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

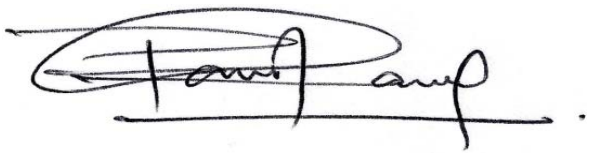
Dear Mr. Bullock

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.dttlab.com.

Sincerely,



Prasanna Gautam
Technical Associate

Table of Contents

Emissions Testing

Documentation

Table of Contents	2
Test Report	3
Test Regulations	4
Test Conditions	5
Test Operation Mode	6
Test Results	7
Test Setup Photographs	8
Test Datasheetss	9

Test Report

Laboratory
Diversified TEST Technologies, Inc.
4675 Burr Drive
Liverpool, NY 13088
315-457-0245

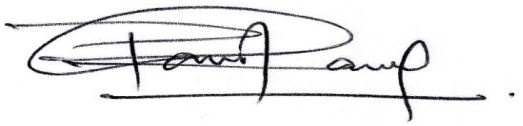
Manufacturer
GOJO Industries
1 GOJO Plaza, Suite 500
Akron, OH. 44311

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

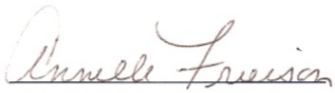
Date Received: **August 8, 2014**
Date Tested: **October 10, 2014 – October 13, 2014**
Model Numbers: Limited Approval Wireless Transmitter Module 2840-513. ABC in the host where the host is Smartlink Ready TFX 28XX-XX dispenser.
FCC ID: O76-T1SG0910A

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:  Date: November 10, 2014

Prasanna Gautam
Technical Associate

Reviewed by:
Signature:  Date: November 10, 2014

Annelle Frierson
Vice- President

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

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

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.

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: 20log(0.491) = -6dB.

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

Test Setup Photographs:

FCC PART 15.249 CLASS C – 910 MHZ

Photograph 1: FCC Part 15.249 Class C

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 Ø9, 2Ø14

GOJO#6492 TFX 3M ANT-HOR

MKR Δ 2ØØ kHz

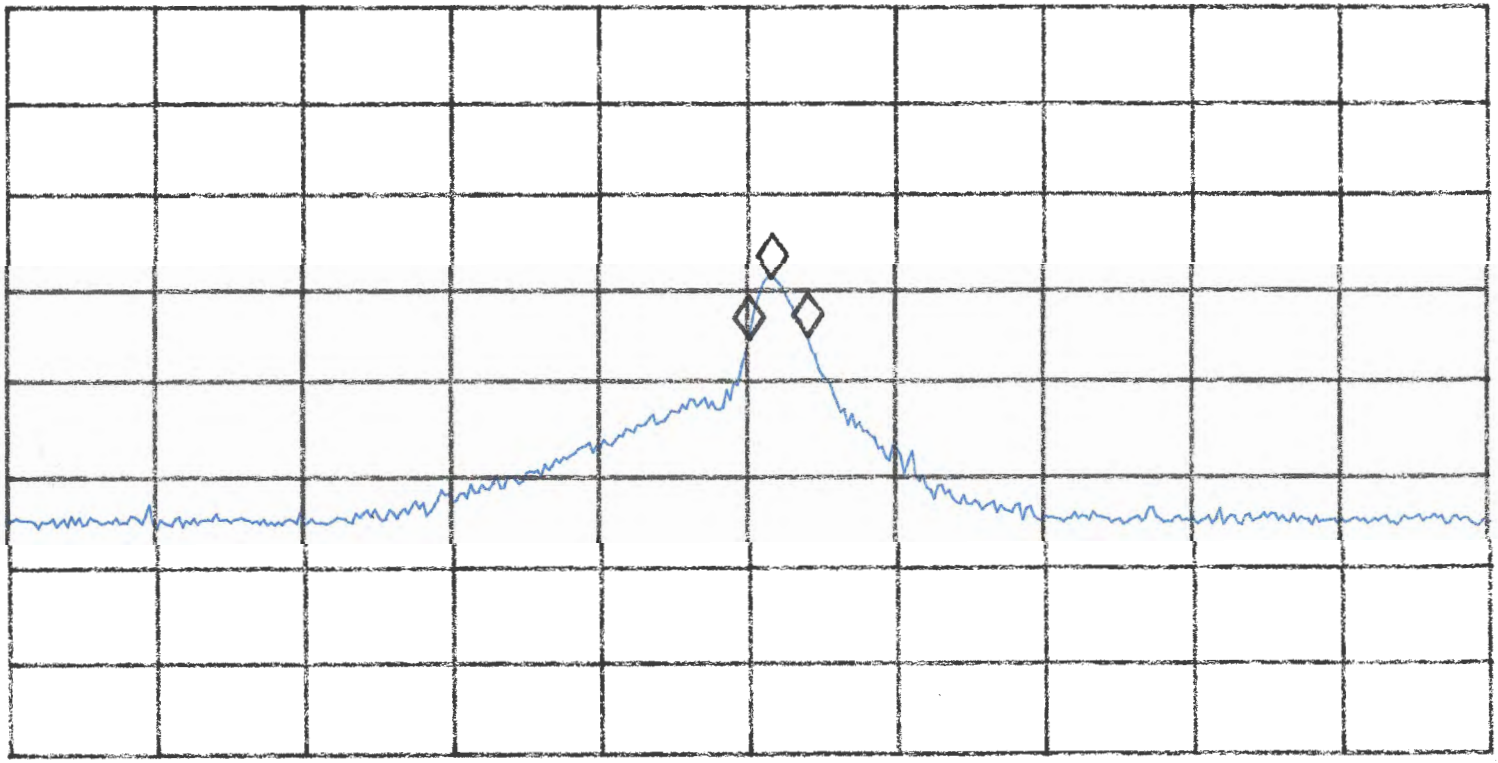
REF 75.Ø dBµV #AT Ø dB .28 dB

PEAK

LOG

1Ø

dB/



Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	9Ø9.988 MHz	46.19 dBuV
2:	(A)	Δ Ref	9Ø9.913 MHz	39.59 dBuV
3:	(A)	ΔFreq	Ø.2ØØ MHz	Ø.28 dB
4:	Inactive			

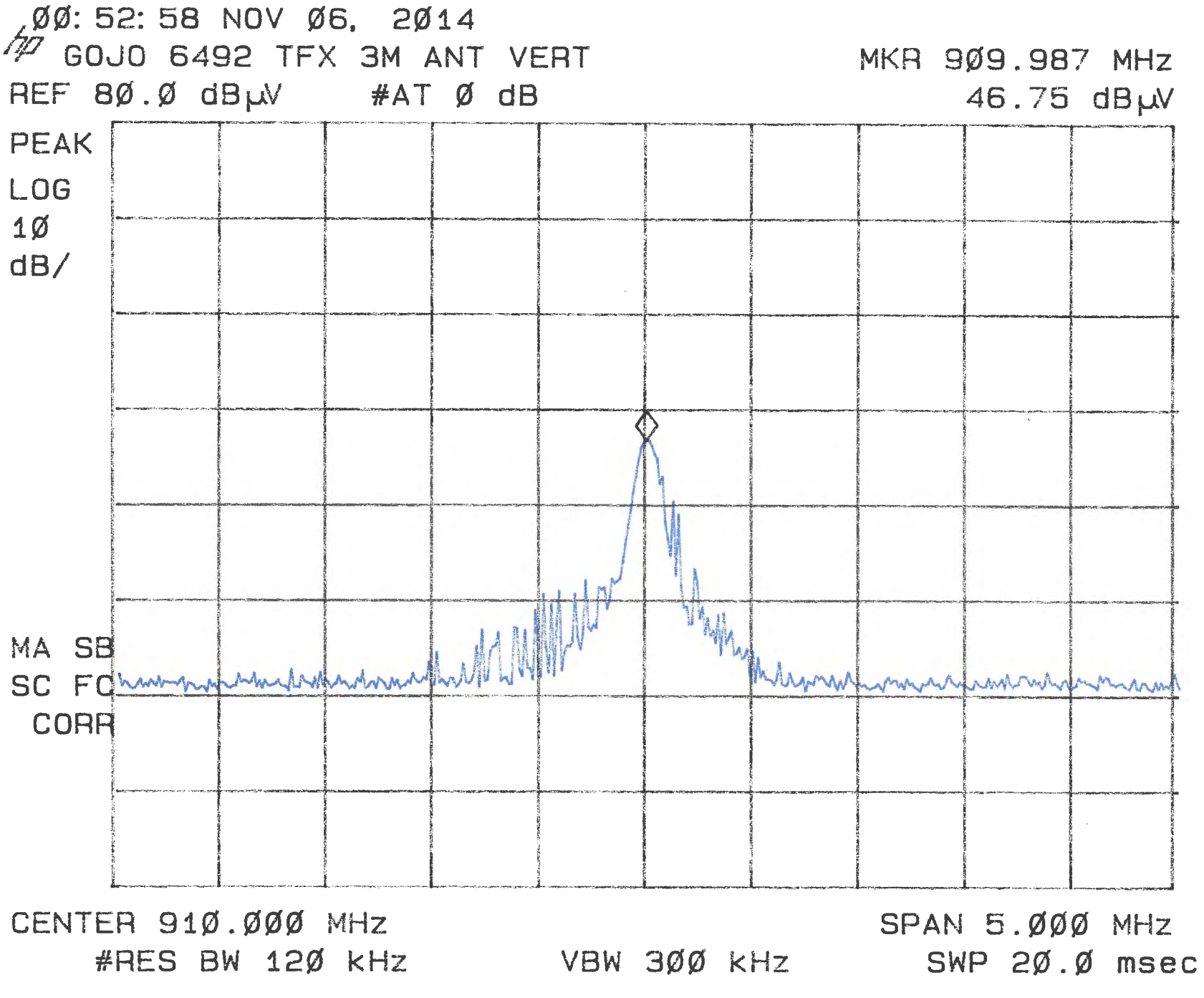
CENTER 9Ø9.912 MHz

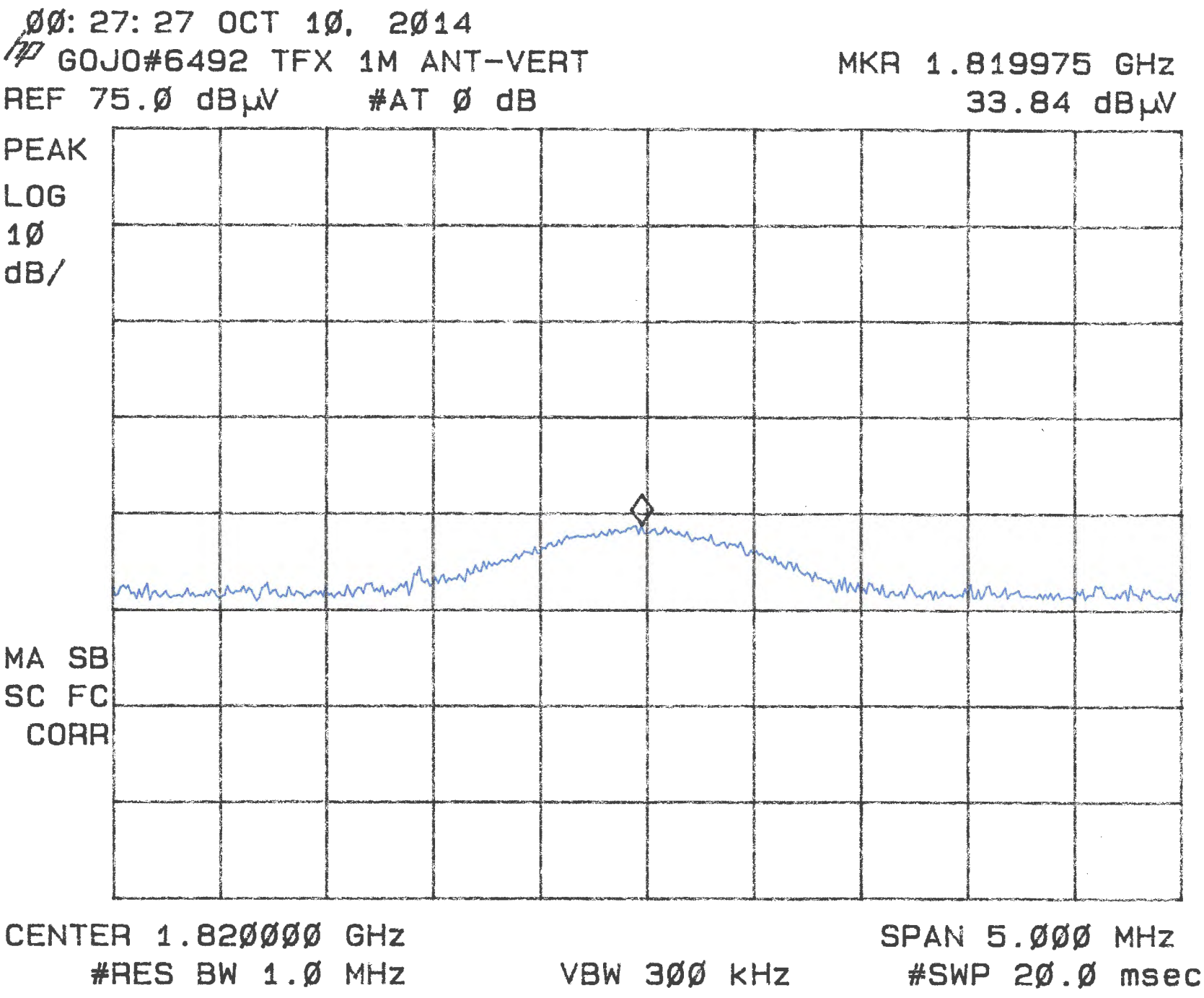
SPAN 5.ØØØ MHz

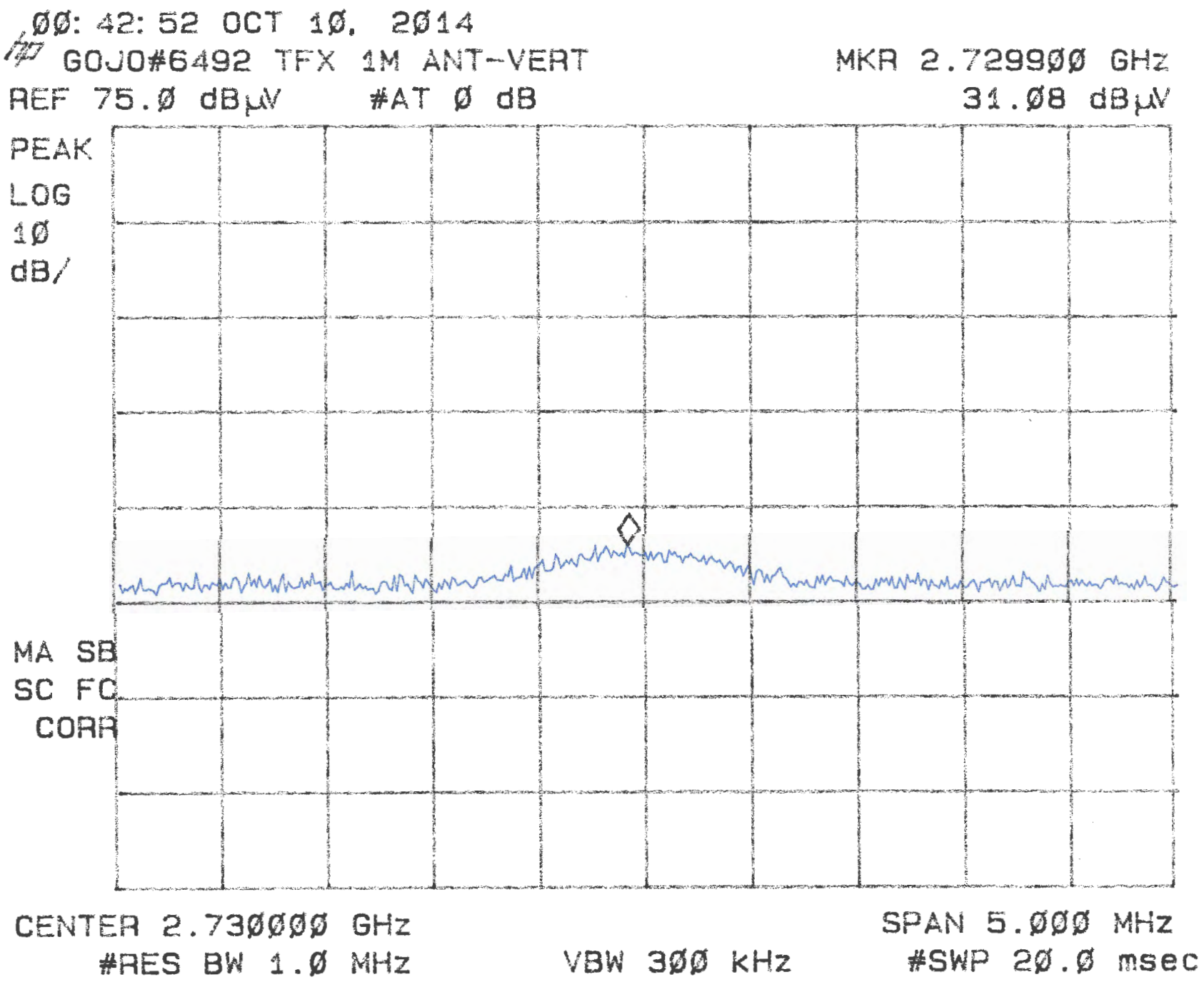
#RES BW 12Ø kHz

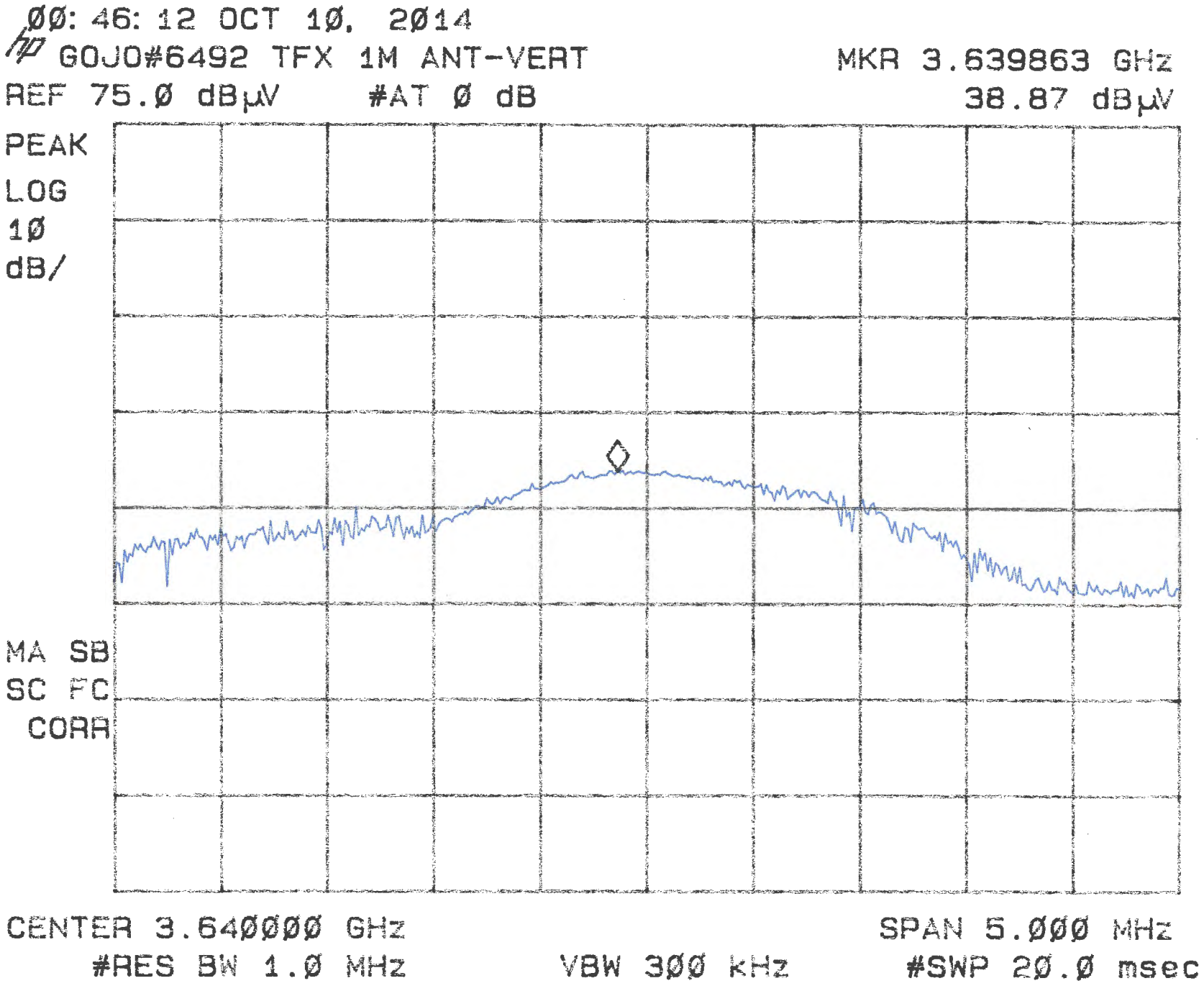
VBW 3ØØ kHz

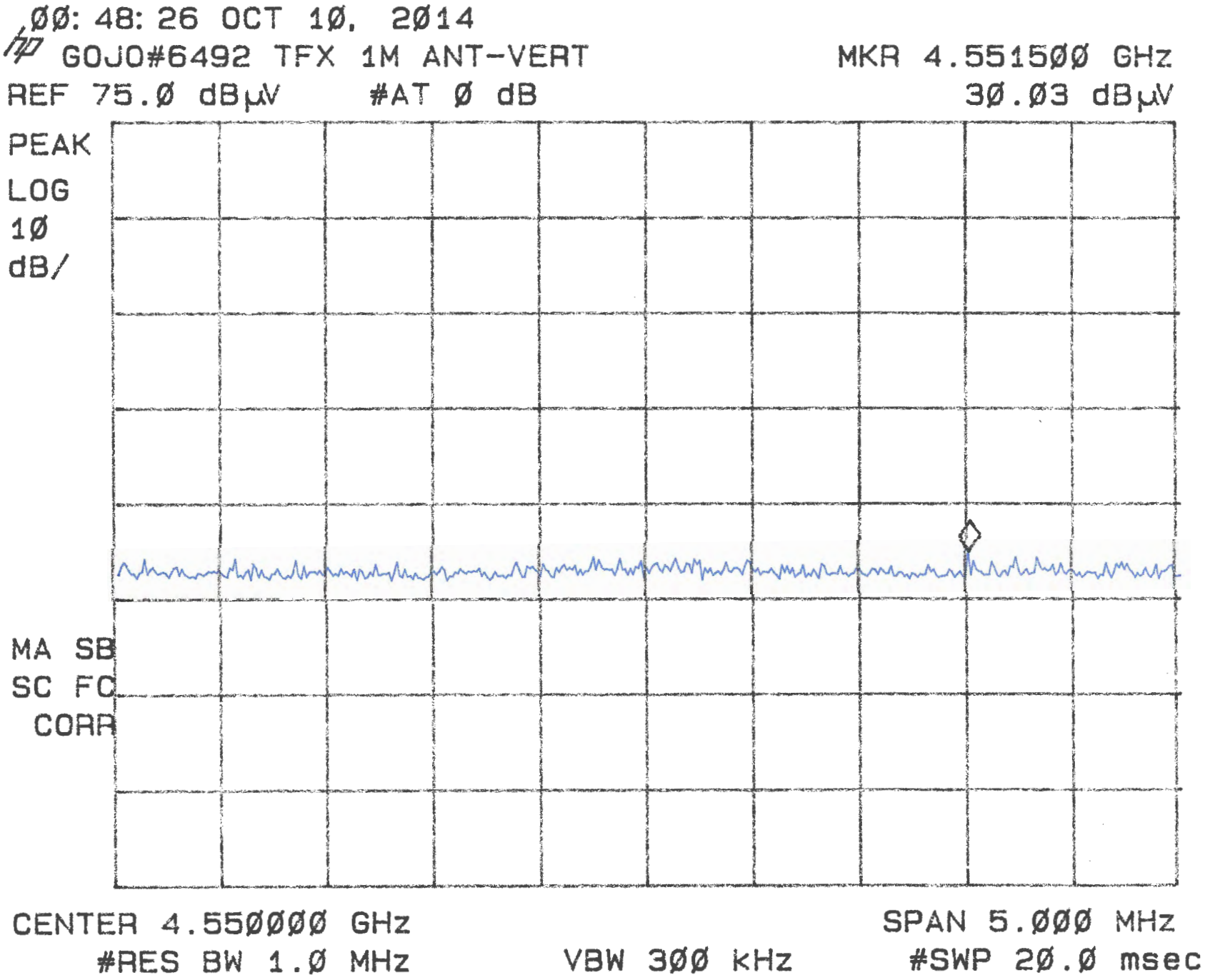
SWP 2Ø.Ø msec

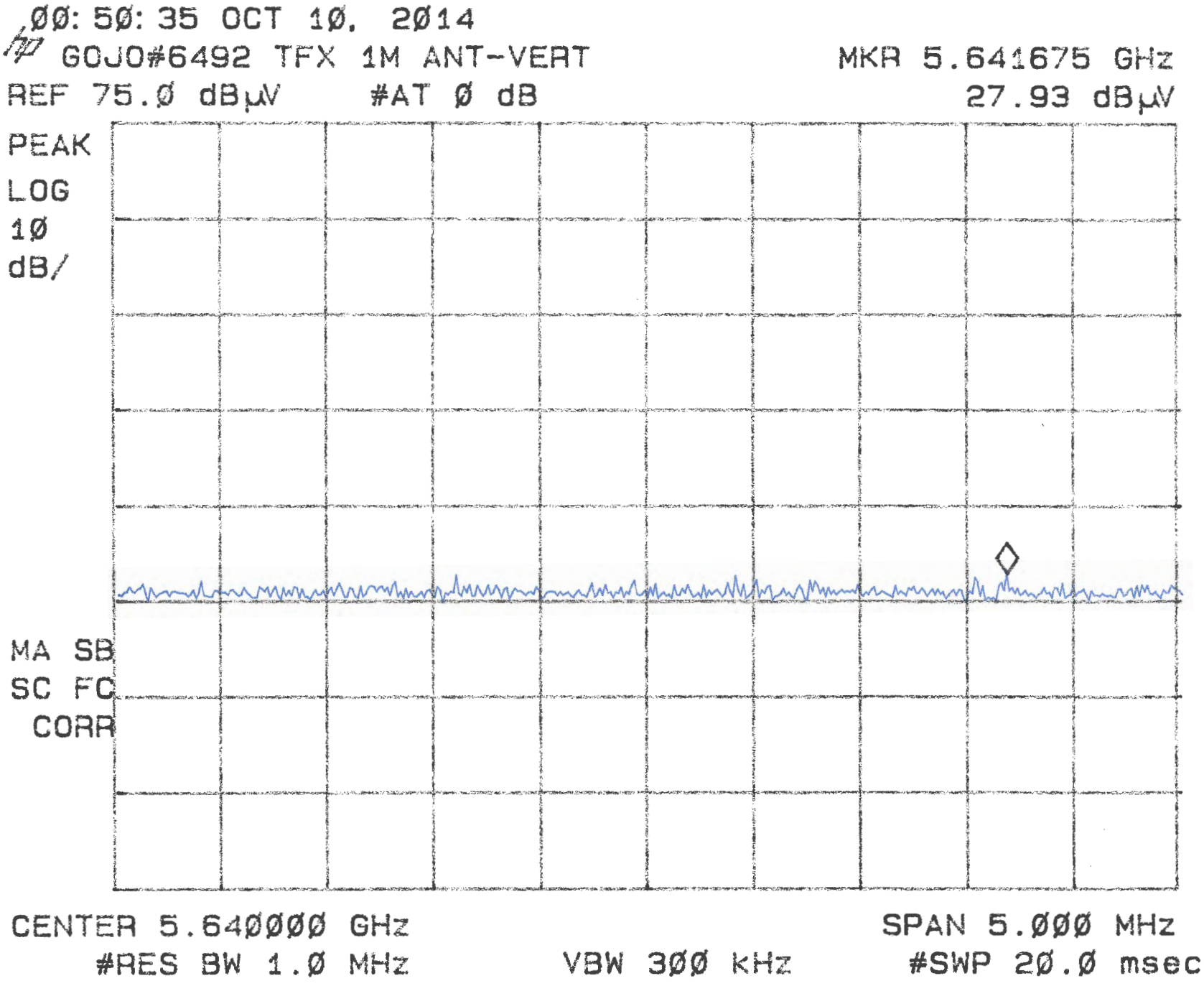

ØØ: 52: 58 NOV Ø6, 2Ø14
GOJO 6492 TFX 3M ANT VERT
MKR 9Ø9.987 MHz
REF 8Ø.Ø dBµV
#AT Ø dB
46.75 dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 91Ø.ØØØ MHz
SPAN 5.ØØØ MHz
#RES BW 12Ø kHz
VBW 3ØØ kHz
SWP 2Ø.Ø msec

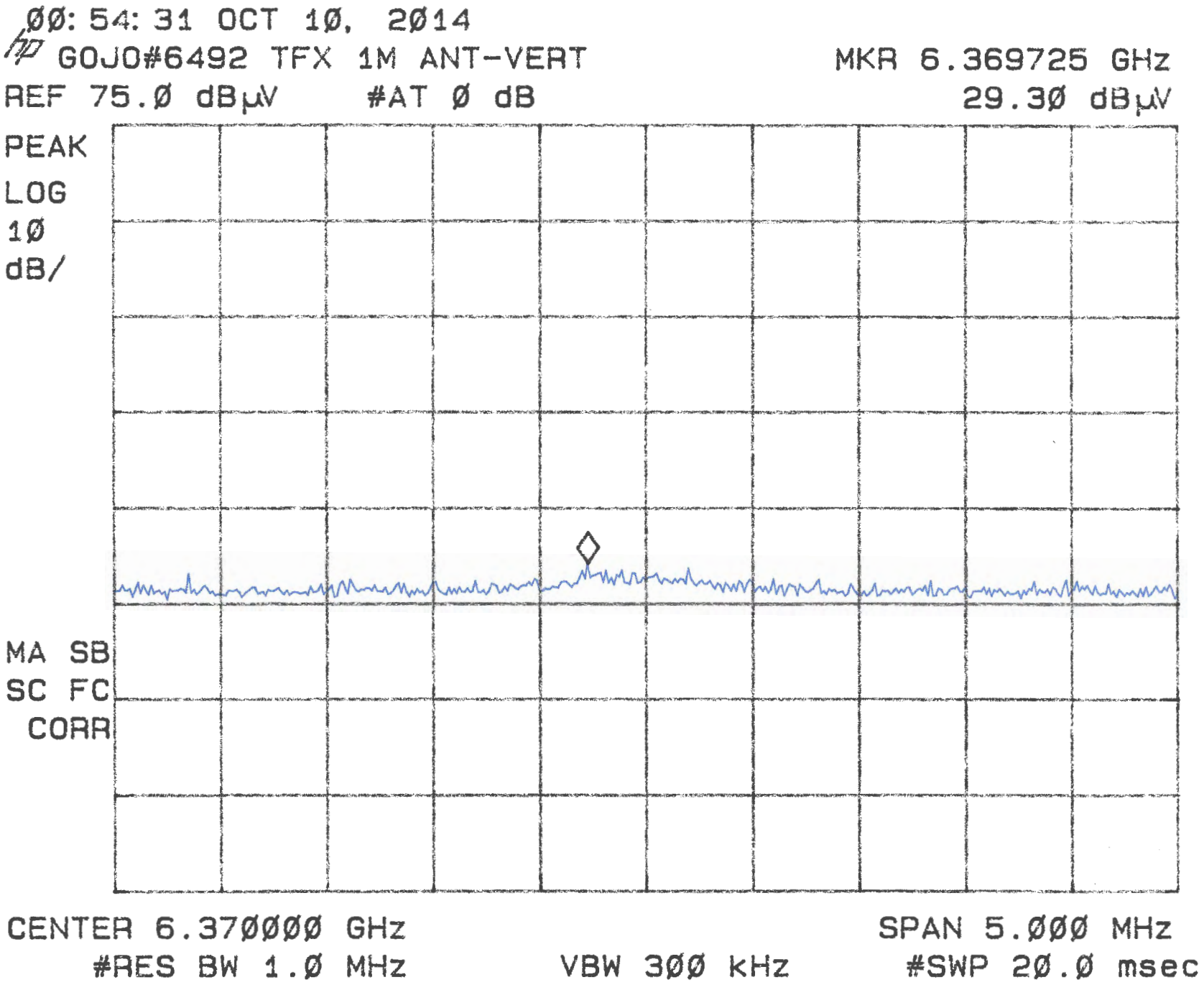

ØØ: 27: 27 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-VERT
MKR 1.819975 GHz
REF 75.Ø dBµV
#AT Ø dB
33.84 dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 1.82ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec

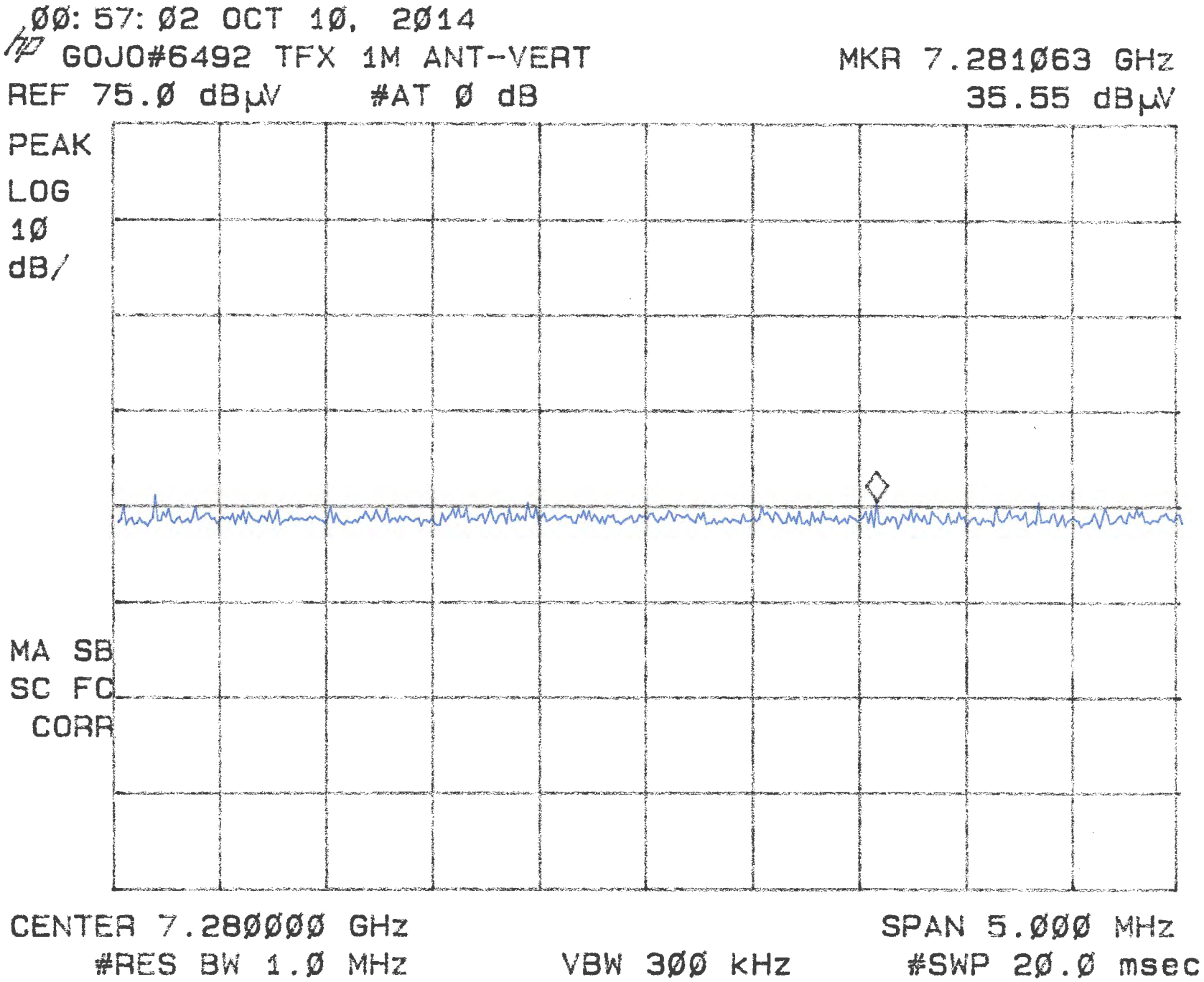

ØØ: 42: 52 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-VERT
MKR 2.729ØØ GHz
REF 75.Ø dBµV
#AT Ø dB
31.Ø8 dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 2.73ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec

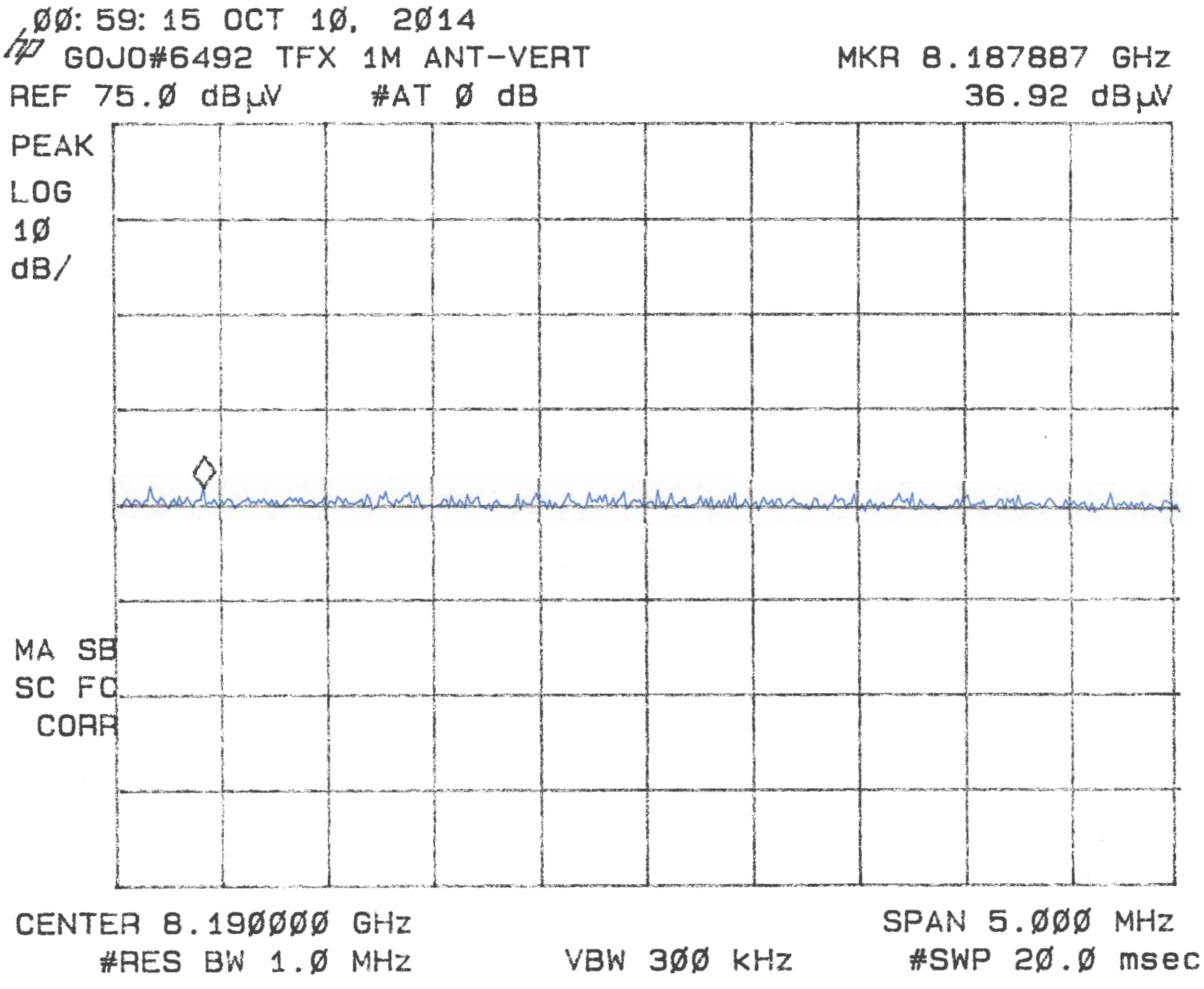

ØØ: 46: 12 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-VERT
MKR 3.639863 GHz
REF 75.Ø dBµV
#AT Ø dB
38.87 dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 3.64ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec

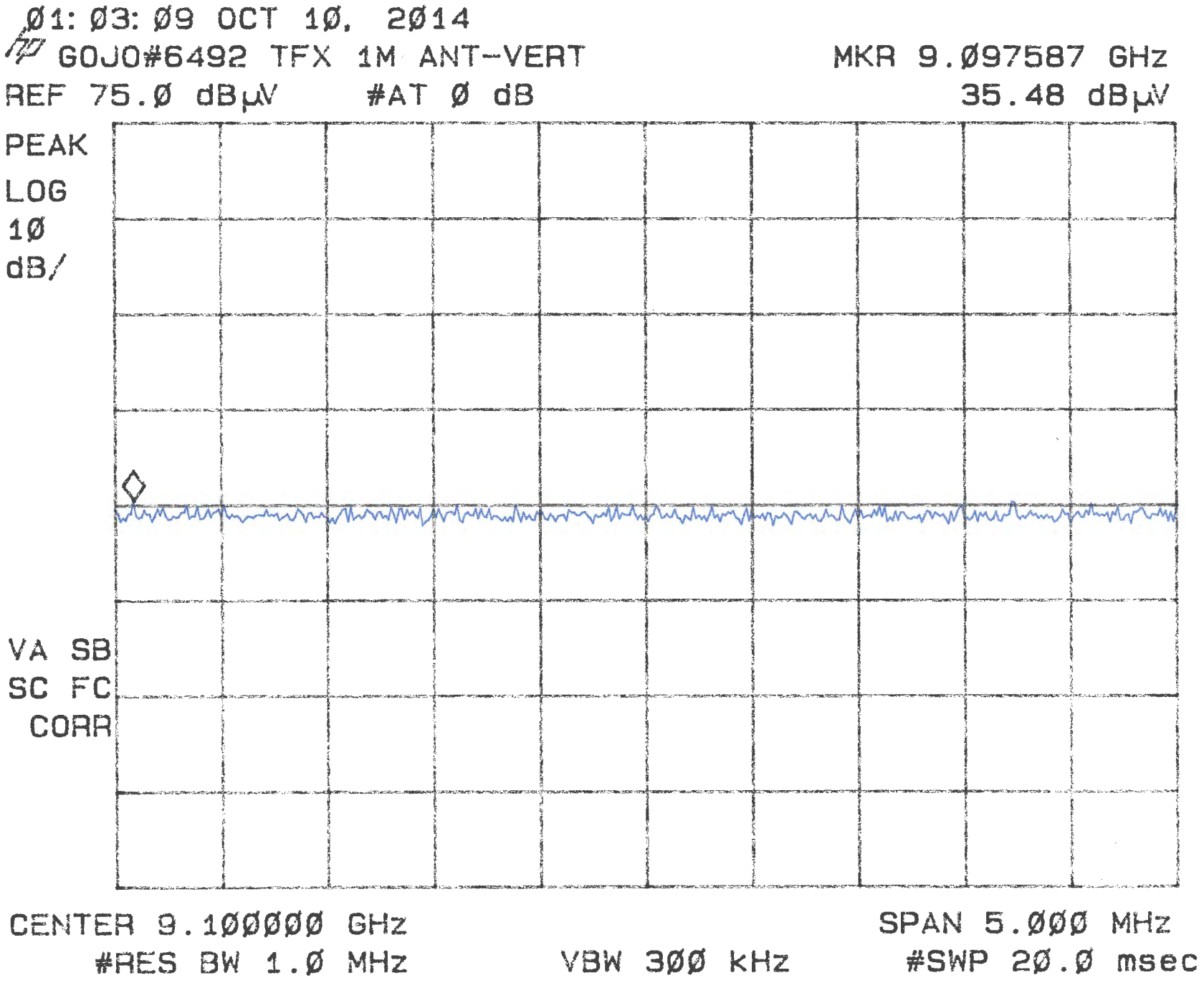

ØØ: 48: 26 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-VERT
MKR 4.551500 GHz
REF 75.Ø dBµV
#AT Ø dB
3Ø.Ø3 dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 4.550000 GHz
SPAN 5.000 MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec

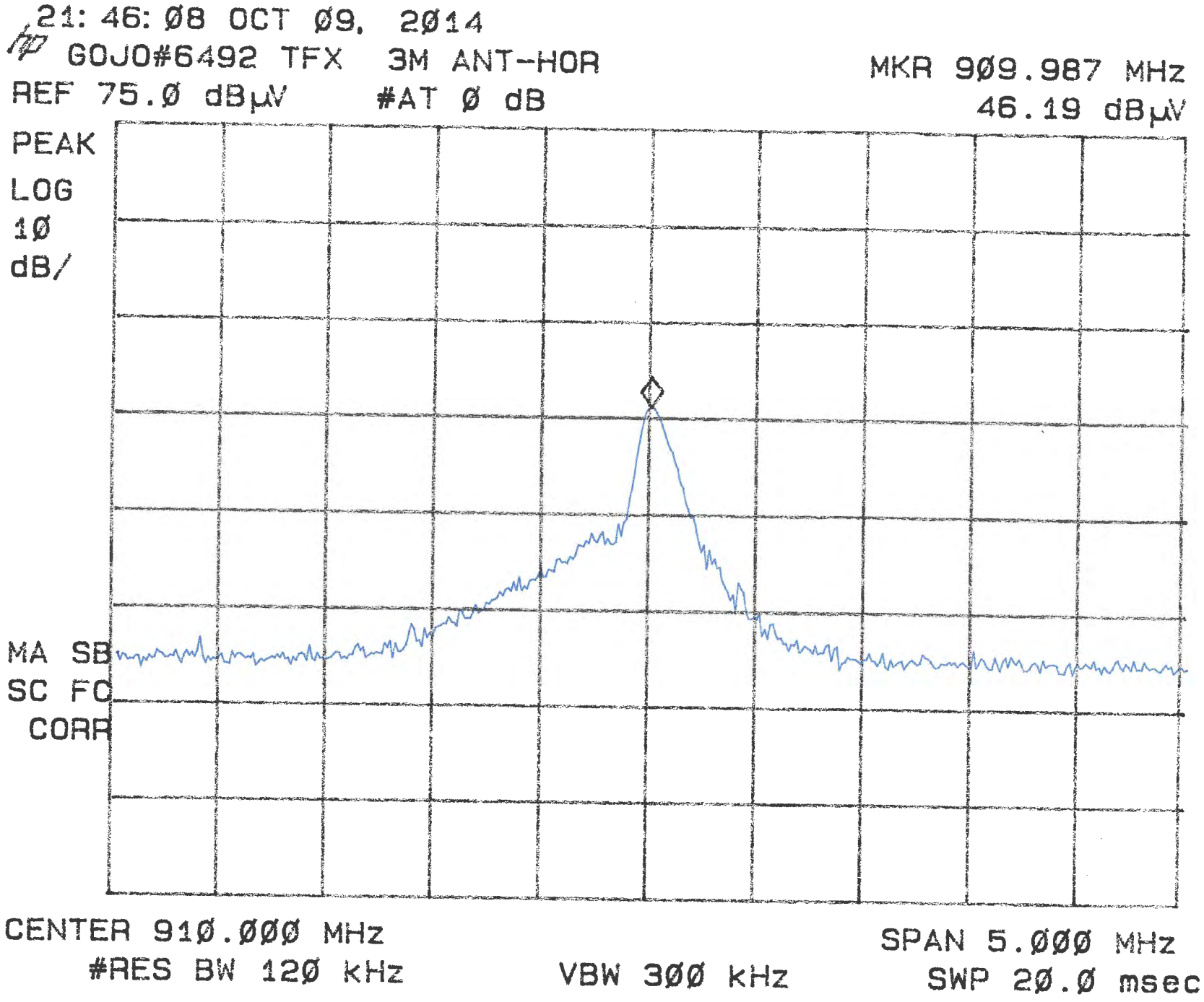

ØØ: 5Ø: 35 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-VERT
MKR 5.641675 GHz
REF 75.Ø dBµV
#AT Ø dB
27.93 dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 5.64ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec

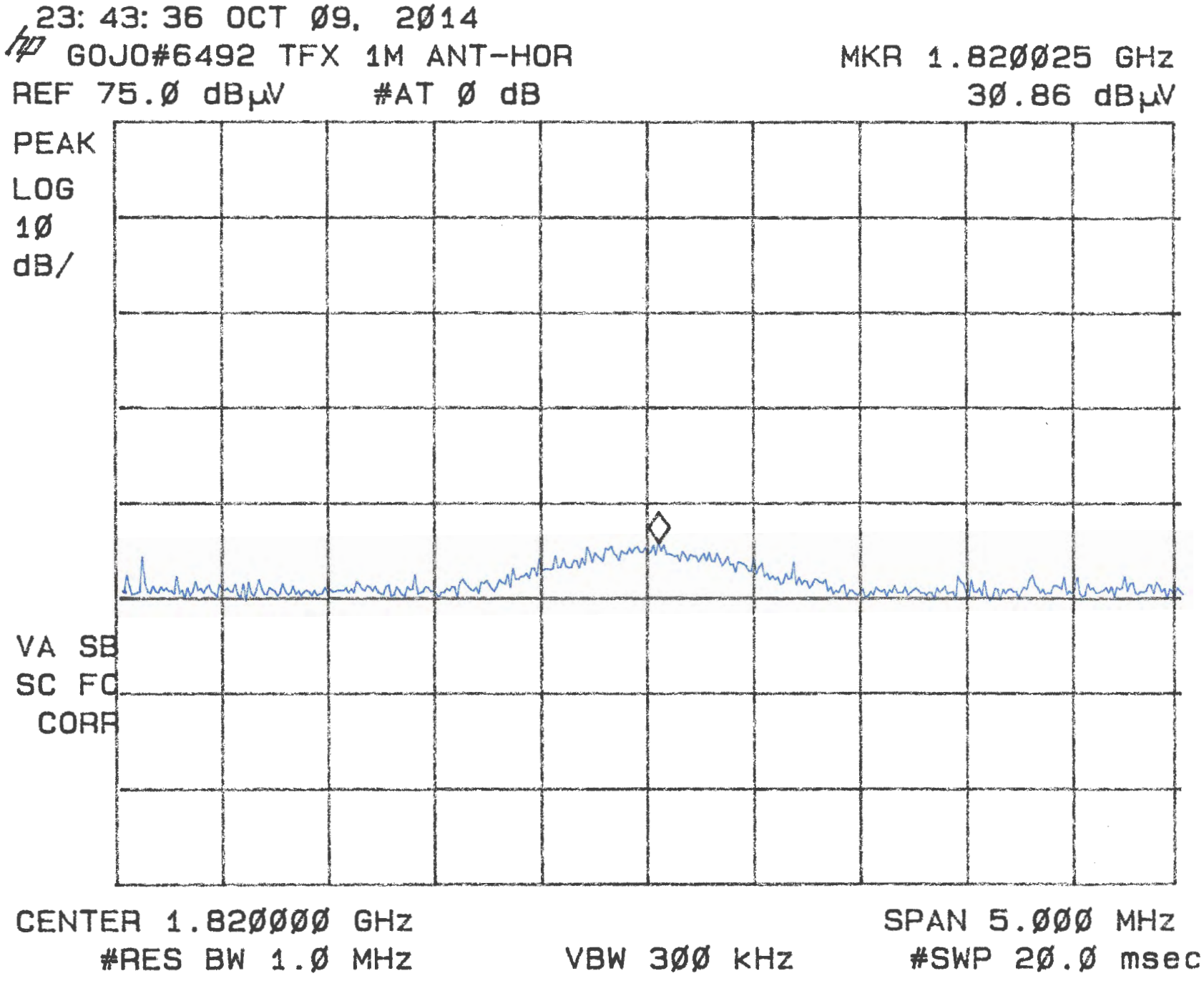

ØØ: 54: 31 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-VERT
MKR 6.369725 GHz
REF 75.Ø dBµV
#AT Ø dB
29.3Ø dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 6.37ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec

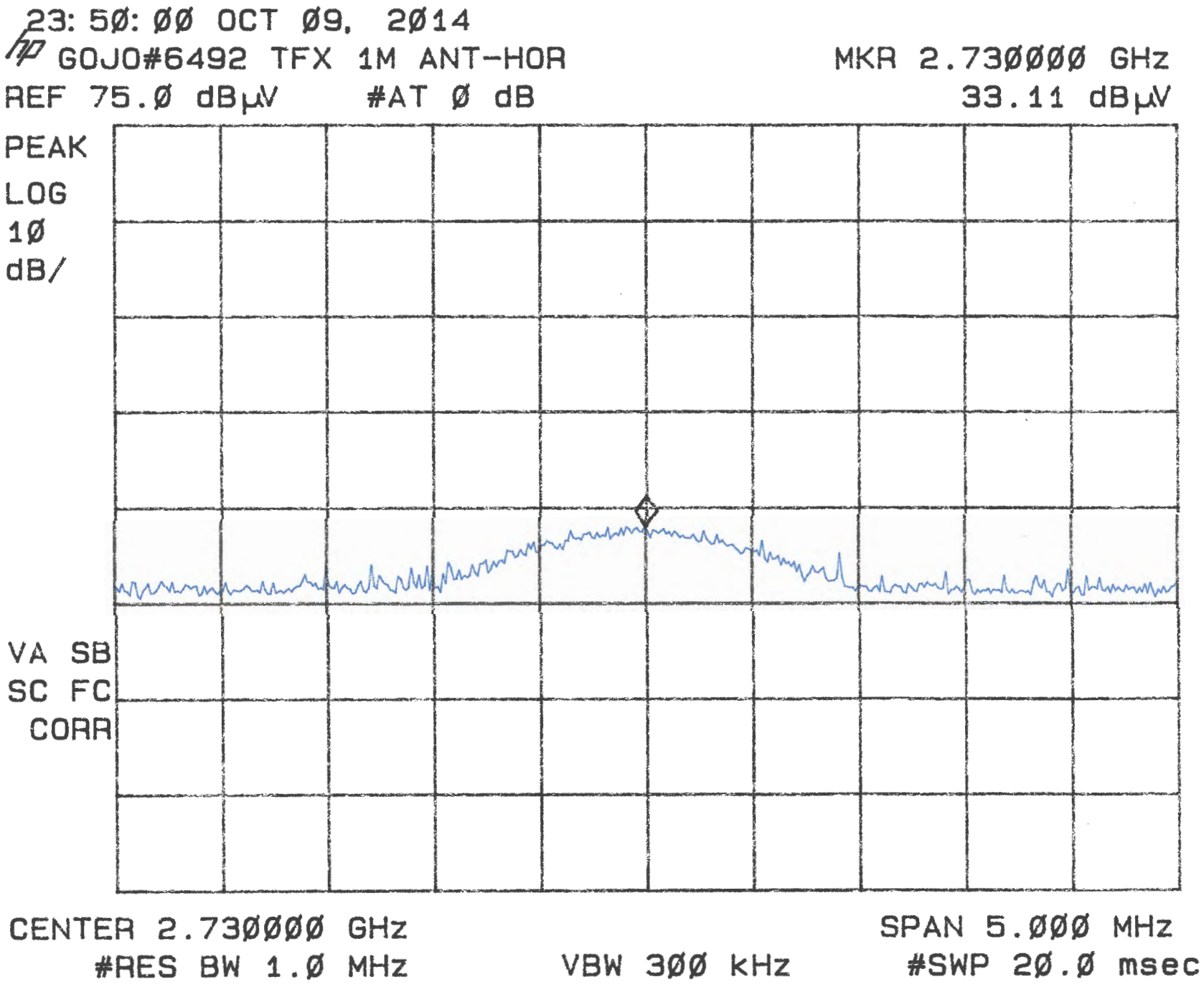

ØØ: 57: Ø2 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-VERT
MKR 7.281Ø63 GHz
REF 75.Ø dBµV
#AT Ø dB
35.55 dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 7.28ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec

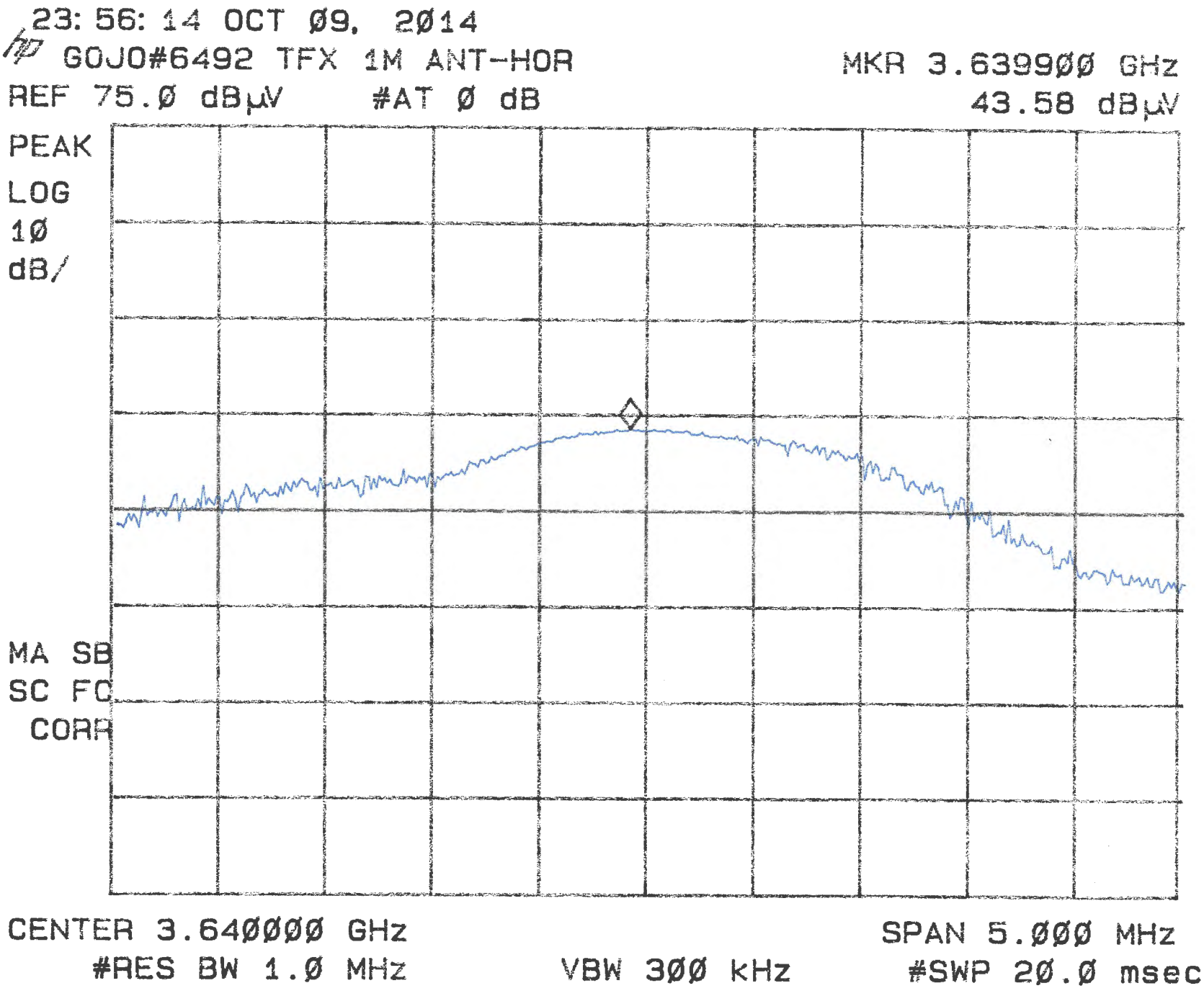

ØØ: 59: 15 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-VERT
MKR 8.187887 GHz
REF 75.Ø dBµV
#AT Ø dB
36.92 dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 8.19ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec

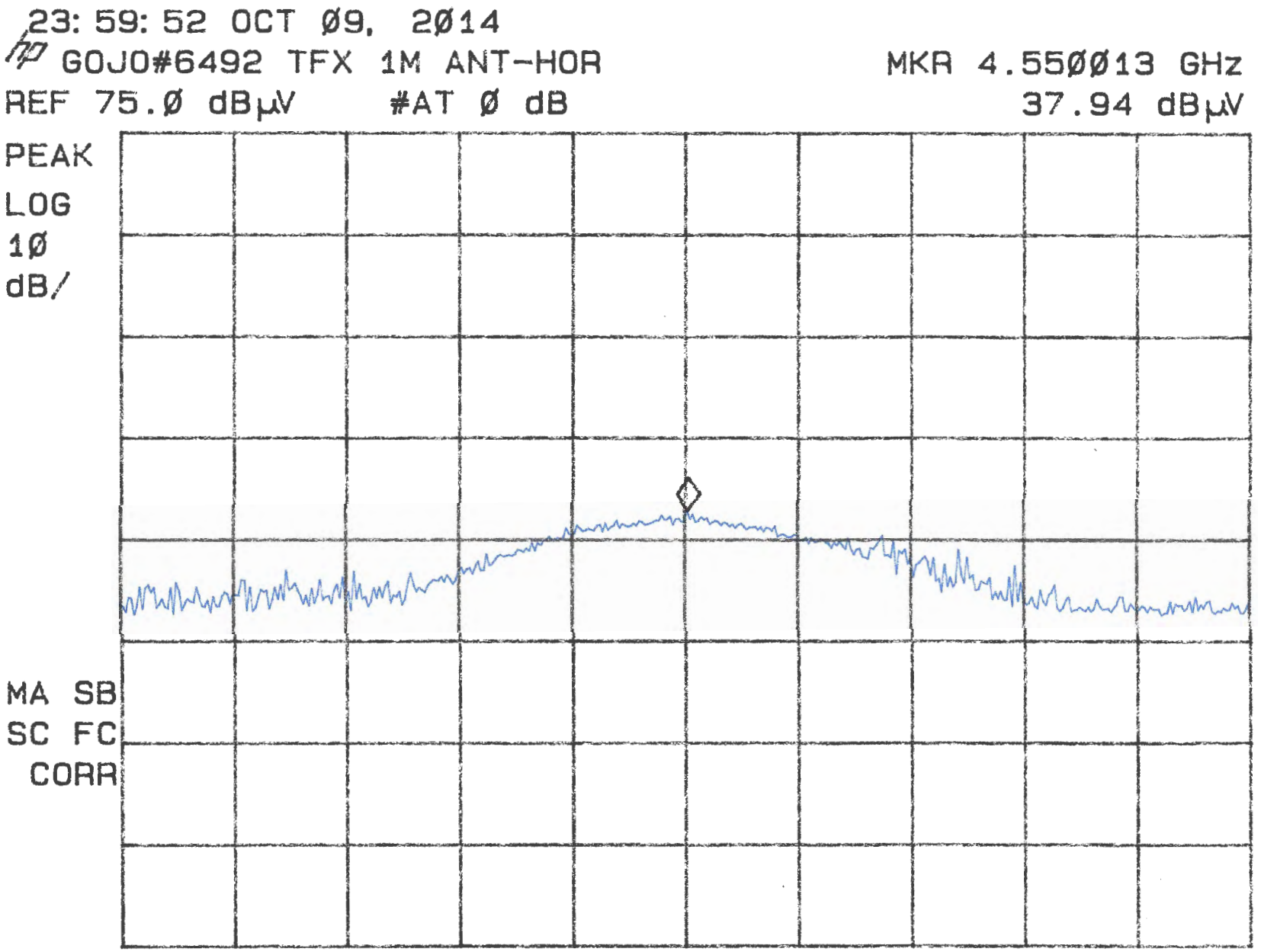

Ø1: Ø3: Ø9 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-VERT
MKR 9.Ø97587 GHz
REF 75.Ø dBµV
#AT Ø dB
35.48 dBµV
PEAK
LOG
1Ø
dB/
VA SB
SC FC
CORR
CENTER 9.1ØØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec

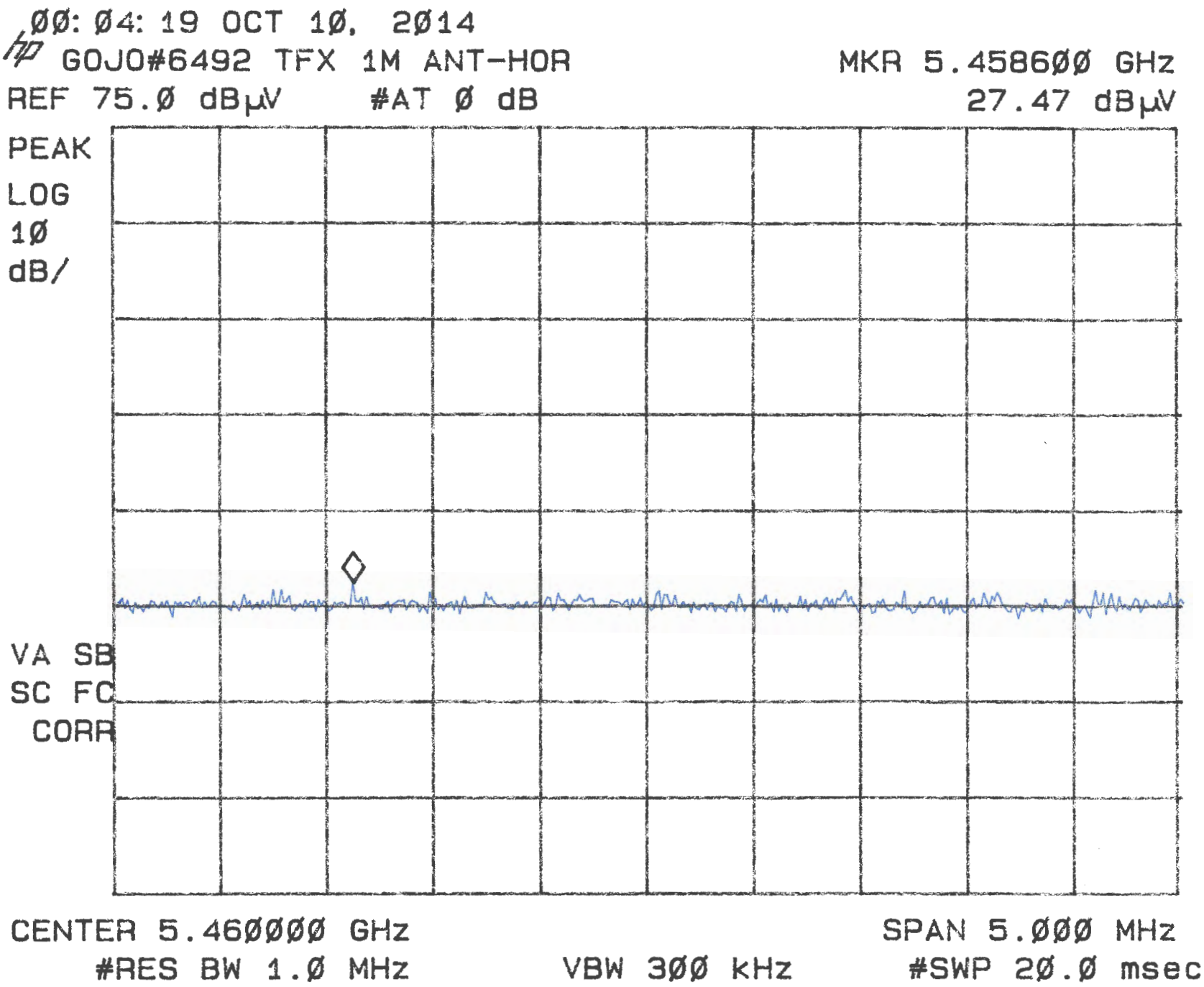

21: 46: Ø8 OCT Ø9, 2Ø14
GOJO#6492 TFX 3M ANT-HOR
REF 75.Ø dBµV
#AT Ø dB
MKR 9Ø9.987 MHz
46.19 dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 91Ø.ØØØ MHz
#RES BW 12Ø kHz
VBW 3ØØ kHz
SPAN 5.ØØØ MHz
SWP 2Ø.Ø msec

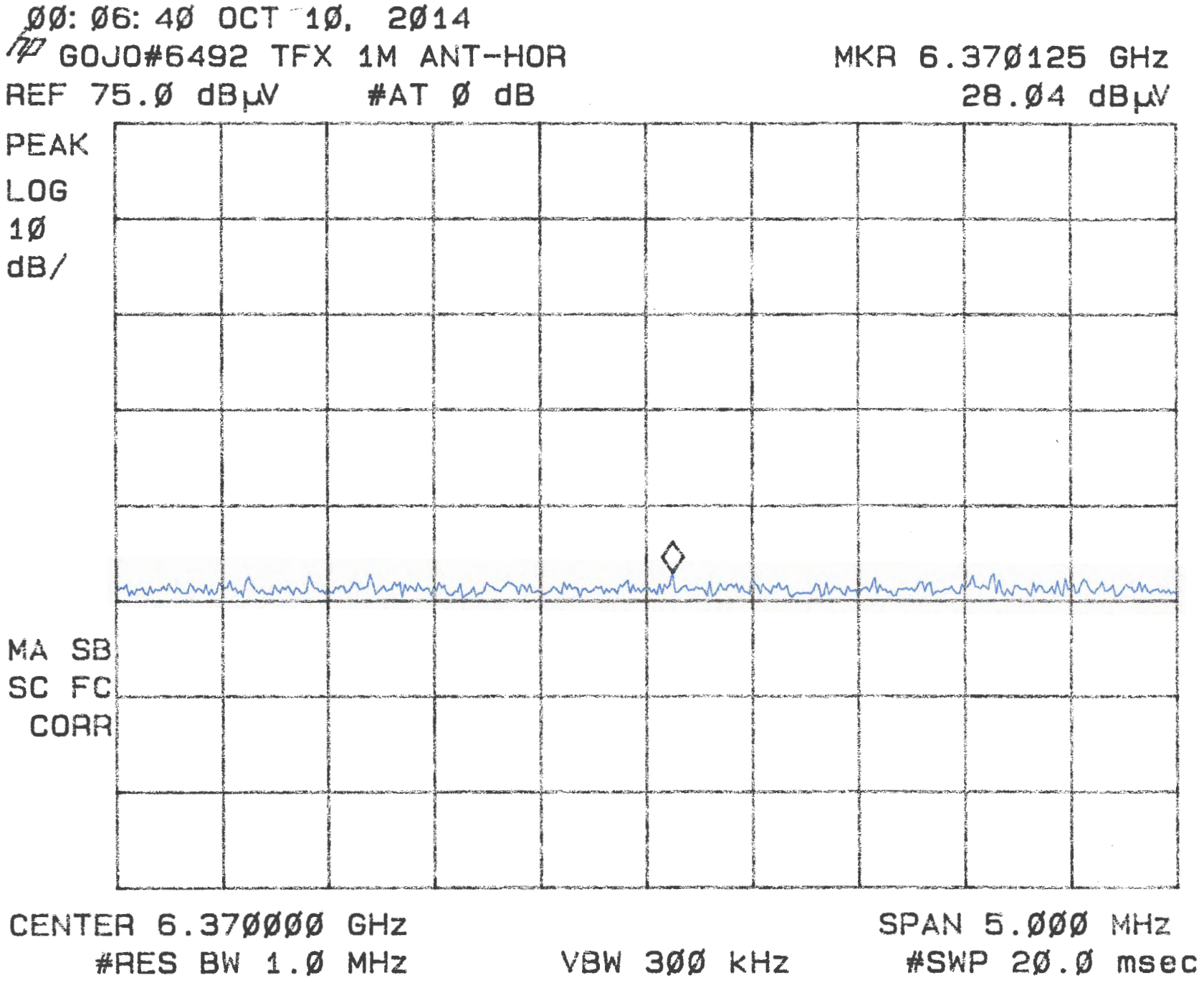

23: 43: 36 OCT Ø9, 2Ø14
GOJO#6492 TFX 1M ANT-HOR
MKR 1.82ØØ25 GHz
REF 75.Ø dBµV
#AT Ø dB
3Ø.86 dBµV
PEAK
LOG
1Ø
dB/
VA SB
SC FC
CORR
CENTER 1.82ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec

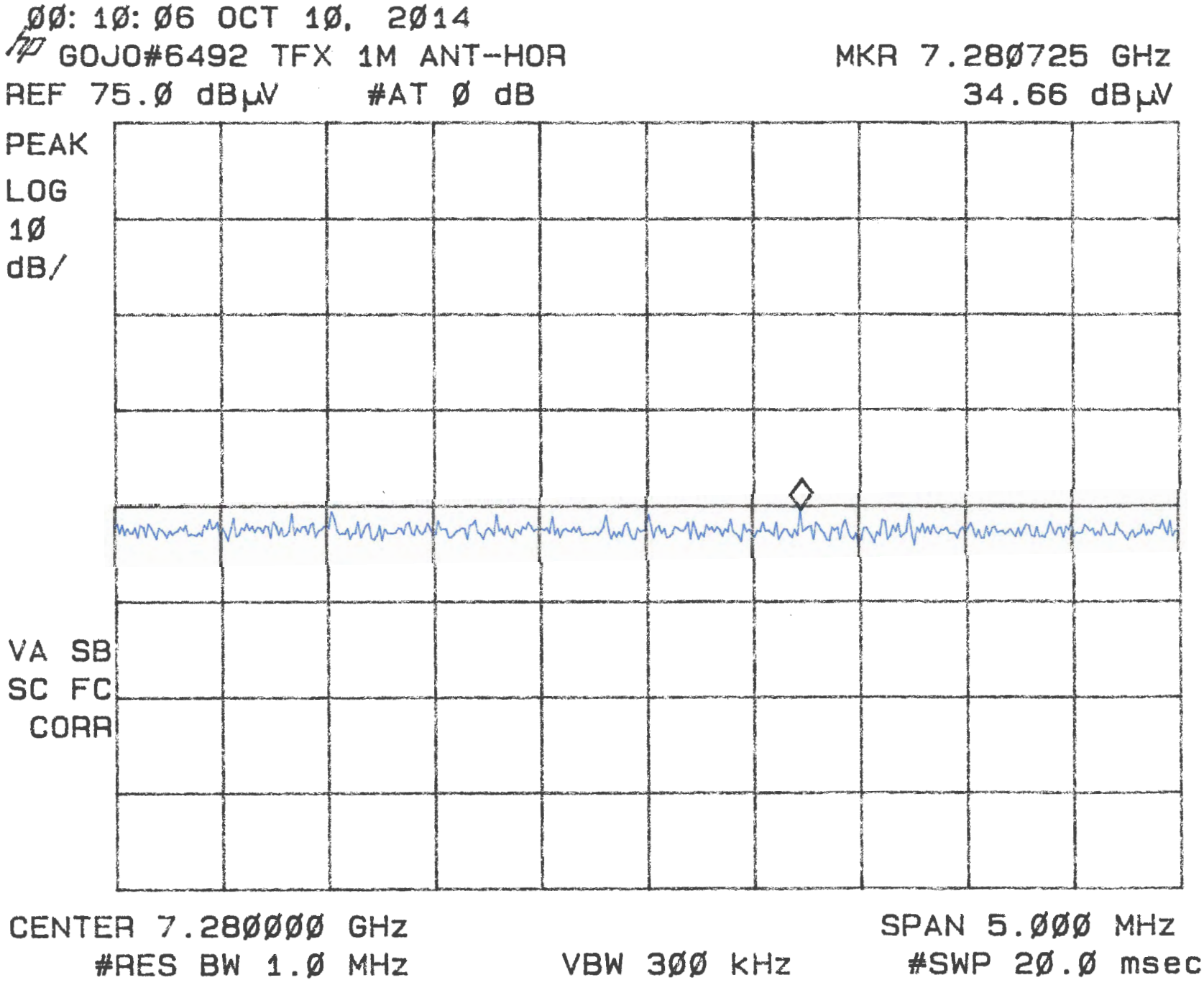

23: 5Ø: ØØ OCT Ø9, 2Ø14
GOJO#6492 TFX 1M ANT-HOR
MKR 2.73ØØØØ GHz
REF 75.Ø dBµV
#AT Ø dB
33.11 dBµV
PEAK
LOG
1Ø
dB/
VA SB
SC FC
CORR
CENTER 2.73ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec

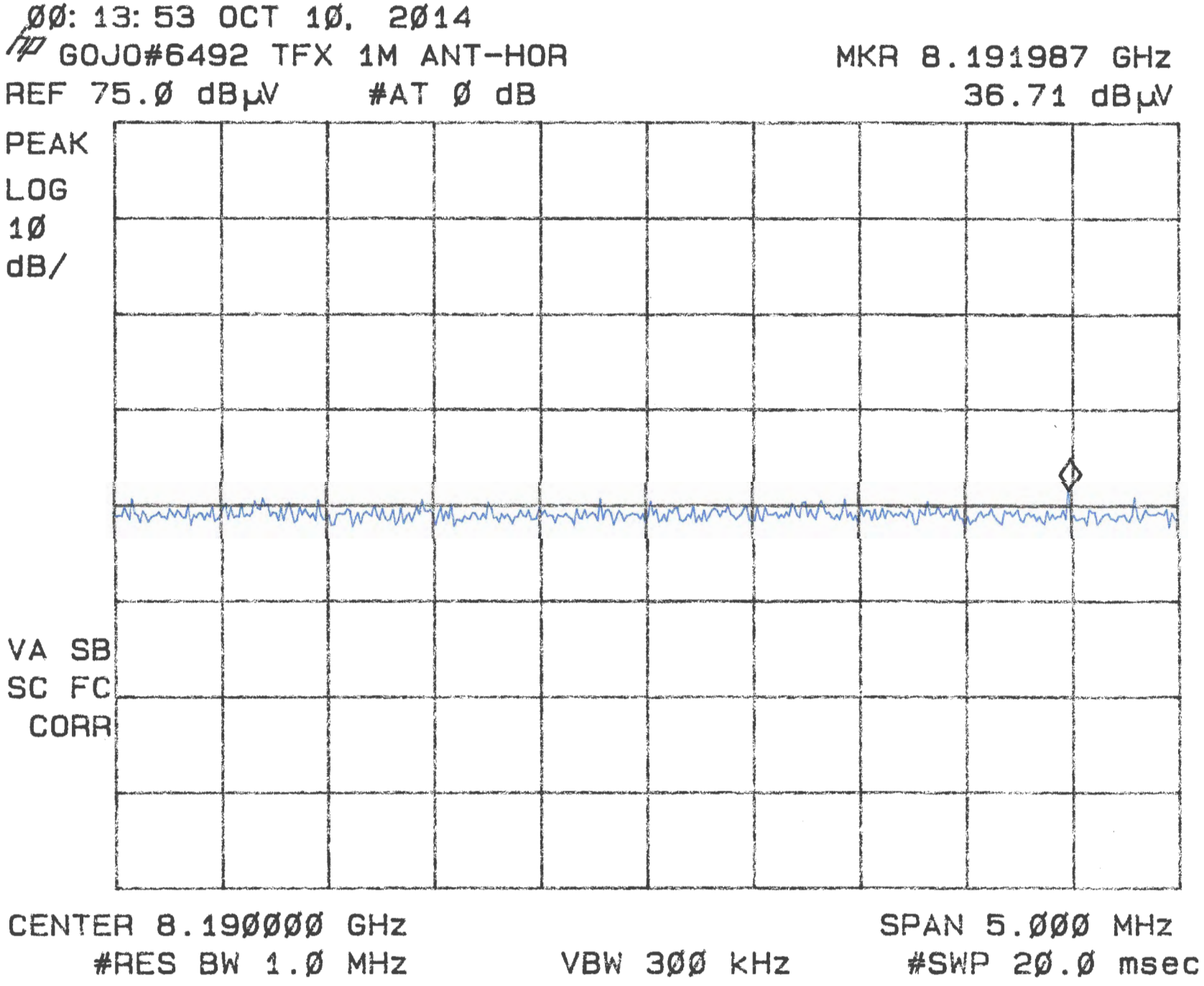

23: 56: 14 OCT Ø9, 2Ø14
GOJO#6492 TFX 1M ANT-HOR
MKR 3.639ØØ GHz
REF 75.Ø dBµV
#AT Ø dB
43.58 dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 3.64ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec

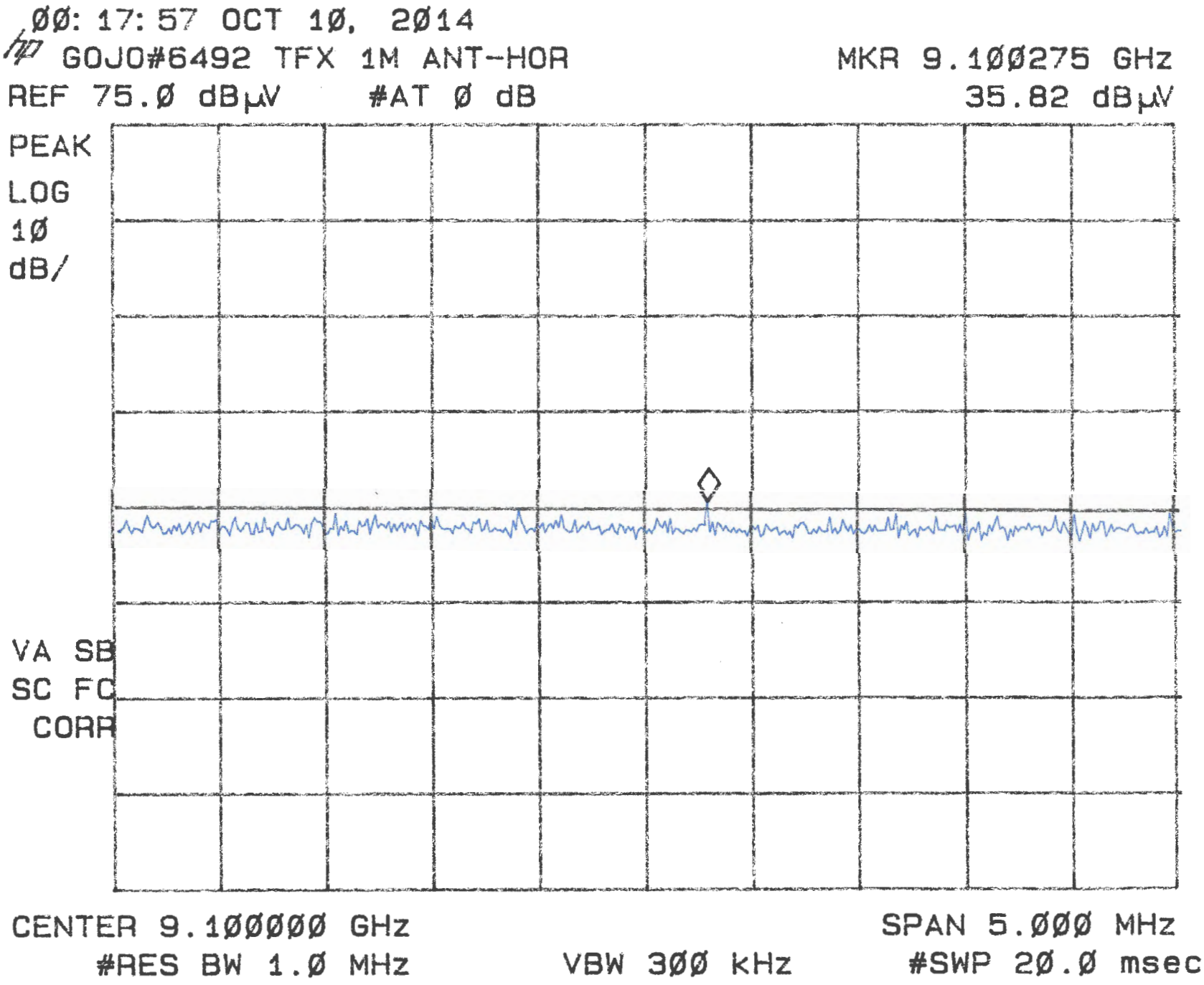

23: 59: 52 OCT Ø9, 2Ø14
GOJO#6492 TFX 1M ANT-HOR
MKR 4.55ØØ13 GHz
REF 75.Ø dBµV
#AT Ø dB
37.94 dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 4.55ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec


ØØ: Ø4: 19 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-HOR
MKR 5.458ØØ GHz
REF 75.Ø dBµV
#AT Ø dB
27.47 dBµV
PEAK
LOG
1Ø
dB/
VA SB
SC FC
CORR
CENTER 5.46ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec


ØØ: Ø6: 4Ø OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-HOR
MKR 6.37Ø125 GHz
REF 75.Ø dBµV
#AT Ø dB
28.Ø4 dBµV
PEAK
LOG
1Ø
dB/
MA SB
SC FC
CORR
CENTER 6.37ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec


ØØ: 1Ø: Ø6 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-HOR
MKR 7.28Ø725 GHz
REF 75.Ø dBµV
#AT Ø dB
34.66 dBµV
PEAK
LOG
1Ø
dB/
VA SB
SC FC
CORR
CENTER 7.28ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec


ØØ: 13: 53 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-HOR
MKR 8.191987 GHz
REF 75.Ø dBµV
#AT Ø dB
36.71 dBµV
PEAK
LOG
1Ø
dB/
VA SB
SC FC
CORR
CENTER 8.19ØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec


ØØ: 17: 57 OCT 1Ø, 2Ø14
GOJO#6492 TFX 1M ANT-HOR
MKR 9.1ØØ275 GHz
REF 75.Ø dBµV
#AT Ø dB
35.82 dBµV
PEAK
LOG
1Ø
dB/
VA SB
SC FC
CORR
CENTER 9.1ØØØØØ GHz
SPAN 5.ØØØ MHz
#RES BW 1.Ø MHz
VBW 3ØØ kHz
#SWP 2Ø.Ø msec