Product Safety Engineering, Inc
12955 Bellamy Brothers Blvd.
Dade City, FL 33525
352-588-2209

Testing Certification # 1367-01

TEST REPORT

14F447
09/30/2014

Applicant:

UTC Fire & Security Americas Corporation, INc.
8995 Town Center Parkway
Bradenton, FL 34202

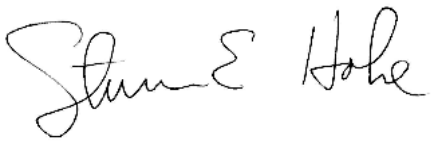
Product:
Model - 682HDS-OEM-ATT01
Wireless Heat Detector

In Accordance with FCC Part 15.247 & RSS:210, Issue 8, RSS-GEN, Issue 4

Test dates:
09/19/2014 - 09/29/2014

Receive Date:
09/04/2014

Prepared by: Steven E. Hoke - EMC Site Manager



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Test Procedures

Product description: The system utilizes a FHSS type transmitter. It is a simple transceiver responsible for monitoring the presence of smoke.

Powerline conducted interference: The AC powerline conducted emissions measurements were not applicable due to battery operation.

20 dB Bandwidth: The EUT had its hopping function disabled while modulated. The spectrum analyzer span was set to (2-3) times the (20) dB bandwidth. The spectrum analyzer was placed in peak hold mode and the upper and lower points of the waveform were measured at a level that was (20) dB down from the peak amplitude. This was repeated for a low, mid and high frequency channel.

Channel Separation: The EUT had its hopping function enabled. The span on the spectrum analyzer was set wide enough to capture at least (2) adjacnet channels. The channel separation was determined by measuring the peak frequency of (2) adjacent channels.

Description of frequency hopping system: The system utilizes 101 channels between 902 MHz to 928 MHz in the ISM band. The system initiates data transmissions completely asynchronously from the hopping system which creates a random distribution of data for each channel. All channels are used all of the time. There are not any facilities to detect jammed or undesirable channels and remove them from the hopping system.

Receiver bandwidth: The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Number of hopping frequencies: With the spectrum analyzer in peak hold, we stored an image of all the channels operating and then produced a plot of the analyzer. We manually counted each channel to determine the number.

Dwell time: The EUT had its hopping function enabled. The average time of occupancy was first determined by measuring the width of a single channel with the spectrum analyzer in a zero span mode and then with the analyzer in a peak hold mode, a (10) second sweep was then performed to determine how many single channels occupied a (10) second period of time.

RF Exposure Compliance Requirements: Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. Computations included in test report.

Peak output power: The EUT has an integrated antenna that prohibited direct connection to the measuring equipment. We performed radiated field strength measurements as an alternative test procedure as defined in FCC DA 00-705.

Conducted output power: Not applicable for integrated antenna.

Operation with directional antenna gains greater than 6 dBi: Not applicable for integrated antenna.

Spurious emissions: All spurious emissions were measured up to the tenth harmonic per ANSI 63.10:2013 .

Restricted Band Compliance: All emissions were measured per ANSI 63.10:2013 and compared to the restricted band list.

Other conditions of operation per 15.247

15.247 (a) (1) - The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter.

Described in the Operational Description File

15.247 (g) - Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

Described in the Operational Description File

15.247 (h) - The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Described in the Operational Description File

Test Summary

Name of Test	Paragraph No.	Specification	Measurement	Result
Powerline Conducted	FCC 15.207(a)	Table 15.207(a)	Not applicable	Complies
Powerline Conducted	RSS-GEN	Table 3	Not applicable	Complies
Channel Separation	15.247(a)(1)	Greater of 25 kHz or 20 dB bandwidth	245 kHz	Complies
Channel Separation	RSS-210 A8.1(b)	Greater of 25 kHz or 20 dB bandwidth	245 kHz	Complies
Pseudo-random Hopping Algorithm	15.247(a)(1)	See Page 4	Not applicable	Complies
Random Hopping	RSS-210 A8.1(a)	See Page 4	Not applicable	Complies
Hopping Frequencies	15.247(a)(1)(i)	at least 25	89	Complies
Hopping Frequencies	RSS-210 A8.1(c)	at least 50	89	Complies
Dwell Time	15.247(a)(1)(ii)	<0.4 sec in 10 sec	0.078 sec in 10 sec	Complies
Dwell Time	RSS-210 A8.1(d)	<0.4 sec in 20 sec	0.156 sec in 20 sec	Complies
20 dB Occupied Bandwidth	15.247(a)(1)	<500 kHz	115 kHz	Complies
20 dB Occupied Bandwidth	RSS-210 A8.1(c)	<500 kHz	115 kHz	Complies
Peak Output Power	15.247(b)	1.0 Watts	0.0128 Watts	Complies
Peak Output Power	RSS-210 A8.4(1)	1.0 Watts	0.0128 Watts	Complies
Spurious Emissions (Conducted / Radiated)	15.247(d)	-20 dBc (peak) -30 dBc (avg)	Not applicable	Complies
Spurious Emissions (Conducted / Radiated)	RSS-210 A8.5	-20 dBc (peak) -30 dBc (avg)	Not applicable	Complies
Spurious Emissions (Radiated)	15.247(d)	54.0 dBuV/m per Table 15.209(a)	50.4 dBuV/m	Complies
Spurious Emissions (Radiated)	RSS-GEN 8.10	54.0 dBuV/m per Table 15.209(a)	50.4 dBuV/m	Complies

Test: Output Power per 15.247(b)(2)

Date: 03/26/2014

Requirement: The maximum peak conducted output power of the intentional radiator shall not exceed 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels

Result: Peak Output Power = (10.2) mW
See exhibit # 6.
RBW: (1) MHz VBW: (3) MHz

$P = ((ED^2) / 30 * Gn)$
Gn = 10 ^ (Gdbi/10)
G = -1.0 dBi
Gn = (0.794)
105.3 dBuV/m = 0.184 E/m
P = (0.184 * 3)^2 / (30 * 0.794)
P = 12.8 mW

Channel	Level Received dBuV	ACF, Cable loss & Preamp Gain	Corrected Level dBuV/m	Level V/m	Distance	Antenna Gain (N)	Watts mW
low	76.8	28.5	105.3	0.184	3 m	1	12.8
Mid	75.2	28.5	103.7	0.153	3 m	1	8.8
high	74.6	28.5	103.1	0.143	3 m	1	7.7

Test Equipment:

Manufacturer	Model	Description	Serial Number	Cal Due	cal interval
Hewlett Packard	8566B	Spectrum Analyzer	2532A02418	11/05/14	1 YR
Hewlett Packard	8447D	Preamp 0.1 - 1,000 MHz	2944A06901	12/10/14	1 YR
Hewlett Packard	8449B	Preamp 1 - 26.5 GHz	3008A00320	06/06/15	1 YR
ETS Lindgren	3148	Log Periodic Antenna	75741	02/07/16	2 YR
Electro-Mechanics	3115	Double Ridge Guide Ant	3810	07/16/15	2 YR
EMCO	3104C	Biconical Antenna	75927	05/14/16	2 YR

Test: Powerline conducted interference per 15.207

Date: NA

Requirement: An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table:

Freq (MHz)	Quasi-peak dBuV	Average dBuV
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Result: The EUT is battery powered and therefore exempt from this test.

RBW: (9) kHz
VBW: (10) kHz

See exhibit 1

Test: 20 dB Bandwidth

Date:03/26/2014

Requirement: The 20 dB bandwidth is required for other technical requirements.

Result: The 20 dB bandwidth was measured at the low, mid and high frequency of operation. The bandwidths are listed below:

Frequency (MHz)	Channel	Measured 20dB bandwidth
902.3	Low	420 kHz
915.2	Mid	412 kHz
927.7	High	380 kHz

See exhibit 2

Span:1 MHz

RBW: (100) kHz

VBW: (300) MHz

Channel: Low, mid and high

Test Equipment:

Manufacturer	Model	Description	Serial Number	Cal Due	cal interval
Hewlett Packard	8566B	Spectrum Analyzer	2532A02418	11/05/14	1 YR
Hewlett Packard	8447D	Preamp 0.1 - 1,000 MHz	2944A06901	12/10/14	1 YR
Hewlett Packard	8449B	Preamp 1 - 26.5 GHz	3008A00320	06/06/15	1 YR
ETS Lindgren	3148	Log Periodic Antenna	75741	02/07/16	2 YR
Electro-Mechanics	3115	Double Ridge Guide Ant	3810	07/16/15	2 YR
EMCO	3104C	Biconical Antenna	75927	05/14/16	2 YR

Test: Carrier Frequency Separation per 15.247(a)(1)

Date: 03/26/2014

Requirement: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Result: The 20 dB bandwidth was measured at the mid frequency of operation. The separation was found to be (245) kHz..

See Exhibit 3

RBW: (100) kHz

VBW: (300) kHz

Test Equipment:

Manufacturer	Model	Description	Serial Number	Cal Due	cal interval
Hewlett Packard	8566B	Spectrum Analyzer	2532A02418	11/05/14	1 YR
Hewlett Packard	8447D	Preamp 0.1 - 1,000 MHz	2944A06901	12/10/14	1 YR
Hewlett Packard	8449B	Preamp 1 - 26.5 GHz	3008A00320	06/06/15	1 YR
ETS Lindgren	3148	Log Periodic Antenna	75741	02/07/16	2 YR
Electro-Mechanics	3115	Double Ridge Guide Ant	3810	07/16/15	2 YR
EMCO	3104C	Biconical Antenna	75927	05/14/16	2 YR

Test: Number of hopping frequencies per 15.247(a)(1)(i)

Date: 03/26/2014

Requirement: If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies

Result: The 20 dB bandwidth was measured for low, middle and high frequency operation and the bandwidth was found to be between (435 - 492) kHz. We observed 101 hopping frequencies.

See exhibit 4.

RBW: (100) kHz

VBW: (300) kHz

Test Equipment:

Manufacturer	Model	Description	Serial Number	Cal Due	cal interval
Hewlett Packard	8566B	Spectrum Analyzer	2532A02418	11/05/14	1 YR
Hewlett Packard	8447D	Preamp 0.1 - 1,000 MHz	2944A06901	12/10/14	1 YR
Hewlett Packard	8449B	Preamp 1 - 26.5 GHz	3008A00320	06/06/15	1 YR
ETS Lindgren	3148	Log Periodic Antenna	75741	02/07/16	2 YR
Electro-Mechanics	3115	Double Ridge Guide Ant	3810	07/16/15	2 YR
EMCO	3104C	Biconical Antenna	75927	05/14/16	2 YR

Test: Dwell time per 15.247(a)(1)(i)

Date:03/26/2014

Requirement: The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period when the 20 dB bandwidth of the hopping channel is greater than 250 kHz.

Result: The analyzer was placed in a peak hold mode for greater than (10) seconds. The dwell time was measured and found to be (78) mSec which is less than the (400) mSec allowed..

Note: The 20 dB bandwidth was measured for low, middle and high frequency operation and the maximum bandwidth was found to be between (435 - 492) kHz

See exhibit 5.

Span: Zero

RBW: (300) kHz

VBW: (1) MHz

Test Equipment:

Manufacturer	Model	Description	Serial Number	Cal Due	cal interval
Hewlett Packard	8566B	Spectrum Analyzer	2532A02418	11/05/14	1 YR
Hewlett Packard	8447D	Preamp 0.1 - 1,000 MHz	2944A06901	12/10/14	1 YR
Hewlett Packard	8449B	Preamp 1 - 26.5 GHz	3008A00320	06/06/16	1 YR
ETS Lindgren	3148	Log Periodic Antenna	75741	02/07/16	2 YR
Electro-Mechanics	3115	Double Ridge Guide Ant	3810	07/16/15	2 YR
EMCO	3104C	Biconical Antenna	75927	05/14/16	2 YR

Test: Spurious emissions per 15.247(d)

Date: 03/26/2014

Requirement: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

Result: The spurious emissions were measured from (9) kHz up to the tenth harmonic of the fundamental. The highest spurious emission was found to be (2.783) GHz at (3.6) dB under the limit.

See exhibit 6

RBW: (1) MHz

VBW: (3) MHz

Channel: Low, mid and high.

Additional Requirement: Emissions which fall in the restricted bands, as defined by in 15.205(a), must also comply with the radiated emissions limits specified in 15.209.

Result: Emissions found in restricted bands did not exceed the limit as shown on exhibit 6.

Test Equipment:

Manufacturer	Model	Description	Serial Number	Cal Due	cal interval
Hewlett Packard	8566B	Spectrum Analyzer	2532A02418	11/05/14	1 YR
Hewlett Packard	8447D	Preamp 0.1 - 1,000 MHz	2944A06901	12/10/14	1 YR
Hewlett Packard	8449B	Preamp 1 - 26.5 GHz	3008A00320	06/06/15	1 YR
ETS Lindgren	3148	Log Periodic Antenna	75741	02/07/16	2 YR
Electro-Mechanics	3115	Double Ridge Guide Ant	3810	07/16/15	2 YR
EMCO	3104C	Biconical Antenna	75927	05/14/16	2 YR
Electro-Metrics	ALR30M	Magnetic Loop Ant	824	07/15/15	2 YR

RF Exposure - Power Density Compliance Calculation

15.247(I) - Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

Compliance is based upon section CFR 47 section 1.1310, Table (1) Limits for Maximum Permissible Exposure (MPE), (b) Limits for General Population/Uncontrolled Exposure. The stated limit is (1.0) mW/cm2 and compliance was calculated using the following formula:

$$S=(P\ G) / (4\ \pi\ r^2)$$

Where:

S = Power density in mW/cm2

P = Power in mW

G = Numerical antenna gain

r = Distance in cm

Maximum output power = (10.2) mW

Antenna gain (numeric) = 1.00 dB

Distance = 20 cm

S = (12.8 * 0.794) / (12.57 * 400)

S= (10.2) / (5,028)

S= (0.000202) mW / cm^2

Limit = (1.0) mW / cm^2

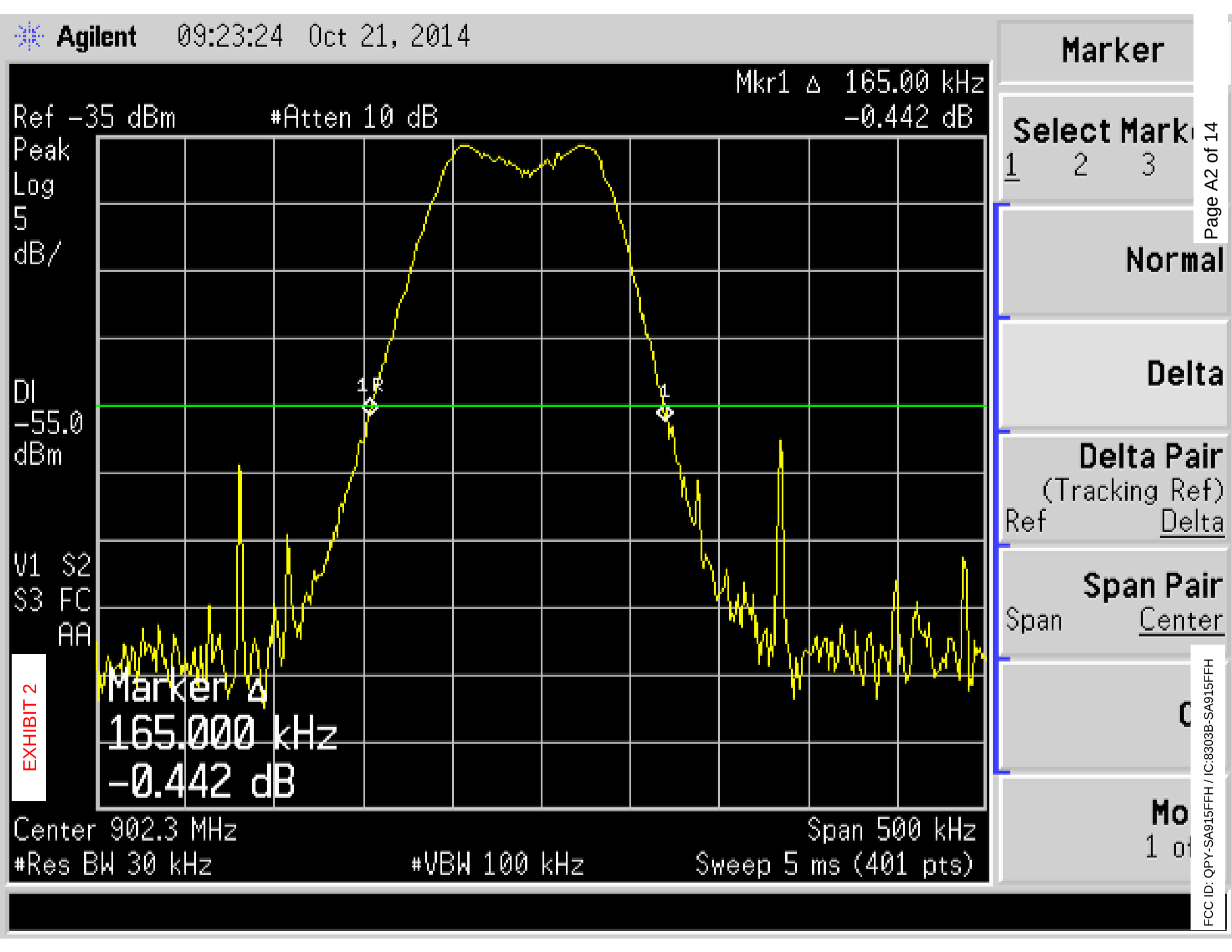
Antenna Specifications

This EUT incorporates a Johanson chip antenna part number (0915AT43A0026), peak gain -1.0 dBi.

EXHIBIT 1

POWERLINE CONDUCTED DATA

NA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Peak
Log
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dB/
Dl
-55.0
dBm
1R
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V1 S2
S3 FC
AA
Marker Δ
165.000 kHz
-0.442 dB
Center 902.3 MHz
#Res BW 30 kHz
#VBW 100 kHz
Span 500 kHz
Sweep 5 ms (401 pts)
Marker
Select Marker
1 2 3
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
EXHIBIT 2
Page A2 of 14
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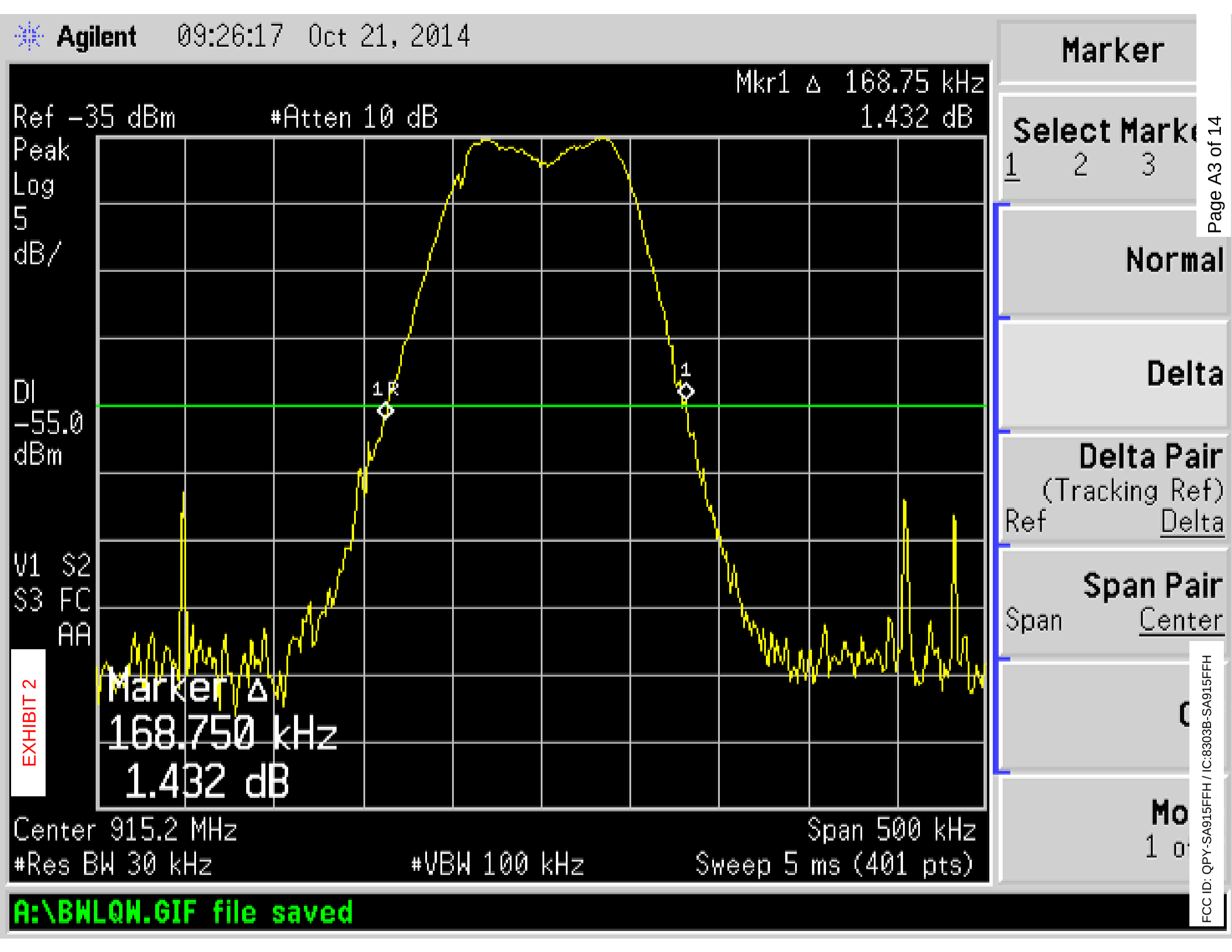
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1.432 dB
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Peak
Log
5
dB/
Dl
-55.0
dBm
V1 S2
S3 FC
AA
Marker Δ
168.750 kHz
1.432 dB
Center 915.2 MHz
#Res BW 30 kHz
#VBW 100 kHz
Span 500 kHz
Sweep 5 ms (401 pts)
Marker
Select Marke
1 2 3
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Mo
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EXHIBIT 2
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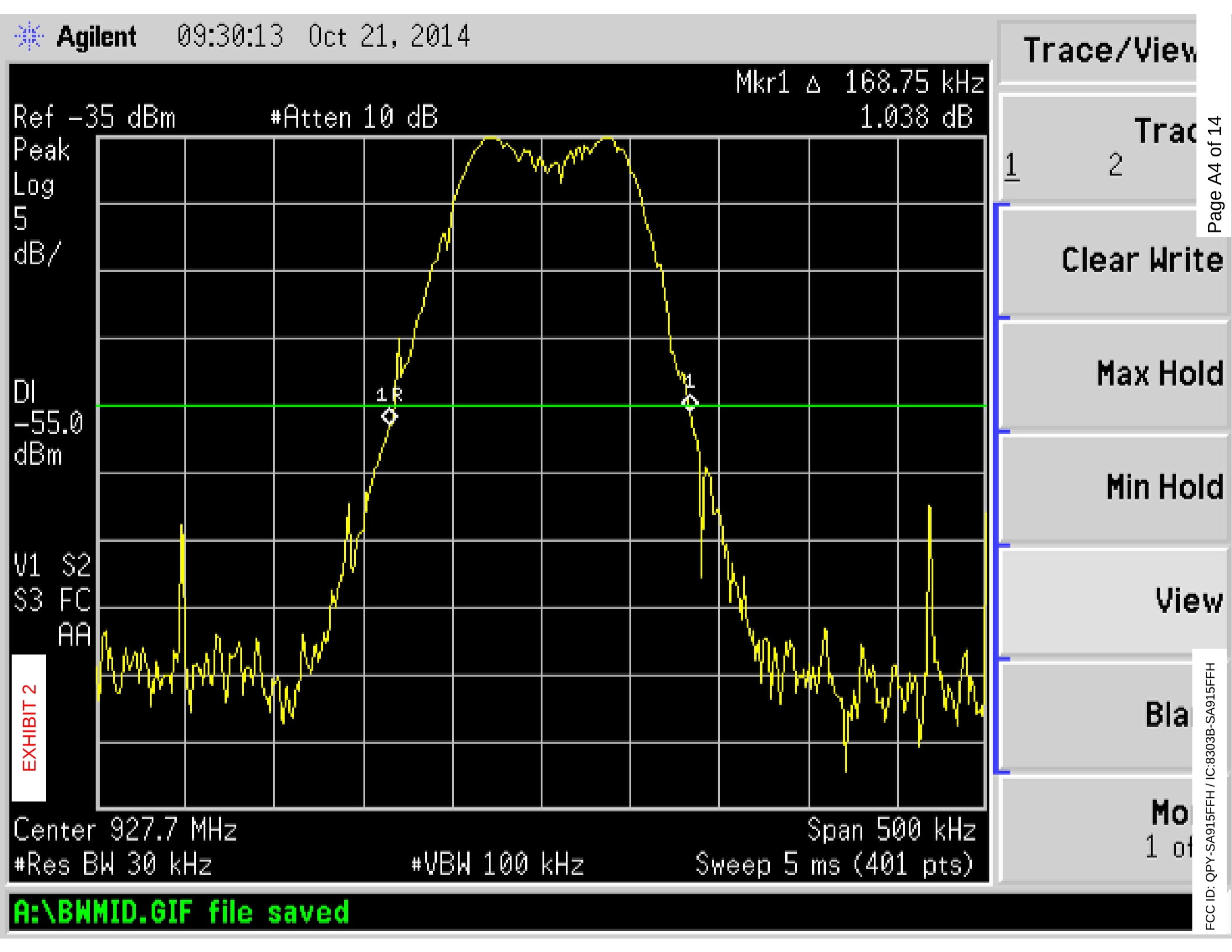

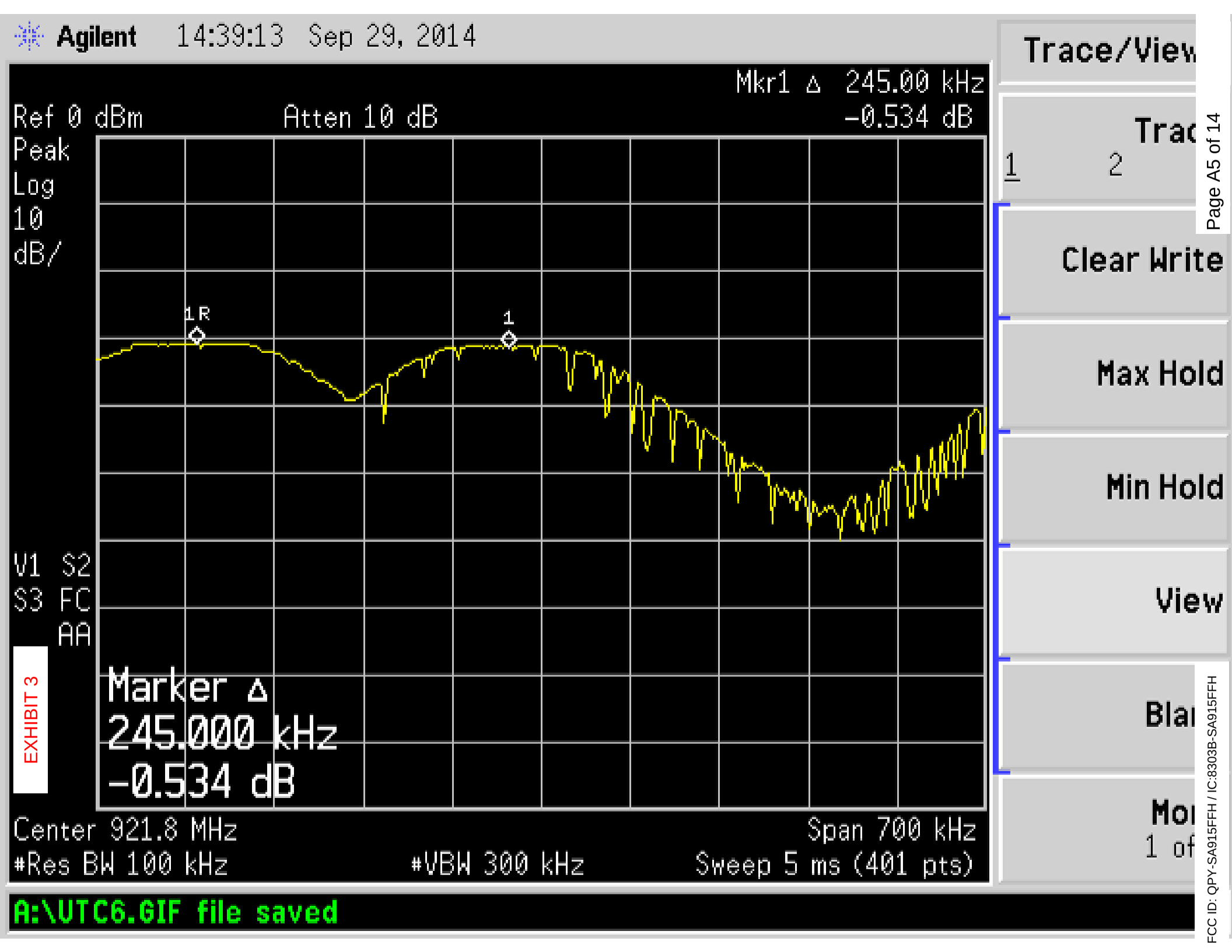
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Atten 10 dB
Peak
Log
10
dB/
1R
1
V1 S2
S3 FC
AA
Marker Δ
245.000 kHz
-0.534 dB
Center 921.8 MHz
#Res BW 100 kHz
#VBW 300 kHz
Span 700 kHz
Sweep 5 ms (401 pts)
Trace/View
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Clear Write
Max Hold
Min Hold
View
Blan
Mor
1 of
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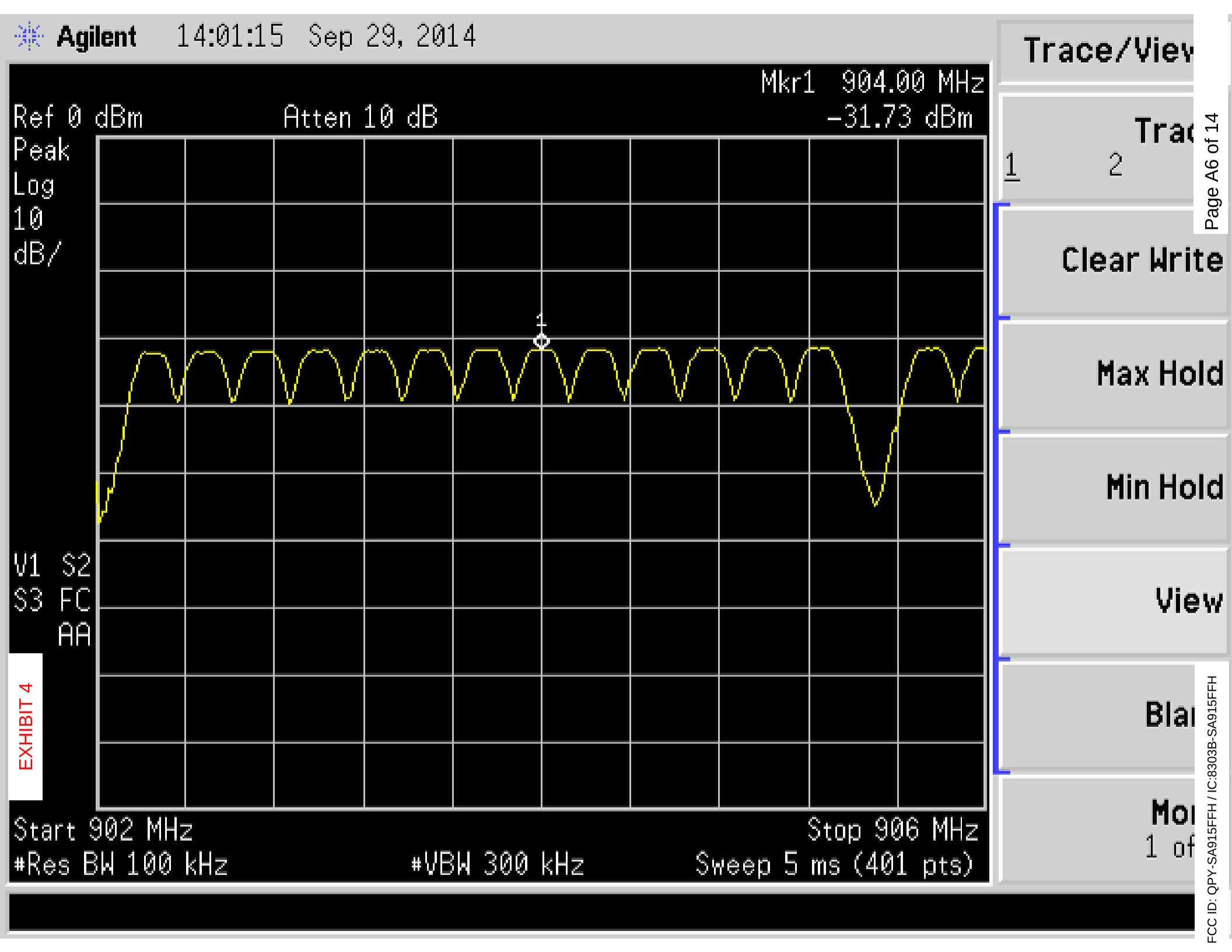
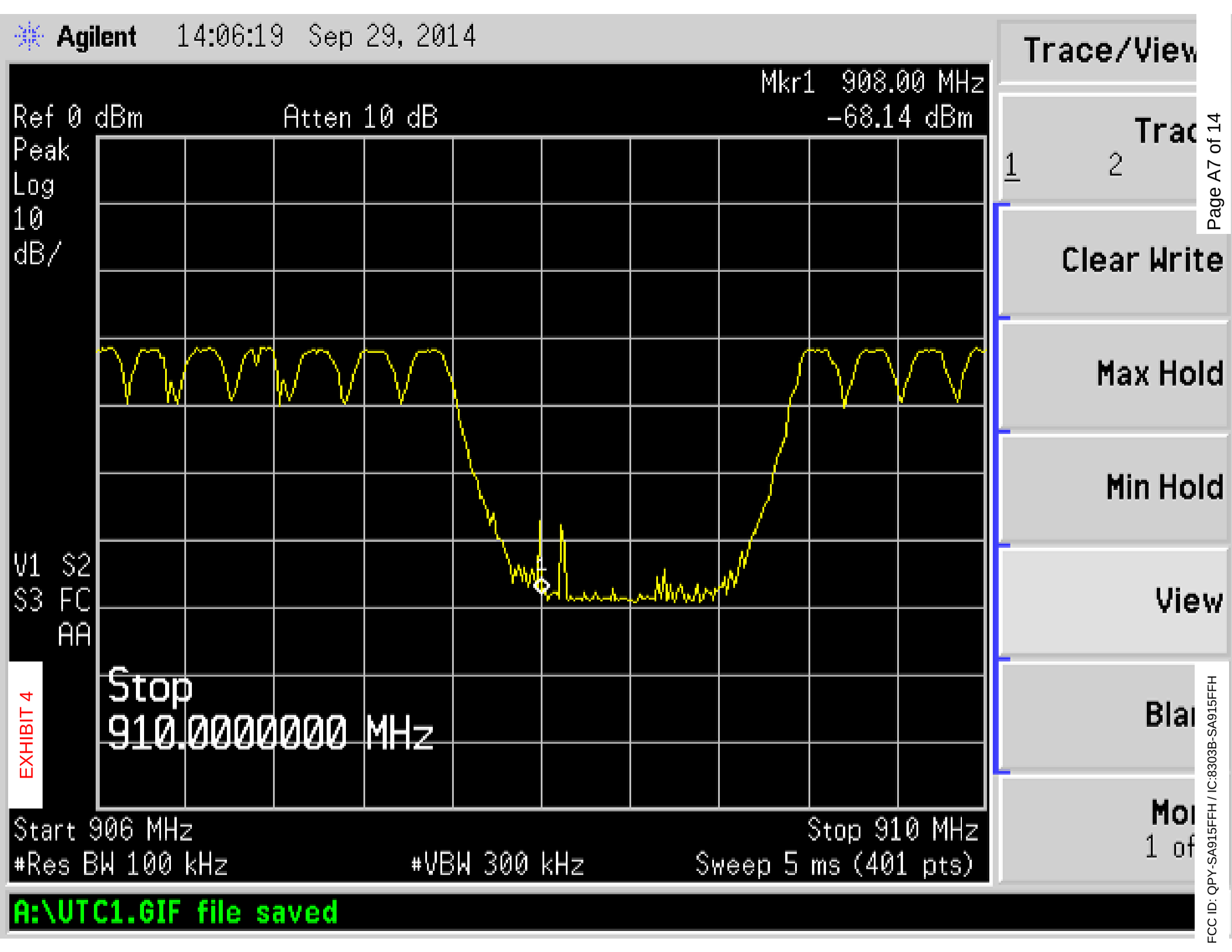
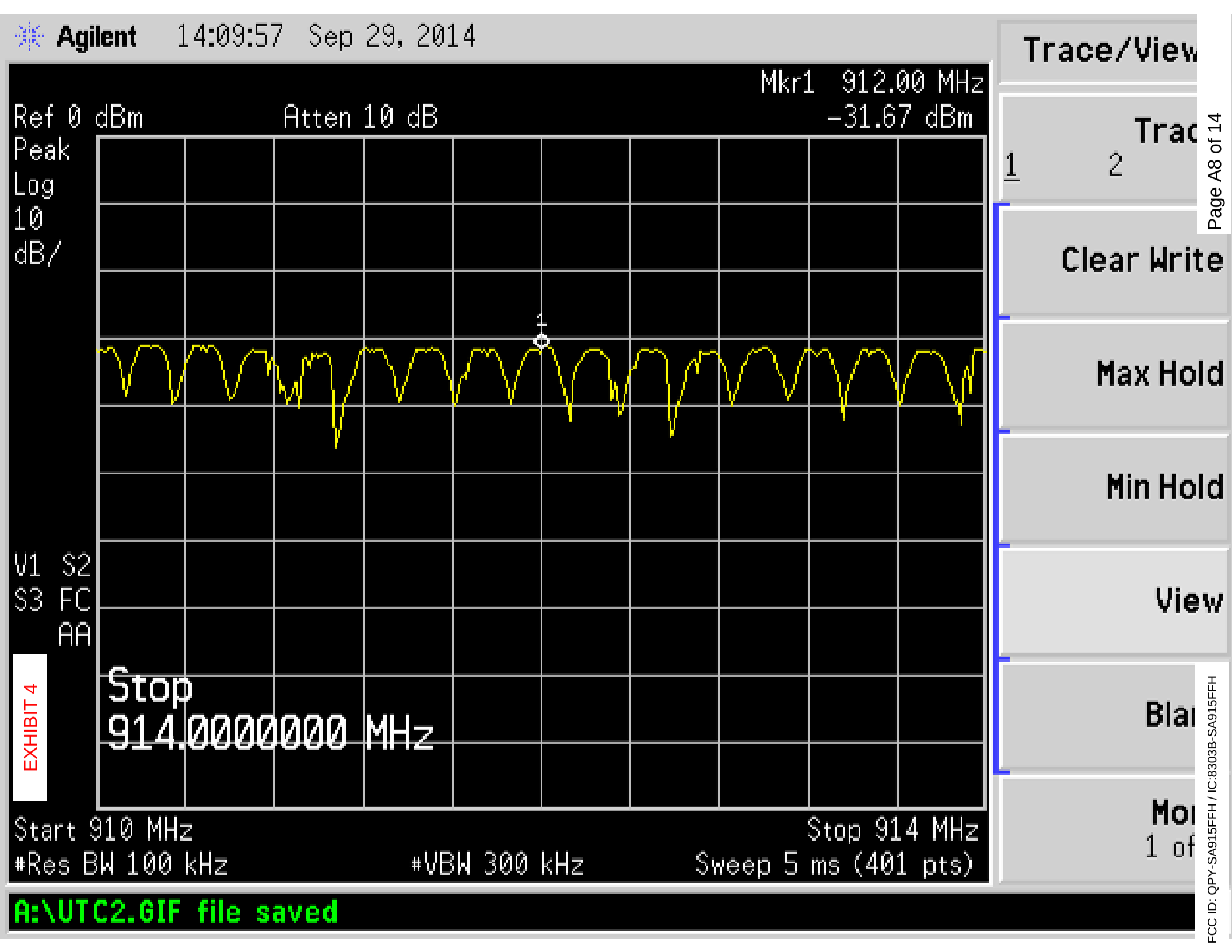
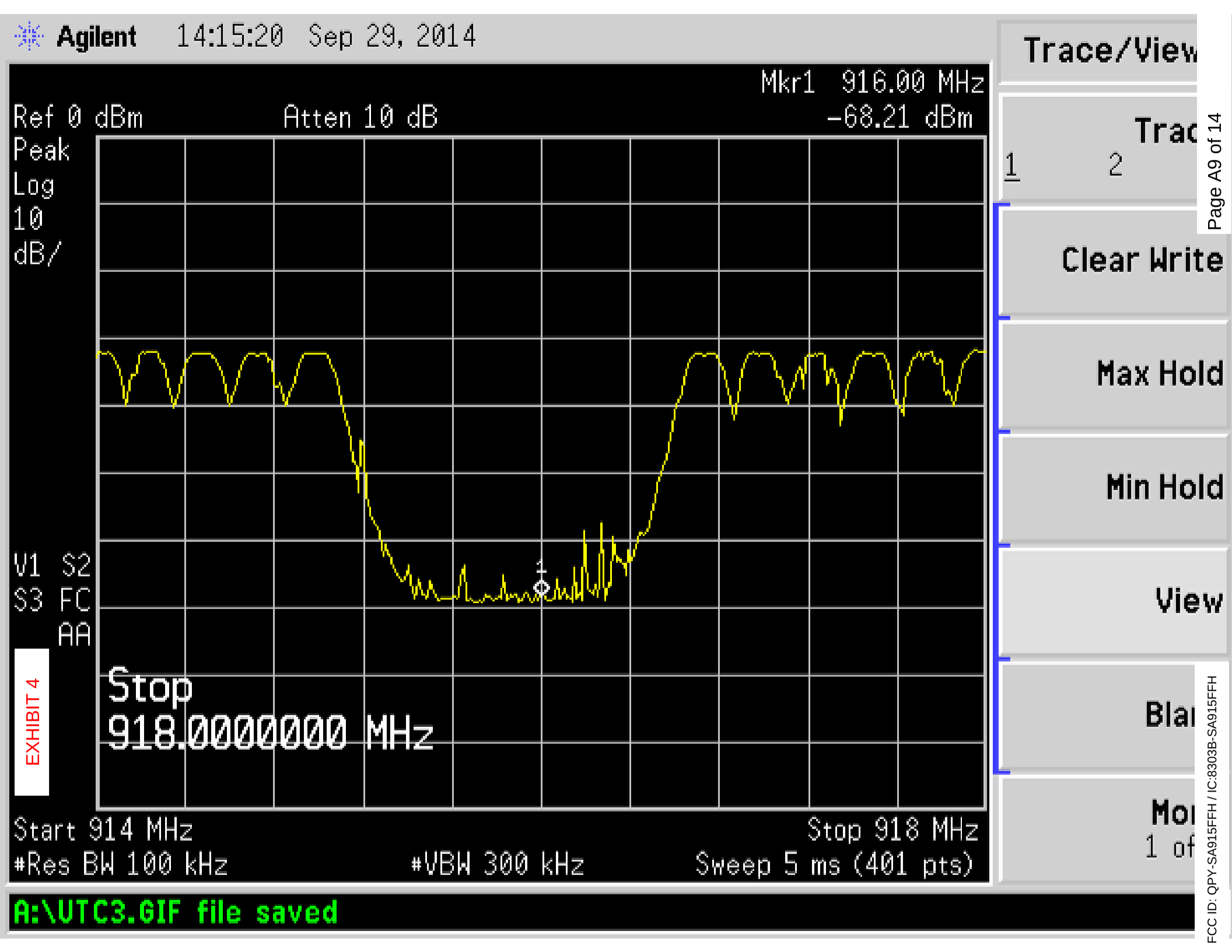
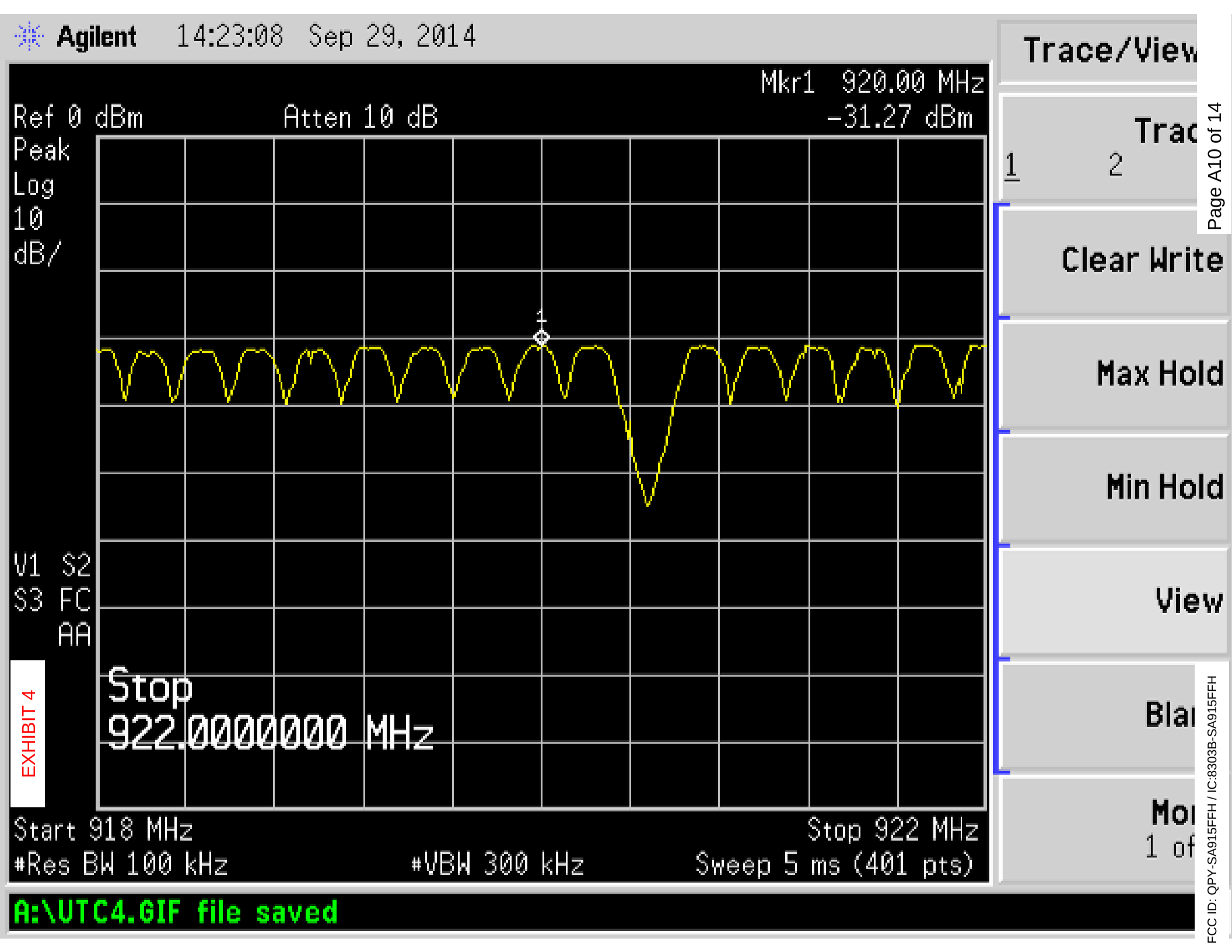
EXHIBIT 3

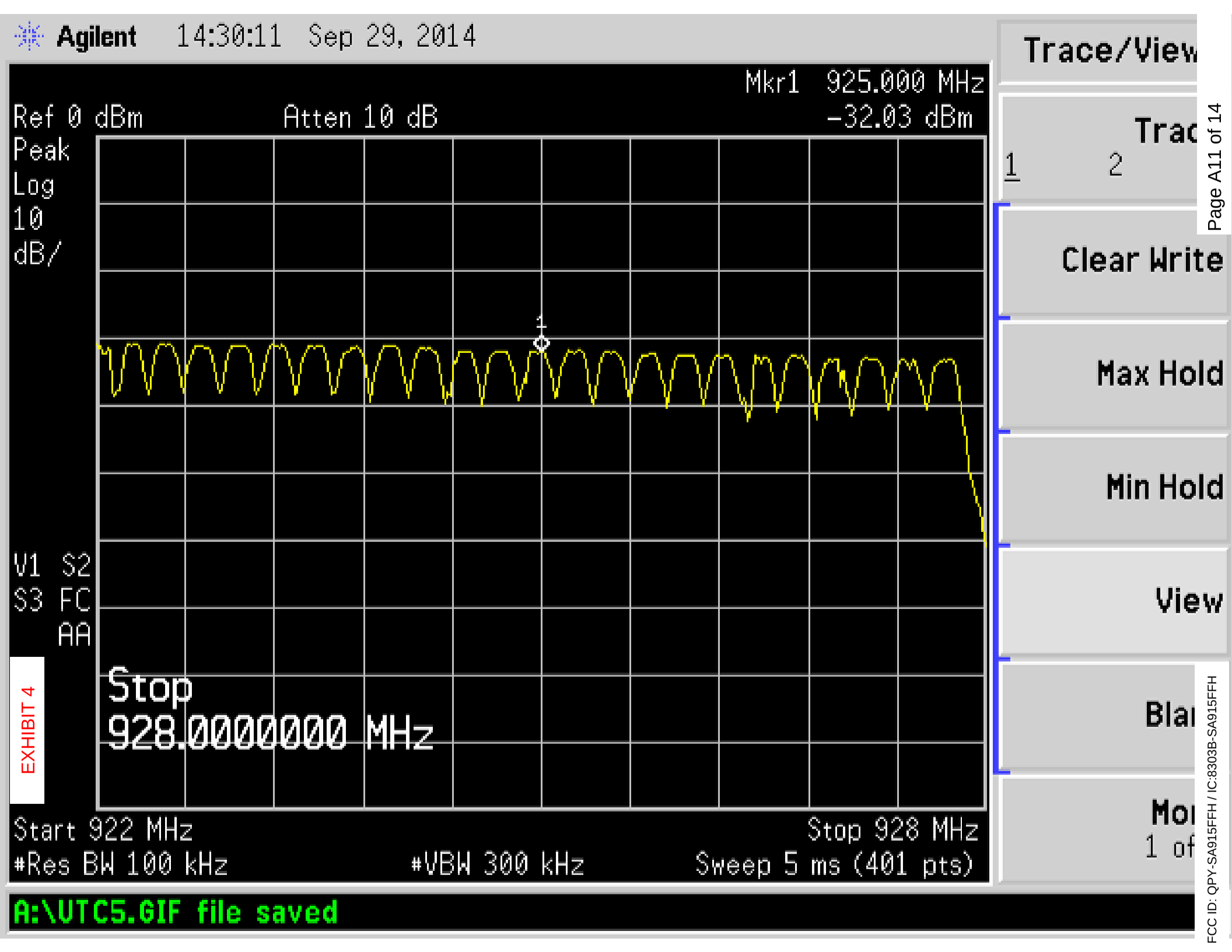


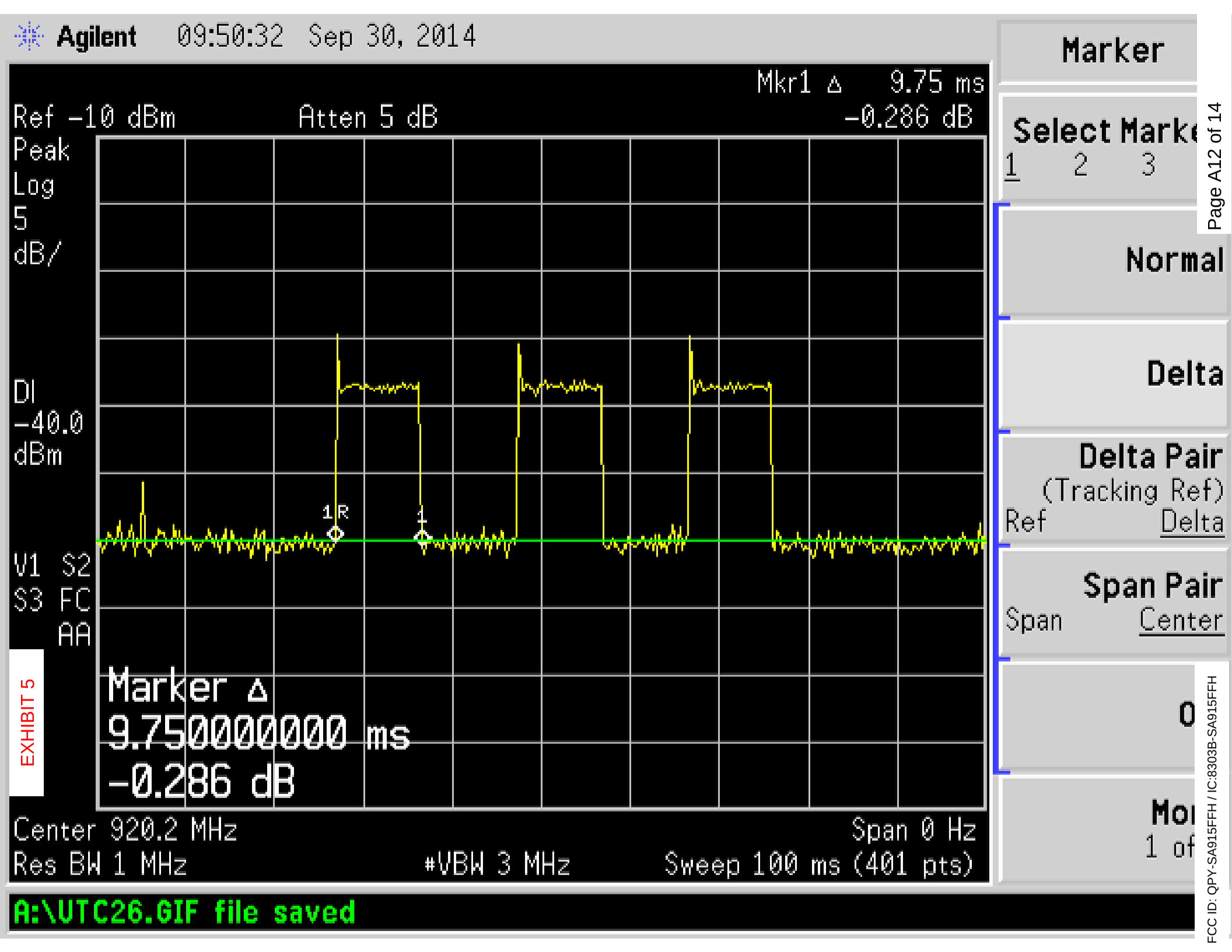


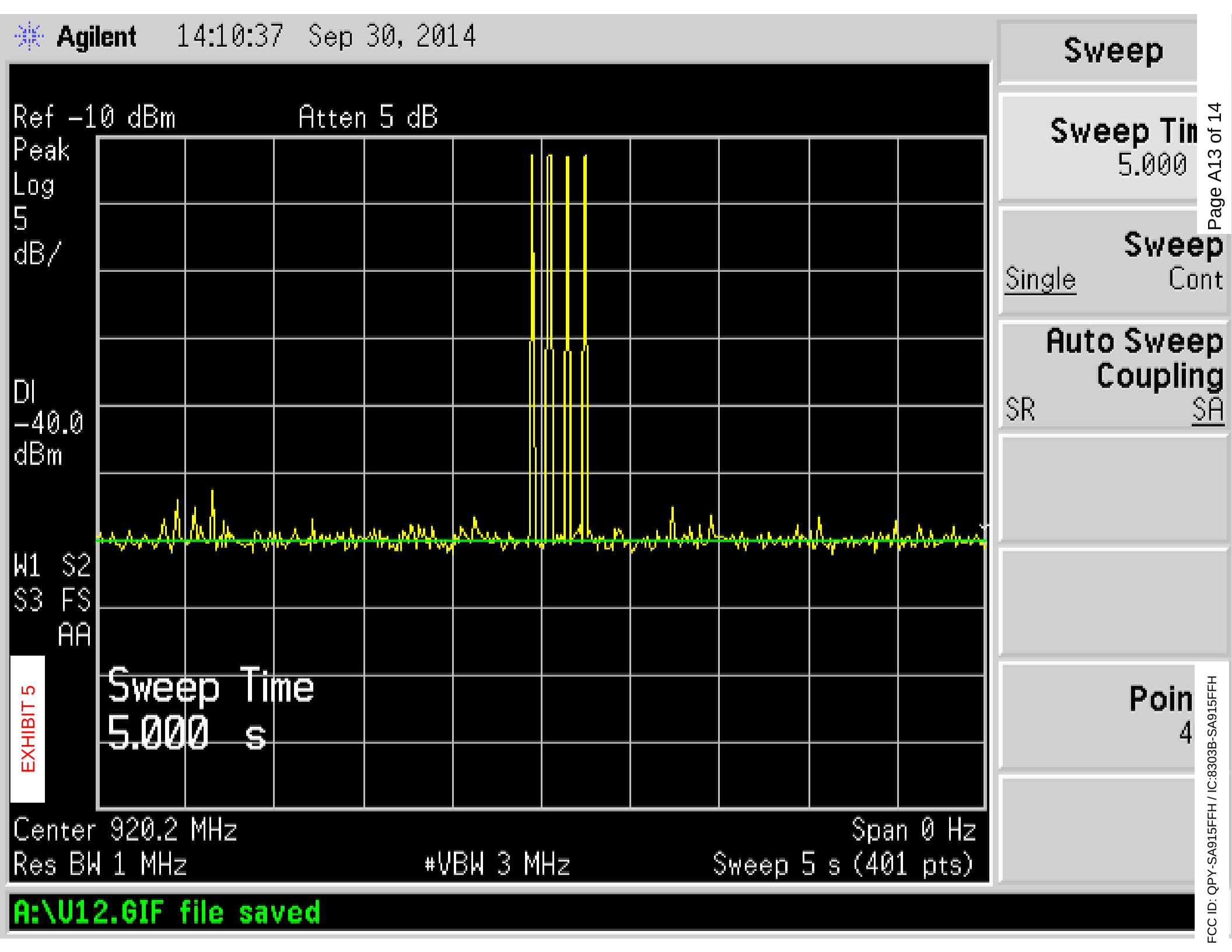








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Ref -10 dBm
Atten 5 dB
Peak
Log
5
dB/
Dl
-40.0
dBm
W1 S2
S3 FS
AA
Sweep Time
5.000 s
Center 920.2 MHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 5 s (401 pts)
Sweep
Sweep Tim
5.000
Sweep
Single
Cont
Auto Sweep
Coupling
SR
SA
Poin
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EXHIBIT 5

UTC F&S FHSS SAMPLE

3 Meter Distance @ PSE OATS

September 19th & 22nd, 2014

FUNDAMENTAL EMISSIONS

Freq.	Quasi peak Measured @ 3 m	ACF	CL	PA Gain	Adj QP	QP Limit	Delta	Polarity	Detector	Comments
MHz	dBuV	dB/M	dB	dB	dBuV/M	dBuV/M	dB			
902.2	**76.8**	23.6	4.9	0	105.3		105.3	H	QP	No PA used
915.2	**75.2**	23.6	4.9	0	103.7		103.7	H	QP	No PA used
927.7	**74.6**	23.6	4.9	0	103.1		103.1	H	QP	No PA used

No PA used FOR Fundamental Emissions

HARMONICS of 927.7 MHz

Freq.	AVERAGE DET LEVEL Measured @ 3 m	ACF	System Gain PA - CL	Adj AVG	Average Limit	Delta	Polarity	Detector	Comments
MHz	dBuV		dB	dBuV/M	dBuV/M	dB			PA = HP 87449B
1855.4	40.8	27.5	23	45.3	83.1	-37.8	H	Average	
2783.1	42.9	29.2	21.7	50.4	54	-3.6	V	Average	**RESTRICTED BAND**
3710.8	29.9	32.1	20.5	41.5	54	-12.5	H	Average	**RESTRICTED BAND**
4638.5	30.8	32.5	18.4	44.9	54	-9.1	H	Average	**RESTRICTED**

All harmonic emissions above 5 GHz are greater than 20 dB below the limit

HARMONICS of 915.2 MHz

Freq.	AVERAGE DET LEVEL Measured @ 3 m	ACF	System Gain PA - CL	Adj AVG	Average Limit	Delta	Polarity	Detector	Comments
MHz	dBuV		dB	dBuV/M	dBuV/M	dB			PA = HP 87449B
1830.4	39.2	27.5	23	43.7	83.7	-40	H		
2745.6	42.6	29.2	21.7	50.1	54	-3.9	H		**RESTRICTED BAND**
3660.8	32	32.1	20.5	43.6	54	-10.4	H		**RESTRICTED BAND**
4576	33.9	32.5	18.4	48	54	-6	H		**RESTRICTED BAND**

All harmonic emissions above 5 GHz are greater than 20 dB below the limit

HARMONICS of 902.2 MHz

Freq.	AVERAGE DET LEVEL Measured @ 3 m	ACF	System Gain PA - CL	Adj AVG	Average Limit	Delta	Polarity	Detector	Comments
MHz	dBuV		dB	dBuV/M	dBuV/M	dB			PA = HP 87449B
1804.5	40	27.5	23	44.5	85.3	-40.8	H		
2706.7	40.2	29.2	21.7	47.7	54	-6.3	V		**RESTRICTED BAND**
3609	36.6	32.1	20.5	48.2	54	-5.8	H		**RESTRICTED BAND**
4511.2	32.6	32.5	18.4	46.7	54	-7.3	H		**RESTRICTED BAND**

* All harmonics above 5 GHz are greater than 20 below the limit