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: **Defer until:**	No: X
Company Name **agrees to notify the Commission by:** **of the intended date of announcement of the product so that the grant can be issued on that date.**	N/A	
Transition Rules Request per 15.37?	Yes:	*No:

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

Report Prepared by:

TÜV PRODUCT SERVICE
10040 Mesa Rim Road
San Diego, CA 92121-2912
Phone: 858 546 3999
Fax: 858 546 0364

TABLE OF CONTENTS

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

☐ Permanent OR ☐ Removable Length (in meters): _____
☐ Shielded OR ☐ Unshielded
☒ 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	☒ ☐		☒ ☐			Metalized D-Sub	RF connections/dc power		☐ ☒

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			☐ Switched-mode: (Frequency) _____

1.1 Product Description (continued)

Power Line Filters		
Manufacturer	***Model #***	***Location in EUT***
Spectrum Control	52-978-107-FA3	Multifunction Board
Panasonic	ELK-E103FA	Multifunction Board

Critical EMI Components (Capacitors, ferrites, etc.)				
Description	***Manufacturer***	***Part # or Value***	***Qty***	***Component # / Location***
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

TÜV PRODUCT SERVICE

Test Report #:	S0467 Run 01	Test Area:	Site 3 Roof	Temperature:	20 °C
Test Method:	Part 2, Para 2.1053	Test Date:	10-Nov-2000	Relative Humidity:	65 %
EUT Model #:	Seahawk G3L-800-60004	EUT Power:	29 Vdc	Air Pressure:	100.1 kPa
EUT Serial #:				Page:	1 of 3
Manufacturer:	Powerwave				
EUT Description:	800 MHz RF Amplifier				
Notes:	60 Watts rated power				

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

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dB\m) (dB)	FINAL ()	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

TÜV PRODUCT SERVICE

Test Report #:	S0467 Run 01	Test Area:	Site 3 Roof	Temperature:	20 °C
Test Method:	Part 2, Para 2.1053	Test Date:	10-Nov-2000	Relative Humidity:	65 %
EUT Model #:	Seahawk G3L-800-60004	EUT Power:	29 Vdc	Air Pressure:	100.1 kPa
EUT Serial #:					
Manufacturer:	Powerwave				
EUT Description:	800 MHz RF Amplifier				
Notes:	60 Watts rated power				

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

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	()	(m) (DEG)	FCC Part 24.238	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)

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 gaine, 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:

Corrected Meter Reading Limit (CMRL) = SAR + AF + CL - AG - 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:

CMRL = 29.4 dBuV + 9.2dB = 1.4 dB - 20 dB/M - 0.0 dB

CMRL = 20.0 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**

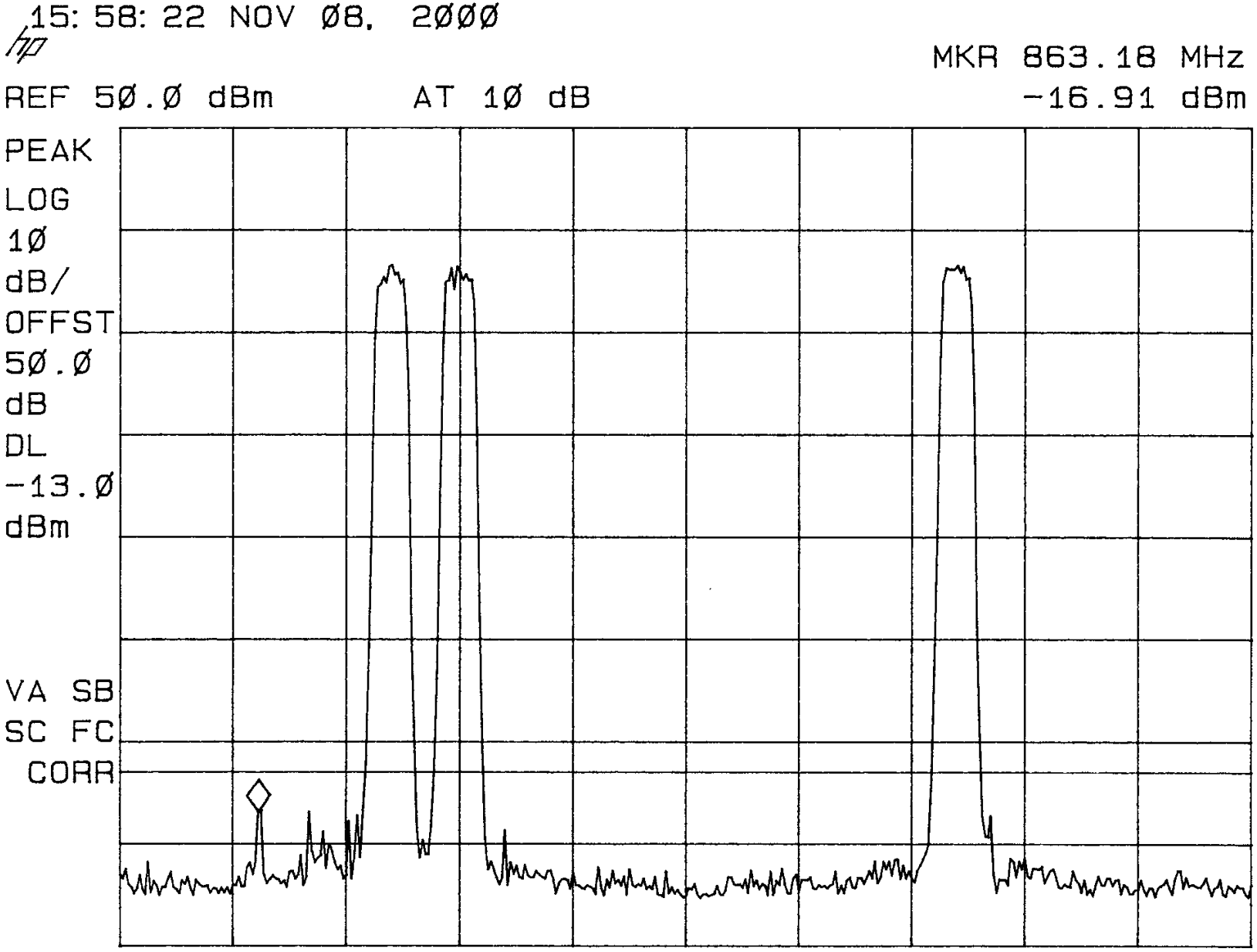
■ - SR-3, Shielded Room, 12' x 20' x 8', Metal Chamber

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

16: 57: 45 NOV Ø8, 2ØØØ

Input Power

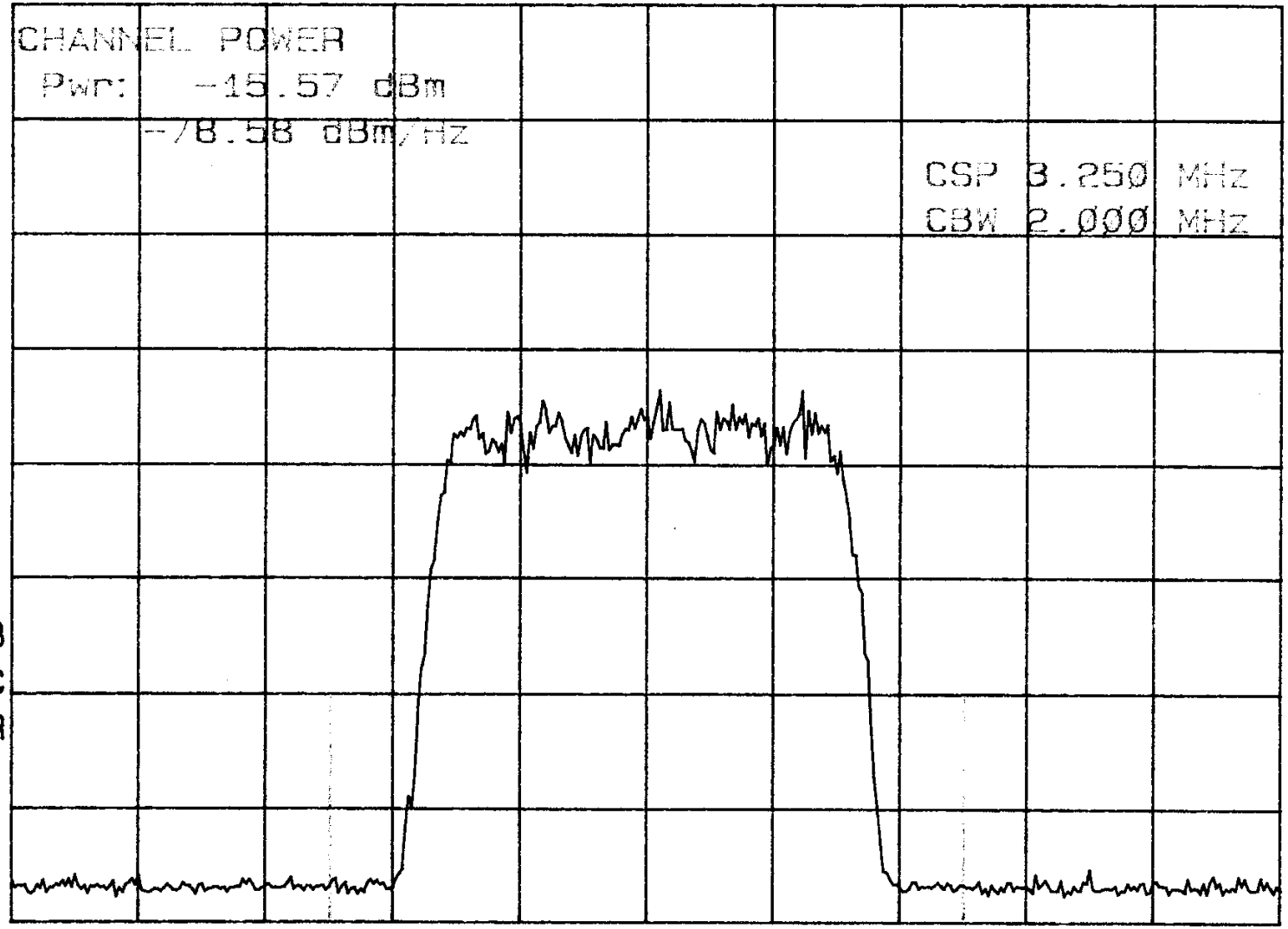
REF 5.7 dBm AT 2Ø dB

SMPL

LOG

1Ø

dB/



VA SB

SC FC

CORR

CENTER 869.ØØØ MHz SPAN 4.ØØØ MHz

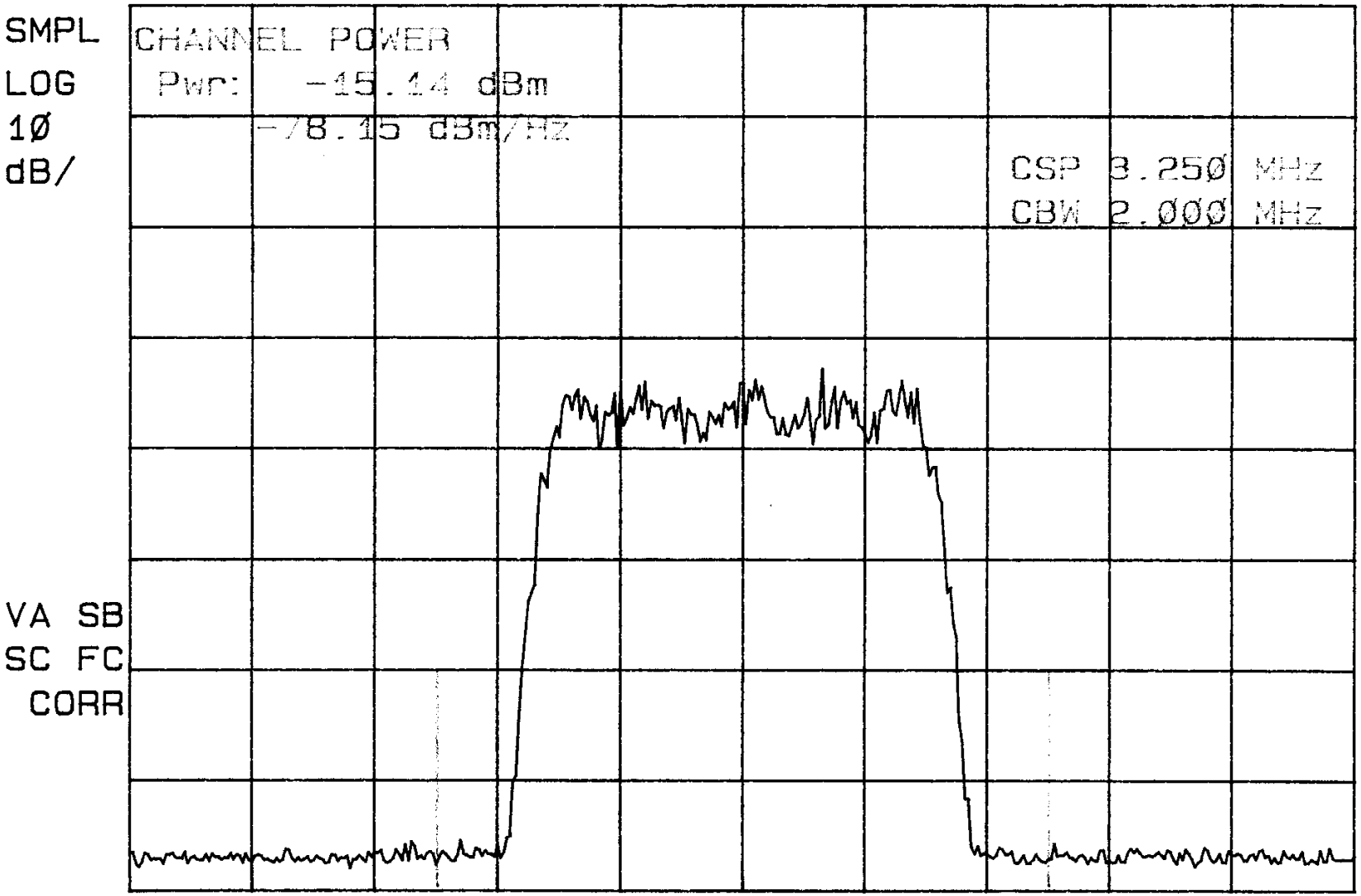
#RES BW 3Ø kHz #VBW 3ØØ kHz SWP 2Ø.Ø msec

16

16: 54: 27 NOV Ø8, 2ØØØ

Input Power

REF 5.7 dBm AT 2Ø dB

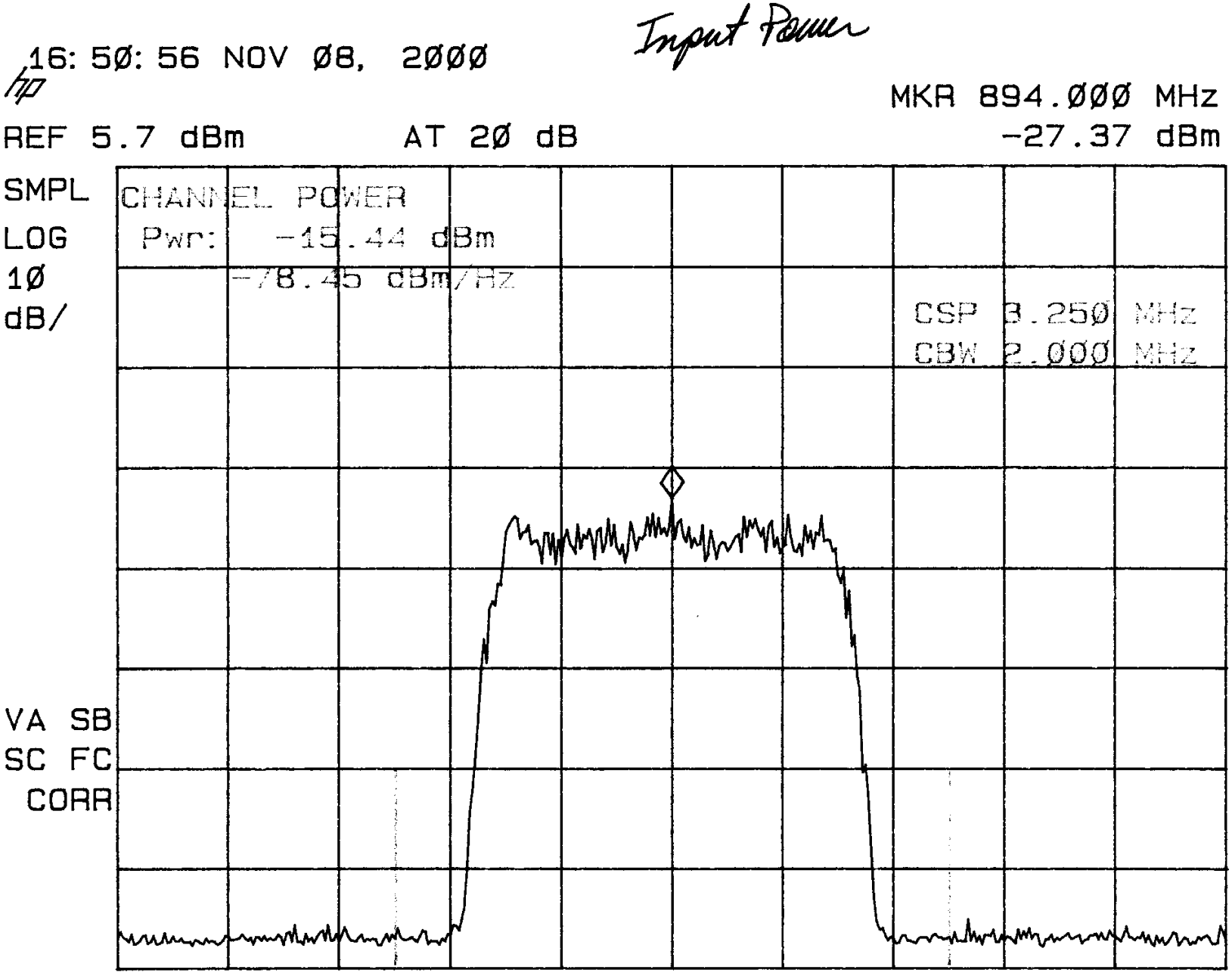


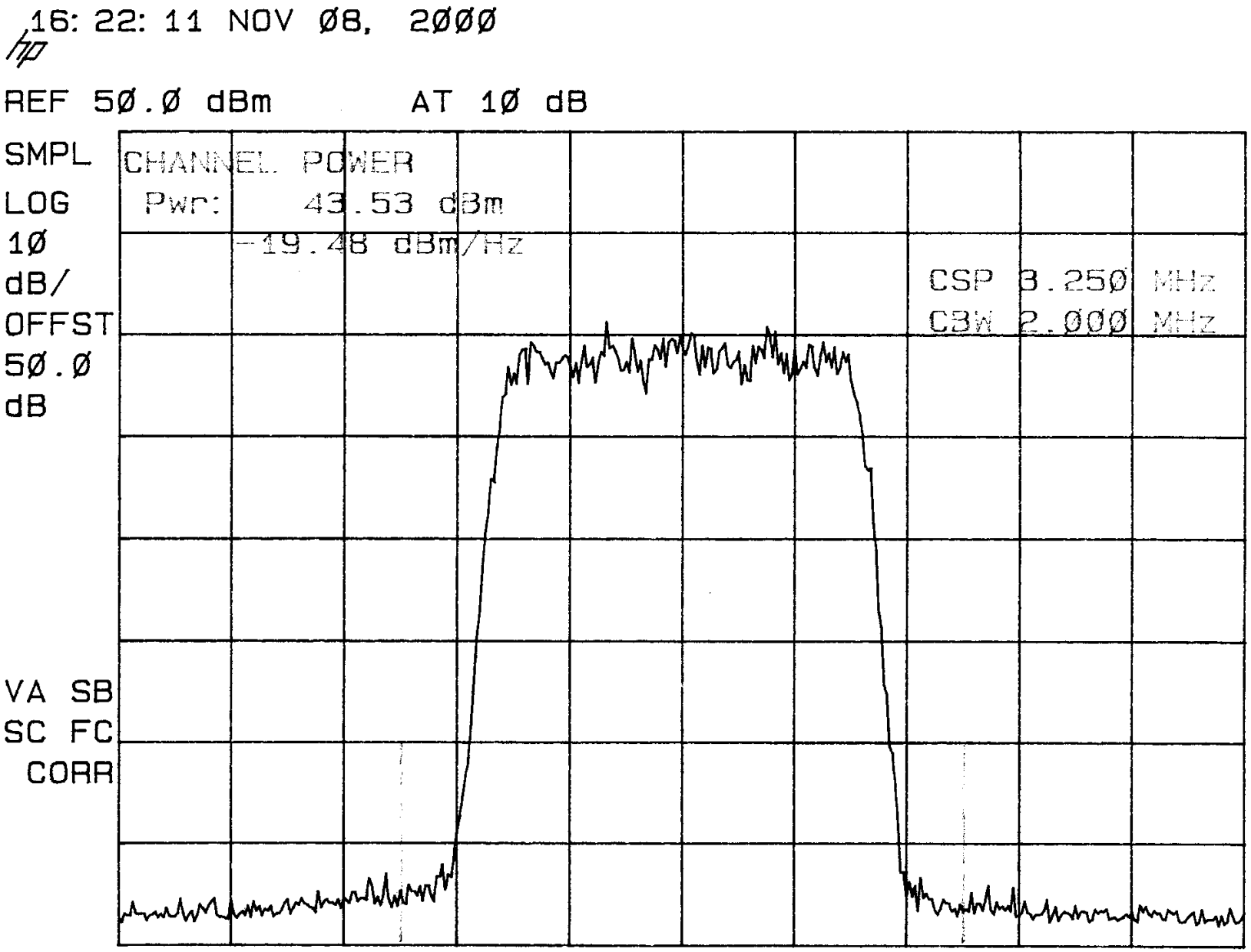
CENTER 881.ØØØ MHz SPAN 4.ØØØ MHz

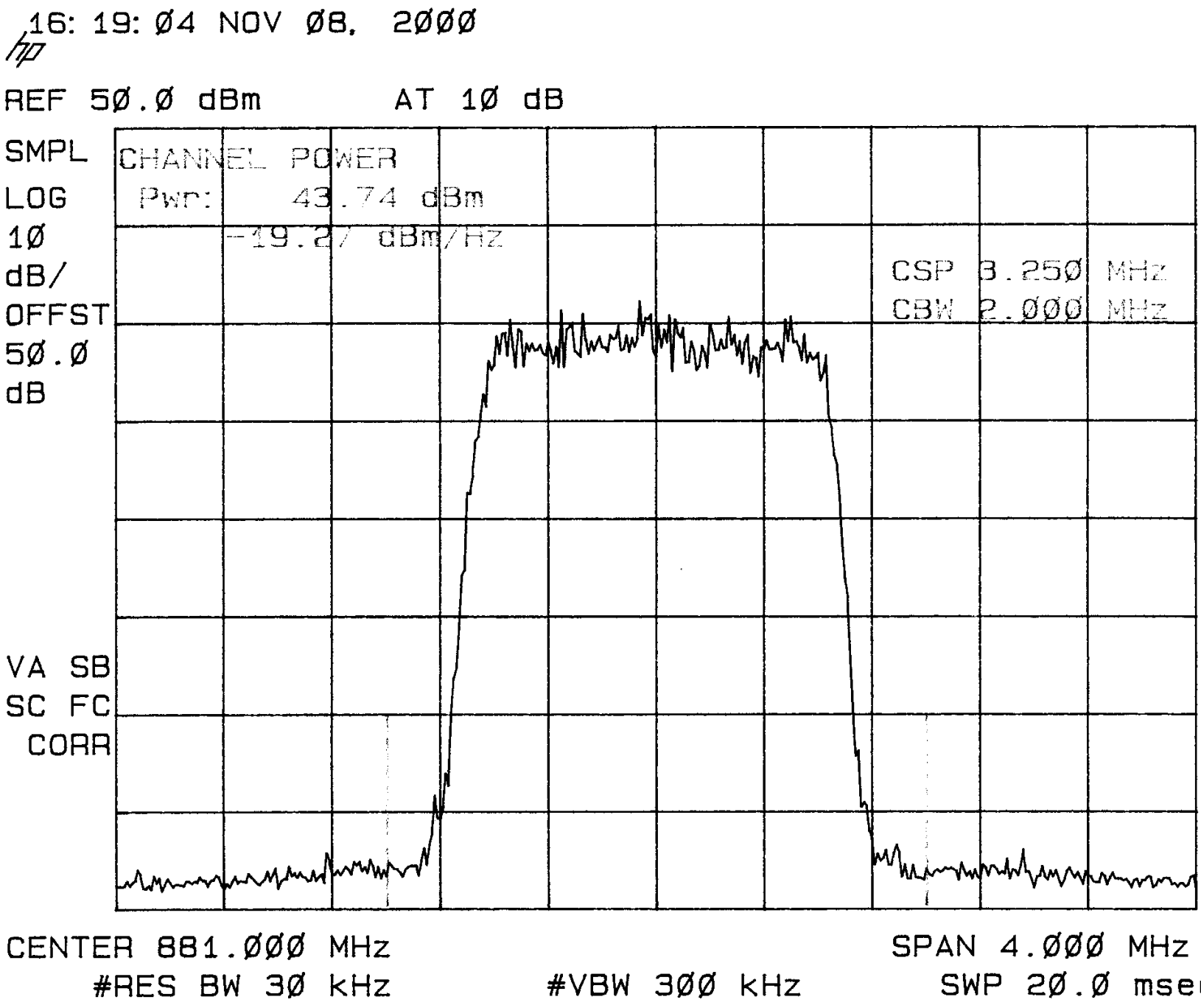
#RES BW 3Ø kHz #VBW 3ØØ kHz SWP 2Ø.Ø msec

17

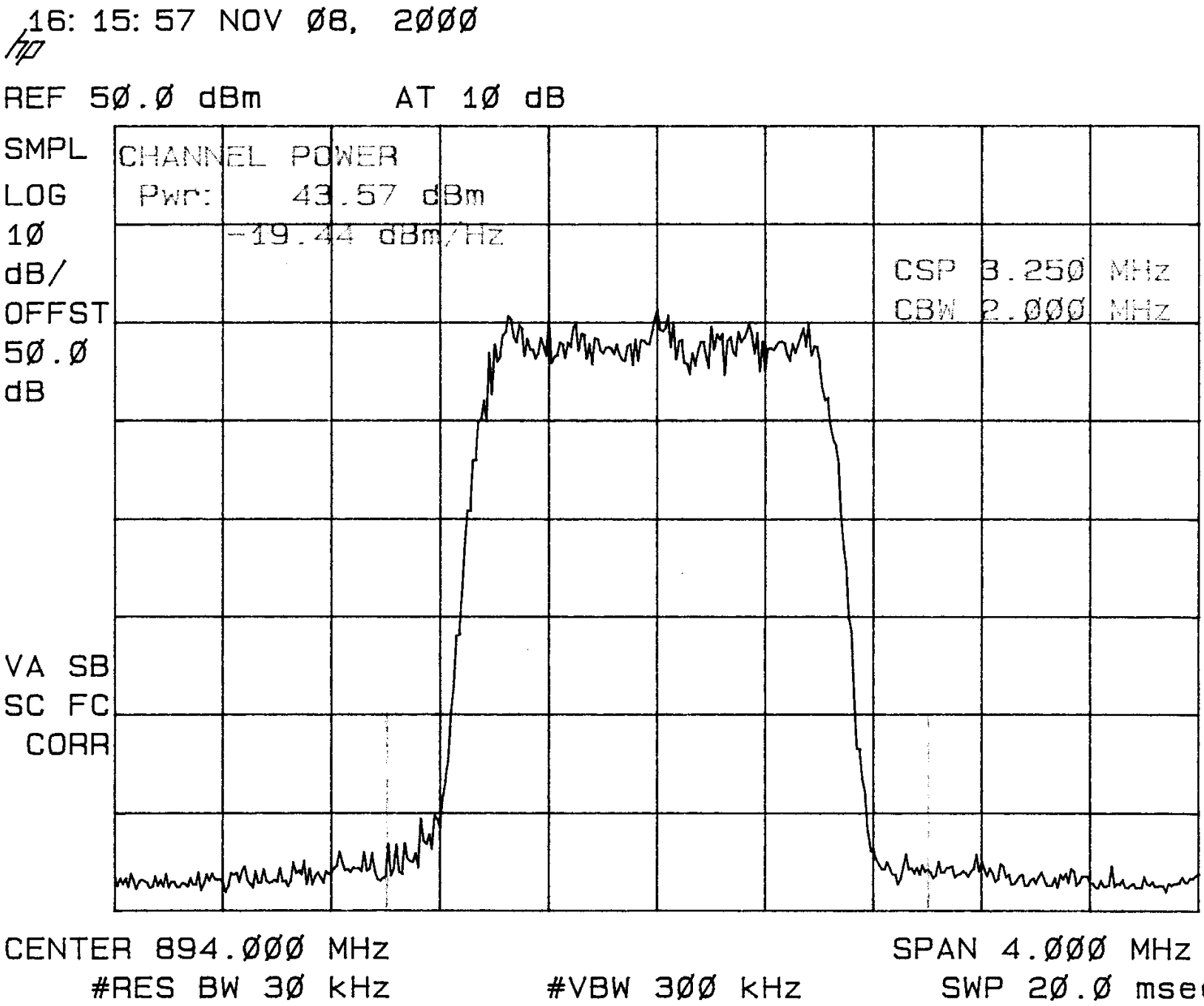
Input Power


16: 5Ø: 56 NOV Ø8, 2ØØØ
MKR 894.ØØØ MHz
REF 5.7 dBm
AT 2Ø dB
-27.37 dBm
SMPL
LOG
1Ø
dB/
CHANNEL POWER
Pwr: -15.44 dBm
-78.45 dBm/Hz
CSP 3.25Ø MHz
CBW 2.ØØØ MHz
VA SB
SC FC
CORR
CENTER 894.ØØØ MHz
#RES BW 3Ø kHz
#VBW 3ØØ kHz
SPAN 4.ØØØ MHz
SWP 2Ø.Ø msec


16: 22: 11 NOV Ø8, 2ØØØ
REF 5Ø.Ø dBm
AT 1Ø dB
SMPL
LOG
1Ø
dB/
OFFST
5Ø.Ø
dB
CHANNEL POWER
Pwr: 43.53 dBm
-19.48 dBm/Hz
CSP 3.25Ø MHz
CBW 2.ØØØ MHz
VA SB
SC FC
CORR
CENTER 869.ØØØ MHz
#RES BW 3Ø kHz
#VBW 3ØØ kHz
SPAN 4.ØØØ MHz
SWP 2Ø.Ø msec

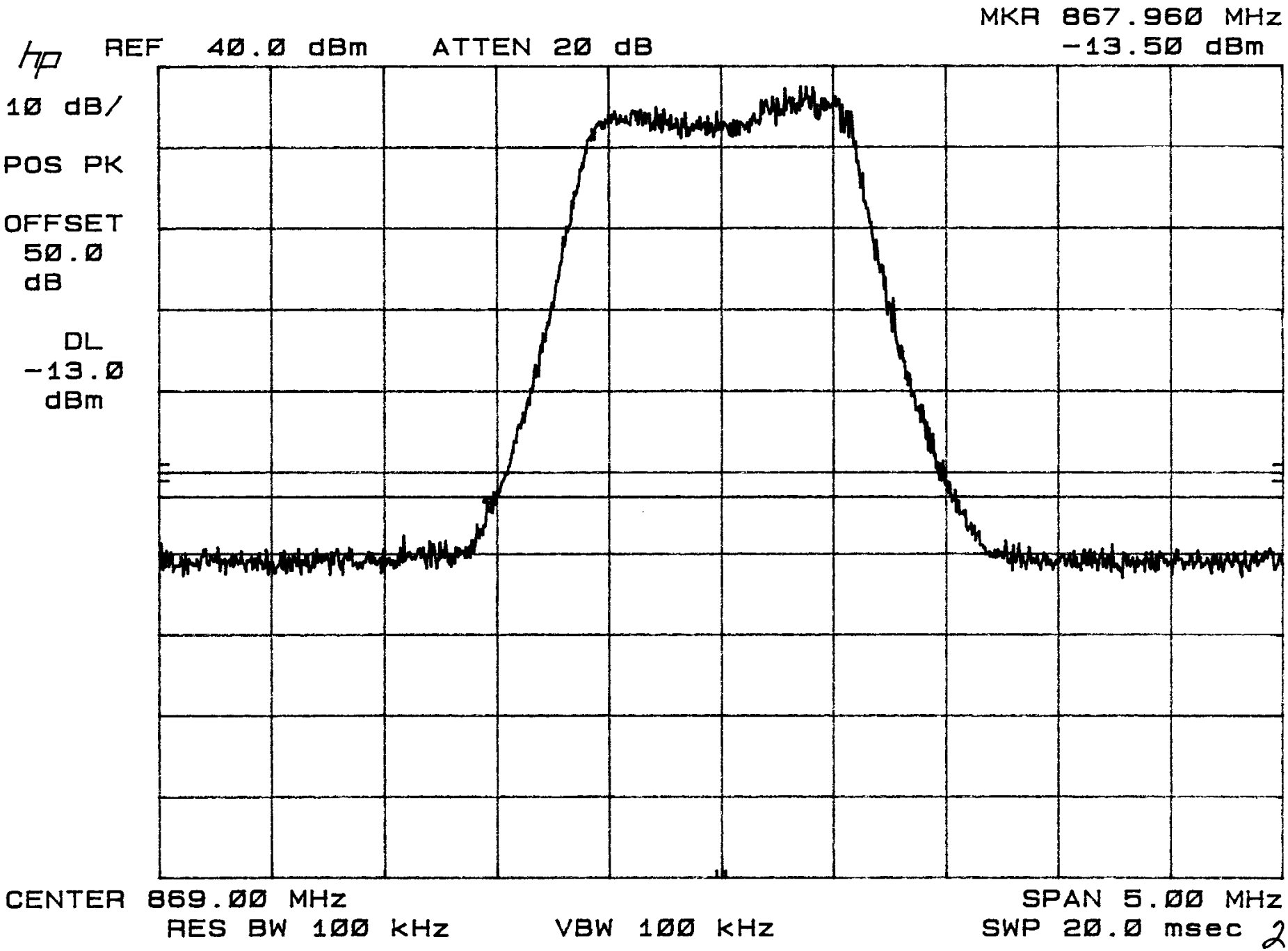

16: 19: Ø4 NOV Ø8, 2ØØØ
REF 5Ø.Ø dBm
AT 1Ø dB
SMPL
LOG
1Ø
dB/
OFFST
5Ø.Ø
dB
CHANNEL POWER
Pwr: 43.74 dBm
-19.27 dBm/Hz
CSP 3.25Ø MHz
CBW 2.ØØØ MHz
VA SB
SC FC
CORR
CENTER 881.ØØØ MHz
#RES BW 3Ø kHz
#VBW 3ØØ kHz
SPAN 4.ØØØ MHz
SWP 2Ø.Ø msec

20


16: 15: 57 NOV Ø8, 2ØØØ
REF 5Ø.Ø dBm
AT 1Ø dB
SMPL
LOG
1Ø
dB/
OFFST
5Ø.Ø
dB
CHANNEL POWER
Pwr: 43.57 dBm
-19.44 dBm/Hz
CSP 3.25Ø MHz
CBW 2.ØØØ MHz
VA SB
SC FC
CORR
CENTER 894.ØØØ MHz
#RES BW 3Ø kHz
#VBW 3ØØ kHz
SPAN 4.ØØØ MHz
SWP 2Ø.Ø msec

21

Band Edge, FCC Part 22, Paragraph 22.917(e)



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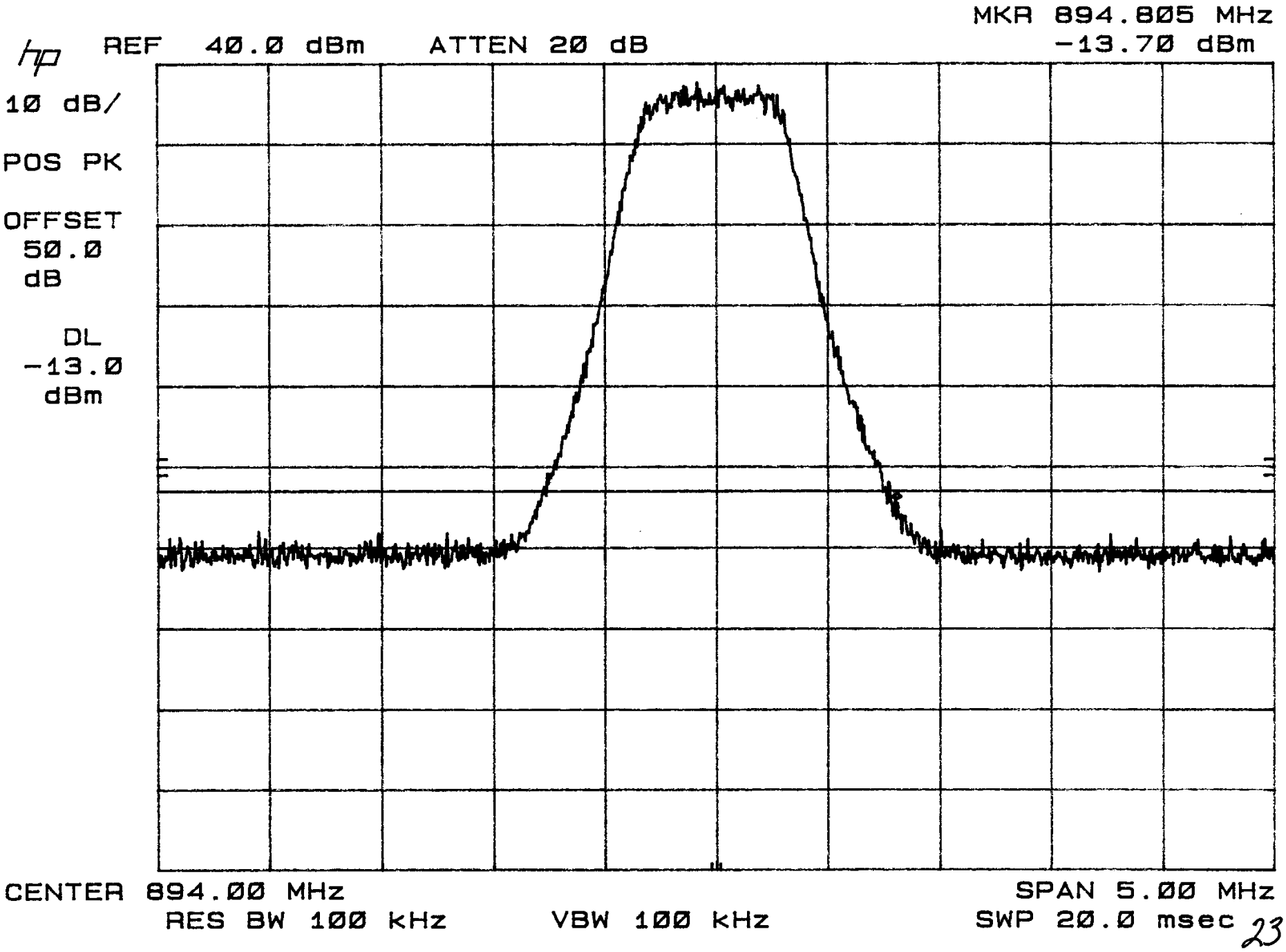
Band Edge, FCC Part 22, Paragraph 22.917(e)



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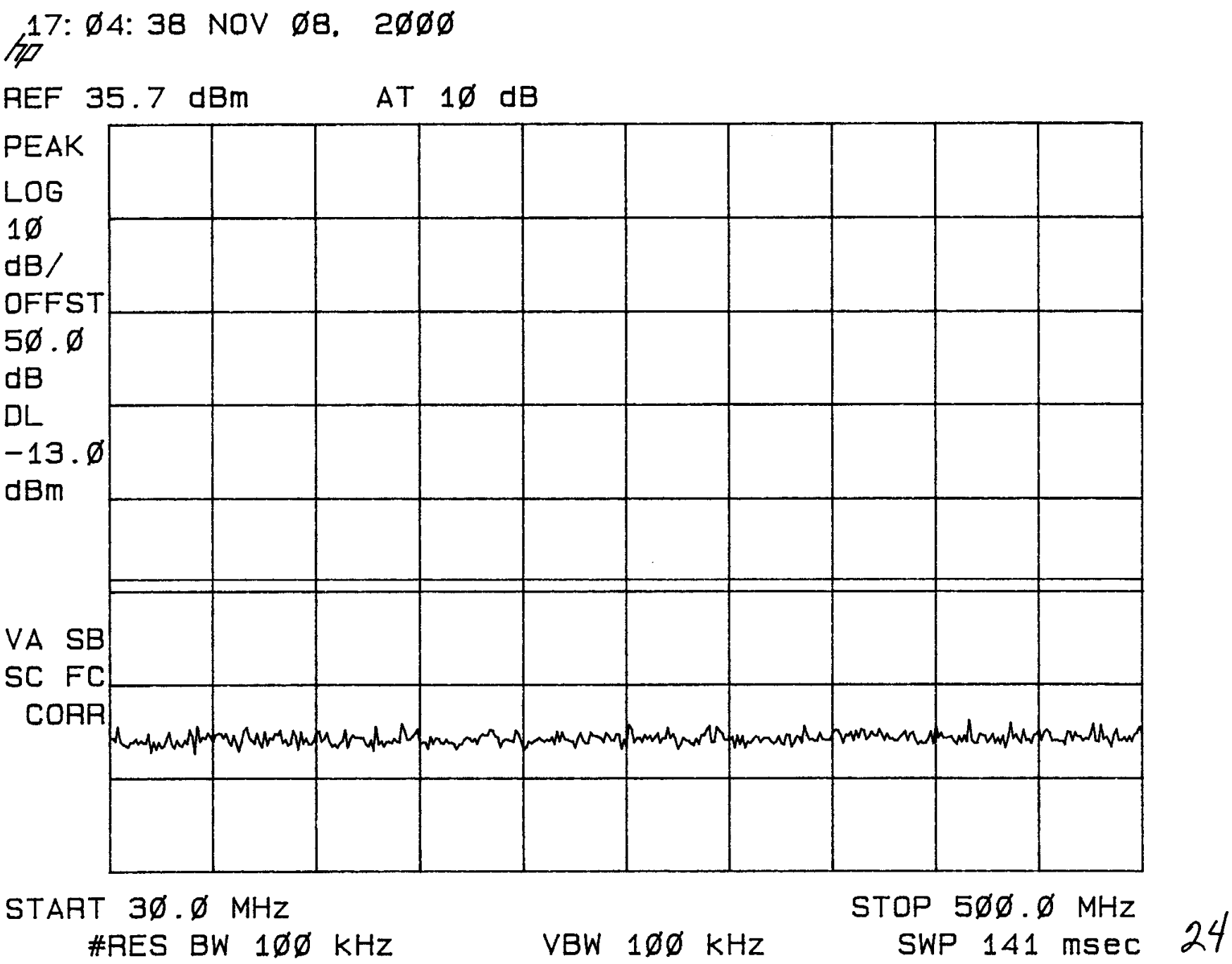
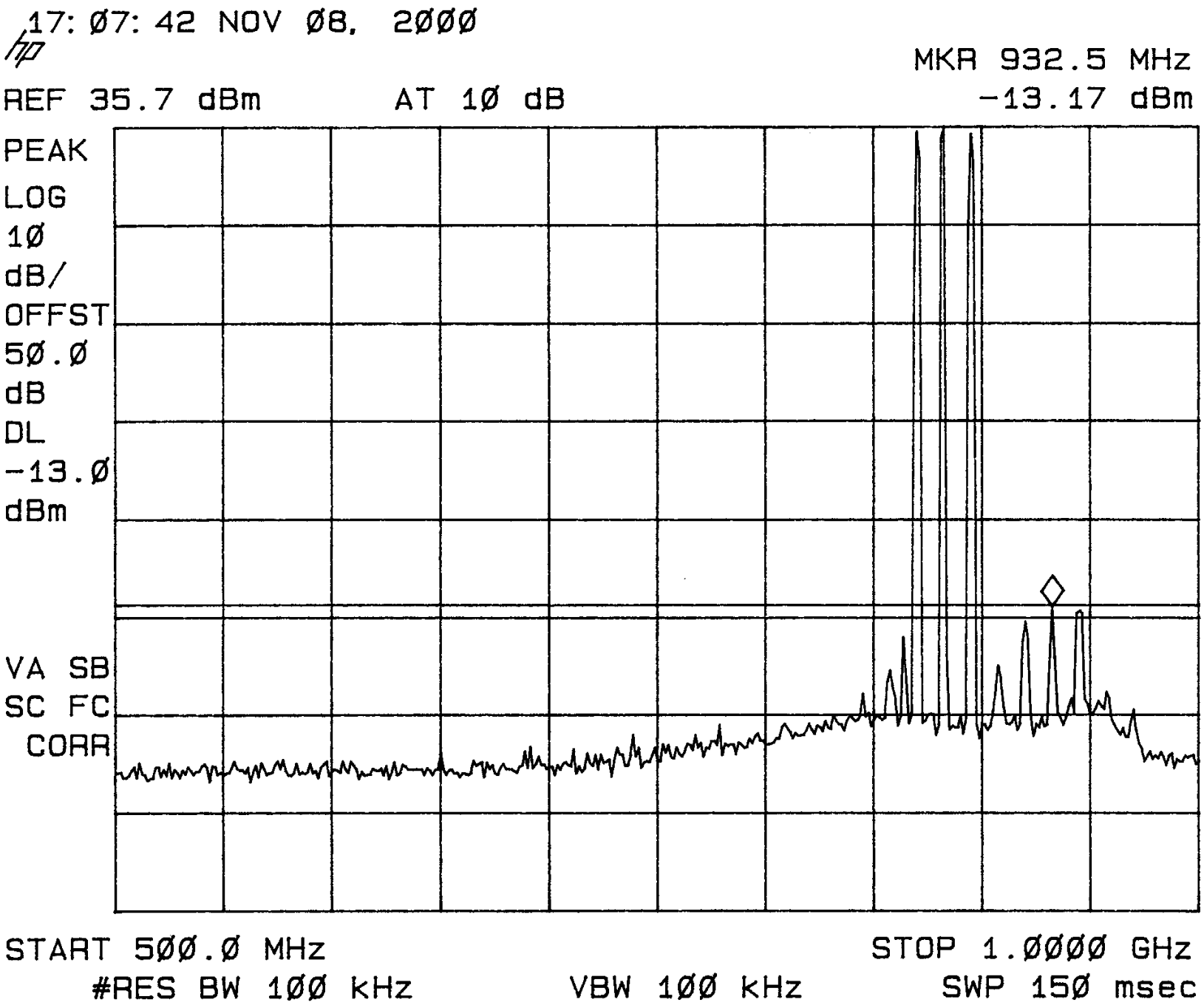
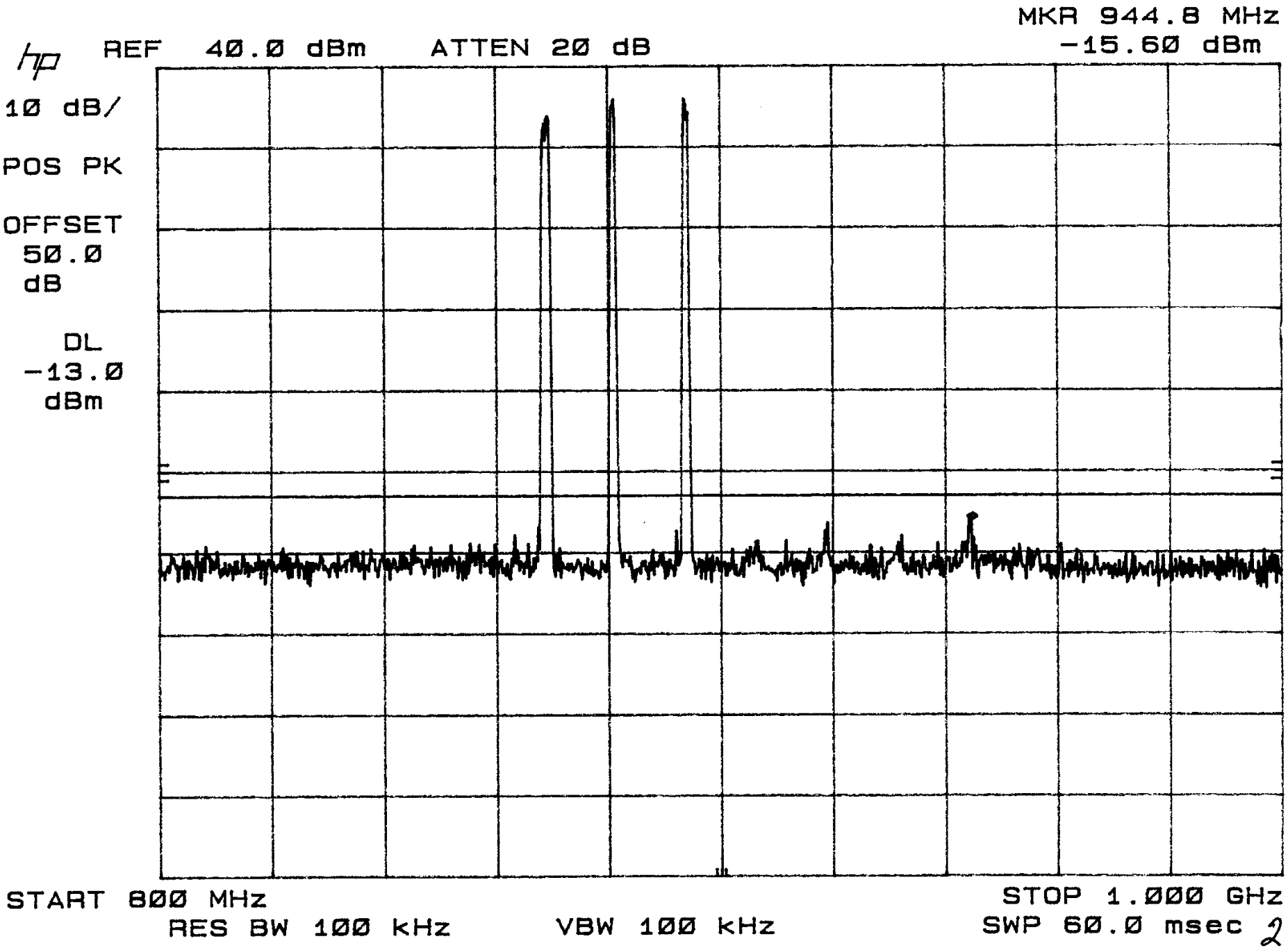
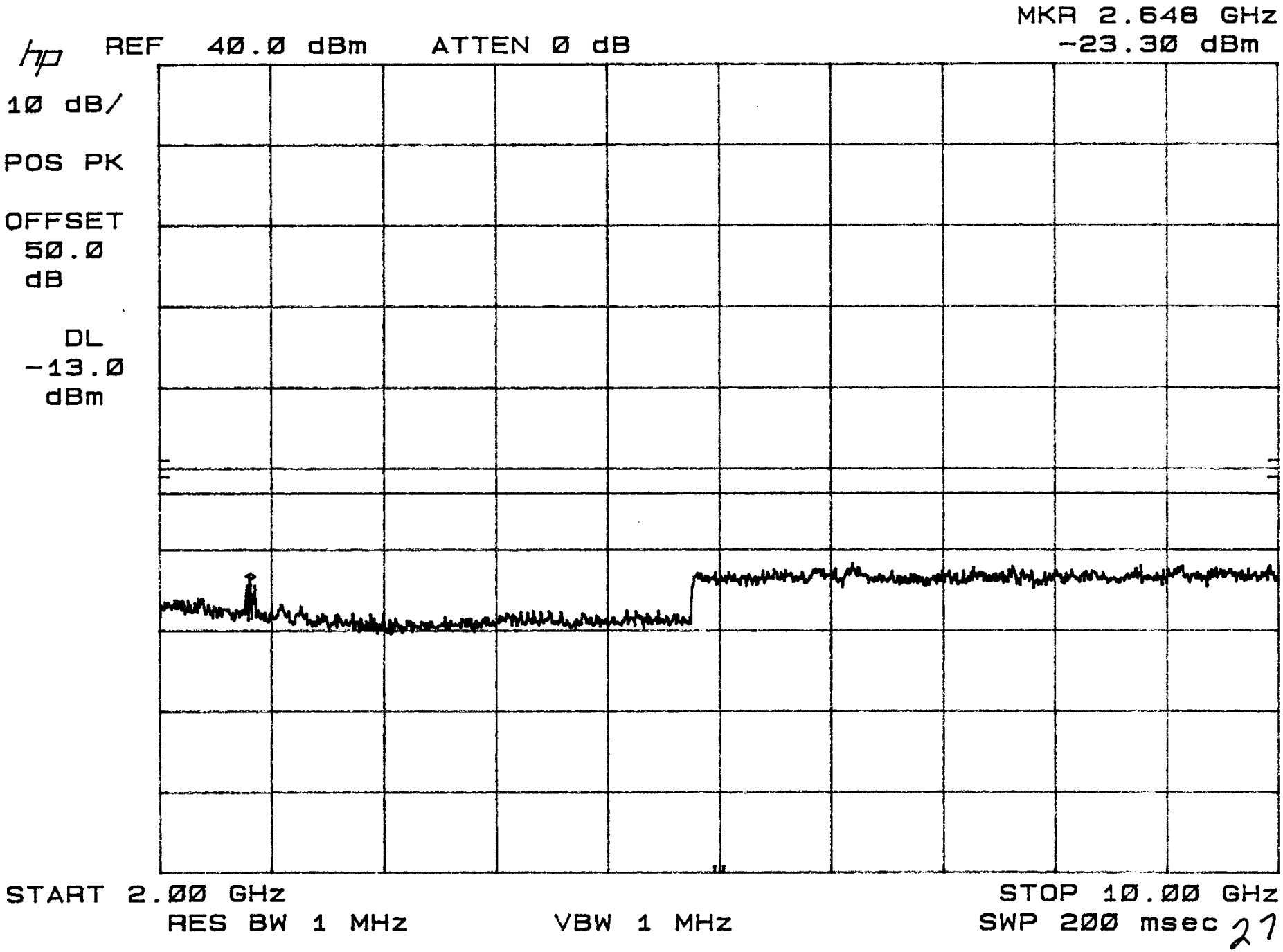

17: Ø4: 38 NOV ØB, 2ØØØ
REF 35.7 dBm
AT 1Ø dB
PEAK
LOG
1Ø
dB/
OFFST
5Ø.Ø
dB
DL
-13.Ø
dBm
VA SB
SC FC
CORR
START 3Ø.Ø MHz
STOP 5ØØ.Ø MHz
#RES BW 1ØØ kHz
VBW 1ØØ kHz
SWP 141 msec


17: Ø7: 42 NOV Ø8, 2ØØØ
MKR 932.5 MHz
REF 35.7 dBm
AT 1Ø dB
-13.17 dBm
PEAK
LOG
1Ø
dB/
OFFST
5Ø.Ø
dB
DL
-13.Ø
dBm
VA SB
SC FC
CORR
START 5ØØ.Ø MHz
STOP 1.ØØØØ GHz
#RES BW 1ØØ kHz
VBW 1ØØ kHz
SWP 15Ø msec


MKR 944.8 MHz
-15.60 dBm
REF 40.0 dBm
ATTEN 20 dB
10 dB/
POS PK
OFFSET
50.0
dB
DL
-13.0
dBm
START 800 MHz
STOP 1.000 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 60.0 msec


MKR 2.648 GHz
-23.30 dBm
REF 40.0 dBm
ATTEN 0 dB
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

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:

Jim Owen
(EMC Engineer)