ITS Intertek Testing Services

TEST REPORT
FCC Part 24, Subpart E

Spectrian

Power Amplifier
Model No.: Oriole

FCC ID: I20-ORIOLE1

Report # J98026572

Date of Report: September 30, 1998

Total No. of Pages Contained in this Report: 18

The results contained in this report were derived from measurements performed on the identified test samples. Any implied performance of other samples on this report is dependent on the representative of the samples tested.

NVLAP®

FCC Part 24

Intertek Testing Services NA Inc.
1365 Adams Court, Menlo Park, CA 94025
Telephone 650-463-2900 Fax 650-463-2910 Home Page www.worldlab.com

Table of Contents

1.0 Introduction

1.1 Test Summary

FCC RULE	DESCRIPTION OF TEST	RESULT	PAGE
2.985	RF Power Output	Pass	3
24.232(a)	Radiated Power	Pass	4
2.989(h), 24.238	Occupied Bandwidth, Emission limits	Pass	5
2.991	Spurious emissions at antenna terminals	Pass	7
2.993, 15.109	Field Strength of Spurious Radiation	Pass	12
15.107	Line Conducted Emissions	N/A	-
2.995(a), 24.235	Frequency Stability vs. Temperature	N/A	-
2.995(d)(1), 24.235	Frequency Stability vs. Voltage	N/A	-

David Chernomordik

David Chernomordik
EMC Site Manager

9/5/98
Date

1.2 Product Description

The EUT is a Model: Oriole, CDMA Power Amplifier, 1930 MHz - 1990 MHz frequency range,. manufactured by Spectrian.

For more details, refer to the users manual.

2.0 **RF Power Output**, FCC §2.985(a)

2.1 Test Procedure

The amplifier's output was connected to a power meter and spectrum analyzer through a calibrated coaxial attenuator and directional coupler. The CDMA test signal was applied to the amplifier's input from a signal generator, and the input level was adjusted to obtain 42.5 dBm average output power.

2.2 Test Equipment

Hewlett Packard 8482A Power Sensor, 438A Power Meter
Hewlett Packard 8594E Spectrum Analyzer, 9 kHz - 2.9 GHz
Tektronix AWG2021 Arbitrary Waveform Generator
Hewlett Packard E4432B Signal Generator, 250 kHz-3 GHz

2.3 Test Results

The average output power is 42.5 dBm (or 17.8 W), measured with a power meter.

3.0 **Radiated Power**, FCC §24.232 (a)

Requirement: The Equivalent Isotropically Radiated Power (EIRP) shall not exceed 1640 Watts.

3.1 Test Procedure

The EMCO 3115 Double Ridged Horn Antenna was connected to the amplifier's output. The EUT was positioned on a non-conductive turntable in an anechoic chamber.

The radiated emission at the fundamental frequency was measured at 3 m distance with a test antenna and spectrum analyzer. The maximum emission was recorded with the rotation of the turntable and the raising and lowering of the test antenna. The spectrum analyzer reading was recorded.

The EIRP was calculated as follows:

$$EIRP_{(dBm)} = E_{(dBuV/m)} + 20 \log D - 10 \log 30 - 10 \log G - 90$$

where D = 3m, distance
G = 5.9, gain of the horn antenna.

3.2 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer, 100 Hz - 22 GHz
EMCO 3115 Double-Ridged Horn antenna, 1-18 GHz

3.3 Test Results

Refer to the table below.

Frequency MHz	Spectrum Analyzer Reading dB(uV)	Antenna Factor dB(1/m)	Cable loss dB	Field Strength dB(uV/m)	EIRP dBm
1931	114.7	29.1	1.5	145.3	42.4
1960	115.0	29.1	1.5	145.6	42.7
1989	115.2	29.1	1.5	145.8	42.9

Judgement: Passed

4.0 **Occupied Bandwidth, Emission limits.** FCC §2.989(h), §24.238.

Requirements:

On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10Log (P), dB

4.1 Test Procedure

The RF output of the EUT was connected to the input of the spectrum analyzer through sufficient attenuation.

The spectrum with no modulation was plotted. The EUT was set up to transmit a CDMA signal and the spectrum with modulation was plotted. The measurements were made for lowest frequency (F=1931 MHz) and for highest frequency (F=1989 MHz).

4.2 Test Equipment

HP 8566B Spectrum Analyzer, 100 Hz - 22 GHz
HP 7470A Plotter

4.3 Test Results

For test results, refer to the attached plots 4.3.a.- 4.3.d shown emission on the amplifier's output.

PLOT NUMBER	DESCRIPTION
4.3.a	F=1931 MHz, Resolution bandwidth 30 kHz
4.3.b	F=1931 MHz, Resolution bandwidth 10 kHz
4.3.c	F=1989 MHz, Resolution bandwidth 30 kHz
4.3.d	F=1989 MHz, Resolution bandwidth 10 kHz

Note:

The plots with 30 kHz spectrum analyzer resolution bandwidth show marginal compliance with the Requirements (the emissions on the band edge shall not exceed -13 dBm). According to the FCC §24.238, these measurements may be made with 1% of the 26 dB emission bandwidth, which is approximately 1.4 MHz.(e.g. 14 kHz). As can be seen from the plots 4.3.b and 4.3.d, with resolution bandwidth 10 kHz, the emissions on the band edges are well below the limit.

The EUT passed the test.

5.0 **Out-of-Band Emissions at Antenna Terminals** , FCC §2.991

Requirements:

On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10Log (P), dB

5.1 Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The CDMA test signal was set up. Sufficient scans were made to show the out-of-band emissions if any up to 10th harmonic for 3 frequencies: 1931 MHz, 1960 MHz, 1989 MHz.

5.2 Test Equipment

HP 8566B Spectrum Analyzer, 100 Hz - 22 GHz
HP 7470A Plotter

5.3 Test Results

Refer to the attached plots: 5.3.a - 5.3.o.

The EUT passed the test.

Plots of Out-of Band-Emissions at antenna terminal.

PLOT NUMBER	DESCRIPTION
5.3.a	F=1931 MHz, scan 1MHz - 30 MHz
5.3.b	F=1931 MHz, scan 30 MHz - 1 GHz
5.3.c	F=1931 MHz, scan 1 GHz - 2.5 GHz
5.3.d	F=1931 MHz, scan 2.5 GHz - 10 GHz
5.3.e	F=1931 MHz, scan 10 GHz - 20 GHz
5.3.f	F=1960 MHz, scan 1MHz - 30 MHz
5.3.g	F=1960 MHz, scan 30 MHz - 1 GHz
5.3.h	F=1960 MHz, scan 1 GHz - 2.5 GHz
5.3.i	F=1960 MHz, scan 2.5 GHz - 10 GHz
5.3.j	F=1960 MHz, scan 10 GHz - 20 GHz
5.3.k	F=1989 MHz, scan 1MHz - 30 MHz
5.3.l	F=1989 MHz, scan 30 MHz - 1 GHz
5.3.m	F=1989 MHz, scan 1 GHz - 2.5 GHz
5.3.n	F=1989 MHz, scan 2.5 GHz - 10 GHz
5.3.o	F=1989 MHz, scan 10 GHz - 20 GHz

6.0 **Field Strength of Spurious Radiation**, FCC § 2.993, §15.109

6.1 Test Procedure

A 50 Ohm coaxial load was connected to the amplifier's output. A CDMA test signal was applied to the amplifier's input, and the output power was set up to 42.5 dBm.

The transmitter was placed on a wooden turntable. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

The spurious harmonic attenuation was calculated as the difference between Field Strength (E) in dB(uV/m) at the fundamental frequency and at the spurious emission frequency. The Field Strength at fundamental frequency was calculated using the following formula:

$$E_{(dBuV/m)} = P_{(dBm)} + 10 \log 30 - 20 \log D + 90$$

where D = 3 m, distance
P = 42.5 dBm, output power.

6.2 Test Equipment

HP 8566B Spectrum Analyzer, 100 Hz - 22 GHz
CDI P950 Preamplifier, 30 - 1000 MHz
CDI P1000+ Preamplifier, 1-10 GHz
Avantek AFT-18855 Preamplifier, 8-18 GHz
Mini-Circuits ALO/400/\-8023 Preamplifier, 18-40 GHz
CDI B100 Biconical Antenna, 30-200 MHz
EMCO 3143 Log-Periodic Antenna, 200-1000 MHz
EMCO 3115 Double-Ridged Horn Antenna, 1-18 GHz
EMCO 3160-09 Horn Antenna, 18-26.5 GHz
High Pass Filter

6.4 Test Results

Spurious Harmonic Attenuation

Test site: #1
Test Engineer: D. Chernomordik
Operation Mode: Transmitting at 1931 MHz, The Output is terminated with dummy load

Frequency MHz	Antenna Pol.	SA Reading dB(uV)	Antenna Factor dB(1/m)	Pre-amp. Correct. dB	Cable loss dB	Distance Correct. dB	Field Strength dB(uV/m)	Spurious attenuat. dB	Margin dB
1931	-	-	-	-	-	-	137.7	-	-
3862	V	41.0	32.5	-27.9	2.3	0	47.9	89.8	-34.3
5793	V	31.2	35.0	-26.0	2.8	0	43.0	94.7	-39.2
7724	V	30.0	37.5	-26.0	3.4	0	44.9	92.8	-37.3
9655	V&H	27.0 *	38.2	-26.0	3.8	0	43.0	94.7	-39.2
11586	V&H	29.0 *	39.0	-32.5	5.6	0	41.1	96.6	-41.1
13517	V&H	31.0 *	41.7	-32.5	6.2	0	46.4	91.3	-35.8
15448	V&H	32.0 *	41.4	-32.5	6.9	0	47.8	89.9	-34.4
17379	V&H	33.0 *	45.0	-32.5	7.5	-9.5**	43.5	94.2	-38.7
19310	V&H	37.5 *	44.5	-33.0	8.2	-9.5**	47.7	90.0	-34.5

Note: Measurements were made at 3 m distance
Limit of spurious emission attenuation equals $43 + 10 \log P = 55.5$ dB
Reading with (*) is a noise floor
** Measurements were made at 1 m distance.

Spurious Harmonic Attenuation

Test site: #1
Test Engineer: D. Chernomordik
Operation Mode: Transmitting at 1960 MHz, The Output is terminated with dummy load

Frequency MHz	Antenna Pol.	SA Reading dB(uV)	Antenna Factor dB(1/m)	Pre-amp. Correct. dB	Cable loss dB	Distance Correct. dB	Field Strength dB(uV/m)	Spurious attenuat. dB	Margin dB
1960	-	-	-	-	-	-	137.7	-	-
3920	H	40.9	32.5	-27.9	2.3	0	47.8	89.9	-34.4
5880	H	35.8	35.0	-26.0	2.8	0	47.6	90.1	-34.6
7840	V	29.5	37.5	-26.0	3.4	0	44.4	93.3	-37.8
9800	V&H	27.0 *	38.2	-26.0	3.8	0	43.0	94.7	-39.2
11760	V&H	29.0 *	39.0	-32.5	5.6	0	41.1	96.6	-41.1
13720	V&H	31.0 *	41.7	-32.5	6.2	0	46.4	91.3	-35.8
15680	V&H	32.0 *	41.4	-32.5	6.9	0	47.8	89.9	-34.4
17640	V&H	33.0 *	45.0	-32.5	7.5	-9.5**	43.5	94.2	-38.7
19600	V&H	37.5 *	44.5	-33.0	8.2	-9.5**	47.7	90.0	-34.5

Note: Measurements were made at 3 m distance
Limit of spurious emission attenuation equals $43 + 10 \log P = 55.5$ dB
Reading with (*) is a noise floor
** Measurements were made at 1 m distance.

Spurious Harmonic Attenuation

Test site: #1
Test Engineer: D. Chernomordik
Operation Mode: Transmitting at 1989 MHz, The Output is terminated with dummy load

Frequency MHz	Antenna Pol.	SA Reading dB(uV)	Antenna Factor dB(1/m)	Pre-amp. Correct. dB	Cable loss dB	Distance Correct. dB	Field Strength dB(uV/m)	Spurious attenuat. dB	Margin dB
1989	-	-	-	-	-	-	137.7	-	-
3978	V	39.5	32.5	-27.9	2.3	0	46.4	91.3	-35.8
5967	V	33.3	35.0	-26.0	2.8	0	45.1	92.6	-37.1
7956	V	29.1	37.5	-26.0	3.4	0	44.0	93.7	-38.2
9945	V&H	27.0 *	38.2	-26.0	3.8	0	43.0	94.7	-39.2
11934	V&H	29.0 *	39.0	-32.5	5.6	0	41.1	96.6	-41.1
13923	V&H	31.0 *	41.7	-32.5	6.2	0	46.4	91.3	-35.8
15912	V&H	32.0 *	41.4	-32.5	6.9	0	47.8	89.9	-34.4
17901	V&H	33.0 *	45.0	-32.5	7.5	-9.5**	43.5	94.2	-38.7
19890	V&H	37.5 *	44.5	-33.0	8.2	-9.5**	47.7	90.0	-34.5

Note: Measurements were made at 3 m distance
Limit of spurious emission attenuation equals 43 + 10 log P = 55.5 dB
Reading with (*) is a noise floor
** Measurements were made at 1 m distance.

Justification: Passed

FCC Part 15.109 Radiated Emission

Test site: #1
Test Engineer: D. Chernomordik
Operation Mode: Transmitting at 1960 MHz, The Output is terminated with dummy load.

Frequency MHz	Antenna Polarization V/H	Reading at 3 m dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Corrected Reading dB(uV/m)	Limit at 3 m dB(uV/m)	Margin dB
No emissions were detected above the noise floor level which is at least 20 dB below the limit							

Note: All measurements were made at 3 m distance.
Frequency range investigated is from 30 to 1000 MHz.

Justification: Passed

7.0 **Line Conducted Emissions**, FCC § 15.107

7.1 Test Procedure

Test procedure described in the ANSI C63.4 Standard was employed.

The EUT was connected to an AC line through the LISNs.

Both HOT and NEUTRAL leads were tested.

7.2 Test Configuration Setup - Line Conducted Emissions

Not Applicable.

7.3 Test Results

Not Applicable.

8.0 **Frequency Stability vs Temperature**, FCC § 2.995(a), 24.135(a)

8.1 Test Procedure

The RF output of the EUT was connected to a spectrum analyzer via feedthrough attenuators. The EUT was placed inside the temperature chamber. The RF output cable exited the chamber through an opening.

After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the spectrum analyzer.

8.2 Test Equipment

Thermotron Ind. Temperature Chamber, Model S-8C
Hewlett Packard 8591E Spectrum Analyzer

8.3 Test Results

Not Applicable

9.0 **Frequency Stability vs Voltage,** FCC 2.995(d)(2), 24.135(a)

9.1 Test Procedure

An external variable AC power source was connected to the EUT. The frequency of the transmitter was measured for 115% of the AC nominal value and for 85% of the nominal value.

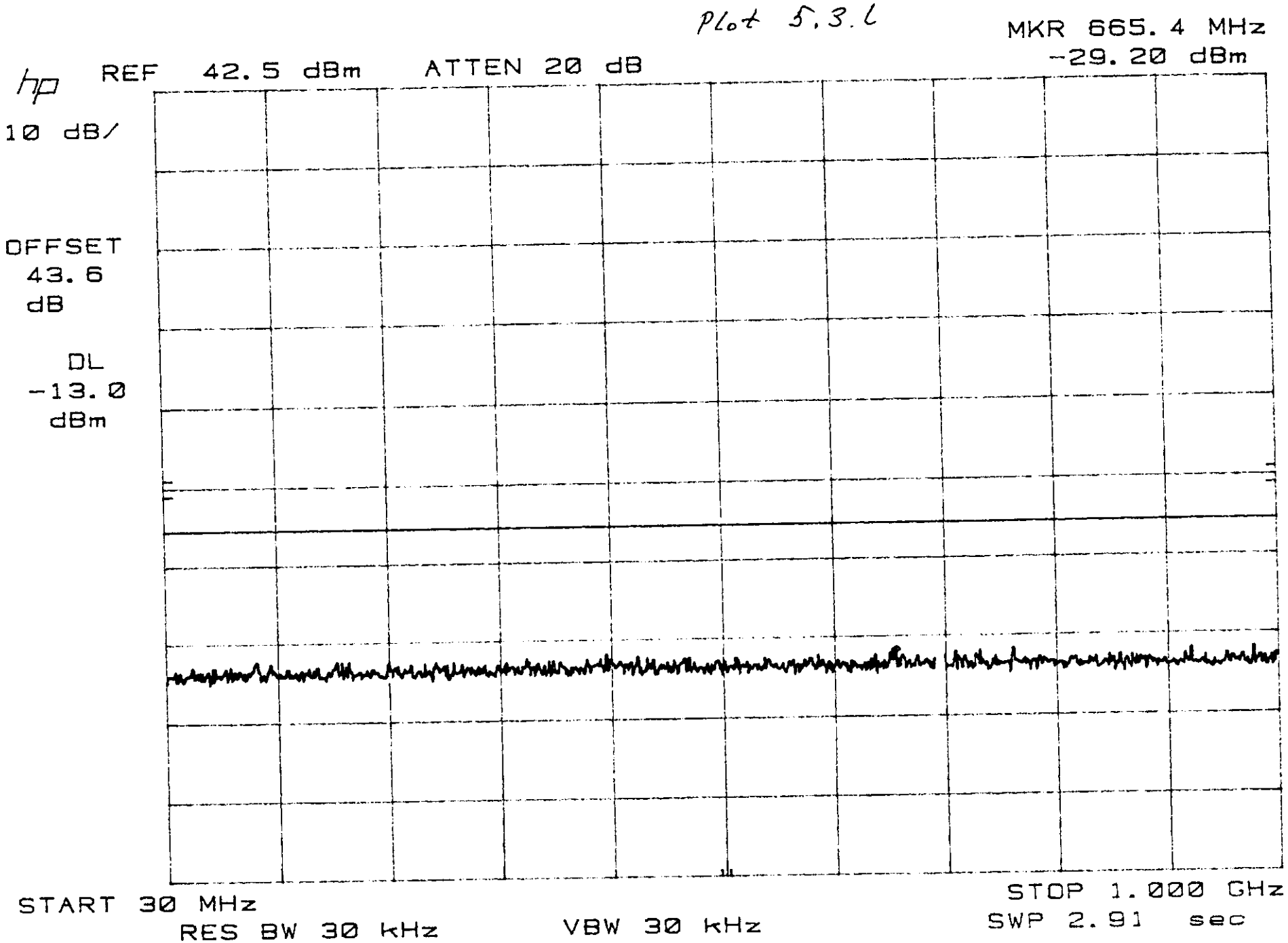
9.2 Test Equipment

Hewlett Packard 8591E Spectrum Analyzer

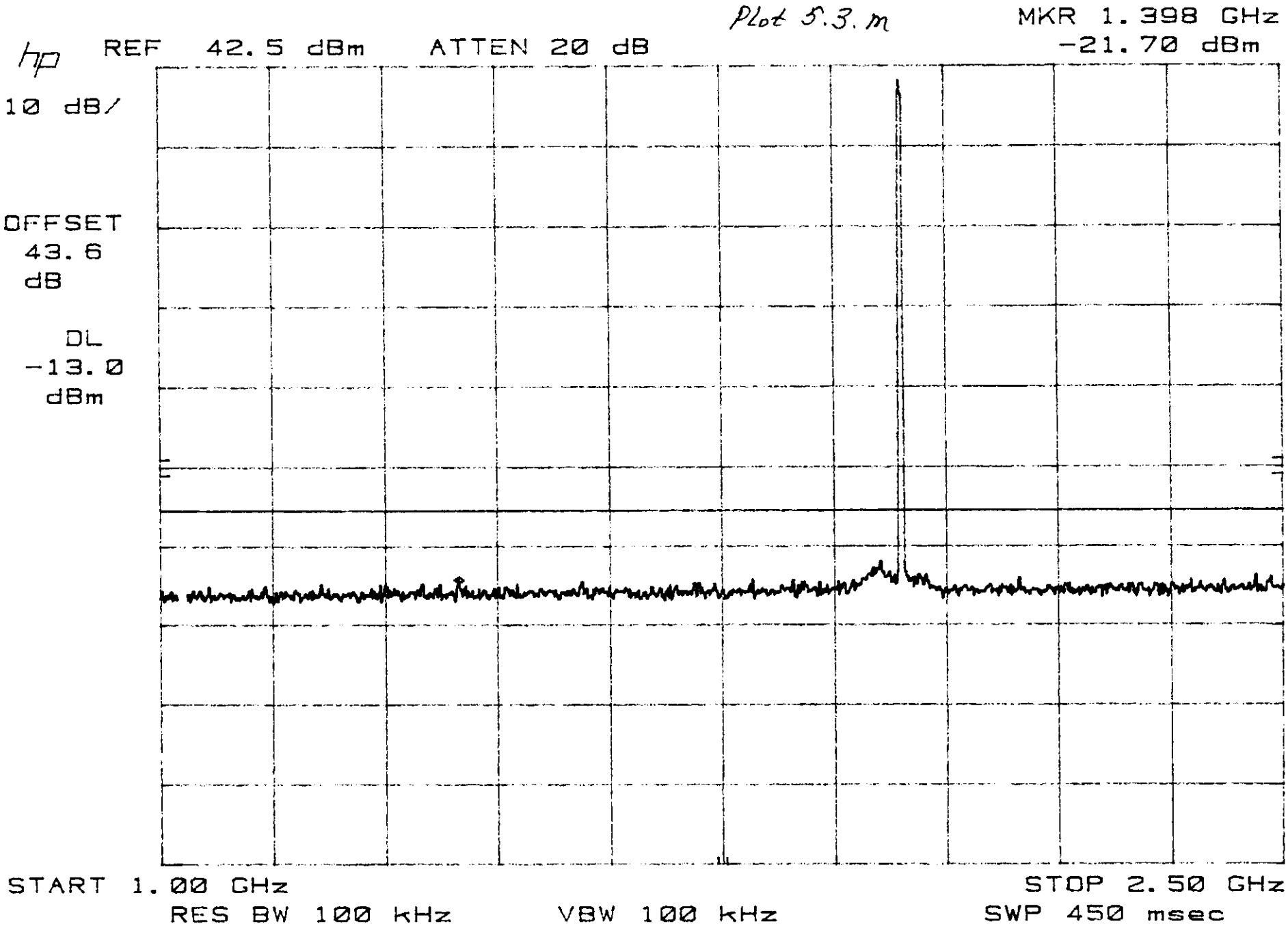
9.3 Test Results.

Not Applicable.

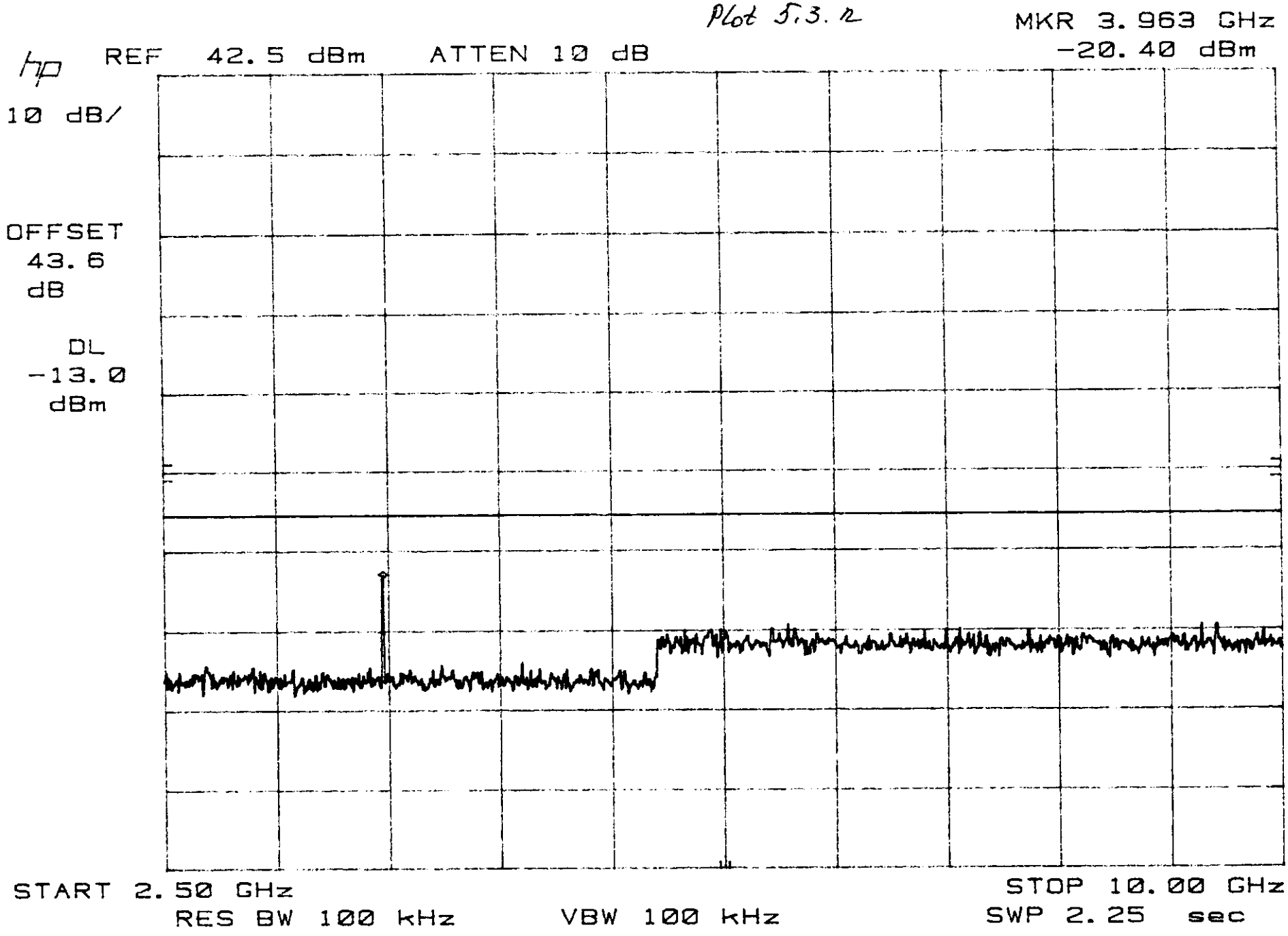
plot 5.3.1


MKR 665.4 MHz
-29.20 dBm
hp REF 42.5 dBm ATTEN 20 dB
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 30 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 1.000 GHz
SWP 2.91 sec

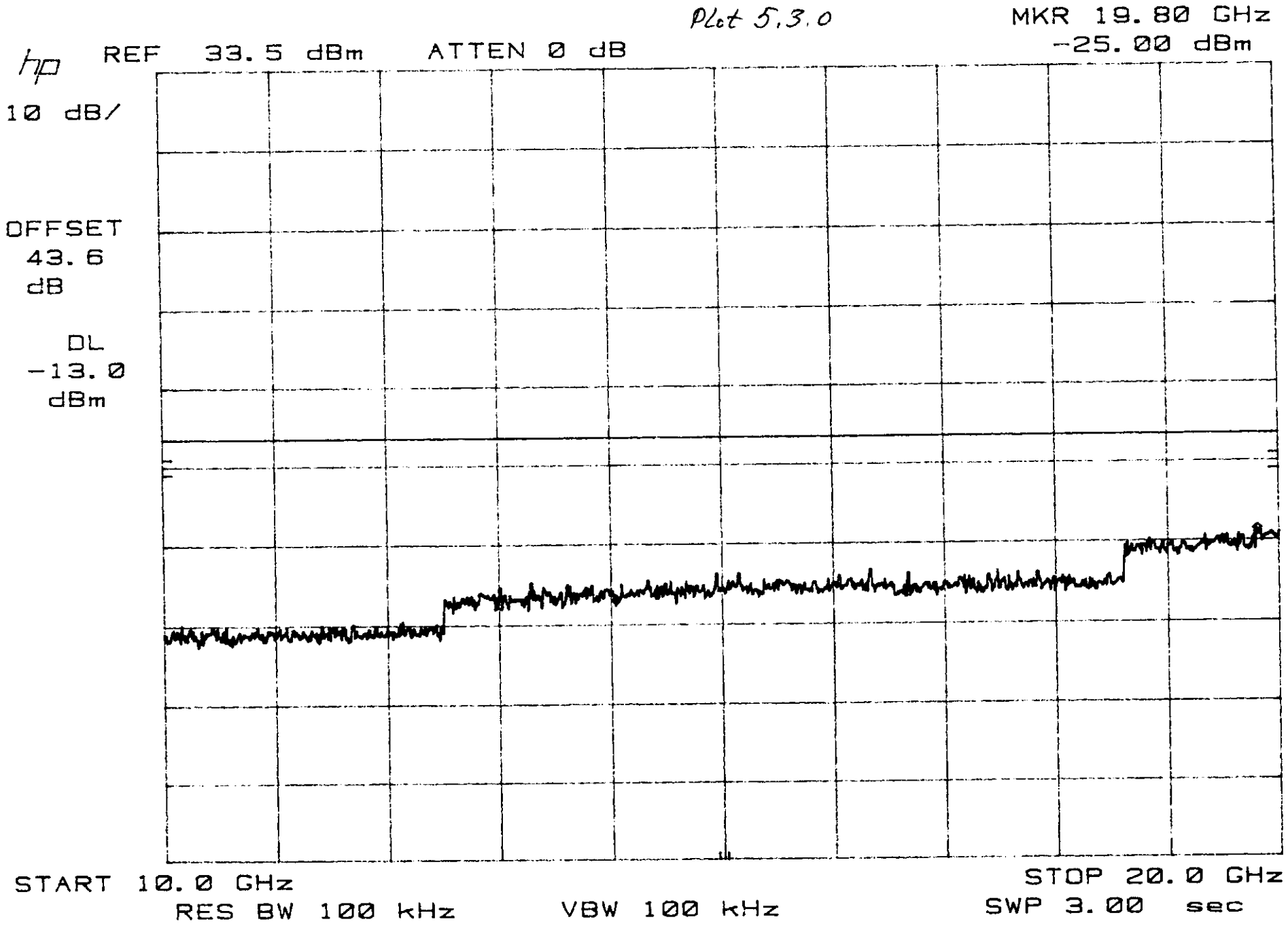
Plot 5.3.m


hp
REF 42.5 dBm
ATTEN 20 dB
MKR 1.398 GHz
-21.70 dBm
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 1.00 GHz
STOP 2.50 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 450 msec

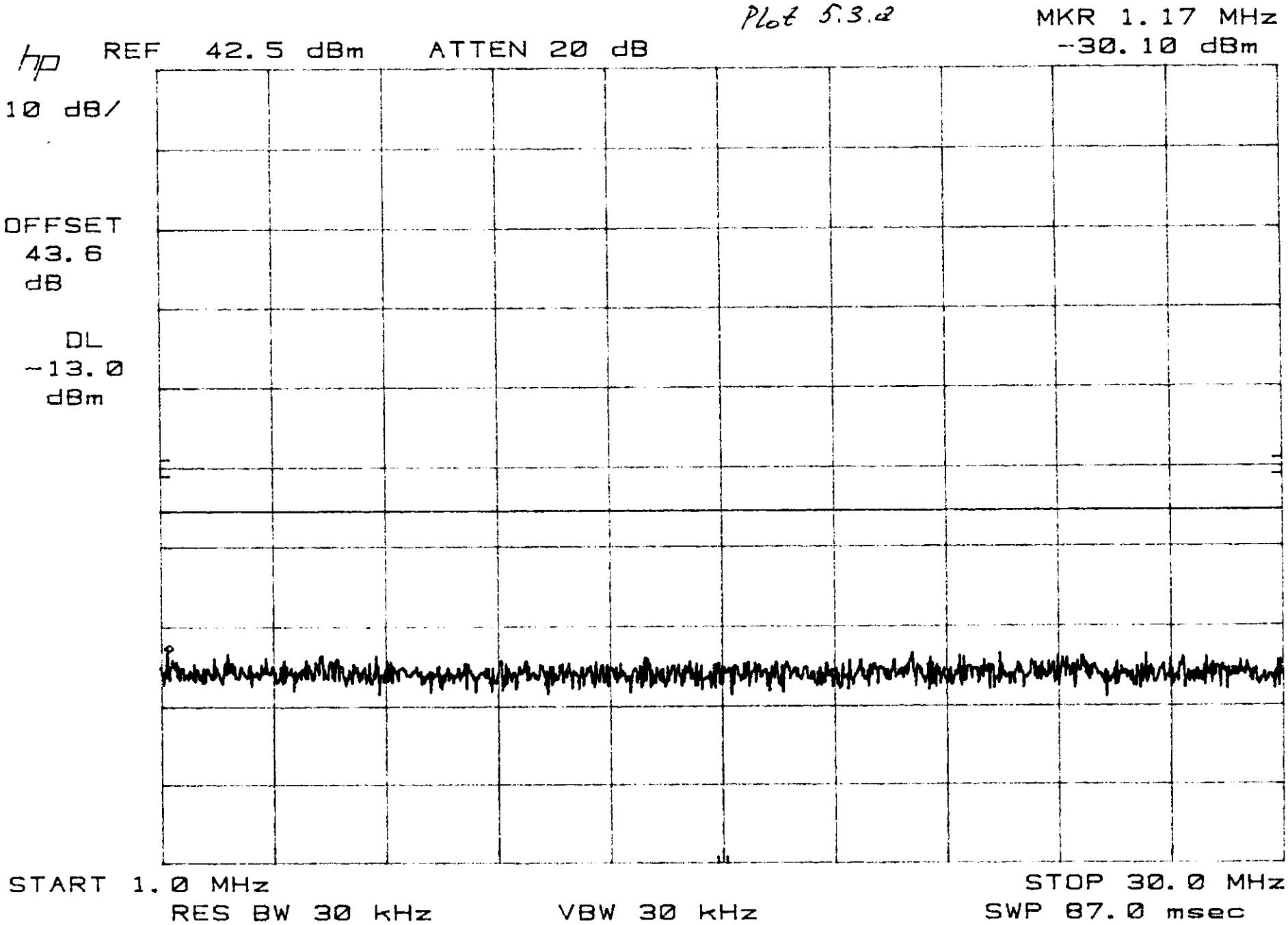
Plot 5.3.2


MKR 3.963 GHz
-20.40 dBm
hp
REF 42.5 dBm
ATTEN 10 dB
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 2.50 GHz
STOP 10.00 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 2.25 sec

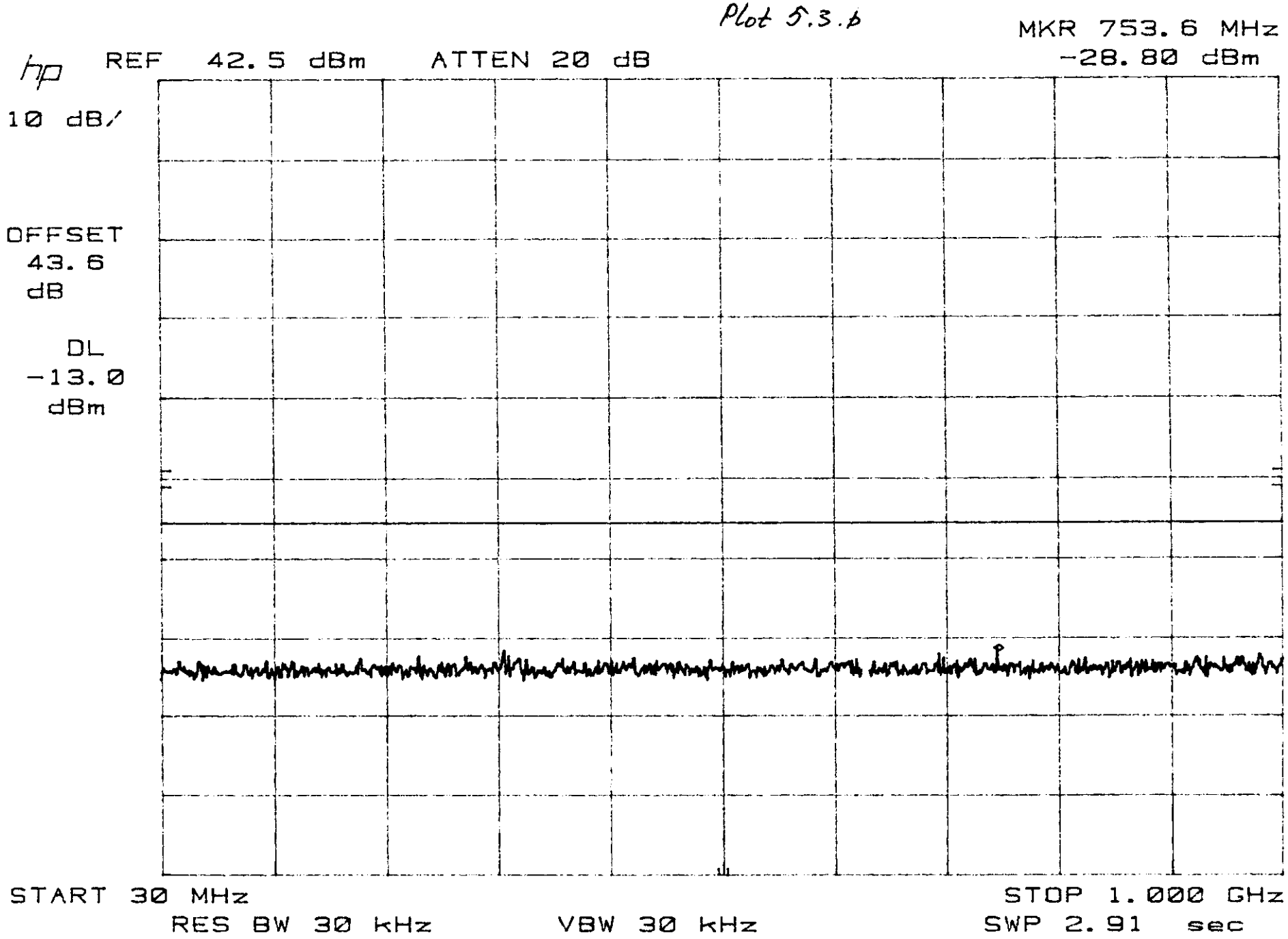
Plot 5.3.0


MKR 19.80 GHz
-25.00 dBm
hp REF 33.5 dBm ATTEN 0 dB
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 10.0 GHz
STOP 20.0 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 3.00 sec

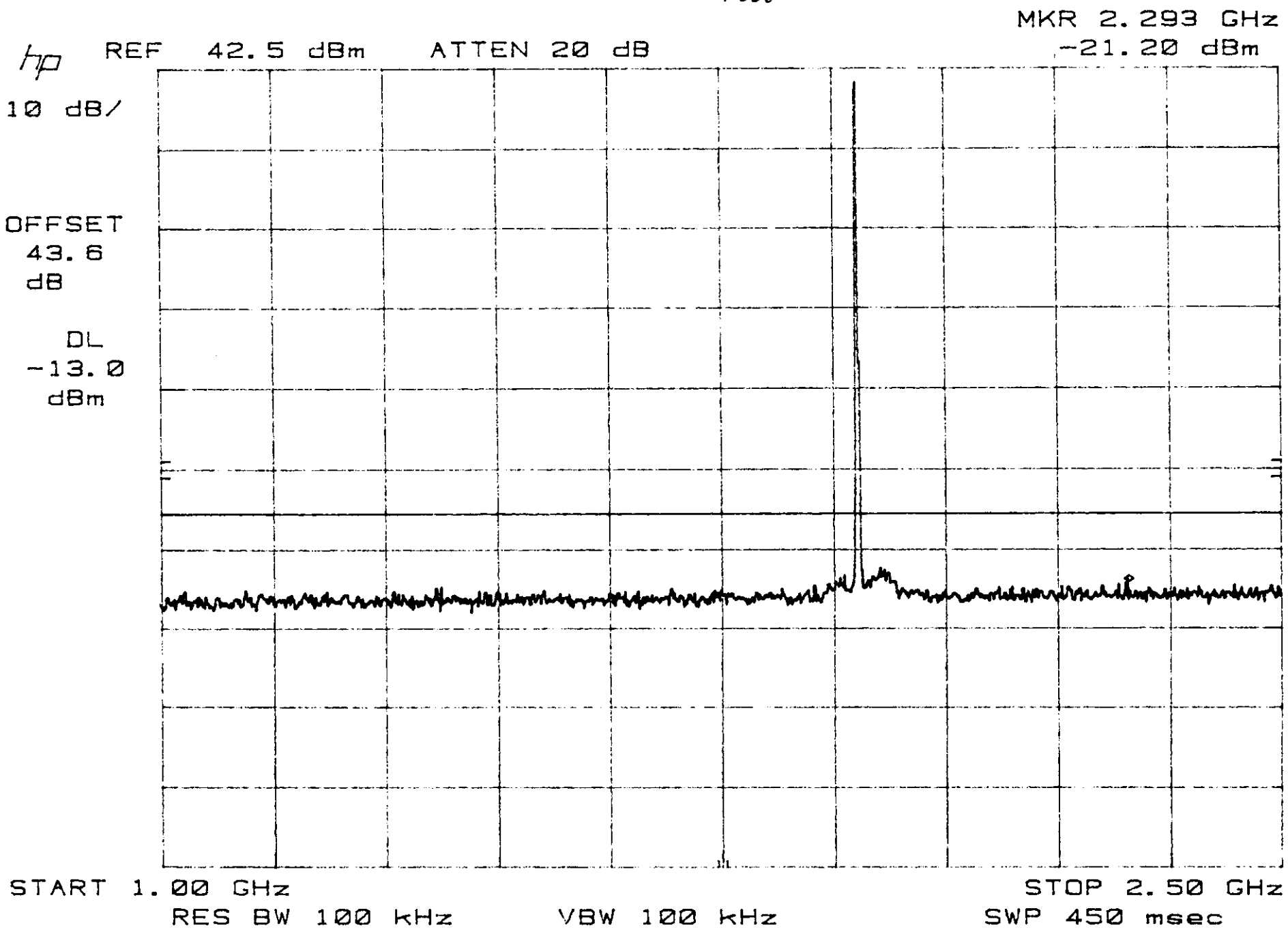
Plot 5.3.a


hp
REF 42.5 dBm
ATTEN 20 dB
MKR 1.17 MHz
-30.10 dBm
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 1.0 MHz
STOP 30.0 MHz
RES BW 30 kHz
VBW 30 kHz
SWP 87.0 msec

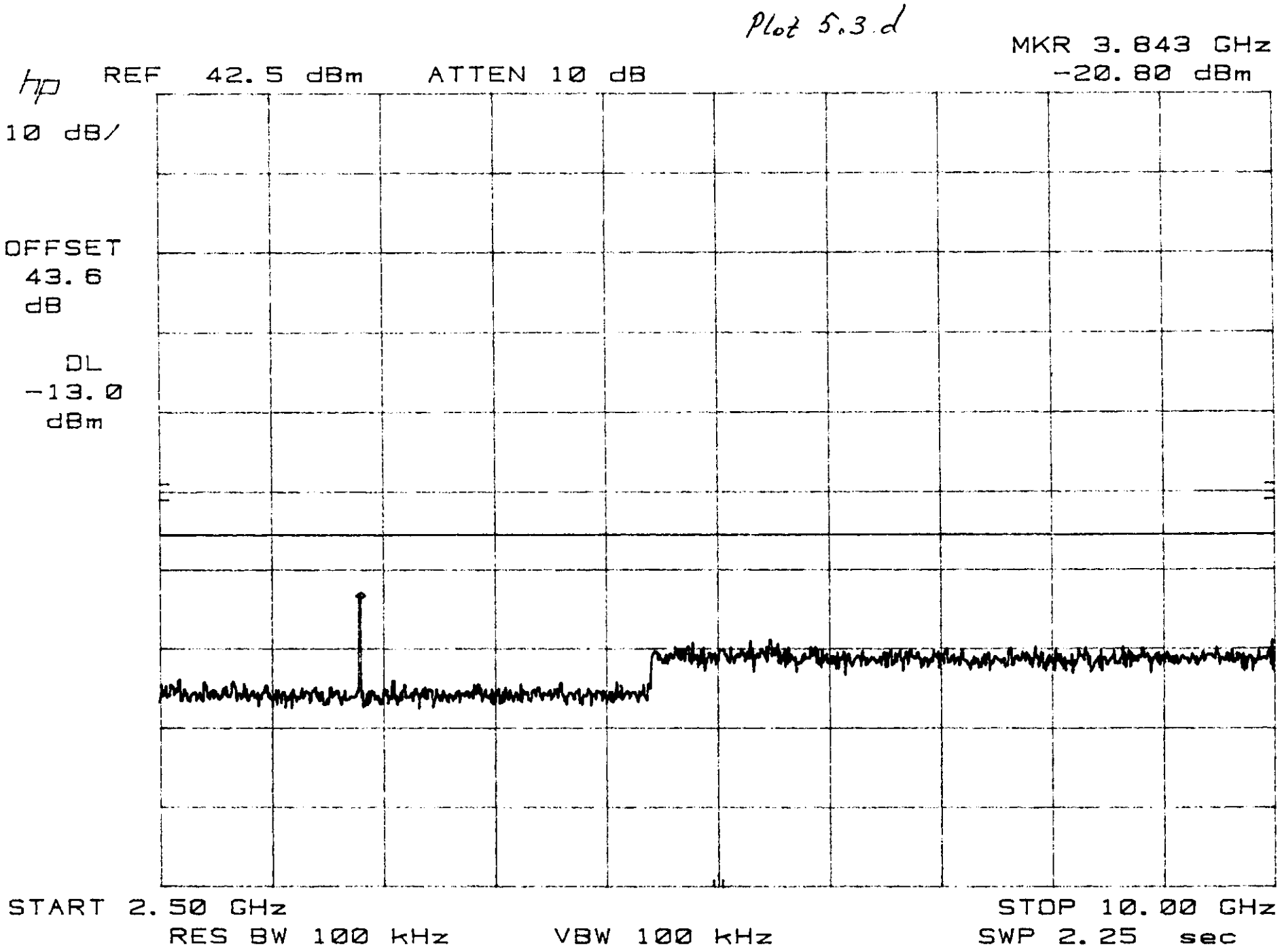
Plot 5.3.b


MKR 753.6 MHz
-28.80 dBm
hp REF 42.5 dBm ATTEN 20 dB
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 30 MHz
STOP 1.000 GHz
RES BW 30 kHz
VBW 30 kHz
SWP 2.91 sec

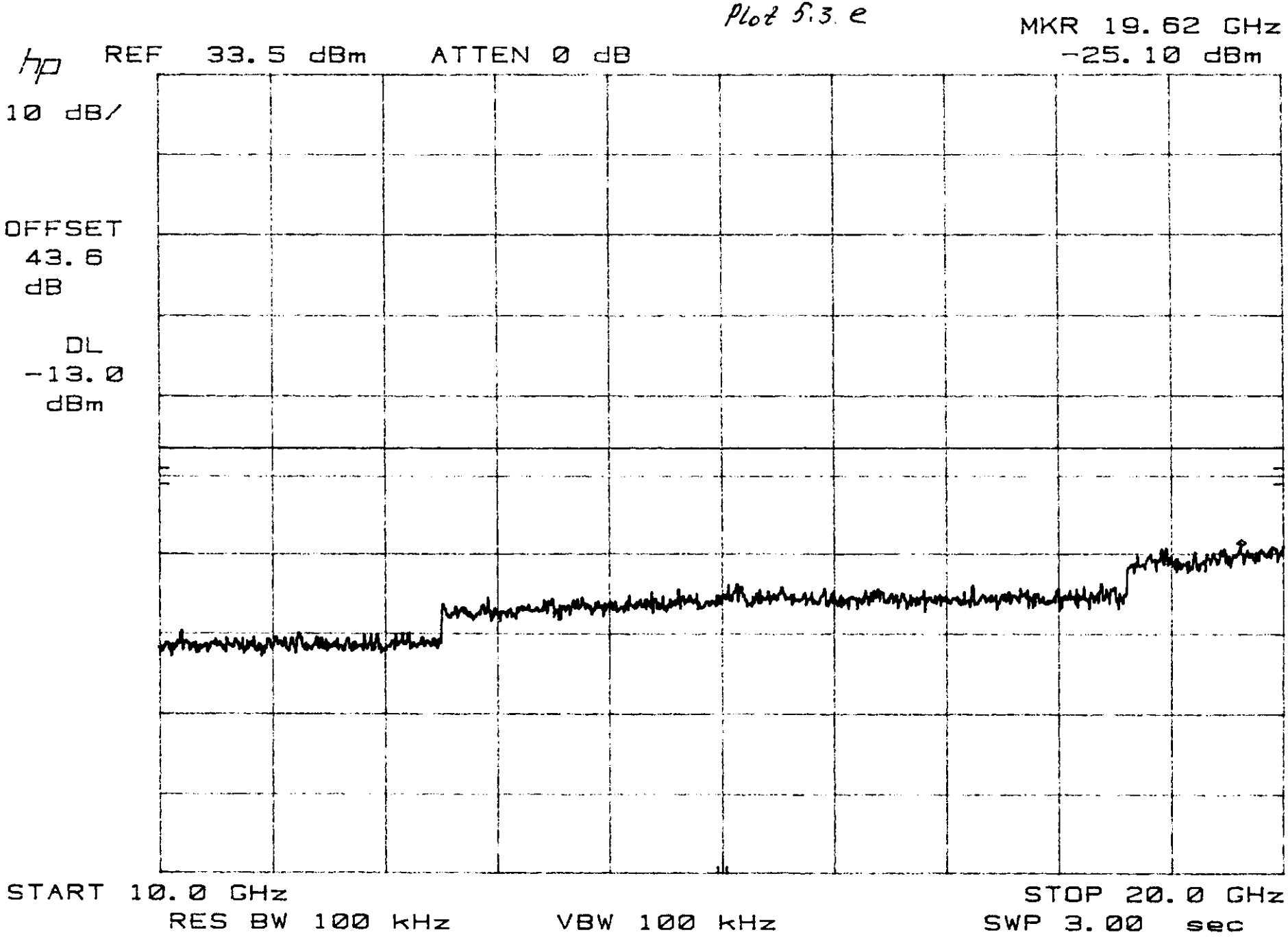
Plot 5.3.c


MKR 2.293 GHz
-21.20 dBm
hp REF 42.5 dBm ATTEN 20 dB
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 1.00 GHz
STOP 2.50 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 450 msec

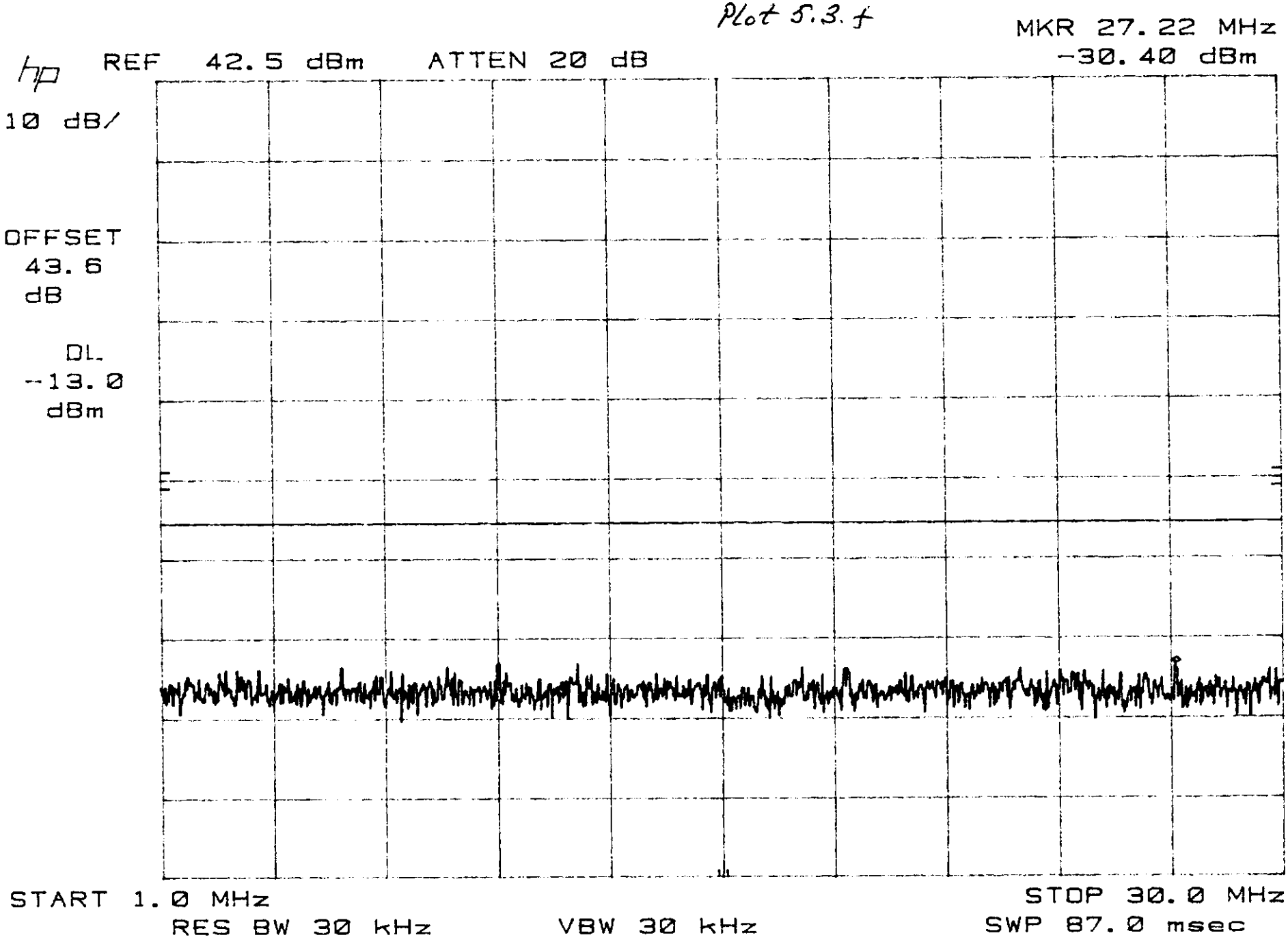
Plot 5.3.d


MKR 3.843 GHz
-20.80 dBm
hp REF 42.5 dBm ATTEN 10 dB
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 2.50 GHz
STOP 10.00 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 2.25 sec

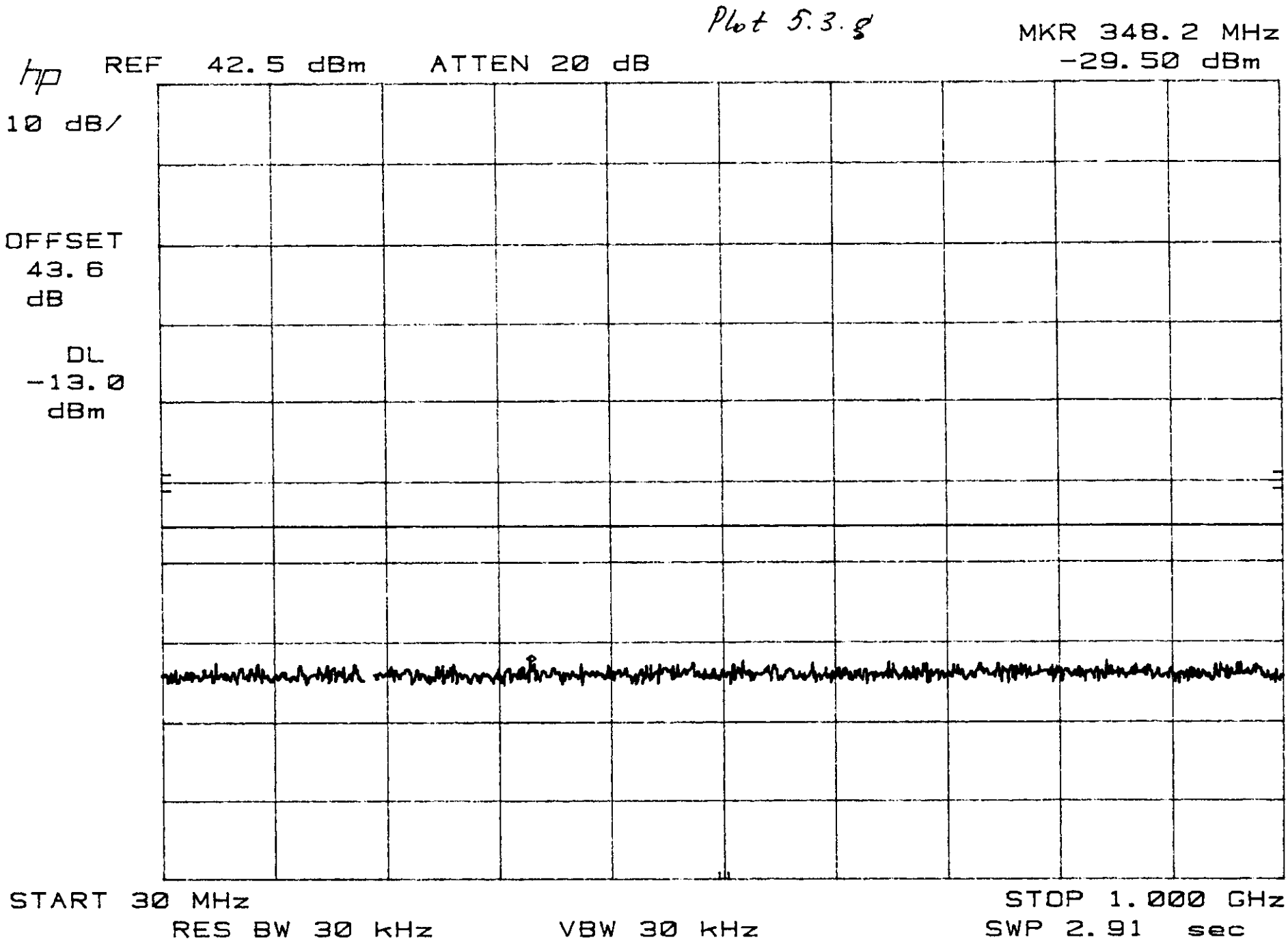
Plot 5.3.e


hp
REF 33.5 dBm
ATTEN 0 dB
MKR 19.62 GHz
-25.10 dBm
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 10.0 GHz
STOP 20.0 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 3.00 sec

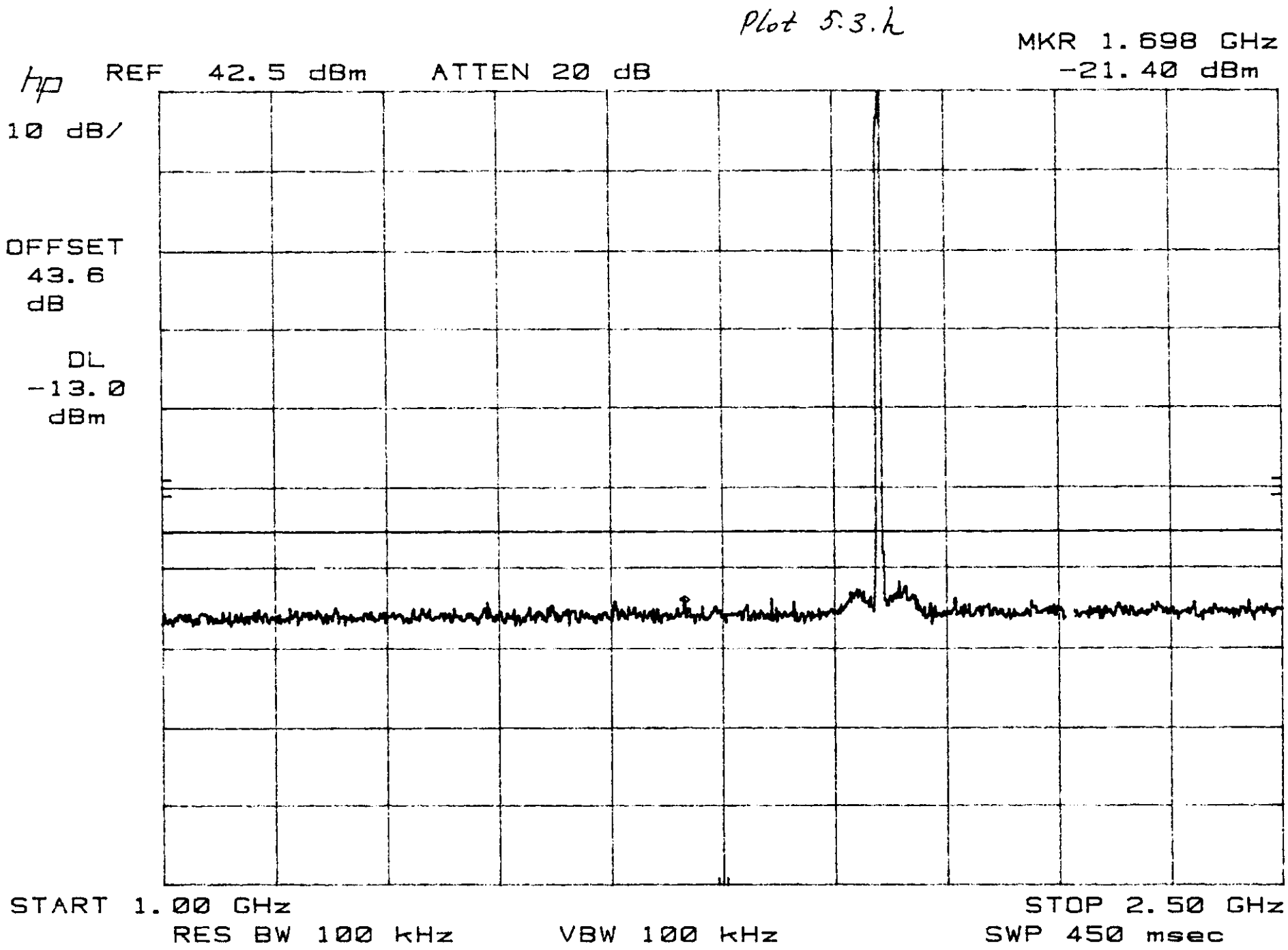
Plot 5.3.f


MKR 27.22 MHz
-30.40 dBm
hp
REF 42.5 dBm
ATTEN 20 dB
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 1.0 MHz
STOP 30.0 MHz
RES BW 30 kHz
VBW 30 kHz
SWP 87.0 msec

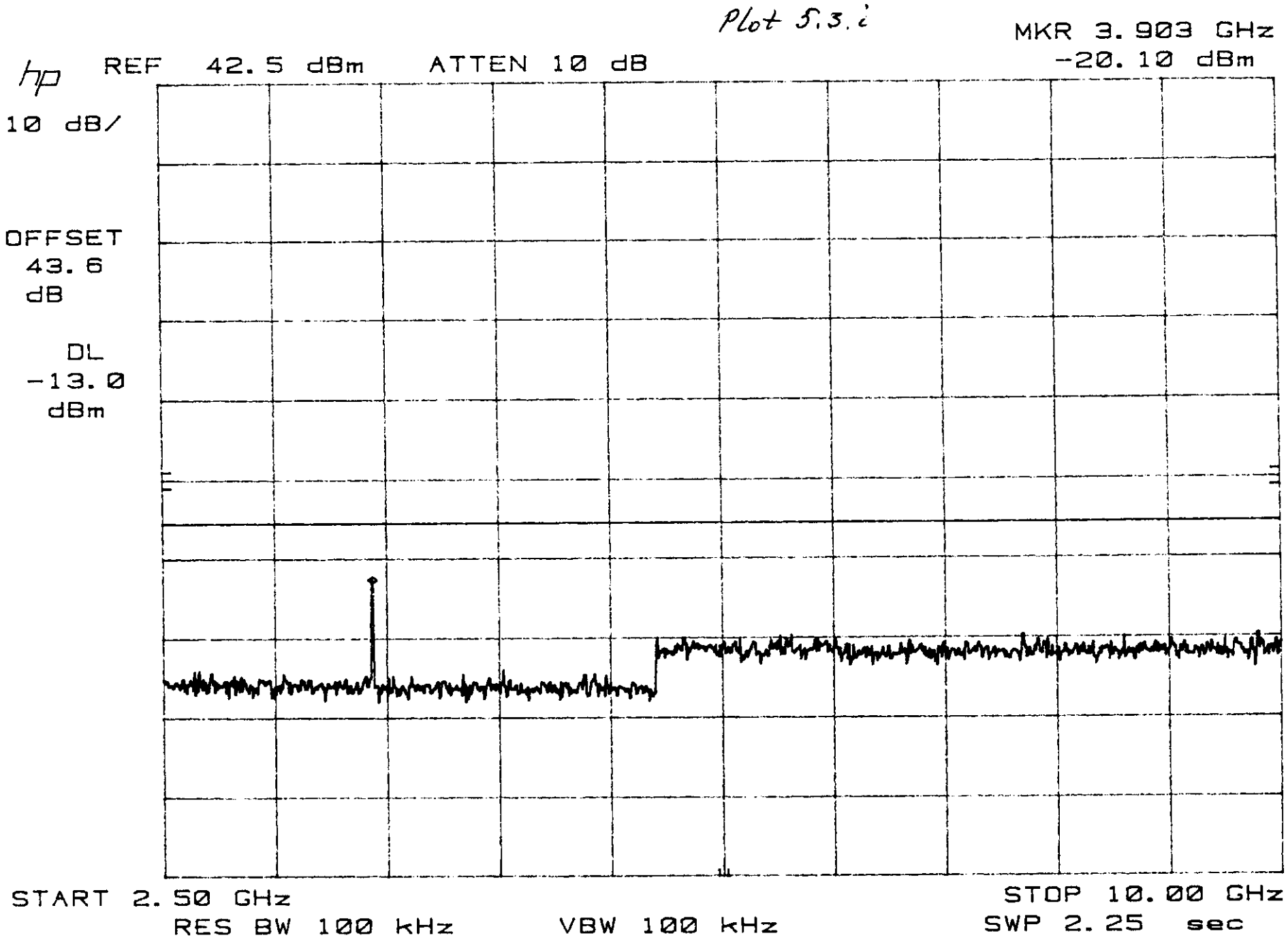
Plot 5.3.8


hp
REF 42.5 dBm
ATTEN 20 dB
MKR 348.2 MHz
-29.50 dBm
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 30 MHz
STOP 1.000 GHz
RES BW 30 kHz
VBW 30 kHz
SWP 2.91 sec

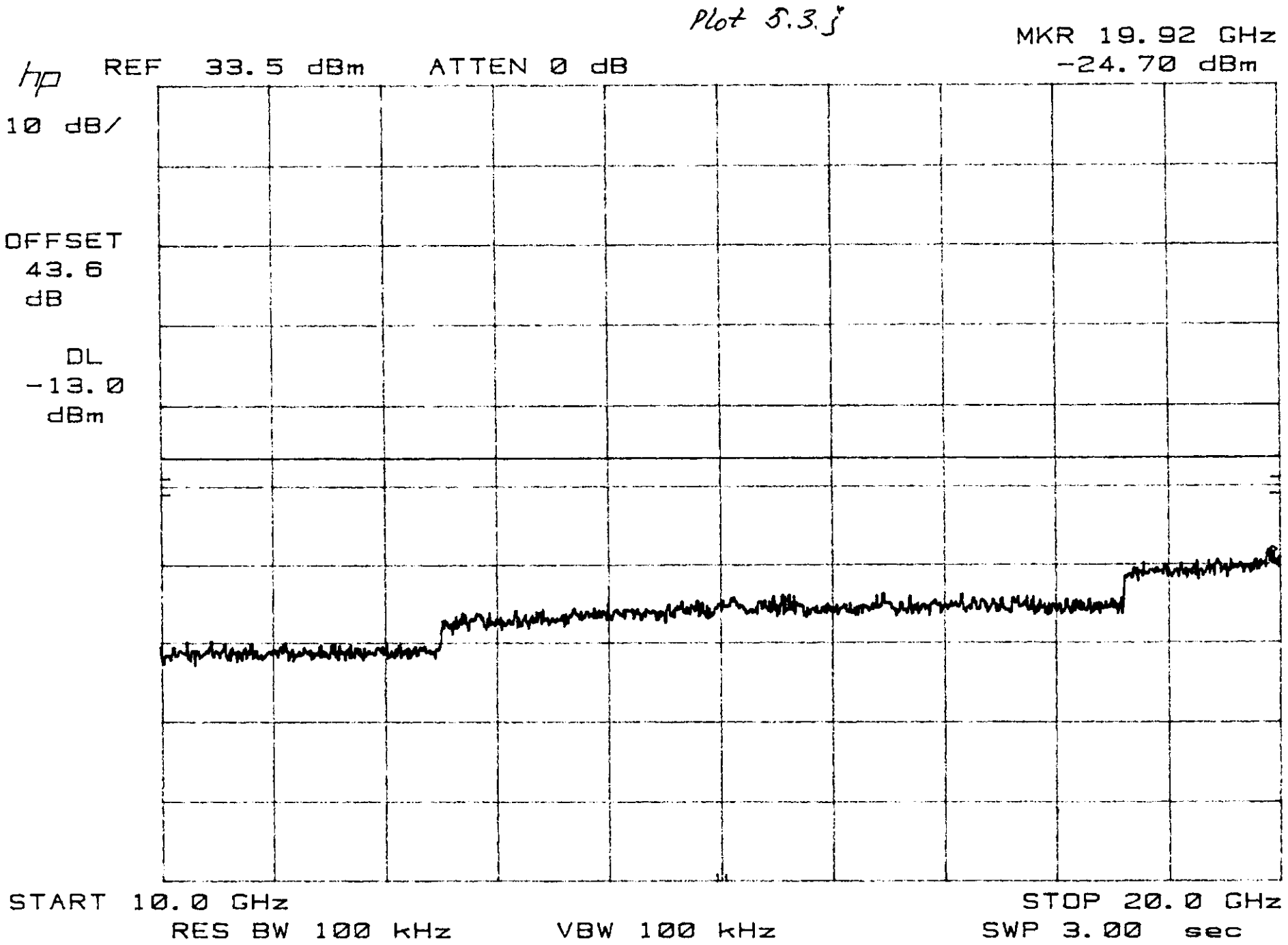
Plot 5.3.k


MKR 1.698 GHz
-21.40 dBm
hp REF 42.5 dBm ATTEN 20 dB
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 1.00 GHz
STOP 2.50 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 450 msec

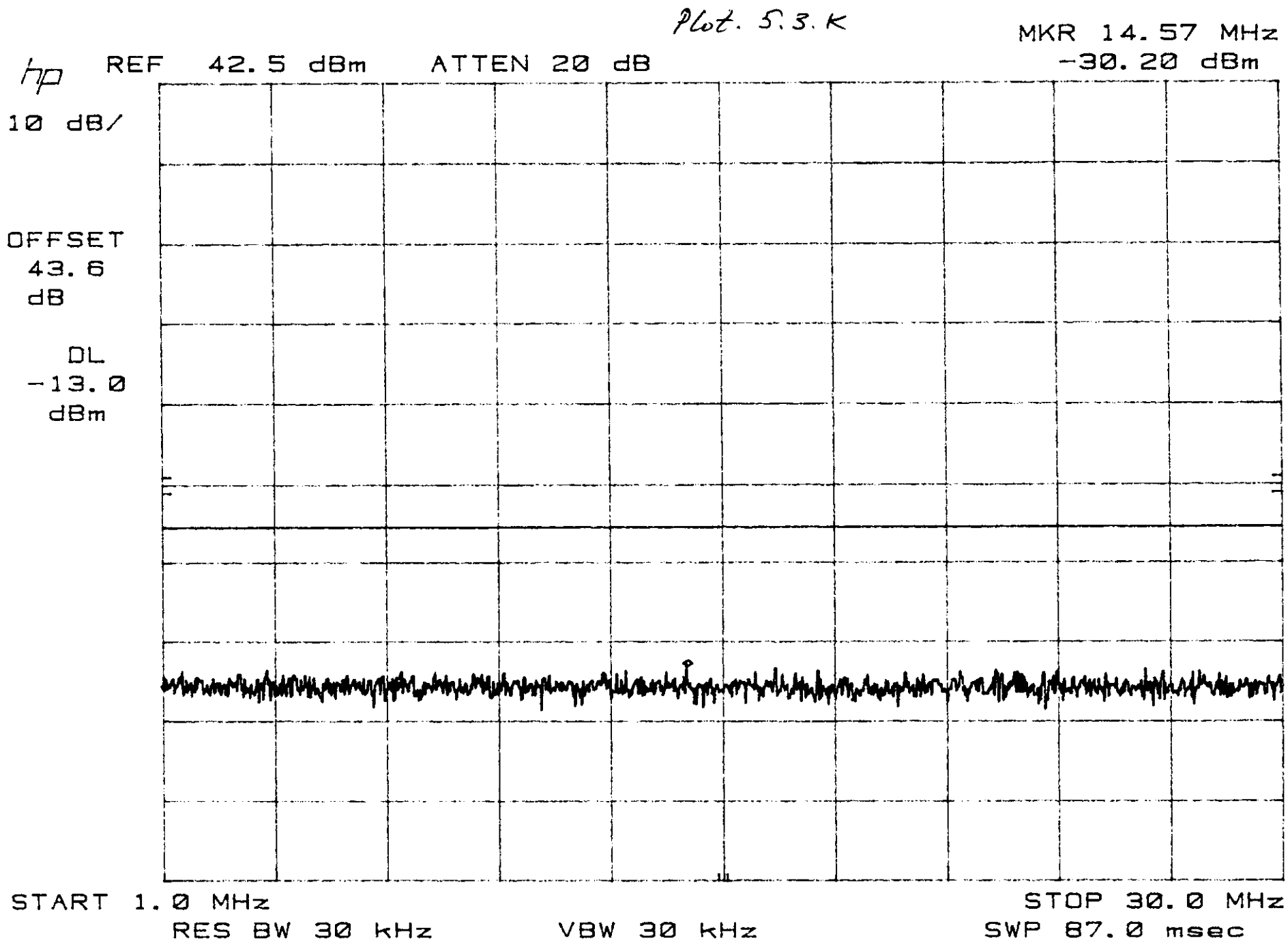
Plot 5.3.i


MKR 3.903 GHz
-20.10 dBm
hp REF 42.5 dBm ATTEN 10 dB
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 2.50 GHz
STOP 10.00 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 2.25 sec

Plot 5.3.5


MKR 19.92 GHz
-24.70 dBm
hp REF 33.5 dBm ATTEN 0 dB
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 10.0 GHz
STOP 20.0 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 3.00 sec

Plot. 5.3.K


MKR 14.57 MHz
-30.20 dBm
REF 42.5 dBm
ATTEN 20 dB
10 dB/
OFFSET
43.6
dB
DL
-13.0
dBm
START 1.0 MHz
STOP 30.0 MHz
RES BW 30 kHz
VBW 30 kHz
SWP 87.0 msec

10:27:35 SEP 22, 1998

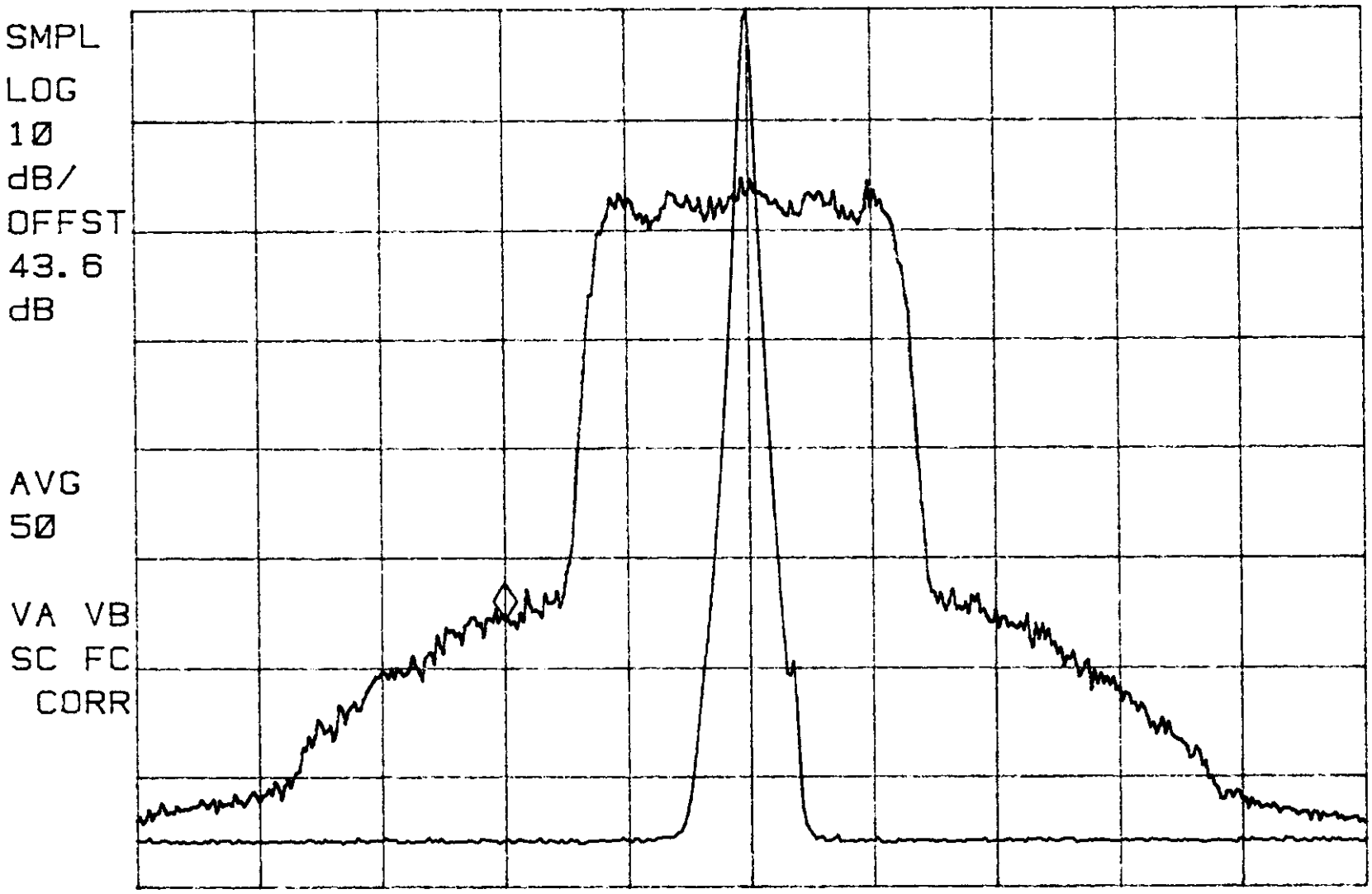
Plot 4.3.e

MKR 1.930000 GHz

-13.02 dBm

REF 42.5 dBm

#AT 20 dB



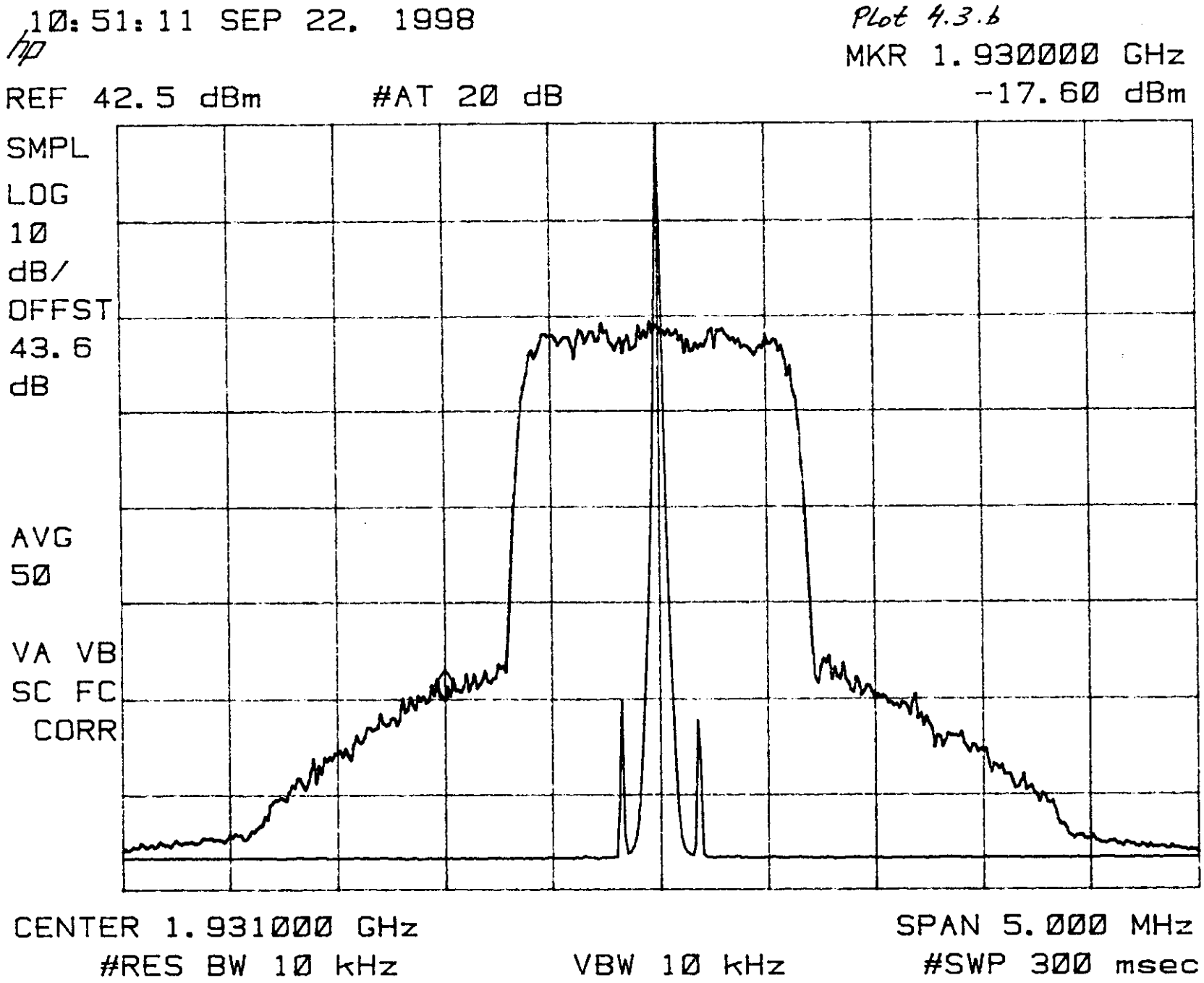
CENTER 1.931000 GHz

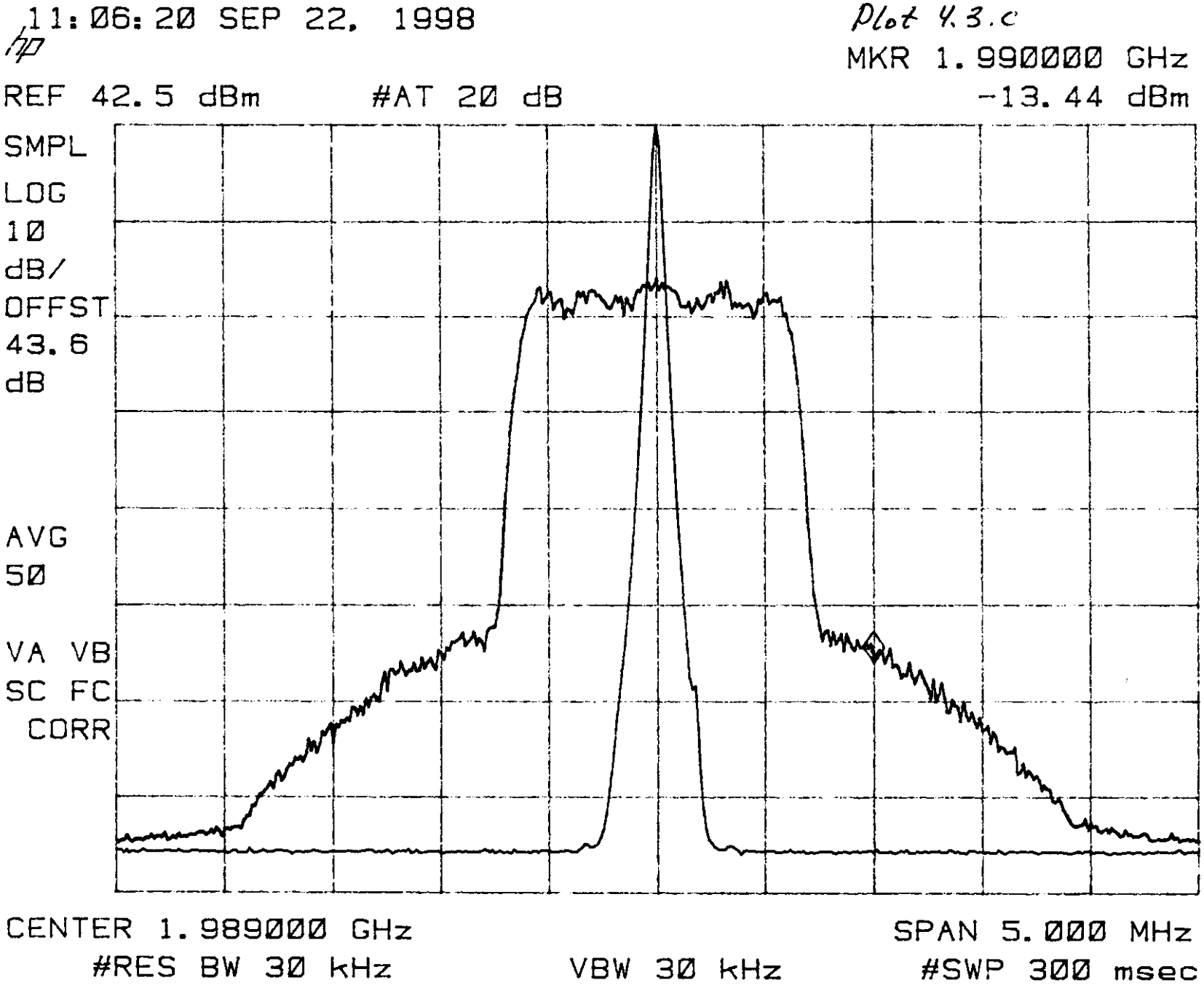
SPAN 5.000 MHz

#RES BW 30 kHz

VBW 30 kHz

SWP 20.0 msec


10:51:11 SEP 22. 1998
Plot 4.3.6
MKR 1.930000 GHz
-17.60 dBm
REF 42.5 dBm
#AT 20 dB
SMPL
LOG
10
dB/
OFFST
43.6
dB
AVG
50
VA VB
SC FC
CORR
CENTER 1.931000 GHz
SPAN 5.000 MHz
#RES BW 10 kHz
VBW 10 kHz
#SWP 300 msec


11:06:20 SEP 22, 1998
Plot 4.3.c
MKR 1.990000 GHz
-13.44 dBm
REF 42.5 dBm
#AT 20 dB
SMPL
LOG
10
dB/
OFFST
43.6
dB
AVG
50
VA VB
SC FC
CORR
CENTER 1.989000 GHz
SPAN 5.000 MHz
#RES BW 30 kHz
VBW 30 kHz
#SWP 300 msec

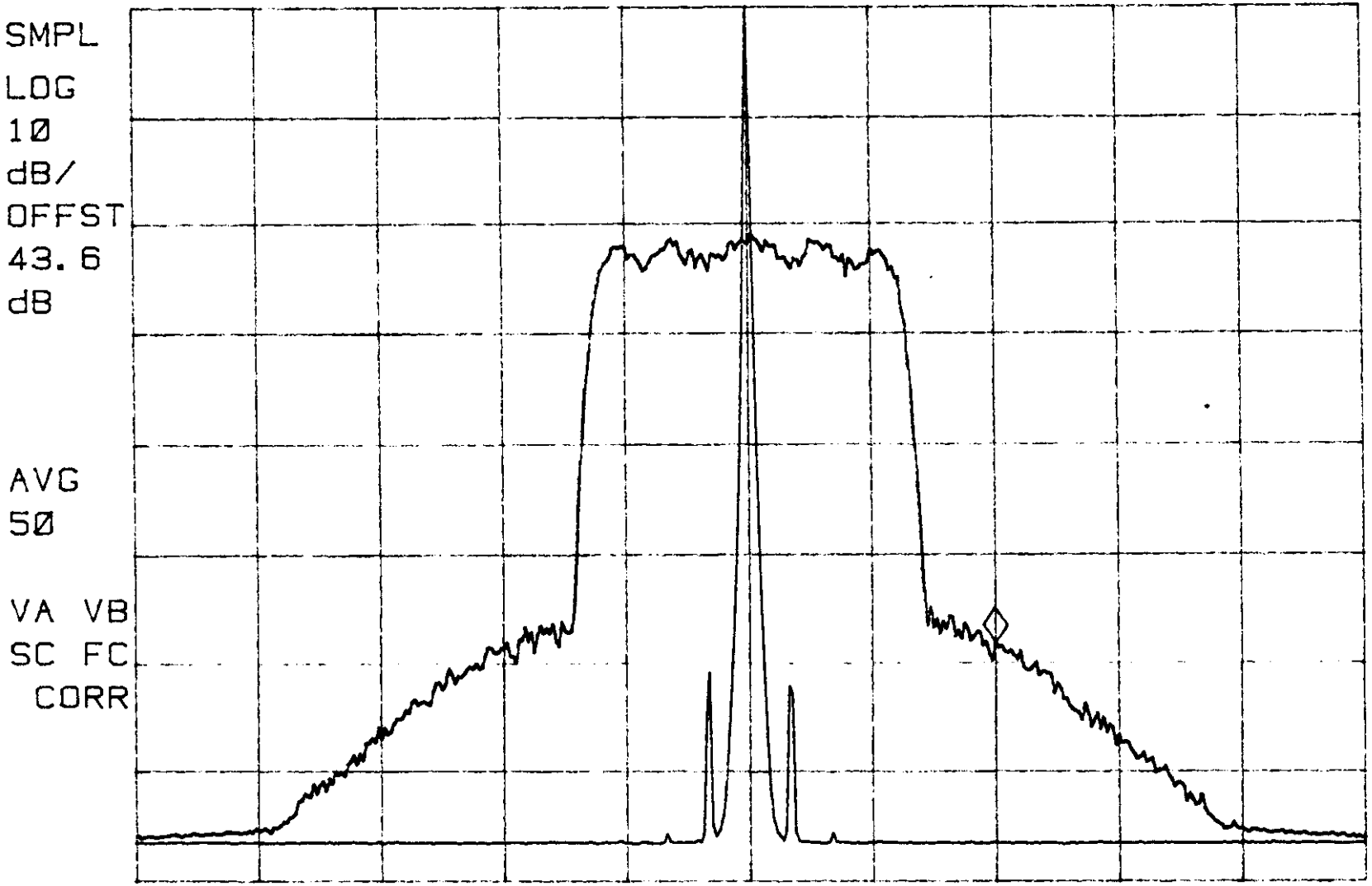
11:01:49 SEP 22. 1998

Plot 4.3.d

hp

MKR 1.990000 GHz

REF 42.5 dBm #AT 20 dB -15.61 dBm



CENTER 1.989000 GHz SPAN 5.000 MHz

#RES BW 10 kHz VBW 10 kHz #SWP 300 msec