EMC Testing Laboratories, Inc.

RF Emissions Test Report
To Determine Compliance With:
FCC, Part 15.249
Rules and Regulations

Model number: DSR-750b

Date: January 23, 2013

Manufacturer: Smart Wire Grid, Inc.
1300 Clay Street, Ste 840
Oakland, CA 94612-1428

Contents Section

Section 1

GENERAL INFORMATION

Manufacturer:	Smart Wire Grid, Inc. 1300 Clay Street, Ste 840 Oakland, CA 94612
Manufacturer representative:	**Ms. Julie Couillard**
Equipment covered by this report:	Model no. DSR-750b
Equipment serial number:	1231A001
Options covered by this report:	None
Transmitting Frequency:	902 - 928 MHz
Test specifications:	To determine compliance with: FCC, Part 15.249, Subpart B and C, Rules and Regulations, Class B.
Test report number:	12-215A
FCC ID	QPS01001
Test commenced:	November 27, 2012
Test completed:	February 22, 2013
Test engineer:	**Glenn Barnes**

Test Facility: The test facility used to perform these tests is on file with the FCC under registration number 637500 and IC no. 3519A and located at:

EMC Testing Laboratories, Inc.
2100 Brandon Trail
Suite 101
Alpharetta, GA 30004
770-475-8819

Section 2

PRODUCT DESCRIPTION AND TEST SUMMARY

Product description:
The product is an industrial device that is designed to be hanged on the high-voltage transmission lines. The device contains microcontroller and two identical 0.5W 915MHz ISM band transceiver. The unit starts RF transmission automatically when powered up and has no operator controls.

Normally, the device is powered by the transmission line current – up to 1000A, but for testing purpose it will be equipped with a rechargeable battery placed inside the unit.

The two low-gain, cavity-backed slot antennas are located at the ends of the device. Each antenna is connected to its own transceiver. As the transceivers and the antennas are equal and are not intended to be transmitting at the same time, testing just one channel should be sufficient.

The integral antenna is a cavity-backed slot antenna.

The test results apply only to the products identified on this test report.

Test program: The product was tested in accordance with 15.249. This product is exempt from the 15.209 Radiated emissions tests in accordance with paragraph 15.103 b and c.

Test configuration:
The equipment under test (EUT) was set-up and configured as specified by the manufacturer as follows:

1- The product was connected to the following support peripherals:

A. Laptop to program output frequency.

2- The product utilized the following cables and were connected as indicated below:

A- None

Modifications:
The following modifications were required to comply with the radiated emission limits:

1- None

Product Description and Test Summary …

Engineering Statement:
All measurement data of this test report was taken in accordance with the FCC, Part 15.249, Class B Rules and Regulations and ANSI C63.4 (09) by EMC Testing Laboratories, Inc. located in Alpharetta, Georgia. Although this data is taken under stringent laboratory conditions and to the best of our knowledge, represents accurate data, it must be recognized that emissions from or immunity to this type equipment may be greatly affected by the final installation of the equipment. Therefore, EMC Testing Laboratories, Inc., while supporting the accuracy of the data in this report, takes no responsibility for use of equipment based on these tests. The manufacturer of this equipment must take full responsibility for any field problems which may arise, and agrees that EMC Testing Laboratories, Inc., in performing its functions in accordance with its objectives and purposes, does not assume or undertake to discharge any responsibility of the manufacturer to any other party or parties.

Conclusion:
With the above-indicated modifications, the product covered by this report has been tested and found to comply with the above-indicated standards.

Tested by: **Glenn Barnes, RF Engineer**

Approved by: *Gene Bailey*
Gene Bailey, Engineering Manager
EMC Test Laboratories, Inc.

Section 3

STANDARD REFERENCE

The following primary standards were used for this test:

1- **ANSI C63.4 (09):** Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9 KHz to 40 GHz.

2- **US Code of Federal Regulations (CFR):** Title 47, Part 15, Radio Frequency Devices, Subpart B, Intentional Radiators.

Note: Applicable amendments were applied to all standards.

Section 4

TEST METHOD

INTRODUCTION:

The product covered by this report were subjected to electromagnetic interference emissions measurements to determine compliance with the FCC, Part 15.249 requirements.

Radiated and conducted emissions were measured in accordance with the Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz, ANSI C63.4.

MEASUREMENT CALCULATIONS:

Radiated Emissions:

For radiated emissions measurements, the signal attenuation due to impedance losses in the antenna and signal cable were significant and was added to the spectrum analyzer reading to give corrected signal strength reading. If a preamplifier was used, the signal gain was subtracted from the signal strength reading. Radiated emissions data was specified as decibels above 1 microvolt per meter (dBμV/m) of radiated field strength.

Radiated emissions (dBμV) = Analyzer reading (dBμV) plus
antenna factor (dB) plus cable factor (dB) minus Amplifier gain (dB)

Conducted Emissions:

For conducted emissions, the signal attenuation due to impedance losses in the LISN and signal cables was negligible and assumed to be 0dB. The conducted emissions were directly equal to the spectrum analyzer reading. Conducted emissions data was specified as decibels above 1 microvolt (dBμV) of conducted line voltage.

Conducted emissions (dBμV) = Analyzer reading (dBμV)

Test Method cont…

RADIATED EMISSIONS MEASUREMENT:

Radiated emissions measurements were performed at an open field test site. The receiving antenna was positioned 3 meters from the equipment under test along the center axis of the test site. Measurements were made with broadband antennas and if necessary, detected emissions were verified with dipole antennas. The dipole antenna was manually tuned to the signal frequency by adjusting the length of the antenna elements. The radiated emissions were measured for both the horizontal and vertical signal planes by rotating the antennas. Additionally, the EUT was rotated by the turntable and the antenna height was raised and lowered 1 to 4 meters to locate the maximum emission strength at each frequency.

The radiated emissions were measured over the frequency span of 26 MHz to 24.04 GHz. The following antennas were used to measure the radiated emissions within the specified frequency spans.

CONDUCTED EMISSIONS MEASUREMENT:

Conducted emissions measurements were performed on a ground plane that was electrically bonded to earth ground. The equipment under test was positioned 0.8 meter above the ground plane and 0.8 meter minimum from the LISN that was positioned on the ground plane. The LISN housings were electrically bonded to the ground plane. The conducted emissions for both the ungrounded supply conductor (L1) and the grounded conductor (L2) of the power supply cord were measured. The conducted emissions were measured over the frequency span of 0.15 to 30 MHz. The measurements were conducted in the quasi-peak and average detector modes.

INSTRUMENTATION:

Radiated and conducted signal strength measurements were taken with a spectrum analyzer. Radiated emissions were measured with broadband and tuned dipole antennas. Conducted emissions were measured with a 50 UH line impedance stabilization network (LISN).

Test Method cont…

DETECTOR FUNCTION:

Unless otherwise indicated in this report, all measurements were taken using a peak hold signal detector function. In this mode, the spectrum analyzer makes continuous scans across the frequency band and stores the highest emission value detected at each frequency for all scans. The peak hold integration will detect transient or low duty cycle emissions peak, which might be missed on single scan measurement. The emission value at each frequency was a true value.

SPECTRUM ANALYZER SETTING:

For all measurements, the spectrum analyzer was set for 10 dB input attenuation, 10 dB/Division vertical scale and 90 or 100 dBµV reference level. The resolution bandwidth was set at 9 KHz for the 0.15 - 30 MHz span and at 120 KHz for 30 – 9.200 GHz span. The video bandwidth and sweep rate were automatically coupled by the analyzer.

RADIATED EMISSIONS MEASUREMENTS

Model numbers: DSR-750b **Test Date:** February 22, 2013

Frequency: < 1 GHz

Frequency, MHz	**Measurement Reading, dBµV/m**	**Corrected Reading, dBµV/m**	**FCC Limit, dBµV/m**	**Minimum Margin, dBµV/m**
Vertical				
There were no radiated emissions from the EUT within 15dB of the limits.				

***** - Measurement in the QP detection mode
****** - Limit for the average detection mode

HARMONICS MEASUREMENTS

Model numbers: DSR-750b **Test Date:** February 22, 2013

Transmit frequency: 902MHz Test distance: 1 meter

Frequency, GHz	Measurement Reading, dBµV/m	Corrected Reading, dBµV/m	FCC Limit, dBµV/m	Minimum Margin, dBµV/m
Vertical				
1.804- V	63.99	51.89	54.0	-2.11
2.706- V	59.33	51.13	54.0	-2.87
3.608- V	46.15	41.05	54.0	-12.95
1.804- H	58.02	45.92	54.0	-8.08
2.706- H	50.24	42.04	54.0	-11.96

Transmit frequency: 915MHz Test distance: 1 meter

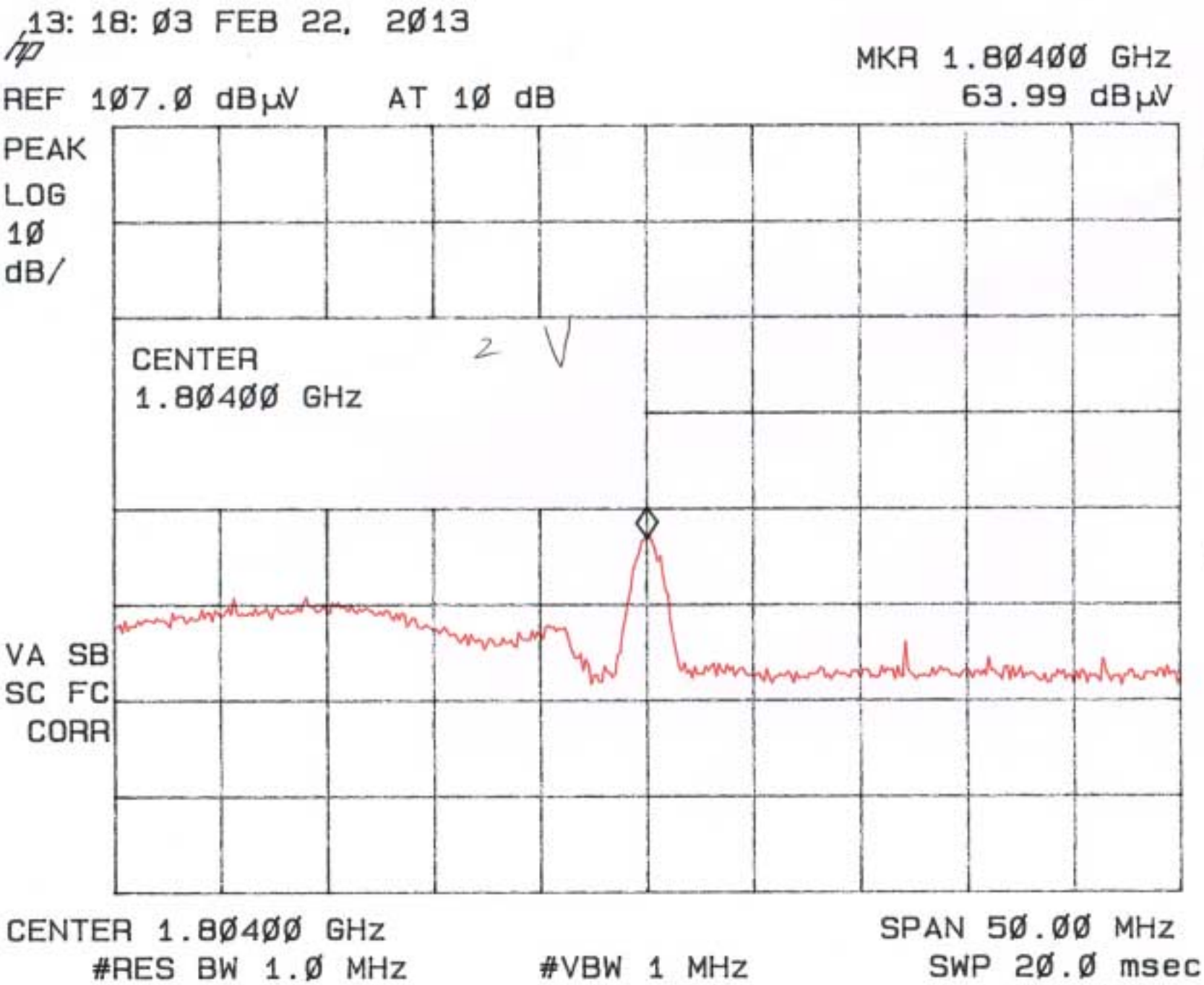
Frequency, GHz	Measurement Reading, dBµV/m	Corrected Reading, dBµV/m	FCC Limit, dBµV/m	Minimum Margin, dBµV/m
Vertical				
1.830- V	61.91	49.81	54.0	-2.11
2.745- V	55.79	47.59	54.0	-2.87
1.830- H	61.41	49.31	54.0	-4.69
2.705- H	55.56	47.36	54.0	-8.08

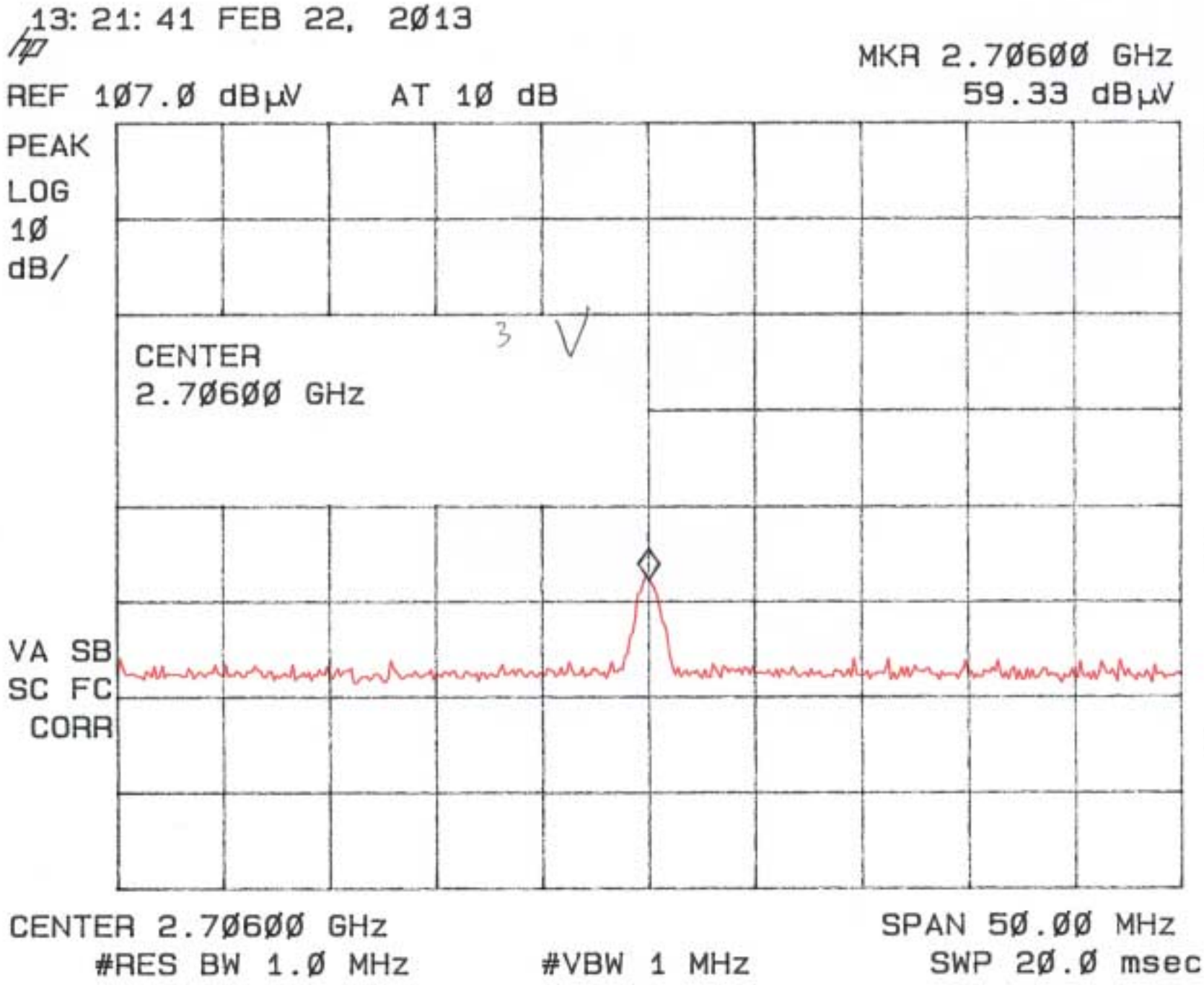
Harmonics Measurements Cont…

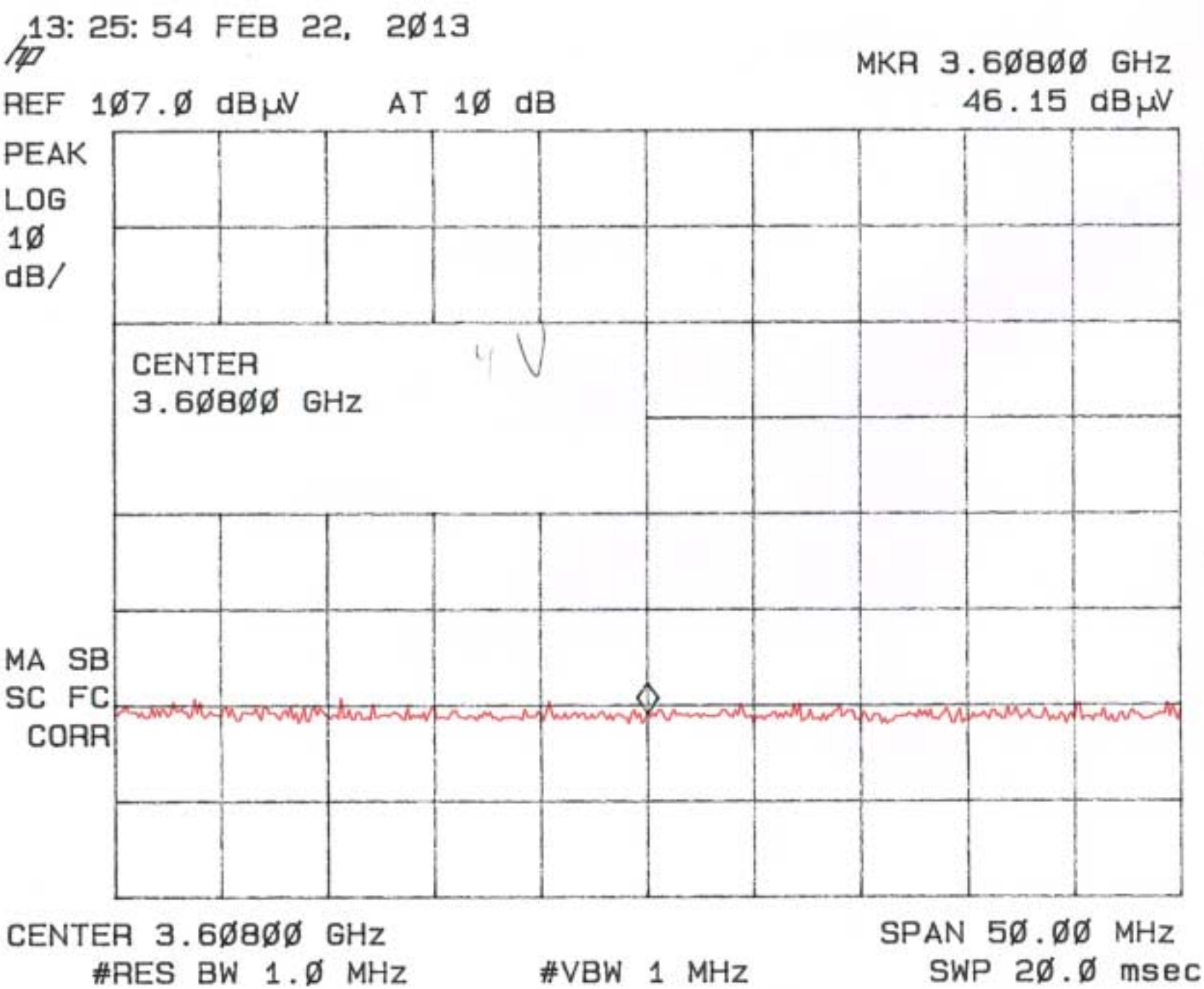
Model numbers: DSR-750b **Test Date:** February 22, 2013

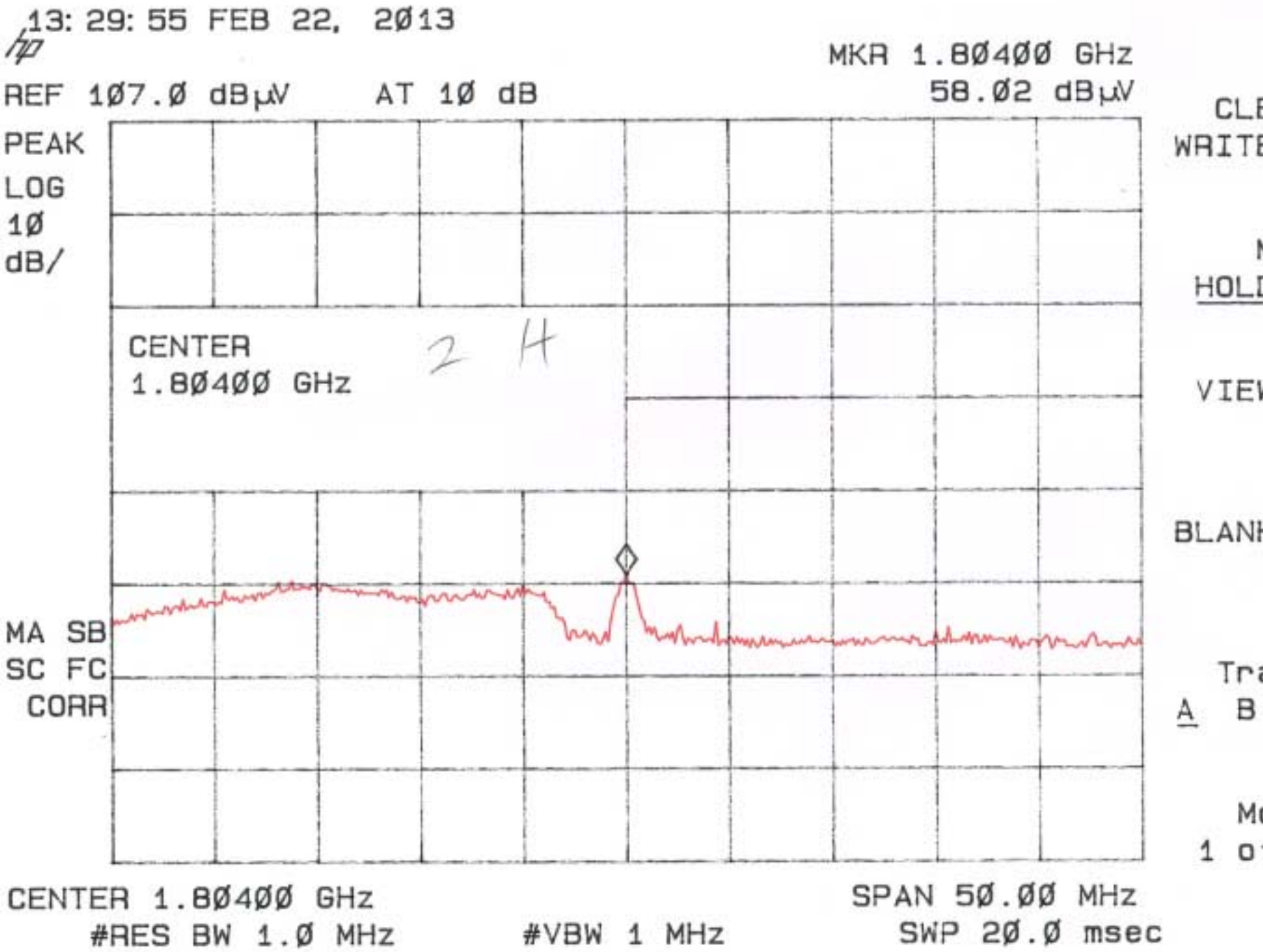
Transmit frequency: 928MHz Test distance: 1 meter

Frequency, GHz	Measurement Reading, dBµV/m	Corrected Reading, dBµV/m	FCC Limit, dBµV/m	Minimum Margin, dBµV/m
Vertical				
1.856- V	56.86	46.16	54.0	-7.84
1.856- H	57.97	46.27	54.0	-7.73


13: 18: Ø3 FEB 22, 2Ø13
MKR 1.8Ø4ØØ GHz
REF 1Ø7.Ø dBµV
AT 1Ø dB
63.99 dBµV
PEAK
LOG
1Ø
dB/
CENTER
1.8Ø4ØØ GHz
VA SB
SC FC
CORR
CENTER 1.8Ø4ØØ GHz
#RES BW 1.Ø MHz
#VBW 1 MHz
SPAN 5Ø.ØØ MHz
SWP 2Ø.Ø msec


13: 21: 41 FEB 22, 2013
MKR 2.7060Ø GHz
REF 107.Ø dBµV
AT 1Ø dB
59.33 dBµV
PEAK
LOG
1Ø
dB/
3
CENTER
2.7060Ø GHz
VA SB
SC FC
CORR
CENTER 2.7060Ø GHz
#RES BW 1.Ø MHz
#VBW 1 MHz
SPAN 5Ø.ØØ MHz
SWP 2Ø.Ø msec


13: 25: 54 FEB 22, 2013
MKR 3.6Ø8ØØ GHz
REF 1Ø7.Ø dBµV
AT 1Ø dB
46.15 dBµV
PEAK
LOG
1Ø
dB/
CENTER
3.6Ø8ØØ GHz
MA SB
SC FC
CORR
CENTER 3.6Ø8ØØ GHz
#RES BW 1.Ø MHz
#VBW 1 MHz
SPAN 5Ø.ØØ MHz
SWP 2Ø.Ø msec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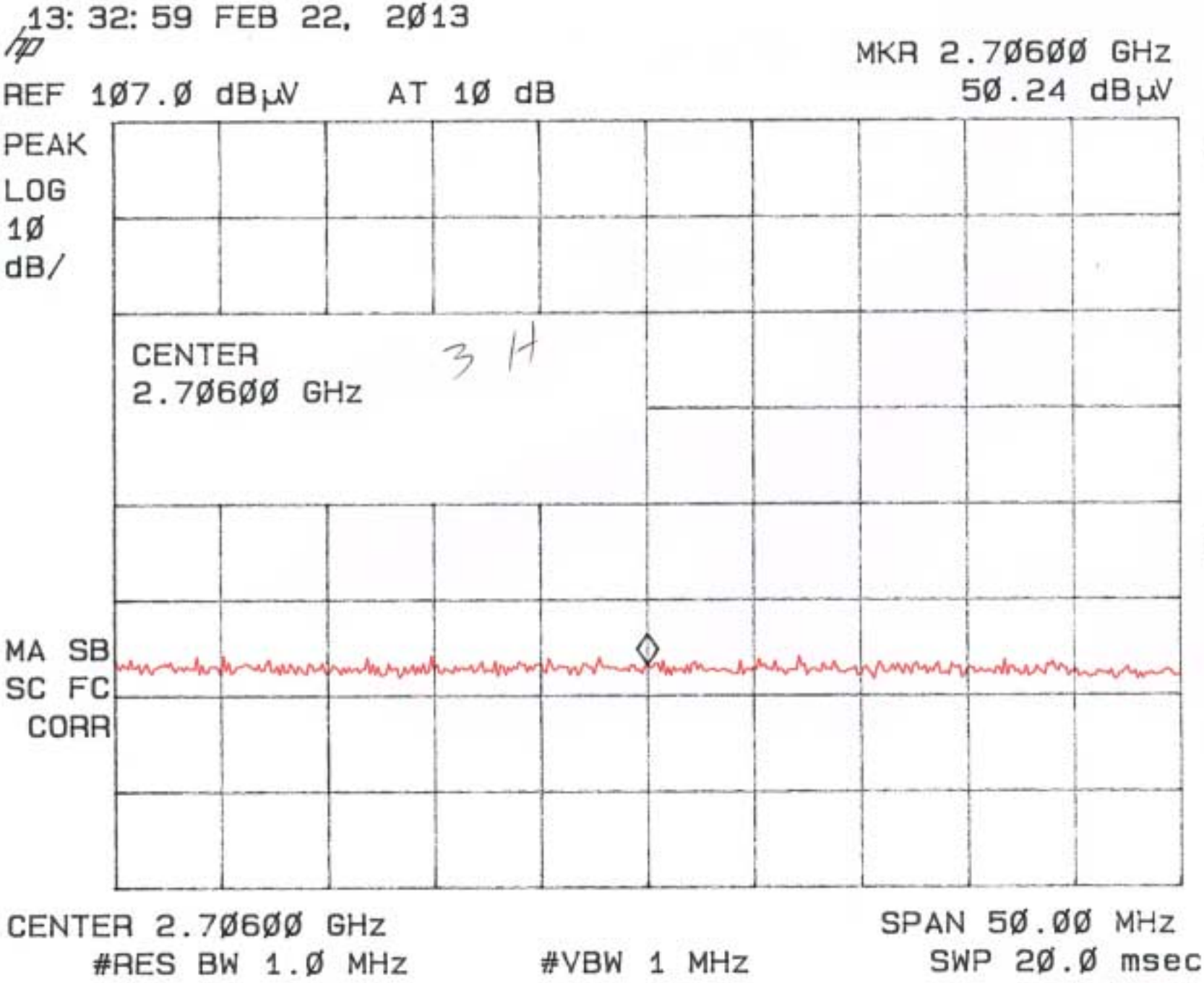
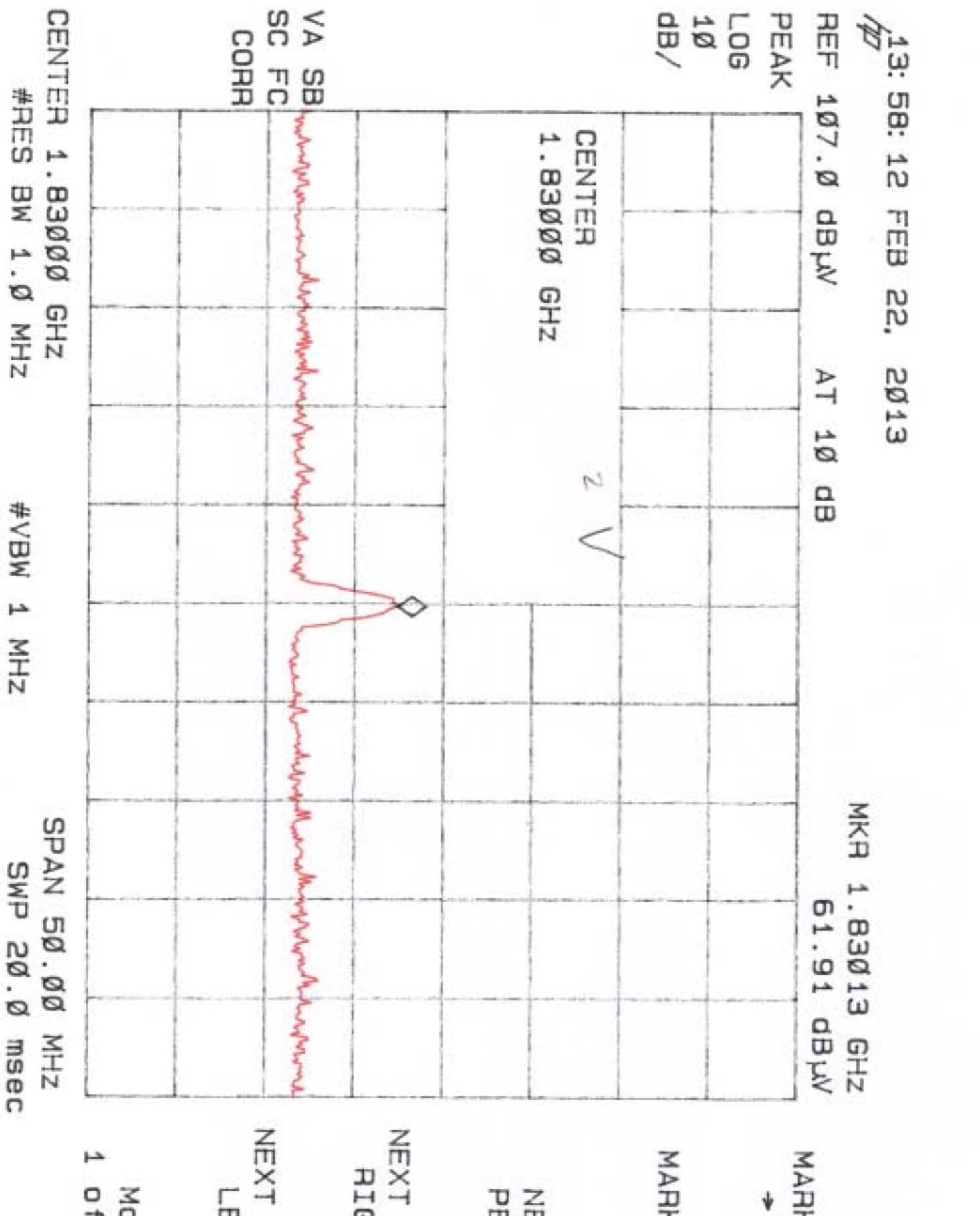
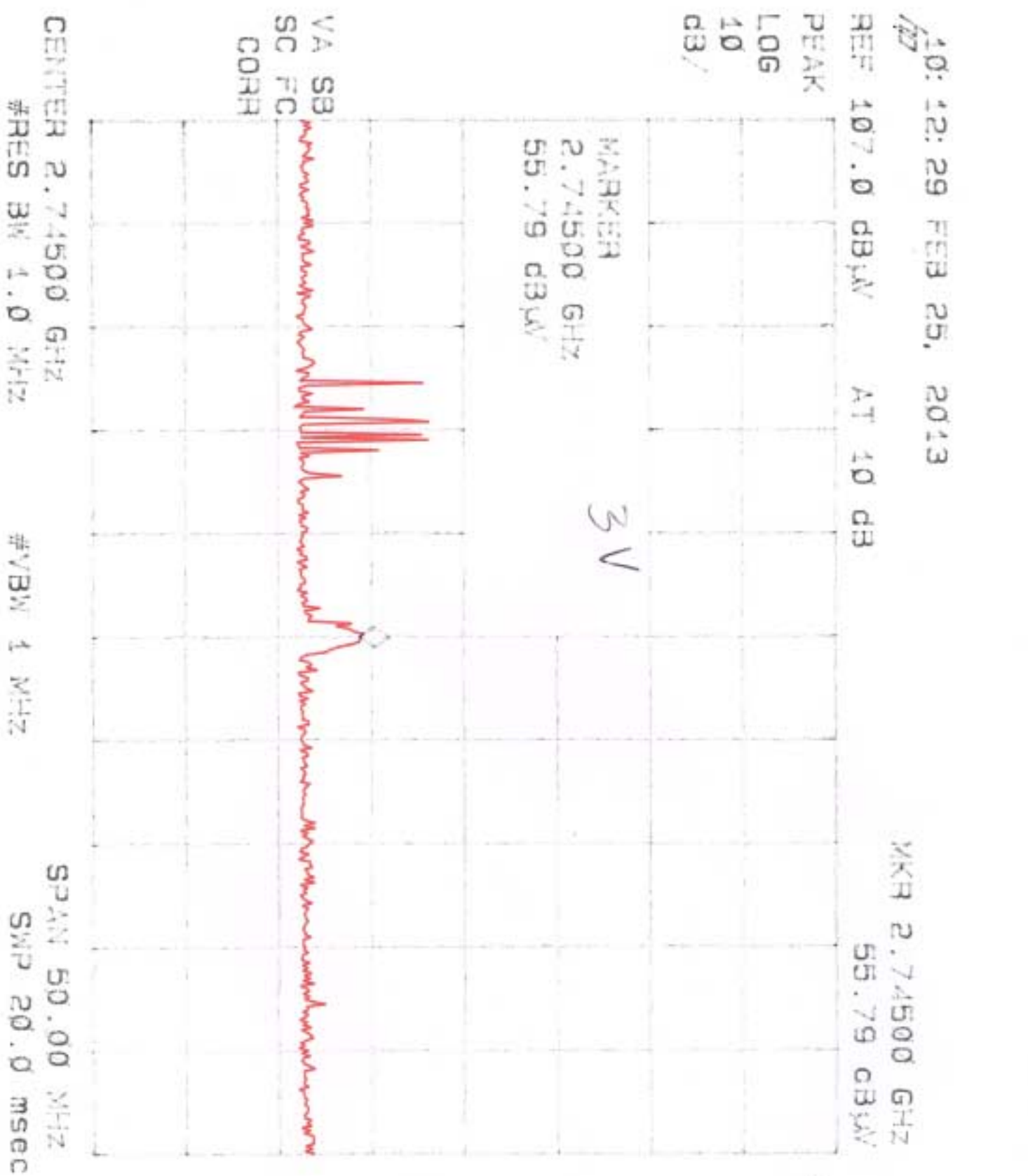
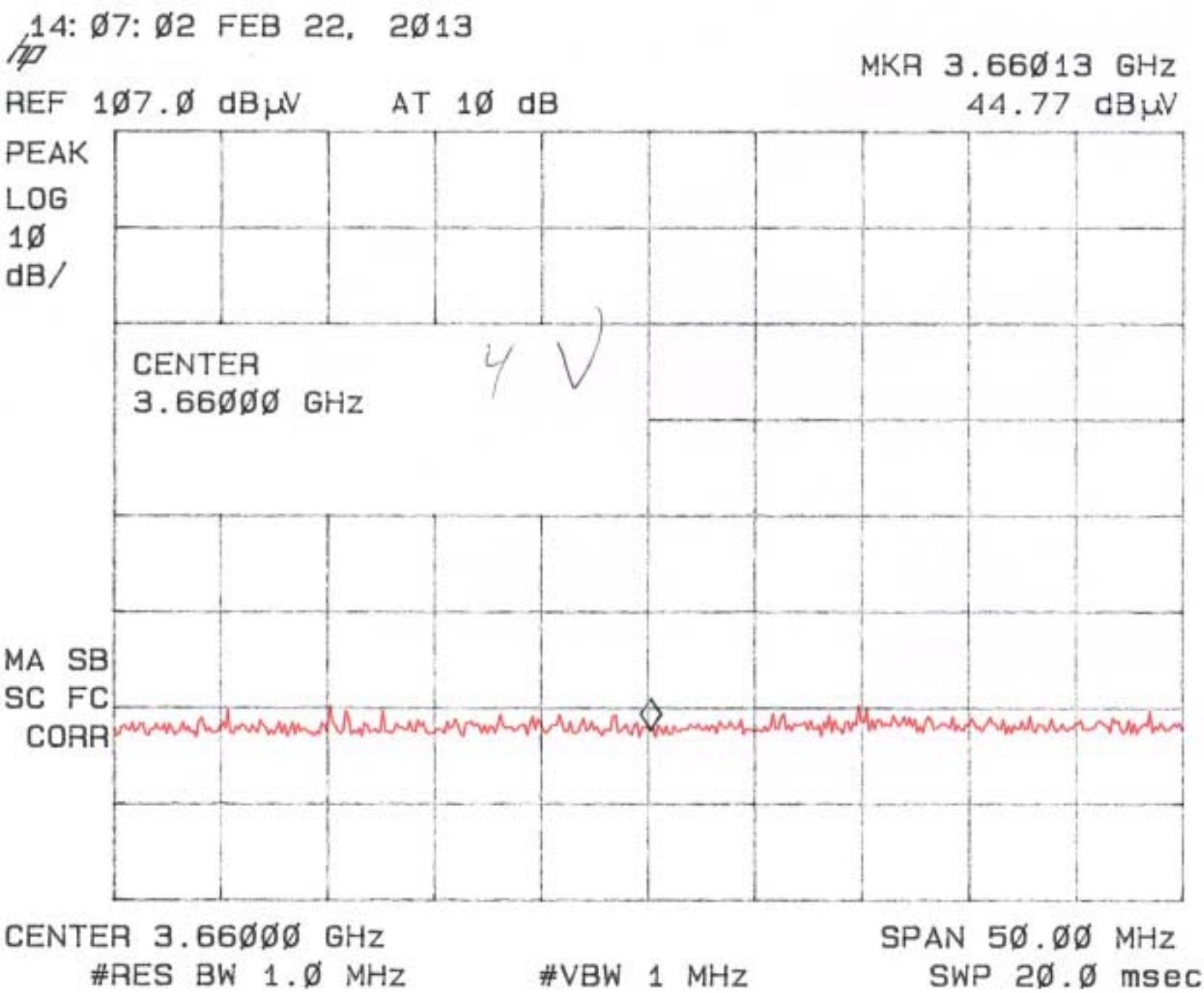
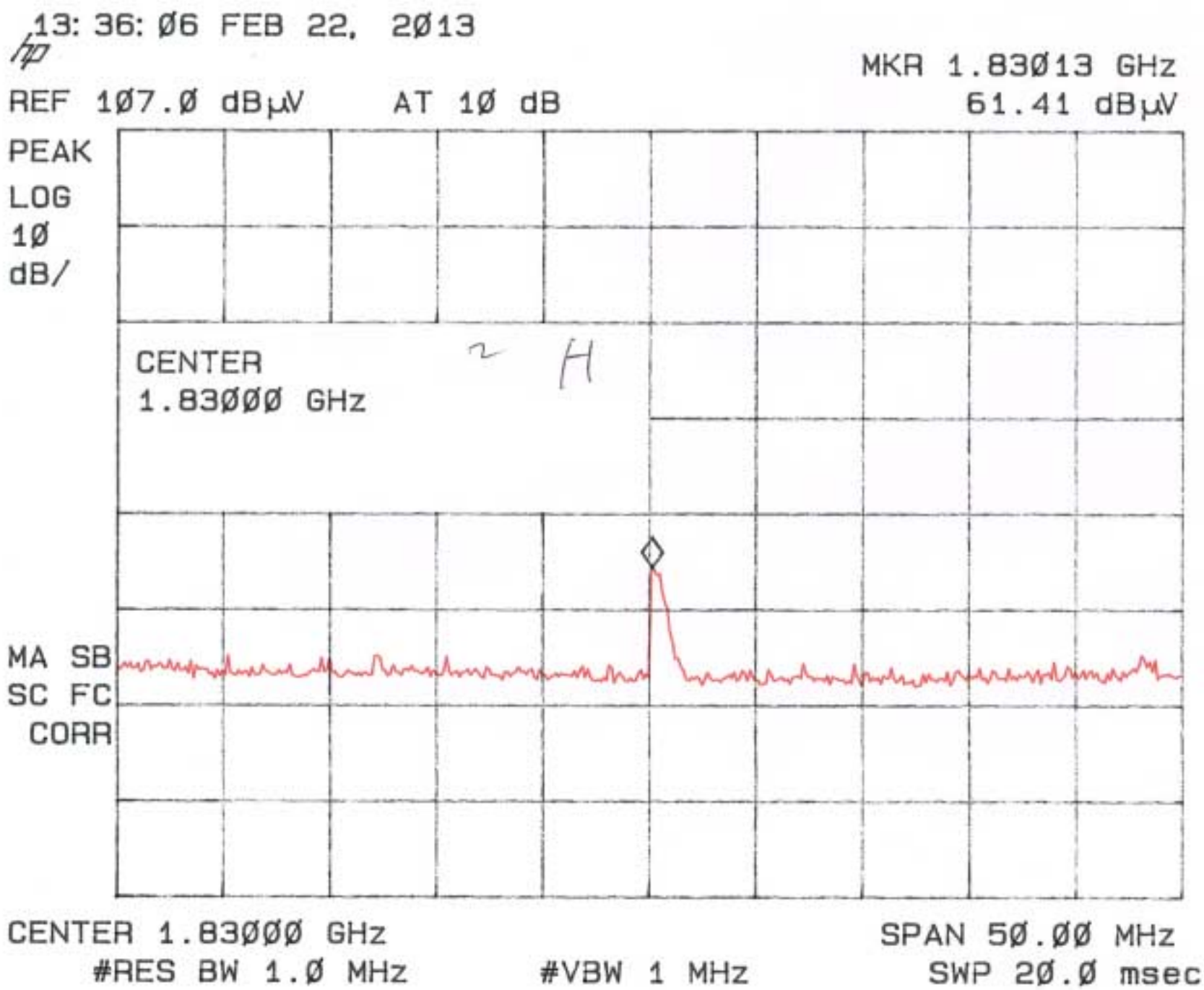
MKR 1.8Ø4ØØ GHz
58.Ø2 dBµV
REF 1Ø7.Ø dBµV
AT 1Ø dB
PEAK
LOG
1Ø
dB/
CENTER
1.8Ø4ØØ GHz
2 H
MA SB
SC FC
CORR
CENTER 1.8Ø4ØØ GHz
#RES BW 1.Ø MHz
#VBW 1 MHz
SPAN 5Ø.ØØ MHz
SWP 2Ø.Ø msec

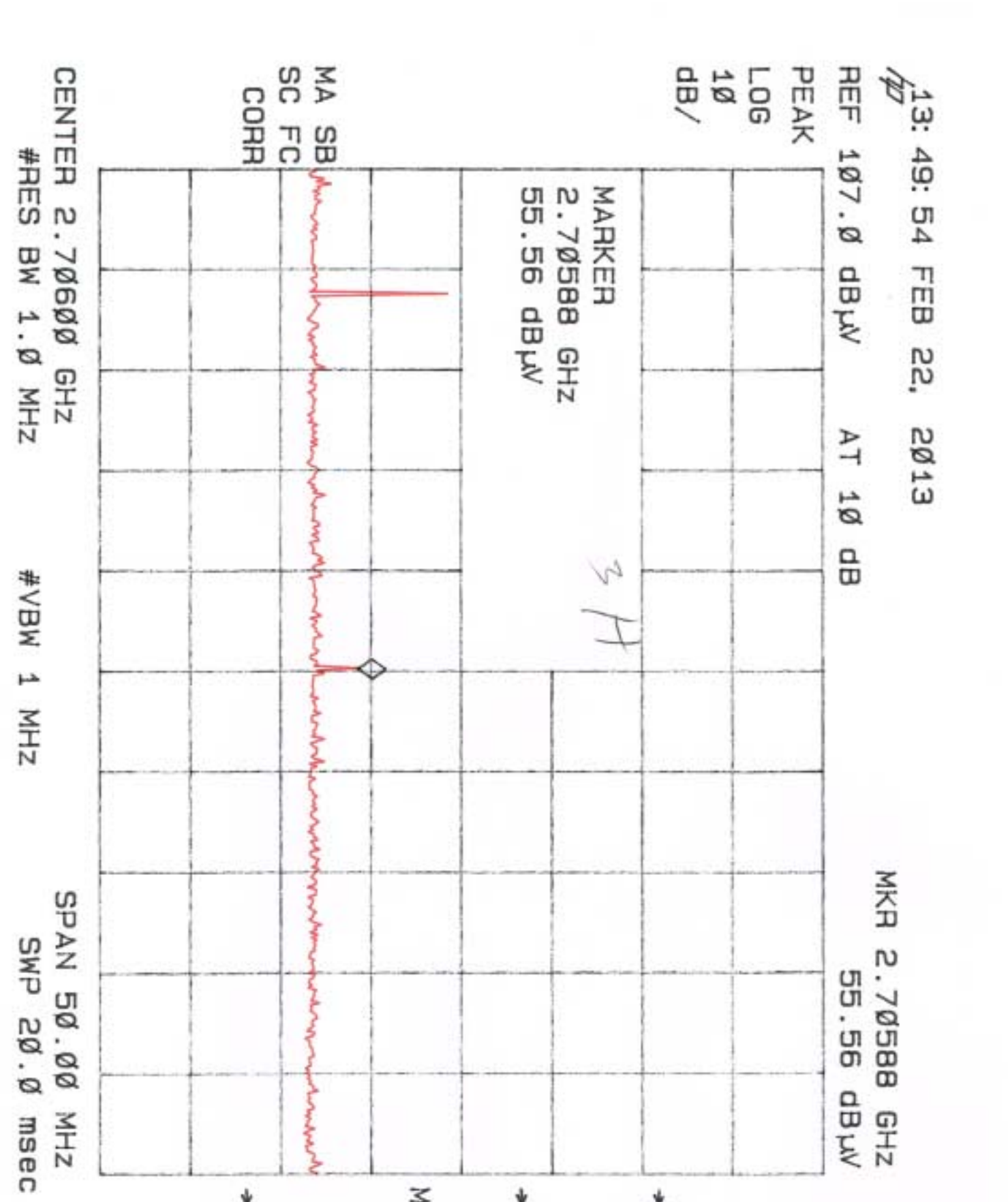

13: 32: 59 FEB 22, 2013
MKR 2.7060Ø GHz
REF 107.Ø dBµV
AT 10 dB
50.24 dBµV
PEAK
LOG
10
dB/
CENTER
2.7060Ø GHz
3 H
MA SB
SC FC
CORR
CENTER 2.7060Ø GHz
#RES BW 1.Ø MHz
#VBW 1 MHz
SPAN 50.ØØ MHz
SWP 20.Ø msec

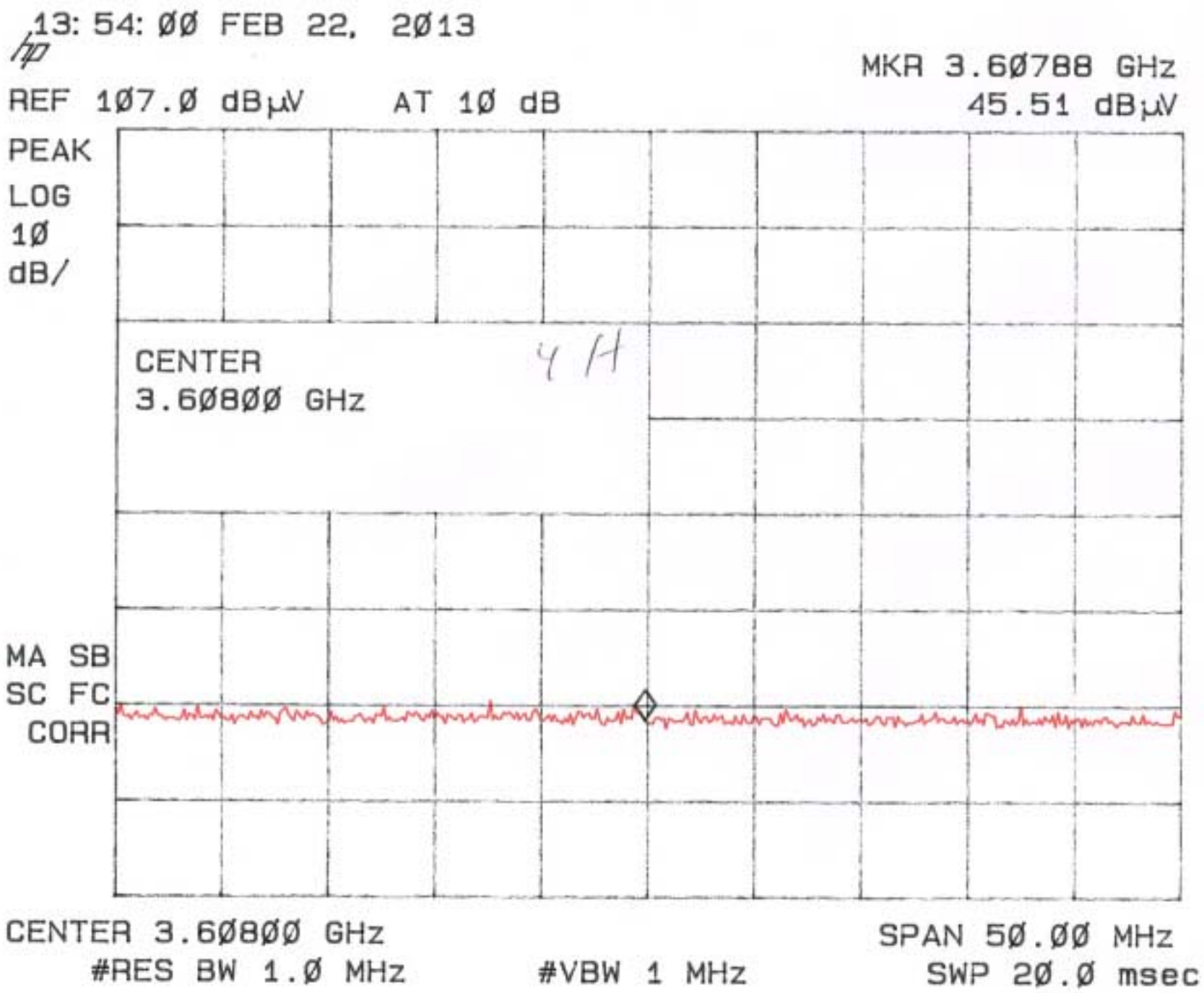

13: 58: 12 FEB 22, 2013
REF 107.0 dBµV
AT 10 dB
PEAK
LOG
10
dB/
CENTER
1.830000 GHz
VA SB
SC FC
CORR
MKR 1.83013 GHz
61.91 dBµV
CENTER 1.830000 GHz
#RES BW 1.0 MHz
#VBW 1 MHz
SPAN 50.00 MHz
SWP 20.0 msec

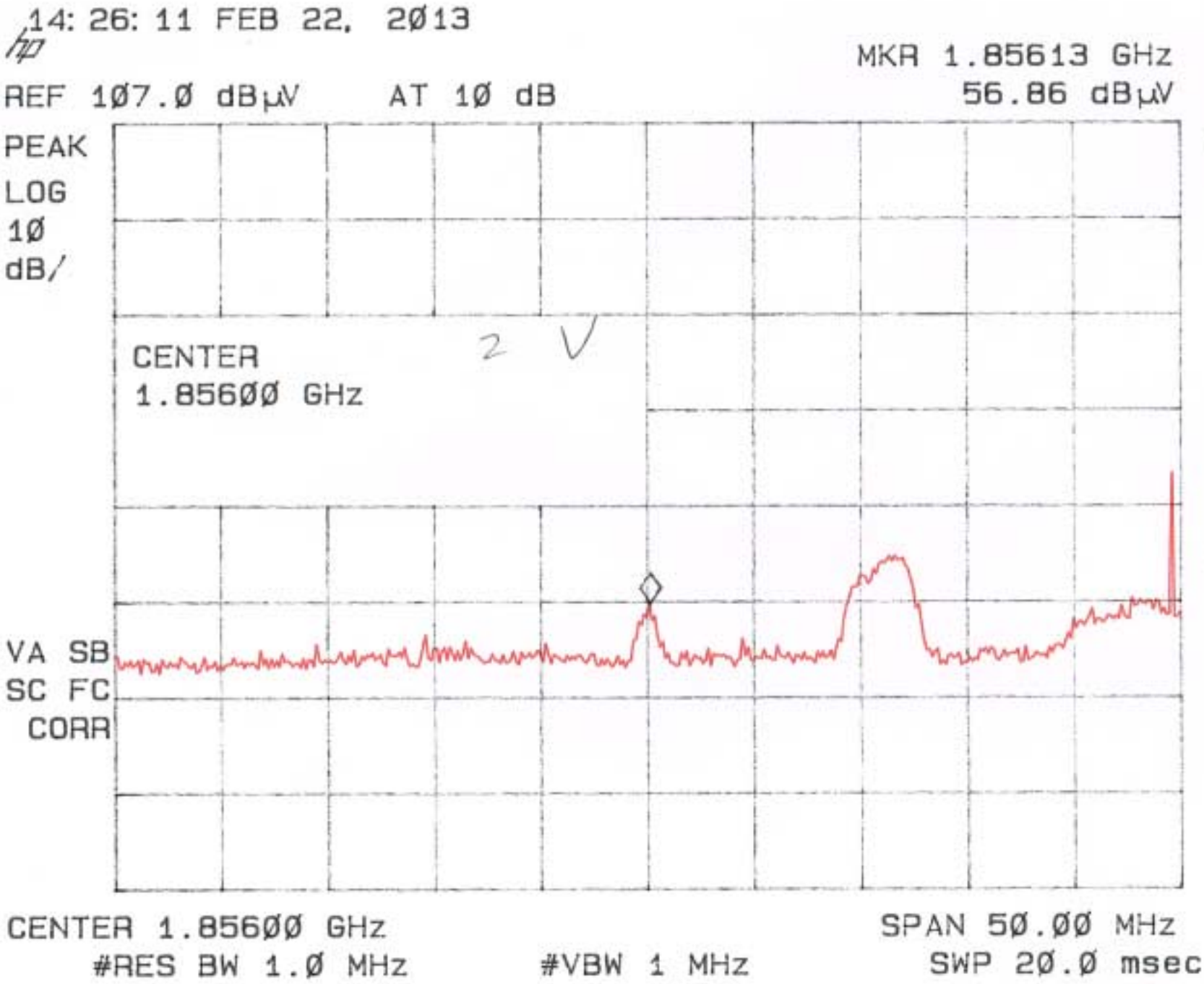

10: 12: 29 FEB 25, 2013
REF 107.0 dBµV
AT 10 dB
PEAK
LOG
10
dB/
MARKER
2.74500 GHz
55.79 dBµV
3V
MKR 2.74500 GHz
55.79 dBµV
VA SB
SC FC
CORR
CENTER 2.74500 GHz
#RES BW 1.0 MHz
#VBW 1 MHz
SPAN 50.00 MHz
SWP 20.0 msec

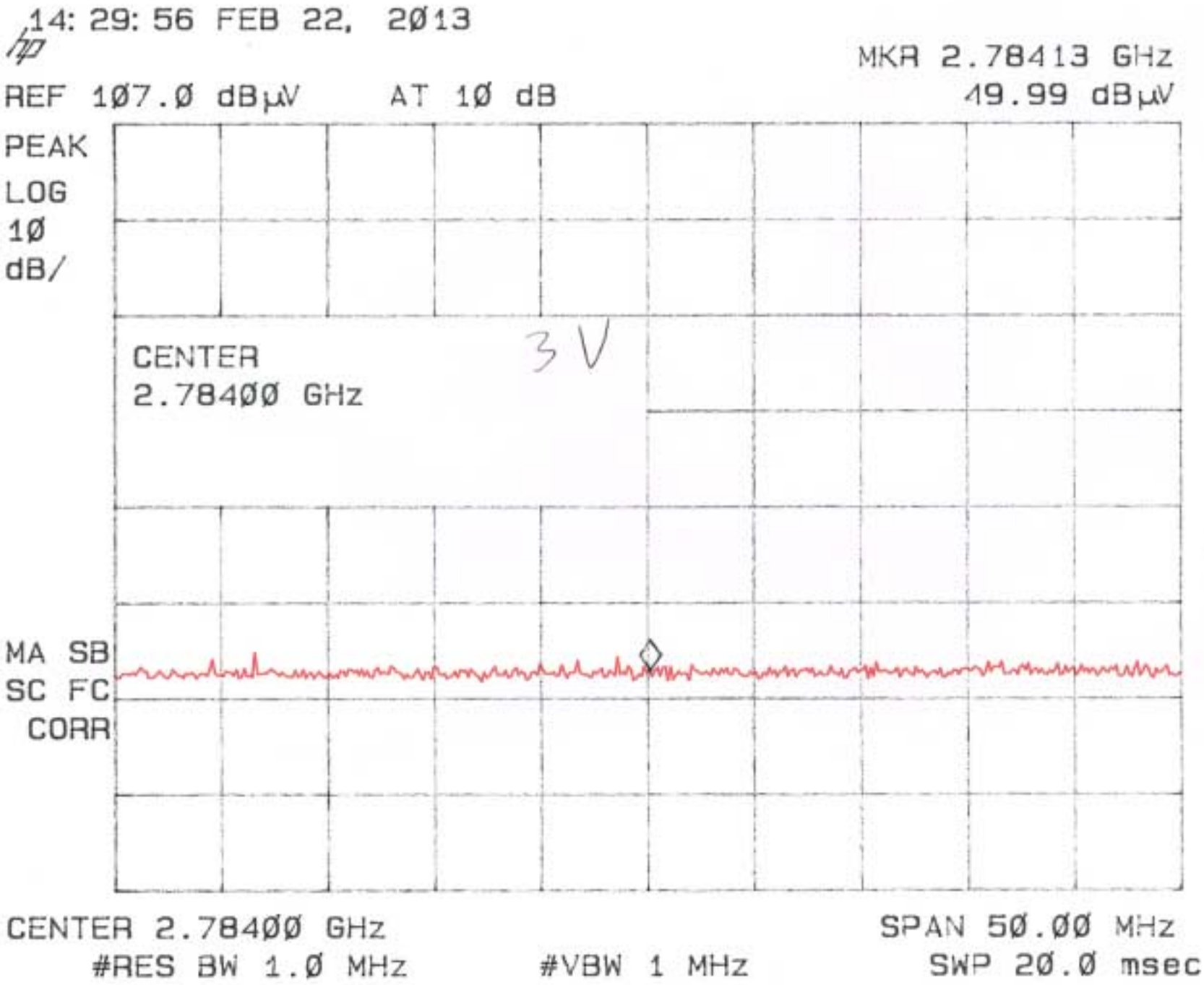

14: Ø7: Ø2 FEB 22, 2Ø13
MKR 3.66Ø13 GHz
REF 1Ø7.Ø dBµV
AT 1Ø dB
44.77 dBµV
PEAK
LOG
1Ø
dB/
CENTER
3.66ØØØ GHz
4 V
MA SB
SC FC
CORR
CENTER 3.66ØØØ GHz
#RES BW 1.Ø MHz
#VBW 1 MHz
SPAN 5Ø.ØØ MHz
SWP 2Ø.Ø msec

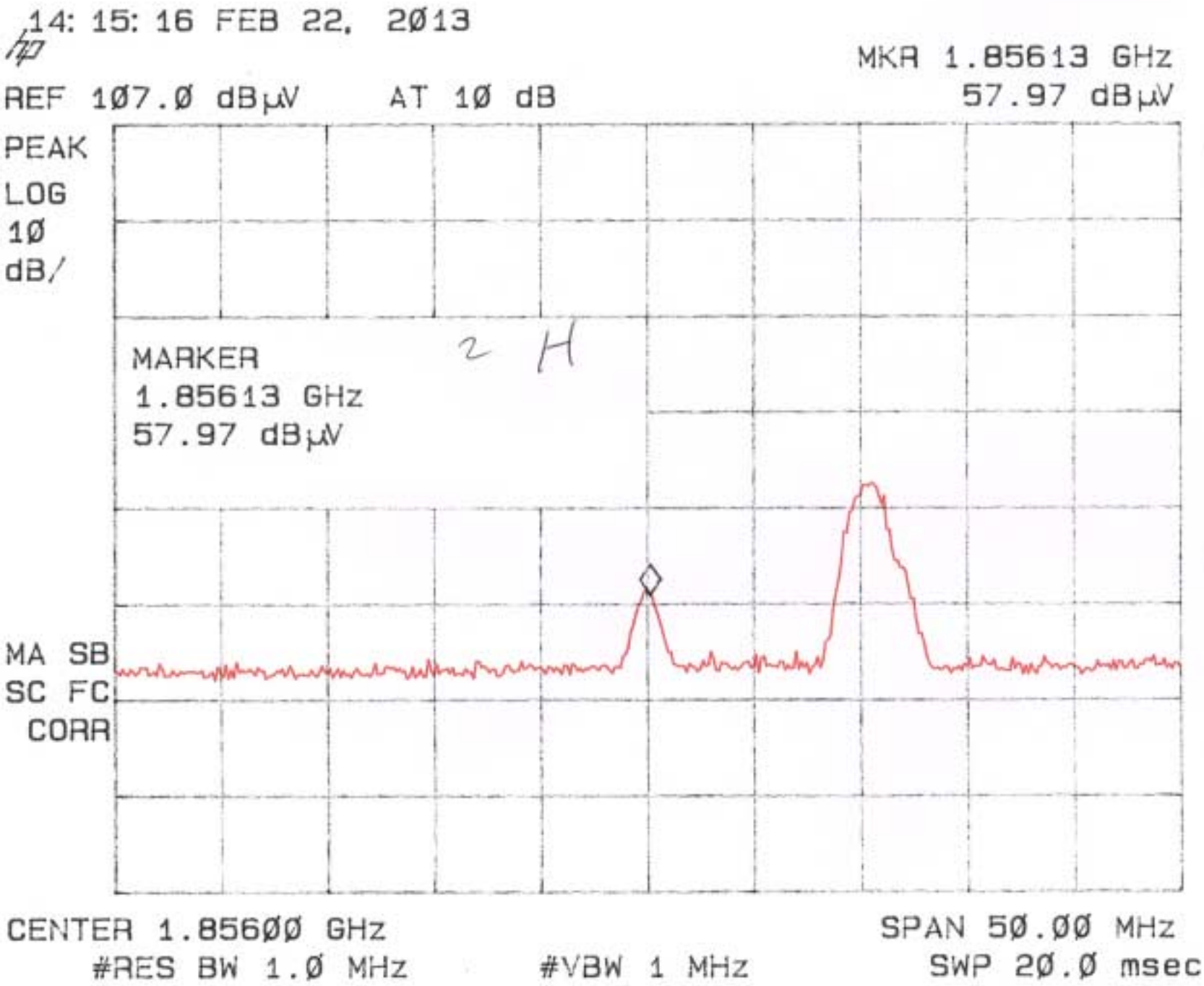

13: 36: Ø6 FEB 22, 2Ø13
MKR 1.83Ø13 GHz
REF 1Ø7.Ø dBµV
AT 1Ø dB
61.41 dBµV
PEAK
LOG
1Ø
dB/
CENTER
1.83ØØØ GHz
2 H
MA SB
SC FC
CORR
CENTER 1.83ØØØ GHz
#RES BW 1.Ø MHz
#VBW 1 MHz
SPAN 5Ø.ØØ MHz
SWP 2Ø.Ø msec

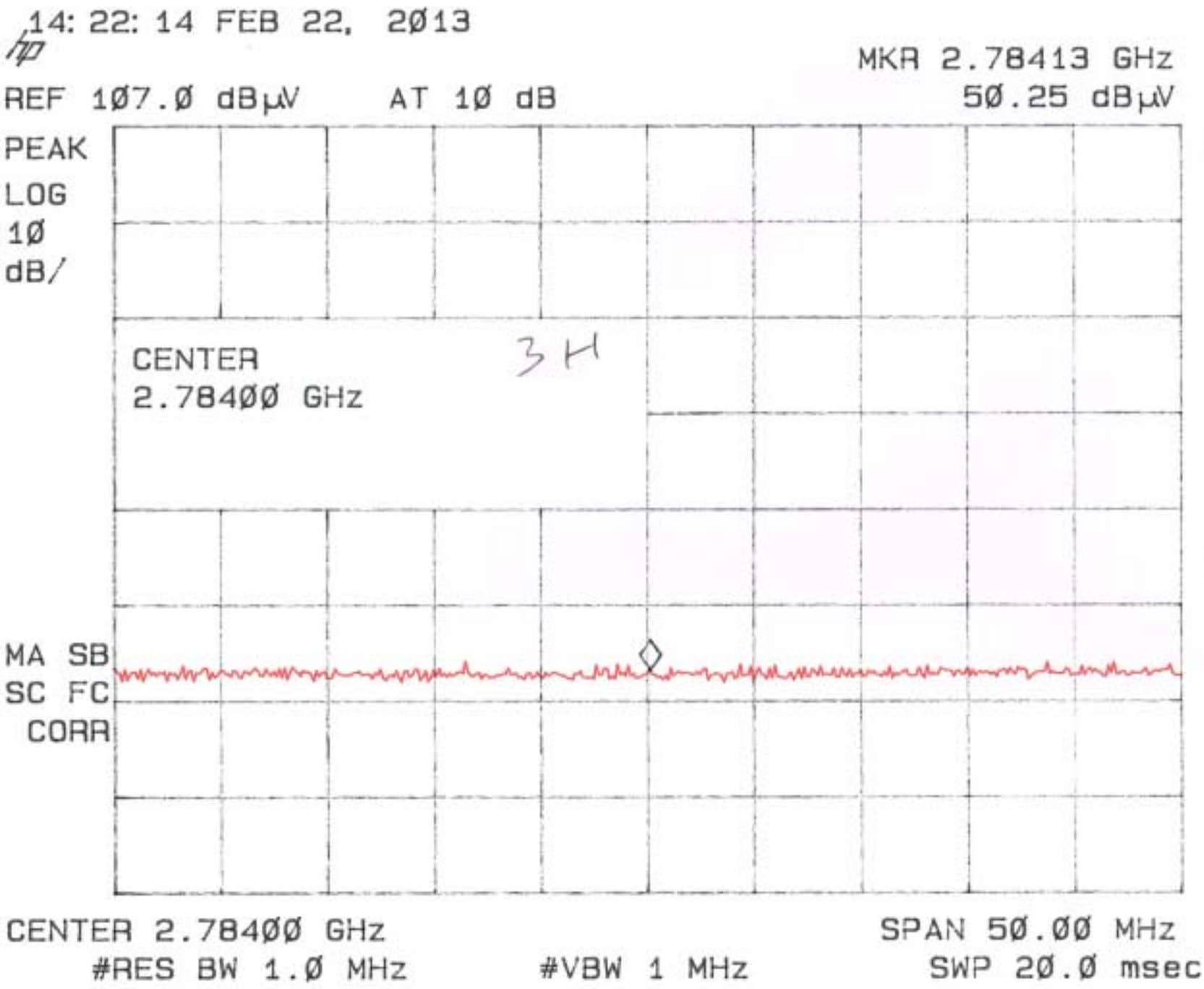

13: 49: 54 FEB 22, 2013
REF 107.0 dBµV
AT 10 dB
PEAK
LOG
10
dB/
MARKER
2.70588 GHz
55.56 dBµV
MKR 2.70588 GHz
55.56 dBµV
MA SB
SC FC
CORR
CENTER 2.706000 GHz
#RES BW 1.0 MHz
#VBW 1 MHz
SPAN 50.00 MHz
SWP 20.0 msec


13: 54: ØØ FEB 22, 2Ø13
MKR 3.6Ø788 GHz
REF 1Ø7.Ø dBµV
AT 1Ø dB
45.51 dBµV
PEAK
LOG
1Ø
dB/
CENTER
3.6Ø8ØØ GHz
4 H
MA SB
SC FC
CORR
CENTER 3.6Ø8ØØ GHz
#RES BW 1.Ø MHz
#VBW 1 MHz
SPAN 5Ø.ØØ MHz
SWP 2Ø.Ø msec


14: 26: 11 FEB 22, 2013
MKR 1.85613 GHz
REF 107.0 dBµV
AT 10 dB
56.86 dBµV
PEAK
LOG
10
dB/
CENTER
1.856ØØ GHz
2 V
VA SB
SC FC
CORR
CENTER 1.856ØØ GHz
#RES BW 1.Ø MHz
#VBW 1 MHz
SPAN 5Ø.ØØ MHz
SWP 2Ø.Ø msec


14: 29: 56 FEB 22, 2013
MKR 2.78413 GHz
REF 107.0 dBµV
AT 10 dB
49.99 dBµV
PEAK
LOG
10
dB/
3V
CENTER
2.784000 GHz
MA SB
SC FC
CORR
CENTER 2.784000 GHz
#RES BW 1.0 MHz
#VBW 1 MHz
SPAN 50.00 MHz
SWP 20.0 msec


14: 15: 16 FEB 22, 2013
MKR 1.85613 GHz
REF 107.0 dBµV
AT 10 dB
57.97 dBµV
PEAK
LOG
10
dB/
2 H
MARKER
1.85613 GHz
57.97 dBµV
MA SB
SC FC
CORR
CENTER 1.856ØØ GHz
SPAN 5Ø.ØØ MHz
#RES BW 1.Ø MHz
#VBW 1 MHz
SWP 2Ø.Ø msec

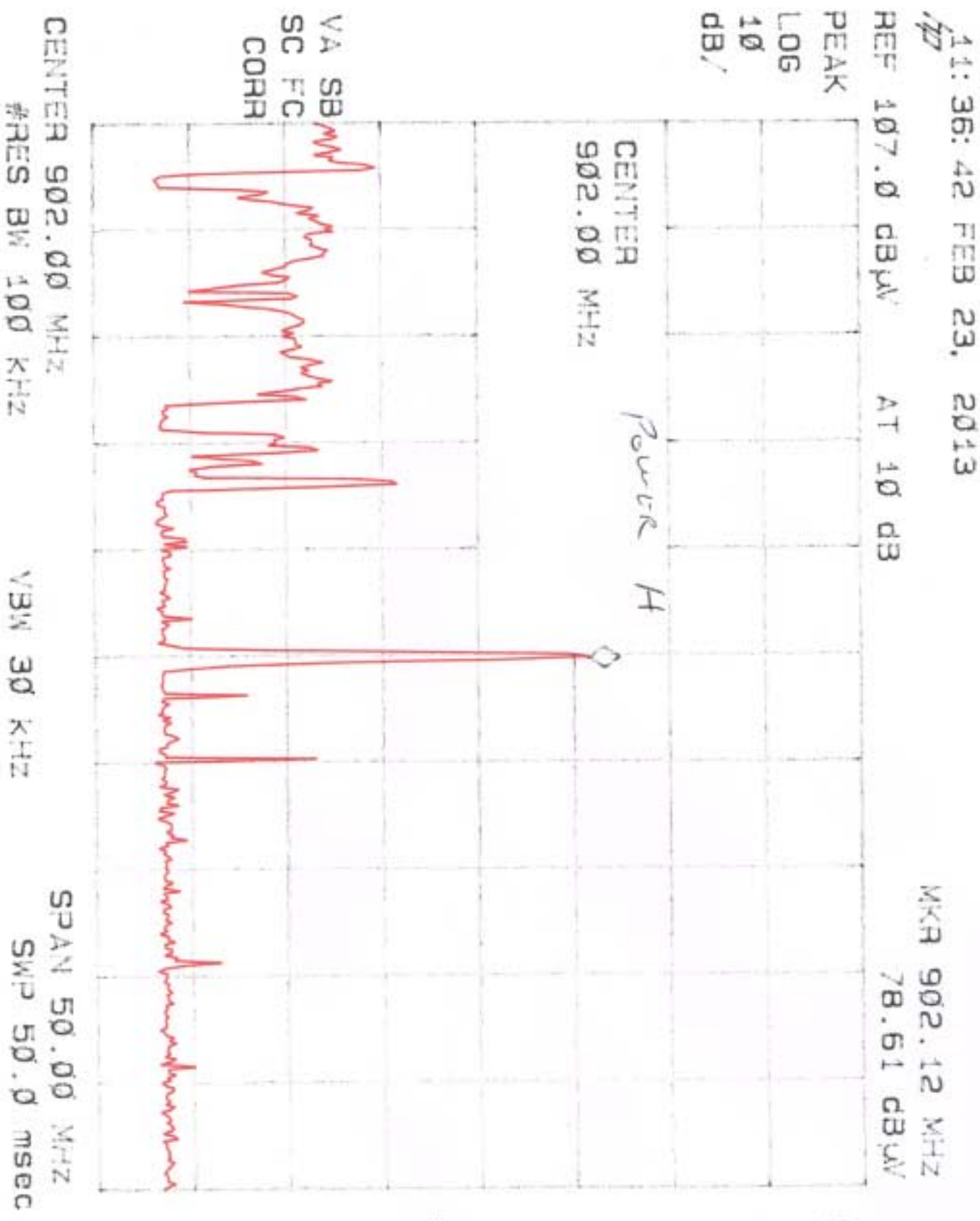

14: 22: 14 FEB 22, 2013
MKR 2.78413 GHz
REF 107.0 dBµV
AT 10 dB
50.25 dBµV
PEAK
LOG
10
dB/
CENTER
2.784ØØ GHz
3H
MA SB
SC FC
CORR
CENTER 2.784ØØ GHz
#RES BW 1.Ø MHz
#VBW 1 MHz
SPAN 5Ø.ØØ MHz
SWP 2Ø.Ø msec

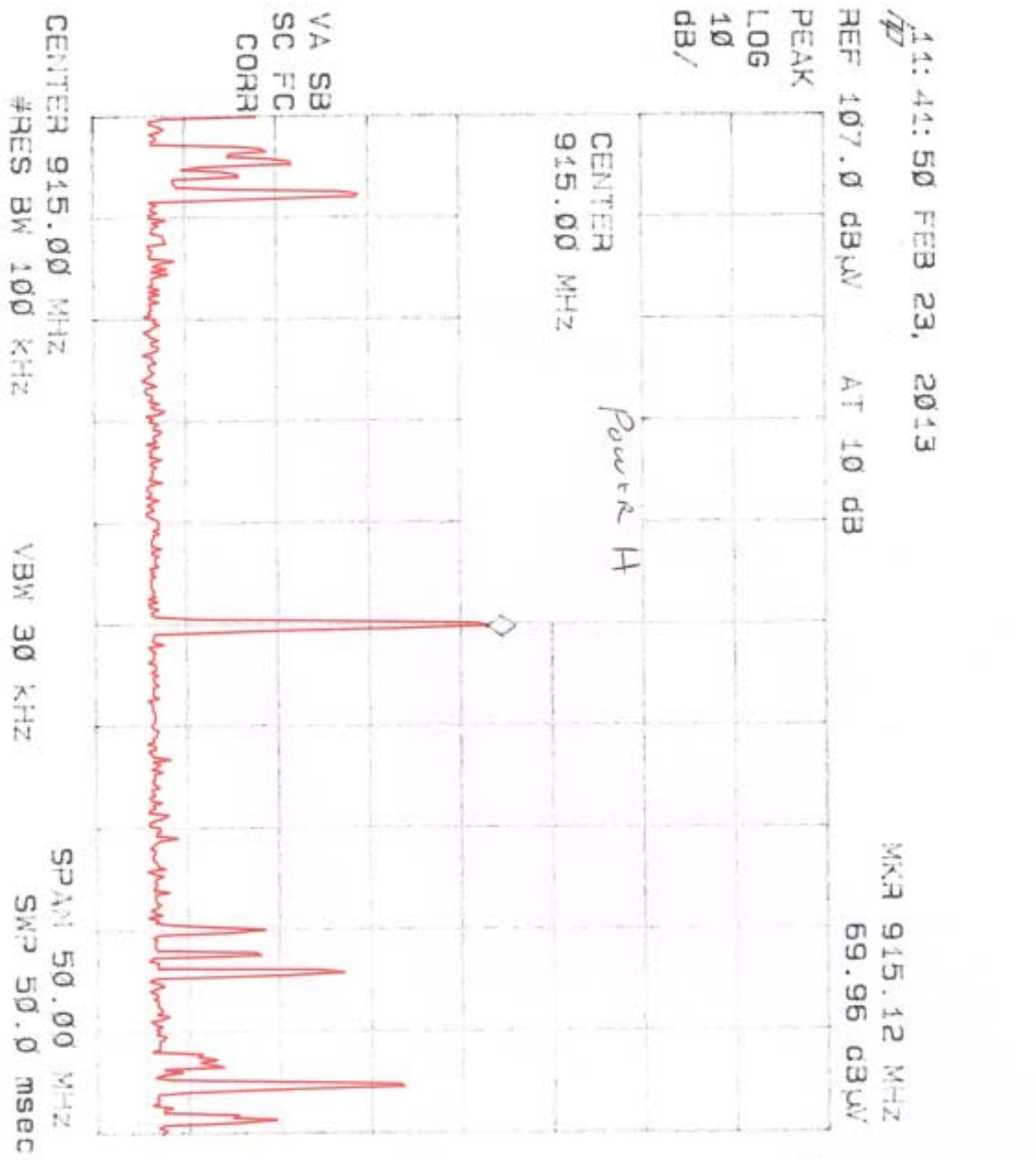
Section 5

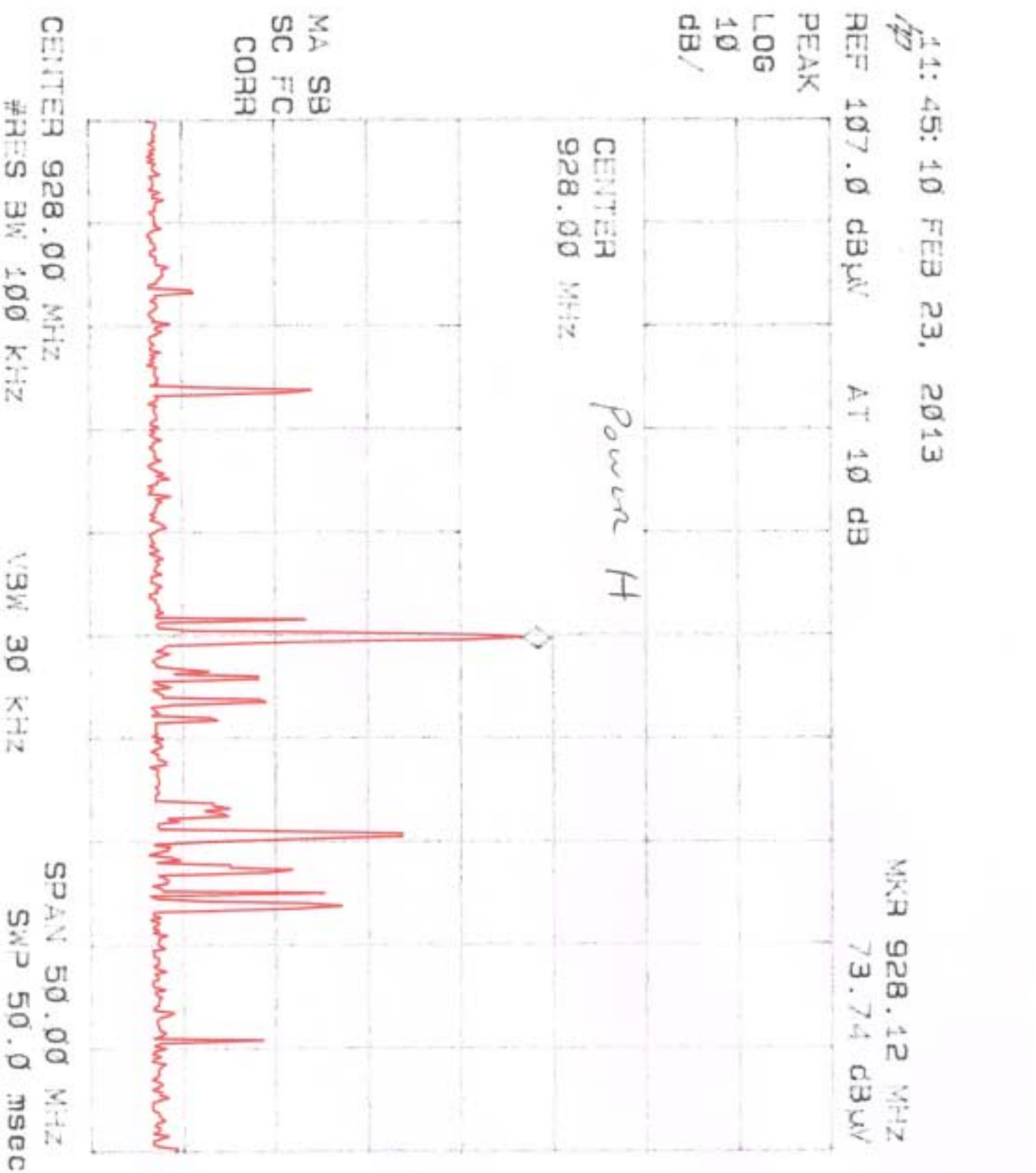
OUTPUT POWER

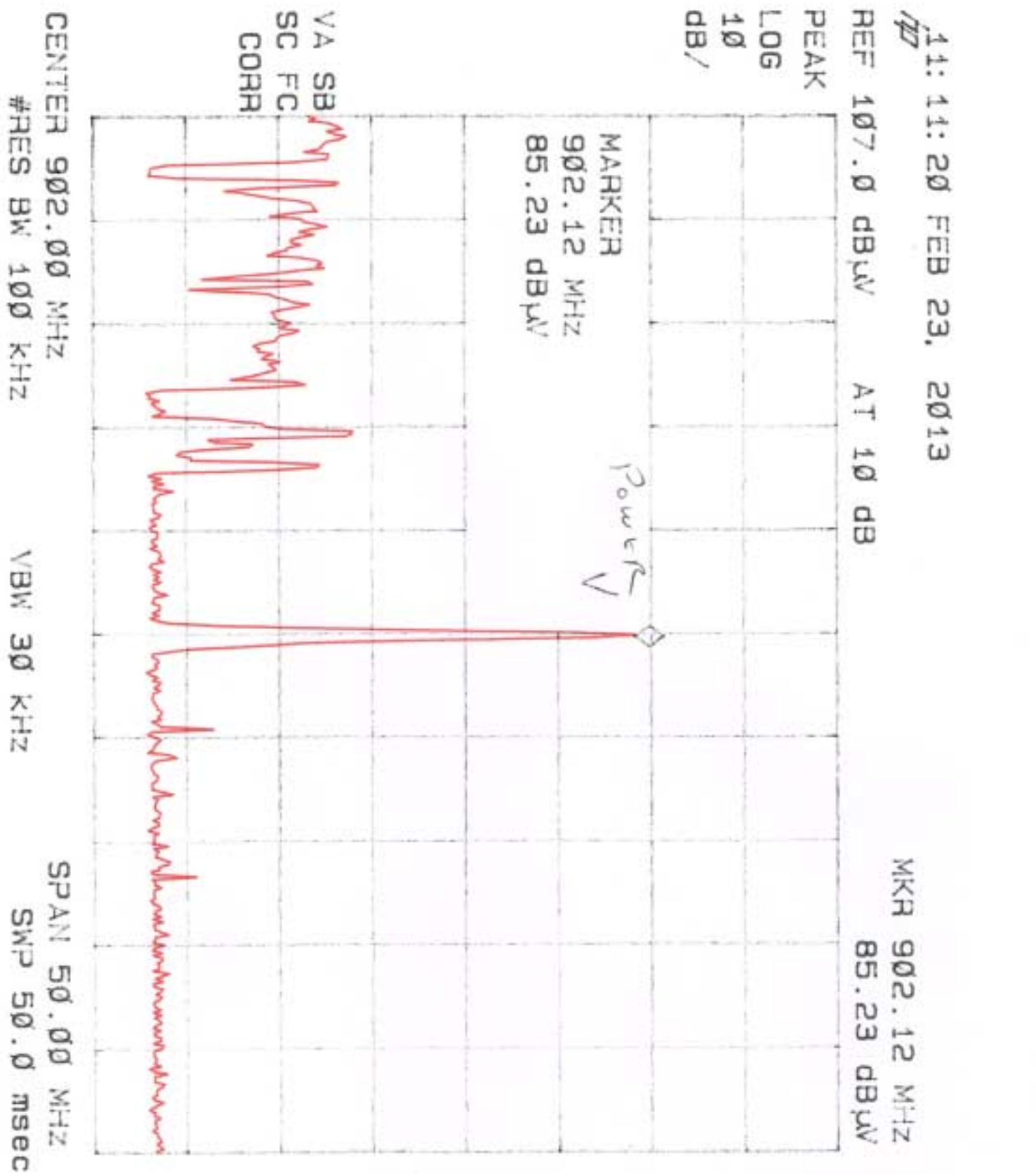
Test Results

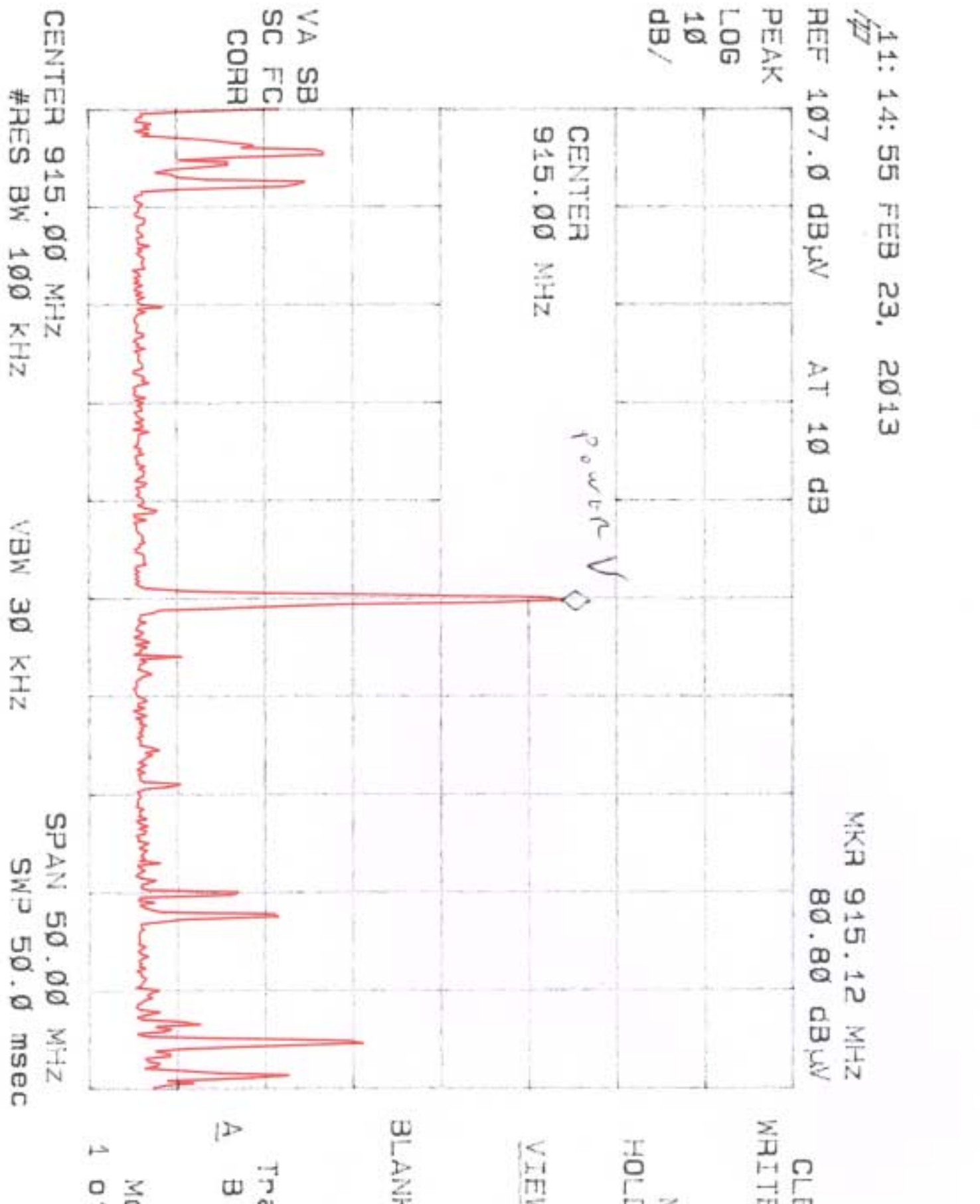
Frequency (MHz)	Antenna Polarization	Output in dBμV/m	Corrected reading	FCC Limits dBμV/m	Margin dBμV/m
902.12	V	85.23	90.03	94.0	-3.97
902.12	H	78.61	83.41	94.0	-10.59
915.12	V	80.80	86.0	94.0	-8.0
915.12	H	69.96	75.16	94.0	-18.84
928.12	V	77.81	83.31	94.0	-10.69
928.12	H	73.74	79.24	94.0	-14.76

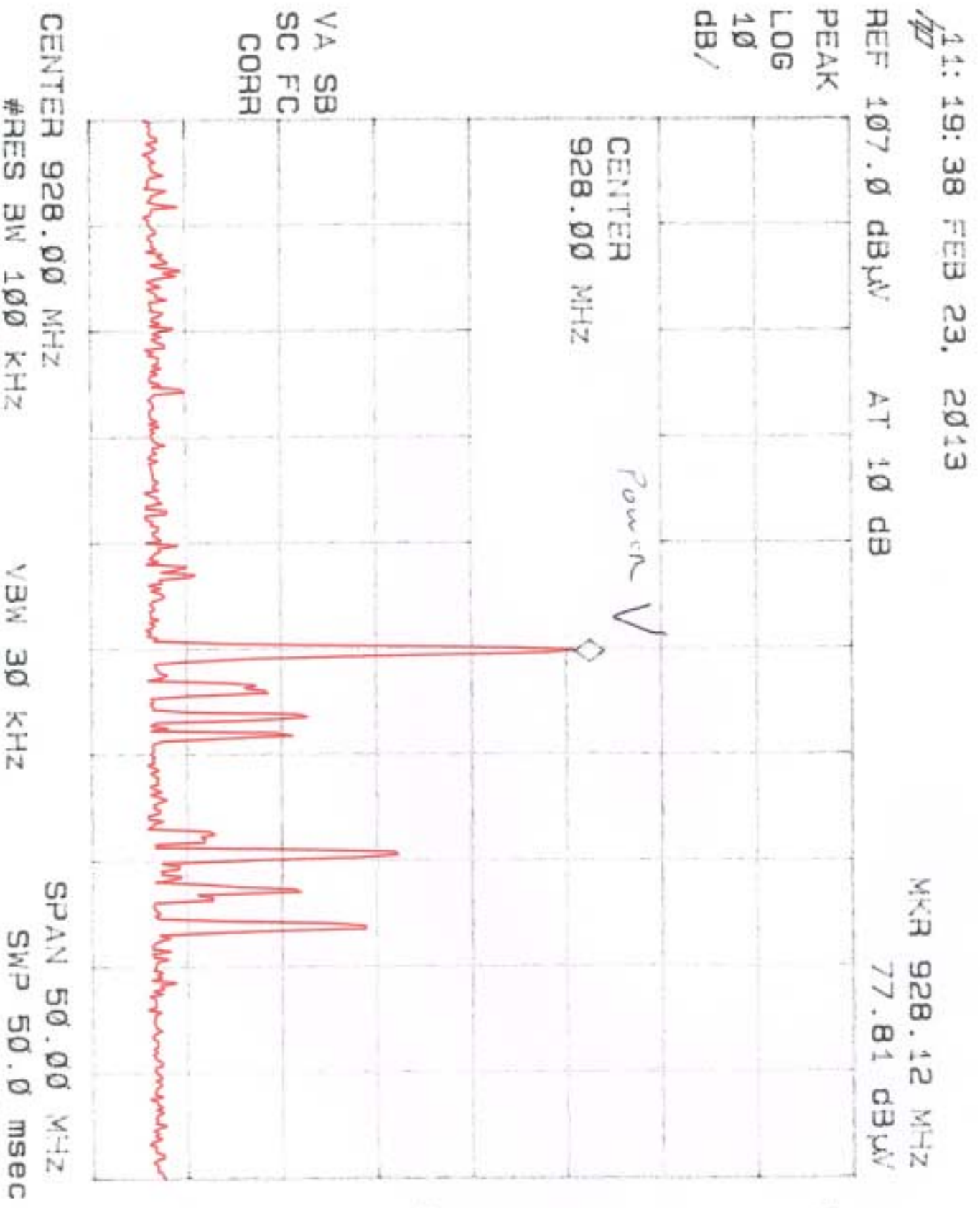

11: 36: 42 FEB 23, 2013
REF 107.0 dBµV
AT 10 dB
PEAK
LOG
10
dB/
MKR 902.12 MHz
78.61 dBµV
CENTER
902.00 MHz
Power H
VA SB
SC FC
CORR
CLR
WRITE
HOLD
BLANK
VIEW
CENTER 902.00 MHz
#RES BW 100 KHz
VBW 30 KHz
SPAN 50.00 MHz
SWP 50.0 msec


11: 41: 50 FEB 23, 2013
REF 107.0 dBµV
AT 10 dB
PEAK
LOG
10
dB/
CENTER
915.00 MHz
Power H
MKR 915.12 MHz
69.96 dBµV
VA SB
SC FC
CORR
CENTER 915.00 MHz
#RES BW 100 kHz
VBW 30 kHz
SPAN 50.00 MHz
SWP 50.0 msec


11: 45: 10 FEB 23, 2013
REF 107.0 dBµV
AT 10 dB
PEAK
LOG
10
dB/
MKR 928.42 MHz
73.74 dBµV
CENTER
928.00 MHz
Power H
MA SB
SC FC
CORR
CENTER 928.00 MHz
#RES BW 100 kHz
VBW 30 kHz
SPAN 50.00 MHz
SWP 50.0 msec

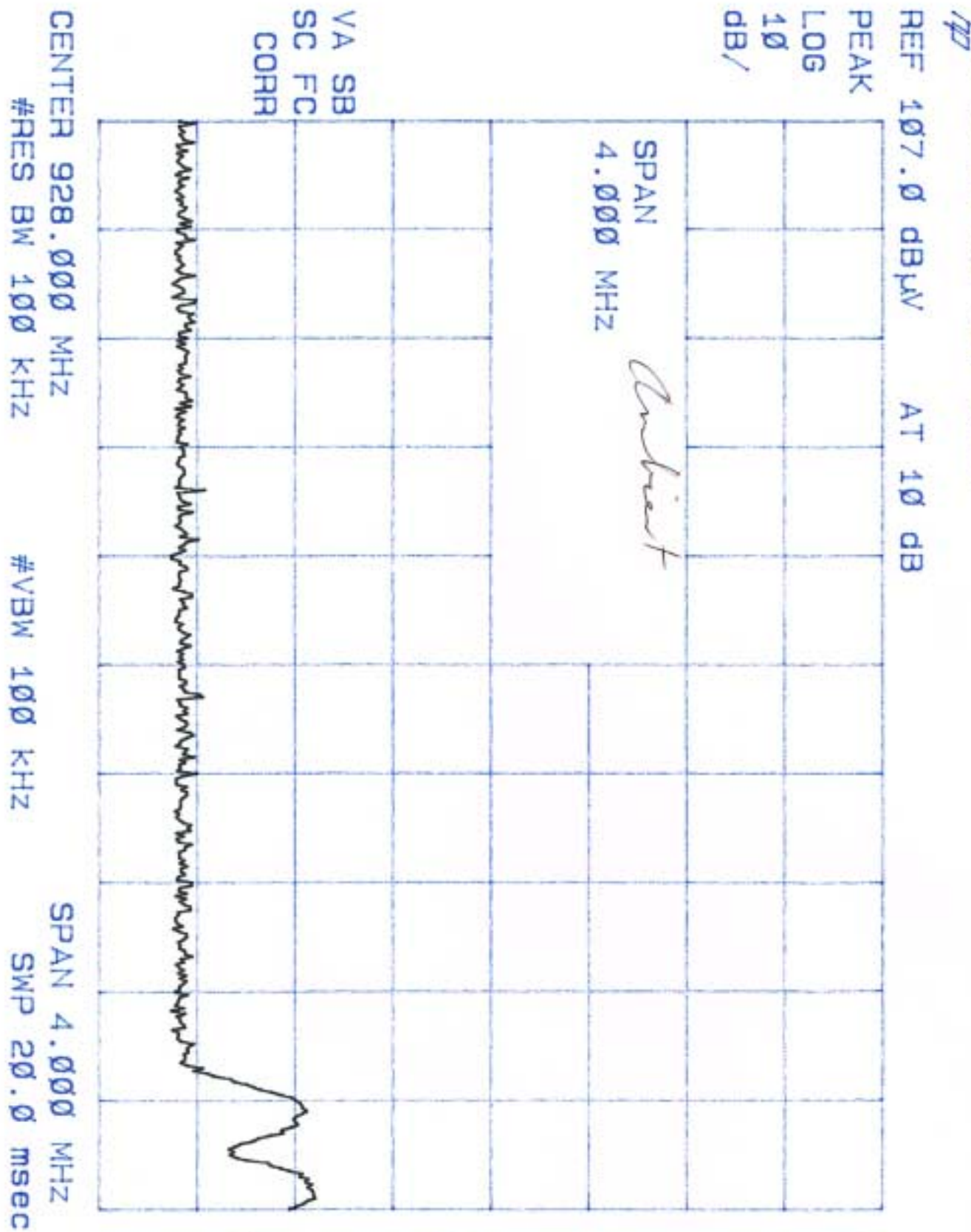

11: 11: 20 FEB 23, 2013
REF 107.0 dBµV
AT 10 dB
PEAK
LOG
10
dB/
MARKER
902.12 MHz
85.23 dBµV
Power
MKR 902.12 MHz
85.23 dBµV
VA SB
SC FC
CORR
CENTER 902.00 MHz
#RES BW 100 kHz
VBW 30 kHz
SPAN 50.00 MHz
SWP 50.0 msec

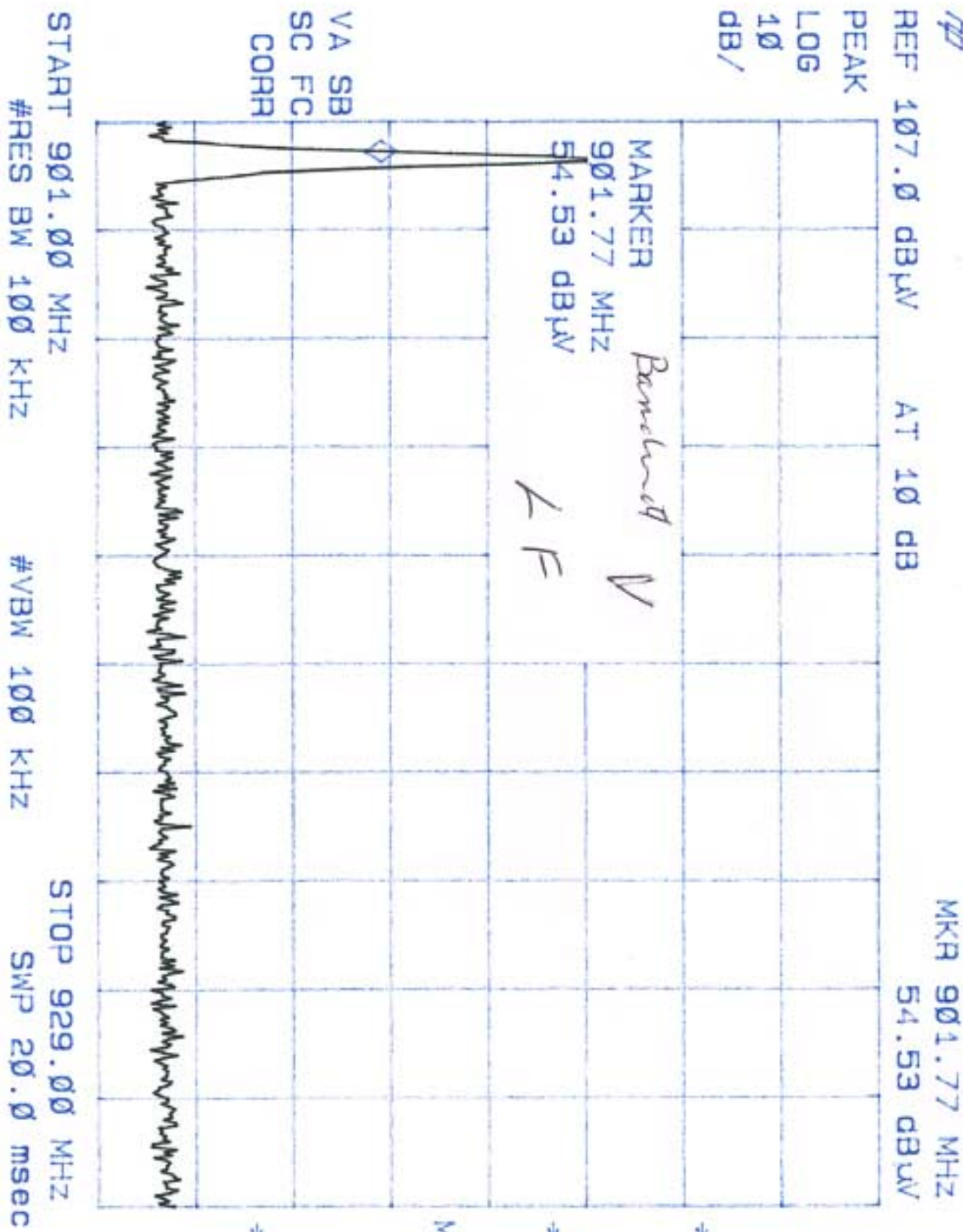

11: 14: 55 FEB 23, 2013
MKR 915.12 MHz
REF 107.0 dBµV
AT 10 dB
80.80 dBµV
PEAK
LOG
10
dB/
CENTER
915.00 MHz
Power V
VA SB
SC FC
CORR
CLR
WRITE
VIEW
BLANK
Tr
A
B
CENTER 915.00 MHz
#RES BW 100 kHz
VBW 30 kHz
SPAN 50.00 MHz
SWP 50.0 msec

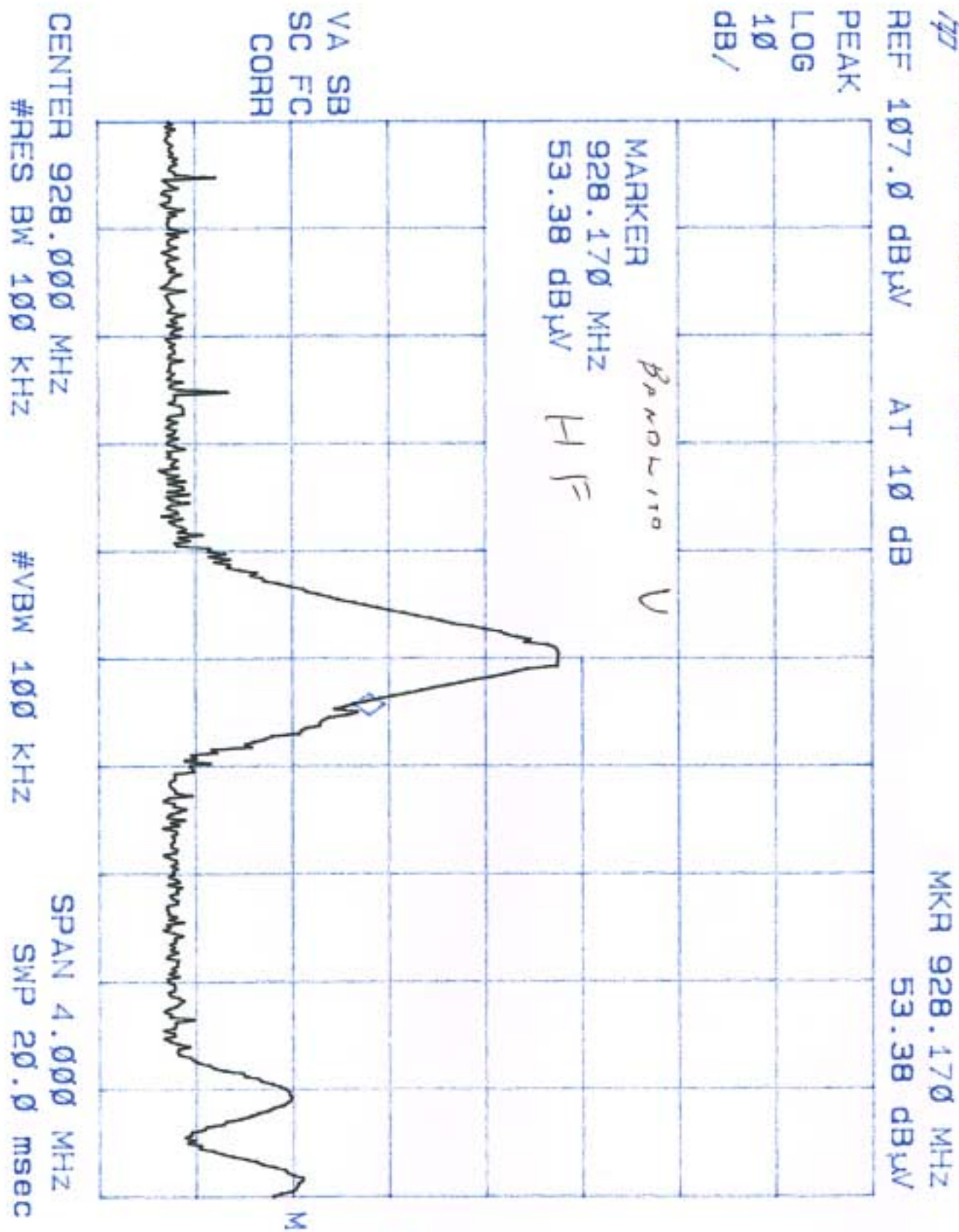

11: 19: 38 FEB 23, 2013
REF 107.0 dBµV
AT 10 dB
PEAK
LOG
10
dB/
MKR 928.12 MHz
77.81 dBµV
CENTER
928.00 MHz
Power V
VA SB
SC FC
CORR
CENTER 928.00 MHz
#RES BW 100 kHz
VBW 30 kHz
SPAN 50.00 MHz
SWP 50.0 msec

Section 6

20dB BANDWIDTH

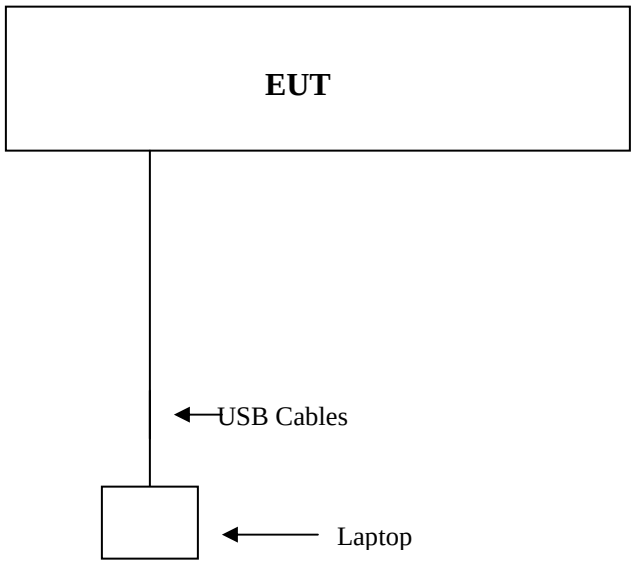

12: 45: 12 NOV 28, 2012
REF 107.0 dBµV
AT 10 dB
PEAK
LOG
10
dB/
SPAN
4.000 MHz
Ambient
VA SB
SC FC
CORR
CENTER 928.000 MHz
#RES BW 100 kHz
#VBW 100 kHz
SPAN 4.000 MHz
SWP 20.0 msec
CL
WRITE
HOLD
VIEW
BLANK
Tr
A
B
M
1


14: 51: 03 NOV 28, 2012
REF 107.0 dBµV
AT 10 dB
PEAK
LOG
10
dB/
MARKER
901.77 MHz
54.53 dBµV
Banded V
LF
VA SB
SC FC
CORR
START 901.00 MHz
#RES BW 100 kHz
#VBW 100 kHz
STOP 929.00 MHz
SWP 20.0 msec
MKR 901.77 MHz
54.53 dBµV


12: 49: 27 NOV 28, 2012
MKR 928.170 MHz
53.38 dBµV
REF 107.0 dBµV
AT 10 dB
PEAK
LOG
10
dB/
MARKER
928.170 MHz
53.38 dBµV
Bandlo
H F
VA SB
SC FC
CORR
CENTER 928.000 MHz
SPAN 4.000 MHz
#RES BW 100 kHz
#VBW 100 kHz
SWP 20.0 msec

Section 7

CONFIGURATION



Section 8

TEST EQUIPMENT

Test Equipment	Manufacturer	Model No.	Serial no.	Cal. Due Date
Spectrum Analyzer	HP	8591A	2919A00171	5/13
Spectrum Analyzer	HP	8592L	3649A00744	7/13
Signal Generator	HP	8648C	3847A0928	5/13
LISN	Emco	3825/2	9305-2088	5/13
Preamplifier	HP	8449B	3808A00914	5/13

Antennas	Manufacturer	Model No.	Serial no.	Cal. Due Date
Biconical	Electro-Metrics	BIA-25	2451	3/14
Log Periodic	Emco	3146	9306-3643	3/14
Active Loop Antenna	Emco	6502	9809-4032	5/13
Horn	Emco	3115	9405-4264	5/13
Horn	Emco	3116	9406-4396	5/13

All test equipment and antennas are calibrated annually