Testing Tomorrow's Technology

Application
For

Title 47 USC, Part 2, Subpart J, Paragraph 2.902, Equipment Authorization of Verification for an Unintentional Radiator per Part 15, Subpart B, Paragraphs 15.107 and 15.109

And

Part 2, Subpart J, Paragraph 2.907 Equipment Authorization of Certification for an Intentional Radiator per Part 15, Subpart C, paragraph 15.247

For the

Radio Systems Corporation

IRIS SMARTDOOR, Model: 300-2645

FCC ID: KE3-3002645
IC: 2721A-3002645

UST Project: 13-0175
Issue Date: June 10, 2013

Total Pages: 66

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I certify that I am authorized to sign for the Test Agency and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: Alan Ghasiani

Name: 

Title: Compliance Engineer – President

Date June 10, 2013

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MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Radio Systems Corporation

MODEL: 300-2645

FCC ID: KE3-3002645
IC ID: 2721A-3002645

DATE: June 10, 2013

This report concerns (check one): Original grant [X]
Class II change

Equipment type: 2.4 GHz Transmitter

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes_____ No X

If yes, defer until: _____N/A_____
date
agrees to notify the Commission by N/A
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

US Tech
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Alpharetta, GA 30004

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1 General Information

1.1 Purpose of this Report

This report is prepared as a means of conveying test results information concerning the suitability of this exact product for public distribution according to the FCC Rules and Regulations Part 15, Section 247.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on May 29, 2013 in good operating condition.

1.3 Product Description

The Equipment Under Test (EUT) is the Radio Systems Corporation Iris electronic pet door, Model 300-2645 The pet wears a 433 MHz transmitter on their collar, which is not included in this testing, that transmits a beacon once every 1.5 seconds. The pet door being tested receives this beacon and if the ID is one stored in the pet door, automatically opens the door to allow the pet to enter or exit. If the ID is not recognized, the door ignores the beacon. This allows an owner to prevent unwanted entry of stray animals and wildlife into their residence. The door being tested also includes a 2.4 GHz ZigBee radio that connects to a Lowe's Iris Hub (not included in this testing) to report pet activity, battery status, and door configuration to the Iris Cloud Server periodically. This is what is being tested in this evaluation. It also can receive door configuration change information via the Zigbee network. The door will connect to the hub and report to the Iris Cloud whenever a state change occurs on the door, but at least once every 2 minutes.

1.4 Configuration of Tested System

The Test Sample was tested per *ANSI C63.4:2003, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2003)* for FCC subpart B Digital equipment Verification requirements and per FCC KDB Publication number 558074 for Digital Transmission Systems Operating Under section 15.247.

Digital RF conducted and radiated verification emissions data (FCC 15.107 and 109) below 1 GHz were taken with the measuring receiver (or spectrum analyzer's) resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements performed above 1.0 GHz were made with a RBW of 1 MHz. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process.

A list of EUT and Peripherals is found in Table 1 below. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are provided in separate Appendices.

1.5 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA 30004. This site has been fully described and registered with the FCC under site registration number 186022. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 2982A-1.

1.6 Related Submittal(s)/Grant(s)

The EUT will be used to wirelessly send/receive data.

The EUT is subject to the following FCC Equipment Authorizations:

a) Certification of the transmitter, see test data presented herein
b) Declaration of Conformity as a Receiver

Table 1. EUT and Peripherals

PERIPHERAL MANUFACTURER.	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
2.4 GHz Radio Radio Systems (EUT)	300-2645	Engineering Sample	Pending: KE3-3002645	NA
Antenna See antenna details	--	--	--	--

2 Tests and Measurements

2.1 Test Equipment

Table 2 below lists test equipment used to evaluate this product. Model numbers, serial numbers and their calibration status are included herein.

Table 2. Test Instruments

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8593E	AGILENT	US41442935	10/29/2012
SPECTRUM ANALYZER	8566B	HEWLETT-PACKARD	2410A00109	11/21/2012
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	2944A06291	3/4/2013
LOOP ANTENNA	SAS-200/562	A. H. Systems	142	8/9/2011 2 year Cal.
BICONICAL ANTENNA	3110B	EMCO	9306-1708	7/2/2012 2 year Cal.
LOG PERIODIC	3146	EMCO	3110-3236	6/5/2012 2 year Cal.
HORN ANTENNA	3115	EMCO	9107-3723	8/10/2011 2 year Cal.
HORN ANTENNA	3116	EMCO	9505-2255	8/09/2012 2 year Cal.
PREAMP	8449B	HEWLETT-PACKARD	3008A00480	3/4/2013
CALCULATION PROGRAM	N/A	N/A	Ver. 6.0	N/A

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

2.2 Modifications to EUT Hardware

No modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C Intentional Radiator Limits for the transmitter portion of the EUT or the Subpart B Unintentional Radiator Limits (Receiver and Digital Device) Requirements.

2.3 Number of Measurements for Intentional Radiators (15.31(m))

Measurements of intentional radiators or receivers shall be performed and reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in Table 3 as follows.

Table 3. Number of Test Frequencies for Intentional Radiators

Frequency Range over which the device operates	Number of Frequencies	Location in the Range of operation
1 MHz or Less	1	Middle
1 to 10 MHz	2	1 near the top 1 near the bottom
Greater than 10 MHz	3	1 near top 1 near middle 1 near bottom

Because the EUT operates over 2.4 GHz to 2.4835 GHz, 3 test frequencies will be used.

2.4 Frequency Range of Radiated Measurements (Part 15.33)

2.4.1 Intentional Radiator

The spectrum shall be investigated for the intentional radiator from the lowest RF signal generated in the EUT, without going below 9 kHz to the 10th harmonic of the highest fundamental frequency generated or 40 GHz, whichever is the lowest.

2.4.2 Unintentional Radiator

For the digital device, an unintentional radiator, the frequency range shall be 30 MHz to 1000 MHz, or to the range specified in 2.4.1 above, whichever is the higher range of investigation.

2.5 Measurement Detector Function and Bandwidth (CFR 15.35)

The radiated and conducted emissions limits shown herein are based on the following:

2.5.1 Detector Function and Associated Bandwidth

On frequencies below 1000 MHz, the limits herein are based upon measurement equipment employing a CISPR Quasi-peak detector function and related measurement bandwidths (i.e. 9 kHz from 150 kHz to 30 MHz and 120 kHz from 30 MHz to 1000 MHz). Alternatively, measurements may be made with equipment employing a peak detector function as long as the same bandwidths specified for the Quasi-peak device are used.

2.5.2 Corresponding Peak and Average Requirements

Above 1000 MHz, radiated limits are based on measuring instrumentation employing an average detector function. When average radiated emissions are specified there is also a corresponding Peak requirement, as measured using a peak detector, of 20 dB greater than the average limit. For all measurements above 1000 MHz the Resolution Bandwidth shall be at least 1 MHz.

2.5.3 Pulsed Transmitter Averaging

When the radiated emissions limit is expressed as an average value, and the transmitter is pulsed, the measured field strength shall be determined by applying a Duty Cycle Correction Factor based upon dividing the total ON time during the first 100 ms period by 100 ms (or by the period if less than 100 ms). The duty cycle may also be expressed logarithmically in dB. Please section 2.8 herein for details.

2.6 EUT Antenna Requirements (CFR 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. Only the antenna(s) listed in Table 4 will be used with this module.

Table 4. Allowed Antenna(s)

MANUFACTURER	TYPE OF ANTENNA	MODEL	REPORT REFERENCE	GAIN dB_i	TYPE OF CONNECTOR
Texas Instruments	Inverted F Antenna	DN0007	Antenna 1	3.3	Trace Antenna

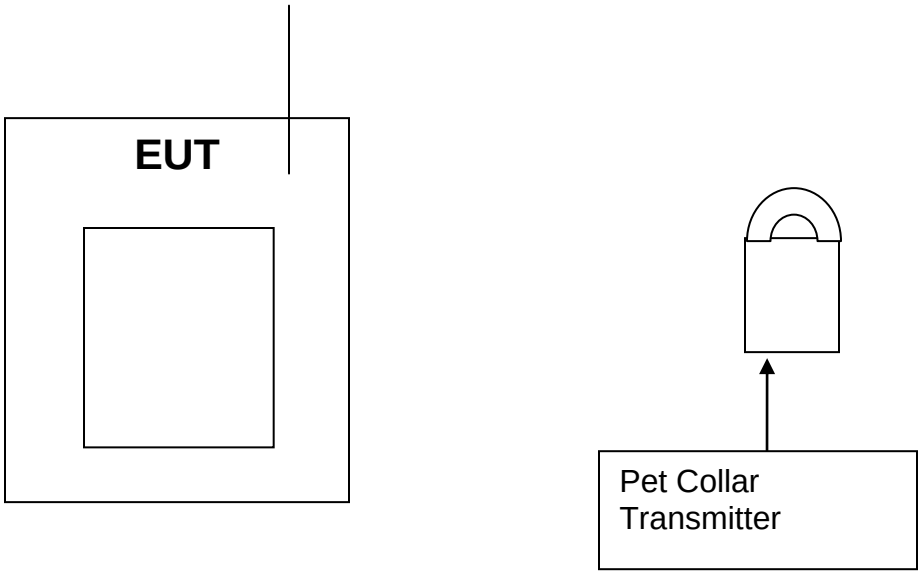


Figure 1. Test Configuration

2.7 Restricted Bands of Operation (Part 15.205)

Only spurious emissions can fall in the frequency bands of CFR 15.205. The field strength of these spurious cannot exceed the limits of 15.209. Radiated harmonics and other Spurious are examined for this requirement see paragraph 2.10.

2.8 Transmitter Duty Cycle (CFR 35 (c))

The duty cycle de-rating factor used in the calculation of average radiated limits (per CFR 15.209 and 15.35(c)) is described below. This factor was calculated by first determining the worst case scenario for system operation. Below are two screen shots of a single channel.

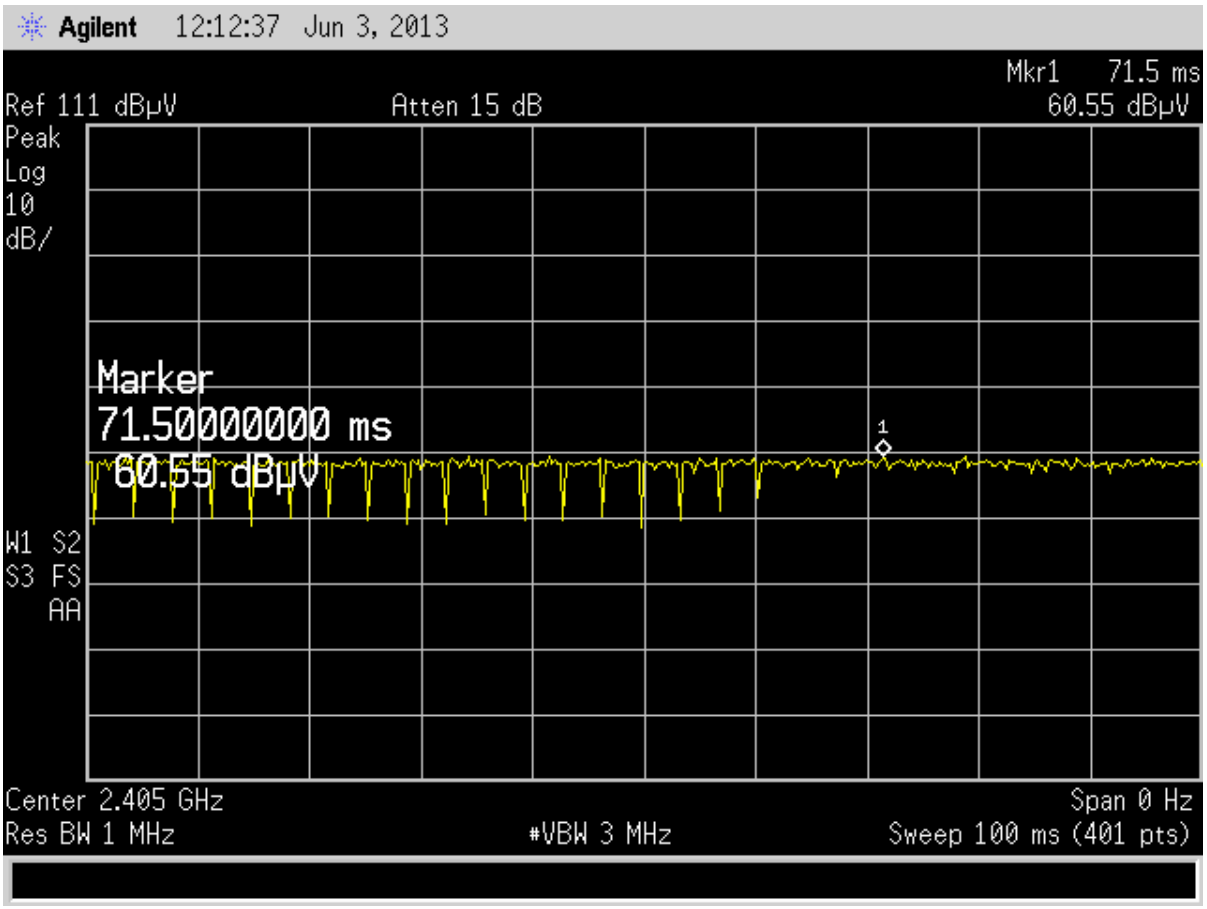


Figure 2. Duty Cycle, Screen Shot #1

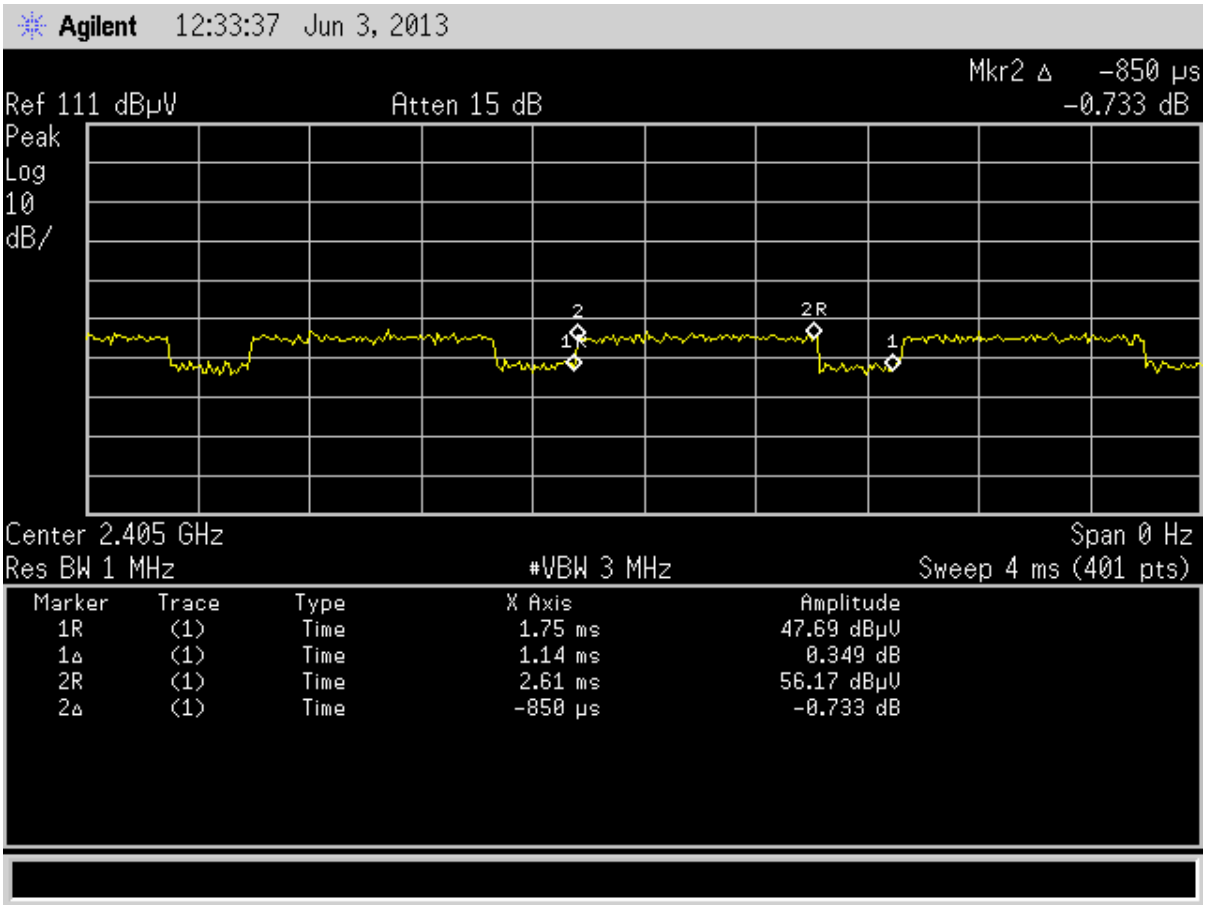


Figure 3. Duty Cycle, Screen Shot #2

Duty Cycle = Time On / Time Off
Duty Cycle = 850µS / 1.14mS
Duty Cycle = 0.746

Duty Cycle Offset = 10Log(Duty Cycle)
Duty Cycle Offset = 10Log(0.746)
Duty Cycle Offset = -1.27 dB

2.9 Intentional Radiator, Power Lines Conducted Emissions (CFR 15.207)

The power line conducted voltage emission measurements have been carried out in accordance with CFR 15.207, per ANSI C63.4:2003, Paragraph 7, with a spectrum analyzer connected to an LISN and the EUT placed into a continuous mode of transmission.

The EUT is a battery powered device; there are no conducted emissions to measure.

Table 5. Transmitter Power Line Conducted Emissions Test Data, Part 15.207

CONDUCTED EMISSIONS 150 kHz to 30 MHz						
Tested By: JW	Specification Requirement: FCC Part 15.207 Class B		Project No.: 13-0175	Manufacturer/Model: Radio Systems Corporation/ Model 300-2645		
Frequency (MHz)	**Test Data (dBuV)**	**LISN+CL-PA (dB)**	**Corrected Results (dBuV)**	**Avg Limits (dBuV)**	**Margin (dB)**	**Detector**
EUT is Battery Powered						

(*)= Quasi-Peak limit used
SAMPLE CALCULATIONS: N/A

2.10 Intentional Radiator, Radiated Emissions (Antenna Conducted) (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a))

The EUT was put into a continuous-transmit mode of operation and tested per FCC KDB Publication 558074 for conducted out of band emissions emanating from the antenna port over the frequency range of 30 MHz to 25 GHz. A conducted scan was performed on the EUT to identify and record spurious signals that were related to the transmitter. Antenna Conducted Emissions of a significant magnitude that fell within restricted bands were then measured as radiated emissions on the OATS. The conducted emissions graphs are found in Figures 3 through 8 below. The limit for antenna conducted power is 1 Watt (30 dBm) per 15.247 (b)(3).

For radiated measurements, the EUT was set into a continuous transmission mode. Below 1 GHz, the RBW of the measuring instrument was set equal to 120 kHz. Peak measurements above 1 GHz were measured using a RBW = 1 MHz, with a VBW ≥ RBW. The results of peak radiated spurious emissions falling within restricted bands are given in Table 6 below.

For Average Voltage measurements above 1 GHz, the emissions were measured using RBW = 1 MHz and VBW = 10 Hz. For a pulse-modulated transmitter, the EUT's average emissions are further modified by adding to them the worst-case duty cycle, determined by adding the EUT's total pulse widths (on time) over a 100 ms period and dividing by 100 ms.

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)) (Cont'd).

On the OATS, the EUT was mounted on top of a non-conductive table, 80 cm above the floor, by placing it in the X-Z plane along the Z axis with its bottom cover in parallel with the ground. The front of the EUT faced the measurement antenna located 3 meters away. Each signal measured was maximized by raising and lowering the receive antenna between 1 and 4 meters in height while monitoring the ever changing spectrum analyzer display (with channel A in the Clear-Write mode and channel B in the Max-Hold mode) for the largest signal visible. That exact antenna height where the signal was maximized was recorded for reproducibility purposes. Also, the EUT was rotated about its Y-axis while monitoring the Spectrum Analyzer display for maximum. The EUT azimuth was recorded for reproducibility purposes. The EUT was measured when both maxima were simultaneously satisfied.

The test data is detailed below in for this section. Several radiated emissions above 1 GHz were measured at a distance of 1 meter. The measured value at 1 meter was then extrapolated to the resultant at 3 meters using an inverse distance extrapolation factor of -20 dB/decade. There were no test failures.

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)) (Cont'd).

2.10.1 Antenna Conducted Spurious Emissions

The EUT's Antenna Conducted Spurious Emissions, A.C.S.E, was measured by replacing antenna with a 50ohn co-axial cable with an SMA type connector at the end. An 8dB attenuator was placed on the SMA connector; the total loss of the system was calculated to be 9dB. This loss was corrected for with the External preamp gain of the spectrum analyzer. The assemblage was connected to a spectrum analyzer. The EUT transmitter was placed in constant operation. The output from the EUT was recorded in the screen shots below. There are 3 sets of screen shots. The low channel is in yellow. Mid channel is in aqua. High channel is in purple.

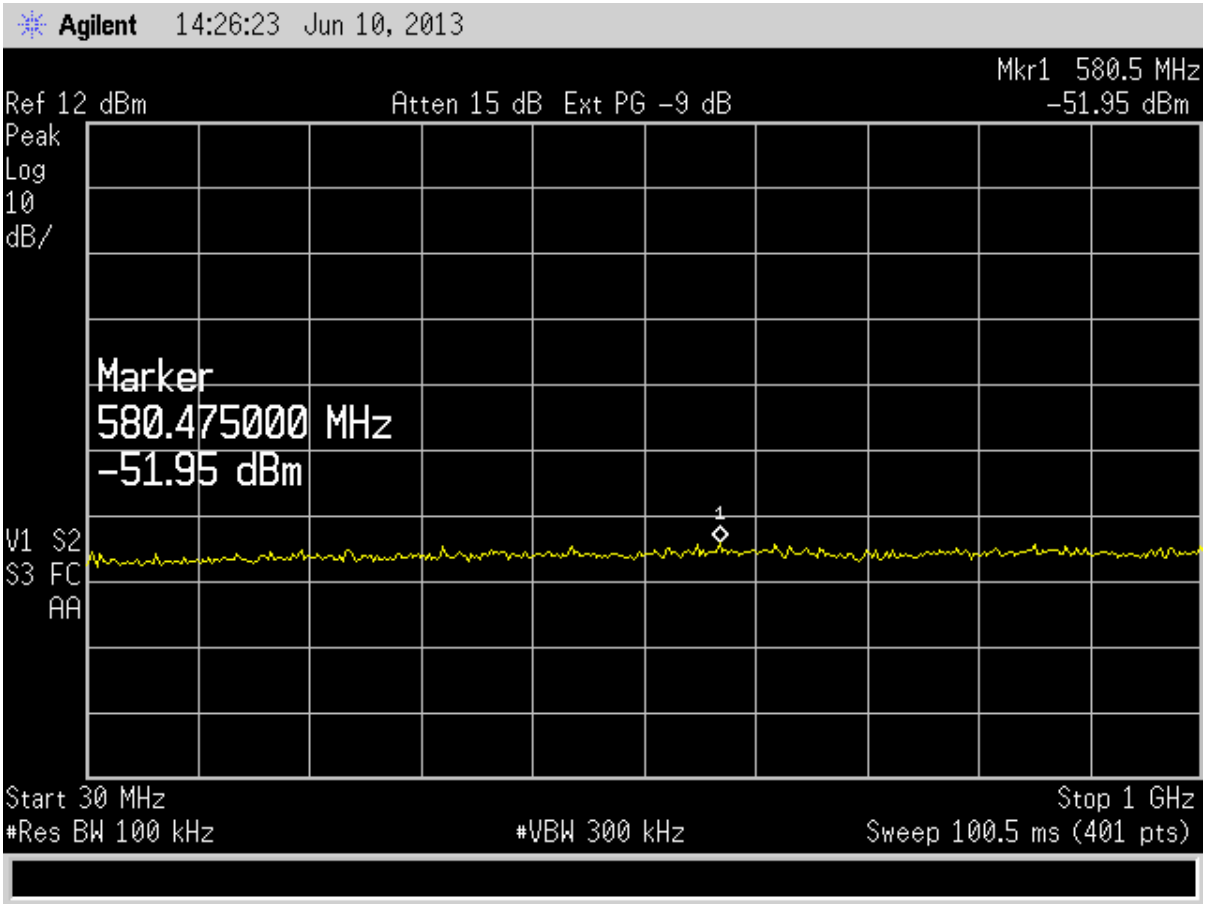


Figure 4. Low Channel A.C.S.E. – 30 Mhz through 1 GHz

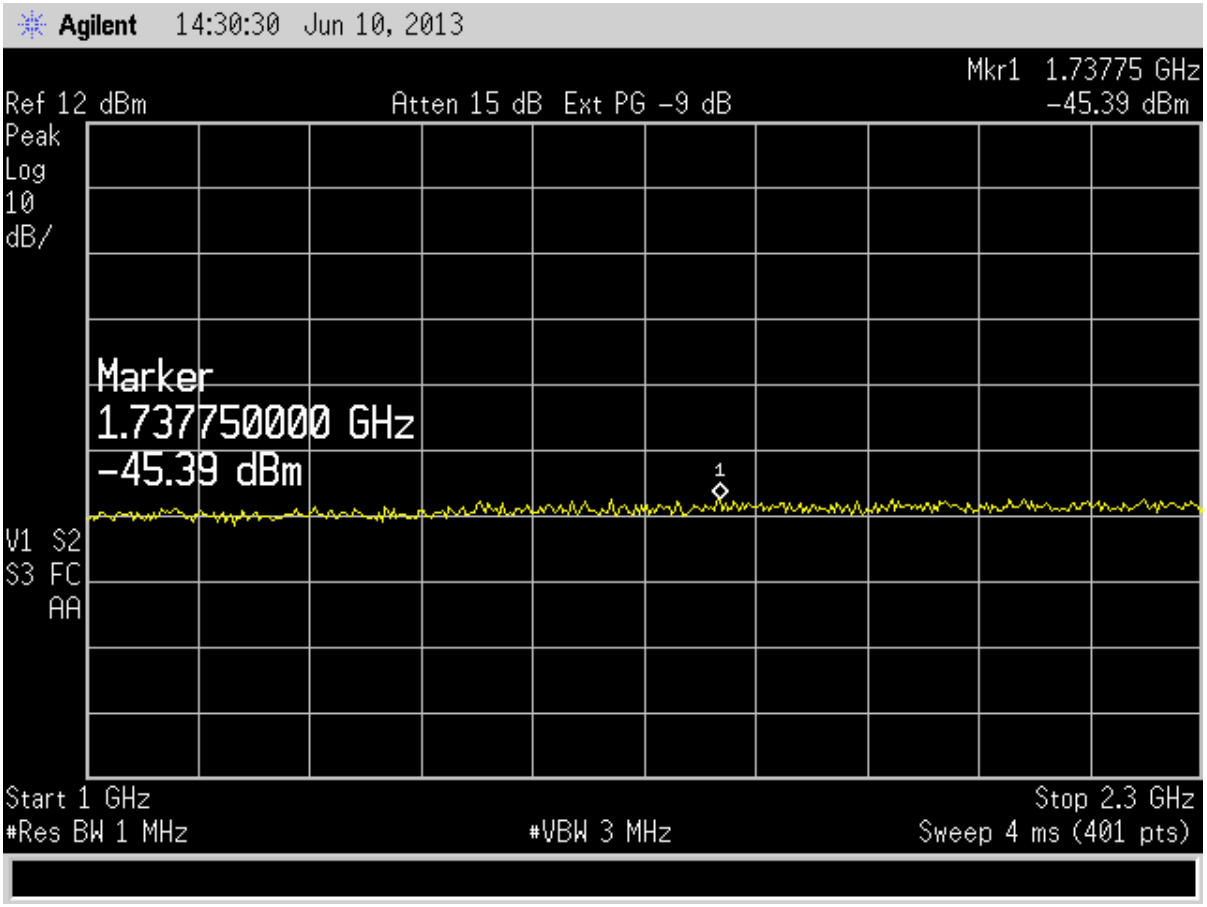


Figure 5. Low Channel A.C.S.E. – 1GHz through 2.3GHz

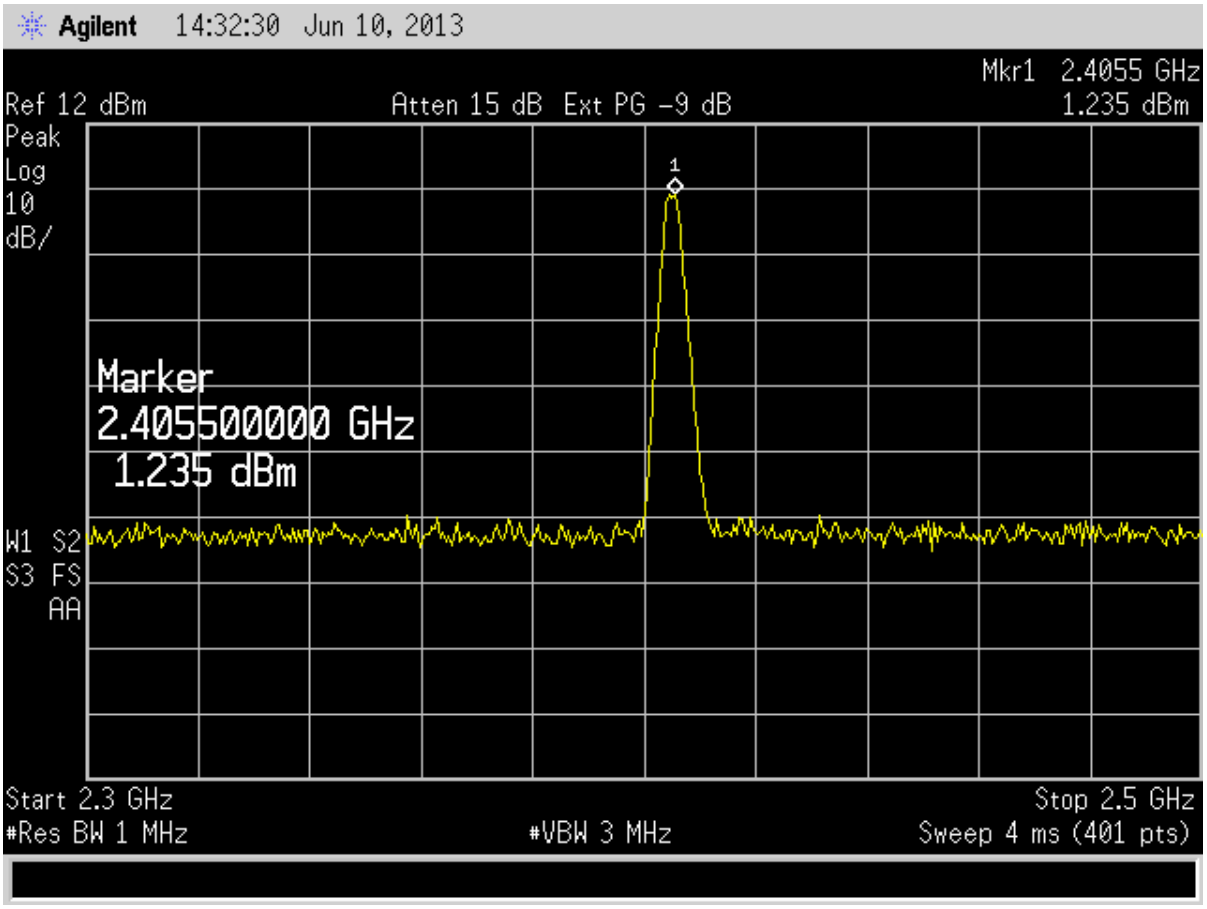


Figure 6. Low Channel A.C.S.E. – 2.3GHz through 2.5GHz

Note: Large emission is the fundamental frequency.

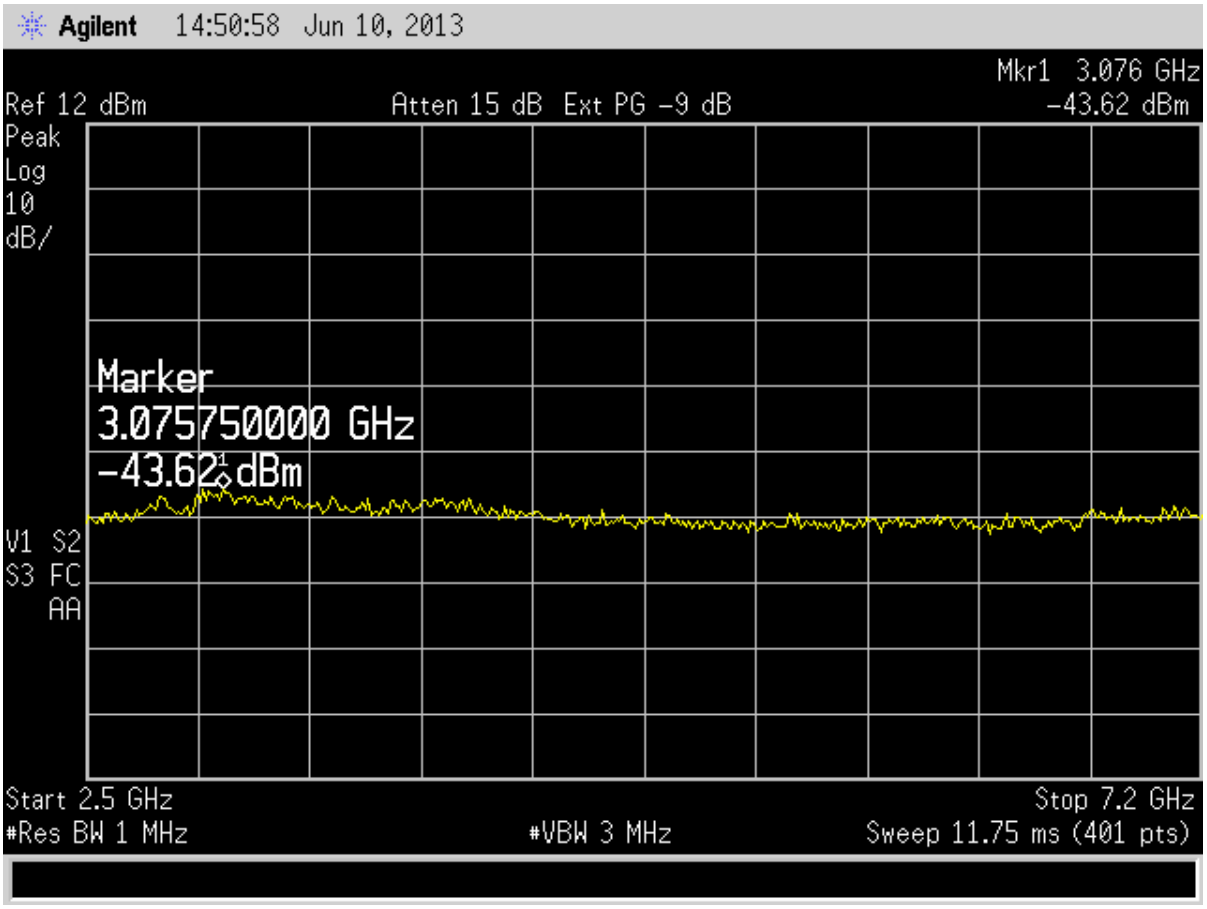


Figure 7. Low Channel A.C.S.E. – 2.5GHz through 7.2GHz

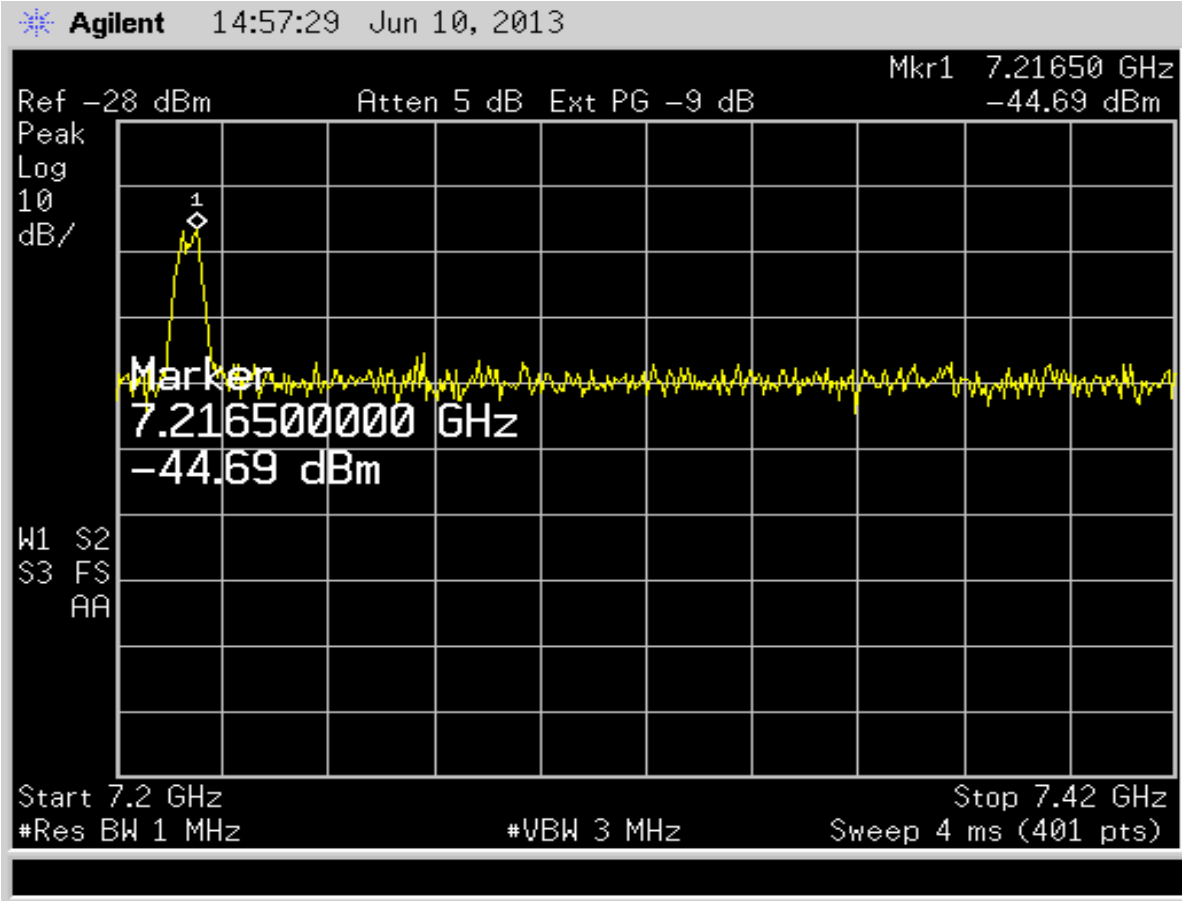


Figure 8. Low Channel A.C.S.E. – 7.2GHz through 7.42GHz
Note: Large emission is the third harmonic.

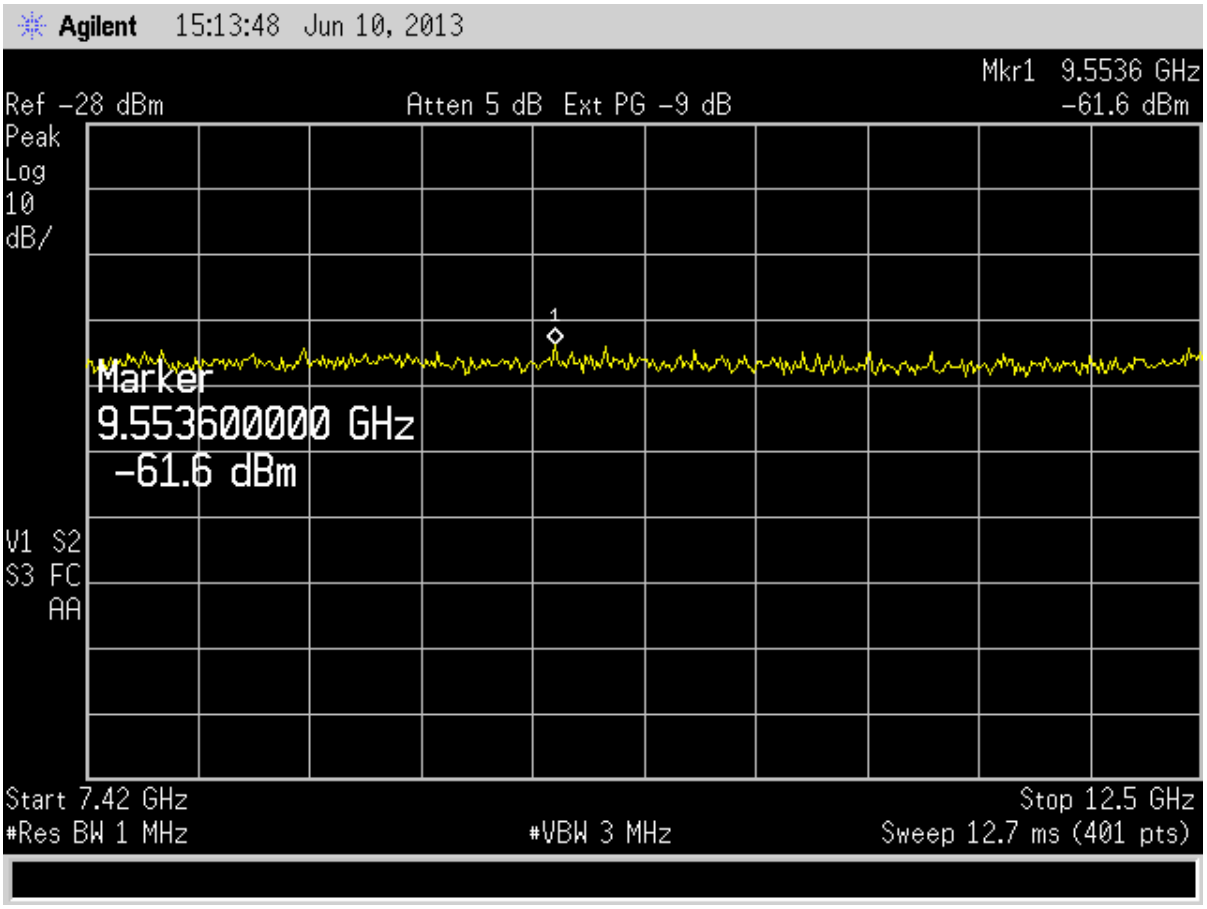


Figure 9. Low Channel A.C.S.E. – 7.42GHz through 12.5GHz

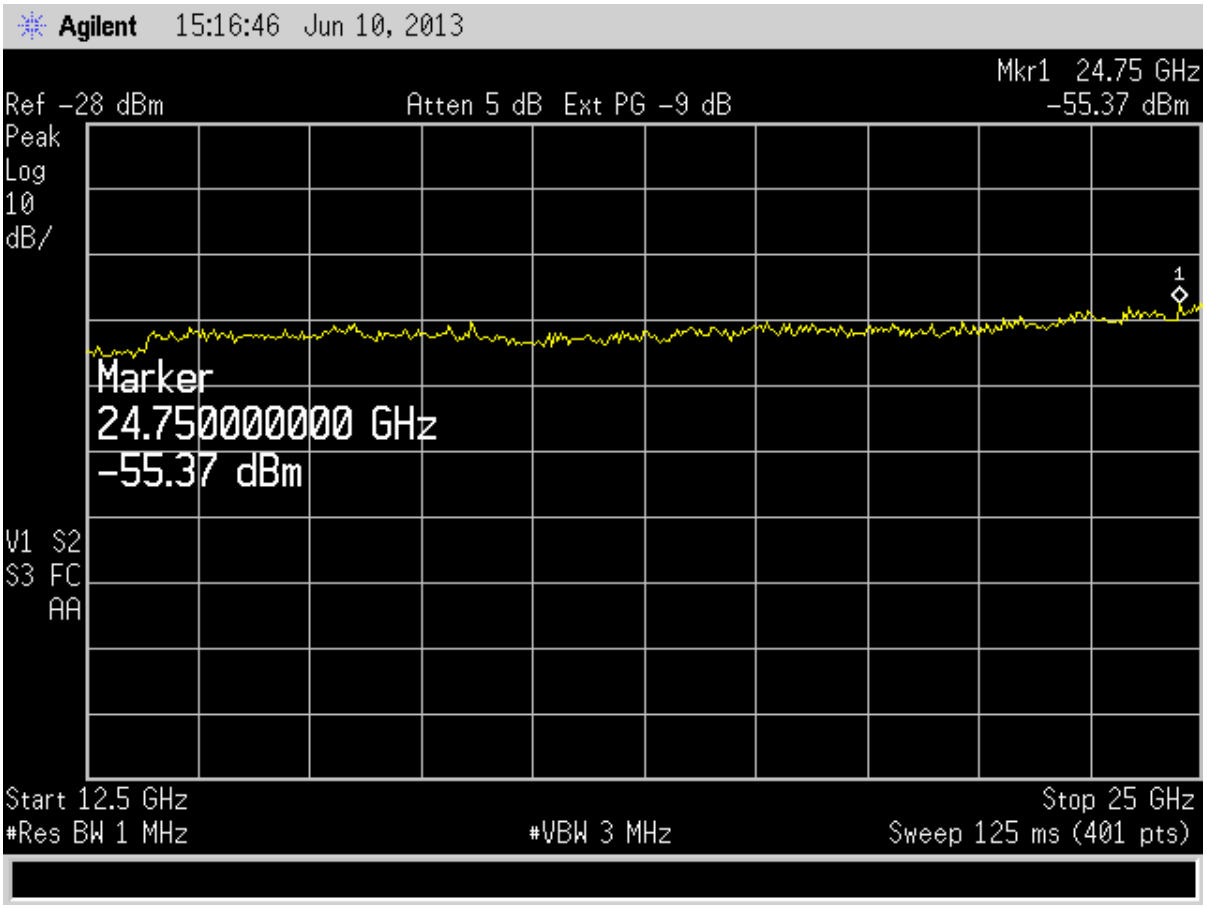


Figure 10. Low Channel A.C.S.E. – 12.5GHz through 25GHz

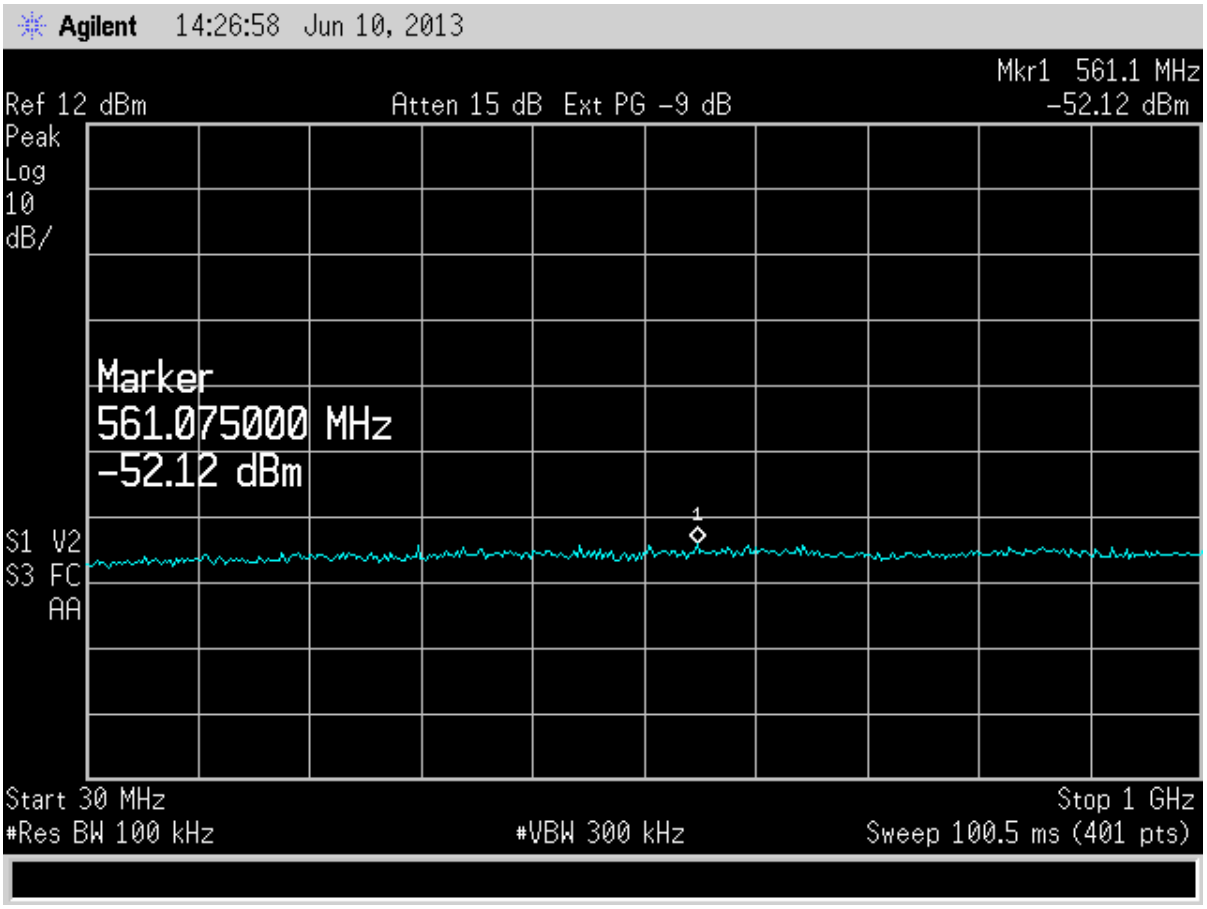


Figure 11. Mid Channel A.C.S.E. – 30 MHz through 1GHz

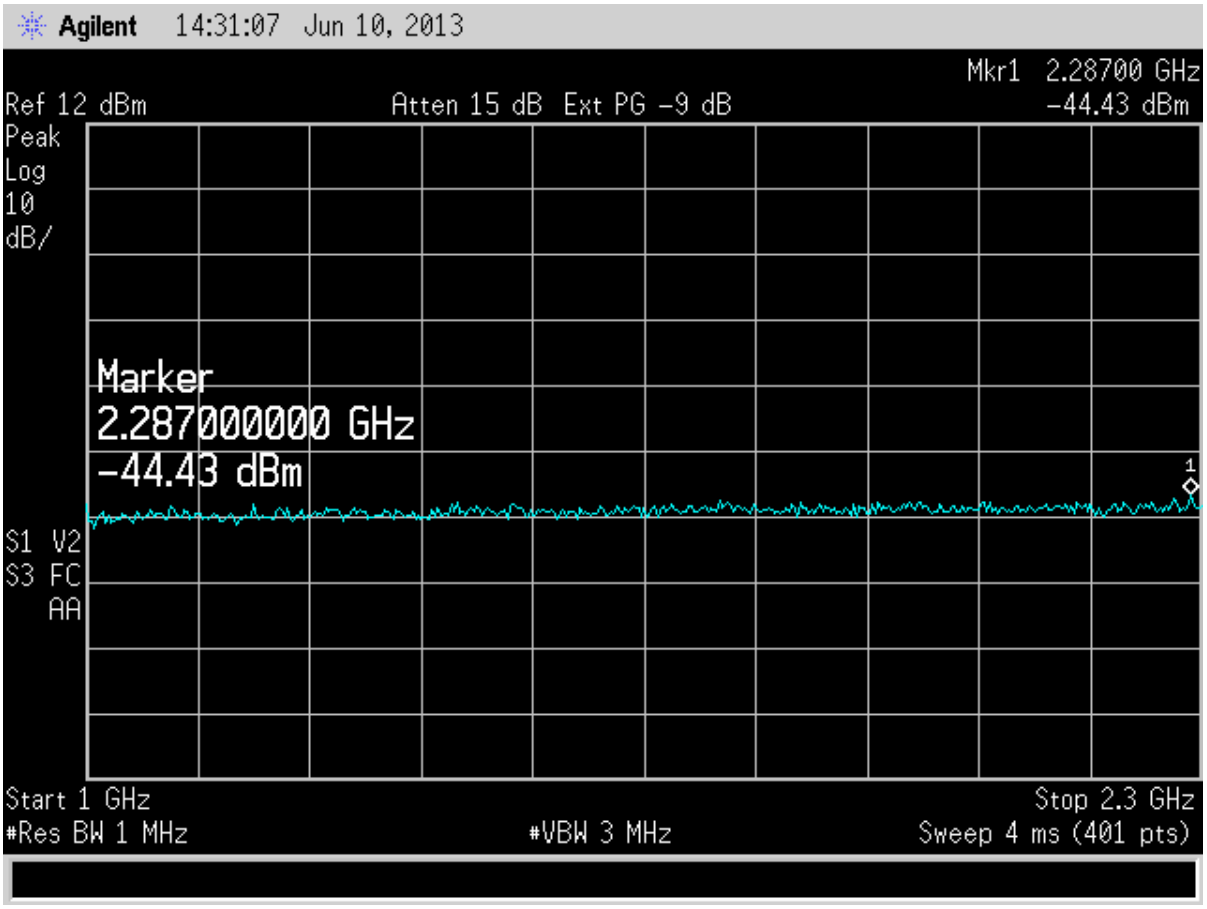


Figure 12. Mid Channel A.C.S.E. – 1GHz through 2.3GHz

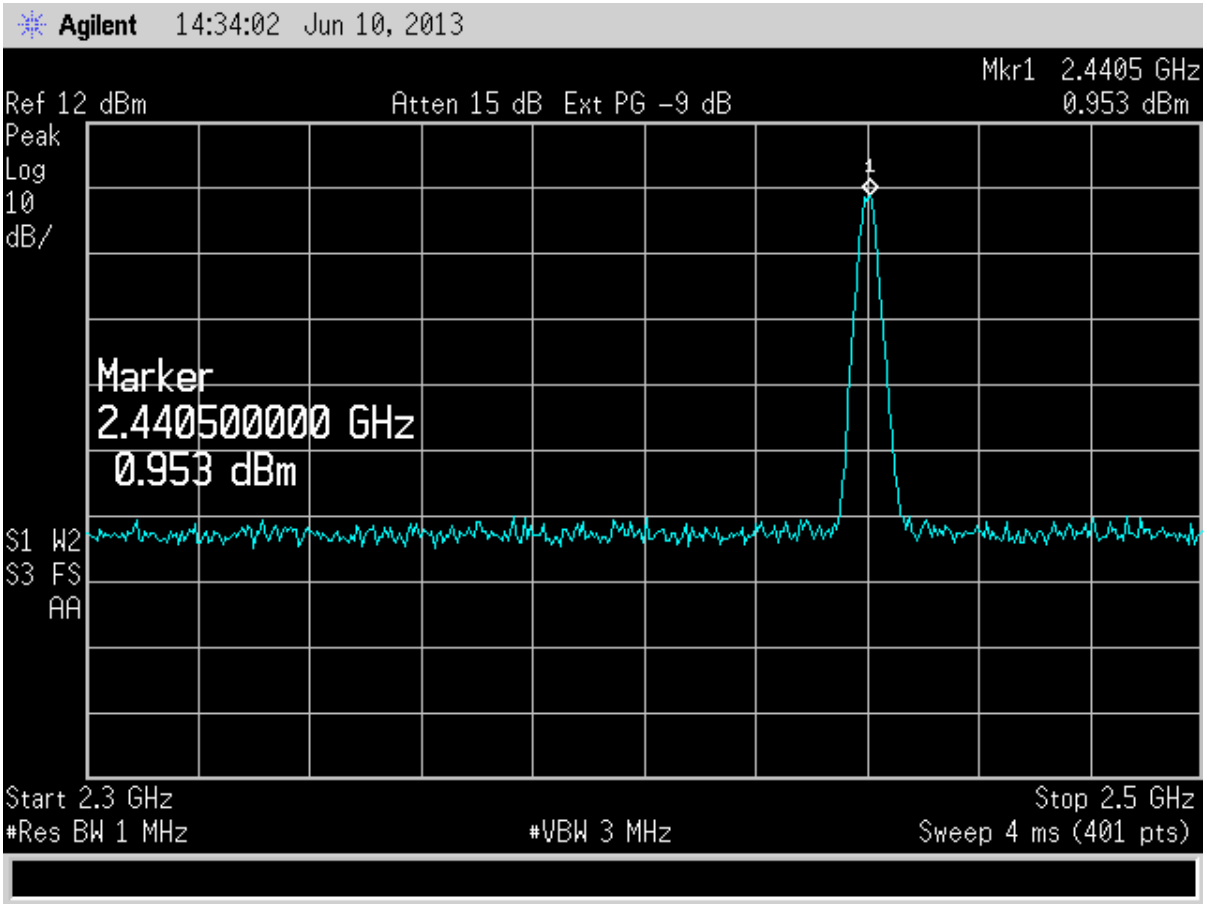


Figure 13. Mid Channel A.C.S.E. – 2.3GHz through 2.5GHz

Note: Large emission is the fundamental frequency.

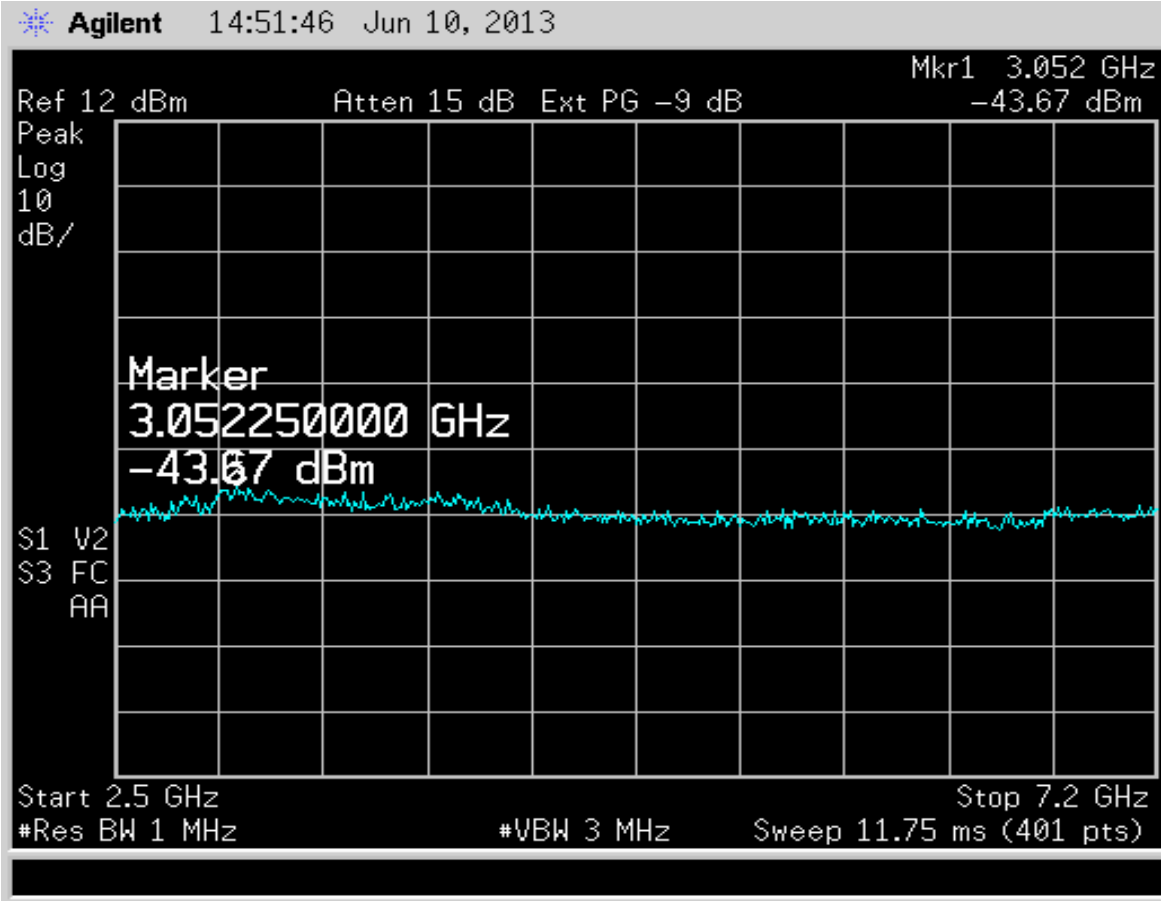


Figure 14. Mid Channel A.C.S.E. – 2.5GHz through 7.2GHz

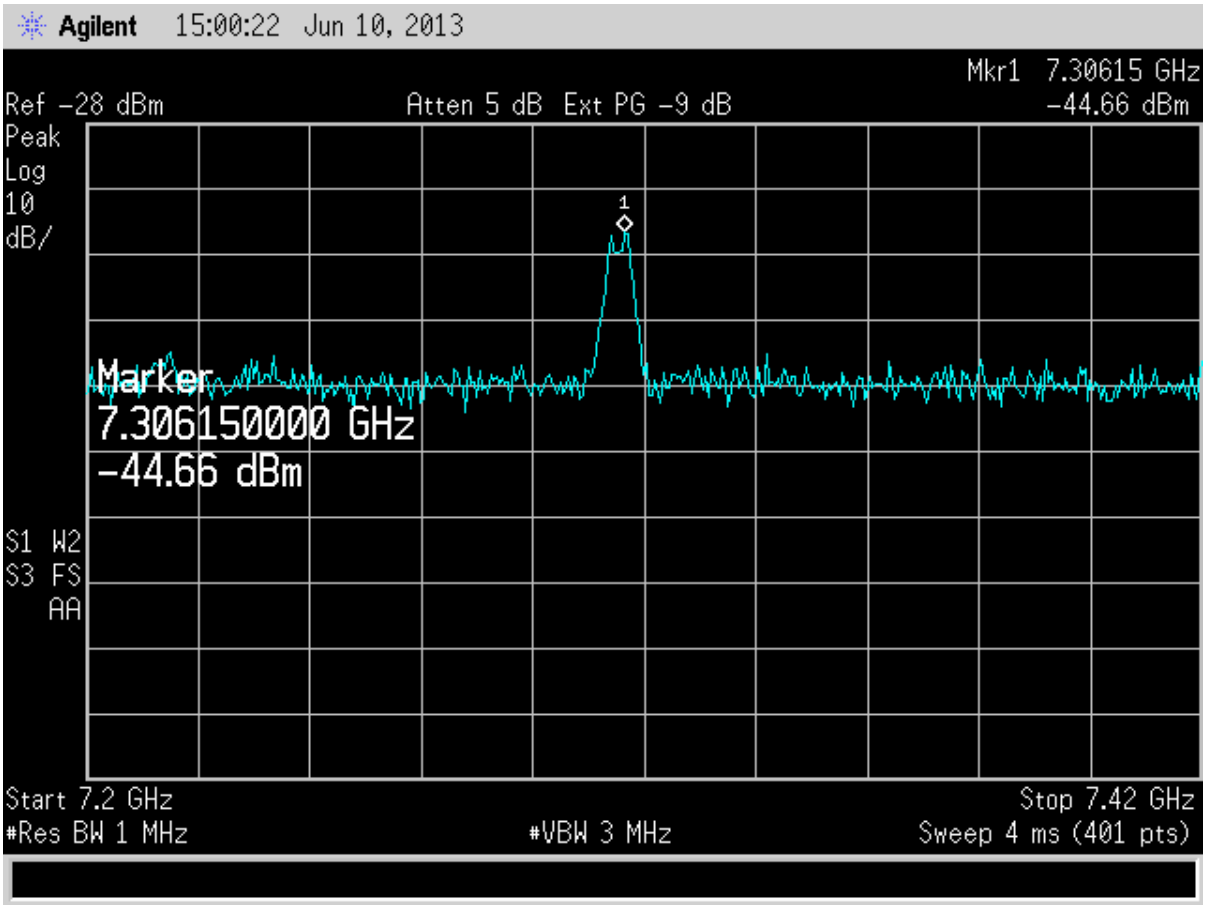


Figure 15. Mid Channel A.C.S.E. – 7.2GHz through 7.42GHz

Note: Large emission is the third harmonic.

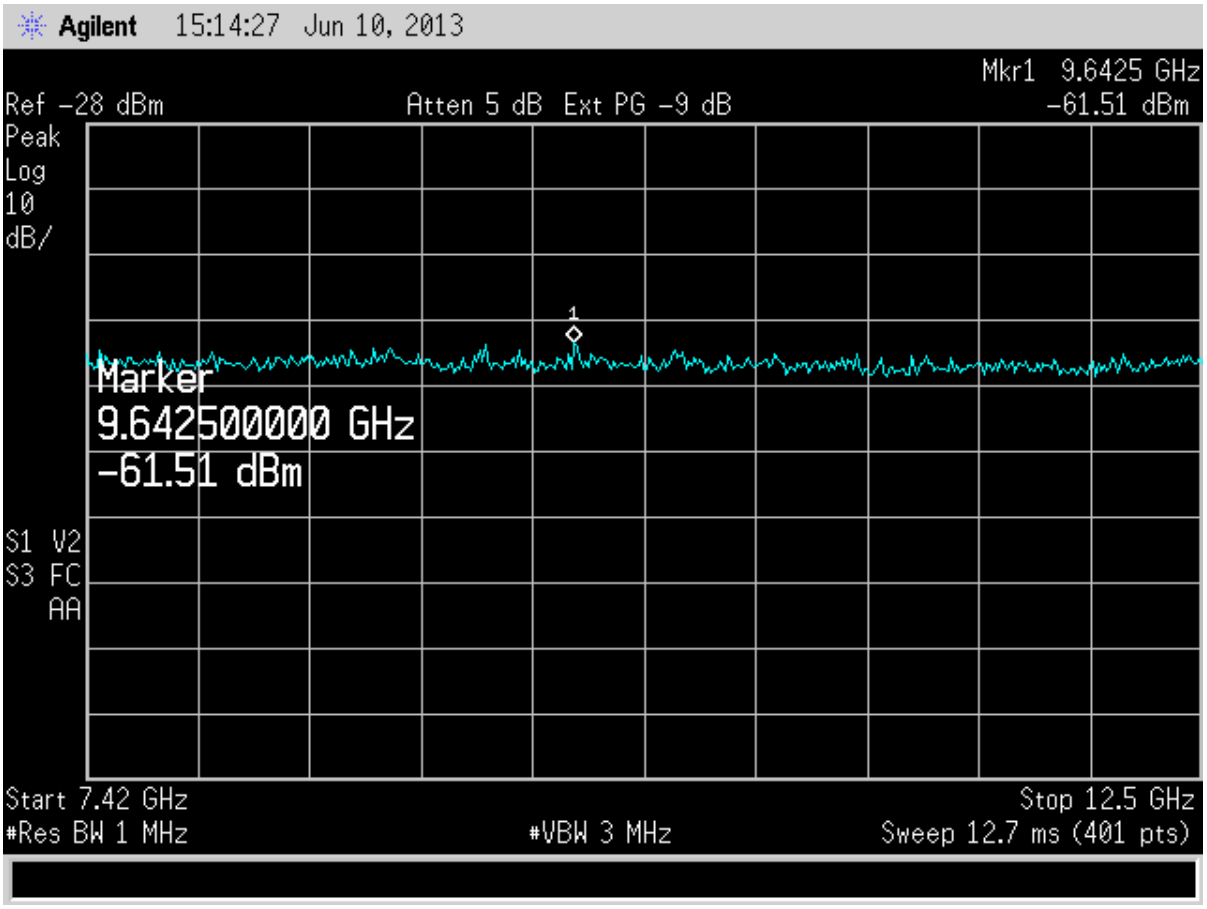


Figure 16. Mid Channel A.C.S.E. – 7.42GHz through 12.5GHz

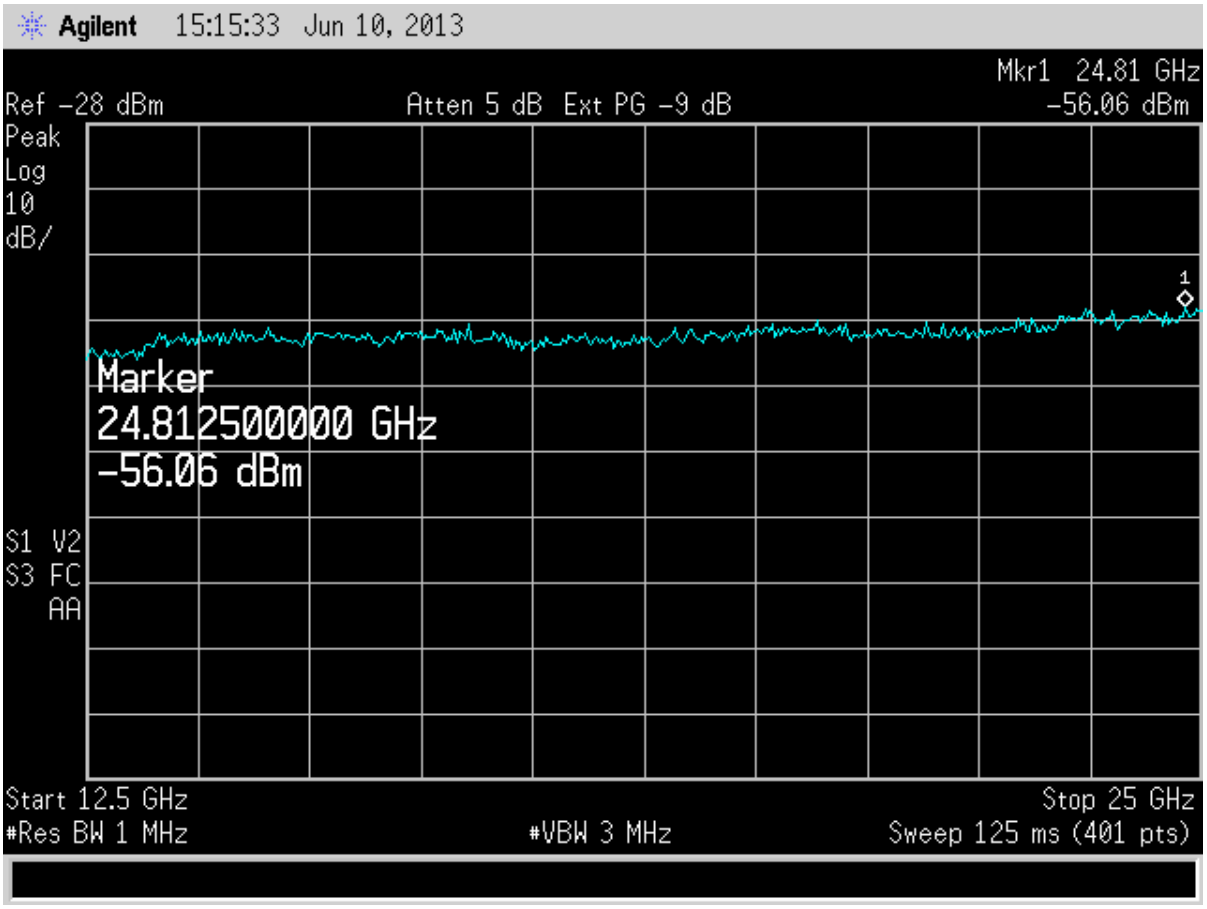


Figure 17. Mid Channel A.C.S.E. – 12.5GHz through 25GHz

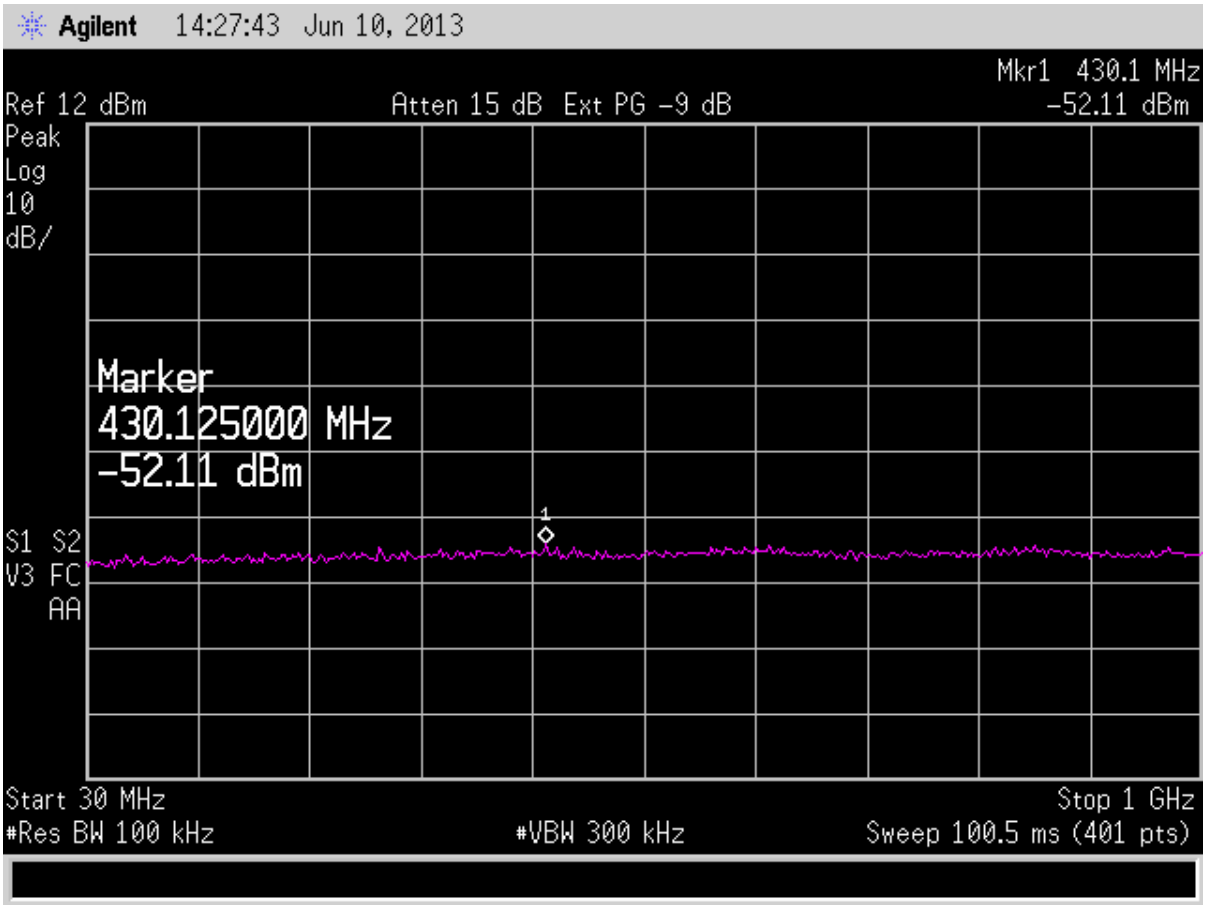


Figure 18. High Channel A.C.S.E. – 30MHz through 1GHz

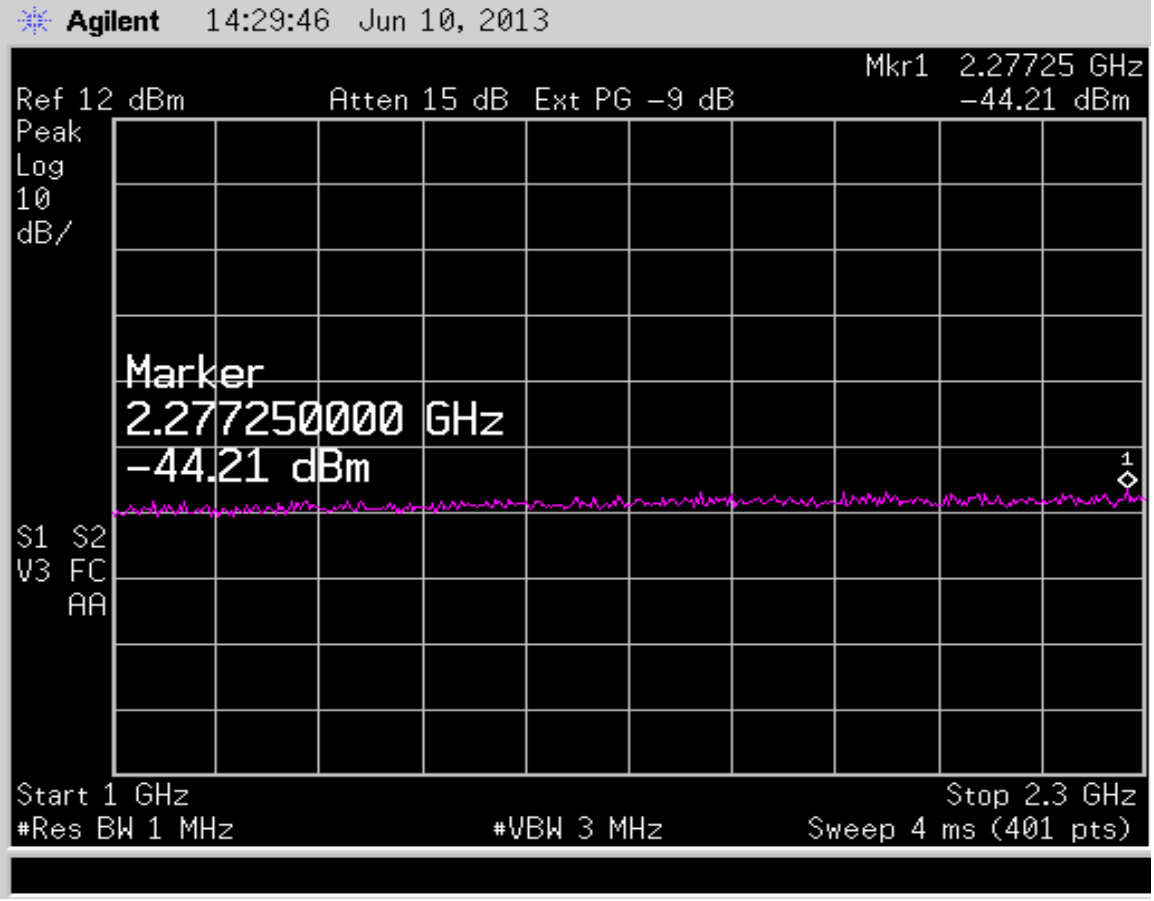


Figure 19. High Channel A.C.S.E. – 1GHz through 2.3GHz

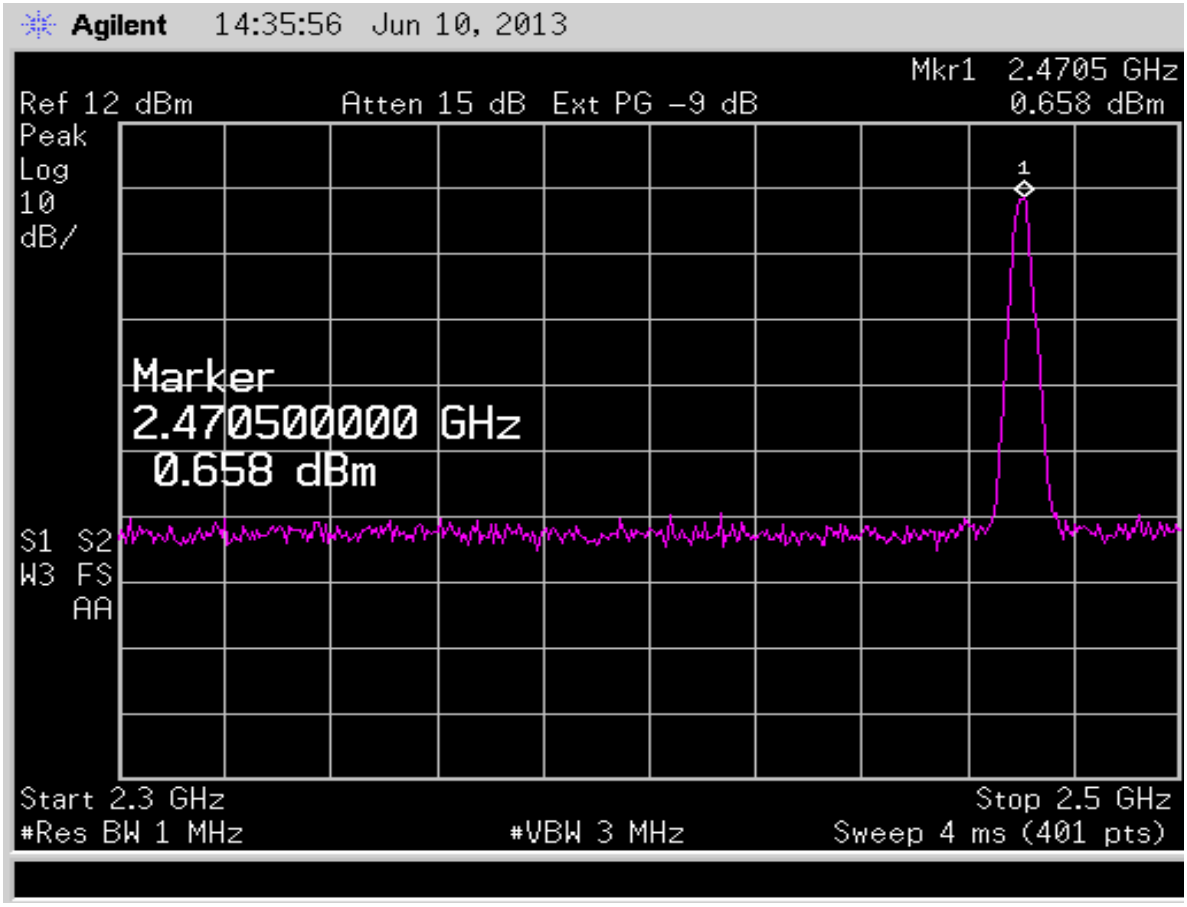


Figure 20. High Channel A.C.S.E. – 2.3GHz through 2.5GHz

Note: Large emission is the fundamental frequency.

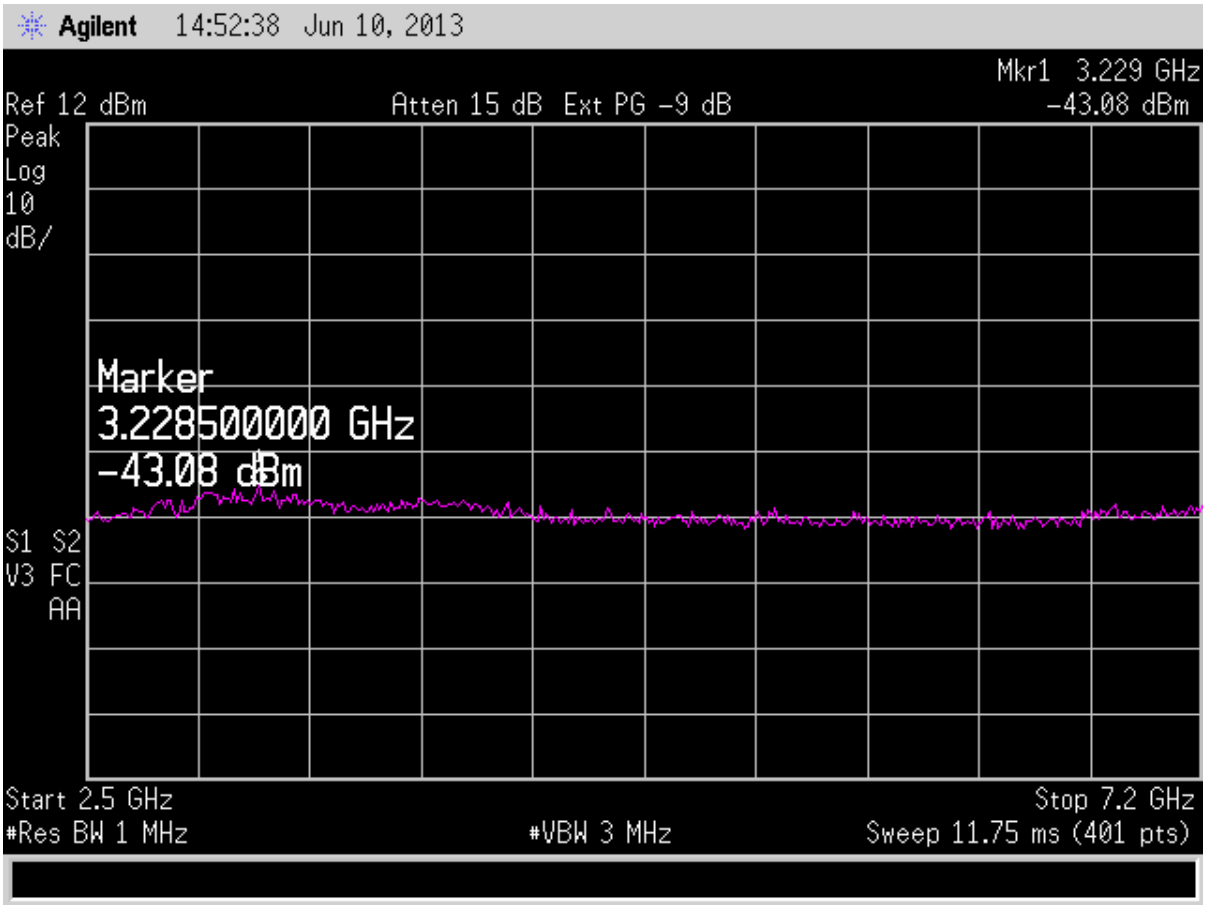


Figure 21. High Channel A.C.S.E. – 2.5GHz through 7.2GHz

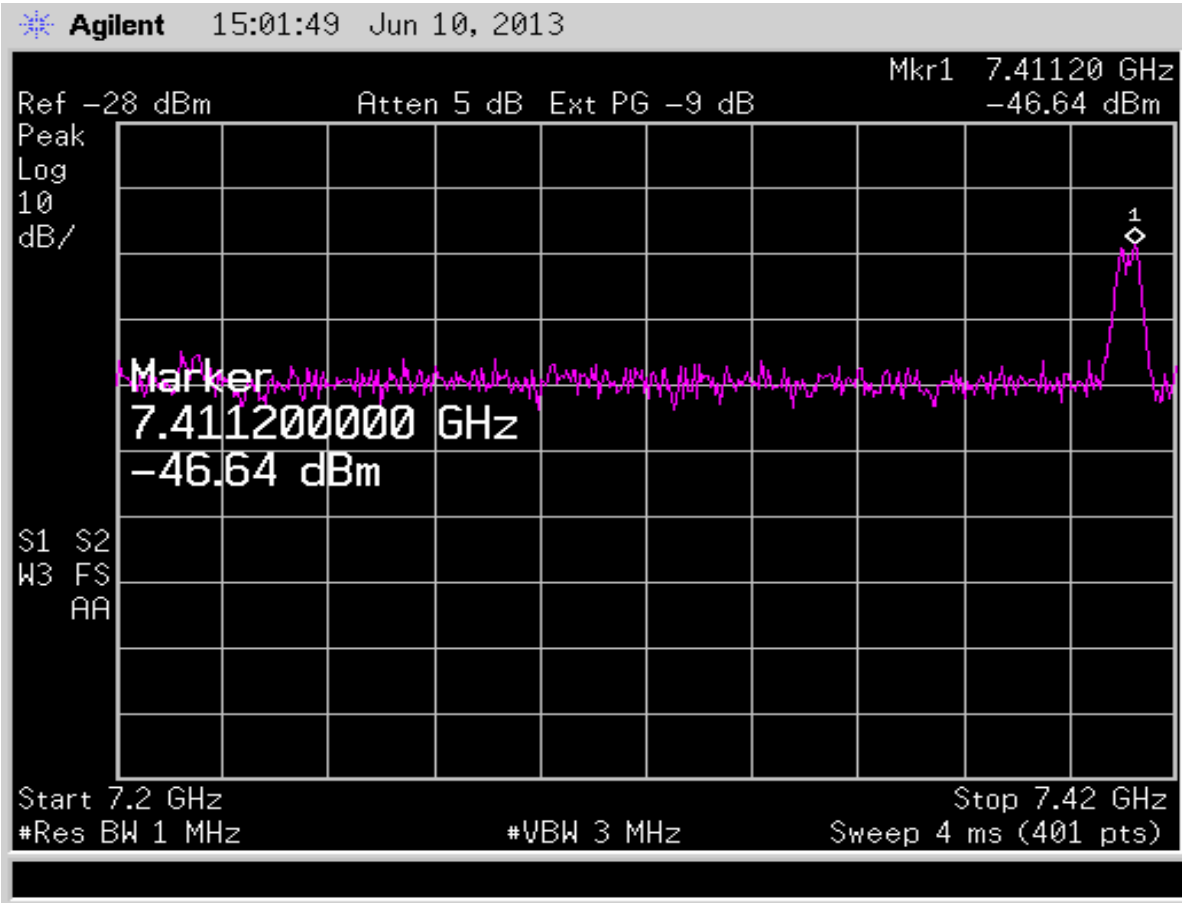


Figure 22. High Channel A.C.S.E. – 7.2GHz through 7.42GHz

Note: Large emission is the third harmonic.

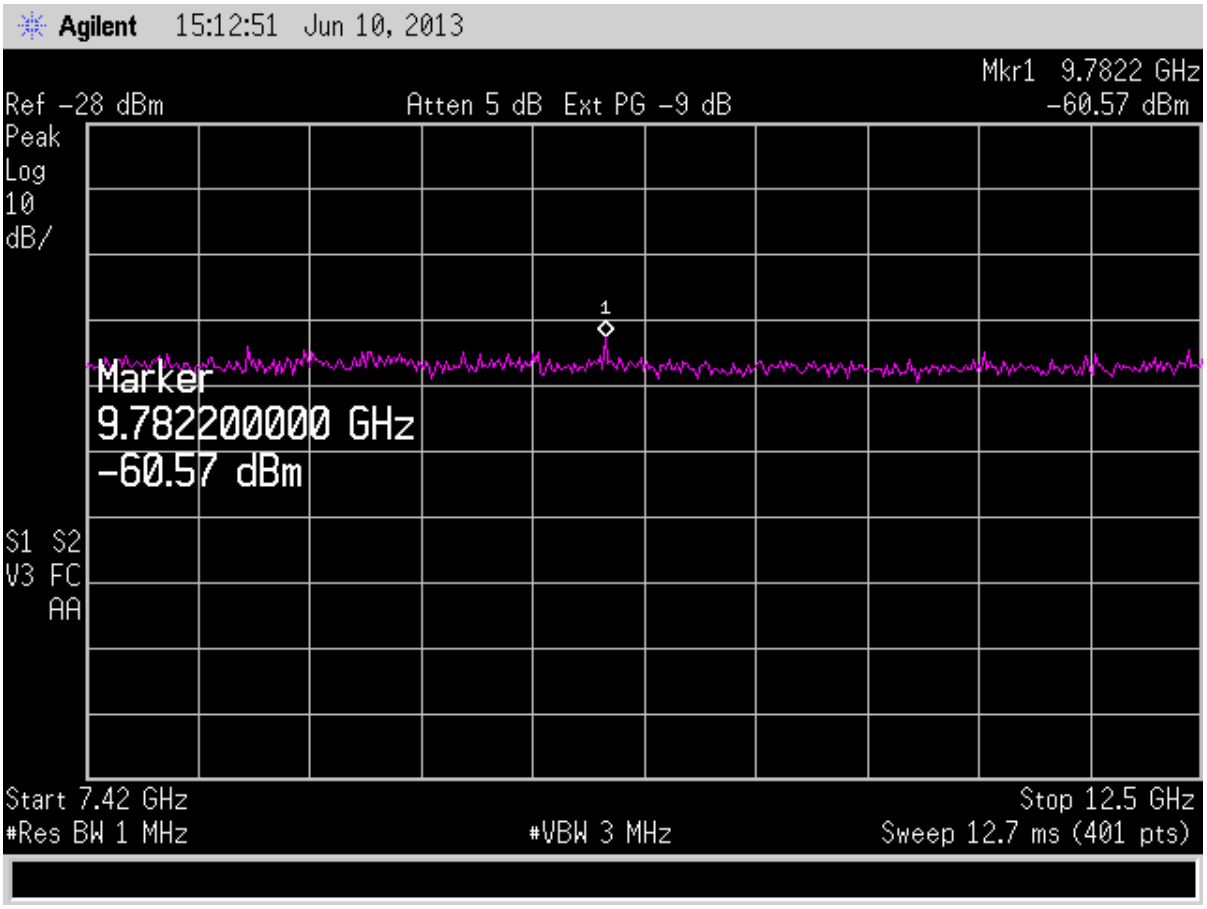


Figure 23. High Channel A.C.S.E. – 7.42GHz through 12.5GHz

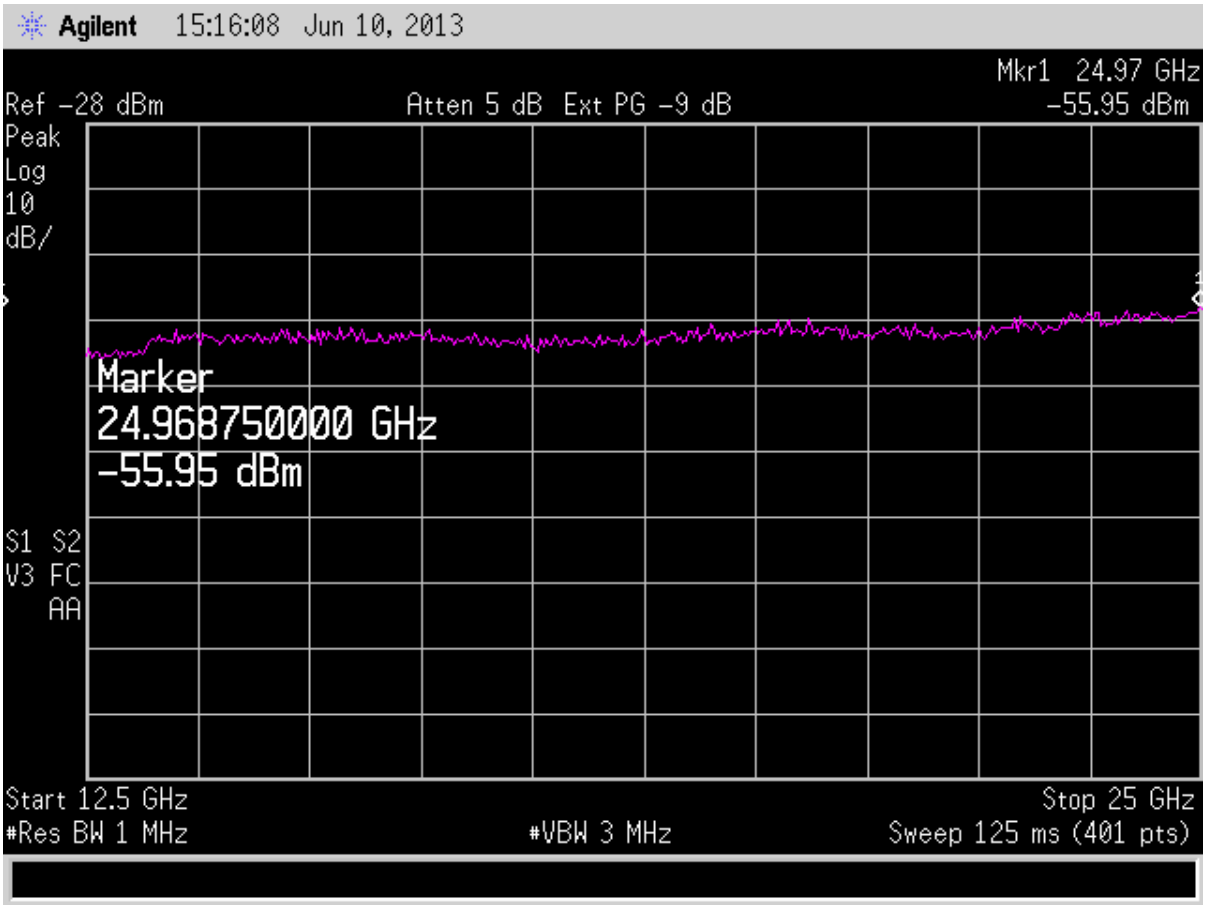


Figure 24. High Channel A.C.S.E. – 12.5GHz through 25GHz

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)) (Cont'd)

Table 6. Peak Radiated Harmonic & Spurious Emissions

Radiated Harmonic and Spurious Emissions, Tested from 30 MHz – 25 GHz							
Tested By: JW	Test: FCC Part 15, Para 15.247(d)			Client: Radio Systems Corporation			
	Project: 13-0175			Model: 300-2645			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB/m)**	**Corrected Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Pass Margin (dB)**	**Detector PK / AVG**
LOW BAND - PEAK							
2405.21	71.1	31.8	102.90		3m/Hor.		**PK**
No harmonics seen greater than 20 dB from the limit.							
MID BAND- PEAK							
2440.1	70.5	31.8	102.30		3m/Hor.		**PK**
No harmonics seen greater than 20 dB from the limit.							
HIGH BAND- PEAK							
2469.95	69.8	31.97	101.77		3m/Hor.		**PK**
No harmonics seen greater than 20 dB from the limit.							

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic (25GHz using EMCO 3116 Horn Antenna)
3. Measurements taken at 1 meter distance were extrapolated to 3 meter using a factor of (-9.5 dB).
4. 1 dB loss factor is added for all measurement using the high pass filter.
RESULTS: At 2405.21 MHz: = 71.1 dBuV+ 31.8 dB/m = 102.9 dBuV/m @ 3m

Test Date: May 28, 2013
Tested By
Signature: John C Wynn Name: John C. Wynn

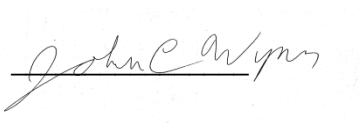
2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)) (Cont'd)

Table 7. Average Radiated Spurious

Radiated Spurious Emissions, Tested from 30 MHz – 25 GHz							
Tested By: JW	Test: FCC Part 15, Para 15.247(d)			Client: Radio Systems Corporation			
	Project: 13-0175			Model: 300-2645			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA+DC (dB/m)**	**Corrected Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Pass Margin (dB)**	**Detector PK / AVG**
LOW BAND - PEAK							
2405.21	46.30	31.80	78.10		3m/Hor.		**AVG**
No harmonics seen greater than 20 dB from the limit.							
MID BAND- PEAK							
2440.10	45.90	31.80	77.70		3m/Hor.		**AVG**
No harmonics seen greater than 20 dB from the limit.							
HIGH BAND- PEAK							
2469.95	44.40	31.97	76.37		3m/Hor.		**AVG**
No harmonics seen greater than 20 dB from the limit.							

1. (*) Falls within the restricted bands of CFR 15.205.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic (25GHz using EMCO 3116 Horn Antenna)
3. Test data values measured at 1 meter include a factor of -9.54 dB for distance extrapolation from a test distance of 1 meter to 3 meters.
4. Additional factors include a Duty Cycle, DC = -20.0 dB and filter factor of +1.0 dB.
SAMPLE CALCULATION:
RESULTS: At 2405.21 MHz: = 46.3 dBuV+ 31.8 dB/m = 78.1 dBuV/m @ 3m

Test Date: May 28, 2013

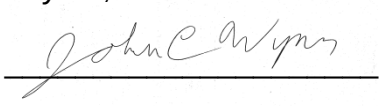
Tested By
Signature:  Name: John C. Wynn

2.11 Six (6) dB Bandwidth per CFR 15.247(a)(2), (IC RSS 210, A8.2(a))

The EUT antenna port was connected to a spectrum analyzer having a 50 Ω input impedance. Measurements were performed similar to the method of FCC, KDB Publication No. 558074 for a bandwidth of 6 dB. The RBW was set to approximately 1/100 of the manufacturers claimed RBW and with the VBW ≥ RBW. The results of this test are given in Table 12 and Figures 12 through 14.

Table 8. Six (6) dB Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)
2405	1.575	0.5
2440	1.567	0.5
2470	1.638	0.5

Test Date: May 24, 2013
Tested By
Signature:  Name: John C. Wynn

2.11 Six dB Bandwidth per CFR 15.247(a)(2), (IC RSS 210, A8.2(a))

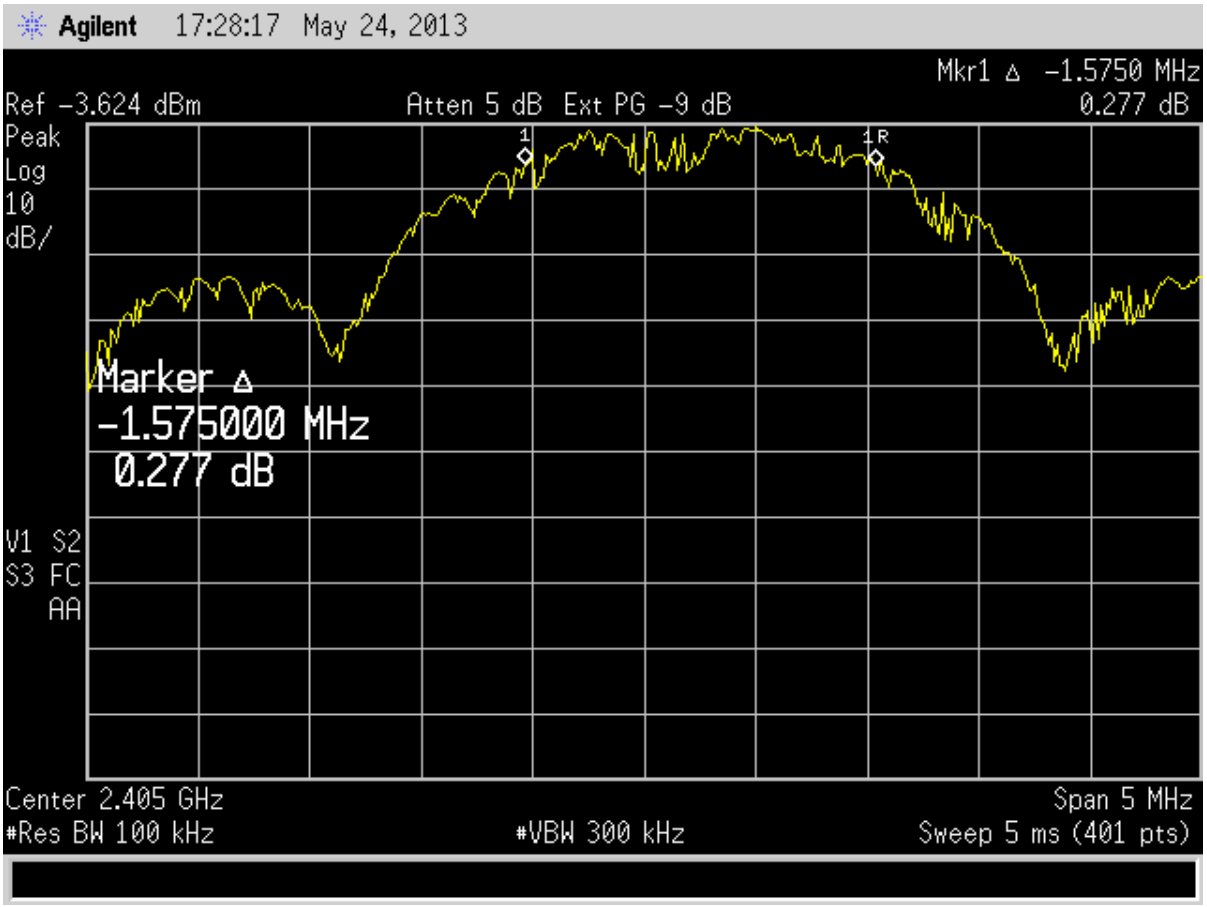


Figure 25. Six (6) dB Bandwidth - 15.247 (a) (2) - Low Channel

2.11 Six dB Bandwidth per CFR 15.247(a)(2), (IC RSS 210, A8.2(a))

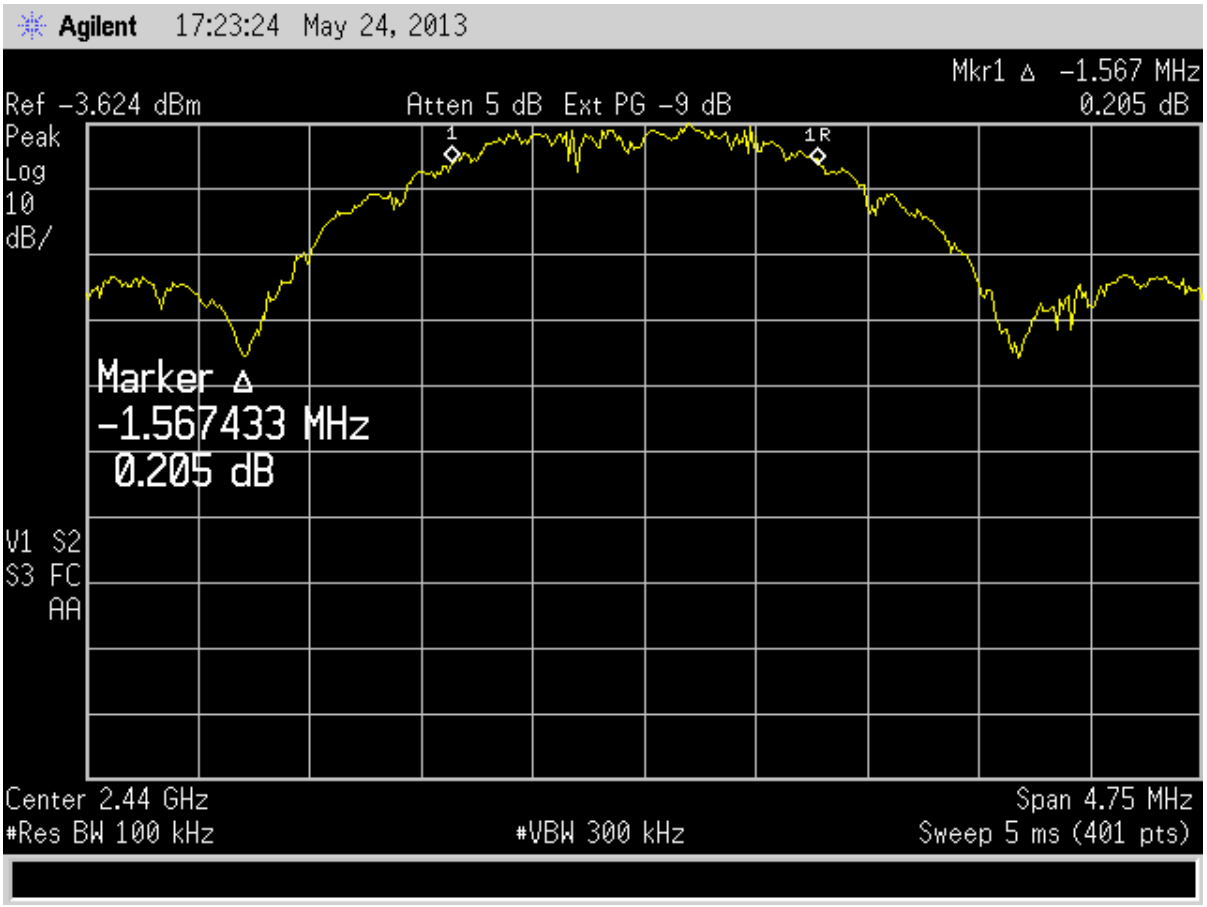


Figure 26. Six dB Bandwidth - 15.247 (a) (2) - Mid Channel

2.11 Six dB Bandwidth per CFR 15.247(a)(2), (IC RSS 210, A8.2(a))

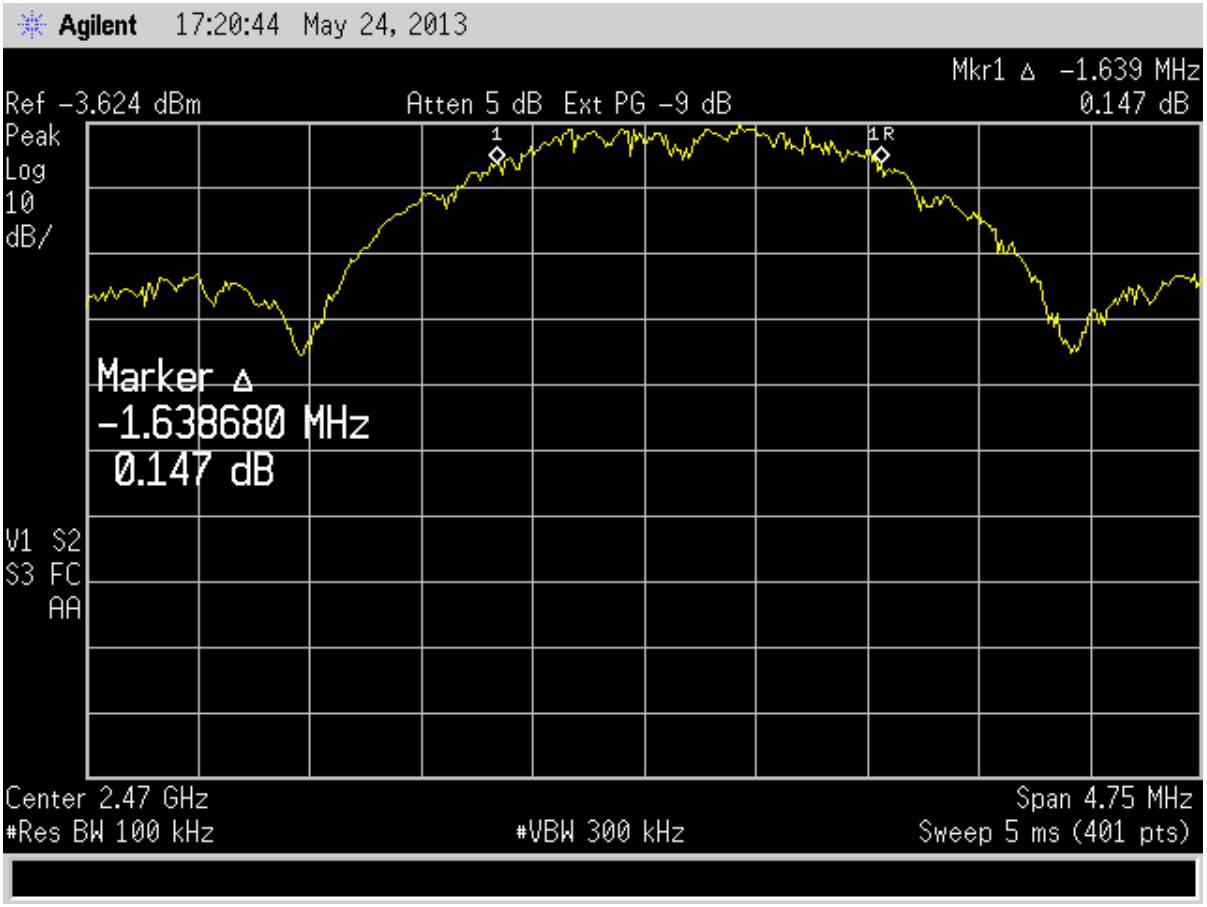


Figure 27. Six dB Bandwidth - 15.247 (a) (2) - High Channel

2.12 Maximum Peak Conducted Output Power (CFR 15.247 (b) (3))

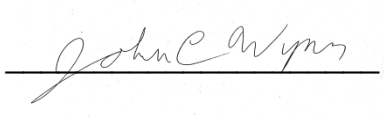
Peak power within the band 2400 MHz to 2483.5 MHz was measured per FCC KDB Publication 558074 as an Antenna Conducted test with a spectrum analyzer by connecting the spectrum analyzer directly, via a short RF cable, to the antenna output terminals on the EUT. The spectrum analyzer was set for an impedance of 50 Ω with the RBW set greater than the 6 dB bandwidth of the EUT, and the VBW ≥ RBW. The loss of the short cable is 0.5 dB, and addition of an attenuator, 8.0 dB and the final corrected measurements were determined by adding 8.5 dB to the raw data measured values of Figures 15 to 17. Peak antenna conducted output power is tabulated in Table 9 below.

Antenna Conducted Output Power was measured at Low Channel, Mid Channel and High Channel frequencies. See Figures 15 to 17 above. The 0.5 dB loss for the RF wire is taken into consideration here (Corrected Measurement column).

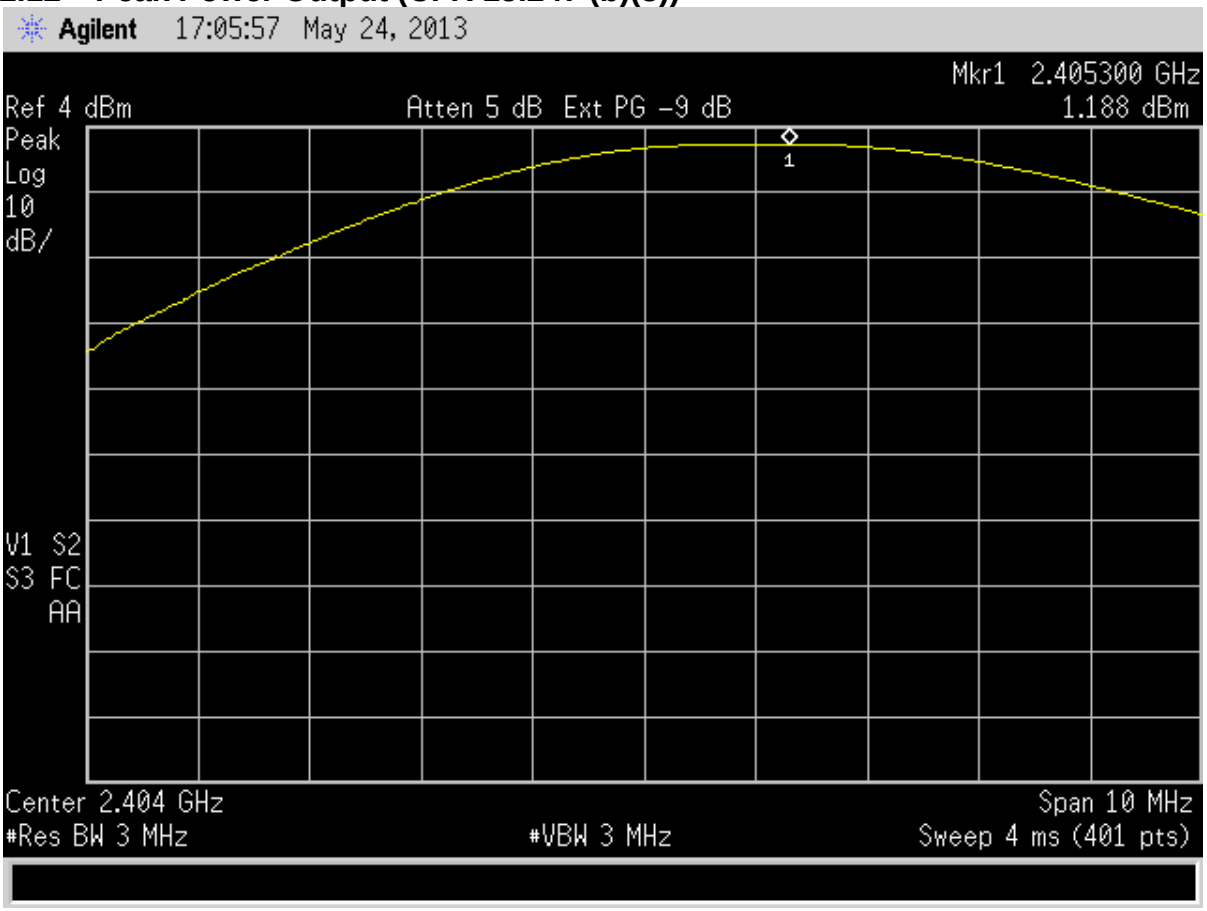
Table 9. Peak Antenna Conducted Output Power per Part 15.247 (b) (3) (Same as EIRP)

Frequency of Fundamental (MHz)	Raw Test Data dBm	Corrected Measurement (dBm)	(mW)	FCC Limit (mW Maximum)
2405	1.188	1.188	1.135	1000
2440	1.157	1.157	1.305	1000
2470	0.940	0.940	1.242	1000

Note: reference adjusted for correction factor, 9.0 dB for attenuator and cable loss.

Test Date: May 28, 2013
Tested By
Signature:  Name: John C. Wynn

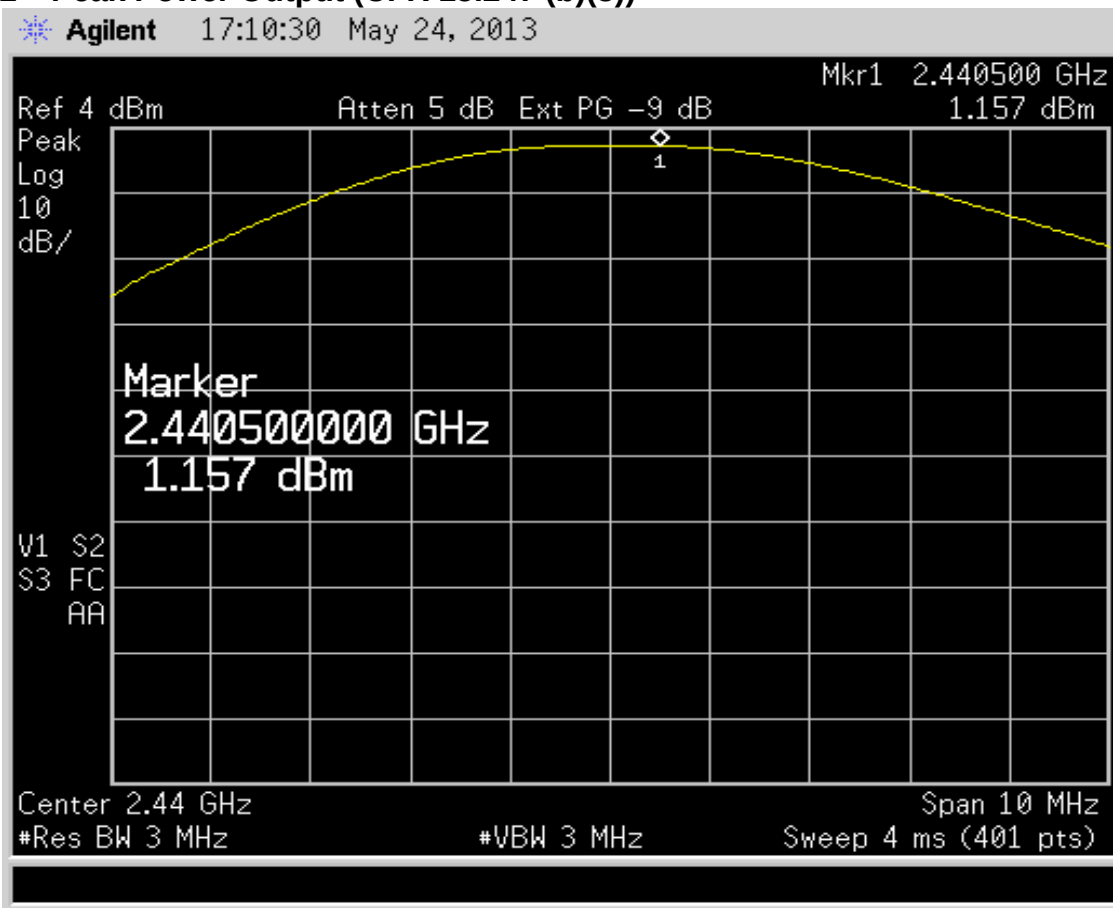
2.12 Peak Power Output (CFR 15.247 (b)(3))



Note: reference adjusted for correction factor.

Figure 28. Peak Antenna Conducted Output Power, Low Channel

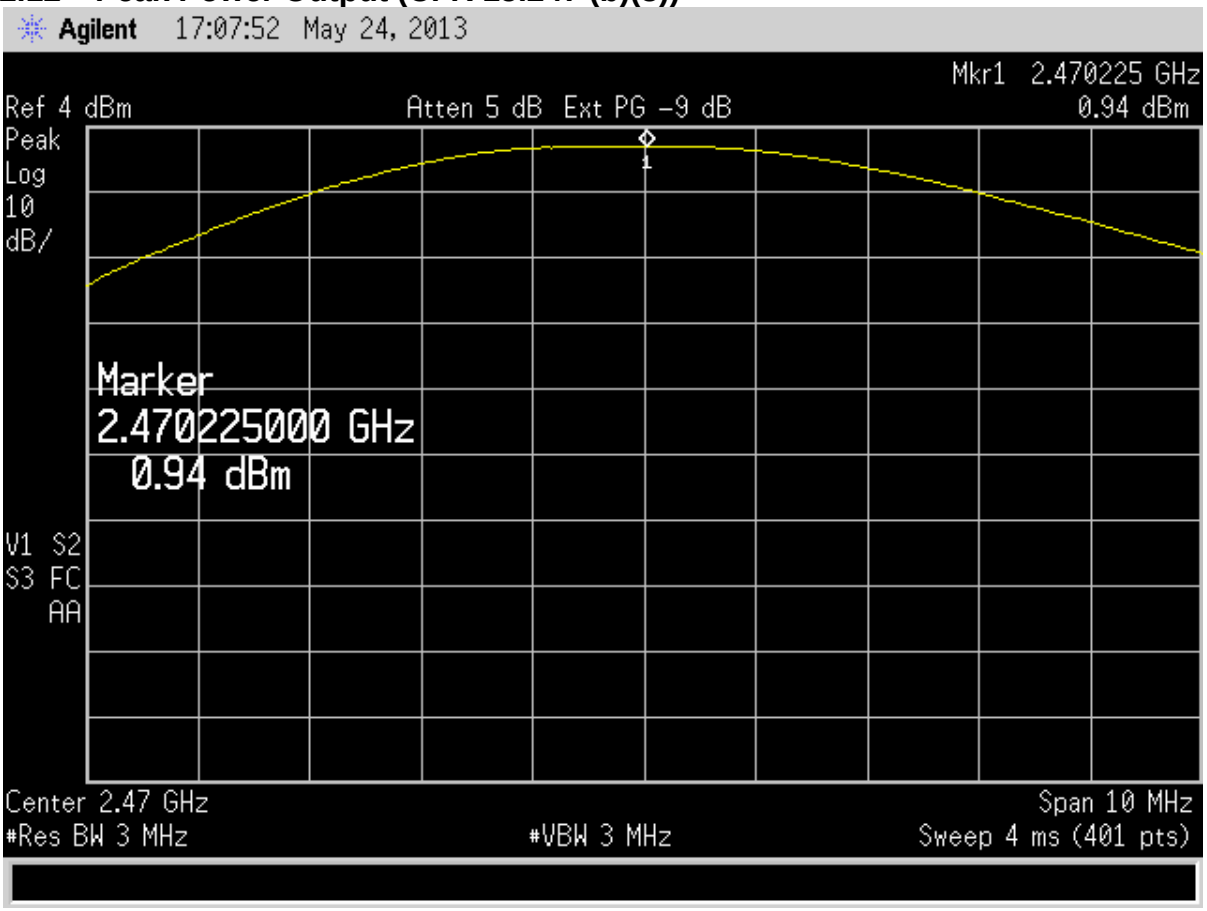
2.12 Peak Power Output (CFR 15.247 (b)(3))



Note: reference adjusted for correction factor.

Figure 29. Peak Antenna Conducted Output Power, Mid Channel

2.12 Peak Power Output (CFR 15.247 (b)(3))



Note: reference adjusted for correction factor.

Figure 30. Peak Antenna Conducted Output Power, High Channel

2.13 Power Spectral Density (CFR 15.247(e)) (IC RSS 210 A8.5)

The transmitter was placed into a continuous mode of operation at all applicable frequencies. The measurements were performed per the procedures of FCC KDB Procedure 558074. The RBW was set to 3 kHz and the Video Bandwidth was set to ≥ RBW. The trace capture time was set to (Span/3 kHz).

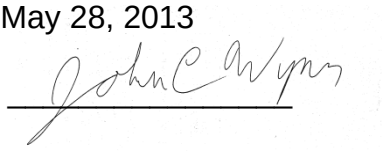
In accordance with 15.247 (e), the power spectral density shall be no greater than +8 dBm per any 3 kHz band.

Results are shown in table 14 and Figures 18 through 20 below. Results are corrected by adding 0.5 dB to the measured value to account for the cable loss. All are less than +8 dBm per 3 kHz band.

Table 10. Power Spectral Density for Low, Mid and High Bands

Frequency (MHz)	Test Data (dBm/3 KHz)	Results (dBm/3 kHz)	FCC Limit (dBm/3 kHz)
Low-2405	-31.44	-31.44	+8.0
Mid-2440	-32.00	-32.00	+8.0
High-2470	-33.18	-33.18	+8.0

Note: reference adjusted for correction factor, 9.0 dB for attenuator and cable loss.

Test Date: May 28, 2013
Tested By
Signature: 

Name: John C. Wynn

2.13 Power Spectral Density (CFR 15.247(e)) (IC RSS 210 A8.5)

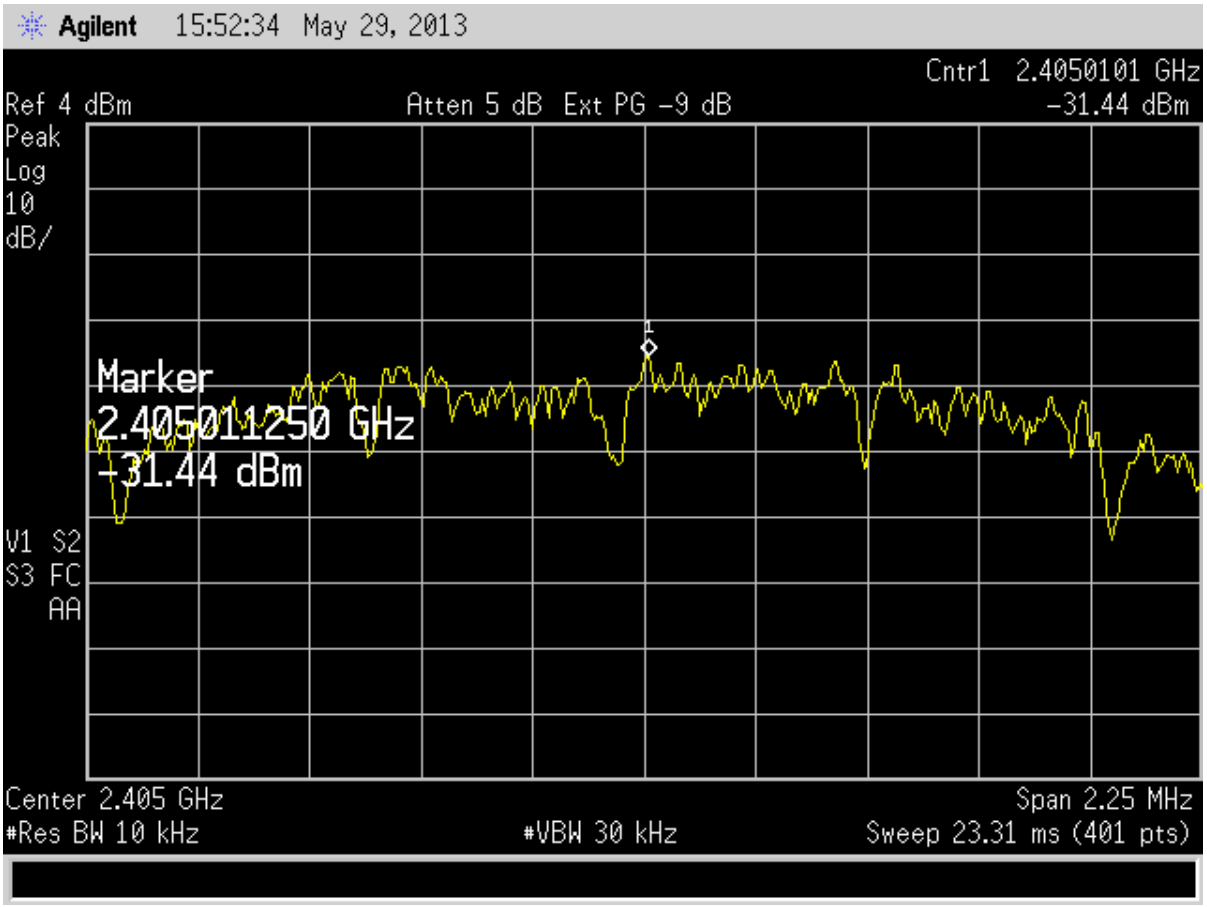


Figure 31. Peak Power Spectral Density - Part 15.247 (e) - Low Channel

Note: reference adjusted for correction factor, 8.5 dB for attenuator and cable loss.

2.13 Power Spectral Density (CFR 15.247(e)) (IC RSS 210 A8.5)

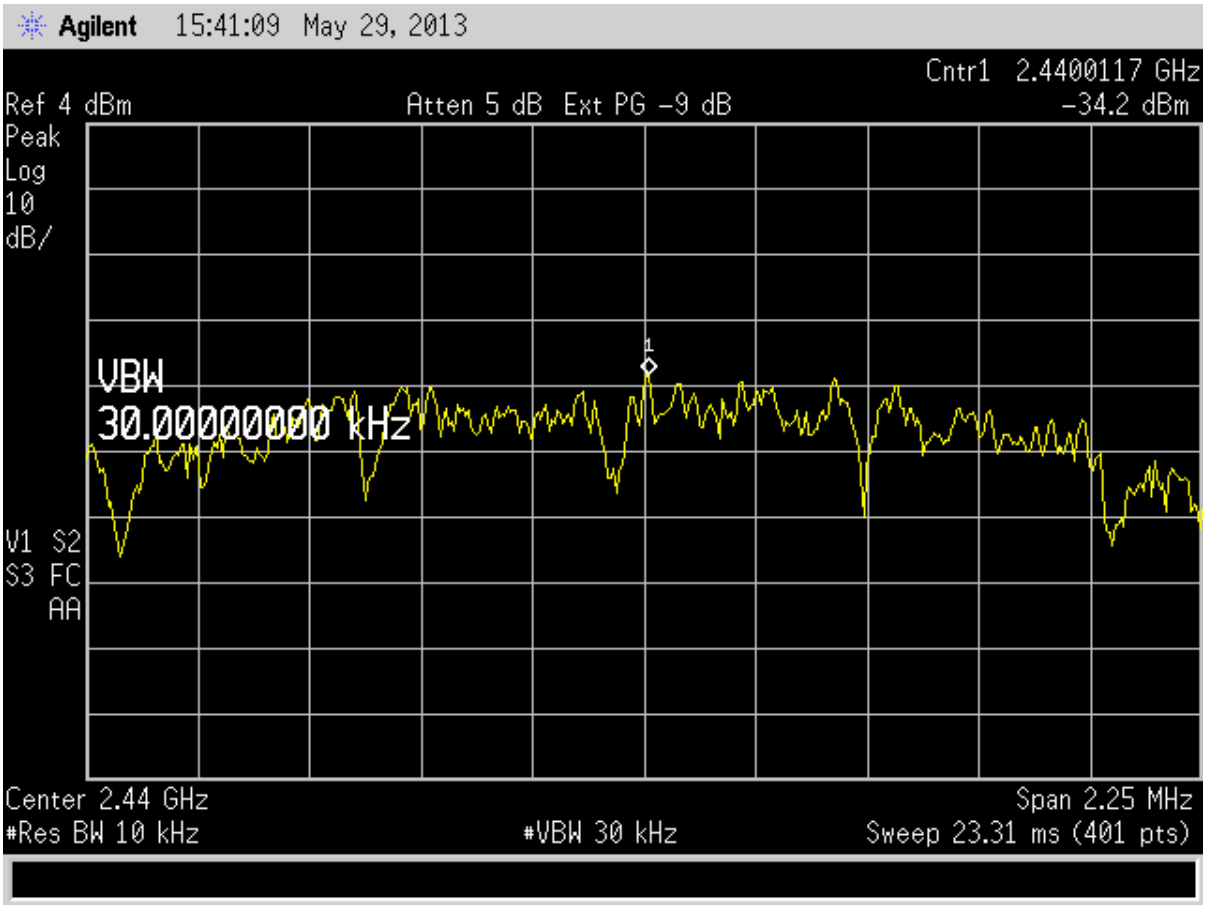


Figure 32. Power Spectral Density - Part 15.247 (e) - Mid Channel

Note: reference adjusted for correction factor, 8.5 dB for attenuator and cable loss.

2.13 Power Spectral Density (CFR 15.247(e)) (IC RSS 210 A8.5)

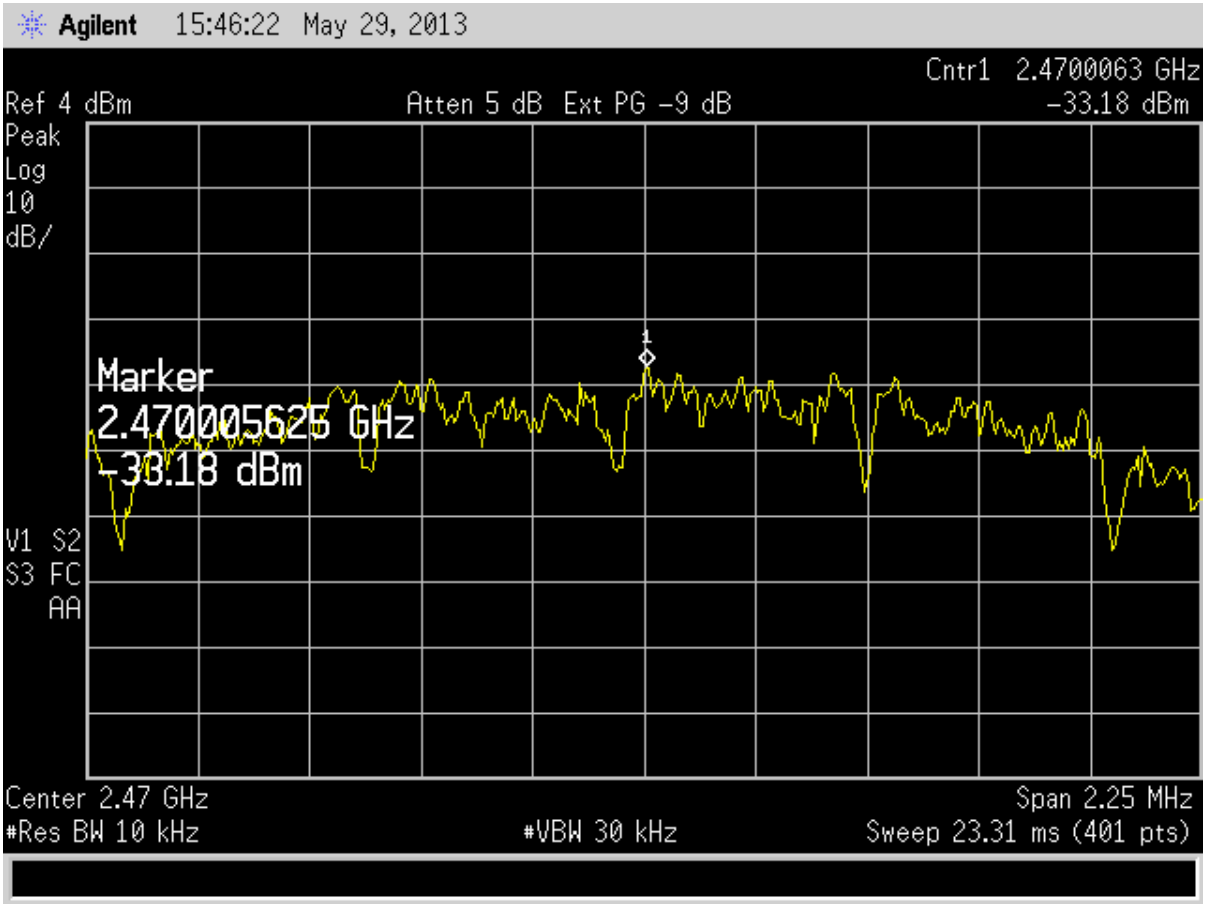


Figure 33. Peak Power Spectral Density - Part 15.247 (e) - High Channel

Note: reference adjusted for correction factor, 8.5 dB for attenuator and cable loss.

2.14 Band Edge Measurements – (CFR 15.247 (d))

Band Edge measurements are made following the guidelines in FCC KDB Publication No. 558074 with the EUT initially operating on the Lowest Channel and then operating on the Highest Channel within its band of operation. Antenna port conducted measurements are performed to demonstrate compliance with the requirement of 15.247(d) that all emissions outside of the band edges be attenuated by at least 20 dB when compared to its highest in-band value (contained in a 100 kHz band). Because these frequencies occur above 1000 MHz they have both a peak and average requirement.

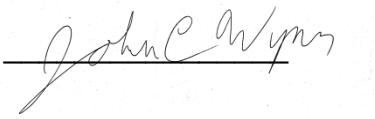
To capture the band edge set the Spectrum Analyzer frequency span large enough (usually around 10 MHz) to capture the peak level of the emission operating on the channel closest to the band edge as well as any modulation products falling outside of the authorized band of operation. Conducted measurements are performed with RBW ≥1% of the frequency span. In all cases, the VBW is set ≥ RBW. See figure 24 and 25 below.

2.14 Band Edge (Cont'd)

Table 11. Upper Band Edge - Radiated Emissions

Peak Radiated Higher Band Edge Measurements							
Test By: JCW	Test: FCC Part 15.247			Client: Radio Systems Corporation			
	Project: 13-0175	Class: B		Model: IRIS SMARTDOOR			
Frequency (MHz)	**Test Data (dBµV)**	**AF+CA-AMP+DC dB/m**	**Corrected Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarity**	**Margin (dB)**	**Detector PK / AVG**
Fundamental 2469.95	69.8	31.97	101.77		3m/Hor.	**PK**	
Band Edge 2469.95	(101.77-52.43)	--	49.34	74.0 PK 54.0 AVG	3m./	See calculation below	**PK**

Note: row two shows the calculation process using the corrected fundamental value from row one.

Test Date: May 28, 2013
Tested By
Signature: 

Name: John C. Wynn

The limit for the average value of radiated emissions in a Restricted Band is 54 dBuV/m. To compute the average values of the band edge emissions, the duty cycle correction factor of -20.0 dB is applied to the values in the Corrected Results column. After this correction the EUT is found to have met the restrictions placed on average radiated emissions in Restricted Bands. The worst-case measurement is computed below.

CALCULATION OF WORST-CASE AVERAGE UPPER BAND EDGE MEASUREMENT:
Results = Peak Corrected Results + Duty Cycle Correction Factor
Results = 101.77 dBuV/m –(Δ52.43 dB)= 43.34 dBuV/m + (-1.27)= 48.07 dBuV/m
Peak vs Average Margin = Limit – Results = 54 – 41.37 = 5.93 dB

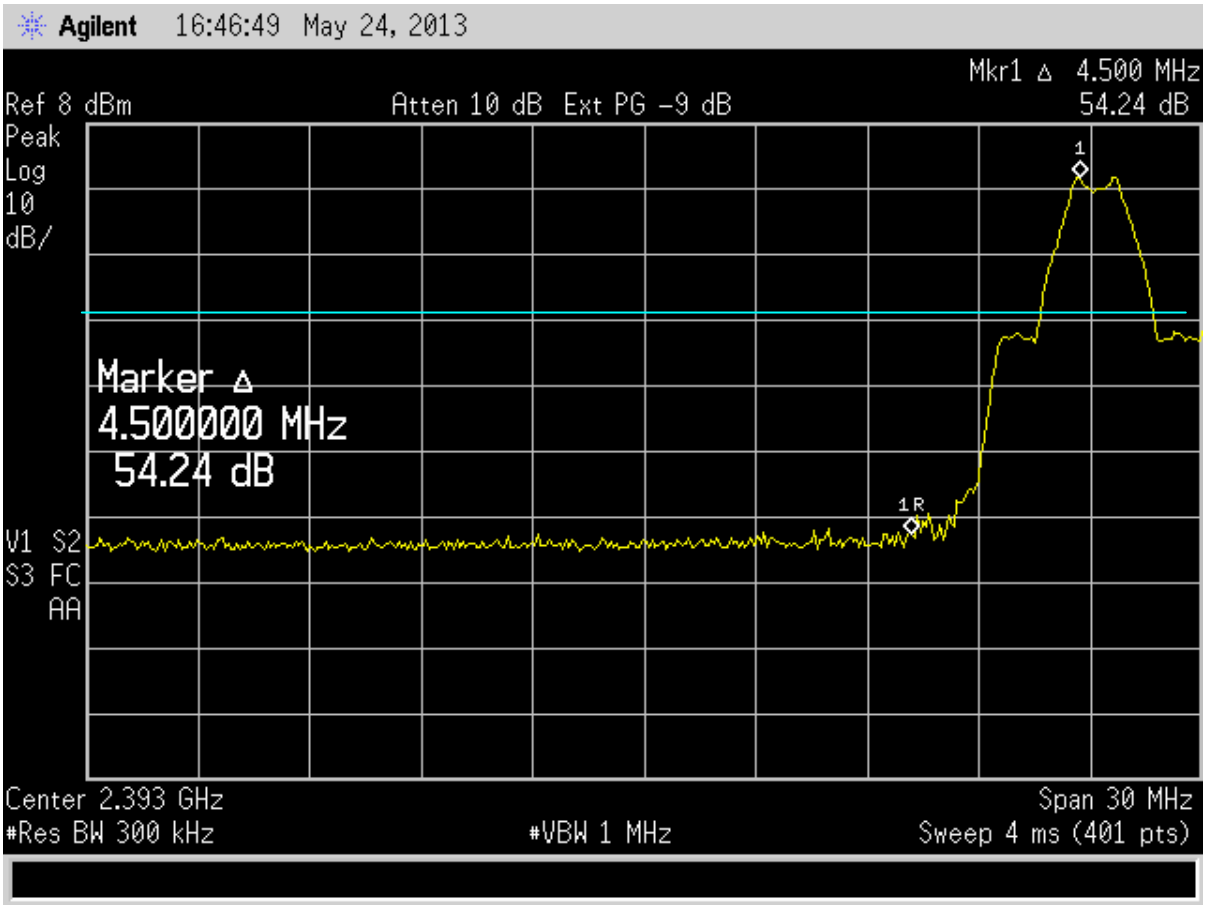


Figure 34. Band Edge Compliance – Low Channel Delta - Peak

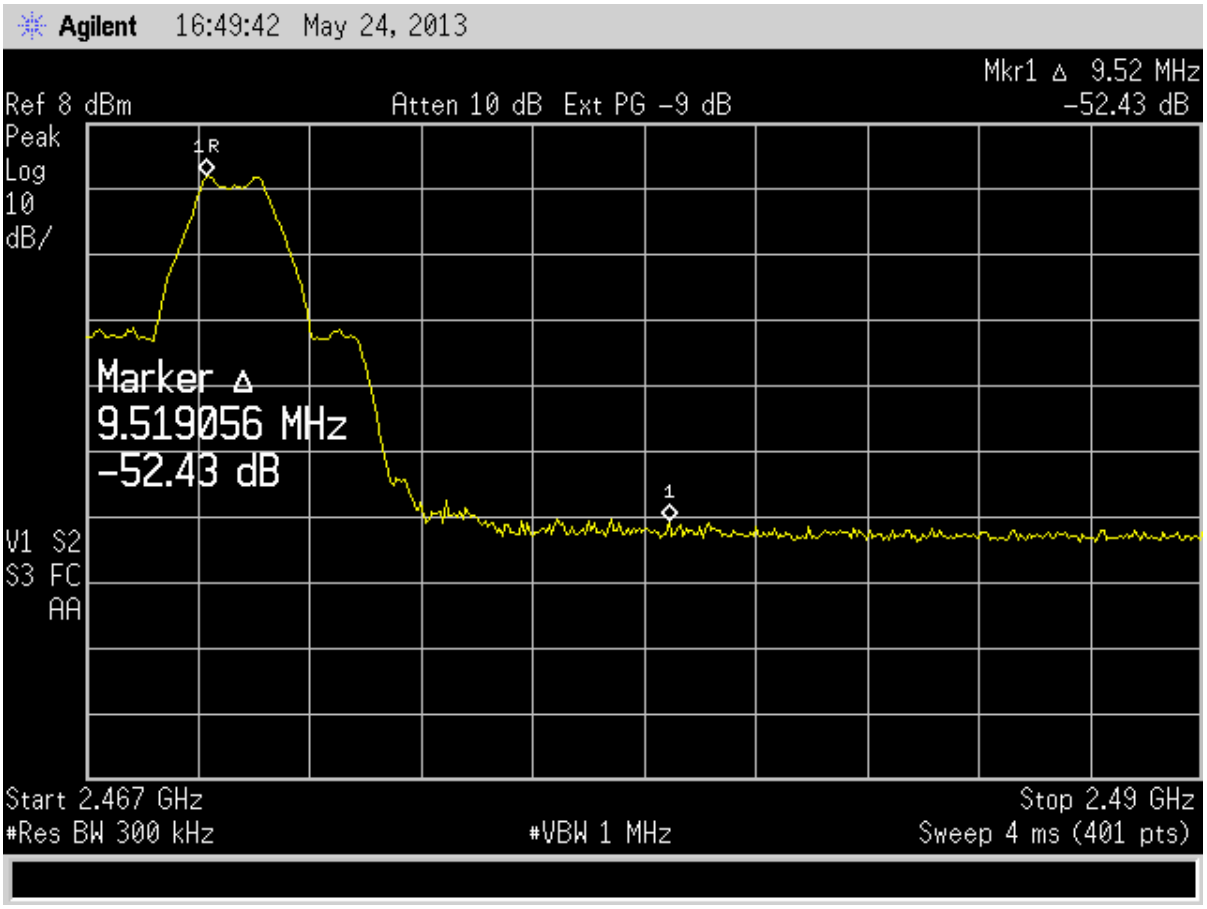


Figure 35. Band Edge Compliance – High Channel Delta - Peak

2.15 20 dB Bandwidth Measurement per CFR 15.247, 99% Occupied Bandwidth (IC RSS 210, A8.1)

The EUT antenna port was connected to a spectrum analyzer having a 50 Ω input impedance. Measurements were performed similar to the method of FCC, KDB Publication No. 558074 for a bandwidth of 20 dB. The RBW was set to approximately 1/100 of the manufacturers claimed RBW and with the VBW ≥ RBW. The results of this test are given in Table 16 and Figures 23 through 25.

Table 12. 20 dB Bandwidth and 99% Occupied Bandwidth

Frequency (MHz)	20 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2405.0	2.81	2.81
2440.0	2.81	2.81
2470.0	2.83	2.83

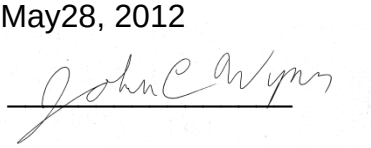
Test Date: May28, 2012
Tested By
Signature:  Name: John C. Wynn

Figure 36. Low Channel 99% Bandwidth

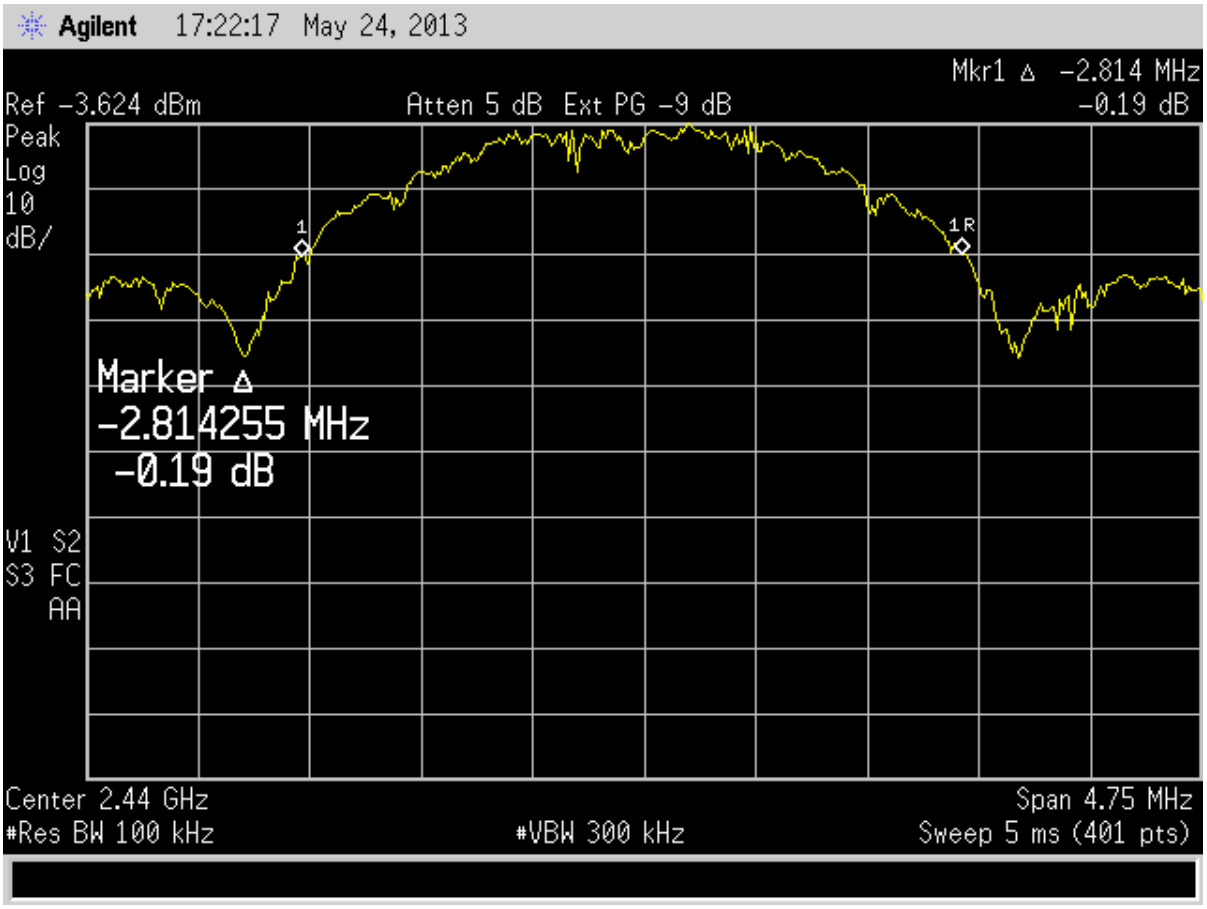


Figure 37. Mid Channel 99% Bandwidth

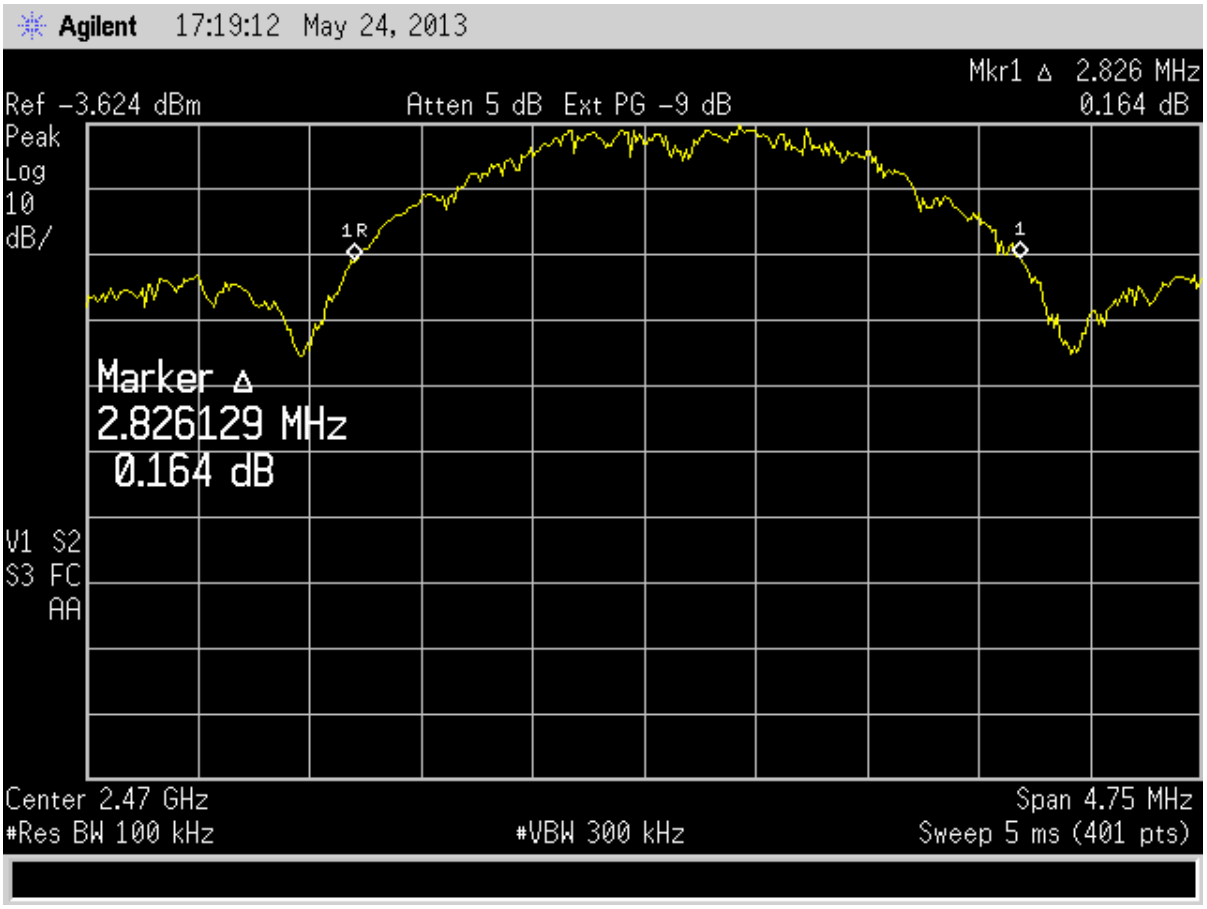


Figure 38. High Channel 99% Bandwidth

2.16 Unintentional Radiator Power Lines Conducted Emissions (CFR 15.107)

The test data provided herein is to support the Verification requirement for the digital apparatus. The power line conducted voltage measurements for Receiver and Digital Devices have been carried out in accordance with CFR 15.107 and ANSI C63.4:2003, Paragraph 7, with a spectrum analyzer connected to an LISN and the EUT placed into an idle condition or a continuous mode of receive (non-transmitting). Please refer to the results as shown in the table below.

Table 13. Power Line Conducted Emissions Data, Class B Part 15.107, Peak Measurement vs. Avg. Limits

CONDUCTED EMISSIONS 150 kHz to 30 MHz						
Tested By: JW	Specification Requirement: FCC Part 15.207 Class B		Project No.: 13-0175	Manufacturer/Model: Radio Systems Corporation/ Model 300-2645		
Frequency (MHz)	**Test Data (dBuV)**	**LISN+CL-PA (dB)**	**Corrected Results (dBuV)**	**Avg Limits (dBuV)**	**Margin (dB)**	**Detector**
EUT is battery powered						

(*)= Quasi-Peak limit used
SAMPLE CALCULATIONS: NA

2.17 Unintentional/Intentional Radiator, Radiated Emissions (CFR 15.109, 15.209)

The test data provided herein is to support the verification requirement for digital devices. Radiated emissions coming from the EUT in a non-transmit state per 15.109 were evaluated from 30 MHz to 12.5 GHz as well as radiated emission coming for the EUT in a transmitting state per 15.209 and were investigated from 9kHz or the lowest operating clock frequency to 25 GHz and tested as detailed in ANSI C63.4:2003, Paragraph 8. The worst case emissions is presented herein.

Radiated emissions within the band of 9 kHz to 30 MHz were investigated using a calibrated Loop Antenna and per the requirements of ANSI C63.4:2003.

Measurements were made with the analyzer's resolution bandwidth set to 120 kHz for measurements made below 1 GHz and 1 MHz for measurements made above 1 GHz. The video bandwidth was set to three times the resolution bandwidth; 1 MHz RBW and 3 MHz VBW. The test data were maximized for magnitude by rotating the turn-table through 360 degrees and raising and lowering the receiving antenna between 1 to 4 meters in height as a part of the measurement procedure.

All measured signals were at least 7.5 dB below the specification limit. The results are shown in the table below.

Table 14. Unintentional/Intentional Radiated Emissions

Radiated Emissions 9 kHz to 1 GHz							
Test By: RN	Test: FCC Part 15.109, 15.209			Client: Radio Systems Corporation			
	Project: 13-0175 Class: B			Model: 300-2654			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**DETECTOR PK / QP**
Tested from 9 kHz to 1 GHz							
49.8760	49.90	-17.39	32.51	40.0	3m/Vert	7.5	**PK**
75.9010	48.30	-17.70	30.60	40.0	3m/Hor	9.4	**PK**
142.4500	36.60	-13.88	22.72	43.5	3m/Vert	20.8	**PK**
337.2050	40.60	-11.58	29.02	46.0	3m/Hor	17.0	**PK**
386.5650	41.20	-11.21	29.99	46.0	3m/Hor	16.0	**PK**
440.6750	38.30	-10.75	27.55	46.0	3m/Vert	18.4	**PK**

No other emissions detected within 20 dB of the FCC Part 15.109/15.209 limits
AF is antenna factor. CL is cable loss. PA is preamplifier gain

SAMPLE CALCULATION: At 75.9 MHz: = 48.3+ (-17.7) = 30.60 dBuV/m @ 3m
Margin = (40-30.60) = 9.4 dB

Test Date: June 3, 2013

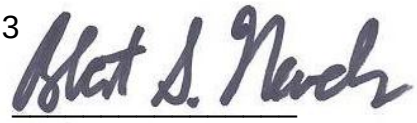
Tested By Signature:  Name: Robert Nevels

Table 15. Unintentional/Intentional Radiated Emissions Above 1GHz

Radiated Emissions 1 GHz to 25 GHz							
Test By: RN	Test: FCC Part 15.109, 15.209			Client: Radio Systems Corporation			
	Project: 13-0175 Class: B			Model: 300-2645			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**DETECTOR PK / AVG**
Tested from 1 GHz to 25 GHz							
2593.25	40.10	-3.08	37.02	54.0	3m/Vert	17.0	**AVG**
3046.93	45.47	-9.92	35.55	54.0	3m/Hor	18.5	**PK**
71670.00	44.78	-5.60	39.18	54.0	3m/Hor	14.8	**PK**
9423.50	45.15	-9.70	35.45	54.0	3m/Hor	18.5	**PK**

No other emissions detected within 20 dB of the FCC Part 15.109/15.209 limits
AF is antenna factor. CL is cable loss. PA is preamplifier gain

SAMPLE CALCULATION: At 2593.25 MHz: = 40.1+ (-3.08) = 37.02 dBuV/m @ 3m
Margin = (54-37.02) = 17.0 dB

Test Date: June 3, 2013

Tested By Signature:  Name: Robert Nevels