipole with a gain of 2 dBi. The antenna can be terminated in the Murata BFA or polarized SMA. A drawing of this antenna is attached.

6) The IBM Antenna is integrated inside an IBM portable computer. The antennas has a gain of 2 dBi and a dipole style pattern.

16.0 APPENDIX A

ANTENNA DATA

RADIATED DATA SHEET - SIRIUS ANTENNAS

EUT: Sirius Surface Mount Antenna

Customer name: Symbol

Rule Part: 15.209

Test Distance: 3 m

Restricted Frequency
Radiated Emissions

FREQ. MHz	READING dB(uV)	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
2851	57.8	PK	27.8	5.3	-35.5	0	55.4	74.0	-18.6
2851	51.0	AV	27.8	5.3	-35.5	0	48.6	54.0	-5.4
2773	57.2	PK	27.8	5.3	-35.5	0	54.8	74.0	-19.2
2773	50.0	AV	27.8	5.3	-35.5	0	47.6	54.0	-6.4
2357.8	60.0	PK	27.6	5.3	-35.5	0	57.41	74.0	-16.6
2357.8	42.0	AV	27.6	5.3	-35.5	0	39.41	54.0	-14.6
2485.9	53.6	PK	27.6	5.3	-35.5	0	51.01	74.0	-23.0
2485.9	38.7	AV	27.6	5.3	-35.5	0	36.11	54.0	-17.9

Remarks: fc + 371 MHz Local Oscillator
No other restricted emission location for fc +/- n * 371 MHz
for n = 1, 2, 3

Rule Part: 15.247

Test Distance: 3 m

FREQ. MHz	READING dB(uV)	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
4804	47.6	31.4	7.0	-35.0	0	51.03	74.0	-23.0
4804	40.5	31.4	7.0	-35.0	0	43.93	54.0	-10.1
7206	48.8	34.5	10.6	-35.0	0	58.88	74.0	-15.1
7206	36.1	34.5	10.6	-35.0	0	46.18	54.0	-7.8
4880	47.7	31.4	7.0	-35.0	0	51.13	74.0	-22.9
4880	38.3	31.4	7.0	-35.0	0	41.73	54.0	-12.3
7320	47.3	34.5	10.6	-35.0	0	57.38	74.0	-16.6
7320	36.1	34.5	10.6	-35.0	0	46.18	54.0	-7.8
4960	47.2	31.4	7.0	-35.0	0	50.63	74.0	-23.4
4960	39.6	31.4	7.0	-35.0	0	43.03	54.0	-11.0
7440	48.8	34.5	10.6	-35.0	0	58.88	74.0	-15.1
7440	36.4	34.5	10.6	-35.0	0	46.48	54.0	-7.5

RADIATED DATA SHEET - SIRIUS ANTENNAS

EUT: Sirius Cushman Antenna   Customer name: Symbol
Rule Part: 15.209

Test Distance: 3 m   Restricted Frequency
Radiated Emissions

FREQ. MHz	READING dB(uV)	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
2773	39.7	PK	27.8	5.3	-35.5	0	37.31	74.0	-36.7
2773	34.6	AV	27.8	5.3	-35.5	0	32.23	54.0	-21.8
2851	52.6	PK	27.8	5.3	-35.5	0	50.16	74.0	-23.8
2851	49.6	AV	27.8	5.3	-35.5	0	47.2	54.0	-6.8
2336	58.0	PK	27.6	5.3	-35.5	0	55.41	74.0	-18.6
2336	40.7	AV	27.6	5.3	-35.5	0	38.11	54.0	-15.9
2486	52.2	PK	27.6	5.3	-35.5	0	49.61	74.0	-24.4
2486	35.2	AV	27.6	5.3	-35.5	0	32.61	54.0	-21.4

Remarks: fc + 371 MHz Local Oscillator
No other restricted emission location for fc +/- n * 371 MHz

for n = 1, 2, 3

Rule Part: 15.247

Test Distance: 3 m

FREQ. MHz	READING dB(uV)	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
4804	48.1	31.4	7.0	-35.0	0	51.53	74.0	-22.5
4804	37.2	31.4	7.0	-35.0	0	40.63	54.0	-13.4
7206	47.9	34.5	10.6	-35.0	0	57.98	74.0	-16.0
7206	36.0	34.5	10.6	-35.0	0	46.08	54.0	-7.9
4880	46.1	31.4	7.0	-35.0	0	49.53	74.0	-24.5
4880	34.4	31.4	7.0	-35.0	0	37.83	54.0	-16.2
7320	48.6	34.5	10.6	-35.0	0	58.68	74.0	-15.3
7320	36.1	34.5	10.6	-35.0	0	46.18	54.0	-7.8
4960	44.9	31.4	7.0	-35.0	0	48.33	74.0	-25.7
4960	33.5	31.4	7.0	-35.0	0	36.93	54.0	-17.1
7440	48.9	34.5	10.6	-35.0	0	58.98	74.0	-15.0
7440	36.4	34.5	10.6	-35.0	0	46.48	54.0	-7.5

FCC RADIATED DATA SHEET

EUT: DI-POLE   CUSTOMER NAME: SYMBOL

RULE PART: 15.247, 15.205

DIST dB: 0   DUTY dB 0   ATTN dB: 0

HP IL dB: 0

FREQ. MHz	READING dB(uV)	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
4804	47.0	PK	31.4	7.0	-35.0	0	50 43	74.0	-23.6
4804	38.0	AV	31.4	7.0	-35.0	0	41.43	54.0	-12.6
7206	48.7	PK	34.5	10.6	-35.0	0	58 78	74.0	-15.2
7206	36 0	AV	34.5	10.6	-35 0	0	46.08	54.0	-7.9
9608	48.4	PK	36.8	13.0	-35 0	-9.54	53.64	74.0	-20.4
9608	35.7	AV	36:8	13.0	-35.0	-9.54	40.94	54.0	-13.1
12010	49.3	PK	39.0	13.6	-35.0	-9.54	57.33	74.0	-16.7
12010	36.3	AV	39.0	13.6	-35.0	-9.54	44.33	54.0	-9.7
14412	54.2	PK	41.8	14.5	-35.0	-20	55.46	74.0	-18.5
14412	41.6	AV	41.8	14.5	-35.0	-20	42.86	54.0	-11.1
4880	45.0	PK	31.4	7.0	-35.0	0	48.43	74.0	-25.6
4880	34 0	AV	31.4	7.0	-35.0	0	37.43	54.0	-16.6
7320	48.4	PK	34.5	10.6	-35.0	0	58.48	74.0	-15.5
7320	36.0	AV	34.5	10.6	-35.0	0	46.08	54.0	-7.9
9760	48.0	Pk	36.8	13.0	-35.0	-9.54	53.24	74.0	-20.8
9760	35.6	AV	36.8	13.0	-35.0	-9.54	40.84	54.0	-13.2
12200	47.7	PK	39.0	13.6	-35.0	-9.54	55.73	74.0	-18.3
12200	36.3	AV	39.0	13.6	-35.0	-9.54	44.33	54.0	-9.7
14640	53.4	PK	41.9	15.5	-35.0	-20	55.84	74.0	-18.2
14640	41.6	AV	41.9	15.5	-35.0	-20	44.04	54.0	-10.0
4960	46.4	PK	31.4	7.0	-35.0	0	49.83	74.0	-24.2
4960	37.7	AV	31.4	7.0	-35.0	0	41.13	54.0	-12.9
7440	48.8	PK	34.5	10.6	-35.0	0	58.88	74.0	-15.1
7440	36.3	AV	34.5	10.6	-35.0	0	46.38	54.0	-7.6
9920	47.8	PK	36.8	13.0	-35 0	-9.54	53.04	74.0	-21.0
9920	35.5	AV	36.8	13.0	-35.0	-9.54	40.74	54.0	-13.3
12400	47.7	PK	39.0	13.6	-35.0	-9.54	55.73	74.0	-18.3
12400	35.8	AV	39.0	13.6	-35.0	-9.54	43.83	54.0	-10.2
14880	53 3	PK	41.9	15.5	-35 0	-20	55.74	74.0	-18.3
14880	41.5	AV	41.9	15.5	-35 0	-20	43.94	54.0	-10.1

FCC RADIATED DATA SHEET

EUT: ENCAP ANT | CUSTOMER NAME: SYMBOL

RULE PART: 15.247, 15.205

DIST dB: 0 | DUTY dB 0 | ATTN dB: 0

HP IL dB: 0

FREQ. MHz	READING dB(uV)	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
4804	44.8	PK	31.4	7.0	-35.0	0	48.23	74.0	-25.8
4804	31.9	AV	31.4	7.0	-35.0	0	35.33	54.0	-18.7
7206	49.9	PK	34.5	10.6	-35.0	0	59.98	74.0	-14.0
7206	40.1	AV	34.5	10.6	-35.0	0	50.18	54.0	-3.8
9608	48.5	PK	36.8	13.0	-35.0	-9.54	53.74	74.0	-20.3
9608	35.7	AV	36.8	13.0	-35.0	-9.54	40.94	54.0	-13.1
12010	47.8	PK	39.0	13.6	-35.0	-9.54	55.83	74.0	-18.2
12010	36.2	AV	39.0	13.6	-35.0	-9.54	44.23	54.0	-9.8
14412	53.6	PK	41.8	14.5	-35.0	-20	54.86	74.0	-19.1
14412	41.6	AV	41.8	14.5	-35.0	-20	42.86	54.0	-11.1
4880	48.9	PK	31.4	7.0	-35.0	0	52.33	74.0	-21.7
4880	40.0	AV	31.4	7.0	-35.0	0	43.43	54.0	-10.6
7320	50.8	PK	34.5	10.6	-35.0	-9.54	51.34	74.0	-22.7
7320	36.2	AV	34.5	10.6	-35.0	-9.54	36.74	54.0	-17.3
9760	48.0	Pk	36.8	13.0	-35.0	-9.54	53.24	74.0	-20.8
9760	35.7	AV	36.8	13.0	-35.0	-9.54	40.94	54.0	-13.1
12200	48.7	PK	39.0	13.6	-35.0	-9.54	56.73	74.0	-17.3
12200	36.2	AV	39.0	13.6	-35.0	-9.54	44.23	54.0	-9.8
14640	54.3	PK	41.9	15.5	-35.0	-20	56.74	74.0	-17.3
14640	41.7	AV	41.9	15.5	-35.0	-20	44.14	54.0	-9.9
4960	45.6	PK	31.4	7.0	-35.0	0	49.03	74.0	-25.0
4960	34.8	AV	31.4	7.0	-35.0	0	38.23	54.0	-15.8
7440	54.0	PK	34.5	10.6	-35.0	-9.54	54.54	74.0	-19.5
7440	38.6	AV	34.5	10.6	-35.0	-9.54	39.14	54.0	-14.9
9920	47.6	PK	36.8	13.0	-35.0	-9.54	52.84	74.0	-21.2
9920	35.6	AV	36.8	13.0	-35.0	-9.54	40.84	54.0	-13.2
12400	48.0	PK	39.0	13.6	-35.0	-9.54	56.03	74.0	-18.0
12400	36.1	AV	39.0	13.6	-35.0	-9.54	44.13	54.0	-9.9
14880	52.1	PK	41.9	15.5	-35.0	-20	54.54	74.0	-19.5
14880	41.8	AV	41.9	15.5	-35.0	-20	44.24	54.0	-9.8

OUT OF BAND EMISSIONS (LOWER BAND EDGE 2)

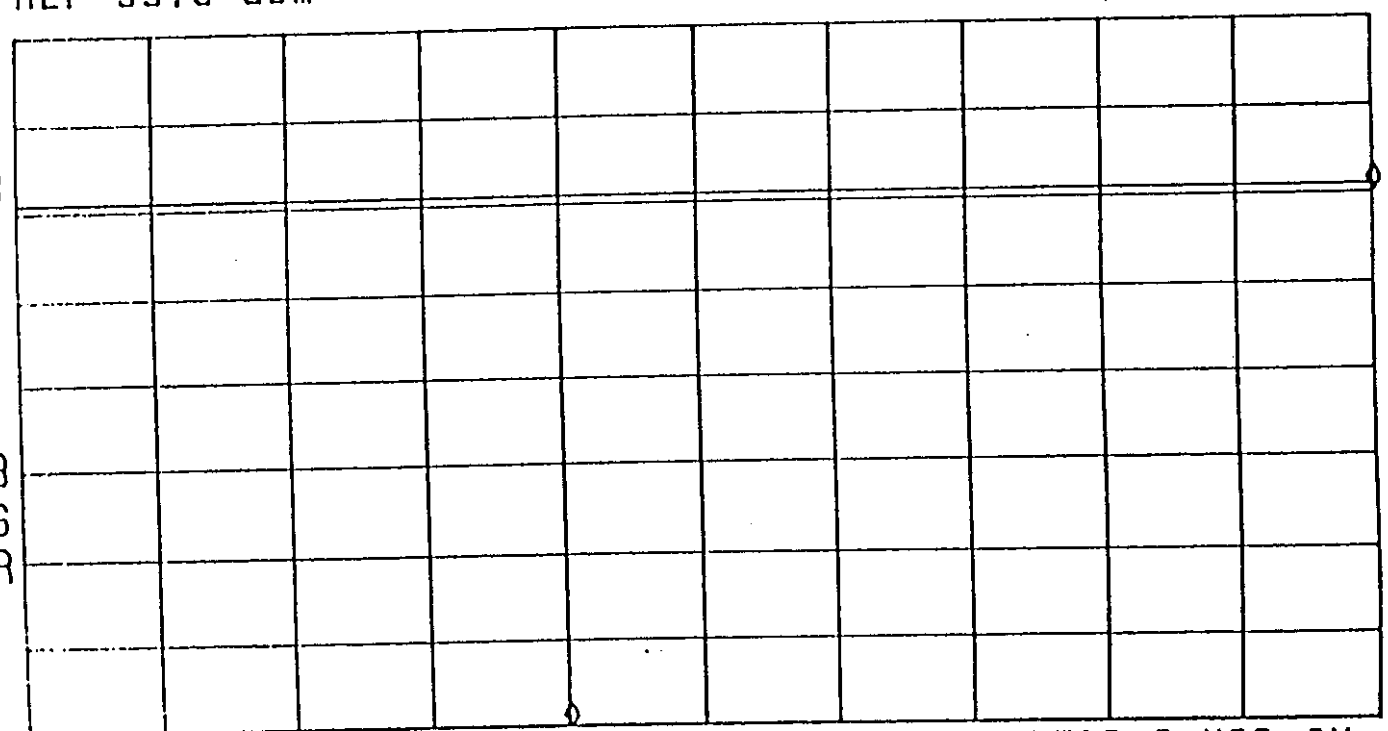
10:59:49 JUL 26, 1995
16:20:11 MAR 02, 1994SYMBOL SIRIUS BW OCC

SWEEPTIME
428 msec

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR∆ -908 MHz
-61.53 dB

LOG REF 35.0 dBm
5
dB/
ATN
50 dB

DL
25.6
dBm
WA WB
SC FS
CORR



START 975 MHz
#IF BW 100 kHz #AVG BW 300 kHz
STOP 2.400 GHz
SWP 420 msec

FCC ID NO. H9PLA24005AZL

OUT OF BAND EMISSIONS (UPPER BAND EDGE)

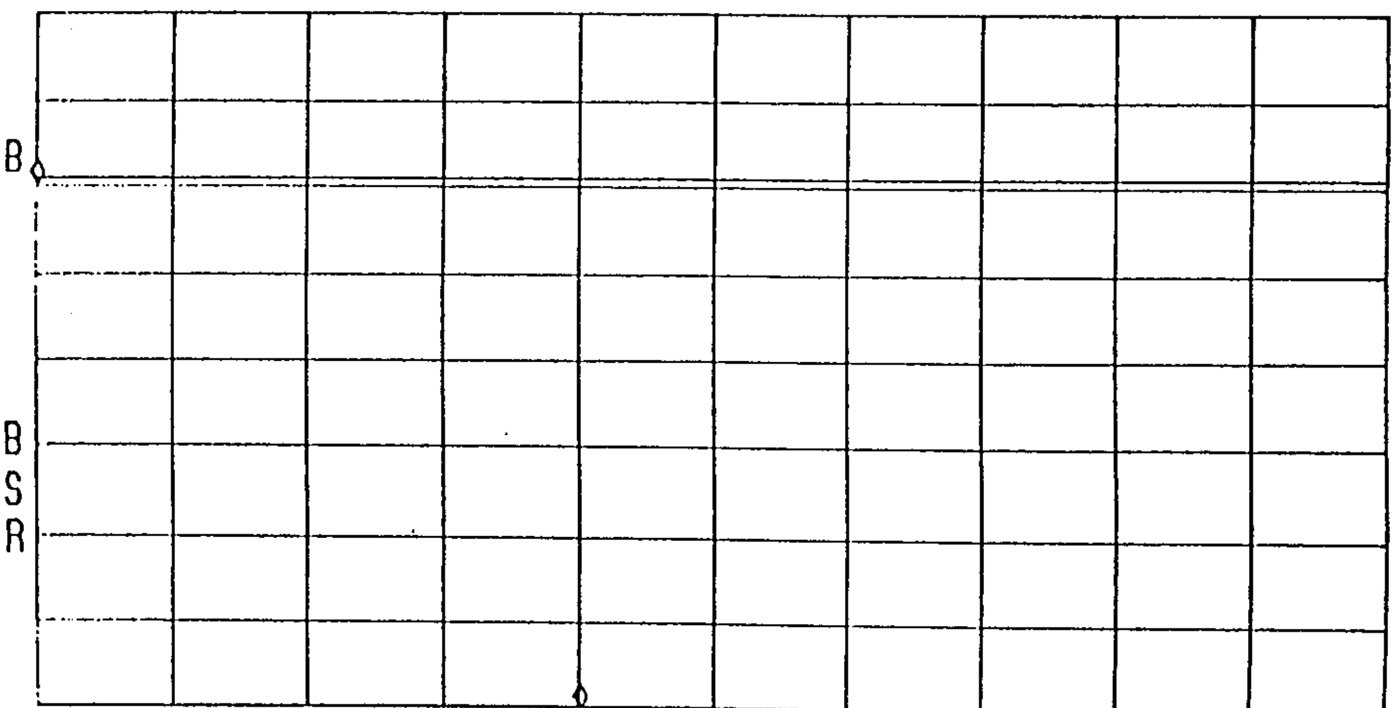
10:54:20 JUL 26, 1995
16:20:11 MAR 02, 1994SYMBOL SIRIUS BW OCC

SWEEPTIME
1.21 sec

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR∆ 1.640 GHz
-58.83 dB

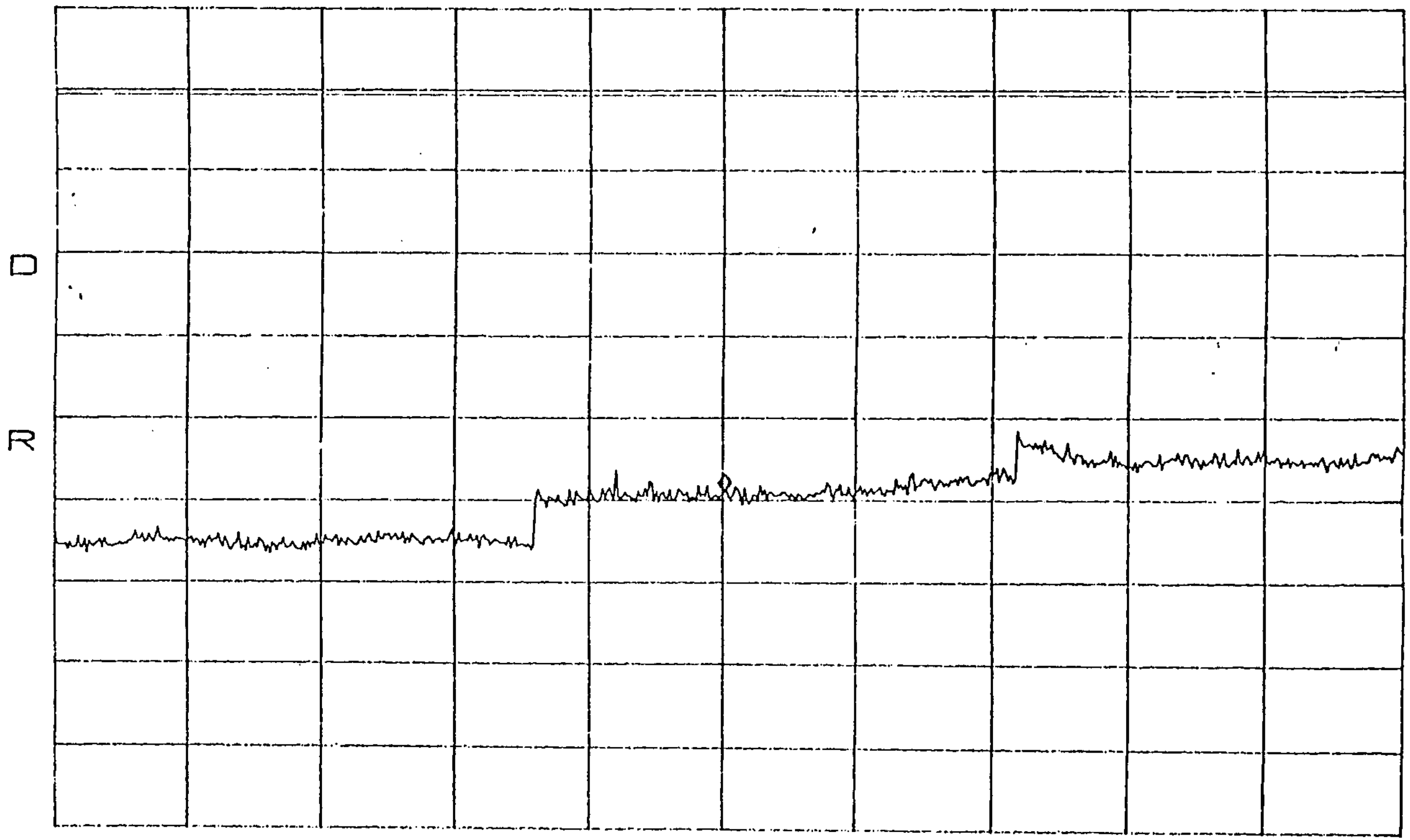
LOG REF 35.0 dBm
5
dB/
ATN
50 dB

DL
25.6
dBm
MA WB
SC FS
CORR



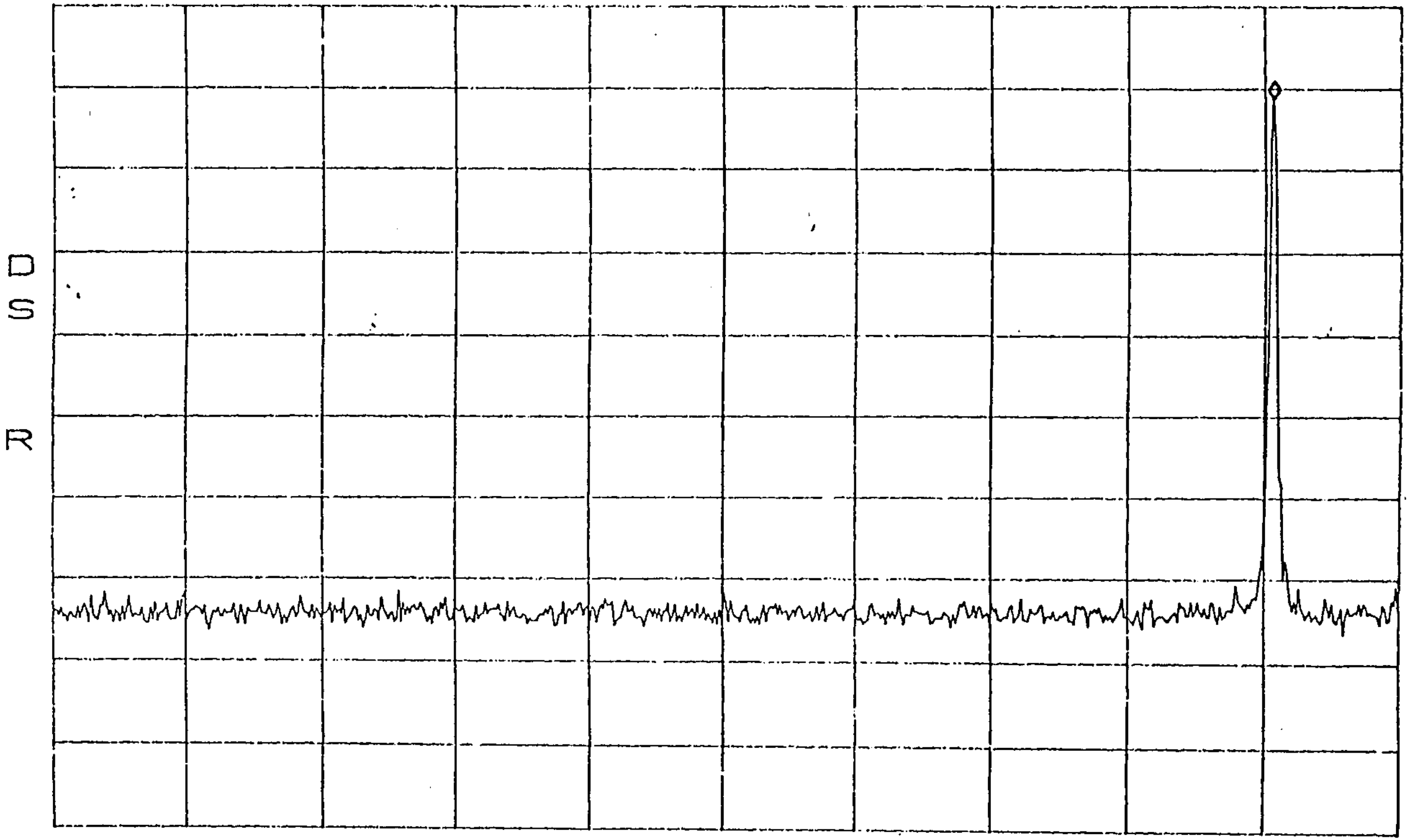
START 2.484 GHz
#IF BW 100 kHz
#AVG BW 300 kHz
STOP 6.509 GHz
SWP 1.21 sec

FCC ID NO. H9PLA24005AZL


ATTEN 30dB
RL 36.9dBm
10dB/
MKR -21.93dBm
15.63GHz
D
R
START 6.40GHz
STOP 24.80GHz
*RBW 100kHz
VBW 100kHz
SWP 4.6sec

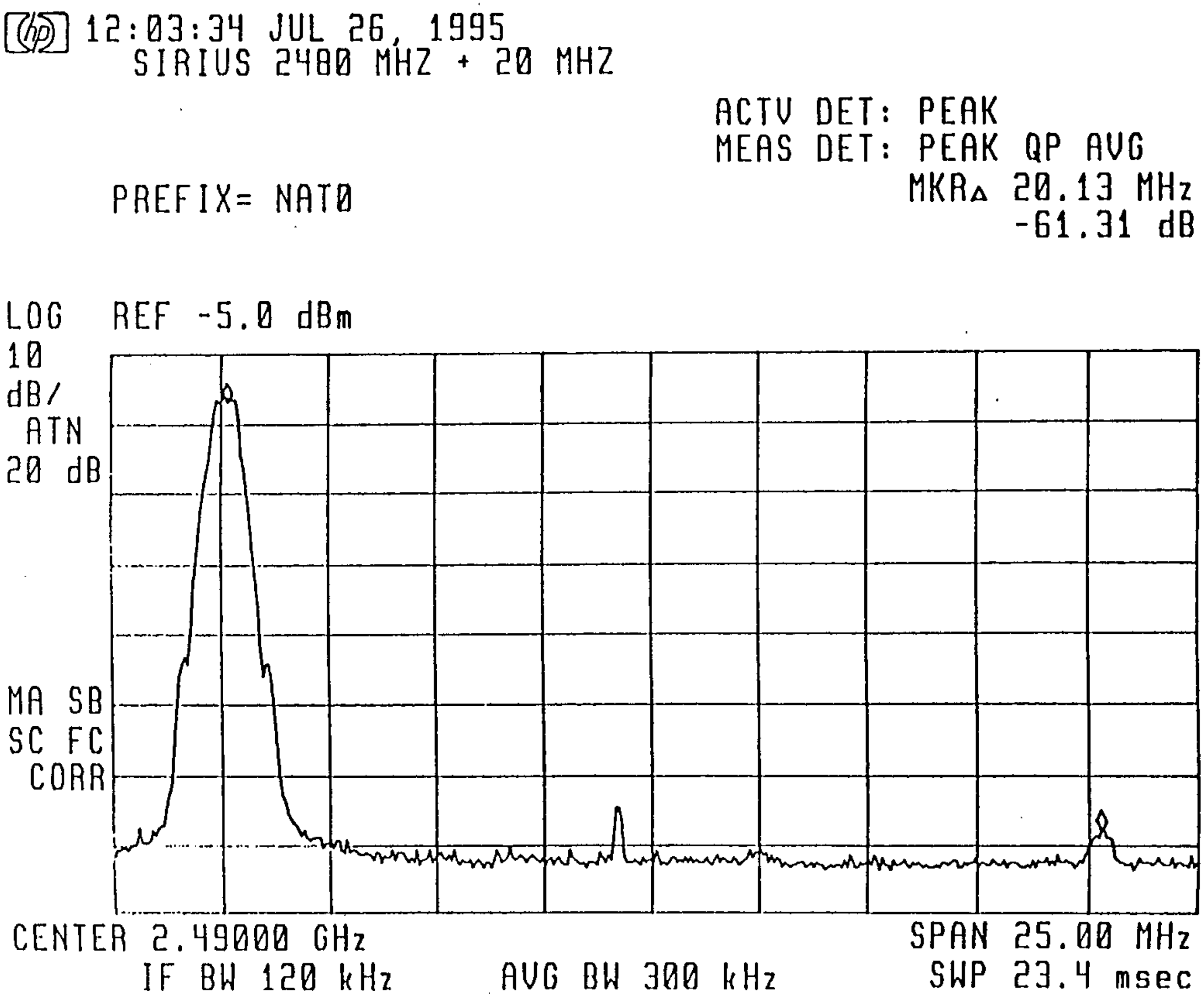
'Restricted Band Emissions Low Band Edge'

ATTEN 30dB MKR 25.90dBm
RL 36.9dBm 10dB/ 2.4027GHz



START 2.3120GHz STOP 2.4120GHz
*RBW 100kHz VBW 100kHz SWP 50ms

RESTRICTED BAND 2500 MHz



FCC ID NO. H9PLA24005AZL

18.0 APPENDIX C

RADIATED/CONDUCTED EMISSIONS DATA

Electronic Compliance Laboratories, Inc.
1249 Birchwood Ave.
Sunnyvale, CA

Conducted Emissions
Frequency range: 150KHz-30MHz

Government Agency and Limit: CISPR Class A

QP = Quasi-Peak   Note: Ignore peak readings when Quasi-Peak reading exists
PK = Peak

Customer:	Symbol	Operator:	Rich Hedlund
Date:	07-26-1995	Time:	14:52:38
Temperature Range:	60-80 Deg F	Percent Humidity:	50
E.U.T.:	SIRIUS		
Serial Number:	146		
Support Devices:	NEC VERSA LAP TOP		
Serial Number:	53009650		
FCC ID:			
Exercise Program:			
Modifications:	None		
Report File Name:	C:\SCANS\5072401.C		

TEST FREQ	TEST dBuV	CLASS A LIMIT	VERSUS A LIMIT	CONDUCTOR	TYPE
0.189	43.5	79.0	-35.5	LINE	PK
0.252	33.6	79.0	-45.4	LINE	PK
0.377	31.4	79.0	-47.6	LINE	PK
0.439	28.4	79.0	-50.6	LINE	PK
0.187	39.7	79.0	-39.3	NEUTRAL	PK
0.255	30.6	79.0	-48.4	NEUTRAL	PK
0.371	26.5	79.0	-52.5	NEUTRAL	PK
0.434	21.3	79.0	-57.7	NEUTRAL	PK
0.940	37.1	74.0	-36.9	LINE	PK
7.800	29.4	74.0	-44.6	LINE	PK
17.400	32.5	74.0	-41.5	LINE	PK
20.700	28.9	74.0	-45.1	LINE	PK
0.940	37.3	74.0	-36.7	NEUTRAL	PK
3.820	28.3	74.0	-45.7	NEUTRAL	PK
16.900	31.5	74.0	-42.5	NEUTRAL	PK
20.800	31.6	74.0	-42.4	NEUTRAL	PK

Electronic Compliance Laboratories, Inc.
1249 Birchwood Ave.
Sunnyvale, CA

Radiated Emissions
Frequency range: 30MHz-1000MHz

10 Meter Open Site
Site Calibrated: April 1995

Government Agency and Limit: FCC Class A

QP = Quasi-Peak   Note: Ignore peak readings when Quasi-Peak reading exists
PK = Peak

Customer:	SYMBOL	Operator:	Rich Hedlund
Date:	07-25-1995	Time:	16:16:00
Temperature Range:	60-80 Deg F	Percent Humidity:	50
E.U.T.:	Sirius		
Serial Number:			
Support Devices:	NEC VERSA LAP TOP		
Serial Number:	53009650		
FCC ID:			
Exercise Program:			
Modifications:	None		
Report File Name:	C:\SCANS\5072401.RF		

Antenna Type: BICONICAL

TEST FREQ	TEST dBuV	ACTUAL dBuV/m	CLASS A LIMIT	VERSUS A LIMIT	TABLE DEGREES	ANTENNA HEIGHT	POLAR-IZATION	DETECTOR Type
NOTE: 30-300 MHz AT OR BELOW NOISE FLOOR								
CHANGED ANTENNA TO LOG PERIODIC								
300.000	36.5	27.9	46.5	-18.6	90	1.0	V	PK
376.000	36.0	30.7	46.5	-15.8	90	1.0	V	PK
400.000	34.5	29.8	46.5	-16.7	90	1.0	V	PK
426.000	36.0	32.5	46.5	-14.0	270	1.0	V	PK
432.000	36.5	33.3	46.5	-13.2	90	1.0	V	PK
440.000	38.0	35.2	46.5	-11.3	90	1.0	V	PK
456.000	38.0	35.9	46.5	-10.6	90	1.0	V	PK
NOTE: 457-1000 MHz AT OR BELOW NOISE FLOOR								

NOTE: ALL HORIZONTAL READINGS LOWER

FCC RADIATED DATA SHEET

EUT: IBM ANT | CUSTOMER NAME: SYMBOL

RULE PART: 15.247, 15.205

DIST dB: 0 | DUTY dB 0 | ATTN dB: 0

CALCULATED ANT GAIN 2.2dBi | HP IL dB: 0

FREQ. MHz	READING dB(uV)	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
4804	43.8	PK	31.4	7.0	-35.0	0	47.23	74.0	-26.8
4804	31.7	AV	31.4	7.0	-35.0	0	35.13	54.0	-18.9
7206	47.4	PK	34.5	10.6	-35.0	0	57.48	74.0	-16.5
7206	36.2	AV	34.5	10.6	-35.0	0	46.28	54.0	-7.7
9608	47.7	PK	36.8	13.0	-35.0	-9.54	52.94	74.0	-21.1
9608	35.9	AV	36.8	13.0	-35.0	-9.54	41.14	54.0	-12.9
12010	48.8	PK	39.0	13.6	-35.0	-9.54	56.83	74.0	-17.2
12010	36.4	AV	39.0	13.6	-35.0	-9.54	44.43	54.0	-9.6
14412	53.8	PK	41.8	14.5	-35.0	-20	55.06	74.0	-18.9
14412	41.7	AV	41.8	14.5	-35.0	-20	42.96	54.0	-11.0
4880	44.0	PK	31.4	7.0	-35.0	0	47.43	74.0	-26.6
4880	31.5	AV	31.4	7.0	-35.0	0	34.93	54.0	-19.1
7320	48.8	PK	34.5	10.6	-35.0	0	58.88	74.0	-15.1
7320	36.2	AV	34.5	10.6	-35.0	0	46.28	54.0	-7.7
9760	48.0	Pk	36.8	13.0	-35.0	-9.54	53.24	74.0	-20.8
9760	35.7	AV	36.8	13.0	-35.0	-9.54	40.94	54.0	-13.1
12200	46.6	PK	39.0	13.6	-35.0	-9.54	54.63	74.0	-19.4
12200	36.2	AV	39.0	13.6	-35.0	-9.54	44.23	54.0	-9.8
14640	54.3	PK	41.9	15.5	-35.0	-20	56.74	74.0	-17.3
14640	41.7	AV	41.9	15.5	-35.0	-20	44.14	54.0	-9.9
4960	43.7	PK	31.4	7.0	-35.0	0	47.13	74.0	-26.9
4960	31.8	AV	31.4	7.0	-35.0	0	35.23	54.0	-18.8
7440	48.3	PK	34.5	10.6	-35.0	0	58.38	74.0	-15.6
7440	36.5	AV	34.5	10.6	-35.0	0	46.58	54.0	-7.4
9920	48.0	PK	36.8	13.0	-35.0	-9.54	53.24	74.0	-20.8
9920	35.6	AV	36.8	13.0	-35.0	-9.54	40.84	54.0	-13.2
12400	47.8	PK	39.0	13.6	-35.0	-9.54	55.83	74.0	-18.2
12400	36.0	AV	39.0	13.6	-35.0	-9.54	44.03	54.0	-10.0
14880	53.8	PK	41.9	15.5	-35.0	-20	56.24	74.0	-17.8
14880	41.7	AV	41.9	15.5	-35.0	-20	44.14	54.0	-9.9

Restricted band 2483.5 - 2500

FCC RADIATED DATA SHEET

EUT:	Sirius	LA2400	CUSTOMER NAME:	Symbol
RULE PART:		15.205		

DIST dB: 0 DUTY dB 0 ATTN dB: 0

CUSHMAN, IBM, HP IL dB: 0

Big rubber duck, little rubber d antennas

FREQ. MHz	READING dB(uV)	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL. dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
Little	Rubber	Duck							
2489	39.0	Pk	28.6	1.0	0.0	-20	48.6	74.0	-25.4
2489	32.0	Av	28.6	1.0	0.0	-20	41.6	54.0	-12.4
2491	42.0	Pk	28.6	1.0	0.0	-20	51.6	74.0	-22.4
2491	35.1	Av	28.6	1.0	0.0	-20	44.7	54.0	-9.3
CUSHMAN									
2489	47.2	Pk	28.6	1.0	0.0	-20	56.8	74.0	-17.2
2489	40.4	Av	28.6	1.0	0.0	-20	50	54.0	-4.0
2491	43.4	Pk	28.6	1.0	0.0	-20	53	74.0	-21.0
2491	37.5	Av	28.7	1.0	0.0	-20	47.2	54.0	-6.8
IBM									
2489	44.7	Pk	28.6	1.0	0.0	-20	54.3	74.0	-19.7
2489	37.2	Av	28.6	1.0	0.0	-20	46.8	54.0	-7.2
2491	47.5	Pk	28.6	1.0	0.0	-20	57.1	74.0	-16.9
2491	40.9	Av	28.6	1.0	0.0	-20	50.5	54.0	-3.5
Big	Rubber	Duck							
2489	45.1	Pk	28.6	1.0	0.0	-20	54.7	74.0	-19.3
2489	36.2	Av	28.6	1.0	0.0	-20	45.8	54.0	-8.2
2491	44.2	Pk	28.6	1.0	0.0	-20	53.8	74.0	-20.2
2491	34.9	Av	28.6	1.0	0.0	-20	44.5	54.0	-9.5

Restricted Band 2310 - 2390 and 2483.5 - 2500

FCC RADIATED DATA SHEET

EUT: Sirius LA2400 | CUSTOMER NAME: Symbol

RULE PART: 15.205

DIST dB: 0 | DUTY dB 0 | ATTN dB: 0

TCOM & ENDCAP Antennas | HP IL dB: 0

FREQ. MHz	READING dB(uV)	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
TCOM	2310 -	2390 MHz							
2232	35.4	Pk	28.6	1.0	0.0	-20	45	54.0	-9.0
2232	29.3	Av	28.6	1.0	0.0	-20	38.9	54.0	-15.1
2362	37.3	Pk	28.6	1.0	0.0	-20	46.9	30.0	16.9
2362	33.4	Av	28.6	1.0	0.0	-20	43	30.0	13.0
ENDCAP	2310 -	2390 MHz							
2338	32.8	Pk	28.6	1.0	0.0		62.4	74.0	-11.6
2338	24.8	Av	28.6	1.0	0.0		54.4	74.0	-19.6
2387	31.5	Pk	28.6	1.0	0.0		61.1	74.0	-12.9
2387	25.8	Av	28.7	1.0	0.0		55.5	74.0	-18.5
ENDCAP	2384.5 -	2500 MHz							
2489.2	24.1	Pk	28.6	1.0	0.0	0	53.7	74.0	-20.3
2489.2	18.0	Av	28.6	1.0	0.0	0	47.6	74.0	-26.4
TCOM	2384.5 -	2500 MH							
2489	13.2	Pk	28.6	1.0	0.0	0	42.8	54.0	-11.2

Restricted Band 2310 - 2390

FCC RADIATED DATA SHEET

EUT: Sirius LA2400 CUSTOMER NAME: Symbol

RULE PART: 15.205

DIST dB: 0 DUTY dB 0 ATTN dB: 0

CUSHMAN, IBM, HP IL dB: 0

Big rubber duck, little rubber d antennas

FREQ. MHz	READING dB(uV)	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
Little	Rubber	Duck							
2322	42.8	Pk	28.6	1.0	0.0	-20	52.4	74.0	-21.6
2322	33.9	Av	28.6	1.0	0.0	-20	43.5	54.0	-10.5
2362	44.2	Pk	28.6	1.0	0.0	-20	53.8	74.0	-20.2
2362	37.4	Av	28.6	1.0	0.0	-20	47	54.0	-7.0
CUSHMAN									
2322	44.8	Pk	28.6	1.0	0.0	-20	54.4	74.0	-19.6
2322	36.4	Av	28.6	1.0	0.0	-20	46	54.0	-8.0
2362	44.9	Pk	28.6	1.0	0.0	-20	54.5	74.0	-19.5
2362	36.8	Av	28.7	1.0	0.0	-20	46.5	54.0	-7.5
IBM									
2322	45.9	Pk	28.6	1.0	0.0	-20	55.5	74.0	-18.5
2322	39.2	Av	28.6	1.0	0.0	-20	48.8	54.0	-5.2
2362	47.8	Pk	28.6	1.0	0.0	-20	57.4	74.0	-16.6
2362	41.6	Av	28.6	1.0	0.0	-20	51.2	54.0	-2.8
Big	Rubber	Duck							
2322	41.7	Pk	28.6	1.0	0.0	-20	51.3	74.0	-22.7
2322	33.6	Av	28.6	1.0	0.0	-20	43.2	54.0	-10.8
2362	45.0	Pk	28.6	1.0	0.0	-20	54.6	74.0	-19.4
2362	39.6	Av	28.6	1.0	0.0	-20	49.2	54.0	-4.8

CHANNEL UTILIZATION (79 HOPPING CHANNELS)

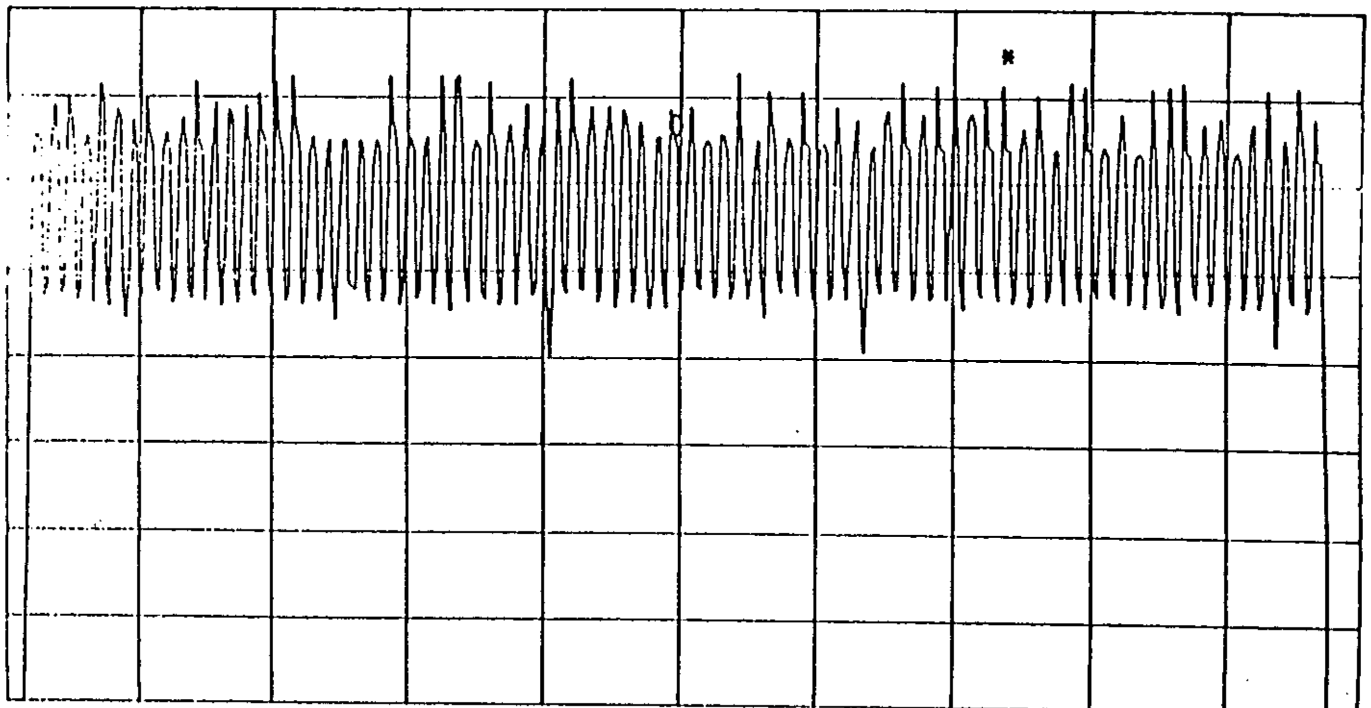
11:41:50 JUL 26, 1995
SIRIUS # OF HOPPING CHANNELS = 79

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.44133 GHz
20.67 dBm

PREFIX= NAT0

LOG REF 20.0 dBm
5 dB/
ATN 70 dB

PREAMP ON



SA MB
SC FS
CORR

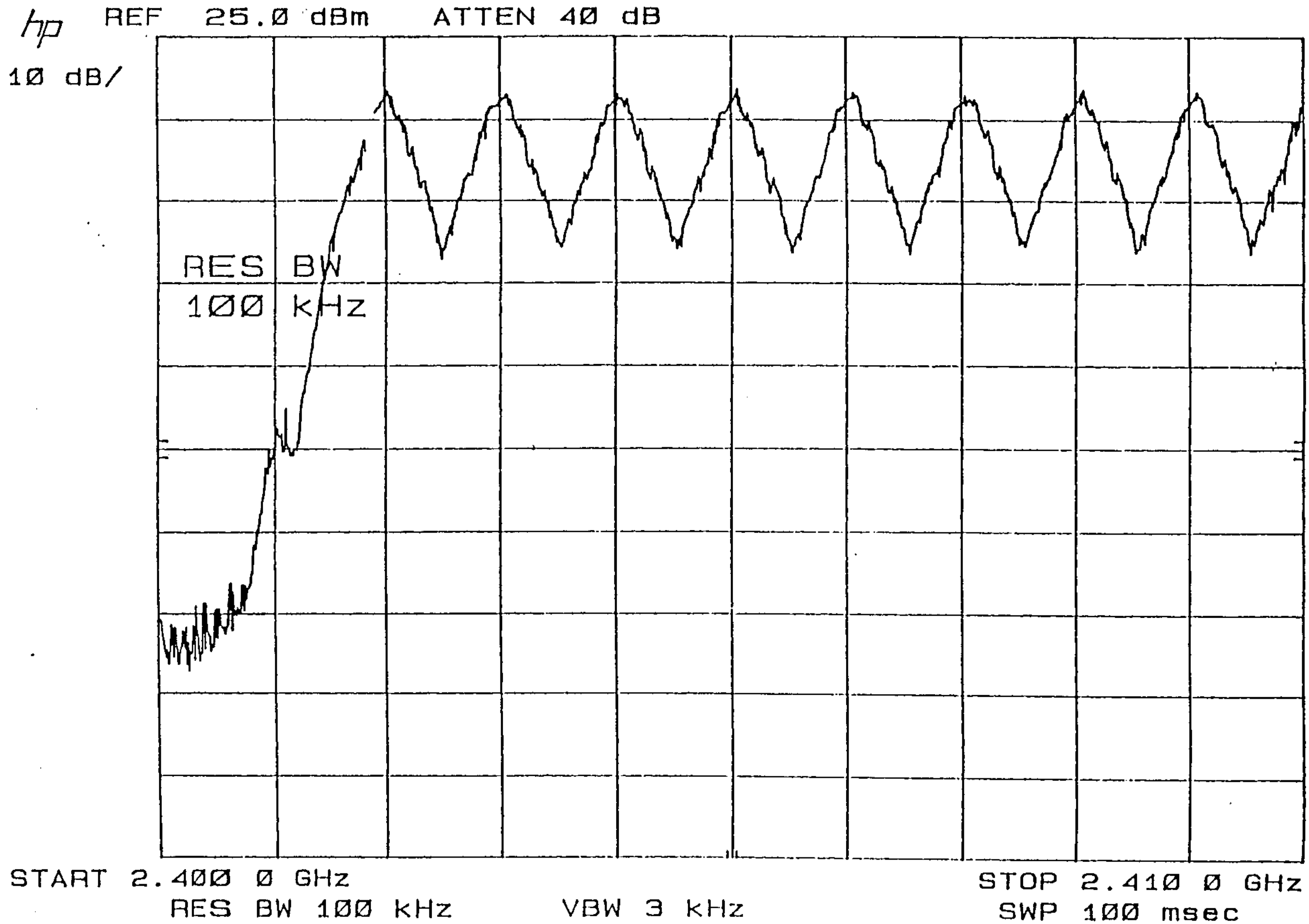
START 2.40000 GHz
#IF BW 30 kHz

#AVG BW 300 kHz

STOP 2.48350 GHz
SWP 270 msec

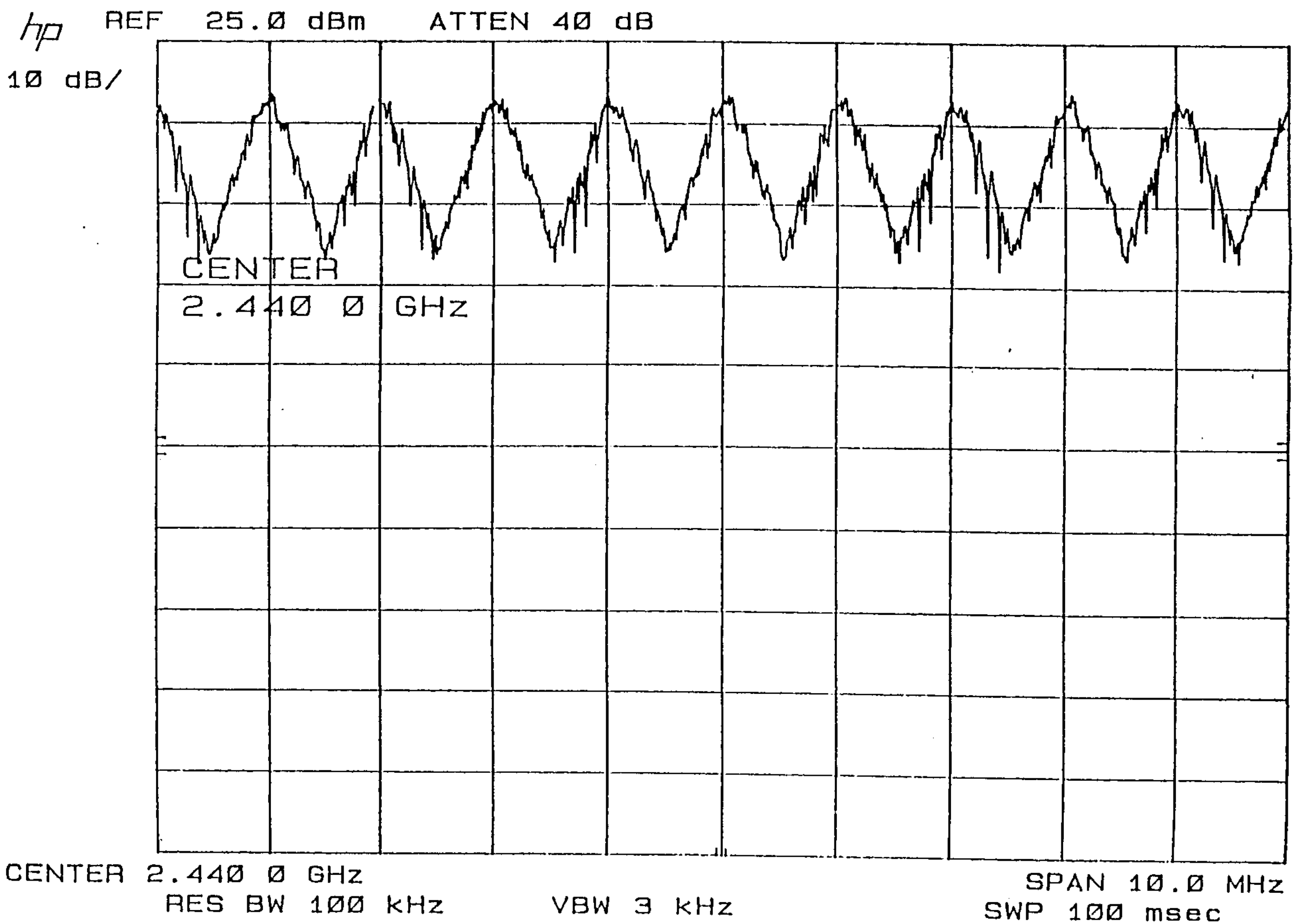
FCC ID NO. H9PLA24005AZL

Channe Spacing

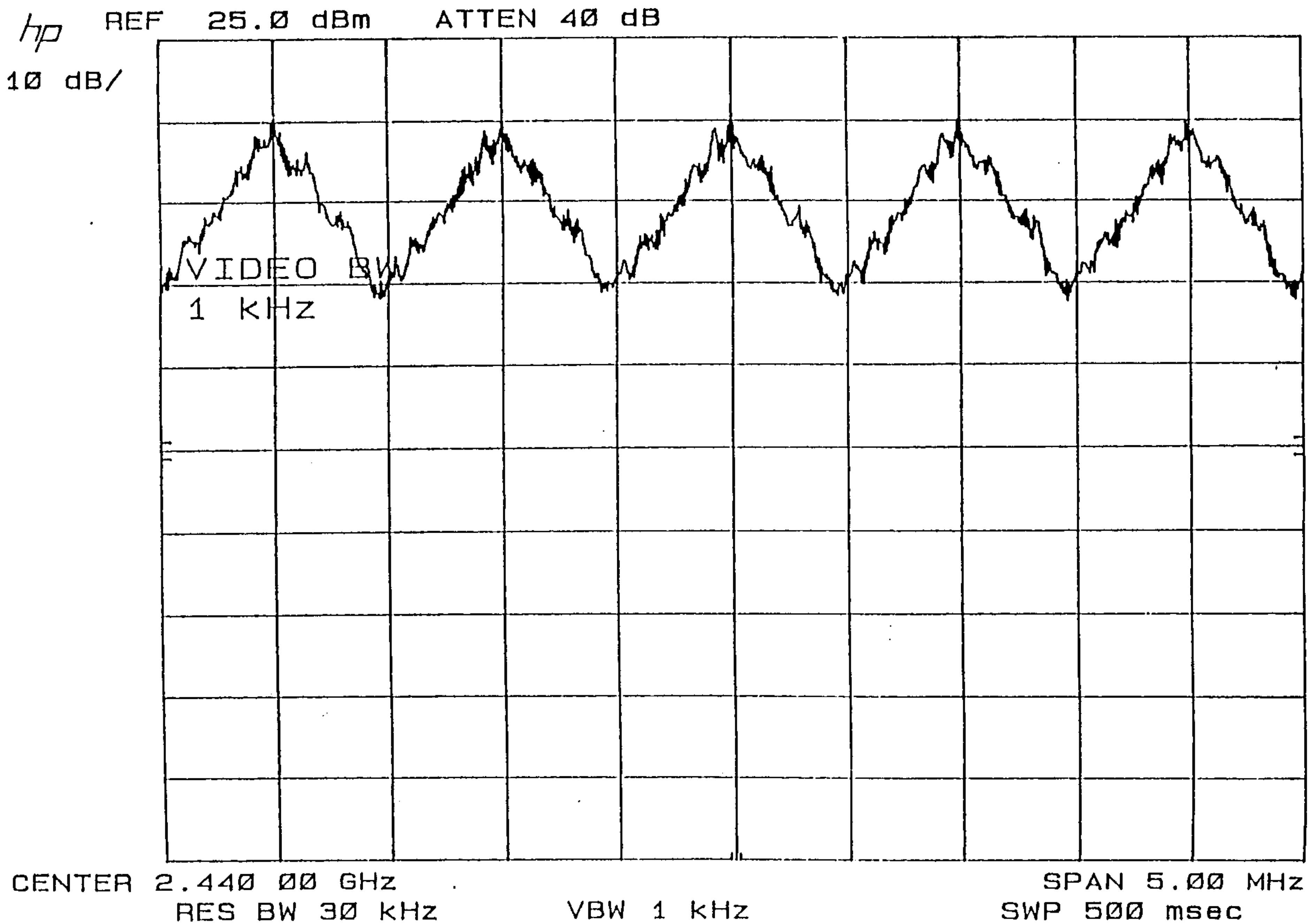


40

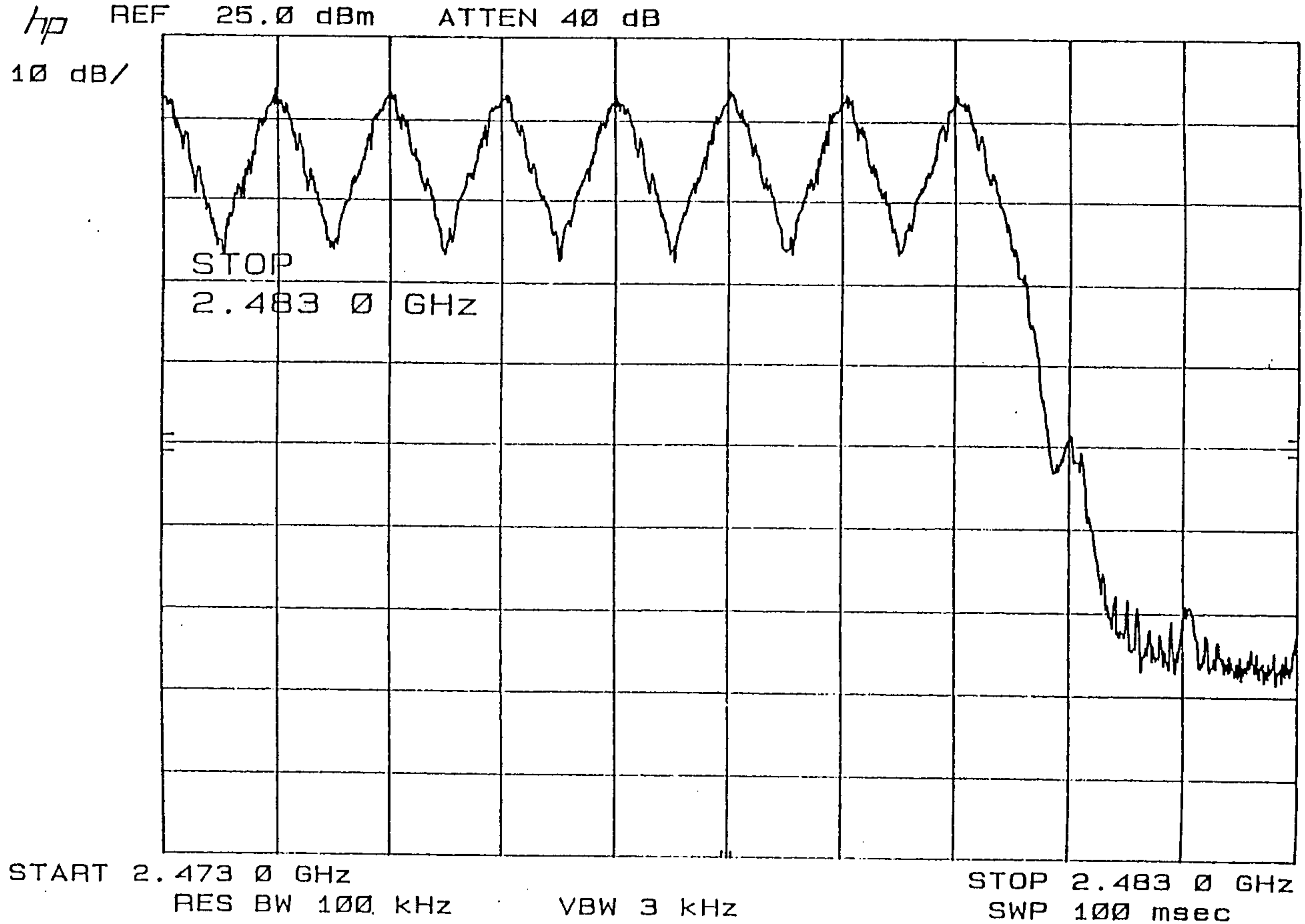
Channel Spacing

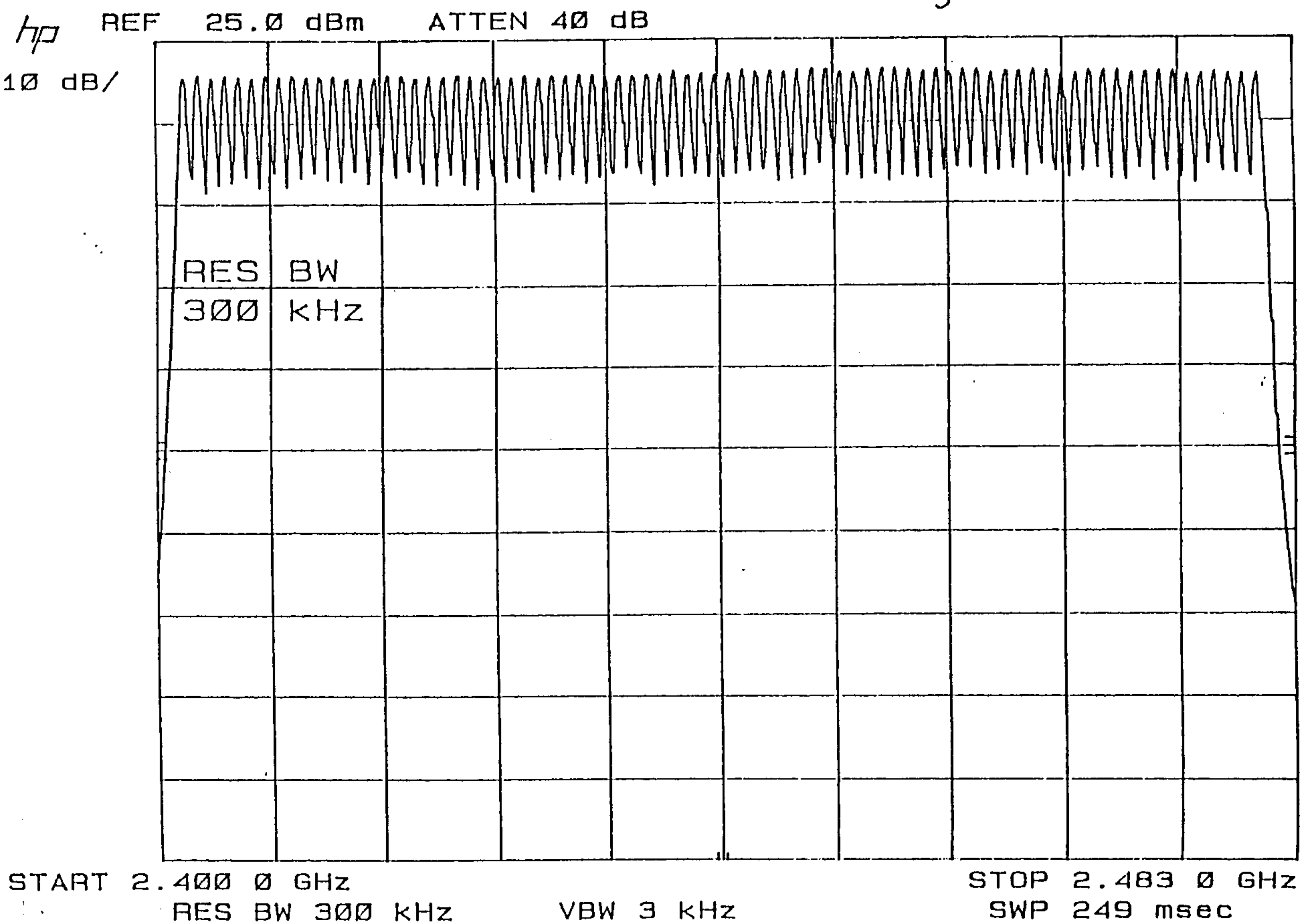


Channel Spacing

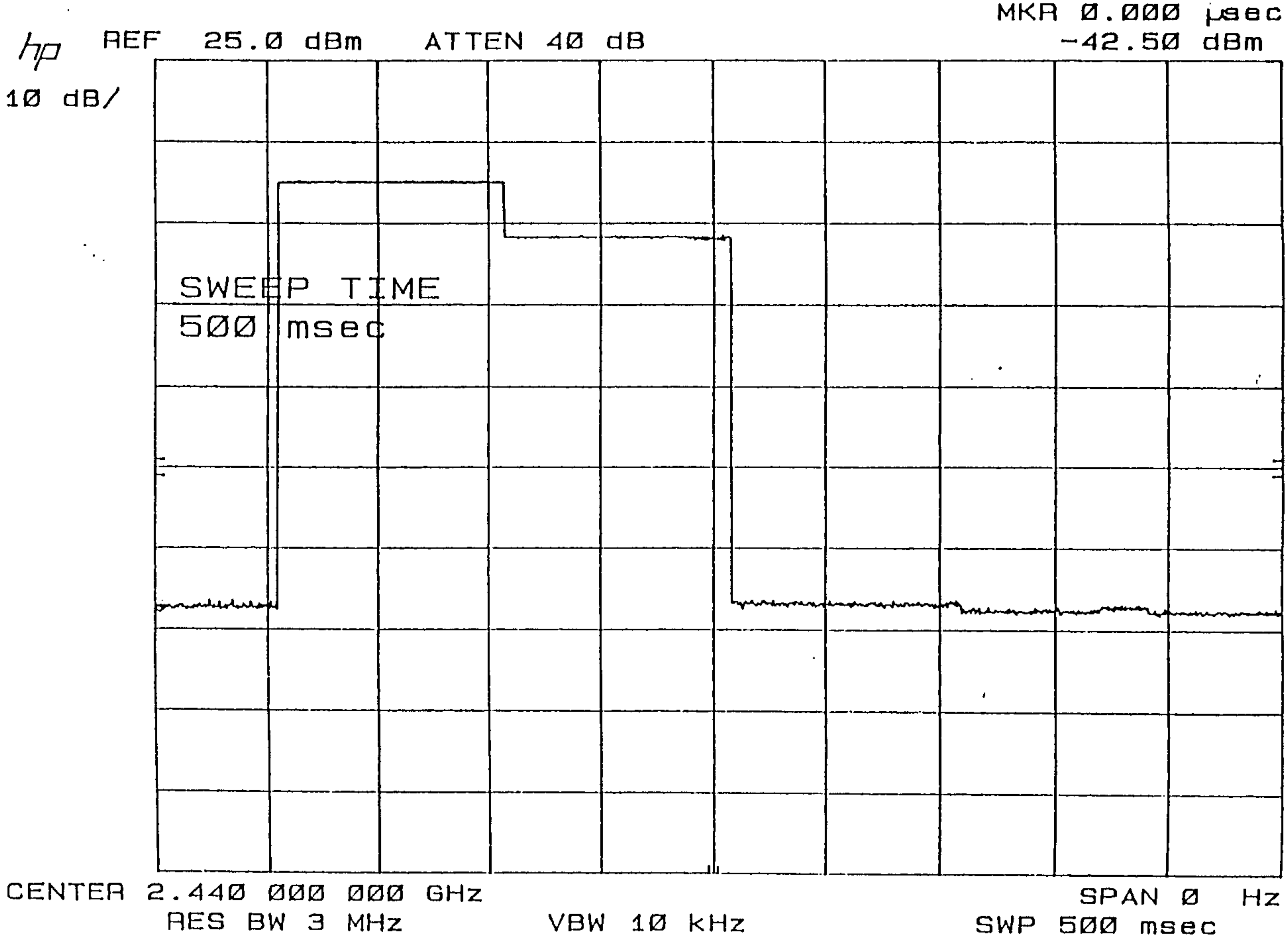


Cher :l Speciys



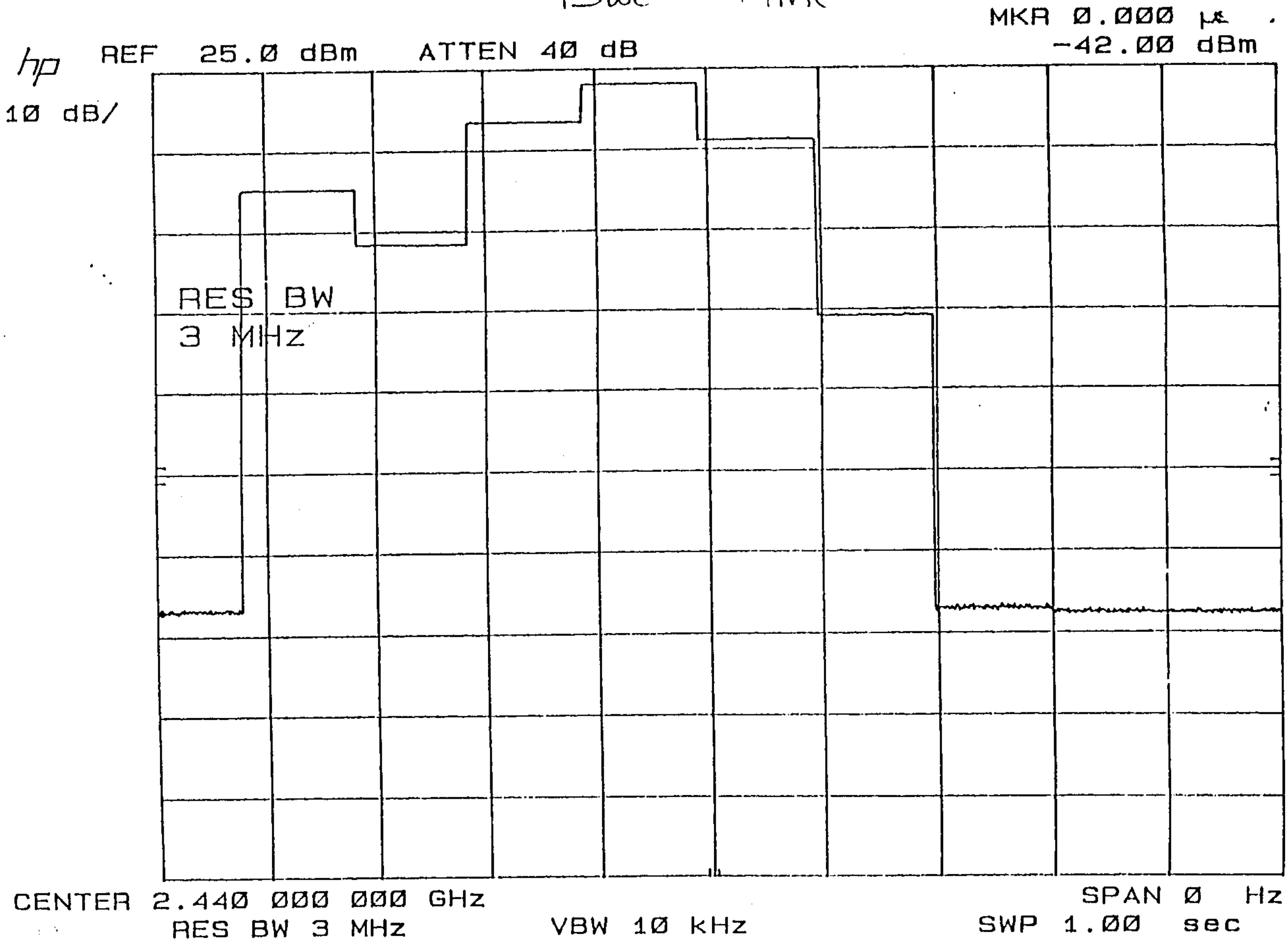

hp
REF 25.Ø dBm ATTEN 4Ø dB
1Ø dB/
RES BW
3ØØ kHz
START 2.4ØØ Ø GHz
RES BW 3ØØ kHz
VBW 3 kHz
STOP 2.483 Ø GHz
SWP 249 msec

Dwell Time

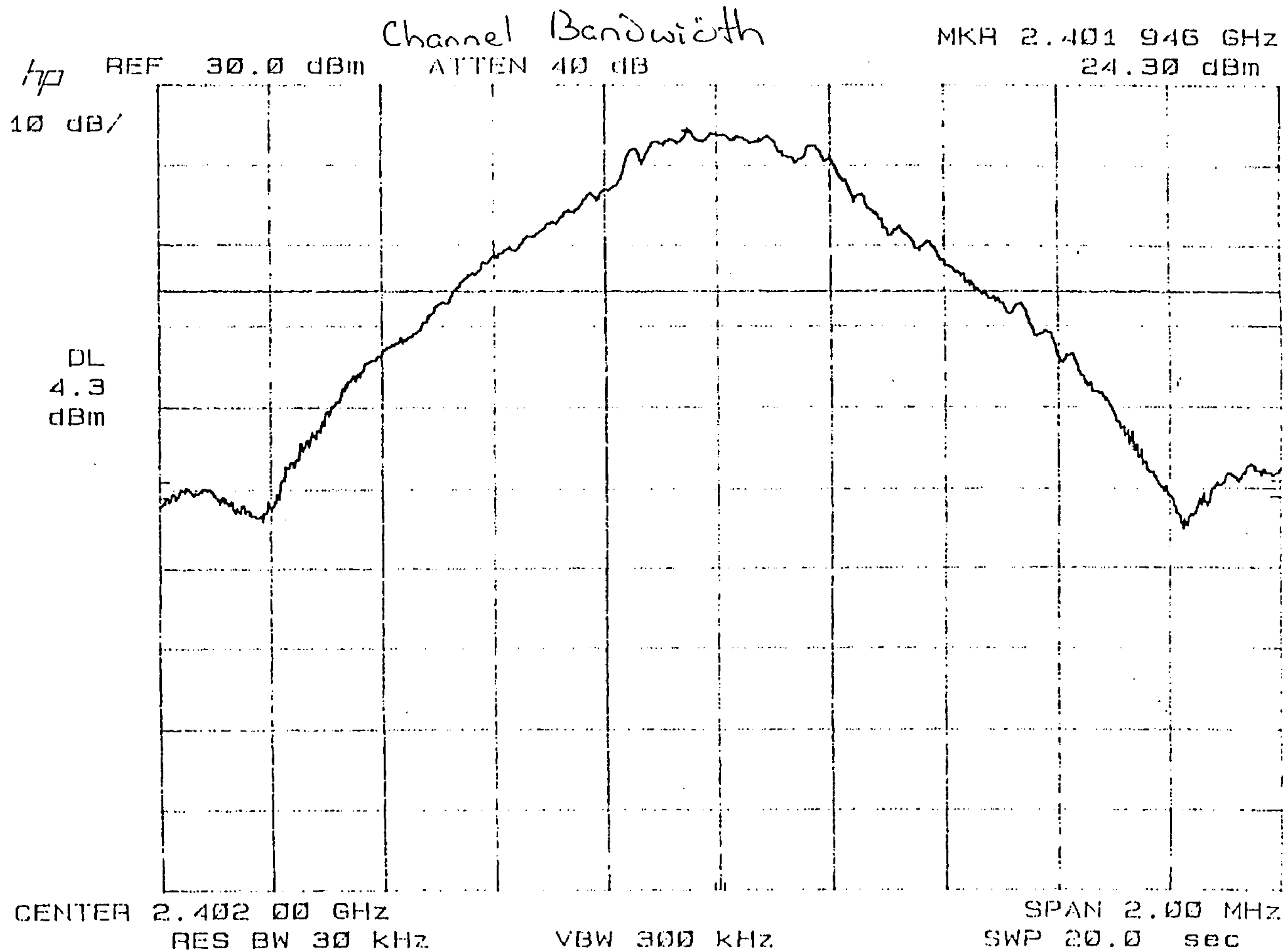


hp REF 25.0 dBm ATTEN 40 dB
MKR 0.000 µsec
-42.50 dBm
10 dB/
SWEEP TIME
500 msec
CENTER 2.440 000 000 GHz
SPAN 0 Hz
RES BW 3 MHz
VBW 10 kHz
SWP 500 msec

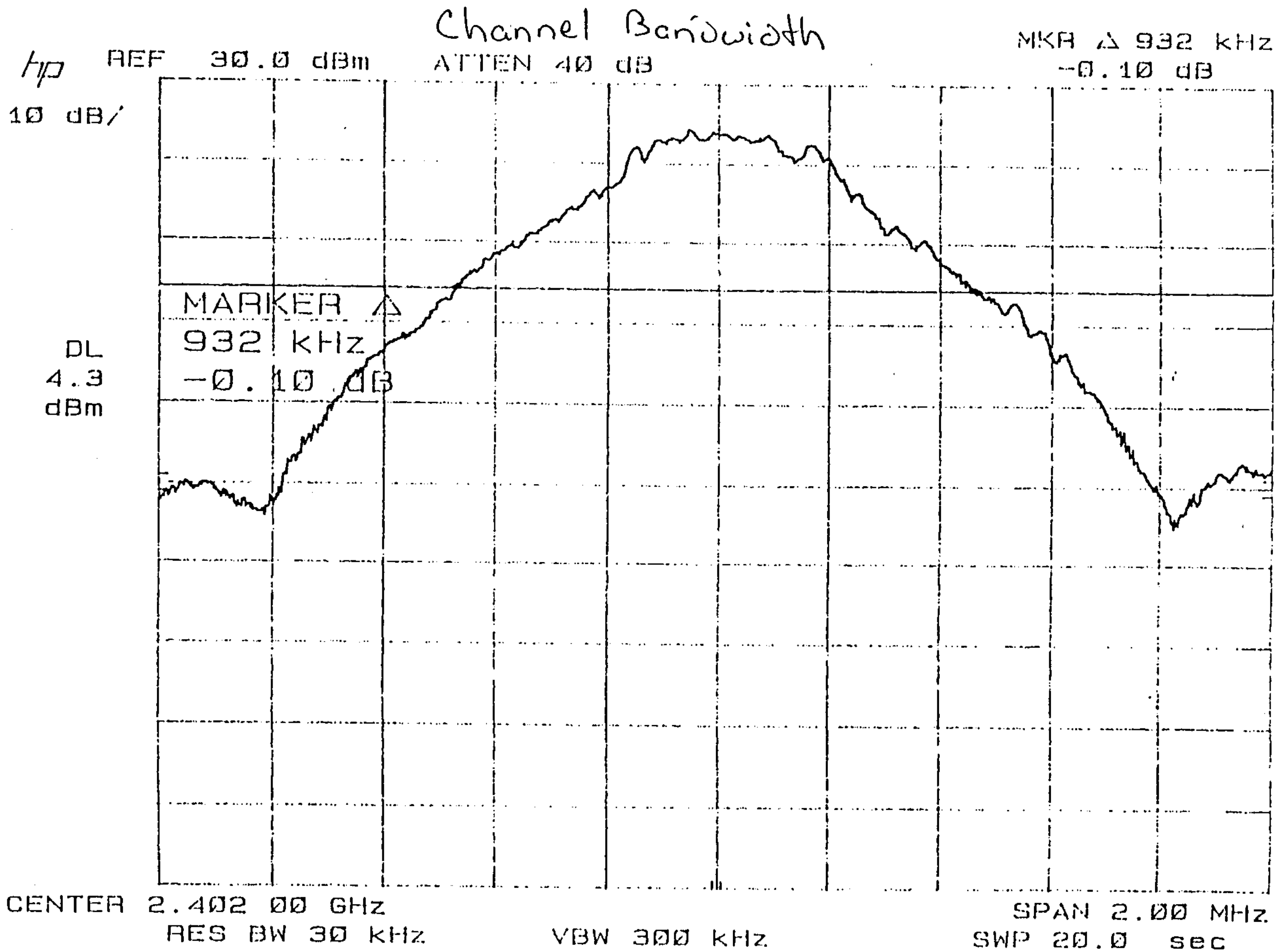
Dwell Time

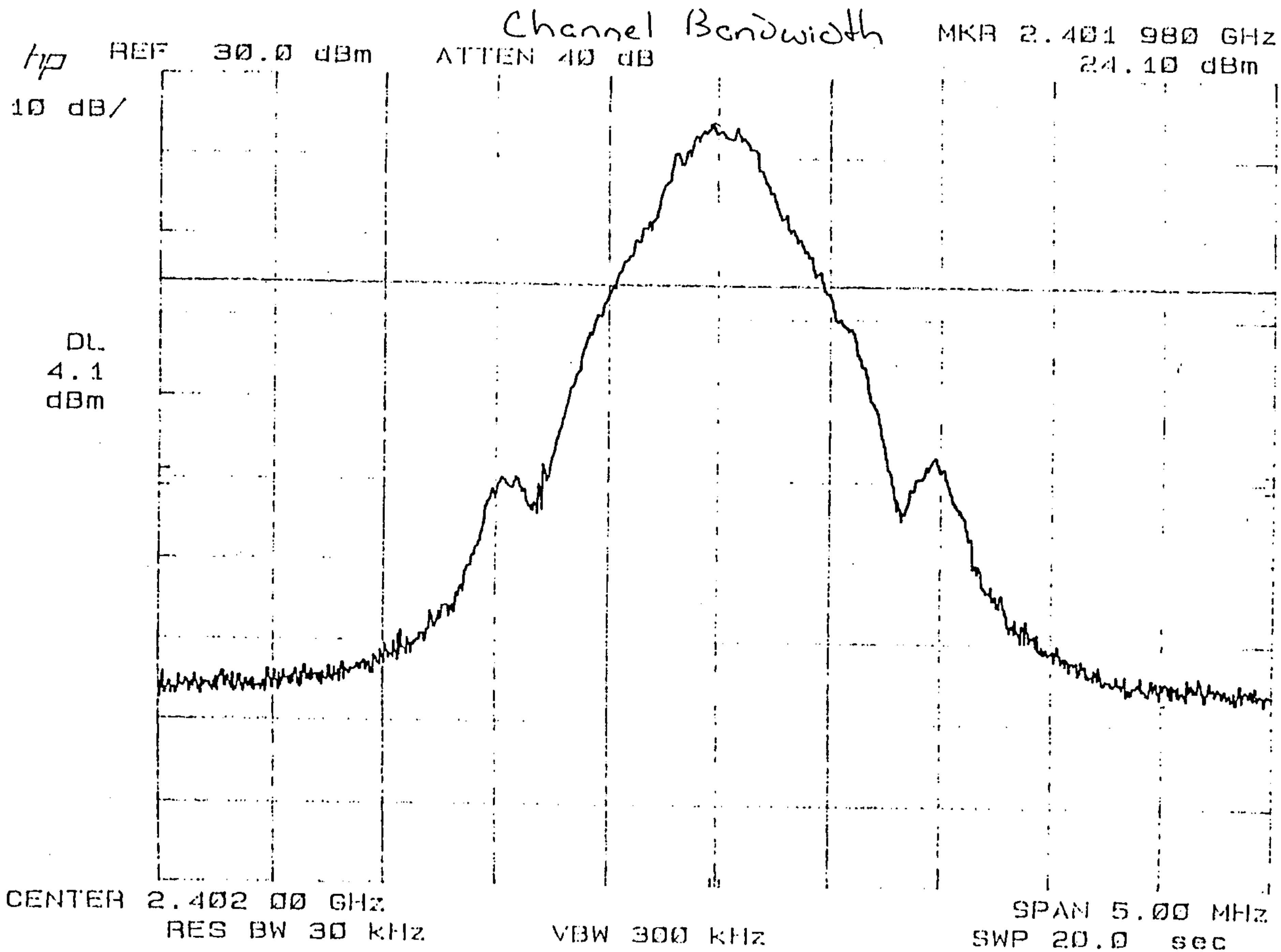


MKR Ø.ØØØ µs
-42.ØØ dBm
REF 25.Ø dBm
ATTEN 4Ø dB
10 dB/
RES BW
3 MHz
CENTER 2.44Ø ØØØ ØØØ GHz
SPAN Ø Hz
RES BW 3 MHz
VBW 1Ø kHz
SWP 1.ØØ sec



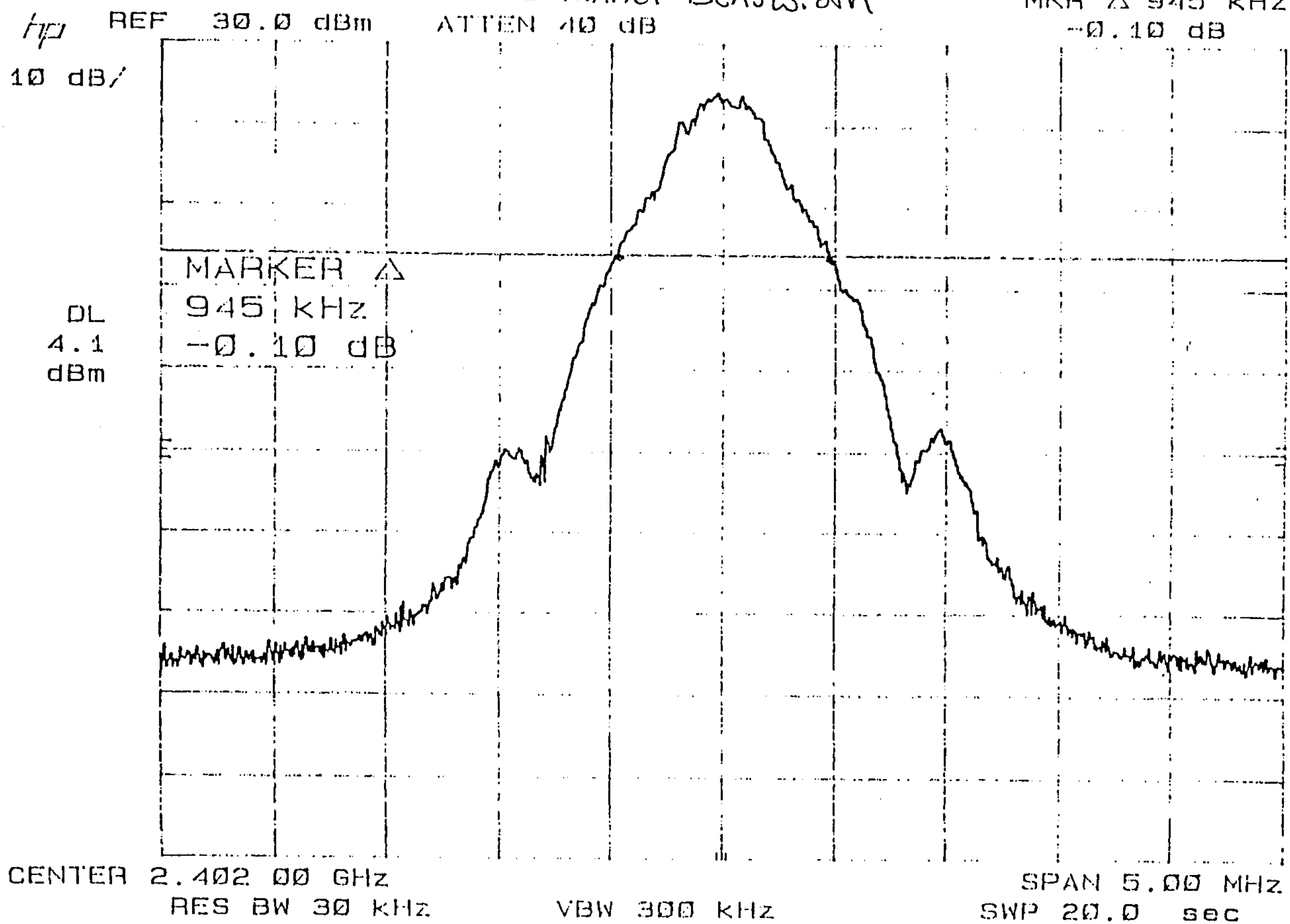
Channel Bandwidth
MKR 2.401 946 GHz
24.30 dBm
hp
REF 30.0 dBm
ATTEN 40 dB
10 dB/
DL
4.3
dBm
CENTER 2.402 00 GHz
RES BW 30 kHz
VBW 300 kHz
SPAN 2.00 MHz
SWP 20.0 sec

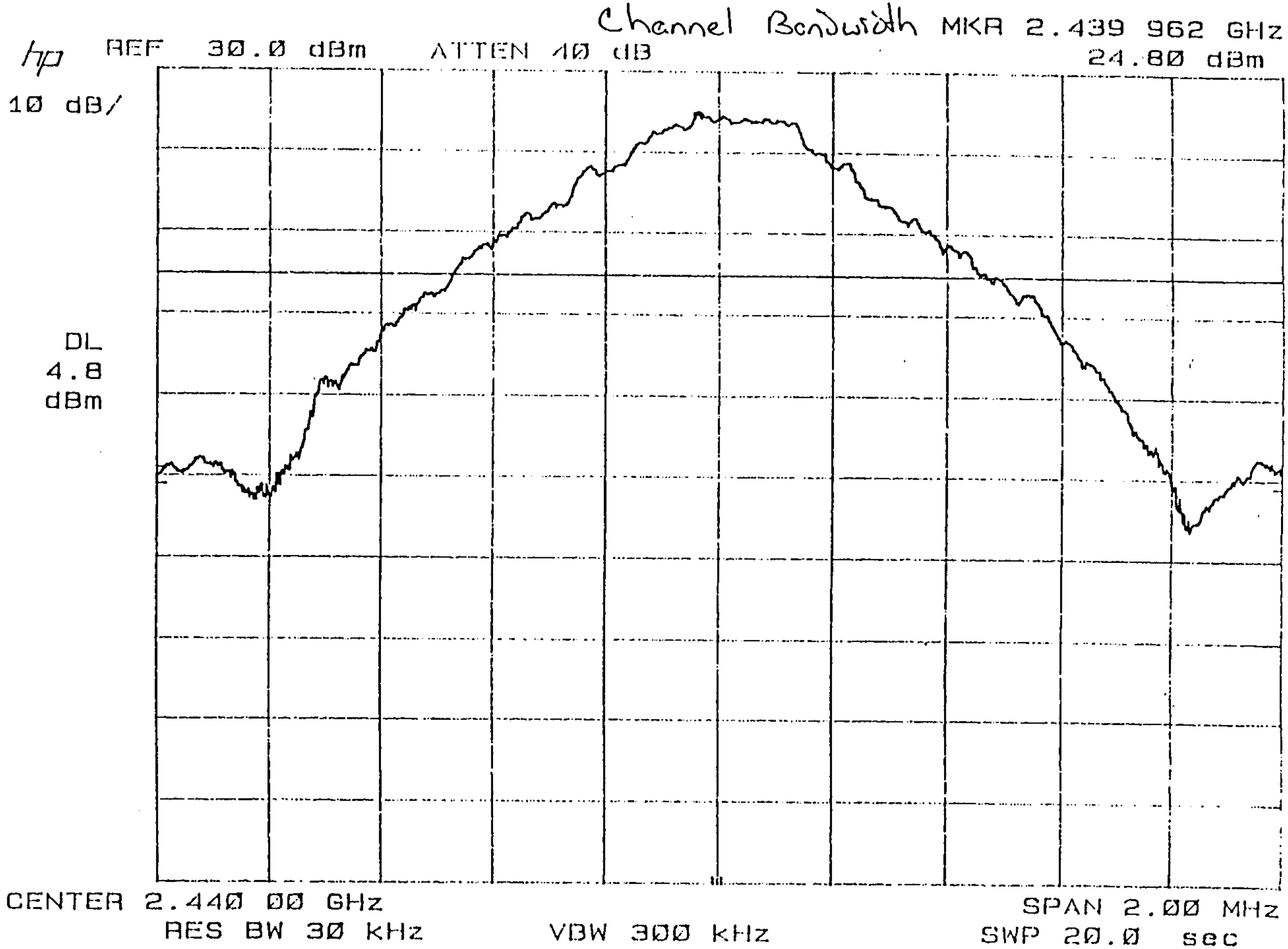

Channel Bandwidth
hp
REF 30.0 dBm
ATTEN 40 dB
MKR Δ 932 kHz
-0.10 dB
10 dB/
DL
4.3
dBm
MARKER Δ
932 kHz
-0.10 dB
CENTER 2.402 00 GHz
RES BW 30 kHz
VBW 300 kHz
SPAN 2.00 MHz
SWP 20.0 sec



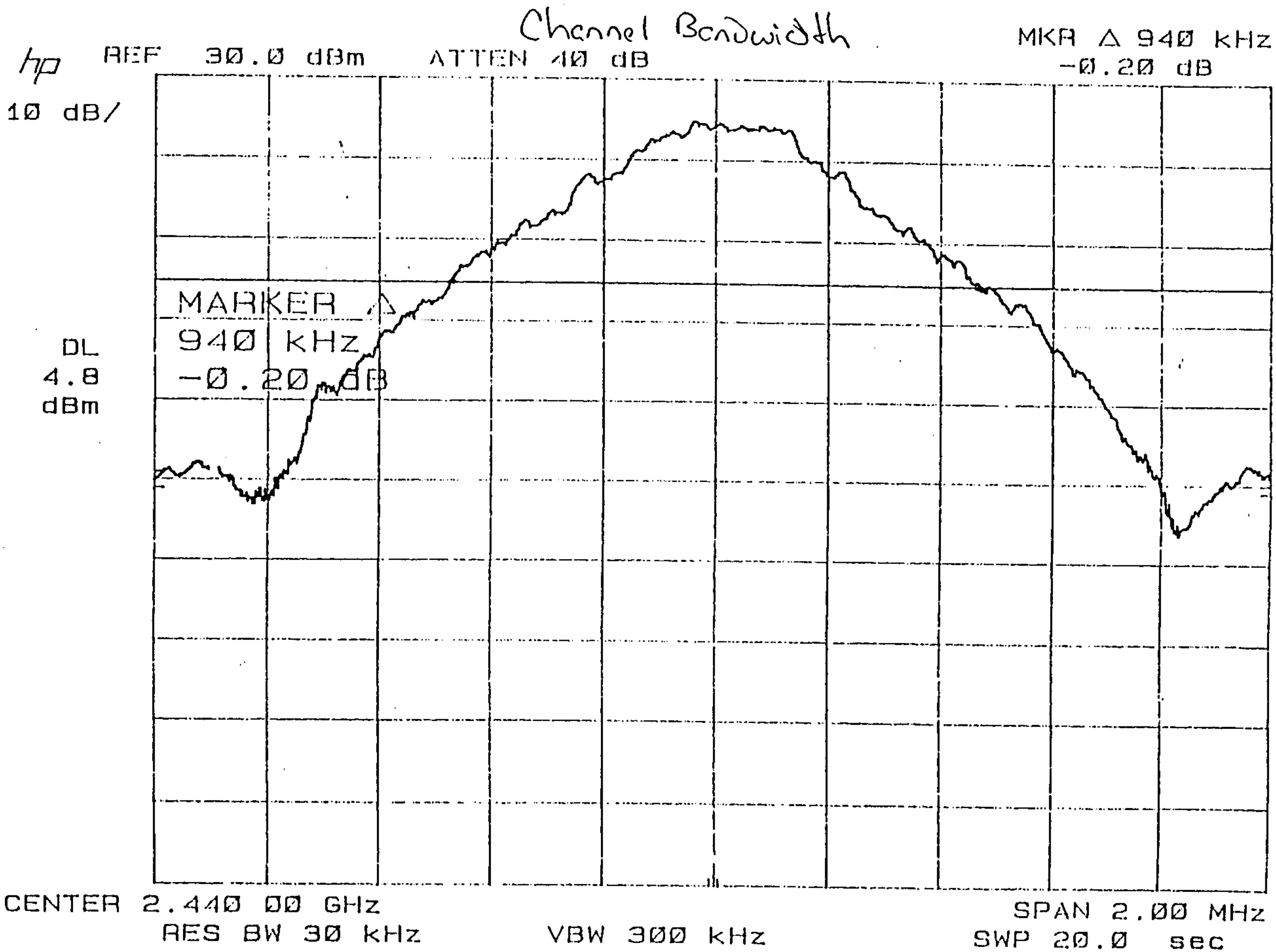
Channel Bandwidth
hp
REF 30.0 dBm
ATTEN 40 dB
MKR 2.401 980 GHz
24.10 dBm
10 dB/
DL
4.1
dBm
CENTER 2.402 00 GHz
RES BW 30 kHz
VBW 300 kHz
SPAN 5.00 MHz
SWP 20.0 sec

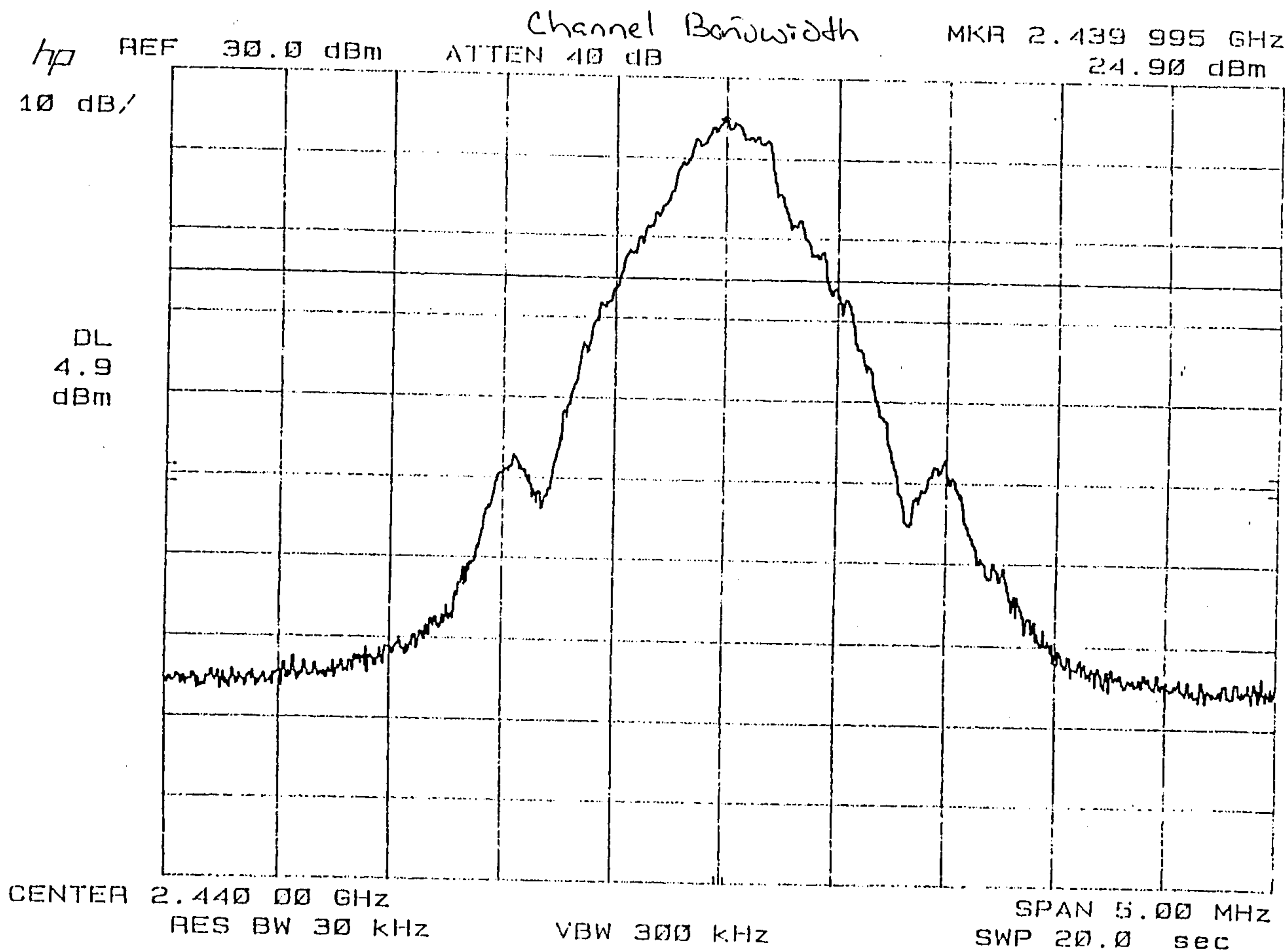
Channel Bandwidth

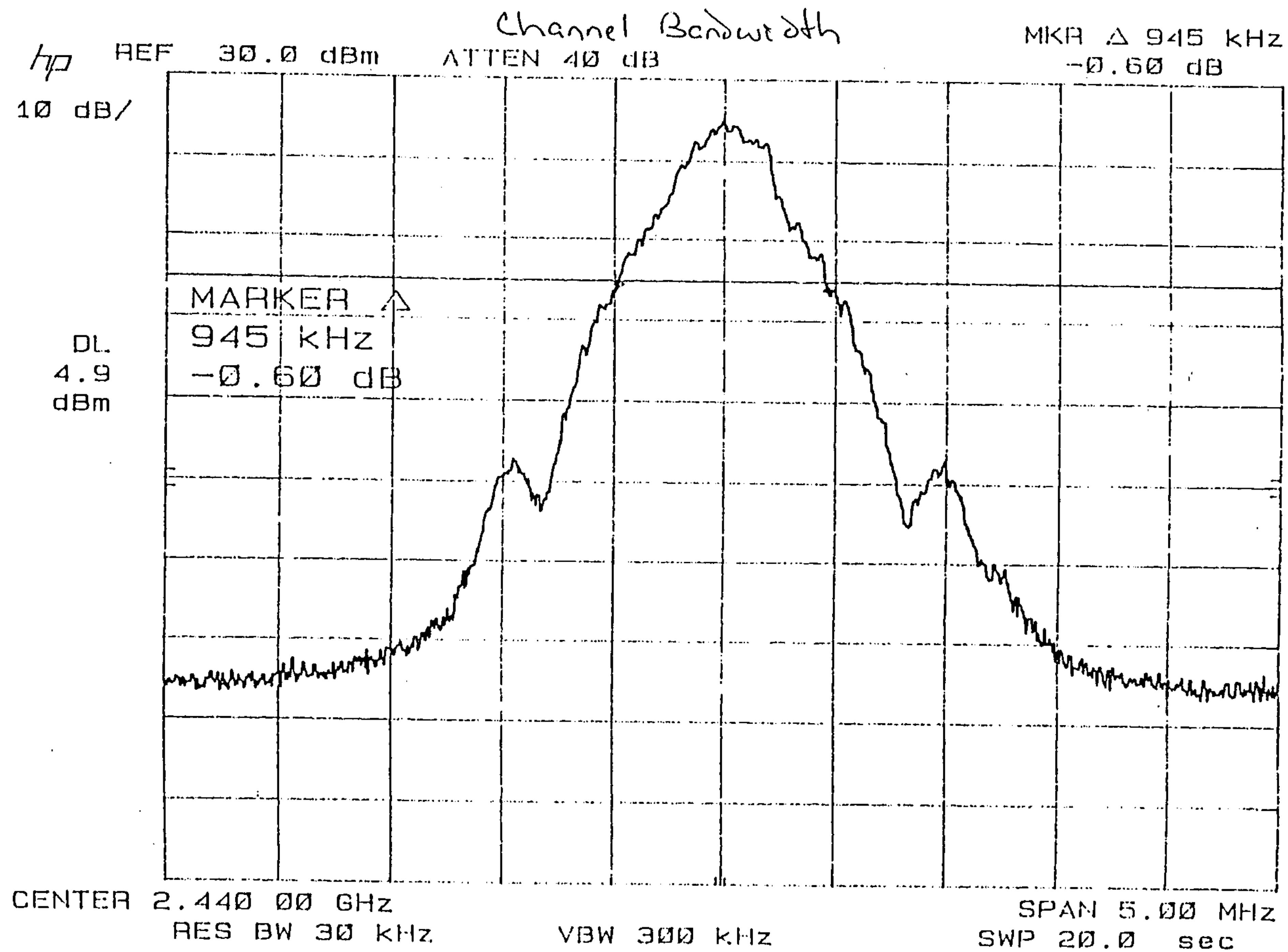


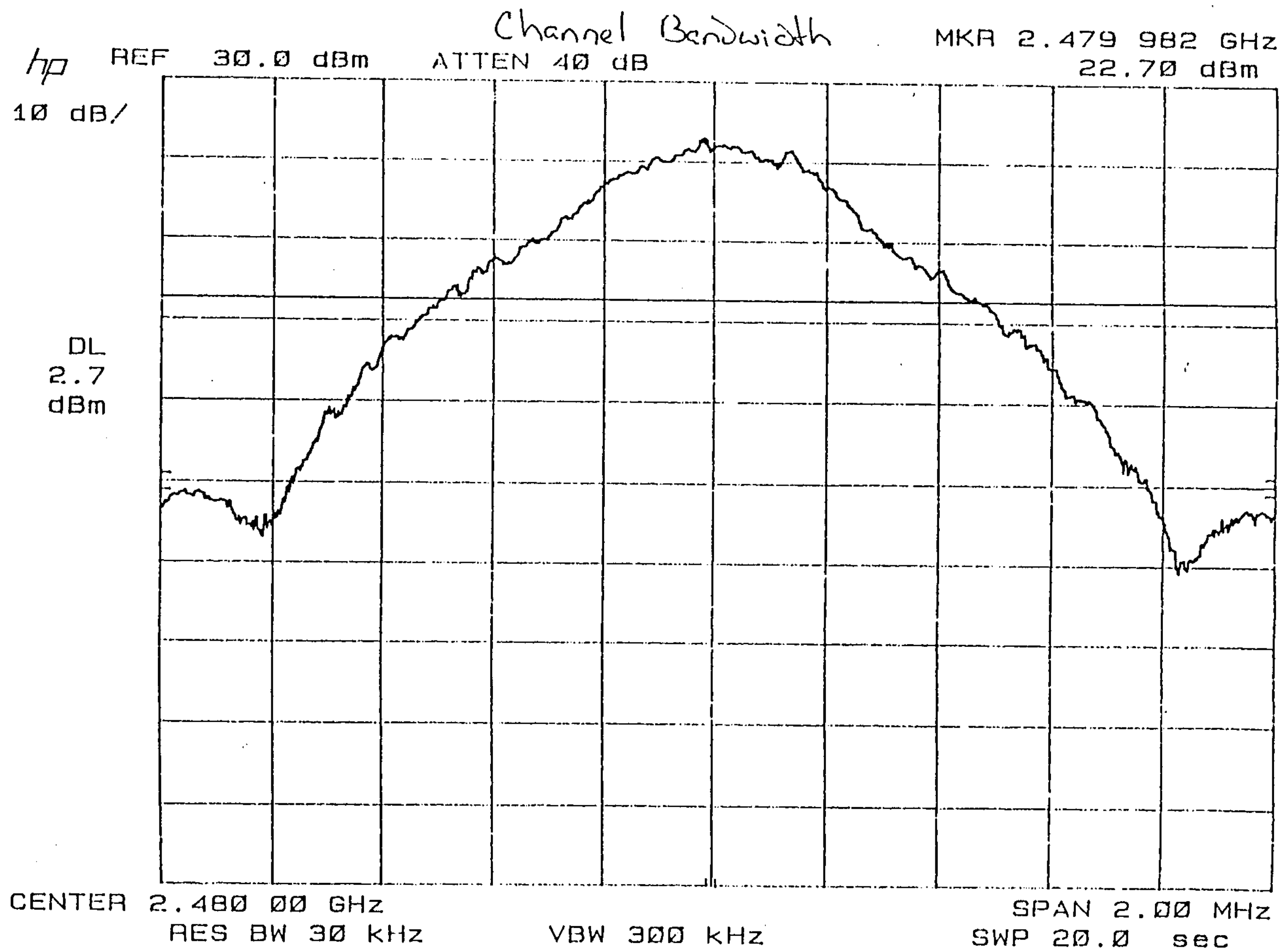


Channel Bandwidth
hp
REF 30.0 dBm
ATTEN 40 dB
MKR 2.439 962 GHz
24.80 dBm
10 dB/
DL
4.8
dBm
CENTER 2.440 00 GHz
RES BW 30 kHz
VBW 300 kHz
SPAN 2.00 MHz
SWP 20.0 sec

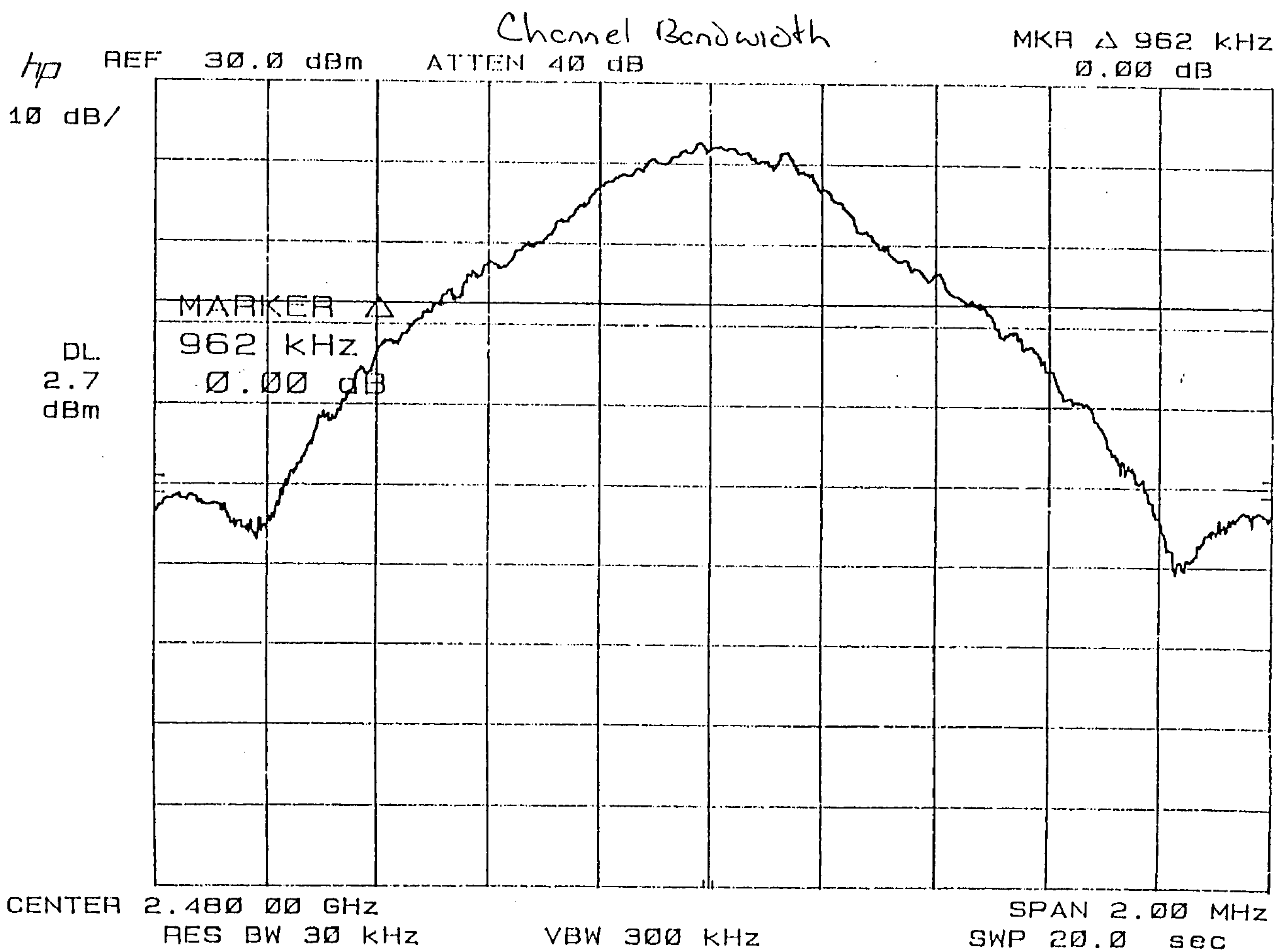

Channel Bandwidth
hp
REF 30.0 dBm
ATTEN 40 dB
MKR △ 940 kHz
-0.20 dB
10 dB/
DL
4.8
dBm
MARKER △
940 kHz
-0.20 dB
CENTER 2.440 00 GHz
RES BW 30 kHz
VBW 300 kHz
SPAN 2.00 MHz
SWP 20.0 sec

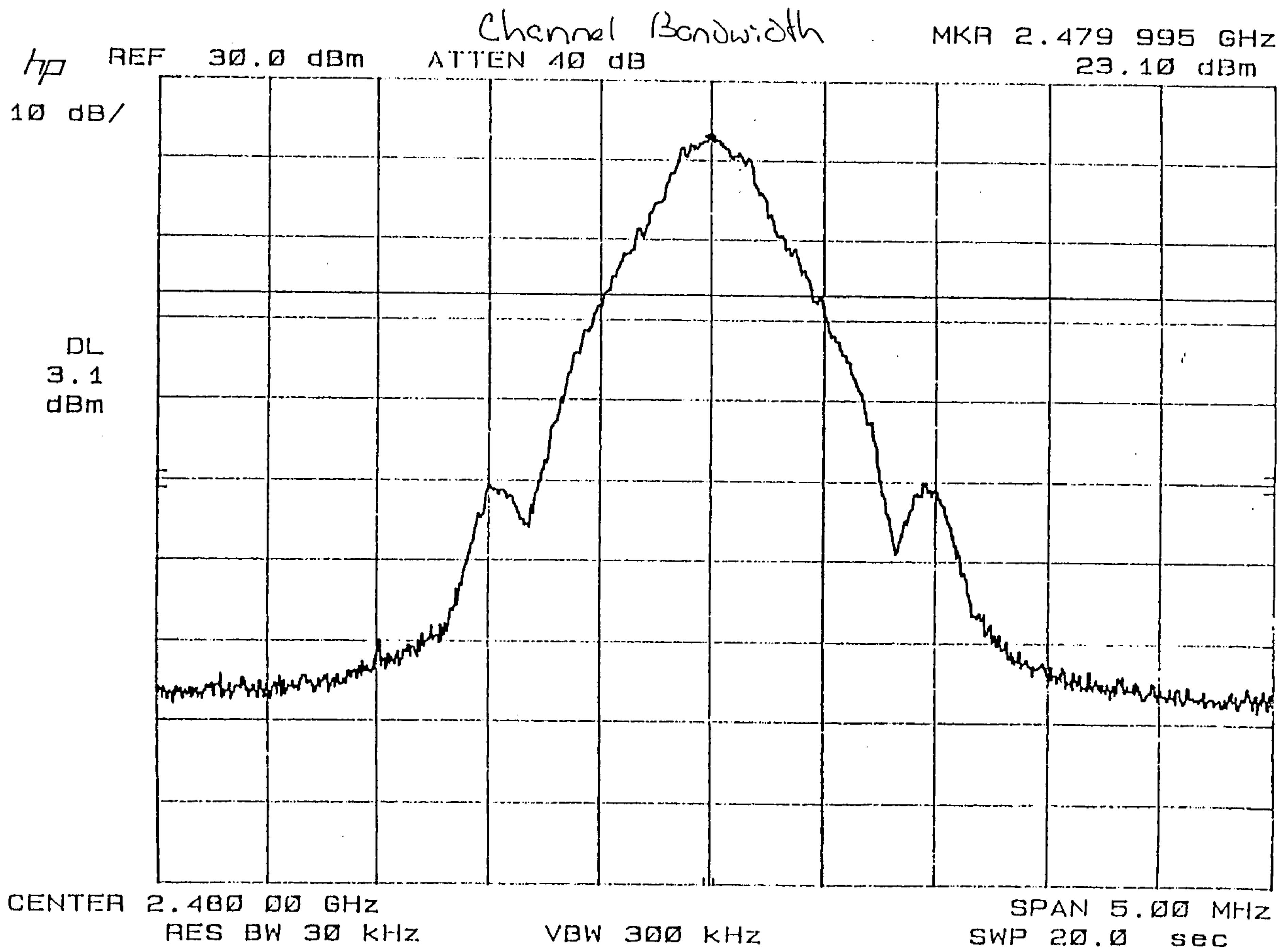

Channel Bandwidth
hp
REF 30.0 dBm
ATTEN 40 dB
MKR 2.439 995 GHz
24.90 dBm
10 dB/
DL
4.9
dBm
CENTER 2.440 00 GHz
RES BW 30 kHz
VBW 300 kHz
SPAN 5.00 MHz
SWP 20.0 sec

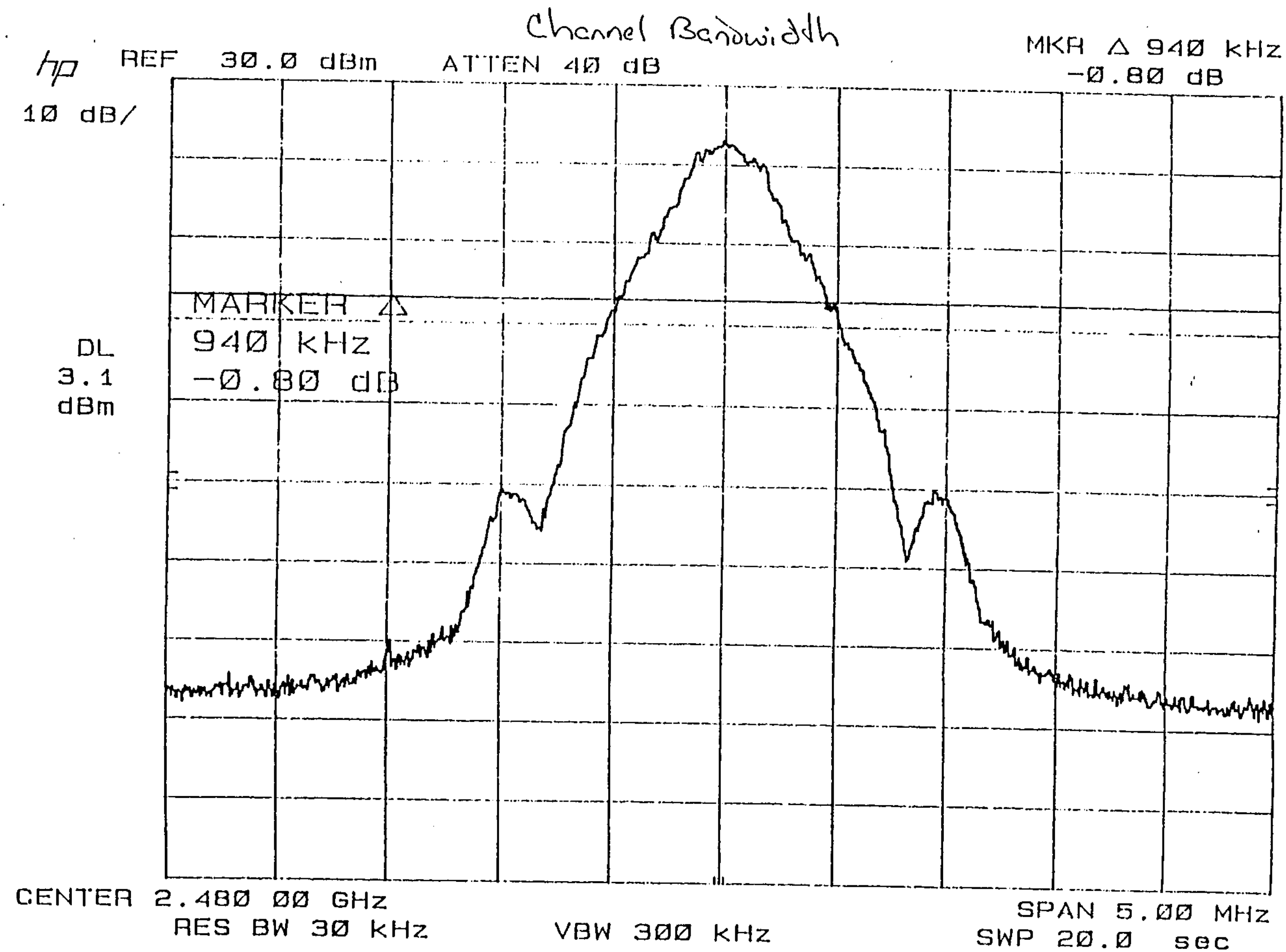

Channel Bandwidth
hp REF 30.0 dBm ATTEN 40 dB
MKR Δ 945 kHz
-0.60 dB
10 dB/
MARKER Δ
945 kHz
-0.60 dB
DL
4.9
dBm
CENTER 2.440 00 GHz
RES BW 30 kHz
VBW 300 kHz
SPAN 5.00 MHz
SWP 20.0 sec



Channel Bandwidth
hp REF 30.0 dBm ATTEN 40 dB
MKR 2.479 982 GHz
22.70 dBm
10 dB/
DL
2.7
dBm
CENTER 2.480 00 GHz
RES BW 30 kHz
VBW 300 kHz
SPAN 2.00 MHz
SWP 20.0 sec


Channel Bandwidth
hp
REF 30.0 dBm
ATTEN 40 dB
MKR Δ 962 kHz
0.00 dB
10 dB/
MARKER Δ
962 kHz
0.00 dB
DL
2.7
dBm
CENTER 2.480 00 GHz
RES BW 30 kHz
VBW 300 kHz
SPAN 2.00 MHz
SWP 20.0 sec


Channel Bandwidth
hp
REF 30.0 dBm
ATTEN 40 dB
MKR 2.479 995 GHz
23.10 dBm
10 dB/
DL
3.1
dBm
CENTER 2.480 00 GHz
RES BW 30 kHz
VBW 300 kHz
SPAN 5.00 MHz
SWP 20.0 sec



Channel Bandwidth
hp
REF 30.0 dBm
ATTEN 40 dB
MKR Δ 940 kHz
-0.80 dB
10 dB/
MARKER Δ
940 kHz
-0.80 dB
DL
3.1
dBm
CENTER 2.480 00 GHz
RES BW 30 kHz
VBW 300 kHz
SPAN 5.00 MHz
SWP 20.0 sec

OUT OF BAND EMISSIONS (LOWER BAND EDGE 1)

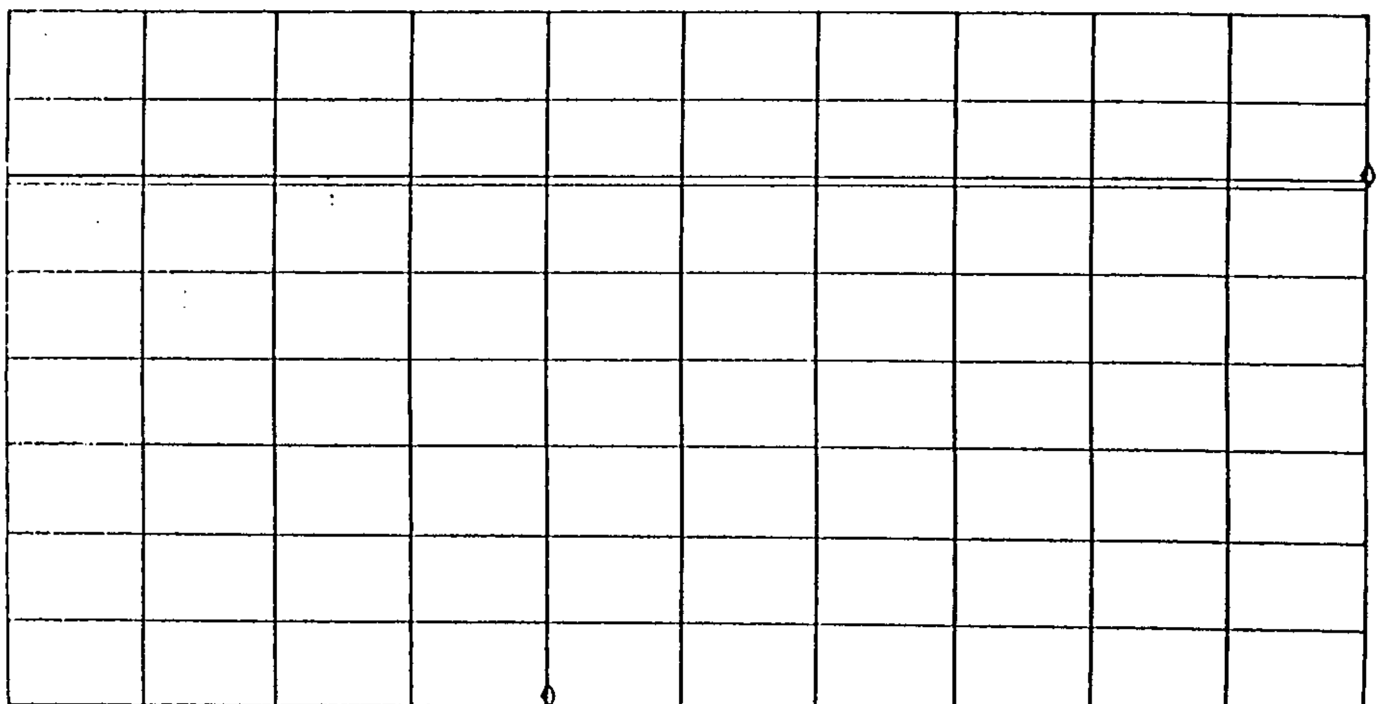
11:04:47 JUL 26, 1995
16:20:11 MAR 02, 1994SYMBOL SIRIUS BW OCC

SWEEPTIME
207 msec

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR∆ -2.0514 GHz
-60.42 dB

LOG REF 20.0 dBm
5
dB/
ATN
50 dB

DL
10.6
dBm
MA WB
SC FS
CORR



START 20.0 MHz
STOP 975.0 MHz
#IF BW 100 kHz
#AVG BW 300 kHz
SWP 207 msec

FCC ID NO. H9PLA24005AZL

symbol®

Mobile & Wireless Systems Division

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Federal Communications Commission
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046
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FAX: (301) 344 –2050

Copy

Re: FCC ID: H9PWWC1049

Date: March 3, 1998

Dear Mr. Fabina

Thank you for your FAX of January 22 addressed to Amit Shah and your FAX of December 2 to Thomas Schneider. Regarding each of the items of concern, in order following your FAXs:

FAX of December 2

1) Concerning the Radiated emissions test data:

We tested the 2.4 GHz spread spectrum transmitter in its new housing and antenna configuration. Please see the attached test data sheets. Note that the data sheets omit a column for duty cycle correction factor. All magins on the data sheet need to be adjusted for a -9 dB duty cycle factor to increase the magins. Please see the attached duty cycle calculation.

2) Concerning public exposure to excess radio frequency energy:

Please see the attached Product Compliance Test Report for SAR.

3) Concerning antenna discription:

Please see the enclosed outline drawing, photograph, and Saturn Stub drawing.

4) Concerning intended usage statement or users manual.

See Symbol Technoloiges, Inc. letter from Amit Shah of January 8.

FAX of January 22

1) Concerning public exposure to excess radio frequency energy:

Please see the attached Product Compliance Test Report for SAR.

2) Concerning periodic beacon equal usage.

The beacons are generated only by the Spectrum24 Access Point not by the mobile units (like the WWC1049). The beacons occur once during each channel hop. The hop pattern as discussed is a psuedo-random sequence which selects one of 79, 1 MHz channels centered from 2402 to 2480 MHz. Each channel of the hop sequence is evenly utilized by selecting each channel once and only once in each cycle, and using identical dwells at each channel. Each channel is evenly utilized by selecting each channel once and only once in each cycle, and using identical dwells at each channel. The hop pattern does not reset (recycle) until the hop pattern has been completed.

Thank you for your attention.

Respectfully submitted,

Norman H. Nelson
Symbol Technologies

Intertek Testing Services

Company: Simbol Technologies
Model: FCCID H9PWWC1049

Engineer: Marianna Belinkaya
Date of test: 02/26/98

FCC. 15.247 Radiated Emissions

Frequency MHz	Anntena Polarity (H/V)	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Distance Correction dB	Corrected Reading dB(uV/m)	Limit dB(uV/m)	Margin dB	Detector
4804.0	V	15.8	32.4	3.5	0.0	51.7	74.0	-22.3	P
4804.0	V	11.9	32.4	3.5	0.0	47.8	54.0	-6.2	A
4804.0	H	16.7	32.4	3.5	0.0	52.6	74.0	-21.4	P
4804.0	H	14.0	32.4	3.5	0.0	49.9	54.0	-4.1	A
12010.0	V/H	6.5*	39.0	5.5	-9.5	41.5	74.0	-32.5	P
12010.0	V/H	-3.0*	39.0	5.5	-9.5	32.0	54.0	-22.0	A
19216.0	V/H	31.0*	37.5	6.5	-20.0	55.0	74.0	-19.0	P
19216.0	V/H	20.5*	37.5	6.5	-20.0	44.5	54.0	-9.5	A

All measurement were made at 3 m.
* Noise floor
Negative signs (-) in the margin column signify levels below the limit.

Company: Simbol Technologies
Model: FCCID H9PWWC1049
Engineer: Marianna Belinkaya
Date of test: 02/26/98

FCC. 15.247 Radiated Emissions

Frequency MHz	Anntena Polarity (H/V)	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Distance Correction dB	Corrected Reading dB(uV/m)	Limit dB(uV/m)	Margin dB	Detector
4880.0	V	18.9	32.6	3.5	0.0	55.0	74.0	-19.0	P
4880.0	V	15.9	32.6	3.5	0.0	52.0	54.0	-2.0	A
4880.0	H	16.8	32.8	3.5	0.0	53.1	74.0	-20.9	P
4880.0	H	12.8	32.8	3.5	0.0	49.1	54.0	-4.9	A
7320.0	V	13.0	36.8	4.0	0.0	53.8	74.0	-20.2	P
7320.0	V	5.2	36.8	4.0	0.0	46.0	54.0	-8.0	A
7320.0	H	16.0	36.4	4.0	0.0	56.4	74.0	-17.6	P
7320.0	H	5.4	36.4	4.0	0.0	45.8	54.0	-8.2	A
12200.0	V/H	6.5*	39.1	5.5	-9.5	41.6	74.0	-32.4	P
12200.0	V/H	-3.0*	39.1	5.5	-9.5	32.1	54.0	-21.9	A
19500.0	V/H	31.0*	40.5	6.5	-20.0	58.0	74.0	-16.0	P
19500.0	V/H	20.5*	40.5	6.5	-20.0	47.5	54.0	-6.5	A

All measurement were made at 3 m.
* Noise floor
Negative signs (-) in the margin column signify levels below the limit.

Intertek Testing Services

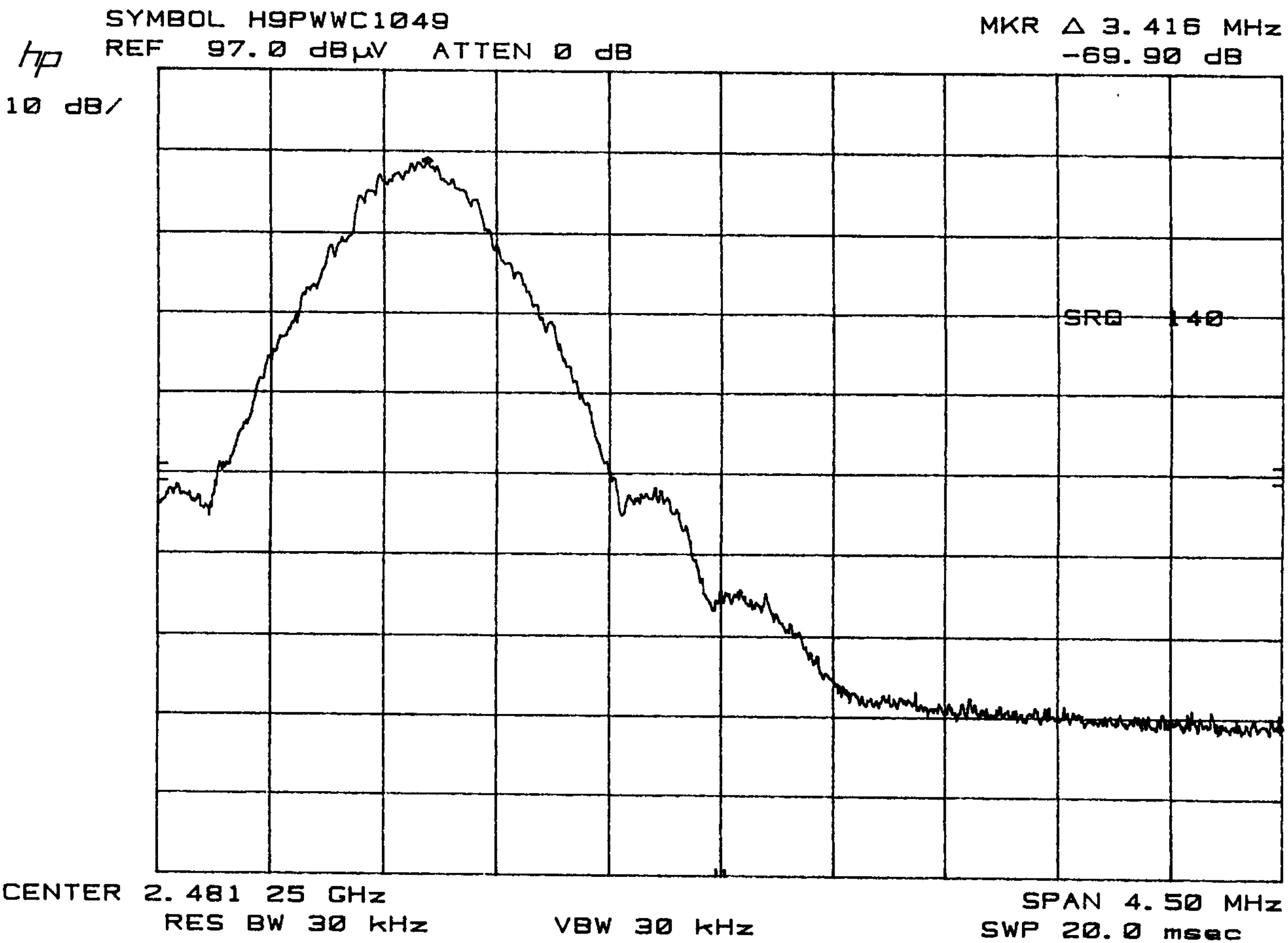
Company: Simbol Technologics
Model: FCCID H9PWWC1049

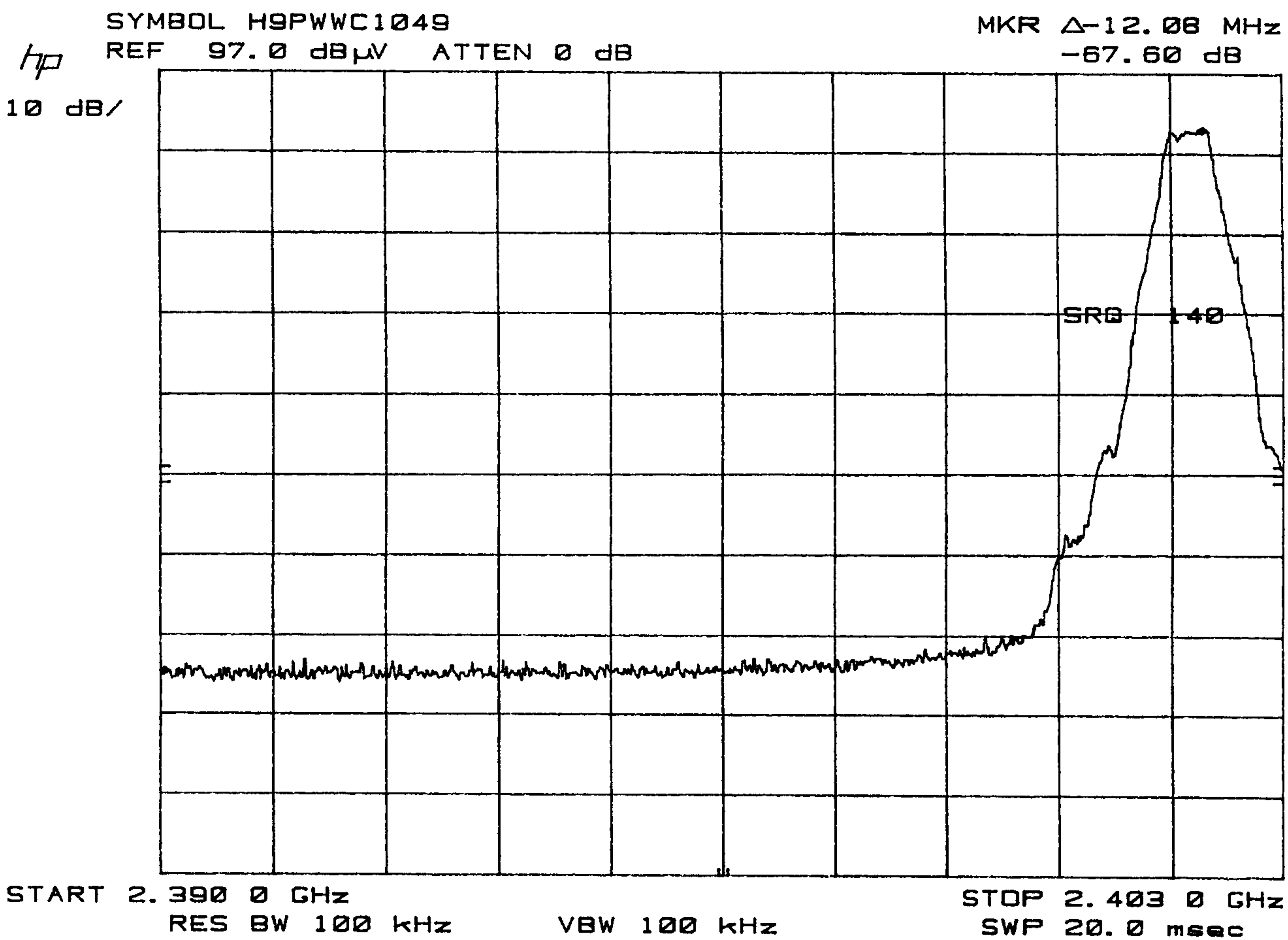
Engineer: Marianna Belinkaya
Date of test: 02/26/98

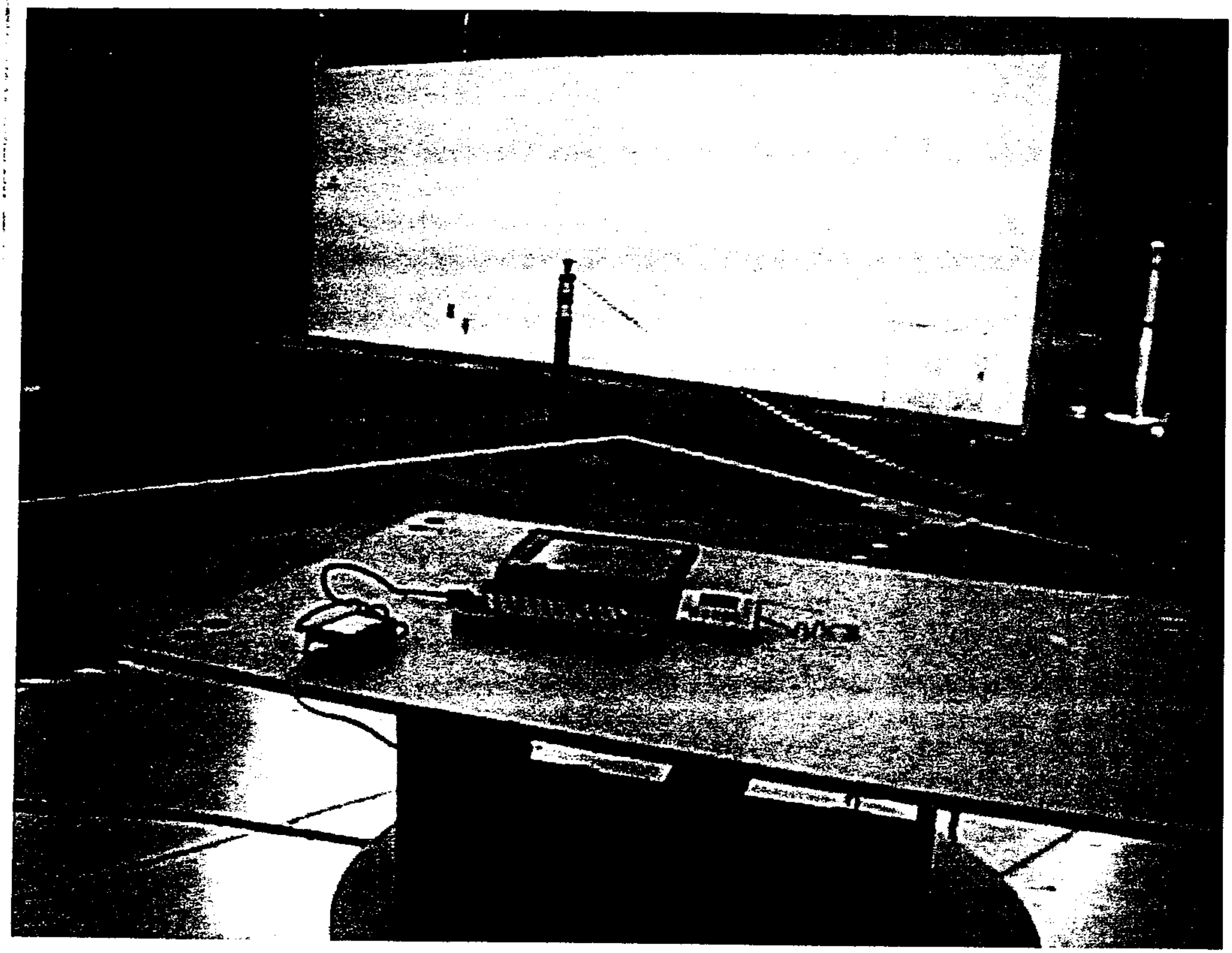
FCC. 15.247 Radiated Emissions

Frequency MHz	Anntena Polarity (H/V)	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Distance Correction dB	Corrected Reading dB(uV/m)	Limit dB(uV/m)	Margin dB	Detector
4960.0	V	16.0	32.6	3.5	0.0	52.1	74.0	-21.9	P
4960.0	V	12.9	32.6	3.5	0.0	49.0	54.0	-5.0	A
4960.0	H	16.0	32.8	3.5	0.0	52.3	74.0	-21.7	P
4960.0	H	3.1*	32.8	3.5	0.0	36.3	54.0	-17.7	A
7440.0	V	13.0	37.5	4.0	0.0	54.5	74.0	-19.5	P
7440.0	V	4.3	37.5	4.0	0.0	45.8	54.0	-8.2	A
7440.0	H	16.0	37.5	4.0	0.0	57.5	74.0	-16.5	P
7440.0	H	5.4	37.5	4.0	0.0	46.9	54.0	-7.1	A
12400.0	V/H	6.5*	39.1	5.5	-9.5	41.6	74.0	-32.4	P
12400.0	V/H	-3.0*	39.1	5.5	-9.5	32.1	54.0	-21.9	A
19840.0	V/H	31.0*	40.5	6.5	-20.0	58.0	74.0	-16.0	P
19840.0	V/H	20.5*	40.5	6.5	-20.0	47.5	54.0	-6.5	A
22320.00	V/H	36.0*	40.5	6.5	-20.0	63.0	74.0	-11.0	P
22320.00	V/H	25.0*	40.5	6.5	-20.0	52.0	54.0	-2.0	A

All measurement were made at 3 m.
* Noise floor
Negative signs (-) in the margin column signify levels below the limit.


SYMBOL H9PWWC1049
REF 97.0 dBµV ATTEN 0 dB
MKR △ 3.416 MHz
-69.90 dB
10 dB/
SRQ 140
CENTER 2.481 25 GHz
RES BW 30 kHz
VBW 30 kHz
SPAN 4.50 MHz
SWP 20.0 msec


SYMBOL H9PWWC1049
REF 97.0 dBµV ATTEN 0 dB
MKR Δ-12.08 MHz
-67.60 dB
hp
10 dB/
SRQ 140
START 2.390 0 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 2.403 0 GHz
SWP 20.0 msec



Duty Cycle Calculation

The LA2400 PC Card is used in mobile hand held computers which communicate with Spectrum 24 Access Points which also contain a LA2400 PC Card. The communication is half duplex, when one unit is in transmit the other is in receive. The Access Point acts like a base station in that it talks to one or more mobiles on a time shared basis and relays the messages. The mobiles and Access Point compete for transmit time with a listen before talk protocol.

Mobile Duty Cycle

The communications from the mobile to the Access Point begins with the mobile listening (in receive mode, transmitter off) to determine if any other transmission is under way the listening takes place for at least .1 msec. The mobile then transmits a maximum packet of 548 bytes with addressing and other packet overhead the packet size is 609 bytes at 1 Mbit per second the packet time is therefore (609 bytes x 8 bits/byte / 1 Mbitsec = 4.872 msec). The Access Point replies with an acknowledgment in .02 msec the acknowledgment packet is .2 msec long and during the acknowledgment packet the mobile is in receive mode (transmitter is off). The mobile then prepares another packet, which takes 10 msec or more during which the mobile transmitter is off. The process then repeats itself. For the mobile the maximum transmit duty cycle is

Total transaction time ≥ .1 msec (mobile receive) + 4.872 msec (mobile transmit) + .02 msec (turn from transmit to receive) + .2 msec (mobile receive) + 10 msec (mobile prepares next packet)

Total transaction time ≥ 15.19 msec
Total mobile transmit time ≤ 4.872 msec (mobile transmit)
Duty Cycle ≤ Total mobile transmit time / Total transaction time = 4.872 / 15.19
Duty Cycle < 0.32, 32%, -9.9 dB

Access Point Duty Cycle

The Access Point can communicate with many mobiles, but only one at a time. The Access Point sends out periodic beacons at a rate of 1 every 100 msec. The maximum length of a beacon is 100 usec. The mobiles and the Access Point compete for transmit time between beacons using a listen before talk protocol. Each mobile when clear to talk will go through the exchange as described above. The Access Point can also initiate a transmission just as the mobiles do. The worst case transmit duty cycle for the Access Point is when the Access Point is the only unit needing to transmit, so it is not competing with mobile units for transmit time. In this case the Access Point will be going through the same cycle as the remote did above. However the wait time for preparing a new packet can be as low as 3 msec.

Total transaction time $\geq$ .1 msec (access point receive) + 4.872 msec (access point transmit) + .02 msec (turn from transmit to receive) + .2 msec (access point receive) + 3 msec (mobile prepares next packet)

Total transaction time $\geq$ 8.19 msec
Total access point transmit time $\leq$ 4.872 msec (access point transmit)
Duty Cycle $\leq$ Total access point transmit time / Total transaction time = 4.872 / 8.19
Duty Cycle < 0.60, 60%, -4.4 dB

Summary:

Unit	Max Duty Cycle	Duty Cycle Offset
Mobile	32%	-9.9 dB
Access Point	60%	-4.4 dB