

MEASUREMENT AND TECHNICAL REPORT
POWERWAVE TECHNOLOGIES
2026 McGaw Avenue
Irvine, CA 92614

DATE: 08 December 2000

This Report Concerns:	Original Grant: X	Class II Change:
Equipment Type:	Seahawk 800, Model G3L-800-60	
Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?	Yes:	No: X
	Defer until:	
<i>Company Name</i> agrees to notify the Commission by:	N/A	
of the intended date of announcement of the product so that the grant can be issued on that date.		
Transition Rules Request per 15.37?	Yes:	*No:
<i>(*) FCC Part 2, Paragraphs, 2.1046, 2.1047, 2.1051, 2.1053 and Part 22, Paragraph 22.917(e)</i>		
Report Prepared by:	TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 546 3999 Fax: 858 546 0364	

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1 GENERAL INFORMATION

1.1 Product Description

EUT Description	Multi-channel power amplifier		
EUT Name	G3L-800-60		
Model No.:	G3L-800-60	Serial No.:	--
Product Options:	N/A		
Configurations to be tested:	60 Watt output		

Power Requirements

Voltage: 27 Vdc (If battery powered, make sure battery life is sufficient to complete testing.)

of Phases: N/A

Current (Amps/phase(max)): 30A Current (Amps/phase(nominal)): N/A

Other _____

Typical Installation and/or Operating Environment

(ie. Hospital, Small Business, Industrial/Factory, etc.)
Telcom

1.1 Product Description (continued)

EUT Power Cable			
<input type="checkbox"/> Permanent	OR	<input type="checkbox"/> Removable	Length (in meters): _____
<input type="checkbox"/> Shielded	OR	<input type="checkbox"/> Unshielded	
<input checked="" type="checkbox"/> Not Applicable			

EUT Interface Ports and Cables												
Interface			Shielding									
Type	Analog	Digital	Qty	Yes	No	Type	Termination	Connector Type	Port Termination	Length (in meters)	Removable	Permanent
RF/In/Out DC Power	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>			Metalized D-Sub	RF connections/dc power		<input type="checkbox"/>	<input checked="" type="checkbox"/>

EUT Operating Modes to be Tested --

1. RF applied to reach 60 watt output

EUT System Components --			
Description	Model #	Serial #	FCC ID #
Power amplifier module	G3L-800-60		

Support Equipment			
Description	Model #	Serial #	FCC ID #
HP Signal Generator	E4436B	US39260103	
HP Power Meter	E4419B	GB40201926	
RF Cables & Connectors			

Oscillator Frequencies			
Frequency	Derived Frequency	Component # / Location	Description of Use
15 MHz	15 MHz	Y1 Multifunction Board	Clock

Power Supply			
Manufacturer	Model #	Serial #	Type
N/A			<input type="checkbox"/> Switched-mode: (Frequency) _____

1.1 Product Description (continued)

Power Line Filters		
---------------------------	--	--

<i>Manufacturer</i>	<i>Model #</i>	<i>Location in EUT</i>
Spectrum Control	52-978-107-FA3	Multifunction Board
Panasonic	ELK-E103FA	Multifunction Board

Critical EMI Components (Capacitors, ferrites, etc.)				
---	--	--	--	--

<i>Description</i>	<i>Manufacturer</i>	<i>Part # or Value</i>	<i>Qty</i>	<i>Component # / Location</i>
Ferrite	Fair-Rite	2743021447	10	FB1-FB10 Multifunction Bd
Bandpass Filter	Panasonic	ELK-E103FA		FL17/Multifunction Bd

EMC Critical Detail -- Describe other EMC Design details used to reduce high frequency noise.
--

Inductive filters, capacitive filters, noise filters

1 GENERAL INFORMATION (continued)

1.2 Related Submittal/Grant

None

1.3 Tested System Details

The FCC IDs for all equipment, plus descriptions of all cables used in the tested system are:

None

1.4 Test Methodology

Purpose of Test: To demonstrate compliance with the ANSI C63.4 setup.

Test Performed: X 1. Conducted Emissions, FCC Part 2, Paragraphs 2.1047, 2.1051 and Part 22, Paragraph 22.917(e)
2. Radiated Emissions EN55022: 1992 Class B limit, 30 - 1,000 MHz, 10 meters
X 3. Radiated Emission per FCC Part 2, Paragraph 2.153
4. Engineering evaluations
5. Frequency Stability, Part 2, Paragraph 2.995, and Part 87, Paragraph 87.133
X RF Output Power, Part 2, Paragraph 1.1046

Both Conducted and radiated testing were performed according to the procedures in FCC/ANSI C63.4 and CSA 108.8 - M1983. Radiated testing was performed at an antenna-to-EUT distance of 3 meters (1 - 10 GHz).

1.5 Test Facility

The open area test site and conducted measurement data were tested by:

TÜV PRODUCT SERVICE
10040 Mesa Rim Road
San Diego, CA 92121-2912
Phone: 619 546 3999
Fax: 619 546 0364

The Test Site Data and performance comply with ANSI 63.4 and are registered with the FCC, 7435 Oakland Mills Rd, Columbia Maryland 21046. All Measurement Data is acquired according to the content of FCC Measurement Procedure and ANSI C63.4, unless supplemented with additional requirements as noted in the test report.

1.6 Part 2 Requirements

Multi-channel power amplifier.
Microprocessor Model Number: MC68HC812A4

DC voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range. 27 Vdc / 30 A

Equipment does not employ digital modulation techniques.

2. SYSTEM TEST CONFIGURATION

2.1 Justification

The Seahawk was initially tested for FCC emission in the following configuration:

See Block Diagram.

2.2 EUT Exercise Software

None

2.3 Special Accessories

None

2.4 Modification

None

2.5 Configuration of Tested System

See Block Diagram.

3 RADIATED EMISSION EQUIPMENT/DATA

The following data lists the significant emission frequencies, measured levels, correction factor (which includes cable and antenna corrections), the corrected reading, and the limit.

See following page(s).

See test setup photos for radiated emissions test setup.

Radiated Electromagnetic Emissions



Test Report #: S0467 Run 01 Test Area: Site 3 Roof
 Test Method: Part 2, Para 2.1053 Test Date: 10-Nov-2000
 EUT Model #: Seahawk G3L-800-60004 EUT Power: 29 Vdc
 EUT Serial #: _____
 Manufacturer: Powerwave
 EUT Description: 800 MHz RF Amplifier
 Notes: 60 Watts rated power

Temperature: 20 °C
 Relative Humidity: 65 %
 Air Pressure: 100.1 kPa
 Page: 1 of 3

Level Key	
Pk - Peak	Nb - Narrow Band
Qp - QuasiPeak	Bb - Broad Band
Av - Average	

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dBm) (dB)	FINAL (i)	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) FCC Part 24.238	DELTA2 (dB) FCC Part 90.210
Antenna: LPA- 3146						
881.00	38.5 Av	2.3 / 23.2 / 0.0	64.0	H / 1.0 / 0.0	N/A	N/A
881.00	41.4 Av	2.3 / 23.2 / 0.0	66.9	V / 1.0 / 0.0	N/A	N/A
881.00	55.7 Pk	2.3 / 23.2 / 0.0	81.2	V / 1.0 / 0.0	-1.0	-1.0
869.00	56.0 Pk	2.4 / 23.2 / 0.0	81.6	V / 1.0 / 0.0	-0.6	-0.6
869.00	44.8 Av	2.4 / 23.2 / 0.0	70.4	V / 1.0 / 0.0	N/A	N/A
869.00	51.2 Pk	2.4 / 23.2 / 0.0	76.8	H / 1.0 / 0.0	-5.4	-5.4
869.00	41.5 Av	2.4 / 23.2 / 0.0	67.1	H / 1.0 / 0.0	N/A	N/A
894.00	53.8 Pk	2.4 / 23.2 / 0.0	79.4	H / 1.0 / 0.0	-2.8	-2.8
894.00	40.0 Av	2.4 / 23.2 / 0.0	65.6	H / 1.0 / 0.0	N/A	N/A
894.00	56.0 Pk	2.4 / 23.2 / 0.0	81.6	V / 1.0 / 0.0	-0.6	-0.6
894.00	46.1 Av	2.4 / 23.2 / 0.0	71.7	V / 1.0 / 0.0	N/A	N/A
Antenna: Horn PN:453 3 meters						
PreAmp: 38 dB Preamp						
Attenuator: PN:657 6 ft						
Below are ambient measurements - not detectable emissions						
1788.00	48.3 Pk	4.0 / 27.9 / 39.9	40.3	V / 1.0 / 0.0	-41.9	-41.9
2682.00	50.3 Pk	5.3 / 31.0 / 39.5	47.1	V / 1.0 / 0.0	-35.1	-35.1
3576.00	48.4 Pk	6.7 / 33.1 / 39.6	48.6	V / 1.0 / 0.0	-33.6	-33.6
4470.00	48.4 Pk	7.3 / 33.5 / 40.6	48.6	V / 1.0 / 0.0	-33.6	-33.6
5364.00	47.1 Pk	7.5 / 35.9 / 38.8	51.6	V / 1.0 / 0.0	-30.6	-30.6
6258.00	51.1 Pk	7.8 / 36.6 / 37.2	58.3	V / 1.0 / 0.0	-23.9	-23.9
7152.00	50.1 Pk	8.5 / 37.4 / 36.5	59.5	V / 1.0 / 0.0	-22.7	-22.7
8046.00	50.5 Pk	9.4 / 37.1 / 36.9	60.1	V / 1.0 / 0.0	-22.1	-22.1
8940.00	50.8 Pk	10.1 / 39.9 / 37.4	63.3	V / 1.0 / 0.0	-18.9	-18.9
8940.00	50.8 Pk	10.1 / 39.9 / 37.4	63.3	H / 1.0 / 0.0	-18.9	-18.9
8046.00	50.5 Pk	9.4 / 37.1 / 36.9	60.1	H / 1.0 / 0.0	-22.1	-22.1
7152.00	50.7 Pk	8.5 / 37.4 / 36.5	60.1	H / 1.0 / 0.0	-22.1	-22.1
6258.00	51.5 Pk	7.8 / 36.6 / 37.2	58.7	H / 1.0 / 0.0	-23.5	-23.5

Tested by: J Owen
Printed


 Signature

Radiated Electromagnetic Emissions



Test Report #: S0467 Run 01 Test Area: Site 3 Roof
 Test Method: Part 2, Para 2.1053 Test Date: 10-Nov-2000
 EUT Model #: Seahawk G3L-800-60004 EUT Power: 29 Vdc
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 Manufacturer: Powerwave
 EUT Description: 800 MHz RF Amplifier
 Notes: 60 Watts rated power

Temperature: 20 °C
 Relative Humidity: 65 %
 Air Pressure: 100.1 kPa
 Page: 2 of 3

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dBm) (dB)	FINAL ()	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) FCC Part 24.238	DELTA2 (dB) FCC Part 90.210
5364.00	46.4 Pk	7.5 / 35.9 / 38.8	50.9	H / 1.0 / 0.0	-31.3	-31.3
4470.00	47.6 Pk	7.3 / 33.5 / 40.6	47.8	H / 1.0 / 0.0	-34.4	-34.4
Below are emission measurements						
3576.00	53.7 Pk	6.7 / 33.1 / 39.6	53.9	H / 1.0 / 0.0	-28.3	-28.3
2682.00	56.9 Pk	5.3 / 31.0 / 39.5	53.7	H / 1.0 / 0.0	-28.5	-28.5
Below is an ambient measurement - no detectable emissions						
1788.00	49.1 Pk	4.0 / 27.9 / 39.9	41.1	H / 1.0 / 0.0	-41.1	-41.1
Only detectable emissions recorded below						
Mid Channel						
2643.00	62.7 Pk	5.2 / 30.9 / 39.5	59.3	H / 1.0 / 0.0	-22.9	-22.9
2643.00	66.5 Pk	5.2 / 30.9 / 39.5	63.1	V / 1.0 / 0.0	-19.1	-19.1
Low Channel						
3476.00	50.3 Pk	6.6 / 32.7 / 39.4	50.2	H / 1.0 / 0.0	-32.0	-32.0
3476.00	53.7 Pk	6.6 / 32.7 / 39.4	53.6	V / 1.0 / 0.0	-28.6	-28.6
2607.00	55.5 Pk	5.2 / 30.8 / 39.6	51.9	V / 1.0 / 0.0	-30.3	-30.3

Tested by: J Owen
 Printed


 Signature

10

Emissions Test Conditions: RADIATED EMISSIONS, FCC Part 2, Paragraph 2.1053

The *RADIATED EMISSIONS* measurements were performed at the following test location :

- Test not applicable

- Roof (Small Open Area Test Site), San Diego

Testing was performed at a test distance of:

- 1 meters

- 3 meters

- 10 meters

Test Equipment Used :

Model No.	Prop. No.	Description	Manufacturer	Serial No.	Cal Date
3115	453	Antenna, Double Ridge Guide	EMCO	9412-4363	10/01
AMF-5D-010180-35-10P	719	Pre-amplifier (38 dB gain, 1 - 18 GHz)	EMCO	549460	*
8566B	407	Spectrum Analyzer	Hewlett Packard	211500842	11/02
85662B	406	Spectrum Analyzer Display	Hewlett Packard	2112A02185	11/02
AA-190-6.00.0	657	HF Cable	Micropore		

Remarks: (*) Verified

Field Strength Calculation

If a preamplifier was used during the Radiated Emission Testing, it is required that the amplifier gain must be subtracted from the Spectrum Analyzer (Meter) Reading. In addition, a correction factor for the antenna , cable used and a distance factor, if any, must be applied to the Meter Reading before a true field strength reading can be obtained. In the automatic measurement, these considerations are automatically presented as a part of the print out. In the case of manual measurements and for greater efficiency and convenience, instead of using these correlation factors for each meter reading, the specification limit was modified to reflect these correlation factors at each frequency value so that the meter readings can be compared directly to the modified specification limit. This modified specification limit is referred to as the "Corrected Meter Reading Limit" or simply the CMRL, which is the actual field strength present at the antenna. The quantity can be derived in the following manner:

$$\text{Corrected Meter Reading Limit (CMRL)} = \text{SAR} + \text{AF} + \text{CL} - \text{AG} - \text{DC}$$

Where, SAR = Spectrum Analyzer Reading

AF = Antenna Factor

CL = Cable Loss

AG = Amplifier Gain (if any)

DC = Distance Correction (if any)

Assume the following situation: A meter reading of 29.4 dBuV was obtained from a Class A computing device measured at 83 MHz. Assume an antenna factor of 9.2 dB, a cable loss of 1.4 dB and amplifier gain of 20.0 dB at 83 MHz. The final field strength would be determined as follows:

$$\text{CMRL} = 29.4 \text{ dBuV} + 9.2 \text{ dB} - 1.4 \text{ dB} - 20 \text{ dB/M} - 0.0 \text{ dB}$$

$$\text{CMRL} = 20.0 \text{ dBuV/M}$$

This result is well below the FCC and CSA Class A limit of 29.5 dbuV/m at 83 MHz.

For the manual mode of measurement, a table of corrected meter reading limit was used to permit immediate comparison of the meter reading to determine if the measure emission amplitude exceeded the specification limit at that specific frequency.

4 CONDUCTED EMISSION EQUIPMENT/DATA

See following page(s).

Emissions Test Conditions: CONDUCTED EMISSIONS, FCC Part 2, 2.1046, 2.1047, 2.1051 and Part 22, Paragraph 22.917(e)

The *RADIATED EMISSIONS* measurements were performed at the following test location :

- Test not applicable

■ - SR-3, Shielded Room, 12' x 20' x 8', Metal Chamber

Test Equipment Used :

Signal Generator, Hewlett Packard, Model HPE4436B, S/N US39260103, cal 08/02
Signal Generator, Hewlett Packard, Model HPE4436B, S/N US40051726, cal 08/02
Signal Generator, Hewlett Packard, Model HPE4436B, S/N US40051734, cal 09/01
Combiner, KDI, Model KDI D336LS, NCR
AT1, Narda, Model NARDA 769-30, S/N 17328, NCR
AT2, Narda, Model NARDA 769-20, S/N 5793, NCR
DC1, Hewlett Packard, Model HP778D, S/N 769-30, NCR
PS1, Hewlett Packard, Model HP8481D, S/N US37290516, cal 07/01
PM1, Hewlett Packard, Model HPE4419, S/N GB40201926, cal 07/01
SA, Hewlett Packard, Model HP8294E, P/N 430, cal 05/01

Remarks: _____

Intermodulation

15:58:22 NOV 08, 2000

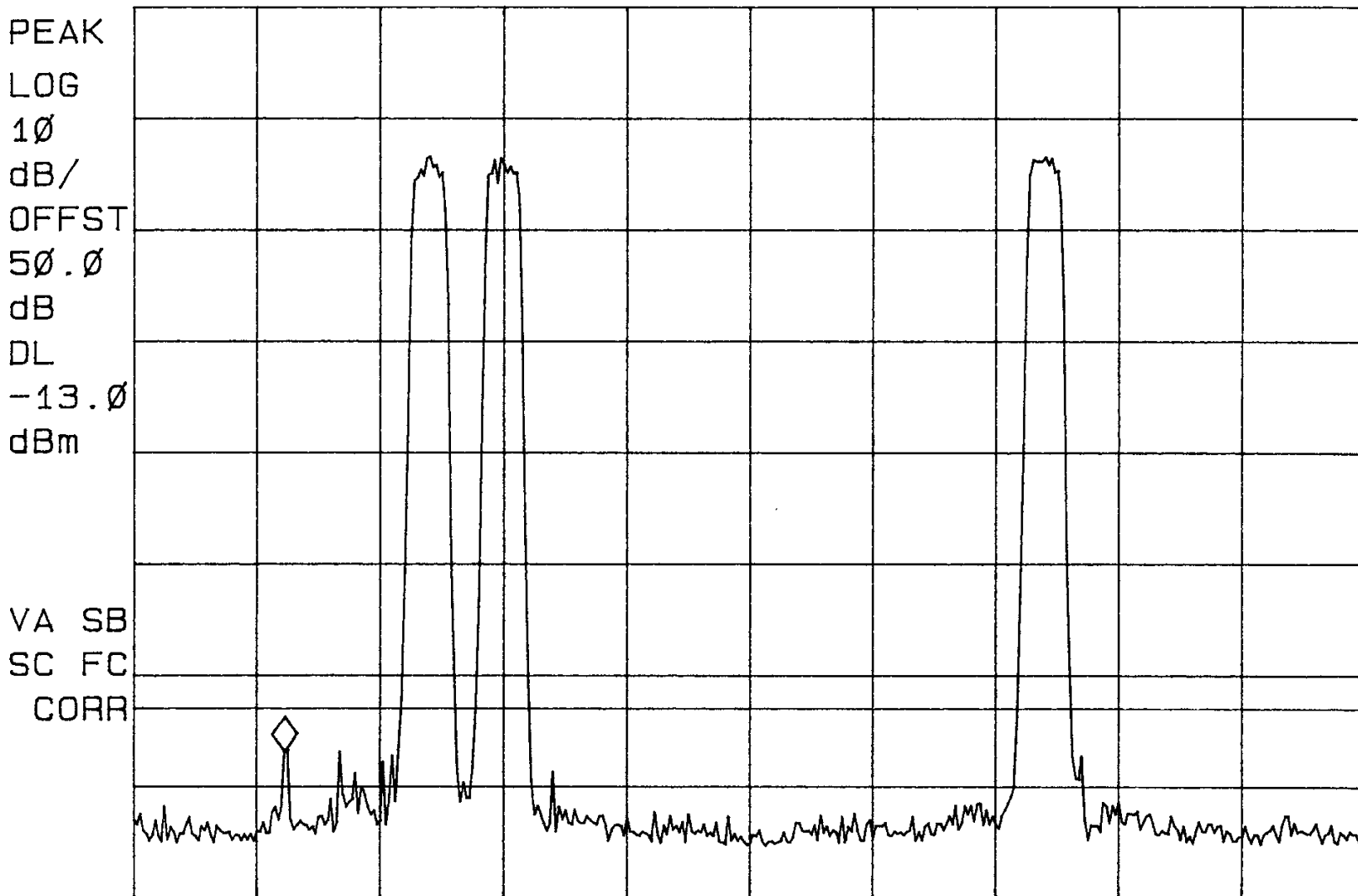
~~17~~

REF 50.0 dBm

AT 10 dB

MKR 863.18 MHz

-16.91 dBm



CENTER 882.06 MHz

#RES BW 100 kHz

VBW 100 kHz

SPAN 50.00 MHz

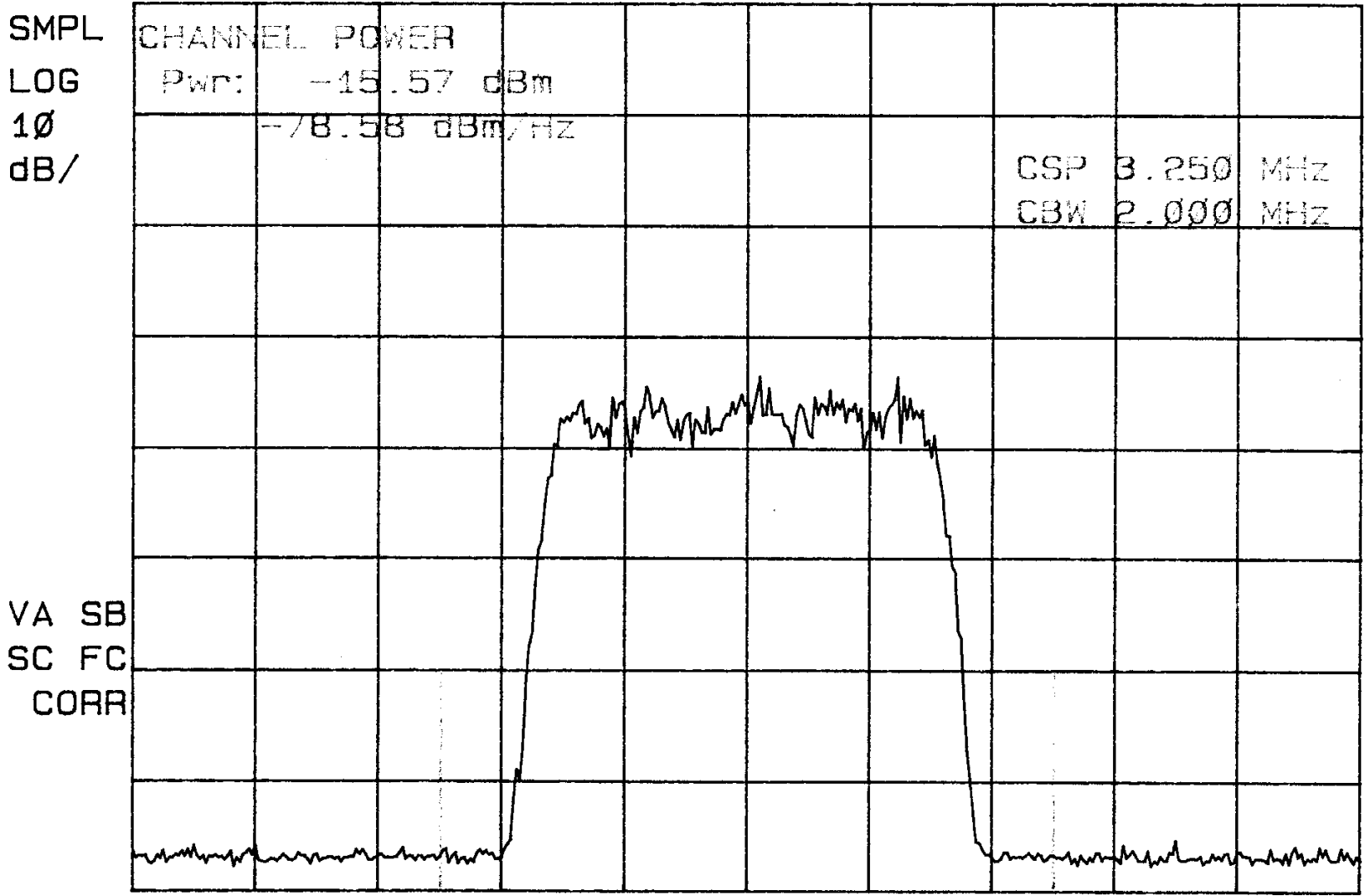
SWP 20.0 msec

15

16: 57: 45 NOV 08. 2000
hp

Input Power

REF 5.7 dBm AT 20 dB



CENTER 869.000 MHz
#RES BW 30 KHZ

#VBW 300 KHZ

SPAN 4.000 MHz
SWP 20.0 msec

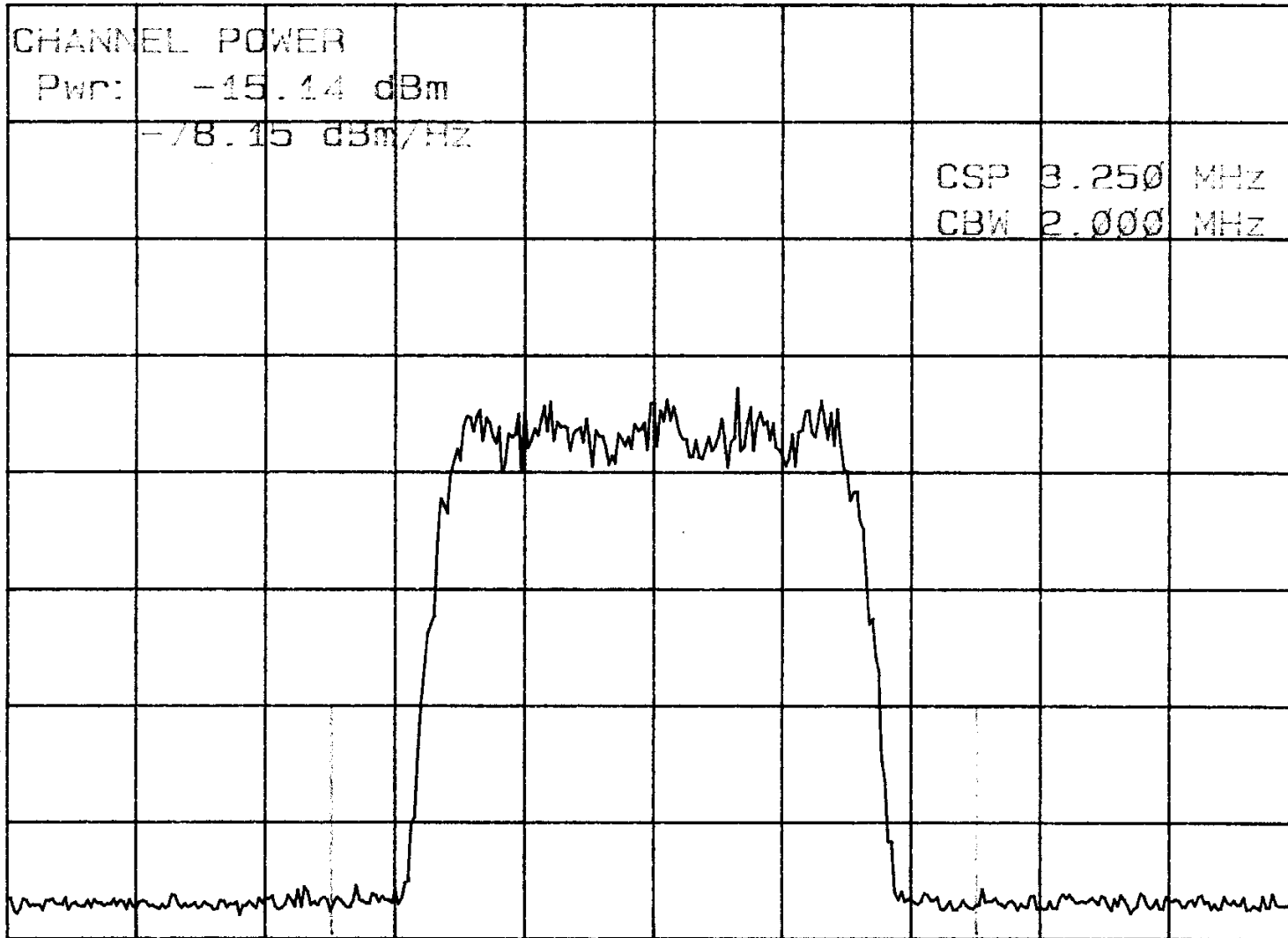
16:54:27 NOV 08, 2000
HP

Input Power

REF 5.7 dBm

AT 20 dB

SMPL
LOG
10
dB/



CENTER 881.000 MHz
#RES BW 30 KHz

#VBW 300 KHz

SPAN 4.000 MHz
SWP 20.0 msec

17

Input Power

16:50:56 NOV 08, 2000
hp

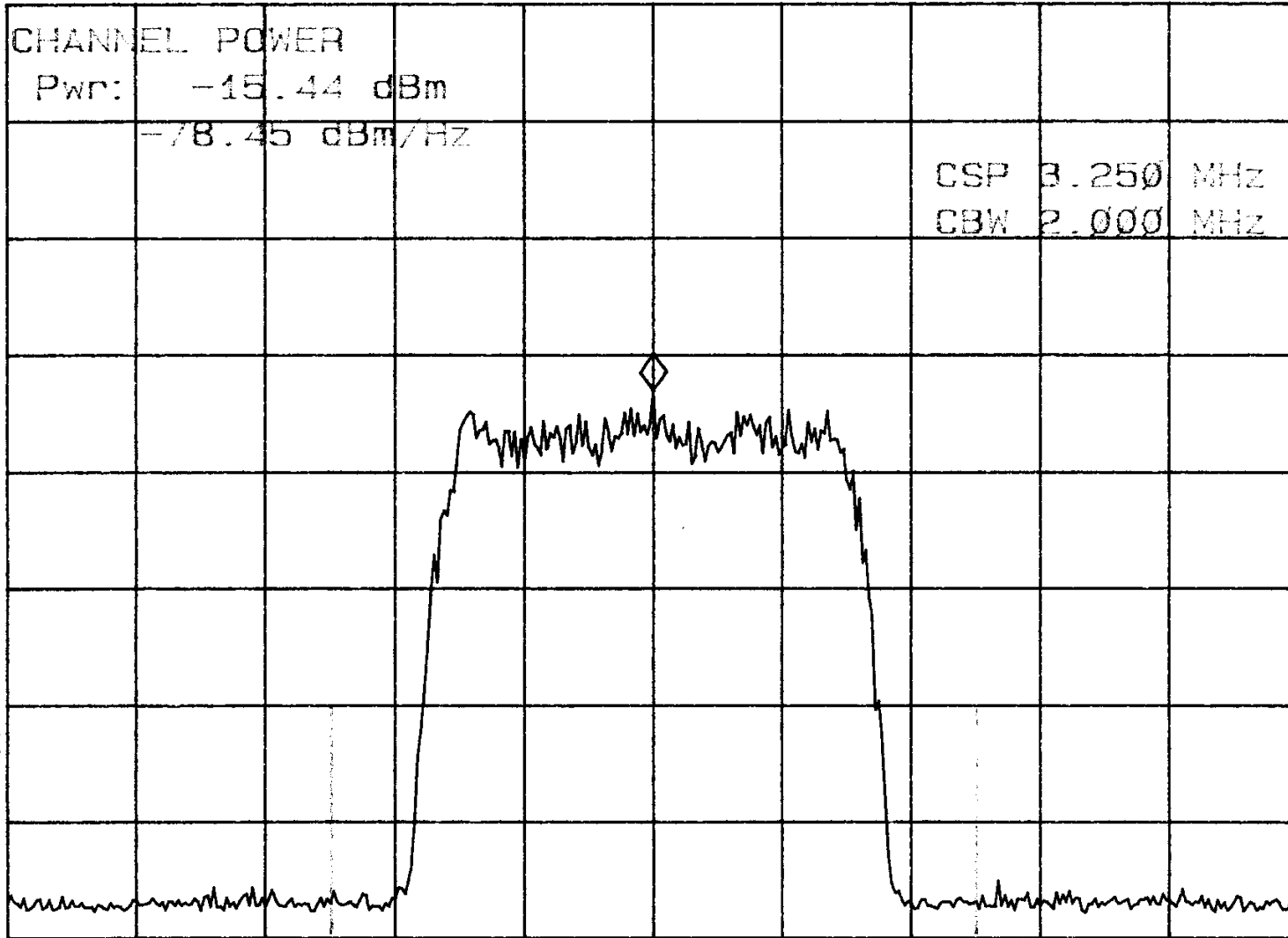
REF 5.7 dBm

AT 20 dB

MKR 894.000 MHz

-27.37 dBm

SMPL
LOG
10
dB/



VA SB
SC FC
CORR

CENTER 894.000 MHz

#RES BW 30 kHz

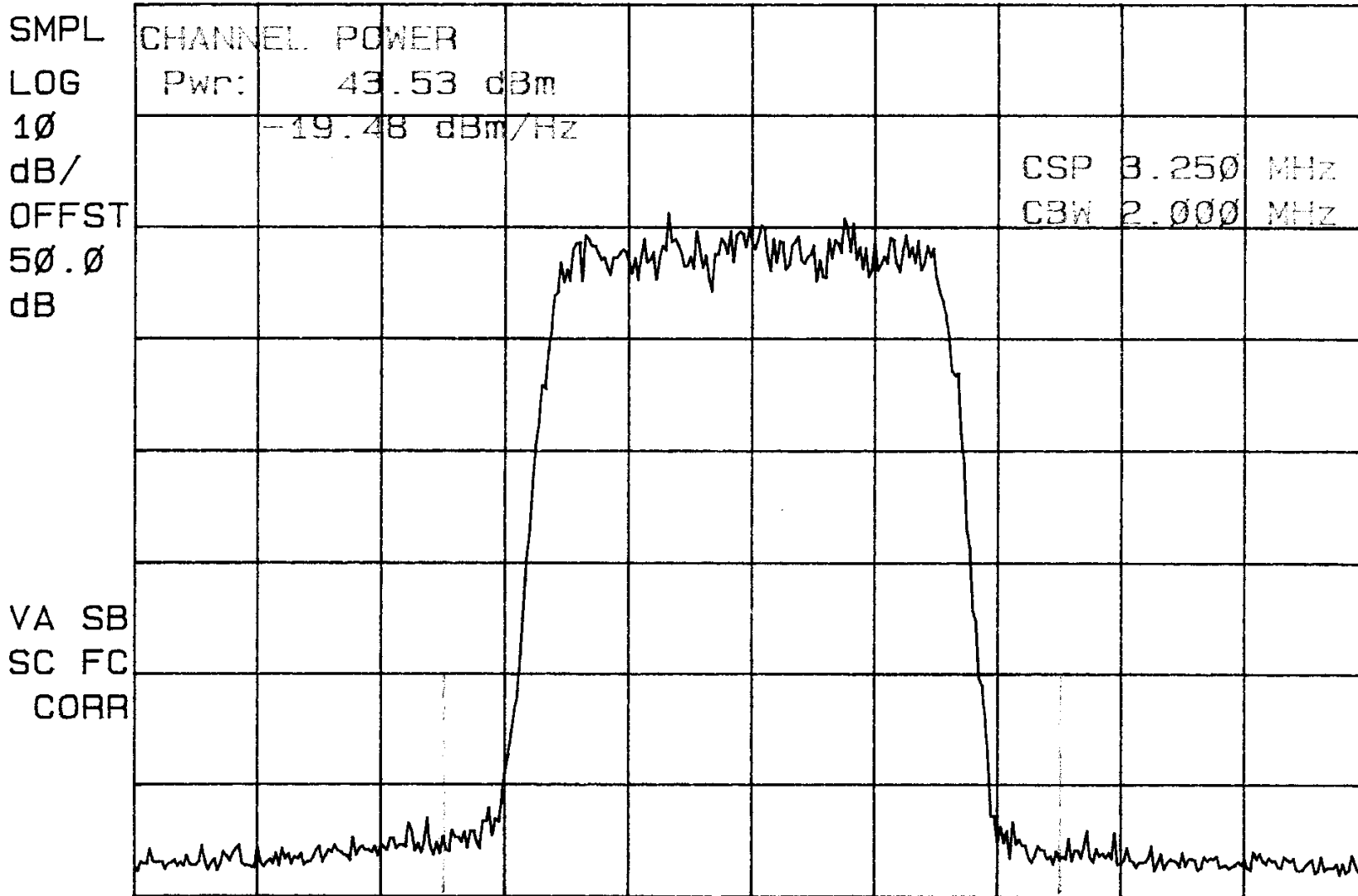
#VBW 300 kHz

SPAN 4.000 MHz

SWP 20.0 msec

16: 22: 11 NOV 08, 2000

REF 50.0 dBm AT 10 dB



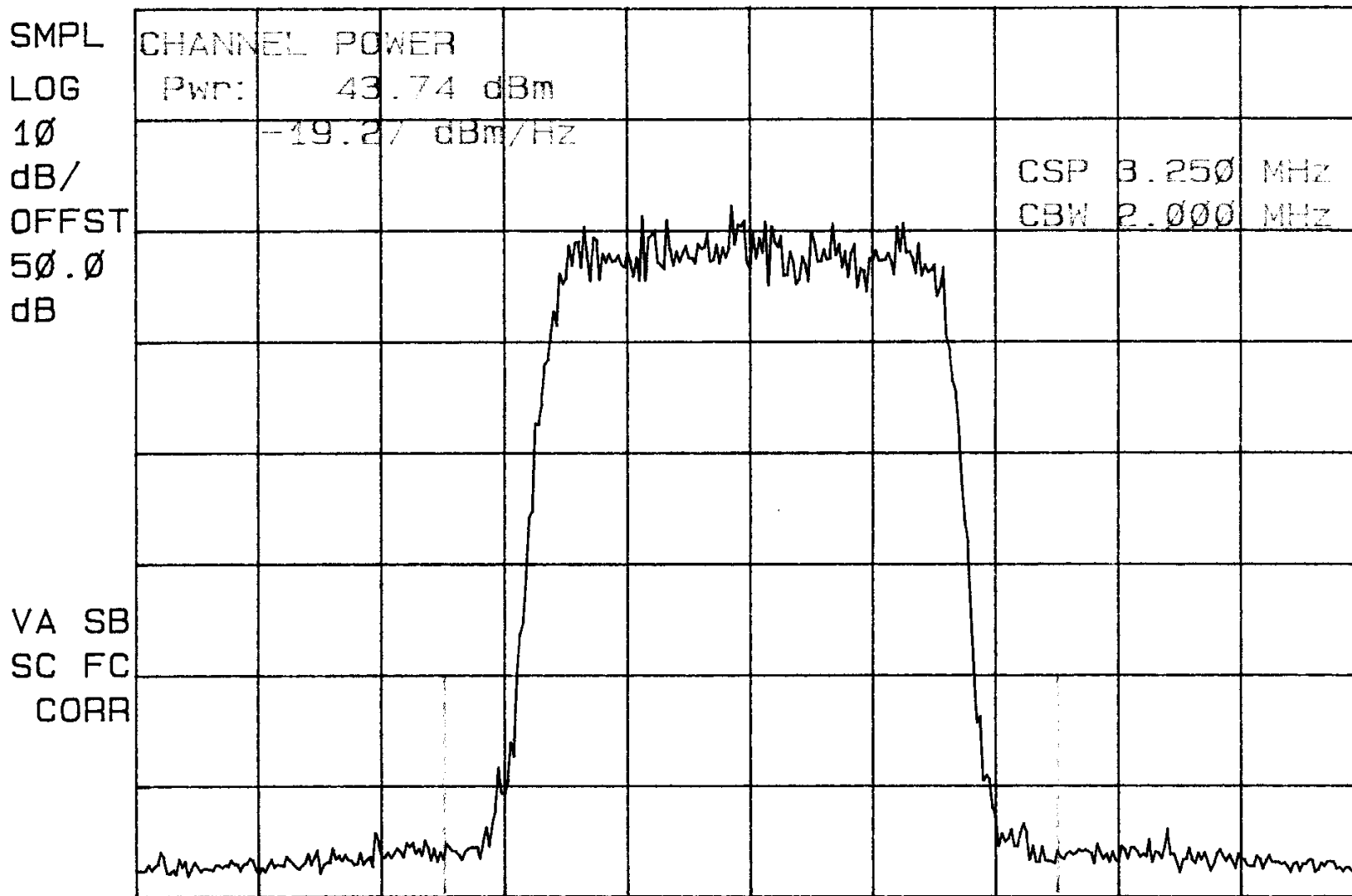
CENTER 869.000 MHz
#RES BW 300 KHz

#VBW 300 KHz

SPAN 4.000 MHz
SWP 20.0 msec

16: 19: 04 NOV 08, 2000

REF 50.0 dBm AT 10 dB



CENTER 881.000 MHz

SPAN 4.000 MHz

#RES BW 30 KHz

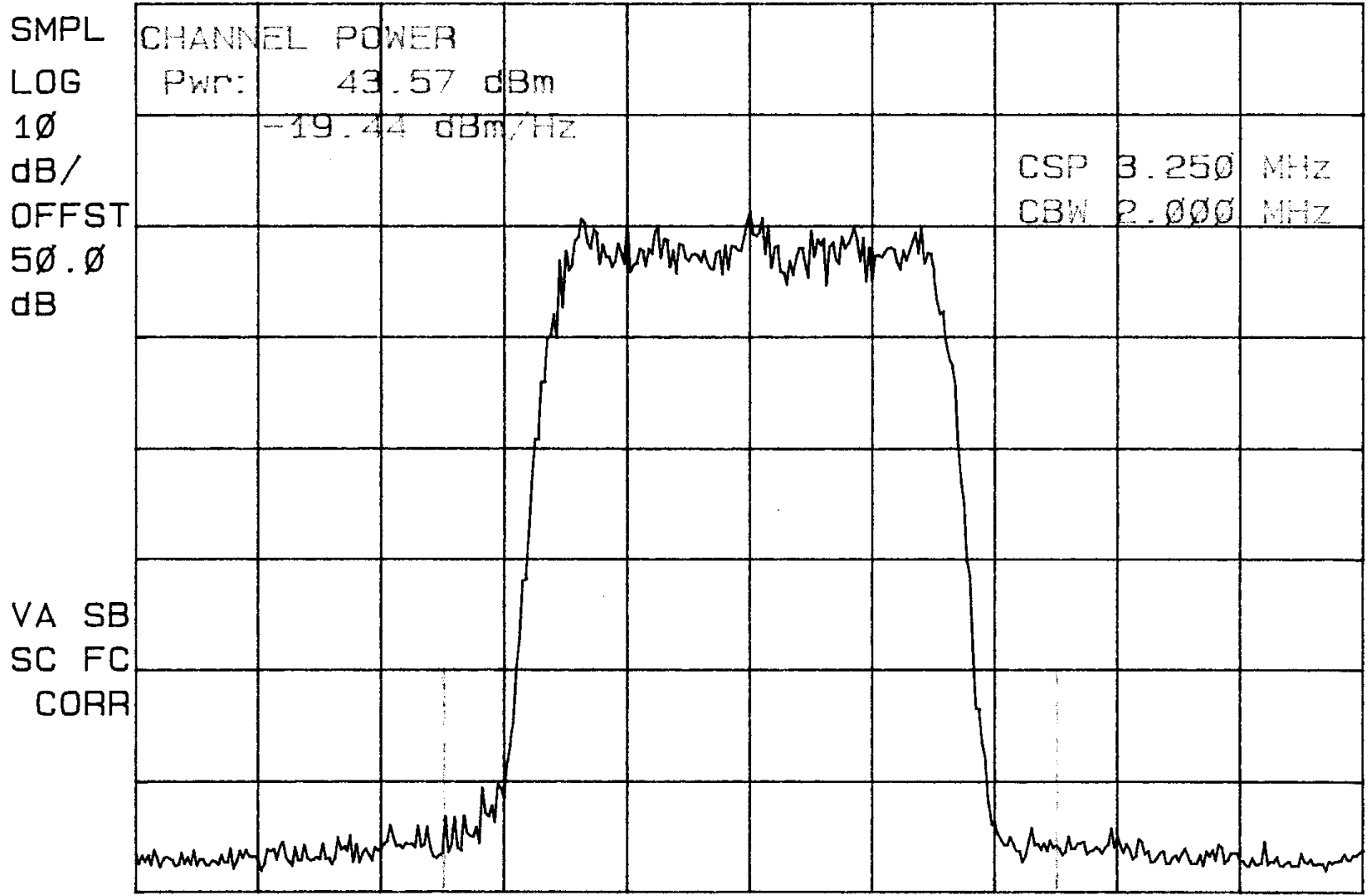
#VBW 300 KHz

SWP 20.0 msec

20

16: 15: 57 NOV 08, 2000
hp

REF 50.0 dBm AT 10 dB



CENTER 894.000 MHz
#RES BW 30 KHz

#VBW 300 KHz

SPAN 4.000 MHz
SWP 20.0 msec

21

MKR 867.960 MHz
-13.50 dBm

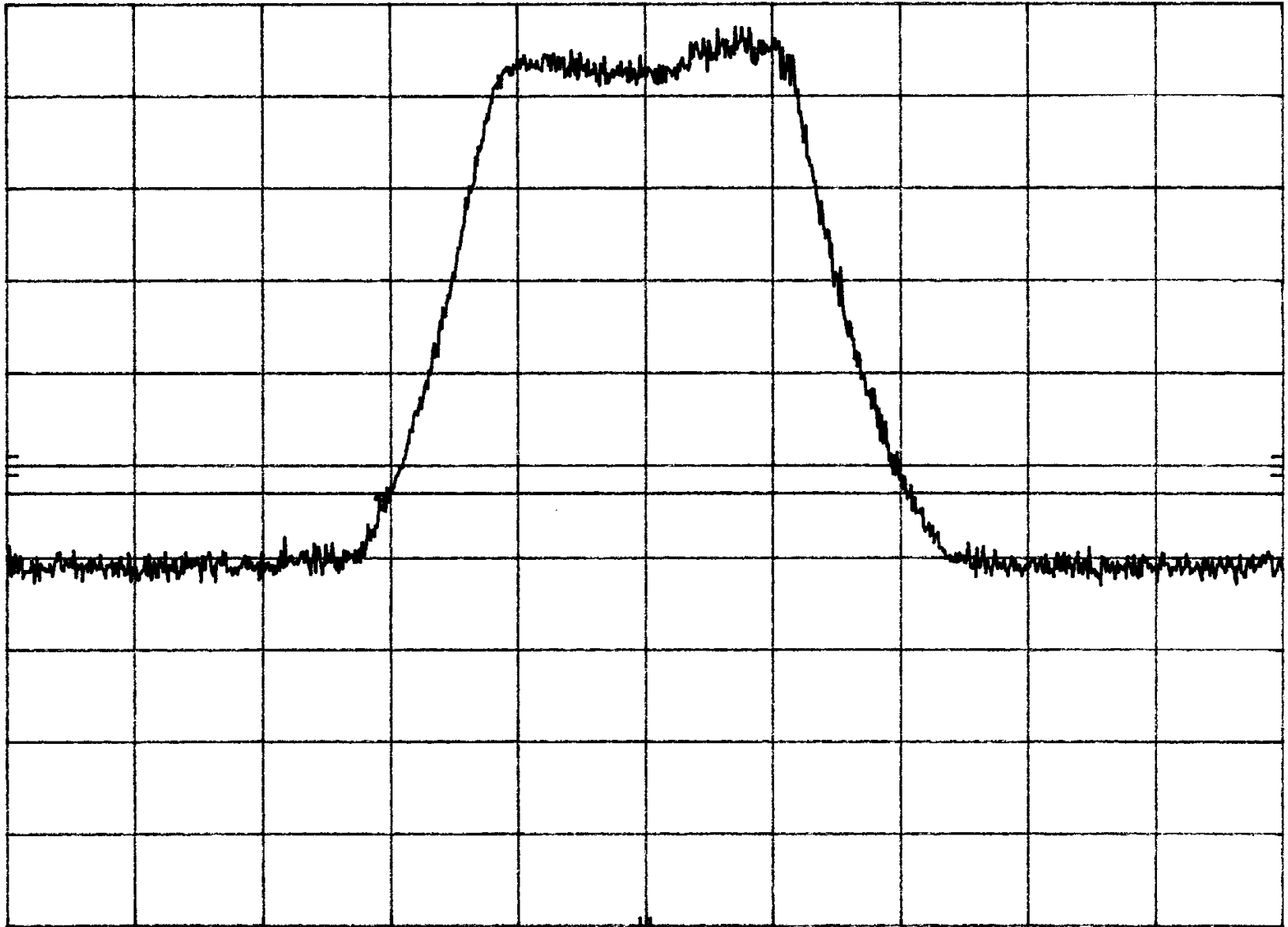
hp REF 40.0 dBm ATTEN 20 dB

10 dB/

POS PK

OFFSET
50.0
dB

DL
-13.0
dBm



CENTER 869.00 MHz

RES BW 100 KHz

VBW 100 KHz

SPAN 5.00 MHz

SWP 20.0 msec 22

MKR 894.805 MHz
-13.70 dBm

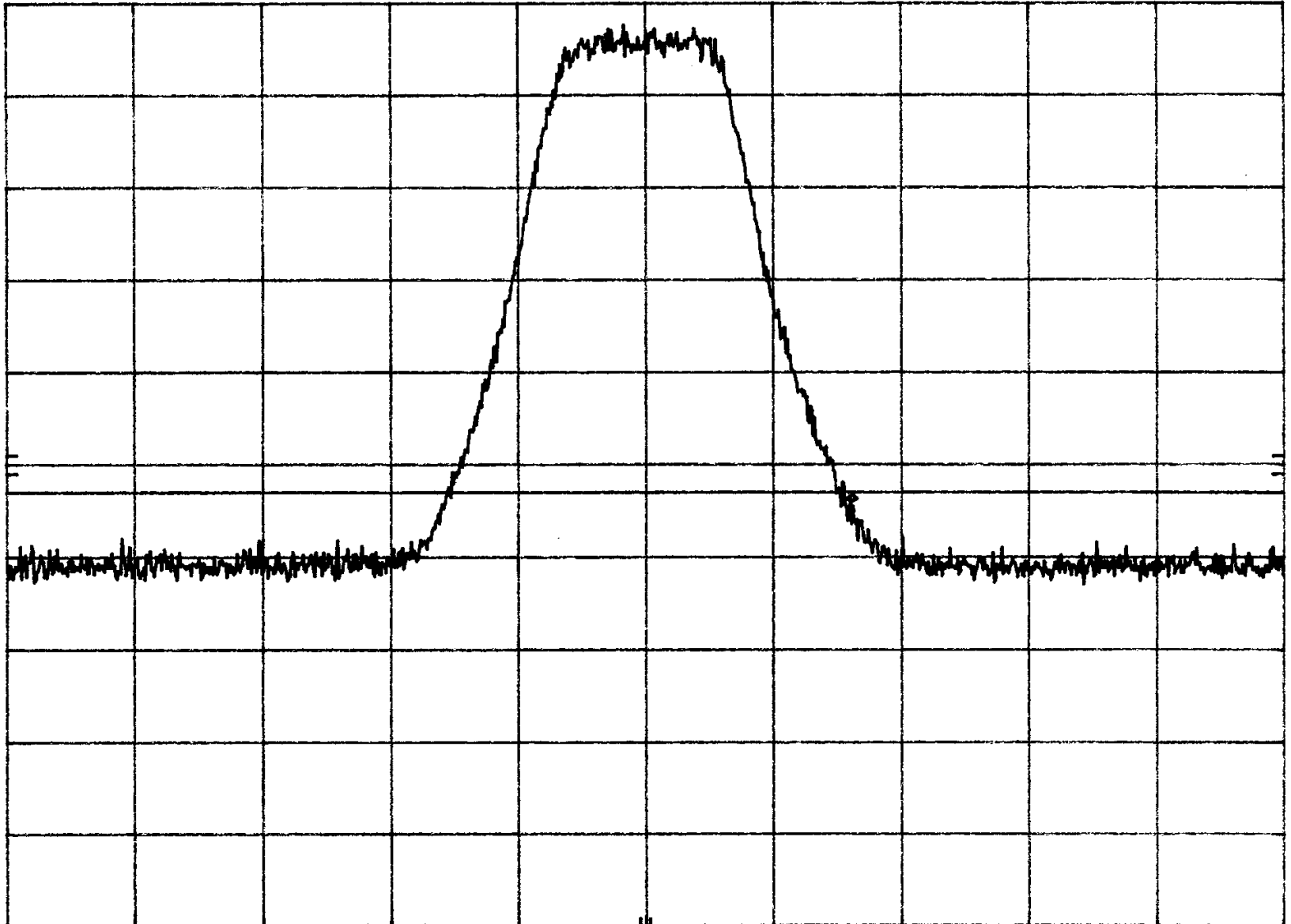
hp REF 40.0 dBm ATTEN 20 dB

10 dB/

POS PK

OFFSET
50.0
dB

DL
-13.0
dBm



CENTER 894.00 MHz

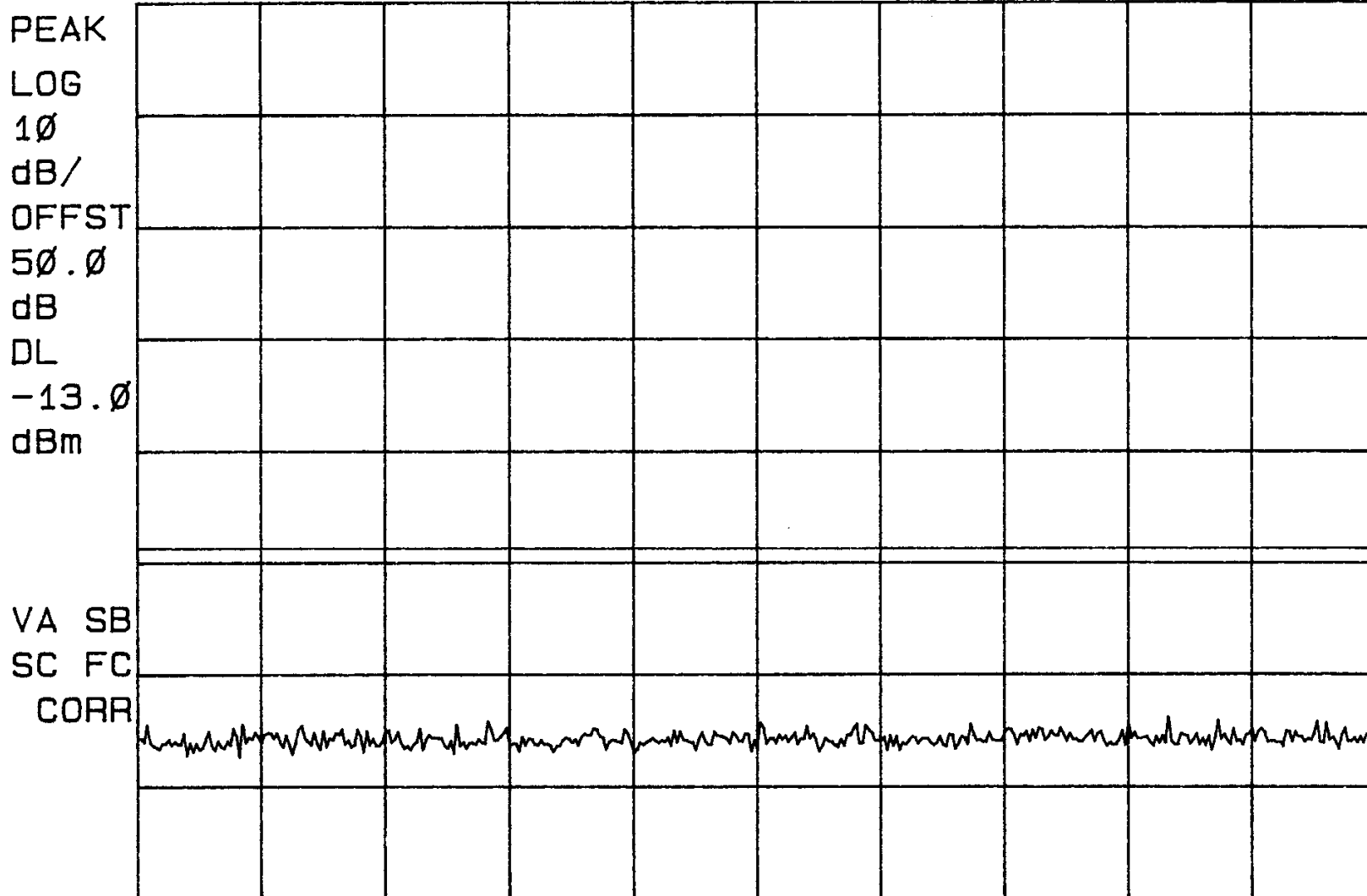
RES BW 100 KHz

VBW 100 KHz

SPAN 5.00 MHz
SWP 20.0 msec

17:04:38 NOV 08, 2000
hp

REF 35.7 dBm AT 10 dB



START 30.0 MHz

#RES BW 100 KHz

VBW 100 KHz

STOP 500.0 MHz

SWP 141 msec

24

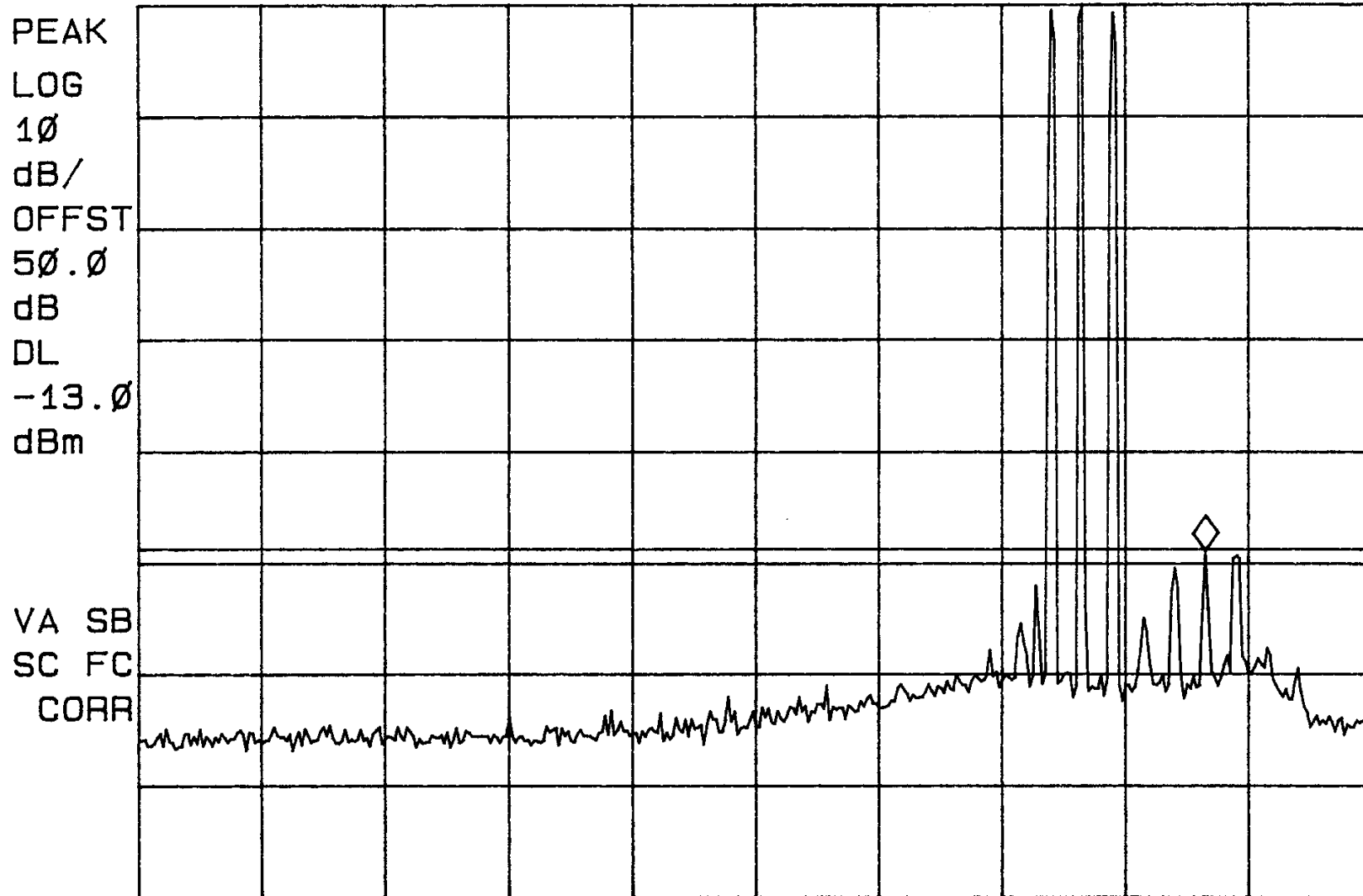
17:07:42 NOV 08, 2000
hp

MKR 932.5 MHz

REF 35.7 dBm

AT 10 dB

-13.17 dBm



START 500.0 MHz

#RES BW 100 KHz

VBW 100 KHz

STOP 1.0000 GHz

SWP 150 msec

25

MKR 944.8 MHz
-15.60 dBm

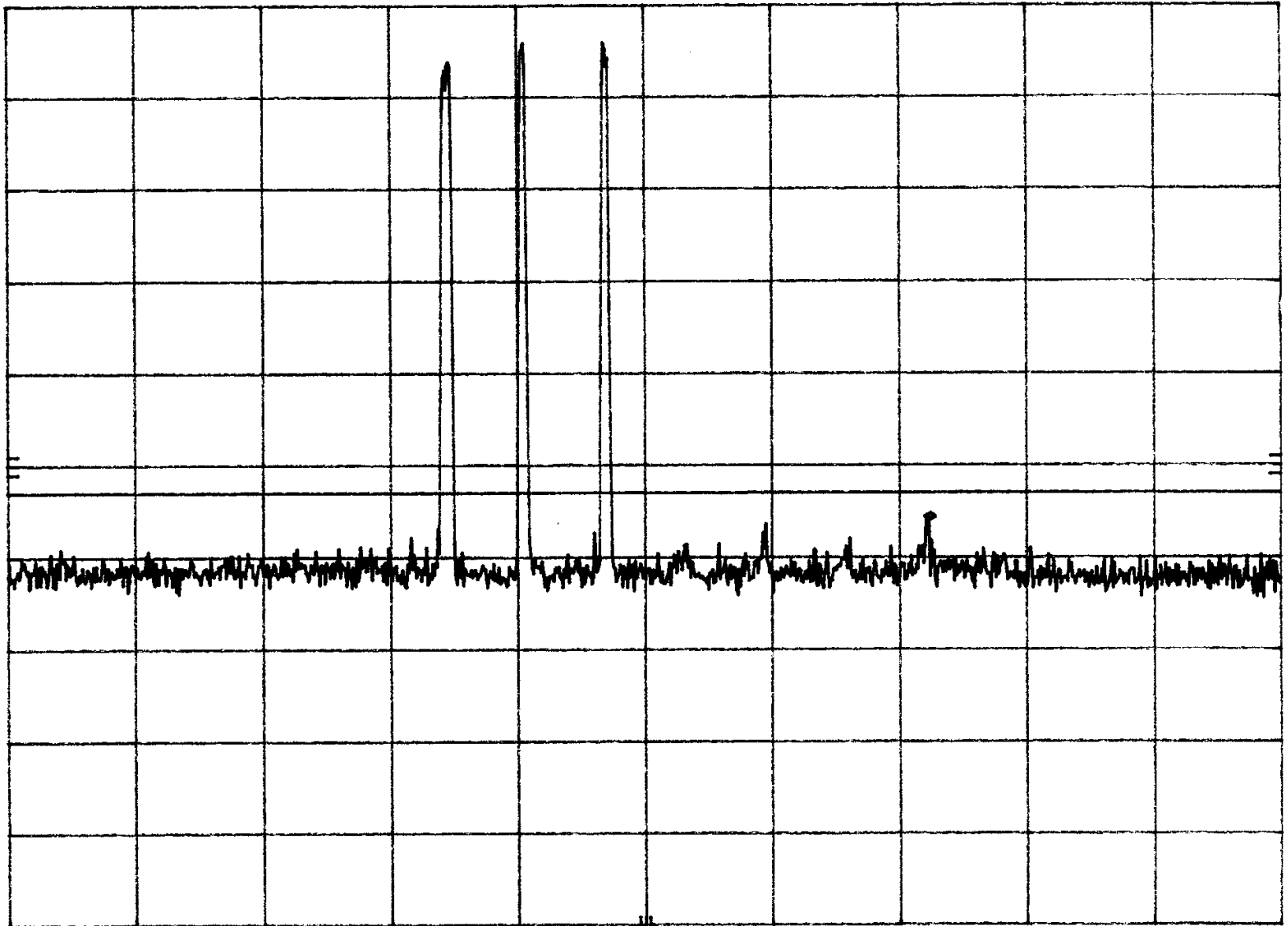
hp REF 40.0 dBm ATTEN 20 dB

10 dB/

POS PK

OFFSET
50.0
dB

DL
-13.0
dBm



START 800 MHz

RES BW 100 kHz

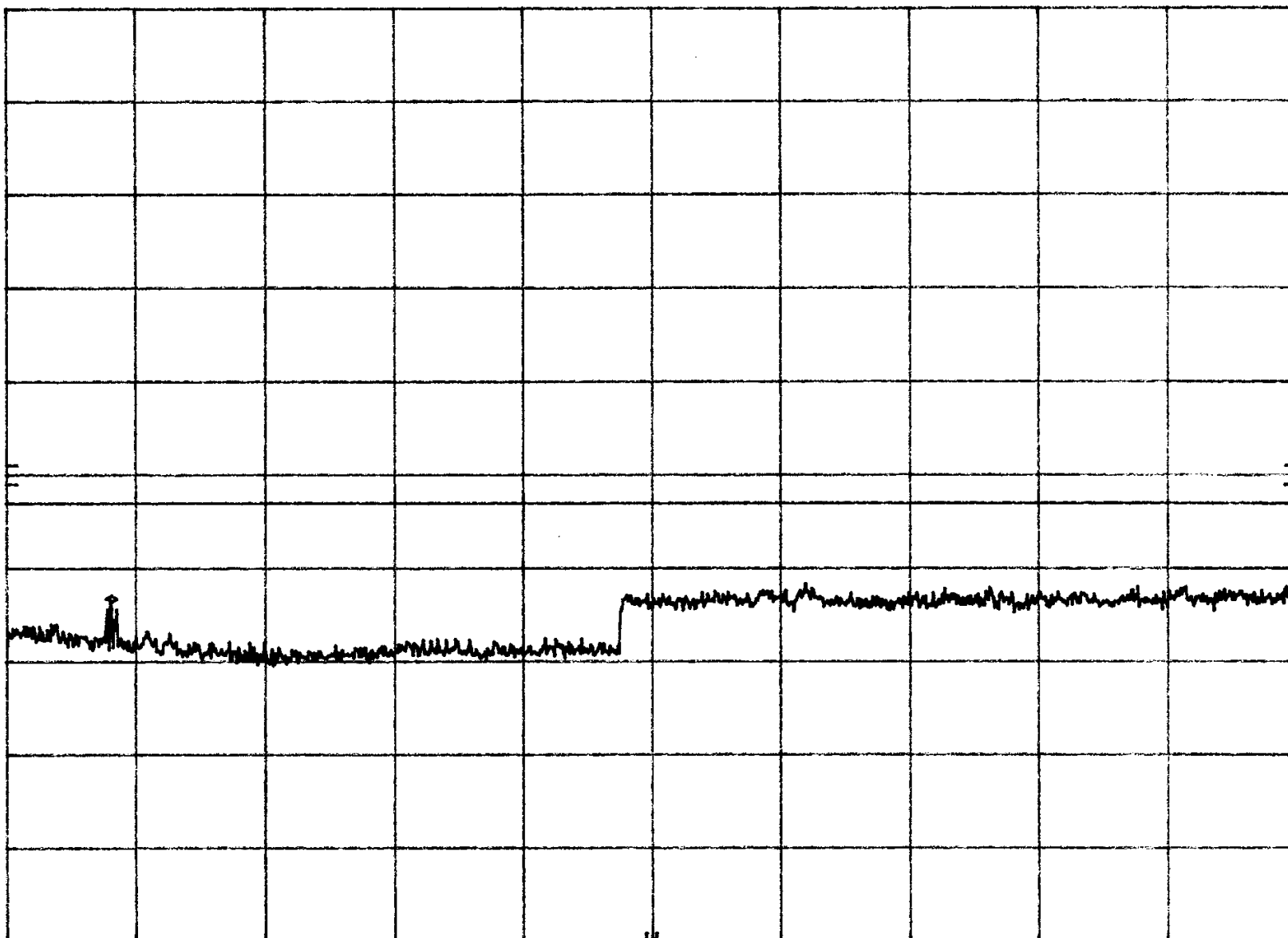
VBW 100 kHz

STOP 1.000 GHz

SWP 60.0 msec 26

MKR 2.648 GHz
-23.30 dBm

hp
10 dB/
POS PK
OFFSET
50.0
dB
DL
-13.0
dBm



START 2.00 GHz

RES BW 1 MHz

VBW 1 MHz

STOP 10.00 GHz

SWP 200 msec 27

7 SIGNATURE PAGE

GENERAL REMARKS:

SUMMARY:

All tests according *FCC Part 2, Paragraphs, 2.1046, 2.1047, 2.1051, 2. 1053 and Part 22, Paragraph 22.917(e)* were.

■ - Performed

The Equipment Under Test

■ - **Fulfills** the requirements of *FCC Part 2, Paragraphs, 2.1046, 2.1047, 2.1051, 2. 1053 and Part 22, Paragraph 22.917(e)*.

- TÜV PRODUCT SERVICE, INC. -

Responsible Engineer:

A handwritten signature in black ink, appearing to read "Jim Owen". The signature is fluid and cursive, with a large initial "J" and "O".

Jim Owen
(EMC Engineer)