Intertek Testing Services

APPLICATION FOR FCC CERTIFICATION

TT System LLC

DSSS Cordless Telephone

Model: IBM-2.4GIG

FCC ID: OVQIBM-24GIG

Job # J99030602
Report # J99030602B

Number of Pages: 15 + Supporting Data and Documents

Date of Report: January 27, 2000

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1.0 Summary of Tests

DSSS Cordless Telephone – Model: IBM-2.4GIG
FCC ID: OVQIBM-24GIG

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)	N/A
Radiated Emission in Restricted Bands	15.35(b)(c)	Pass
AC Conducted Emission	15.207	N/A
Radiated Emission from Digital Part	15.109	Pass
Radiated Emission from Receiver L.O.	15.109	N/A
Processing Gain Measurements	15.247(e)	Pass
Antenna Requirement	15.203	Pass

Test Engineer: Xi-Ming Yang Date: January 27, 2000
Xi-Ming Yang

Telco Manager: David Chernomordik Date: January 27, 2000
David Chernomordik

2.0 General Description

2.1 Product Description

The Model IBM-2.4GIG is a DSSS cordless telephone. For more details, please refer to the EUT description.

A production version of the sample was received on December 28, 1999 in good condition.

Overview of Model IBM-2.4GIG

Applicant	TT System LLC
Trade Name & Model No.	IBM, IBM-2.4GIG
FCC Identifier	OVQIBM-24GIG
Use of Product	DSSS Cordless Telephone
Manufacturer & Model of Spread Spectrum Module	Giant Electronics Ltd.
Type of Transmission	Direct Sequence
Rated RF Output (mW)	100 mW
Frequency Range (MHz)	2404.8 – 2475.0
Number of Channel(s)	40
Antenna(s) & Gain, dBi	0
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	[X] 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. [ ] The EUT requires professional installation (attach supporting documentation if using this option).
Manufacturer name & address	Giant Electronics Ltd. 1,2,5,6 & 11/F., Elite Building Nam Tau, Shen Zhen People's Republic of China

2.2 Related Submittal(s) Grants

None.

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

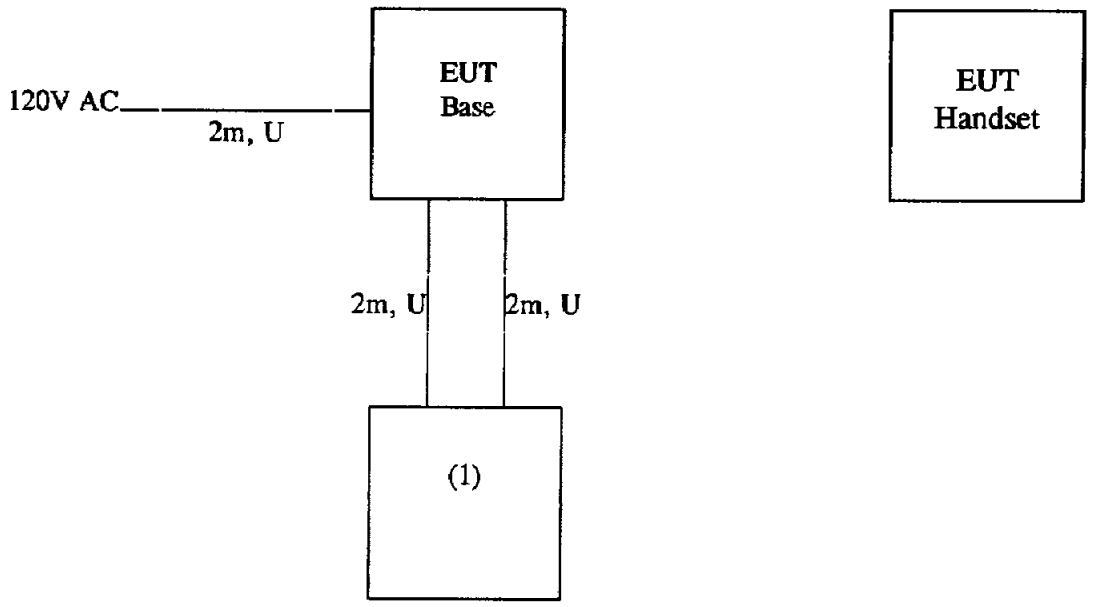
The open area test site and conducted measurement facility used to collect the radiated data is site . This test facility and site measurement data have been fully placed on file with the FCC and NVLAP accredited.

3.0 System Test Configuration

3.1 Support Equipment and description

Support equipment					
Qty	**Equipment**	**Manufacturer**	**Model #**	**S/N #**	**FCC ID**
1	Telephone Line Simulator	Teltone	TLS-3	022733	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.

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

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with 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

The EUT was running in a transmitting mode.

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 prior to compliance testing):

No modifications were made to the EUT by Intertek Testing Services.

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Maximum Radiated Output Power, FCC RULES 15.247(b):

Test Procedure

The EUT was positioned on a non-conductive turntable, 0.8m above the ground plane on an open test site.

The radiated emission at the fundamental frequency was measured at 3m distance with a test antenna and spectrum analyzer. During the measurement, the resolution and video bandwidth of the spectrum analyzer were set to 1 MHz. To maximize emissions, the system was rotated through 360°, the antenna height was varied from 1m to 4m, and the antenna polarization was changed.

The ERP was calculated using equation:

$$E = \frac{\sqrt{30 \cdot P \cdot G}}{D}$$

Where E = Field Strength (V/m),
D = Distance between two antennae(m)
G = Numeric Gain of Antenna (1 for isotropic antenna),
P = ERP (W) = EIRP (G=1)

Base			
Frequency (MHz)		Output in dBm	Output in mWatt
Low Channel:	1	19.2	84.6
Middle Channel:	20	19.4	88.7
High Channel:	40	19.7	94.8

Please refer to the following plots:

Plot B1a: Low Channel, Spectrum Analyzer Reading (Base)
Plot B1b: Middle Channel, Spectrum Analyzer Reading (Base)
Plot B1c: High Channel, Spectrum Analyzer Reading (Base)

Data Sheet - Radiated Emission (Output Power)

Handset			
Frequency (MHz)		Output in dBm	Output in mWatt
Low Channel:	1	18.2	67.2
Middle Channel:	20	18.6	73.6
High Channel:	40	19.4	88.6

Please refer to the following plots:

Plot H1a: Low Channel, Spectrum Analyzer Reading (Handset)
Plot H1b: Middle Channel Output Power Reading (Handset)
Plot H1c: High Channel Output Power Reading (Handset)

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Radiated Emissions Test Data

Company:	TT System LLC	Model #:	IBM-2.4GIG	Req:	FCC 2.993		
EUT:	Cordless Phone Base	S/N or FCC #:		Test Dist:	3	meters	
Project #:	J9903060 2	Test Date:	December 28, 1999	TP:	0.04	Watt	
Test Mode:	Tx Power for Low, Mid. Hing Ch	Engineer:	Xi Ming Y.	Min. Attn:	29.13	dBc	

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	14	21	0	8	13	0	0	12	0
Model:	EMCO 3143	EMCO 3115	3160-9	None	CDI_P1000	ACO/400	None	None	Gm_M+L	None

Frequency	Reading	Detector	Ant.	Amp	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	Net	ERP	EIRP	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB(μV/m	mW	mW	dB
2404.76	82.1	Peak	14	0	V	30.1	0.0	2.3	114.5	5.16E+01	84.6	
2440.48	82.3	Peak	14	0	V	30.1	0.0	2.3	114.7	5.40E+01	88.7	
2475.00	82.6	Peak	14	0	V	30.1	0.0	2.3	115.0	5.78E+01	94.8	

Notes:

a) O.C.F. Other Correction Factor
b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.
c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.
d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).
e) Negative signs (-) in Margin column signify levels below the limits.

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Radiated Emissions Test Data

Company:	TT System LLC	Model #:	IBM-2.4GIG	Req.	FCC 15.247
EUT:	Cordless Phone Hand set	S/N or FCC #:		Test Dist	3 meters
Project #:	J99030602	Test Date:	December 28, 1999	TP	Watt
Test Mode:	Tx Power for Low, Mid, High Ch.	Engineer:	Xi Ming Y.	Min. Attn.	dBc

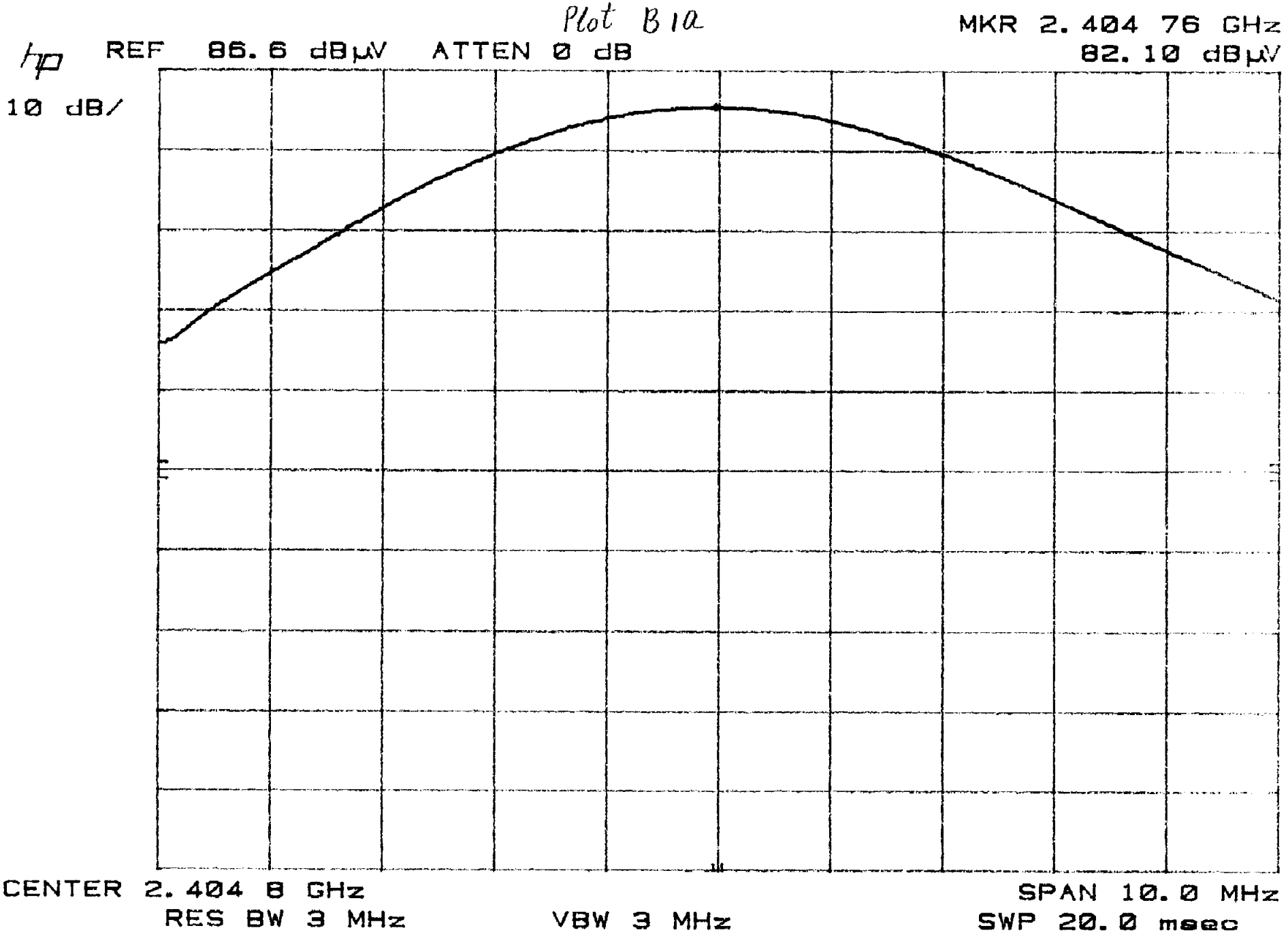
	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	14	21	0	8	13	0	0	12	0
Model:	EMCO 3143	EMCO 3115	3160-9	None	CDI_P1000	ACO/400	None	None	Gm_M+L	None

Frequency	Reading	Detector	Ant	Amp	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	Net	ERP	EIRP	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB(μV/m)	mW	mW	dB
2404.80	81.1	Peak	14	0	V	30.1	0.0	2.3	113.5	4.10E+01	67.2	---
2440.80	81.5	Peak	14	0	V	30.1	0.0	2.3	113.9	4.49E+01	73.6	---
2475.00	82.3	Peak	14	0	V	30.1	0.0	2.3	114.7	5.40E+01	88.6	---
												---

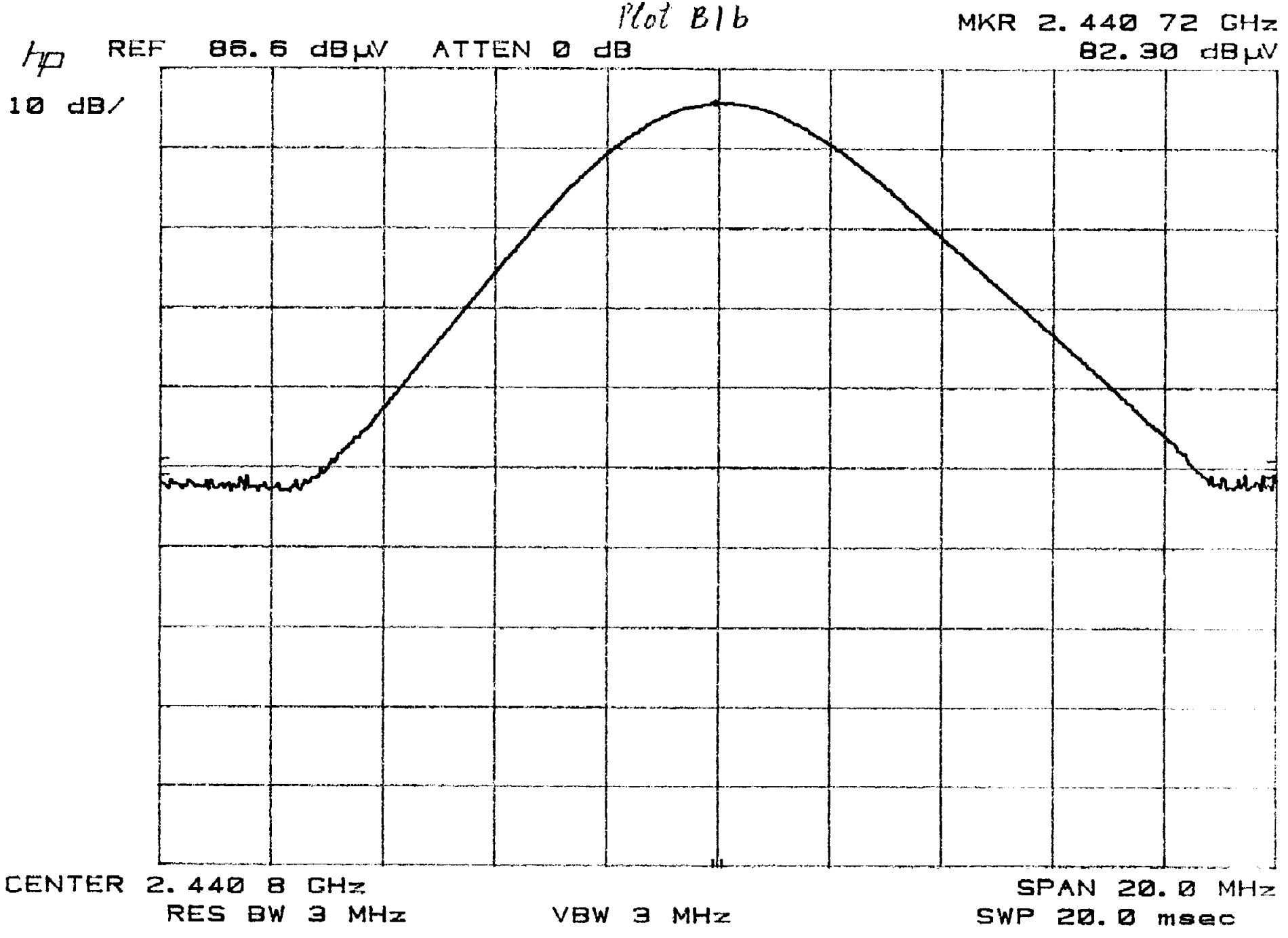
Notes:

a) O.C.F. Other Correction Factor
b) Insert. Loss = Cable A + Cable B + Cable C + Transducer
c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.
d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics)
e) Negative signs (-) in Margin column signify levels below the limits.

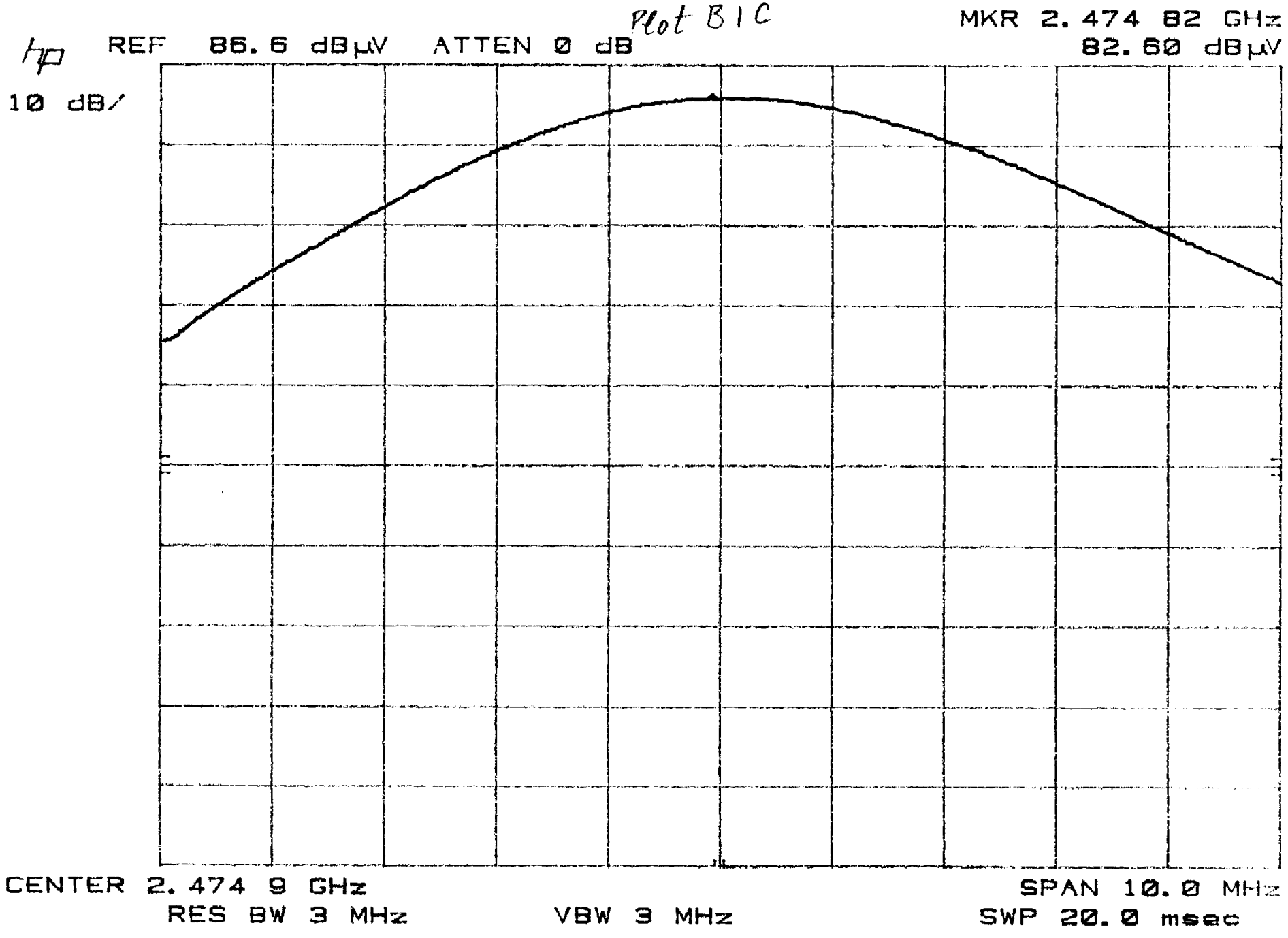
Plot B 1a


hp
REF 86.6 dBμV
ATTEN 0 dB
MKR 2.404 76 GHz
82.10 dBμV
10 dB/
CENTER 2.404 8 GHz
SPAN 10.0 MHz
RES BW 3 MHz
VBW 3 MHz
SWP 20.0 msec

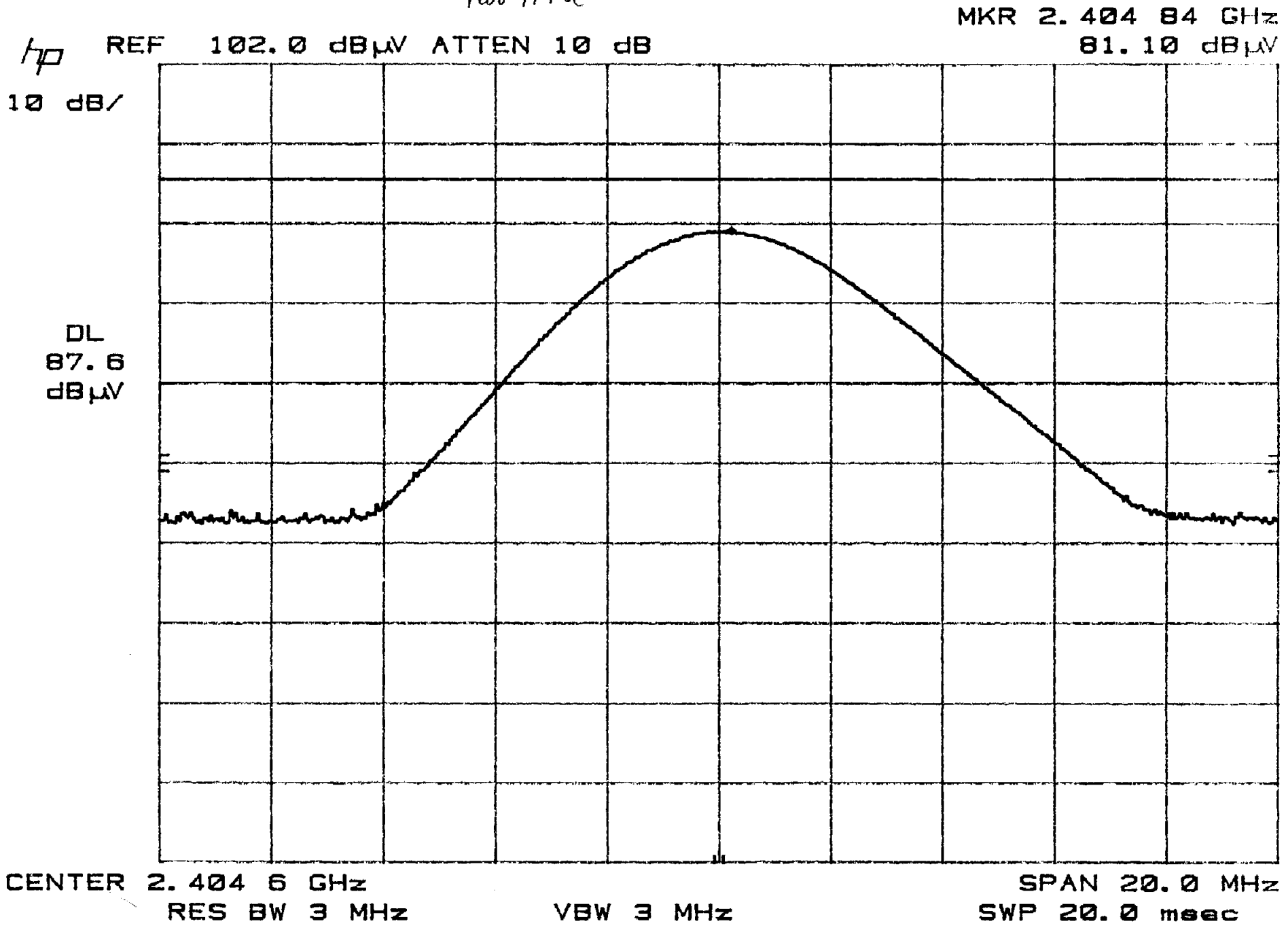
Plot B1b


hp
REF 86.6 dBμV
ATTEN 0 dB
MKR 2.440 72 GHz
82.30 dBμV
10 dB/
CENTER 2.440 8 GHz
RES BW 3 MHz
VBW 3 MHz
SPAN 20.0 MHz
SWP 20.0 msec

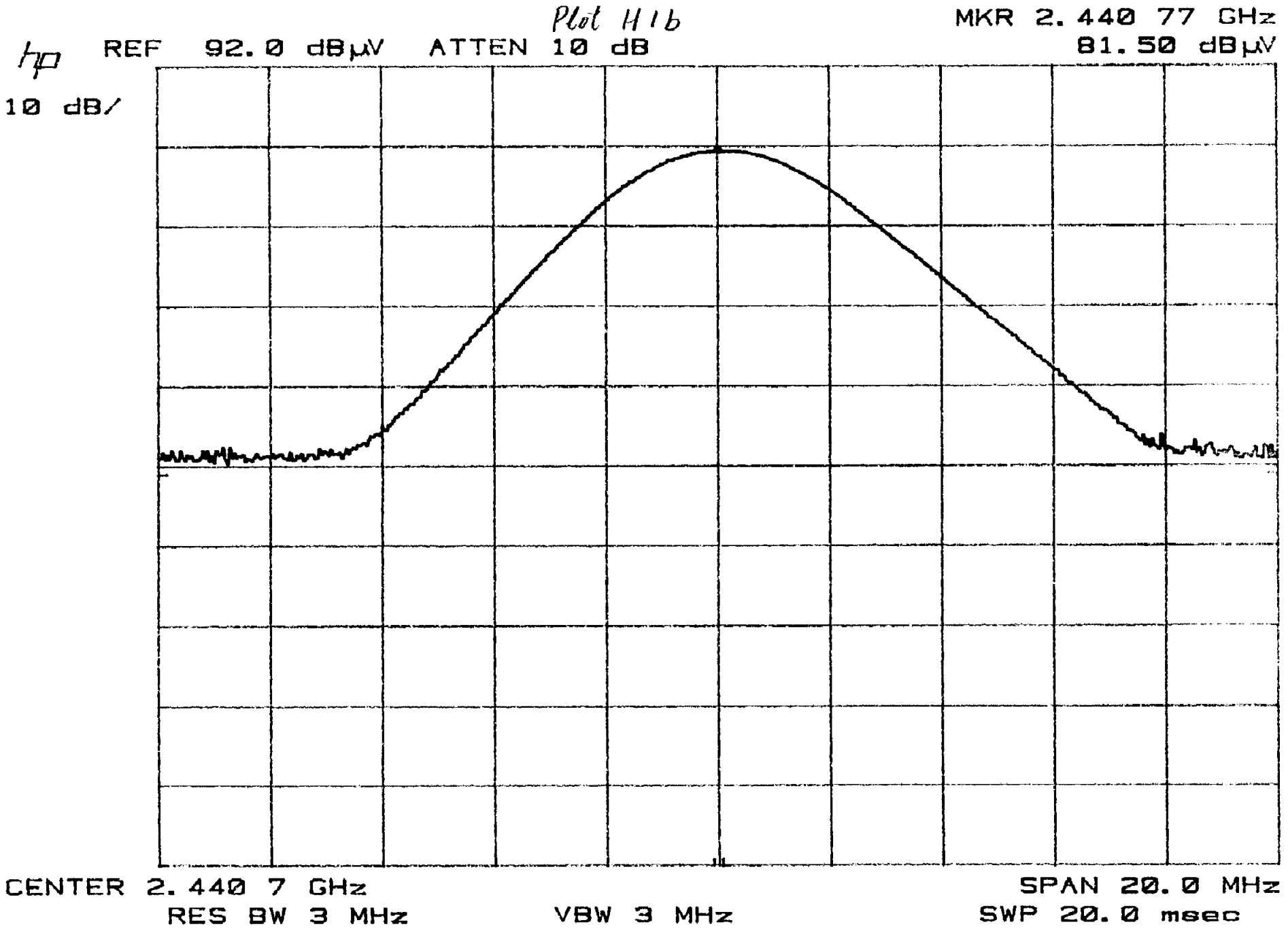
Plot B1C


hp
REF 86.6 dBμV
ATTEN 0 dB
MKR 2.474 82 GHz
82.60 dBμV
10 dB/
CENTER 2.474 9 GHz
SPAN 10.0 MHz
RES BW 3 MHz
VBW 3 MHz
SWP 20.0 msec

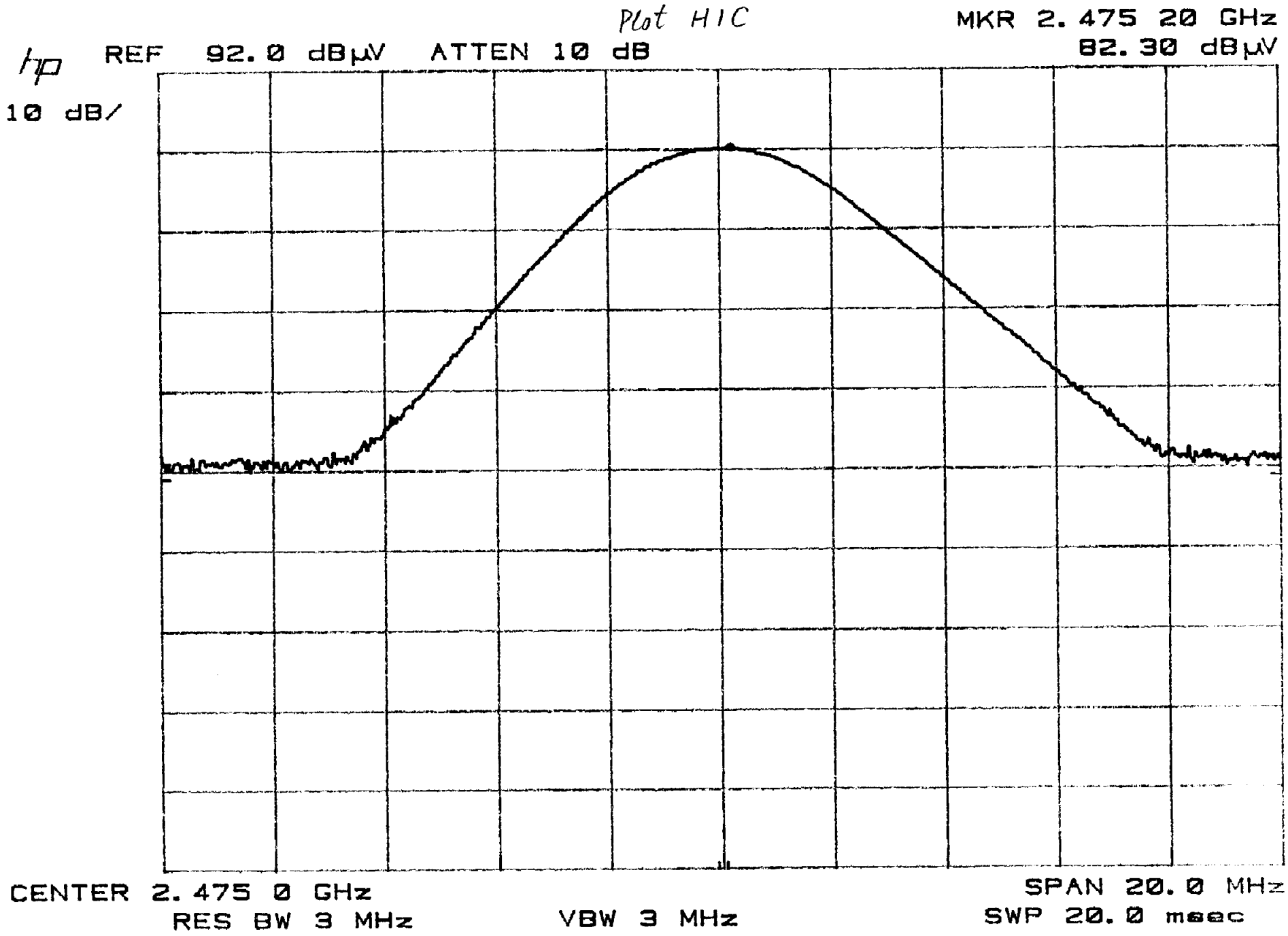
Plot H1a


MKR 2.404 84 GHz
81.10 dBµV
REF 102.0 dBµV ATTEN 10 dB
10 dB/
DL
87.6
dBµV
CENTER 2.404 6 GHz
SPAN 20.0 MHz
RES BW 3 MHz
VBW 3 MHz
SWP 20.0 msec

Plot H1b


REF 92.0 dBµV
ATTEN 10 dB
MKR 2.440 77 GHz
81.50 dBµV
10 dB/
CENTER 2.440 7 GHz
SPAN 20.0 MHz
RES BW 3 MHz
VBW 3 MHz
SWP 20.0 msec

Plot H1C


hp
REF 92.0 dBµV
ATTEN 10 dB
MKR 2.475 20 GHz
82.30 dBµV
10 dB/
CENTER 2.475 0 GHz
RES BW 3 MHz
VBW 3 MHz
SPAN 20.0 MHz
SWP 20.0 msec

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.

Base		
Frequency (MHz)	Min. 6 dB Bandwidth (kHz)	Limit (kHz)
2400.8	1442	500

Refer to the following plots for 6 dB bandwidth sharp:

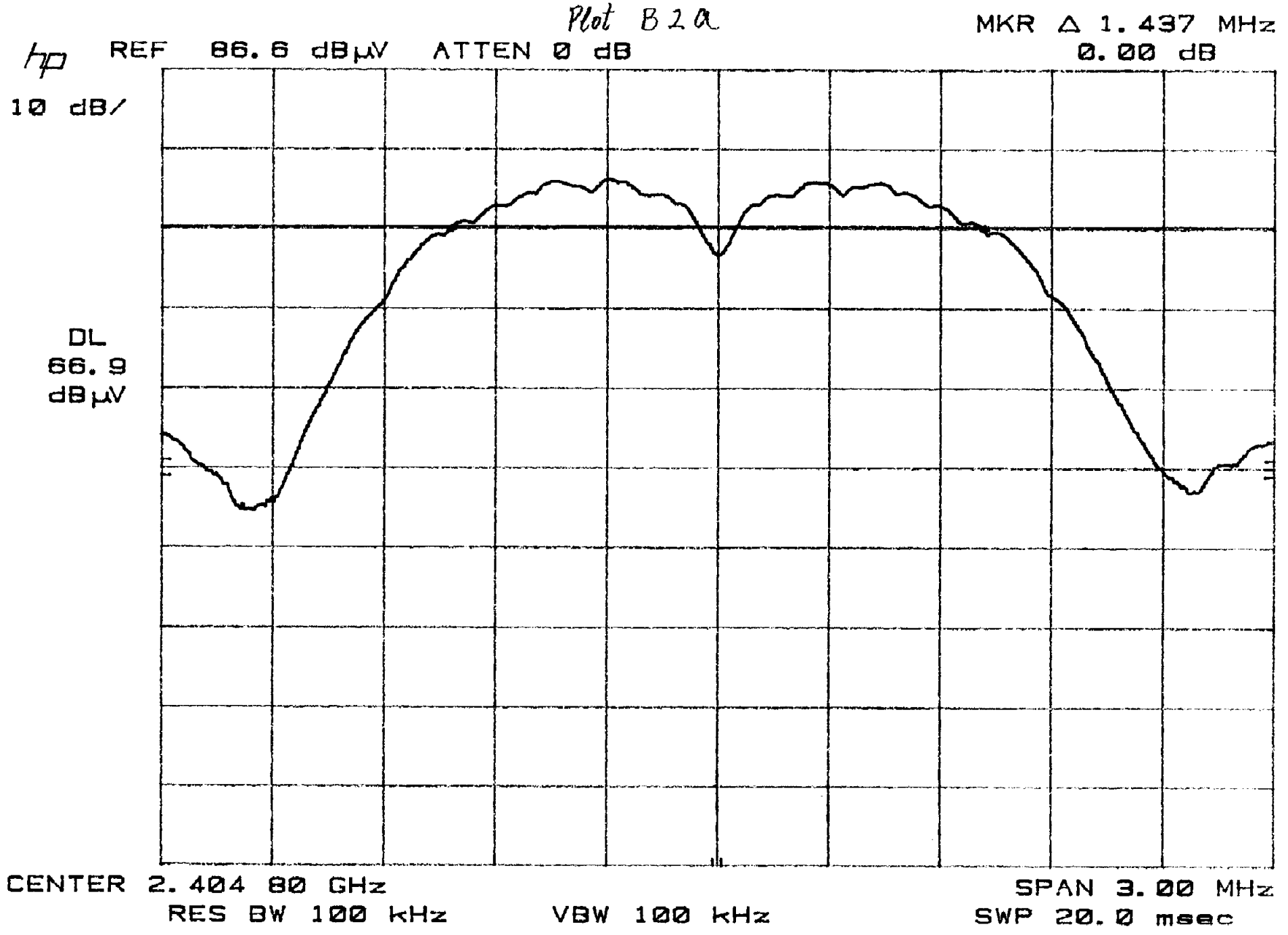
Plot B2a: Low Channel 6 dB RF Bandwidth
Plot B2b: Middle Channel 6 dB RF Bandwidth
Plot B2c: High Channel 6 dB RF Bandwidth

Handset		
Frequency (MHz)	Min. 6 dB Bandwidth (kHz)	Limit (kHz)
2475	1434	500

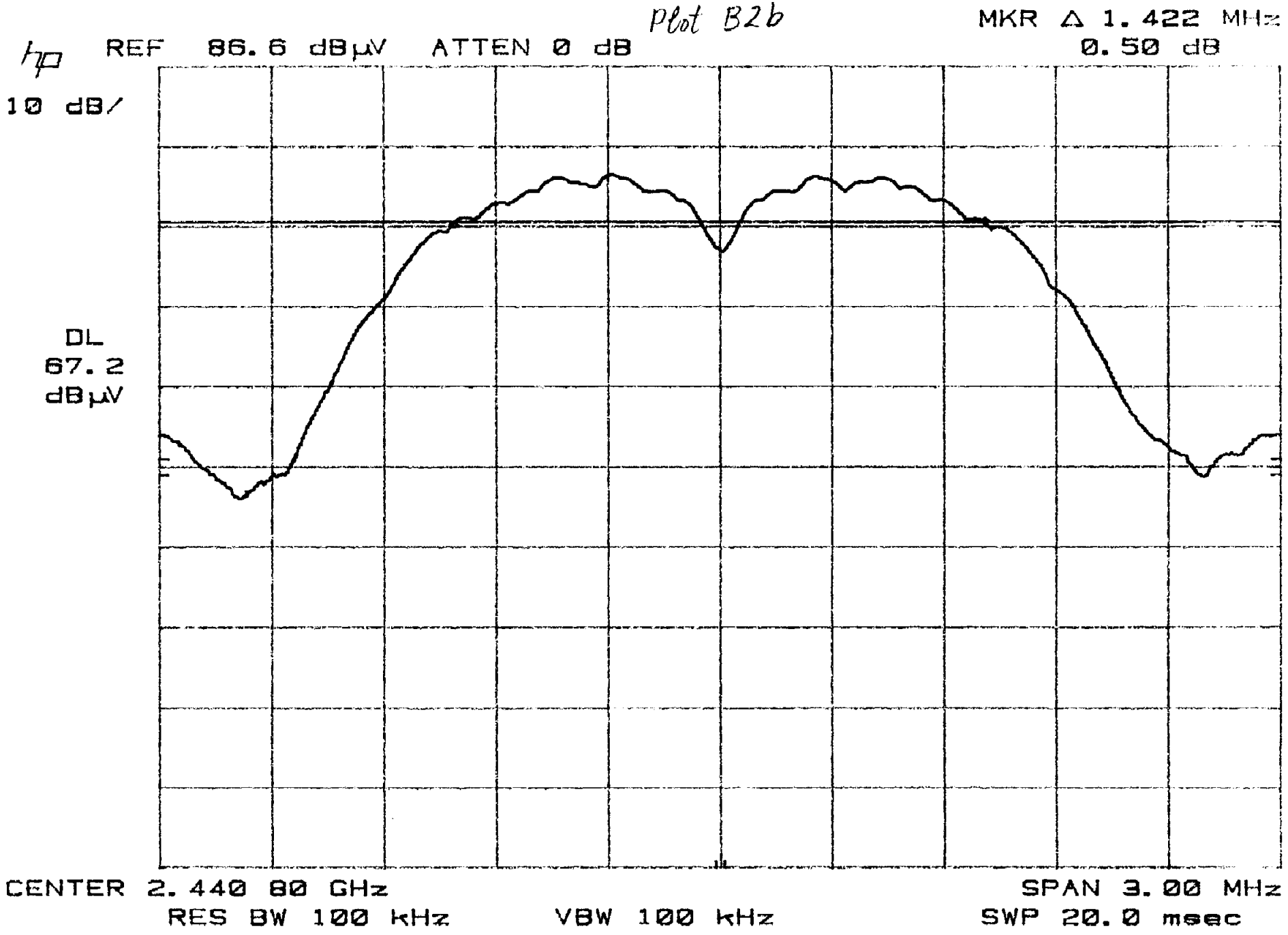
Refer to the following plots for 6 dB bandwidth sharp:

Plot H2a: Low Channel 6 dB RF Bandwidth
Plot H2b: Middle Channel 6 dB RF Bandwidth
Plot H2c: High Channel 6 dB RF Bandwidth

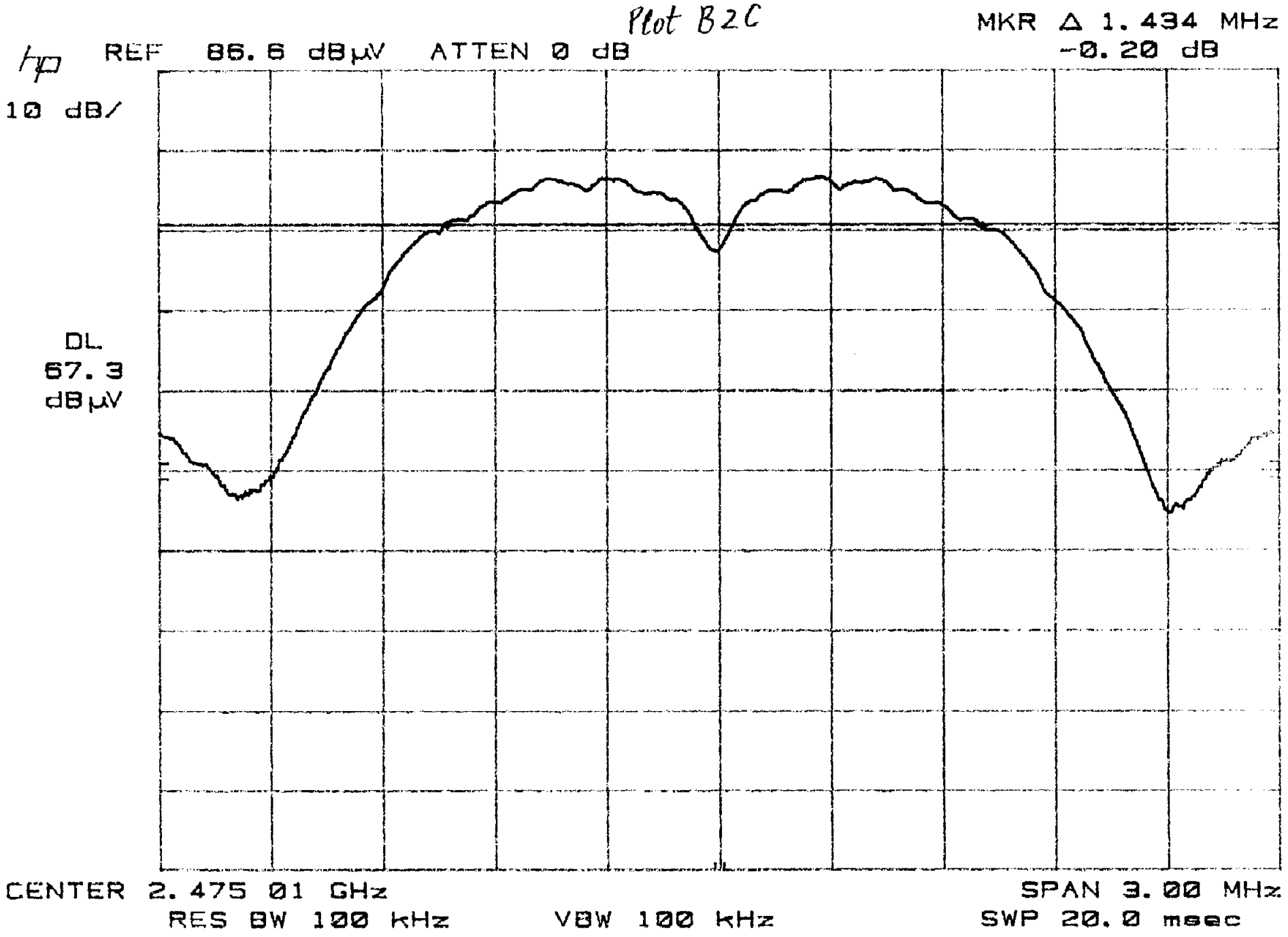
Plot B2a


hp
REF 86.6 dBµV
ATTEN 0 dB
MKR Δ 1.437 MHz
0.00 dB
10 dB/
DL
66.9
dBµV
CENTER 2.404 80 GHz
SPAN 3.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

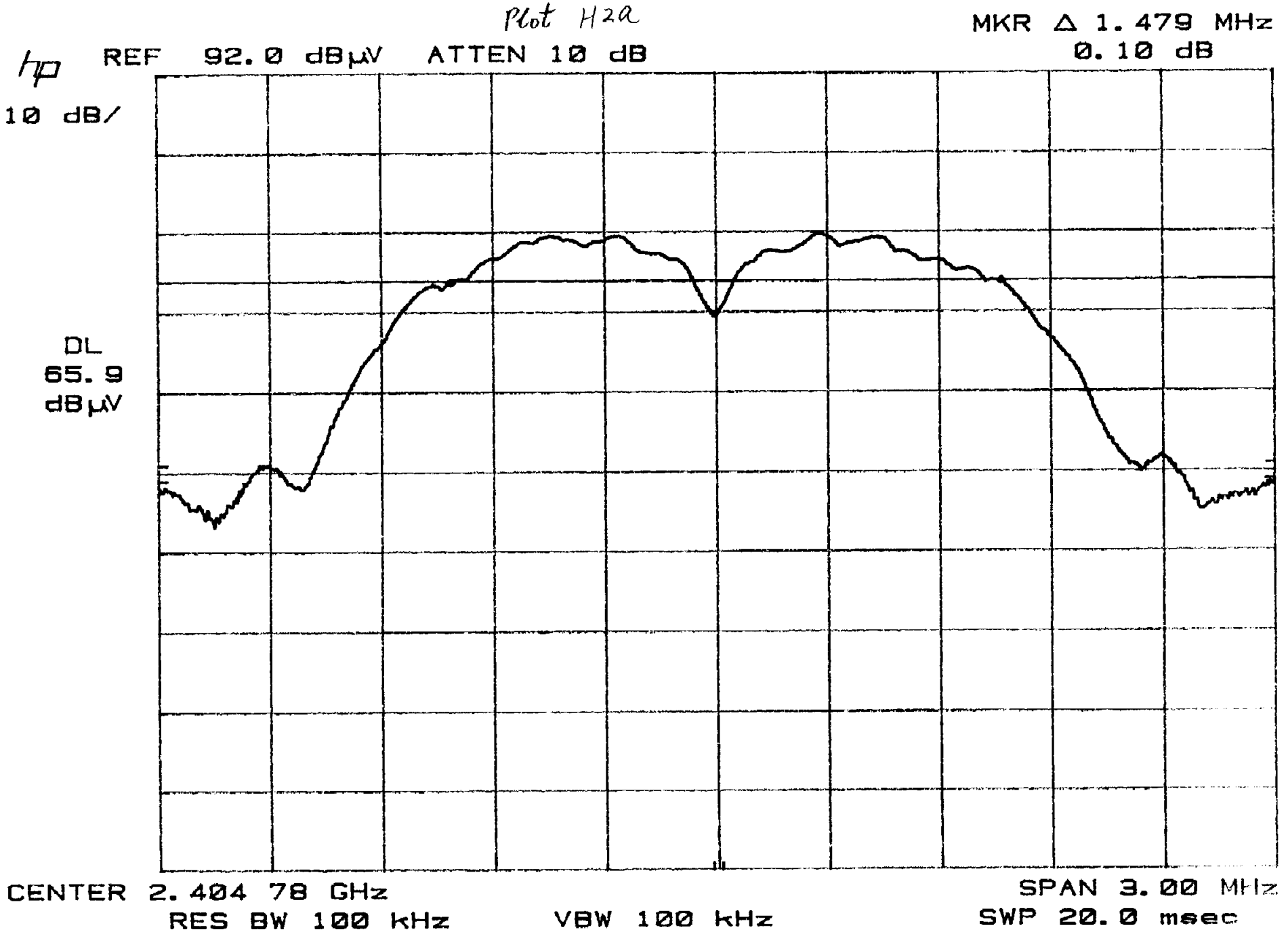
Plot B2b


MKR Δ 1.422 MHz
0.50 dB
hp REF 86.6 dBµV ATTEN 0 dB
10 dB/
DL
67.2
dBµV
CENTER 2.440 80 GHz
SPAN 3.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

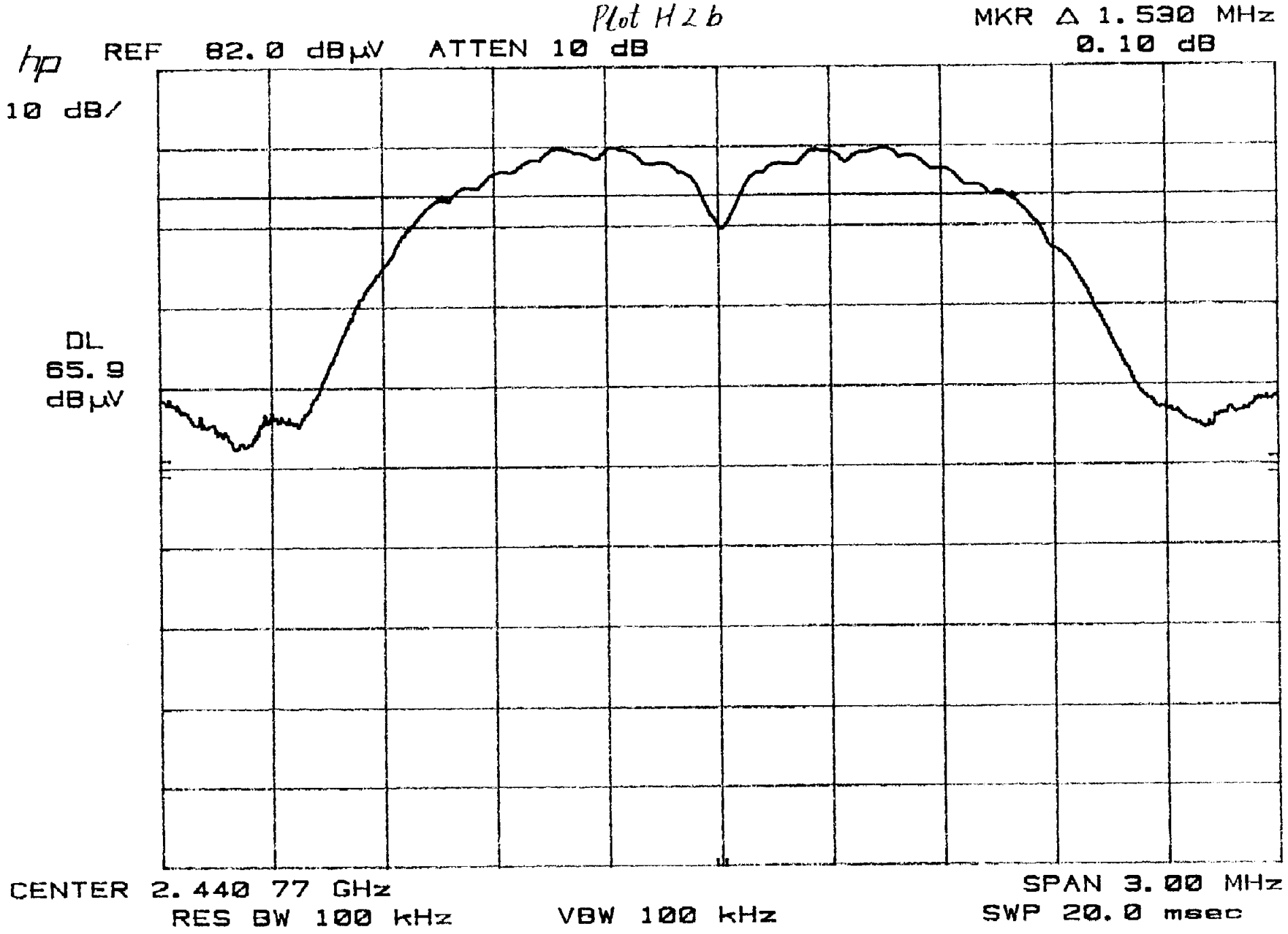
Plot B2C


hp
REF 86.6 dBµV
ATTEN 0 dB
MKR Δ 1.434 MHz
-0.20 dB
10 dB/
DL
67.3
dBµV
CENTER 2.475 01 GHz
SPAN 3.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

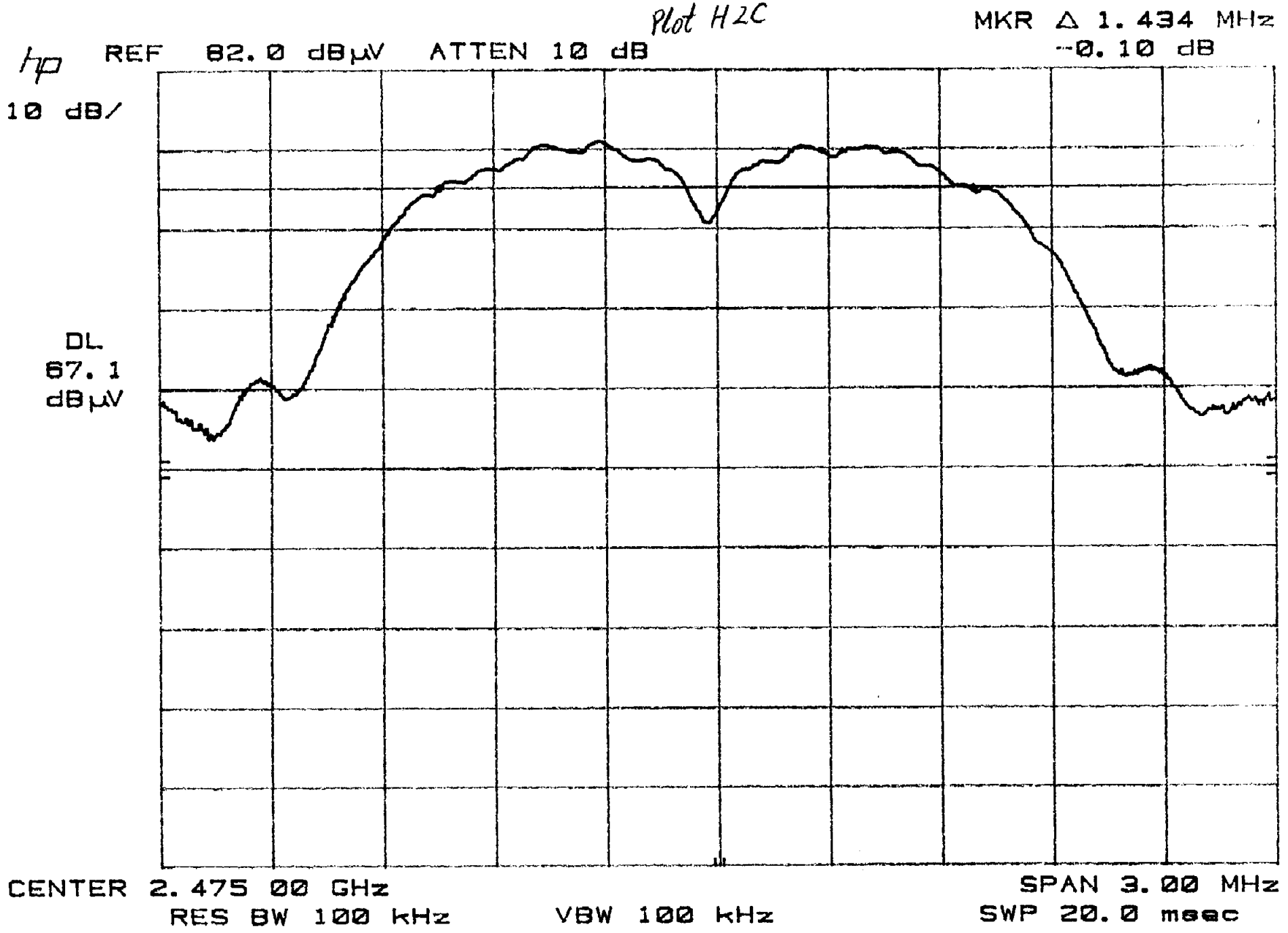
Plot H2a


MKR Δ 1.479 MHz
0.10 dB
REF 92.0 dBµV
ATTEN 10 dB
10 dB/
DL
65.9
dBµV
CENTER 2.404 78 GHz
SPAN 3.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

Plot H2b


hp
REF 82.0 dBμV
ATTEN 10 dB
MKR Δ 1.530 MHz
0.10 dB
10 dB/
DL
65.9
dBμV
CENTER 2.440 77 GHz
SPAN 3.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

Plot H2C


hp
REF 82.0 dBµV
ATTEN 10 dB
MKR Δ 1.434 MHz
-0.10 dB
10 dB/
DL
67.1
dBµV
CENTER 2.475 00 GHz
SPAN 3.00 MHz
RES BW 100 kHz
VBW 100 kHz
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

Radiated method was used; power density was calculated from field strength.

$$P = (ED)^2/30$$
$$G = 1$$

Base		
Frequency (MHz)	Power Density (dBm)	Limit (dBm)
2475.30	4.2	8.0

Handset		
Frequency (MHz)	Power Density (dBm)	Limit (dBm)
2474.68	4.2	8.0

Frequency Span = 600 kHz

Sweep Time = 600 Frequency Span/3 kHz
= 200 seconds

Refer to Appendix C for the following plots:

Plot B3a.1 - B3a.2 Low Channel Power Density
Plot B3b.1 - B3b.2 Middle Channel Power Density
Plot B3c.1 - B3c.2: High Channel Power Density
Plot H3a.1 - H3a.2 Low Channel Power Density
Plot H3b.1 - H3b.2 Middle Channel Power Density
Plot H3c.1 - H3c.2: High Channel Power Density
Radiated Emission (Output Power Density) Handset and Base

ITS Intertek Testing Services

Radiated Emissions Test Data

Company:	TT System LLC	Model #: IBM-2.4GIG		Req.	FCC 15.247		
EUT:	Cordless Phone Hand set	S/N or FCC #:		Test Dist	3	meters	
Project #:	J99030602	Test Date:	December 28, 1999	TP		Watt	
Test Mode:	Tx Power Density for Low, Mid, Hing Ch	Engineer:	Xi Ming Y.	Min. Attn.		dBc	

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	14	21	0	8	13	0	0	12	0
Model:	EMCO 3148	EMCO 3115	3160-9	None	CDI_P1000	ACO/400	None	None	Grn_M-L	None

Frequency	Reading	Detector	Ant.	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	Net	EIRP	Limit	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB(μV/m)	dBm	dBm	dB
2405.08	66.0	Peak	14	0	V	30.1	0.0	2.3	98.4	3.1	8.0	-4.9
2440.48	66.0	Peak	14	0	V	30.1	0.0	2.3	98.4	3.1	8.0	-4.9
2474.68	67.1	Peak	14	0	V	30.1	0.0	2.3	99.5	4.2	8.0	-3.8

Notes:

a) O.C.F.:Other Correction Factor
b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.
c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.
d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).
e) Negative signs (-) in Margin column signify levels below the limits.

ITS Intertek Testing Services

Radiated Emissions Test Data

Company:	TT System LLC	Model #:	IBM-2.4GIG	Req	FCC 15.247
EUT:	Cordless Phone Base	S/N or FCC #:		Test Dist	3 meters
Project #:	J9903060 2	Test Date:	December 28, 1999	TP	Watt
Test Mode:	Tx Power Density for Low, Mid, Hing Ch	Engineer:	Xi Ming Y.	Min. Attn.	dBc

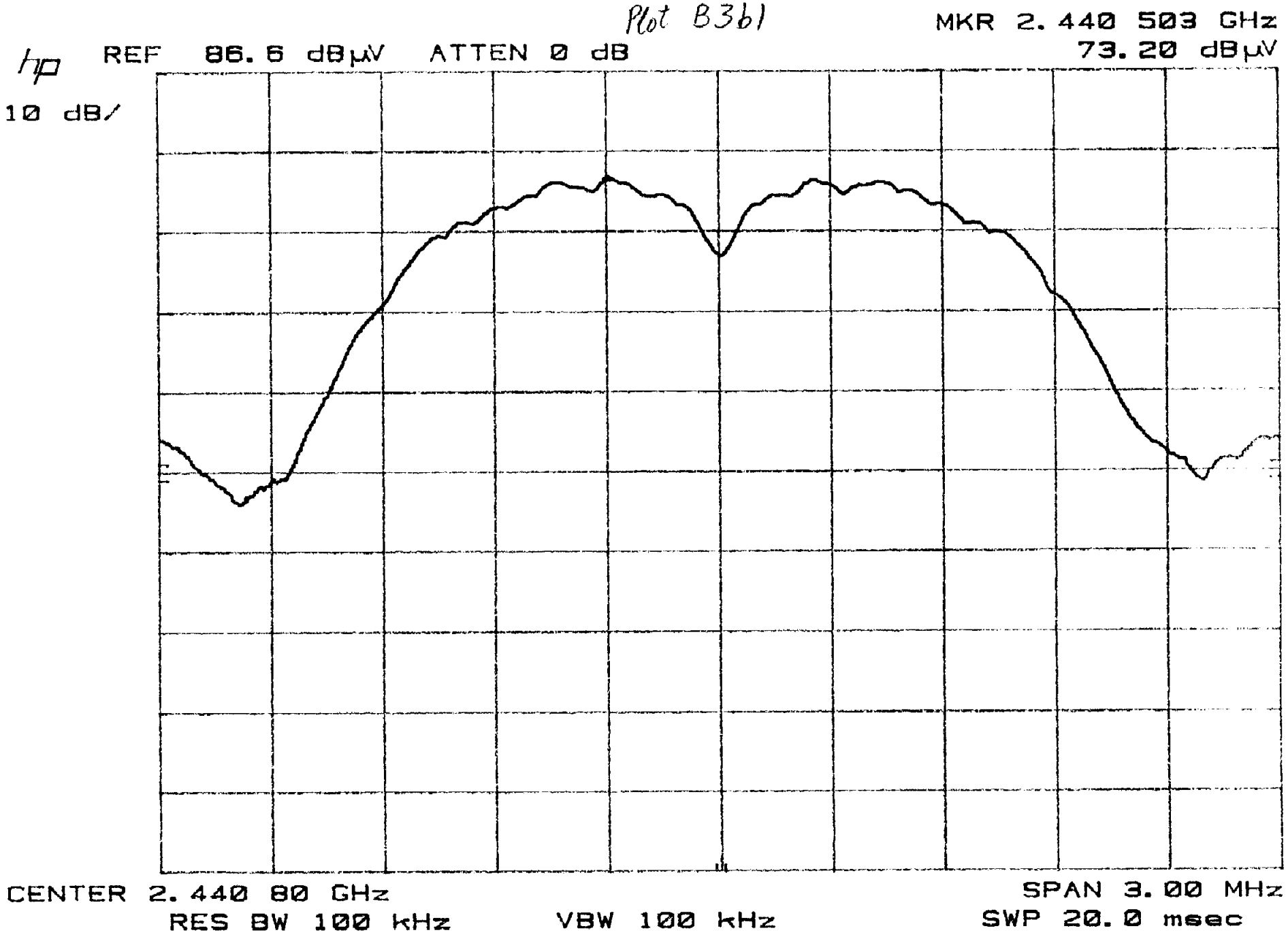
	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	14	21	0	8	13	0	0	12	0
Model:	EMCO 3143	EMCO 3115	3160-9	None	CDI_P1000	ACO/400	None	None	Cm_M+L	None

Frequency MHz	Reading dB(μV)	Detector P/A/Q	Ant. #	Amp. #	Ant. Pol. H/V	Ant. Factor dB(1/m)	Pre-Amp dB	Insert. Loss dB	Net dB(μV/m)	EIRP dBm	Limit dBm	Margin dB
2404.50	66.5	Ave.	14	0	V	30.1	0.0	2.3	98.9	3.6	8.0	-4.4
2440.50	66.9	Peak	14	0	V	30.1	0.0	2.3	99.3	4.0	8.0	-4.0
2475.30	67.1	Ave.	14	0	V	30.1	0.0	2.3	99.5	4.2	8.0	-3.8

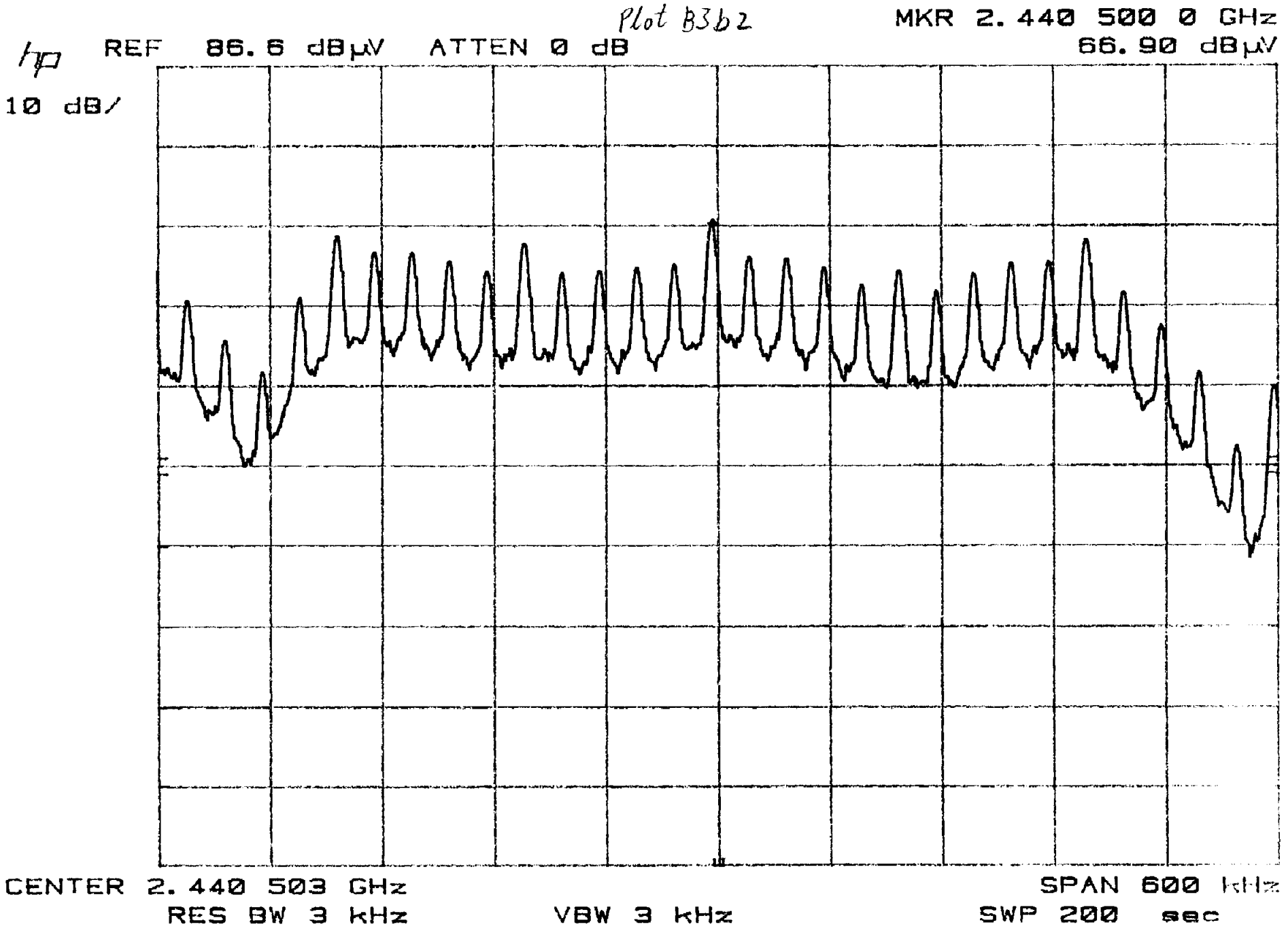
Notes:

a) O.C.F.:Other Correction Factor
b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.
c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.
d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics)
e) Negative signs (-) in Margin column signify levels below the limits.

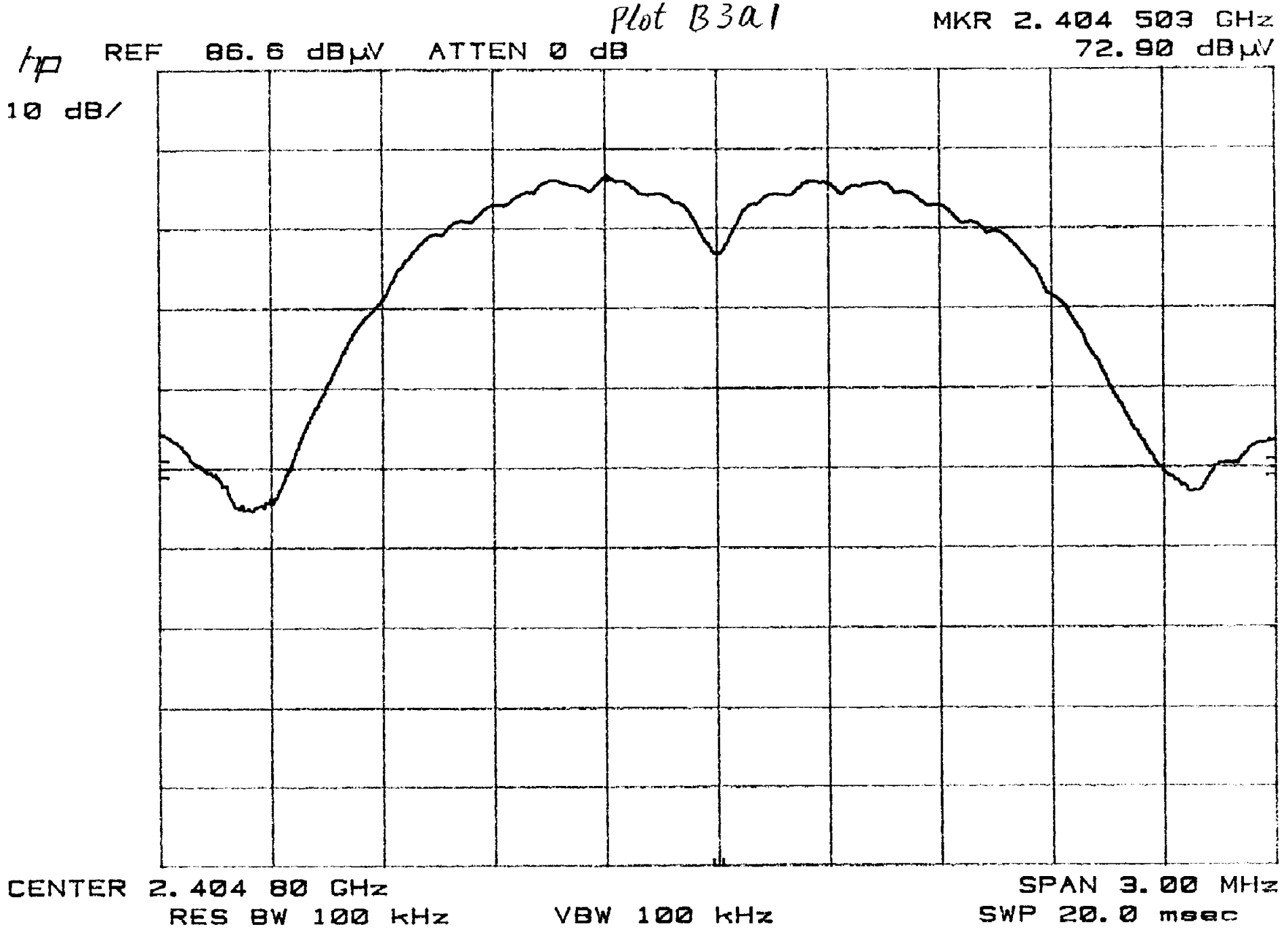
Plot B3b1


MKR 2.440 503 GHz
73.20 dBµV
REF 86.6 dBµV ATTEN 0 dB
10 dB/
CENTER 2.440 80 GHz
SPAN 3.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

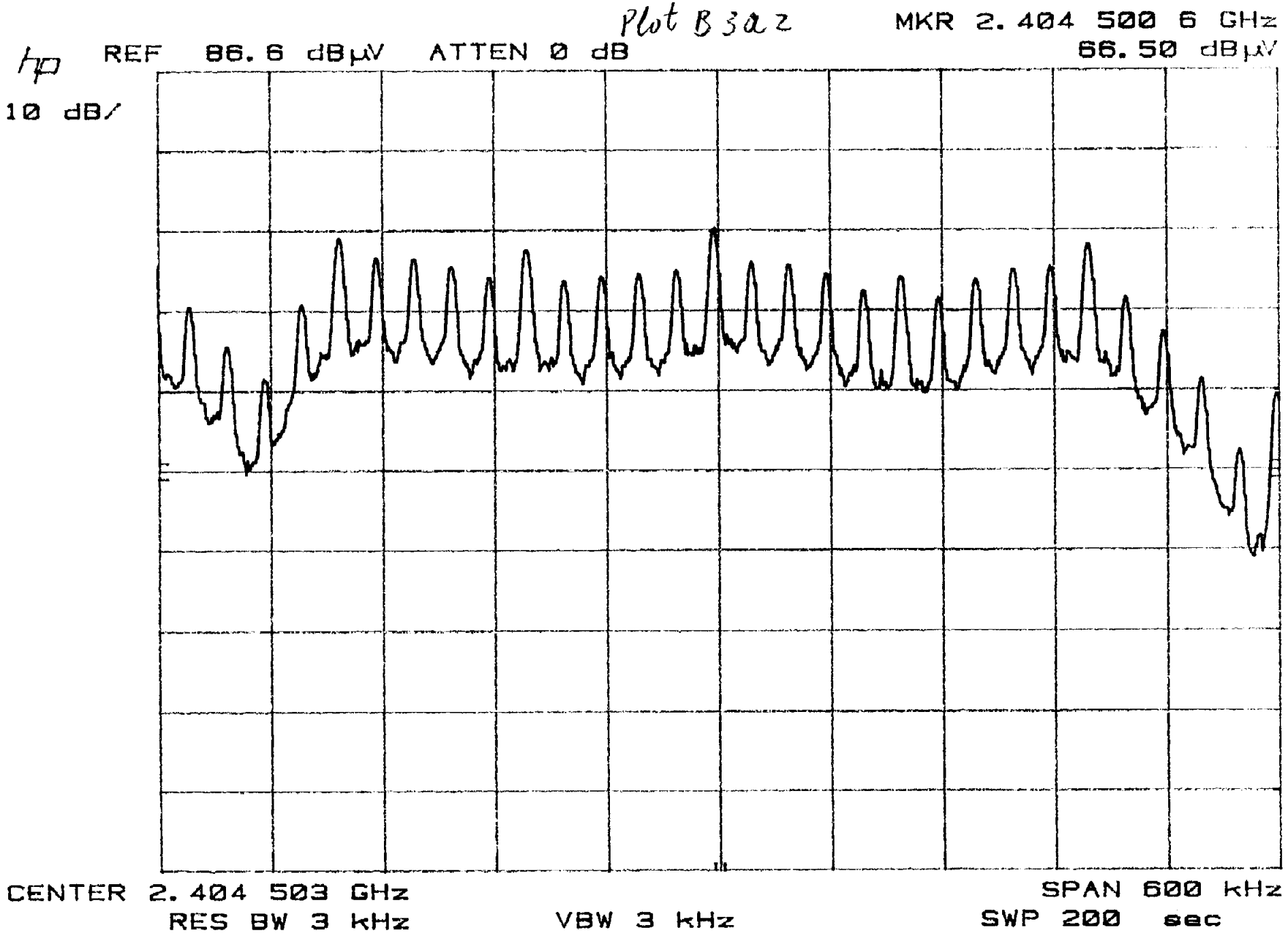
Plot B3b2


MKR 2.440 500 0 GHz
66.90 dBµV
REF 86.6 dBµV
ATTEN 0 dB
10 dB/
CENTER 2.440 503 GHz
SPAN 600 kHz
RES BW 3 kHz
VBW 3 kHz
SWP 200 sec

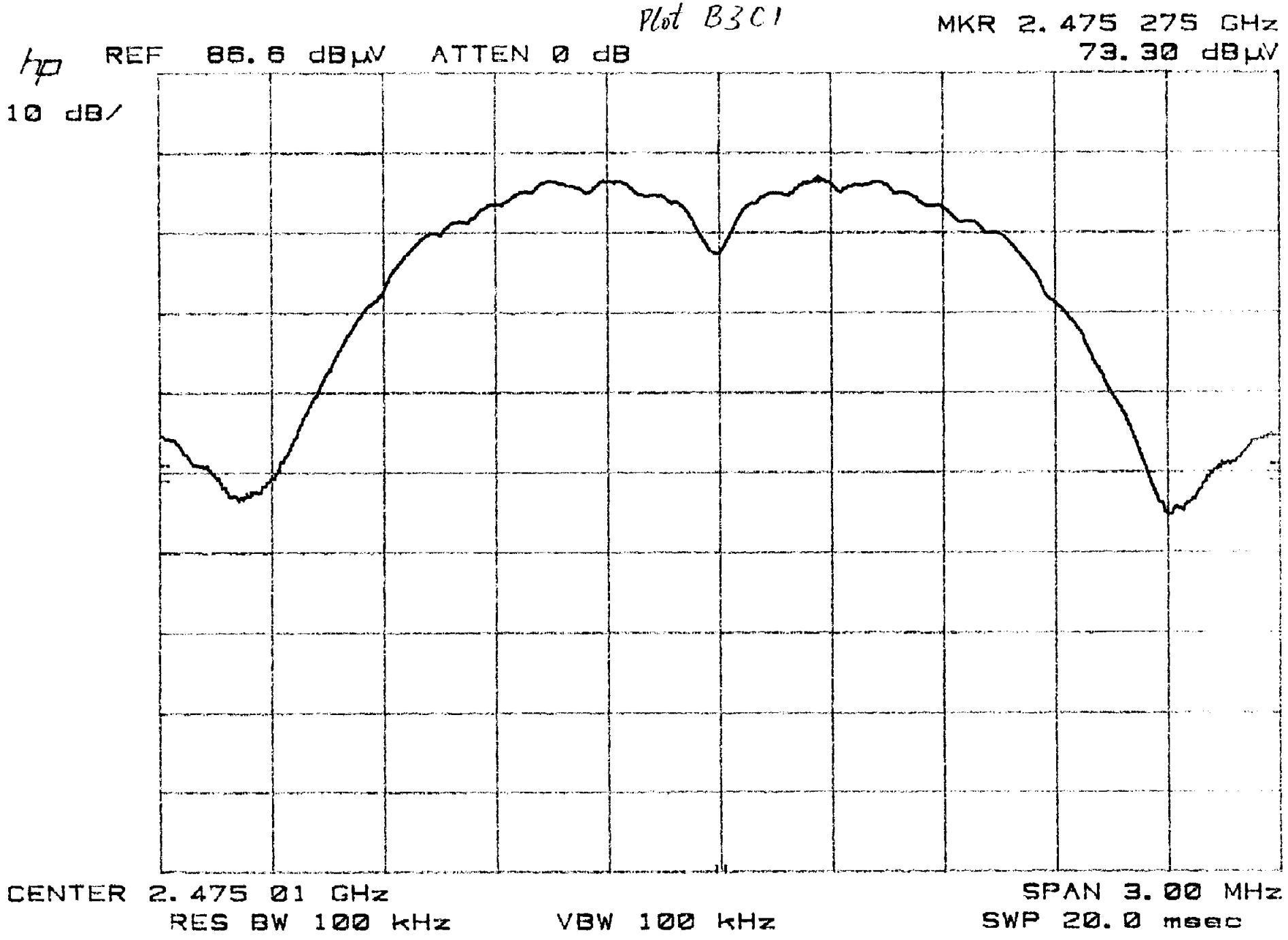
Plot B3a1


MKR 2.404 503 GHz
72.90 dBµV
hp REF 86.6 dBµV ATTEN 0 dB
10 dB/
CENTER 2.404 80 GHz
SPAN 3.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

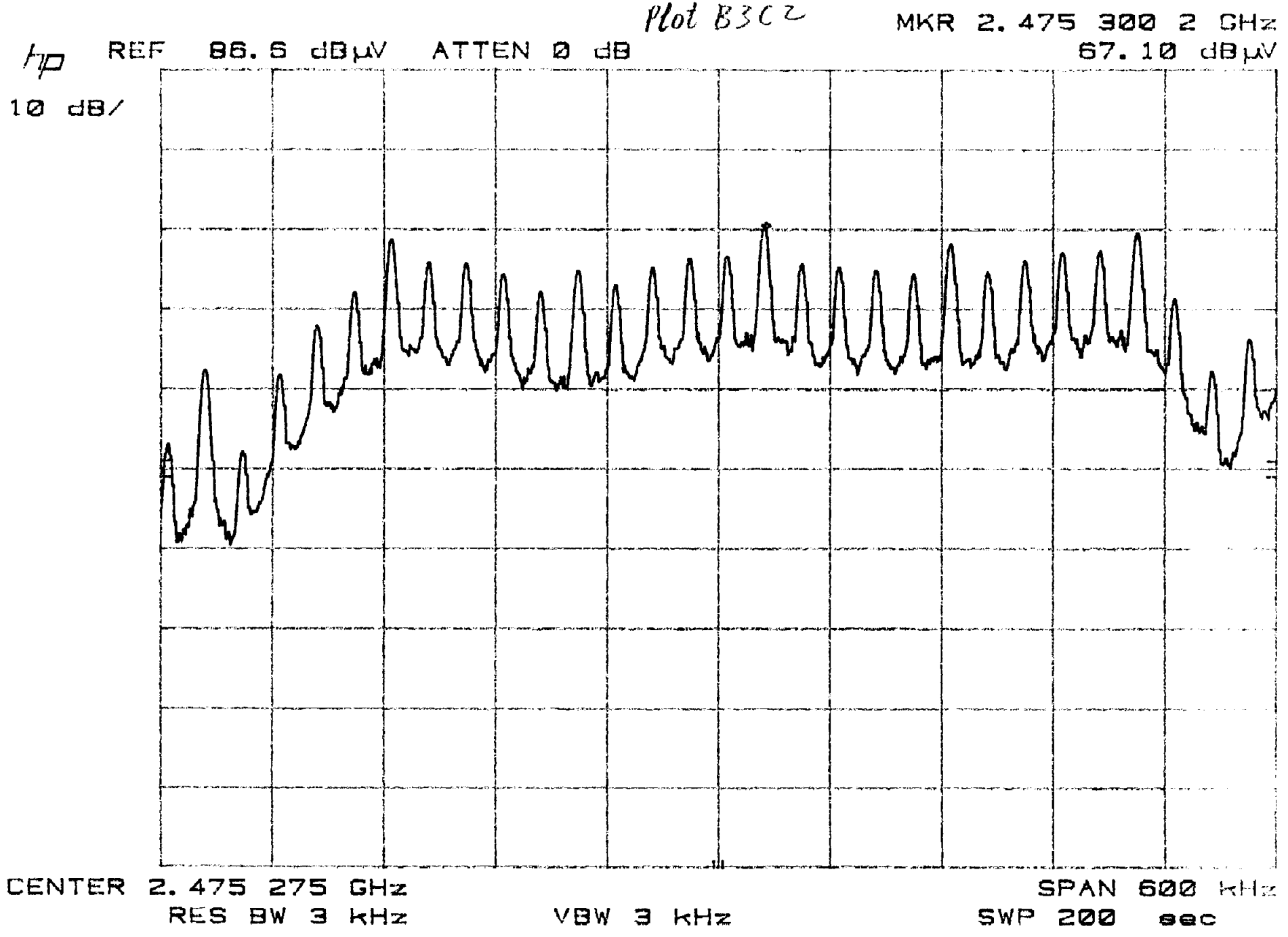
Plot B3a2


hp
REF 86.6 dBµV
ATTEN 0 dB
MKR 2.404 500 6 GHz
66.50 dBµV
10 dB/
CENTER 2.404 503 GHz
SPAN 600 kHz
RES BW 3 kHz
VBW 3 kHz
SWP 200 sec

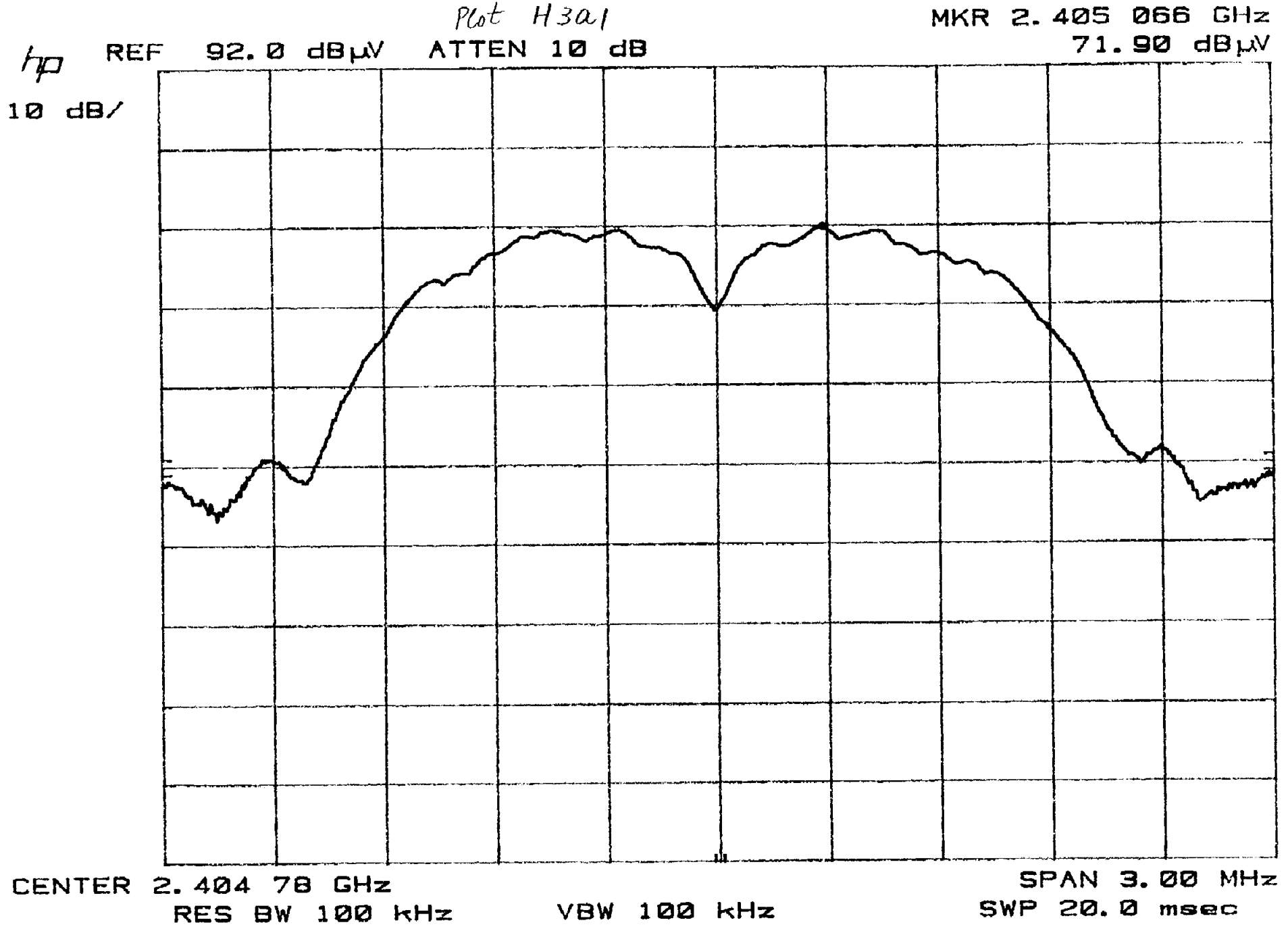
Plot B3C1


MKR 2.475 275 GHz
73.30 dBµV
hp REF 86.6 dBµV ATTEN 0 dB
10 dB/
CENTER 2.475 01 GHz
SPAN 3.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

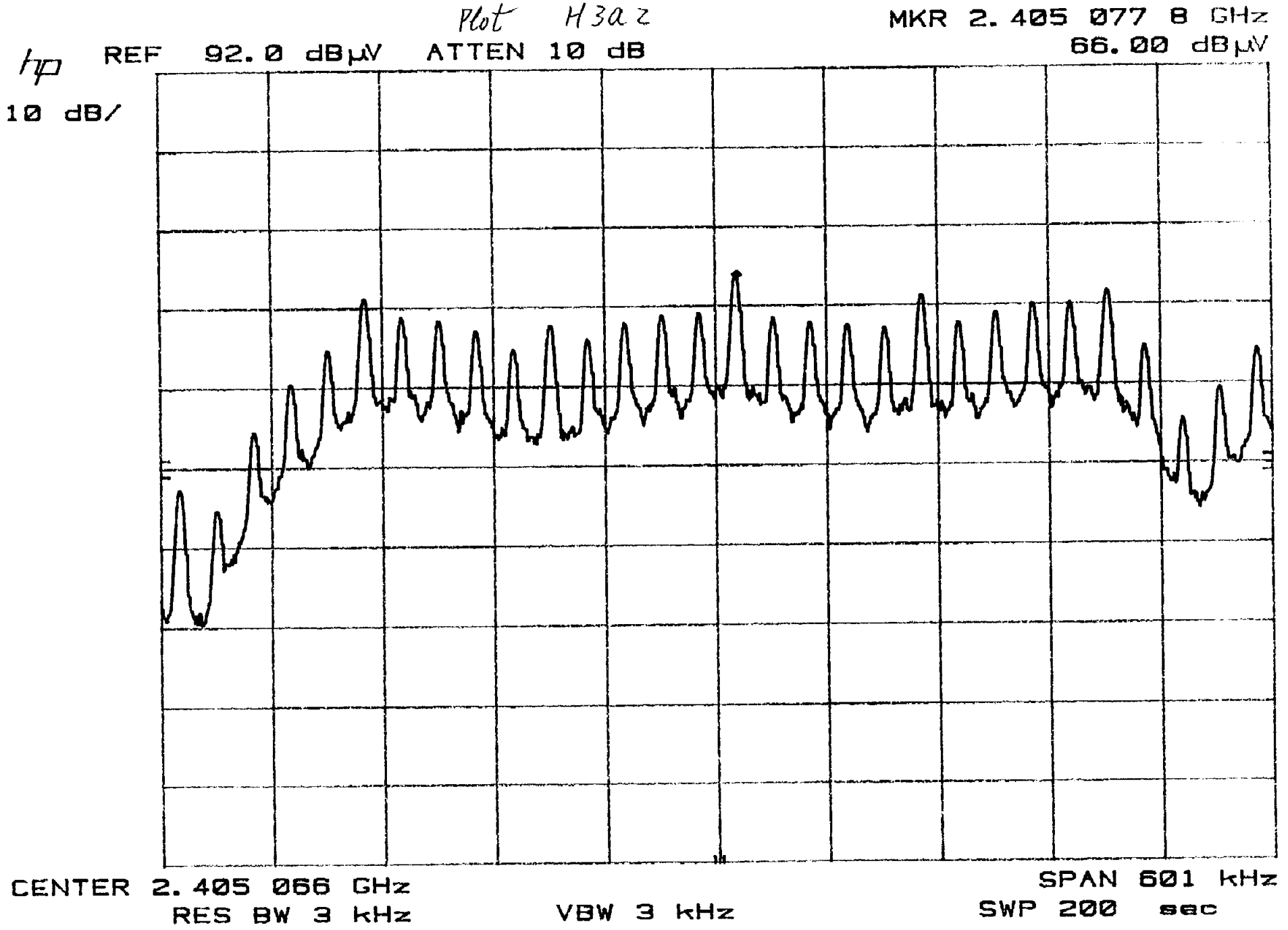
Plot B3C2


REF 86.6 dBµV
ATTEN 0 dB
MKR 2.475 300 2 GHz
67.10 dBµV
10 dB/
CENTER 2.475 275 GHz
SPAN 600 kHz
RES BW 3 kHz
VBW 3 kHz
SWP 200 sec

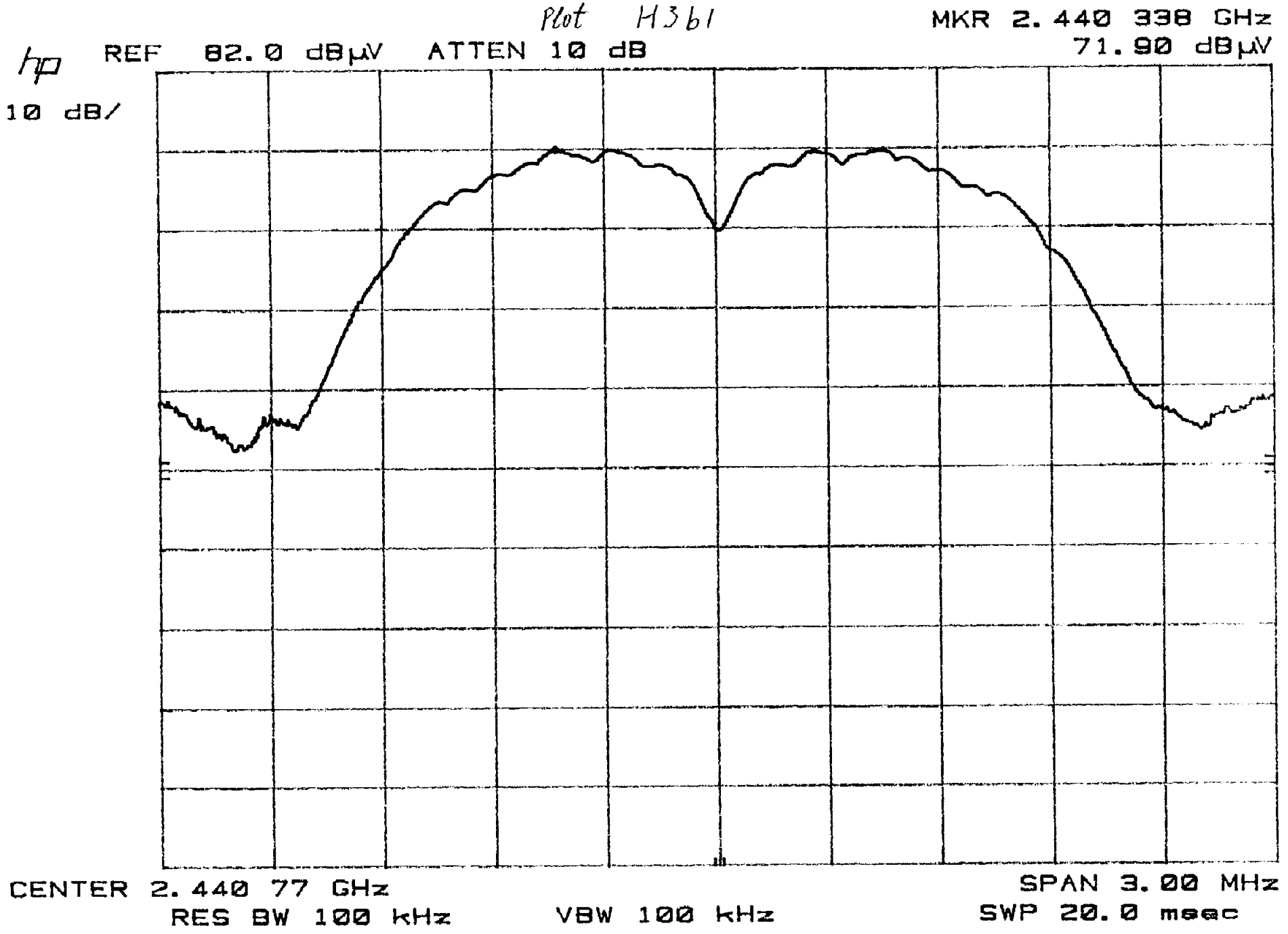
Plot H3a1


hp
REF 92.0 dBµV
ATTEN 10 dB
MKR 2.405 066 GHz
71.90 dBµV
10 dB/
CENTER 2.404 78 GHz
SPAN 3.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

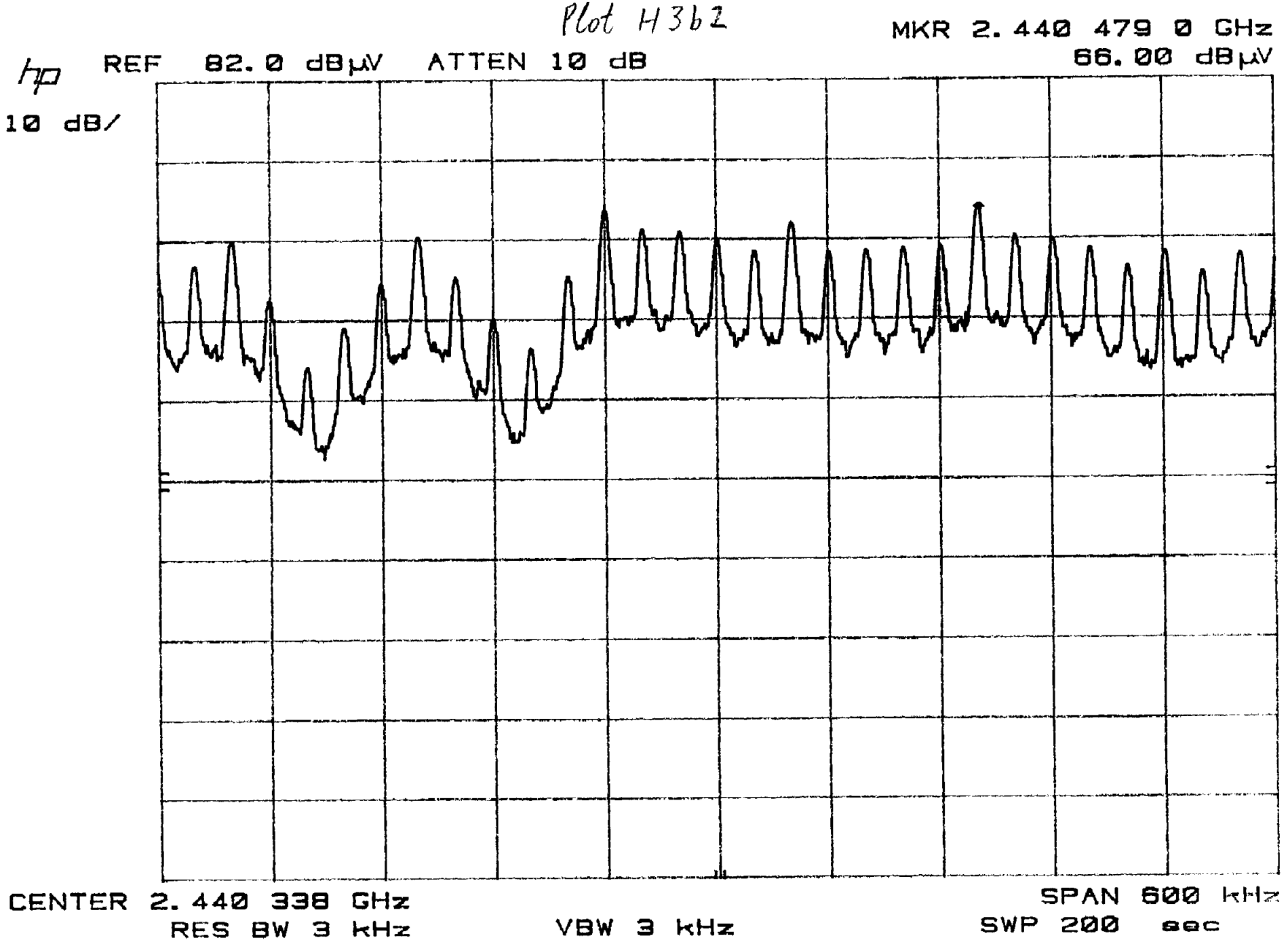
Plot H3a 2


MKR 2.405 077 8 GHz
66.00 dBµV
hp REF 92.0 dBµV ATTEN 10 dB
10 dB/
CENTER 2.405 066 GHz
RES BW 3 kHz
VBW 3 kHz
SPAN 601 kHz
SWP 200 sec

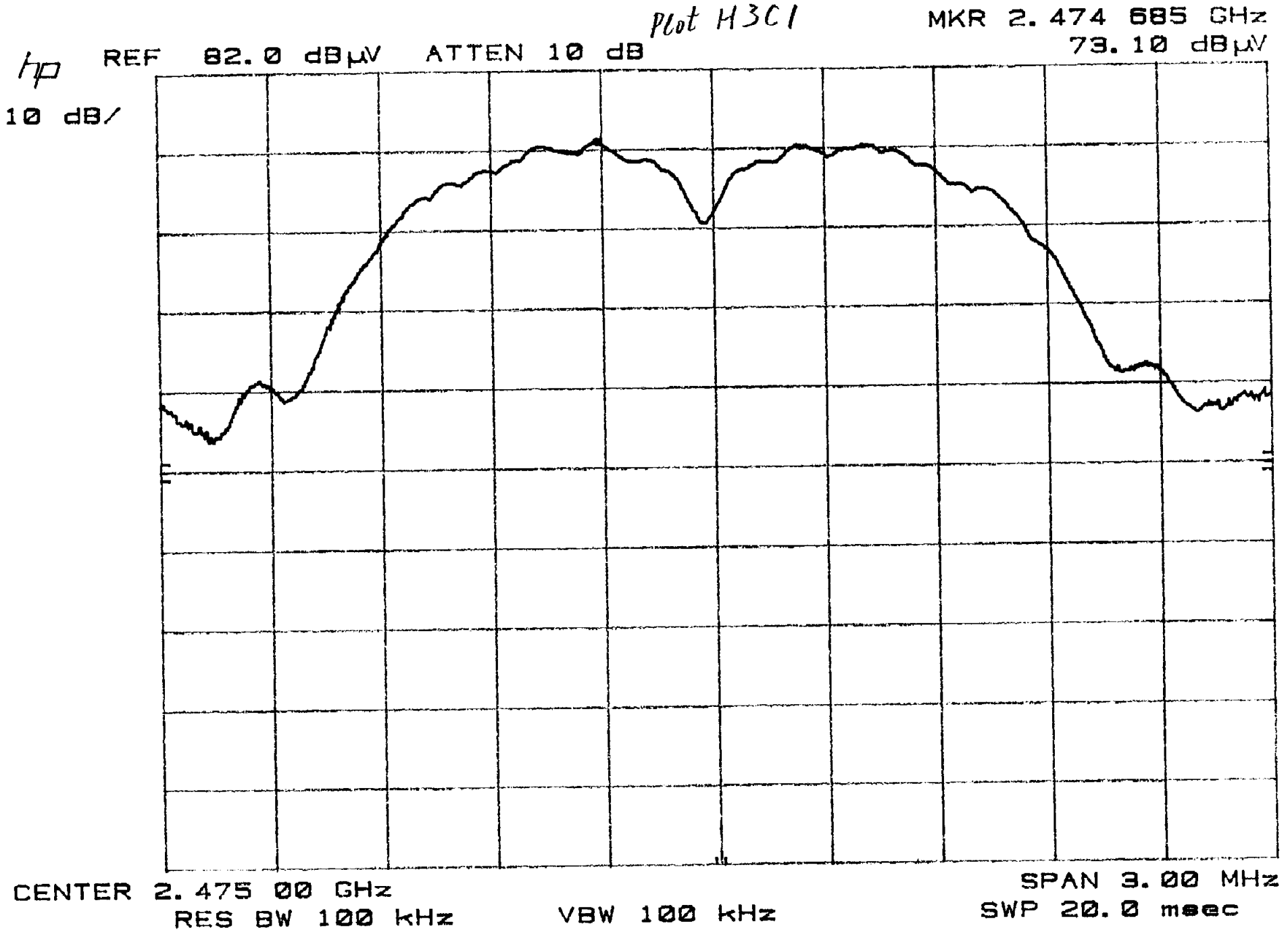
Plot H361

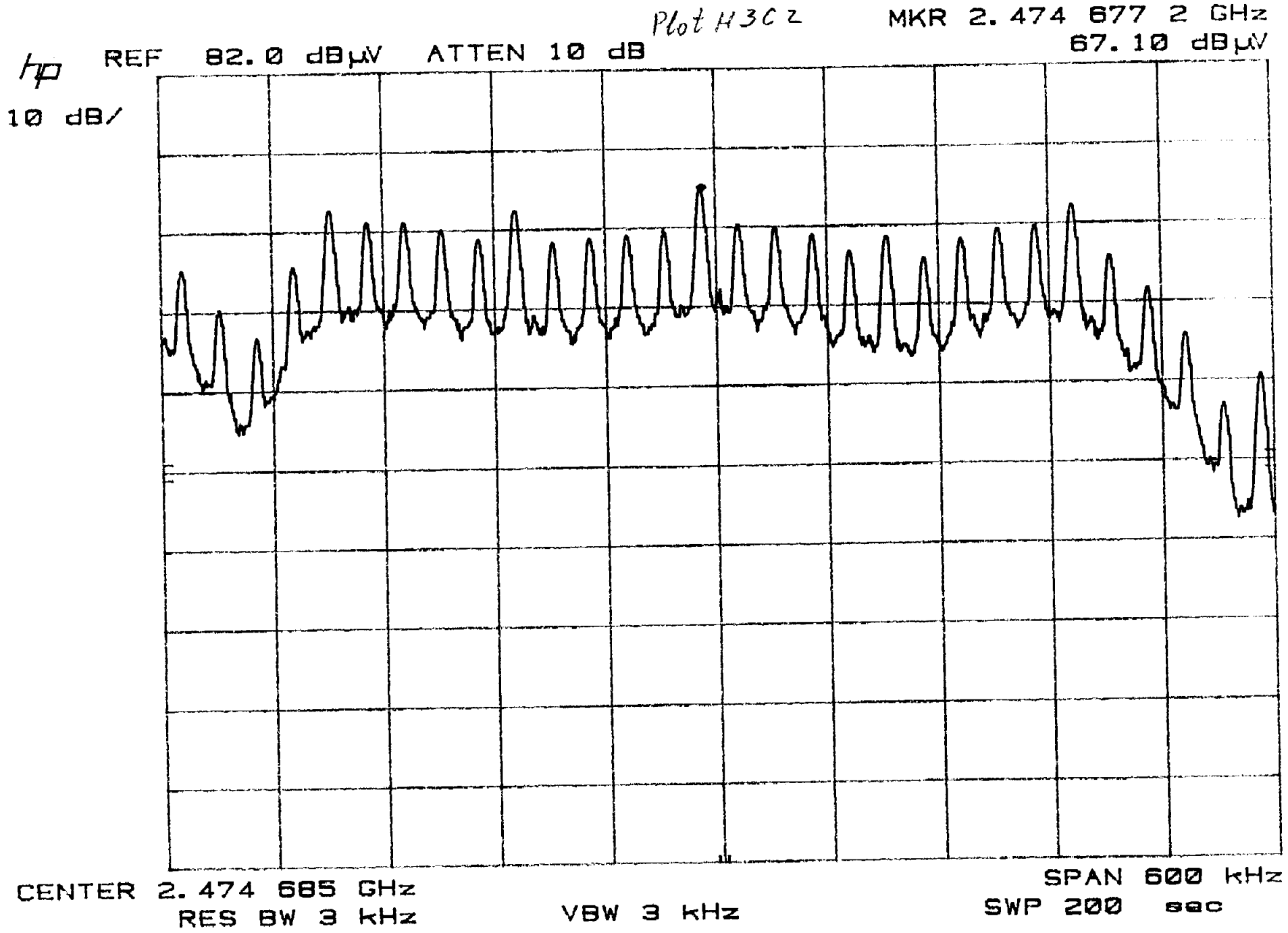

hp
REF 82.0 dBµV
ATTEN 10 dB
MKR 2.440 338 GHz
71.90 dBµV
10 dB/
CENTER 2.440 77 GHz
SPAN 3.00 MHz
RES BW 100 kHz
VBW 100 kHz
SWP 20.0 msec

Plot H3b2


MKR 2.440 479 0 GHz
66.00 dBµV
hp REF 82.0 dBµV ATTEN 10 dB
10 dB/
CENTER 2.440 338 GHz
RES BW 3 kHz
VBW 3 kHz
SPAN 600 kHz
SWP 200 sec

plot H3C1


MKR 2.474 685 GHz
73.10 dBµV
hp REF 82.0 dBµV ATTEN 10 dB
10 dB/
CENTER 2.475 00 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 3.00 MHz
SWP 20.0 msec


Plot H3C 2
MKR 2.474 677 2 GHz
67.10 dBµV
REF 82.0 dBµV
ATTEN 10 dB
10 dB/
CENTER 2.474 685 GHz
RES BW 3 kHz
VBW 3 kHz
SPAN 600 kHz
SWP 200 sec