FCC Part 15.247 Test Report
for
Western Multiplex
on the
Spread Spectrum Radio
Model: 31350
FCC ID: HZB-S24-08

Test Report #: J99022866g
Date of Report: January 21, 2000

Job #: J99022866
Date of Test: December 8 and 20, 1999

Total No. of Pages Contained in this Report: 19 + data pages

NVLAP®

Xi-Ming Yang	Xi-Ming Yang, Test Engineer
David Chernomordik	David Chernomordik, Ph.D., EMC Site Manager

Table of Contents

1.0 Summary of Tests

MODEL: 31550
FCC ID: HZB-S24-08

TEST	REFERENCE	RESULTS
Max. Output power	15.247(b)	Pass
6 dB Bandwidth	15.247(a)(2)	Pass
Max. Power Density	15.247(d)	Pass
Out of Band Antenna Conducted Emission	15.247(c)	Pass
Out of Band Radiated Emission	15.247(c)	Not Applicable
Radiated Emission in Restricted Bands	15.35(b)(c)	Pass
AC Conducted Emission	15.207	Pass
Radiated Emission from Digital Part	15.109	Pass
Radiated Emission from Receiver L.O.	15.109	Not Applicable
Processing Gain Measurements	15.247(e)	Provided by applicant
Antenna Requirement	15.203	Pass

Test Engineer: Xi-Ming Yang Date: 1-21-2000
Xi-Ming Yang

EMC Site Manager: David Chernomordik Date: 01/25/2000
David Chernomordik, Ph.D.
EMC Site Manager

2.0 General Description

2.1 Product Description

The EUT is a spread spectrum radio used for point-to-point fixed wireless interconnection.

A pre-production version of the sample was received on December 8, 1999 in good condition.

Overview of Spread Spectrum Radio

Applicant	Western Multiplex
Trade Name & Model No.	Western Multiplex / 31350
FCC Identifier	HZB-S24-08
Use of Product	Point-to-point fixed wireless interconnect
Manufacturer & Model of Spread Spectrum Module	Western Multiplex
Type of Transmission	Direct Sequence
Rated RF Output (mW)	190
Frequency Range (MHz)	2408-2467
Number of Channel(s)	4
Antenna(s) & Gain, dBi	27.7
Processing Gain Measurements	[X] Will be provided to ITS for submission with the application [ ] Will be provided directly to the FCC reviewing engineer by the client or manufacturer of the spread spectrum module
Antenna Requirement	[ ] The EUT uses a permanently connected antenna. [ ] The antenna is affixed to the EUT using a unique connector which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector. [X] The EUT requires professional installation (attach supporting documentation if using this option).
Manufacturer name & address	Western Multiplex 1196 Borregas Ave Sunnyvale CA 94089

2.2 Related Submittal(s) Grants

2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Data Sheet"** of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

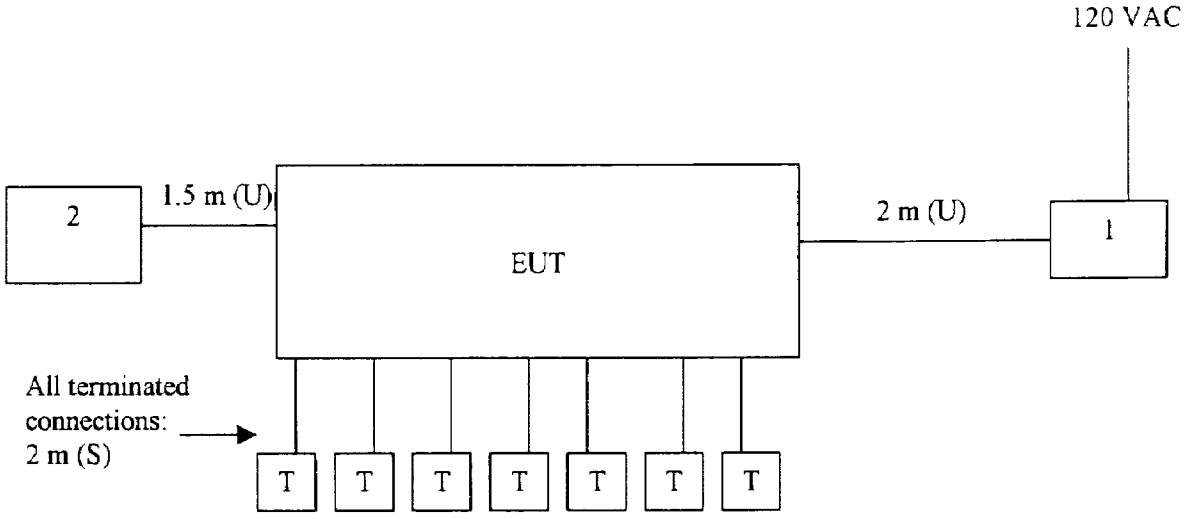
The open area test site and conducted measurement facility used to collect the radiated data is site 1. This test facility and site measurement data have been fully placed on file with the FCC and NVLAP accredited.

3.0 System Test Configuration

3.1 Support Equipment and description

Item #	Description	Model No.	Serial No.
1	DC Power Supply	TPS-4000	917003
2	Antenna	P-24A48G	N/A

3.2 Block Diagram of Test Setup



* = EUT	S = Shielded;	F = With Ferrite
** = No ferrites on video cable	U = Unshielded	

3.3 Justification

For emission testing, the equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For radiated emission measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power without modulation.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. For emissions testing, the units were setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing.

3.5 Mode of Operation During Test

For emissions testing, the EUT was setup to transmit continuouisly to simplify the measurement methodology. Care was taken to ensure porper power supply voltages during tesing. The transmittign signal was set to low, middle, and high frequencies.

3.6 Modifications Required for Compliance

The following modifications were installed during compliance testing in order to bring the product into compliance (Please note that this list does not include changes made specifically by Glenayre Western Multiplex prior to compliance testing):

No modifications were made by Intertek Testing Services

3.7 Additions, deviations and exclusions from standards

No additions, deviations, or exclusions were made to the standard.

4.0 Measurement Results

4.1 Maximum Conducted Output Power at Antenna Terminals, FCC Rules 15.247(b):

[X] The antenna port of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.

[ ] The antenna port of the EUT was connected to the input of a spectrum analyzer. The analyzer was set for maximun RES BW and power was read directly in dBm. External attenuation and cable loss were compensated for using the OFFSET function of the analyzer.

For antennas with gains of 6 dBi or less , maximum allowed transmitter output is 1 watt (+30 dBm).

For antennas with gains greater than 6 dBi, transmitter output level must be decreased by an amount equal to (GAIN - 6)/3 dB.

Max. antenna gain = 27.7		
Frequency (MHz)	**Output in dBm**	**Output in mWatt**
Low Channel: 2408.0	22.8	189.5
Mid Channel: 2449.0	22.8	190.0
High Channel: 2467.0	22.8	190.0

Cable loss: 0 dB External Attenuation: 0 dB

Cable loss, external attenuation: [ ] included in OFFSET function
[ ] added to SA raw reading

EUT maximum allowed peak output power = 30-(27.7-6)/3 = 22.8 dBm

4.2 Minimum 6 dB RF Bandwidth, FCC Rule 15.247(a)(2):

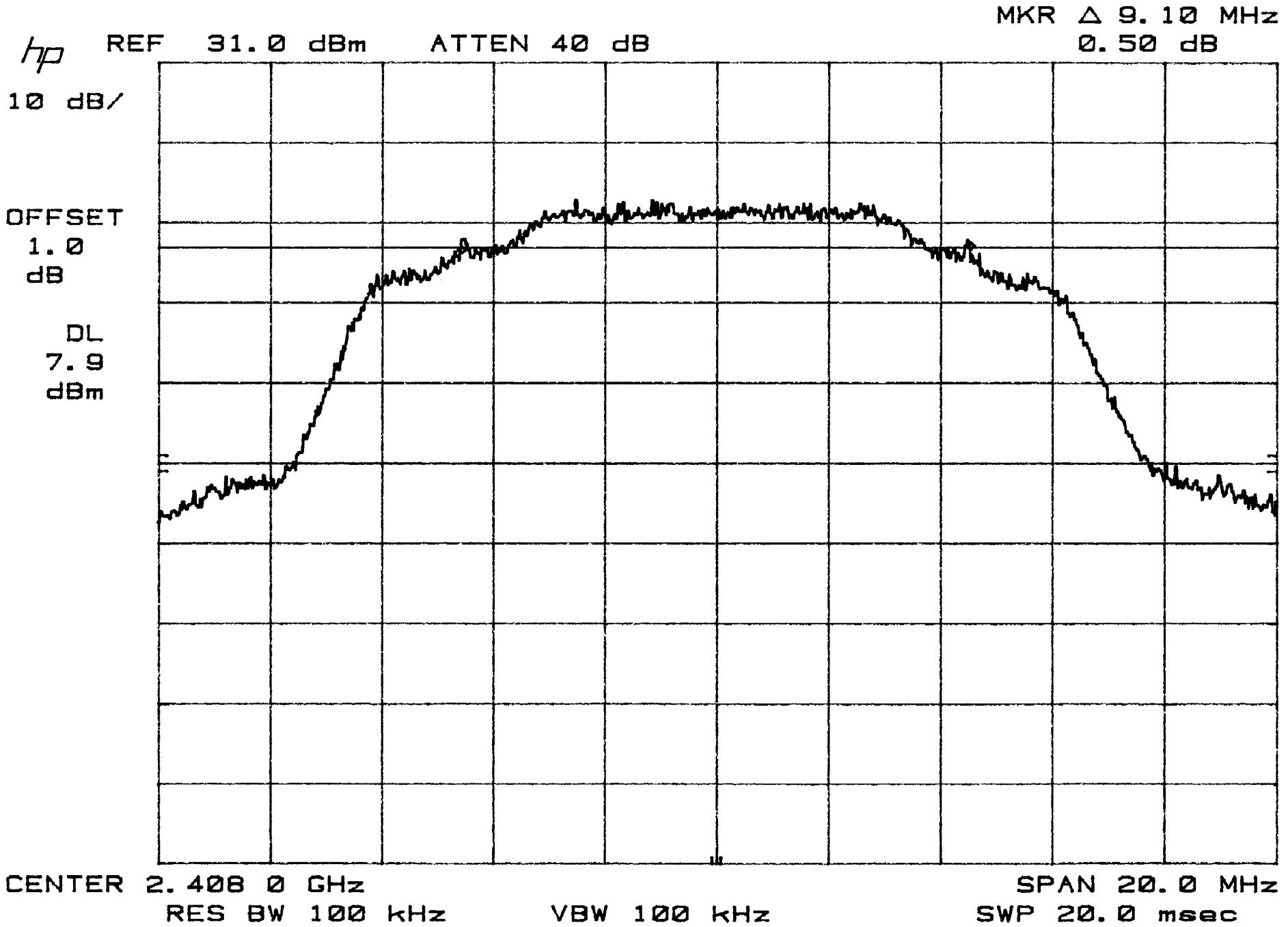
The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

Frequency (MHz)	Min. 6 dB Bandwidth
2408.0	9.10 MHz

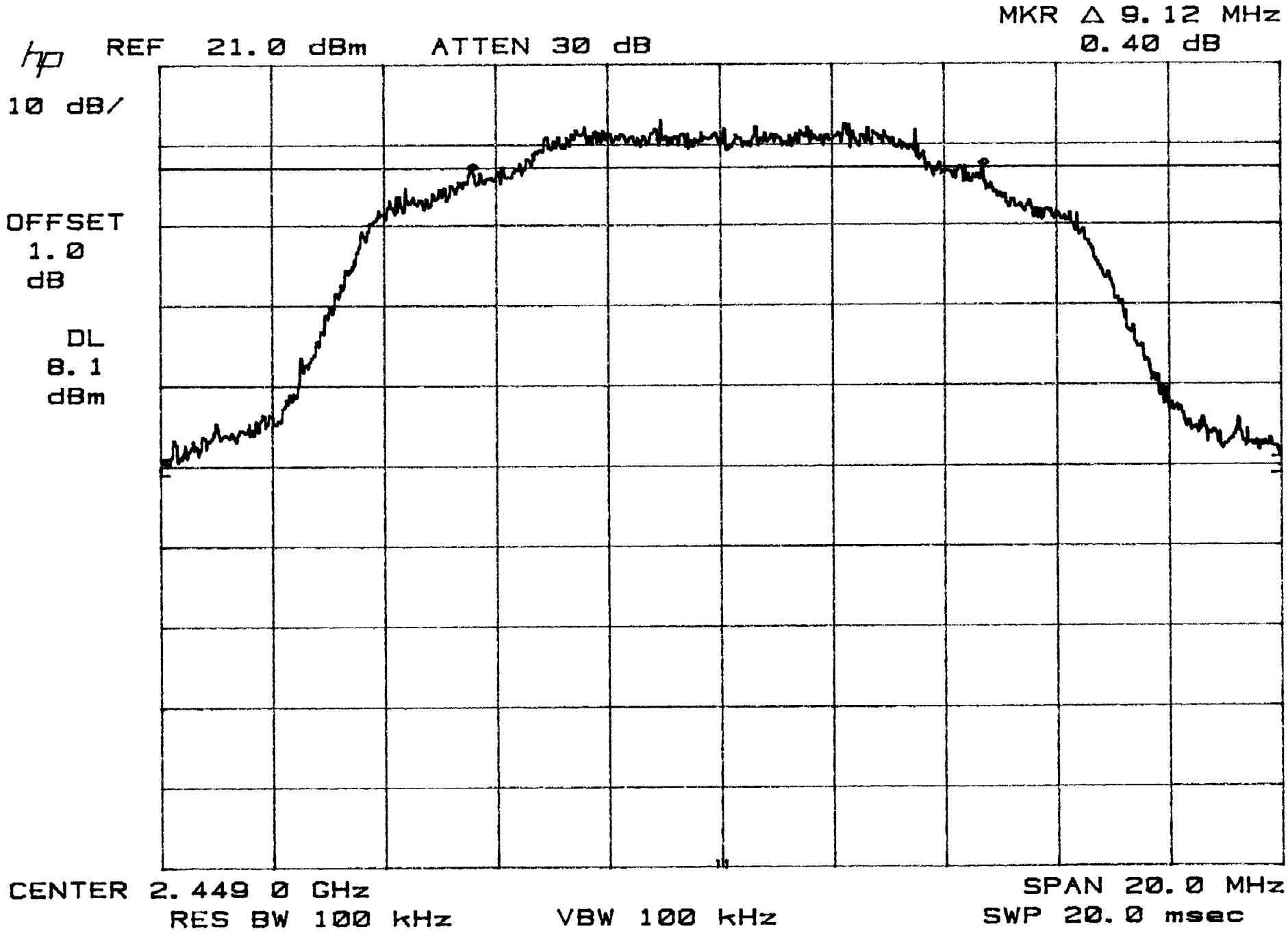
Refer to the following plots for 6 dB bandwidth sharp:

Plot 2a: Low Channel 6 dB RF Bandwidth
Plot 2b: Mid Channel 6 dB RF Bandwidth
Plot 2c: High Channel 6 dB RF Bandwidth

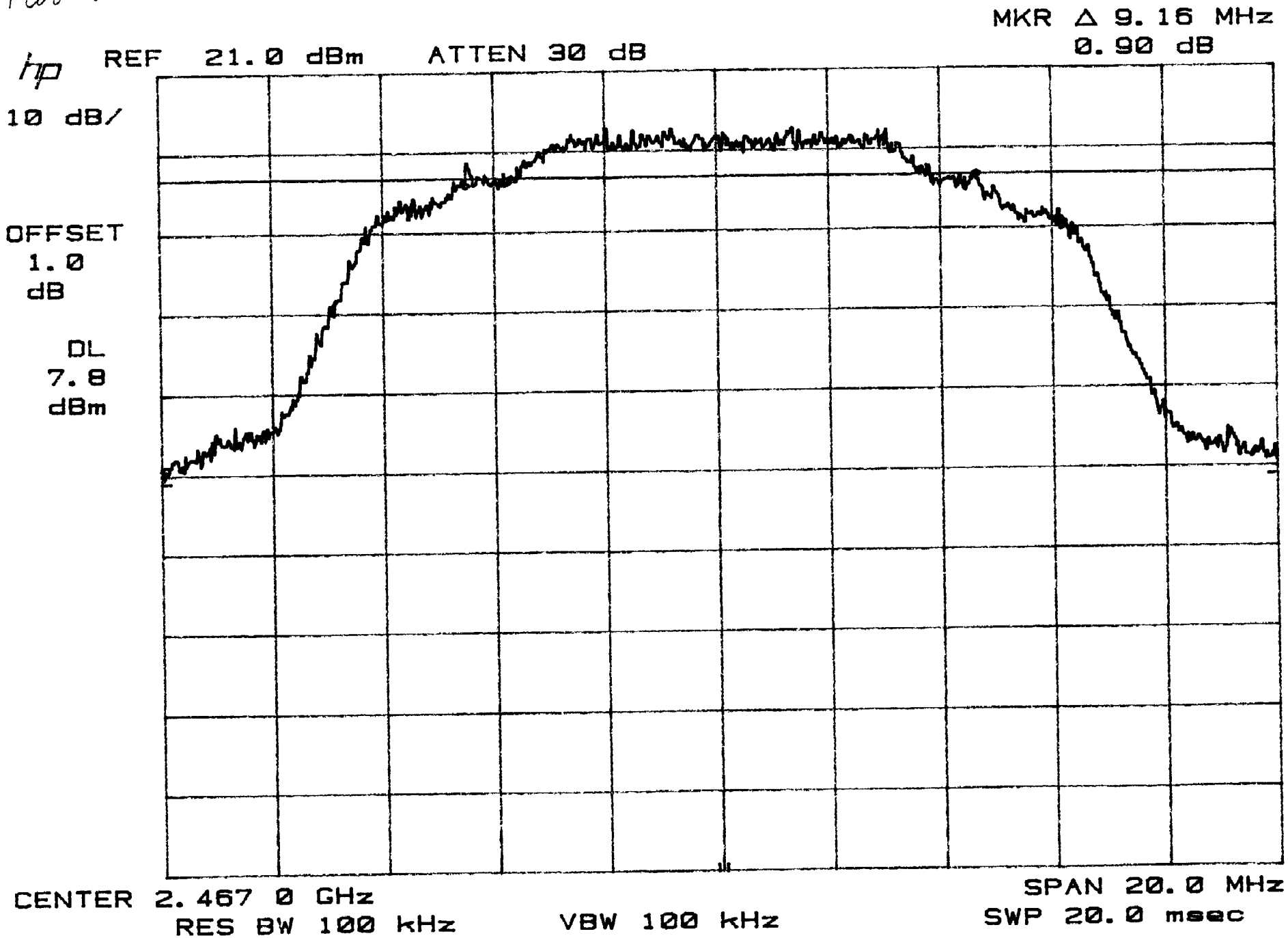
Plot 2.a.


MKR Δ 9.10 MHz
0.50 dB
hp REF 31.0 dBm ATTEN 40 dB
10 dB/
OFFSET
1.0
dB
DL
7.9
dBm
CENTER 2.408 0 GHz
SPAN 20.0 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

Plot 2b


MKR Δ 9.12 MHz
0.40 dB
REF 21.0 dBm
ATTEN 30 dB
10 dB/
OFFSET
1.0
dB
DL
8.1
dBm
CENTER 2.449 0 GHz
SPAN 20.0 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

Plot 2C


MKR Δ 9.16 MHz
0.90 dB
hp REF 21.0 dBm ATTEN 30 dB
10 dB/
OFFSET
1.0
dB
DL
7.8
dBm
CENTER 2.467 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 20.0 MHz
SWP 20.0 msec

4.3 Maximum Power Density Reading, FCC Rule 15.247(d):

The spectrum analyzer RES BW was set to 3 kHz. The START and STOP frequencies were set to the band edges of the maximum output passband. If there is no clear maximum amplitude in any given portion of the band, it may be necessary to make measurements at a number of bands defined by several START and STOP frequency pairs. The specification calls for a 1 second interval at each 3 kHz bandwidth; total SWEEP TIME is calculated as follows:

SWEEP TIME (SEC) = (Fstop, kHz - Fstart, kHz)/3 kHz

Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

Frequency (MHz)	Power Density (dBm)
2449	0.3

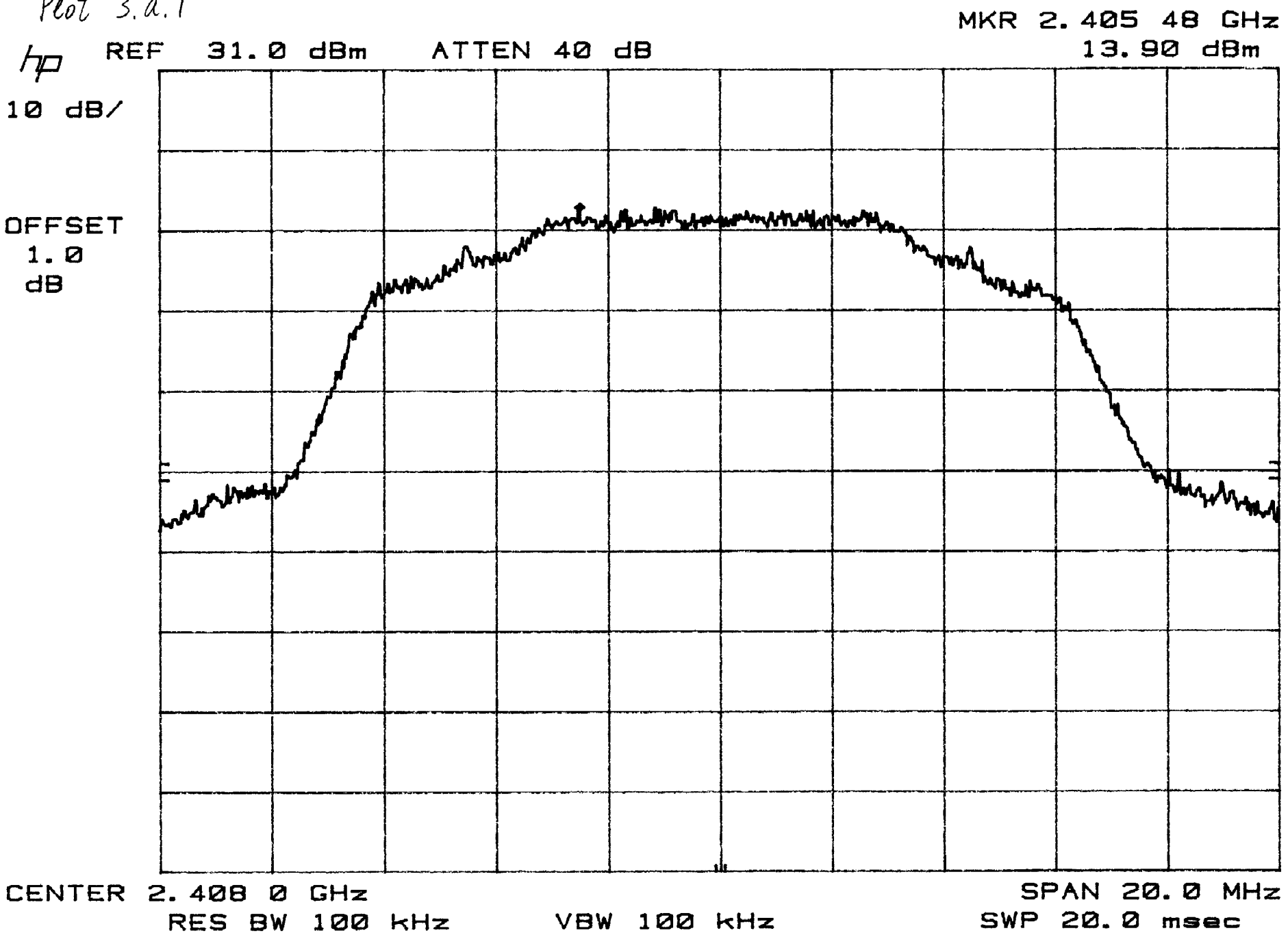
Frequency Span = 2100 kHz

Sweep Time = 2100 Frequency Span/3 kHz
= 700 seconds

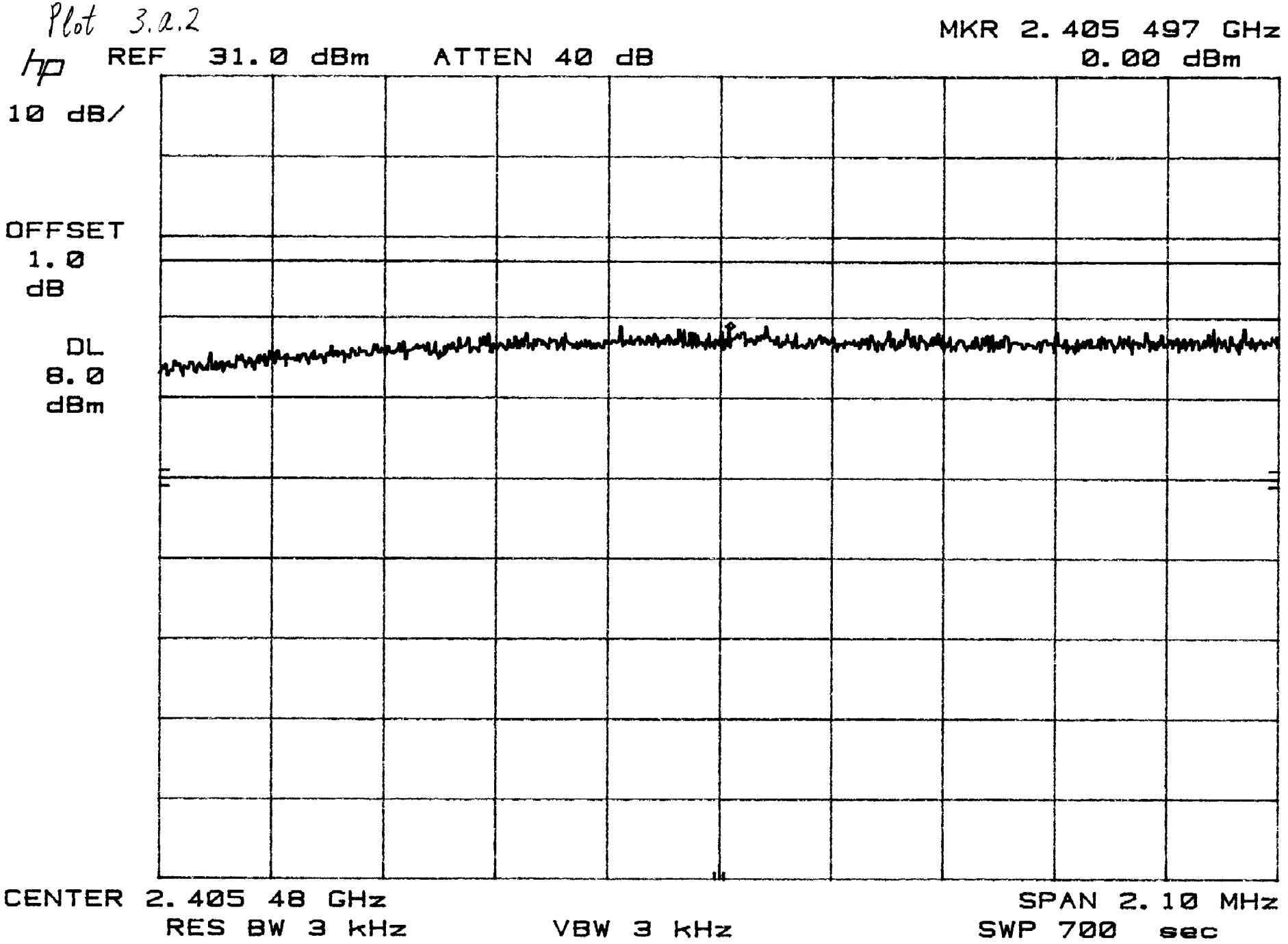
Refer to the following plots for power density data:

Plot 3.a.1-3.s.2: Low Channel Power Density
Plot 3.b.1-3.b.2: Mid Channel Power Density
Plot 3.c.1-3.c.2: High Channel Power Density

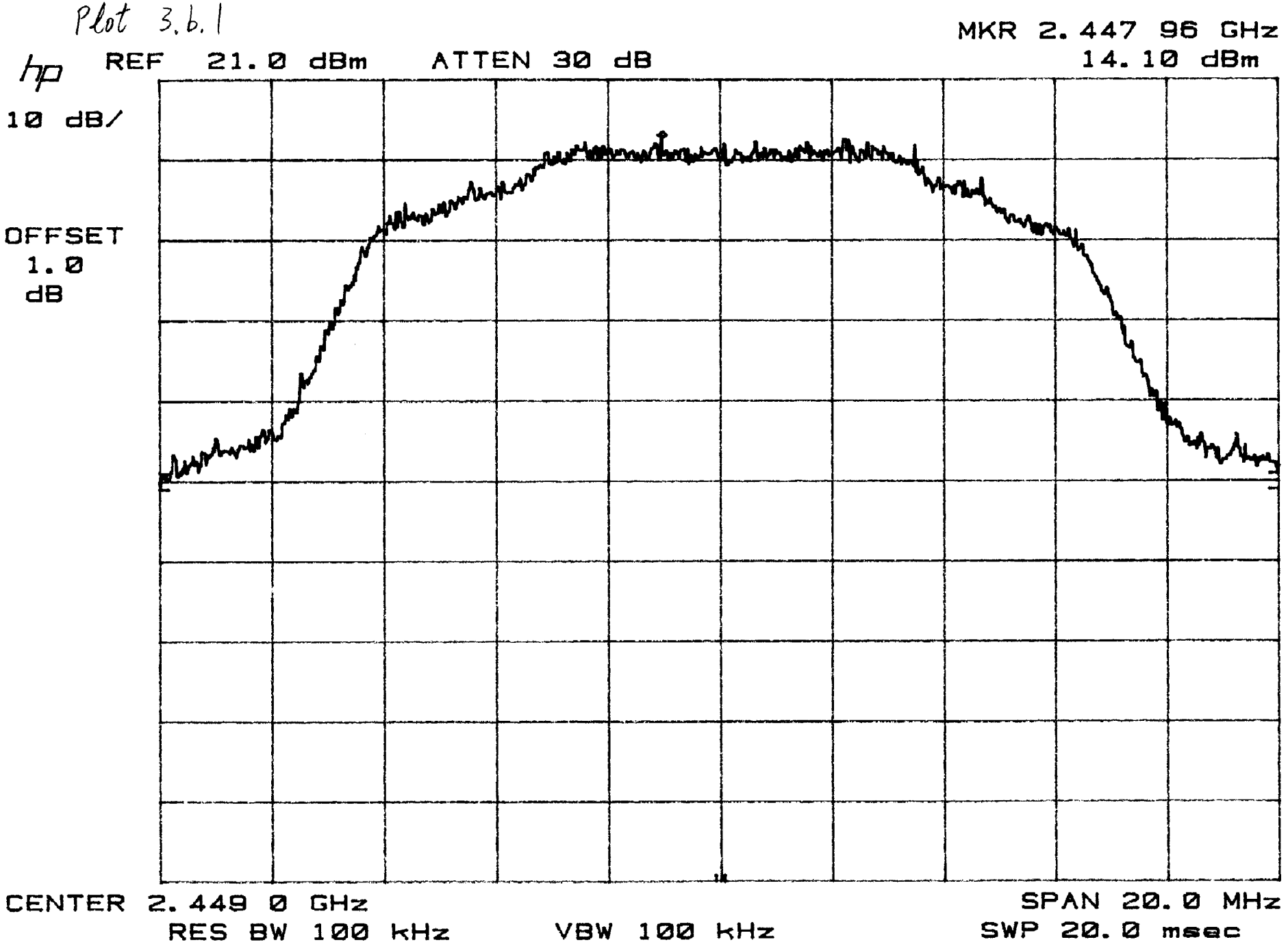
Plot 3.a.1


MKR 2.405 48 GHz
13.90 dBm
REF 31.0 dBm
ATTEN 40 dB
10 dB/
OFFSET
1.0
dB
CENTER 2.408 0 GHz
SPAN 20.0 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

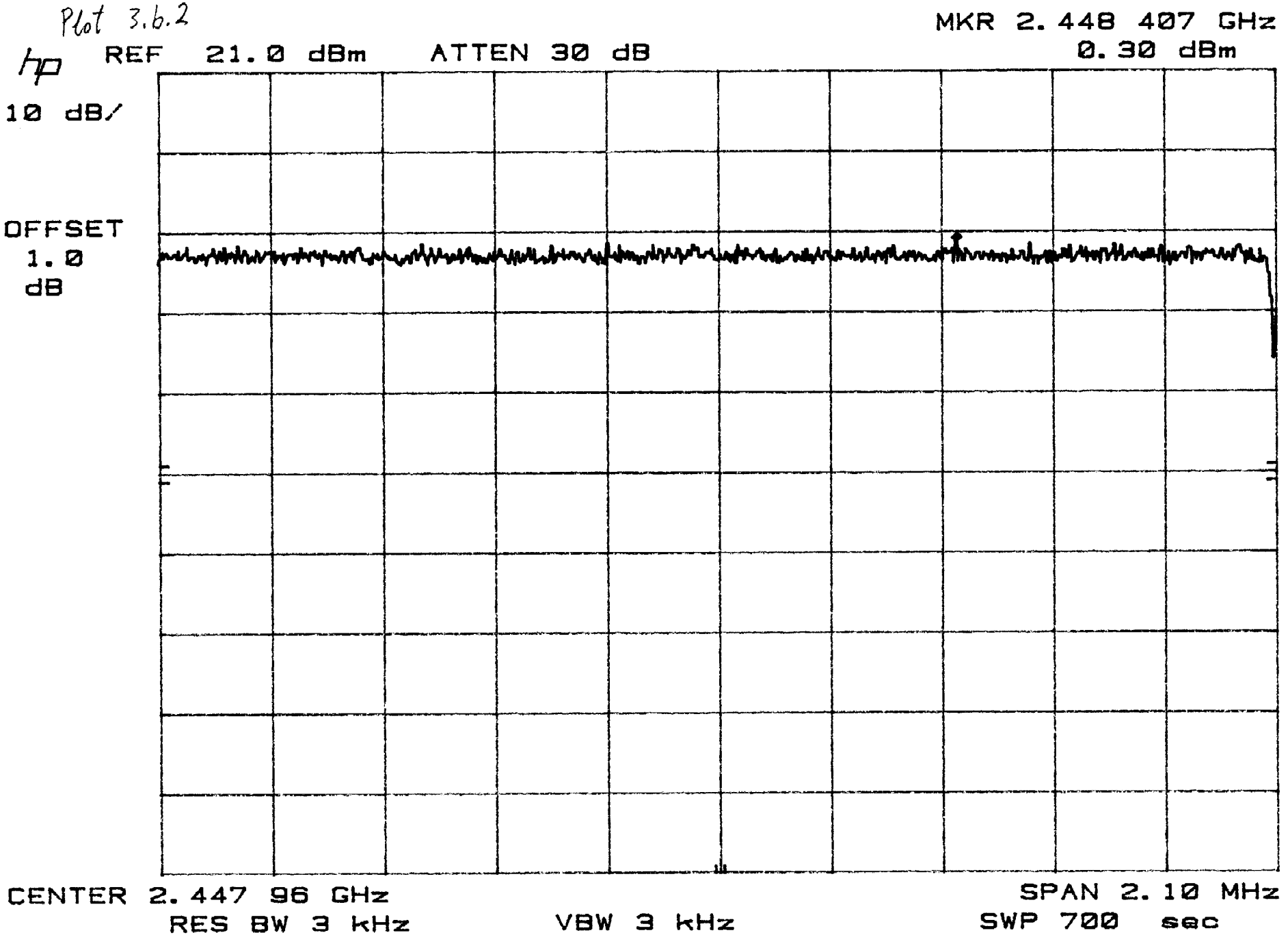
Plot 3.a.2


hp
REF 31.0 dBm
ATTEN 40 dB
MKR 2.405 497 GHz
0.00 dBm
10 dB/
OFFSET
1.0
dB
DL
8.0
dBm
CENTER 2.405 48 GHz
SPAN 2.10 MHz
RES BW 3 kHz
VBW 3 kHz
SWP 700 sec

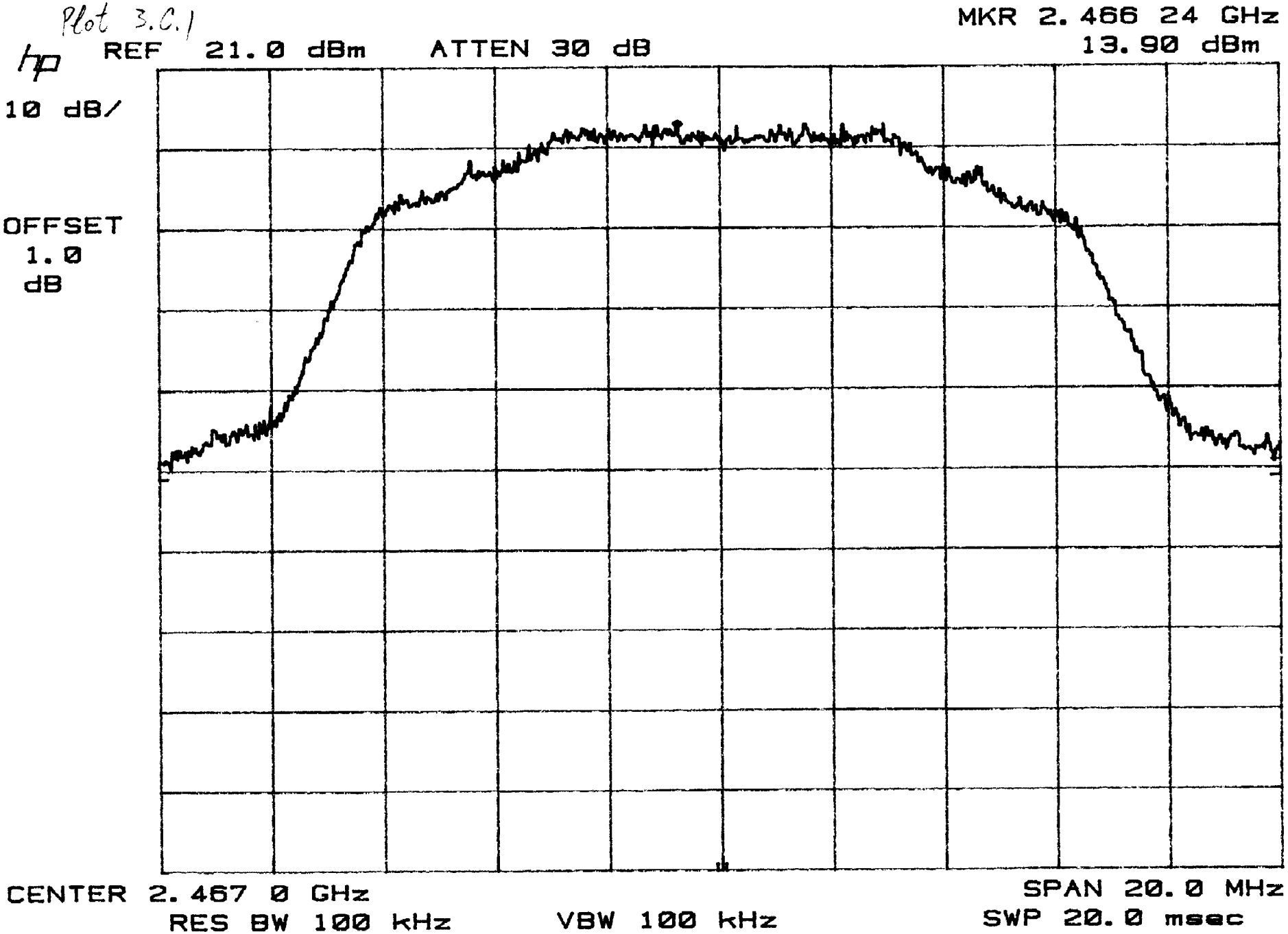
Plot 3.b.1


MKR 2.447 96 GHz
14.10 dBm
REF 21.0 dBm
ATTEN 30 dB
10 dB/
OFFSET
1.0
dB
CENTER 2.449 0 GHz
SPAN 20.0 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

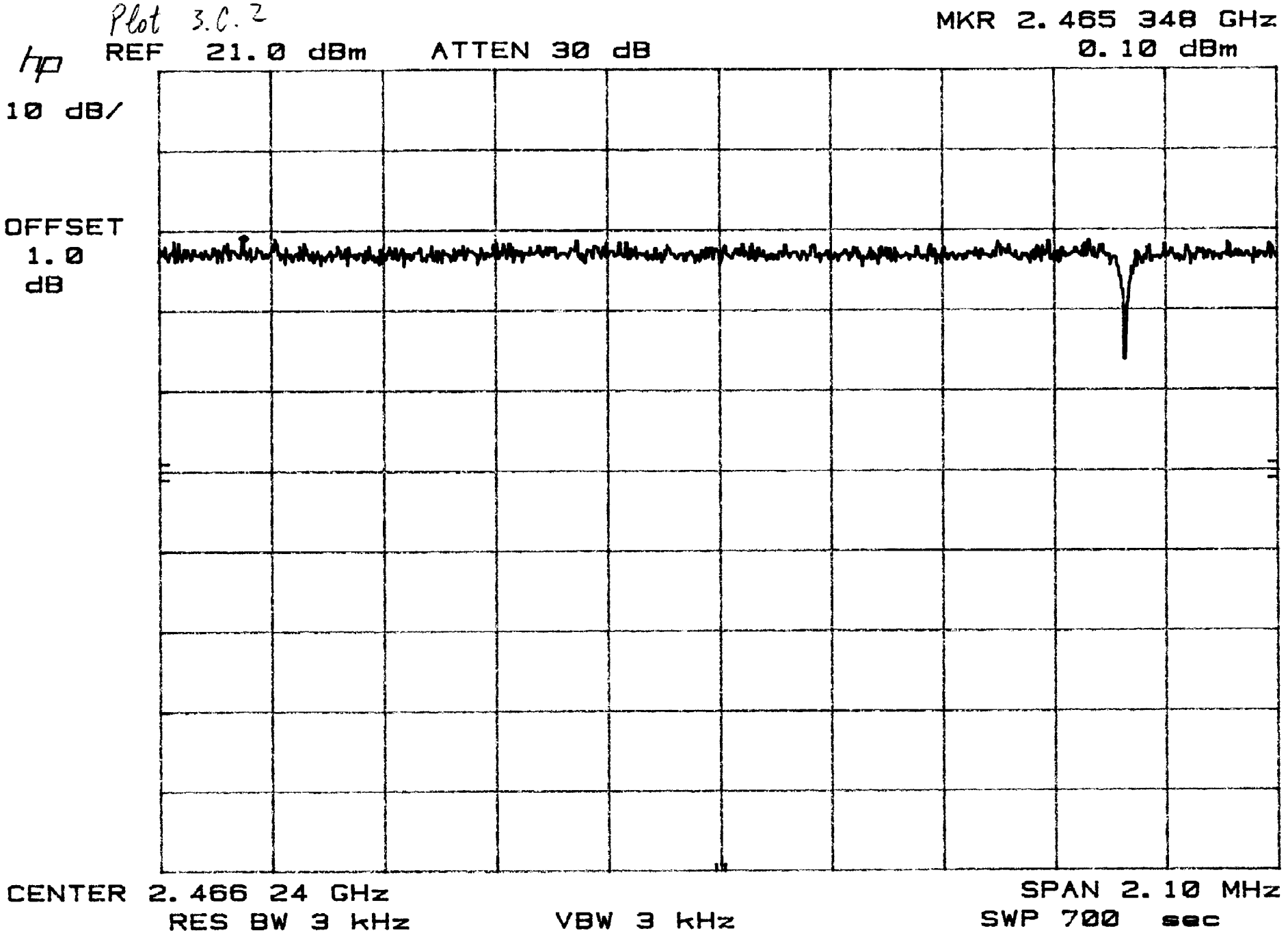
Plot 3.6.2


MKR 2.448 407 GHz
0.30 dBm
REF 21.0 dBm
ATTEN 30 dB
10 dB/
OFFSET
1.0
dB
CENTER 2.447 96 GHz
RES BW 3 kHz
VBW 3 kHz
SPAN 2.10 MHz
SWP 700 sec

Plot 3.C.1


hp
REF 21.0 dBm
ATTEN 30 dB
MKR 2.466 24 GHz
13.90 dBm
10 dB/
OFFSET
1.0
dB
CENTER 2.467 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 20.0 MHz
SWP 20.0 msec

Plot 3.C.2


MKR 2.465 348 GHz
0.10 dBm
REF 21.0 dBm
ATTEN 30 dB
10 dB/
OFFSET
1.0
dB
CENTER 2.466 24 GHz
RES BW 3 kHz
VBW 3 kHz
SPAN 2.10 MHz
SWP 700 sec

4.4 Out of Band Conducted Emissions, FCC Rule 15.247(c):

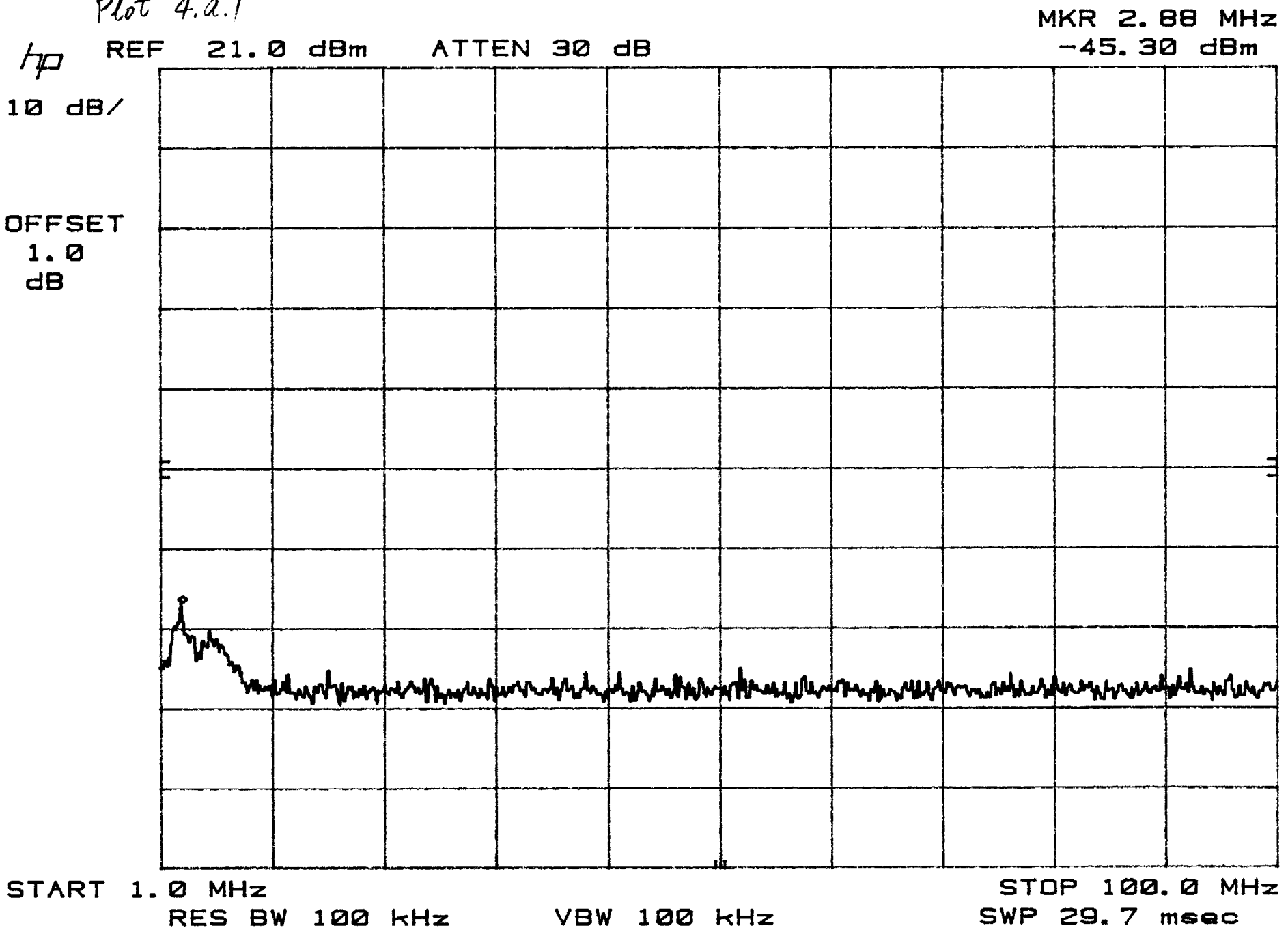
In any 100 kHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, or else shall meet the general limits for radiated emissions at frequencies outside the passband, whichever results in lower attenuation.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the passband.

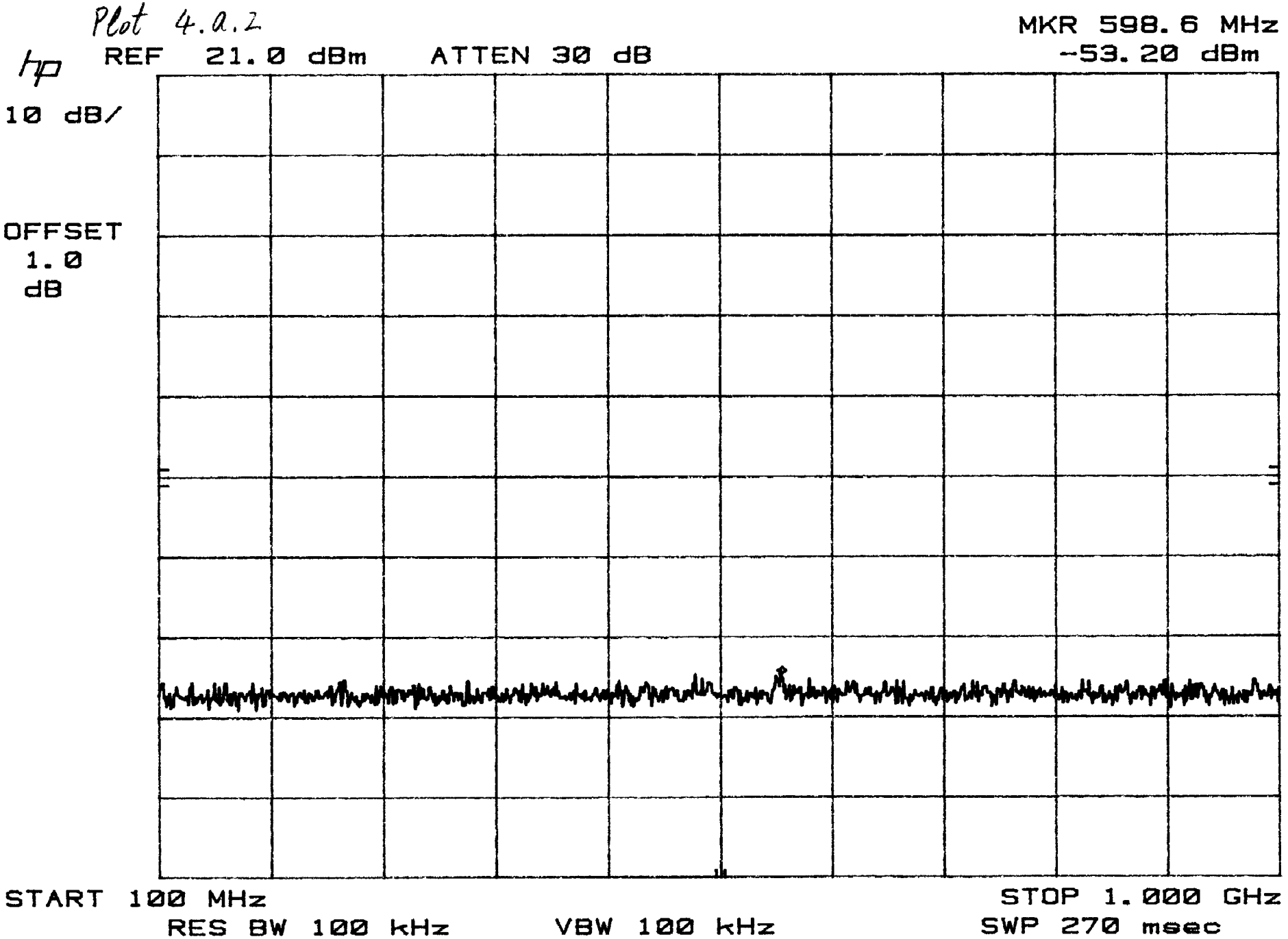
Refer to the following plots for out of band conducted emissions data:

Plot 4.a.1 – 4.a.8: Low Channel Emissions
Plot 4.b.1 – 4.b.7: Mid Channel Emissions
Plot 4.c.1 – 4.c.8: High Channel Emissions

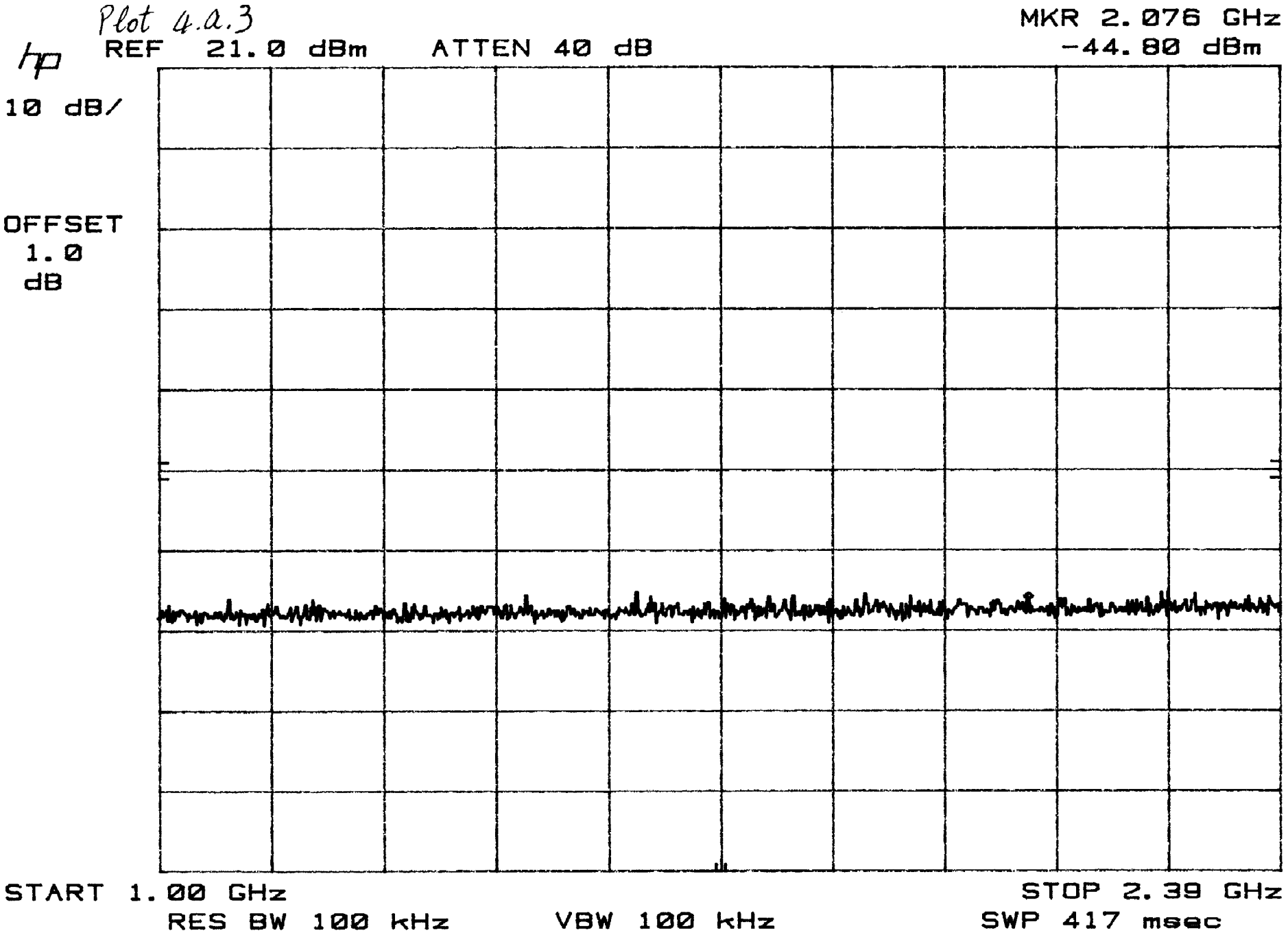
Plot 4.a.1


MKR 2.88 MHz
-45.30 dBm
REF 21.0 dBm
ATTEN 30 dB
10 dB/
OFFSET
1.0
dB
START 1.0 MHz
STOP 100.0 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 29.7 msec

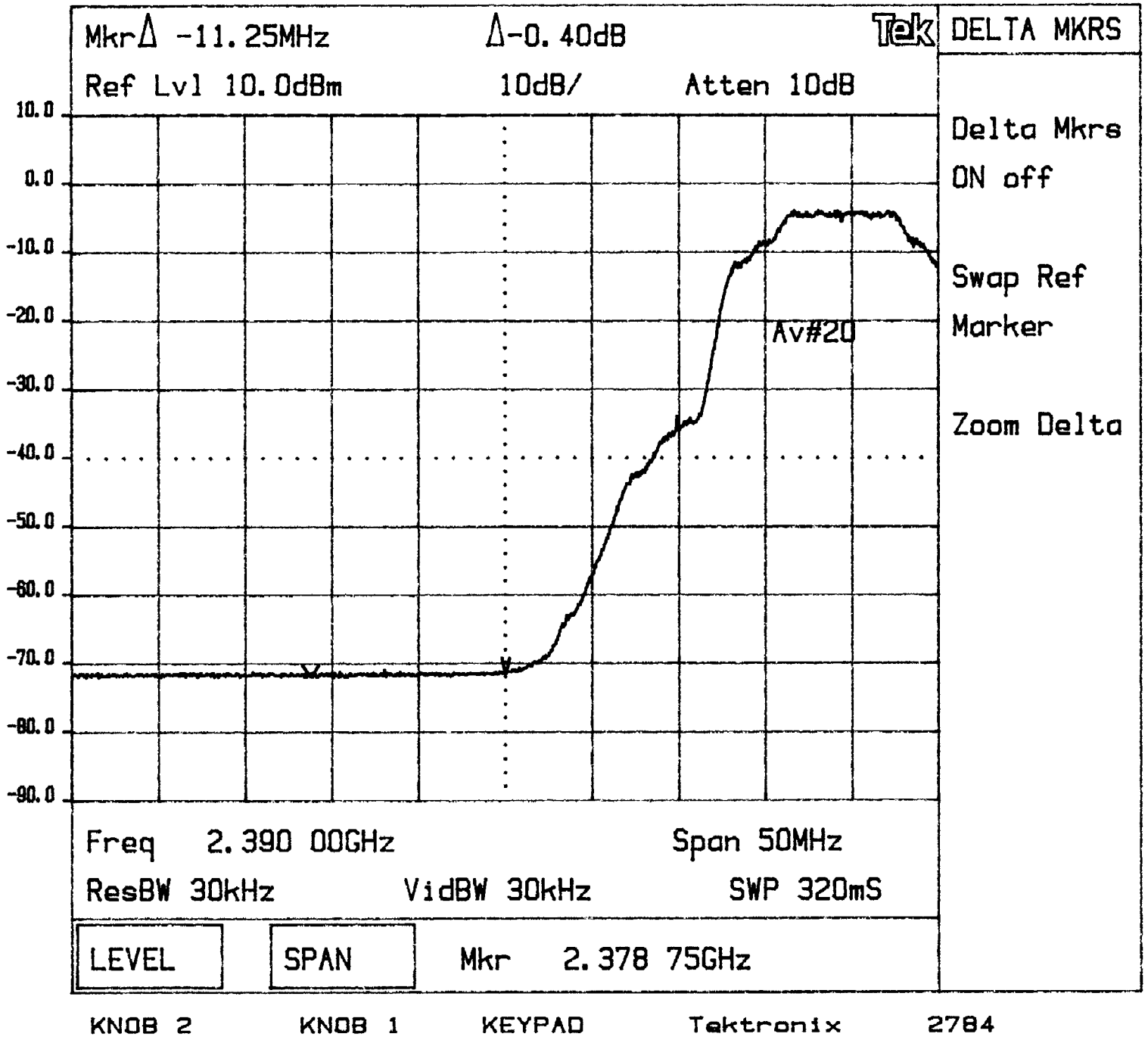
Plot 4.a.2


hp
REF 21.0 dBm
ATTEN 30 dB
MKR 598.6 MHz
-53.20 dBm
10 dB/
OFFSET
1.0
dB
START 100 MHz
RES BW 100 kHz
VBW 100 kHz
STOP 1.000 GHz
SWP 270 msec

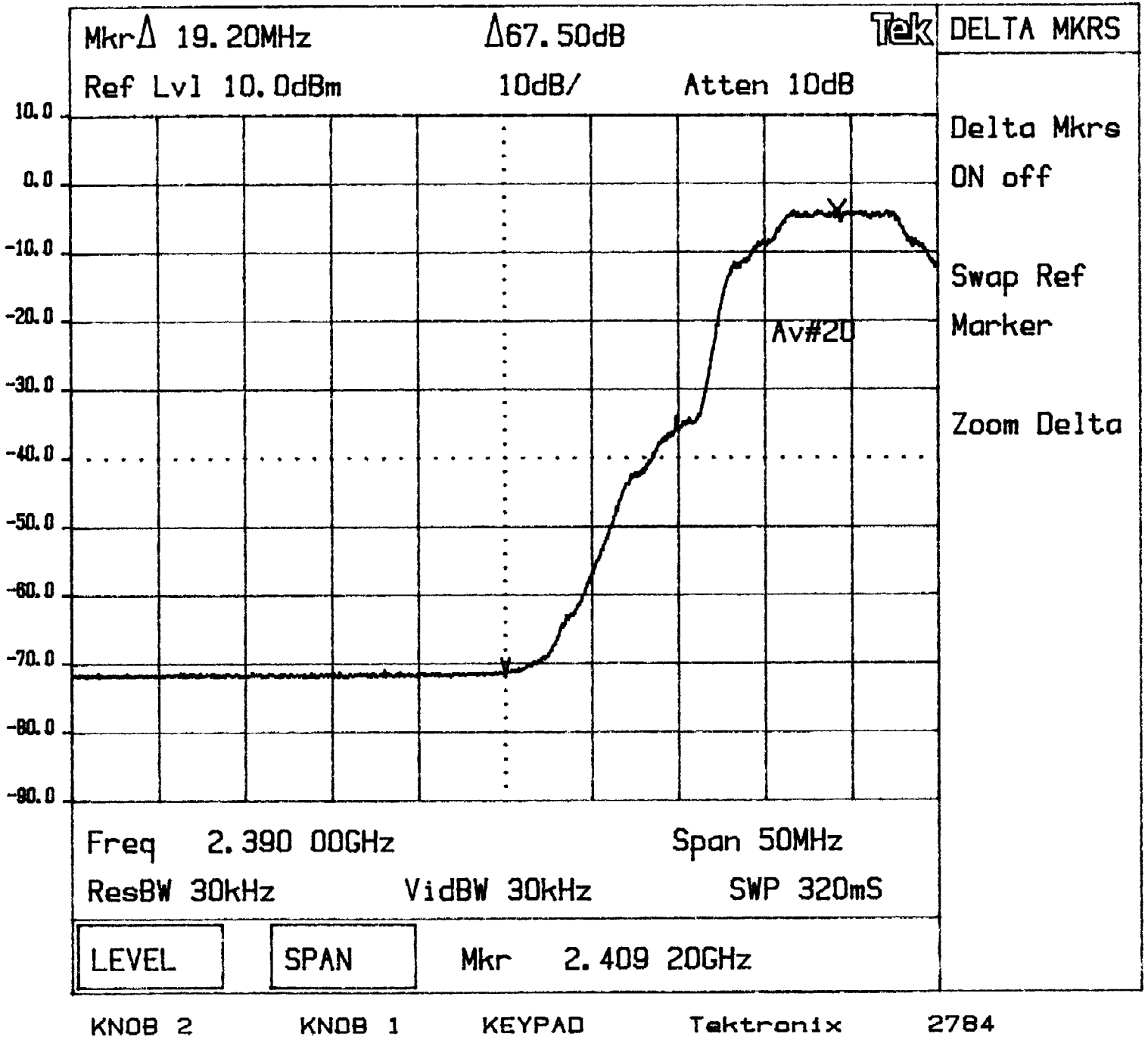
Plot 4.a.3


hp
REF 21.0 dBm
ATTEN 40 dB
MKR 2.076 GHz
-44.80 dBm
10 dB/
OFFSET
1.0
dB
START 1.00 GHz
STOP 2.39 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 417 msec

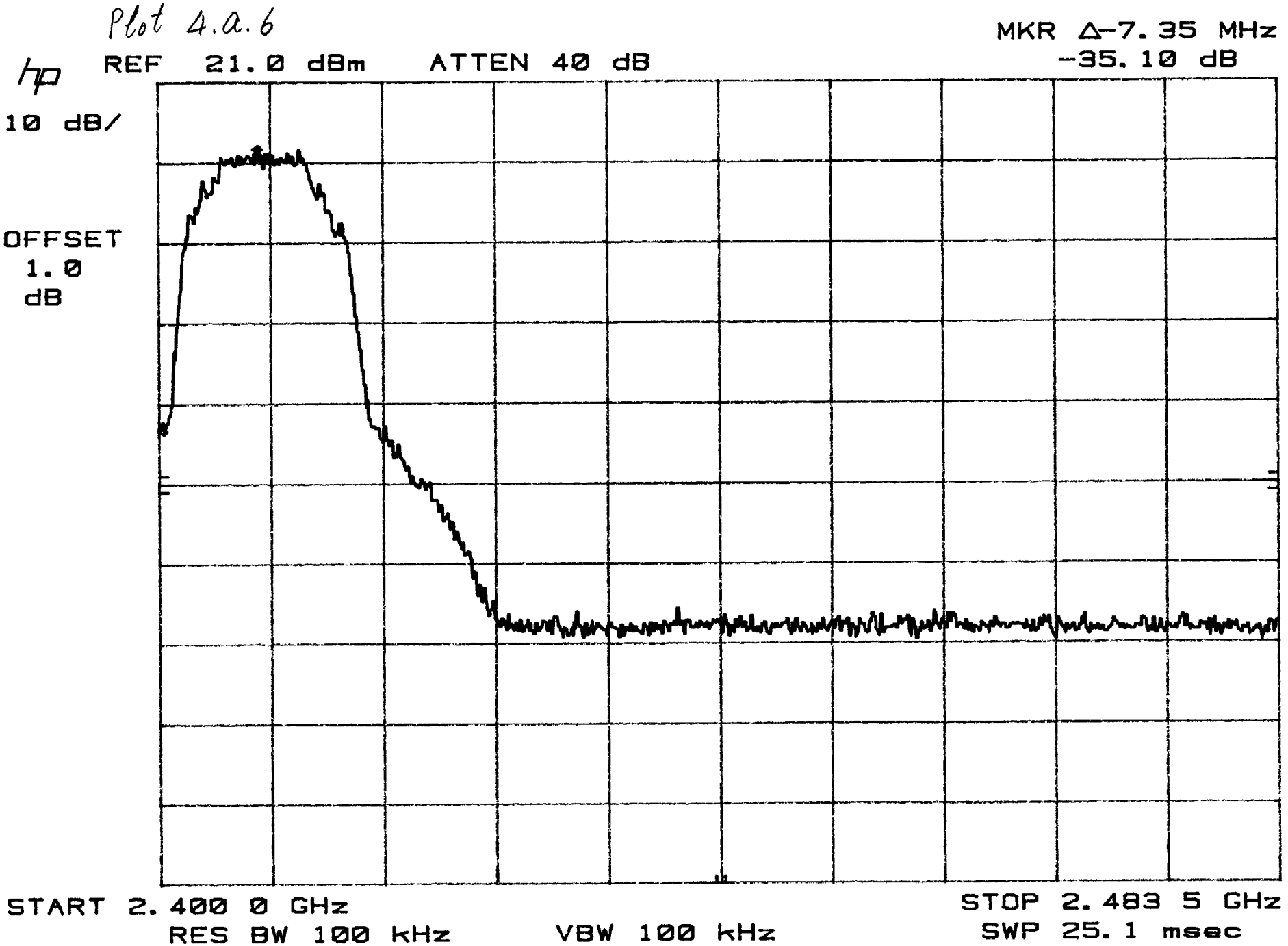
Plot 4.2.4


MkrΔ -11.25MHz
Δ-0.40dB
Tek
DELTA MKRS
Ref Lvl 10.0dBm
10dB/
Atten 10dB
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
Av#20
Delta Mkrs
ON off
Swap Ref
Marker
Zoom Delta
Freq 2.390 00GHz
Span 50MHz
ResBW 30kHz
VidBW 30kHz
SWP 320mS
LEVEL
SPAN
Mkr 2.378 75GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

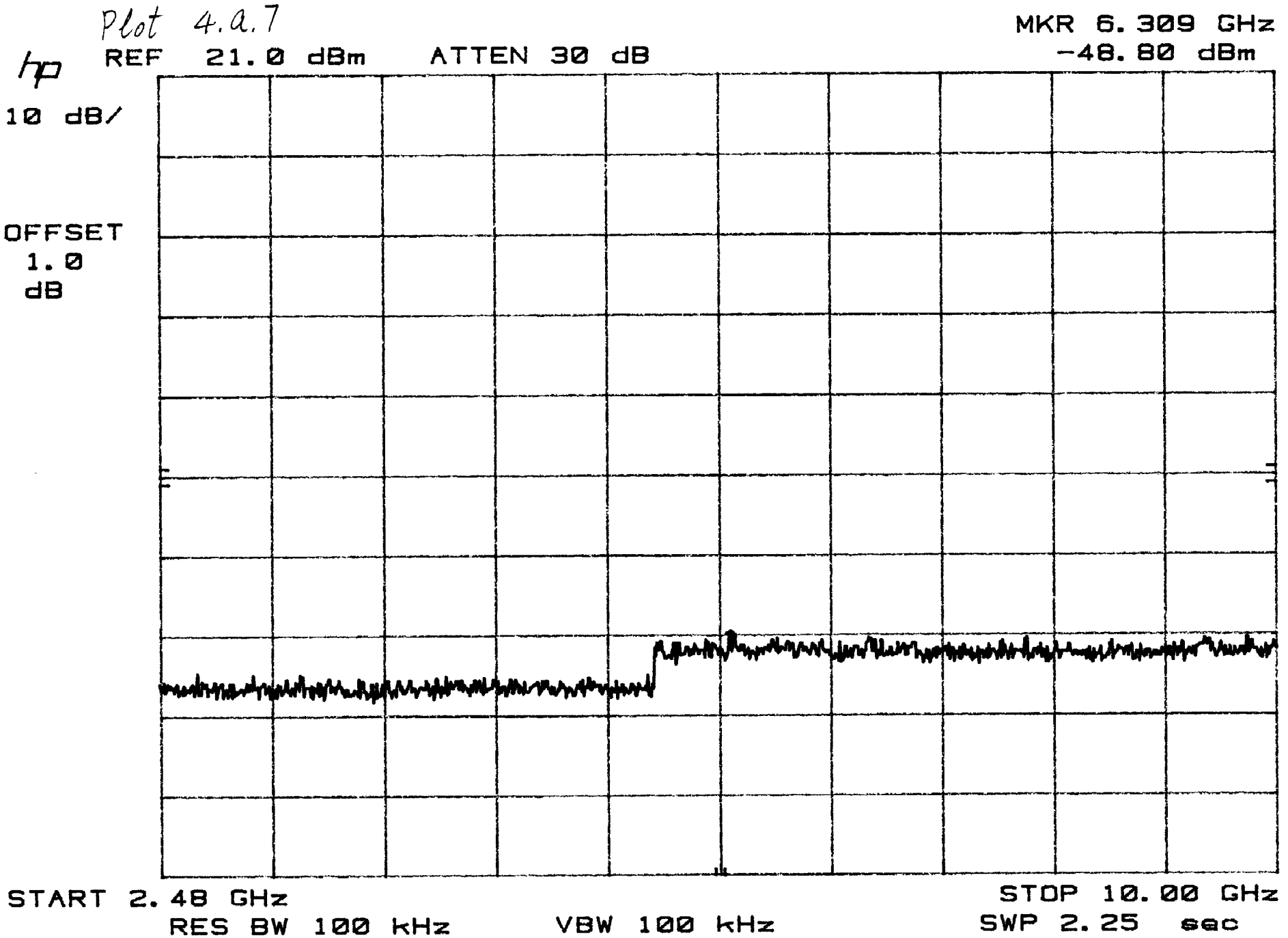
Plot 4.a.5.


MkrΔ 19.20MHz
Δ67.50dB
Tek
DELTA MKRS
Ref Lvl 10.0dBm
10dB/
Atten 10dB
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
Av#20
Delta Mkrs
ON off
Swap Ref
Marker
Zoom Delta
Freq 2.390 00GHz
Span 50MHz
ResBW 30kHz
VidBW 30kHz
SWP 320mS
LEVEL
SPAN
Mkr 2.409 20GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

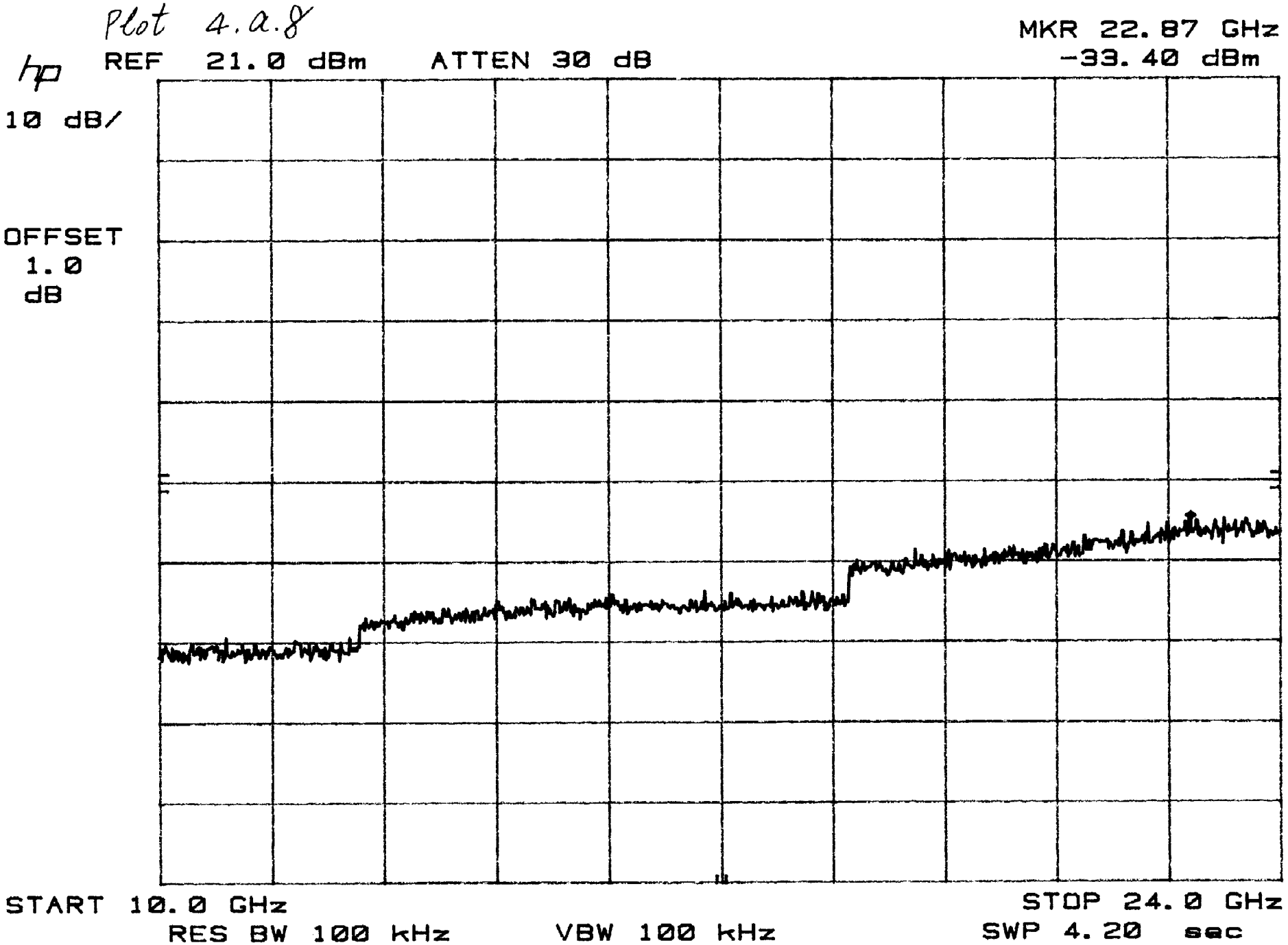
Plot 4.a.6


MKR Δ-7.35 MHz
-35.10 dB
REF 21.0 dBm
ATTEN 40 dB
10 dB/
OFFSET
1.0
dB
START 2.400 0 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 2.483 5 GHz
SWP 25.1 msec

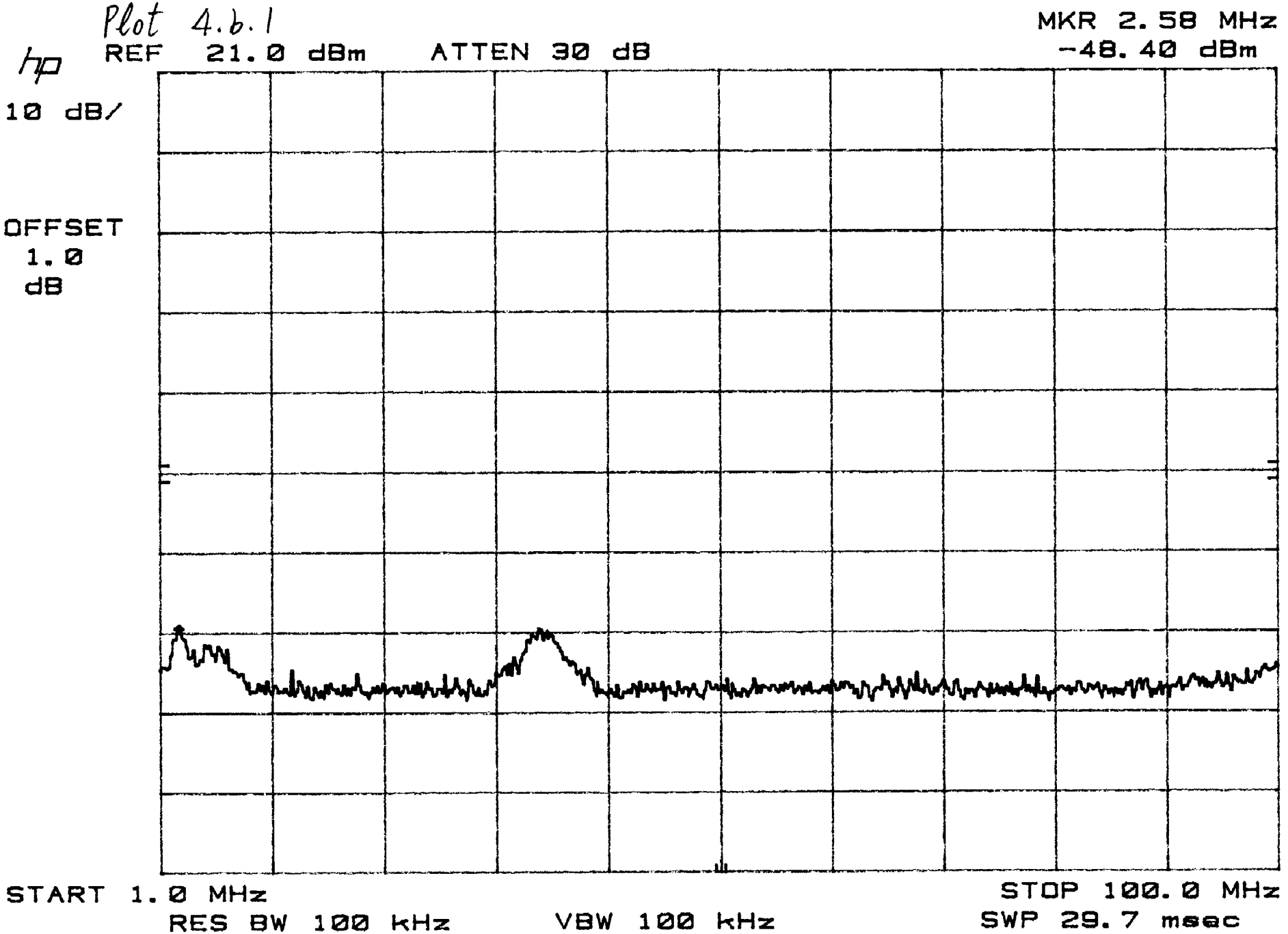
Plot 4.a.7


MKR 6.309 GHz
-48.80 dBm
REF 21.0 dBm
ATTEN 30 dB
10 dB/
OFFSET
1.0
dB
START 2.48 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 10.00 GHz
SWP 2.25 sec

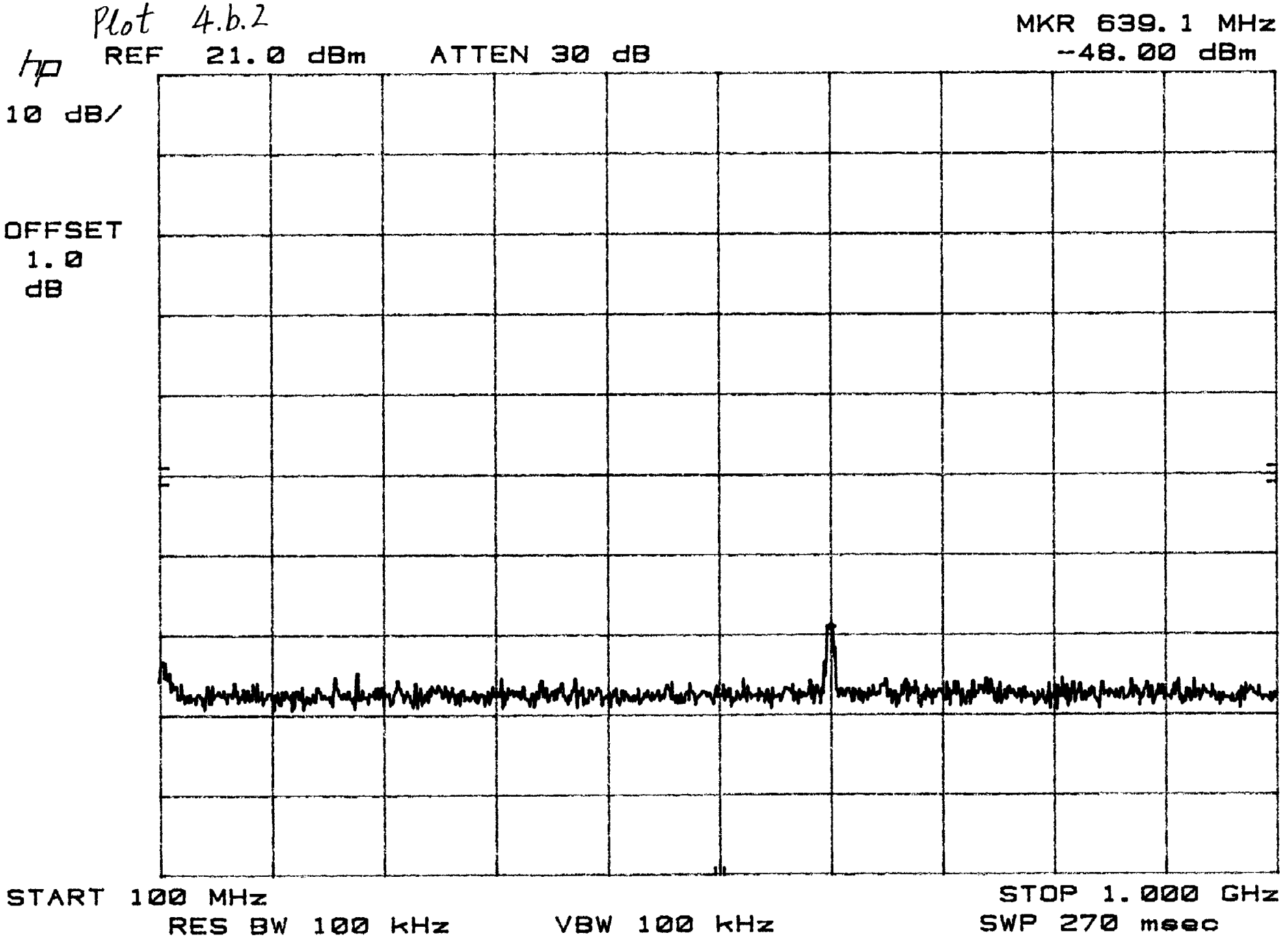
Plot 4.a.8


hp
REF 21.0 dBm
ATTEN 30 dB
MKR 22.87 GHz
-33.40 dBm
10 dB/
OFFSET
1.0
dB
START 10.0 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 24.0 GHz
SWP 4.20 sec

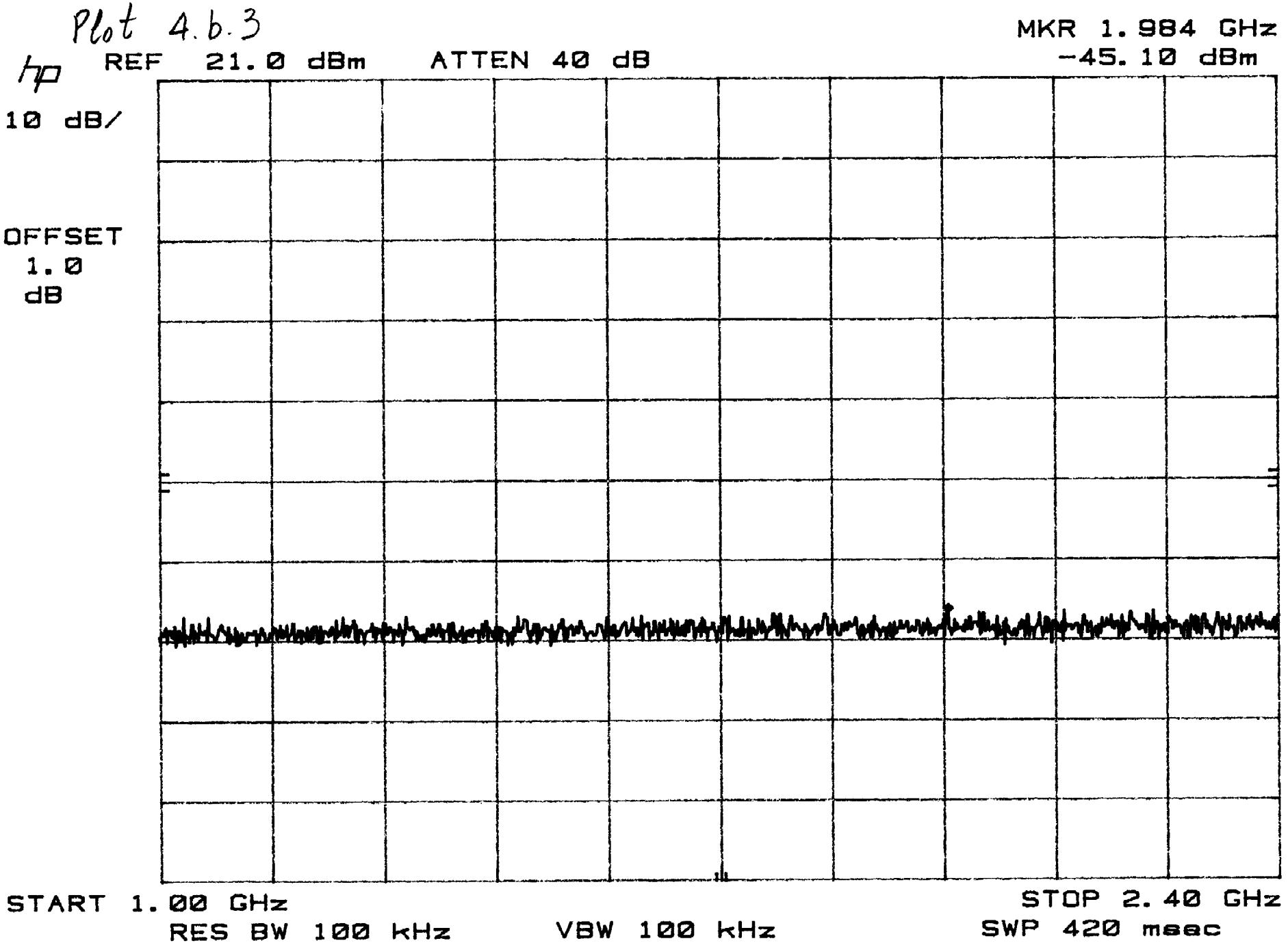
Plot 4.6.1


hp
REF 21.0 dBm
ATTEN 30 dB
MKR 2.58 MHz
-48.40 dBm
10 dB/
OFFSET
1.0
dB
START 1.0 MHz
RES BW 100 kHz
VBW 100 kHz
STOP 100.0 MHz
SWP 29.7 msec

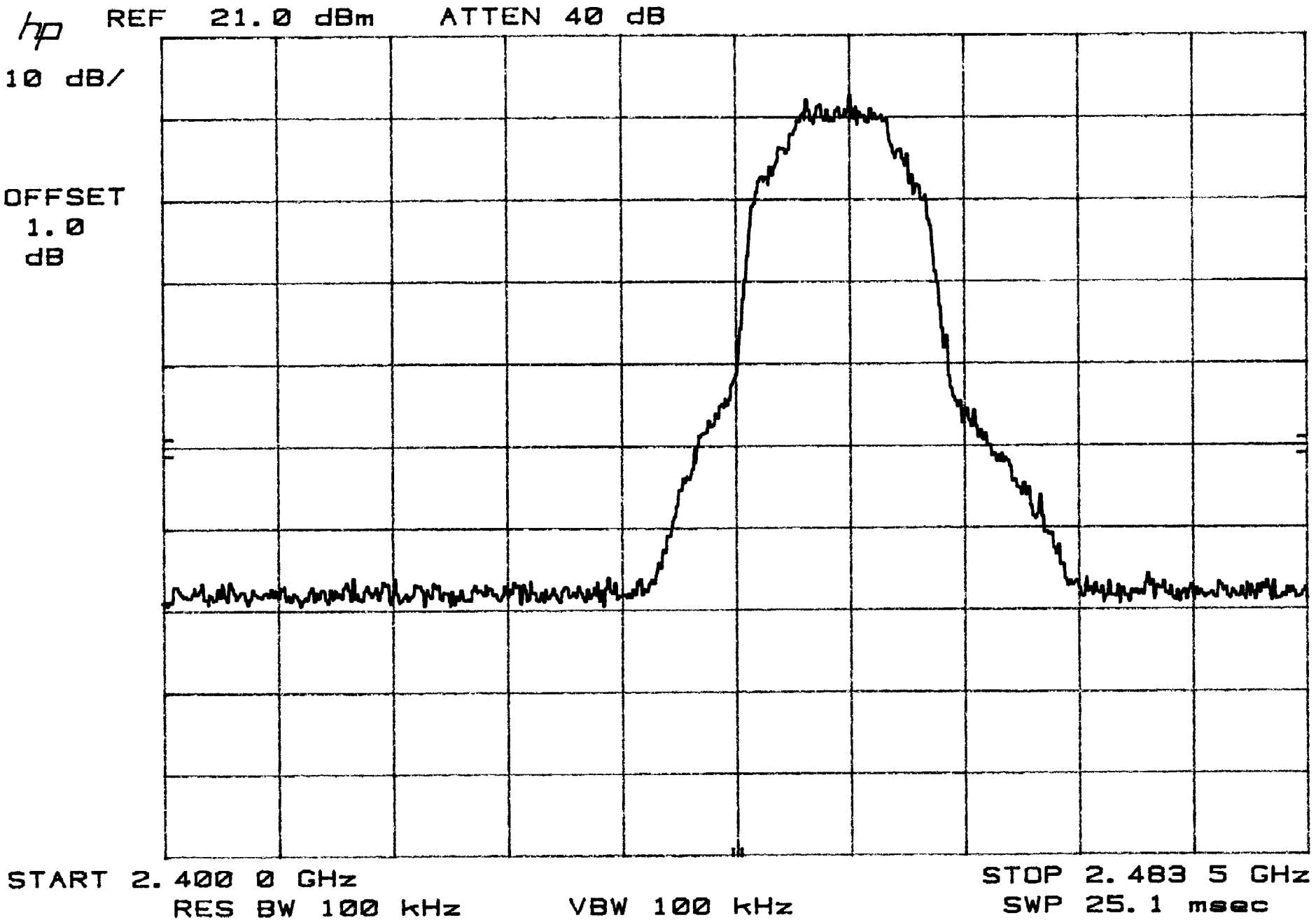
Plot 4.b.2


hp
REF 21.0 dBm
ATTEN 30 dB
MKR 639.1 MHz
-48.00 dBm
10 dB/
OFFSET
1.0
dB
START 100 MHz
RES BW 100 kHz
VBW 100 kHz
STOP 1.000 GHz
SWP 270 msec

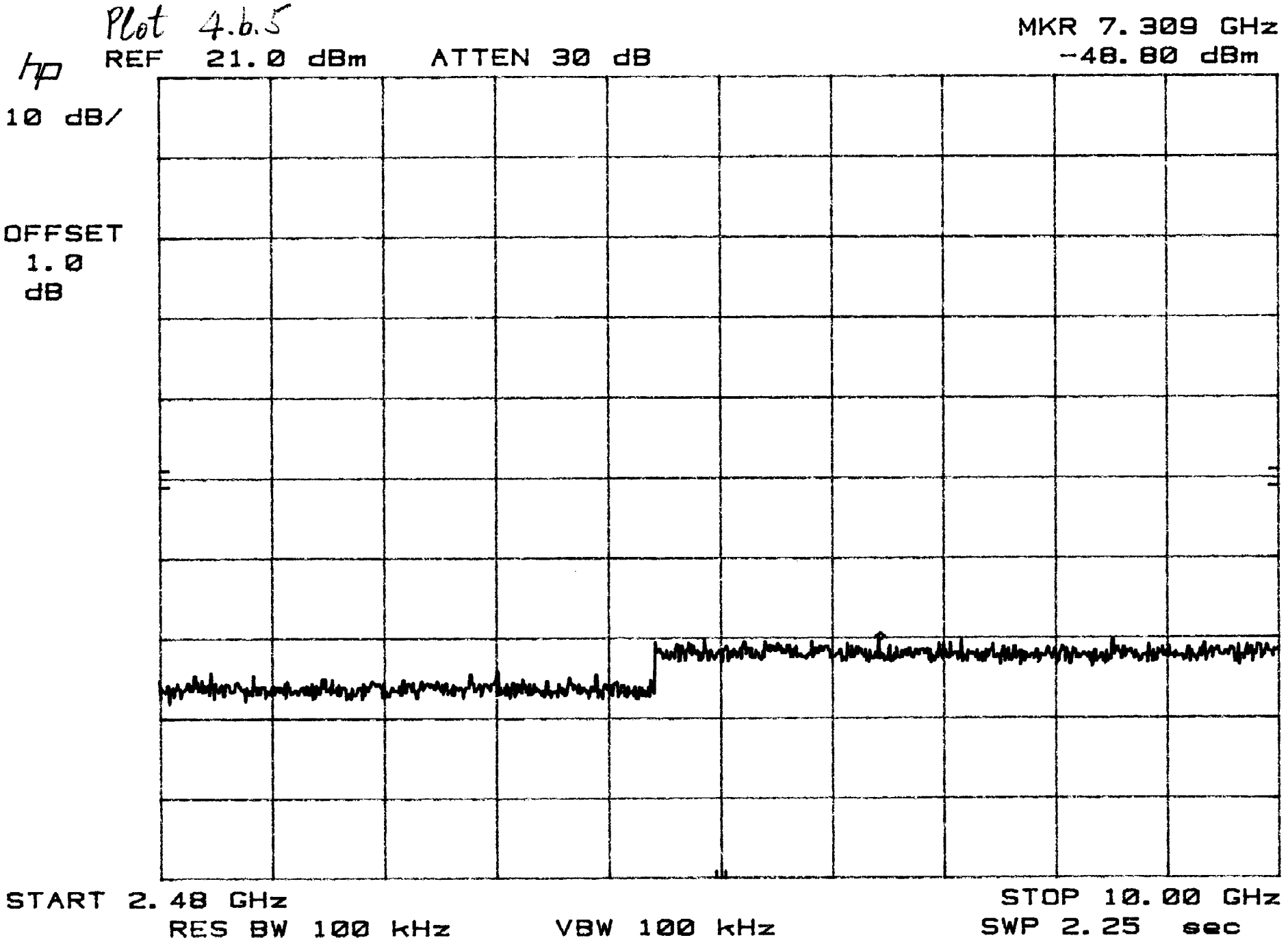
Plot 4.b.3


hp
REF 21.0 dBm
ATTEN 40 dB
MKR 1.984 GHz
-45.10 dBm
10 dB/
OFFSET
1.0
dB
START 1.00 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 2.40 GHz
SWP 420 msec

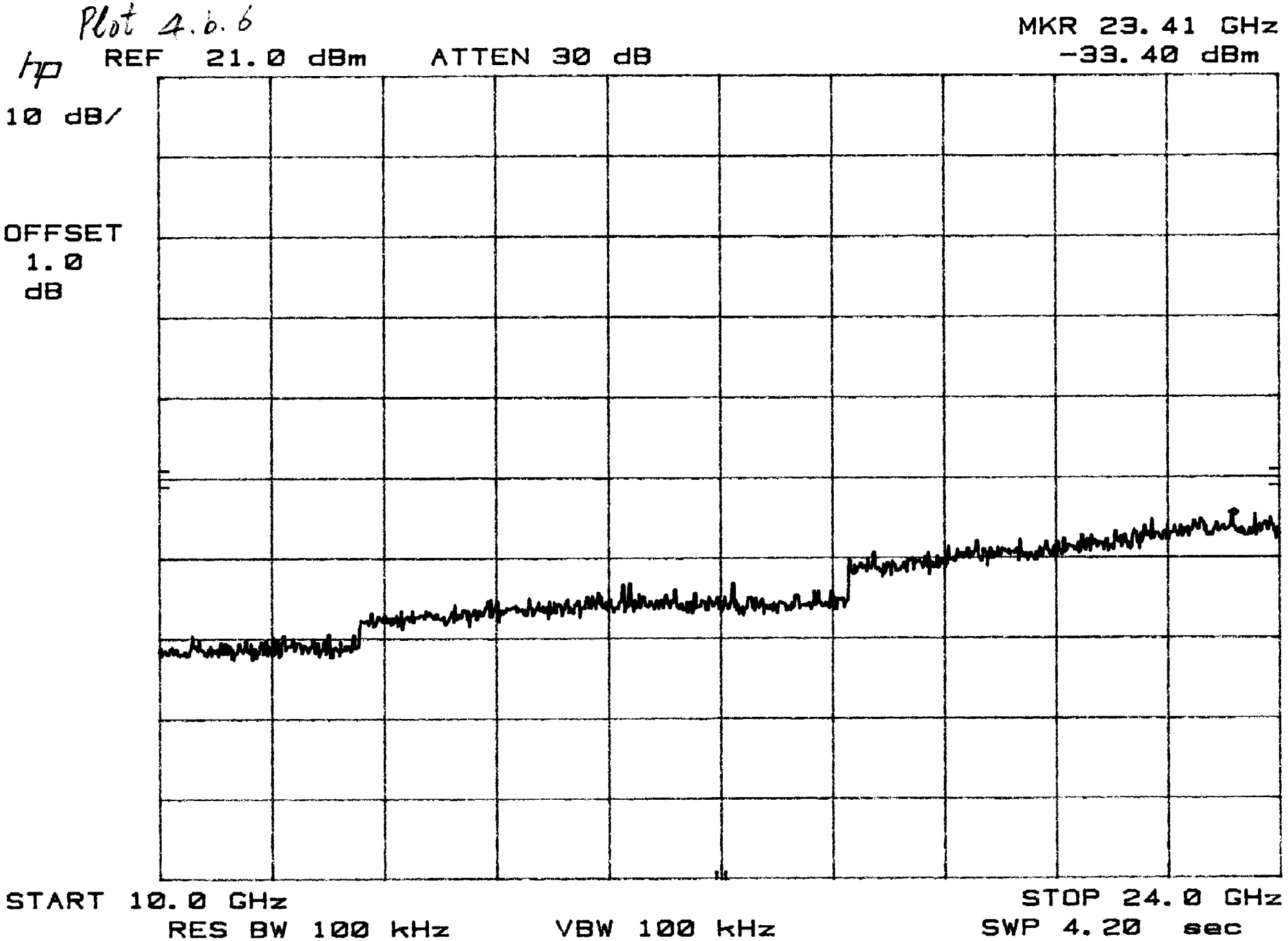
Plot 4.b.4


hp
REF 21.0 dBm
ATTEN 40 dB
10 dB/
OFFSET
1.0
dB
START 2.400 0 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 2.483 5 GHz
SWP 25.1 msec

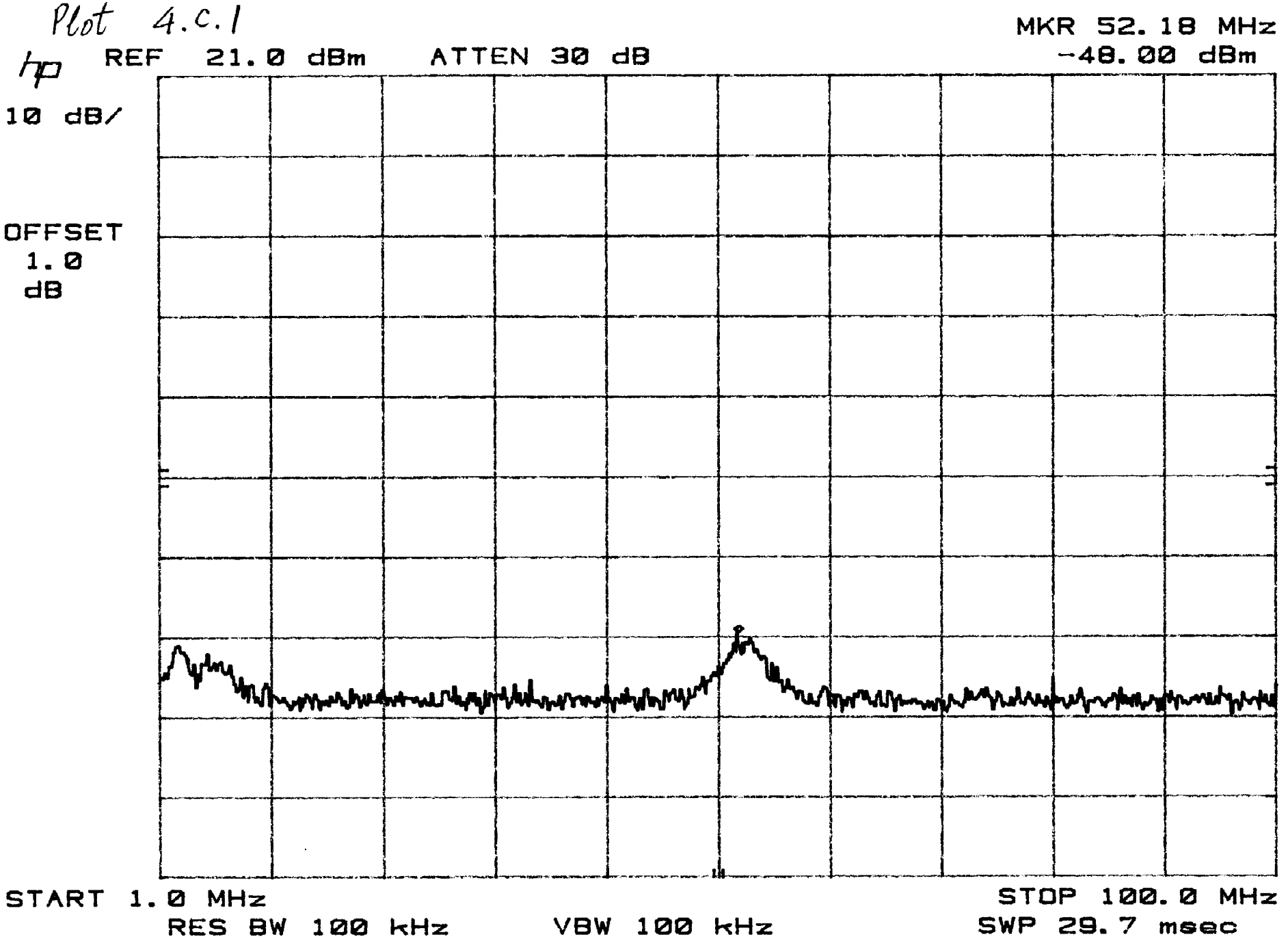
Plot 4.6.5


hp
REF 21.0 dBm
ATTEN 30 dB
MKR 7.309 GHz
-48.80 dBm
10 dB/
OFFSET
1.0
dB
START 2.48 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 10.00 GHz
SWP 2.25 sec

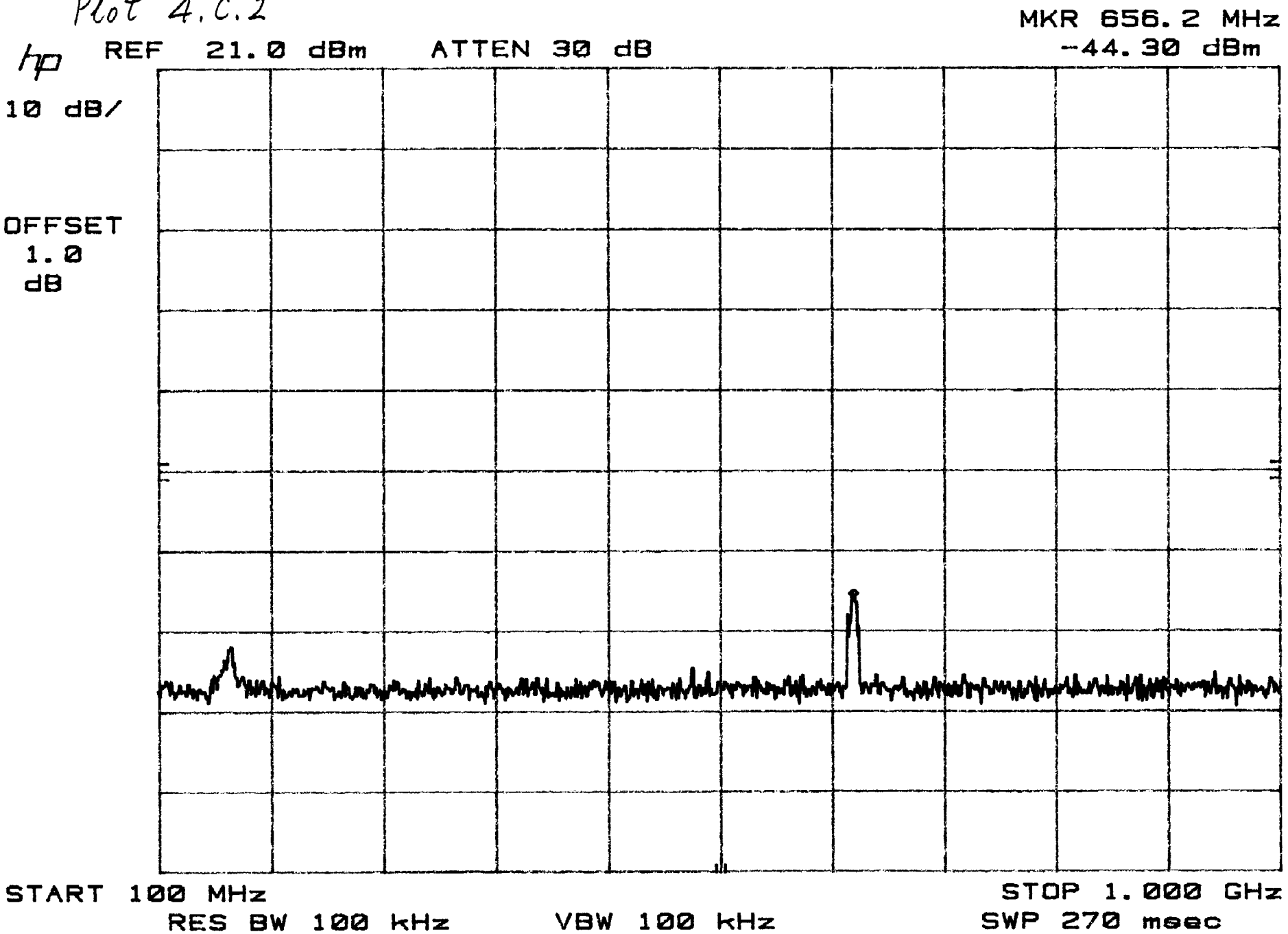
Plot 4.6.6


hp
REF 21.0 dBm
ATTEN 30 dB
MKR 23.41 GHz
-33.40 dBm
10 dB/
OFFSET
1.0
dB
START 10.0 GHz
STOP 24.0 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 4.20 sec

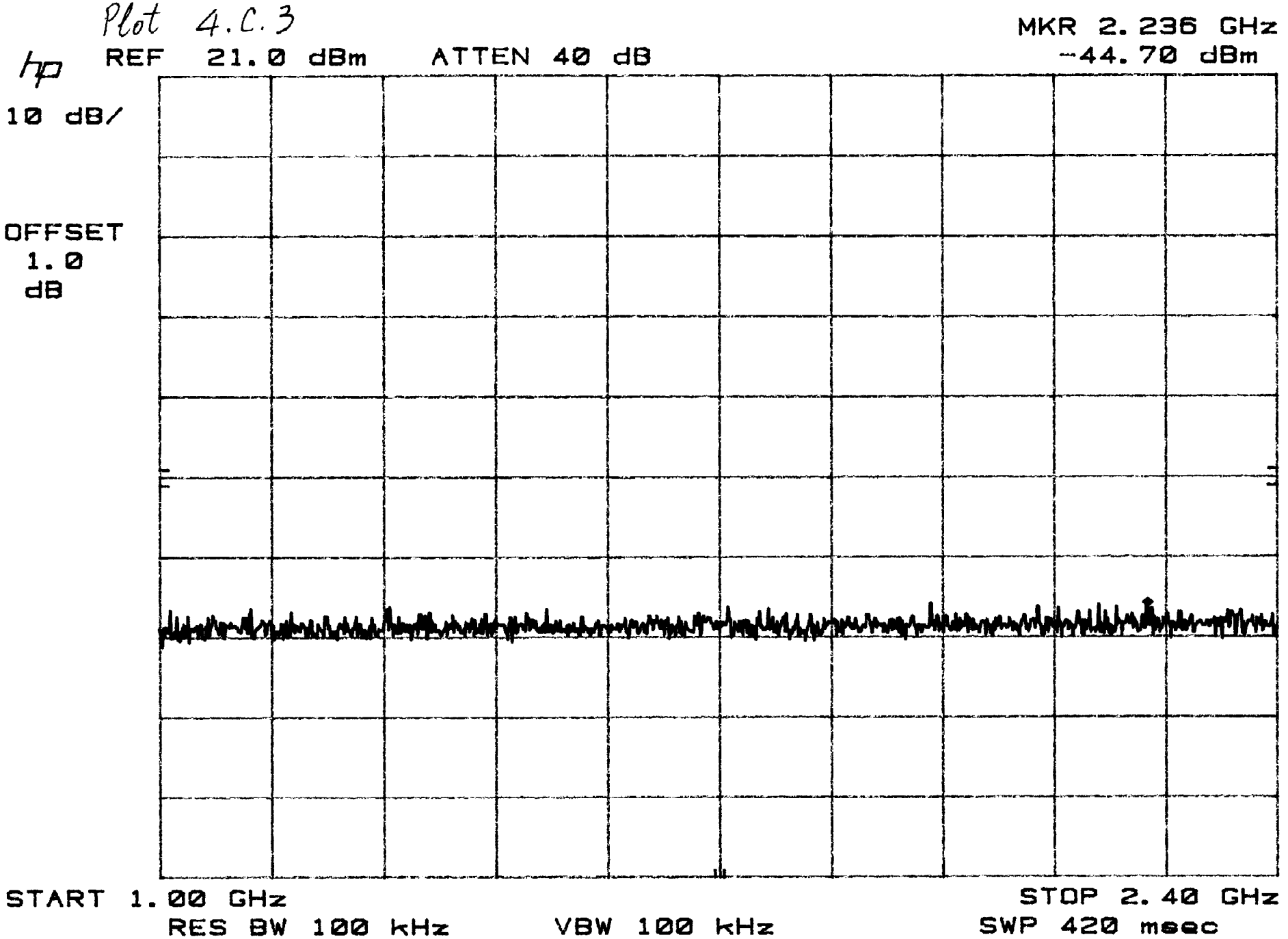
Plot 4.c.1


hp
REF 21.0 dBm
ATTEN 30 dB
MKR 52.18 MHz
-48.00 dBm
10 dB/
OFFSET
1.0
dB
START 1.0 MHz
RES BW 100 kHz
VBW 100 kHz
STOP 100.0 MHz
SWP 29.7 msec

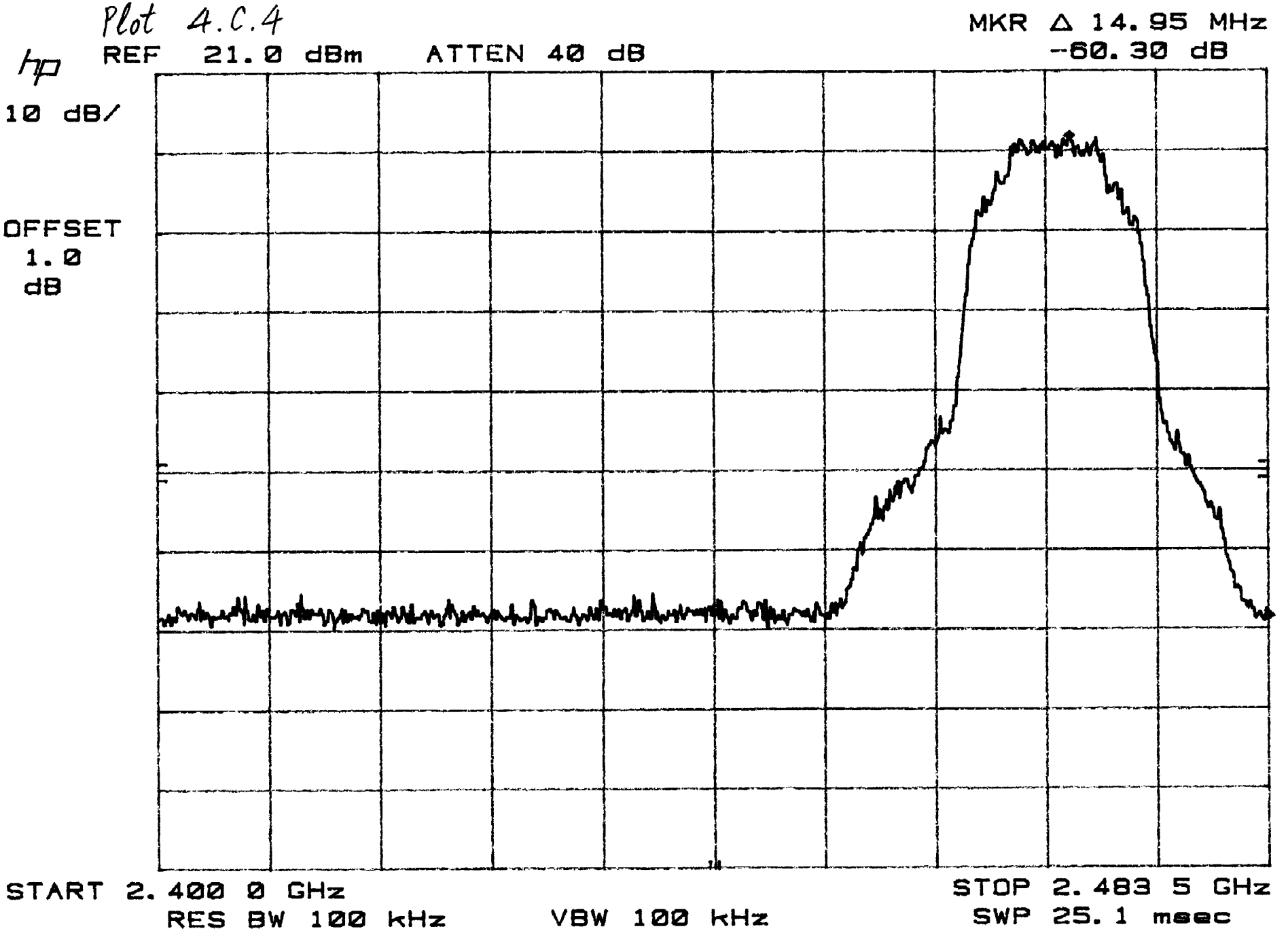
Plot 4.C.2


hp
REF 21.0 dBm
ATTEN 30 dB
MKR 656.2 MHz
-44.30 dBm
10 dB/
OFFSET
1.0
dB
START 100 MHz
RES BW 100 kHz
VBW 100 kHz
STOP 1.000 GHz
SWP 270 msec

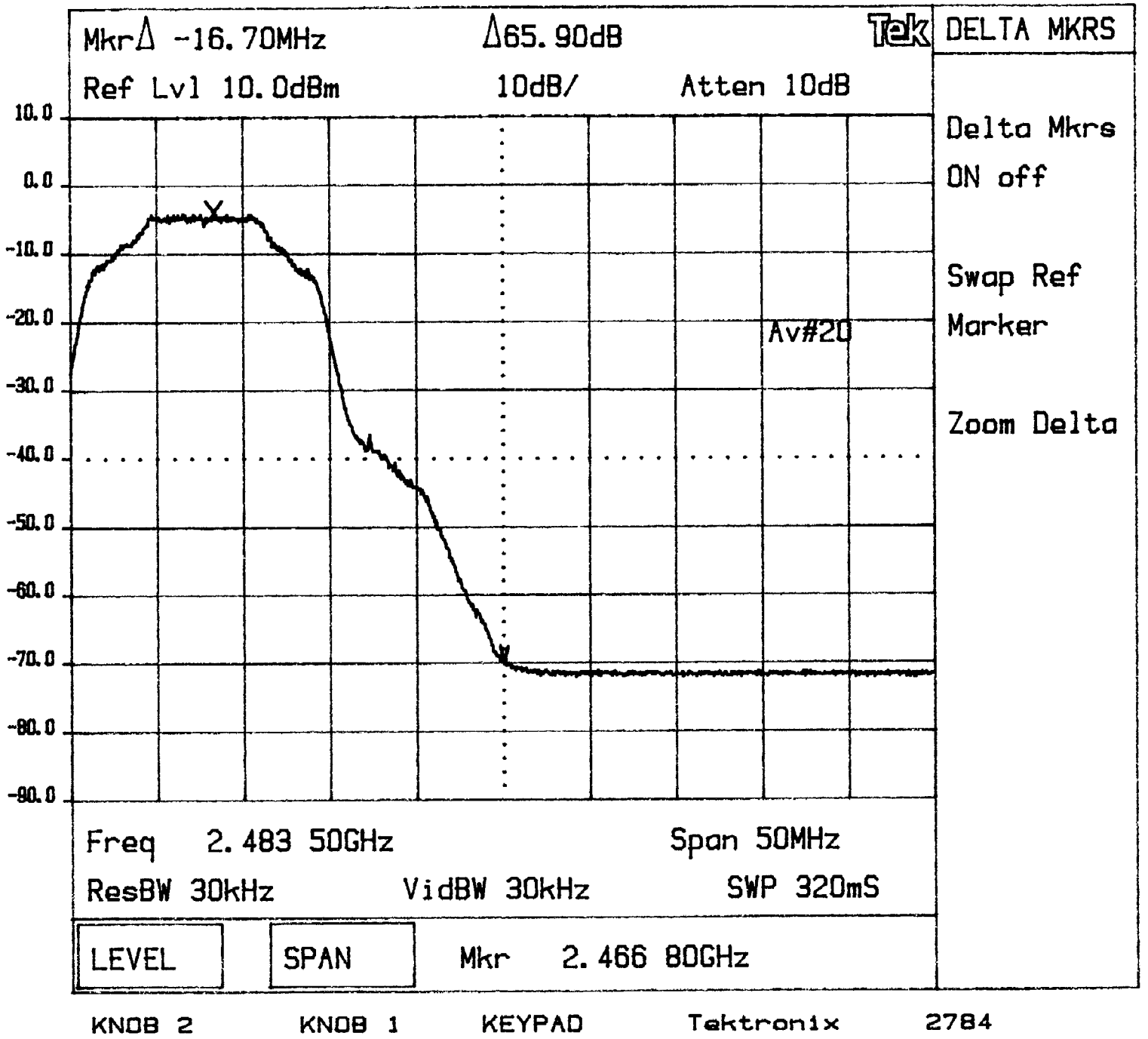
Plot 4.C.3


hp
REF 21.0 dBm
ATTEN 40 dB
MKR 2.236 GHz
-44.70 dBm
10 dB/
OFFSET
1.0
dB
START 1.00 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 2.40 GHz
SWP 420 msec

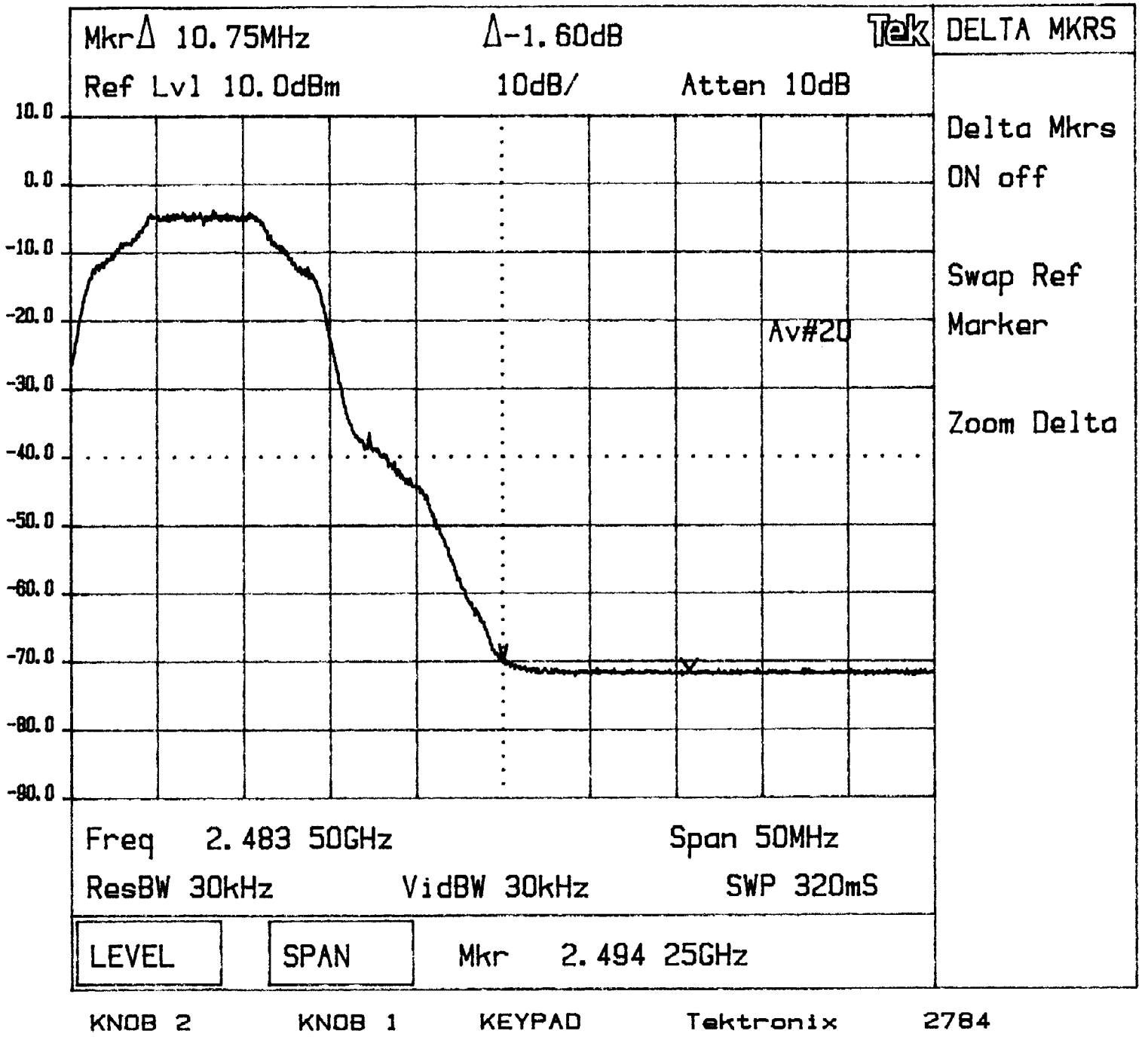
Plot 4.C.4


MKR Δ 14.95 MHz
-60.30 dB
REF 21.0 dBm
ATTEN 40 dB
10 dB/
OFFSET
1.0
dB
START 2.400 0 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 2.483 5 GHz
SWP 25.1 msec

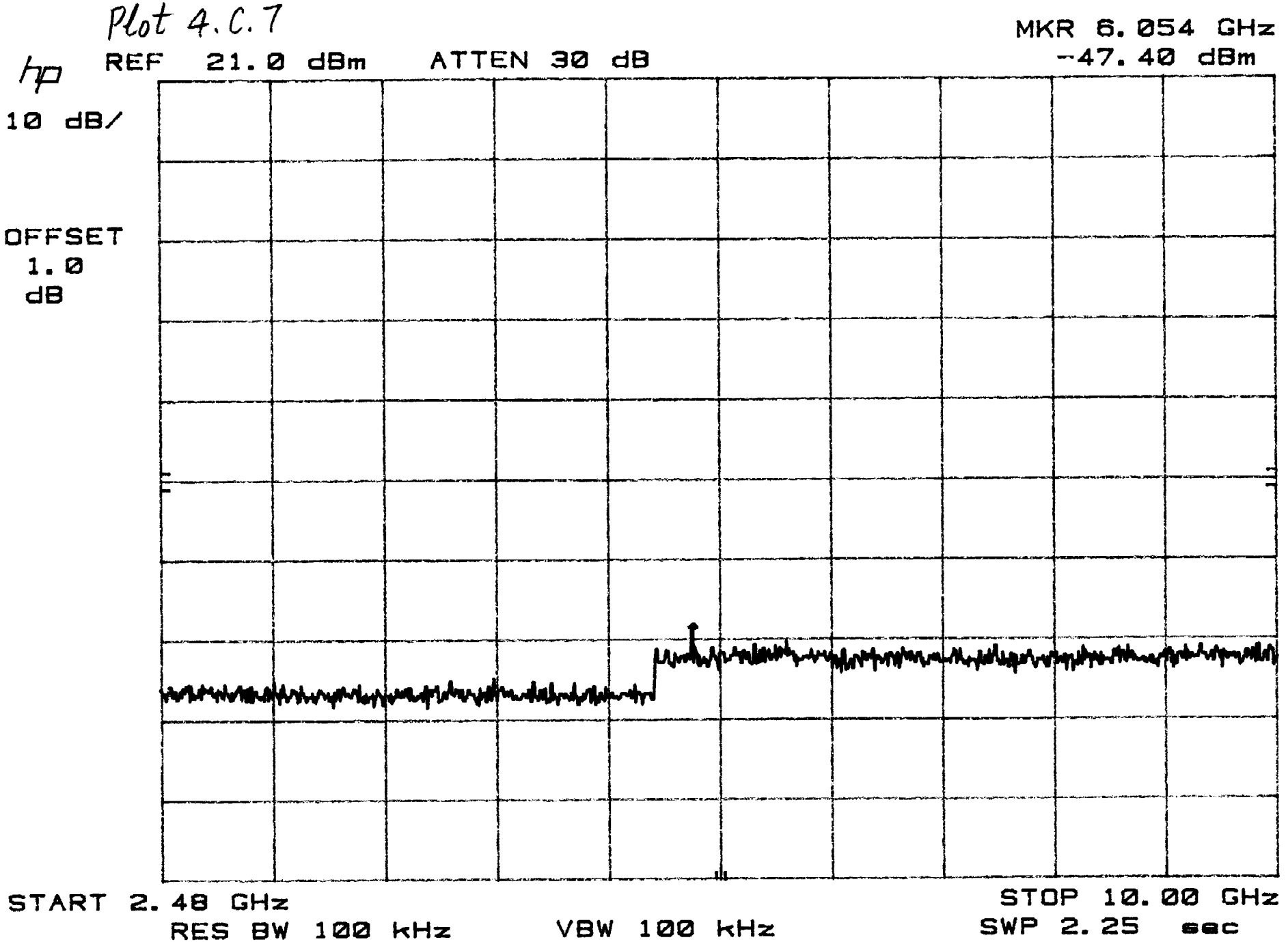
Plot 4.C.5


MkrΔ -16.70MHz
Δ65.90dB
Tek
DELTA MKRS
Ref Lvl 10.0dBm
10dB/
Atten 10dB
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
Av#20
Delta Mkrs
ON off
Swap Ref
Marker
Zoom Delta
Freq 2.483 50GHz
Span 50MHz
ResBW 30kHz
VidBW 30kHz
SWP 320mS
LEVEL
SPAN
Mkr 2.466 80GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

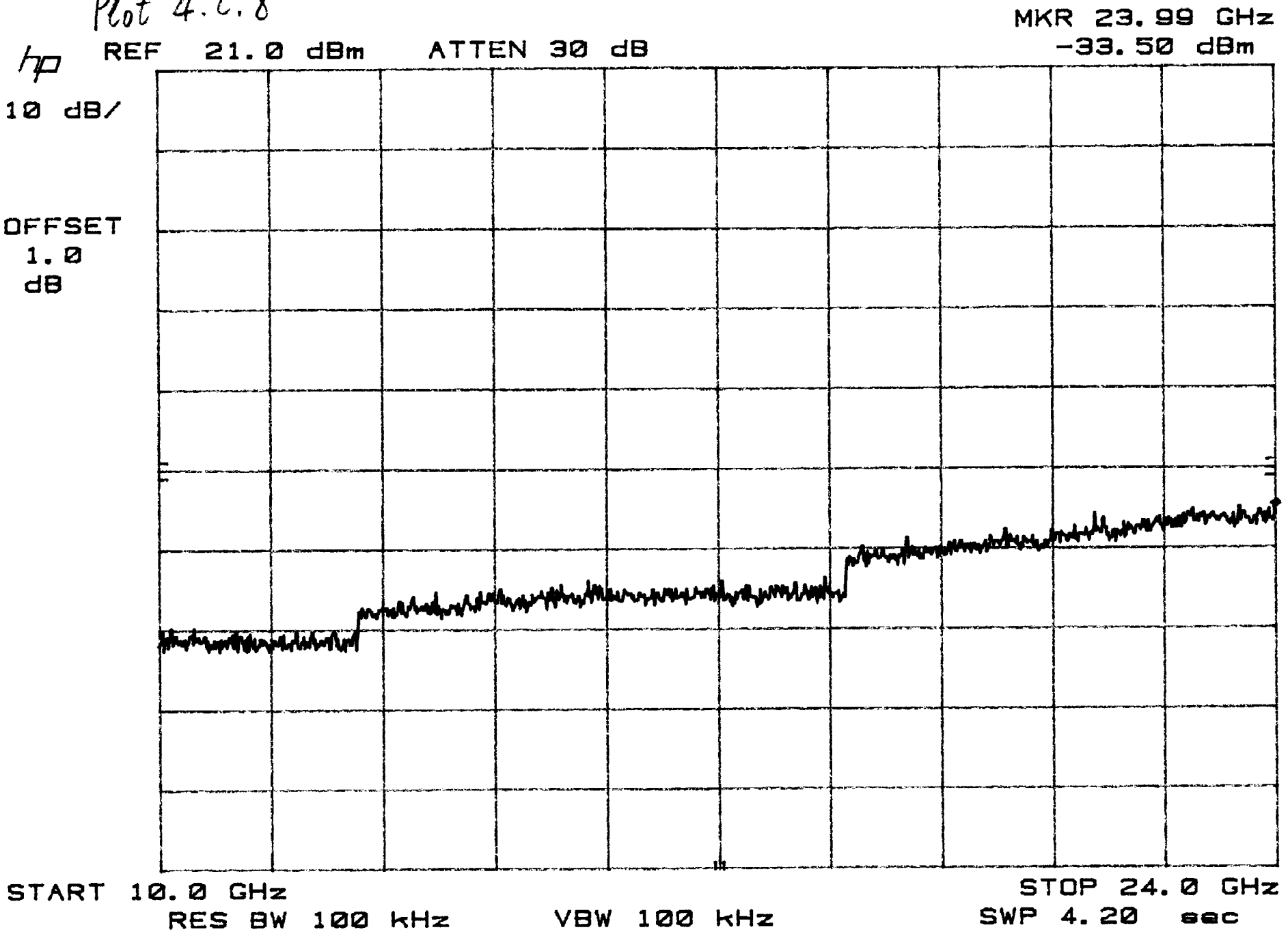
Plot 4.C.6


MkrΔ 10.75MHz
Δ-1.60dB
Tek
DELTA MKRS
Ref Lvl 10.0dBm
10dB/
Atten 10dB
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
Av#20
Delta Mkrs
ON off
Swap Ref
Marker
Zoom Delta
Freq 2.483 50GHz
Span 50MHz
ResBW 30kHz
VidBW 30kHz
SWP 320mS
LEVEL
SPAN
Mkr 2.494 25GHz
KNOB 2
KNOB 1
KEYPAD
Tektronix
2784

Plot 4.C.7


hp
REF 21.0 dBm
ATTEN 30 dB
MKR 6.054 GHz
-47.40 dBm
10 dB/
OFFSET
1.0
dB
START 2.48 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 10.00 GHz
SWP 2.25 sec

Plot 4.C.8


MKR 23.99 GHz
-33.50 dBm
REF 21.0 dBm
ATTEN 30 dB
10 dB/
OFFSET
1.0
dB
START 10.0 GHz
STOP 24.0 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 4.20 sec

4.5 Out of Band Radiated Emissions (for emissions in 4. above that are less than 26 dB below carrier), FCC Rule 15.247(c):

For out of band emissions that are close to the 20 dB attenuation requirement described in the specification, radiated measurements were performed at a 3 m separation distance to determine whether these emissions complied with the general radiated emission requirement.

[X] Not required
[ ] See attached data sheet

4.6 Transmitter Radiated Emissions in Restricted Bands, FCC Rule 15.35(b), (c):

Radiated emission measurements were performed from 30 MHz to 24000.00 MHz. Analyzer resolution is 100 kHz or greater for 30 MHz to 1000 MHz, 1 MHz for >1000 MHz.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak and average detection.

To show compli8ance on the band edge frequency (2483.5 MHz) and up to 2500 MHz, the "delta" method was used. See notes on the next page. The same method was used to show compliance in the band 2310-2390 MHz.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

4.6 Transmitter Radiated Emissions in Restricted Bands, FCC Rule 15.35(b), (c):

Radiated emission measurements were performed from 30 MHz to 24000.00 MHz. Analyzer resolution is 100 kHz or greater for 30 MHz to 1000 MHz, 1 MHz for >1000 MHz.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak and average detection.

To show compliance on the band edge frequency (2483.5 MHz) and up to 2500 MHz, the "delta" method was used. See notes on the next page. The same method was used to show compliance in the band 2310-2390 MHz.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

The field strength at the bandedge frequencies was calculated as follows:

For the bandedge at 2390 MHz calculation:

- From the plot 4.a.4 (Signal plus Noise) – Noise = 0.4 dB < 1 dB, for 1 dB , signal is 6.87 dB lower than noise floor.
- From the plot 4.a.5, delta is 67.5 dB.

Therefore, the total delta is 67.5 + 6.87 = 74.37 dB.

The field strength at 2390 MHz:

Peak level 132.6 – 74.37 = 58.2 dBµV/m
Average level 125.9 – 74.37 = 51.53 dBµV/m

For the bandedge at 2483.5 MHz calculation:

- From the plot 4.c.6 (Signal plus Noise) – Noise = 1.6 dB, for 1.6 dB , signal is 5.11 dB lower than noise floor.
- From the plot 4.c.5, delta is 65.9 dB.

Therefore, the total delta is 65.9 + 5.11 = 71.0 dB.

The field strength at 2483.5 MHz:

Peak level 132.4 – 71.0 = 61.4 dBµV/m
Average level 125.9 – 71.0 = 53.5 dBµV/m

ITS Intertek Testing Services

Radiated Emissions Test Data

Company:	Glenayre Western Multiplex	**Model #:**	4XE1	**Standard**	FCC § 15.247 (R.B.)
EUT:		**S/N #:**		**Limits**	11
Project #:	J99032175	**Test Date:**	December 22, 1999	**Test Distance**	3 meters
Test Mode:	Tx @ 2408MHz	**Engineer:**	Xi-Ming Y.	**Duty Relaxation**	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	11	8	21	8	10	13	0	0	12	0
Model:	LPB-2520A	EMCO 3115	3160-9	CDI_P1000	AFT18855	ACO/400	None	None	Gm_M+L	None

Frequency	Reading	Detector	Ant.	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(µV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(µV/m)	dB(µV/m)	dB
2408.00	100.7	Peak	8	0	V	29.6	0.0	2.3	0.0	132.6		
2408.00	94.0	Ave.	8	0	V	29.6	0.0	2.3	0.0	125.9		
2390.00		Peak								58.2	74.0	-15.8
2390.00		Ave.								51.5	54.0	-2.5
4816.00	33.0	Peak	8	8	V	33.5	28.1	3.2	0.0	41.6	74.0	-32.4
4816.00	24.0	Ave.	8	8	V	33.5	28.1	3.2	0.0	32.6	54.0	-21.4
12040.00	35.0	Peak	8	10	V	42.5	39.1	5.9	0.0	44.3	74.0	-29.8
12040.00	25.0	Ave.	8	10	V	42.5	39.1	5.9	0.0	34.3	54.0	-19.8
19264.00	41.0	Peak	21	13	V	40.2	23.3	7.7	-9.5	56.1	74.0	-17.9
19264.00	31.0	Ave.	21	13	V	40.2	23.3	7.7	-9.5	46.1	54.0	-7.9

Notes:

a) D.C.F.:Distance Correction Factor

b) Insert. Loss (dB) = Cable A + Cable B + Cable C .

c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).

d) Negative signs (-) in Margin column signify levels below the limits.

e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

ITS Intertek Testing Services

Radiated Emissions Test Data

Company:	Glenayre Western Multiplex	**Model #:**	4XE1	**Standard_**	**FCC § 15.247 (R.B.)**
EUT:		**S/N #:**		**Limits**	11
Project #:	J99032175	**Test Date:**	December 22, 1999	**Test Distance_**	3 meters
Test Mode:	Tx @ 2449MHz	**Engineer:**	Xi-Ming Y.	**Duty Relaxation**	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	11	8	21	8	10	13	0	0	12	0
Model:	LPB-2520A	EMCO 3115	3160-9	CDI_P1000	AFT18855	ACO/400	None	None	Grn_M+L	None

Frequency	Reading	Detector	Ant	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(μV/m)	dB(μV/m)	dB
4898.00	33.0	Peak	8	8	V	33.5	28.1	3.2	0.0	41.6	74.0	-32.4
4898.00	24.0	Ave.	8	8	V	33.5	28.1	3.2	0.0	32.6	54.0	-21.4
7347.00	34.0	Peak	8	8	V	38.0	28.0	4.3	0.0	48.3	74.0	-25.7
7347.00	25.0	Ave.	8	8	V	38.0	28.0	4.3	0.0	39.3	54.0	-14.7
12245.00	35.0	Peak	8	10	V	42.5	39.1	5.9	0.0	44.3	74.0	-29.8
12245.00	25.0	Ave.	8	10	V	42.5	39.1	5.9	0.0	34.3	54.0	-19.8
19592.00	41.0	Peak	21	13	V	40.3	23.3	7.7	-9.5	56.2	74.0	-17.8
19592.00	31.0	Ave.	21	13	V	40.3	23.3	7.7	-9.5	46.2	54.0	-7.8
22041.00	42.0	Peak	21	13	V	40.3	23.3	7.9	-9.5	57.4	74.0	-16.6
22041.00	32.0	Ave.	21	13	V	40.3	23.3	7.9	-9.5	47.4	54.0	-6.6

Notes:

a) D.C.F.:Distance Correction Factor

b) Insert. Loss (dB) = Cable A + Cable B + Cable C .

c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).

d) Negative signs (-) in Margin column signify levels below the limits.

e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

ITS Intertek Testing Services

Radiated Emissions Test Data

Company:	Glenayre Western Multiplex	**Model #:**	XE21	**Standard_**	FCC § 15.247 (R.B.)
EUT:		**S/N #:**		**Limits**	11
Project #:	J99032175	**Test Date:**	December 22, 1999	**Test Distance_**	3 meters
Test Mode:	Tx @ 2467MHz	**Engineer:**	Xi-Ming Y.	**Duty Relaxation**	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	11	8	21	8	10	0	0	0	12	0
Model:	LPB-2520A	EMCO 3115	3160-9	CDI_P100 0	AFT18855	None	None	None	Gm_M+ L	None

Frequency	Reading	Detector	Ant	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(µV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(µV/m	dB(µV/m)	dB
2467.00	100.5	Peak	8	0	V	29.6	0.0	2.3	0.0	132.4		
2467.00	93.0	Ave.	8	0	V	29.6	0.0	2.3	0.0	124.9		
2483.50										61.4	74.0	-12.6
2483.50										53.5	54.0	-0.5
4934.00	33.0	Peak	8	8	V	33.5	28.1	3.2	0.0	41.6	74.0	-32.4
4934.00	24.0	Ave.	8	8	V	33.5	28.1	3.2	0.0	32.6	54.0	-21.4
7401.00	34.0	Peak	8	8	H	36.8	28.0	4.3	0.0	47.1	74.0	-26.9
7401.00	25.0	Ave.	8	8	H	36.8	28.0	4.3	0.0	38.1	54.0	-15.9
12335.00	35.0	Peak	8	10	V	42.5	39.1	5.9	0.0	44.3	74.0	-29.8
12335.00	25.0	Ave.	8	10	V	42.5	39.1	5.9	0.0	34.3	54.0	-19.8
19736.00	41.0	Peak	21	13	V	40.3	23.3	7.7	-9.5	56.2	74.0	-17.8
19736.00	31.0	Ave.	21	13	V	40.3	23.3	7.7	-9.5	46.2	54.0	-7.8
22203.00	42.0	Peak	21	13	V	40.3	23.3	7.9	-9.5	57.4	74.0	-16.6
22203.00	32.0	Ave.	21	13	V	40.3	23.3	7.9	-9.5	47.4	54.0	-6.6

Notes:

a) D.C.F.:Distance Correction Factor

b) Insert. Loss (dB) = Cable A + Cable B + Cable C .

c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).

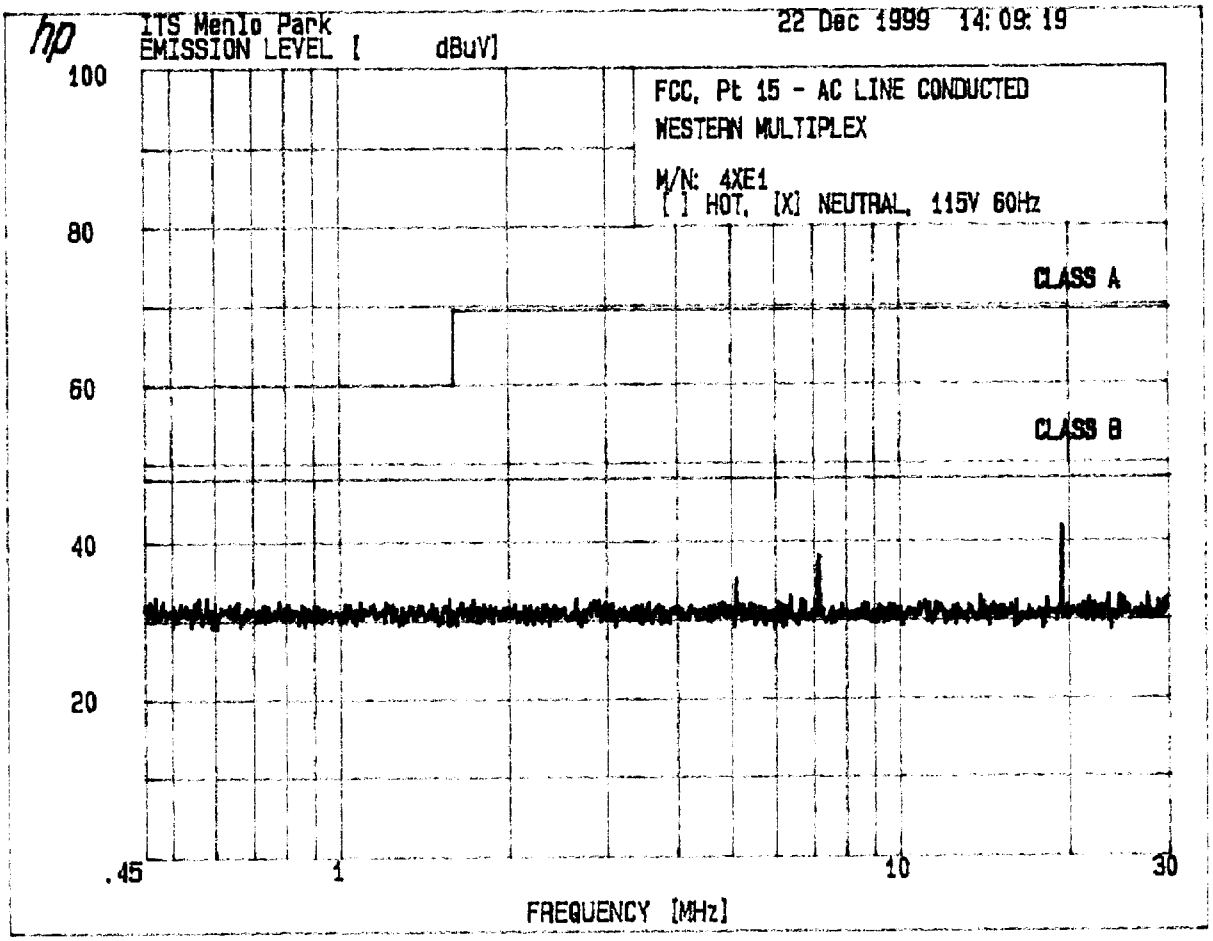
d) Negative signs (-) in Margin column signify levels below the limits.

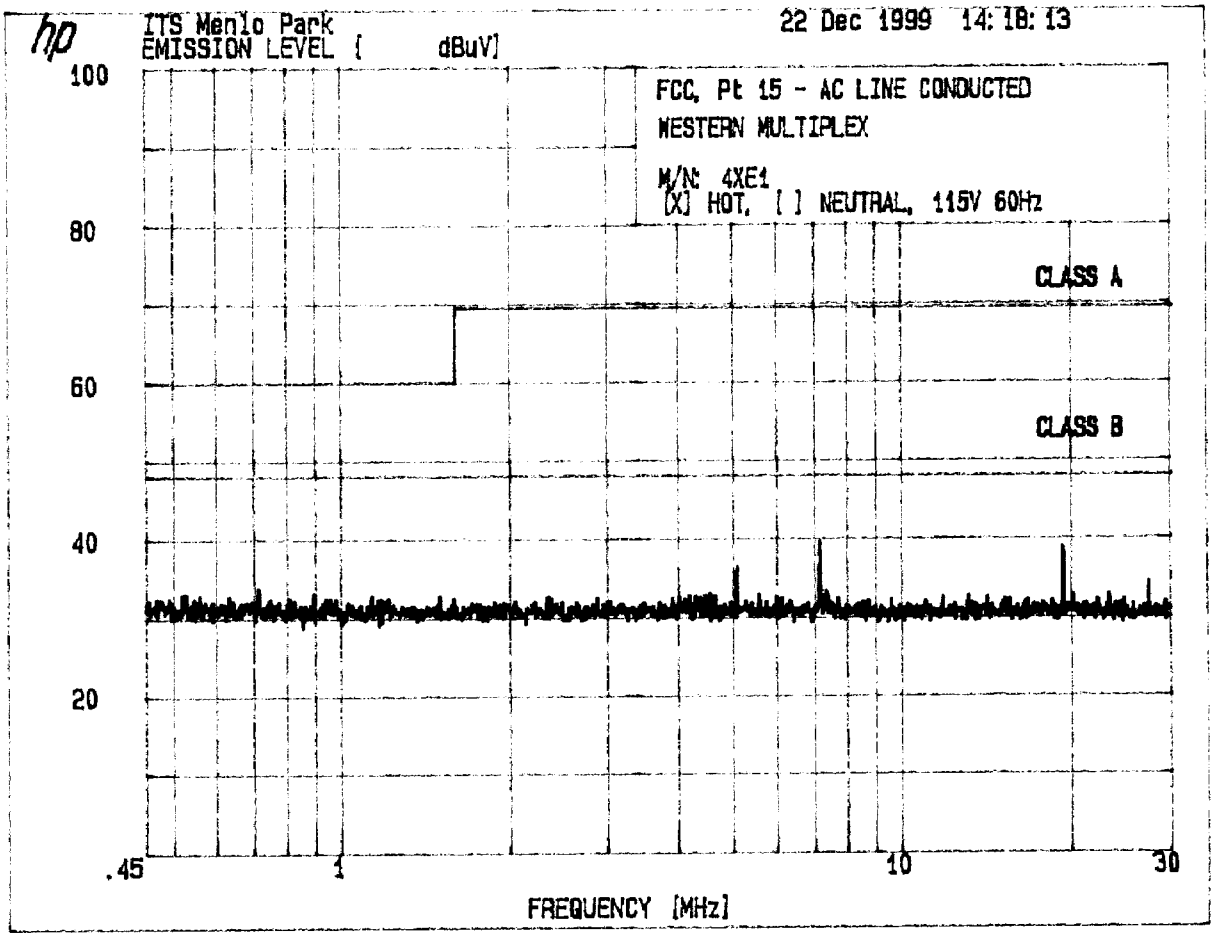
e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

4.7 AC Line Conducted Emission, FCC Rule 15.207:

[ ] Not required; battery operation only

[X] Test data attached


ITS Menlo Park
EMISSION LEVEL [dBuV]
22 Dec 1999 14:09:19
FCC, Pt 15 - AC LINE CONDUCTED
WESTERN MULTIPLEX
M/N: 4XE1
[ ] HOT, [X] NEUTRAL, 115V 60Hz
CLASS A
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]


ITS Menlo Park
EMISSION LEVEL [dBuV]
22 Dec 1999 14:18:13
FCC, Pt 15 - AC LINE CONDUCTED
WESTERN MULTIPLEX
M/N: 4XE1
[X] HOT, [ ] NEUTRAL, 115V 60Hz
CLASS A
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]

4.8 Radiated Emissions from Digital Section of Transceiver (Transmitter), FCC Ref: 15.109

[ ] Not required - No digital part
[X] Test results are attached
[ ] Included in the separate DOC report.

ITS Intertek Testing Services

Radiated Emissions Test Data

Company:	Glenayre Western Multiplex	**Model #:**	4XE1	**Standard**	FCC § 15B
EUT:		**S/N #:**		**Limits**	2
Project #:	J99032175	**Test Date:**	December 22, 1999	**Test Distance**	3 meters
Test Mode:		**Engineer:**	Xi-Ming Y.	**Duty Relaxation**	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	11	8	6	5	10	13	0	0	1	0
Model:	LPB-2520A	EMCO 3115	EMCO 3146	CDI_P450	AFT16695	ACO/400	None	None	Site 1	None

Frequency	Reading	Detector	Ant.	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(μV/m)	dB(μV/m)	dB
179.44	41.0	Peak	11	5	V	10.4	18.9	1.2	0.0	33.7	43.5	-9.8
233.27	41.0	Peak	11	5	H	12.5	18.4	1.6	0.0	36.7	46.0	-9.3
251.20	42.7	Peak	11	5	H	12.9	18.2	1.6	0.0	39.0	46.0	-7.0
260.16	38.0	Peak	11	5	H	13.2	18.2	1.6	0.0	34.6	46.0	-11.4
269.16	46.0	Peak	11	5	H	13.5	18.2	1.6	0.0	42.9	46.0	-3.1
292.89	35.0	Peak	11	5	H	13.3	17.8	1.6	0.0	32.1	46.0	-13.9
412.72	41.0	Peak	11	5	H	16.0	16.9	2.1	0.0	42.2	46.0	-3.8
466.54	39.0	Peak	11	5	H	17.3	16.5	2.0	0.0	41.8	46.0	-4.2
574.23	30.0	Peak	11	5	H	19.2	15.8	2.7	0.0	36.1	46.0	-9.9

Notes:

a) D.C.F.:Distance Correction Factor

b) Insert. Loss (dB) = Cable A + Cable B + Cable C .

c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).

d) Negative signs (-) in Margin column signify levels below the limits.

e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

4.9 Radiated Emissions from Receiver Section of Transceiver (L.O. Radiation), FCC Ref: 15.109, 15.111

[X] Not required - EUT operation above 960 MHz only

[ ] Not required - EUT is transmitter only

[ ] Not performed; exempt until June 1999

[ ] Test results are attached

4.10 Processing Gain Measurements, FCC Rule 15.247(e)

The processing gain shall be determined from the ratio in dB of the signal to noise ratio with the system spreading code turned OFF, to the signal to noise ratio with the system spreading code turned ON, as measured at the demodulated output of the receiver. The processing gain shall be at least 10 dB for a direct sequence spread spectrum system.

	Refer to attached test procedure and data sheets.
	Refer to circuit analysis and processing gain calculations provided by manufacturer.
X	Refer to Exhibit 13 of FCC Application

4.11 Transmitter Duty Cycle Calculation and Measurements, FCC Rule 15.35(b), (c)

The EUT antenna output port was connected to the input of the spectrum analyzer. The analyzer center frequency was set to EUT RF channel carrier. The SWEEP function on the analyzer was set to ZERO SPAN. The transmitter ON time was determined from the resultant time-amplitude display:

Duty cycle = Maximum ON time in 100 msec/100

Duty cycle correction, dB = 20 * log(DC)

	See attached spectrum analyzer chart(s) for transmitter timing
	See transmitter timing diagram provided by manufacturer
X	No duty cycle was applied

5.0 Document History

Revision/Job Number	Date	Change
1.0 / J99022866g	1/21/00	Original document