COMPATIBLE ELECTRONICS

FCC PART 15, SUBPART C
TEST METHOD: ANSI C63.4-1992

for

FUNPAD

Model: FP1-99

Prepared for

ENTERTAINMENT SYSTEMS TECHNOLOGY
17011 BEACH BLVD., SUITE 530
HUNTINGTON BEACH, CALIFORNIA 92647-5989

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DATE: NOVEMBER 1, 1999

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GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form unless done so in full with the written permission of Compatible Electronics.

This report must not be used to claim product endorsement by NVLAP or any other agency of the U.S. Government.

Device Tested:	Funpad Model: FP1-99 S/N: N/A
Modifications:	The EUT was not modified in order to meet the specifications.
Manufacturer:	Entertainment Systems Technology 17011 Beach Blvd., Suite 530 Huntington Beach, California 92647-5989
Test Dates:	October 13 (spurious emissions for the digital circuits and receiver portion) October 26 and 28, 1999
File # For Canada	IC2154-D
Test Specifications:	EMI requirements FCC Title 47, Part 15 Subpart B; and Subpart C, sections 15.205, 15.207, 15.209, and 15.247
Test Procedure:	ANSI C63.4: 1992
Test Deviations:	The test procedure was not deviated from during the testing.

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 450 kHz – 30 MHz	The EUT runs off a 10.8Vdc, 4800 mAh battery only. Thusly, this test was not performed.
2	Spurious Radiated RF Emissions, 10 kHz – 1000 MHz	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart B, section 15.109(b) (**See Note 1 and Note 2**)
3	Fundamental and Emissions produced by the intentional radiator in non-restricted bands, 10 kHz – 25 GHz	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247(c)
4	Emissions produced by the intentional radiator in restricted bands, 10 kHz – 25 GHz	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.205 and 15.209(a)
5	6 dB Bandwidth	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (a)(2)
6	Maximum Peak Output Power	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (b)(1)
7	RF Antenna Conducted	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (c)
8	Peak Power Spectral Density Conducted from the Intentional Radiator to the Antenna	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (d)
9	Processing Gain	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (e)

Note 1: **The digital circuits of the EUT have been tested and verified to comply with FCC Part 15, Subpart B, Verification – Class A Digital Devices. This test report can be provided upon FCC request. This device will be used for commercial and/or business environments only (i.e. restaurants)**

Note 2: The receiver portion is exempt because according to FCC 15.101 (b), “Receivers operating above 960 MHz or below 30 MHz, except for CB receivers, are exempt from complying with the technical provisions of this part but are subject to 15.5”

1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the Funpad Model: FP1-99. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4: 1992. The tests were performed in order to determine whether the electromagnetic emissions from the Funpad, referred to as EUT hereafter, are within the specification limits defined by FCC Title 47, Part 15, Subpart C, sections 15.207, 15.209, and 15.247.

2. ADMINISTRATIVE DATA

2.1 Location of Testing

The EMI tests described herein were performed at the test facility of Compatible Electronics, 114 Olinda Drive, Brea, California 92823.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

Entertainment Systems Technology

Anthony Le	Senior Project Engineer
Tony Wong	Senior Engineer
Tony Lopez	President

Compatible Electronics Inc.

Kyle Fujimoto	Test Engineer
Scott McCutchan	Lab Manager

2.4 Date Test Sample was Received

The test sample was received on October 13, 1999

2.5 Disposition of the Test Sample

The test sample was returned to Entertainment Systems Technology on November 1, 1999.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network

3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

SPEC	TITLE
FCC Title 47, Part 15 Subpart C.	FCC Rules - Radio frequency devices (including digital devices) – Intentional Radiators.
ANSI C63.4 1992	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.
FCC Title 47, Part 15 Subpart B	FCC Rules - Radio frequency devices (including digital devices) – Unintentional Radiators.

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration - EMI

Specifics of the EUT and Peripherals Tested

The Funpad Model: FP1-99 (EUT) was placed on the wooden table and tested in three orthogonal axis. The low (channel 1), medium (channel 6), and high (channel 11) channels were tested. The EUT runs off a 10.8Vdc, 4800 mAh battery only. The EUT was transmitting and receiving on a continuous basis. The radiated data was taken in this mode of operation. All initial investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the photographs in Appendix C.

The axis that produced the highest emissions levels was the X axis.

For the fundamental and harmonics, complete data is given in **Appendix D** of this report. For the spurious emissions, this data can be found in the Subpart B, Verification, Class A Digital Devices test report. This report can be provided upon the request of the FCC.

4.1.1 Cable Construction and Termination

The EUT has no external cables

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
FUNPAD (EUT)	ENTERTAINMENT SYSTEMS TECHNOLOGY	FP1-99	N/A	ORUEST-9-1998
ANTENNA (INTERNAL TO THE EUT)	TOKO	P/N: DAC2450CT1	N/A	N/A
BATTERY (INTERNAL TO THE EUT)	FOXLINK	FT-202S	N/A	N/A

5.2 EMI Test Equipment (For the transmitter radiated emissions)

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Spectrum Analyzer	Hewlett Packard	8566B	3638A08768	Dec. 11, 1998	Dec. 11, 1999
Preamplifier	Com Power	PA-102	1017	Jan. 16, 1999	Jan. 16, 2000
Quasi-Peak Adapter	Hewlett Packard	85650A	2430A00424	July 14, 1999	July 14, 2000
Biconical Antenna	Com Power	AB-100	1548	Oct. 14, 1999	Oct. 14, 2000
Log Periodic Antenna	Com Power	AL-100	16039	Oct. 14, 1999	Oct. 14, 2000
Antenna Mast	Com Power	AM-100	N/A	N/A	N/A
Turntable	Com Power	TT-100	N/A	N/A	N/A
Computer	Hewlett Packard	D5251A 888	US74458128	N/A	N/A
Printer	Hewlett Packard	C5886A	SG7CM1P090	N/A	N/A
Monitor	Hewlett Packard	D5258A	DK74889705	N/A	N/A
Loop Antenna	Com-Power	AL-130	25309	Feb. 5, 1999	Feb. 5, 2000
Horn Antenna	Antenna Research	DRG-118/A	1053	Dec. 8, 1995	N.C.R.
Horn Antenna	Antenna Research	MWH-1826/B	1004	Jan. 21, 1997	N.C.R.
Microwave Preamplifier	Hewlett Packard	8449B	3008A008766	Jan. 30, 1999	Jan. 30, 2000
Amplifier	Hewlett Packard	11975A	2403A00202	Dec. 14, 1998	Dec. 14, 1999
Harmonic Mixer	Hewlett Packard	11970K	3003A05460	Feb. 25, 1999	Feb. 25, 2000
Power Meter	Hewlett Packard	436A	2236A15362	July 15, 1999	July 15, 2000
Power Sensor	Hewlett Packard	8482H	GG00000006	July 15, 1999	July 15, 2000

Note: This is for the transmitter radiated emissions only, tested on October 26 and 28, 1999. The emissions testing for the digital circuits and receiver portion of the EUT were tested on October 13, 1999. The EMI equipment used for that testing is in the Subpart B, Verification, Class A Digital Devices test report.

5.3 Processing Gain Test Equipment

Note: This information is from the OEM WLAN PC Card 13316C, Model No.: GERSHWIN3, FCC-ID: MRF13316C test report. This testing was performed at UltraTech Engineering Labs Inc. 4181 Sladeview Crescent, Unit 33, Mississauga, Ontario, Canada, L5L 5R2. **Entertainment Systems Technology has received permission from the manufacturer of the OEM WLAN PC card, Celestica, Inc., to have this information below included in the test report.**

The same exact design of the OEM WLAN PC is incorporated onto the FP Multimedia PCB of the EUT.

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Spectrum Analyzer	Advantest	R3271	15050203	N/A	N/A
3 dB, 40 dB Attenuators, 50 Ohm IN/OUT	N/A	NA	N/A	N/A	N/A
RF Signal Generator	FLUKE	6061A	N/A	N/A	N/A
RF Peak Power Meter	Hewlett Packard	8900	N/A	N/A	N/A
Communication Analyzer	BERT	Firebird 4000	N/A	N/A	N/A

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 and 8.1.2 of this report for EMI test location.

6.2 EUT Mounting, Bonding and Grounding

The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

The EUT was not grounded.

7. CHARACTERISTICS OF THE TRANSMITTER

7.1 Transmitter Power

Transmit power is herein defined as the power delivered to a 50 Ohm load at the proprietary antenna connector on the RadioWire unit.

Power	Channel Number	Accuracy
10.29 dBm	1	+1/-1 dB
10.28 dBm	6	+1/-1 dB
9.59 dBm	11	+1/-1 dB

7.2 Channel Number and Frequencies

Channel Number	Channel center Frequency (MHz)
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462

7.3 Chipping Rate

11 chips / bits by IEEE 802.11 Standard

7.4 Spreading Gain

The theoretical spreading gain, is 10.4 dB.

7.5 Antenna Gain

0 dBi typical, 2.15 dBi maximum

7.6 Description of Transmitter

This transmitter design consists of Harris Prism Chipset and an AMD Media Access Controller. The modulation scheme is Direct Sequence Spread Spreadtrum (DSSS) conforming to IEEE802.11 standard. The transmitter's frequency range is 2412-2462 MHz with the maximum data rate of 2 Mbps using DQPSK.

7.7 Processing Gain

NOTE: This information is from the OEM WLAN PC Card 13316C, Model No.: GERSHWIN3, FCC-ID: MRF13316C test report. This testing was performed at UltraTech Engineering Labs Inc. 4181 Sladeview Crescent, Unit 33, Mississauga, Ontario, Canada, L5L 5R2. **Entertainment Systems Technology has received permission from the manufacturer of the OEM WLAN PC card, Celestica, Inc., to have this information below included in the test report.**

The same exact design of the OEM WLAN PC is incorporated onto the FP Multimedia PCB of the EUT.

Jamming Margin Method

The processing gain was measured using the CW jamming margin method. The test consists of stepping a signal generator in 50 kHz increments across the passband of the system. At each point, the generator level required to produce the recommended Bit Error Rate (BER) was recorded. This level is the jammer level. The output power of the transmitting unit is measured at the same point. The Jammer to Signal (J/S) ratio is then calculated. The worst 20% of the J/S data points were discarded. The lowest remaining J/S ratio was used to calculating the Process Gain.

Processing Gain (Continued)

NOTE: This information is from the OEM WLAN PC Card 13316C, Model No.: GERSHWIN3, FCC-ID: MRF13316C test report. This testing was performed at UltraTech Engineering Labs Inc. 4181 Sladeview Crescent, Unit 33, Mississauga, Ontario, Canada, L5L 5R2. **Entertainment Systems Technology has received permission from the manufacturer of the OEM WLAN PC card, Celestica, Inc., to have this information below included in the test report.**

The same exact design of the OEM WLAN PC is incorporated onto the FP Multimedia PCB of the EUT.

The signal to noise ratio for an ideal differentially coherent detection of a differentially encoded DPSK receiver can be derived from the Bit error probability (Pb) versus Signal-to-Noise ratio.

For the measurement of the (S/N)o we use the Pb of 1.0 X 10 to the minus 5 minimum

Ref: Viterbi, A.J. Principles of Coherent Communications (New York: McGraw-HILL 1966), Pg. 207

Using equation (1) shown above, calculate the signal to noise ratio required for your chosen BER. This value and the measured J/S ratio are used in the following equation to calculate the Process Gain (Gp) of the system.

Gp = (S/N)o+Mj+Lsys

Where:

(S/N)o: Theoretical signal to noise ratio required to maintain the normal operation just before the BER appears. In real measurements the maximum error of 1.0 X 10 to the minus 5.

Mj: Maximum jammer to Signal Ratio that recorded at the detected BER.

Lsys: System losses such as non-ideal synchronization, tracking circuitry, non-optimal baseband receiver filtering and etc… These losses can be in excess of 2 dB for each transmitter and receiver pair. For the purpose of this processing gain calculation we assume a Lsys at its minimum value of 2 dB.

Ref.: Dixon, R, **Spread Spectrum Systems**. (New York: Wiley, 1984), Chapter 1.

Test Results: Conforms.

Test Personnel: Tri M. Luu, P. Eng.

Date: October 07, 1996

The data sheets, charts, and block diagram are located in **Appendix D** of this test report under "Processing Gain Data Sheets."

8. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

8.1 RF Emissions

8.1.1 Radiated Emissions (Spurious and Harmonics) Test

The spectrum analyzer was used as a measuring meter along with the quasi-peak adapter. Amplifiers were used to increase the sensitivity of the instrument. The Com Power Preamplifier Model: PA-102 was used for frequencies from 30 MHz to 1 GHz, and the Hewlett Packard Microwave Amplifier Model: 8449B was used for frequencies above 1 GHz. The spectrum analyzer was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the spectrum analyzer records the highest measured reading over all the sweeps. The quasi-peak adapter was used only for those readings which are marked accordingly on the data sheets. The frequencies above 1 GHz were averaged manually by narrowing the video filter down to 1 Hz and putting the sweep time on AUTO on the spectrum analyzer to keep the amplitude reading calibrated. The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
10 kHz to 150 kHz	200 Hz	Active Loop Antenna
150 kHz to 30 MHz	9 kHz	Active Loop Antenna
30 MHz to 300 MHz	120 kHz	Biconical Antenna
300 MHz to 1 GHz	120 kHz	Log Periodic Antenna
1 GHz to 25 GHz	1 MHz	Horn Antenna

The open field test site of Compatible Electronics, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.4: 1992. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna in order to ensure accurate results.

Radiated Emissions (Spurious and Harmonics) Test (con't)

The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was tested at a 3 meter test distance to obtain final test data.

For the 22 GHz – 25 GHz span, the Hewlett Packard 11970K Harmonic Mixer and the Hewlett Packard 11975A Amplifier were used to allow the spectrum analyzer to scan up to 25 GHz.

8.2 6 dB Bandwidth for Direct Sequence Systems

The 6 dB Bandwidth was taken using the spectrum analyzer. The bandwidth was measured using a direct connection from the RF out on the RF board. The resolution bandwidth was 100 kHz, and the video bandwidth 300 kHz.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.209 (a)(2). The bandwidth is at least 500 kHz. Please see the data sheets located in Appendix D.

8.3 Peak Output Power

The peak output power was taken using the Hewlett Packard 436A Power Meter and the Hewlett Packard 8482H Power Sensor. The low (channel 1), middle (channel 6), and high (channel 11) were taken.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.209 (b)(1). The maximum peak output power is less than 1 watt.

8.4 Spectral Density Output

The spectral density output was using the spectrum analyzer. The spectral density output power was measured using a direct connection from the RF out on the RF board into the input of the analyzer. The resolution bandwidth was 3 kHz, and the video bandwidth 10 kHz. The highest 4.5 MHz of the signal was used as the frequency span with the sweep rate being 1 second for every 3 kHz of span.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.209 (d). The spectral density output does not exceed 8 dBm in any 3 kHz band.

8.5 RF Antenna Conducted Test

The RF antenna conducted test was taken using the spectrum analyzer. The RF antenna conducted test was measured using a direct connection from the RF out on the RF board into the input of the analyzer. The resolution bandwidth was 100 kHz, and the video bandwidth 300 kHz. The spans were wide enough to include all the harmonics and emissions that were produced by the intentional radiator.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.209 (c). The RF power that is produced by the intentional radiator is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power.

8.6 RF Band Edges

The RF band edges were taken at the edges of the ISM spectrum (2390 MHz when the EUT was on channel 1 and 2483.5 MHz when the EUT was on channel 11) using the spectrum analyzer. It was also verified that the transmitted signals did not appear in the restricted bands below 2390 MHz and above 2843.5 MHz. A spectral plot of the band edges are included to prove no emissions were found at these frequencies.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (c). The RF power at the band edges at 2390 MHz and 2483.5 MHz meet the limits of section 15.209.

8.7 Processing Gain

Please see section 7.7 of this test report.

9. CONCLUSIONS

The Funpad Model: FP1-99 meets all of the specification limits defined in FCC Title 47, Part 15, Subpart C, sections 15.205, 15.207, 15.209, and 15.247.

APPENDIX A

MODIFICATIONS TO THE EUT

MODIFICATIONS TO THE EUT

The modifications listed below were made to the EUT to pass FCC Subpart B specifications.

All the rework described below was implemented during the test in a method that could be reproduced in all the units by the manufacturer.

Modifications:

No Modifications were made to the EUT during the testing.

APPENDIX B

ADDITIONAL MODELS COVERED UNDER THIS REPORT

ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST	Funpad Model: FP1-99 S/N: N/A

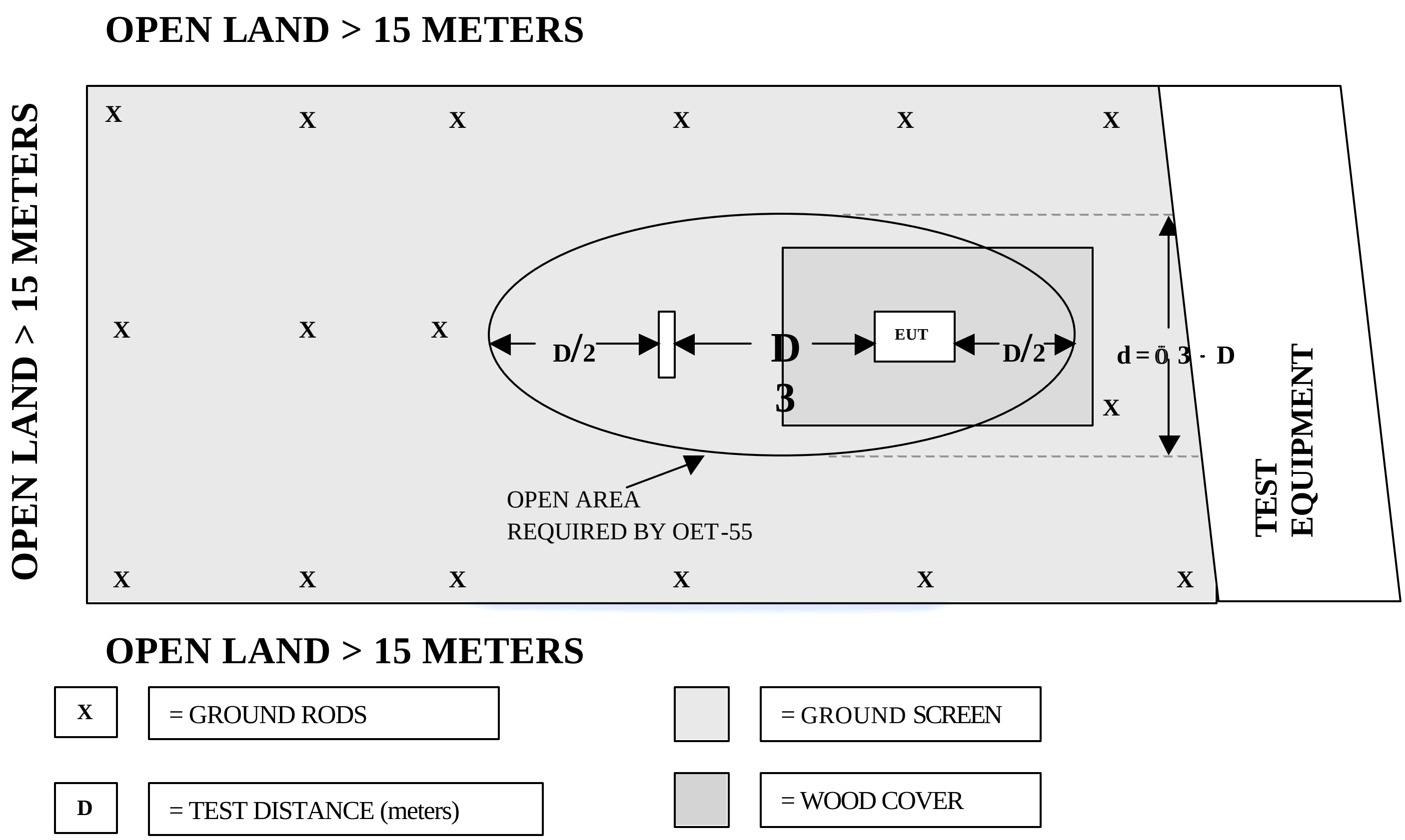
There were no additional models covered under this report.

114 OLINDA DRIVE, BREA, CALIFORNIA 92823 PHONE: (714) 579-0500 FAX: (714) 579-1850

APPENDIX C

DIAGRAMS, CHARTS AND PHOTOS

FIGURE 1: PLOT MAP AND LAYOUT OF RADIATED SITE



FRONT VIEW

ENTERTAINMENT SYSTEMS TECHNOLOGY
FUNPAD
Model: FP1-99
FCC SUBPART C - RADIATED EMISSIONS – 10-28-99

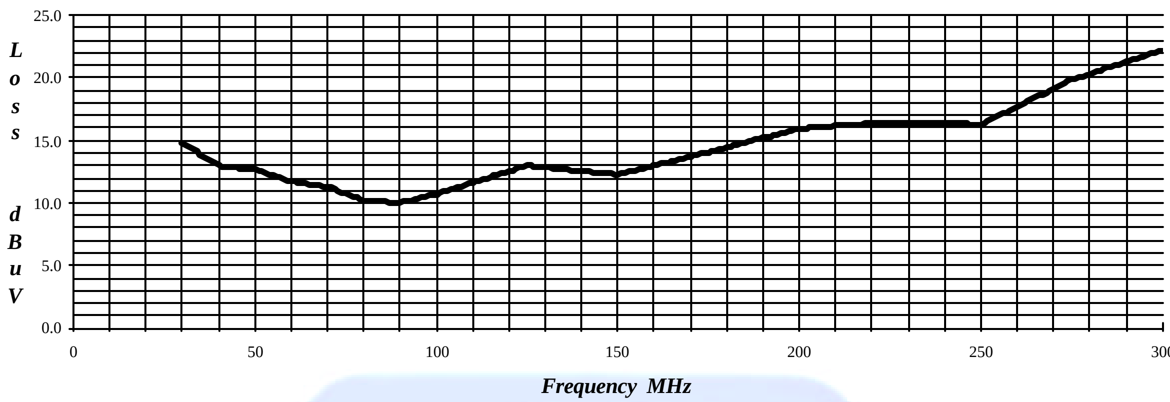
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

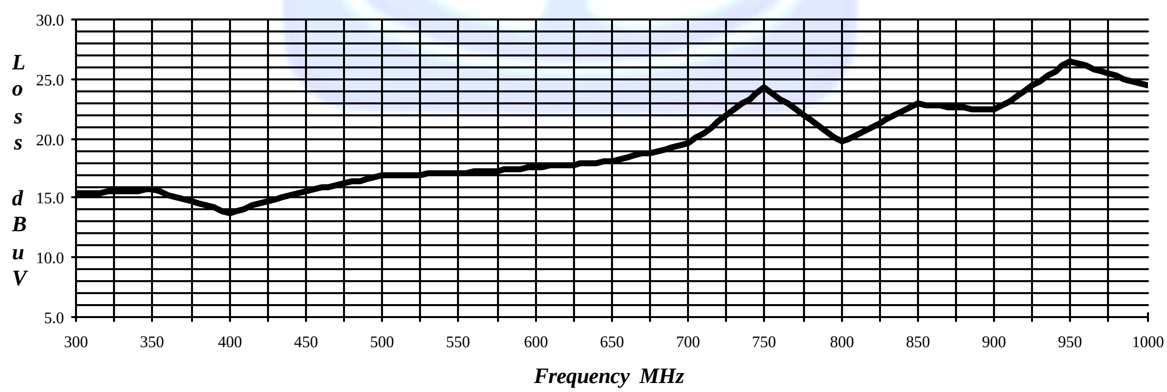
ENTERTAINMENT SYSTEMS TECHNOLOGY
FUNPAD
Model: FP1-99
FCC SUBPART C - RADIATED EMISSIONS – 10-28-99

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

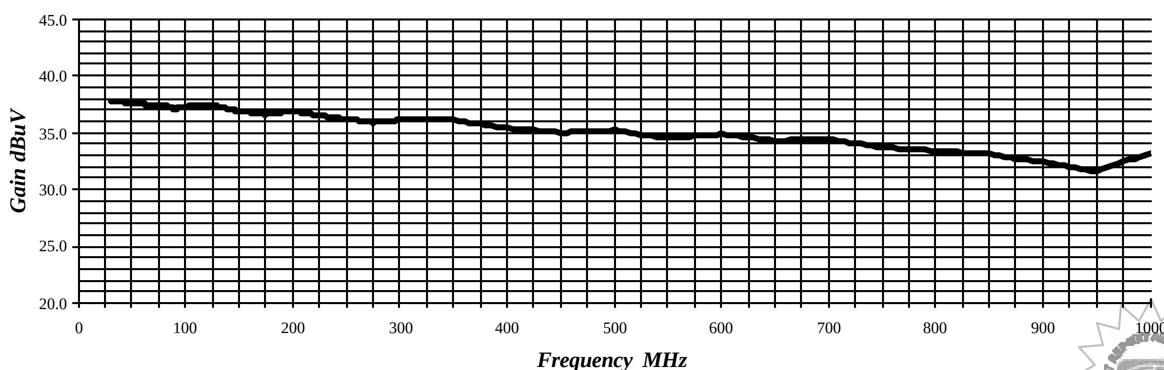
LAB "D" BICONICAL ANTENNA AB-100 S/N 01548 Cal: 10-14-99



LAB "D" LOG PERIODIC ANTENNA AL-100 S/N 16039 Cal: 10-14-99



PREAMPLIFIER EFFECTIVE GAIN AT 3 METERS PA-102 S/N: 1017 Lab "D"
Effective 1-16-99



HEWLETT PACKARD 8449B

MICROWAVE PREAMPLIFIER

S/N: 3008A008766

CALIBRATION DATE: JANUARY 30, 1999

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	36.9	10.5	34.1
1.1	36.3	11.0	33.7
1.2	36.4	11.5	34.0
1.3	36.2	12.0	33.9
1.4	36.3	12.5	34.4
1.5	35.7	13.0	32.9
1.6	35.9	13.5	31.6
1.7	35.7	14.0	31.8
1.8	35.6	14.5	31.9
1.9	35.5	15.0	32.2
2.0	35.4	15.5	32.8
2.5	35.6	16.0	32.4
3.0	35.2	16.5	32.1
3.5	35.2	17.0	32.3
4.0	34.3	17.5	30.3
4.5	34.1	18.0	31.5
5.0	34.3	18.5	31.2
5.5	33.0	19.0	32.2
6.0	34.1	19.5	32.0
6.5	34.5	20.0	32.0
7.0	34.3	20.5	33.2
7.5	33.9	21.0	30.9
8.0	34.5	22.0	32.1
8.5	34.5	23.0	32.8
9.0	34.4	24.0	32.9
9.5	34.3	25.0	32.3
10.0	33.7	26.0	32.6

ANTENNA RESEARCH ASSOCIATES, INC.
11317 Frederick Avenue, Beltsville, MD 20705

E-FIELD ANTENNA FACTOR CALIBRATION

E(dB V/m) = Vo(dB V) + AFE(dB/m)

Model number : DRG-118/A

Frequency GHz	AFE dB/m	Gain dBi
1	22.3	8.0
2	26.7	9.5
3	29.7	10.1
4	29.5	12.8
5	32.3	12.0
6	32.4	13.4
7	36.1	11.0
8	37.4	10.9
9	36.8	12.5
10	39.5	10.7
11	39.6	11.5
12	39.8	12.0
13	39.7	12.8
14	41.8	11.3
15	41.9	11.9
16	38.1	16.3
17	41.0	13.9
18	46.5	8.9

Serial number : 1053
Job number : 96-092
Remarks : 3 meter calibration
Standards : LPD-118/A, TE-1000

Temperature : 72° F
Humidity : 56 %
Traceability : A01887
Date : December 08, 1995

Calibrated By

ANTENNA RESEARCH
11317 Frederick Avenue, Beltsville, MD 20705, USA
TEL: (301)937-8888 FAX: (301)937-2796

E-FIELD ANTENNA FACTOR CALIBRATION

E (dB V/m) = V_O (dB V) + AFE (dB 1/m)

Model Number : MWH-1826/B

Frequency (GHz)	AFE (dB 1/m)	Gain (dBi)
18.000	23.1	32.2
18.850	23.2	32.5
19.700	23.6	32.5
20.550	23.5	33.0
21.400	23.7	33.1
22.250	24.0	33.2
23.100	24.0	33.5
23.950	24.1	33.7
24.800	24.1	34.0
25.650	24.3	34.1
26.500	24.4	34.3

Serial Number : 1004

Com-Power Corporation

(949) 587-9800

Antenna Calibration

Antenna Type:	Loop Antenna
Model:	AL-130
Serial Number:	25309
Calibration Date:	4/13/99

Frequency MHz	Magnetic (dB/m)	Electric dB/m
0.01	-40.6	10.9
0.02	-41.5	10.0
0.03	-39.9	11.6
0.04	-40.2	11.3
0.05	-41.5	10.0
0.06	-41.1	10.4
0.07	-41.3	10.2
0.08	-41.6	9.9
0.09	-41.7	9.8
0.1	-41.7	9.8
0.2	-44.0	7.5
0.3	-41.6	9.9
0.4	-41.6	9.9
0.5	-41.7	9.8
0.6	-41.5	10.0
0.7	-41.4	10.1
0.8	-41.5	10.0
0.9	-41.6	9.9
1	-41.2	10.3
2	-40.5	11.0
3	-40.8	10.7
4	-41.0	10.5
5	-40.5	11.0
6	-40.5	11.0
7	-40.7	10.8
8	-40.8	10.7
9	-40.1	11.4
10	-40.4	11.1
12	-41.0	10.5
14	-42.1	9.4
15	-42.3	9.2
16	-42.7	8.8
18	-41.0	10.5
20	-41.1	10.4
25	-43.4	8.1
30	-45.3	6.2

Trans. Antenna Height	2 meter
Receiving Antenna Height	2 meter

APPENDIX D

DATA SHEETS

114 OLINDA DRIVE, BREA, CALIFORNIA 92823 PHONE: (714) 579-0500 FAX: (714) 579-1850

RADIATED EMISSIONS FOR THE TRANSMITTER DATA SHEETS

COMPATIBLE ELECTRONICS

Test location: Compatible Electronics
Customer : ENTERTAINMENT SYSTEMS Date : 10/28/1999
Manufacturer : ENTERTAINMENT SYSTEMS Time : 17.46
EUT name : FUNPAD Model: FP1-99
Specification: Fcc_B Test distance: 3.0 mtrs Lab: D
Distance correction factor(20*log(test/spec)) : 0.00
Test Mode : SPURIOUS EMISSIONS FROM THE TRANSMITTER
10 kHz to 25 GHz
TEMPERATURE 61 DEGREES F., RELATIVE HUMIDITY 75%
TESTED BY: Kyle Fujimoto
KYLE FUJIMOTO

NO OTHER SIGNIFICANT EMISSIONS WERE FOUND IN THE FREQUENCY RANGE FROM 10 MHz TO 25 GHz FOR THE TRANSMITTER

RP-1

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.247)

COMPATIBLE ELECTRONICS

COMPANY	ENTERTAINMENT SYSTEMS TECHNOLOGY	DATE	10/28/99
EUT	FUNPAD	DUTY CYCLE	N/A
MODEL	FP1-99	PEAK TO AVG	N/A
S/N	N/A	TEST DIST.	3 METERS
TEST ENGINEER	KYLE FUJIMOTO	LAB	D

Frequency MHz	Peak Reading (dBuV)	Average (A) or Quasi-Peak (QP)		Antenna Polar. (V or H)	Antenna Height (meters)	EUT Azimuth (degrees)	EUT Axis (X,Y,Z)	EUT Tx Channel	Antenna Factor (dB)	Cable Loss (dB)	Amplifier Gain (dB)	*Corrected Reading (dBuV/m)	Delta ** (dB)	Spec Limit (dBuV/m)	Comments
2412.0000	71.3	68.4	A	H	1.0	180	X	LOW	28.2	4.5	0.0	**101.1**			
2412.0000	71.6	68.7	A	V	1.0	90	X	LOW	28.2	4.5	0.0	**101.4**			
2437.0000	73.1	70.0	A	H	1.5	180	X	MID	28.2	4.5	0.0	**102.7**			
2437.0000	71.9	68.6	A	V	1.0	90	X	MID	28.2	4.5	0.0	**101.3**			
2462.0000	68.4	65.3	A	H	1.5	180	X	HIGH	28.2	4.5	0.0	**98.0**			
2462.0000	68.0	64.6	A	V	1.0	90	X	HIGH	28.2	4.5	0.0	**97.3**			

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN

** DELTA = SPEC LIMIT - CORRECTED READING

RP-1

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.247)

COMPATIBLE ELECTRONICS

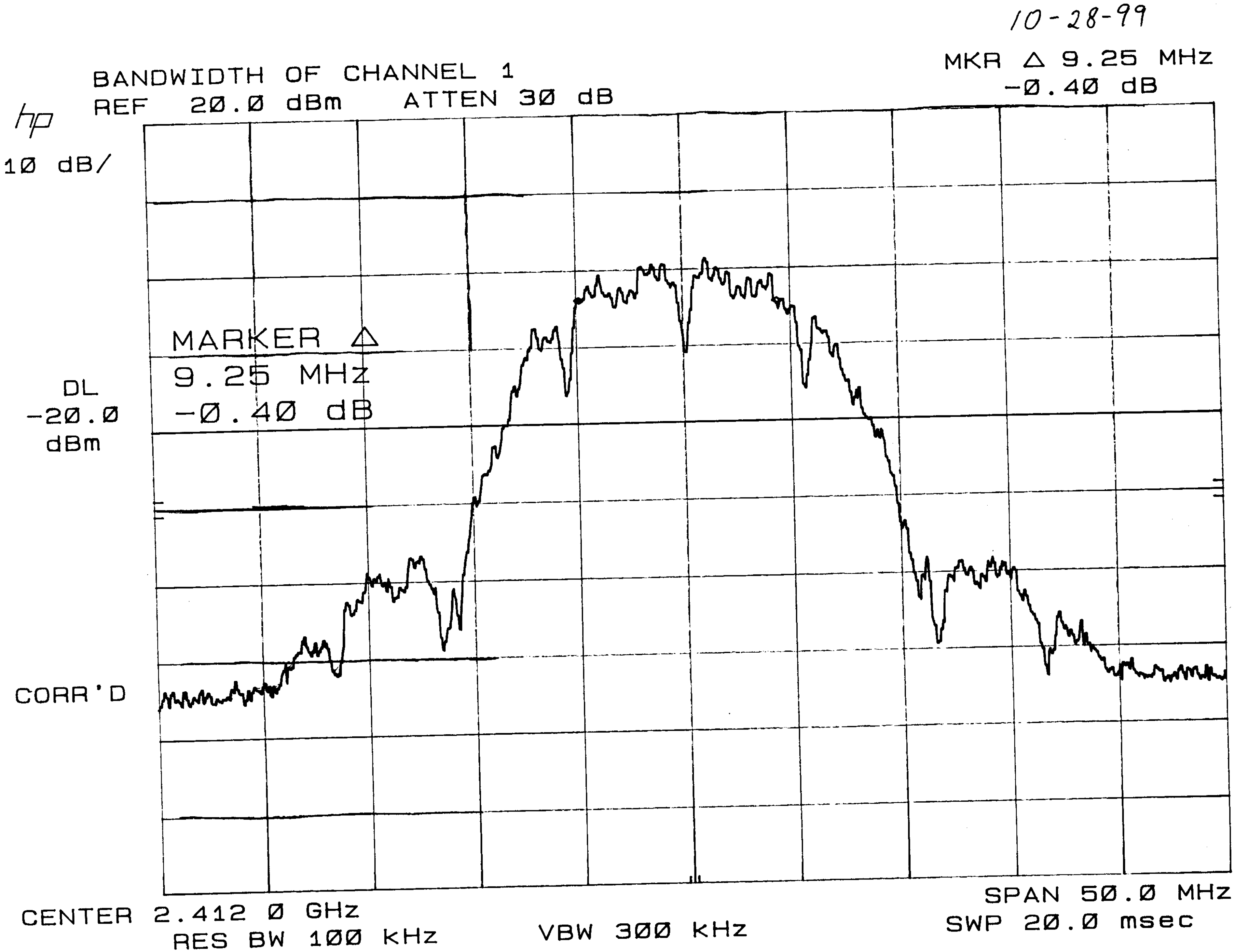
COMPANY	ENTERTAINMENT SYSTEMS TECHNOLOGY	DATE	10/28/99
EUT	FUNPAD	DUTY CYCLE	N/A
MODEL	FP1-99	PEAK TO AVG	N/A
S/N	N/A	TEST DIST.	3 METERS
TEST ENGINEER	KYLE FUJIMOTO	LAB	D

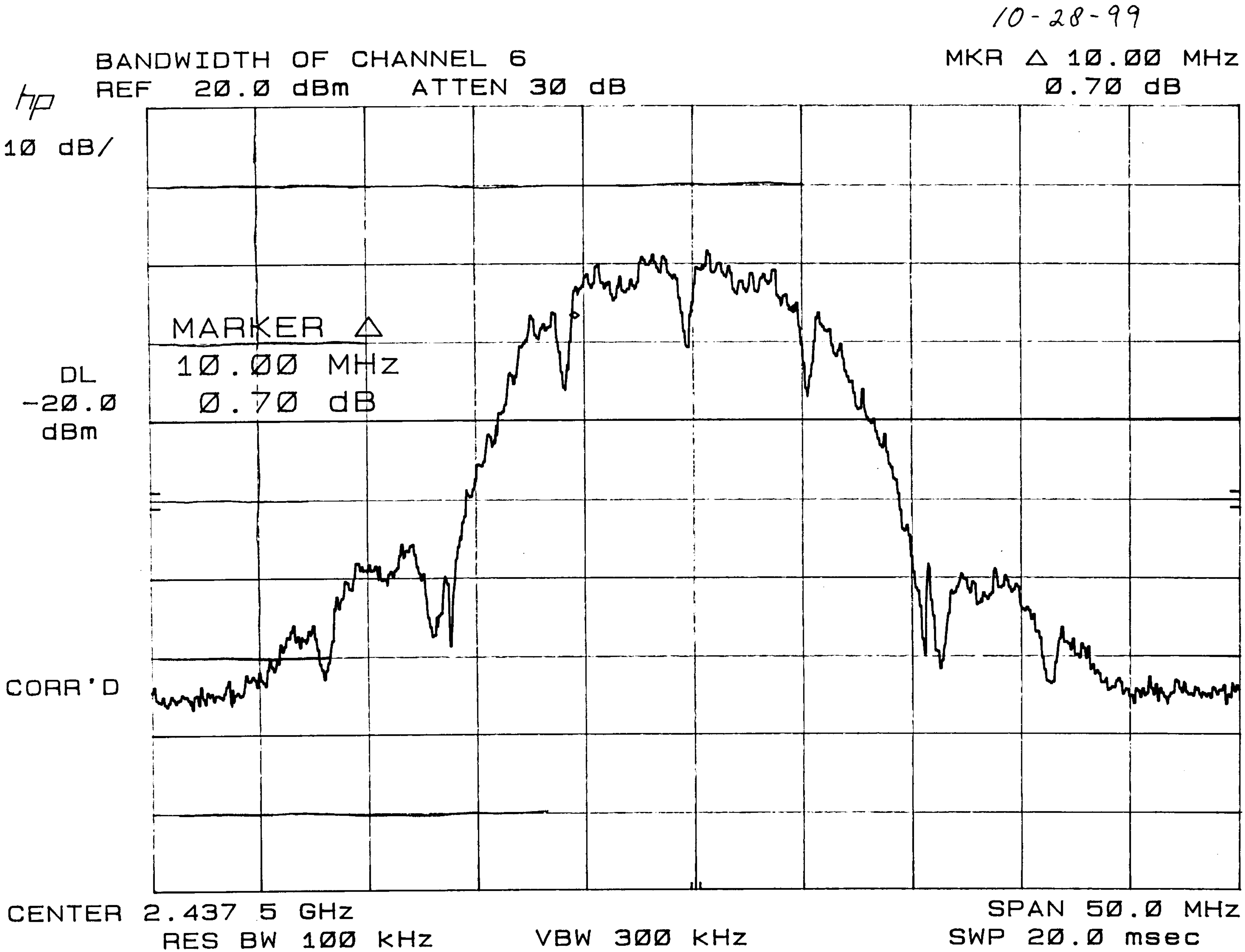
Frequency MHz	Peak Reading (dBuV)	Average (A) or Quasi-Peak (QP)		Antenna Polar. (V or H)	Antenna Height (meters)	EUT Azimuth (degrees)	EUT Axis (X,Y,Z)	EUT Tx Channel	Antenna Factor (dB)	Cable Loss (dB)	Amplifier Gain (dB)	*Corrected Reading (dBuV/m)	Delta ** (dB)	Spec Limit (dBuV/m)	Comments
4824.0000	48.4	45.5	A	H	1.0	90	X	LOW	32.3	5.7	34.3	**49.2**	**-4.8**	**54.0**	
4824.0000	50.9	48.6	A	V	2.0	90	X	LOW	32.3	5.7	34.3	**52.3**	**-1.7**	**54.0**	
4874.0000	47.8	44.7	A	H	1.5	90	X	MID	32.3	5.7	34.3	**48.4**	**-5.6**	**54.0**	
4874.0000	48.5	45.4	A	V	1.0	180	X	MID	32.3	5.7	34.3	**49.1**	**-4.9**	**54.0**	
4924.0000	48.6	45.6	A	H	1.0	90	X	HIGH	32.3	5.7	34.3	**49.3**	**-4.7**	**54.0**	
4924.0000	51.3	48.6	A	V	1.0	90	X	HIGH	32.3	5.7	34.3	**52.3**	**-1.7**	**54.0**	

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN
** DELTA = SPEC LIMIT - CORRECTED READING

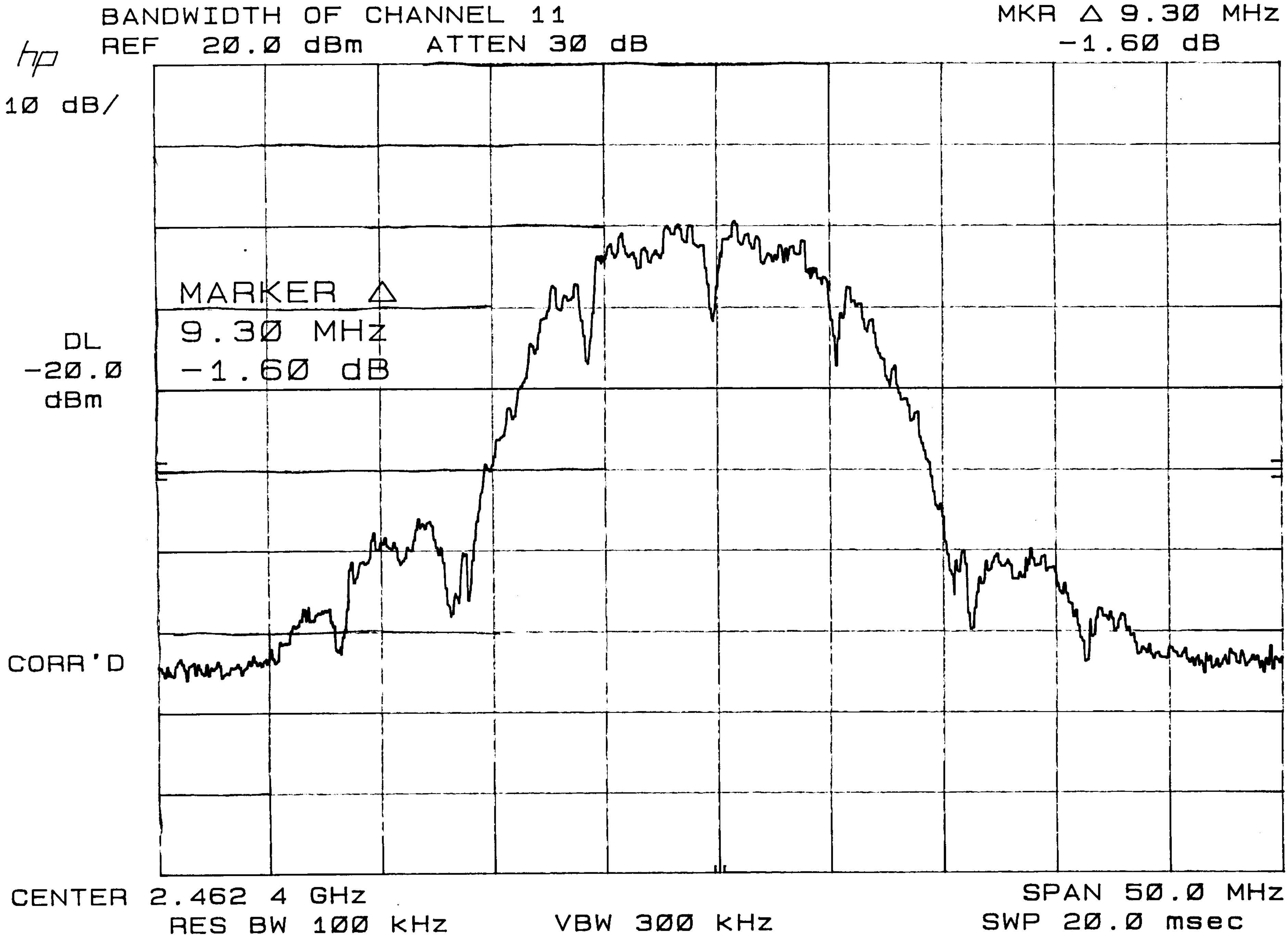
NOTE: NO EMISSIONS FOUND AFTER THE 2ND HARMONIC

6 dB BANDWIDTH DATA SHEETS


10-28-99
BANDWIDTH OF CHANNEL 1
REF 20.0 dBm ATTEN 30 dB
MKR △ 9.25 MHz
-0.40 dB
hp
10 dB/
MARKER △
9.25 MHz
-0.40 dB
DL
-20.0
dBm
CORR'D
CENTER 2.412 0 GHz
RES BW 100 kHz
VBW 300 kHz
SPAN 50.0 MHz
SWP 20.0 msec


10-28-99
BANDWIDTH OF CHANNEL 6
REF 20.0 dBm ATTEN 30 dB
MKR △ 10.00 MHz
0.70 dB
hp
10 dB/
MARKER △
10.00 MHz
0.70 dB
DL
-20.0
dBm
CORR'D
CENTER 2.437 5 GHz
RES BW 100 kHz
VBW 300 kHz
SPAN 50.0 MHz
SWP 20.0 msec

10-28-99



BANDWIDTH OF CHANNEL 11
REF 20.0 dBm ATTEN 30 dB
MKR △ 9.30 MHz
-1.60 dB
hp
10 dB/
MARKER △
9.30 MHz
-1.60 dB
DL
-20.0
dBm
CORR'D
CENTER 2.462 4 GHz
RES BW 100 kHz
VBW 300 kHz
SPAN 50.0 MHz
SWP 20.0 msec

PEAK OUTPUT POWER DATA SHEETS

ENTERTAINMENT SYSTEMS TECHNOLOGY

FUNPAD

MODEL: FP1-99

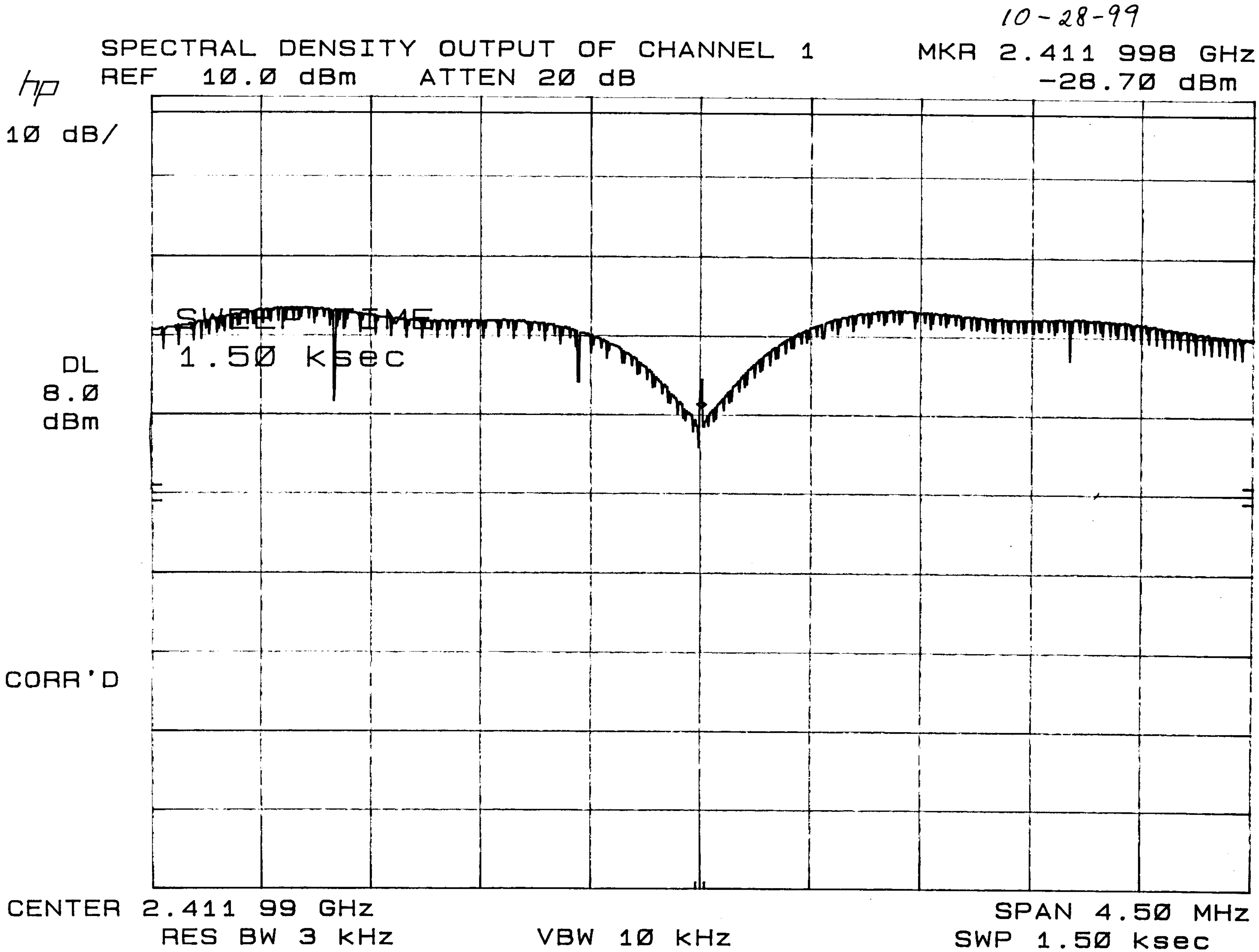
FCC ID: ORUEST-9-1998

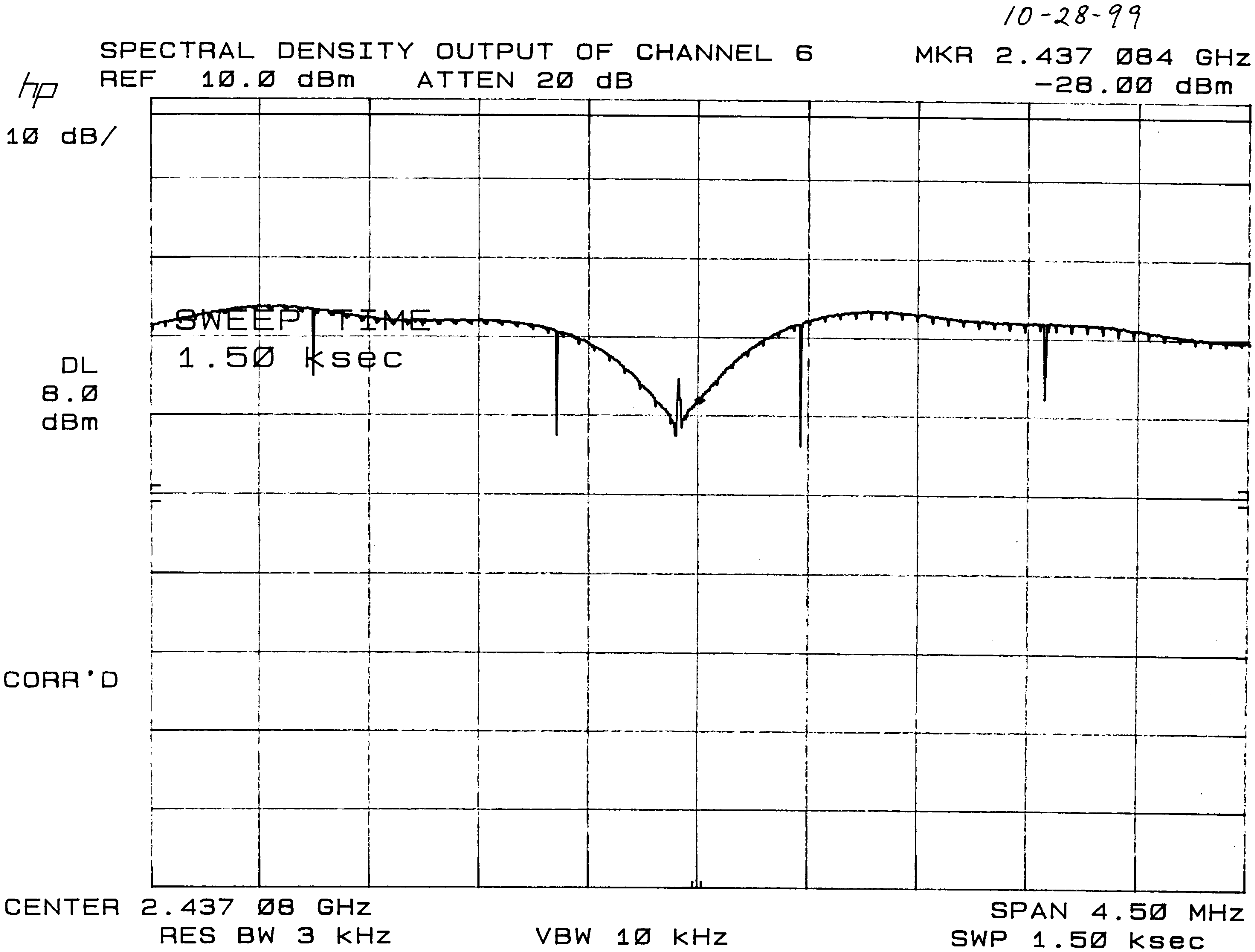
PEAK POWER OUTPUT READINGS

TEST DATE: OCTOBER 26, 1999

FREQUENCY (MHz)	**CHANNEL**	**POWER OUT (dBm)**	**POWER OUT (mW)**
2412	1	10.29	10.72
2437	6	10.28	10.71
2462	11	9.59	9.12

SPECTRAL DENSITY OUTPUT DATA SHEETS


10-28-99
SPECTRAL DENSITY OUTPUT OF CHANNEL 1
MKR 2.411 998 GHz
REF 10.0 dBm ATTEN 20 dB
-28.70 dBm
hp
10 dB/
SWEEP TIME
1.50 ksec
DL
8.0
dBm
CORR'D
CENTER 2.411 99 GHz
RES BW 3 kHz
VBW 10 kHz
SPAN 4.50 MHz
SWP 1.50 ksec


10-28-99
SPECTRAL DENSITY OUTPUT OF CHANNEL 6
REF 10.0 dBm ATTEN 20 dB
MKR 2.437 084 GHz
-28.00 dBm
hp
10 dB/
SWEEP TIME
1.50 ksec
DL
8.0
dBm
CORR'D
CENTER 2.437 08 GHz
RES BW 3 kHz
VBW 10 kHz
SPAN 4.50 MHz
SWP 1.50 ksec

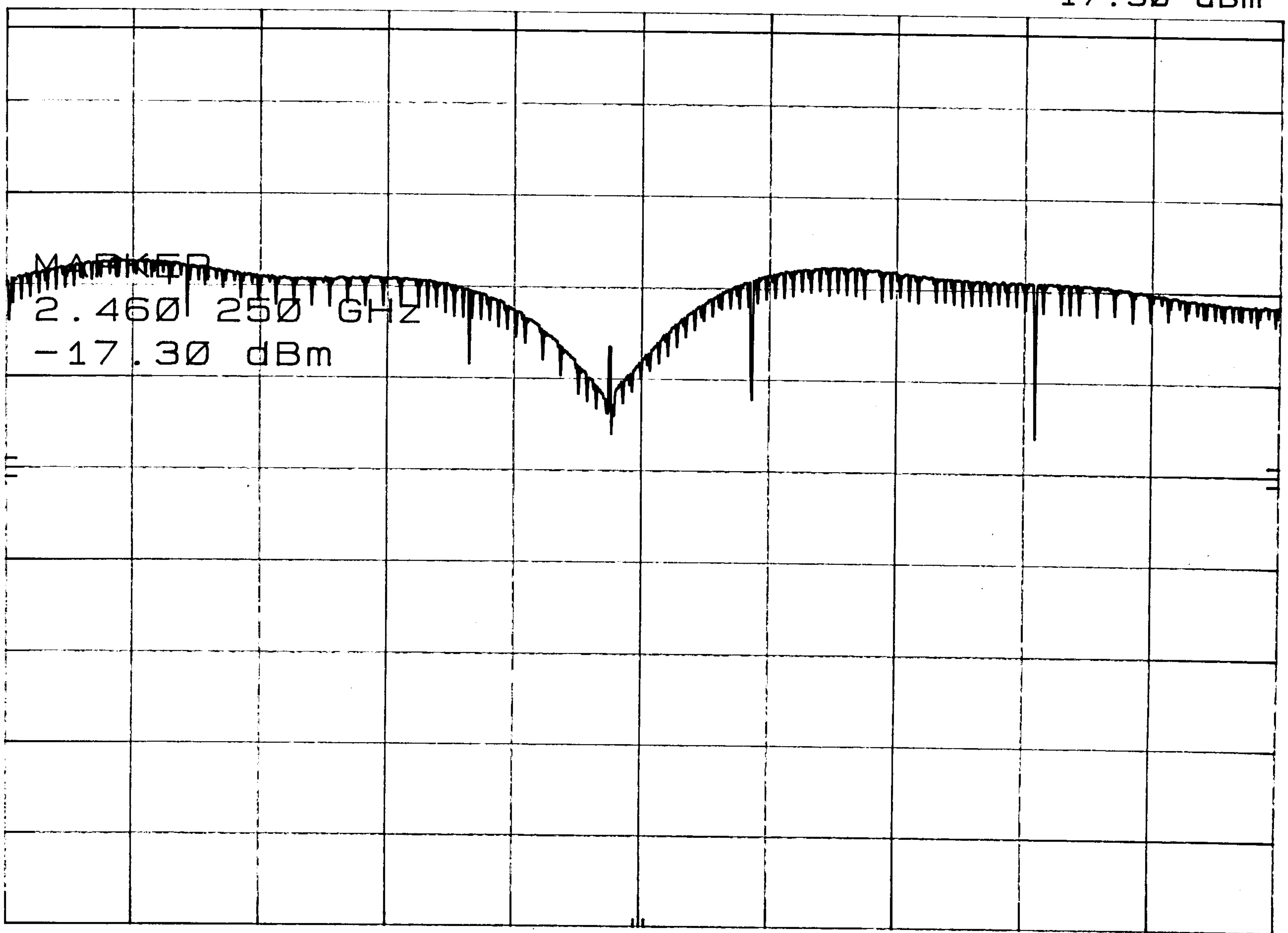
10-28-99

SPECTRAL DENSITY OUTPUT OF CHANNEL 11 MKR 2.460 250 GHz
REF 10.0 dBm ATTEN 20 dB -17.30 dBm

10 dB/

DL
8.0
dBm

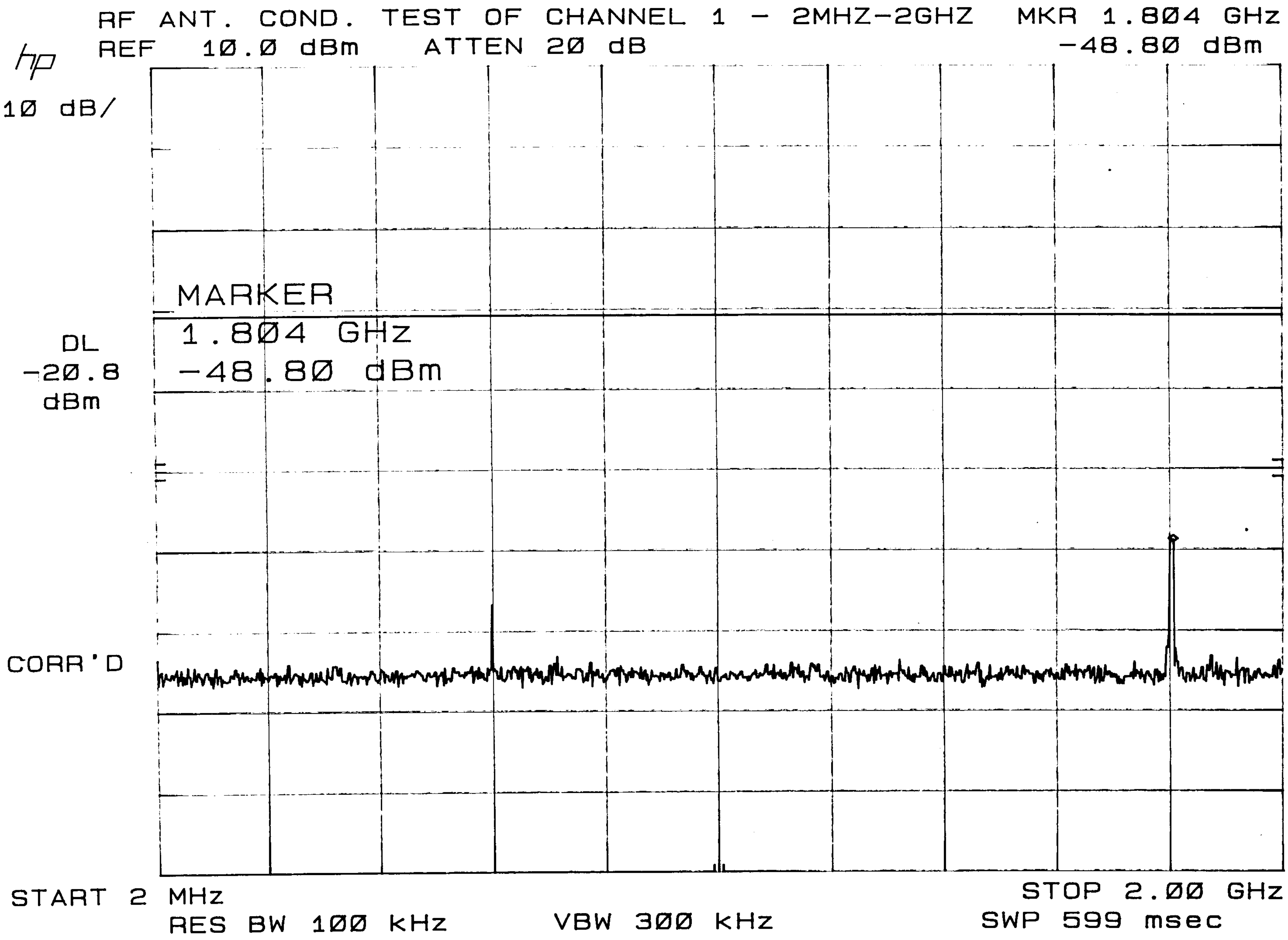
CORR'D



CENTER 2.462 11 GHz SPAN 4.50 MHz
RES BW 3 kHz VBW 10 kHz SWP 1.50 ksec

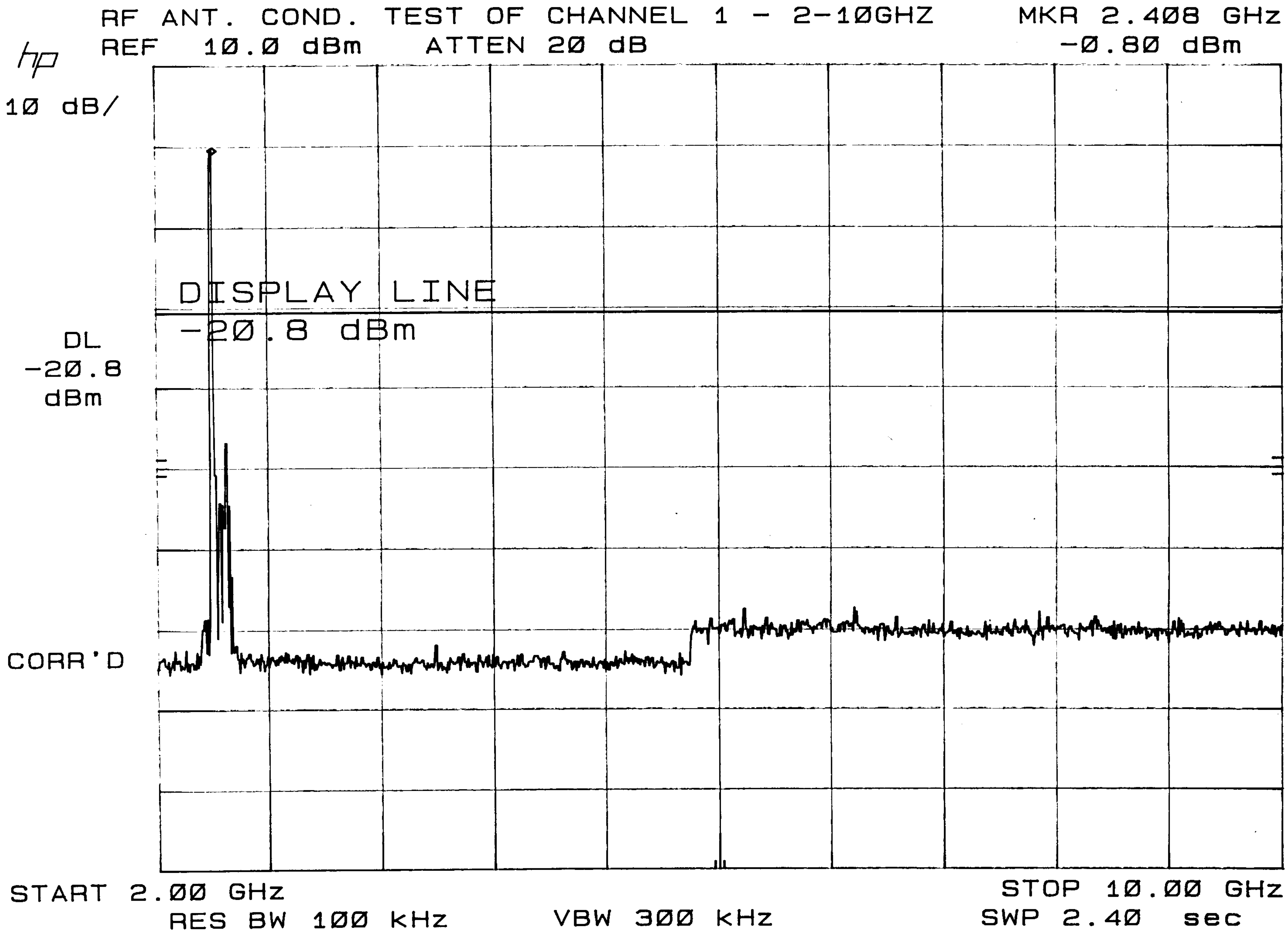
RF ANTENNA CONDUCTED DATA SHEETS

10-28-99



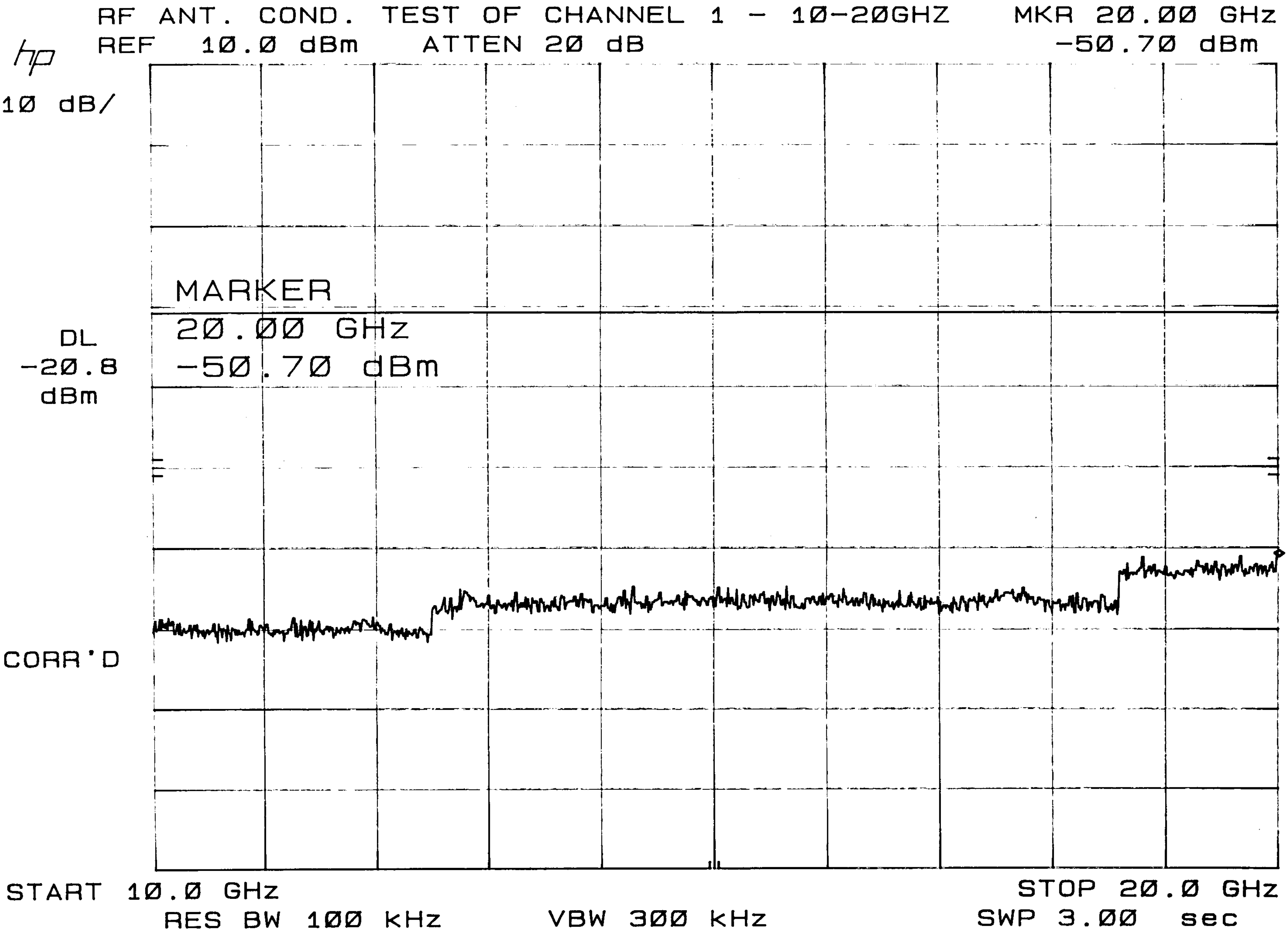
hp
RF ANT. COND. TEST OF CHANNEL 1 - 2MHZ-2GHZ
MKR 1.804 GHz
-48.80 dBm
REF 10.0 dBm ATTEN 20 dB
10 dB/
MARKER
1.804 GHz
-48.80 dBm
DL
-20.8
dBm
CORR'D
START 2 MHz
STOP 2.00 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 599 msec

10-28-99

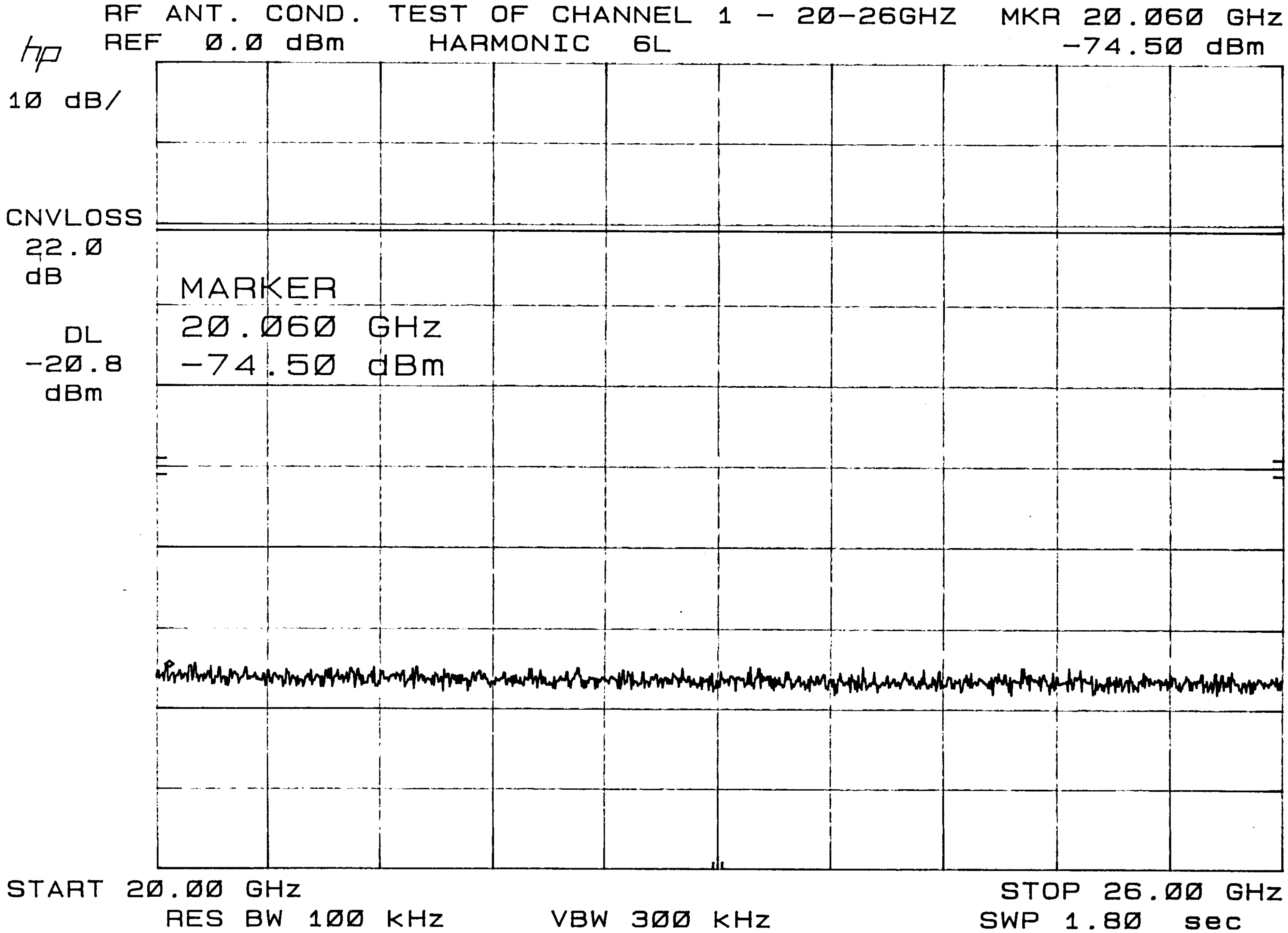


hp
RF ANT. COND. TEST OF CHANNEL 1 - 2-10GHZ
MKR 2.408 GHz
REF 10.0 dBm ATTEN 20 dB
-0.80 dBm
10 dB/
DISPLAY LINE
-20.8 dBm
DL
-20.8
dBm
CORR'D
START 2.00 GHz
STOP 10.00 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 2.40 sec

10-28-99


RF ANT. COND. TEST OF CHANNEL 1 - 10-20GHZ
MKR 20.00 GHz
REF 10.0 dBm ATTEN 20 dB
-50.70 dBm
hp
10 dB/
MARKER
20.00 GHz
-50.70 dBm
DL
-20.8
dBm
CORR'D
START 10.0 GHz
STOP 20.0 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 3.00 sec

10-28-99


RF ANT. COND. TEST OF CHANNEL 1 - 20-26GHZ
MKR 20.060 GHz
-74.50 dBm
REF 0.0 dBm
HARMONIC 6L
hp
10 dB/
CNVLOSS
22.0
dB
DL
-20.8
dBm
MARKER
20.060 GHz
-74.50 dBm
START 20.00 GHz
STOP 26.00 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 1.80 sec

10-28-99

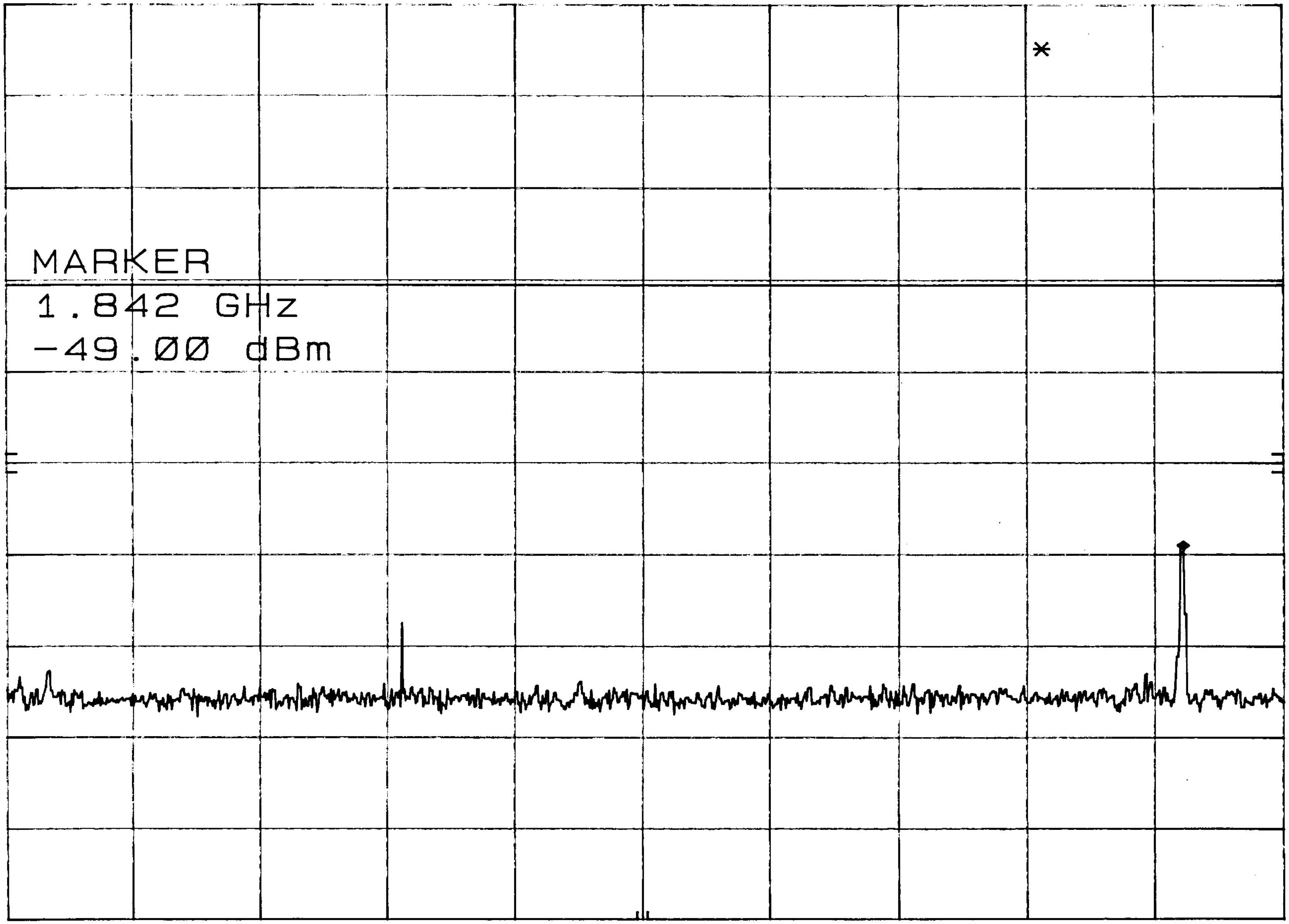
RF ANT. COND. TEST OF CHANNEL 6 - 2MHZ-2GHZ MKR 1.842 GHz
REF 10.0 dBm ATTEN 20 dB -49.00 dBm

hp

10 dB/

DL
-20.5
dBm

CORR'D



START 2 MHz STOP 2.00 GHz
RES BW 100 kHz VBW 300 kHz SWP 599 msec

10-28-99

RF ANT. COND. TEST OF CHANNEL 6 - 2-10GHZ
REF 10.0 dBm ATTEN 20 dB

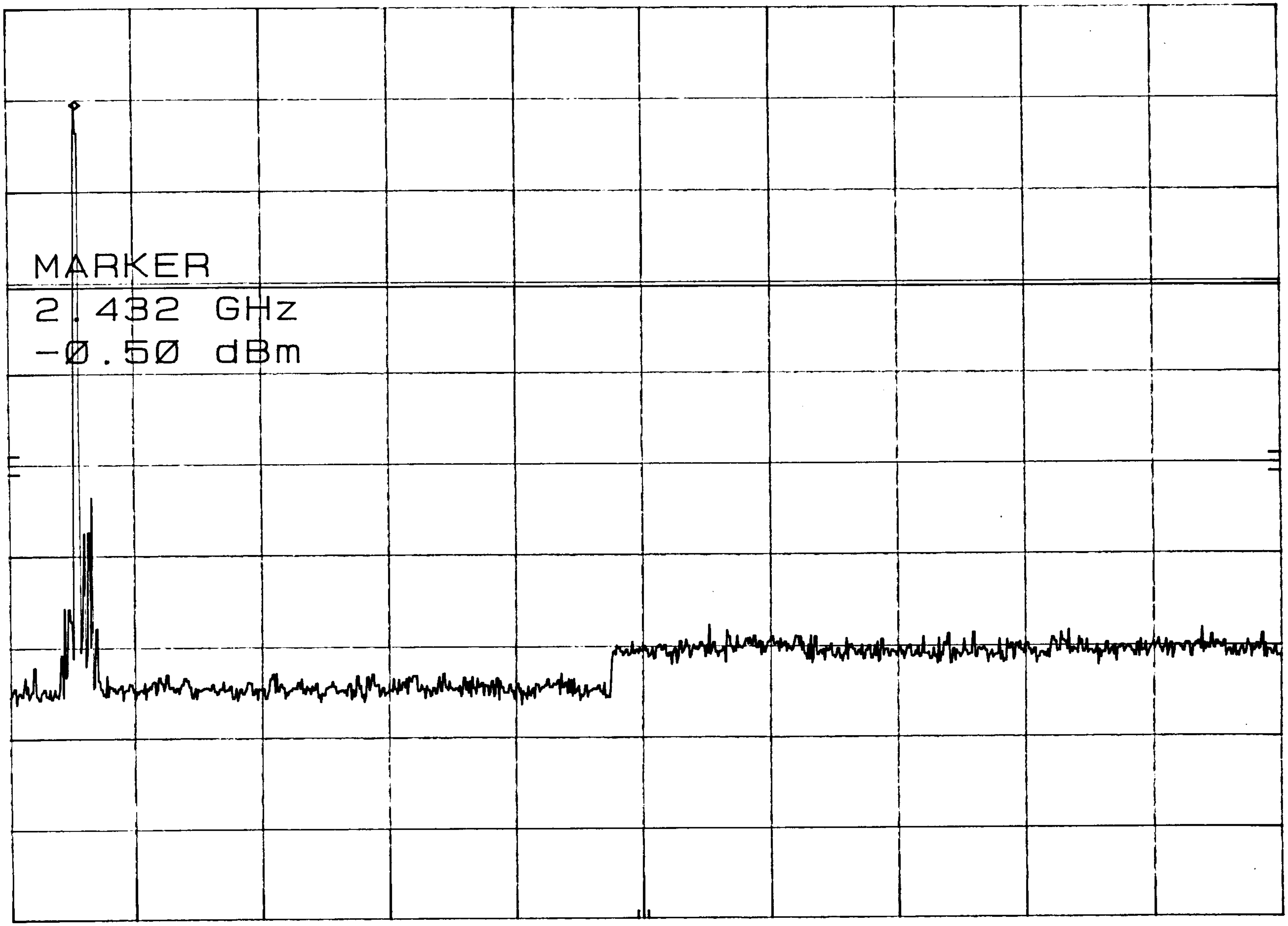
MKR 2.432 GHz
-0.50 dBm

hp

10 dB/

DL
-20.5
dBm

CORR'D



START 2.00 GHz
RES BW 100 kHz
VBW 300 kHz
STOP 10.00 GHz
SWP 2.40 sec

10-28-99

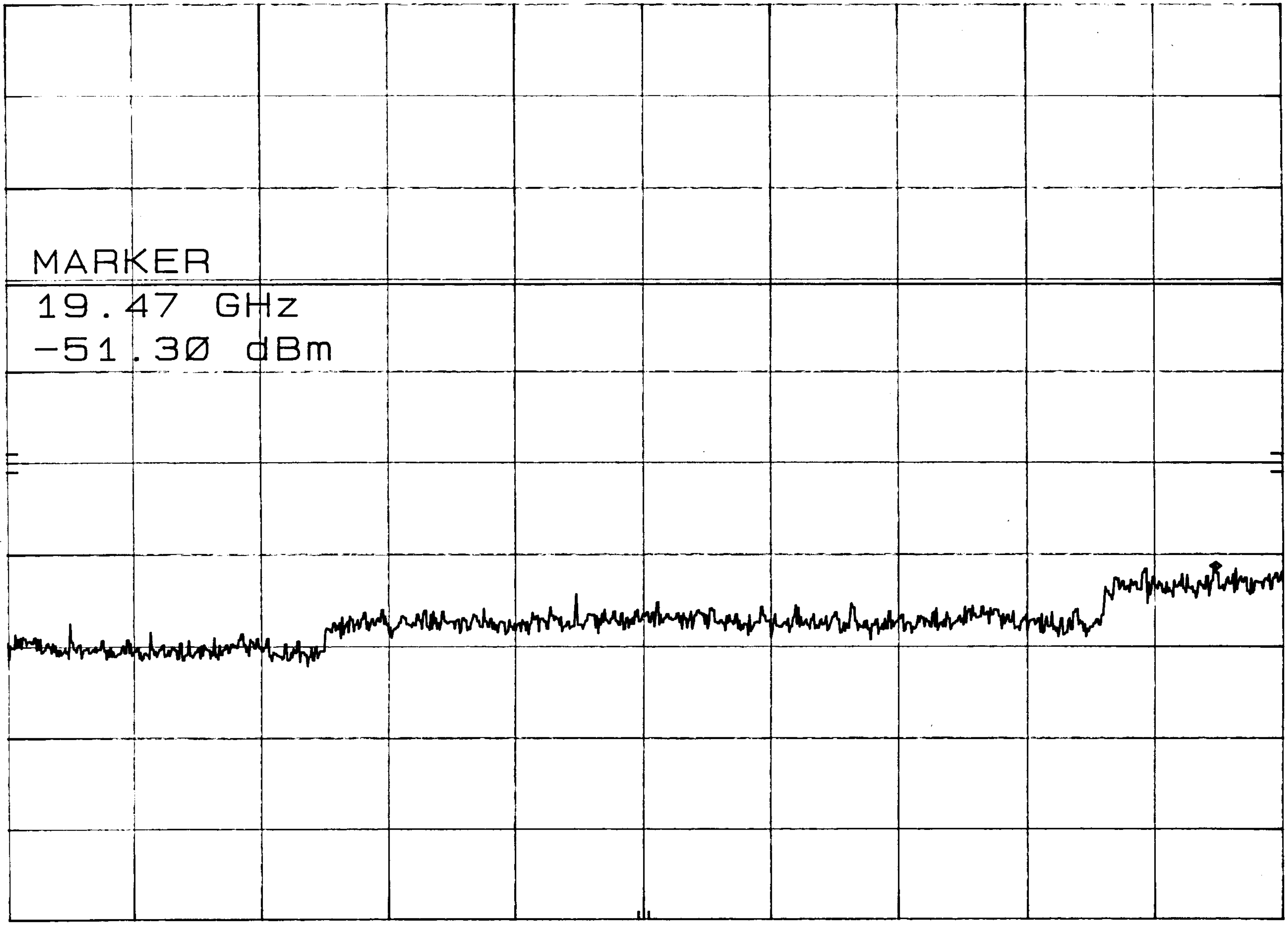
RF ANT. COND. TEST OF CHANNEL 6 - 10GHZ-20GHZ MKR 19.47 GHz
REF 10.0 dBm ATTEN 20 dB -51.30 dBm

hp

10 dB/

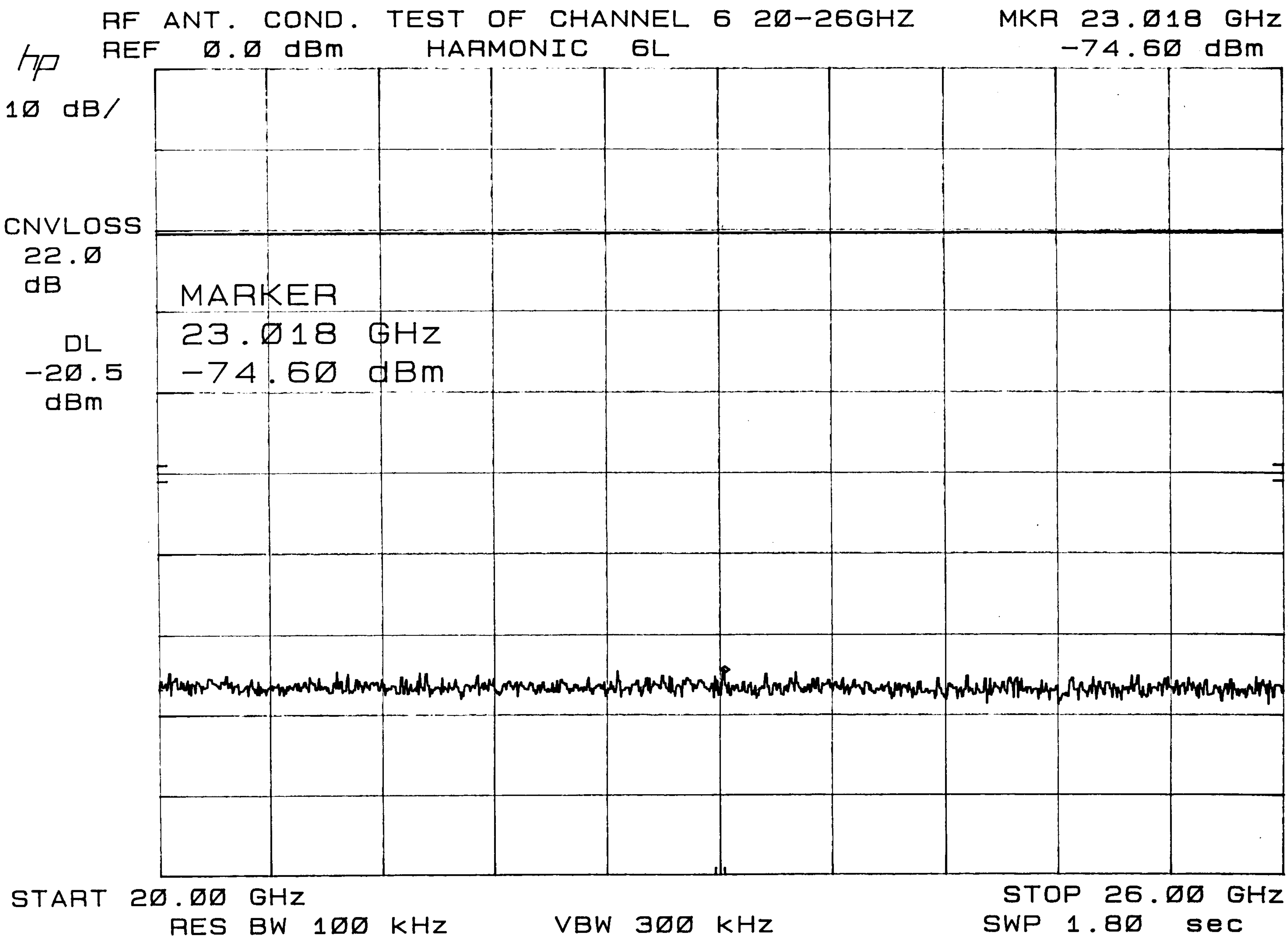
DL
-20.5
dBm

CORR'D



START 10.0 GHz STOP 20.0 GHz
RES BW 100 kHz VBW 300 kHz SWP 3.00 sec

10-28-99


RF ANT. COND. TEST OF CHANNEL 6 20-26GHZ
REF 0.0 dBm
HARMONIC 6L
MKR 23.018 GHz
-74.60 dBm
hp
10 dB/
CNVLOSS
22.0
dB
DL
-20.5
dBm
MARKER
23.018 GHz
-74.60 dBm
START 20.00 GHz
STOP 26.00 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 1.80 sec

10-28-99

RF ANT. COND. TEST OF CHANNEL 11 2MHZ-2GHZ
REF 20.0 dBm ATTEN 30 dB

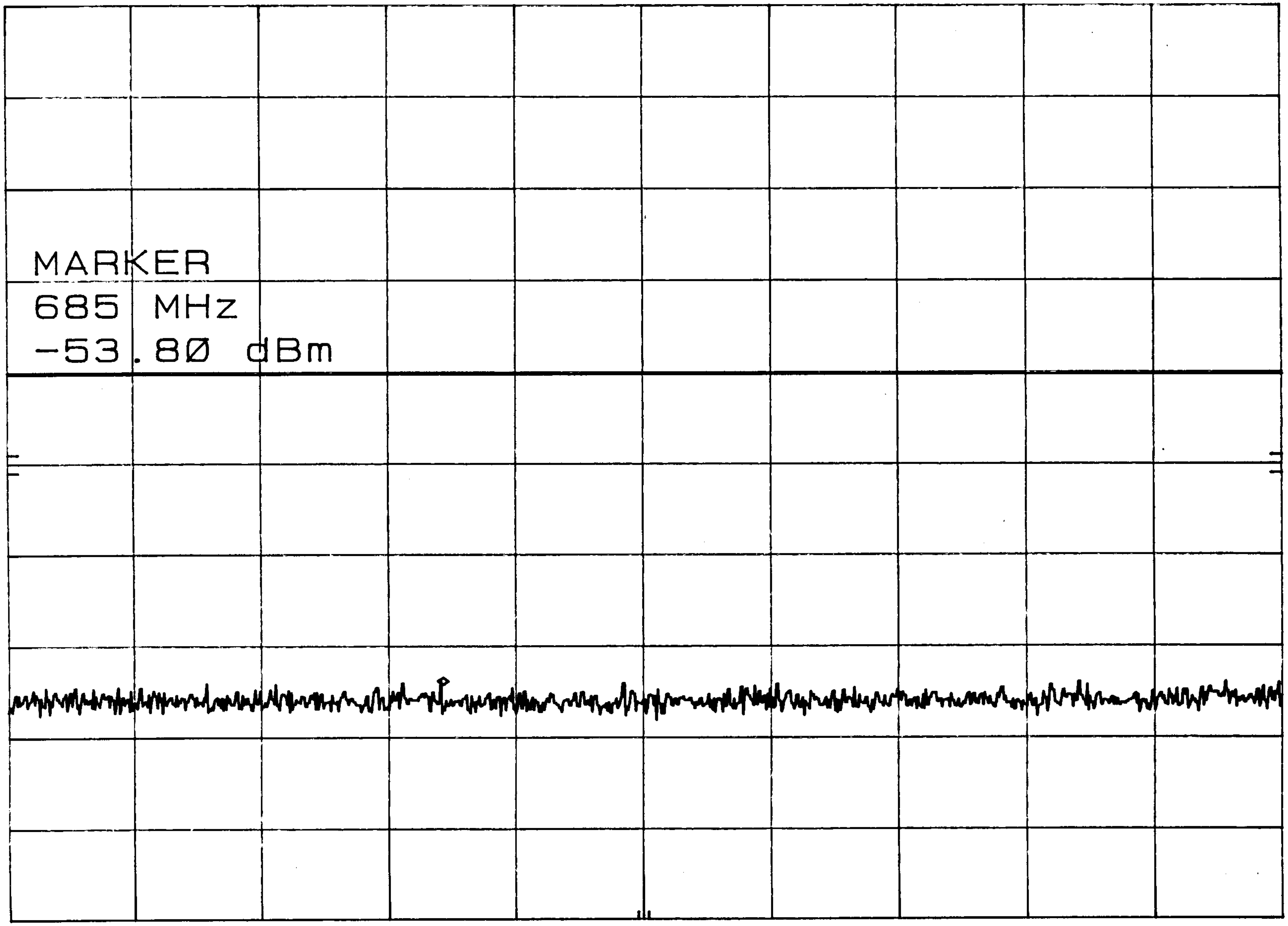
MKR 685 MHz
-53.80 dBm

hp

10 dB/

DL
-20.2
dBm

CORR'D



START 2 MHz
RES BW 100 kHz VBW 300 kHz

STOP 2.00 GHz
SWP 599 msec

10-28-99

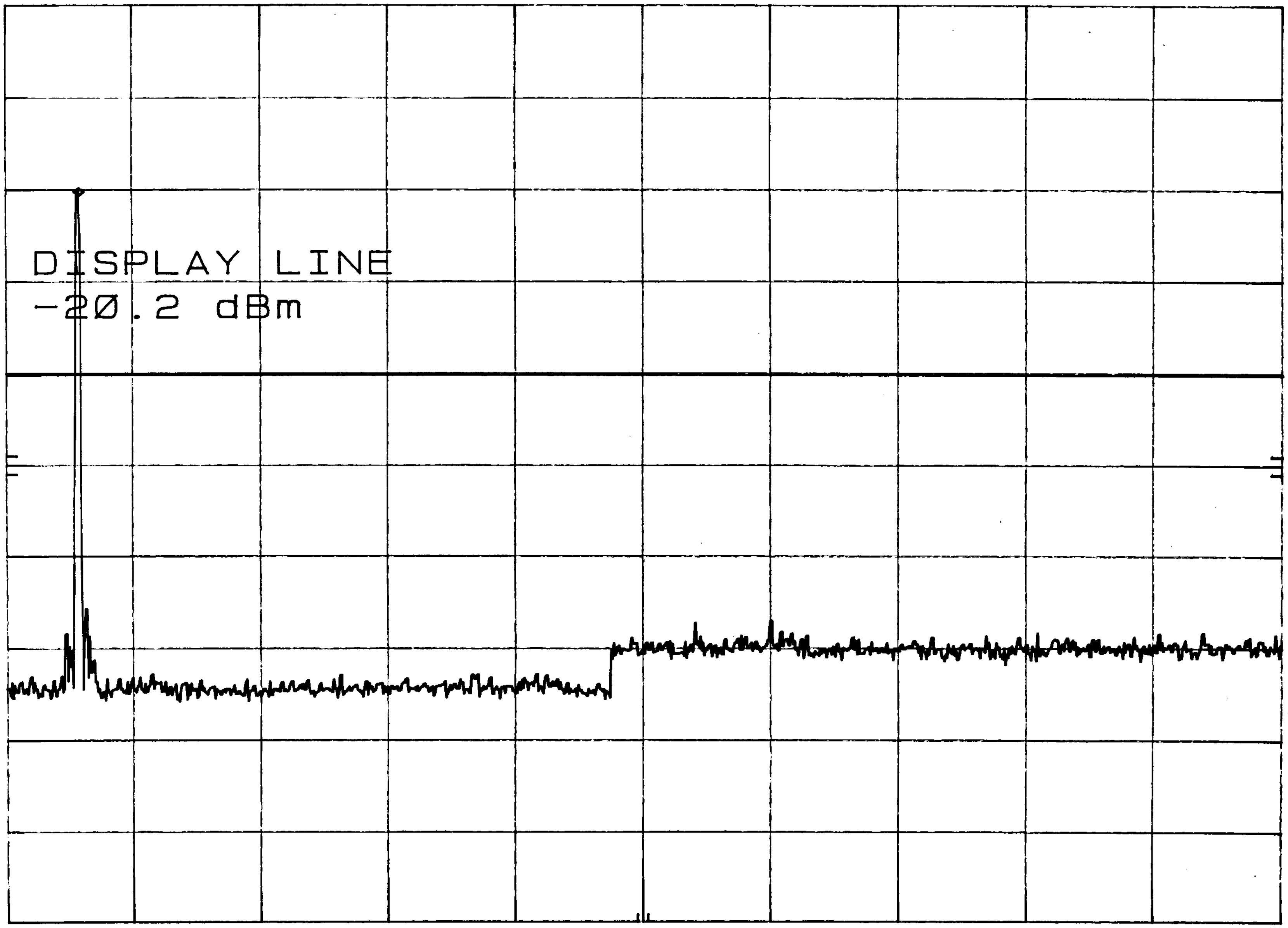
RF ANT. COND. TEST OF CHANNEL 11 - 2-10GHZ MKR 2.456 GHz
REF 20.0 dBm ATTEN 30 dB -0.20 dBm

hp

10 dB/

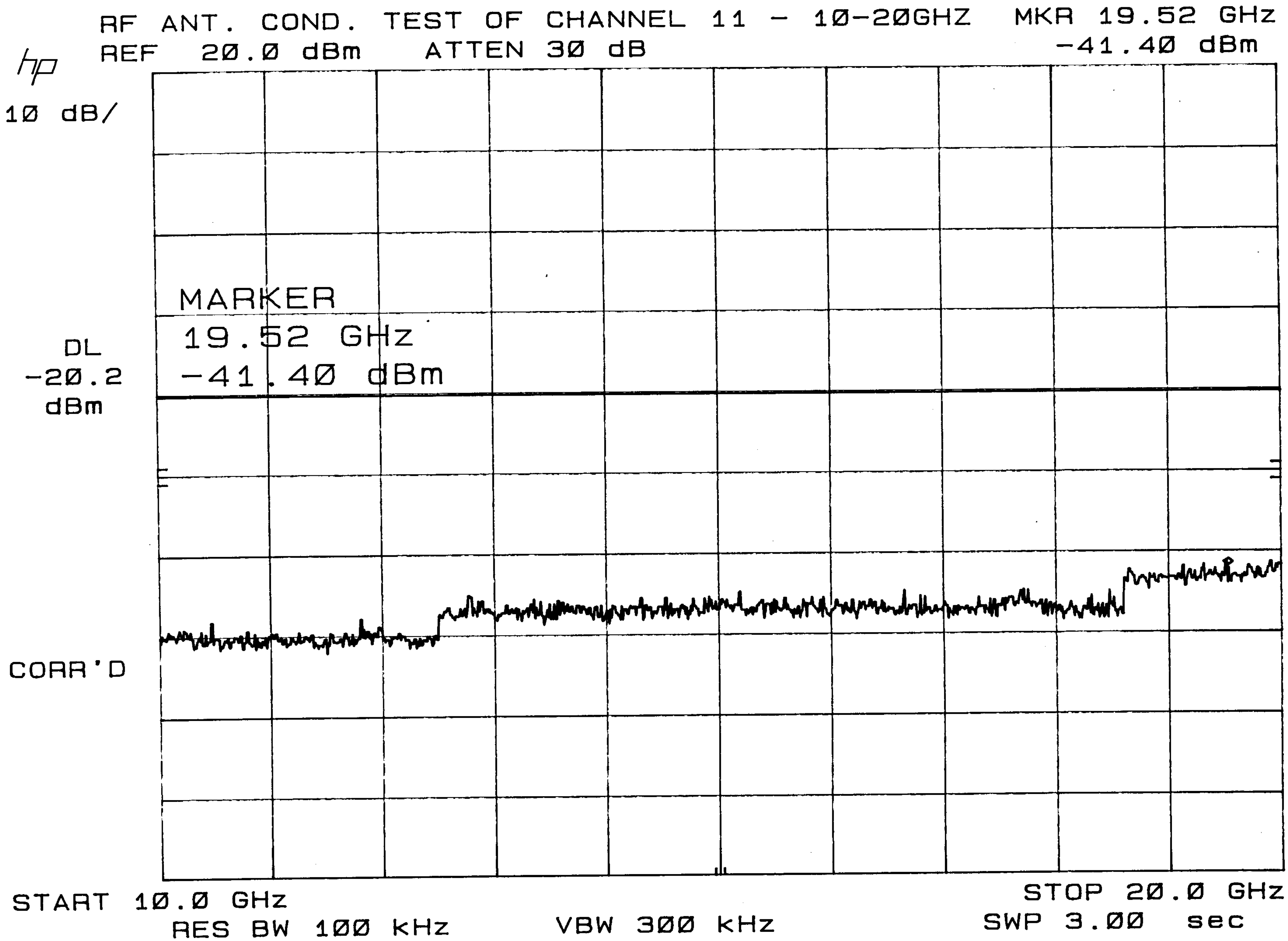
DL
-20.2
dBm

CORR'D



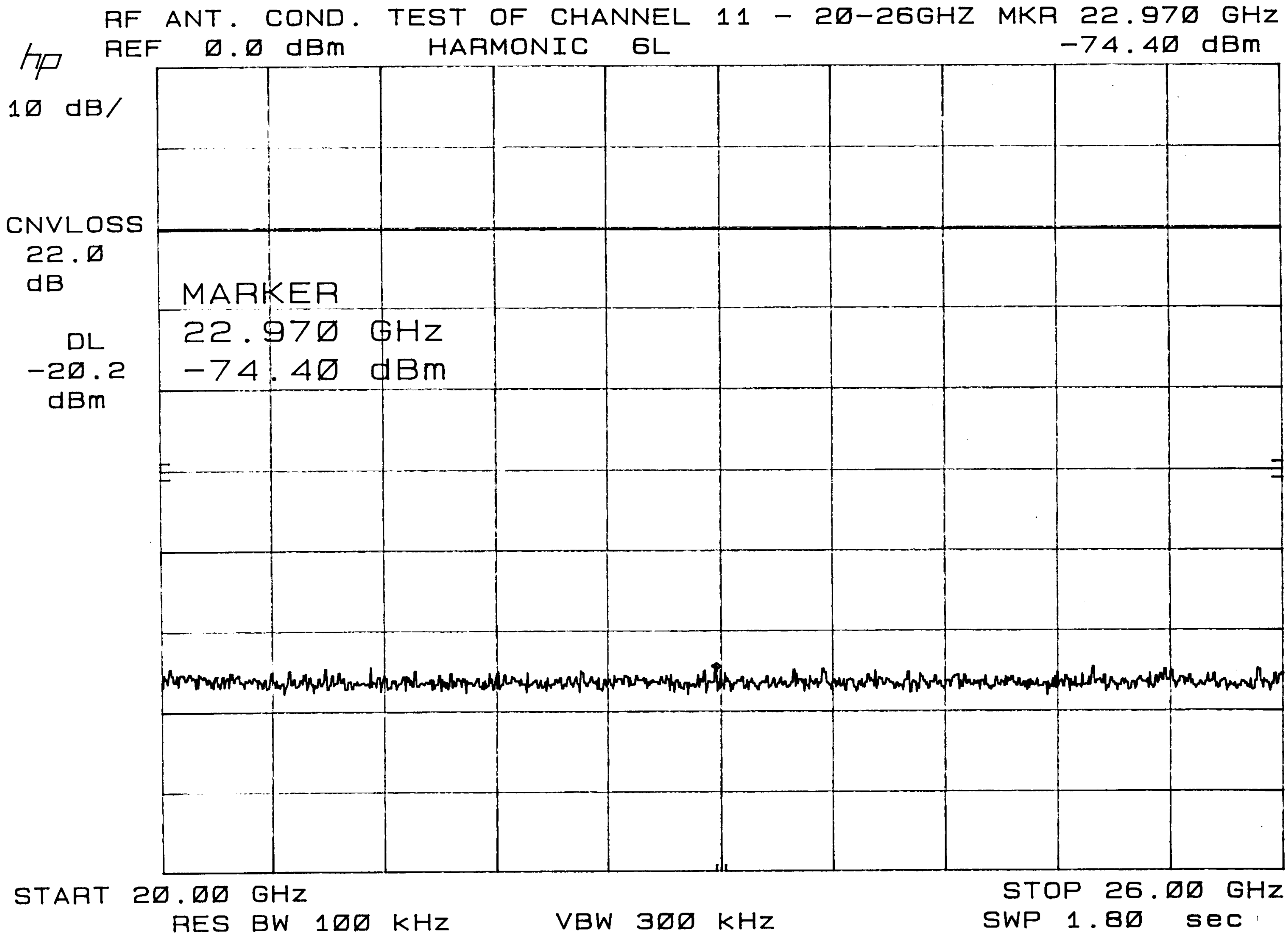
START 2.00 GHz STOP 10.00 GHz
RES BW 100 kHz VBW 300 kHz SWP 2.40 sec

10-28-99

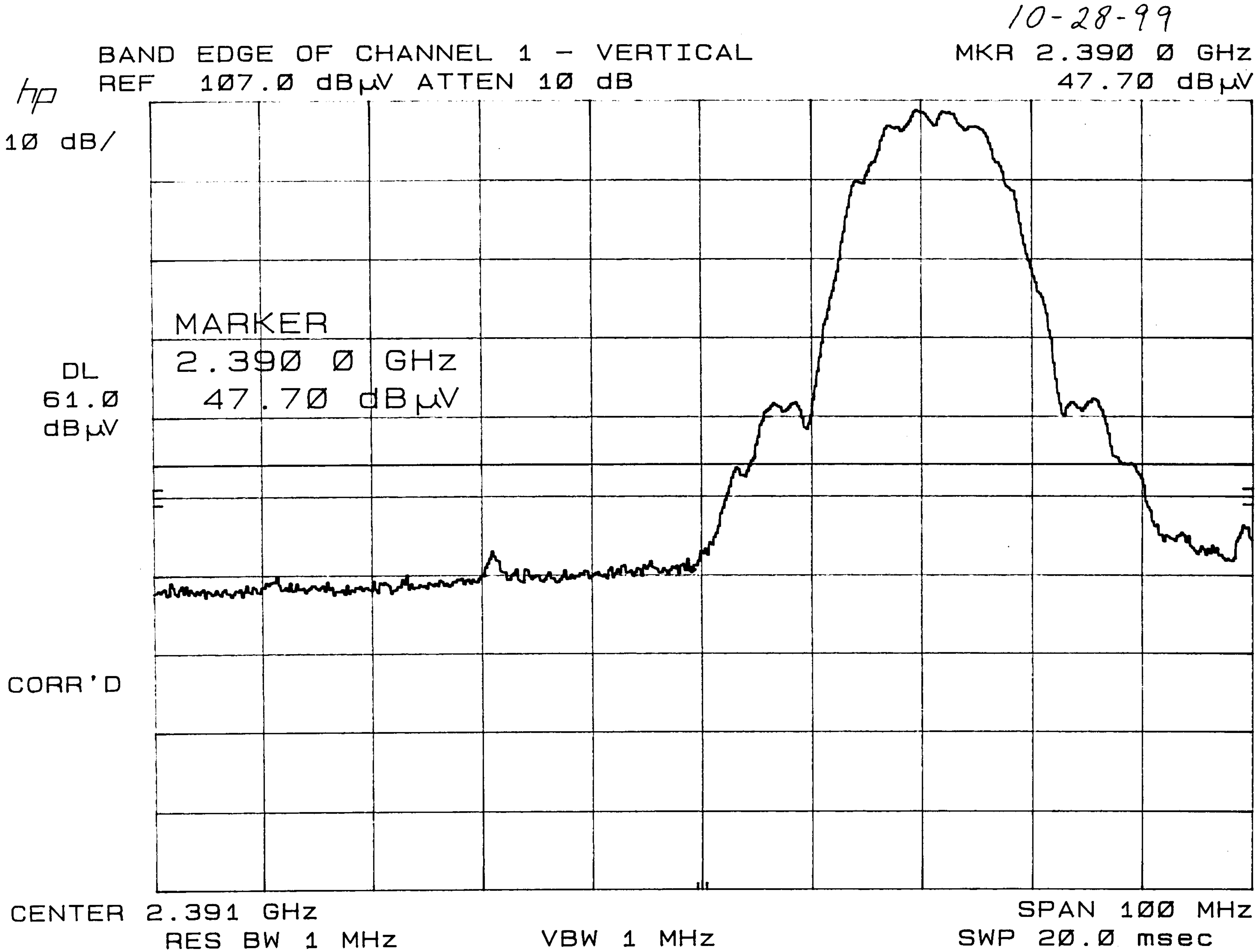


RF ANT. COND. TEST OF CHANNEL 11 - 10-20GHZ
MKR 19.52 GHz
-41.40 dBm
REF 20.0 dBm ATTEN 30 dB
hp
10 dB/
MARKER
19.52 GHz
-41.40 dBm
DL
-20.2
dBm
CORR'D
START 10.0 GHz
STOP 20.0 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 3.00 sec

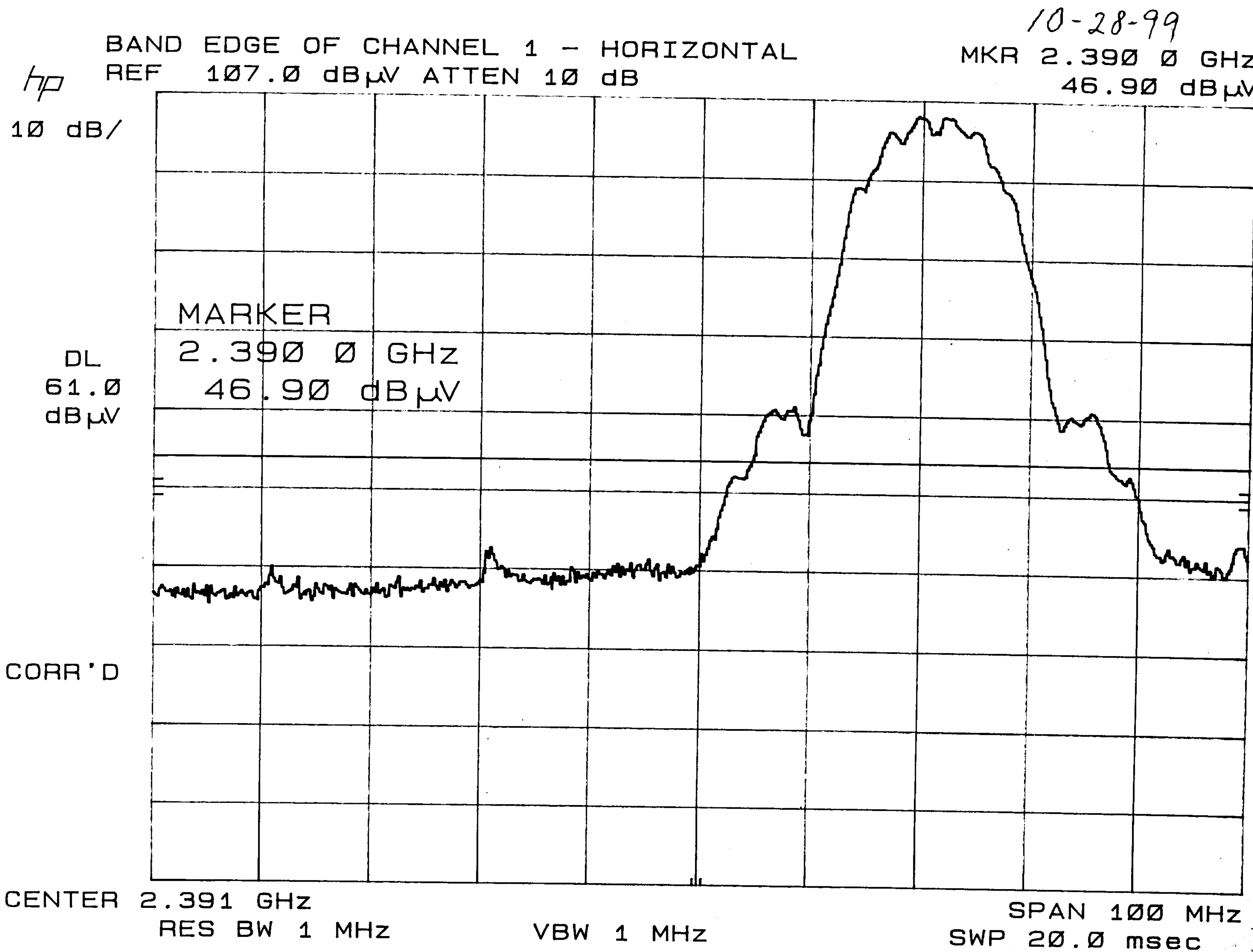
10-28-99

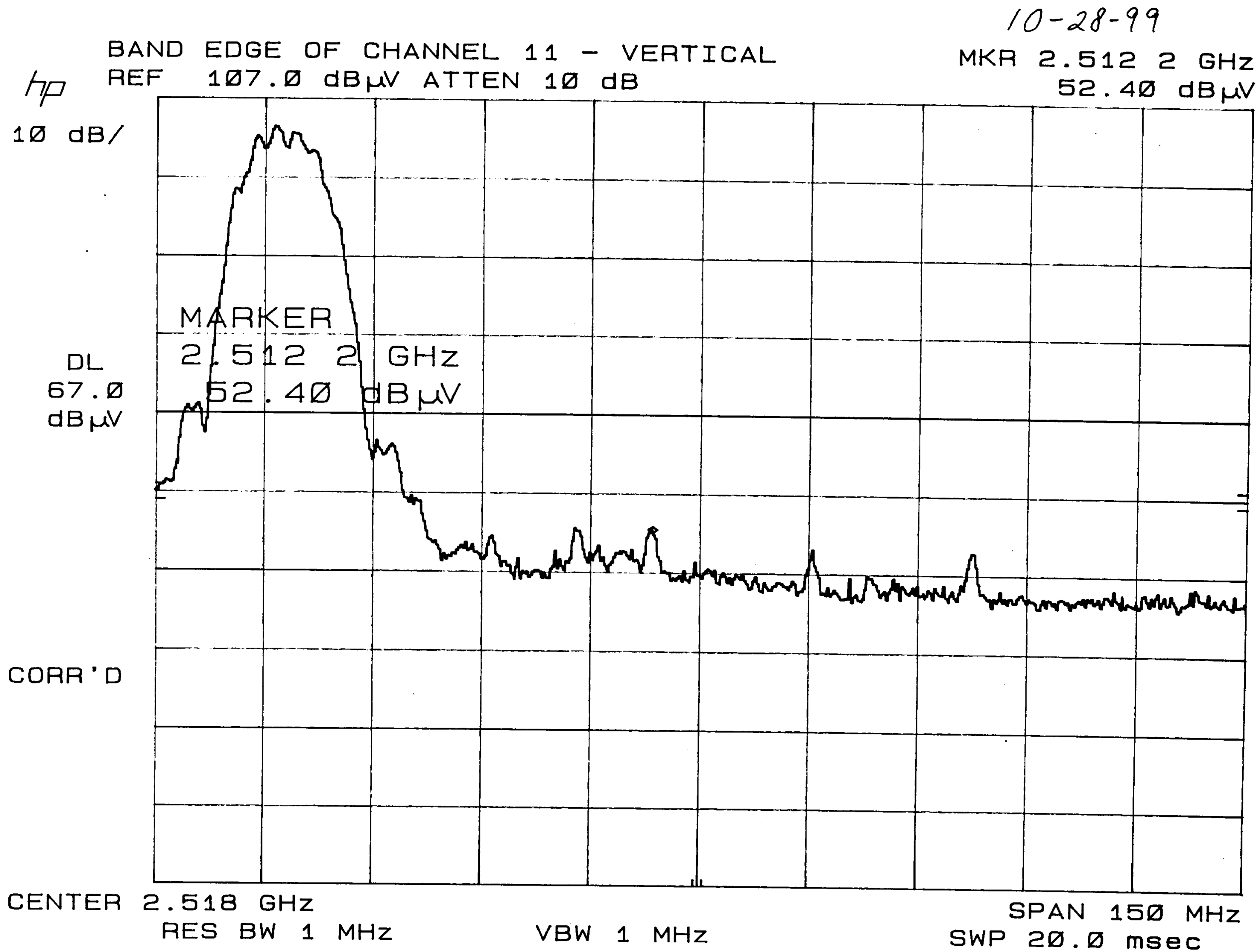

RF ANT. COND. TEST OF CHANNEL 11 - 20-26GHZ MKR 22.970 GHz
REF 0.0 dBm HARMONIC 6L
-74.40 dBm
hp
10 dB/
CNVLOSS
22.0
dB
DL
-20.2
dBm
MARKER
22.970 GHz
-74.40 dBm
START 20.00 GHz
STOP 26.00 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 1.80 sec

RF BAND EDGES
DATA SHEETS



10-28-99
BAND EDGE OF CHANNEL 1 - VERTICAL
MKR 2.390 Ø GHz
REF 107.Ø dBµV ATTEN 1Ø dB
47.7Ø dBµV
hp
1Ø dB/
MARKER
2.39Ø Ø GHz
47.7Ø dBµV
DL
61.Ø
dBµV
CORR'D
CENTER 2.391 GHz
SPAN 1ØØ MHz
RES BW 1 MHz
VBW 1 MHz
SWP 2Ø.Ø msec


10-28-99
BAND EDGE OF CHANNEL 1 - HORIZONTAL
REF 107.Ø dBµV ATTEN 1Ø dB
MKR 2.39Ø Ø GHz
46.9Ø dBµV
hp
1Ø dB/
MARKER
2.39Ø Ø GHz
46.9Ø dBµV
DL
61.Ø
dBµV
CORR'D
CENTER 2.391 GHz
RES BW 1 MHz
VBW 1 MHz
SPAN 1ØØ MHz
SWP 2Ø.Ø msec



10-28-99
BAND EDGE OF CHANNEL 11 - VERTICAL
REF 107.0 dBµV ATTEN 10 dB
MKR 2.512 2 GHz
52.40 dBµV
hp
10 dB/
MARKER
2.512 2 GHz
52.40 dBµV
DL
67.0
dBµV
CORR'D
CENTER 2.518 GHz
RES BW 1 MHz
VBW 1 MHz
SPAN 150 MHz
SWP 20.0 msec

10-28-99

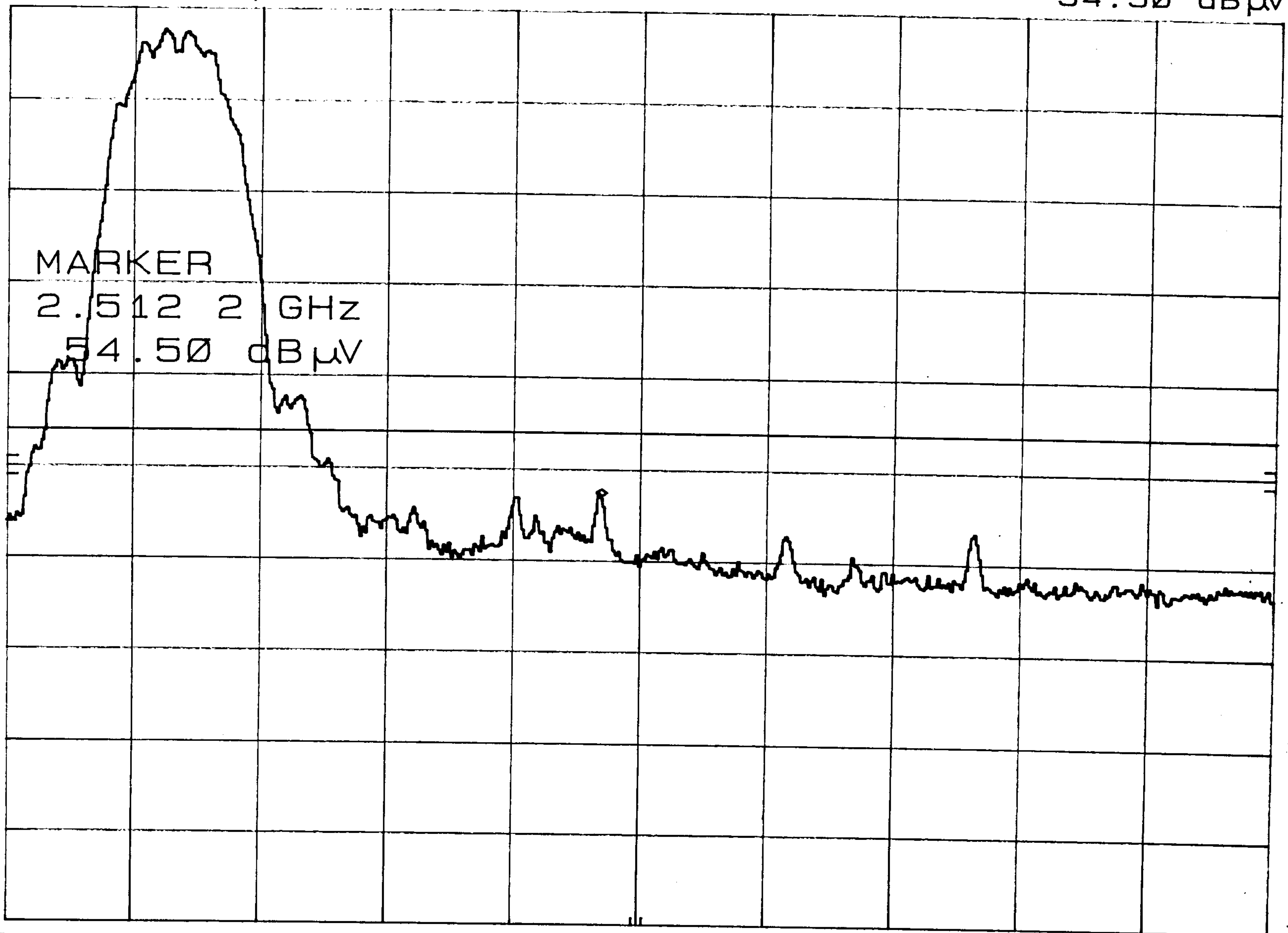
BAND EDGE OF CHANNEL 11 [redacted] - HORIZONTAL
REF 107.0 dBµV ATTEN 10 dB

MKR 2.512 2 GHz
54.50 dBµV

hp
10 dB/

DL
61.0
dBµV

CORR'D



CENTER 2.516 GHz
RES BW 1 MHz
VBW 1 MHz
SPAN 150 MHz
SWP 20.0 msec

RP-1

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.247)

COMPATIBLE ELECTRONICS

COMPANY	ENTERTAINMENT SYSTEMS TECHNOLOGY	DATE	10/28/99
EUT	FUNPAD	DUTY CYCLE	N/A
MODEL	FP1-99	PEAK TO AVG	N/A
S/N	N/A	TEST DIST.	3 METERS
TEST ENGINEER	KYLE FUJIMOTO	LAB	D

Frequency MHz	Peak Reading (dBuV)	Average (A) or Quasi-Peak (QP)	Antenna Polar. (V or H)	Antenna Height (meters)	EUT Azimuth (degrees)	EUT Axis (X,Y,Z)	EUT Tx Channel	Antenna Factor (dB)	Cable Loss (dB)	Amplifier Gain (dB)	*Corrected Reading (dBuV/m)	Delta ** (dB)	Spec Limit (dBuV/m)	Comments
2390.0000	46.9	A	H	1.0	180	X	LOW	27.9	4.5	35.6	**43.7**	**-10.3**	**54.0**	**Band Edge of Low Channel**
														at 3 meters
2390.0000	47.7	A	V	1.0	90	X	LOW	27.9	4.5	35.6	**44.5**	**-9.5**	**54.0**	**Band Edge of Low Channel**
														at 3 meters
2483.5000	54.5	A	H	1.5	180	X	HIGH	28.2	4.5	35.6	**51.6**	**-2.4**	**54.0**	**Band Edge of High Channel**
														at 3 meters
2483.5000	52.4	A	V	1.0	90	X	HIGH	28.2	4.5	35.6	**49.5**	**-4.5**	**54.0**	**Band Edge of High Channel**
														at 3 meters

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN
** DELTA = SPEC LIMIT - CORRECTED READING

PROCESSING GAIN DATA SHEETS

MEASUREMENT DATA:

Test Method Employed: Jamming Margin

Fundamental Frequency: 2437 MHz, Channel 6
Data Rate: 2 Mb/s, Chip Rate: 11 chips/bit

SIG. GEN. FREQ. (MHz)	BER	(S/N)o (dB)	Lsys (dB)	Sigal Gen Total Peak Power @ Rx (dBm)	Transmitter Total Peak Power @ Rx (dBm)	Jammer-to-Signal Ratio Mj (dB)	Processing Gain (dB)
Fc - 1.00	0.000020	9.6	2.0	-24.5	-27.9	3.4	15.0
Fc - 0.90	0.000013	9.8	2.0	-24.4	-27.9	3.5	15.3
Fc - 0.70	0.000010	9.9	2.0	-25.9	-27.9	2.0	13.9
Fc - 0.50	0.000015	9.8	2.0	-26.7	-27.9	1.2	13.0
Fc - 0.45	0.000018	9.7	2.0	-26.0	-27.9	1.9	13.6
Fc - 0.40	0.000015	9.8	2.0	-26.2	-27.9	1.7	13.5
Fc - 0.35	0.000012	9.9	2.0	-26.6	-27.9	1.3	13.2
Fc - 0.30	0.000015	9.8	2.0	-26.9	-27.9	1.0	12.8
Fc - 0.25	0.000018	9.7	2.0	-27.6	-27.9	0.3	12.0
Fc - 0.20	0.000011	9.9	2.0	-27.7	-27.9	0.2	12.1
Fc - 0.15	0.000016	9.8	2.0	-28.0	-27.9	-0.1	11.7
Fc - 0.10	0.000020	9.6	2.0	-28.4	-27.9	-0.5	11.1
Fc - 0.05	0.000010	9.9	2.0	-29.2	-27.9	-1.3	10.6
Fc	0.000020	9.6	2.0	-27.8	-27.9	0.1	11.7
Fc + 0.05	0.000010	9.9	2.0	-27.9	-27.9	0.0	11.9
Fc + 0.10	0.000020	9.6	2.0	-27.8	-27.9	0.1	11.7
Fc + 0.15	0.000017	9.7	2.0	-27.9	-27.9	0.0	11.7
Fc + 0.20	0.000015	9.8	2.0	-26.9	-27.9	1.0	12.8
Fc + 0.25	0.000010	9.9	2.0	-26.2	-27.9	1.7	13.6
Fc + 0.30	0.000010	9.9	2.0	-25.8	-27.9	2.1	14.0
Fc + 0.35	0.000012	9.9	2.0	-25.0	-27.9	2.9	14.8
Fc + 0.40	0.000013	9.8	2.0	-24.7	-27.9	3.2	15.0
Fc + 0.45	0.000014	9.8	2.0	-25.3	-27.9	2.6	14.4
Fc + 0.50	0.000020	9.6	2.0	-25.5	-27.9	2.4	14.0
Fc + 0.70	0.000015	9.8	2.0	-25.2	-27.9	2.7	14.5
Fc + 0.90	0.000016	9.7	2.0	-24.5	-27.9	3.4	15.1
Fc + 1.00	0.000013	9.8	2.0	-24.9	-27.9	3.0	14.8
MINIMUM PROCESSING GAIN: 10.6 dB							

(S/N)o: Refer to attached curves, BER versus (S/N)o for Differentially Coherent Detection of Differentially Encoded DPSK

Processing Gain Gp = (S/N)o + Lsys + Mj = (S/N)o + 2 + Mj

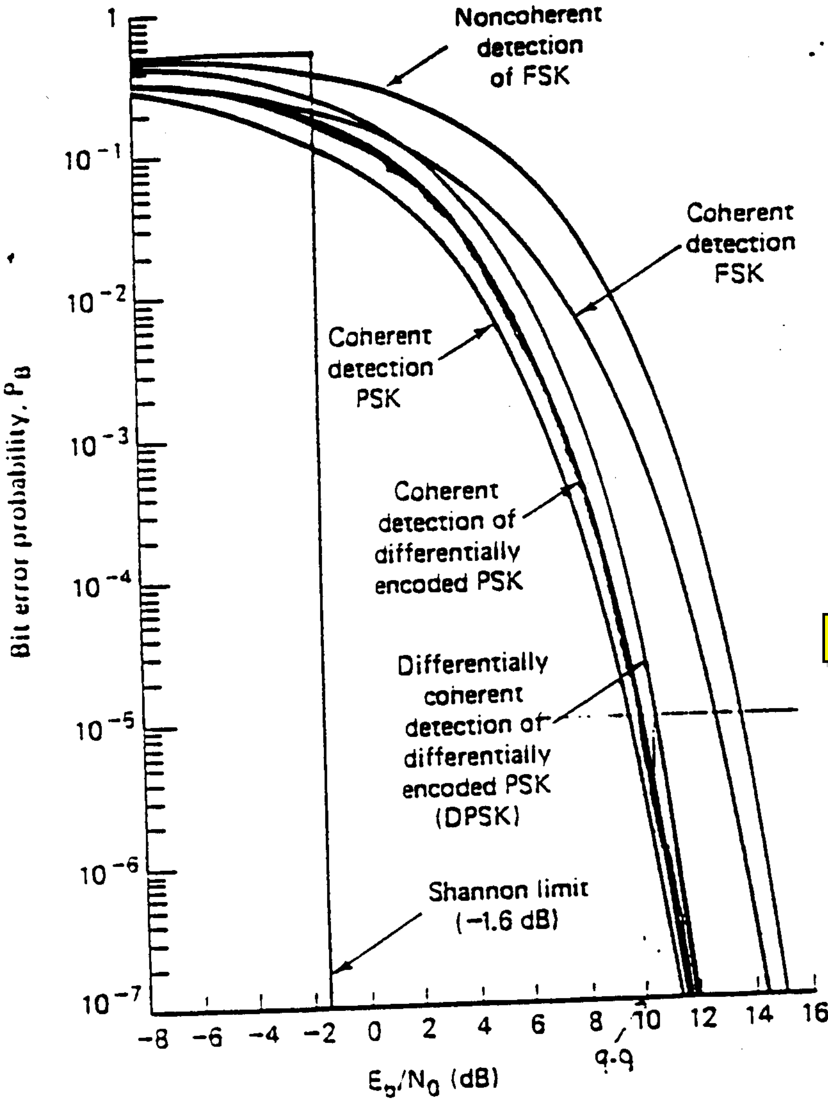


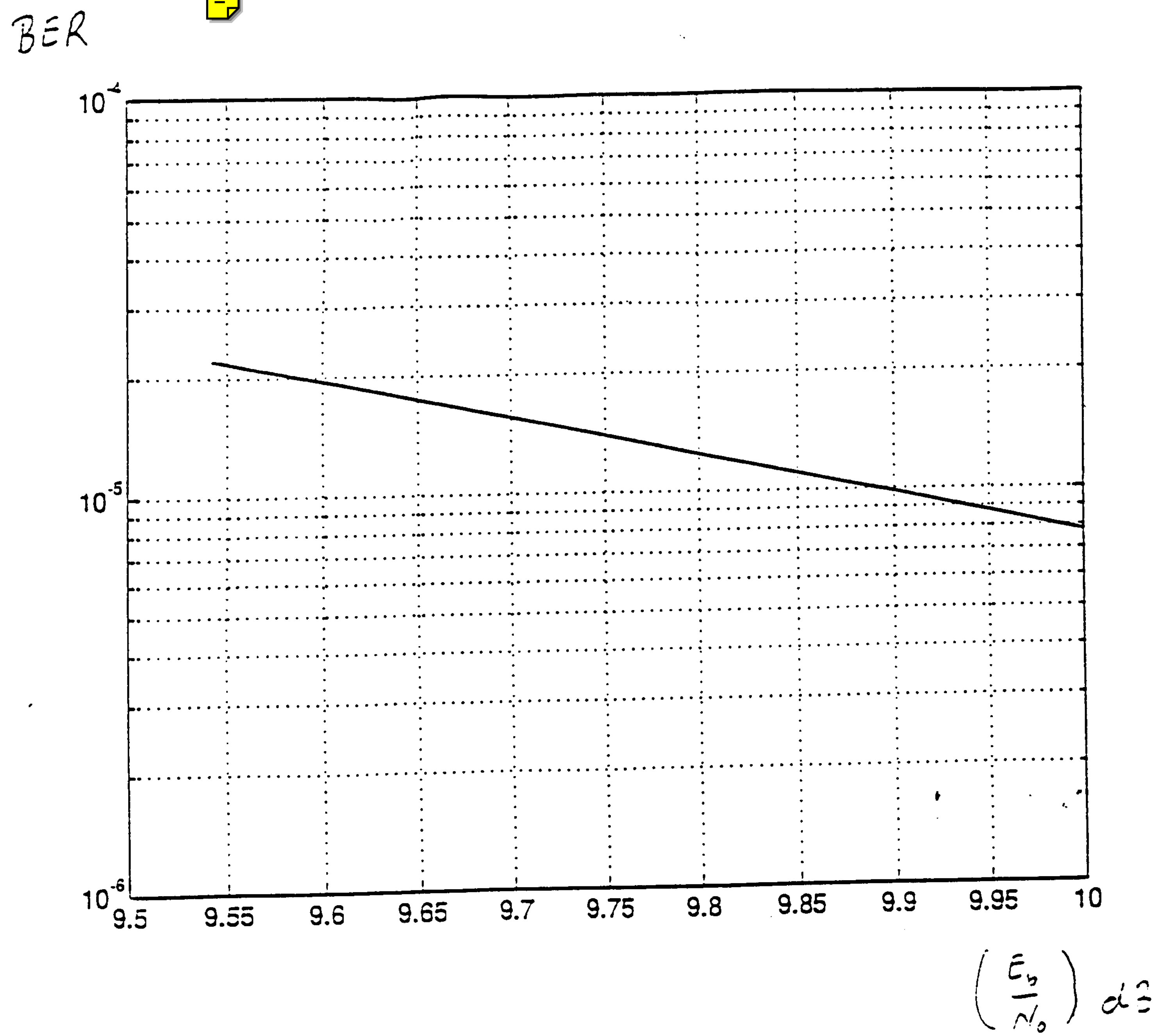
Figure 3.22 Bit error probability for several types of binary systems.

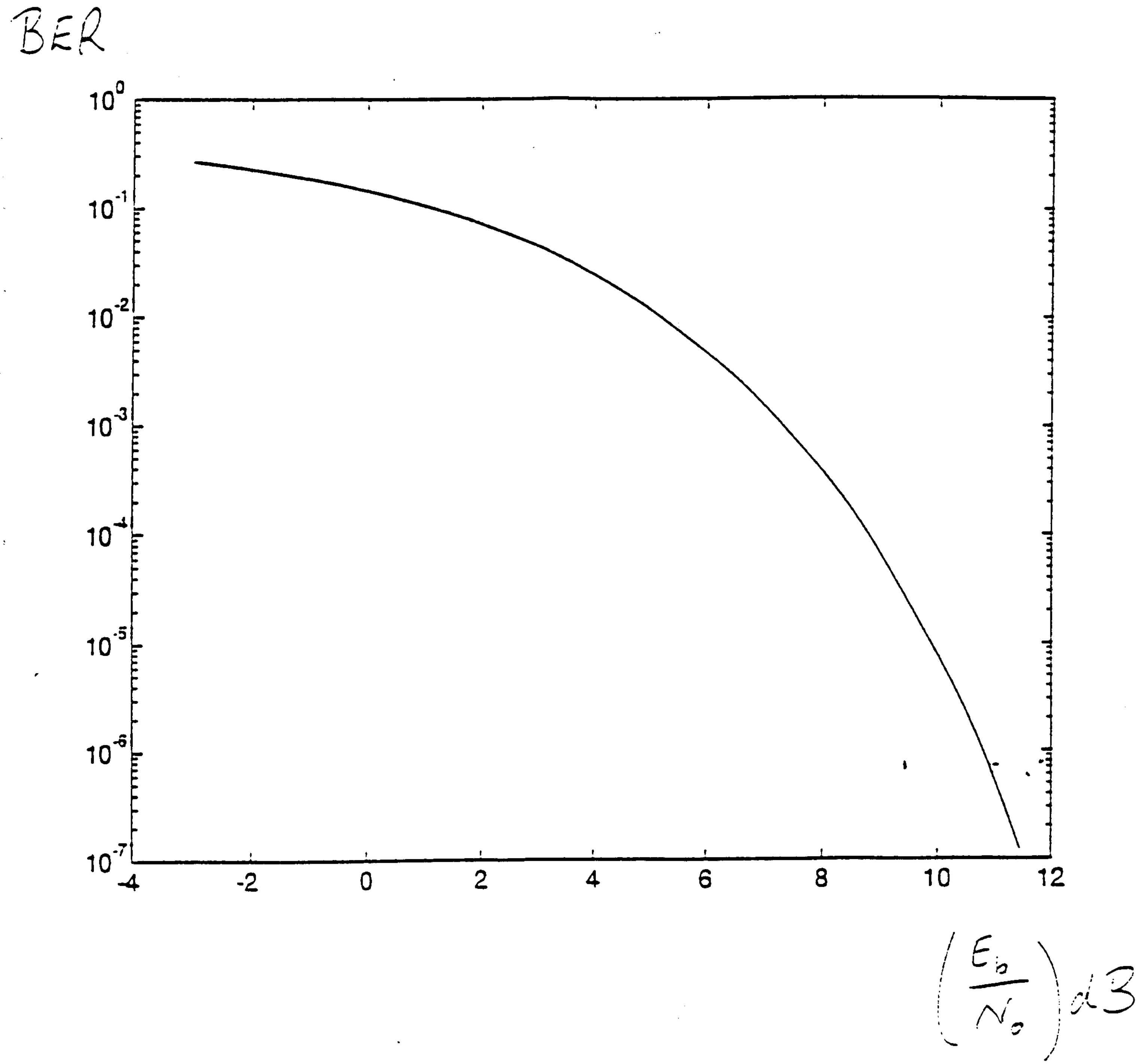
3.7.2 Probability of Bit Error for Coherently Detected Differentially Encoded PSK

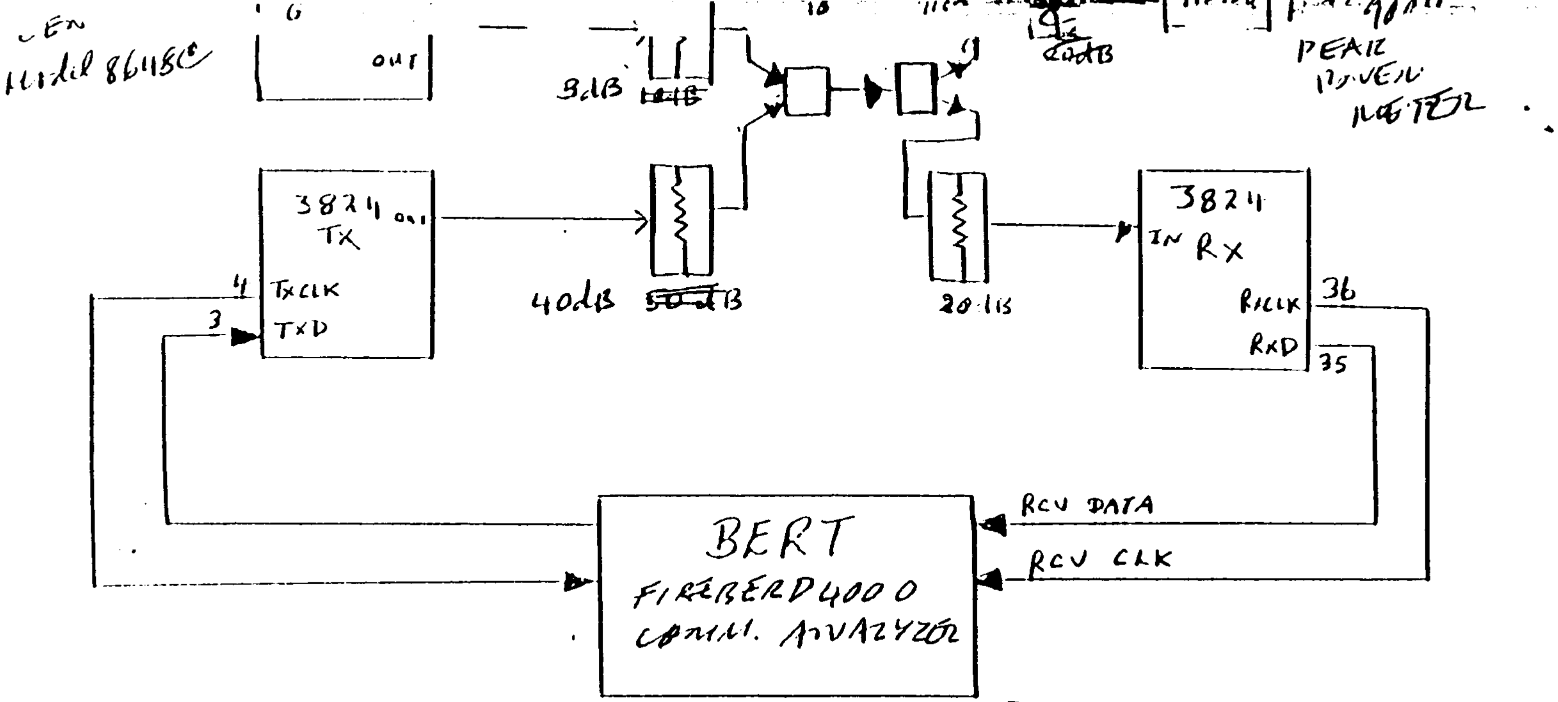
Channel waveforms sometimes experience inversion: for example, when using a coherent reference generated by a phase-locked loop (see Chapter 8), one may have phase ambiguity. If the carrier phase were reversed in a DPSK modulation application, what would be the effect on the message? The only effect would be an error in the bit during which inversion occurred or the bit just after inversion, since the message information is encoded in the similarity or difference between adjacent symbols. The similarity or difference quality remains unchanged if the carrier is inverted. Sometimes, systems are *differentially encoded* and *coherently detected*, simply to avoid these phase ambiguities.

The probability of bit error for coherently detected, differentially encoded PSK is given by [7]

$$P_B = 2Q\left(\sqrt{\frac{2E_b}{N_0}}\right)\left[1 - Q\left(\sqrt{\frac{2E_b}{N_0}}\right)\right]$$


BER
10^-4
10^-5
10^-6
9.5
9.55
9.6
9.65
9.7
9.75
9.8
9.85
9.9
9.95
10
(Eb/No) dB


BER
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
-4
-2
0
2
4
6
8
10
12
(Eb/No) dB



1) Set MAC chip to continuous transmit on the transmit end. This guarantees that TX_PE (Pin 2 on 3824 TX) is set active and DATA will be clocked in from BERT.

2) Set MAC chip to continuous Receive at the Receive end. This guarantees that RX_PE is enabled and the receiver is operational.

Use the MODE switch

1) Set up BERT to work with UNIPOLAR UNBALANCED sig

2) Set Input Impedance to 8 K (check with oscilloscope to make sure too many reflections are not degrading BER)

3) CLK PHASING switch: Use Mod

(A) TX ↑ RCV ↑

4) PATTERN TO use:

Pseudorandom $2^{20}-1$ {1

or $2^{23}-1$ {8

Synchronization declared when 30+n consecutive error f bits received → {50 or {53

5) Set SYNC LOSS ACT = HALT