

DIVERSIFIED

T.E.S.T.

TECHNOLOGIES, INC.

4675 Burr Drive • Liverpool, NY 13088 • 1-800-724-6452 • FAX: 315-457-0428 • 315-457-0245

November 10, 2014

Mr. Mark Bullock
GOJO Industries
1 GOJO Plaza-Suite 500
Akron, OH 44311

Dear Mr. Bullock

Enclosed is the test report for the GOJO Industries Limited Approval Wireless Transmitter Module 2840-513-XXX. ABC in the host where the host is the Smartlink Ready TFX 28XX-XXX dispenser which was tested at our facility located at 4675 Burr Drive in Liverpool, NY. This facility is on file with the Federal Communications Commission (FCC) per 47 CFR 2.948. (Site File Registration Number: 306552) Please see attached annex for information on the Limited Approval Wireless Module 2480-513-XXX.

As narrated in the report, the product configuration meets the requirements of the FCC per CFR 47 Part 15.249 Class C for Intentional Radiators

Thank you for selecting Diversified T.E.S.T. Technologies, Inc. for your testing needs. We look forward to working with you on future projects. Should you have any questions or concerns regarding this report, contact me at 315-457-0245. Please feel free to visit our website at www.dttlabs.com.

Sincerely,

A handwritten signature in black ink, appearing to read "Prasanna Gautam", with a horizontal line extending to the right.

Prasanna Gautam
Technical Associate

DIVERSIFIED T.E.S.T. TECHNOLOGIES, INC. TEST REPORT	
GOJO Industries Limited Approval Wireless Transmitter Module 2840-513-XXX. ABC in the host where the host is Smartlink Ready TFX 28XX- XX dispenser.	Project Number: 6492

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DIVERSIFIED T.E.S.T. TECHNOLOGIES, INC. TEST REPORT

GOJO Industries

Limited Approval Wireless Transmitter Module 2840-513-XXX
Rev. 004 and 1930-513-910 Rev. ABC in the host where the host is
Smartlink Ready TFX 28XX-XX Dispenser

Project Number:
6492

Test Report

Laboratory

Diversified TEST Technologies, Inc.

4675 Burr Drive
Liverpool, NY 13088
315-457-0245

Manufacturer

GOJO Industries

1 GOJO Plaza, Suite 500
Akron, OH. 44311

Report Issue Date: **November 10, 2014**
Project Number: **6492**
Report Number: **6492-111014(Edition 1) FCCC TFX with Limited Approval**
Wireless Transmitter Module

Date Received: **August 8, 2014**
Date Tested: **October 10, 2014 – October 13, 2014**
Model Numbers: **Limited Approval Wireless Transmitter Module 2840-513. ABC in the host where the host is Smartlink Ready TFX 28XX-XX dispenser.**
FCC ID: **076-T1SG0910A**

Traceability: *Reference standards of measurement have been calibrated by a competent body using standards traceable to NIST.*

The testing performed by Diversified TEST Technologies, Inc. has shown that the product referenced above complies with the electromagnetic compatibility requirements according to the standard(s) specified on page 3 of the test report. The results in this test report apply only to the product denoted above. The manufacturer is responsible for ensuring that additional units are manufactured with identical mechanical and electrical characteristics.

The equipment listed above conforms to the specified requirements of the test standards listed on page 3 of this report.

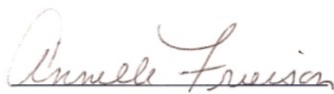
Complied by:
Signature:



Prasanna Gautam
Technical Associate

Date: November 10, 2014

Reviewed by:
Signature:



Annelle Frierson
Vice- President

Date: November 10, 2014

DIVERSIFIED T.E.S.T. TECHNOLOGIES, INC. TEST REPORT	
GOJO Industries Limited Approval Wireless Transmitter Module 2840-513-XXX ABC in the host where the host is Smartlink Ready TFX 28XX- XX Dispenser	Project Number: 6492

Emissions Test Regulations

The emissions tests were performed according to the following regulations:

☐ EN 50081-1:1992

☐ EN 50081-2:1995

☐ EN 55011:1998 / A1:1999 / A2:2001

☐ Group 1

☐ Group 2

☐ Class A

☐ Class B

☐ EN 55013:1990 / A12:1994 / A13:1996 / A14:1999

☐ EN 55014:1993 / A1: 1997

☐ Household appliances and similar

☐ Portable tools

☐ Semiconductor devices

☐ EN 55022:1998

☐ Class A

☐ Class B

☒ **FCC Part 15.249**

☐ Class A

☐ Class B

☒ **Class C**

☒ **Certification**

☐ Verification

☐ Declaration of Conformity

DIVERSIFIED T.E.S.T. TECHNOLOGIES, INC. TEST REPORT	
GOJO Industries Limited Approval Wireless Transmitter Module 2840-513-XXX Rev. 004 and 1930-513-910 Rev. ABC in the host where the host is Smartlink Ready TFX 28XX-XX Dispenser	Project Number: 6492

Emissions Test Conditions: FCC PART 15.249 CLASS C

The Fundamental and Harmonics measurements were tested in a horizontal and vertical polarization at the following test location:

- ☒ Diversified TEST Technologies, Inc. Open Area Test Site
☐ Diversified TEST Technologies, Inc. Lab

At a test distance of:

- ☒ 1 meter
☒ 3 meters
☐ 30 meters

Test equipment used:

Manufacturer	Model	Description	Serial #	Cal Due Date
Hewlett Packard	8593E	Spectrum Analyzer	3235A00144	05/16/15
Electro-Metrics	RGA60	Ridge Horn Antenna	2981	12/9/14
Hewlett Packard	7550A	Plotter	2407A00476	
Electro-Metrics	LPA-25	Log Periodic Antenna 200-1000 MHz	1242	7/8/15
	MFR-57500	Blue low-loss cable	337	
		Non-conductive wooden turntable		
		10-meter open field test range, grounded with ¼ ” x ¼ ” hardware cloth		
		Co-ax Cable, 100-foot RG 8/U, 20-foot RG 223/U		

NOTE: Calibration interval 1 year for the test equipment

DIVERSIFIED T.E.S.T. TECHNOLOGIES, INC. TEST REPORT	
GOJO Industries Limited Approval Wireless Transmitter Module 2840-513-XXX ABC in the host where the host is Smartlink Ready TFX 28XX-XX Dispenser	Project Number: 6492

Equipment under Test (EUT) Test Operation Mode – Emissions Tests:

The device under test was operated under the following conditions during emissions testing:

- ☐ Standby
- ☒ Normal Operating Mode
- ☐ Practice Operation

Description / Configuration of the device under test:

Limited Approval Wireless Transmitter Module 2840-513-XXX Rev. 004 and 1930-513-910 Rev. ABC in the host where the host is Smartlink Ready TFX 28XX-XX Dispenser
The unit was powered by a 6 VDC Battery during the collection of data.

Rationale for EUT setup / configuration:

ANSI C63.4-2009

After numerous trial runs with a full bottle and an empty bottle it was found an empty bottle was worst case so therefore the dispenser was tested with the empty bottle for the entire test.

Deviations from test method:

Testing performed at 1 meter test distance above 1 GHz to better represent harmonic emissions caused by the equipment under test.

Notes:

The Spurious Emissions test data is included in the Subpart B report including the Test data from the Active Loop Antenna.

DIVERSIFIED T.E.S.T. TECHNOLOGIES, INC. TEST REPORT

GOJO Industries

Limited Approval Wireless Transmitter Module 2840-513-XXX
Rev. 004 and 1930-513-910 Rev. ABC in the host where the host is
Smartlink Ready TFX 28XX-XX Dispenser

Project Number:
6492

Emissions Test Results:

FCC Part 15.249 Part C 910 MHz –9100 MHz

The requirements are ☒ **MET** ☐ **NOT MET**

General Remarks:

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be less than 500 kHz.

Measurements were taken up to the tenth harmonic.

The EUT was evaluated in 1 orthogonal orientation and the worst case data is reflected in the test report.

Radiated Measurements on the EUT were performed from 910 MHz up to the 10th Harmonic and any emission found were more than 20 dB below the limit have not been reported.

The transmitter module transmits an OOK modulated data packet following a 10 second delay after an event trigger coming from the TFX dispenser. The use of the TFX dispenser to dispense soap to a customer constitutes an event and once an event occurs a trigger pulse is sent from the TFX dispenser to a microcontroller in the transmitter module. The microcontroller in the module uses the 10 second delay period to watch for additional events during that period of time. After the 10 second period has expired the total number of events that occurred during that 10 second period are sent in the transmitted data packet along with the transmitter module serial (ID) number and other information like the battery level. A drawing of the transmit packet is shown on last page of this report.

The transmitter packet starts with a 50% duty cycle Preamble for 38.76mSec followed by an off Space of 3.04mSec. After the Space, the payload is sent twice for redundancy. Each payload time is 63.84mSec in length and consists of an equal numbers of 1's and 0's. Where each of the 1's has a 25% duty cycle and each of the 0's has a 75% duty cycle. Together the payload has a combined 50% duty cycle. The total packet length is therefore the addition of the 38.76msec Preamble followed by the 3.04mSec Space followed by the two redundant payloads of 63.86mSec each for total packet length of 169.48mSec. The total packet duty cycle consists of 83.22mSec "on" bits and 86.26mSec "off" bits for a total percentage of "on" bits of 0.491%.

Therefore the duty cycle correction in terms of dB is: $20\log(0.491) = -6\text{dB}$.

Summary:

The requirements according to the technical regulations are

- ☒ Met.
☐ Not met.

The device under test does

- ☒ fulfill the general approval requirements mentioned on page 3.
☐ not fulfill the general approval requirements mentioned on page 3.

Testing Start Date: October 10, 2014

Testing End Date: October 13, 2014

DIVERSIFIED T.E.S.T. TECHNOLOGIES, INC. TEST REPORT

GOJO Industries

Limited Approval Wireless Transmitter Module 2840-513-XXX
Rev. 004 and 1930-513-910 Rev. ABC in the host where the host is
Smartlink Ready TFX 28XX-XX Dispenser

Project Number:
6492

Test Setup Photographs:

FCC PART 15.249 CLASS C – 910 MHz

Photograph 1: FCC Part 15.249 Class C



<i>DIVERSIFIED T.E.S.T. TECHNOLOGIES, INC. TEST REPORT</i>	
GOJO Industries	Project Number: 6368

Test Datasheets – 910 MHz- 9100 MHz

23 pages of data sheets to follow.

FCC Part 15.249 Transmitter Test
GOJO 6492

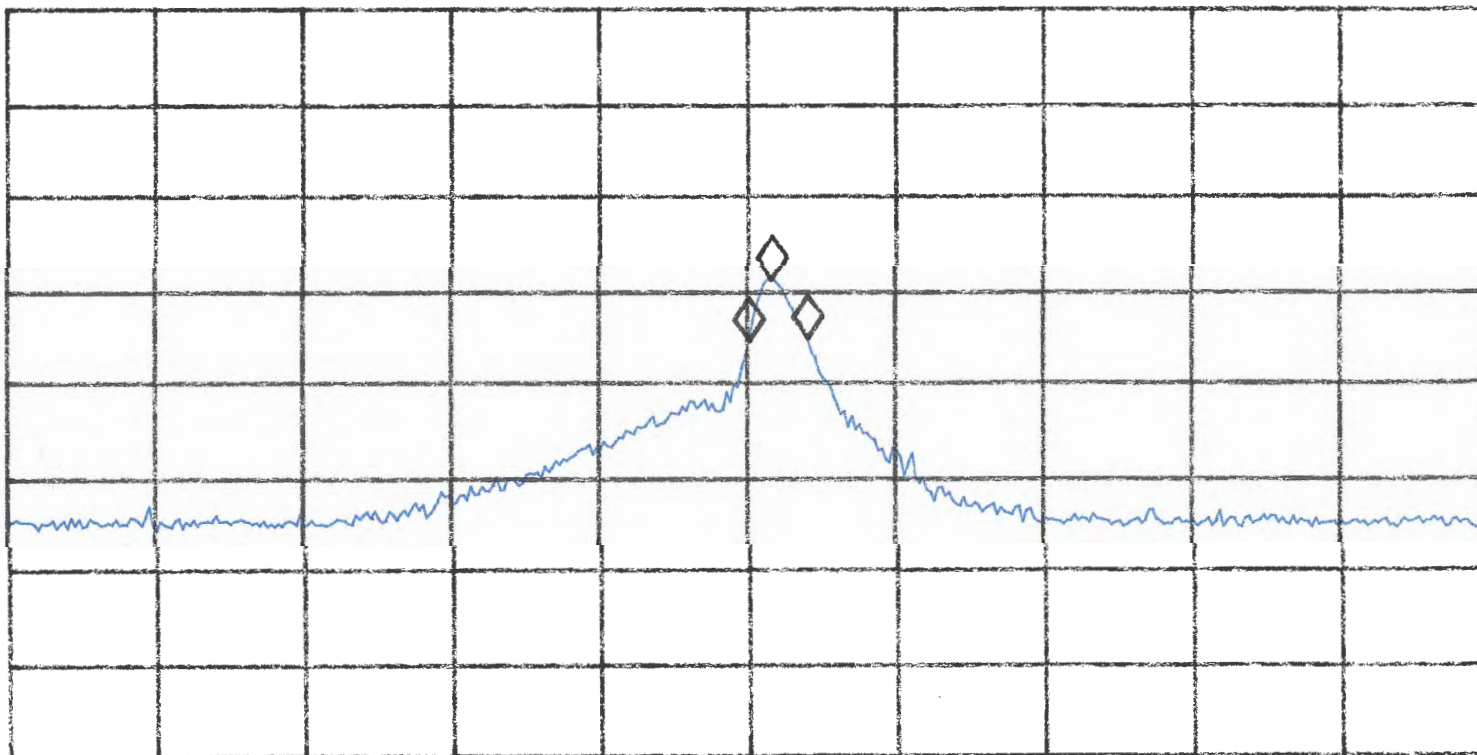
Measured Field Strength (dBμV) Peak	Res. Bandwidth (Khz)	DUT Frequency (Mhz)	Measured Frequency (Mhz)	Azimuth degrees	Cable Factor (dB)	Antenna Gain (dB)	Measurement Distance (Meters)	Duty Cycle Correction (dB)	FCC Limit (uV/M) at 3M	Corrected Field Strength to 3M in uV/M Peak	Delta Limit (dB)	Polarity
46.19	120	910	910	0	17.2	19.6	3	-6	50000	7,071.31	-16.99	H
30.86	120	910	1820	0.00	2.1	7.6	1	-6	500	17.82	-28.96	H
33.11	1000	910	2730	60	2.2	9.2	1	-6	500	28.08	-25.01	H
43.58	1000	910	3640	40	2.4	8.9	1	-6	500	92.66	-14.64	H
37.94	1000	910	4550	70	2.5	10	1	-6	500	55.57	-19.08	H
27.47	1000	910	5460	0	2.7	10	1	-6	500	17.04	-29.35	H
28.04	1000	910	6370	0	2.8	12	1	-6	500	23.17	-26.68	H
34.66	1000	910	7280	0	2.8	10.5	1	-6	500	41.77	-21.56	H
36.71	1000	910	8190	0	3.0	10.3	1	-6	500	52.89	-19.51	H
35.82	1000	910	9100	0	3.1	11.2	1	-6	500	53.56	-19.40	H
	*Antenna factors are pre-calculated into Measured Field Strength (dBμV)											
Unit Under Test: GOJO			TFX	2840-513-XXX			11/6/2014		Full Bottle			

FCC Part 15.249 Transmitter Test												
GOJO 6492												
Measured Field Strength (dBµV) Peak	Res. Bandwidth (Khz)	DUT Frequency (Mhz)	Measured Frequency (Mhz)	Azimuth degrees	Cable Factor (dB)	Antenna Gain (dB)	Measurement Distance (Meters)	Duty Cycle Correction (dB)	FCC Limit (uV/M) at 3M	Corrected Field Strength to 3M in uV/M Peak	Delta Limit (dB)	Polarity
46.75	120	910	910	0	17.2	19.6	3	-6	50000	7,542.23	-16.43	V
33.84	120	910	1820	0	2.1	7.6	1	-6	500	25.11	-25.98	V
31.08	1000	910	2730	0	2.2	9.2	1	-6	500	22.23	-27.04	V
38.87	1000	910	3640	45	2.4	8.9	1	-6	500	53.87	-19.35	V
30.03	1000	910	4550	0	2.5	10	1	-6	500	22.36	-26.99	V
27.93	1000	910	5460	0	2.7	10	1	-6	500	17.96	-28.89	V
29.30	1000	910	6370	0	2.8	12	1	-6	500	26.78	-25.42	V
35.55	1000	910	7280	0	2.8	10.5	1	-6	500	46.28	-20.67	V
36.92	1000	910	8190	0	3.0	10.3	1	-6	500	54.18	-19.30	V
35.48	1000	910	9100	0	3.1	11.2	1	-6	500	51.51	-19.74	V
*Antenna factors are pre-calculated into Measured Field Strength (dBµV)												
Unit Under Test: Gojo			TFX	2840-513-XXX			11/6/2014		Full Bottle			

21: 54: 14 OCT 09, 2014
hp GOJO#6492 TFX 3M ANT-HOR
REF 75.0 dBμV #AT 0 dB

MKR Δ 200 KHz
.28 dB

PEAK
LOG
10
dB/



Marker	Trace Type
1:	(A) Freq
2:	(A) Δ Ref
3:	(A) Δ Freq
4:	Inactive

Freq / Time
909.988 MHz
909.913 MHz
0.200 MHz

Amplitude
46.19 dBuV
39.59 dBuV
0.28 dB

CENTER 909.912 MHz
#RES BW 120 KHz

VBW 300 KHz

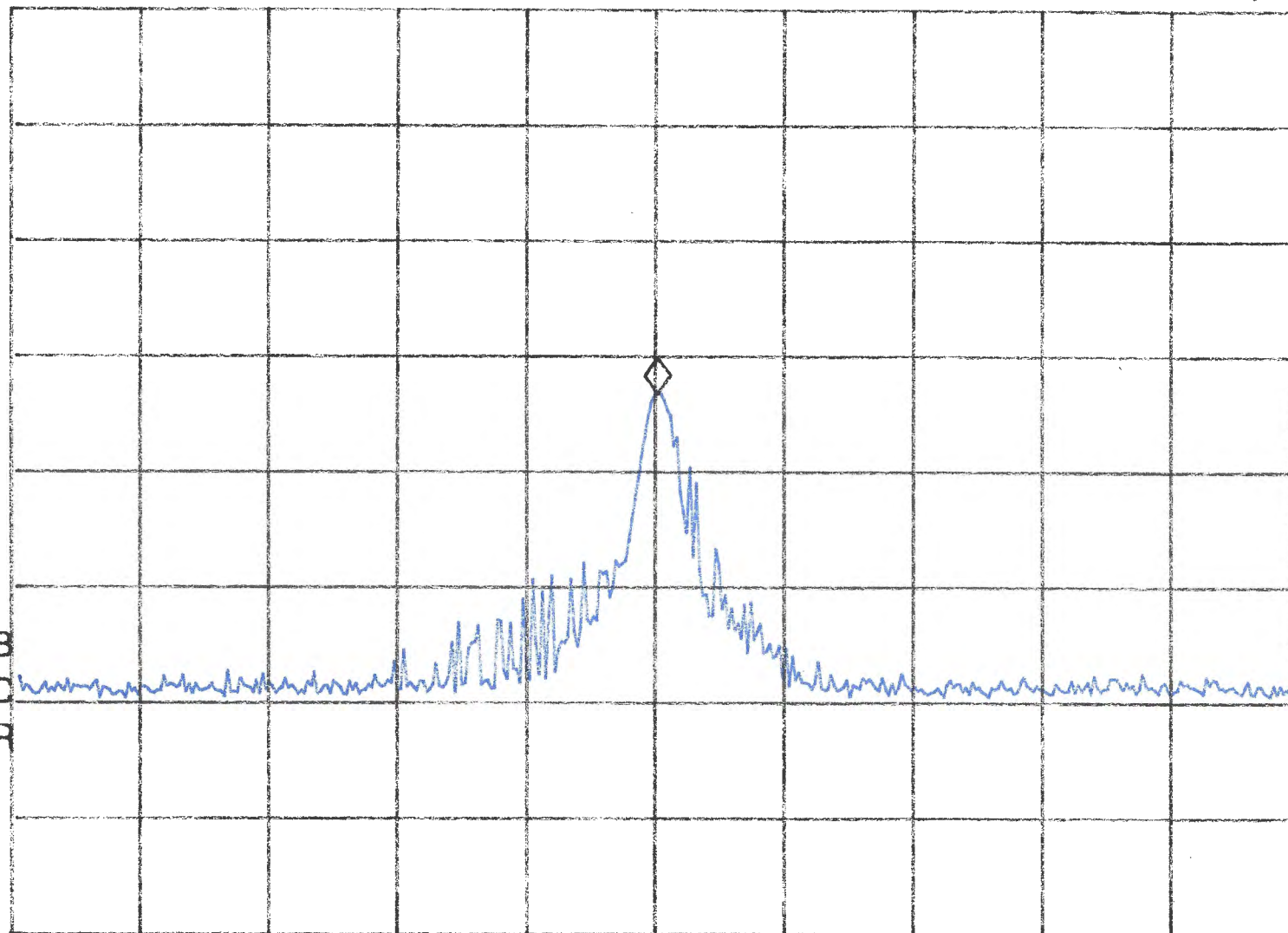
SPAN 5.000 MHz
SWP 20.0 msec

00: 52: 58 NOV 06, 2014
hp GOJO 6492 TFX 3M ANT VERT
REF 80.0 dBμV #AT 0 dB

MKR 909.987 MHz
46.75 dBμV

PEAK
LOG
10
dB/

MA SB
SC FC
CORR



CENTER 910.000 MHz
#RES BW 120 kHz

VBW 300 kHz

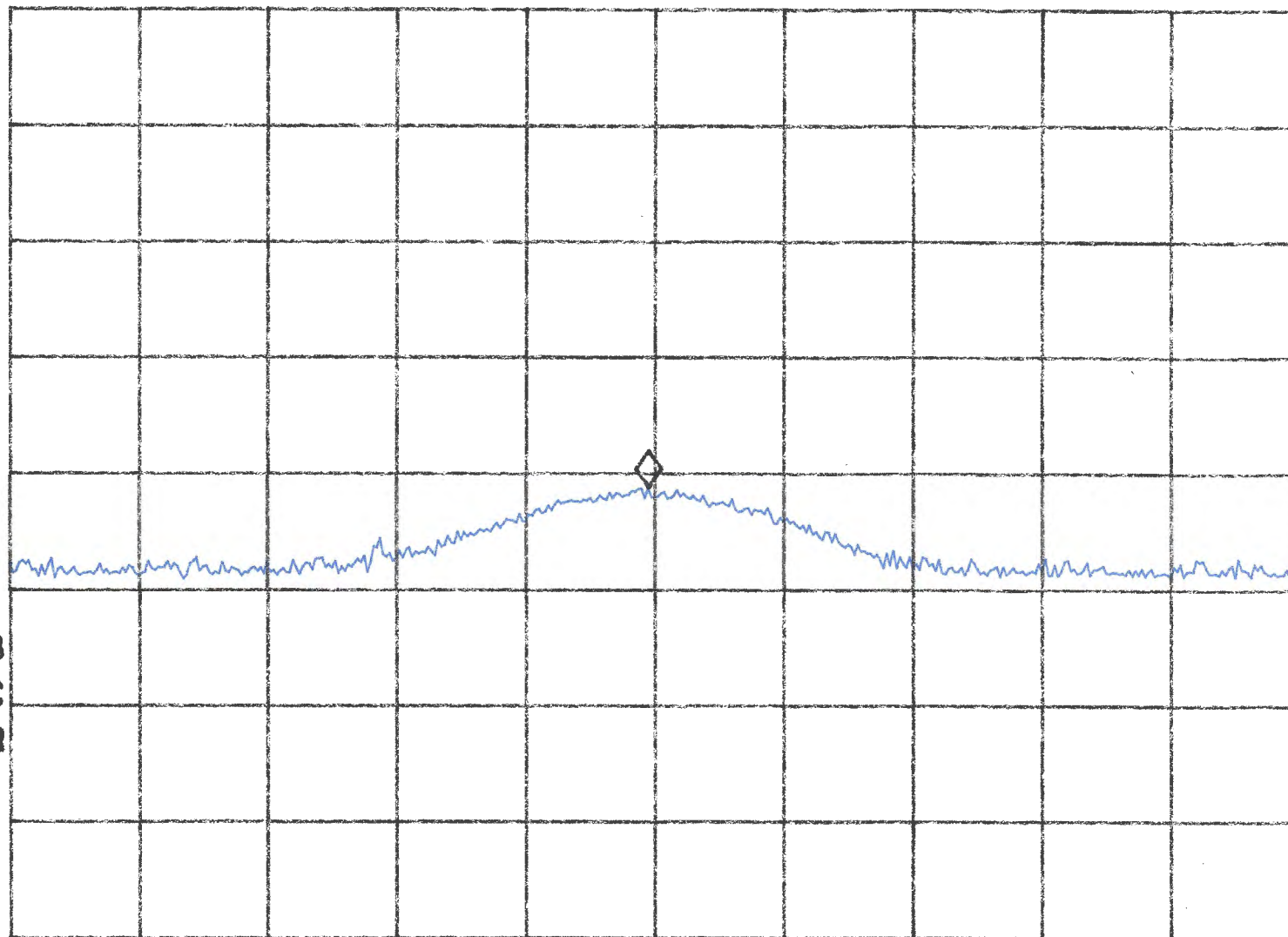
SPAN 5.000 MHz
SWP 20.0 msec

00: 27: 27 OCT 10, 2014
GOJO#6492 TFX 1M ANT-VERT
REF 75.0 dBμV #AT 0 dB

MKR 1.819975 GHz
33.84 dBμV

PEAK
LOG
10
dB/

MA SB
SC FC
CORR



CENTER 1.820000 GHz
#RES BW 1.0 MHz

VBW 300 kHz

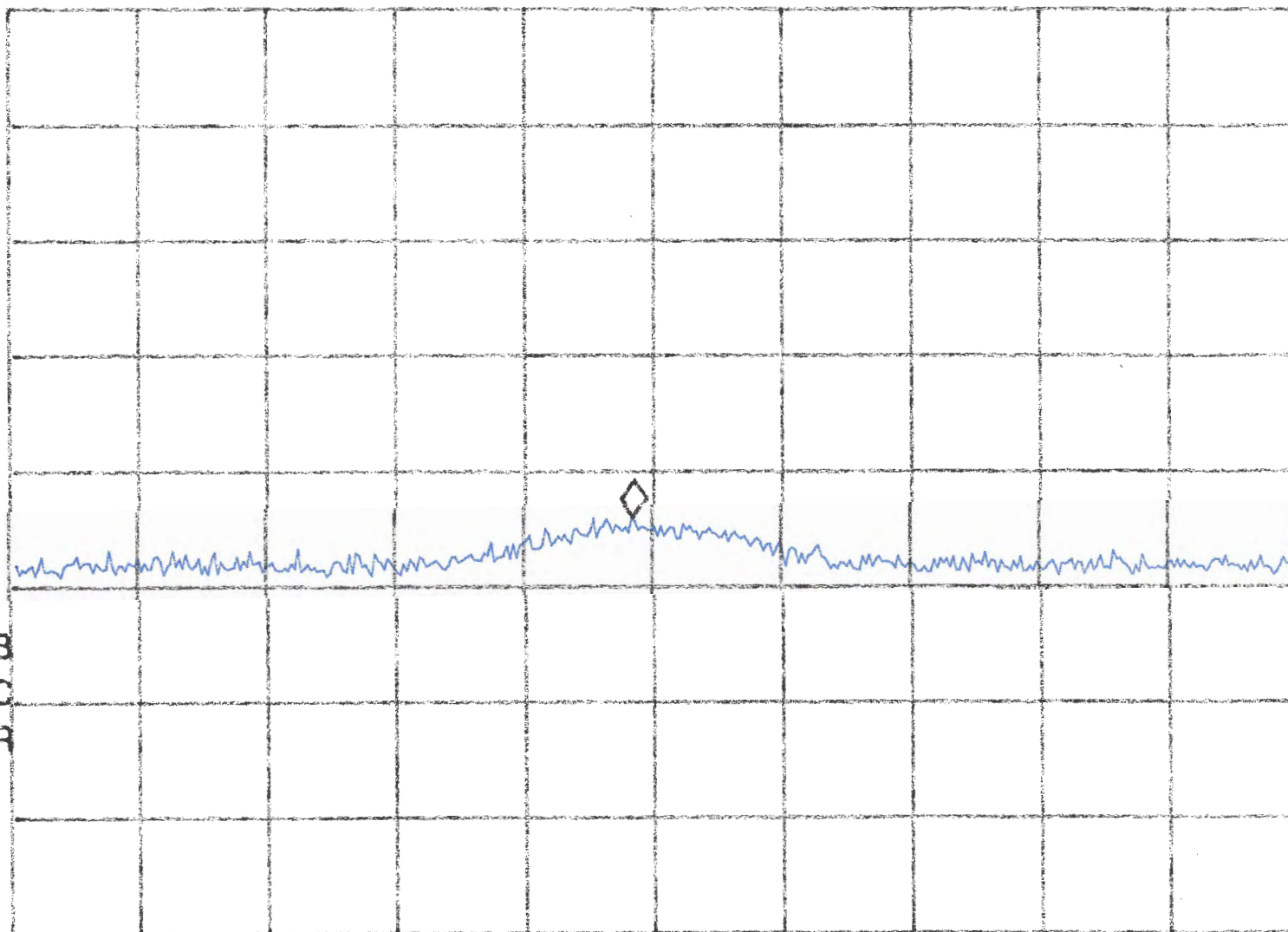
SPAN 5.000 MHz
#SWP 20.0 msec

00: 42: 52 OCT 10, 2014
GOJO#6492 TFX 1M ANT-VERT
REF 75.0 dB μ V #AT 0 dB

MKR 2.729900 GHz
31.08 dB μ V

PEAK
LOG
10
dB/

MA SB
SC FC
CORR



CENTER 2.730000 GHz
#RES BW 1.0 MHz

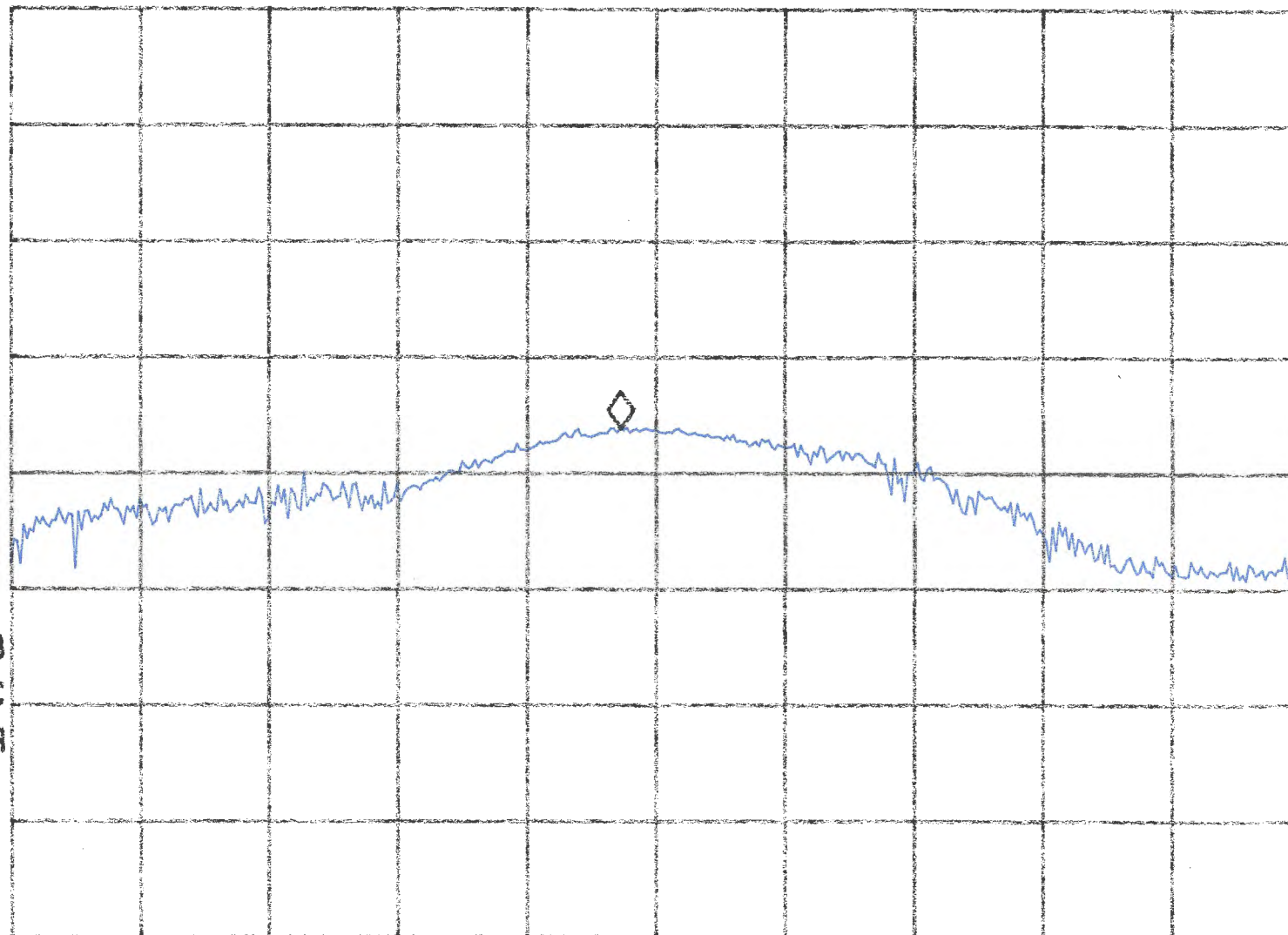
VBW 300 kHz

SPAN 5.000 MHz
#SWP 20.0 msec

00: 46: 12 OCT 10, 2014
hp GOJO#6492 TFX 1M ANT-VERT
REF 75.0 dBμV #AT 0 dB

MKR 3.639863 GHz
38.87 dBμV

PEAK
LOG
10
dB/



MA SB
SC FC
CORR

CENTER 3.640000 GHz
#RES BW 1.0 MHz

VBW 300 kHz

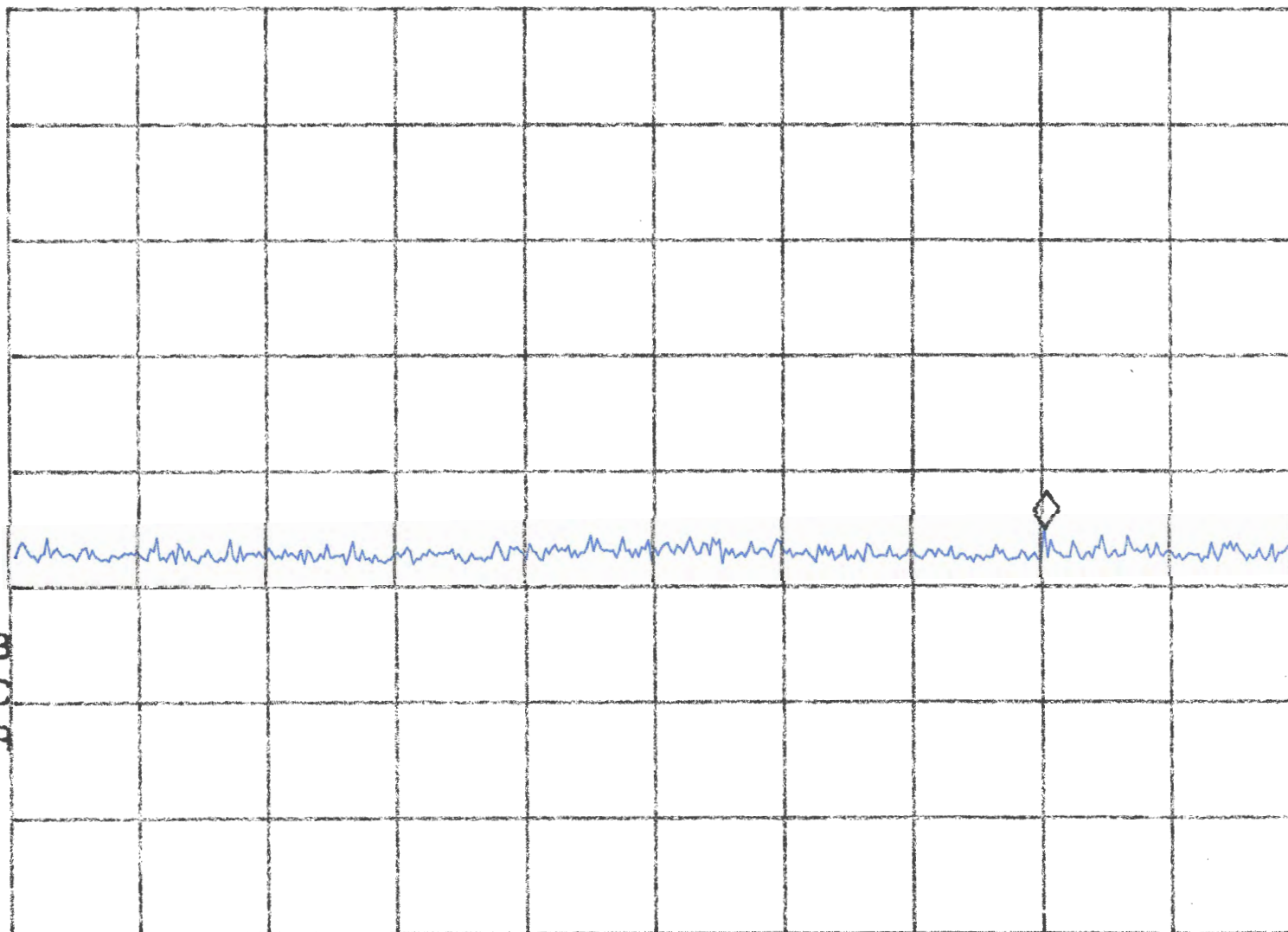
SPAN 5.000 MHz
#SWP 20.0 msec

00: 48: 26 OCT 10, 2014
GOJO#6492 TFX 1M ANT-VERT
REF 75.0 dBμV #AT 0 dB

MKR 4.551500 GHz
30.03 dBμV

PEAK
LOG
10
dB/

MA SB
SC FC
CORR



CENTER 4.550000 GHz
#RES BW 1.0 MHz

VBW 300 kHz

SPAN 5.000 MHz
#SWP 20.0 msec

00:50:35 OCT 10, 2014

hp GOJ0#6492 TFX 1M ANT-VERT

REF 75.0 dB μ V #AT 0 dB

MKR 5.641675 GHz

27.93 dB μ V

PEAK

LOG

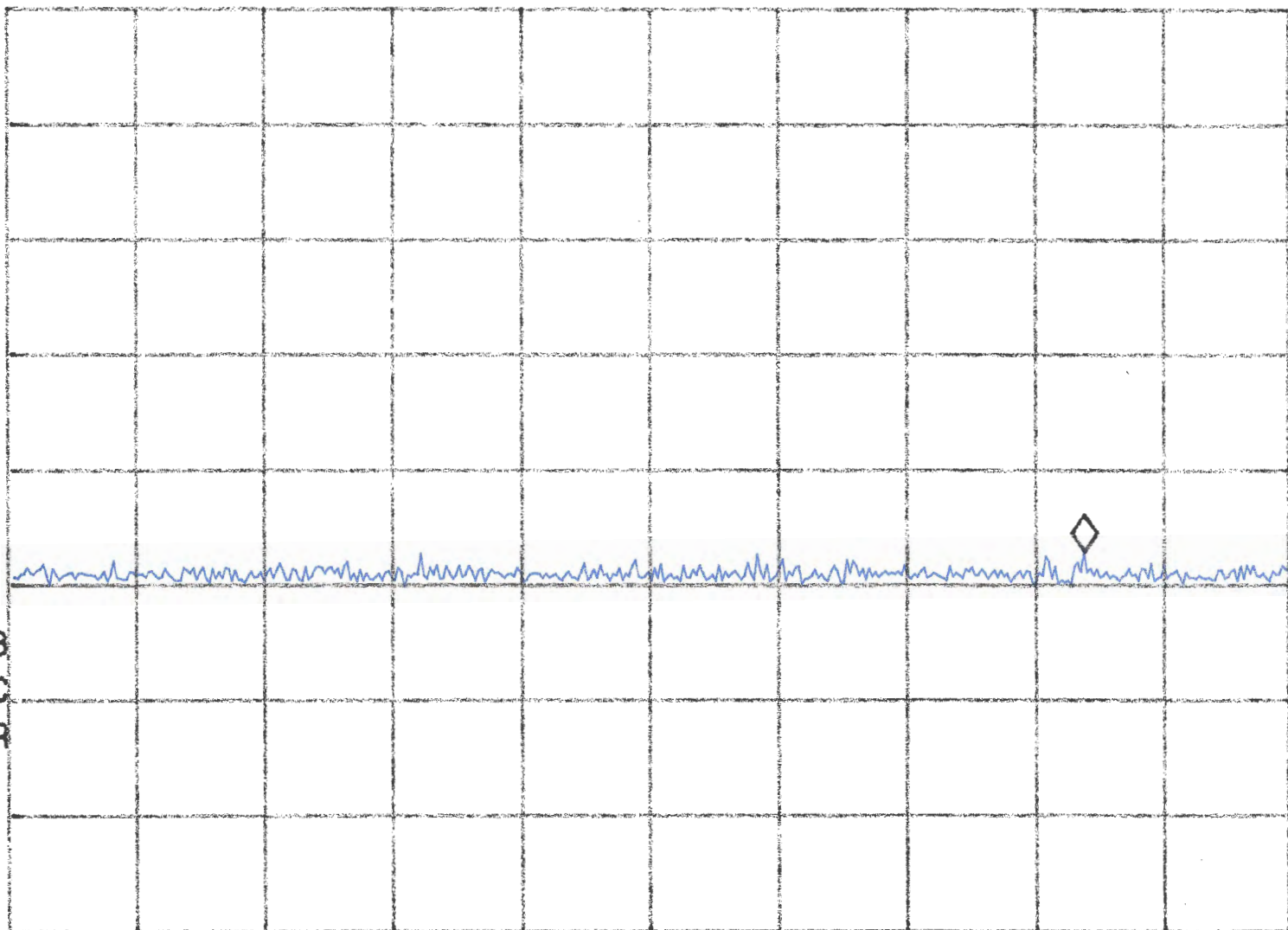
10

dB/

MA SB

SC FC

CORR



CENTER 5.640000 GHz

#RES BW 1.0 MHz

VBW 300 kHz

SPAN 5.000 MHz

#SWP 20.0 msec

00:54:31 OCT 10, 2014

GOJO#6492 TFX 1M ANT-VERT

REF 75.0 dBμV #AT 0 dB

MKR 6.369725 GHz

29.30 dBμV

PEAK

LOG

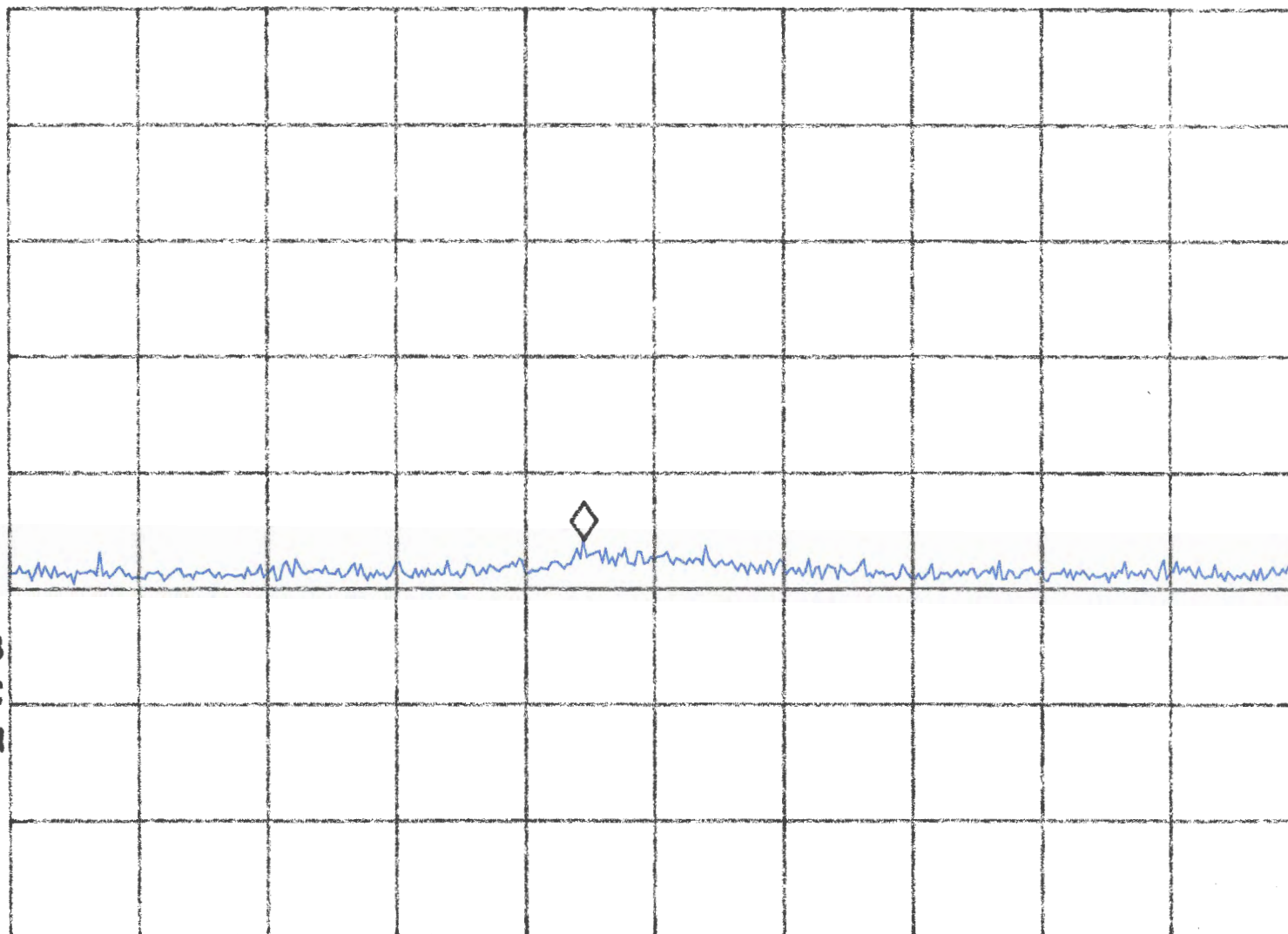
10

dB/

MA SB

SC FC

CORR



CENTER 6.370000 GHz

#RES BW 1.0 MHz

VBW 300 kHz

SPAN 5.000 MHz

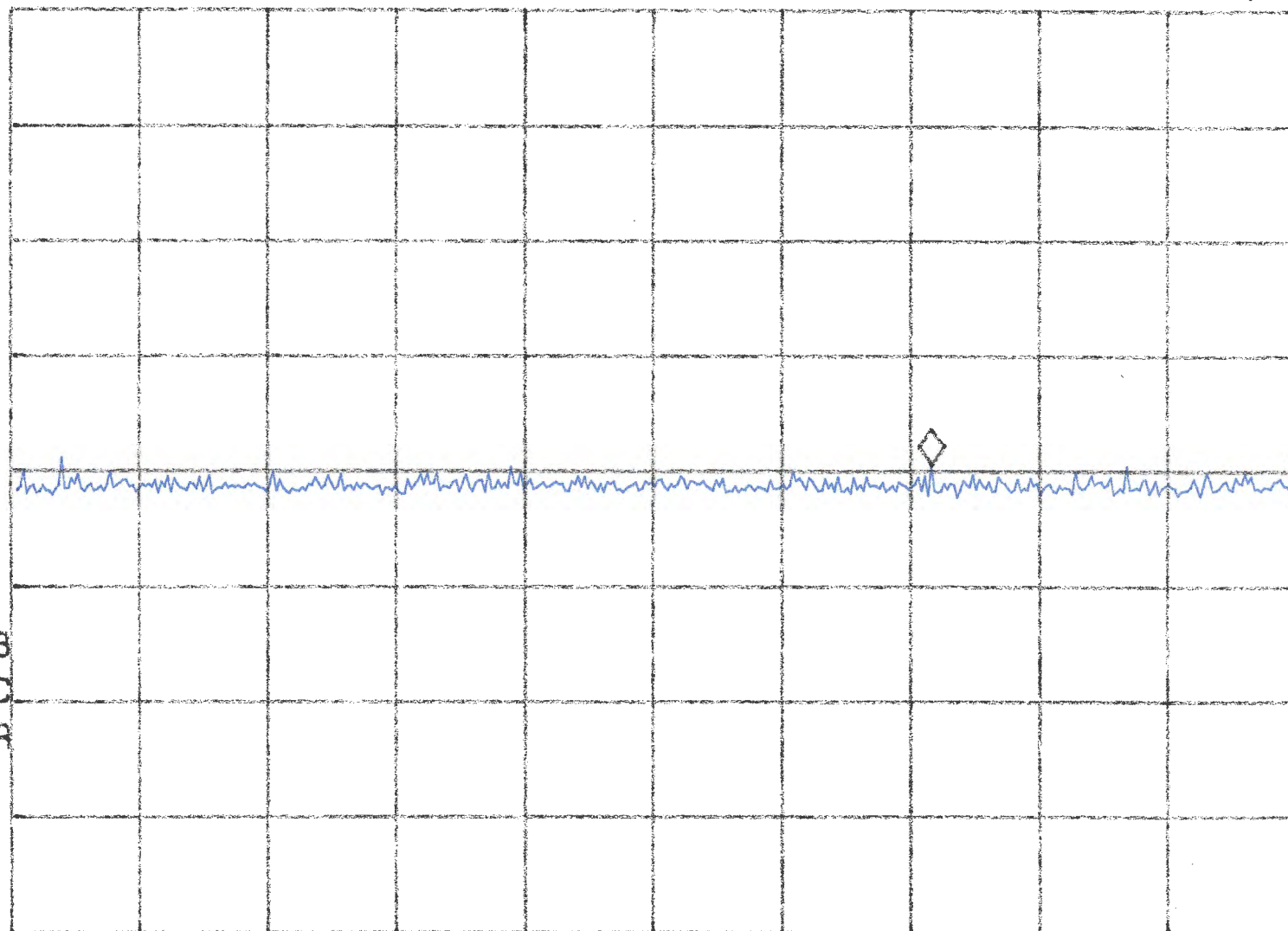
#SWP 20.0 msec

00:57:02 OCT 10, 2014
hp GOJO#6492 TFX 1M ANT-VERT
REF 75.0 dBμV #AT 0 dB

MKR 7.281063 GHz
35.55 dBμV

PEAK
LOG
10
dB/

MA SB
SC FC
CORR



CENTER 7.280000 GHz
#RES BW 1.0 MHz

VBW 300 kHz

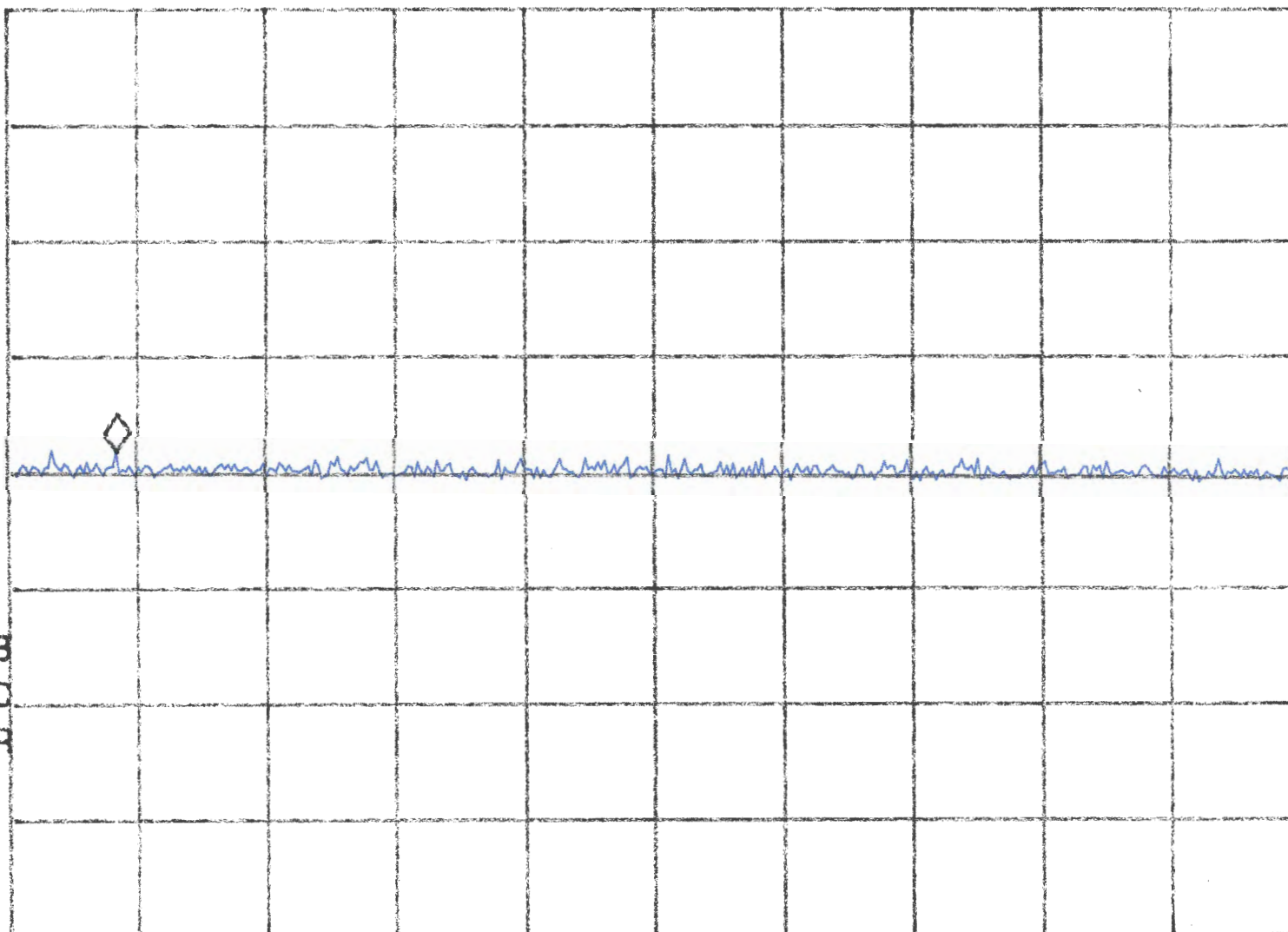
SPAN 5.000 MHz
#SWP 20.0 msec

00:59:15 OCT 10, 2014
hp GOJ0#6492 TFX 1M ANT-VERT
REF 75.0 dBμV #AT 0 dB

MKR 8.187887 GHz
36.92 dBμV

PEAK
LOG
10
dB/

MA SB
SC FC
CORR



CENTER 8.190000 GHz
#RES BW 1.0 MHz

VBW 300 kHz

SPAN 5.000 MHz
#SWP 20.0 msec

01:03:09 OCT 10, 2014

GOJO#6492 TFX 1M ANT-VERT

MKR 9.097587 GHz

REF 75.0 dB μ V #AT 0 dB

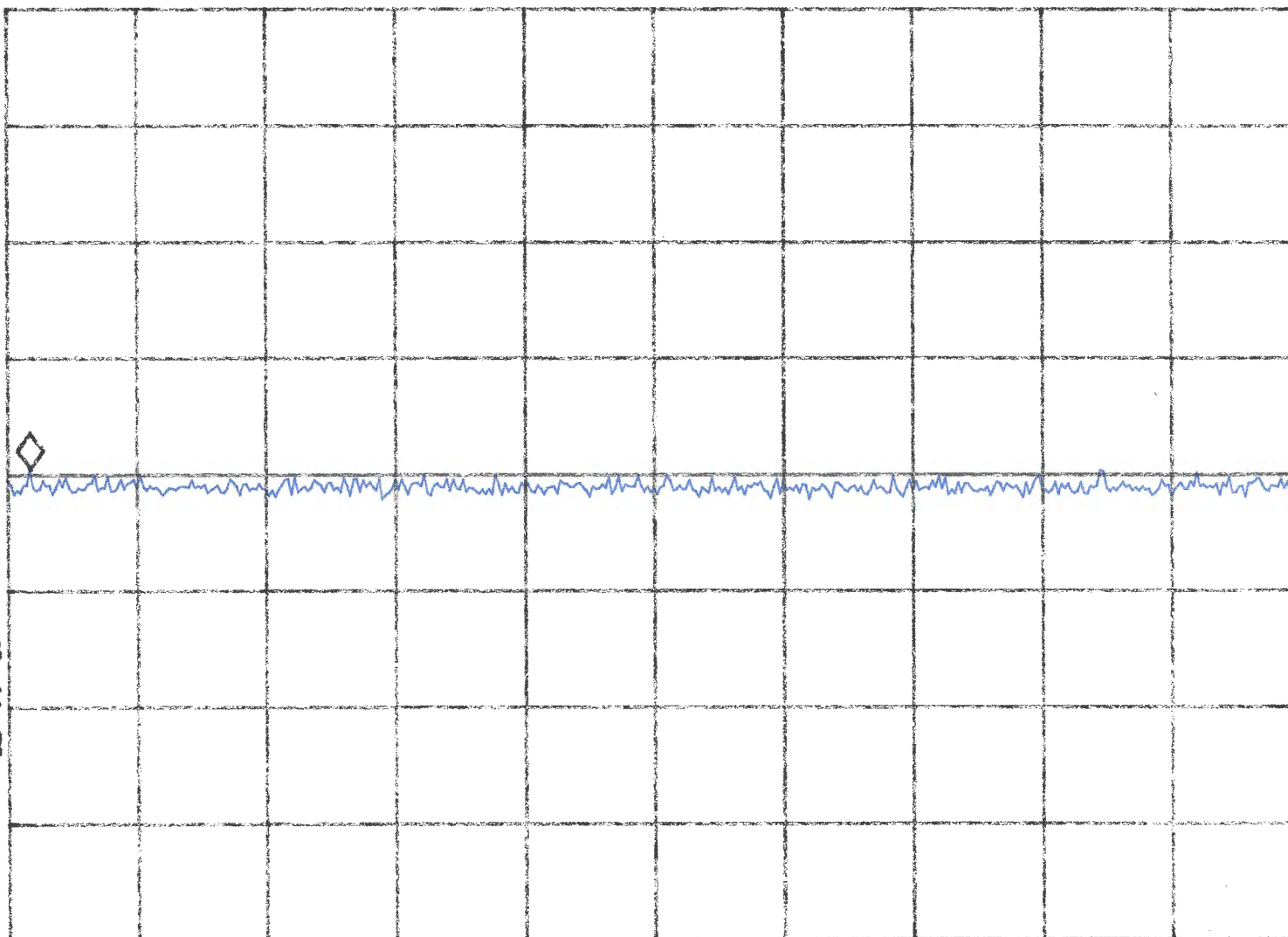
35.48 dB μ V

PEAK

LOG

10

dB/



VA SB

SC FC

CORR

CENTER 9.100000 GHz

#RES BW 1.0 MHz

SPAN 5.000 MHz

VBW 300 kHz

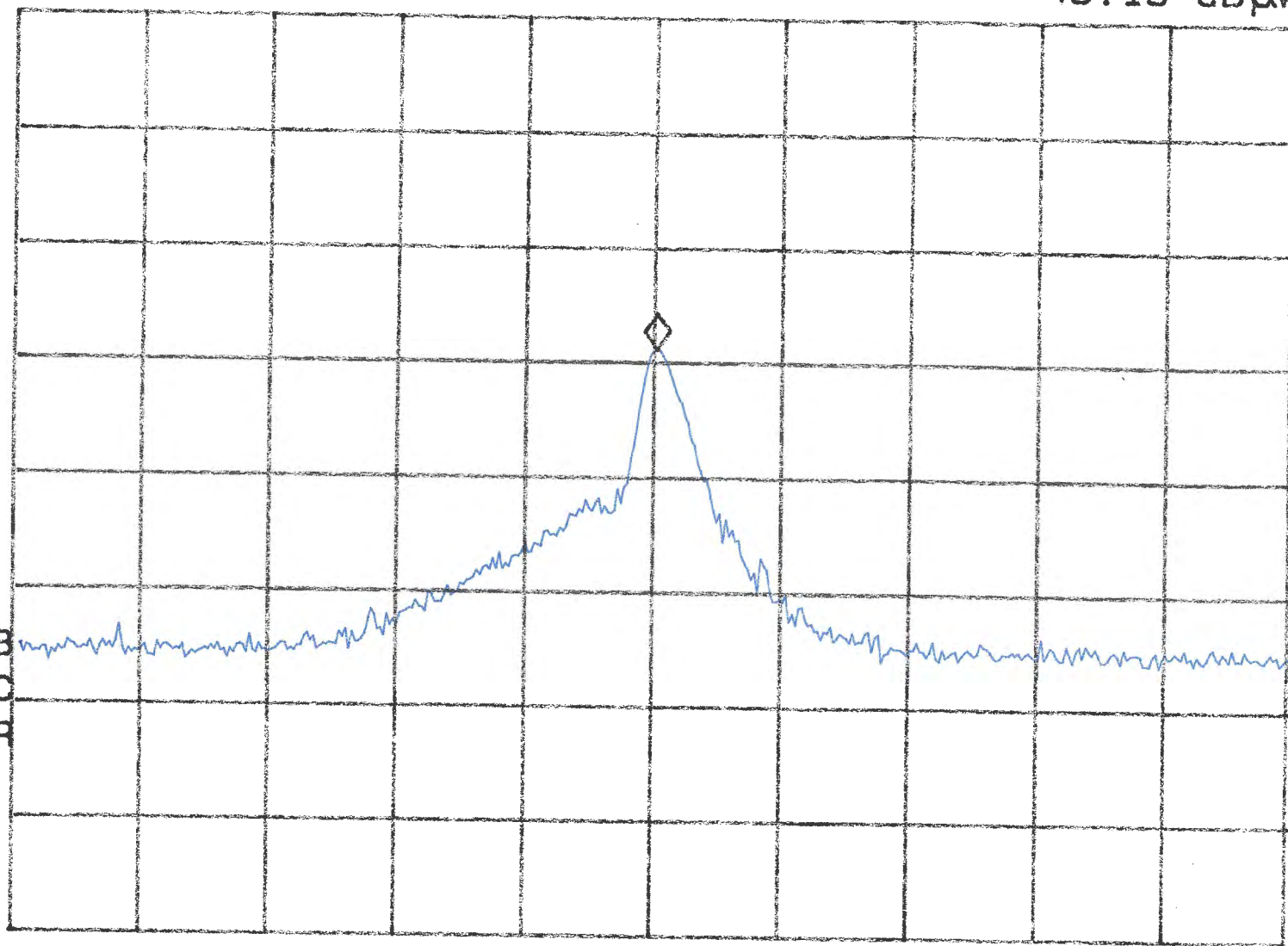
#SWP 20.0 msec

21: 46: 08 OCT 09, 2014
hp GOJO#6492 TFX 3M ANT-HOR
REF 75.0 dBμV #AT 0 dB

MKR 909.987 MHz
46.19 dBμV

PEAK
LOG
10
dB/

MA SB
SC FC
CORR



CENTER 910.000 MHz
#RES BW 120 kHz

VBW 300 kHz

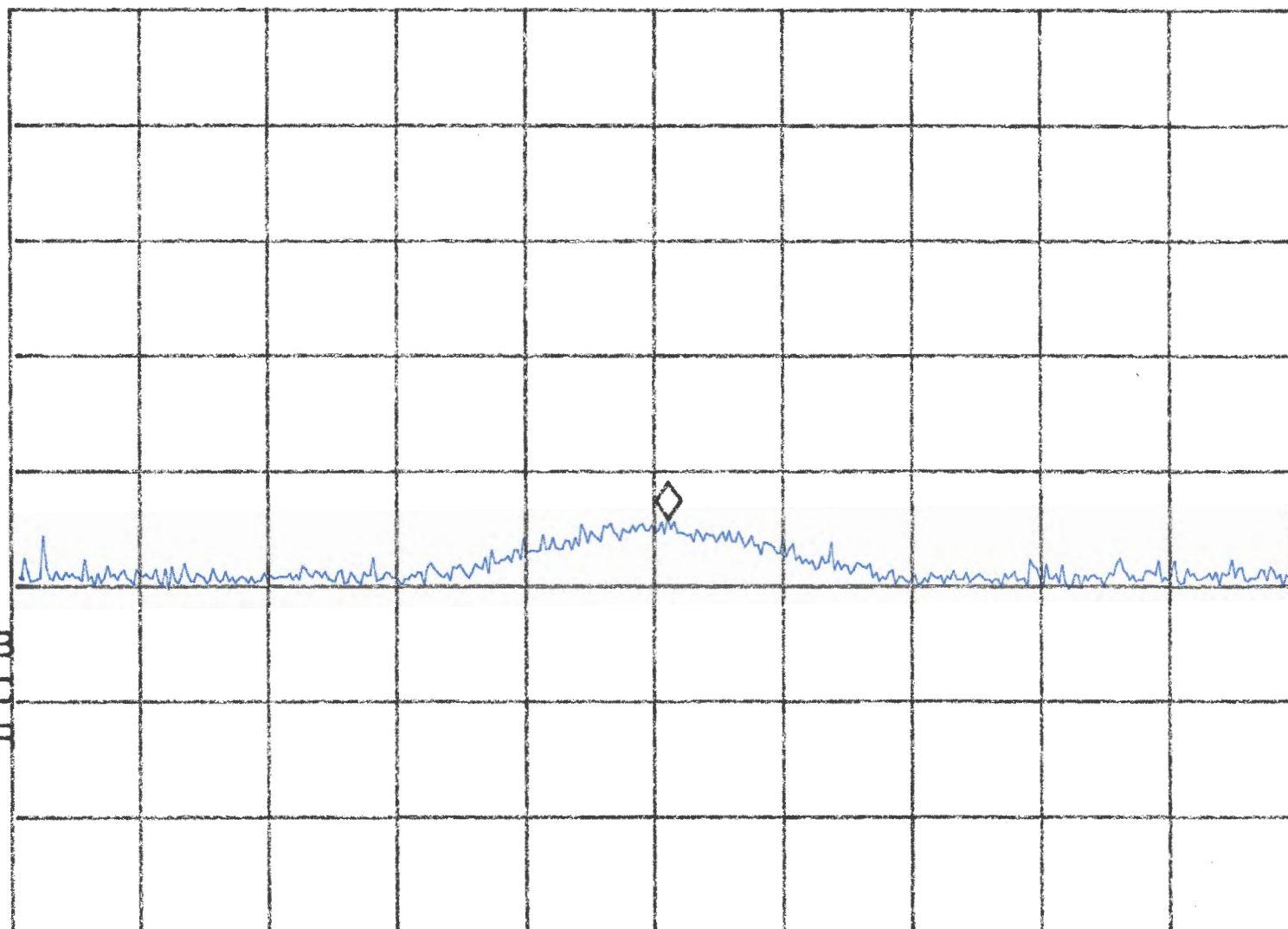
SPAN 5.000 MHz
SWP 20.0 msec

23: 43: 36 OCT 09, 2014
GOJO#6492 TFX 1M ANT-HOR
REF 75.0 dB μ V #AT 0 dB

MKR 1.820025 GHz
30.86 dB μ V

PEAK
LOG
10
dB/

VA SB
SC FC
CORR



CENTER 1.820000 GHz
#RES BW 1.0 MHz

VBW 300 kHz

SPAN 5.000 MHz
#SWP 20.0 msec

23: 50: 00 OCT 09, 2014

GOJO#6492 TFX 1M ANT-HOR

REF 75.0 dB μ V

#AT 0 dB

MKR 2.730000 GHz

33.11 dB μ V

PEAK

LOG

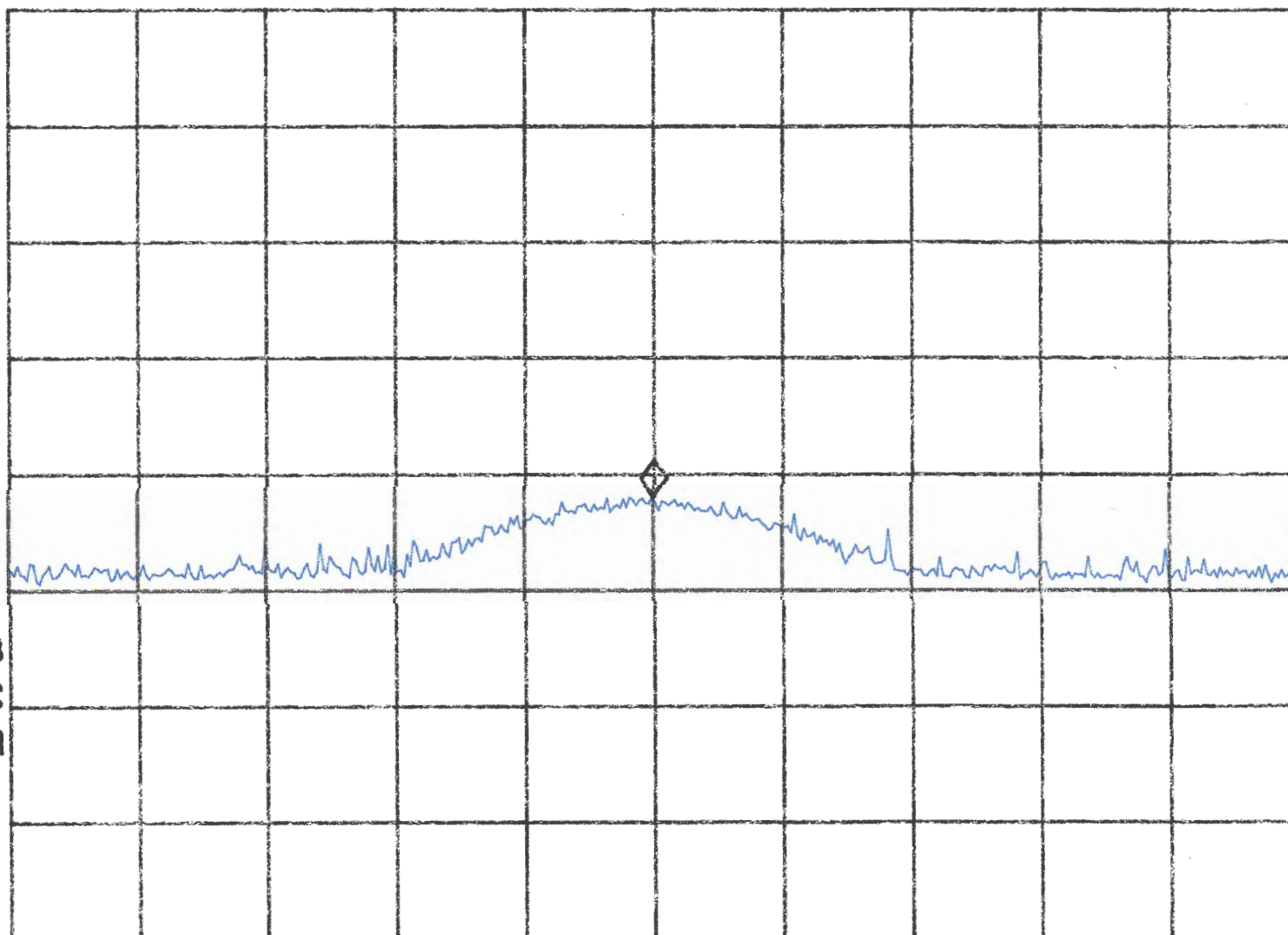
10

dB/

VA SB

SC FC

CORR



CENTER 2.730000 GHz

#RES BW 1.0 MHz

SPAN 5.000 MHz

#SWP 20.0 msec

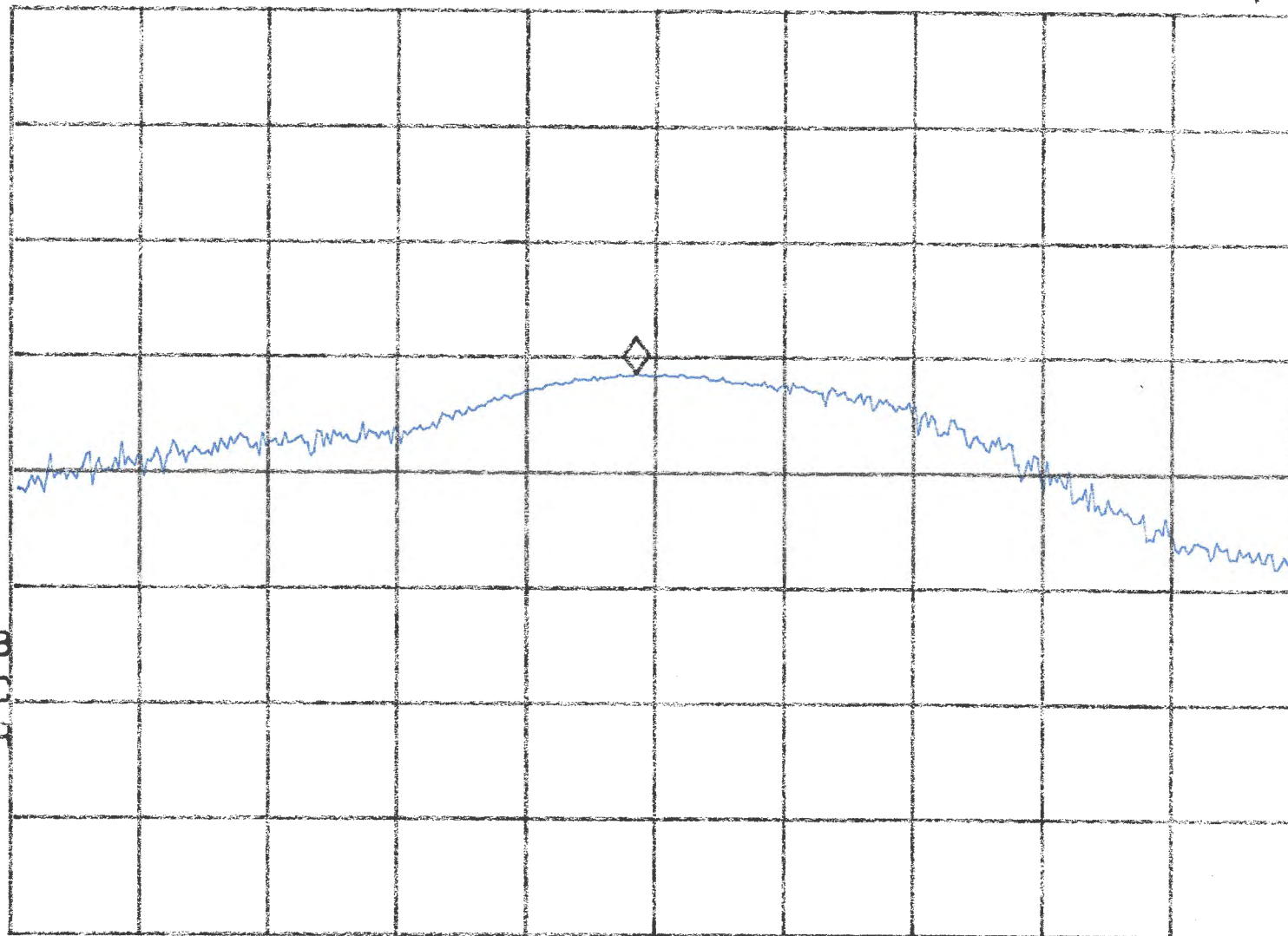
VBW 300 kHz

23:56:14 OCT 09, 2014
hp GOJ0#6492 TFX 1M ANT-HOR
REF 75.0 dBμV #AT 0 dB

MKR 3.639900 GHz
43.58 dBμV

PEAK
LOG
10
dB/

MA SB
SC FC
CORR



CENTER 3.640000 GHz
#RES BW 1.0 MHz

VBW 300 kHz

SPAN 5.000 MHz
#SWP 20.0 msec

23: 59: 52 OCT 09, 2014

HP GOJ0#6492 TFX 1M ANT-HOR

REF 75.0 dB μ V #AT 0 dB

MKR 4.550013 GHz

37.94 dB μ V

PEAK

LOG

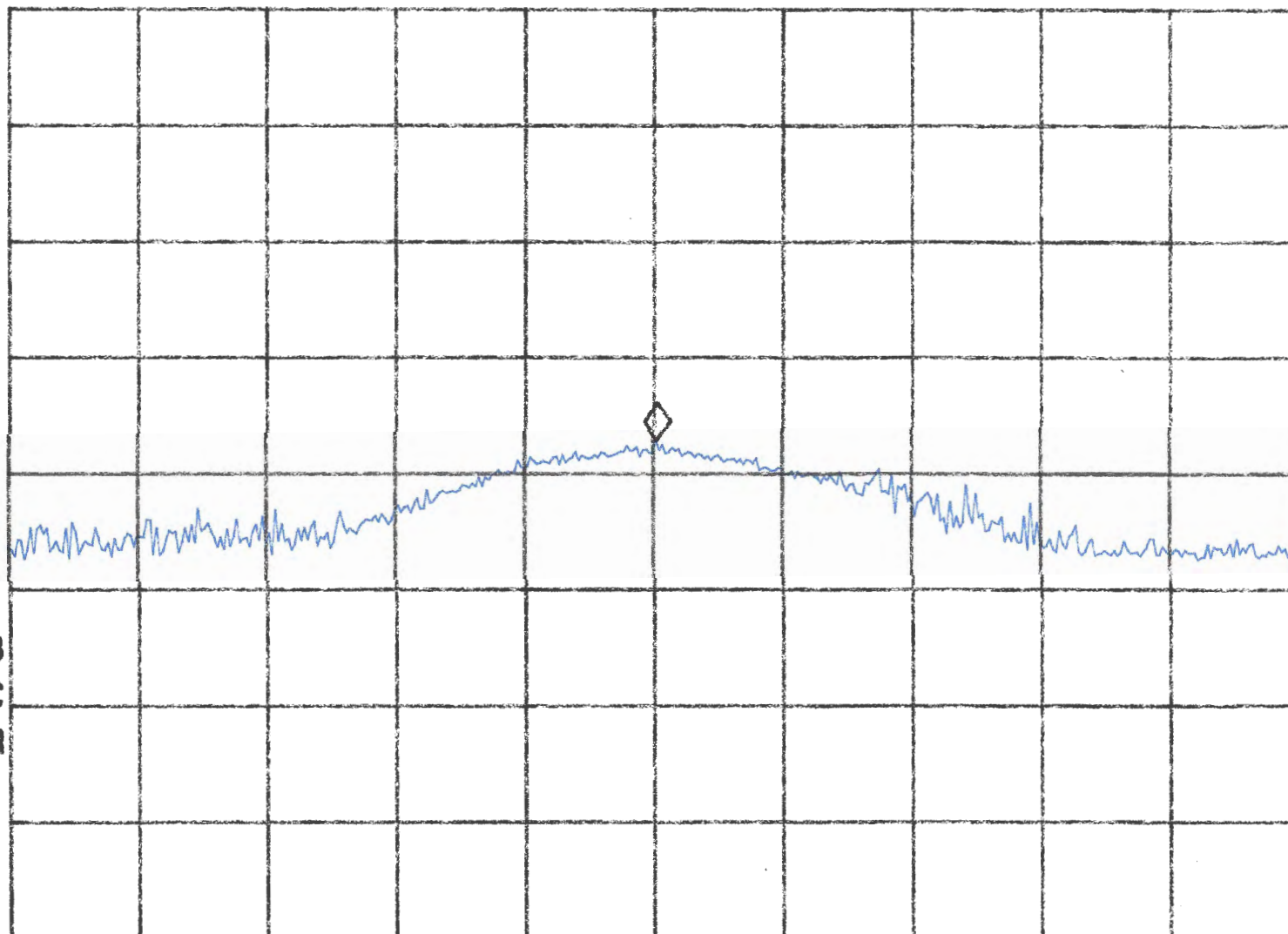
10

dB/

MA SB

SC FC

CORR



CENTER 4.550000 GHz

#RES BW 1.0 MHz

SPAN 5.000 MHz

VBW 300 kHz

#SWP 20.0 msec

00:04:19 OCT 10, 2014

hp GOJO#6492 TFX 1M ANT-HOR

REF 75.0 dBμV #AT 0 dB

MKR 5.458600 GHz

27.47 dBμV

PEAK

LOG

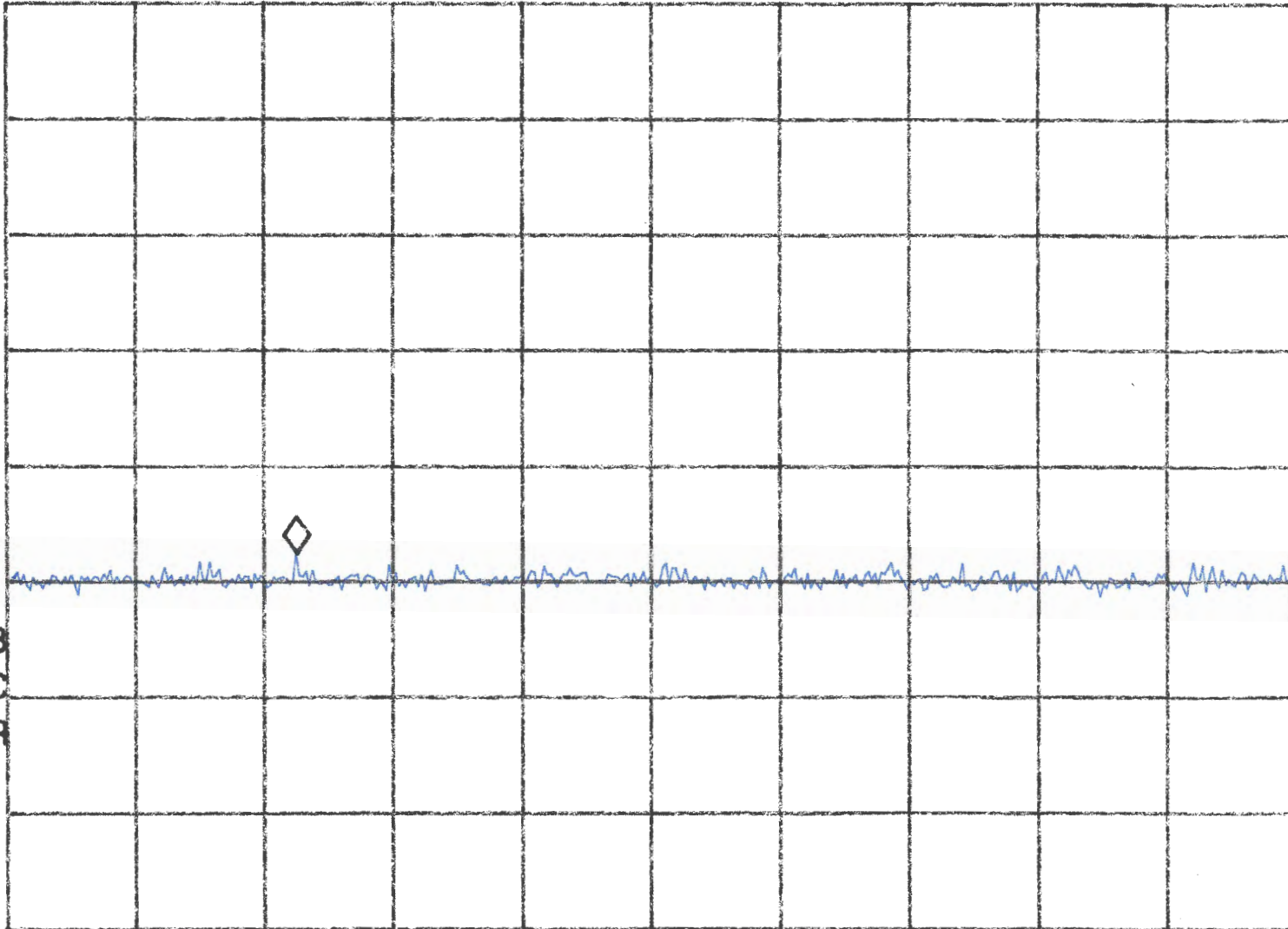
10

dB/

VA SB

SC FC

CORR



CENTER 5.460000 GHz

#RES BW 1.0 MHz

VBW 300 kHz

SPAN 5.000 MHz

#SWP 20.0 msec

00:06:40 OCT 10, 2014

GOJO#6492 TFX 1M ANT-HOR

MKR 6.370125 GHz

REF 75.0 dBμV

#AT 0 dB

28.04 dBμV

PEAK

LOG

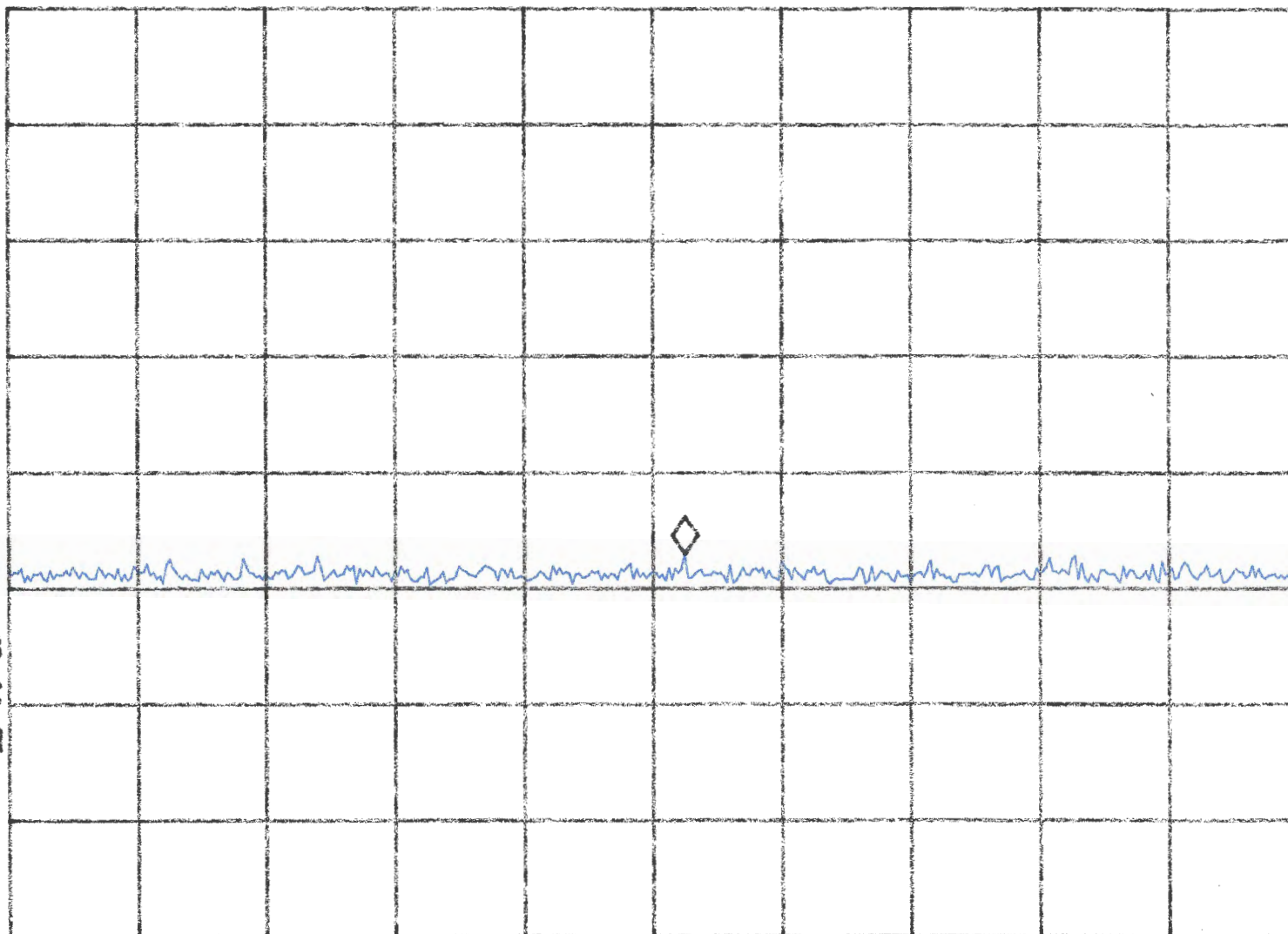
10

dB/

MA SB

SC FC

CORR



CENTER 6.370000 GHz

#RES BW 1.0 MHz

VBW 300 kHz

SPAN 5.000 MHz

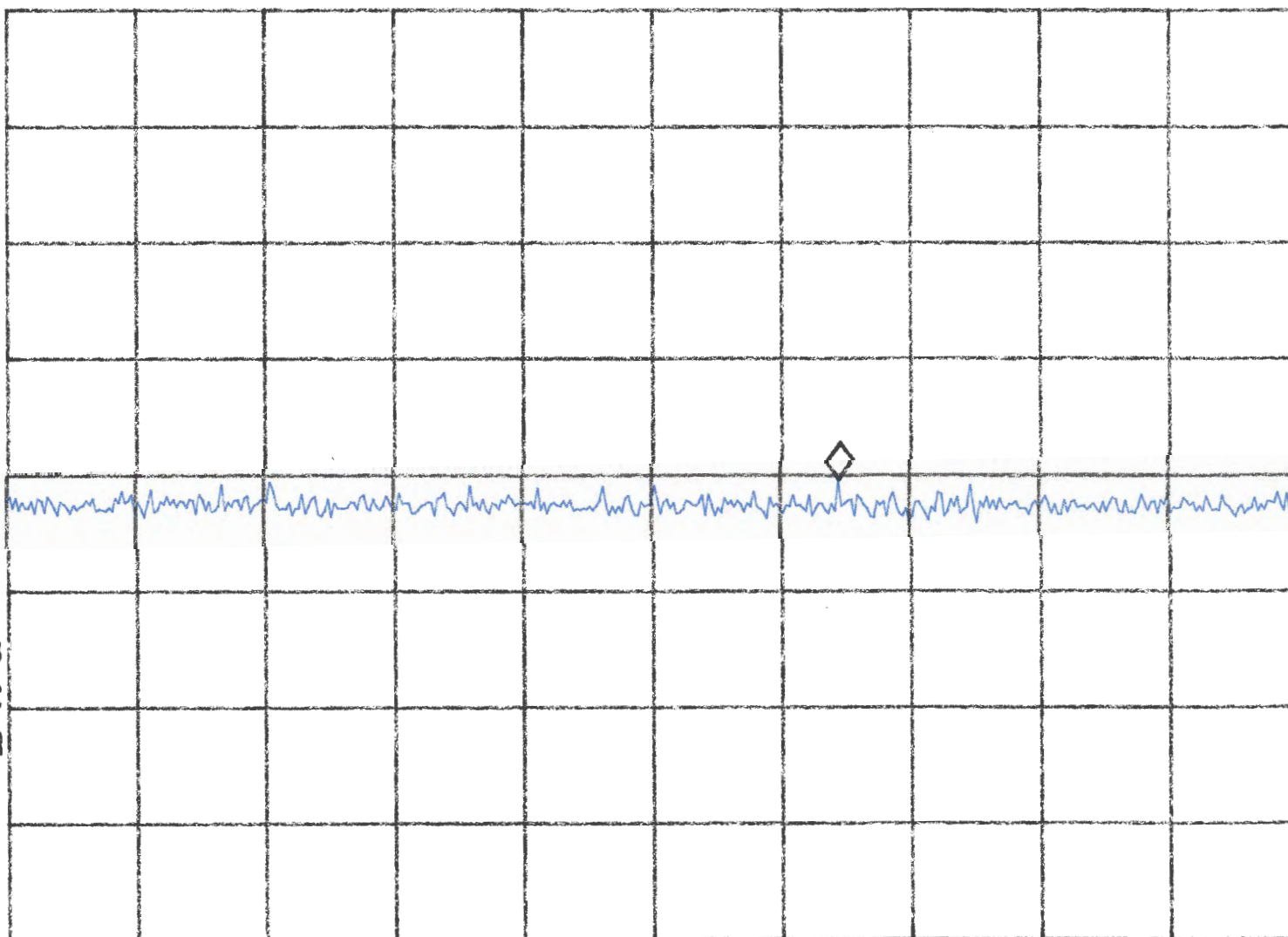
#SWP 20.0 msec

00: 10: 06 OCT 10, 2014
GOJO#6492 TFX 1M ANT-HOR
REF 75.0 dB μ V #AT 0 dB

MKR 7.280725 GHz
34.66 dB μ V

PEAK
LOG
10
dB/

VA SB
SC FC
CORR



CENTER 7.280000 GHz
#RES BW 1.0 MHz

VBW 300 kHz

SPAN 5.000 MHz
#SWP 20.0 msec

00: 13: 53 OCT 10, 2014

GOJO#6492 TFX 1M ANT-HOR

REF 75.0 dB μ V #AT 0 dB

MKR 8.191987 GHz

36.71 dB μ V

PEAK

LOG

10

dB/

VA SB

SC FC

CORR

CENTER 8.190000 GHz

#RES BW 1.0 MHz

VBW 300 kHz

SPAN 5.000 MHz

#SWP 20.0 msec

00: 17: 57 OCT 10, 2014

HP GOJ0#6492 TFX 1M ANT-HOR

MKR 9.100275 GHz

REF 75.0 dB μ V #AT 0 dB

35.82 dB μ V

PEAK

LOG

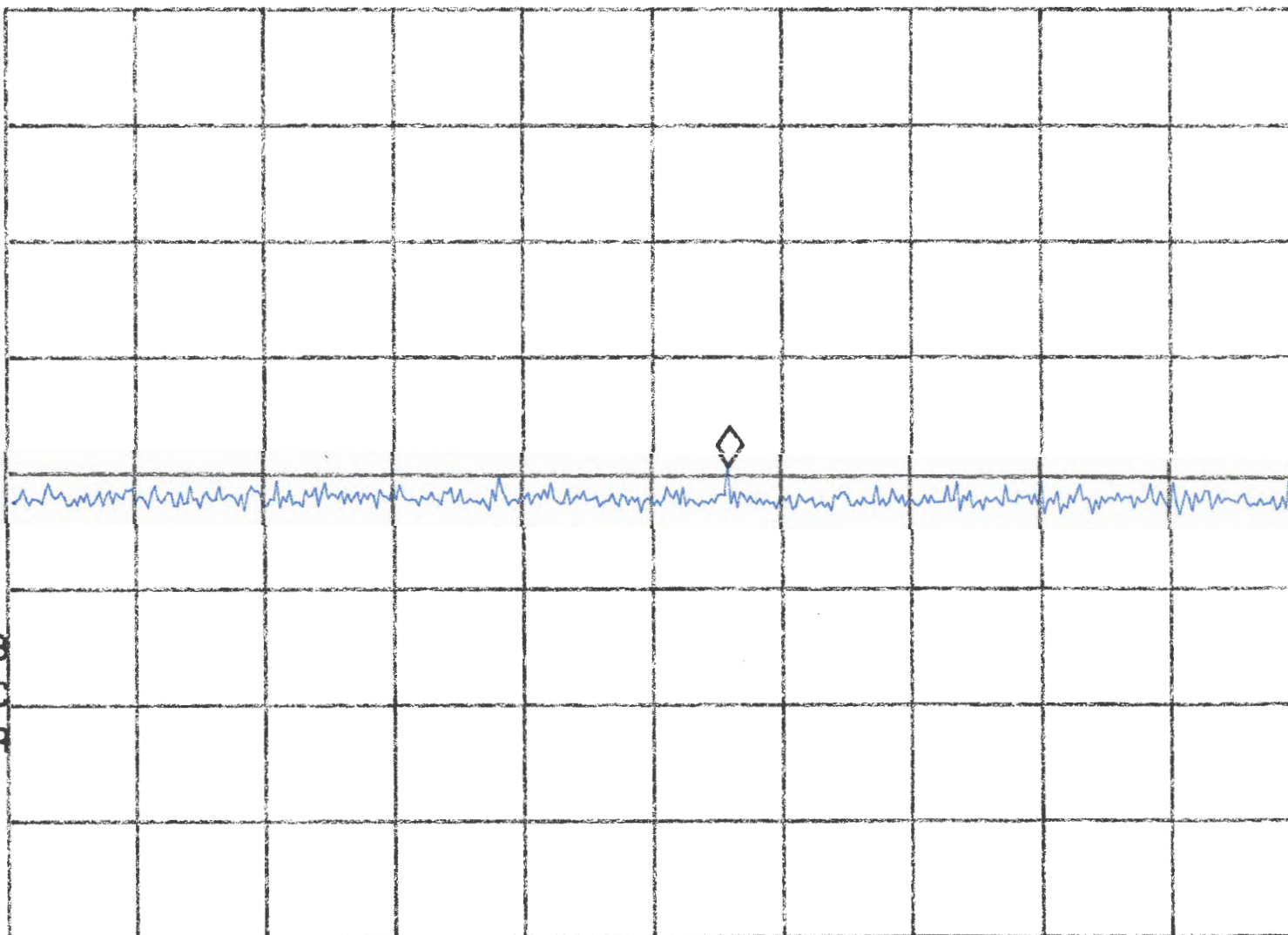
10

dB/

VA SB

SC FC

CORR



CENTER 9.100000 GHz

SPAN 5.000 MHz

#RES BW 1.0 MHz

VBW 300 kHz

#SWP 20.0 msec