FCC PART 15, SUBPART B and C
TEST REPORT

for

BLUETOOTH MODULE

MODEL: BT260136

Prepared for

O'NEIL PRODUCT DEVELOPMENT
8 MASON
IRVINE, CALIFORNIA 92618-2705

Prepared by:______________________

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DATE: NOVEMBER 1, 2002

	REPORT BODY	APPENDICES					TOTAL
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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 without the written permission of Compatible Electronics, unless done so in full.

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

Device Tested:	Bluetooth Module Model: BT260136 S/N: N/A
Product Description:	See Expository Statement.
Modifications:	The EUT was not modified during the testing.
Manufacturer:	O'Neil Product Development 8 Mason Irvine, California 92618-2705
Test Dates:	October 28, 29, and 30, 2002
Test Specifications:	EMI requirements CFR 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	Complies with the **Class B** limits of CFR Title 47, Part 15, Subpart B; and the limits of CFR Title 47, Part 15, Subpart C, section 15.207
2	Spurious Radiated RF Emissions, 30 MHz – 1000 MHz	Complies with the **Class B** limits of CFR Title 47, Part 15, Subpart B; and the limits of CFR Title 47, Part 15, Subpart C, section 15.209
3	Spurious Radiated RF Emissions, 10 kHz – 30 MHz and 1000 MHz – 25000 MHz	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247(c)
4	Fundamental and Emissions produced by the intentional radiator in non-restricted bands, 10 kHz – 25 GHz	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247(c)
5	Emissions produced by the intentional radiator in restricted bands, 10 kHz – 25 GHz	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.205, 15.209(a), and section 15.247 (c)
6	6 dB Bandwidth	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (a)(2)
7	20 dB Bandwidth	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (a)(1)(ii)
8	Peak Power Output	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (b)(1)
9	RF Conducted Antenna Test	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (c)
10	Channel Hopping Separation	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1) and 15.247 (a)(1)(ii)
11	Average Time of Occupancy	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(ii)
12	Peak Power Spectral Density Conducted from the Intentional Radiator to the Antenna	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (d)

1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the Bluetooth Module Model: BT260136. 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 equipment under test, referred to as EUT hereafter, are within the Class B specification limits defined by CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.207, 15.209, and 15.247.

Note: For the unintentional radiator portion of the test, the EUT was within the **Class B** specification limits defined by CFR Title 47, Part 15, Subpart B.

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

O'Neil Product Development

Ken Carlson	Director of Electrical Engineering

Compatible Electronics, Inc.

Kyle Fujimoto	Test Engineer
Michael Christensen	Test Engineer

2.4 Date Test Sample was Received

The test sample was received on October 28, 2002.

2.5 Disposition of the Test Sample

The sample has not been returned to O'Neil Product Development as of November 1, 2002.

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

Setup and operation of the equipment under test.

Specifics of the EUT and Peripherals Tested

The Bluetooth Module Model: BT260136 (EUT) was directly connected to the modular board PCB. The modular board PCB was connected to an AC Adapter via its power port.

Operation of the EUT during the testing

For the intentional radiator portion of the test - The EUT used a program that locked one channel at a time so that the low, middle, and high channels could be tested. This allowed the EUT to be in a no hopping mode. The EUT was testing in three orthogonal axis. The carrier was modulated in the same way it would be when the EUT was in its normal frequency hopping mode. The EUT was investigated during the preliminary scans in DH1, DH3, and DH5 modes. The DH5 mode was found to be worst case.

For the unintentional radiator and conducted emission portion of the test - The EUT used a program that allowed the EUT to function as normal (the channels frequency hopping) on a continuous basis.

Note: The D-9 port on the modular board is a diagnostic port only. It was only connected whenever the channel needed to be changed and/or change modes on the EUT.

The final radiated as well as the conducted data was taken in the mode above. Please see Appendix E for the data sheets.

4.1.1 Cable Construction and Termination

Cable 1 This is a 6 foot unshielded cable connecting the modular board PCB to the AC Adapter. It has a 1/8 inch power connector at the modular board PCB end and is hard wired into the AC Adapter.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
BLUETOOTH MODULE (EUT)	O'NEIL PRODUCT DEVELOPMENT	BT260136	N/A	**TBD**
AC ADAPTER	O'NEIL PRODUCT DEVELOPMENT	481210003C0	N/A	**N/A**
MODULAR PCB	O'NEIL PRODUCT DEVELOPMENT	N/A	N/A	**N/A**

5.2 EMI Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Radiated Emissions Manual Test – Radiated	Compatible Electronics	N/A	N/A	N/A	N/A
Conducted Emissions Test Program	Compatible Electronics	N/A	N/A	N/A	N/A
Spectrum Analyzer – Main Section	Hewlett Packard	8566B	2727A04757	Nov. 9, 2001	Nov. 9, 2002
Spectrum Analyzer – Display Section	Hewlett Packard	85662A	2648A15455	Nov. 9, 2001	Nov. 9, 2002
Spectrum Analyzer – Quasi-Peak Adapter	Hewlett Packard	85650A	3303A01688	Nov. 9, 2001	Nov. 9, 2002
Preamplifier	Com Power	PA-102	1017	Dec. 31, 2001	Dec. 31, 2002
Biconical Antenna	Com Power	AB-100	1548	Sept. 19, 2002	Sept. 19, 2003
Log Periodic Antenna	Com Power	AL-100	16089	Oct. 4, 2002	Oct. 4, 2003
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	17070	June 19, 2002	June 19, 2003
Horn Antenna	Com-Power	AH-118	10073	Jan. 21, 2002	Jan. 21, 2003
Microwave Preamplifier	Com-Power	PA-122	25195	Jan. 7, 2002	Jan. 7, 2003
Amplifier	Hewlett Packard	11975A	2403A00202	Mar. 14, 2002	Mar. 14, 2003
Harmonic Mixer	Hewlett Packard	11970K	3003A05460	Feb. 17, 2001	Feb. 17, 2002
Microwave Preamplifier	Com-Power	PA-840	711013	Mar. 6, 2002	Mar. 6, 2003
Horn Antenna	Antenna Research	MWH-1826/B	1011	Nov. 3, 2001	Nov. 3, 2002

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 and 7.1 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 RF output of the EUT.

Power	Channel	Accuracy
-0.80 dBm	LOW	+2/-2 dB
-1.00 dBm	MIDDLE	+2/-2 dB
-0.60 dBm	HIGH	+2/-2 dB

7.2 Channel Number and Frequencies

There are a total of 79 channels. The low channel is at 2402.0 MHz and the high channel is at 2480.0 MHz. There is a 1 MHz separation between channels.

Channel 1: 2402 MHz
Channel 2: 2403 MHz
(Etc.)

7.3 Antenna Gain

The antenna had a worst case of –4.7 dBd in the YZ-plane. Thus, the antenna gain is –2.55 dBi. (Antenna gain in dBi = Antenna gain in dBd + 2.15)

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 Conducted Emissions Test

The spectrum analyzer was used as a measuring meter. The data was collected with the spectrum analyzer in the peak detect mode with the "Max Hold" feature activated. The quasi-peak was used only where indicated in the data sheets. A 10 dB attenuation pad was used for the protection of the spectrum analyzer input stage, and the offset was adjusted accordingly to read the actual data measured. The LISN output was measured using the spectrum analyzer. The output of the second LISN was terminated by a 50 ohm termination. The effective measurement bandwidth used for this test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI C63.4: 1992. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The conducted emissions from the EUT were maximized for operating mode as well as cable placement. The final data was collected under program control by the Compatible Electronics conducted emissions software in several overlapping sweeps by running the spectrum analyzer at a minimum scan rate of 10 seconds per octave. The final qualification data is located in Appendix E.

Test Results:

The EUT complies with the **Class B** limits of **CFR** Title 47, Part 15, Subpart B; and the limits of CFR Title 47, Part 15, Subpart C, Section 15.207 for conducted emissions.

8.1.2 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 Com-Power Microwave Preamplifier Model: PA-122 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 10 Hz and putting the sweep time on AUTO on the spectrum analyzer to keep the amplitude reading calibrated.

After the readings above 1 GHz were average manually, the reading was further adjusted by a "duty cycle correction factor", derived from 20 log (dwell time / 100 ms). Since the duty cycle was below 10%, the maximum allowed 20 dB was subtracted from the peak reading.

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 by the Radiated Emission Manual Test software. 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 from 10 kHz to 30 MHz and from 1 GHz to 25 GHz to obtain final test data. From 30 MHz to 1000 MHz, the EUT was tested at a 10 meter test distance.

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

The 6 dB bandwidth was measured using the spectrum analyzer. The bandwidth was measured using a direct connection from the RF out on the EUT. The resolution and video bandwidths were 100 kHz.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(2). The bandwidth is at least 500 kHz. Please see the data sheets located in Appendix D.

8.3 20 dB Bandwidth

The 20 dB Bandwidth was measured using the spectrum analyzer. The bandwidth was measured using a direct connection from the RF out on the EUT. The resolution and video bandwidths were >= 1% of the 20 dB bandwidth.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1)(ii). The bandwidth is less than 1 MHz. Please see the data sheets located in Appendix E.

8.4 Peak Output Power

The Peak Output Power was taken using the spectrum analyzer. The bandwidth was measured using a direct connection from the RF out on the EUT. The resolution bandwidth was 3 MHz, and the video bandwidth was 3 MHz. The spectrum analyzer was offset 0.5 dB due to the loss of the coax cable from the RF out on the EUT.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (b)(1). The maximum peak output power is less than 1 watt. Please see the data sheets located in Appendix E.

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 EUT 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 15.247 (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. Please see the data sheets located in Appendix E.

8.6 RF Band Edges

The RF band edges were taken at the edges of the ISM spectrum (2400 MHz when the EUT was on the low channel and 2483.5 MHz when the EUT was on the high channel) using the spectrum analyzer. A preamplifier was used to boost the signal level, with the plots being taken at 3 meter test distance. The frequencies at 2390 MHz and 2483.5 MHz were also averaged manually by narrowing the video filter down to 10 Hz and putting the sweep time on AUTO on the spectrum analyzer to keep the amplitude reading calibrated. A data sheet is also included, which compares the reading from the spectrum analyzer to the spec limit. The EUT was tested in DH5 mode, which is the worst case.

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 2400 MHz and 2483.5 MHz meet the limits of section 15.209. Please see the data sheets located in Appendix E.

8.7 Carrier Frequency Separation

The Channel Hopping Separation Test was measured using the spectrum analyzer. The EUT was operating in its normal operating mode. The resolution bandwidth was 100 kHz, and the video bandwidth 100 kHz. The frequency span was wide enough to include the peaks of two adjacent channels.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1) and 15.247 (a)(1)(ii). The Channel Hopping Separation is greater than the 20 dB bandwidth. Please see the data sheets located in Appendix D.

8.8 Number of Hopping Frequencies

The Channel Hopping Separation Test was measured using the spectrum analyzer. The EUT was operating in its normal operating mode. The resolution bandwidth was 1 MHz, and the video bandwidth 1 MHz. The frequency span was wide enough to include all of the peaks in the frequency band of operation.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1) and 15.247 (a)(1)(ii). The number of hopping frequencies is 79. Please see the data sheets located in Appendix E.

8.8 Average Time of Occupancy Test

The Average Time of Occupancy Test was measured using the spectrum analyzer. The EUT was operating in normal operating mode. The frequency span was taken to 0 Hz with a sweep time of 20 msec to determine the time for each transmission. The EUT was tested in DH1, DH3, and DH5 modes.

For DH1 mode, they system makes a worst case 1600 hops per second with 79 channels. This is if each time slot were to turn on individually. A DH1 packet needs 2 time slots (1 for transmitting, 1 for receiving). This makes the worst case 800 hops per second with 79 channels. That means each channel will have 10.13 hops per second. In 30 seconds, each channel will have 303.9 hops. The measured dwell time was 420 uS. **So we have 303.9 * 420 uS = 127.638 ms per 30 seconds.**

For DH3 mode, they system makes a worst case 1600 hops per second with 79 channels. This is if each time slot were to turn on individually. A DH3 packet needs 4 time slots (3 for transmitting, 1 for receiving). This makes the worst case 400 hops per second with 79 channels. That means each channel will have 5.1 hops per second. In 30 seconds, each channel will have 153 hops. The measured dwell time was 1.720 ms. **So we have 153 * 1.720 ms = 263.16 ms per 30 seconds.**

For DH5 mode, they system makes a worst case 1600 hops per second with 79 channels. This is if each time slot were to turn on individually. A DH5 packet needs 6 time slots (5 for transmitting, 1 for receiving). This makes the worst case 266.7 hops per second with 79 channels. That means each channel will have 3.36 hops per second. In 30 seconds, each channel will have 100.8 hops. The measured dwell time was 2.92 ms. **So we have 100.8 * 2.92 ms = 294.336 ms per 30 seconds.**

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1)(ii). The EUT does not transmit for more than 400 msec during a 30 second period on any frequency. Please see the data sheets located in Appendix E.

9. CONCLUSIONS

The Bluetooth Module 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.

Note: For the unintentional radiator portion of the test, the EUT was within the **Class B** specification limits defined in CFR Title 47, Part 15, Subpart B.

APPENDIX A

LABORATORY RECOGNITIONS

LABORATORY RECOGNITIONS

Compatible Electronics has the following agency accreditations:

National Voluntary Laboratory Accreditation Program - Lab Code: 200528-0

Voluntary Control Council for Interference - Registration Numbers: R-983, C-1026, R-984 and C-1027

Bureau of Standards and Metrology Inspection - Reference Number: SL2-IN-E-1031

Conformity Assessment Body for the EMC Directive Under the US/EU MRA Appointed by NIST

Compatible Electronics is recognized or on file with the following agencies:

Federal Communications Commission

Industry Canada

Radio-Frequency Technologies (Competent Body)

APPENDIX B

MODIFICATIONS TO THE EUT

MODIFICATIONS TO THE EUT

The modifications listed below were made to the EUT to pass FCC 15.231 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.

No modifications were made to the EUT during the testing.

APPENDIX C

ADDITIONAL MODELS COVERED UNDER THIS REPORT

ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST	Bluetooth Module Model: BT260136 S/N: N/A

There were no additional models covered under this report.

APPENDIX D

DIAGRAMS, CHARTS, AND PHOTOS

FIGURE 1: CONDUCTED EMISSIONS TEST SETUP

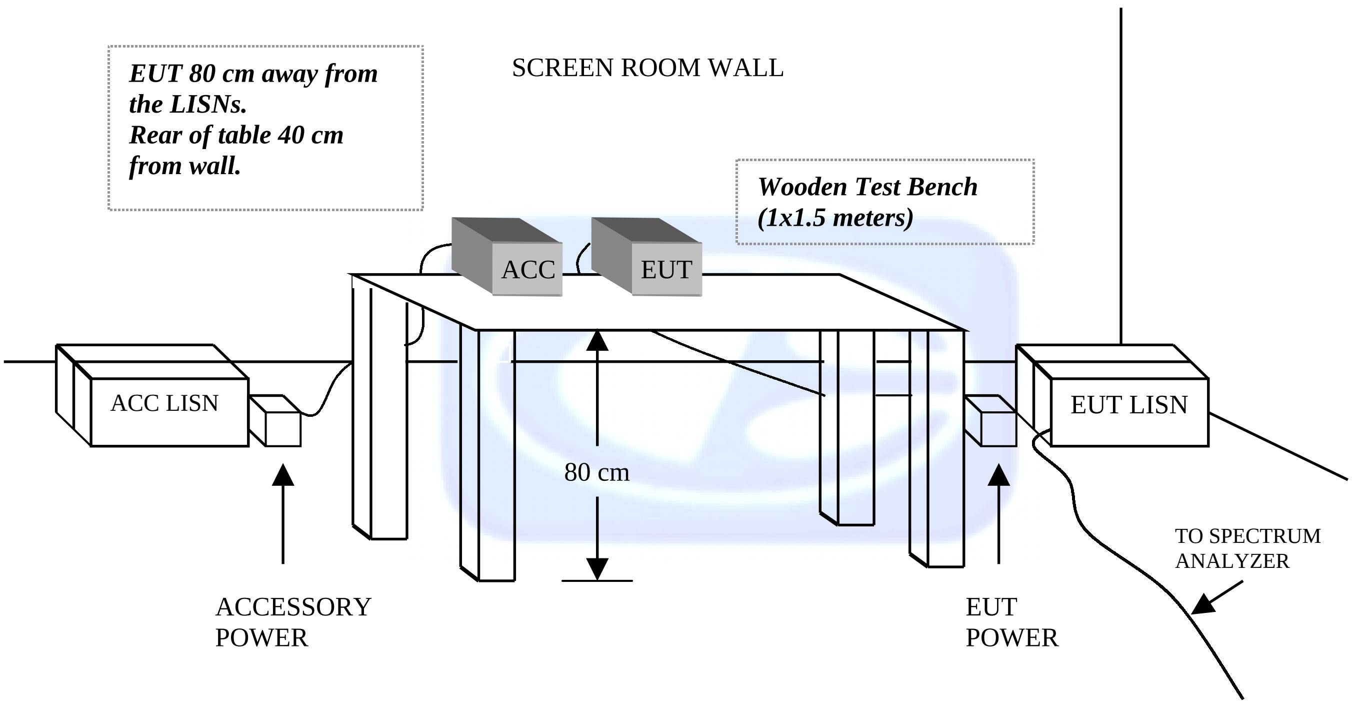
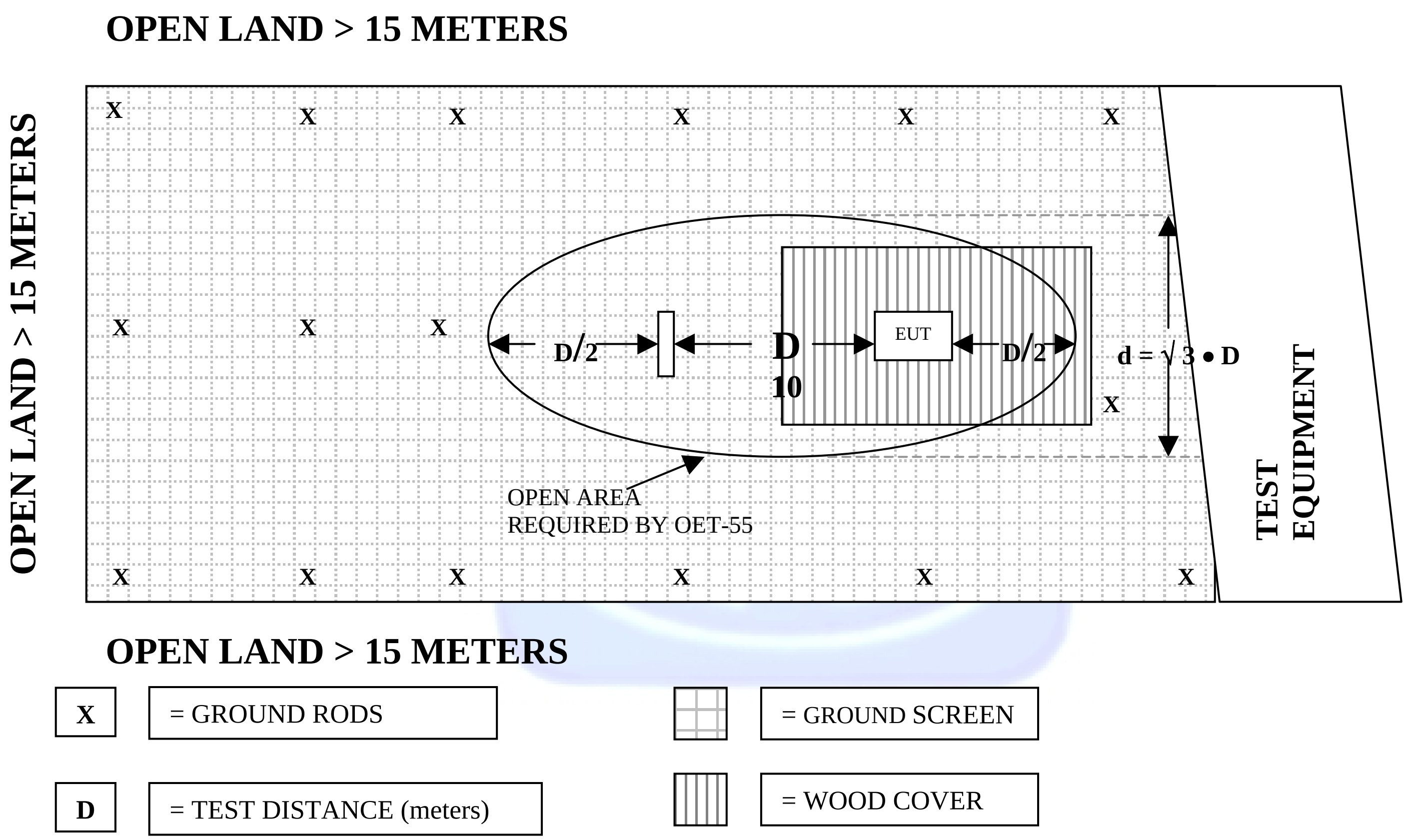


FIGURE 2: PLOT MAP AND LAYOUT OF RADIATED SITE



COM-POWER AB-100

BICONICAL ANTENNA

S/N: 01548

CALIBRATION DATE: SEPTEMBER 19, 2002

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	14.30	120	10.70
35	14.00	125	11.40
40	13.70	140	12.70
45	12.00	150	12.50
50	11.40	160	12.90
60	9.70	175	14.10
70	8.30	180	14.70
80	7.60	200	15.10
90	7.80	250	16.90
100	8.60	300	19.10

COM-POWER AL-100

LOG PERIODIC ANTENNA

S/N: 16089

CALIBRATION DATE: OCTOBER 4, 2002

FREQUENCY (MHz)	**FACTOR (dB)**	**FREQUENCY (MHz)**	**FACTOR (dB)**
300	13.10	700	17.70
350	14.40	750	19.60
400	14.30	800	20.50
450	15.70	850	21.20
500	16.60	900	21.20
550	16.60	950	22.50
600	17.30	1000	24.60
650	18.80		

COM-POWER PA-102

PREAMPLIFIER

S/N: 1017

CALIBRATION DATE: DECEMBER 31, 2001

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	38.5	300	38.5
40	38.5	350	38.4
50	38.5	400	38.2
60	38.5	450	37.8
70	38.5	500	38.0
80	38.5	550	38.2
90	38.3	600	38.2
100	38.3	650	38.0
125	38.6	700	38.1
150	38.5	750	37.7
175	38.4	800	37.4
200	38.5	850	37.9
225	38.5	900	37.2
250	38.4	950	36.8
275	38.4	1000	37.3

COM-POWER PA-122

MICROWAVE PREAMPLIFIER

S/N: 25195

CALIBRATION DATE: JANUARY 7, 2002

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	33.7	9.5	31.8
1.1	33.4	10.0	32.2
1.2	33.1	11.0	31.4
1.3	33.1	12.0	30.2
1.4	33.2	13.0	32.9
1.5	32.5	14.0	33.9
1.6	32.7	15.0	32.4
1.7	32.3	16.0	32.2
1.8	32.3	17.0	31.5
1.9	31.4	18.0	32.2
2.0	32.8	19.0	31.2
2.5	33.3	20.0	31.3
3.0	31.7	21.0	31.7
3.5	31.6	22.0	29.7
4.0	31.2		
4.5	31.2		
5.0	31.0		
5.5	31.3		
6.0	32.1		
6.5	32.1		
7.0	31.8		
7.5	32.0		
8.0	33.1		
8.5	32.0		
9.0	30.8		

ANTENNA RESEARCH DRG-118/A

HORN ANTENNA

S/N: 1053

CALIBRATION DATE: JANUARY 13, 2002

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	25.5	9.5	39.1
1.5	26.6	10.0	39.7
2.0	29.4	10.5	40.9
2.5	30.4	11.0	40.7
3.0	31.2	11.5	42.4
3.5	32.3	12.0	42.6
4.0	32.9	12.5	42.4
4.5	33.0	13.0	41.5
5.0	34.8	13.5	41.0
5.5	35.2	14.0	40.5
6.0	36.4	14.5	43.6
6.5	36.6	15.0	43.7
7.0	38.8	15.5	43.3
7.5	38.8	16.0	42.8
8.0	38.0	16.5	43.0
8.5	38.1	17.0	42.7
9.0	39.9	17.5	44.0
		18.0	41.8

COM-POWER AL-130

LOOP ANTENNA

S/N: 17070

CALIBRATION DATE: JUNE 19, 2002

FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)
0.009	-40.4	11.1
0.01	-40.3	11.2
0.02	-41.2	10.3
0.05	-41.6	9.9
0.07	-41.4	10.1
0.1	-41.7	9.8
0.2	-44.0	7.5
0.3	-41.6	9.9
0.5	-41.3	10.2
0.7	-41.4	10.1
1	-40.9	10.6
2	-40.6	10.9
3	-40.5	11.0
4	-40.8	10.7
5	-40.2	11.3
10	-40.7	10.8
15	-41.4	10.1
20	-41.6	9.9
25	-41.7	9.8
30	-42.9	8.6

COM-POWER AH826

HORN ANTENNA

S/N: 0071957

CALIBRATION DATE: NOVEMBER 03, 2001

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
18.0	32.3	22.5	32.5
18.5	32.2	23.0	32.1
19.0	32.3	23.5	32.3
19.5	31.9	24.0	32.3
20.0	32.0	24.5	32.9
20.5	32.3	25.0	33.1
21.0	32.0	25.5	32.9
21.5	32.3	26.0	33.4
22.0	32.5	26.5	33.0

COM-POWER PA-840

MICROWAVE PREAMPLIFIER

S/N: 711013

CALIBRATION DATE: MARCH 06, 2002

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
18.0	26.4	30.0	27.6
19.0	25.4	31.0	27.3
20.0	24.5	32.0	26.9
21.0	23.9	33.0	26.7
22.0	24.0	34.0	27.0
23.0	24.4	35.0	25.9
24.0	25.2	36.0	25.5
25.0	26.1	37.0	26.2
26.0	26.6	38.0	25.6
27.0	27.2	39.0	23.4
28.0	27.4	40.0	24.3
29.0	27.5		

FRONT VIEW

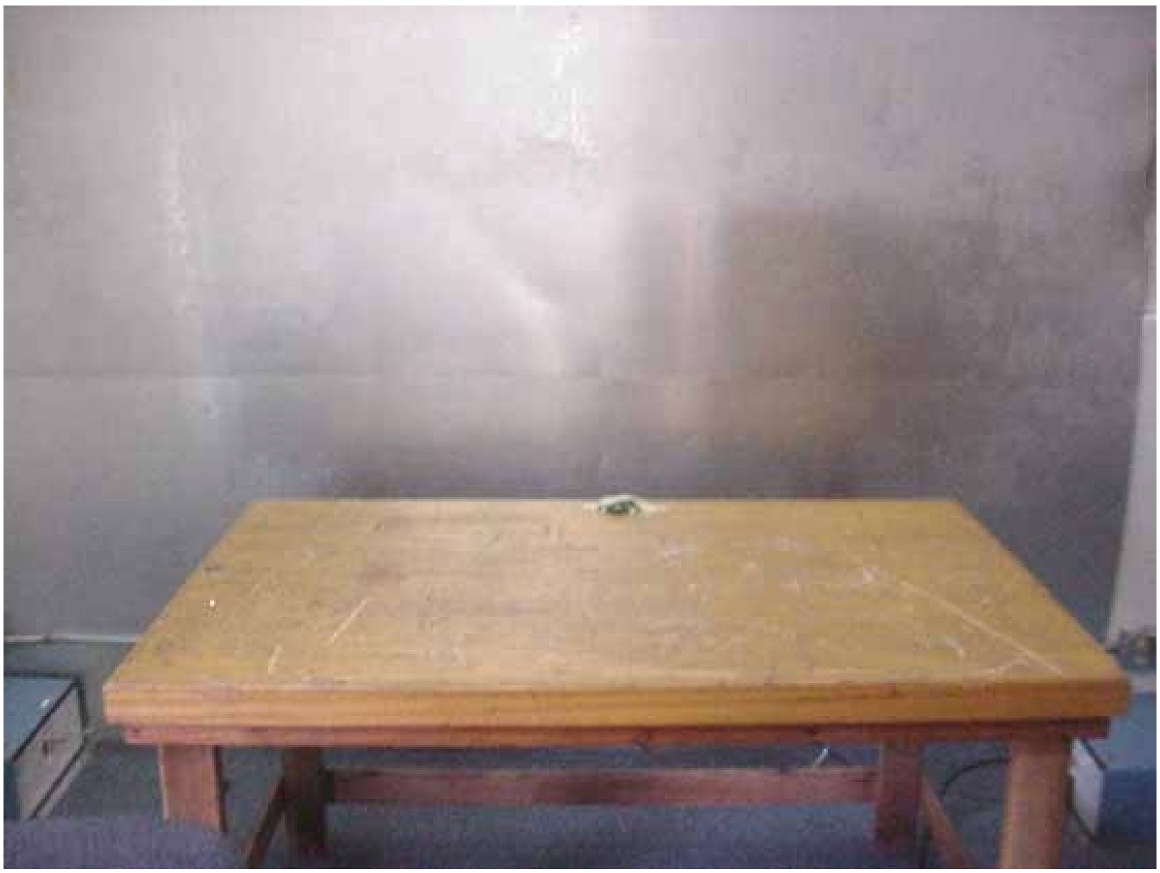
O'NEIL PRODUCT DEVELOPMENT
BLUETOOTH MODULE
MODEL: BT260136
FCC SUBPART B AND C - RADIATED EMISSIONS – 10-28-02 and 10-29-02

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

O'NEIL PRODUCT DEVELOPMENT
BLUETOOTH MODULE
MODEL: BT260136
FCC SUBPART B AND C - RADIATED EMISSIONS – 10-28-02 and 10-29-02

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



FRONT VIEW

O'NEIL PRODUCT DEVELOPMENT
BLUETOOTH MODULE
MODEL: BT260136
FCC SUBPART B AND C - CONDUCTED EMISSIONS – 10-30-02

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

O'NEIL PRODUCT DEVELOPMENT
BLUETOOTH MODULE
MODEL: BT260136
FCC SUBPART B AND C - CONDUCTED EMISSIONS – 10-30-02

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

APPENDIX E

DATA SHEETS

RADIATED EMISSIONS

DATA SHEETS

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.247)

COMPANY	O'NEIL PRODUCT DEVELOPMENT	DATE	10/28/02
EUT	BLUETOOTH MODULE	DUTY CYCLE	<10 %
MODEL	BT260136	PEAK TO AVG	-20 dB
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)	Distance Factor (dB)	Mixer Factor (dB)	*Corrected Reading (dBuV/m)	Delta ** (dB)	Spec Limit (dBuV/m)	Comments
2402.0000	92.7	83.9	A	H	1.0	0	X	LOW	30.2	3.6	33.0	0.0	0.0	**84.6**			
2402.0000	86.8	78.7	A	H	1.0	270	Y	LOW	30.2	3.6	33.0	0.0	0.0	**79.4**			
2402.0000	92.7	84.1	A	H	1.0	180	Z	LOW	30.2	3.6	33.0	0.0	0.0	**84.8**			
2402.0000	91.9	82.1	A	V	1.0	180	X	LOW	30.2	3.6	33.0	0.0	0.0	**82.8**			
2402.0000	92.9	84.1	A	V	1.5	90	Y	LOW	30.2	3.6	33.0	0.0	0.0	**84.9**			
2402.0000	92.7	84.3	A	V	2.0	0	Z	LOW	30.2	3.6	33.0	0.0	0.0	**85.0**			
2442.0000	91.9	83.4	A	H	1.0	270	X	MED.	30.3	3.5	33.1	0.0	0.0	**84.1**			
2442.0000	87.3	78.6	A	H	1.0	270	Y	MED.	30.3	3.5	33.1	0.0	0.0	**79.3**			
2442.0000	95.1	86.3	A	H	1.0	0	Z	MED.	30.3	3.5	33.1	0.0	0.0	**87.0**			
2442.0000	93.6	85.1	A	V	1.0	180	X	MED.	30.3	3.5	33.1	0.0	0.0	**85.7**			
2442.0000	94.1	85.6	A	V	1.0	0	Y	MED.	30.3	3.5	33.1	0.0	0.0	**86.2**			
2442.0000	93.2	84.7	A	V	1.0	180	Z	MED.	30.3	3.5	33.1	0.0	0.0	**85.4**			
2480.0000	90.9	82.3	A	H	1.0	180	X	HIGH	30.4	3.5	33.2	0.0	0.0	**82.9**			
2480.0000	87.6	78.7	A	H	2.0	180	Y	HIGH	30.4	3.5	33.2	0.0	0.0	**79.4**			
2480.0000	93.5	84.5	A	H	1.0	180	Z	HIGH	30.4	3.5	33.2	0.0	0.0	**85.2**			
2480.0000	92.3	81.4	A	V	1.0	180	X	HIGH	30.4	3.5	33.2	0.0	0.0	**82.0**			
2480.0000	94.4	85.7	A	V	1.0	90	Y	HIGH	30.4	3.5	33.2	0.0	0.0	**86.3**			
2480.0000	94.1	85.7	A	V	1.0	90	Z	HIGH	30.4	3.5	33.2	0.0	0.0	**86.3**			

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

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.247)

COMPANY	O'NEIL PRODUCT DEVELOPMENT	DATE	10/28/02
EUT	BLUETOOTH MODULE	DUTY CYCLE	<10 %
MODEL	BT260136	PEAK TO AVG	-20 dB
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)	Distance Factor (dB)	Mixer Factor (dB)	*Corrected Reading (dBuV/m)	Delta ** (dB)	Spec Limit (dBuV/m)	Comments
4804.0000	47.2	A	H	1.0	0	X	LOW	35.0	5.4	31.1	0.0	0.0	56.6	-17.4	74.0	Peak Reading to Peak Limit
4804.0000	49.1	A	H	1.0	0	Y	LOW	35.0	5.4	31.1	0.0	0.0	58.5	-15.5	74.0	Peak Reading to Peak Limit
4804.0000	51.4	A	H	1.0	270	Z	LOW	35.0	5.4	31.1	0.0	0.0	60.8	-13.2	74.0	Peak Reading to Peak Limit
4804.0000	49.2	A	V	1.0	0	X	LOW	35.0	5.4	31.1	0.0	0.0	58.6	-15.4	74.0	Peak Reading to Peak Limit
4804.0000	51.1	A	V	1.0	180	Y	LOW	35.0	5.4	31.1	0.0	0.0	60.5	-13.5	74.0	Peak Reading to Peak Limit
4804.0000	53.1	A	V	2.0	90	Z	LOW	35.0	5.4	31.1	0.0	0.0	62.5	-11.5	74.0	Peak Reading to Peak Limit
4884.0000	45.7	A	H	1.0	0	X	MED.	35.3	5.6	31.0	0.0	0.0	55.5	-18.5	74.0	Peak Reading to Peak Limit
4884.0000	47.5	A	H	2.0	0	Y	MED.	35.3	5.6	31.0	0.0	0.0	57.3	-16.7	74.0	Peak Reading to Peak Limit
4884.0000	46.5	A	H	2.0	0	Z	MED.	35.3	5.6	31.0	0.0	0.0	56.3	-17.7	74.0	Peak Reading to Peak Limit
4884.0000	45.9	A	V	2.0	0	X	MED.	35.3	5.6	31.0	0.0	0.0	55.7	-18.3	74.0	Peak Reading to Peak Limit
4884.0000	47.8	A	V	1.0	0	Y	MED.	35.3	5.6	31.0	0.0	0.0	57.6	-16.4	74.0	Peak Reading to Peak Limit
4884.0000	47.4	A	V	2.0	90	Z	MED.	35.3	5.6	31.0	0.0	0.0	57.2	-16.8	74.0	Peak Reading to Peak Limit
4960.0000	45.5	A	H	1.0	0	X	HIGH	35.6	5.7	31.0	0.0	0.0	55.8	-18.2	74.0	Peak Reading to Peak Limit
4960.0000	47.3	A	H	2.0	0	Y	HIGH	35.6	5.7	31.0	0.0	0.0	57.6	-16.4	74.0	Peak Reading to Peak Limit
4960.0000	49.7	A	H	1.0	0	Z	HIGH	35.6	5.7	31.0	0.0	0.0	60.0	-14.0	74.0	Peak Reading to Peak Limit
4960.0000	44.6	A	V	1.0	0	X	HIGH	35.6	5.7	31.0	0.0	0.0	54.9	-19.1	74.0	Peak Reading to Peak Limit
4960.0000	48.0	A	V	1.0	90	Y	HIGH	35.6	5.7	31.0	0.0	0.0	58.3	-15.7	74.0	Peak Reading to Peak Limit
4960.0000	52.0	A	V	1.0	270	Z	HIGH	35.6	5.7	31.0	0.0	0.0	62.3	-11.7	74.0	Peak Reading to Peak Limit

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

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.247)

COMPANY	O'NEIL PRODUCT DEVELOPMENT	DATE	10/28/02
EUT	BLUETOOTH MODULE	DUTY CYCLE	<10 %
MODEL	BT260136	PEAK TO AVG	-20 dB
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)	Distance Factor (dB)	Mixer Factor (dB)	*Corrected Reading (dBuV/m)	Delta ** (dB)	Spec Limit (dBuV/m)	Comments
7206.0000	37.4	A	H	1.0	180	X	LOW	40.5	8.1	31.9	0.0	0.0	54.1	-19.9	74.0	Peak Reading to Peak Limit
7206.0000	37.9	A	H	1.0	180	Y	LOW	40.5	8.1	31.9	0.0	0.0	54.6	-19.4	74.0	Peak Reading to Peak Limit
7206.0000	36.3	A	H	1.0	180	Z	LOW	40.5	8.1	31.9	0.0	0.0	53.0	-21.0	74.0	Peak Reading to Peak Limit
7206.0000	36.8	A	V	1.0	180	X	LOW	40.5	8.1	31.9	0.0	0.0	53.5	-20.5	74.0	Peak Reading to Peak Limit
7206.0000	38.4	A	V	1.0	180	Y	LOW	40.5	8.1	31.9	0.0	0.0	55.1	-18.9	74.0	Peak Reading to Peak Limit
7206.0000	38.9	A	V	2.0	180	Z	LOW	40.5	8.1	31.9	0.0	0.0	55.6	-18.4	74.0	Peak Reading to Peak Limit
7326.0000	39.0	A	H	1.0	180	X	MED.	40.7	8.1	31.9	0.0	0.0	55.8	-18.2	74.0	Peak Reading to Peak Limit
7326.0000	37.8	A	H	1.0	0	Y	MED.	40.7	8.1	31.9	0.0	0.0	54.6	-19.4	74.0	Peak Reading to Peak Limit
7326.0000	38.9	A	H	1.0	90	Z	MED.	40.7	8.1	31.9	0.0	0.0	55.7	-18.3	74.0	Peak Reading to Peak Limit
7326.0000	38.5	A	V	2.0	0	X	MED.	40.7	8.1	31.9	0.0	0.0	55.3	-18.7	74.0	Peak Reading to Peak Limit
7326.0000	38.6	A	V	1.0	0	Y	MED.	40.7	8.1	31.9	0.0	0.0	55.4	-18.6	74.0	Peak Reading to Peak Limit
7326.0000	36.8	A	V	1.0	0	Z	MED.	40.7	8.1	31.9	0.0	0.0	53.6	-20.4	74.0	Peak Reading to Peak Limit
7440.0000	38.8	A	H	1.0	0	X	HIGH	40.9	7.9	32.0	0.0	0.0	55.6	-18.4	74.0	Peak Reading to Peak Limit
7440.0000	35.0	A	H	1.0	270	Y	HIGH	40.9	7.9	32.0	0.0	0.0	51.8	-22.2	74.0	Peak Reading to Peak Limit
7440.0000	39.1	A	H	1.0	270	Z	HIGH	40.9	7.9	32.0	0.0	0.0	55.9	-18.1	74.0	Peak Reading to Peak Limit
7440.0000	37.0	A	V	2.0	90	X	HIGH	40.9	7.9	32.0	0.0	0.0	53.8	-20.2	74.0	Peak Reading to Peak Limit
7440.0000	39.0	A	V	1.0	180	Y	HIGH	40.9	7.9	32.0	0.0	0.0	55.8	-18.2	74.0	Peak Reading to Peak Limit
7440.0000	38.7	A	V	1.0	180	Z	HIGH	40.9	7.9	32.0	0.0	0.0	55.5	-18.5	74.0	Peak Reading to Peak Limit

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

No Harmonics nor Emissions found after the 3rd Harmoinc

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.247)

COMPANY	O'NEIL PRODUCT DEVELOPMENT	DATE	10/28/02
EUT	BLUETOOTH MODULE	DUTY CYCLE	<10 %
MODEL	BT260136	PEAK TO AVG	-20 dB
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)	Distance Factor (dB)	Mixer Factor (dB)	*Corrected Reading (dBuV/m)	Delta ** (dB)	Spec Limit (dBuV/m)	Comments
4804.0000	47.2	27.2	A	H	1.0	0	X	LOW	35.0	5.4	31.1	0.0	0.0	36.6	-17.4	54.0	The Duty Cycle is less
4804.0000	49.1	29.1	A	H	1.0	0	Y	LOW	35.0	5.4	31.1	0.0	0.0	38.5	-15.5	54.0	than 10%, however only
4804.0000	51.4	31.4	A	H	1.0	270	Z	LOW	35.0	5.4	31.1	0.0	0.0	40.8	-13.2	54.0	a maximum of 20 dB
4804.0000	49.2	29.2	A	V	1.0	0	X	LOW	35.0	5.4	31.1	0.0	0.0	38.6	-15.4	54.0	below the peak may be
4804.0000	51.1	31.1	A	V	1.0	180	Y	LOW	35.0	5.4	31.1	0.0	0.0	40.5	-13.5	54.0	used for the Average
4804.0000	53.1	33.1	A	V	2.0	90	Z	LOW	35.0	5.4	31.1	0.0	0.0	42.5	-11.5	54.0	Reading.
4884.0000	45.7	25.7	A	H	1.0	0	X	MED.	35.3	5.6	31.0	0.0	0.0	35.5	-18.5	54.0	The average readings will
4884.0000	47.5	27.5	A	H	2.0	0	Y	MED.	35.3	5.6	31.0	0.0	0.0	37.3	-16.7	54.0	reflect this (being 20 dB
4884.0000	46.5	26.5	A	H	2.0	0	Z	MED.	35.3	5.6	31.0	0.0	0.0	36.3	-17.7	54.0	below the peak)
4884.0000	45.9	25.9	A	V	2.0	0	X	MED.	35.3	5.6	31.0	0.0	0.0	35.7	-18.3	54.0	
4884.0000	47.8	27.8	A	V	1.0	0	Y	MED.	35.3	5.6	31.0	0.0	0.0	37.6	-16.4	54.0	
4884.0000	47.4	27.4	A	V	2.0	90	Z	MED.	35.3	5.6	31.0	0.0	0.0	37.2	-16.8	54.0	
4960.0000	45.5	25.5	A	H	1.0	0	X	HIGH	35.6	5.7	31.0	0.0	0.0	35.8	-18.2	54.0	
4960.0000	47.3	27.3	A	H	2.0	0	Y	HIGH	35.6	5.7	31.0	0.0	0.0	37.6	-16.4	54.0	
4960.0000	49.7	29.7	A	H	1.0	0	Z	HIGH	35.6	5.7	31.0	0.0	0.0	40.0	-14.0	54.0	
4960.0000	44.6	24.6	A	V	1.0	0	X	HIGH	35.6	5.7	31.0	0.0	0.0	34.9	-19.1	54.0	
4960.0000	48.0	28.0	A	V	1.0	90	Y	HIGH	35.6	5.7	31.0	0.0	0.0	38.3	-15.7	54.0	
4960.0000	52.0	32.0	A	V	1.0	270	Z	HIGH	35.6	5.7	31.0	0.0	0.0	42.3	-11.7	54.0	

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

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.247)

COMPANY	O'NEIL PRODUCT DEVELOPMENT	DATE	10/28/02
EUT	BLUETOOTH MODULE	DUTY CYCLE	<10 %
MODEL	BT260136	PEAK TO AVG	-20 dB
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)	Distance Factor (dB)	Mixer Factor (dB)	*Corrected Reading (dBuV/m)	Delta ** (dB)	Spec Limit (dBuV/m)	Comments
7206.0000	37.4	17.4	A	H	1.0	180	X	LOW	40.5	8.1	31.9	0.0	0.0	45.4	-8.6	54.0	The Duty Cycle is less
7206.0000	37.9	17.9	A	H	1.0	180	Y	LOW	40.5	8.1	31.9	0.0	0.0	45.2	-8.8	54.0	than 10%, however only
7206.0000	36.3	16.3	A	H	1.0	180	Z	LOW	40.5	8.1	31.9	0.0	0.0	45.2	-8.8	54.0	a maximum of 20 dB
7206.0000	36.8	16.8	A	V	1.0	180	X	LOW	40.5	8.1	31.9	0.0	0.0	45.5	-8.5	54.0	below the peak may be
7206.0000	38.4	18.4	A	V	1.0	180	Y	LOW	40.5	8.1	31.9	0.0	0.0	45.2	-8.8	54.0	used for the Average
7206.0000	38.9	18.9	A	V	2.0	180	Z	LOW	40.5	8.1	31.9	0.0	0.0	45.2	-8.8	54.0	Reading.
7326.0000	39.0	19.0	A	H	1.0	180	X	MED.	40.7	8.1	31.9	0.0	0.0	45.7	-8.3	54.0	The average readings will
7326.0000	37.8	17.8	A	H	1.0	0	Y	MED.	40.7	8.1	31.9	0.0	0.0	46.3	-7.7	54.0	reflect this (being 20 dB
7326.0000	38.9	18.9	A	H	1.0	90	Z	MED.	40.7	8.1	31.9	0.0	0.0	46.7	-7.3	54.0	below the peak)
7326.0000	38.5	18.5	A	V	2.0	0	X	MED.	40.7	8.1	31.9	0.0	0.0	45.7	-8.3	54.0	
7326.0000	38.6	18.6	A	V	1.0	0	Y	MED.	40.7	8.1	31.9	0.0	0.0	46.9	-7.1	54.0	
7326.0000	36.8	16.8	A	V	1.0	0	Z	MED.	40.7	8.1	31.9	0.0	0.0	46.1	-7.9	54.0	
7440.0000	38.8	18.8	A	H	1.0	0	X	HIGH	40.9	7.9	32.0	0.0	0.0	45.9	-8.1	54.0	
7440.0000	35.0	15.0	A	H	1.0	270	Y	HIGH	40.9	7.9	32.0	0.0	0.0	45.5	-8.5	54.0	
7440.0000	39.1	19.1	A	H	1.0	270	Z	HIGH	40.9	7.9	32.0	0.0	0.0	45.7	-8.3	54.0	
7440.0000	37.0	17.0	A	V	2.0	90	X	HIGH	40.9	7.9	32.0	0.0	0.0	45.9	-8.1	54.0	
7440.0000	39.0	19.0	A	V	1.0	180	Y	HIGH	40.9	7.9	32.0	0.0	0.0	46.2	-7.8	54.0	
7440.0000	38.7	18.7	A	V	1.0	180	Z	HIGH	40.9	7.9	32.0	0.0	0.0	45.6	-8.4	54.0	

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

No Harmonics nor Emissions found after the 3rd Harmoinc

Test location: Compatible Electronics
Customer : O'NEIL PRODUCT DEVELOPMENT Date : 10/28/2002
Manufacturer : O'NEIL PRODUCT DEVELOPMENT Time : 16.38
EUT name : BLUETOOTH MODULE Model: BT260136
Specification: Fcc_B Test distance: 3.0 mtrs Lab: D
Distance correction factor(20*log(test/spec)) : 0.00
Test Mode : SPURIOUS EMISSIONS 30 MHz TO 1000 MHz
Vertical Polarization
Temperature 72 Degrees F., Relative Humidity 54%
Tested By: Kyle Fujimoto

Pol	Freq MHz	Rdng dBuV	Cable loss dB	Ant factor dB	Amp gain dB	Cor'd rdg = R dBuV	limit = L dBuV/m	Delta R-L dB
1V	30.97	53.30	0.72	14.24	38.50	29.76	40.00	-10.24
2V	43.01	44.10	0.96	12.68	38.50	19.24	40.00	-20.76
3V	84.61	51.30	1.50	7.69	38.41	22.08	40.00	-17.92
4V	147.18	43.00	1.98	12.56	38.51	19.02	43.50	-24.48
5V	163.86	38.60	2.17	13.21	38.44	15.53	43.50	-27.97
6V	178.26	38.80	2.31	14.49	38.41	17.19	43.50	-26.31
7V	290.73	39.20	3.13	18.69	38.46	22.56	46.00	-23.44
8V	299.96	35.20	3.20	19.10	38.50	19.00	46.00	-27.00
9V	330.09	47.70	3.32	13.88	38.44	26.46	46.00	-19.54
10V	355.84	43.50	3.44	14.39	38.38	22.95	46.00	-23.05
11V	360.08	51.70	3.46	14.38	38.36	31.18	46.00	-14.82
12V	450.08	57.50	3.90	15.70	37.80	39.30	46.00	-6.70
13V	535.72	40.10	4.31	16.60	38.14	22.87	46.00	-23.13

Page: 1 of 1

```
Test location: Compatible Electronics
Customer     : O'NEIL PRODUCT DEVELOPMENT        Date : 10/29/2002
Manufacturer : O'NEIL PRODUCT DEVELOPMENT        Time : 08.06
EUT name     : BLUETOOTH MODULE                  Model: BT260136
Specification: Fcc_B    Test distance:  3.0 mtrs   Lab: D
Distance correction factor(20*log(test/spec))        :  0.00
Test Mode    : SPURIOUS EMISSIONS 30 MHz TO 1000 MHz
               Horizontal Polarization
               Temperature 64 Degrees F., Relative Humidity 76%
               Tested By: Kyle Fujimoto
```

Pol	Freq MHz	Rdng dBuV	Cable loss dB	Ant factor dB	Amp gain dB	Cor'd rdg = R dBuV	limit = L dBuV/m	Delta R-L dB
1H	86.03	45.40	1.50	7.72	38.38	16.24	40.00	-23.76
2H	121.03	35.60	1.77	10.84	38.55	9.66	43.50	-33.84
3H	147.49	43.70	1.98	12.55	38.51	19.72	43.50	-23.78
4H	161.75	42.20	2.14	13.04	38.45	18.93	43.50	-24.57
5H	245.83	41.90	2.75	16.75	38.42	22.98	46.00	-23.02
6H	330.03	51.50	3.32	13.88	38.44	30.26	46.00	-15.74
7H	420.09	53.60	3.78	14.86	38.04	34.20	46.00	-11.80
8H	944.58	32.50	5.89	22.36	36.84	23.91	46.00	-22.09

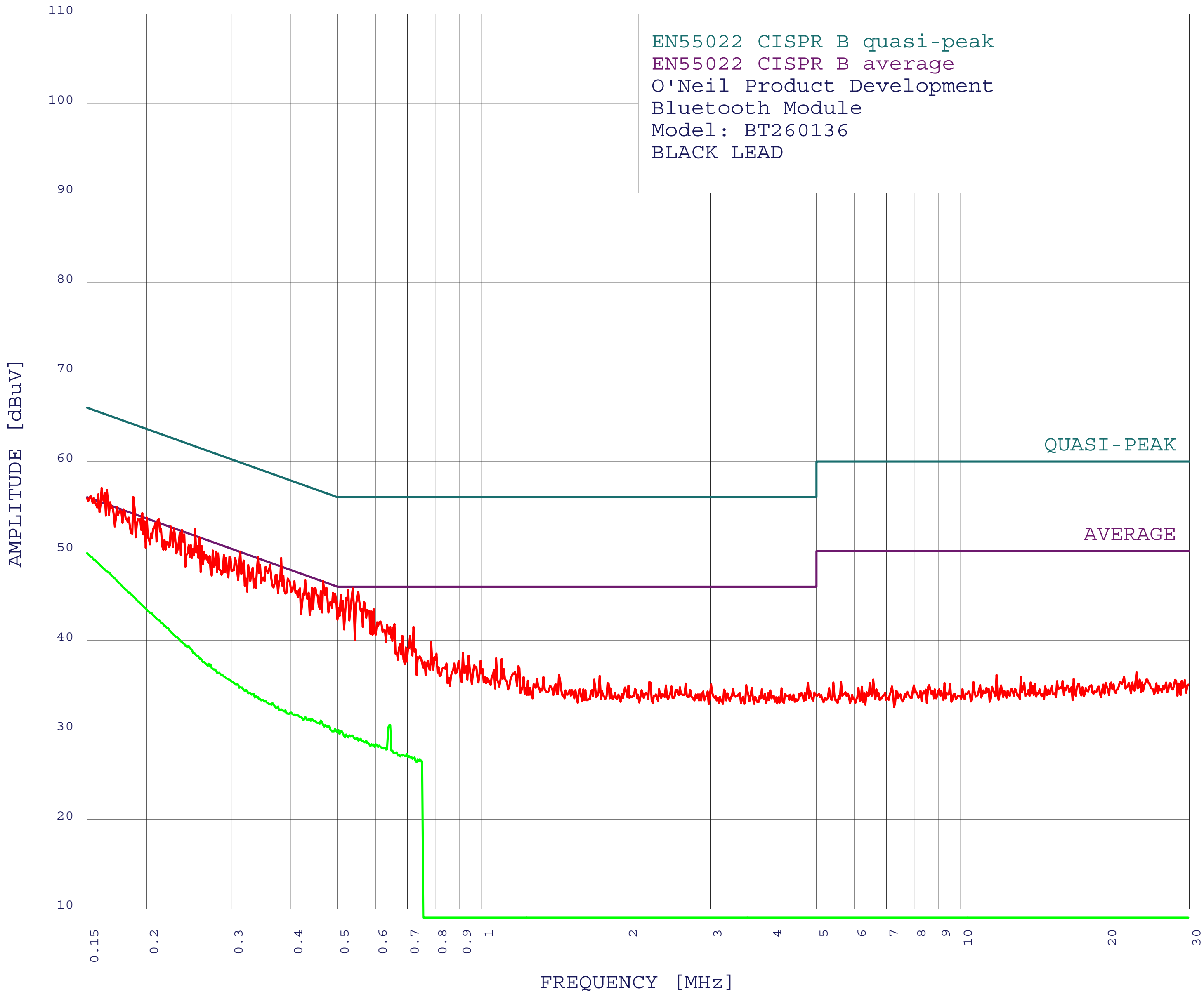
```
                                                             Page: 1 of 1

   Test location: Compatible Electronics
   Customer     : O'NEIL PRODUCT DEVELOPMENT        Date : 10/29/2002
   Manufacturer : O'NEIL PRODUCT DEVELOPMENT        Time : 09.15
   EUT name     : BLUETOOTH MODULE                  Model: BT260136
   Specification: Fcc_B    Test distance:  3.0 mtrs   Lab: D
   Distance correction factor(20*log(test/spec))        :  0.00
   Test Mode    : SPURIOUS EMISSIONS 10 kHz to 30 MHz
                  Vertical and Horizontal Polarization
                  Temperature 67 Degrees F., Relative Humidity 56%
                  Tested By: Kyle Fujimoto

 No Emissions Found in Either Polarization for the EUT from 10 kHz to 30 MHz
```

CONDUCTED EMISSIONS

DATA SHEETS

EMISSION LEVEL [dBuV] PEAK
Graph for Peak & Average

10/30/2002 8:19:12



COMPATIBLE ELECTRONICS

COMPATIBLE ELECTRONICS

10/30/2002 8:19:12

O'Neil Product Development
Bluetooth Module
Model: BT260136
EN 55022 B - Black Lead
TEST ENGINEER : Kyle Fujimoto

18 highest peaks above -50.00 dB of AVERAGE limit line
Peak criteria : 3.00 dB, Curve : Peak

Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)
1	0.187	56.03	54.15	1.89*
2	0.381	49.23	48.25	0.98*
3	0.252	52.43	51.68	0.75*
4	0.341	49.33	49.17	0.16*
5	0.200	53.73	53.61	0.12*
6	0.467	46.63	46.57	0.05*
7	0.313	49.93	49.88	0.05*
8	0.538	45.82	46.00	-0.18*
9	0.527	45.62	46.00	-0.38*
10	0.428	46.73	47.28	-0.56*
11	0.553	45.42	46.00	-0.58*
12	0.720	41.52	46.00	-4.48*
13	0.785	39.82	46.00	-6.18
14	0.914	38.61	46.00	-7.39
15	1.072	38.01	46.00	-7.99
16	1.101	37.91	46.00	-8.09
17	1.764	36.04	46.00	-9.96
18	23.294	36.45	50.00	-13.55

* Please See the Average Readings on the Next Page and on the Plot

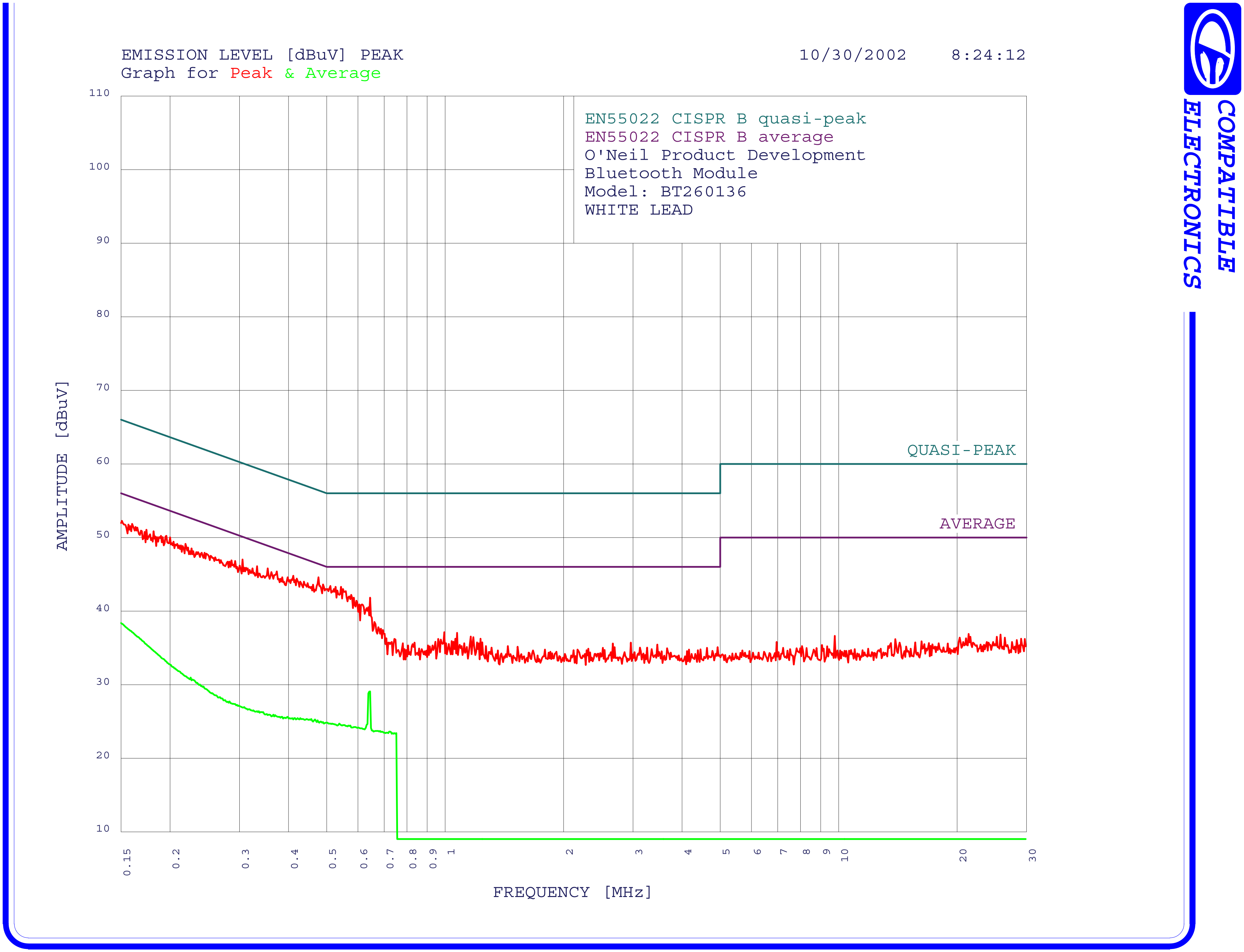
COMPATIBLE ELECTRONICS

10/30/2002 8:19:12

O'Neil Product Development
Bluetooth Module
Model: BT260136
EN 55022 - Black Lead
TEST ENGINEER : Kyle Fujimoto

30 highest peaks above -50.00 dB of AVERAGE limit line
Peak criteria : 0.00 dB, Curve : Average

Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)
1	0.204	43.11	53.44	-10.33
2	0.215	41.99	53.00	-11.00
3	0.221	41.44	52.78	-11.33
4	0.242	39.42	52.03	-12.61
5	0.245	39.33	51.94	-12.61
6	0.263	37.60	51.33	-13.72
7	0.272	37.30	51.06	-13.76
8	0.269	37.38	51.15	-13.77
9	0.278	36.76	50.89	-14.13
10	0.283	36.40	50.72	-14.32
11	0.296	35.72	50.36	-14.64
12	0.309	35.08	50.01	-14.93
13	0.317	34.74	49.79	-15.05
14	0.313	34.78	49.88	-15.10
15	0.322	34.47	49.66	-15.19
16	0.334	34.06	49.34	-15.28
17	0.329	34.13	49.48	-15.35
18	0.645	30.55	46.00	-15.45
19	0.338	33.79	49.26	-15.47
20	0.341	33.68	49.17	-15.49
21	0.366	33.01	48.60	-15.59
22	0.348	33.38	49.00	-15.62
23	0.462	31.04	46.66	-15.62
24	0.345	33.45	49.09	-15.64
25	0.354	33.23	48.87	-15.64
26	0.362	32.91	48.68	-15.78
27	0.376	32.60	48.38	-15.78
28	0.442	31.23	47.01	-15.79
29	0.428	31.47	47.28	-15.82
30	0.389	32.21	48.08	-15.87



EMISSION LEVEL [dBuV] PEAK
Graph for Peak & Average
10/30/2002 8:24:12
EN55022 CISPR B quasi-peak
EN55022 CISPR B average
O'Neil Product Development
Bluetooth Module
Model: BT260136
WHITE LEAD
QUASI-PEAK
AVERAGE
AMPLITUDE [dBuV]
FREQUENCY [MHz]
110
100
90
80
70
60
50
40
30
20
10
0.15
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
2
3
4
5
6
7
8
9
10
20
30
COMPATIBLE ELECTRONICS

COMPATIBLE ELECTRONICS

10/30/2002 8:24:12

O'Neil Product Development
Bluetooth Module
Model: BT260136
EN 55022 B - White Lead
TEST ENGINEER : Kyle Fujimoto

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30 highest peaks above -50.00 dB of AVERAGE limit line
Peak criteria : 1.00 dB, Curve : Peak

Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)
1	0.476	44.60	46.40	-1.80*
2	0.489	43.60	46.18	-2.58*
3	0.544	43.30	46.00	-2.70*
4	0.411	44.80	47.63	-2.83*
5	0.550	43.00	46.00	-3.00*
6	0.374	45.39	48.42	-3.03*
7	0.354	45.79	48.87	-3.07*
8	0.305	46.99	50.09	-3.10*
9	0.333	46.09	49.39	-3.30*
10	0.196	50.23	53.79	-3.56*
11	0.182	50.84	54.41	-3.57*
12	0.160	51.84	55.46	-3.62*
13	0.174	51.04	54.76	-3.72*
14	0.219	49.12	52.86	-3.74*
15	0.190	50.23	54.06	-3.82*
16	0.645	41.81	46.00	-4.19*
17	0.586	41.80	46.00	-4.20*
18	0.615	40.91	46.00	-5.09*
19	0.605	40.90	46.00	-5.10*
20	0.661	38.51	46.00	-7.49*
21	0.695	37.41	46.00	-8.59*
22	0.995	37.12	46.00	-8.88
23	1.072	37.03	46.00	-8.97
24	1.161	36.53	46.00	-9.47
25	1.180	36.43	46.00	-9.57
26	1.230	36.23	46.00	-9.77
27	1.061	36.23	46.00	-9.77
28	0.960	36.22	46.00	-9.78
29	0.743	36.21	46.00	-9.79
30	1.039	35.92	46.00	-10.08

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* Please See the Average Readings on the Next Page and on the Plot

COMPATIBLE ELECTRONICS

10/30/2002 8:24:12

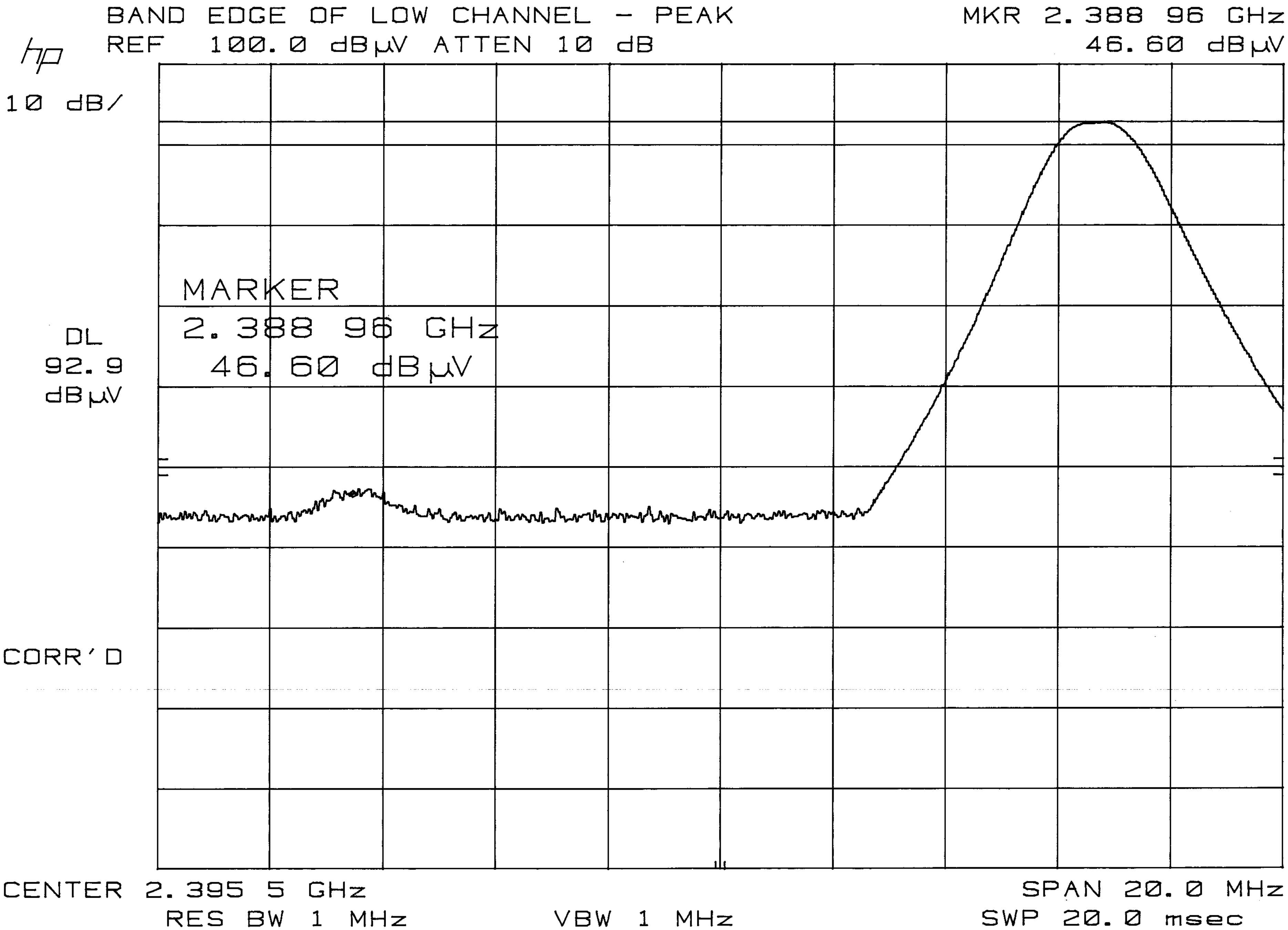
O'Neil Product Development
Bluetooth Module
Model: BT260136
EN 55022 B - White Lead
TEST ENGINEER : Kyle Fujimoto

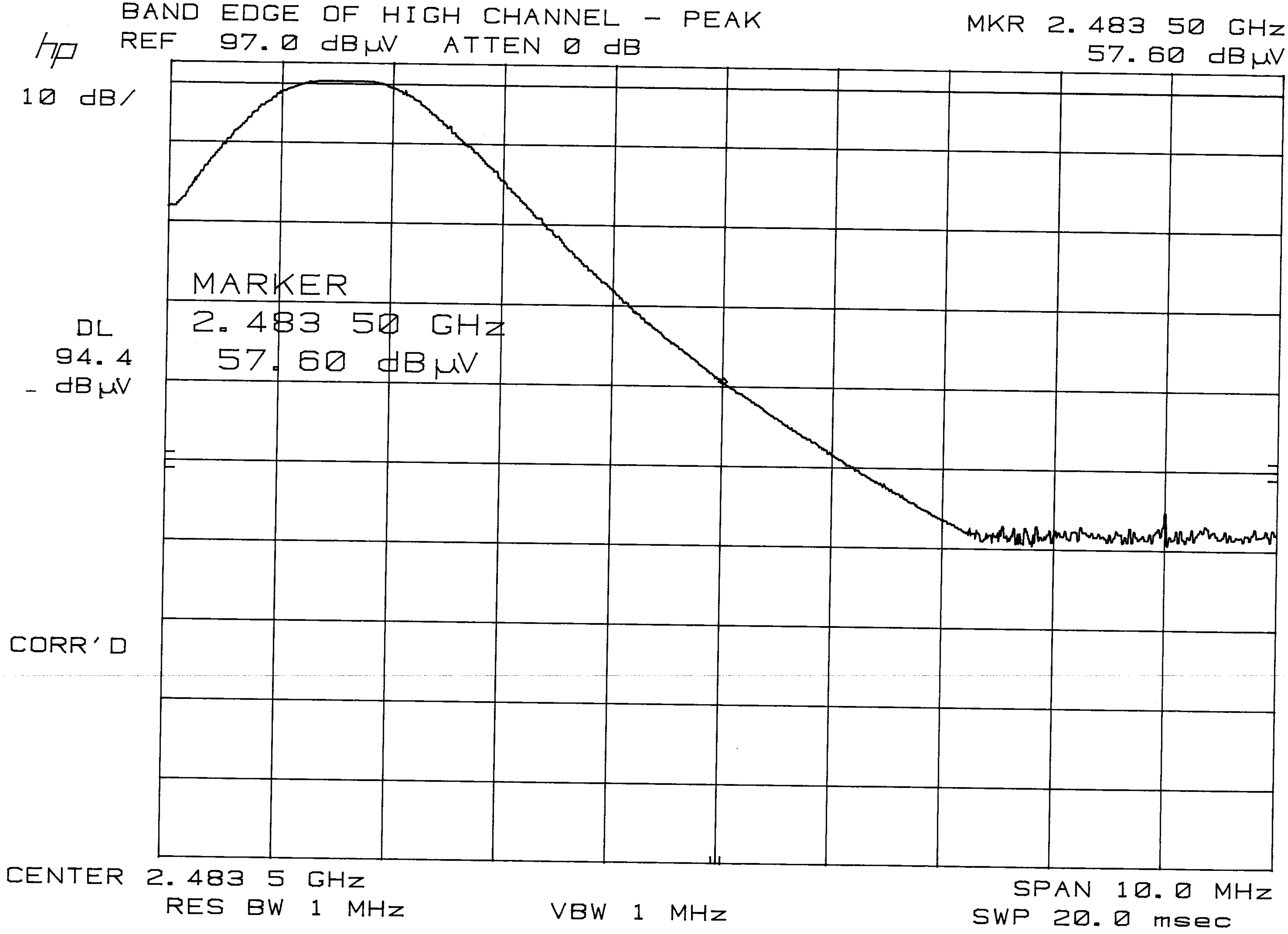
----
30 highest peaks above -50.00 dB of AVERAGE limit line
Peak criteria : 0.00 dB, Curve : Average

Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)
1	0.645	29.08	46.00	-16.92
2	0.503	24.83	46.00	-21.17
3	0.489	24.90	46.18	-21.28
4	0.538	24.71	46.00	-21.29
5	0.516	24.71	46.00	-21.29
6	0.511	24.71	46.00	-21.29
7	0.474	25.15	46.44	-21.30
8	0.467	25.27	46.57	-21.30
9	0.484	24.96	46.27	-21.31
10	0.522	24.64	46.00	-21.36
11	0.527	24.58	46.00	-21.42
12	0.457	25.33	46.75	-21.42
13	0.556	24.51	46.00	-21.49
14	0.574	24.45	46.00	-21.55
15	0.568	24.45	46.00	-21.55
16	0.452	25.27	46.84	-21.57
17	0.562	24.38	46.00	-21.62
18	0.226	30.97	52.61	-21.64
19	0.445	25.33	46.97	-21.64
20	0.592	24.24	46.00	-21.76
21	0.435	25.33	47.15	-21.83
22	0.601	24.17	46.00	-21.83
23	0.428	25.45	47.28	-21.84
24	0.228	30.68	52.52	-21.84
25	0.615	24.05	46.00	-21.95
26	0.422	25.45	47.41	-21.96
27	0.621	23.98	46.00	-22.02
28	0.234	30.25	52.30	-22.05
29	0.415	25.45	47.54	-22.09
30	0.238	30.01	52.16	-22.15

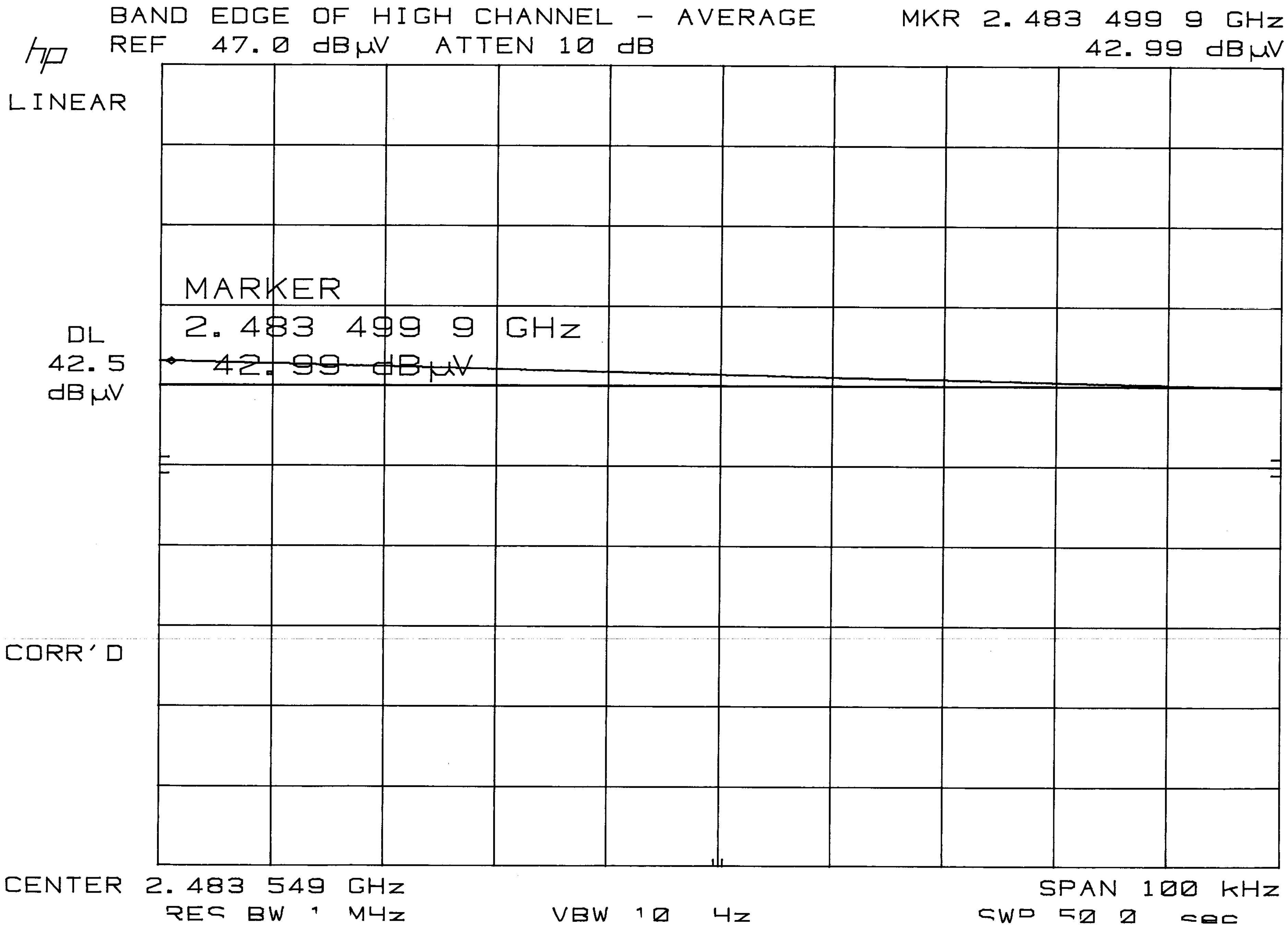
BAND EDGE

DATA SHEETS


BAND EDGE OF LOW CHANNEL - PEAK
REF 100.0 dBµV ATTEN 10 dB
MKR 2.388 96 GHz
46.60 dBµV
10 dB/
MARKER
2.388 96 GHz
46.60 dBµV
DL
92.9
dBµV
CORR'D
CENTER 2.395 5 GHz
RES BW 1 MHz
VBW 1 MHz
SPAN 20.0 MHz
SWP 20.0 msec



BAND EDGE OF HIGH CHANNEL - PEAK
REF 97.0 dBμV ATTEN 0 dB
MKR 2.483 50 GHz
57.60 dBμV
10 dB/
MARKER
2.483 50 GHz
57.60 dBμV
DL
94.4
dBμV
CORR'D
CENTER 2.483 5 GHz
RES BW 1 MHz
VBW 1 MHz
SPAN 10.0 MHz
SWP 20.0 msec


BAND EDGE OF HIGH CHANNEL - AVERAGE
MKR 2.483 499 9 GHz
REF 47.0 dBμV ATTEN 10 dB
42.99 dBμV
LINEAR
MARKER
2.483 499 9 GHz
42.99 dBμV
DL
42.5
dBμV
CORR'D
CENTER 2.483 549 GHz
SPAN 100 kHz
VBW 10 Hz

RADIATED EMISSIONS (FCC SECTION 15.205 AND 15.247)

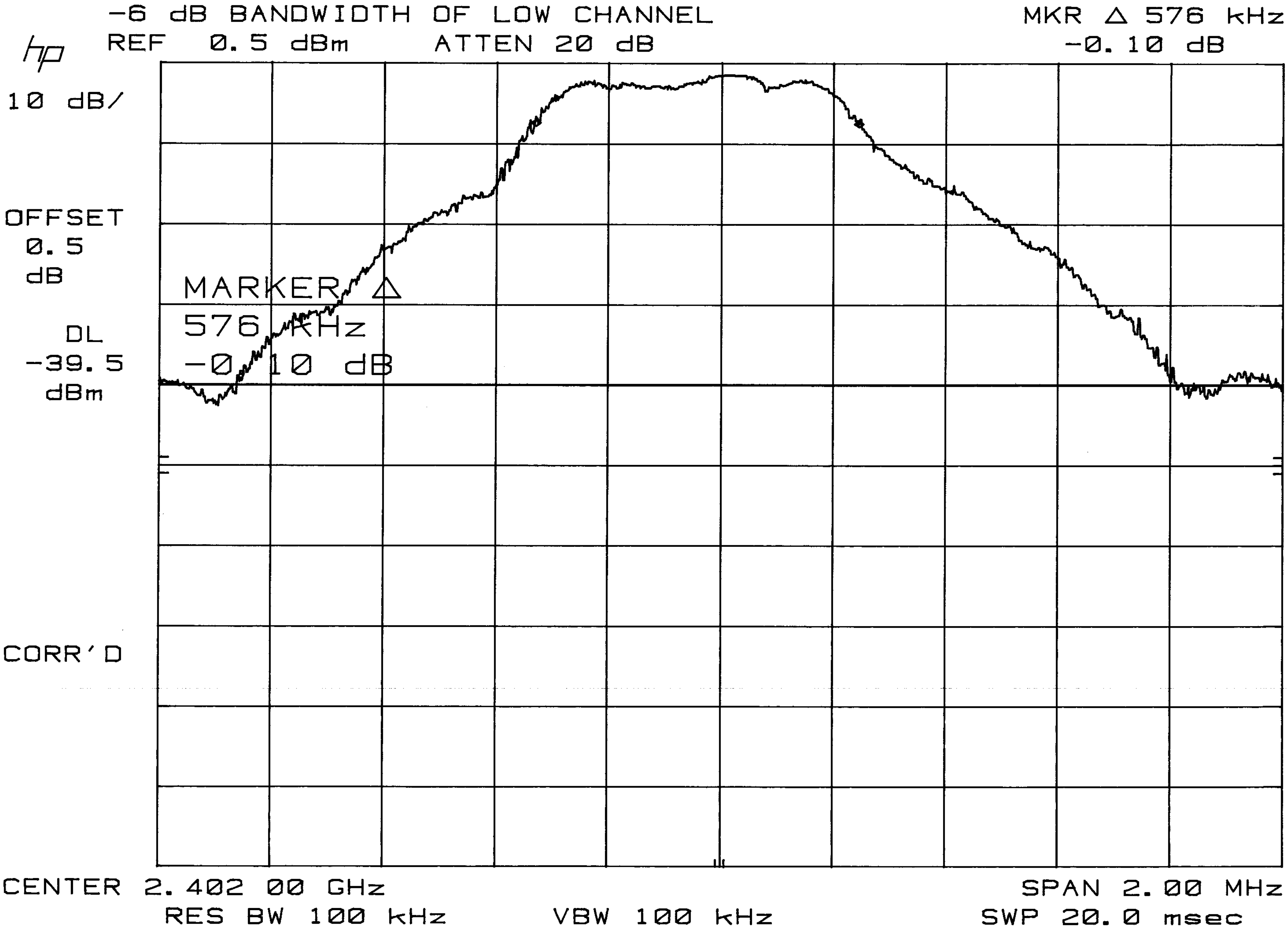
COMPANY	**O'NEIL PRODUCT DEVELOPMENT**	**DATE**	**10/28/02**
EUT	**BLUETOOTH MODULE**	**DUTY CYCLE**	**<10 %**
MODEL	**BT260136**	**PEAK TO AVG**	**-20 dB**
S/N	**N/A**	**TEST DIST.**	**3 Meters**
TEST ENGINEER	**KYLE FUJIMOTO**	**LAB**	**D**

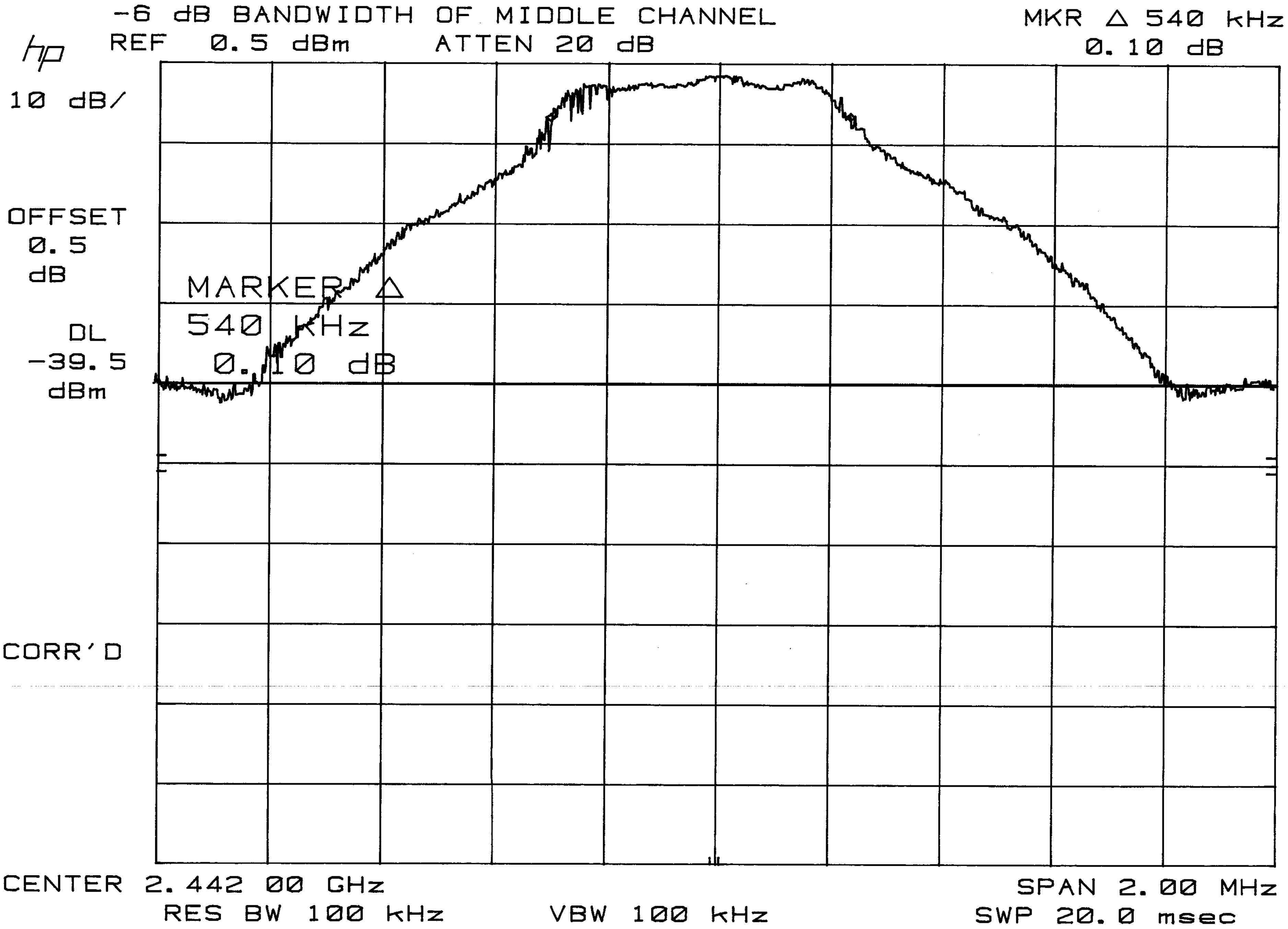
Frequency MHz	Peak Reading (dBuV)	Average (A) or Quasi-Peak (QP)	Antenna Polar. (V or H)	Antenna Height (meters)	EUT Azimuth (degrees)	EUT Axis (X,Y,Z)	EUT Tx Channel	Antenna Factor (dB)	Cable Loss (dB)	Amplifier Gain (dB)	Distance Factor (dB)	Mixer Factor (dB)	*Corrected Reading (dBuV/m)	Delta ** (dB)	Spec Limit (dBuV/m)	Comments
2388.9600	46.6	A	V	1.0	180	Y	LOW	30.2	3.6	33.0	0.0	0.0	**47.4**	**-6.6**	**54.0**	**Band Edge Low Channel**
2483.5000	57.6	43.0 A	V	1.0	90	Y	LOW	30.4	3.5	33.3	0.0	0.0	**43.6**	**-10.4**	**54.0**	**Band Edge High Channel**

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

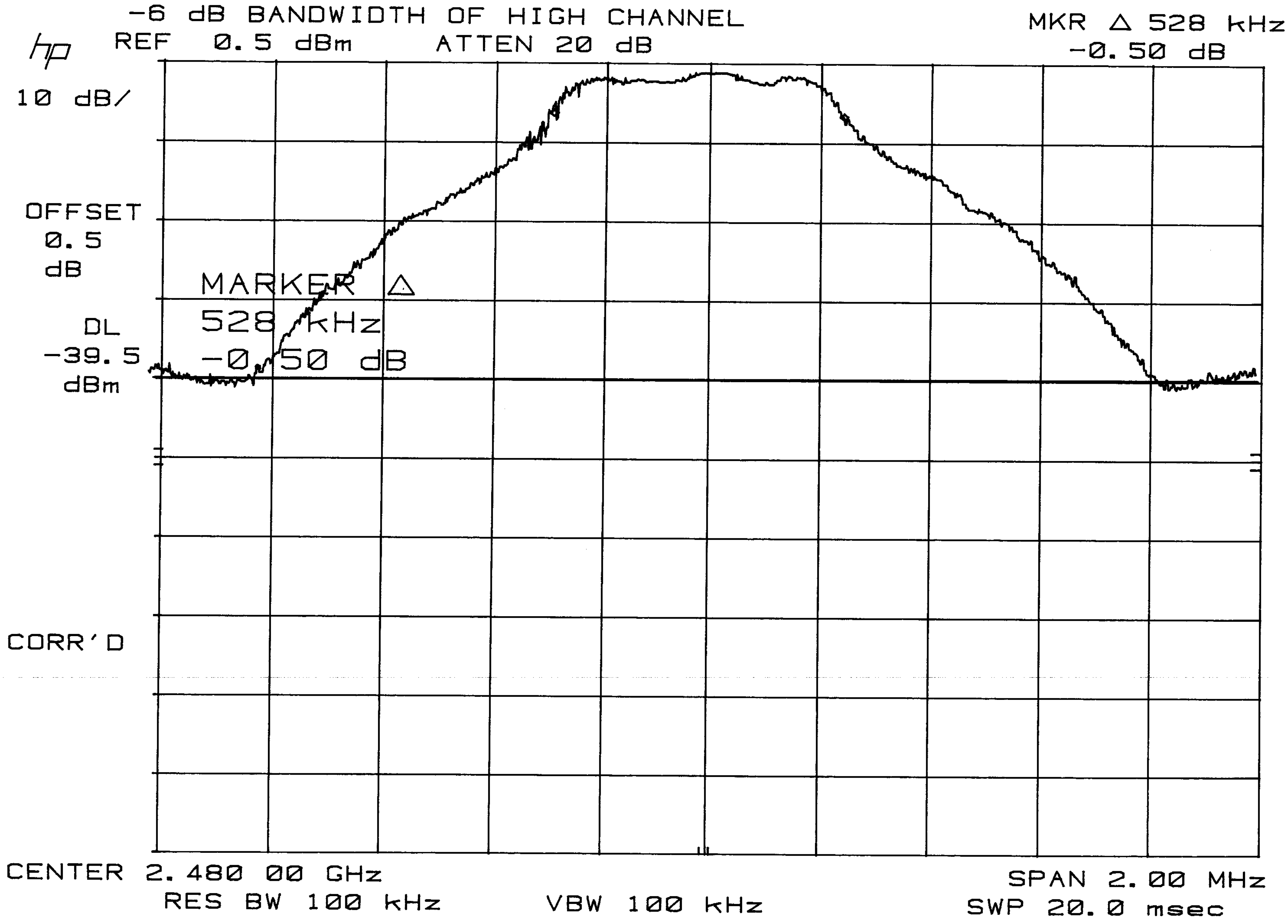
-6 dB BANDWIDTH

DATA SHEETS


-6 dB BANDWIDTH OF LOW CHANNEL
MKR △ 576 kHz
REF 0.5 dBm
ATTEN 20 dB
-0.10 dB
hp
10 dB/
OFFSET
0.5
dB
DL
-39.5
dBm
MARKER △
576 kHz
-0.10 dB
CORR'D
CENTER 2.402 00 GHz
SPAN 2.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

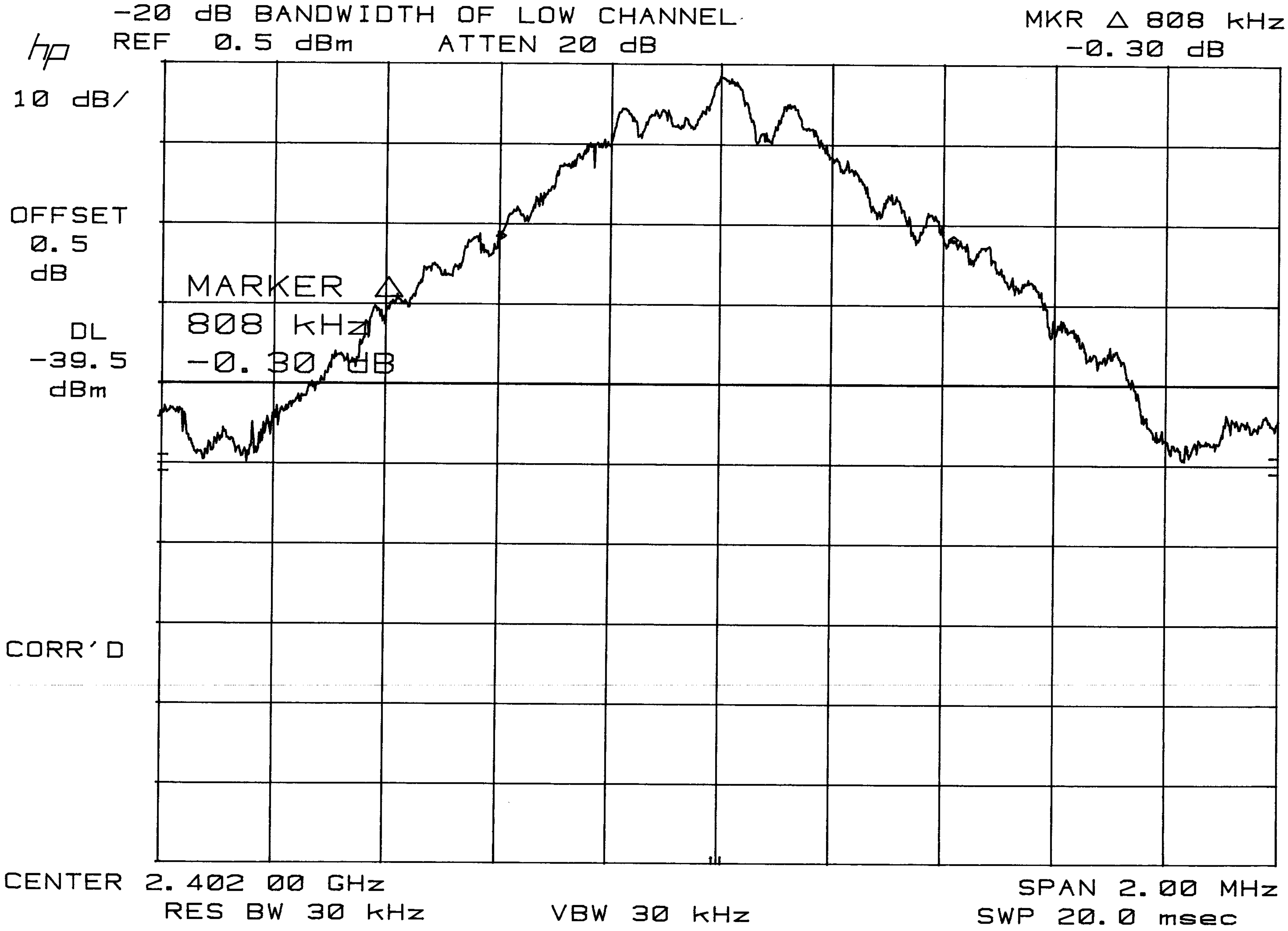


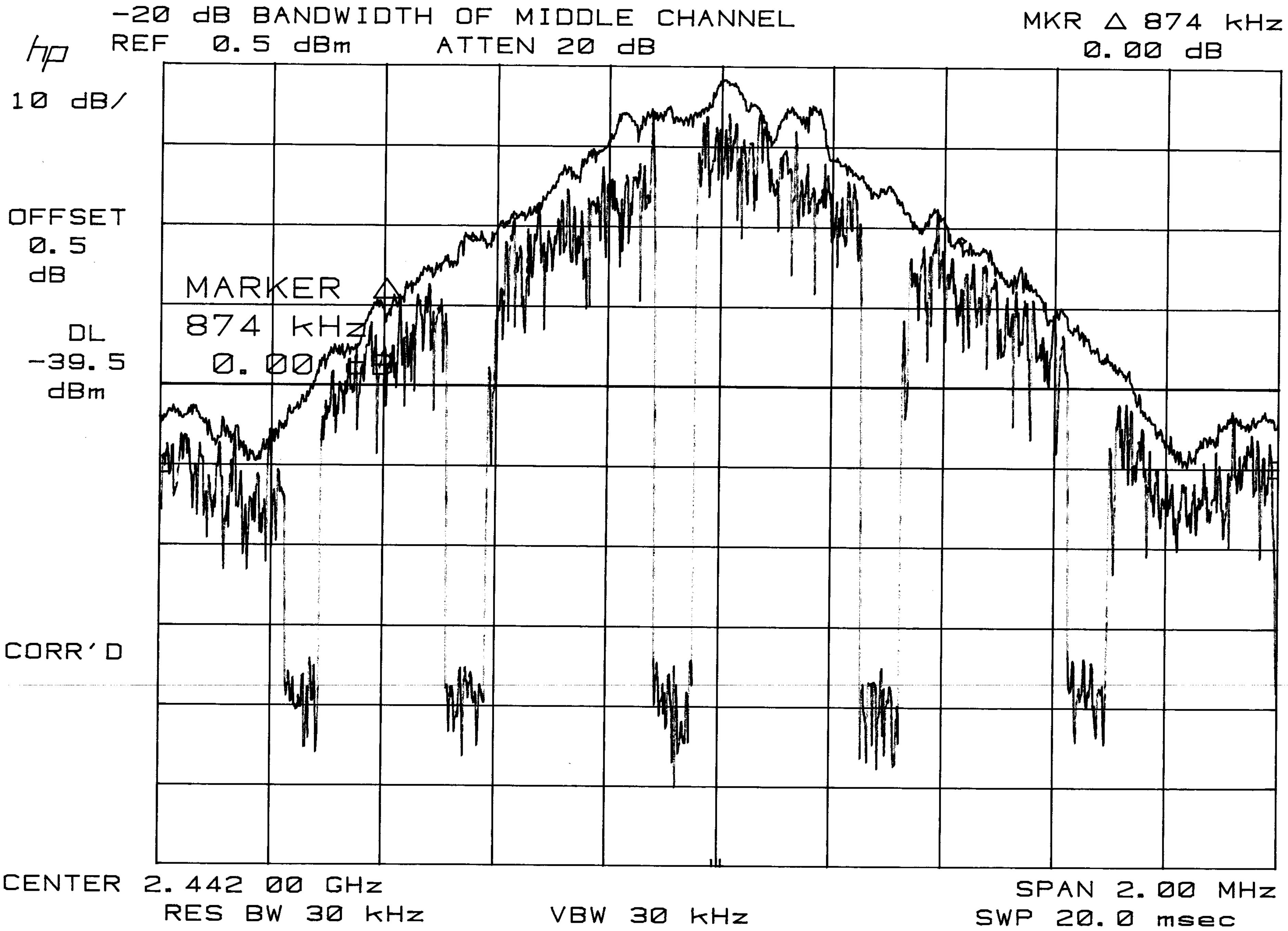
-6 dB BANDWIDTH OF MIDDLE CHANNEL
REF 0.5 dBm ATTEN 20 dB
MKR △ 540 kHz
0.10 dB
hp
10 dB/
OFFSET
0.5
dB
MARKER △
540 kHz
0.10 dB
DL
-39.5
dBm
CORR'D
CENTER 2.442 00 GHz
SPAN 2.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

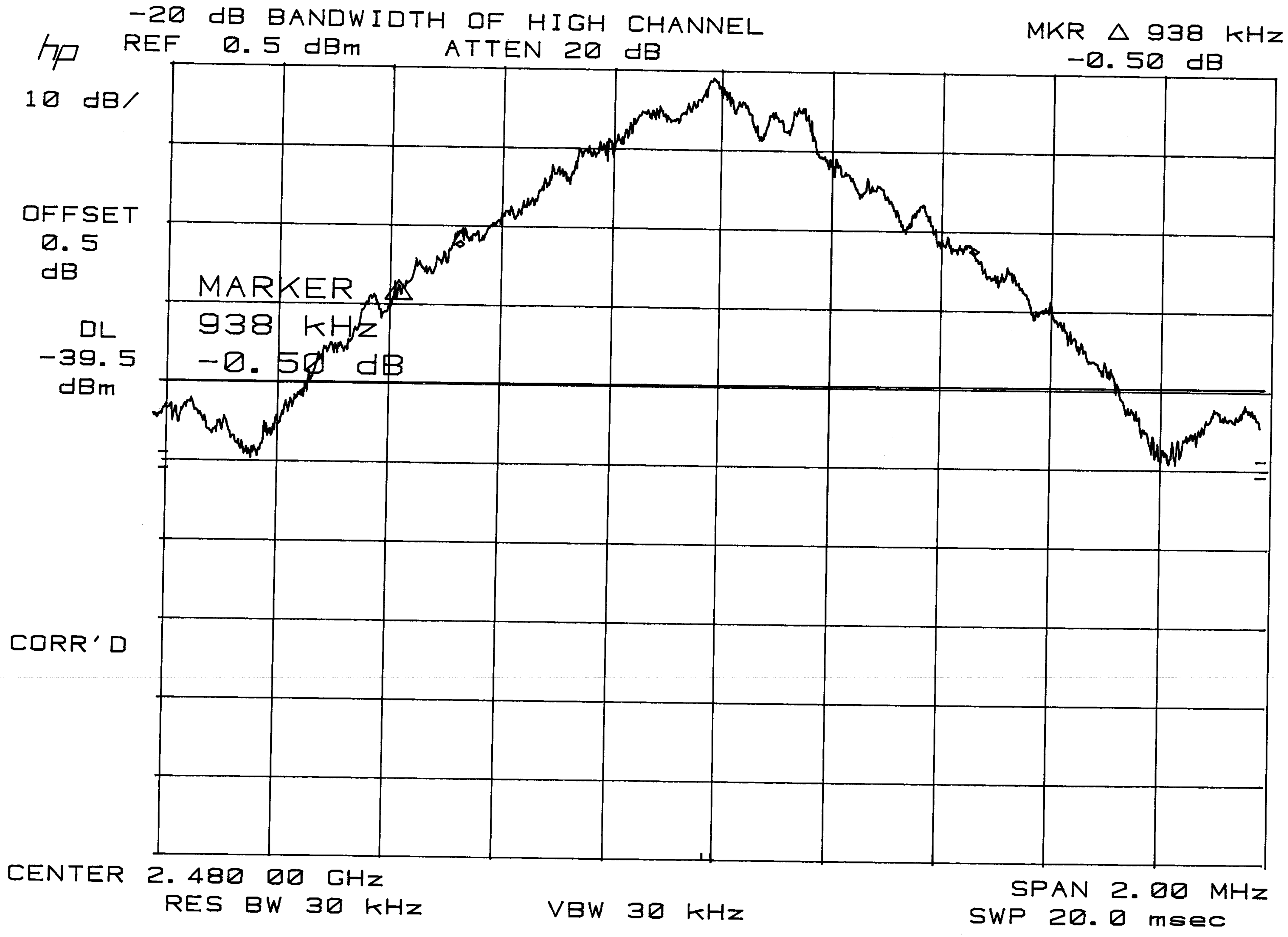

-6 dB BANDWIDTH OF HIGH CHANNEL
REF 0.5 dBm ATTEN 20 dB
MKR △ 528 kHz
-0.50 dB
hp
10 dB/
OFFSET
0.5
dB
MARKER △
528 kHz
-0.50 dB
DL
-39.5
dBm
CORR'D
CENTER 2.480 00 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 2.00 MHz
SWP 20.0 msec

-20 dB BANDWIDTH

DATA SHEETS

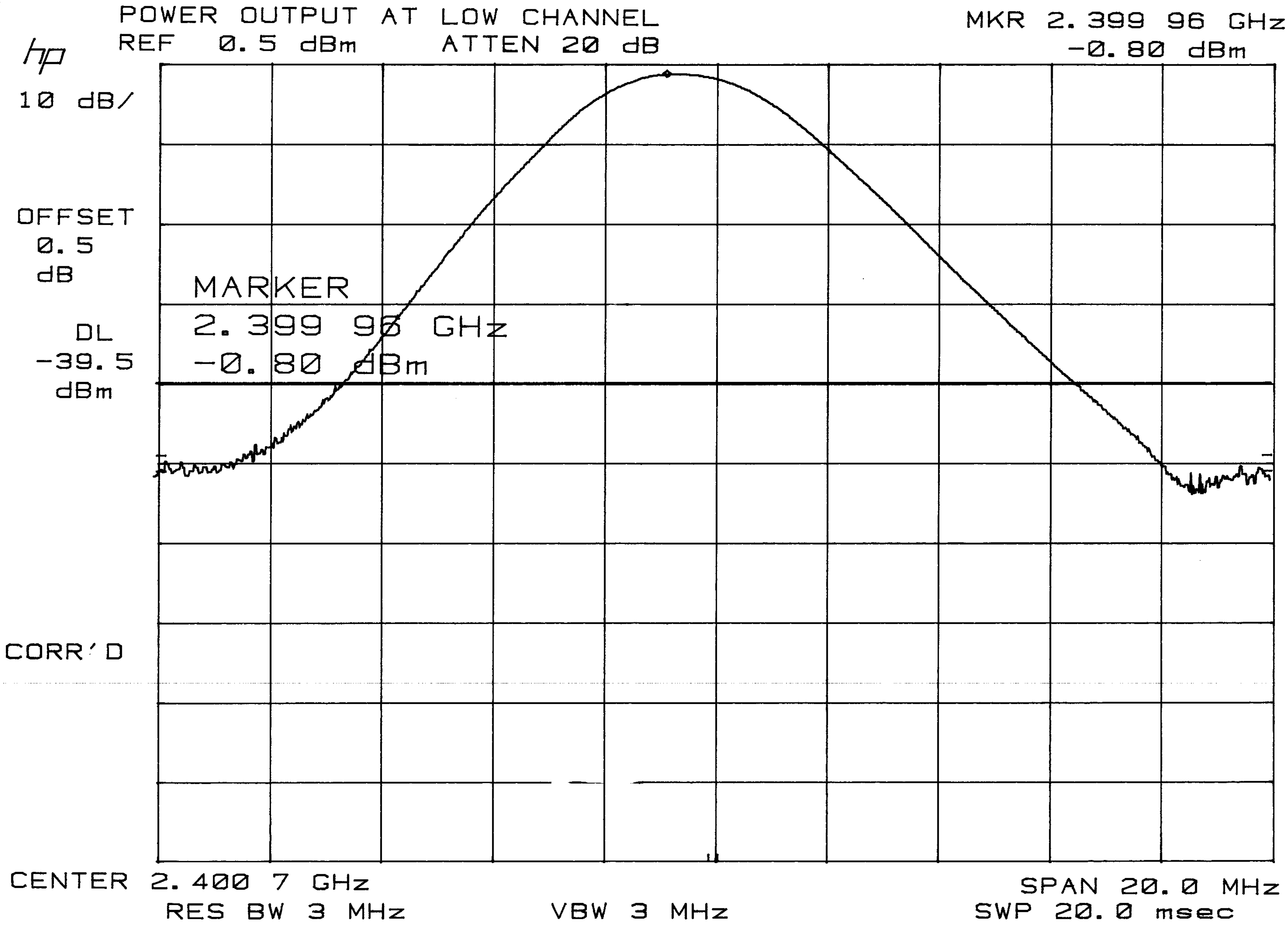

-20 dB BANDWIDTH OF LOW CHANNEL
hp
REF 0.5 dBm ATTEN 20 dB
MKR △ 808 kHz
-0.30 dB
10 dB/
OFFSET
0.5
dB
MARKER △
808 kHz
-0.30 dB
DL
-39.5
dBm
CORR'D
CENTER 2.402 00 GHz
RES BW 30 kHz
VBW 30 kHz
SPAN 2.00 MHz
SWP 20.0 msec

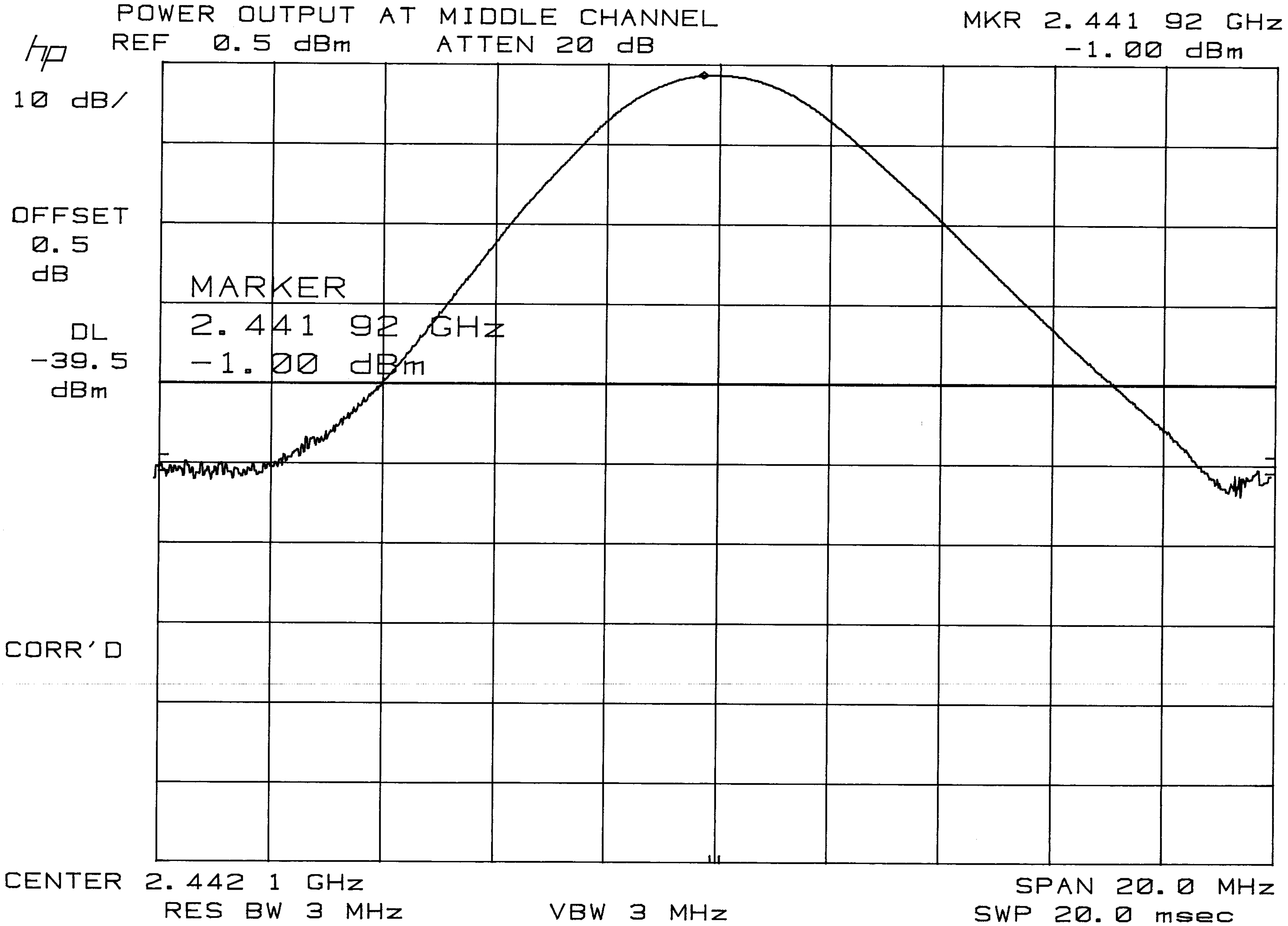

-20 dB BANDWIDTH OF MIDDLE CHANNEL
REF 0.5 dBm ATTEN 20 dB
MKR △ 874 kHz
0.00 dB
hp
10 dB/
OFFSET
0.5
dB
DL
-39.5
dBm
MARKER △
874 kHz
CORR'D
CENTER 2.442 00 GHz
RES BW 30 kHz
VBW 30 kHz
SPAN 2.00 MHz
SWP 20.0 msec

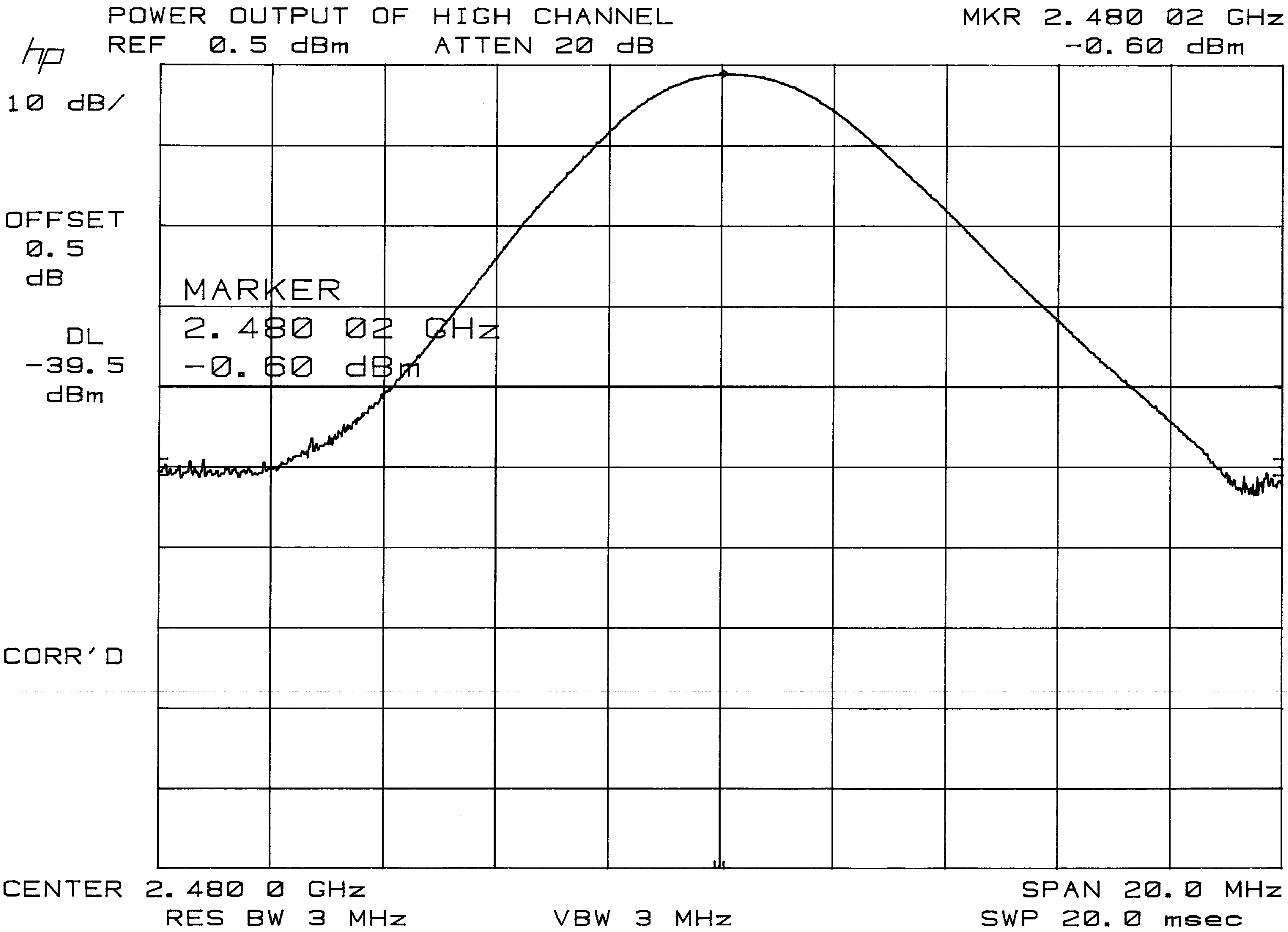

-20 dB BANDWIDTH OF HIGH CHANNEL
hp
REF 0.5 dBm
ATTEN 20 dB
MKR △ 938 kHz
-0.50 dB
10 dB/
OFFSET
0.5
dB
MARKER △
938 kHz
-0.50 dB
DL
-39.5
dBm
CORR'D
CENTER 2.480 00 GHz
RES BW 30 kHz
VBW 30 kHz
SPAN 2.00 MHz
SWP 20.0 msec

PEAK POWER OUTPUT

DATA SHEETS

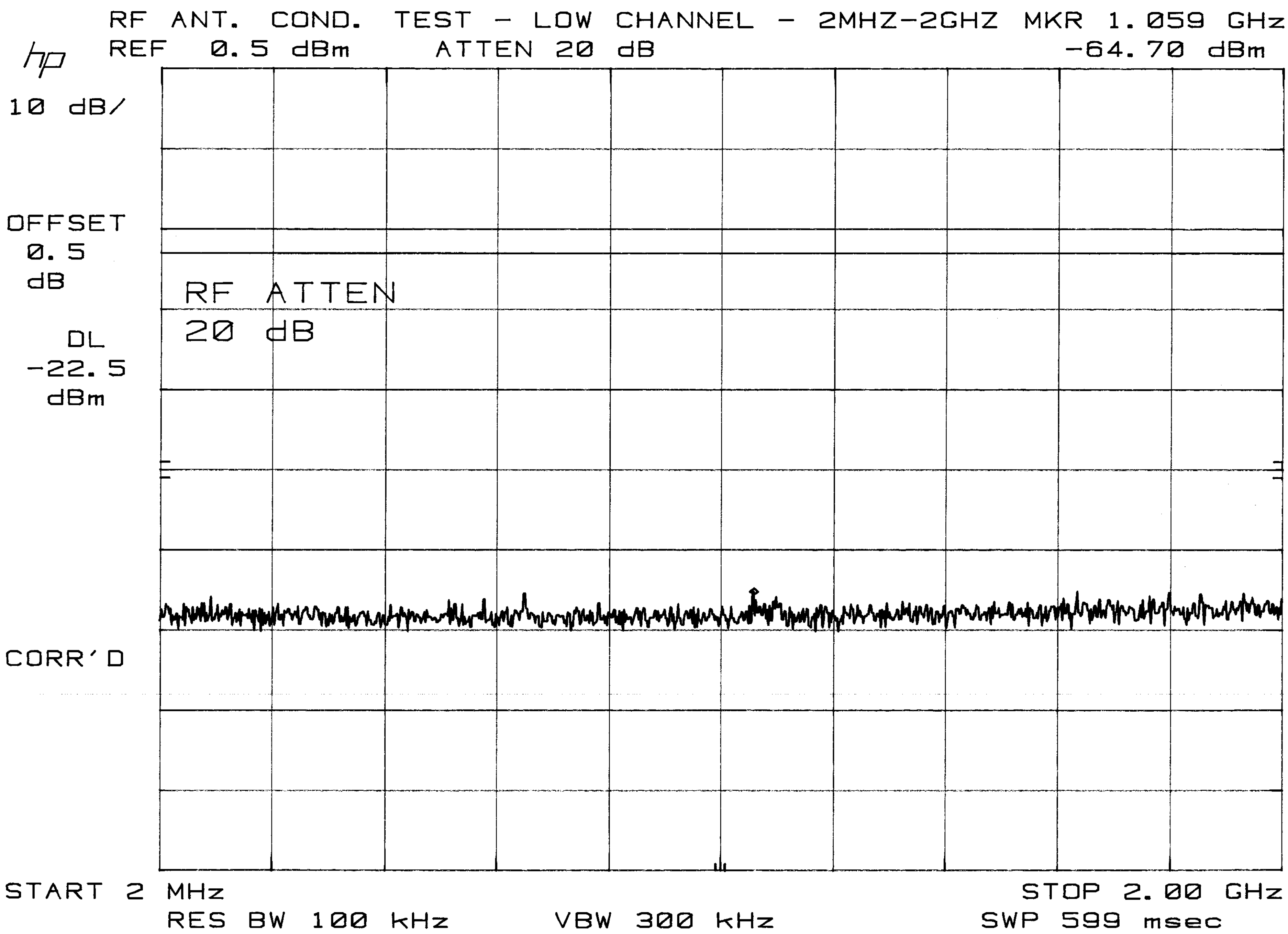

POWER OUTPUT AT LOW CHANNEL
REF 0.5 dBm ATTEN 20 dB
MKR 2.399 96 GHz
-0.80 dBm
hp
10 dB/
OFFSET
0.5
dB
MARKER
2.399 96 GHz
-0.80 dBm
DL
-39.5
dBm
CORR'D
CENTER 2.400 7 GHz
SPAN 20.0 MHz
RES BW 3 MHz
VBW 3 MHz
SWP 20.0 msec

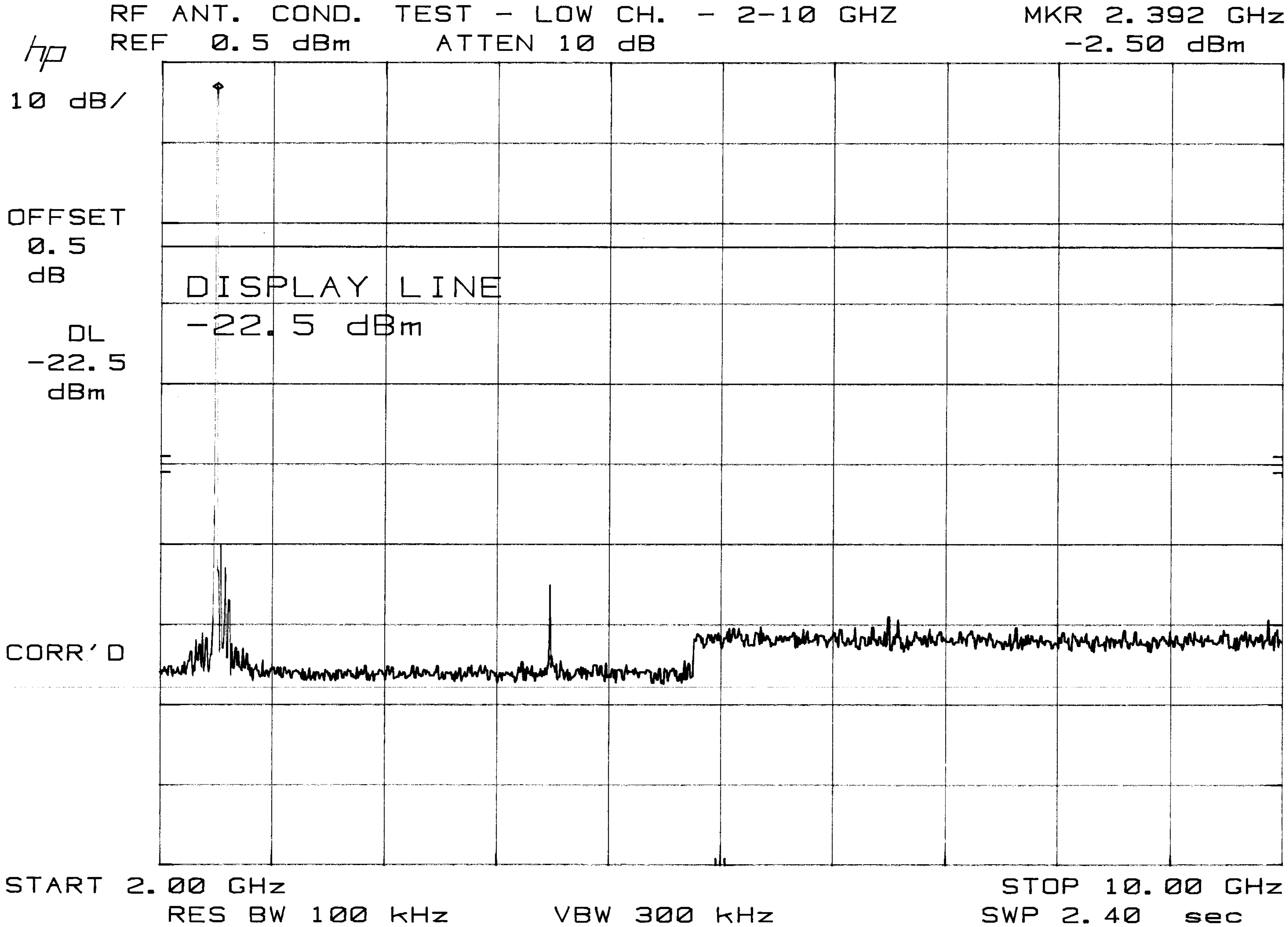

POWER OUTPUT AT MIDDLE CHANNEL
REF 0.5 dBm ATTEN 20 dB
MKR 2.441 92 GHz
-1.00 dBm
10 dB/
OFFSET
0.5
dB
MARKER
2.441 92 GHz
-1.00 dBm
DL
-39.5
dBm
CORR'D
CENTER 2.442 1 GHz
RES BW 3 MHz
VBW 3 MHz
SPAN 20.0 MHz
SWP 20.0 msec

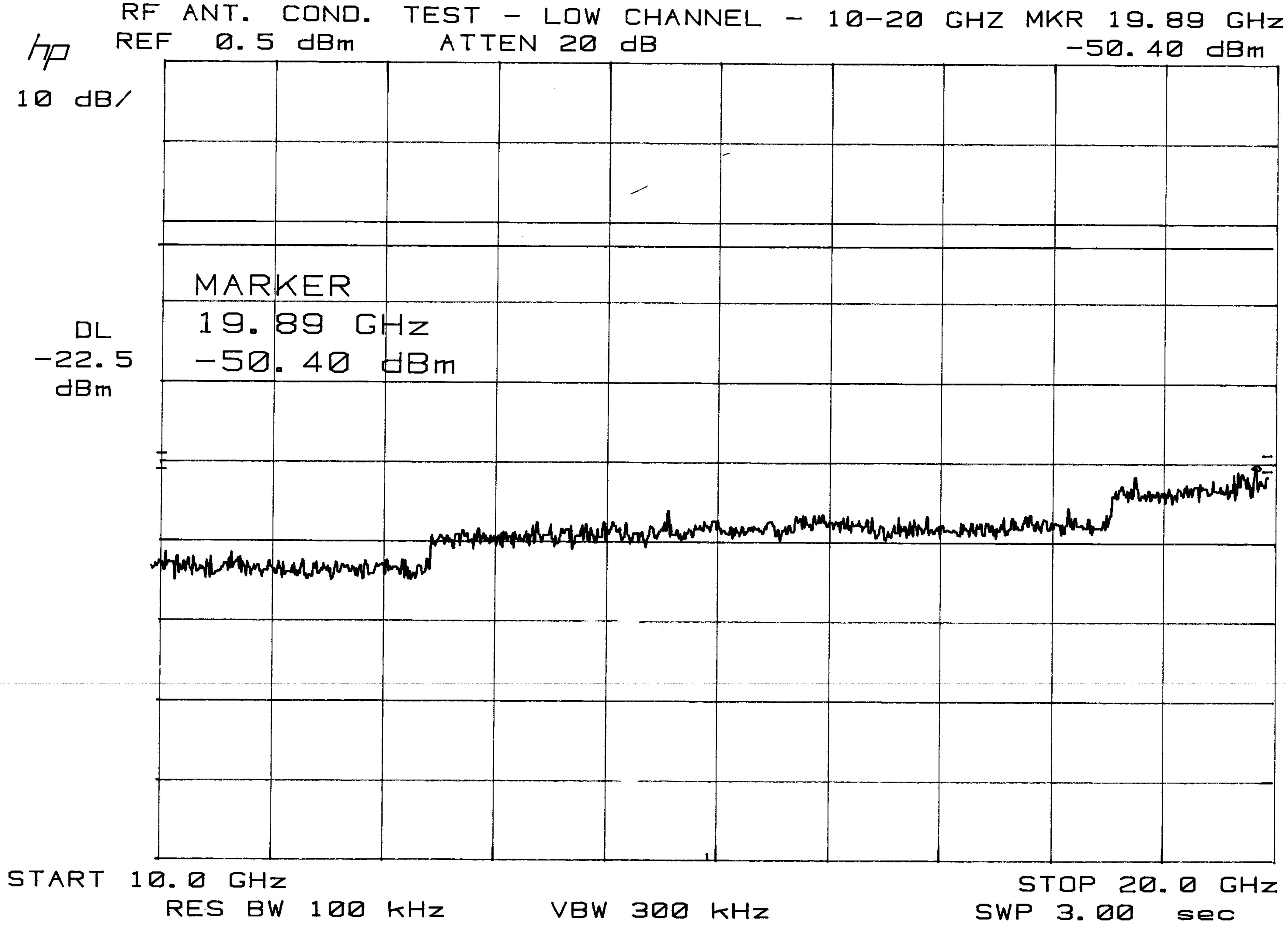

POWER OUTPUT OF HIGH CHANNEL
REF 0.5 dBm ATTEN 20 dB
MKR 2.480 02 GHz
-0.60 dBm
10 dB/
OFFSET
0.5
dB
DL
-39.5
dBm
MARKER
2.480 02 GHz
-0.60 dBm
CORR'D
CENTER 2.480 0 GHz
RES BW 3 MHz
VBW 3 MHz
SPAN 20.0 MHz
SWP 20.0 msec

RF CONDUCTED ANTENNA TEST

DATA SHEETS


RF ANT. COND. TEST - LOW CHANNEL - 2MHZ-2GHZ MKR 1.059 GHz
REF 0.5 dBm ATTEN 20 dB -64.70 dBm
hp
10 dB/
OFFSET
0.5
dB
DL
-22.5
dBm
RF ATTEN
20 dB
CORR'D
START 2 MHz
STOP 2.00 GHz
RES BW 100 kHz VBW 300 kHz SWP 599 msec


RF ANT. COND. TEST - LOW CH. - 2-10 GHZ
MKR 2.392 GHz
REF 0.5 dBm ATTEN 10 dB
-2.50 dBm
hp
10 dB/
OFFSET
0.5
dB
DL
-22.5
dBm
DISPLAY LINE
-22.5 dBm
CORR'D
START 2.00 GHz
STOP 10.00 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 2.40 sec



RF ANT. COND. TEST - LOW CHANNEL - 10-20 GHZ MKR 19.89 GHz
REF 0.5 dBm ATTEN 20 dB
-50.40 dBm
hp
10 dB/
MARKER
19.89 GHz
-50.40 dBm
DL
-22.5
dBm
START 10.0 GHz
RES BW 100 kHz
VBW 300 kHz
STOP 20.0 GHz
SWP 3.00 sec

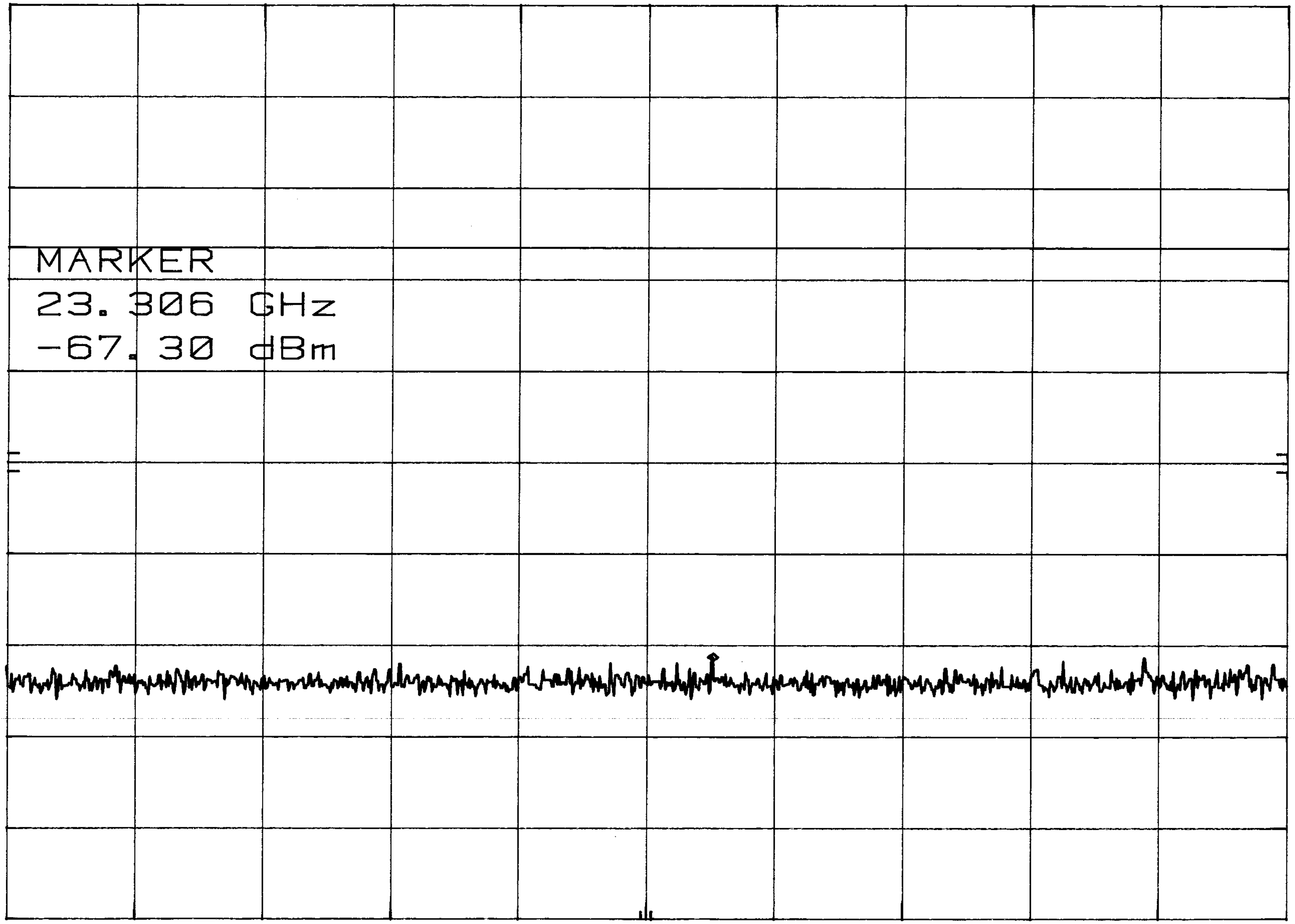
RF ANT. COND. TEST - LOW CHANNEL - 20-26GHZ MKR 23.306 GHz
REF 4.0 dBm HARMONIC 6L -67.30 dBm

hp

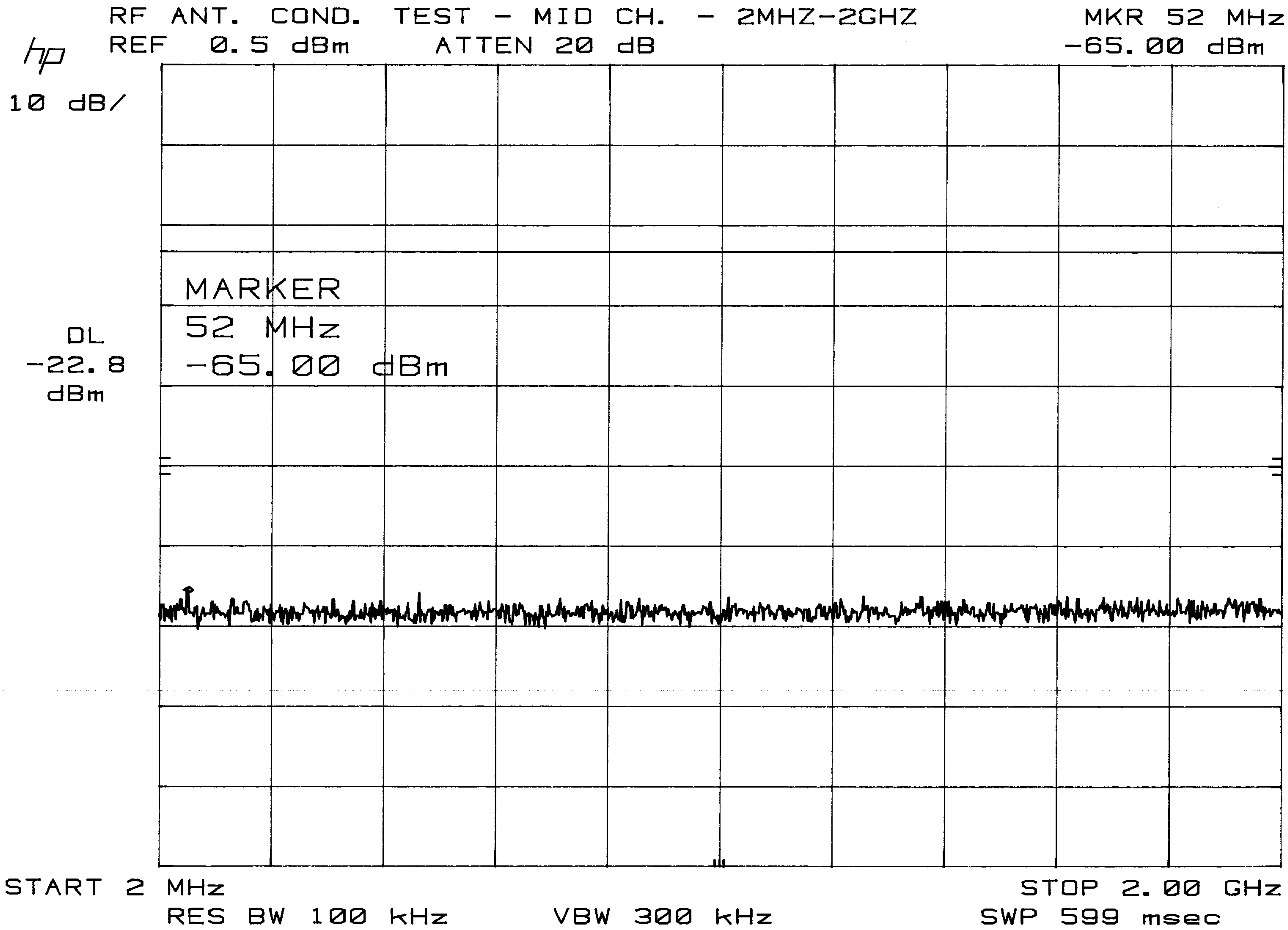
10 dB/

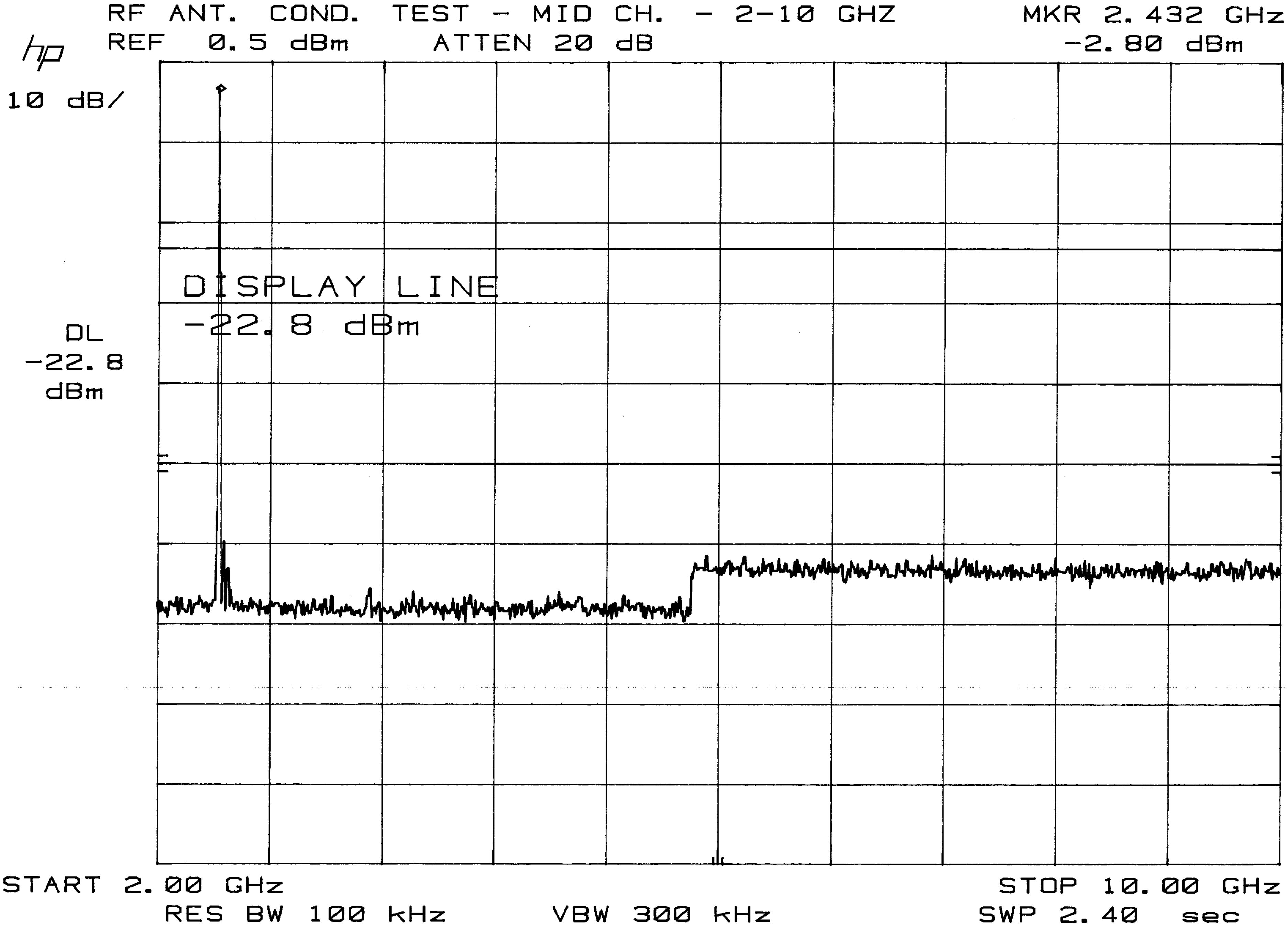
CNVLOSS
22.0
dB

DL
-22.5
dBm

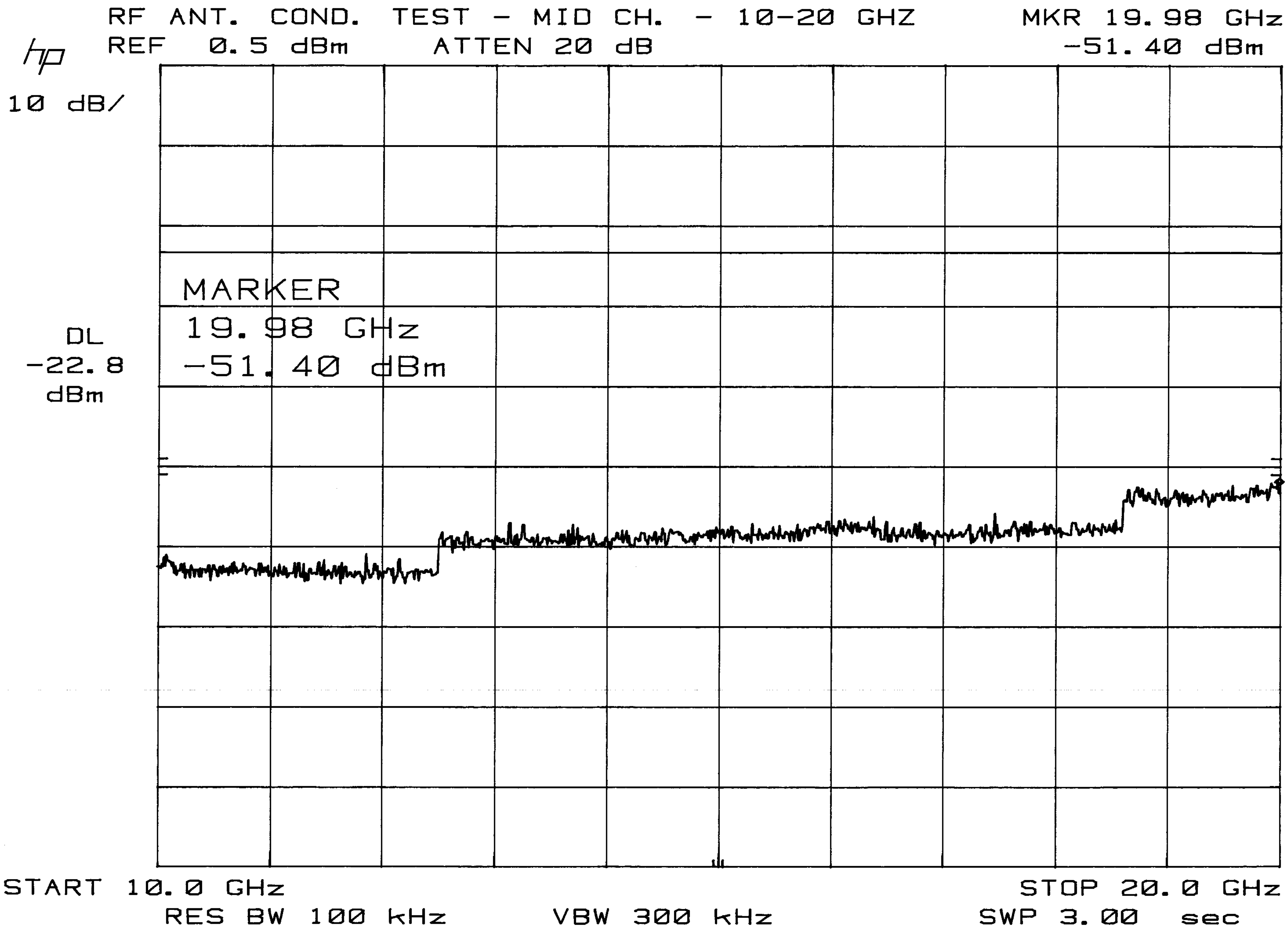


START 20.00 GHz STOP 26.00 GHz
RES BW 100 kHz VBW 300 kHz SWP 1.80 sec

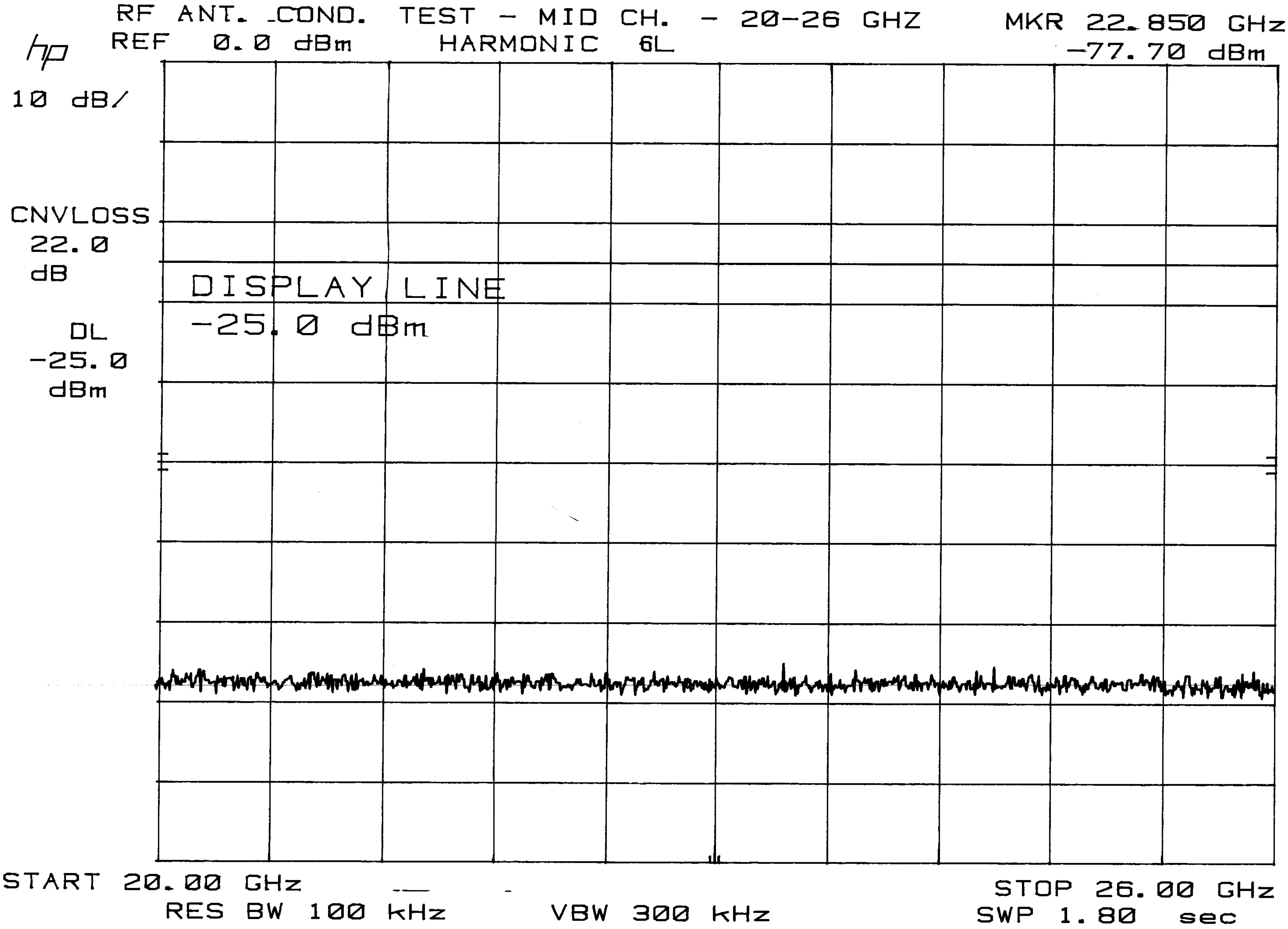

RF ANT. COND. TEST - MID CH. - 2MHZ-2GHZ
MKR 52 MHz
-65.00 dBm
REF 0.5 dBm
ATTEN 20 dB
10 dB/
MARKER
52 MHz
-65.00 dBm
DL
-22.8
dBm
START 2 MHz
STOP 2.00 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 599 msec

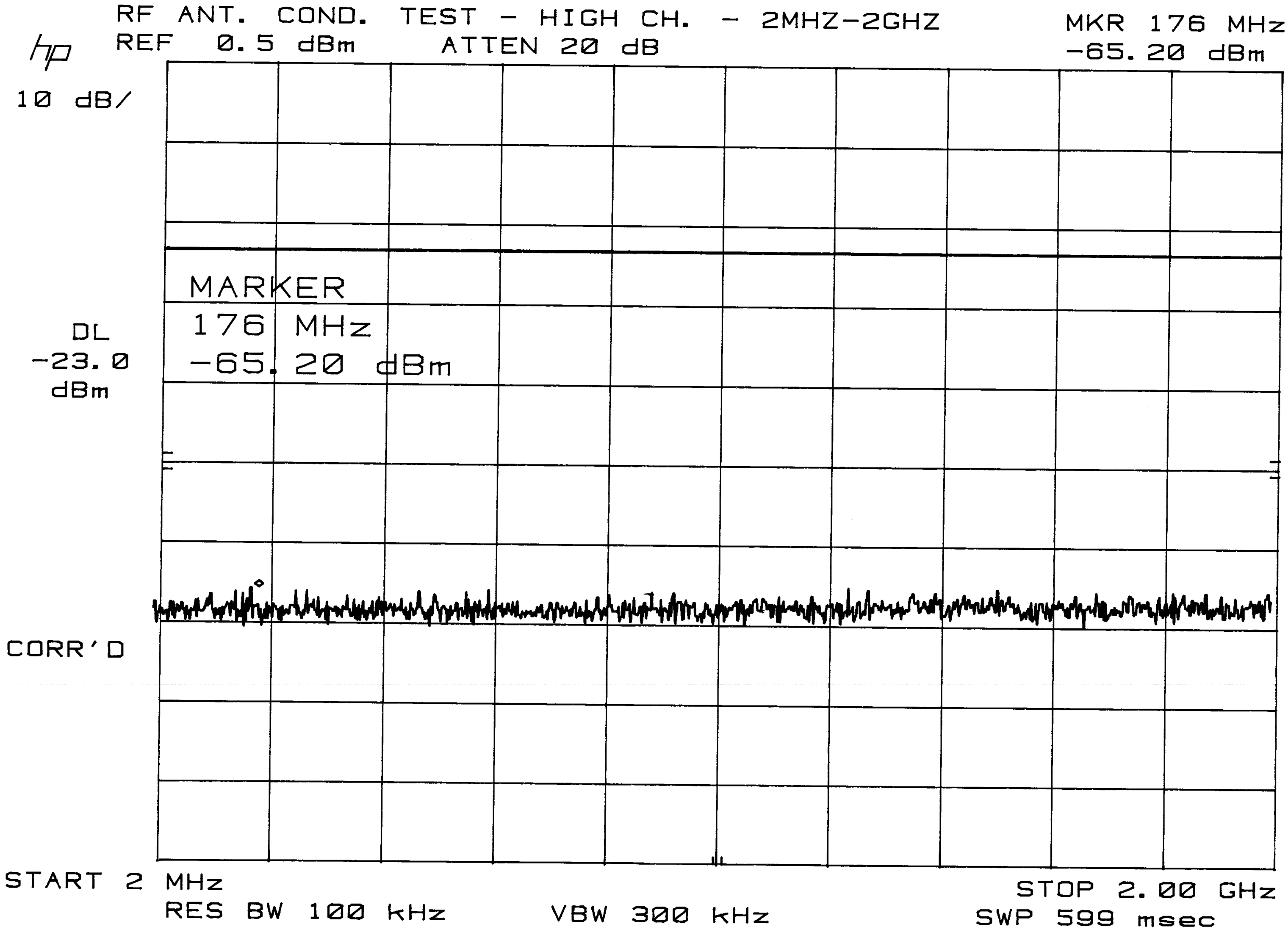


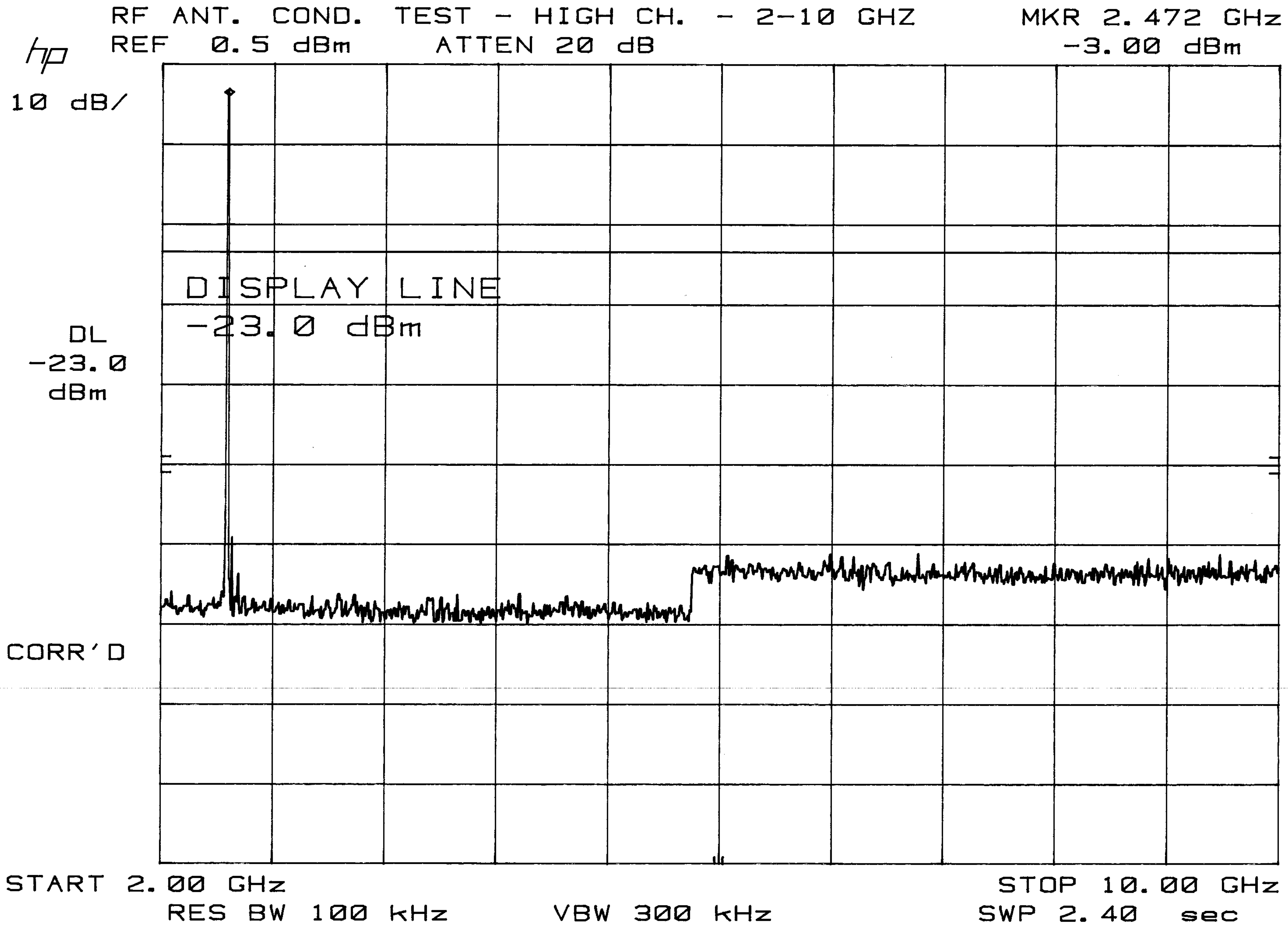
RF ANT. COND. TEST - MID CH. - 2-10 GHZ
MKR 2.432 GHz
-2.80 dBm
hp
REF 0.5 dBm ATTEN 20 dB
10 dB/
DISPLAY LINE
-22.8 dBm
DL
-22.8
dBm
START 2.00 GHz
STOP 10.00 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 2.40 sec

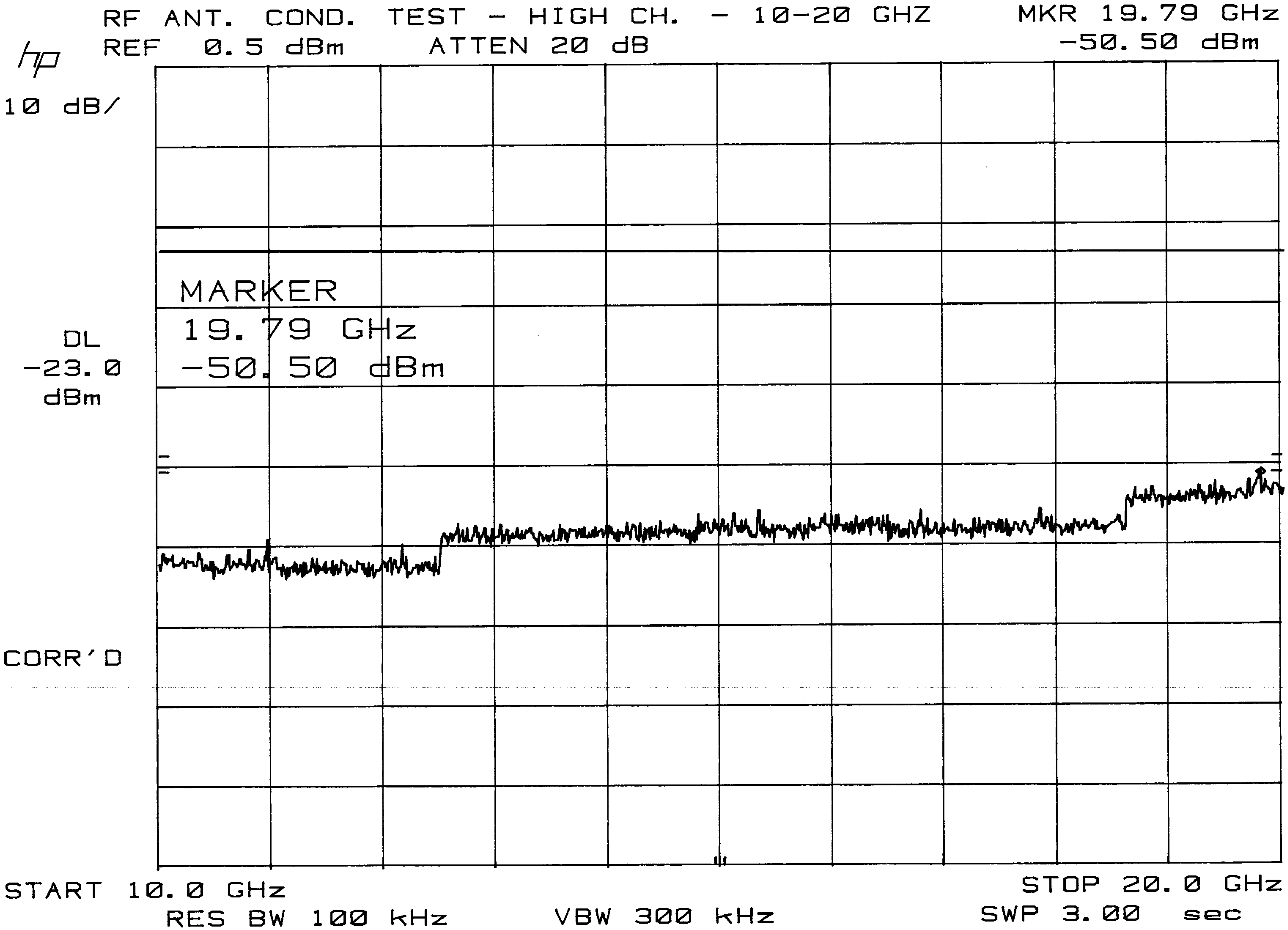


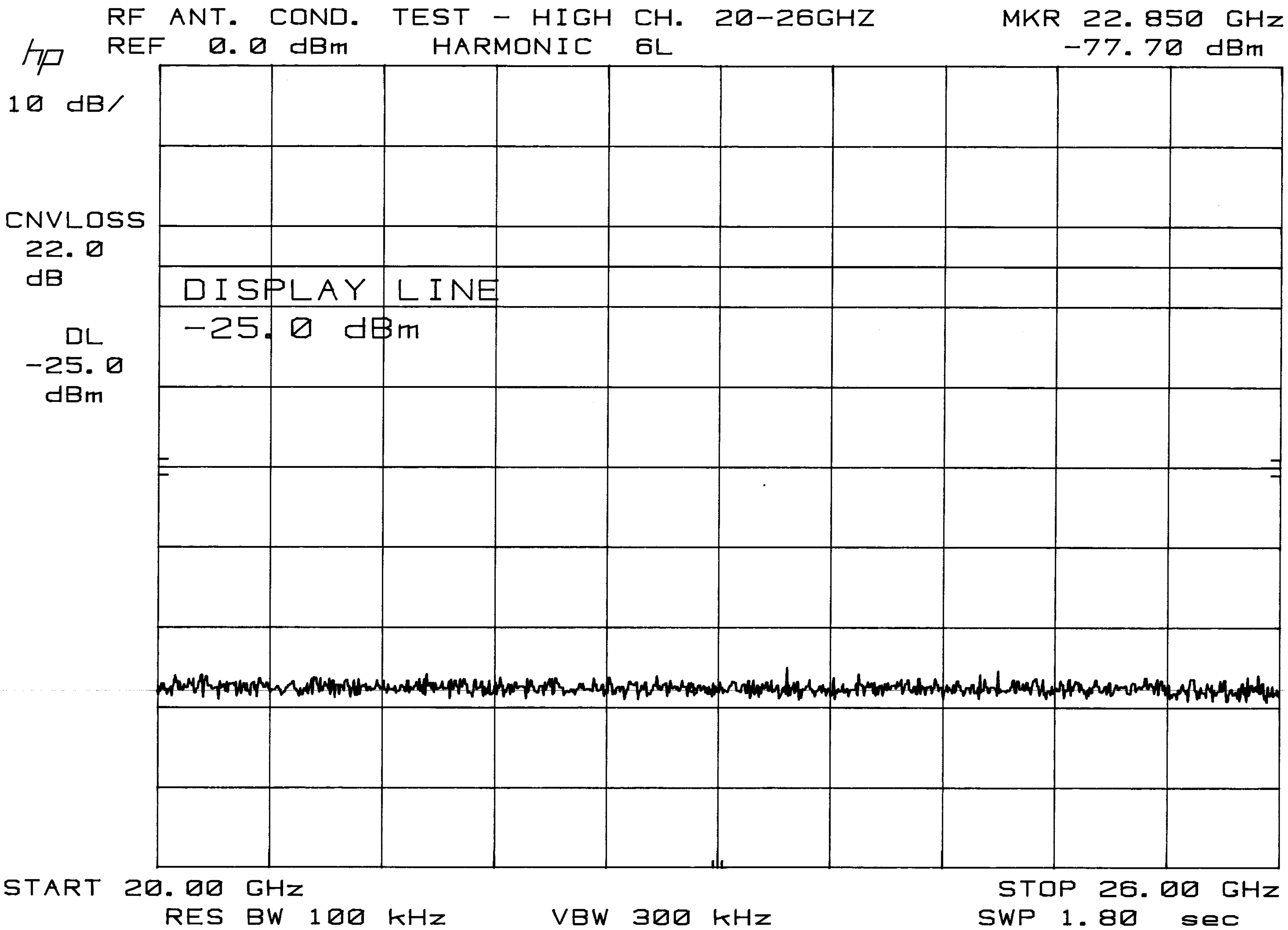
RF ANT. COND. TEST - MID CH. - 10-20 GHZ
MKR 19.98 GHz
-51.40 dBm
hp
REF 0.5 dBm
ATTEN 20 dB
10 dB/
MARKER
19.98 GHz
-51.40 dBm
DL
-22.8
dBm
START 10.0 GHz
STOP 20.0 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 3.00 sec


RF ANT. COND. TEST - MID CH. - 20-26 GHZ
REF 0.0 dBm
HARMONIC 6L
MKR 22.850 GHz
-77.70 dBm
hp
10 dB/
CNVLOSS
22.0
dB
DL
-25.0
dBm
DISPLAY LINE
-25.0 dBm
START 20.00 GHz
RES BW 100 kHz
VBW 300 kHz
STOP 26.00 GHz
SWP 1.80 sec


RF ANT. COND. TEST - HIGH CH. - 2MHZ-2GHZ
REF 0.5 dBm ATTEN 20 dB
MKR 176 MHz
-65.20 dBm
hp
10 dB/
MARKER
176 MHz
-65.20 dBm
DL
-23.0
dBm
CORR'D
START 2 MHz
RES BW 100 kHz
VBW 300 kHz
STOP 2.00 GHz
SWP 599 msec


RF ANT. COND. TEST - HIGH CH. - 2-10 GHZ
MKR 2.472 GHz
REF 0.5 dBm
ATTEN 20 dB
-3.00 dBm
10 dB/
DISPLAY LINE
-23.0 dBm
DL
-23.0
dBm
CORR'D
START 2.00 GHz
STOP 10.00 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 2.40 sec

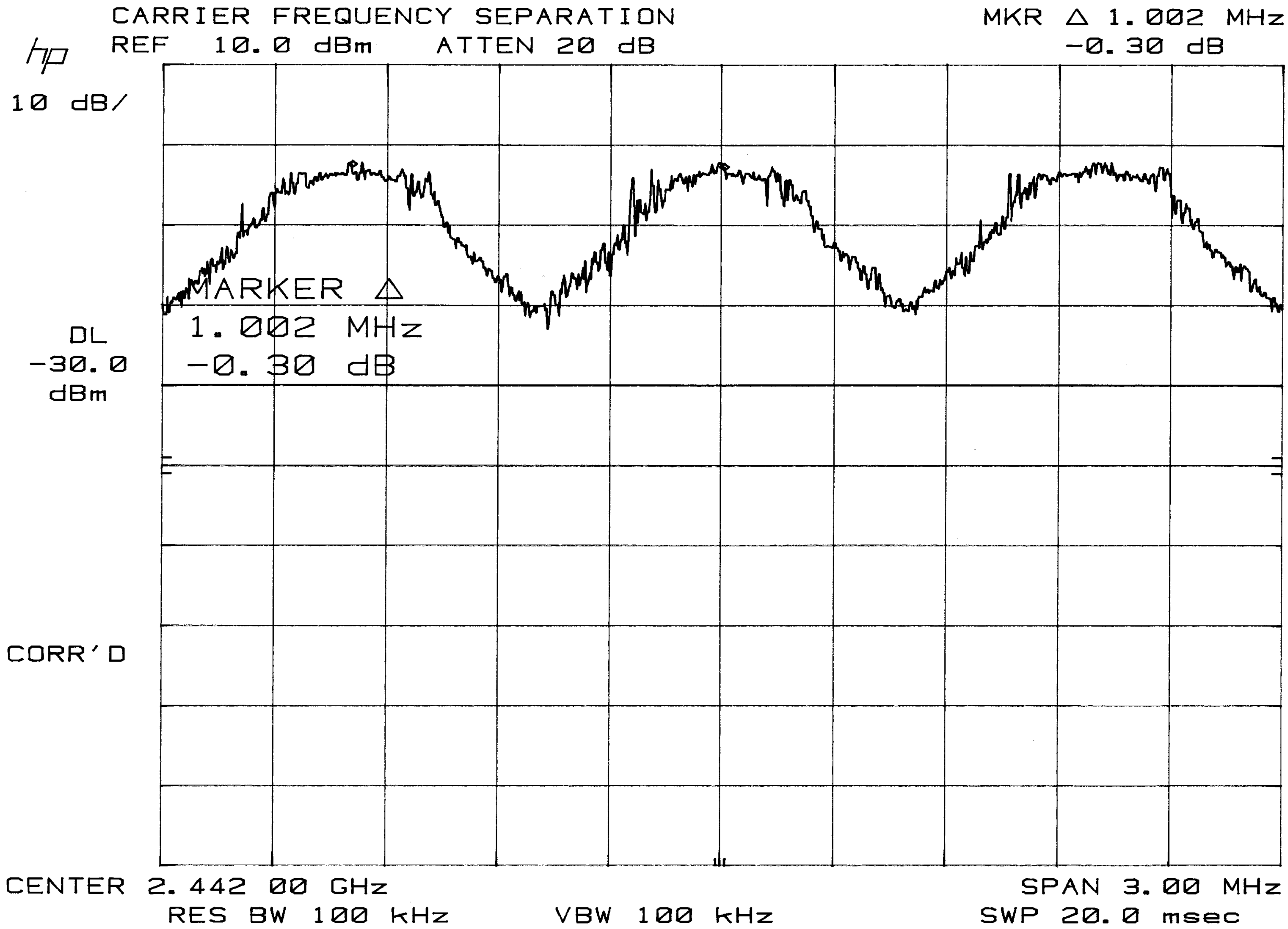

RF ANT. COND. TEST - HIGH CH. - 10-20 GHZ
MKR 19.79 GHz
-50.50 dBm
REF 0.5 dBm
ATTEN 20 dB
10 dB/
MARKER
19.79 GHz
-50.50 dBm
DL
-23.0
dBm
CORR'D
START 10.0 GHz
STOP 20.0 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 3.00 sec



RF ANT. COND. TEST - HIGH CH. 20-26GHZ
MKR 22.850 GHz
REF 0.0 dBm
HARMONIC 6L
-77.70 dBm
hp
10 dB/
CNVLOSS
22.0
dB
DISPLAY LINE
-25.0 dBm
DL
-25.0
dBm
START 20.00 GHz
STOP 26.00 GHz
RES BW 100 kHz
VBW 300 kHz
SWP 1.80 sec

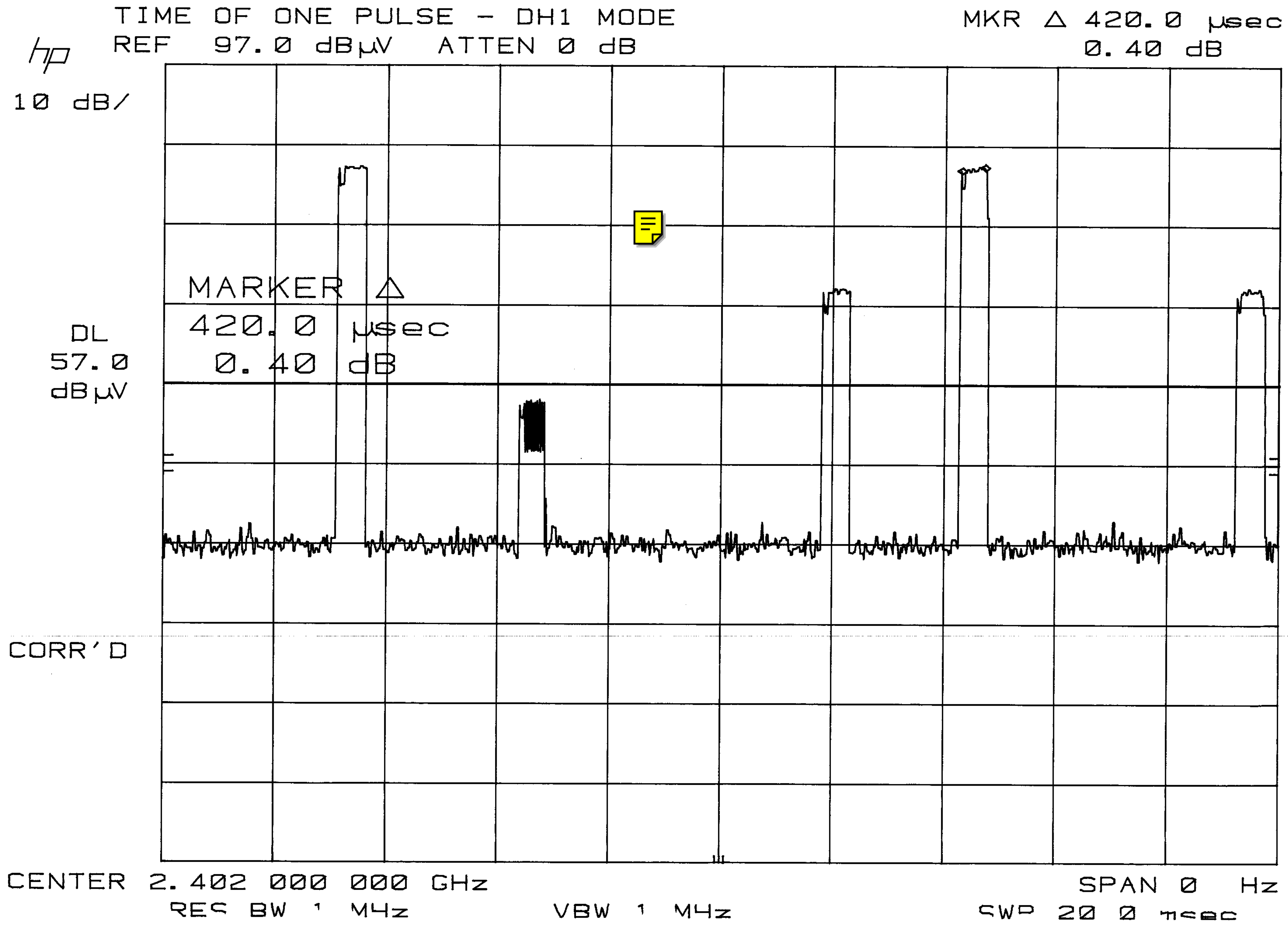
CHANNEL HOPPING SEPARATION

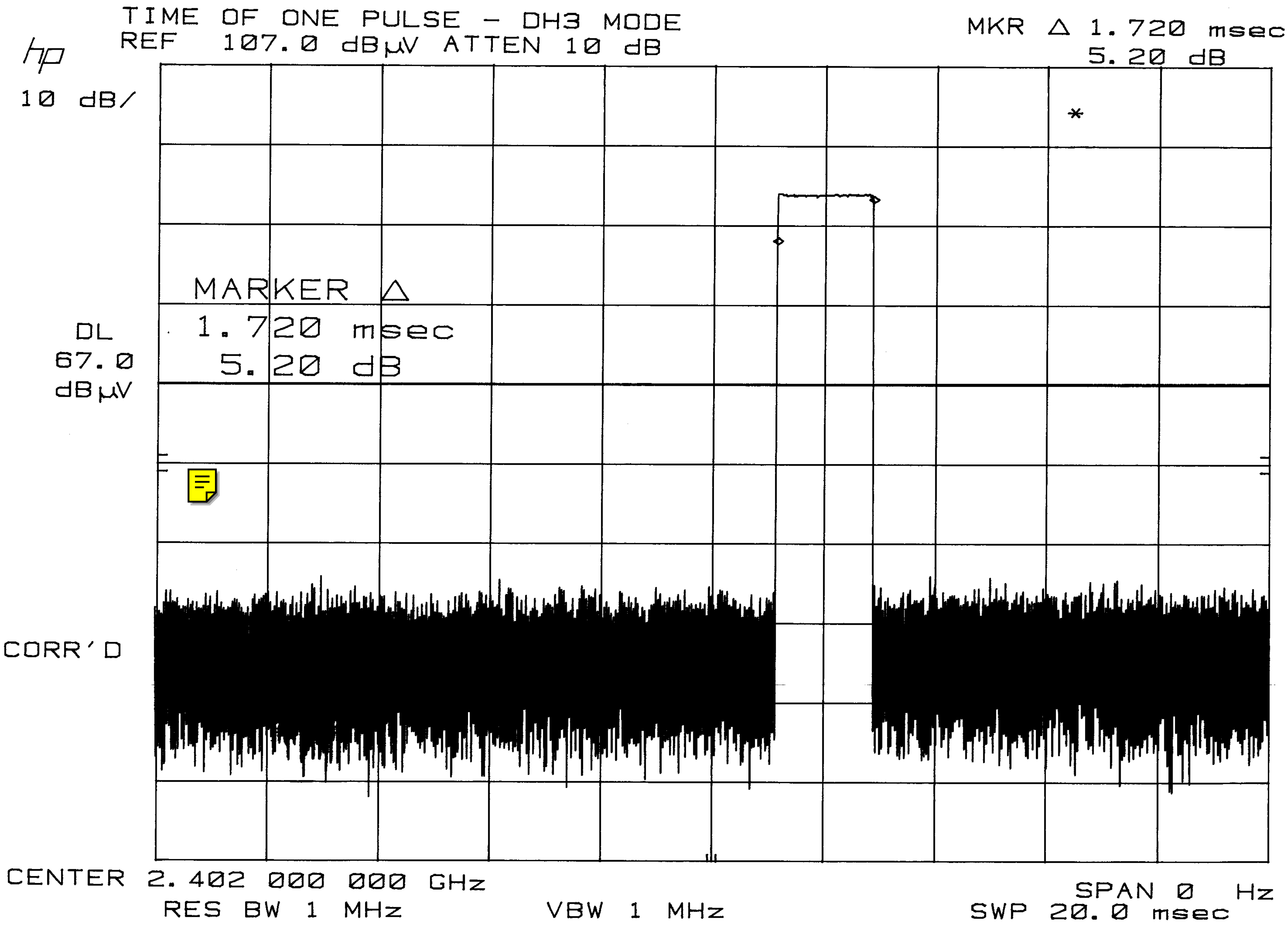
DATA SHEET

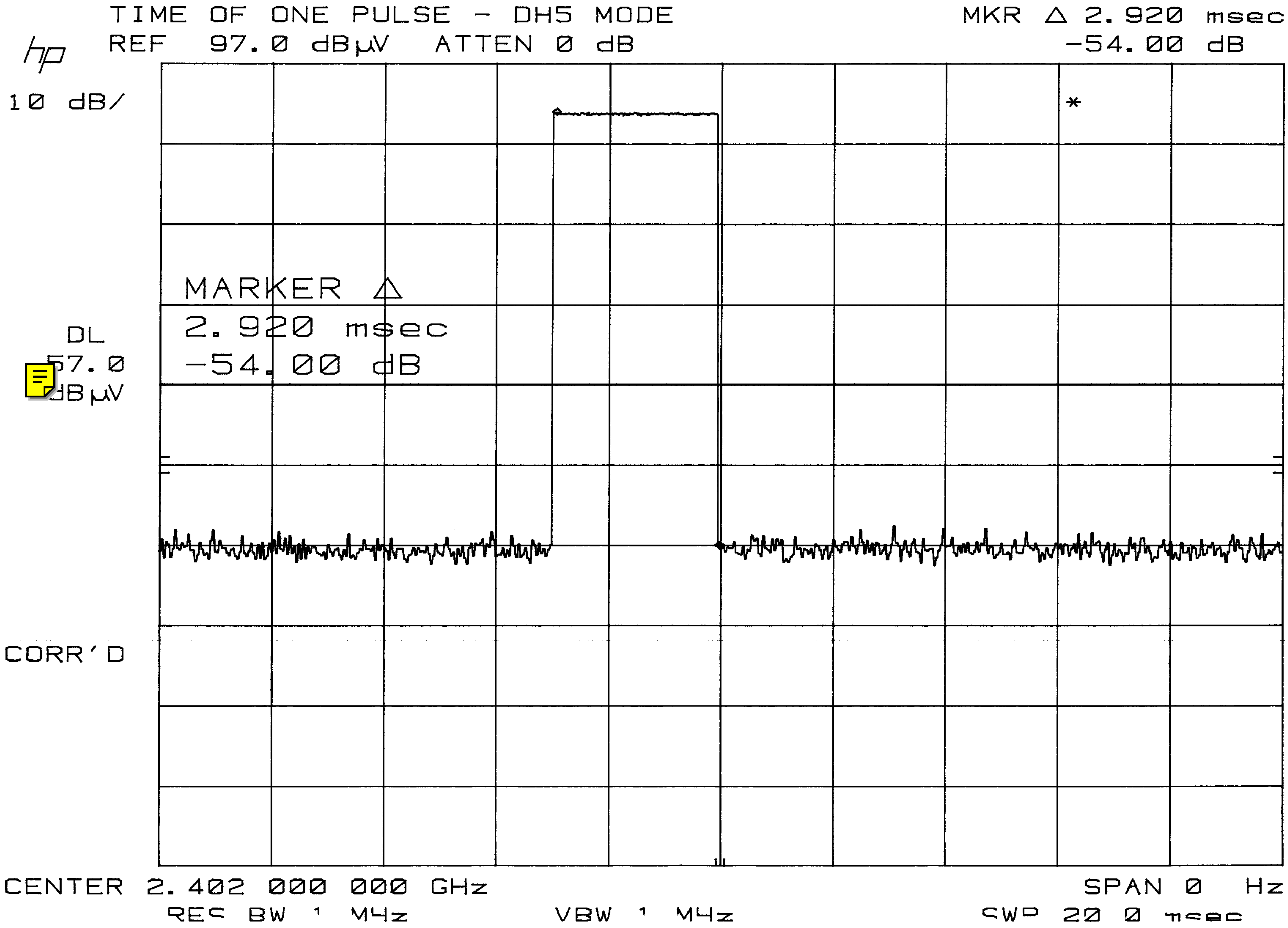

CARRIER FREQUENCY SEPARATION
REF 10.0 dBm ATTEN 20 dB
MKR △ 1.002 MHz
-0.30 dB
hp
10 dB/
MARKER △
1.002 MHz
-0.30 dB
DL
-30.0
dBm
CORR'D
CENTER 2.442 00 GHz
SPAN 3.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

AVERAGE TIME OF OCCUPANCY

DATA SHEETS

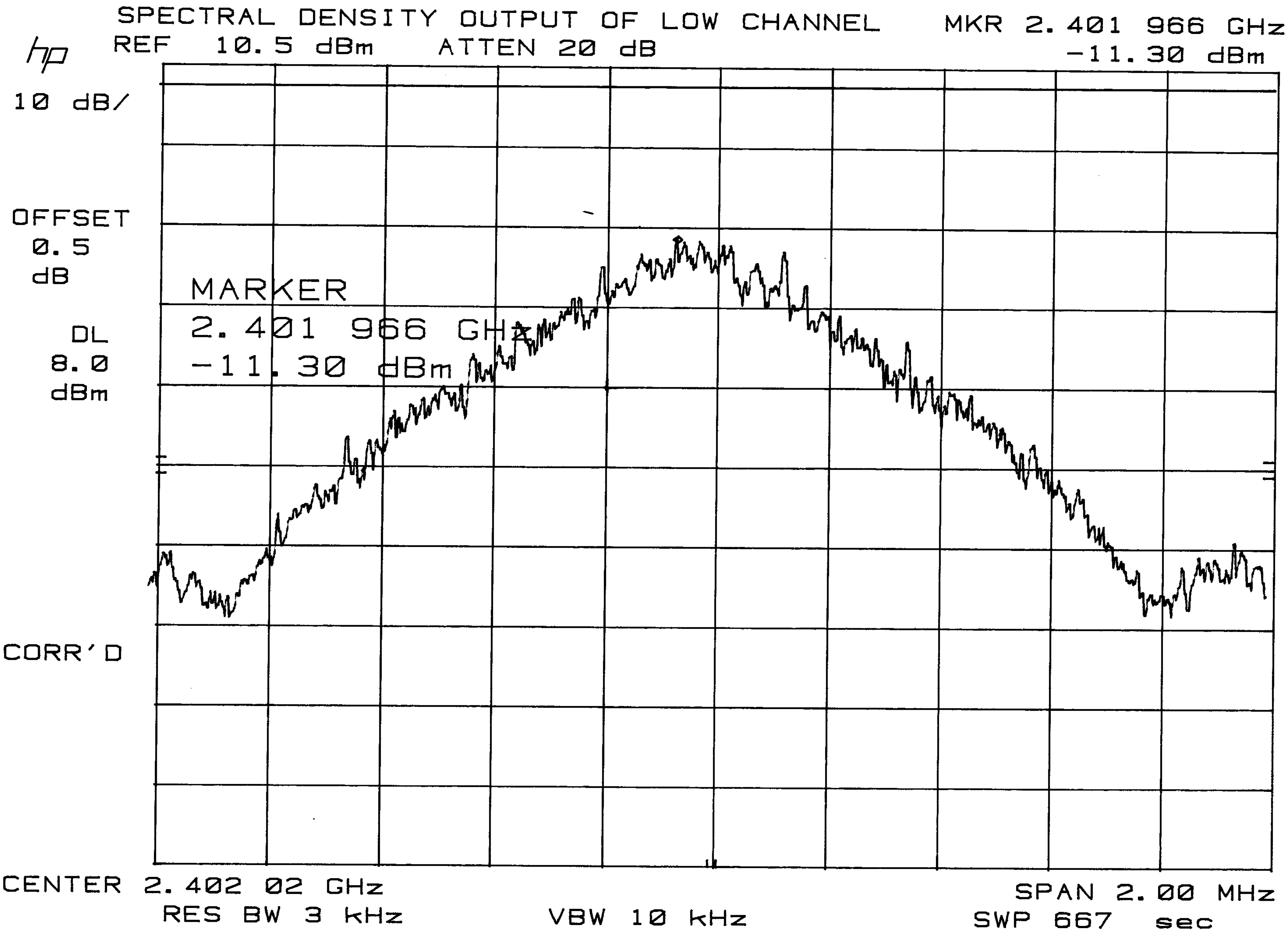

TIME OF ONE PULSE - DH1 MODE
REF 97.0 dBµV ATTEN 0 dB
MKR △ 420.0 µsec
0.40 dB
hp
10 dB/
MARKER △
420.0 µsec
0.40 dB
DL
57.0
dBµV
CORR'D
CENTER 2.402 000 000 GHz
SPAN 0 Hz
RES BW 1 MHz
VBW 1 MHz
SWP 20.0 msec

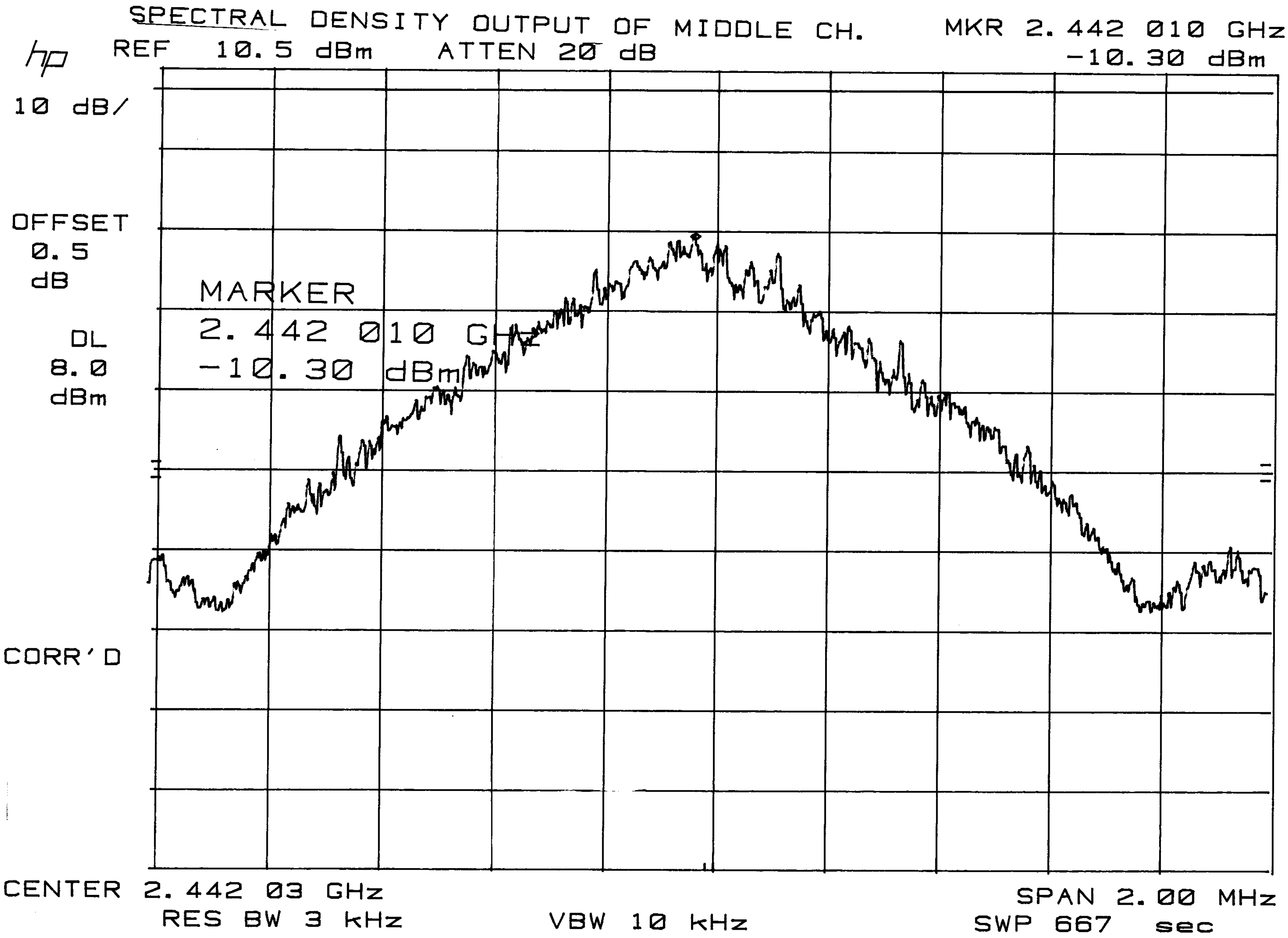

TIME OF ONE PULSE - DH3 MODE
REF 107.0 dBµV ATTEN 10 dB
MKR △ 1.720 msec
5.20 dB
hp
10 dB/
MARKER △
1.720 msec
5.20 dB
DL
67.0
dBµV
CORR'D
CENTER 2.402 000 000 GHz
RES BW 1 MHz
VBW 1 MHz
SPAN 0 Hz
SWP 20.0 msec

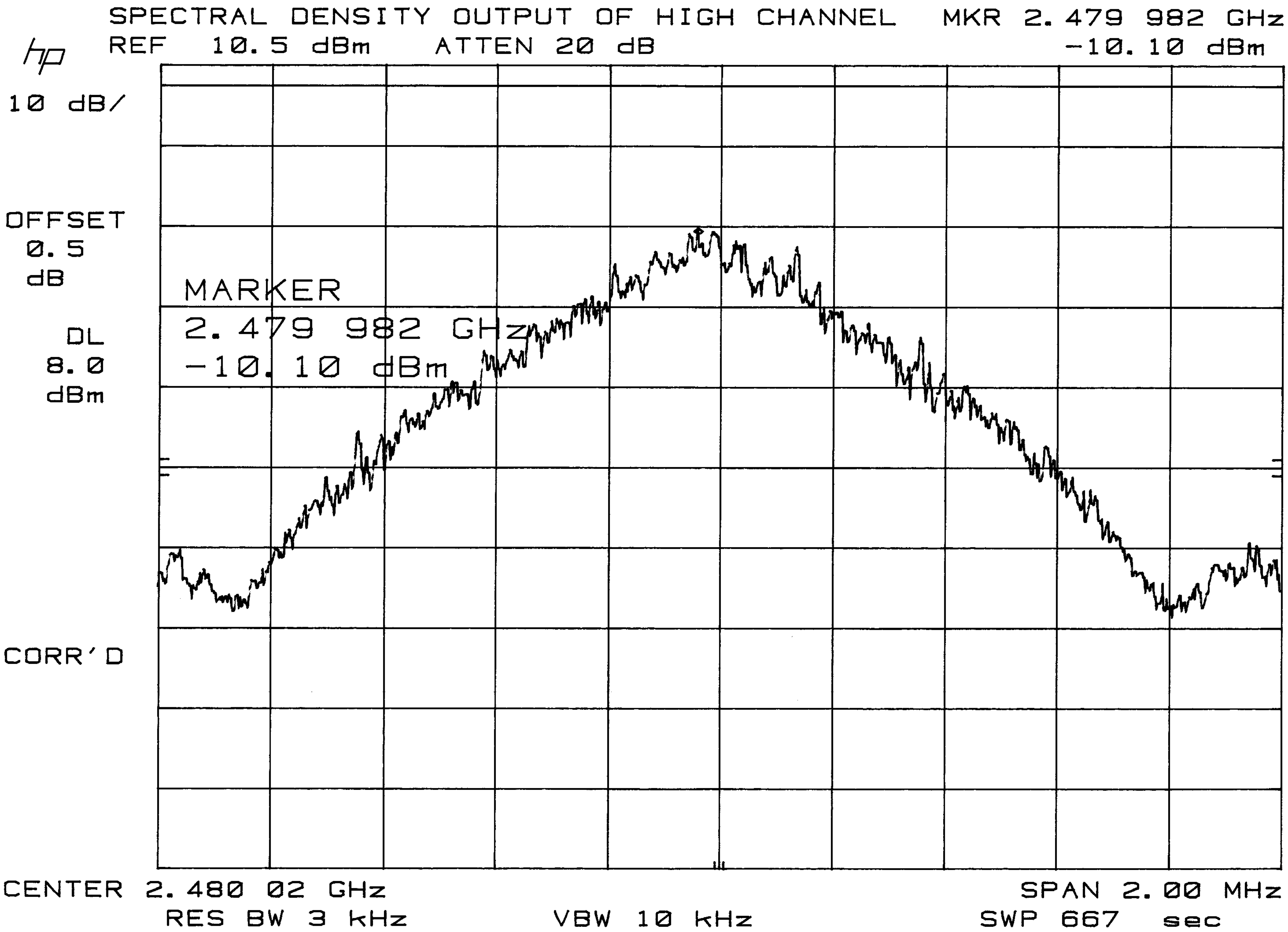

TIME OF ONE PULSE - DH5 MODE
REF 97.0 dBμV ATTEN 0 dB
MKR △ 2.920 msec
-54.00 dB
hp
10 dB/
MARKER △
2.920 msec
-54.00 dB
DL
57.0
dBμV
CORR'D
CENTER 2.402 000 000 GHz
SPAN 0 Hz
RES BW 1 MHz
VBW 1 MHz
SWP 20.0 msec

SPECTRAL DENSITY OUTPUT

DATA SHEETS

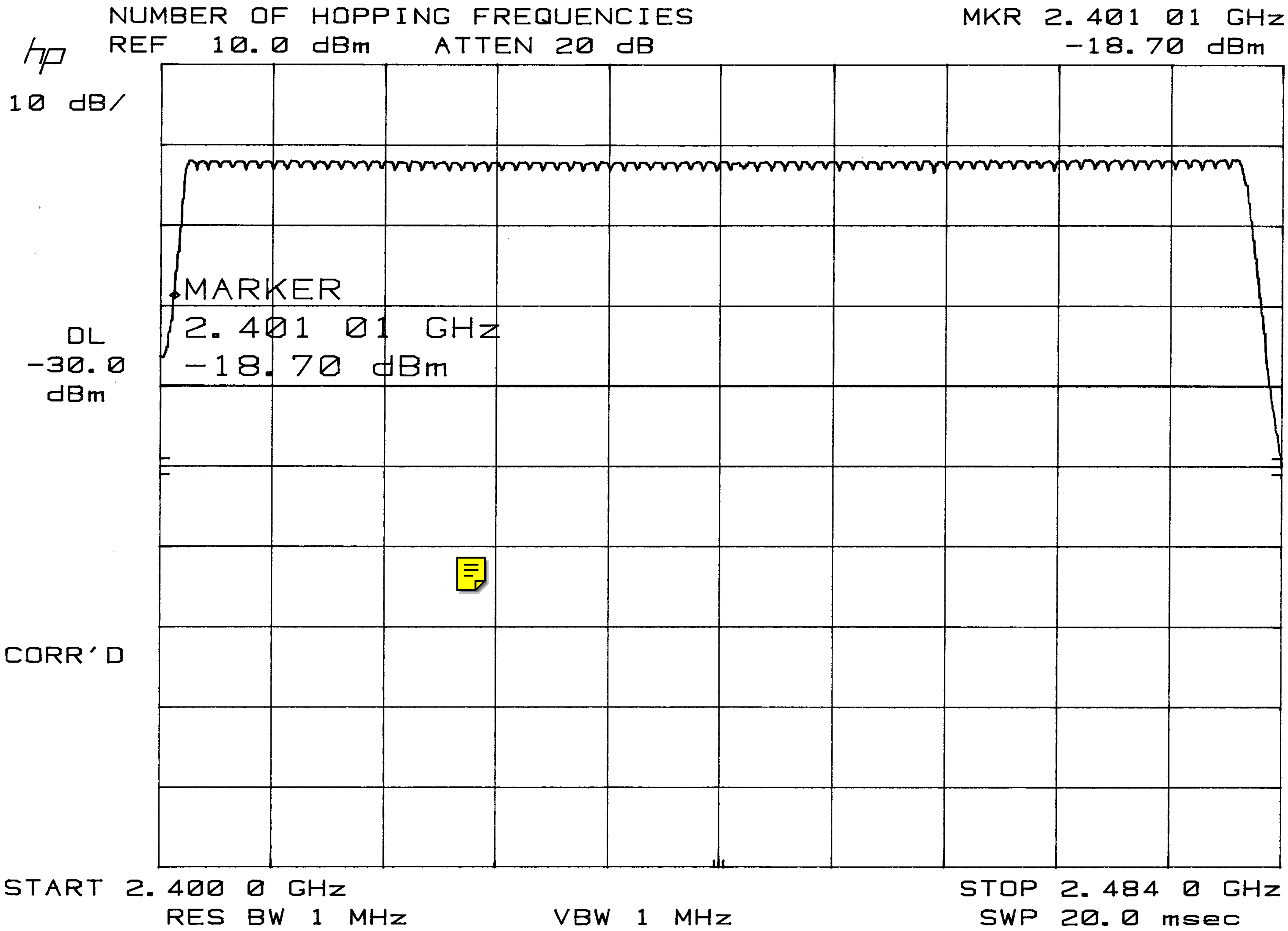

SPECTRAL DENSITY OUTPUT OF LOW CHANNEL
MKR 2.401 966 GHz
-11.30 dBm
hp
REF 10.5 dBm ATTEN 20 dB
10 dB/
OFFSET
0.5
dB
DL
8.0
dBm
MARKER
2.401 966 GHz
-11.30 dBm
CORR'D
CENTER 2.402 02 GHz
RES BW 3 kHz
VBW 10 kHz
SPAN 2.00 MHz
SWP 667 sec


SPECTRAL DENSITY OUTPUT OF MIDDLE CH.
MKR 2.442 010 GHz
-10.30 dBm
hp
REF 10.5 dBm
ATTEN 20 dB
10 dB/
OFFSET
0.5
dB
MARKER
2.442 010 GHz
-10.30 dBm
DL
8.0
dBm
CORR'D
CENTER 2.442 03 GHz
RES BW 3 kHz
VBW 10 kHz
SPAN 2.00 MHz
SWP 667 sec


SPECTRAL DENSITY OUTPUT OF HIGH CHANNEL
MKR 2.479 982 GHz
REF 10.5 dBm ATTEN 20 dB
-10.10 dBm
hp
10 dB/
OFFSET
0.5
dB
DL
8.0
dBm
MARKER
2.479 982 GHz
-10.10 dBm
CORR'D
CENTER 2.480 02 GHz
RES BW 3 kHz
VBW 10 kHz
SPAN 2.00 MHz
SWP 667 sec

NUMBER OF HOPPING FREQUENCIES

DATA SHEET


NUMBER OF HOPPING FREQUENCIES
REF 10.0 dBm ATTEN 20 dB
MKR 2.401 01 GHz
-18.70 dBm
hp
10 dB/
MARKER
2.401 01 GHz
-18.70 dBm
DL
-30.0
dBm
CORR'D
START 2.400 0 GHz
RES BW 1 MHz
VBW 1 MHz
STOP 2.484 0 GHz
SWP 20.0 msec

DUTY CYCLE

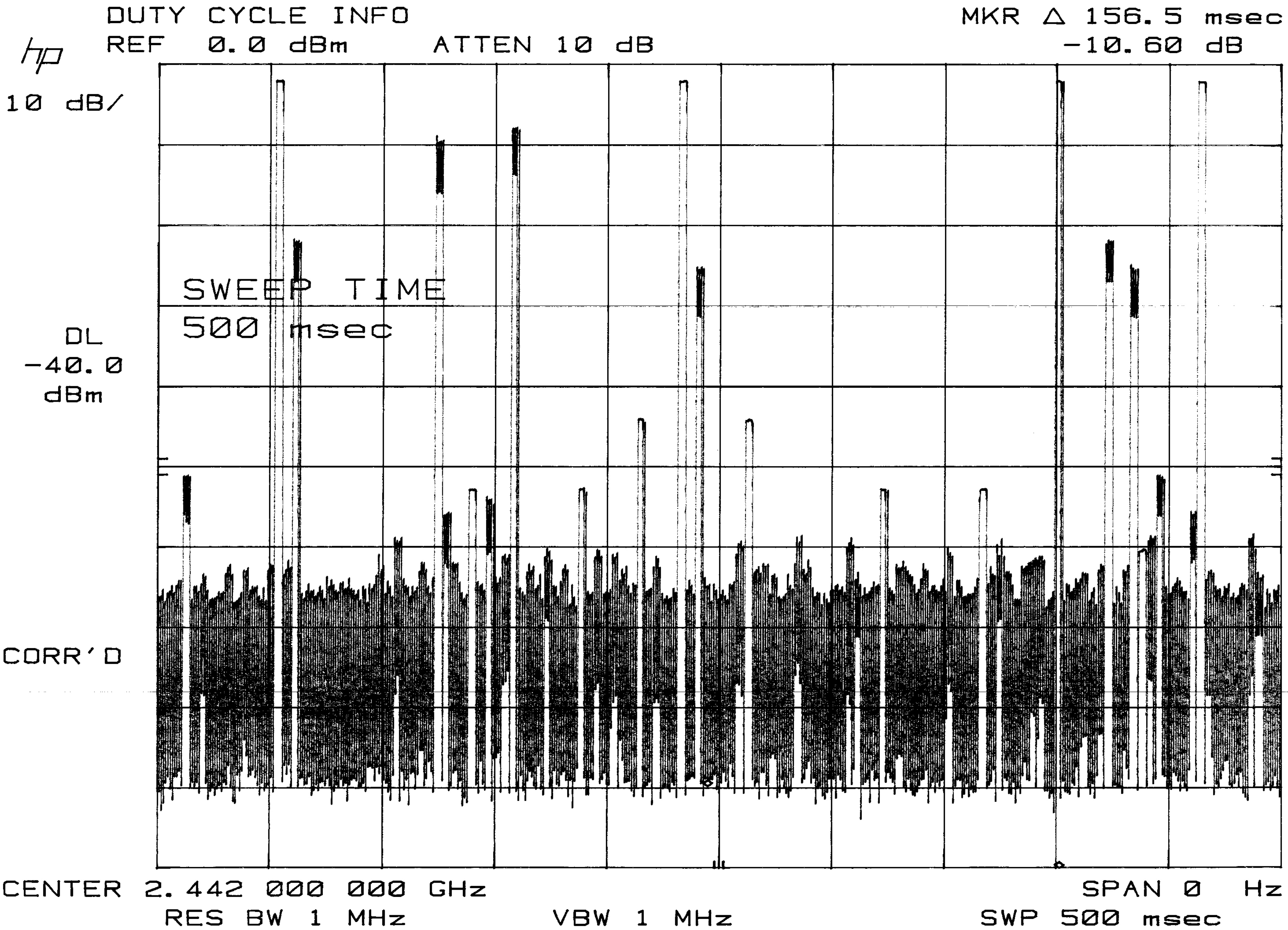
INFORMATION AND DATA SHEET

Company: 15.247 Interpretation	**Subject:** Spurious emission		1227
Remarks:		**Keyword:**	
Rule Parts: 15.247	**City:**	**State:**	**Country:**

INQUIRY: I'm writing the regulatory sections for a new wireless standard, the IEEE 802.15.4 Personal Area Network standard. This is the IEEE's answer to a need for something a bit lower cost than Bluetooth. Since these standards have in the past not done a particularly good job of documenting and interpreting FCC and other applicable regs, I'm really making a special effort to get it right for these guys. However, I've run into a problem on interpretation of Part 15.247 that no one knows the answer to, though it is quite fundamental and should have probably been spelled out in the rules. 15.247 allows harmonics at -20 dBc (easy) for ISM band spread spectrum equipment, but where the harmonics fall in the restricted bands of FCC 15.205 the general level of FCC 15.209 must be met. This is 500 uV/m at 3 meters, or -41.2 dBm ERP. The 2nd, 3rd, and 5th harmonics of 2400 MHz band gear falls into restricted, as does the 3rd and 5th of 902-928 MHz. At a transmit power level of 100 mW steady state, the equipment must attain -61 dBc harmonic rejection, or with higher antenna gain (say on the third where a quarterwave whip resonates) it must get even more. This is a real bear for cheap gear to meet. Now it is common practice to use the provisions of FCC 15.35 to average the transmission over 100 mS and allow the electric field strength to go up inversely with the average from 0 to 100% duty cycle. This may be done to a maximum of 20 dB allowed higher spurious emissions. For example, at 10% duty cycle over 100 mS, the electric field of harmonics may go up 10X, and since power is the square of electric field the peak power of spurs landing in restricted bands may go up 100X, or 20 dB. This is the max allowed, and in this case it makes a hell of a difference. Now the key question is: Do the averaging provisions of FCC 15.35 apply to hoppers? This is true if the standard practice when measuring frequency hopping systems for harmonics is to let the transmitter hop while the test system takes its data in a fixed 1 MHz channel that the system hops through. Or, has the standard practice been to FORCE the transmitter to transmit on a fixed non-hopping frequency and measure harmonics on a fixed channel using the averaging detector? I have pinged the Part 15 author, John Reed, and he is apparently not sure how he intended this to be interpreted when he wrote the rules. Both he and Ray Laforge have referred me to you on this key question. If a policy on this has not been previously spelled out, then whatever is standard practice on Bluetooth would seem to be the standard for all ISM band hopping systems. On the Bluetooth standard with 79 channels, 1600 hops per second, and an average of two hits on a test channel per 100 mS test period, the full 20 dB relaxation on spurious emissions would be attained. This basically allows about 40 dB harmonic suppression (not so hard to get) vs. 60 if the relaxation via averaging does not apply RESPONSE: The spurious emissions that fall in the restricted bands above 1 GHz would be subject to a peak field strength level at 3 meters of 74 dBuV/m (5000uV/m) and an average field strength level of 54 dBuV/m(500uV/m) . The following procedure should be used when measuring the peak level. During these tests the hopping function is disabled. I understand that the hopping channels may overlap in a 1 MHz band in this new proposal. Therefore, the duty factor should take this into account. This was not an issue in the current bluetooth specification as the channel separation is 1 MHz and the 20 db bandwidths do not overlap. Spurious Radiated Emissions This test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings: Span = wide enough to fully capture the emission being measured RBW = 1 MHz for f > 1 GHz, 100 kHz for f < 1 GHz VBW > RBW Sweep = auto Detector function = peak Trace = max hold Follow the guidelines in ANSI C63.4-1992 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data. Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Supporting Images:

ID	Description	File Type


DUTY CYCLE INFO
REF 0.0 dBm ATTEN 10 dB
MKR Δ 156.5 msec
-10.60 dB
10 dB/
SWEEP TIME
500 msec
DL
-40.0
dBm
CORR'D
CENTER 2.442 000 000 GHz
SPAN 0 Hz
RES BW 1 MHz
VBW 1 MHz
SWP 500 msec