



Testing Tomorrow's Technology

**Application
For**

Part 2, Subpart J, Paragraph 2.907 Equipment Authorization of Certification for an Intentional Radiator per Part 15, Subpart C, paragraphs 15.207, 15.209 and 15.247

And

**Innovation, Science, and Economic Development Canada
Certification Per
IC RSS-Gen General Requirements for Radio Apparatus
And
RSS-247 Digital Transmission Systems (DTSS), Frequency Hopping Systems
(FHSS) and License-Exempt Local Area Network (LE-LAN) Devices**

For the

Inventek Systems

Model Number: ISM43903 (2.4 GHz eS-WiFi Module)

FCC ID: O7P-903

IC: 10147A-903

UST Project: 17-0162

Issue Date: October 23, 2017

Total Pages: 215

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Testing Tomorrow's Technology

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 October 23, 2017



TESTING

NVLAP LAB CODE 200162-0

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US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
O7P-903
10147A-903
17-0162
October 23, 2017
Inventek Systems
ISM43903

MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Inventek Systems
MODEL: ISM43903
FCC ID: O7P-903
IC: 10147A-903
DATE: October 23, 2017

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

Equipment type: 2.4 GHz Transmitter Module

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:

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List of Attachments

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| FCC Agency Agreement | External Photographs |
| IC Agency Agreement | Internal Photographs |
| FCC Application Forms | Theory of Operation |
| IC Application Forms | RF Exposure |
| Letter of Confidentiality | User's Manual |
| Equipment Label(s) | IC Cross Reference |
| Block Diagram(s) | FCC Modular Approval Letter |
| Schematic(s) | IC Modular Approval Letter |
| Test Configuration Photographs | |

1 General Information

1.1 Purpose of this Report

This report is prepared as a means of conveying test results and information concerning the suitability of this exact product for public distribution according to IC RSS-247 and 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 July 9, 2017 in good operating condition.

1.3 Product Description

The Equipment Under Test (EUT) is the Inventek eS-WiFi Module, Model ISM43903. The EUT is an embedded Serial WiFi (eS-WiFi), wireless internet connectivity module that operates in the 2.4 GHz spectrum. The eS-WiFi module's hardware consists of an ARM Cortex-based applications processor, a single stream 802.11n MAC/baseband/radio, a power amplifier (PA), and a receive low-noise amplifier (LNA). The eS-WiFi module has two antenna options, an on board PCB etched antenna or an U.FL connector for external 2.4 GHz antenna. The eS-WiFi module provides a UART interface enabling connection to an embedded design. The eS-WiFi module requires no operating system and has a completely integrated TCP/IP Stack. The eS-WiFi module hardware can be used with Inventek's IWIN (Inventek Wireless Interoperability Network). This product is targeted for low cost embedded wireless applications and enables a quick, easy and cost effective method adding WiFi connectivity.

The ISM43903 radio module is sold with the following configuration numbers: ISM43903-R48-L54-E, ISM43903-R48-L54-U, ISM43903-R48-L54-EVB and ISMART43903-E and ISMART49303-U. The configuration evaluated in this test report is the Inventek ISM43903-R48-L54.

The different configurations are applied for marketing reasons only and the suffixes depict variations of the module as follows:

- E = integrated trace antenna
- U = external u.fl antenna connector added
- EVB = evaluation board

1.4 Configuration of Tested System

The Test Sample was tested per *ANSI C63.10:2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices* for the intentional radiator aspect of the device and *ANSI C63.4:2014, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2014)* for the unintentional radiator aspect of the device as well as FCC subpart B and C of Part 15 and per FCC KDB Publication number 558074 v03r05 for Digital Transmission Systems Operating Under section 15.247.

Digital RF conducted and radiated emissions data 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 set to 3 times the RBW or as required per the standard 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. Its designation number is US5301. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 9900A-1.

1.6 Related Submittal(s)/Grant(s)

The EUT is subject to the following FCC Equipment Authorizations:

- a) Certification of the transmitter incorporated within the EUT, see test data presented herein.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
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Table 1. Supporting Equipment

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC/IC ID	CABLES P/D
Hewlett-Packard (Laptop)	EliteBook 8530p	2CE010000TG	Unknown	-
Hewlett-Packard (Power Supply Adapter)	384020-001	PA-1900-08H2	Not Applicable	3.0 m UP
Antenna See antenna details	--	--	--	--

S= Shielded, U= Unshielded, P= Power, D= Data

2 Tests and Measurements

2.1 Test Equipment

The table 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	CALIBRATION DUE DATE
SPECTRUM ANALYZER	E4407B	AGILENT	US41442935	6/22/2018
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	1937A02980	11/01/2017
PREAMP 1.0 GHz to 26.0 GHz	8449B	HEWLETT-PACKARD	3008A00480	10/26/2017
LOOP ANTENNA	SAS-200/562	A. H. Systems	142	12/28/2017 2 yr.
BICONICAL ANTENNA	3110B	EMCO	9307-1431	5/2/2019 2 yr
LOG PERIODIC ANTENNA	3146	EMCO	9305-3600	5/1/2019 2 yr
HORN ANTENNA	3115	EMCO	9107-3723	9/22/2018 2 yr
HIGH PASS FILTER	VHP-16	MINI-CIRCUITS	N/A	3/7/2018
8 dB ATTENUATOR	VAT-8 15542	MINI-CIRCUITS	30519	3/7/2018
20 dB ATTENUATOR	47-20	PASTERNAK	N/A	3/7/2018

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 to bring the EUT into compliance with FCC Part 15.247 or IC RSS-210 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

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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.

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)

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB _i	TYPE OF CONNECTOR
Trace Antenna	Cypress	-	None	0.0	PCB Trace
Single-Band Antenna	Inventek Systems	Dipole	W24P-U	+3.2	U.FL
Dual-Band Antenna	Inventek Systems	Dipole	W2.4-5P-U	+2.6	U.FL

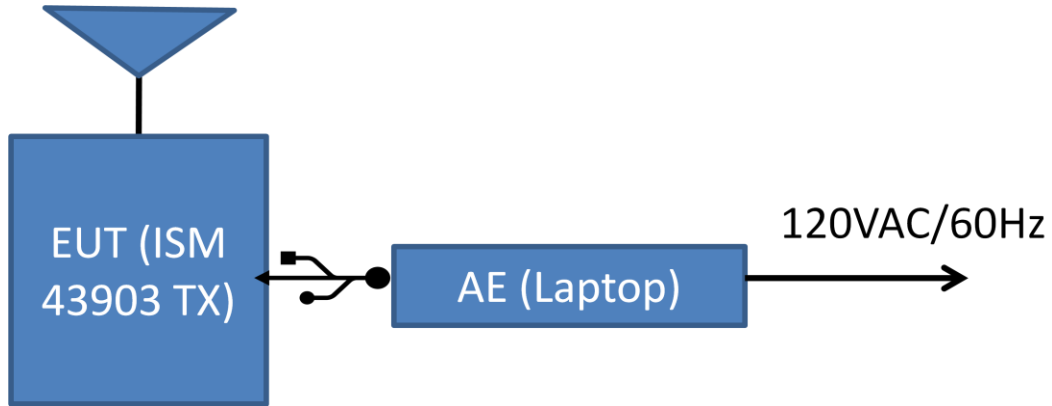


Figure 1. Block Diagram of Test Configuration

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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 (Part 15.35 (c))

The EUT employs pulse transmission however for testing purpose the EUT was programmed to transmit at a rate >98%.

The manufacturer claimed duty cycle is 40%. This is the duty cycle in which the module operates in normal operating mode. The Duty Cycle correction factor is based on this.

Total time ON= 40%

Duty Cycle Factor= $20 \log (DC) = 20 \log (0.40) = -7.96 \text{ dB}$

Note: The transmitter was programmed to transmit at >98% during all testing. Therefore where applicable (when using AVG detection) the duty cycle factor calculated above was applied.

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2.9 Antenna Conducted Intentional and Spurious Emissions (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 ANSI C63.10-2013 for conducted out of band emissions emanating from the antenna port over the frequency range of 30 MHz to ten times the highest clock frequency generate or used in this case, 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 Conducted RF antenna tests, the RBW was set to 100 kHz, video bandwidth (VBW) > RBW, scan up through the 10th harmonic of the fundamental frequency. All harmonics/spurs must be at least 20 dB down from the highest emission level within the authorized band.

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 measurements above 1 GHz, the emissions were measured using RBW = 1 MHz and VBW = 10 Hz or the duty cycle correction factor was applied to the Peak recorded value.

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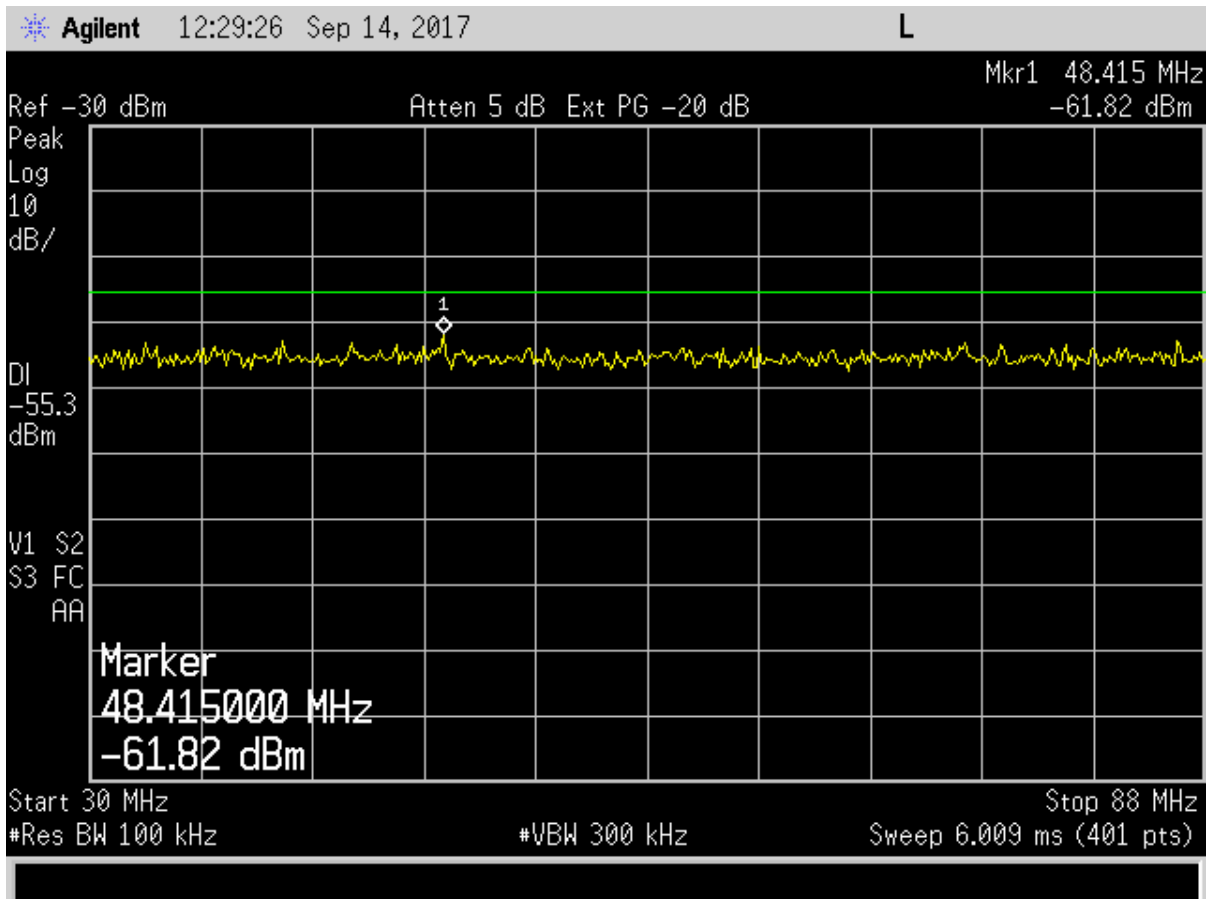


Figure 2. Antenna Conducted Spurious Emissions – b mode Low Channel, 30-88 MHz

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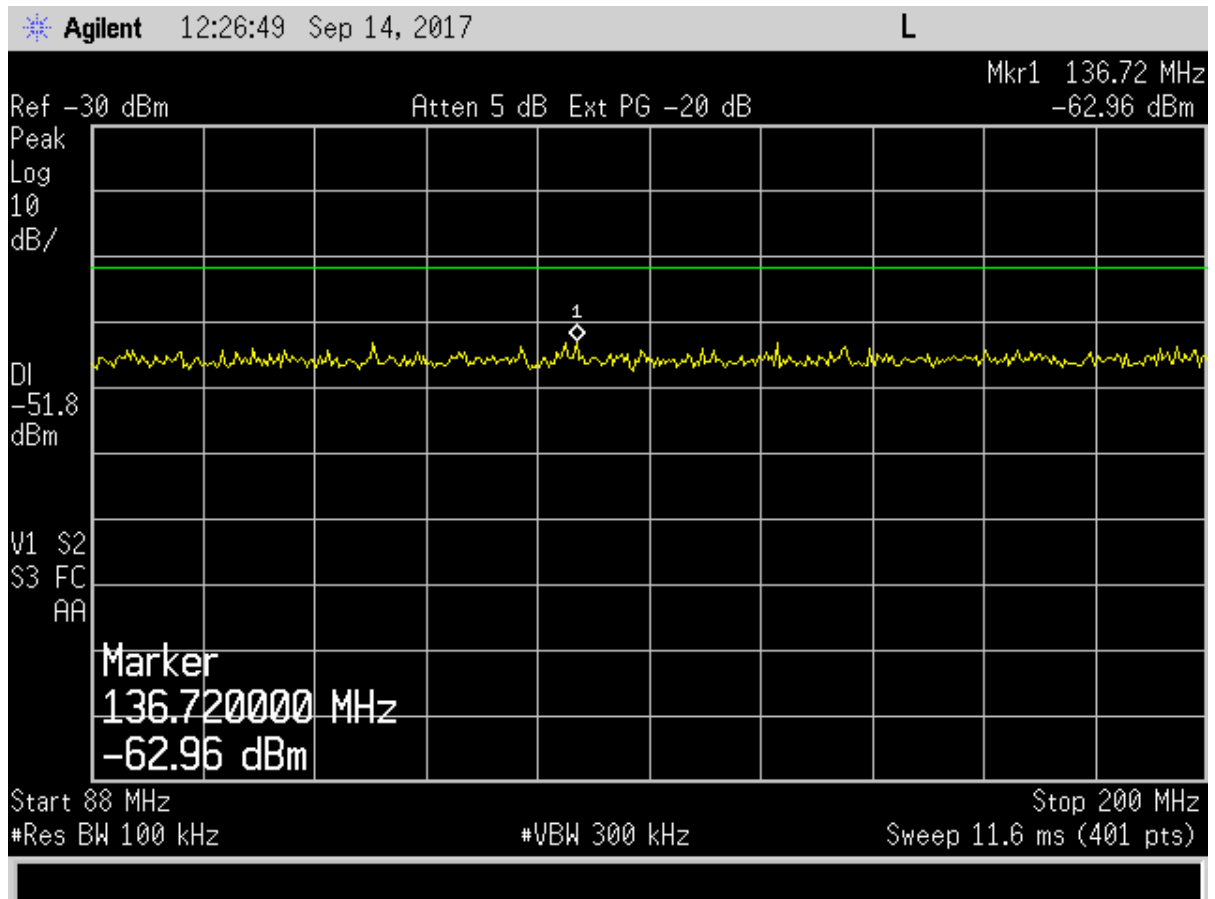


Figure 3. Antenna Conducted Spurious Emissions – b mode Low Channel, 88-200 MHz

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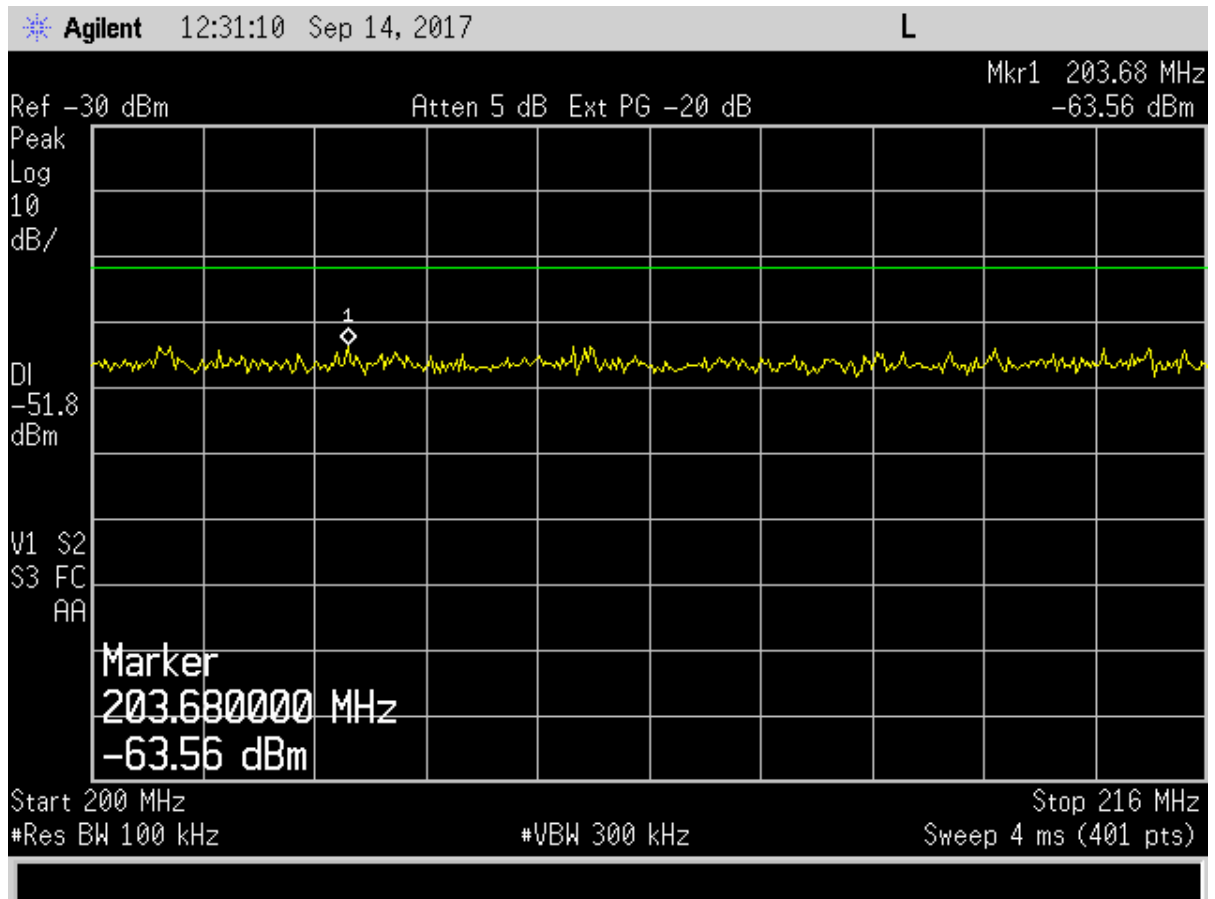


Figure 4. Antenna Conducted Spurious Emissions – b mode Low Channel, 200-216 MHz

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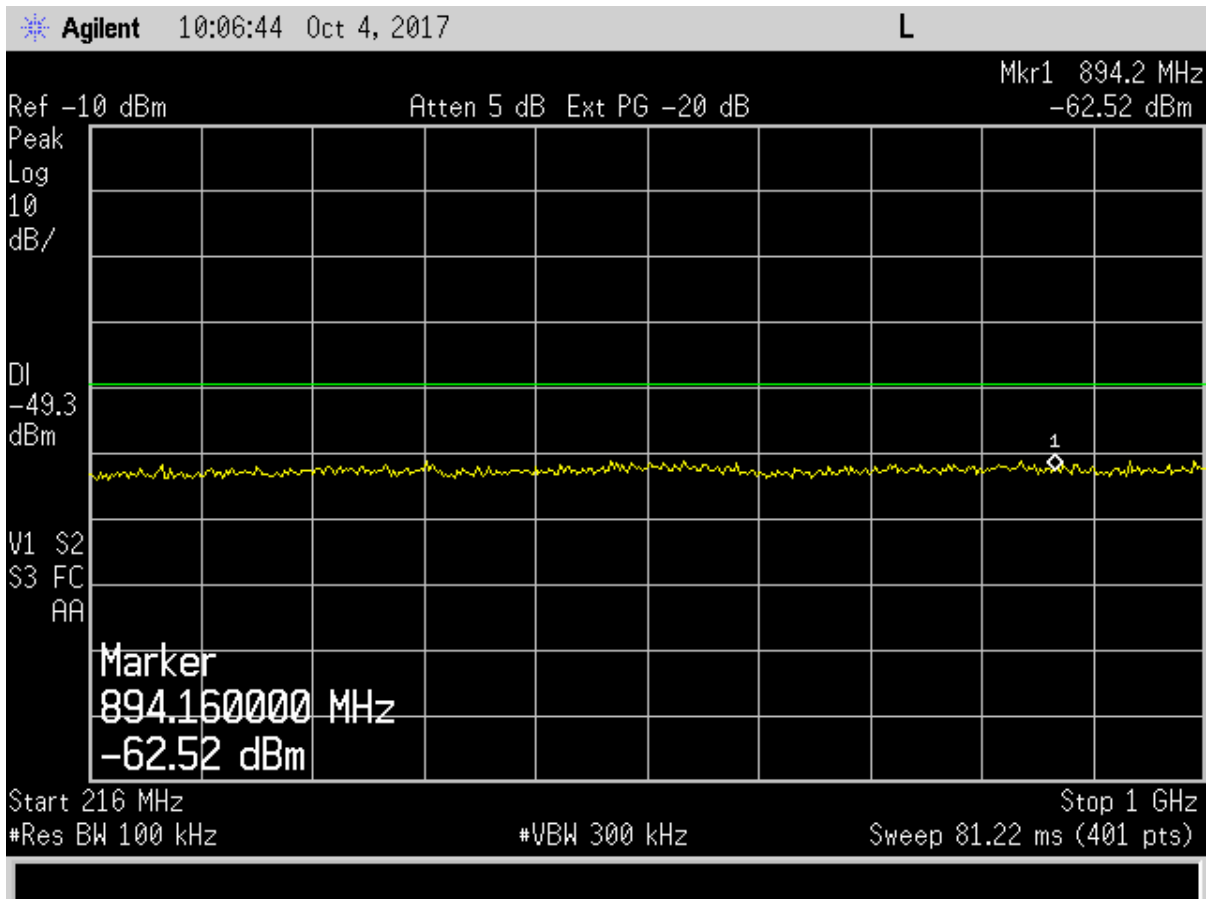


Figure 5. Antenna Conducted Spurious Emissions – b mode Low Channel, 216-1000 MHz

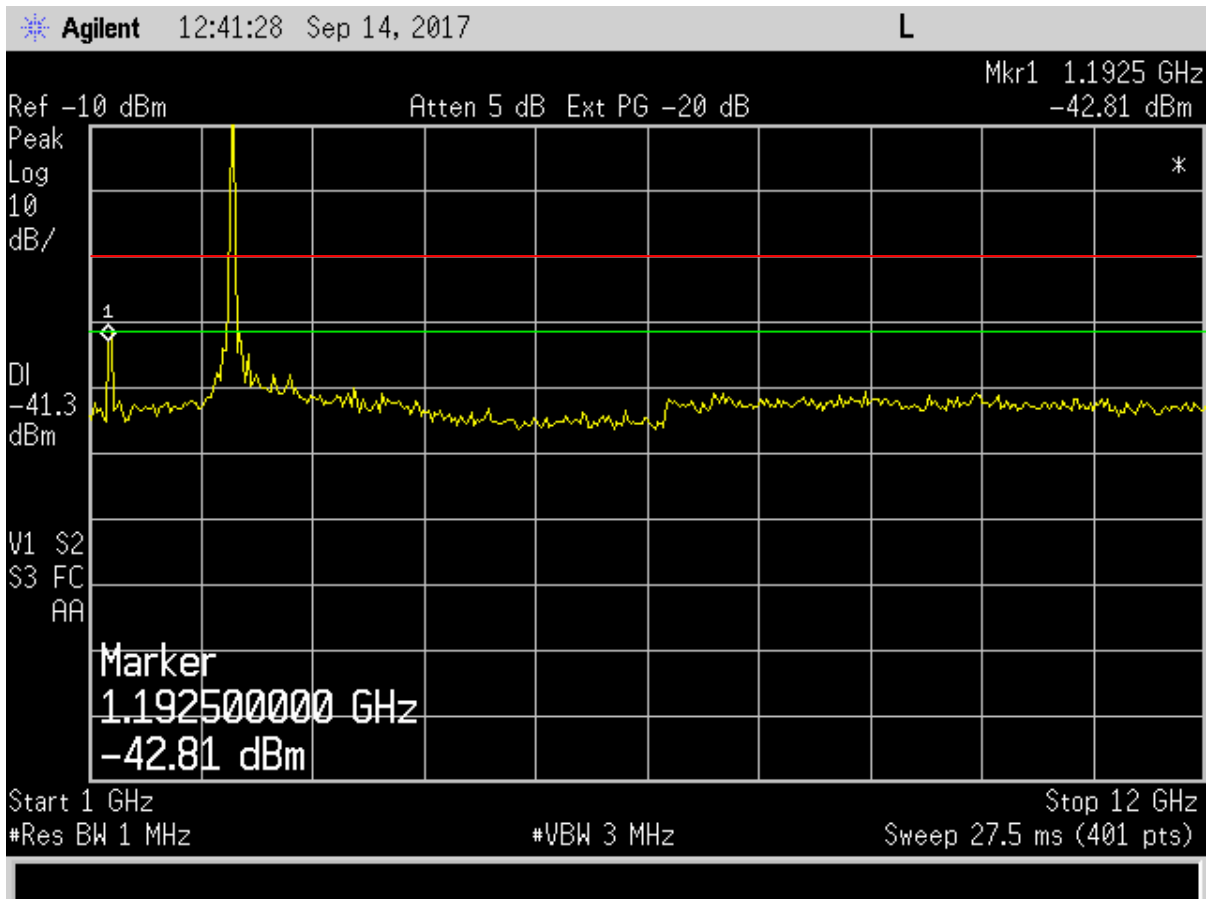


Figure 6. Antenna Conducted Spurious Emissions – b mode Low Channel, 1000-12000 MHz

Note: Large Signal shown is Fundamental Frequency
Note: RED line is limit line.

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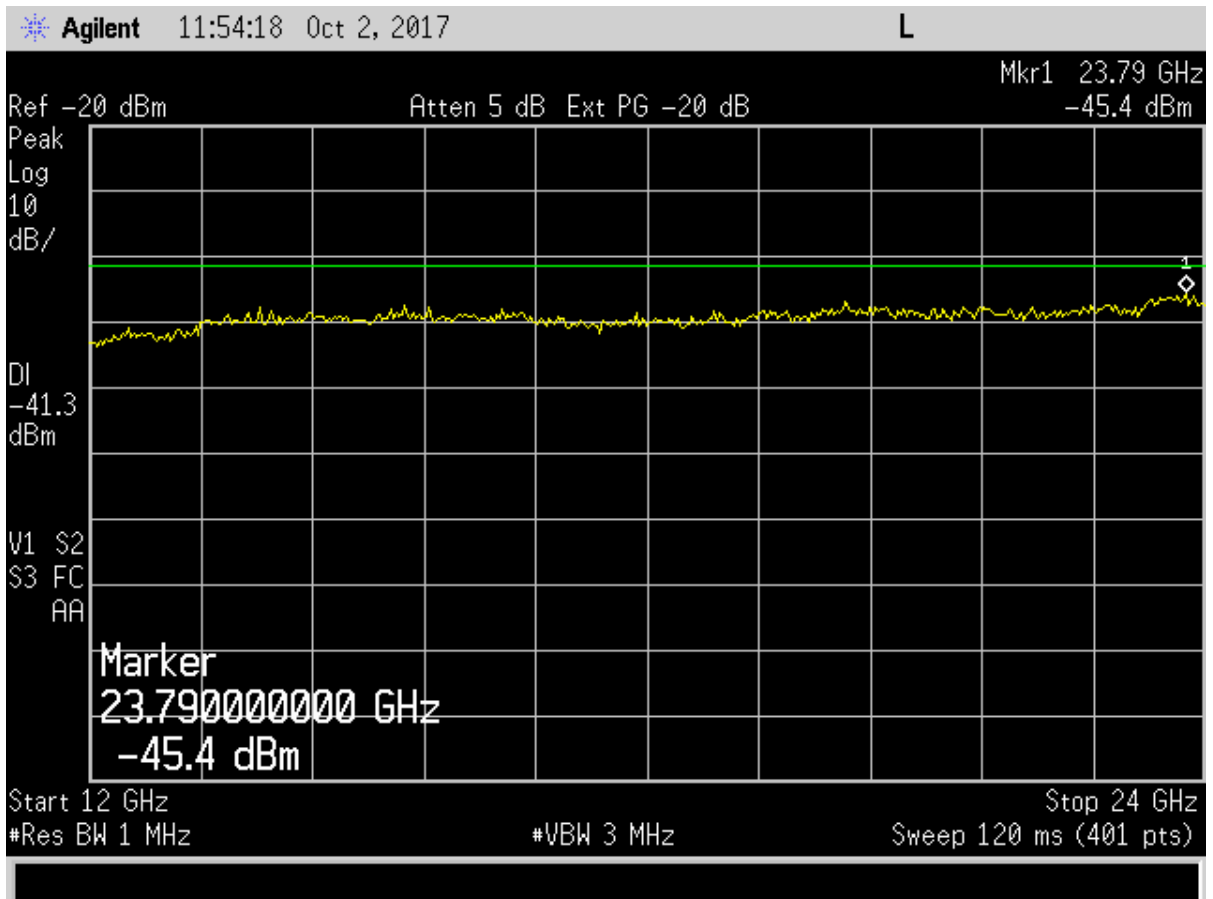


Figure 7. Antenna Conducted Spurious Emissions – b mode Low Channel, 12000-24000 MHz

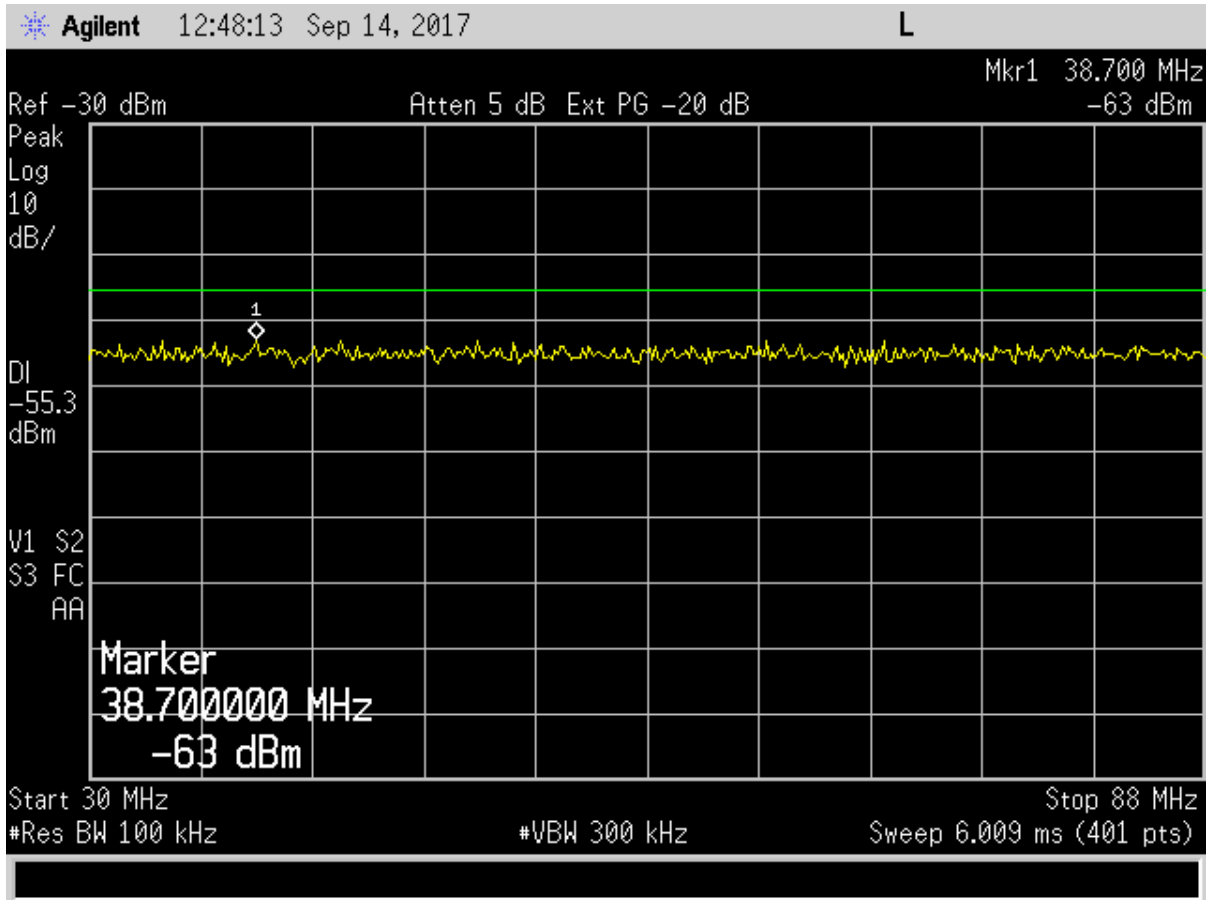


Figure 8. Antenna Conducted Spurious Emissions – b mode Mid Channel, 30-88 MHz

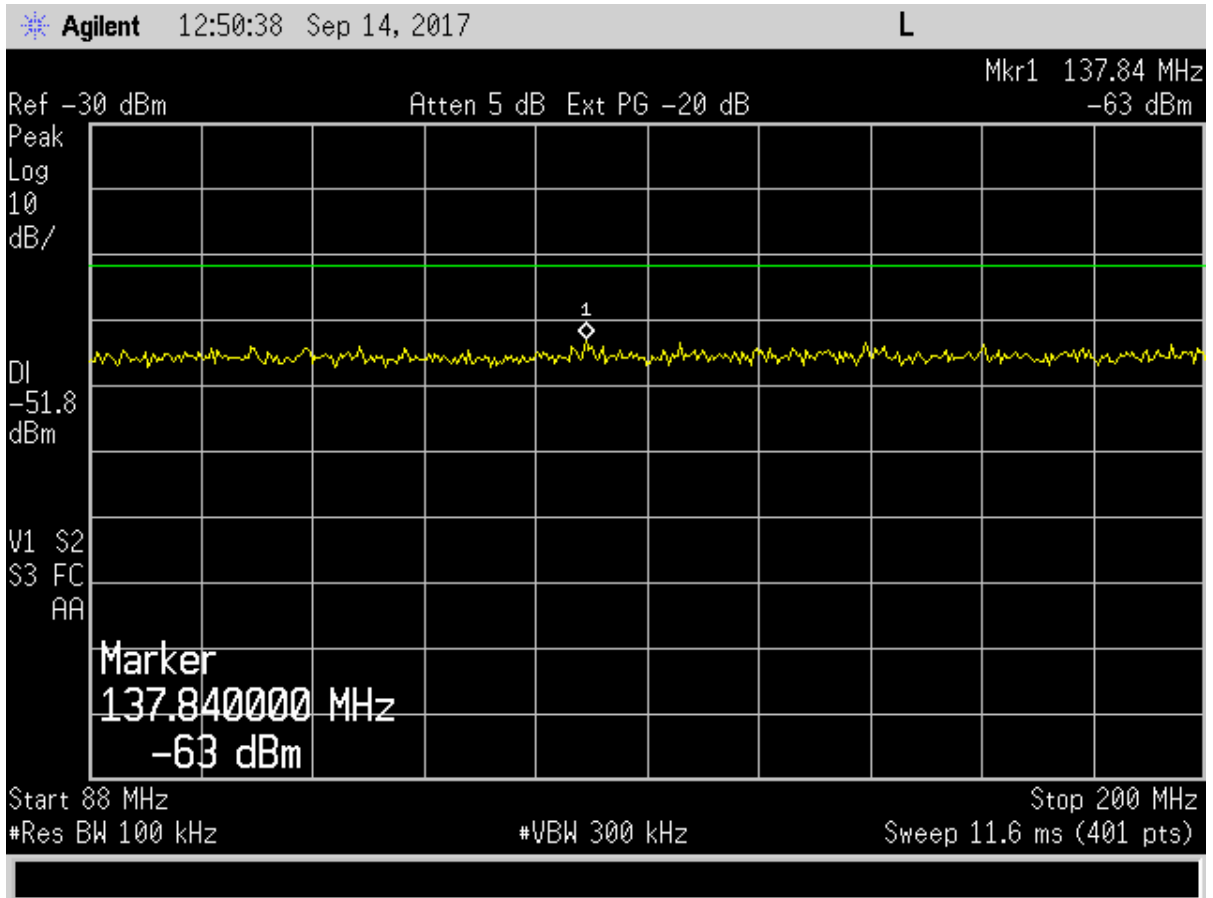


Figure 9. Antenna Conducted Spurious Emissions – b mode Mid Channel, 88-200 MHz

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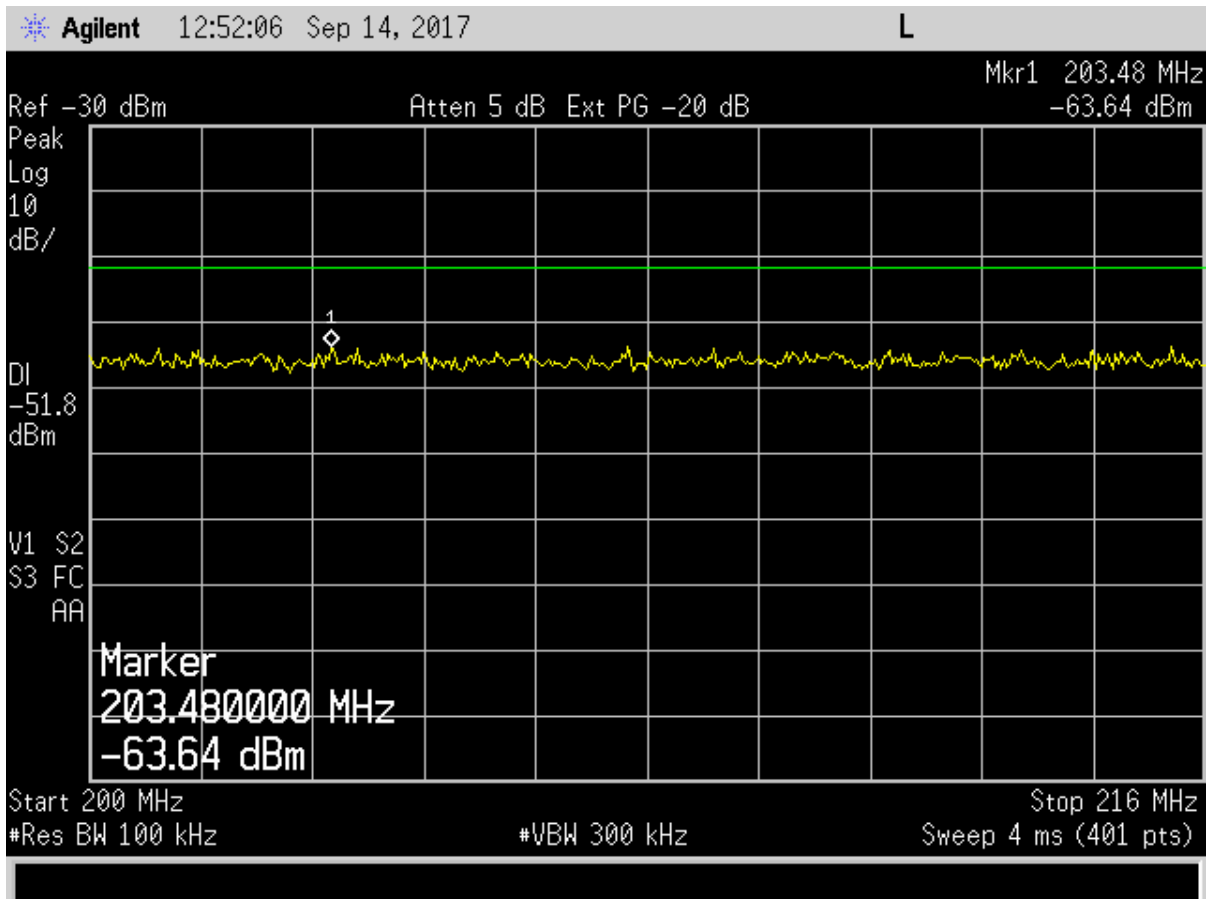


Figure 10. Antenna Conducted Spurious Emissions – b mode Mid Channel, 200-216 MHz

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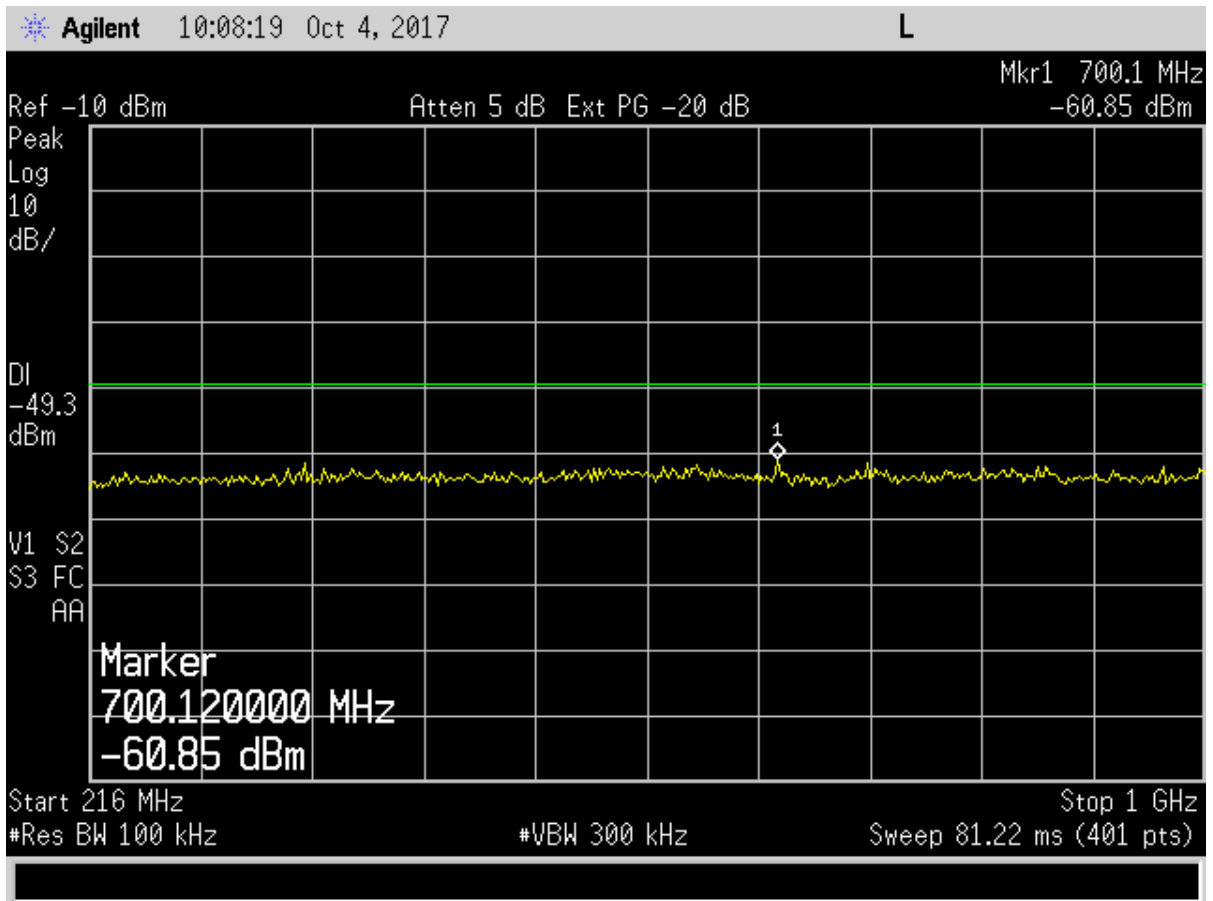


Figure 11. Antenna Conducted Spurious Emissions – b mode Mid Channel, 216-1000 MHz

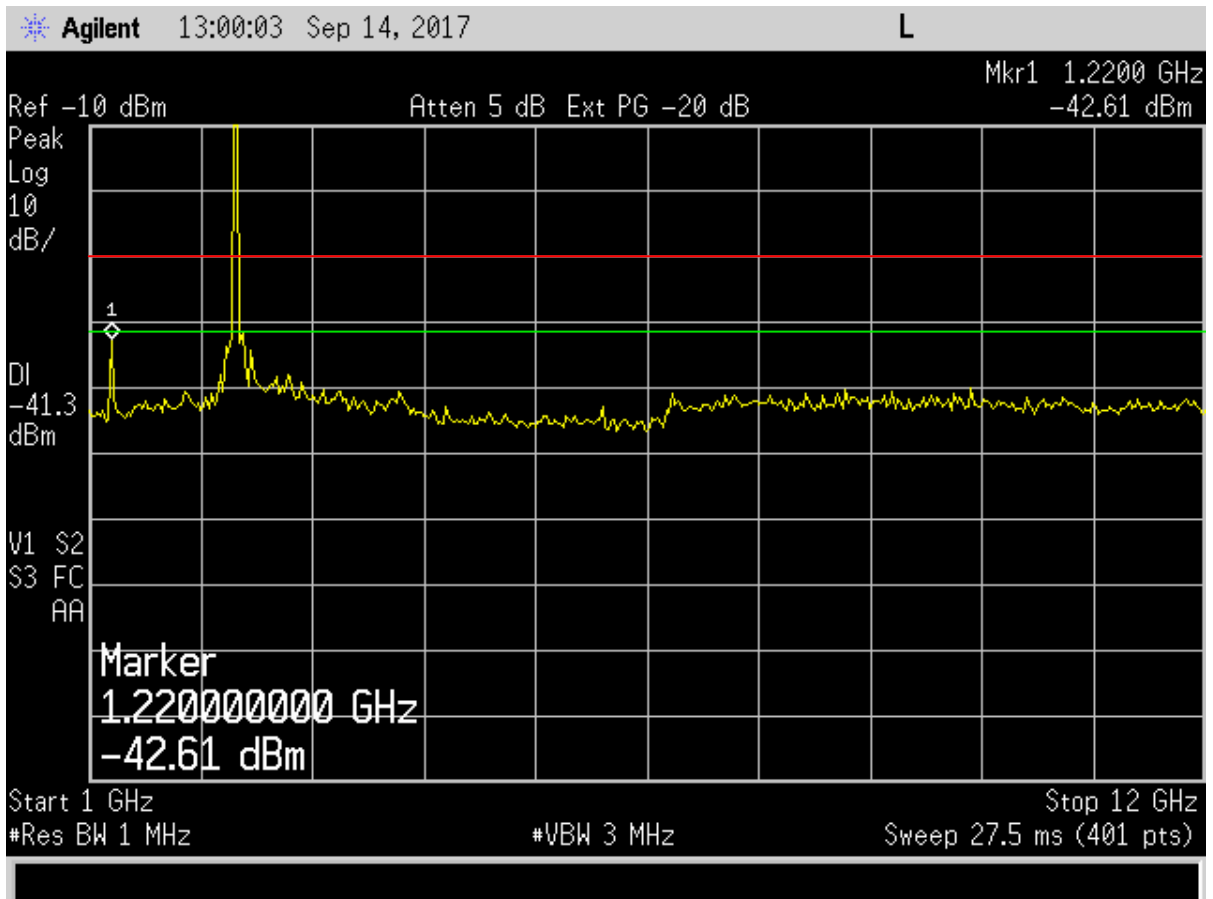


Figure 12. Antenna Conducted Spurious Emissions – b mode Mid Channel, 1000-12000 MHz

Note: Large Signal shown is Fundamental Frequency

Note: RED line is limit line.

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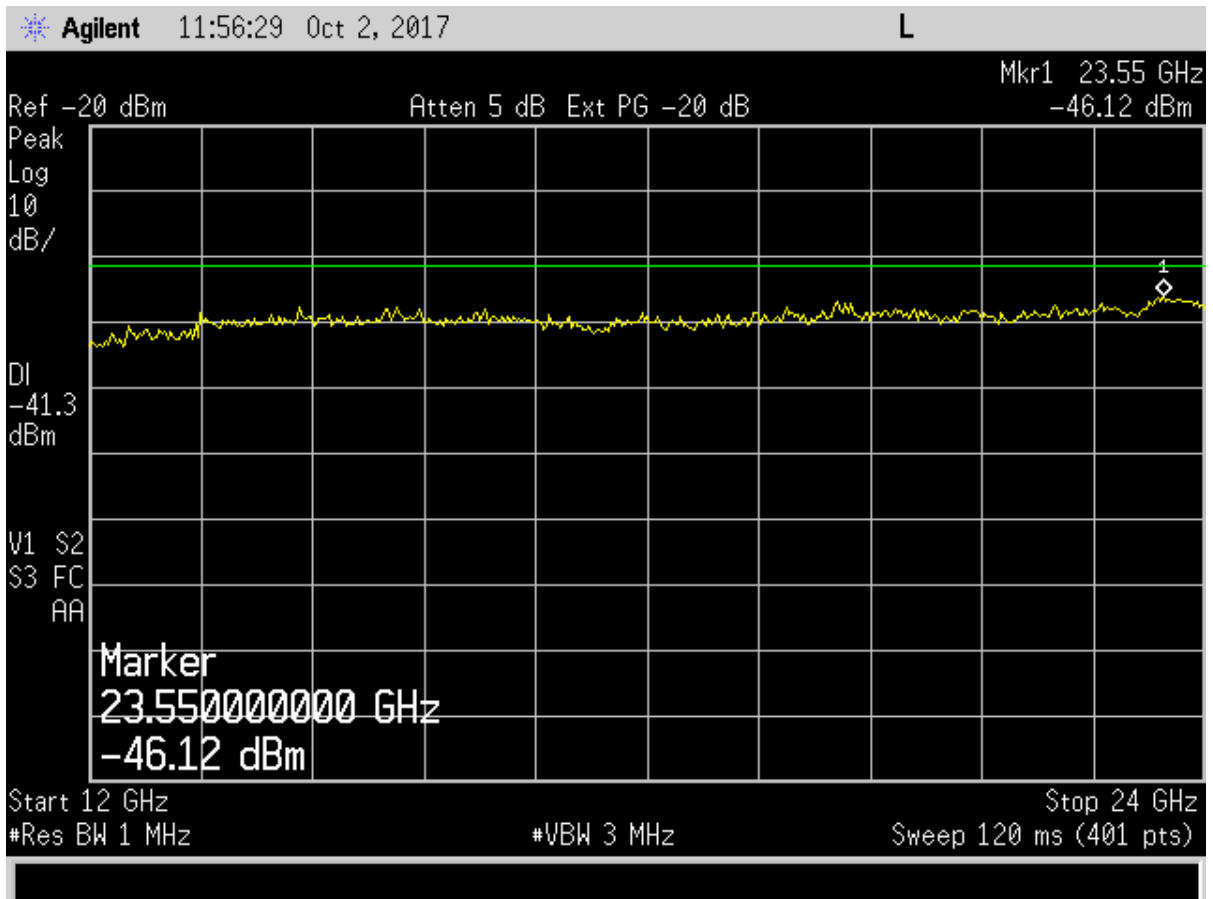


Figure 13. Antenna Conducted Spurious Emissions – b mode Mid Channel, 12000-24000 MHz

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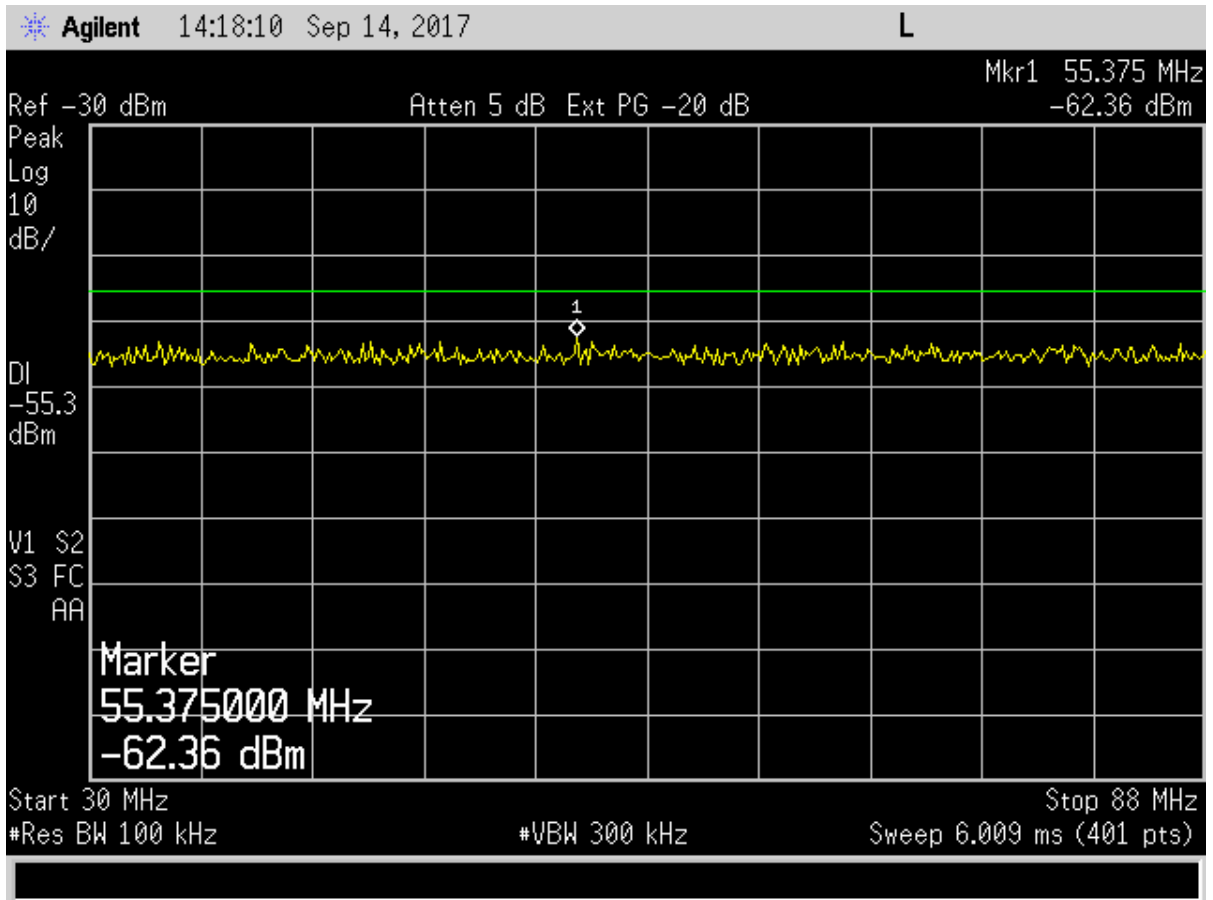


Figure 14. Antenna Conducted Spurious Emissions – b mode High Channel, 30-88 MHz

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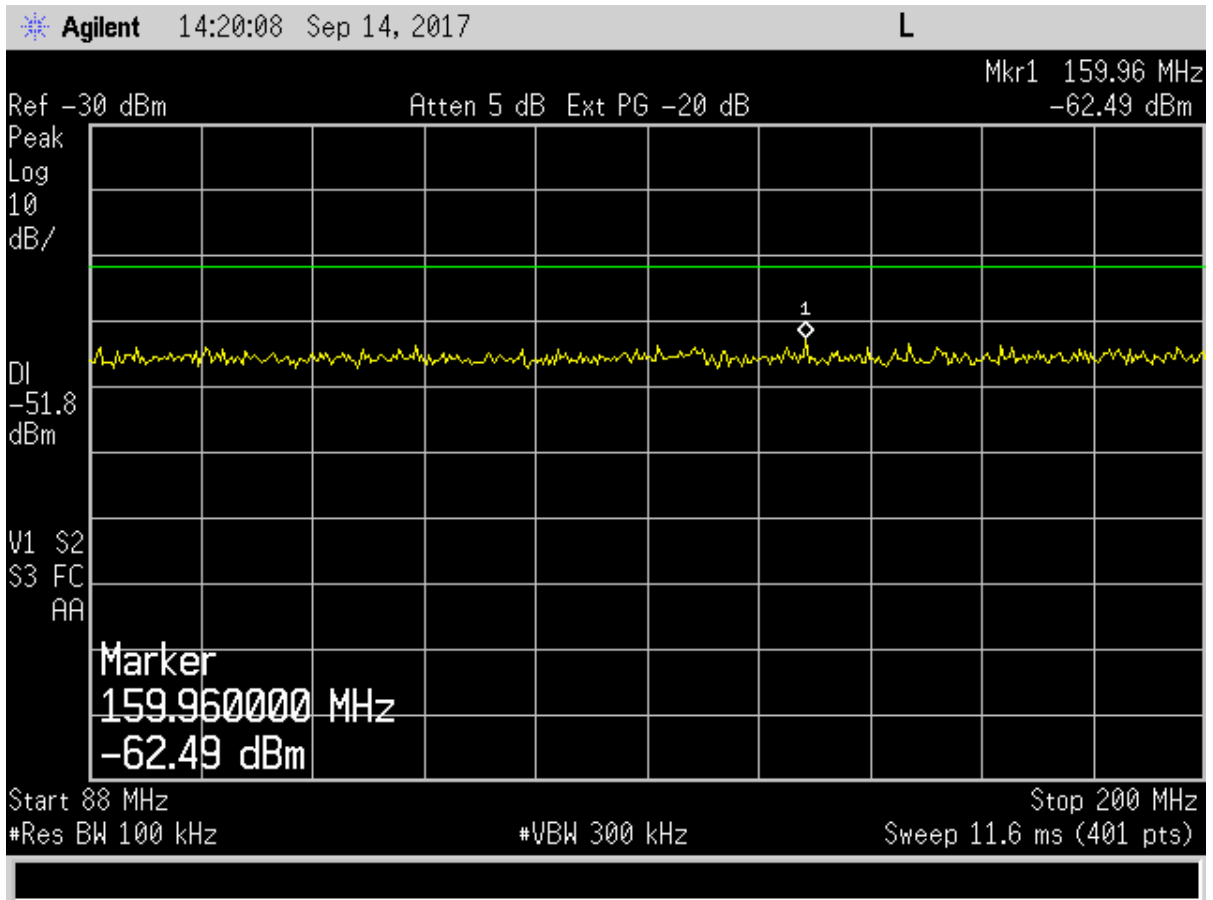


Figure 15. Antenna Conducted Spurious Emissions – b mode High Channel, 88-200 MHz

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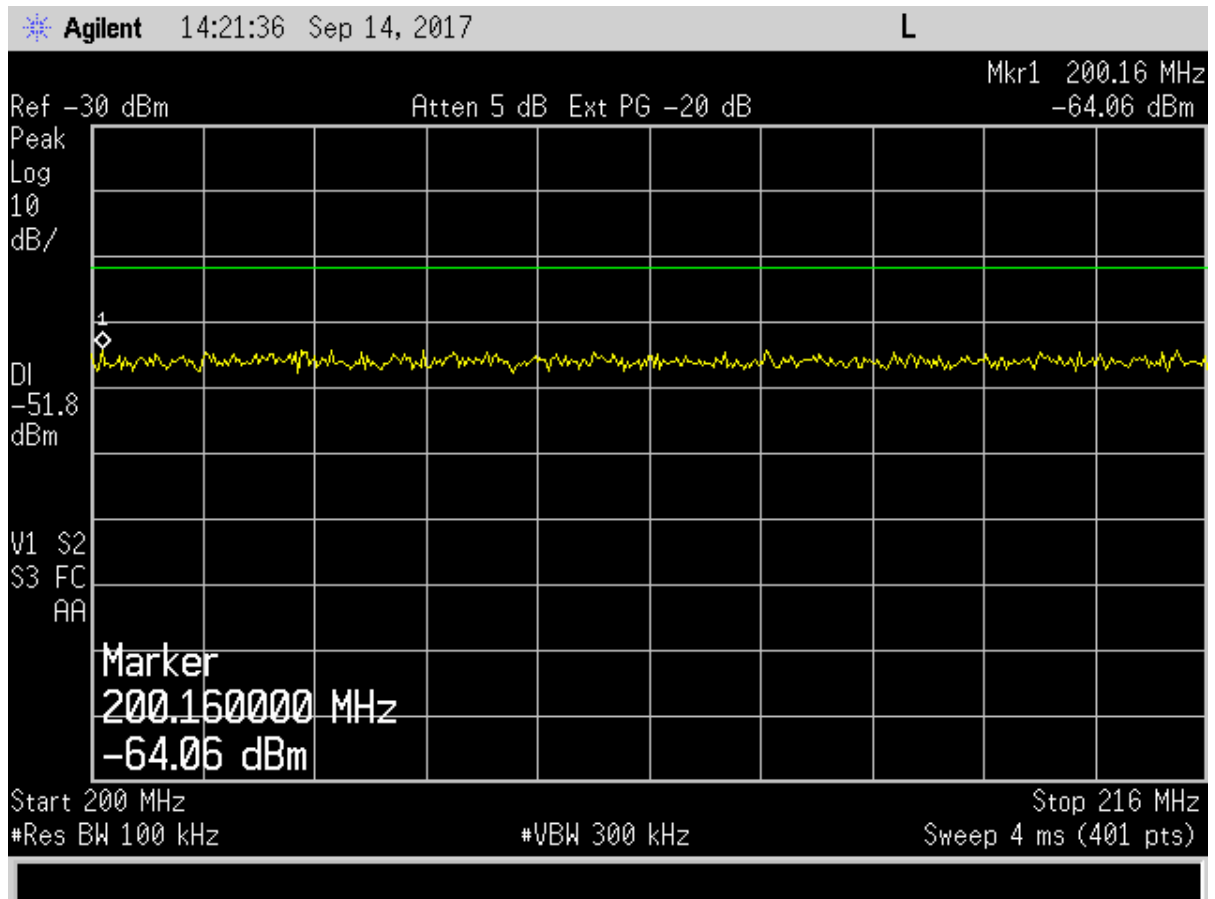


Figure 16. Antenna Conducted Spurious Emissions – b mode High Channel 200-216 MHz

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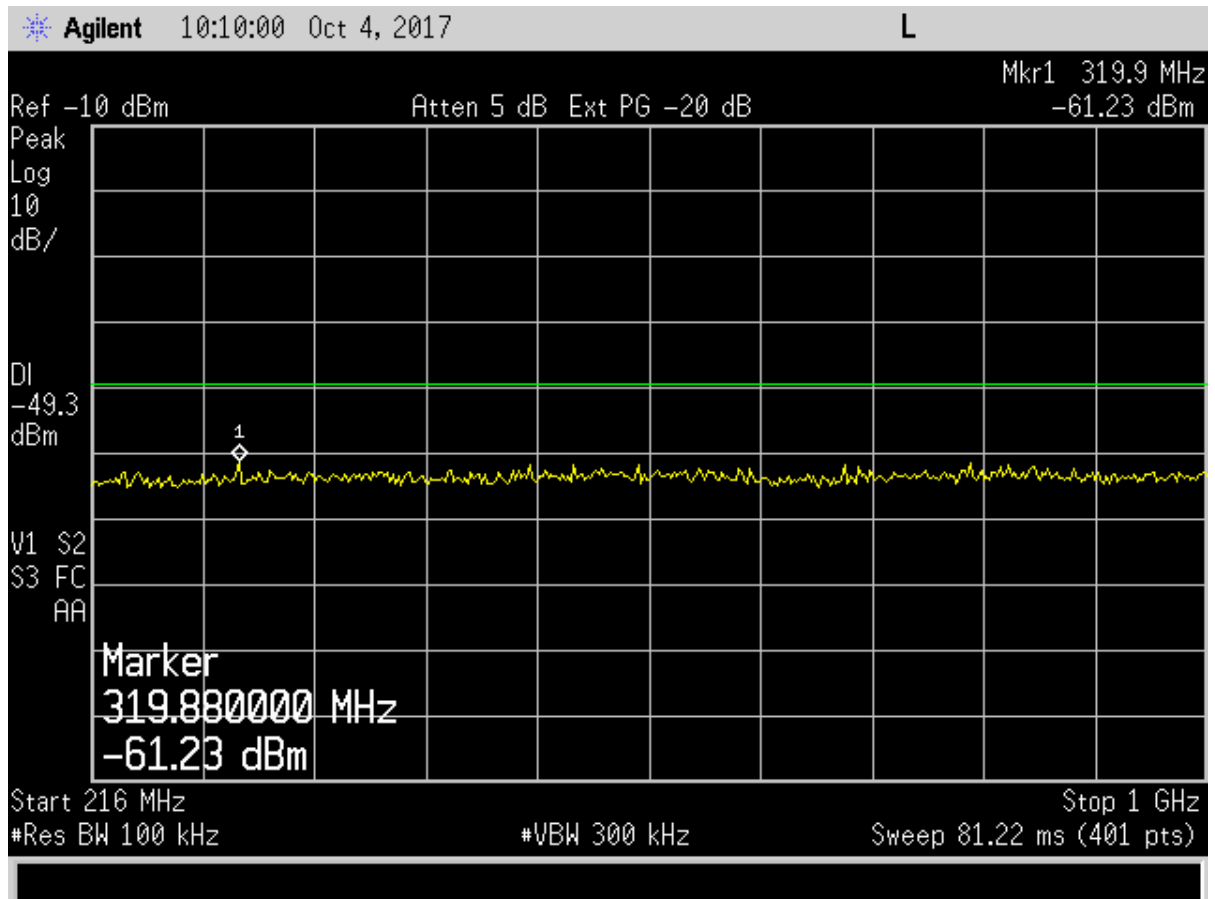


Figure 17. Antenna Conducted Spurious Emissions – b mode High Channel 216-1000 MHz

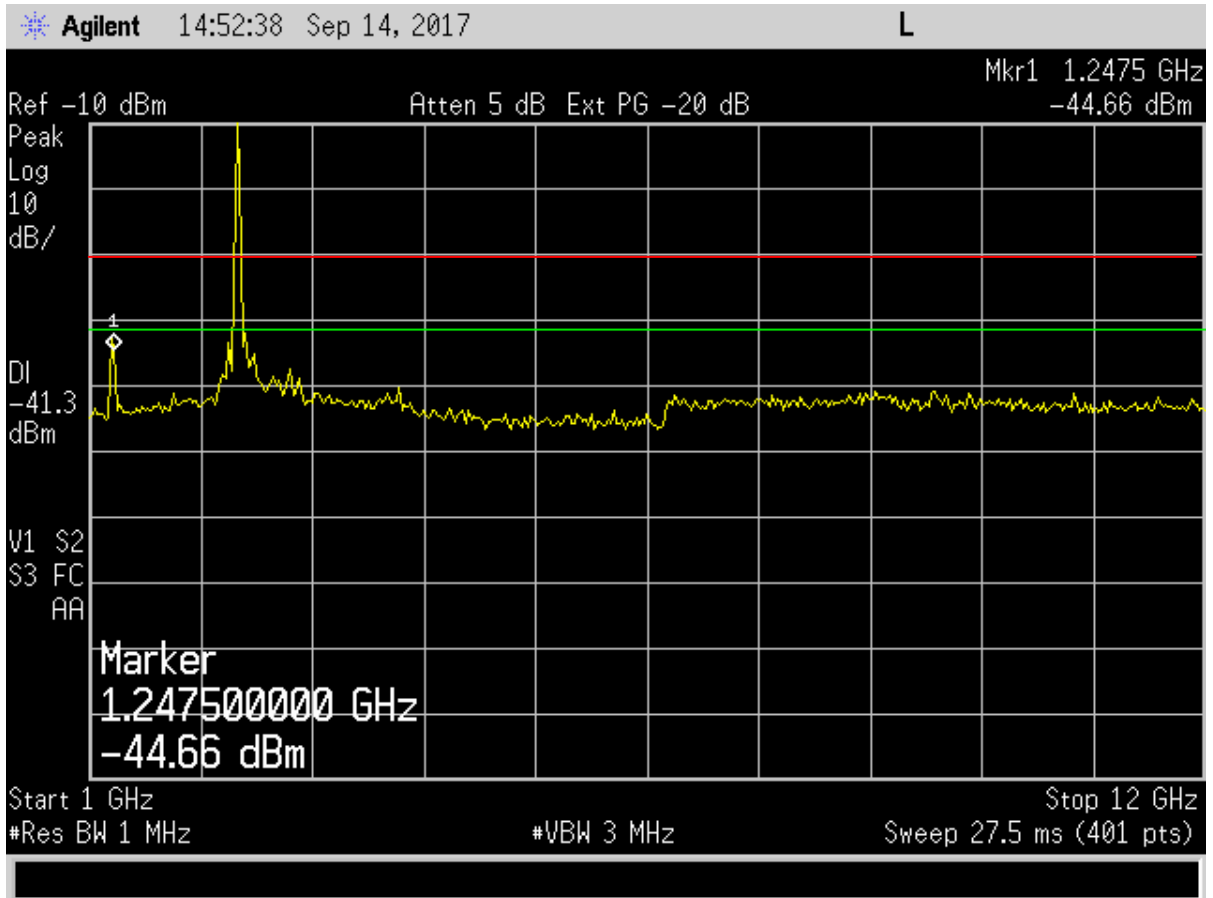


Figure 18. Antenna Conducted Spurious Emissions – b mode High Channel 1000-12000 MHz

Note: Large Signal shown is Fundamental Frequency
Note: RED line is limit line.

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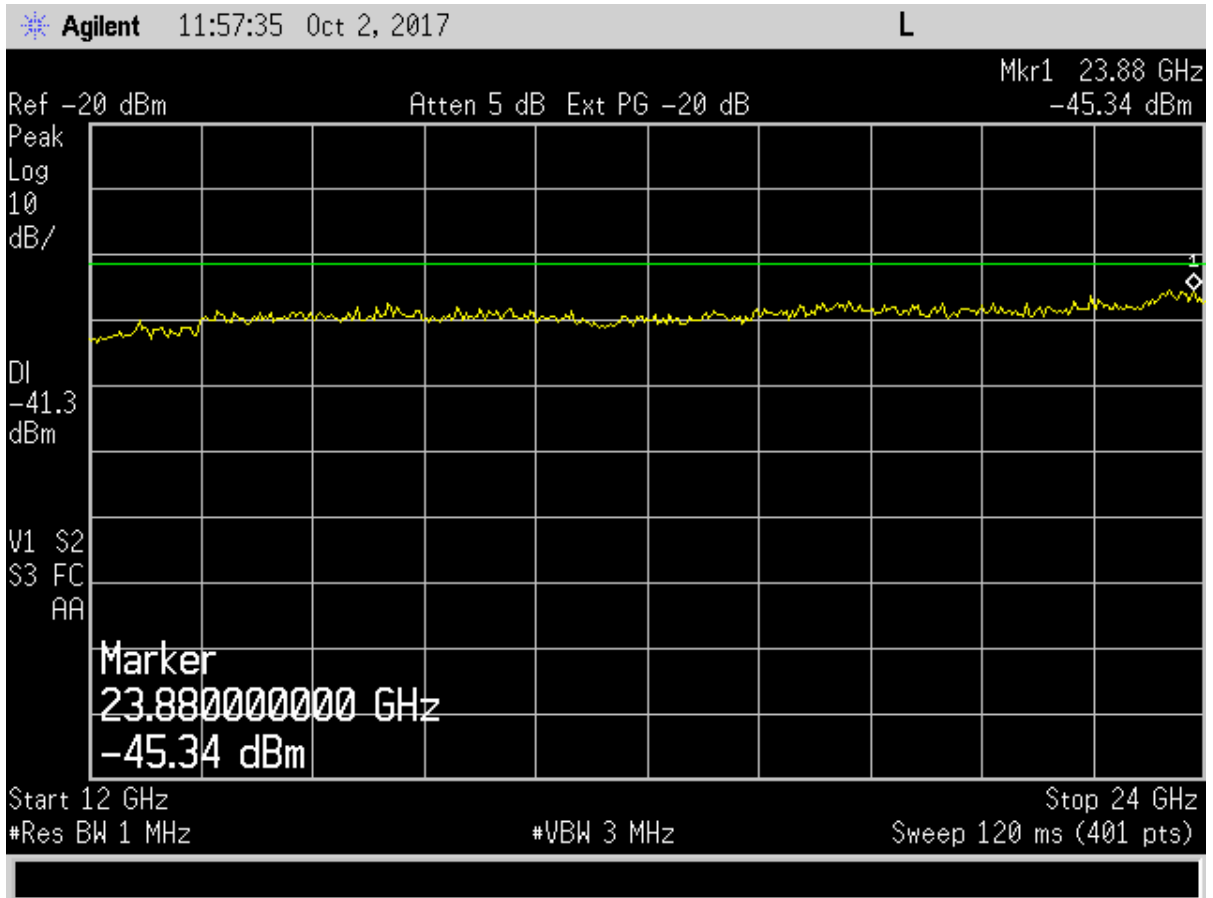


Figure 19. Antenna Conducted Spurious Emissions – b mode High Channel 12000-24000 MHz

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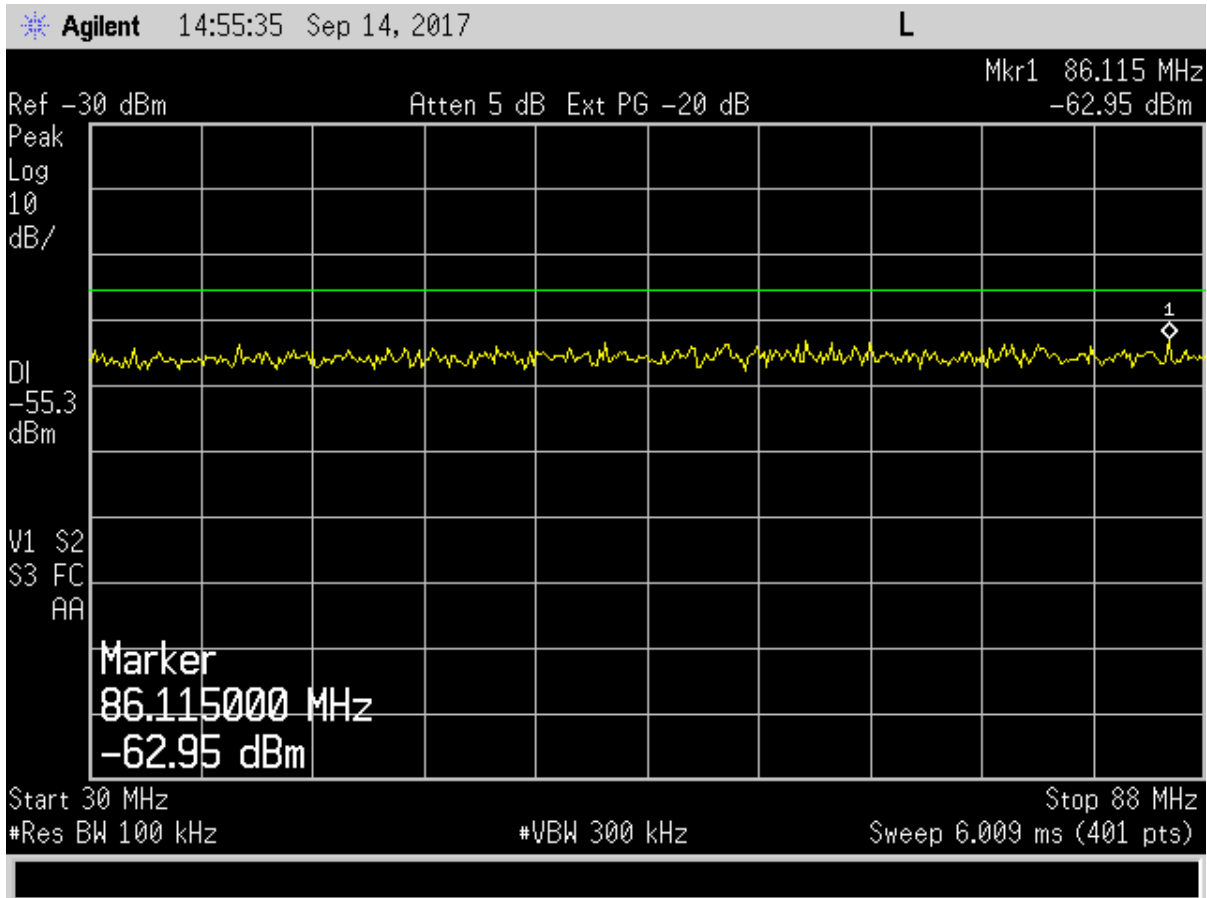


Figure 20. Antenna Conducted Spurious Emissions – g mode Low Channel, 30-88 MHz

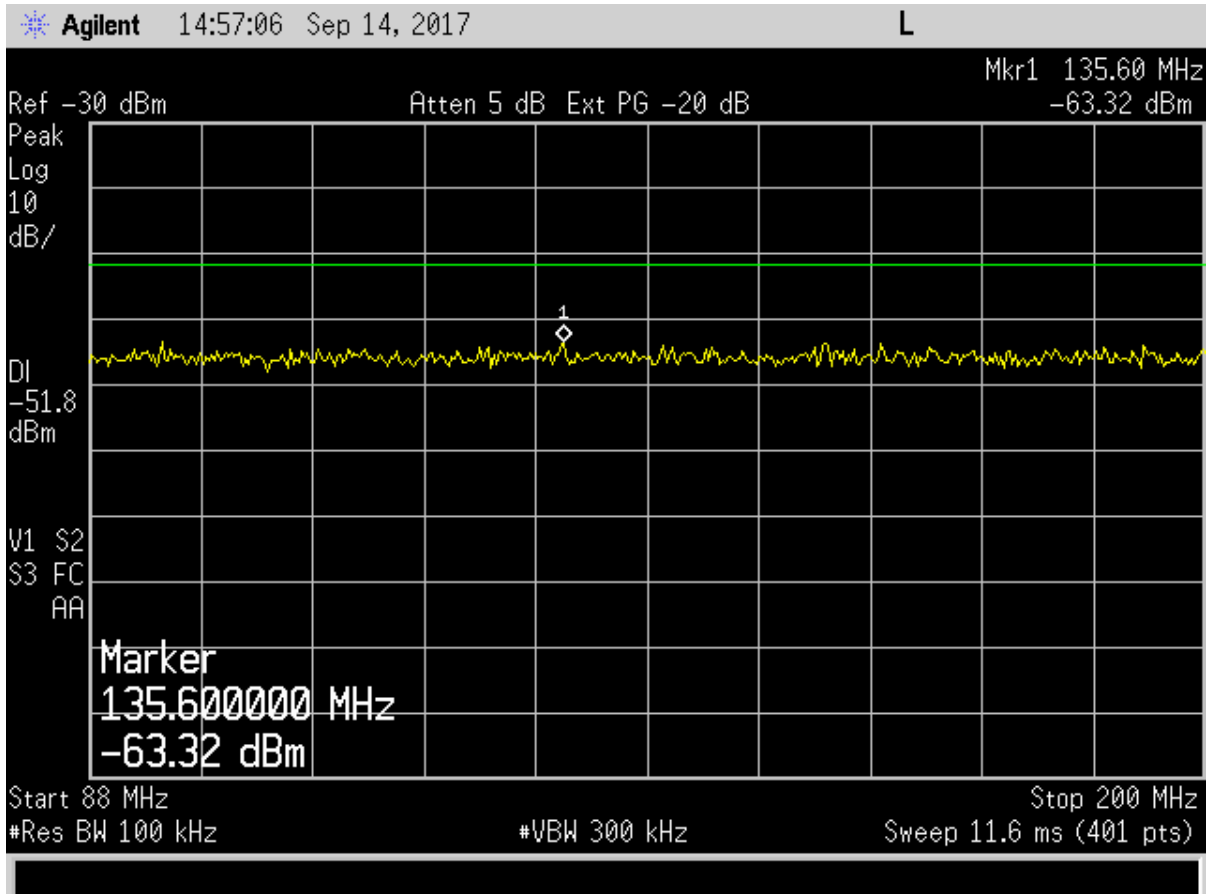


Figure 21. Antenna Conducted Spurious Emissions – g mode Low Channel, 88-200 MHz

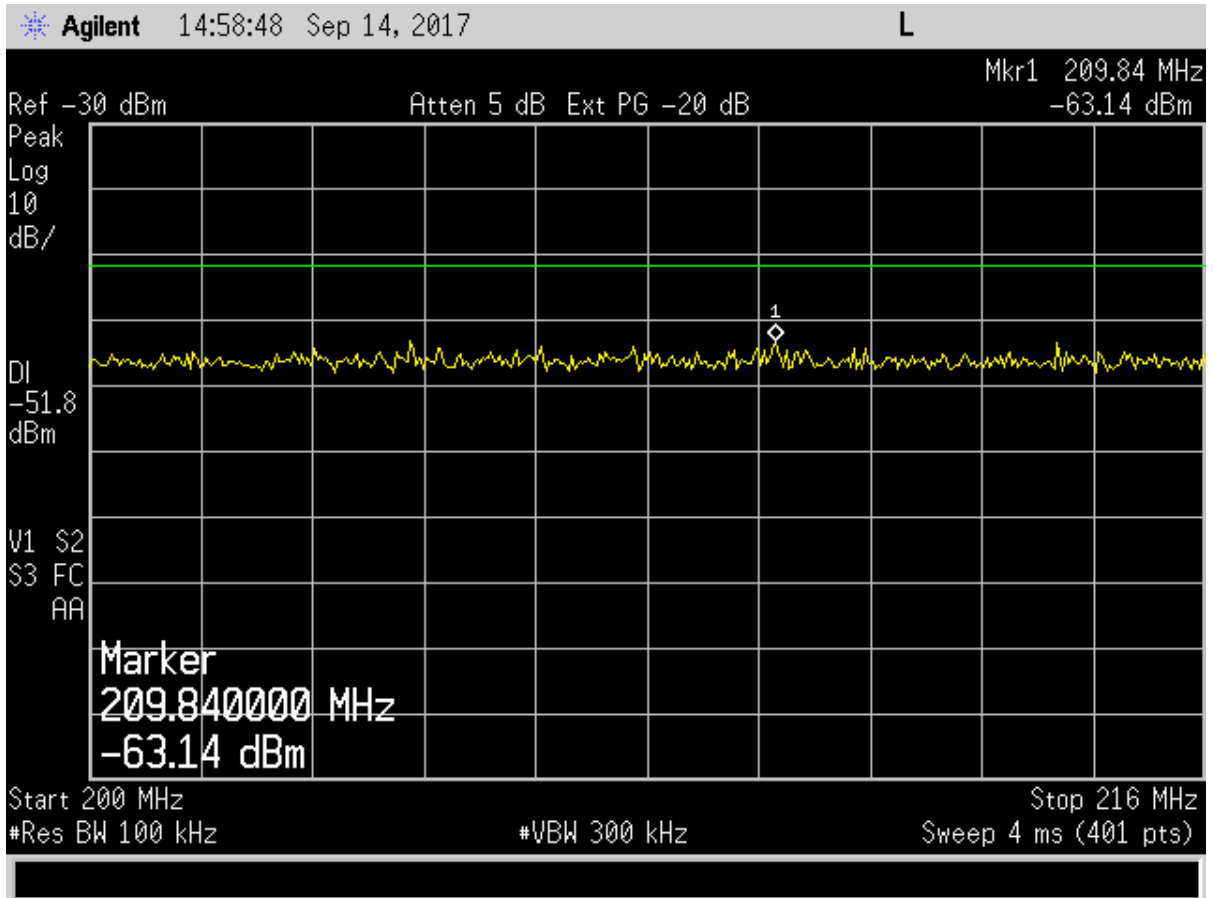


Figure 22. Antenna Conducted Spurious Emissions – g mode Low Channel 200-216 MHz

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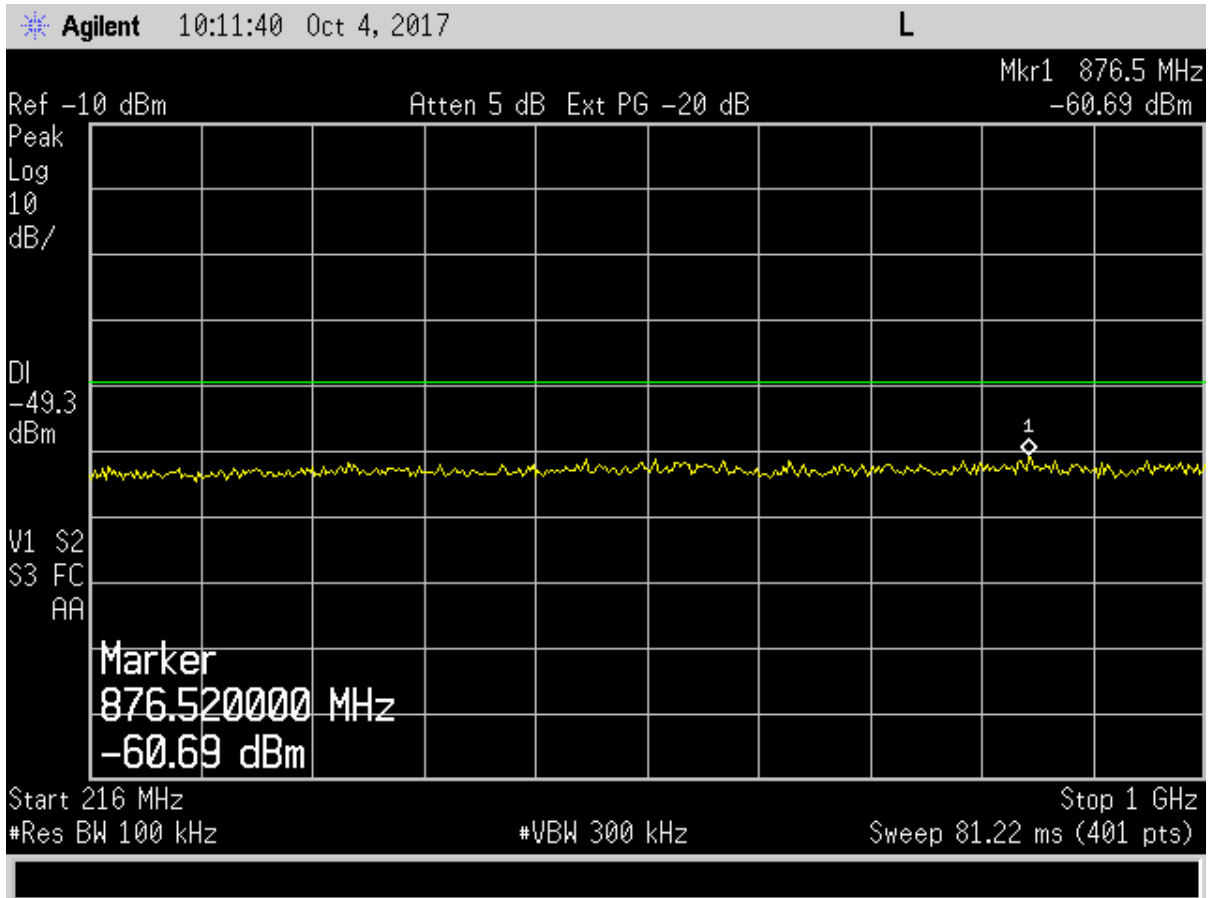


Figure 23. Antenna Conducted Spurious Emissions g mode Low Channel 216-1000 MHz

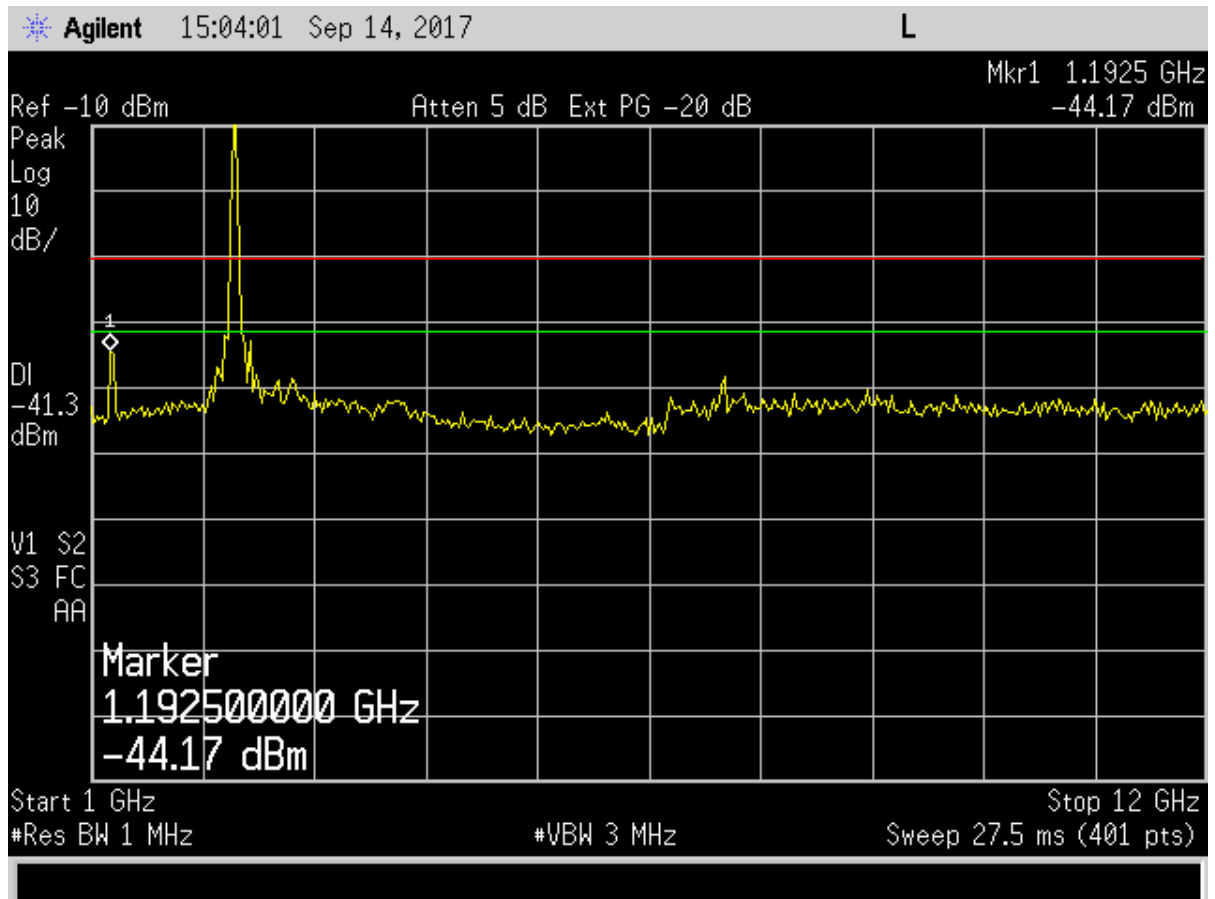


Figure 24. Antenna Conducted Spurious Emissions – g mode Low Channel 1000-12000 MHz

Note: Large Signal shown is Fundamental Frequency
Note: RED line is limit line.

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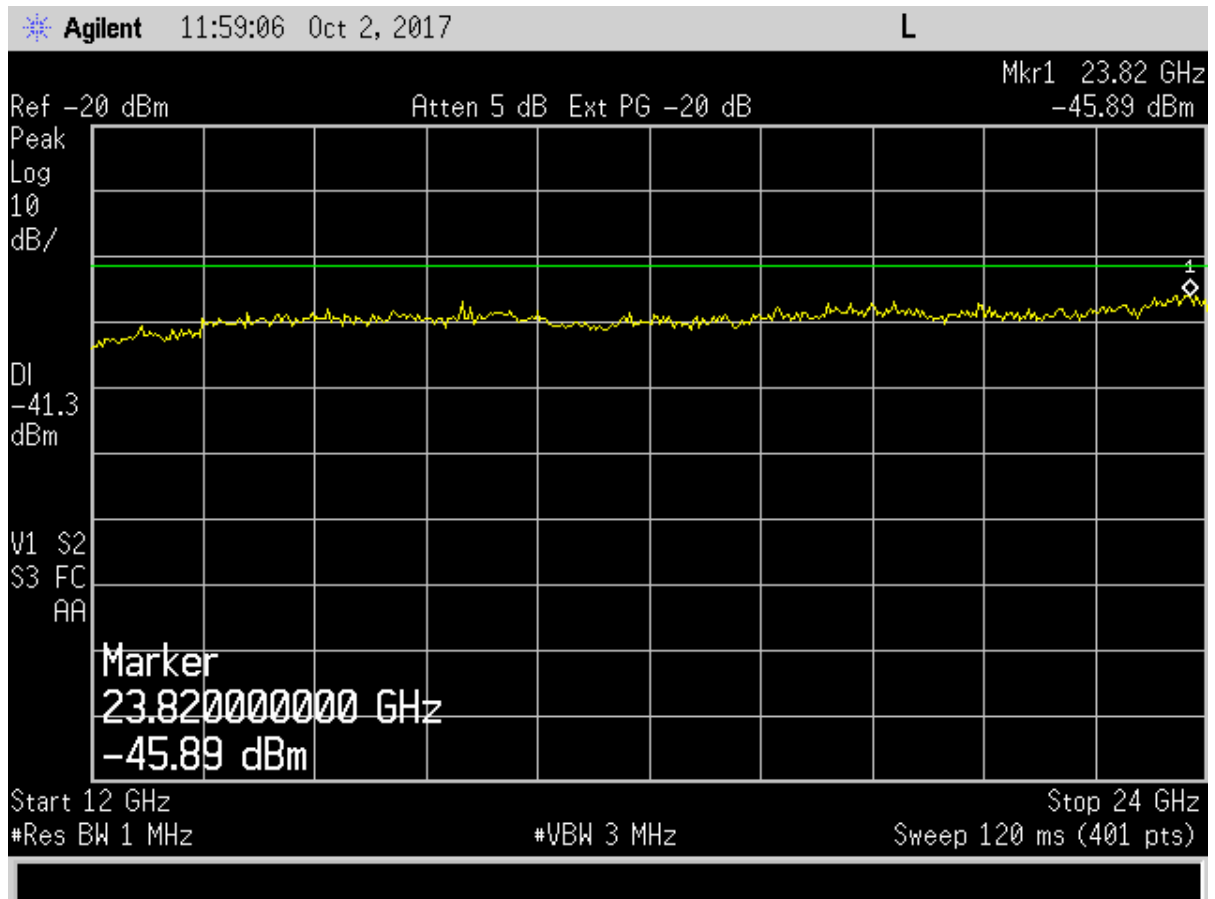


Figure 25. Antenna Conducted Spurious Emissions – g mode Low Channel 12000-24000 MHz

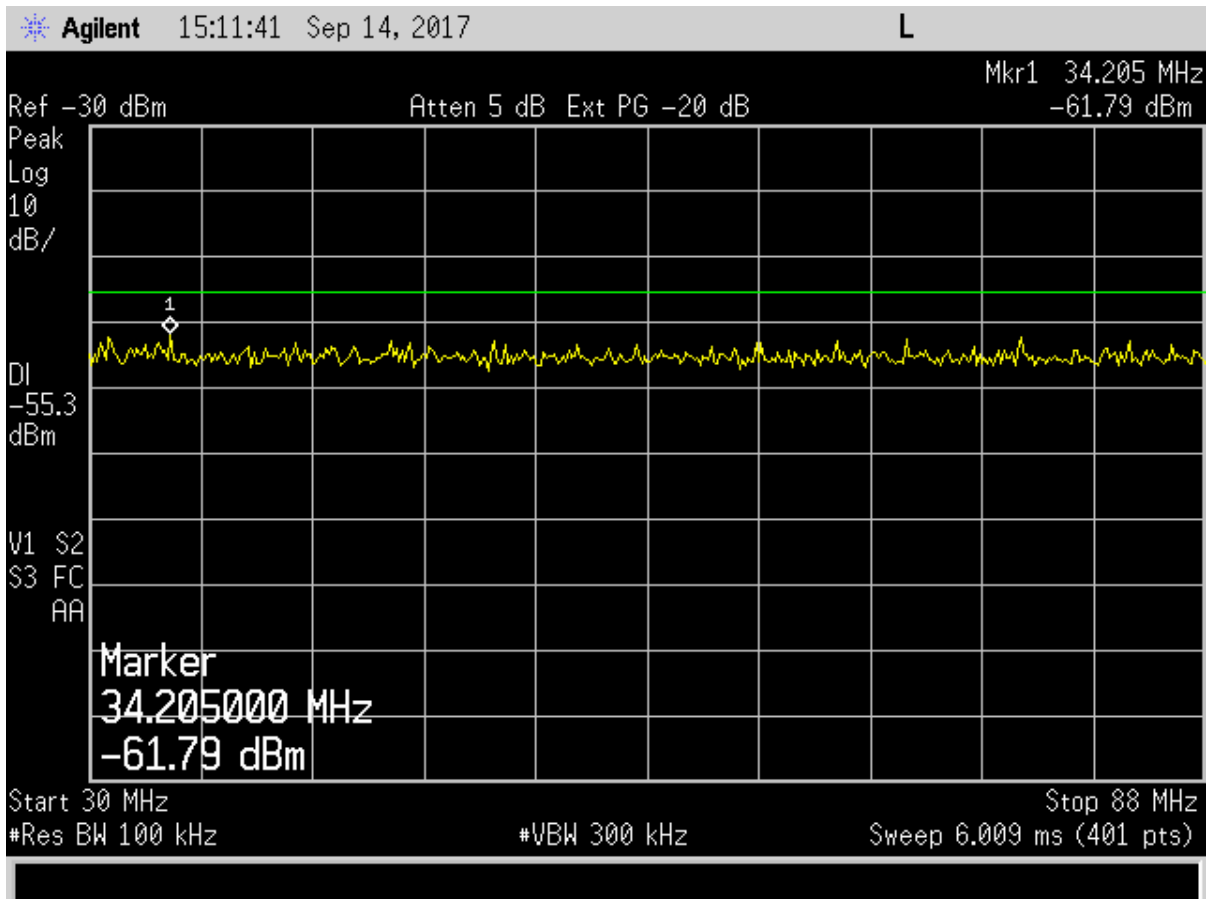


Figure 26. Antenna Conducted Spurious Emissions – g mode Mid Channel, 30-88 MHz

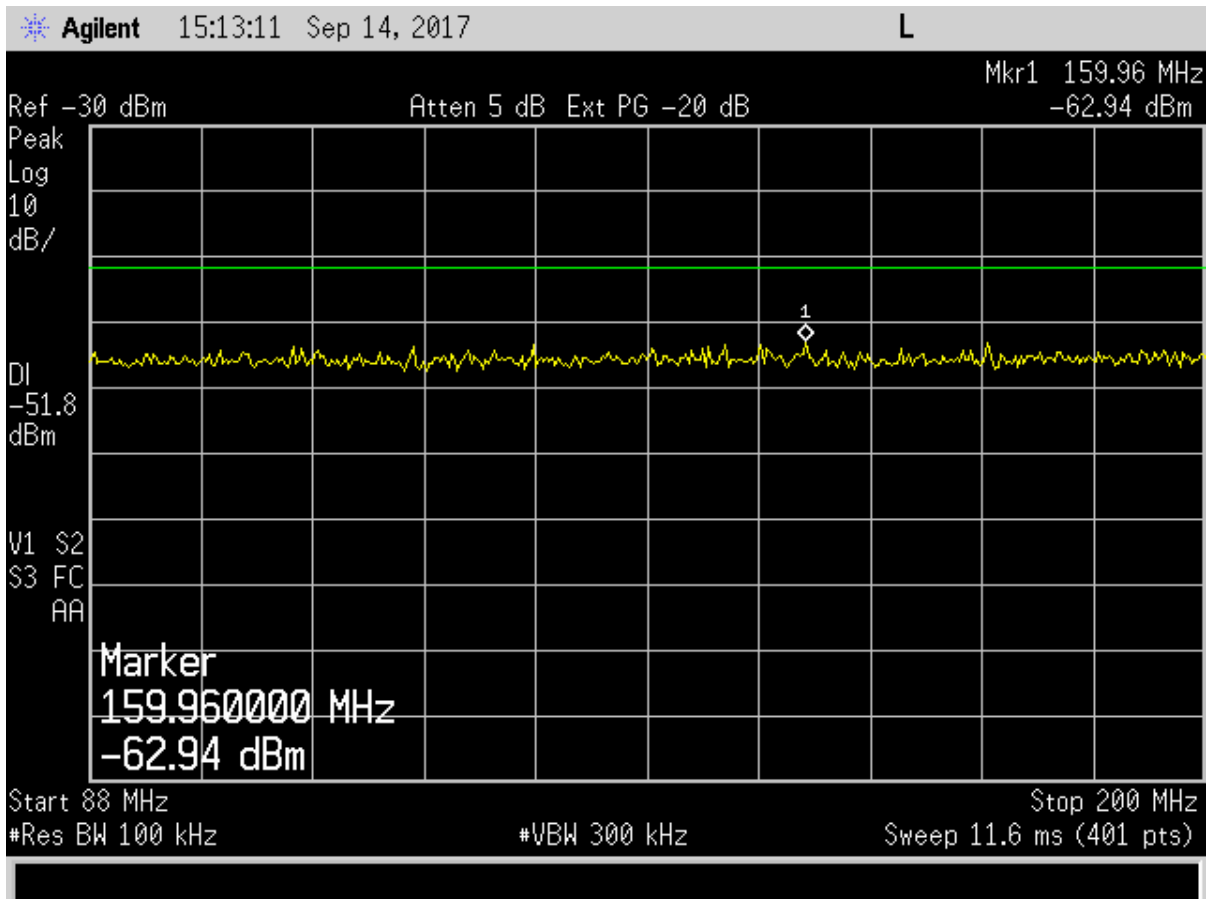


Figure 27. Antenna Conducted Spurious Emissions – g mode Mid Channel, 88-200 MHz

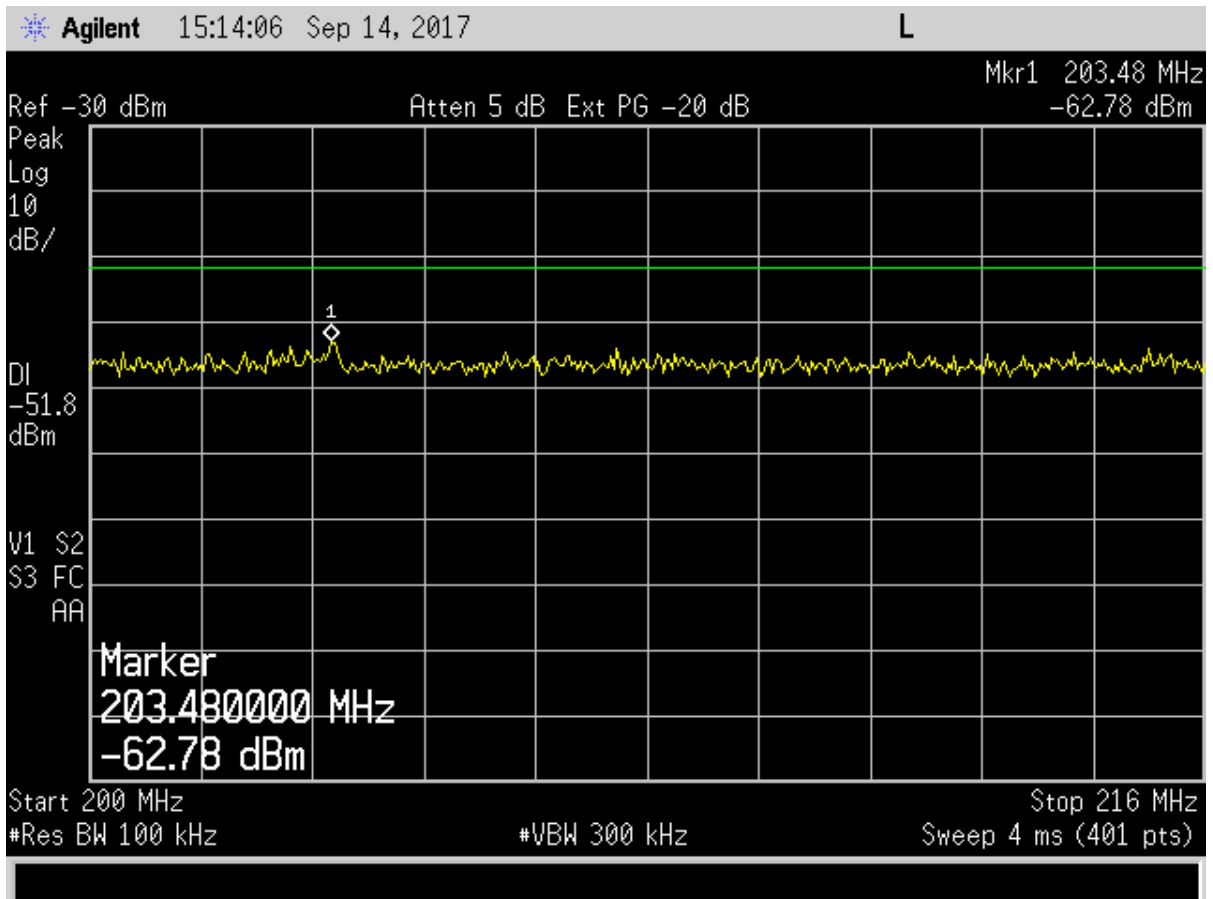


Figure 28. Antenna Conducted Spurious Emissions – g mode Mid Channel 200-216 MHz

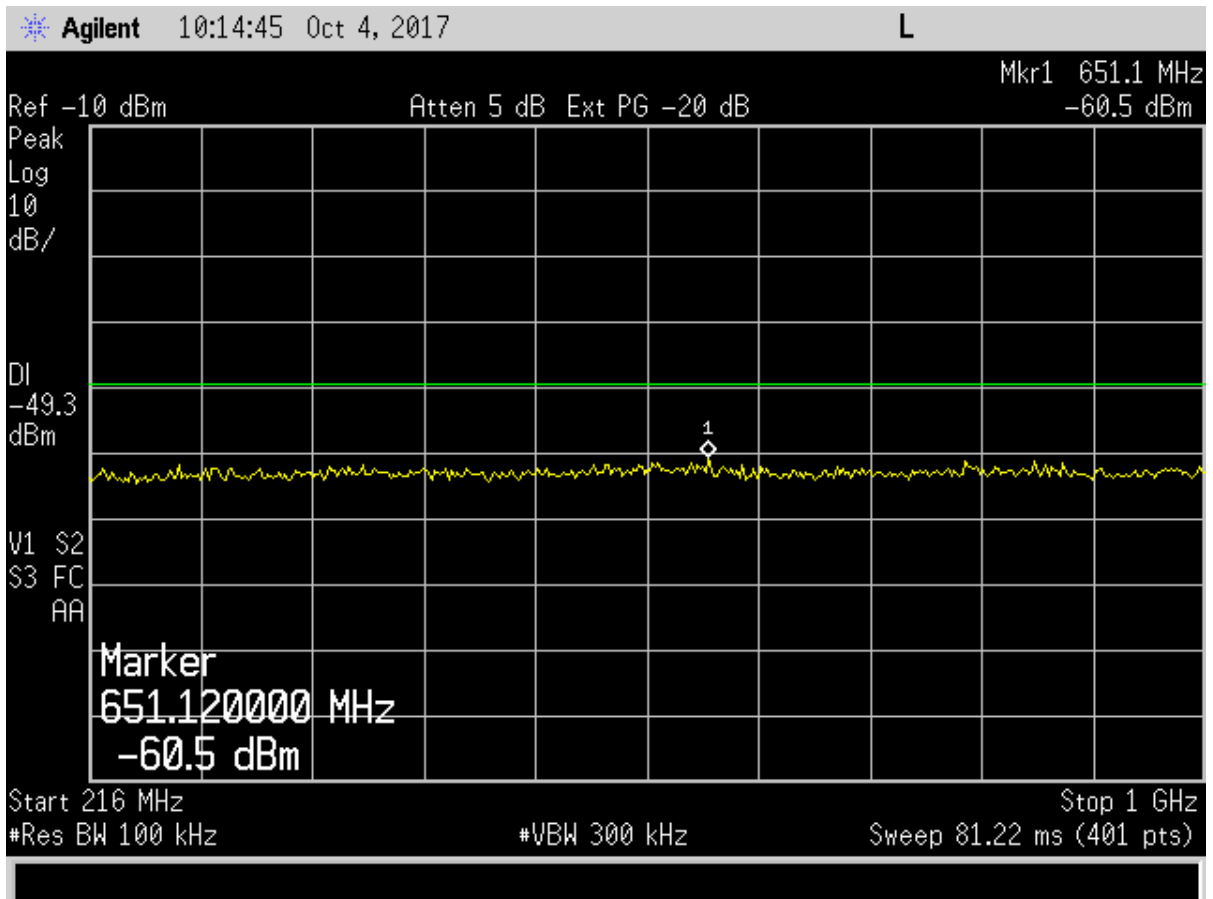


Figure 29. Antenna Conducted Spurious Emissions g mode Mid Channel 216-1000 MHz

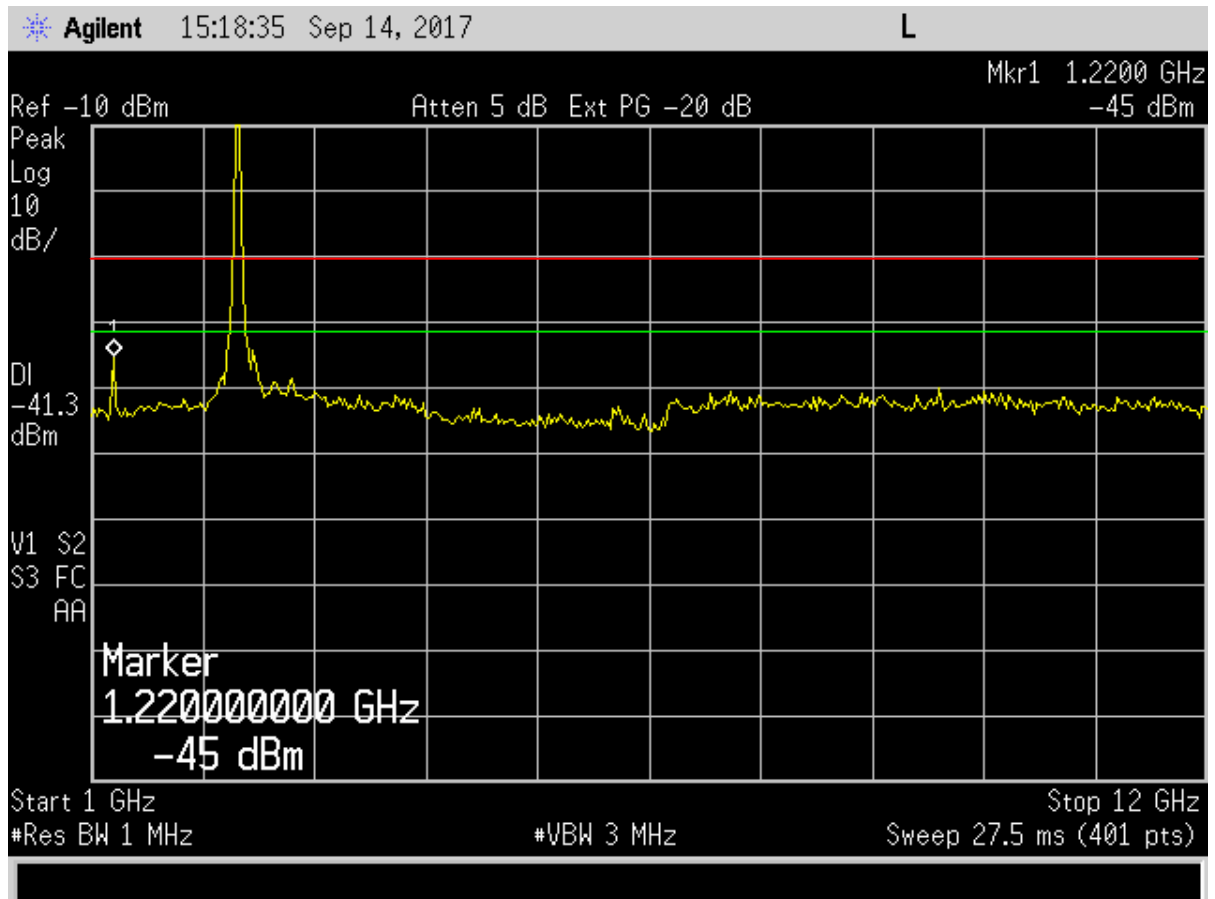


Figure 30. Antenna Conducted Spurious Emissions – g mode Mid Channel 1000-12000 MHz

Note: Large Signal shown is Fundamental Frequency
Note: RED line is limit line.

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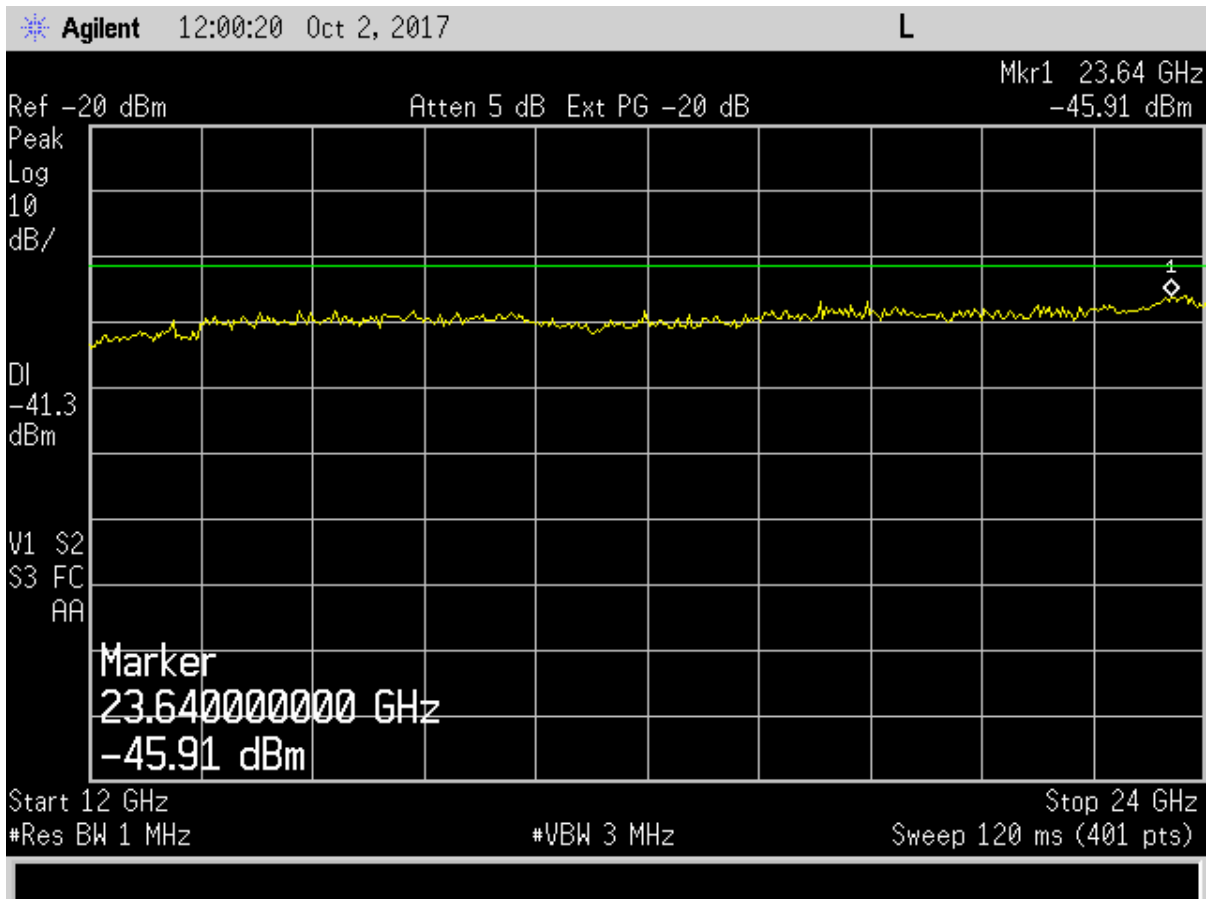


Figure 31. Antenna Conducted Spurious Emissions – g mode Mid Channel 12000-24000 MHz

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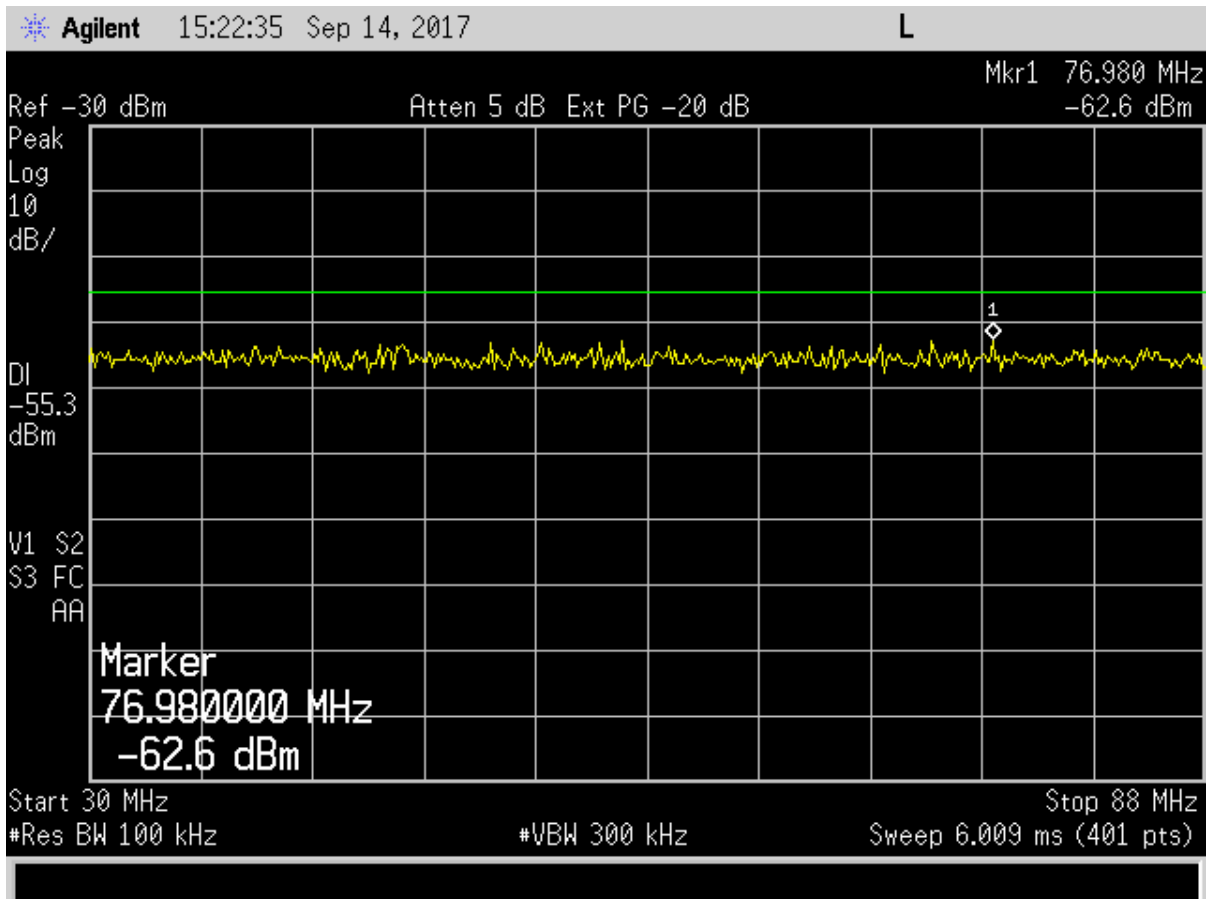


Figure 32. Antenna Conducted Spurious Emissions – g mode High Channel, 30-88 MHz

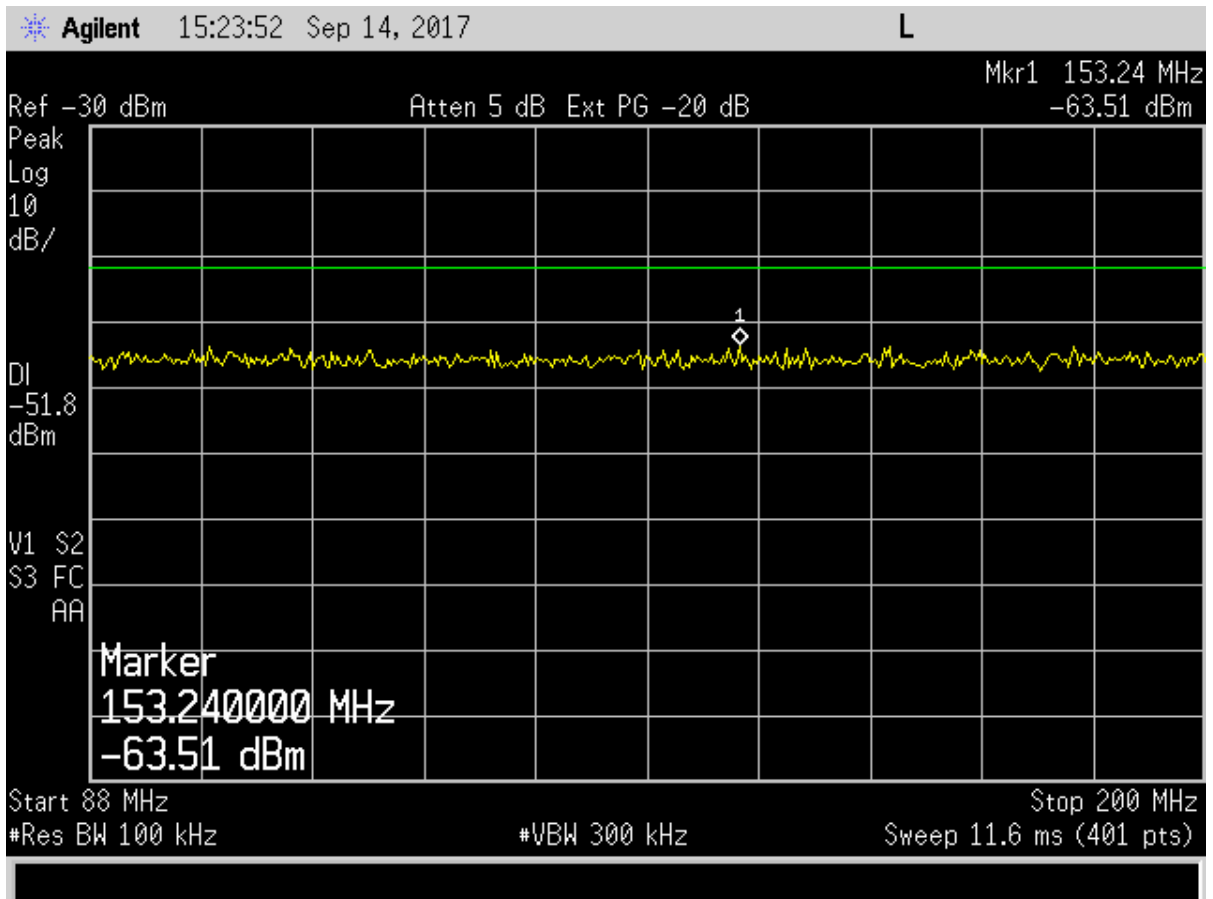


Figure 33. Antenna Conducted Spurious Emissions – g mode High Channel, 88-200 MHz

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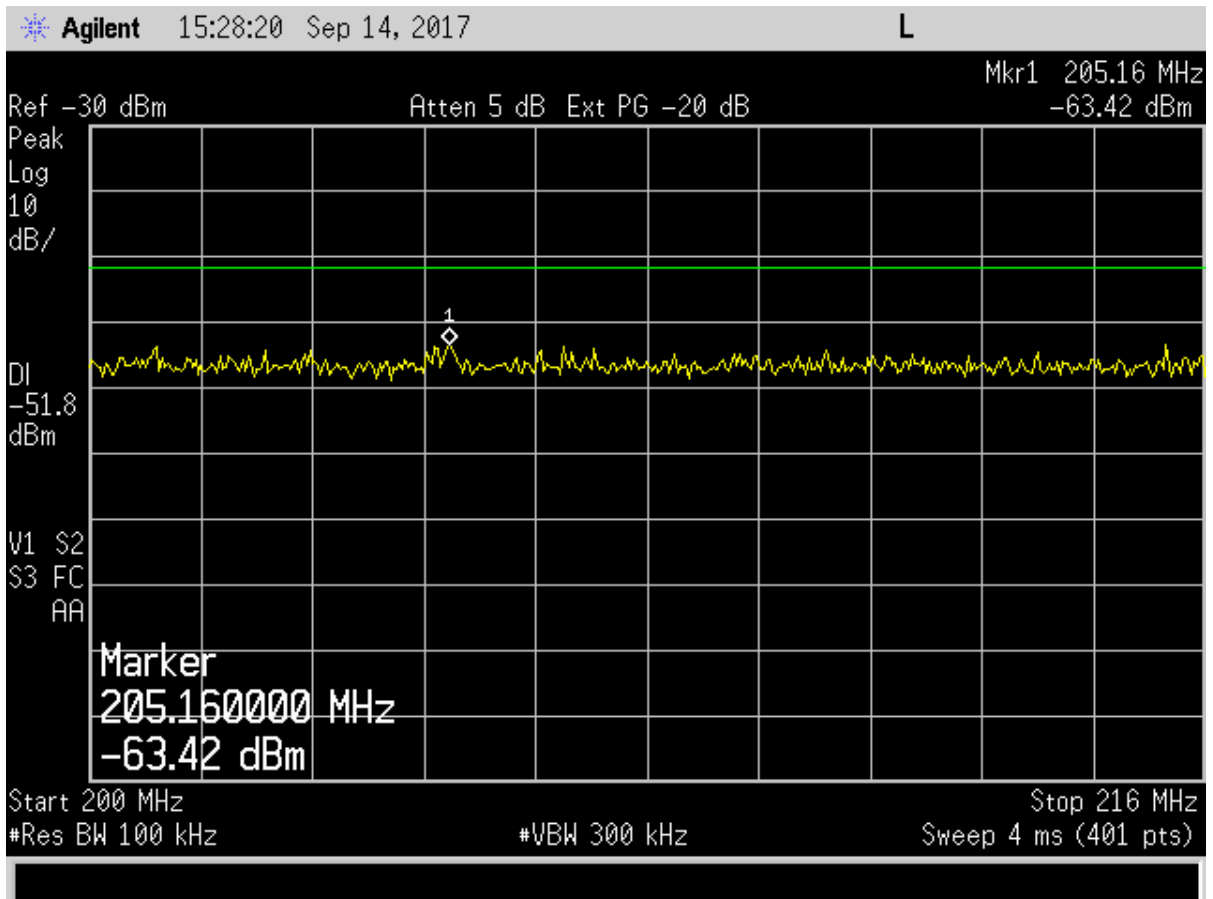


Figure 34. Antenna Conducted Spurious Emissions – g mode High Channel 200-216 MHz

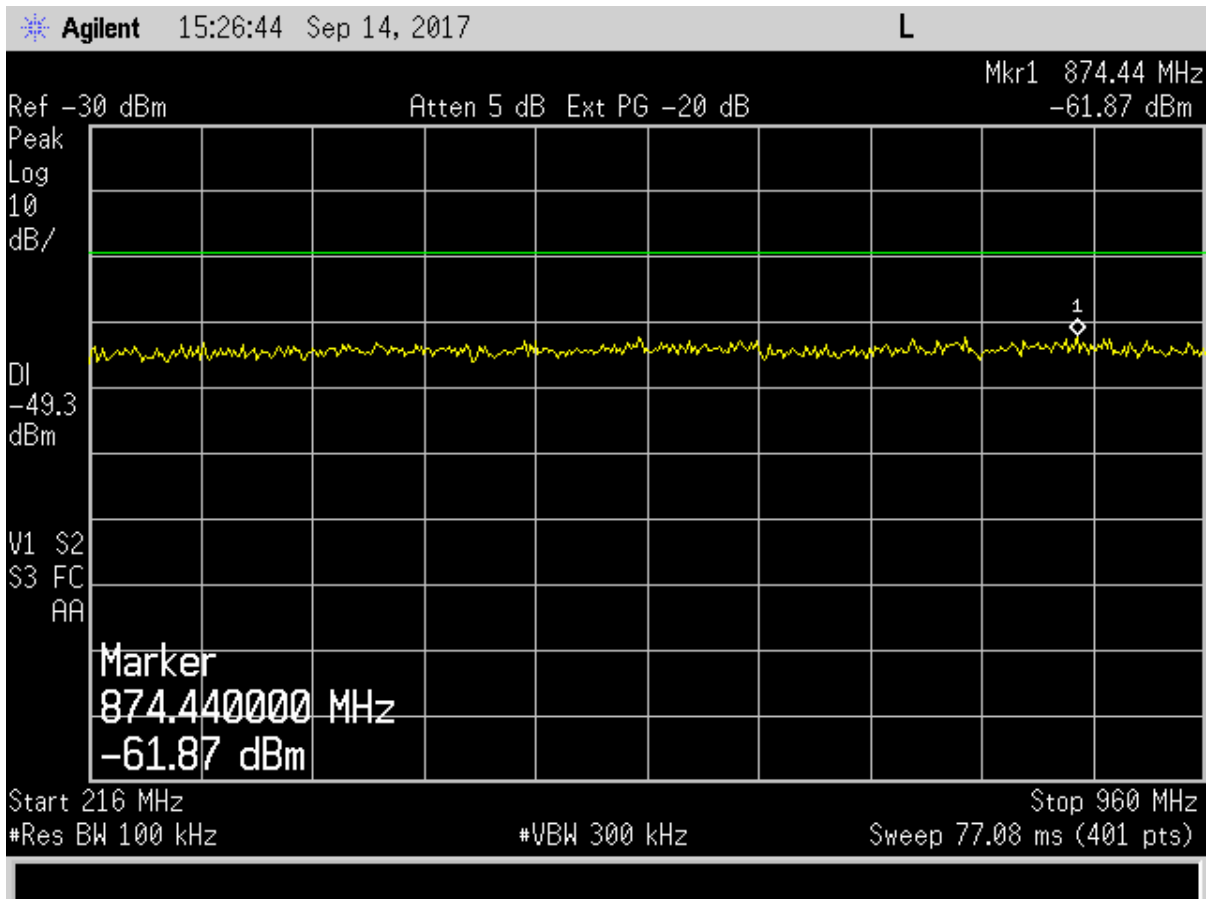


Figure 35. Antenna Conducted Spurious Emissions g mode High Channel 216-1000 MHz

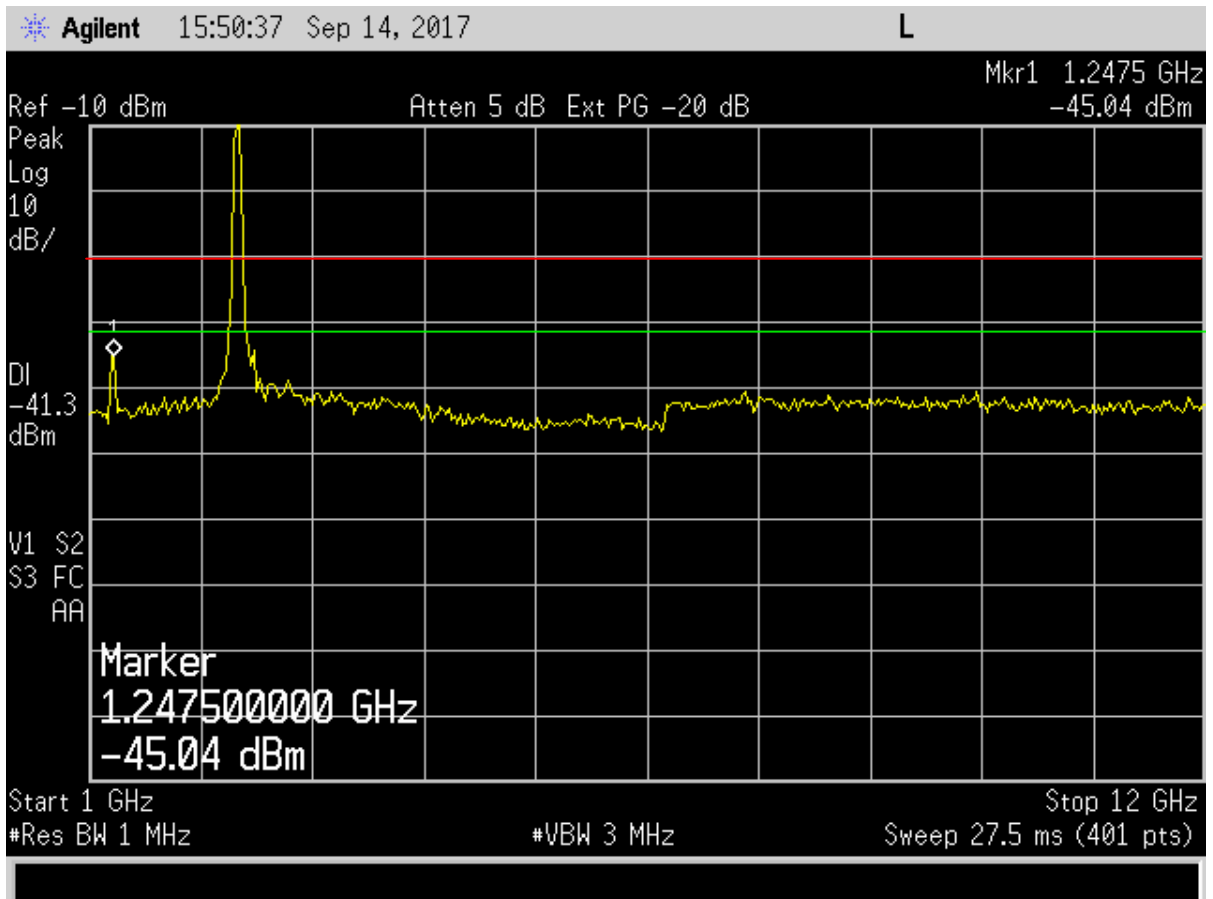


Figure 36. Antenna Conducted Spurious Emissions – g mode High Channel 1000-12000 MHz

Note: Large Signal shown is Fundamental Frequency
Note: RED line is limit line.

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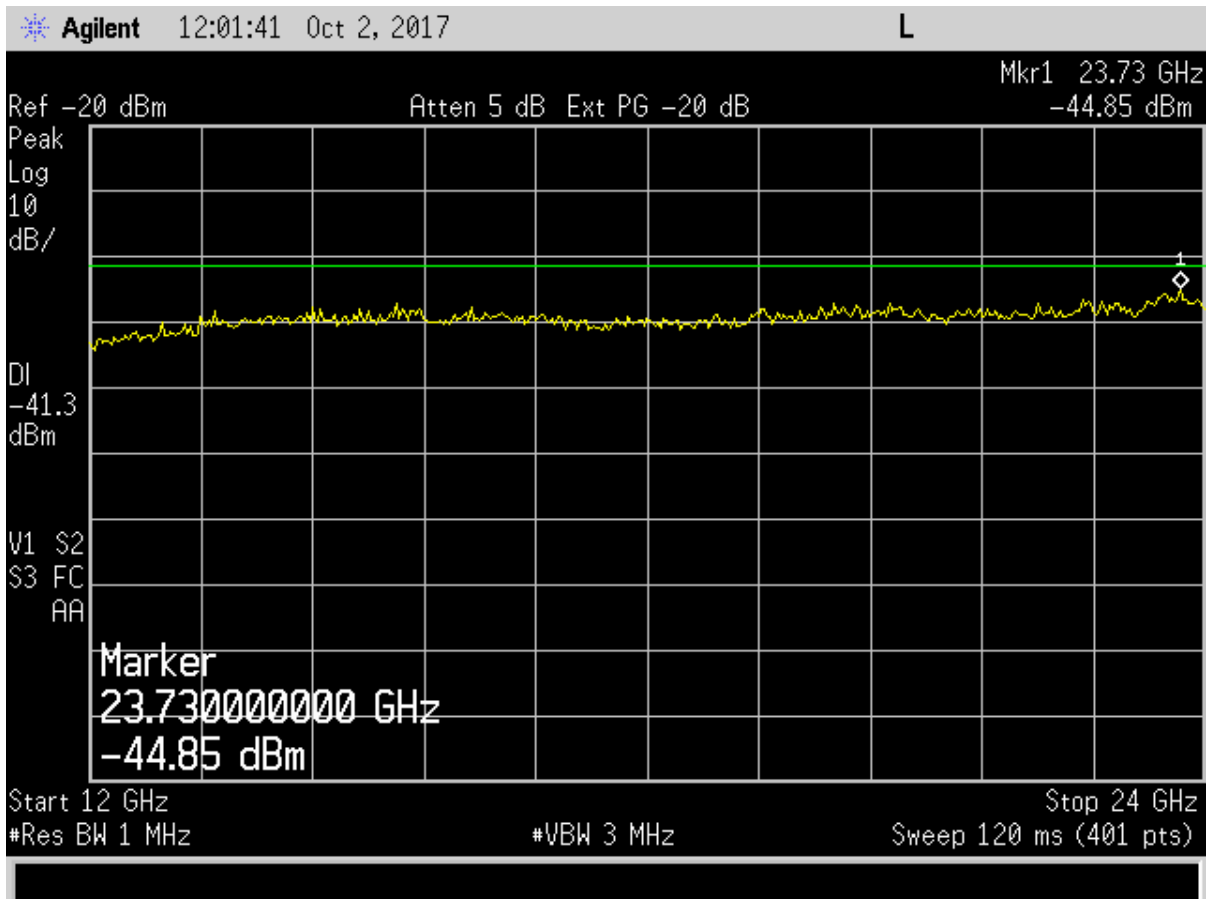


Figure 37. Antenna Conducted Spurious Emissions – g mode High Channel 12000-24000 MHz

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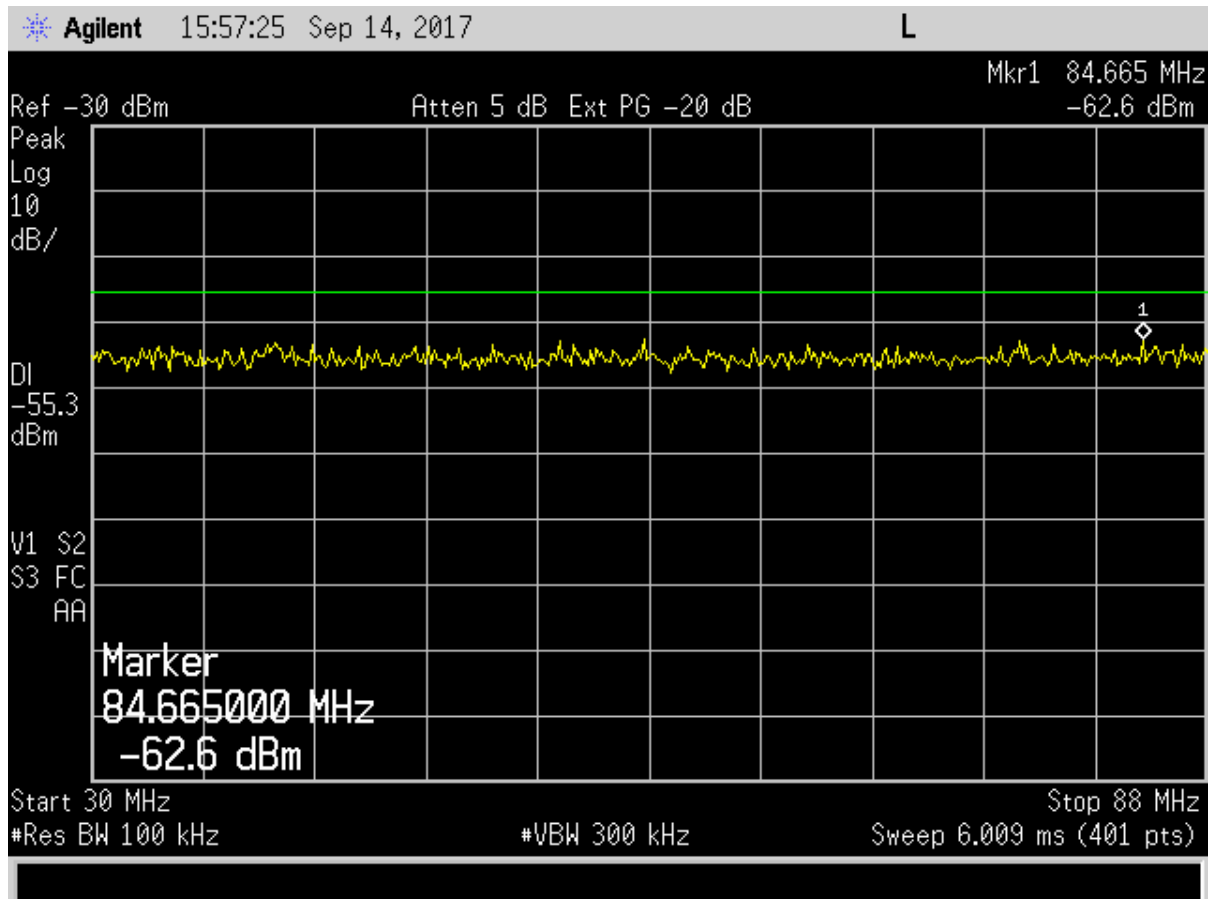


Figure 38. Antenna Conducted Spurious Emissions – n mode Low Channel, 30-88 MHz

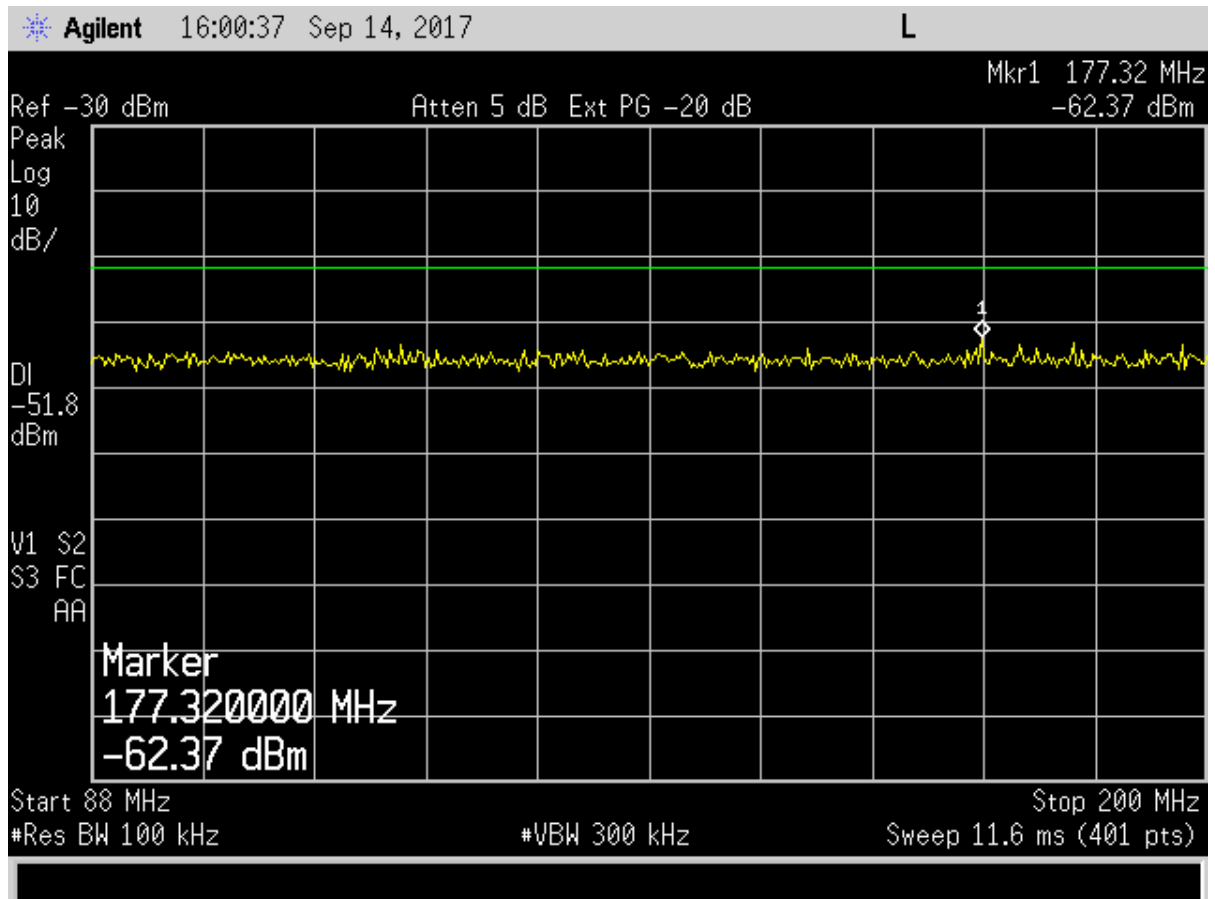


Figure 39. Antenna Conducted Spurious Emissions – n mode Low Channel, 88-200 MHz

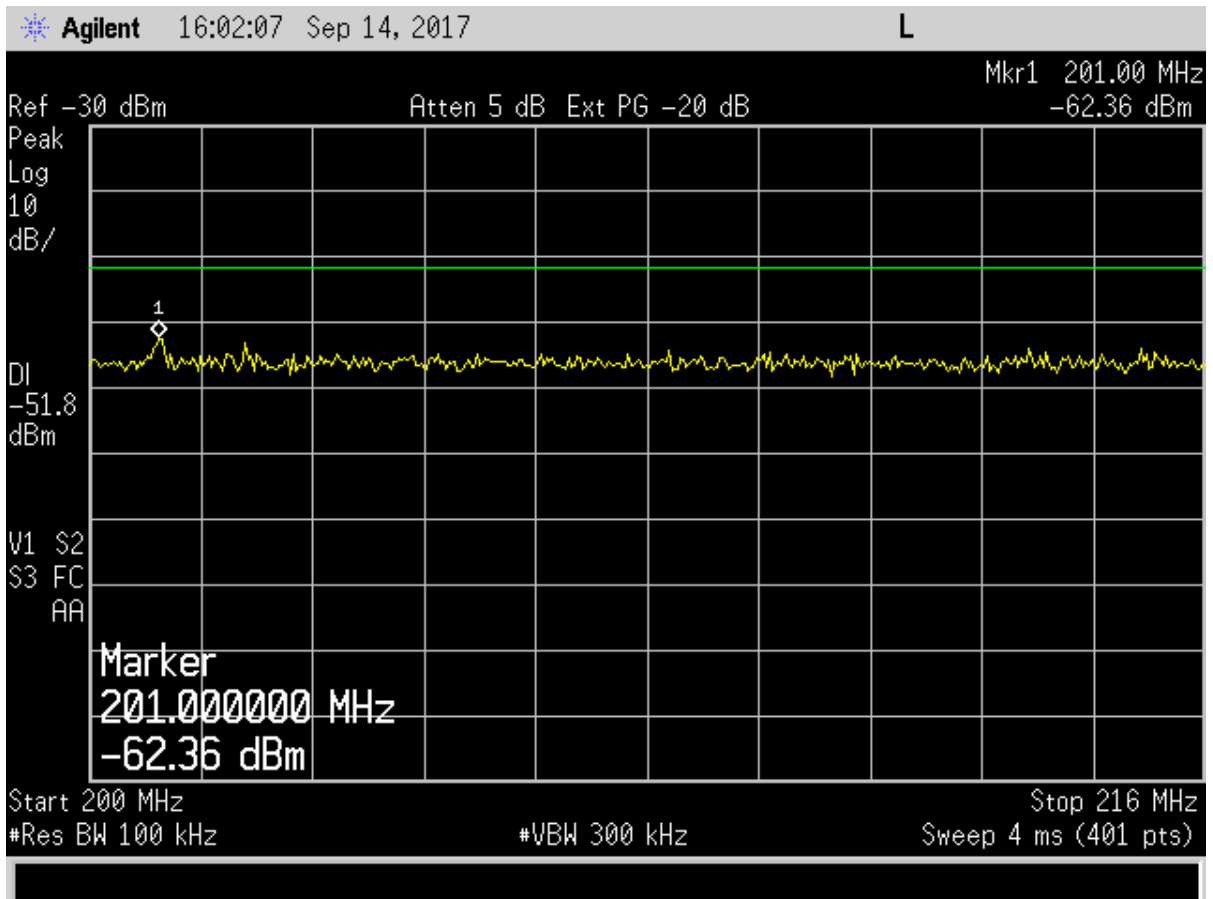


Figure 40. Antenna Conducted Spurious Emissions – n mode Low Channel 200-216 MHz

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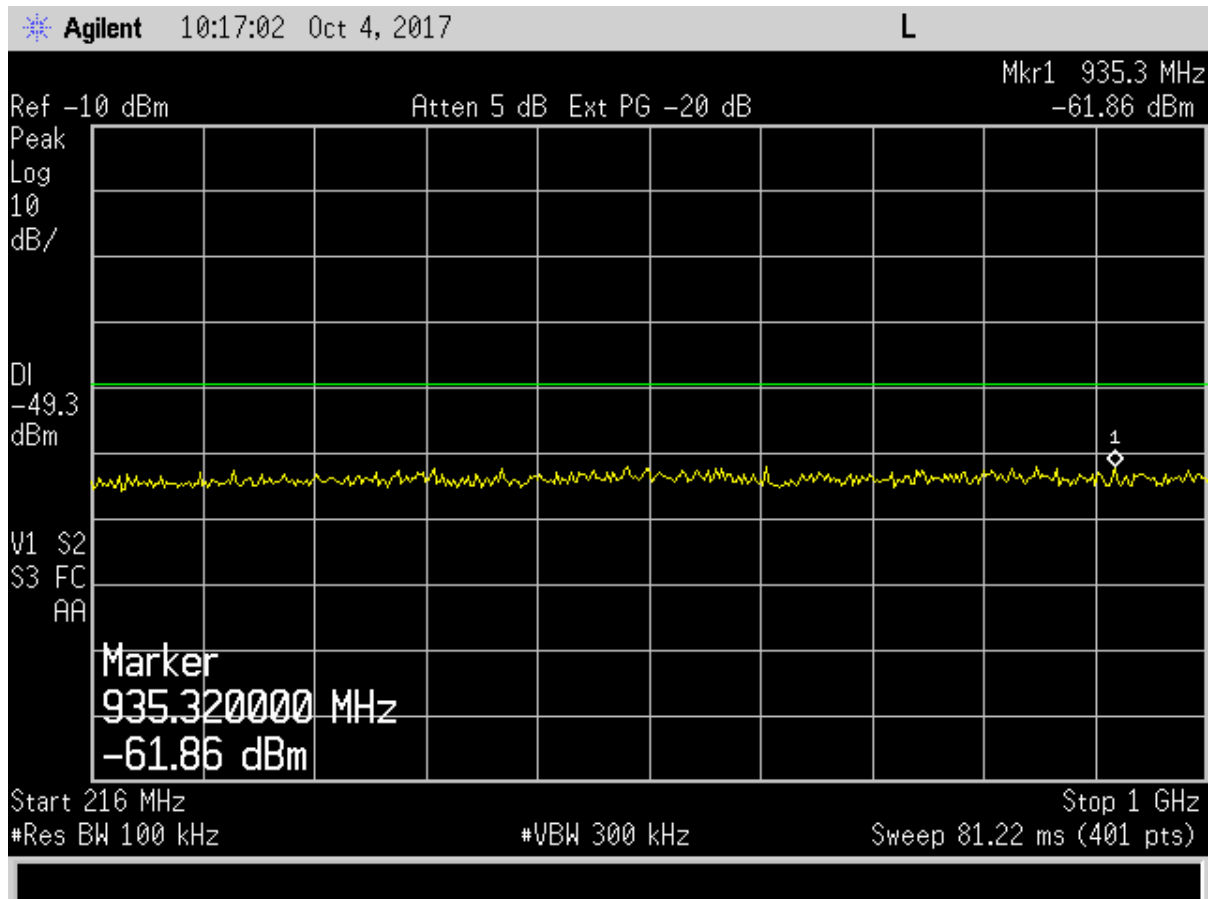


Figure 41. Antenna Conducted Spurious Emissions - n mode Low Channel 216-1000 MHz

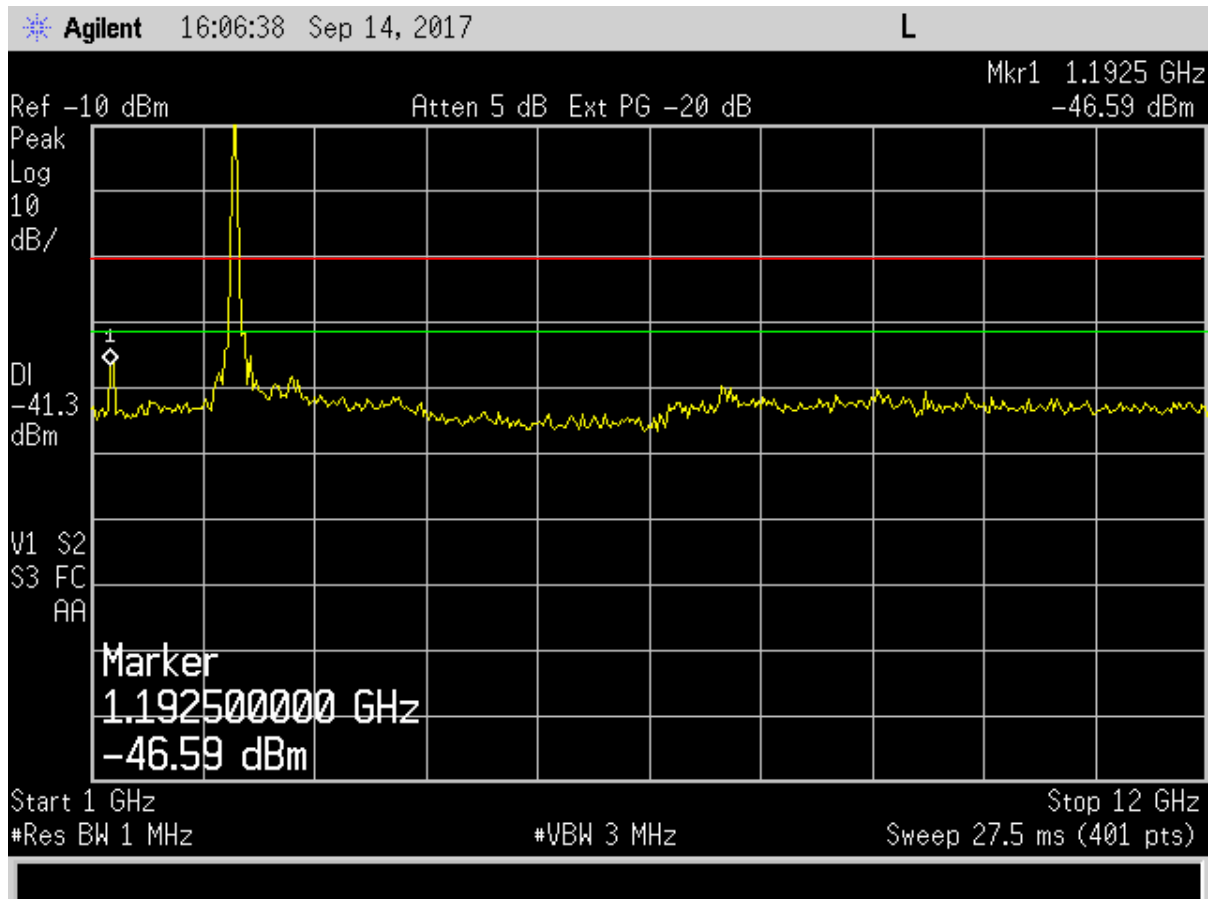


Figure 42. Antenna Conducted Spurious Emissions – n mode Low Channel 1000-12000 MHz

Note: Large Signal shown is Fundamental Frequency
Note: RED line is limit line.

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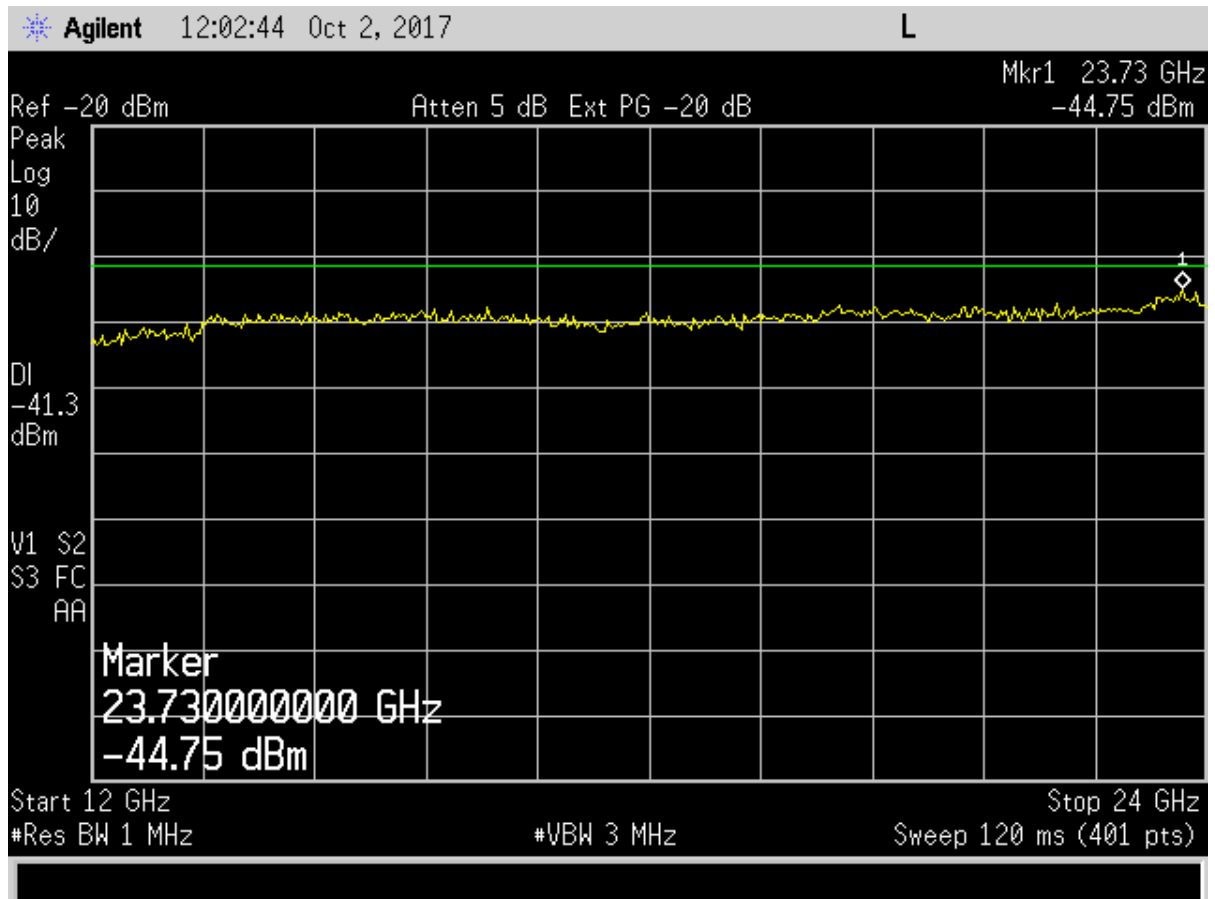


Figure 43. Antenna Conducted Spurious Emissions – n mode Low Channel 12000-24000 MHz

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ISM43903

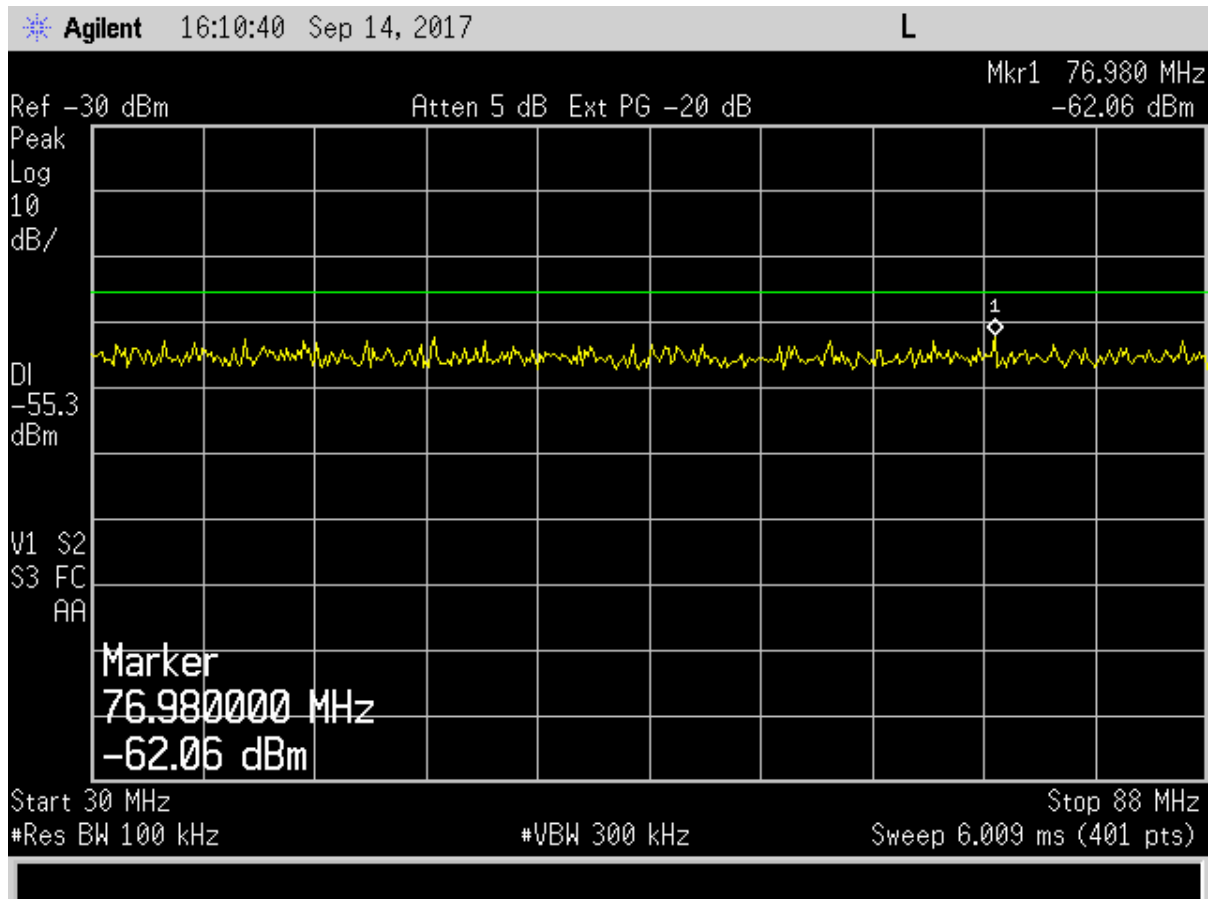


Figure 44. Antenna Conducted Spurious Emissions – n mode Mid Channel, 30-88 MHz

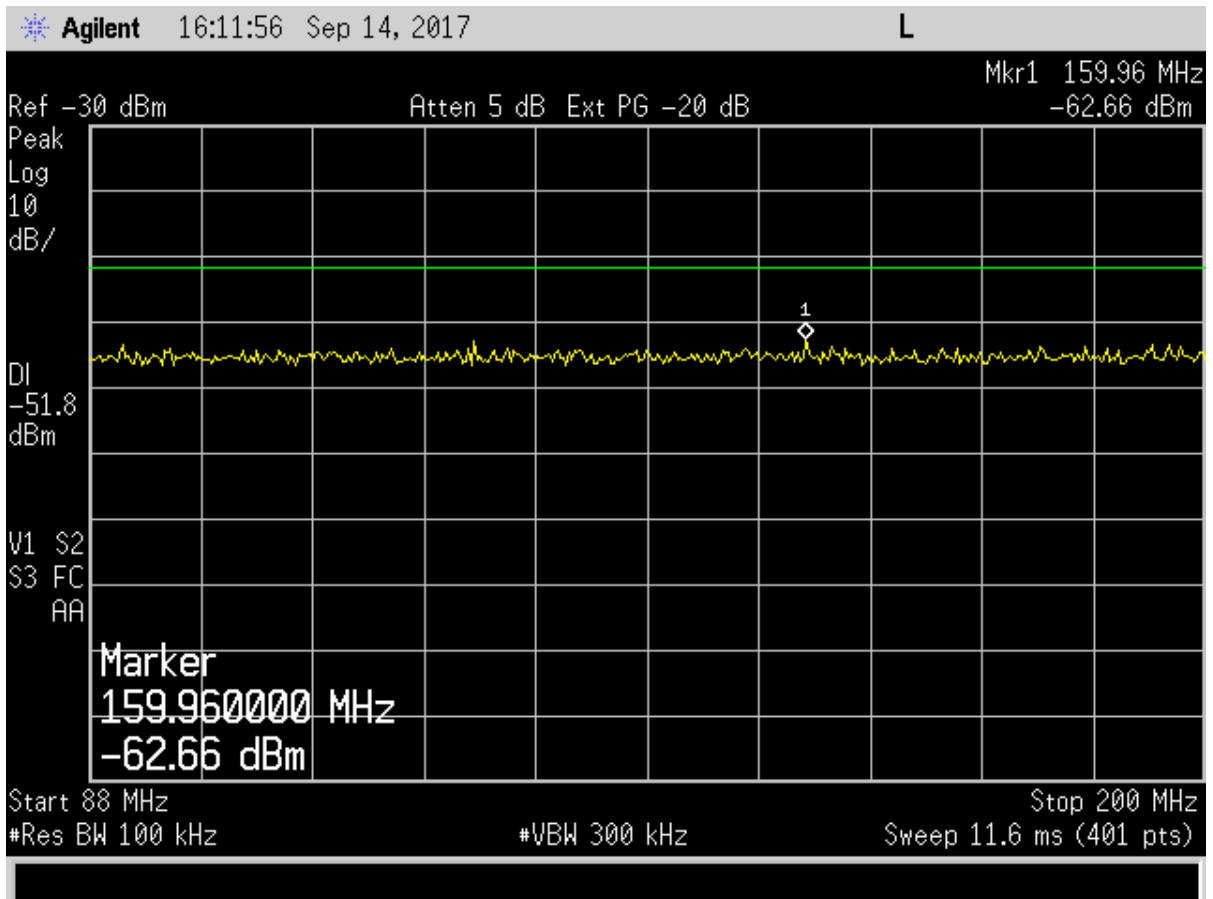


Figure 45. Antenna Conducted Spurious Emissions – n mode Mid Channel, 88-200 MHz

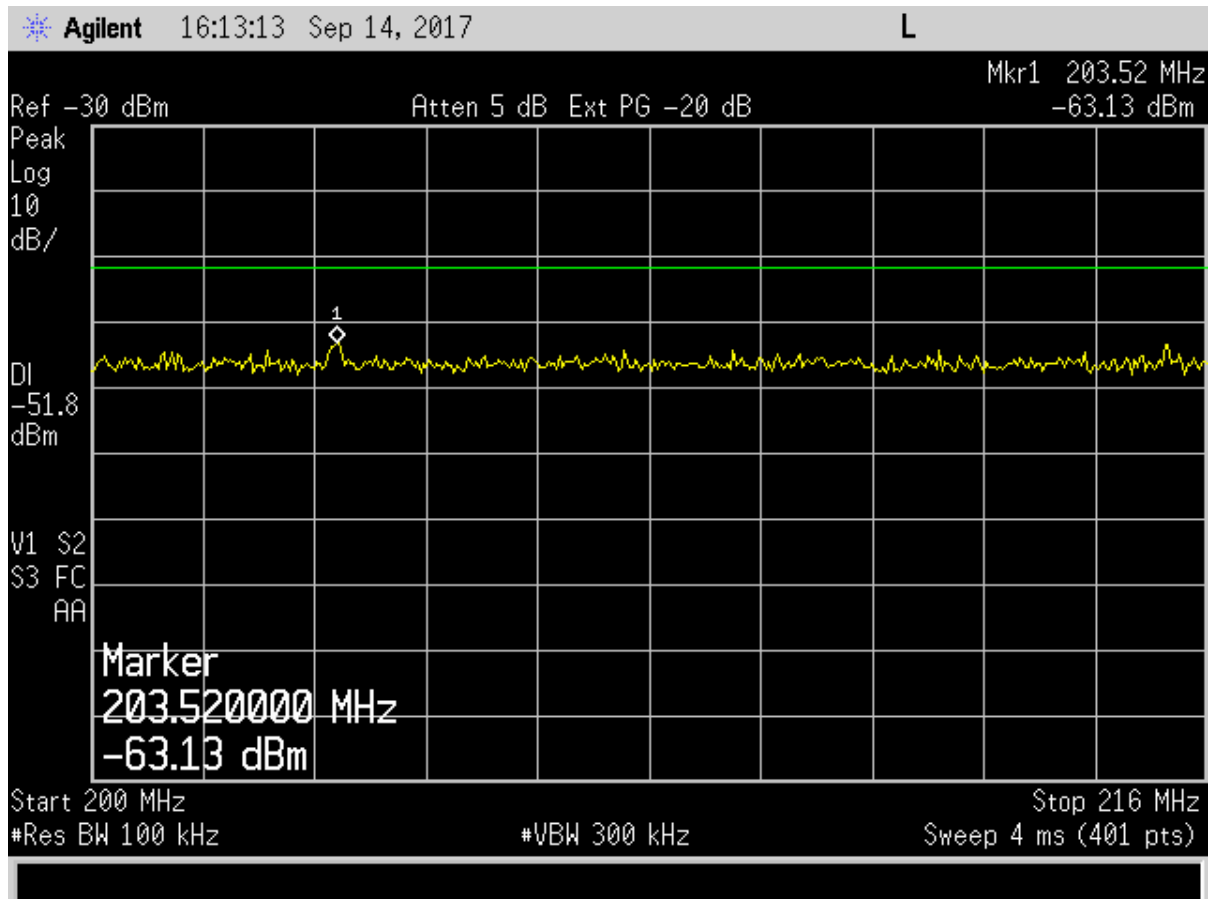


Figure 46. Antenna Conducted Spurious Emissions – n mode Mid Channel 200-216 MHz

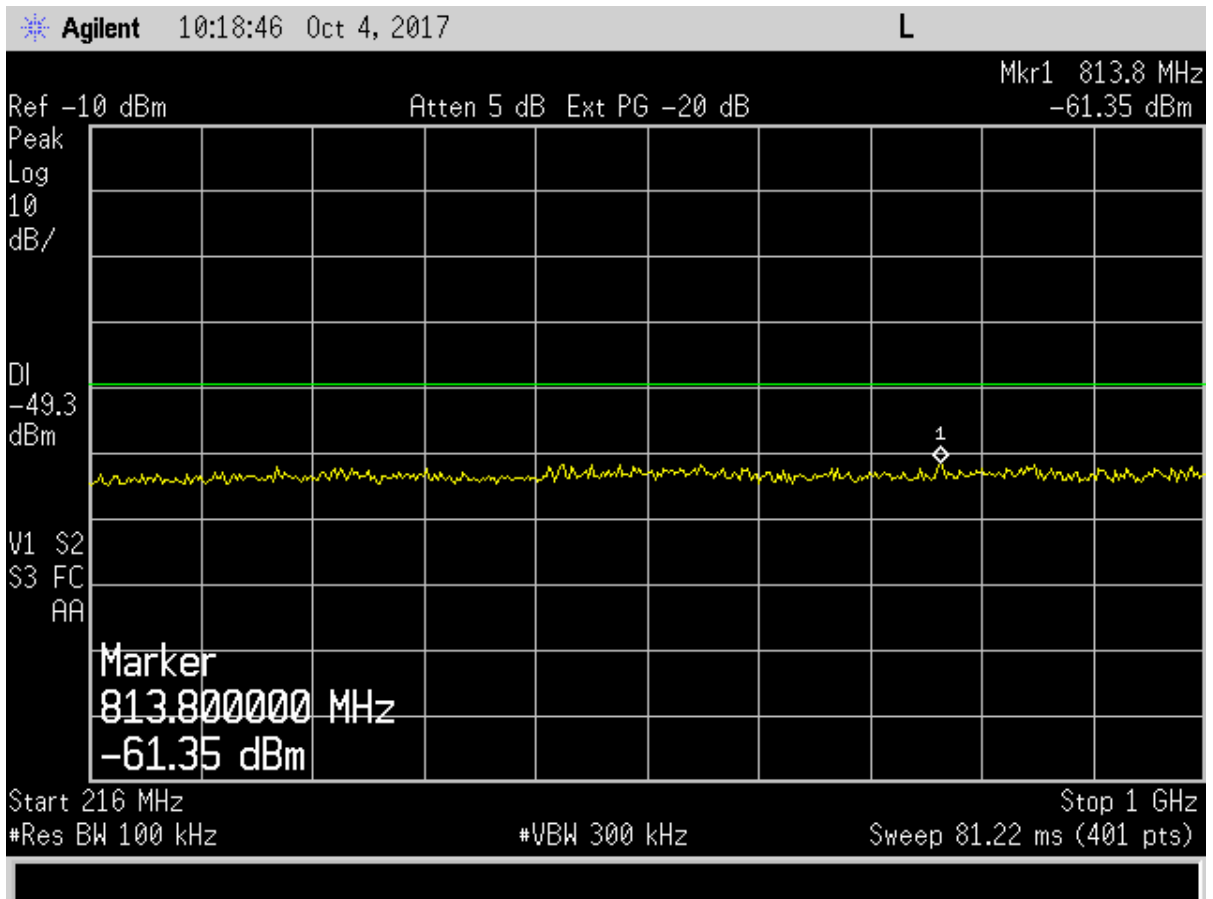


Figure 47. Antenna Conducted Spurious Emissions - n mode Mid Channel 216-1000 MHz

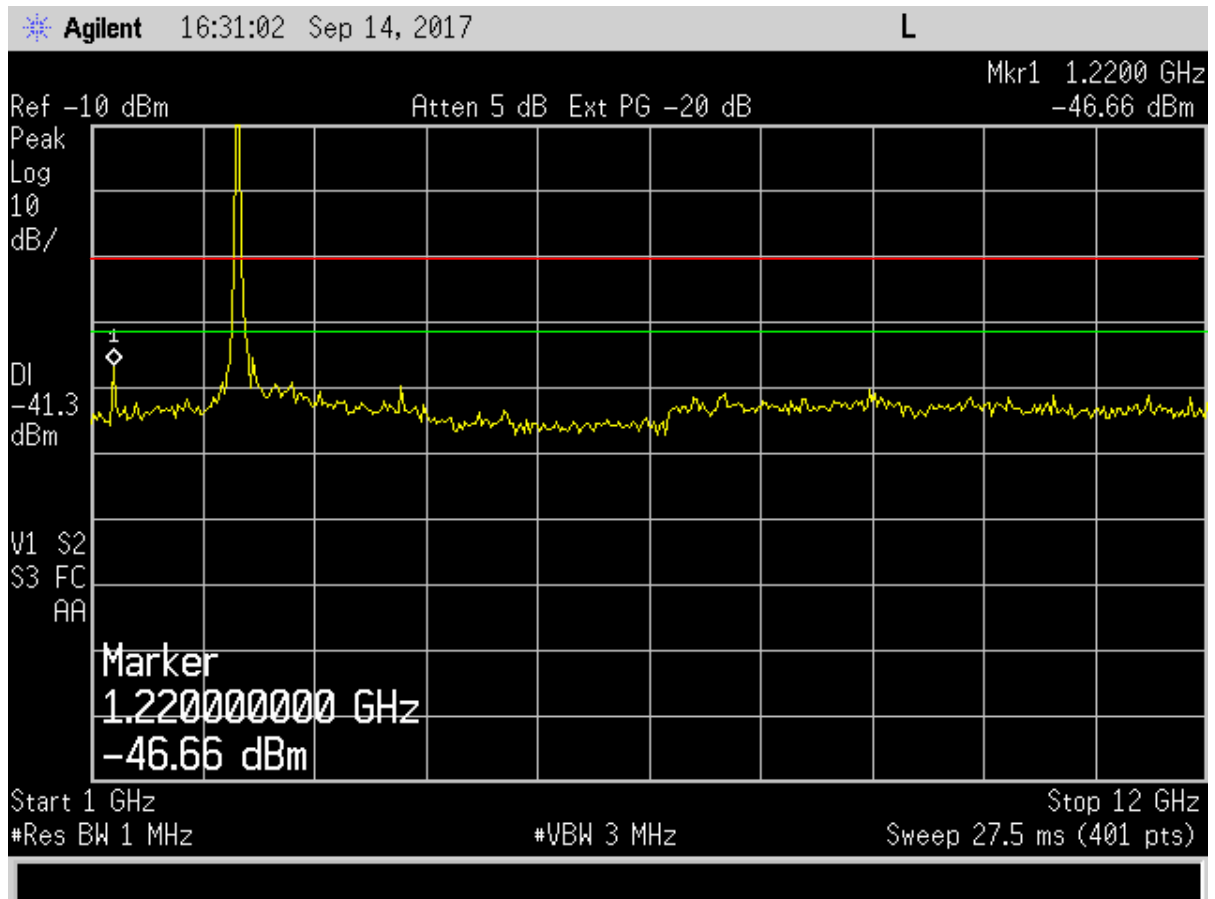


Figure 48. Antenna Conducted Spurious Emissions – n mode Mid Channel 1000-12000 MHz

Note: Large Signal shown is Fundamental Frequency
Note: RED line is limit line

US Tech Test Report:
FCC ID:
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Customer:
Model:

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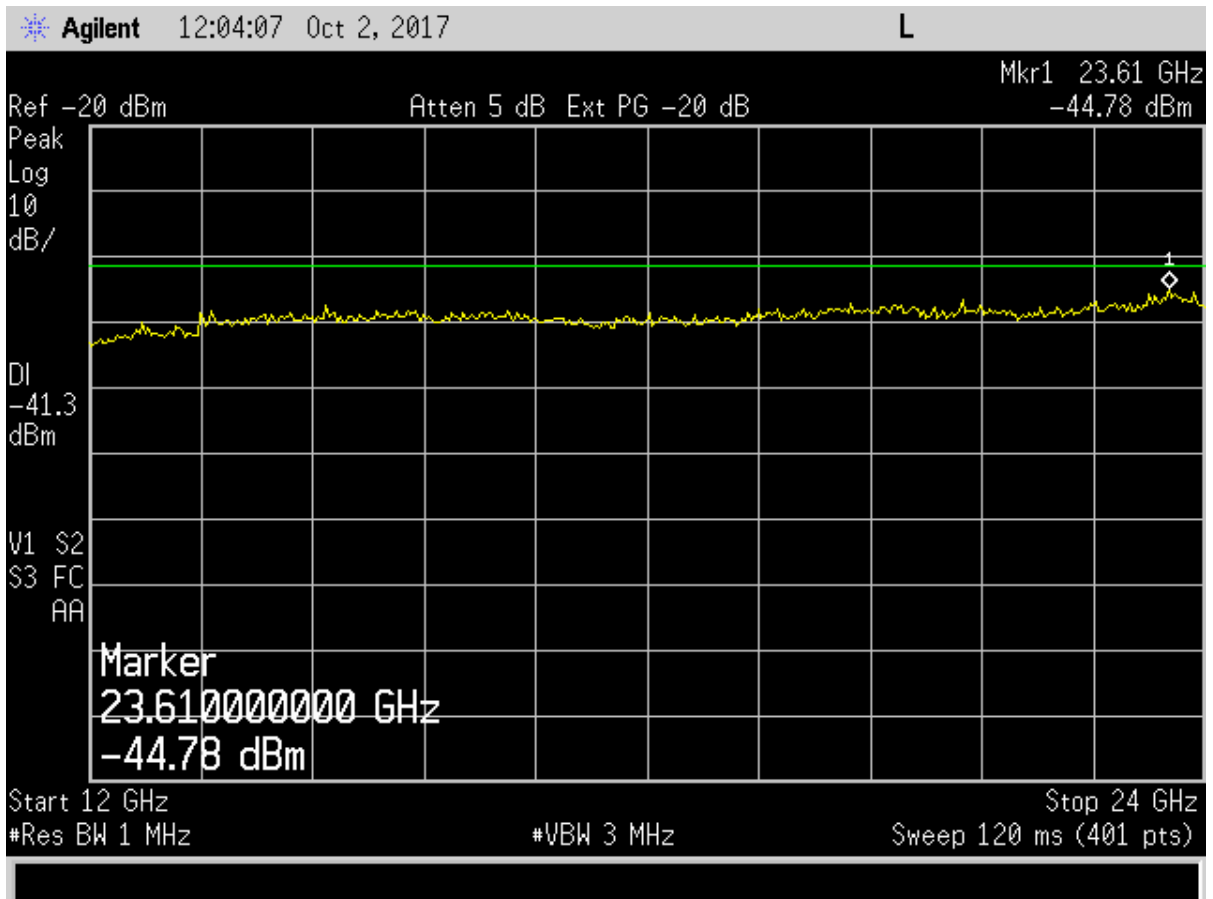


Figure 49. Antenna Conducted Spurious Emissions – n mode Mid Channel 12000-24000 MHz

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

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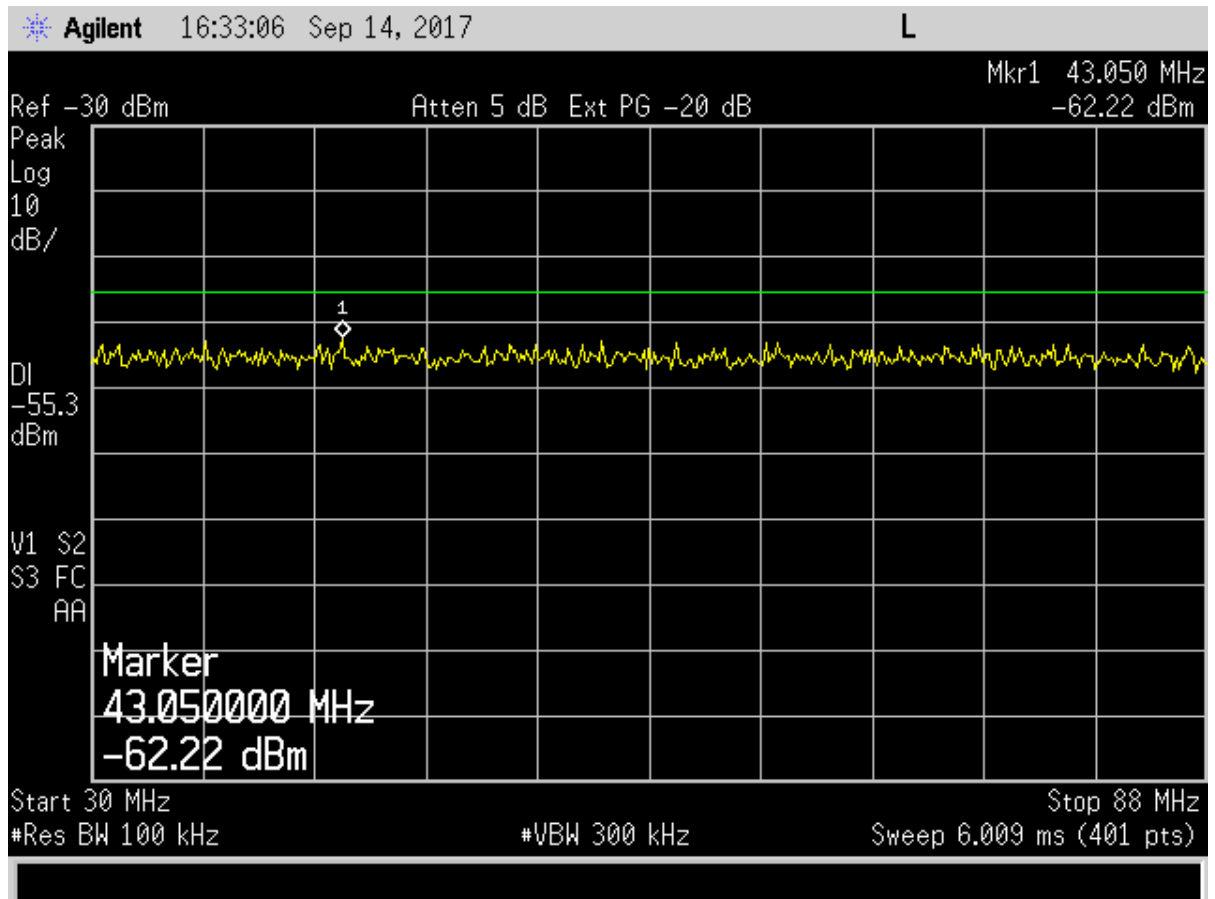


Figure 50. Antenna Conducted Spurious Emissions – n mode High Channel, 30-88 MHz

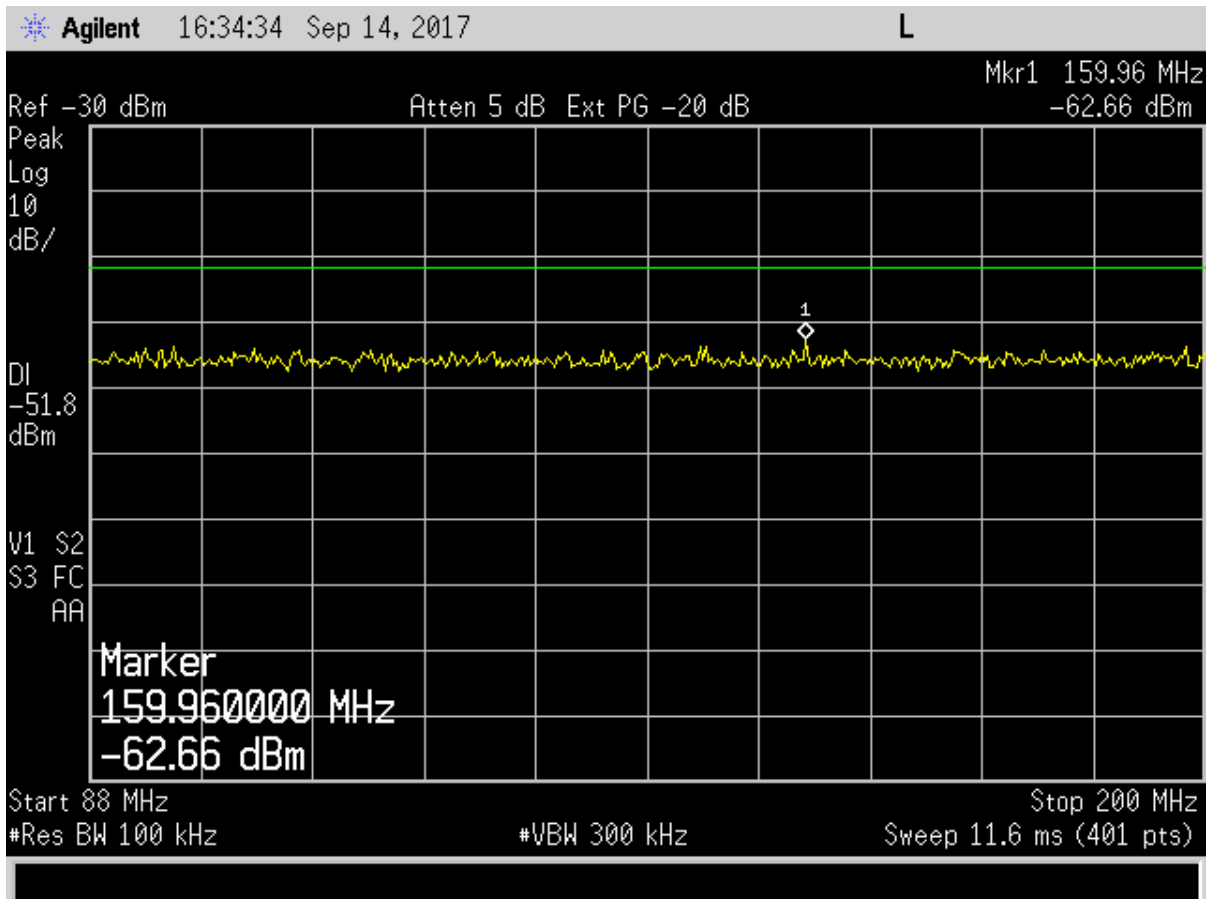


Figure 51. Antenna Conducted Spurious Emissions – n mode High Channel, 88-200 MHz

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

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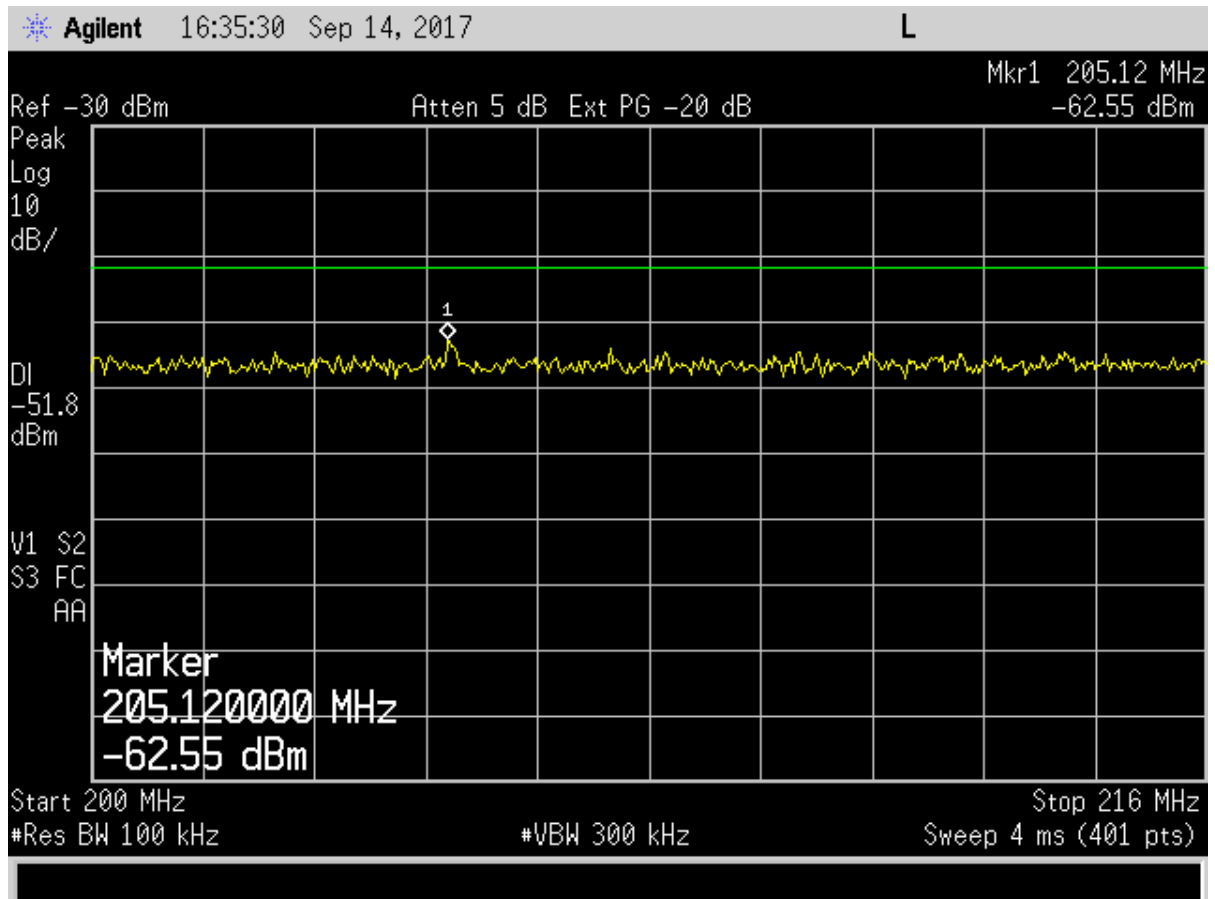


Figure 52. Antenna Conducted Spurious Emissions – n mode High Channel 200-216 MHz

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

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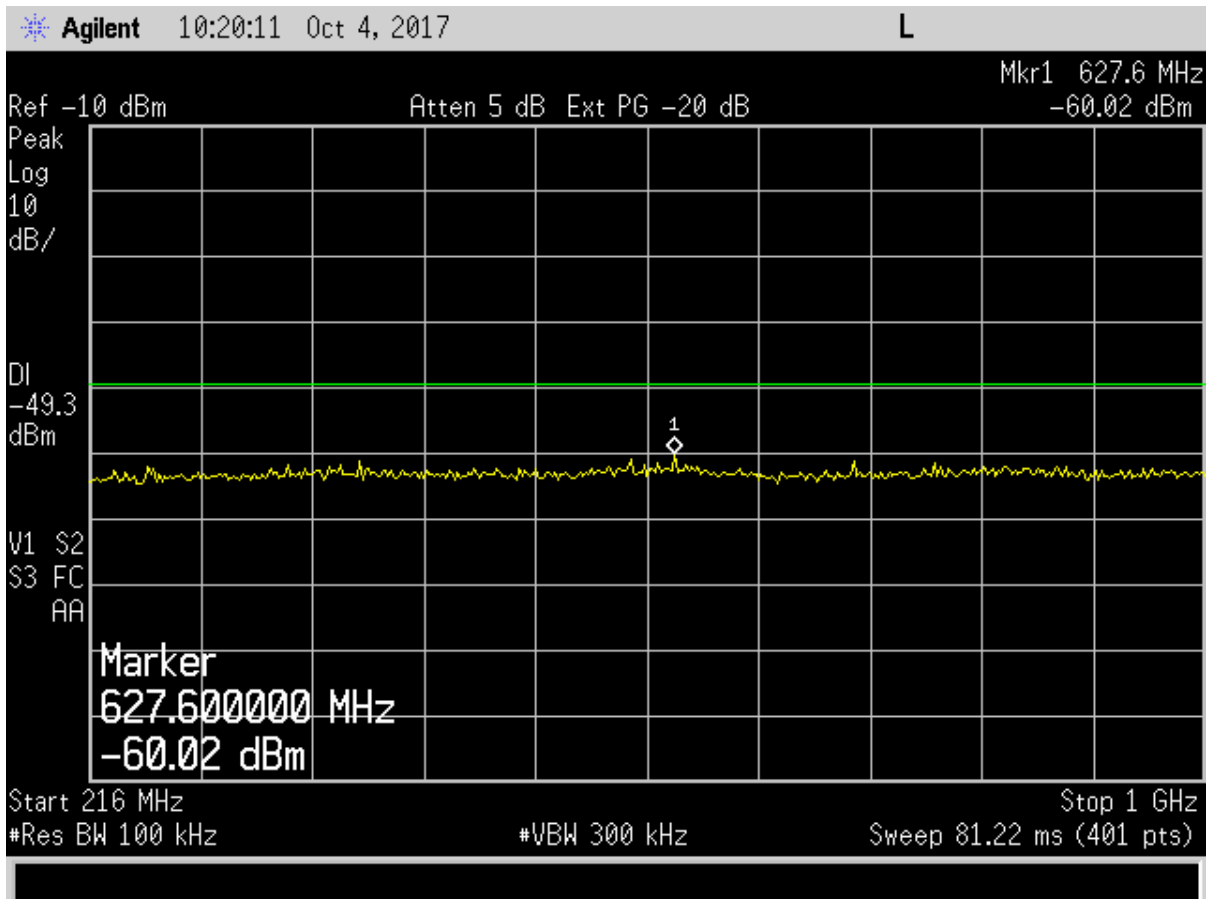


Figure 53. Antenna Conducted Spurious Emissions - n mode High Channel 216-1000 MHz

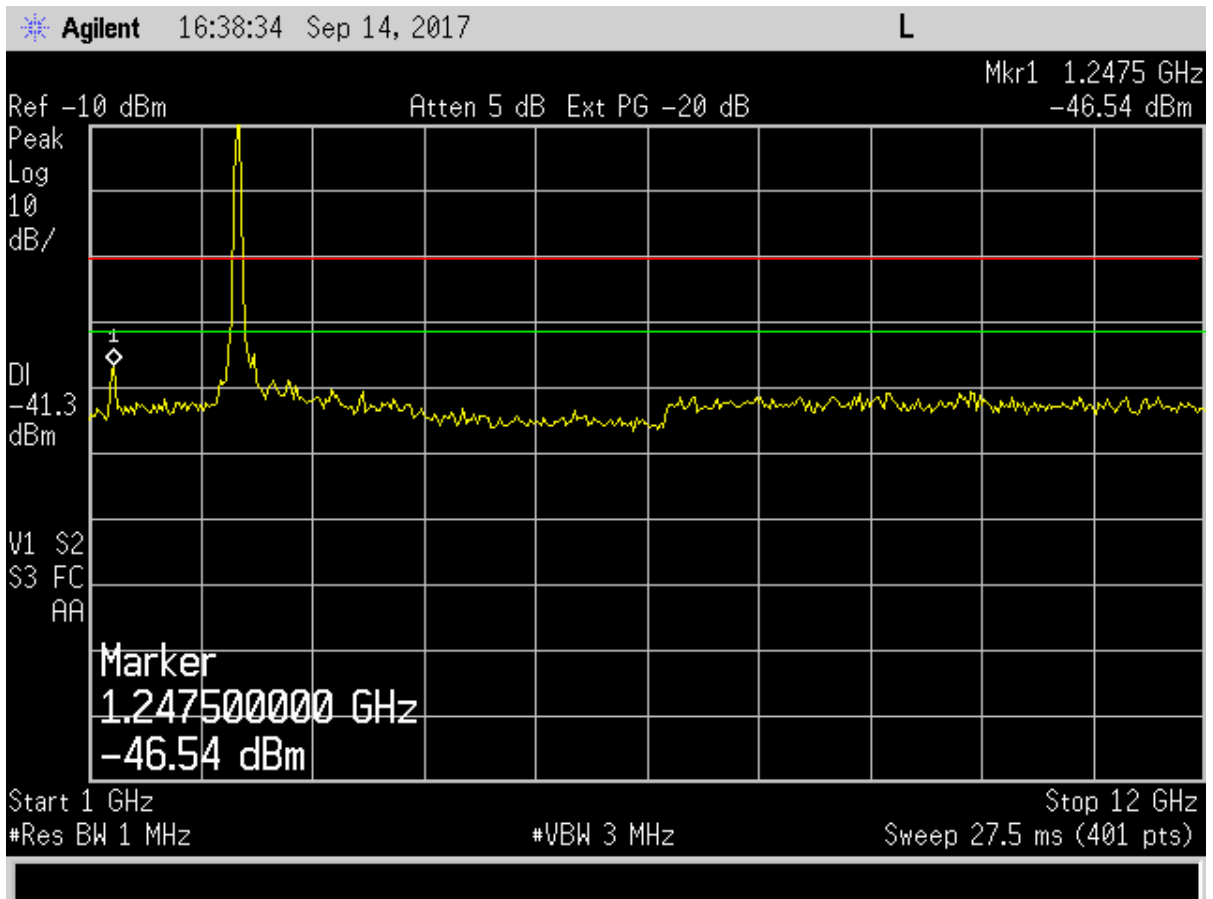


Figure 54. Antenna Conducted Spurious Emissions – n mode High Channel 1000-12000 MHz

Note: Large Signal shown is Fundamental Frequency
Note: RED line is limit line.

US Tech Test Report:
FCC ID:
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Customer:
Model:

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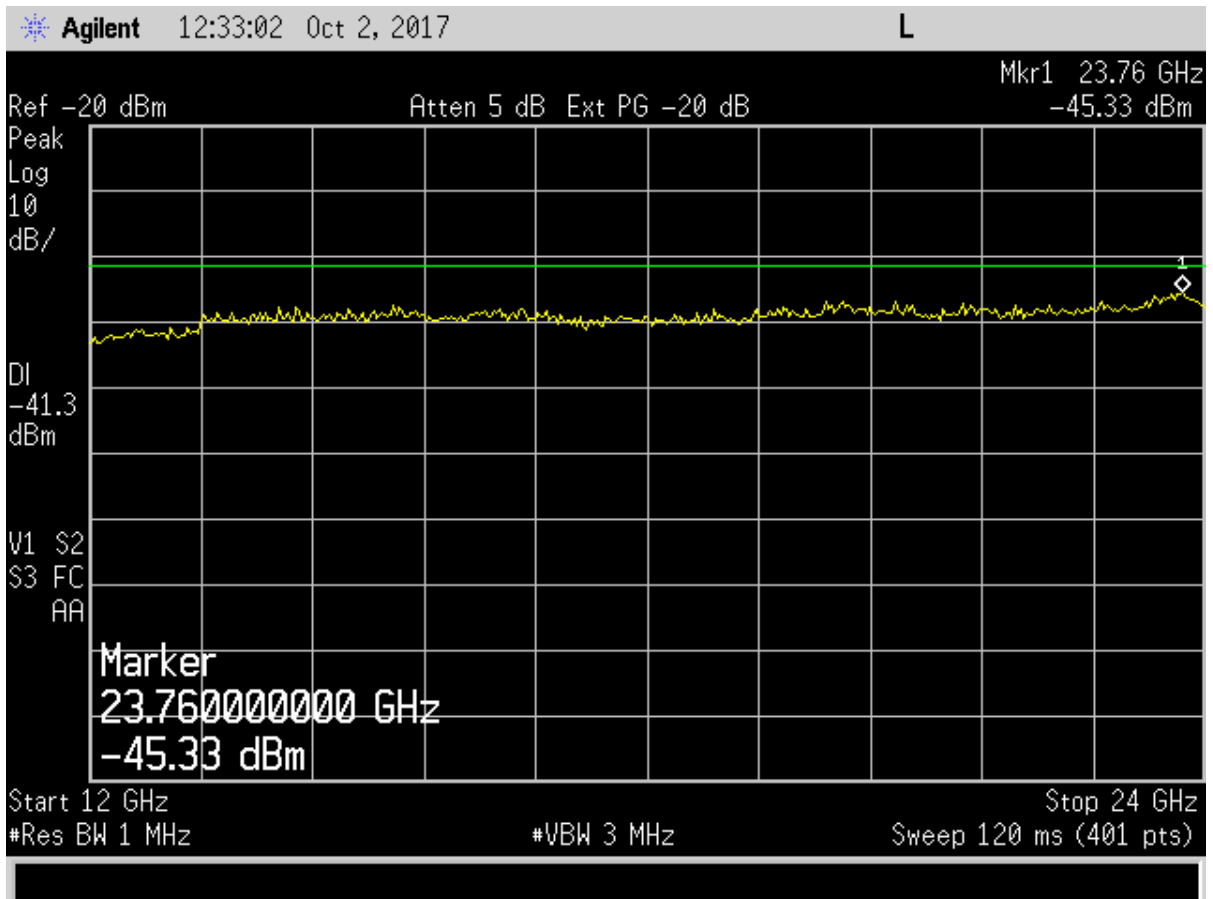


Figure 55. Antenna Conducted Spurious Emissions – n mode High Channel 12000-24000 MHz

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

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2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d))

On the test site, the EUT was placed on top of a non-conductive table, 80 cm above the floor for measurements below 1 GHz and 150 cm above the floor for measurements > 1 GHz. The EUT was also evaluated in three orthogonal positions to determine the worst case position. 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.

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 Issue Date:
 Customer:
 Model:

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Table 5. b mode - Peak Radiated Fundamental & Harmonic Emissions (Dual-Band Antenna)

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel - PEAK								
2412.65	84.52	-	33.39	117.91	125.3	3.0m./VERT	7.3	PK
*4823.75	46.37	-	9.66	56.03	74.0	3.0m./VERT	18.0	PK
7234.00	51.77	-	21.00	72.77	97.9	3.0m./VERT	25.1	PK
Mid Channel - PEAK								
2440.95	82.67	-	33.39	116.06	125.3	3.0m./VERT	9.2	PK
*4884.50	46.24	-	9.66	55.90	74.0	3.0m./VERT	18.1	PK
*7322.00	48.26	-	21.32	69.58	74.0	3.0m./VERT	4.4	PK
High Channel - PEAK								
2462.75	83.87	-	33.39	117.26	125.3	3.0m./VERT	8.0	PK
*4933.15	44.98	-	10.50	55.48	74.0	3.0m./VERT	18.5	PK
*7381.55	49.28	-	21.38	70.66	74.0	3.0m./VERT	3.3	PK

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic

Sample Calculation at 2412.65 MHz:

Magnitude of Measured Frequency	84.52	dBuV
+Additional Factor	0	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.39	dB/m
Corrected Result	117.91	dBuV/m

Test Date: August 29, 2017

Tested By
 Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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**Table 6. b mode - Average Radiated Fundamental & Harmonic Emissions
 (Dual-Band Antenna)**


Tested By: RKM	Test: FCC Part 15.247(d) Project: 17-0162		Client: Inventek Systems Model: ISM43903					
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel - Average								
2412.65	72.32	-7.96	33.39	97.75	105.3	3.0m./VERT	7.5	AVG
*4823.75	32.09	-	9.66	41.75	54.0	3.0m./VERT	12.2	AVG
7234.00	37.85	-	21.00	58.85	77.9	3.0m./VERT	19.1	AVG
Mid Channel - Average								
2440.95	72.74	-7.96	33.39	98.17	105.3	3.0m./VERT	7.1	AVG
*4884.50	30.80	-	9.66	40.46	54.0	3.0m./VERT	13.5	AVG
*7322.00	36.97	-7.96	21.32	50.37	54.0	3.0m./VERT	3.6	AVG
High Channel - Average								
2462.75	74.66	-7.96	33.39	100.09	105.3	3.0m./VERT	5.2	AVG
*4933.15	31.11	-	10.50	41.61	54.0	3.0m./VERT	12.4	AVG
*7381.55	35.59	-7.96	21.38	49.01	54.0	3.0m./VERT	5.0	AVG

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR 15.209 CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Duty cycle applied where applicable.

Sample Calculation at 2412.65 MHz:

Magnitude of Measured Frequency	72.32	dBuV
+Additional Factor (filter + duty cycle)	-7.96	dB
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	33.39	dB/m
Corrected Result	97.75	dBuV/m

Test Date: August 29, 2017

Tested By
 Signature: 

Name: Robert K. Mills

Note: The transmitter was programmed to transmit at >98% during all testing. Therefore where applicable (when using AVG detection) the duty cycle factor calculated above was applied.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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Table 7. g mode - Peak Radiated Fundamental & Harmonic Emissions (Dual-Band Antenna)


Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel - PEAK								
2409.00	81.92	-	33.39	115.31	125.3	3.0m./VERT	9.9	PK
*4814.25	44.03	-	9.66	53.69	74.0	3.0m./VERT	20.3	PK
7233.20	51.06	-	21.00	72.06	95.3	3.0m./VERT	23.2	PK
Mid Channel - PEAK								
2434.55	82.62	-	33.39	116.01	125.3	3.0m./VERT	9.2	PK
*4888.35	44.45	-	10.35	54.80	74.0	3.0m./VERT	19.2	PK
*7328.45	51.48	-	21.32	72.80	74.0	3.0m./VERT	1.2	PK
High Channel - PEAK								
2464.25	83.53	-	33.39	116.92	125.3	3.0m./VERT	8.3	PK
*4918.75	45.66	-	10.50	56.16	74.0	3.0m./VERT	17.8	PK
*7385.60	49.84	-	21.38	71.22	74.0	3.0m./VERT	2.8	PK

- (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247.
- No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic

Sample Calculation at 2409.00 MHz:

Magnitude of Measured Frequency	81.92	dBuV
+Additional Factor	0	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.39	dB/m
Corrected Result	115.31	dBuV/m

Test Date: August 29, 2017

Tested By
 Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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Table 8. g mode - Average Radiated Fundamental & Harmonic Emissions (Dual-Band Antenna)

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel – Average								
2409.00	67.93	-7.96	33.39	93.36	105.3	3.0m./VERT	11.94	AVG
4814.25	31.00	-	9.66	40.66	54.0	3.0m./VERT	13.3	AVG
7233.20	37.05	-	21.00	58.05	75.3	3.0m./VERT	17.3	AVG
Mid Channel – Average								
2434.55	68.84	-7.96	33.39	94.27	105.3	3.0m./VERT	11.0	AVG
4888.35	30.69	-	10.35	41.04	54.0	3.0m./VERT	13.0	AVG
7328.45	36.56	-7.96	21.32	49.92	54.0	3.0m./VERT	4.1	AVG
High Channel – Average								
2464.25	70.24	-7.96	33.39	95.67	105.3	3.0m./VERT	9.6	AVG
4918.75	30.93	-	10.50	41.43	54.0	3.0m./VERT	12.6	AVG
7385.60	36.12	-7.96	21.38	49.54	54.0	3.0m./VERT	4.5	AVG

- (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 CFR 15.35.
- No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
- Duty cycle applied where applicable.

Sample Calculation at 2409.00 MHz:

Magnitude of Measured Frequency	67.93	dBuV
+Additional Factor	-7.96	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.39	dB/m
Corrected Result	93.36	dBuV/m

Test Date: August 29, 2017

Tested By

Signature: 

Name: Robert K. Mills

Note: The transmitter was programmed to transmit at >98% during all testing. Therefore where applicable (when using AVG detection) the duty cycle factor calculated above was applied.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
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 Customer:
 Model:

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Table 9. n mode – Peak Radiated Fundamental & Harmonic Emissions (Dual-Band Antenna)


Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM 43903-R48-L54 (2.4 GHz eS-WiFi Module)				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel - PEAK								
2413.40	80.73	-	33.39	114.12	125.3	3.0m./VERT	11.1	PK
4818.65	45.78	-	9.66	55.44	74.0	3.0m./VERT	18.6	PK
7238.45	50.34	-	21.00	71.34	94.1	3.0m./VERT	22.8	PK
Mid Channel – PEAK								
2440.60	82.90	-	33.39	116.29	125.3	3.0m./VERT	9.0	PK
4882.25	44.49	-	9.66	54.15	74.0	3.0m./VERT	19.8	PK
7326.80	50.86	-	21.32	72.18	74.0	3.0m./VERT	1.8	PK
High Channel – PEAK								
2456.75	82.64	-	33.39	116.03	125.3	3.0m./VERT	9.2	PK
4926.65	46.15	-	10.50	56.65	74.0	3.0m./VERT	17.3	PK
7381.15	50.63	-	21.38	72.01	74.0	3.0m./VERT	2.0	PK

- (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247.
- No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic

Sample Calculation at 2413.40 MHz:

Magnitude of Measured Frequency	80.73	dBuV
+Additional Factor	0	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.39	dB/m
Corrected Result	114.12	dBuV/m

Test Date: August 29, 2017

Tested By
 Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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Table 10. n mode – Average Radiated Fundamental & Harmonic Emissions (Dual-Band Antenna)

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel - Average								
2413.40	66.65	-7.96	33.39	92.08	105.3	3.0m./VERT	13.22	AVG
4818.65	31.66	-	9.66	41.32	54.0	3.0m./VERT	12.7	AVG
7238.45	36.81	-	21.00	57.81	74.1	3.0m./VERT	16.3	AVG
Mid Channel – Average								
2440.60	68.60	-7.96	33.39	94.03	105.3	3.0m./VERT	11.3	AVG
4882.25	31.11	-	9.66	40.77	54.0	3.0m./VERT	13.2	AVG
7326.80	36.87	-7.96	21.32	50.23	54.0	3.0m./VERT	3.8	AVG
High Channel – Average								
2456.75	67.12	-7.96	33.39	92.55	105.3	3.0m./VERT	12.8	AVG
4926.65	31.37	-	10.50	41.87	54.0	3.0m./VERT	12.1	AVG
7381.15	37.18	-7.96	21.38	50.60	54.0	3.0m./VERT	3.4	AVG

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Duty cycle applied where applicable.

Sample Calculation at 2413.40 MHz:

Magnitude of Measured Frequency	66.65	dBuV
+Additional Factor	-7.96	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.39	dB/m
Corrected Result	92.08	dBuV/m

Test Date: August 29, 2017

Tested By

Signature: 

Name: Robert K. Mills

Note: The transmitter was programmed to transmit at >98% during all testing. Therefore where applicable (when using AVG detection) the duty cycle factor calculated above was applied.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
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 Customer:
 Model:

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**Table 11. b mode – Peak Radiated Fundamental & Harmonic Emissions
 (Single-Band Antenna)**

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel - PEAK								
2413.20	75.74	-	33.39	109.13	125.3	3.0m./VERT	16.1	PK
4823.80	42.94	-	9.66	52.60	74.0	3.0m./VERT	21.4	PK
7230.10	43.77	-	21.00	64.77	89.1	3.0m./VERT	24.4	PK
Mid Channel – PEAK								
2443.18	77.85	-	33.39	111.24	125.3	3.0m./VERT	14.0	PK
4893.65	43.19	-	10.35	53.54	74.0	3.0m./VERT	20.5	PK
7331.92	47.21	-	21.32	68.53	74.0	3.0m./VERT	5.5	PK
High Channel – PEAK								
2463.18	80.03	-	33.39	113.42	125.3	3.0m./VERT	11.8	PK
4924.73	44.10	-	10.50	54.60	74.0	3.0m./VERT	19.4	PK
7380.26	45.52	-	21.38	66.90	74.0	3.0m./VERT	7.1	PK

- (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247.
- No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic

Sample Calculation at 2413.20 MHz:

Magnitude of Measured Frequency	75.74	dBuV
+Additional Factor	0	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.39	dB/m
Corrected Result	109.13	dBuV/m

Test Date: July 20, 2017

Tested By

Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15/IC RSS Certification
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Table 12. b mode – Average Radiated Fundamental & Harmonic Emissions (Single-Band Antenna)

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel - Average								
2413.20	66.76	-7.96	33.39	92.19	105.3	3.0m./VERT	13.1	AVG
4823.80	29.94	-	9.66	39.60	54.0	3.0m./VERT	14.4	AVG
7230.10	28.78	-	21.00	49.78	80.2	3.0m./VERT	30.4	AVG
Mid Channel – Average								
2443.18	68.74	-7.96	33.39	94.17	105.3	3.0m./VERT	11.1	AVG
4893.65	28.90	-	10.35	39.25	54.0	3.0m./VERT	14.8	AVG
7331.92	33.34	-7.96	21.32	46.70	54.0	3.0m./VERT	7.3	AVG
High Channel – Average								
2463.18	71.16	-7.96	33.39	96.59	105.3	3.0m./VERT	8.7	AVG
4924.73	29.41	-	10.50	39.91	54.0	3.0m./VERT	14.1	AVG
7380.26	32.16	-7.96	21.38	45.58	54.0	3.0m./VERT	8.4	AVG


1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Duty cycle applied where applicable.

Sample Calculation at 2413.20 MHz:

Magnitude of Measured Frequency	66.76	dBuV
+Additional Factor	-7.96	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.39	dB/m
Corrected Result	92.19	dBuV/m

Test Date: July 20, 2017

Tested By

Signature: 

Name: Robert K. Mills

Note: The transmitter was programmed to transmit at >98% during all testing. Therefore where applicable (when using AVG detection) the duty cycle factor calculated above was applied.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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**Table 13. g mode – Peak Radiated Fundamental & Harmonic Emissions
 (Single-Band Antenna)**

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel - PEAK								
2418.28	75.44	-	33.39	108.83	125.3	3.0m./VERT	16.4	PK
4819.50	43.48	-	9.66	53.14	74.0	3.0m./VERT	20.9	PK
7227.25	48.43	-	21.00	69.43	88.8	3.0m./VERT	19.4	PK
Mid Channel – PEAK								
2439.25	76.17	-	33.39	109.56	125.3	3.0m./VERT	15.7	PK
4881.25	44.74	-	9.66	54.40	74.0	3.0m./VERT	19.6	PK
7326.25	46.15	-	21.32	67.47	74.0	3.0m./VERT	6.5	PK
High Channel – PEAK								
2454.50	79.33	-	33.39	112.72	125.3	3.0m./VERT	12.5	PK
4919.00	44.12	-	10.50	54.62	74.0	3.0m./VERT	19.4	PK
7382.50	46.76	-	21.38	68.14	74.0	3.0m./VERT	5.9	PK


1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic

Sample Calculation at 2418.28 MHz:

Magnitude of Measured Frequency	75.44	dBuV
+Additional Factor	0	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.39	dB/m
Corrected Result	108.83	dBuV/m

Test Date: July 20, 2017

Tested By

Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15/IC RSS Certification
 O7P-903
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 Inventek Systems
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Table 14. g mode – Average Radiated Fundamental & Harmonic Emissions (Single-Band Antenna)

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel - Average								
2418.28	61.95	-7.96	33.39	87.38	105.3	3.0m./VERT	17.9	AVG
4819.50	29.38	-	9.66	39.04	54.0	3.0m./VERT	15.0	AVG
7227.25	35.28	-	21.00	56.28	75.3	3.0m./VERT	19.1	AVG
Mid Channel – Average								
2439.25	63.56	-7.96	33.39	96.95	105.3	3.0m./VERT	8.3	AVG
4881.25	29.69	-	9.66	39.35	54.0	3.0m./VERT	14.6	AVG
7326.25	33.11	-7.96	21.32	45.92	54.0	3.0m./VERT	8.1	AVG
High Channel – Average								
2454.50	66.03	-7.96	33.39	90.91	105.3	3.0m./VERT	14.3	AVG
4919.00	29.36	-	10.50	39.86	54.0	3.0m./VERT	14.1	AVG
7382.50	32.97	-7.96	21.38	45.84	54.0	3.0m./VERT	8.2	AVG

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Duty cycle applied where applicable.

Sample Calculation at 2418.28 MHz:

Magnitude of Measured Frequency	61.95	dBuV
+Additional Factor	-7.96	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.39	dB/m
Corrected Result	87.38	dBuV/m

Test Date: July 20, 2017

Tested By

Signature: 

Name: Robert K. Mills

Note: The transmitter was programmed to transmit at >98% during all testing. Therefore where applicable (when using AVG detection) the duty cycle factor calculated above was applied.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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Table 15. n mode – Peak Radiated Fundamental & Harmonic Emissions (Single-Band Antenna)

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel - PEAK								
2410.63	74.84	-	33.39	108.23	125.3	3.0m./VERT	17.0	PK
4835.63	43.92	-	9.66	53.58	74.0	3.0m./VERT	20.4	PK
7232.75	47.23	-	21.00	68.23	88.8	3.0m./VERT	20.6	PK
Mid Channel – PEAK								
2448.38	76.27	-	33.39	109.66	125.3	3.0m./VERT	15.6	PK
4885.88	44.23	-	9.66	53.89	74.0	3.0m./VERT	20.1	PK
7316.38	46.86	-	21.32	68.18	74.0	3.0m./VERT	5.8	PK
High Channel – PEAK								
2460.88	78.46	-	33.39	111.85	125.3	3.0m./VERT	13.4	PK
4922.88	43.10	-	10.50	53.60	74.0	3.0m./VERT	20.4	PK
7377.13	44.99	-	21.38	66.37	74.0	3.0m./VERT	7.6	PK

- (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247.
- No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic

Sample Calculation at 2410.63 MHz:

Magnitude of Measured Frequency	74.84	dBuV
+Additional Factor	0	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.39	dB/m
Corrected Result	108.23	dBuV/m

Test Date: July 20, 2017

Tested By

Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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Table 16. n mode – Average Radiated Fundamental & Harmonic Emissions (Single-Band Antenna)

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel – Average								
2410.63	61.39	-7.96	33.39	94.78	105.3	3.0m./VERT	10.5	AVG
4835.63	30.20	-	9.66	39.86	54.0	3.0m./VERT	14.1	AVG
7232.75	32.87	-	21.00	53.87	75.3	3.0m./VERT	21.5	AVG
Mid Channel – Average								
2448.38	62.91	-7.96	33.39	88.34	105.3	3.0m./VERT	16.9	AVG
4885.88	29.70	-	9.66	39.36	54.0	3.0m./VERT	14.6	AVG
7316.38	32.92	-7.96	21.32	46.28	54.0	3.0m./VERT	7.7	AVG
High Channel – Average								
2460.88	64.82	-7.96	33.39	90.25	105.3	3.0m./VERT	15.0	AVG
4922.88	29.46	-	10.50	39.96	54.0	3.0m./VERT	14.0	AVG
7377.13	30.99	-7.96	21.38	44.41	54.0	3.0m./VERT	9.6	AVG


- (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 CFR 15.35.
- No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
- Duty cycle applied where applicable.

Sample Calculation at 2410.63 MHz:

Magnitude of Measured Frequency	61.39	dBuV
+Additional Factor	-7.96	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.39	dB/m
Corrected Result	94.78	dBuV/m

Test Date: July 20, 2017

Tested By

Signature: 

Name: Robert K. Mills

Note: The transmitter was programmed to transmit at >98% during all testing. Therefore where applicable (when using AVG detection) the duty cycle factor calculated above was applied.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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Table 17. b mode – Peak Radiated Fundamental & Harmonic Emissions (Trace Antenna)

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: IS 43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel – Average								
2410.75	80.17	-	33.21	113.38	125.3	3.0m./HORZ	11.9	PK
4819.88	46.02	-	9.63	55.65	74.0	3.0m./HORZ	18.3	PK
7237.00	54.44	-	20.96	75.40	93.4	3.0m./HORZ	18.0	PK
Mid Channel – Average								
2443.45	78.22	-	33.21	111.43	125.3	3.0m./HORZ	13.8	PK
4892.45	46.09	-	10.32	56.41	74.0	3.0m./HORZ	17.6	PK
7323.95	54.26	-	21.35	75.61	91.4	3.0m./HORZ	15.8	PK
High Channel – Average								
2460.70	78.11	-	33.21	111.32	125.3	3.0m./HORZ	13.9	PK
4915.15	46.22	-	10.56	56.78	91.3	3.0m./HORZ	34.5	PK
7382.15	52.19	-	21.41	73.60	74.0	3.0m./HORZ	0.4	PK

- (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247.
- No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic

Sample Calculation at 2410.75 MHz:

Magnitude of Measured Frequency	80.17	dBuV
+Additional Factor	0	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.21	dB/m
Corrected Result	113.38	dBuV/m

Test Date: September 1, 2017

Tested By
 Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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**Table 18. b mode – Average Radiated Fundamental & Harmonic Emissions
 (Trace Antenna)**

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel – Average								
2410.75	70.46	-7.96	33.21	95.71	105.3	3.0m./HORZ	9.6	AVG
4819.88	33.55	-	9.63	43.18	54.0	3.0m./HORZ	10.8	AVG
7237.00	41.85	-	20.96	62.81	73.4	3.0m./HORZ	10.6	AVG
Mid Channel – Average								
2443.45	69.51	-7.96	33.21	94.76	105.3	3.0m./HORZ	10.5	AVG
4892.45	33.13	-	10.32	43.45	54.0	3.0m./HORZ	10.5	AVG
7323.95	41.07	-	21.35	62.42	71.4	3.0m./HORZ	9.0	AVG
High Channel – Average								
2460.70	68.88	-7.96	33.21	94.13	105.3	3.0m./HORZ	11.2	AVG
4915.15	33.50	-	10.56	44.06	71.3	3.0m./HORZ	27.3	AVG
7382.15	40.38	-7.96	21.41	53.83	54.0	3.0m./HORZ	0.2	AVG


1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Duty cycle applied where applicable.

Sample Calculation at 2410.75 MHz:

Magnitude of Measured Frequency	70.46	dBuV
+Additional Factor	-7.96	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	33.21	dB/m
Corrected Result	95.71	dBuV/m

Test Date: September 1, 2017

Tested By

Signature: 

Name: Robert K. Mills

Note: The transmitter was programmed to transmit at >98% during all testing. Therefore where applicable (when using AVG detection) the duty cycle factor calculated above was applied.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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Table 19. g mode – Peak Radiated Fundamental & Harmonic Emissions (Trace Antenna)

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel - PEAK								
2409.79	80.60	-	31.26	111.86	125.3	3.0m./HORZ	13.4	PK
4805.38	46.21	-	7.64	53.85	74.0	3.0m./HORZ	20.1	PK
7240.00	58.30	-	18.68	76.98	91.9	3.0m./HORZ	14.9	PK
Mid Channel – PEAK								
2447.63	81.85	-	31.26	113.11	125.3	3.0m./HORZ	12.1	PK
4861.63	46.10	-	7.64	53.74	74.0	3.0m./HORZ	20.3	PK
7316.88	51.49	-	19.07	70.56	74.0	3.0m./HORZ	3.4	PK
High Channel – PEAK								
2467.63	81.80	-	31.26	113.06	125.3	3.0m./HORZ	12.2	PK
4901.25	46.02	-	8.57	54.59	74.0	3.0m./HORZ	19.4	PK
7397.88	51.47	-	19.13	70.60	74.0	3.0m./HORZ	3.4	PK

- (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247.
- No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic

Sample Calculation at 2409.79 MHz:

Magnitude of Measured Frequency	80.60	dBuV
+Additional Factor	0	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	31.26	dB/m
Corrected Result	111.86	dBuV/m

Test Date: September 7, 2017

Tested By
 Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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**Table 20. g mode – Average Radiated Fundamental & Harmonic Emissions
 (Trace Antenna)**

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM 43903-R48-L54 (2.4 GHz eS-WiFi)				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel – Average								
2409.79	67.11	-7.96	31.26	90.41	105.3	3.0m./HORZ	14.9	AVG
4805.38	33.46	-	7.64	41.10	54.0	3.0m./HORZ	12.9	AVG
7240.00	45.41	-	18.68	64.09	71.9	3.0m./HORZ	7.8	AVG
Mid Channel – Average								
2447.63	68.81	-7.96	31.26	92.11	105.3	3.0m./HORZ	13.2	AVG
4861.63	33.56	-	7.64	41.20	54.0	3.0m./HORZ	12.8	AVG
7316.88	38.14	-7.96	19.07	49.25	54.0	3.0m./HORZ	4.8	AVG
High Channel – Average								
2467.63	68.56	-7.96	31.26	91.86	105.3	3.0m./HORZ	13.4	AVG
4901.25	33.52	-	8.57	42.09	54.0	3.0m./HORZ	11.9	AVG
7397.88	38.24	-7.96	19.13	49.41	54.0	3.0m./HORZ	4.6	AVG

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Duty cycle applied where applicable.

Sample Calculation at 2409.79 MHz:

Magnitude of Measured Frequency	67.11	dBuV
+Additional Factor	-7.96	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	31.26	dB/m
Corrected Result	90.41	dBuV/m

Test Date: September 7, 2017

Tested By

Signature: 

Name: Robert K. Mills

Note: The transmitter was programmed to transmit at >98% during all testing. Therefore where applicable (when using AVG detection) the duty cycle factor calculated above was applied.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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Table 21. n mode – Peak Radiated Fundamental & Harmonic Emissions (Trace Antenna)

Tested By: RKM	Test: FCC Part 15,247(d)			Client: Inventek Systems				
	Project: 17-0162			Model: ISM43903				
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Low Channel - PEAK								
2416.25	80.96	-	31.26	112.22	125.3	3.0m./HORZ	13.0	PK
4845.63	46.15	-	7.64	53.79	74.0	3.0m./HORZ	20.2	PK
7237.13	50.70	-	18.68	69.38	74.0	3.0m./HORZ	4.6	PK
Mid Channel – PEAK								
2439.63	78.68	-	31.26	109.94	125.3	3.0m./HORZ	15.3	PK
4885.75	46.81	-	7.64	54.45	74.0	3.0m./HORZ	19.5	PK
7308.63	52.18	-	19.07	71.25	74.0	3.0m./HORZ	2.8	PK
High Channel – PEAK								
2463.38	79.67	-	31.26	110.93	125.3	3.0m./HORZ	14.3	PK
4920.75	45.85	-	8.57	54.42	74.0	3.0m./HORZ	19.6	PK
7389.63	52.30	-	19.13	71.43	74.0	3.0m./HORZ	2.6	PK

- (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 15.247.
- No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic

Sample Calculation at 2416.25 MHz:

Magnitude of Measured Frequency	80.96	dBuV
+Additional Factor	0	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	31.26	dB/m
Corrected Result	112.22	dBuV/m

Test Date: September 7, 2017

Tested By
 Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
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 Customer:
 Model:

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Table 22. n mode – Average Radiated Fundamental & Harmonic Emissions (Trace Antenna)

Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
Tested By: RKM Test: FCC Part 15,247(d) Client: Inventek Systems Project: 17-0162 Model: ISM43903								
Low Channel – Average								
2416.25	67.01	-7.96	31.26	90.31	105.3	3.0m./HORZ	15.0	AVG
4845.63	33.14	-	7.64	40.78	54.0	3.0m./HORZ	13.2	AVG
7237.13	37.97	-7.96	18.68	48.69	54.0	3.0m./HORZ	5.3	AVG
Mid Channel – Average								
2439.63	65.04	-7.96	31.26	88.34	105.3	3.0m./HORZ	16.9	AVG
4885.75	33.47	-	8.33	41.80	54.0	3.0m./HORZ	12.2	AVG
7308.63	38.22	-7.96	19.07	48.78	54.0	3.0m./HORZ	5.2	AVG
High Channel – Average								
2463.38	65.57	-7.96	31.26	88.87	105.3	3.0m./HORZ	16.4	AVG
4920.75	33.54	-	8.57	42.11	54.0	3.0m./HORZ	11.9	AVG
7389.63	39.30	-7.96	19.13	50.47	54.0	3.0m./HORZ	3.5	AVG


1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Duty cycle applied where applicable.

Sample Calculation at 2416.25 MHz:

Magnitude of Measured Frequency	67.01	dBuV
+Additional Factor	-7.96	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	31.26	dB/m
Corrected Result	90.31	dBuV/m

Test Date: September 7, 2017

Tested By

Signature: 

Name: Robert K. Mills

Note: The transmitter was programmed to transmit at >98% during all testing. Therefore where applicable (when using AVG detection) the duty cycle factor calculated above was applied.

US Tech Test Report:
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Model:

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

Band Edge measurements are made following the guidelines in ANSI C63.10-2013 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 $\geq 1\%$ of the frequency span. In all cases, the VBW is set \geq RBW. See figures and calculations below for more detail.

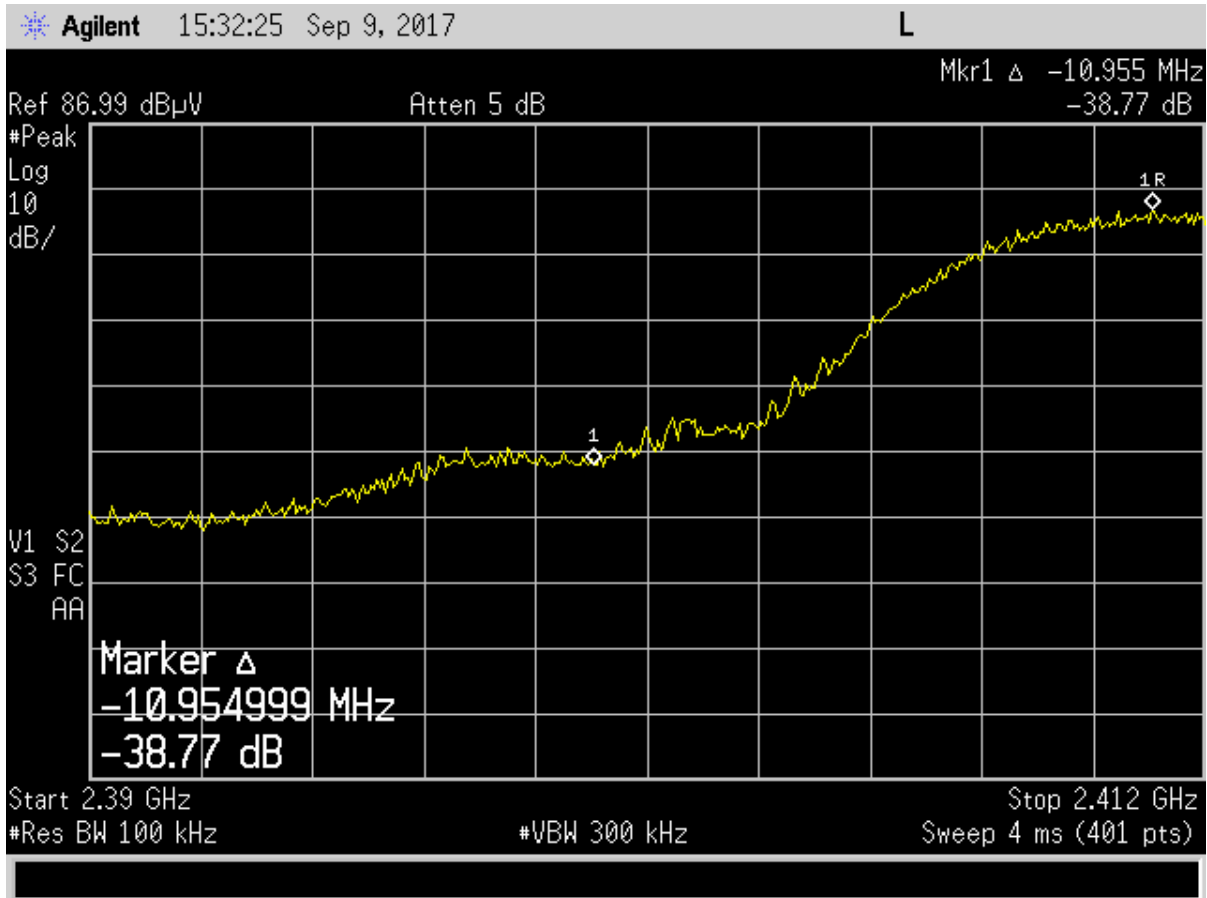


Figure 56. Band Edge Compliance – b mode (Dual-Band Antenna) Low Channel Delta - Peak

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	38.77	dB
Band Edge Limit	20.00	dB
Band Edge Margin	18.77	dB

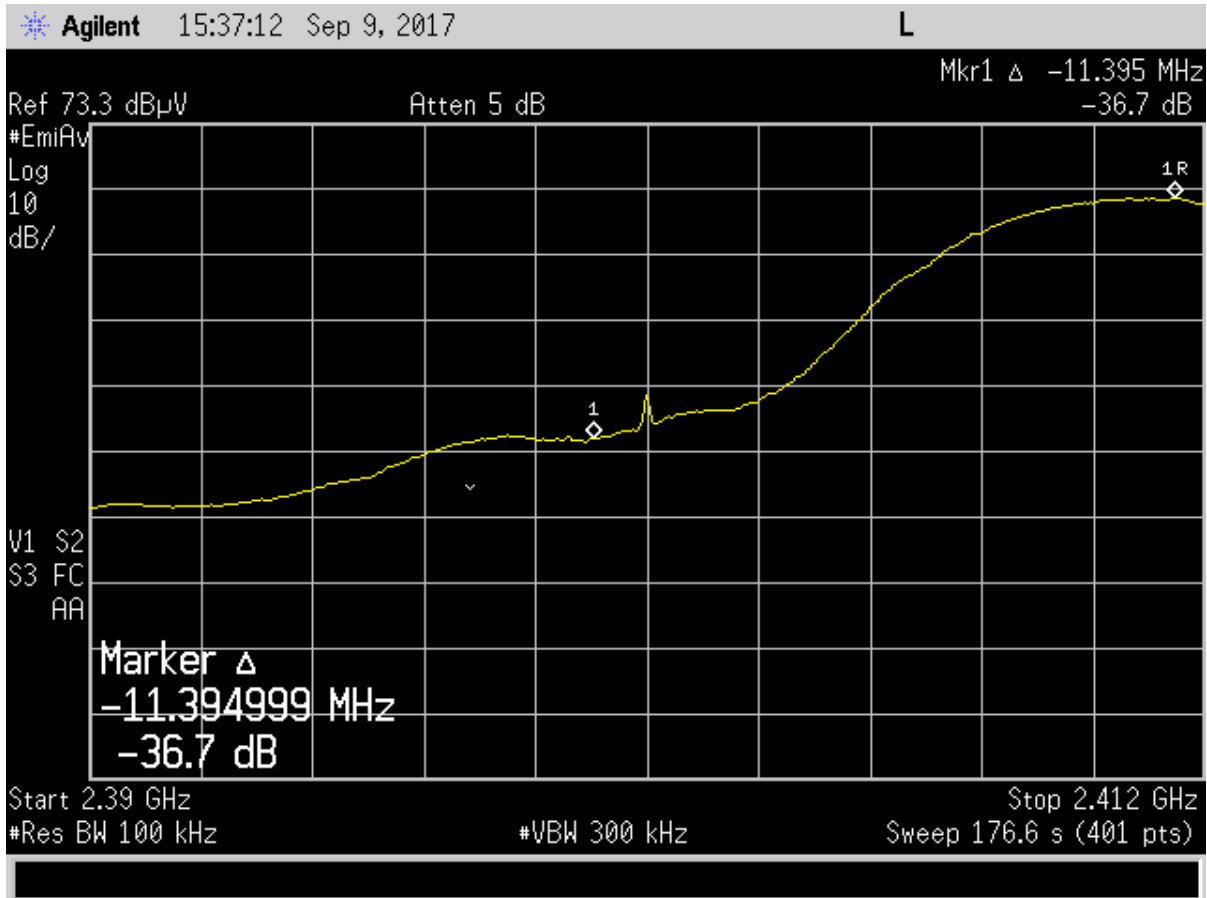


Figure 57. Band Edge Compliance – b mode (Dual-Band Antenna) Low Channel Delta – Average

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	36.70	dB
Band Edge Limit	20.00	dB
Band Edge Margin	16.70	dB

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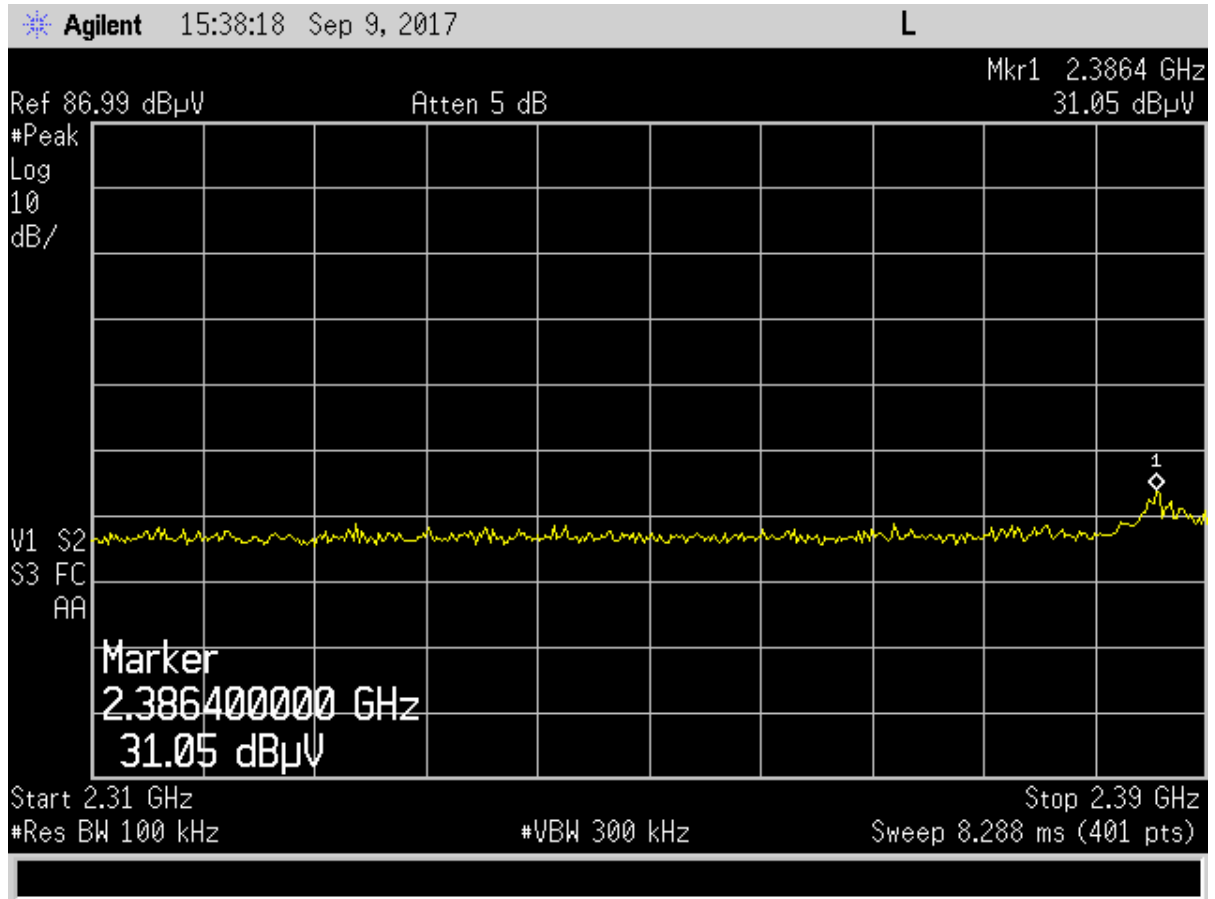


Figure 58. b mode (Dual-Band Antenna) Low Channel Restricted Band - Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2386.40	31.05	32.92	63.97	74.0	3.0m./VERT	10.0	PK

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Figure 59. b mode (Dual-Band Antenna) Low Channel Restricted Band – Average

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2387.40	15.38	32.92	48.30	54.0	3.0m./VERT	5.7	AVG

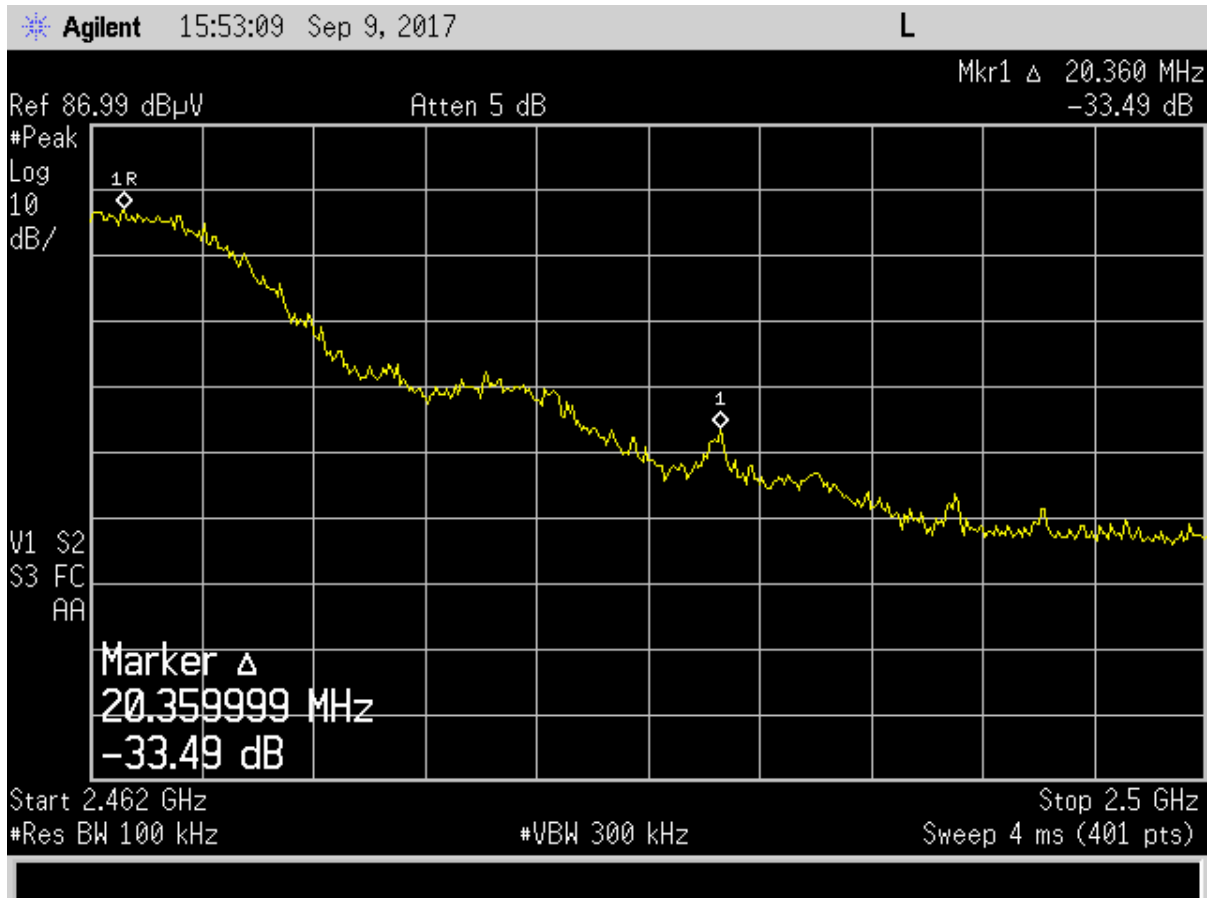


Figure 60. Band Edge Compliance – b mode (Dual-Band Antenna) High Channel Delta - Peak

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	33.49	dB
Band Edge Limit	20.00	dB
Band Edge Margin	13.49	dB

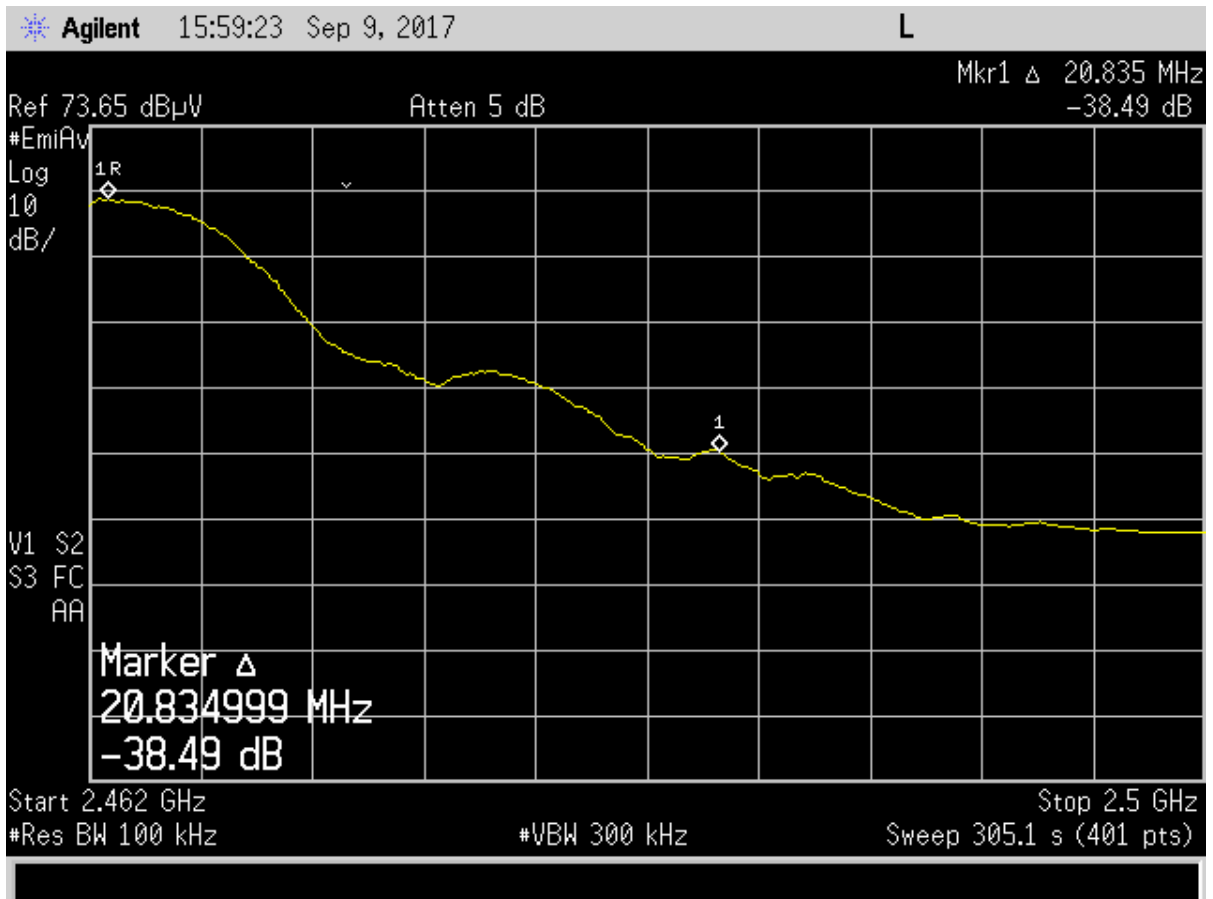


Figure 61. Band Edge Compliance – b mode (Dual-Band Antenna) High Channel Delta - Average

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	38.49	dB
Band Edge Limit	20.00	dB
Band Edge Margin	18.49	dB

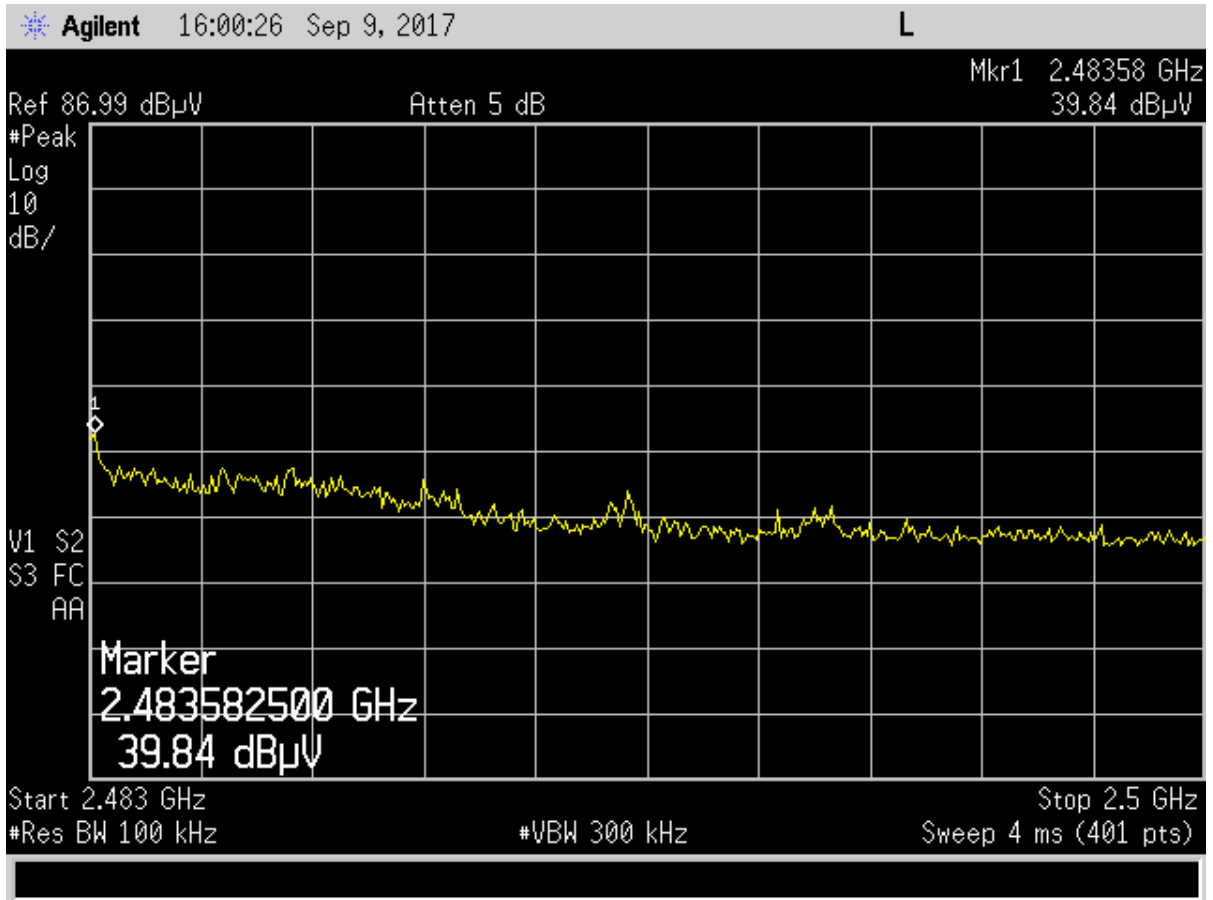


Figure 62. b mode (Dual-Band Antenna) High Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBUV)	AF+CA-AMP+DC (dB/m)	Results (dBUV/m)	Limits (dBUV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.58	39.84	33.39	73.23	74.0	3.0m./VERT	0.8	PK

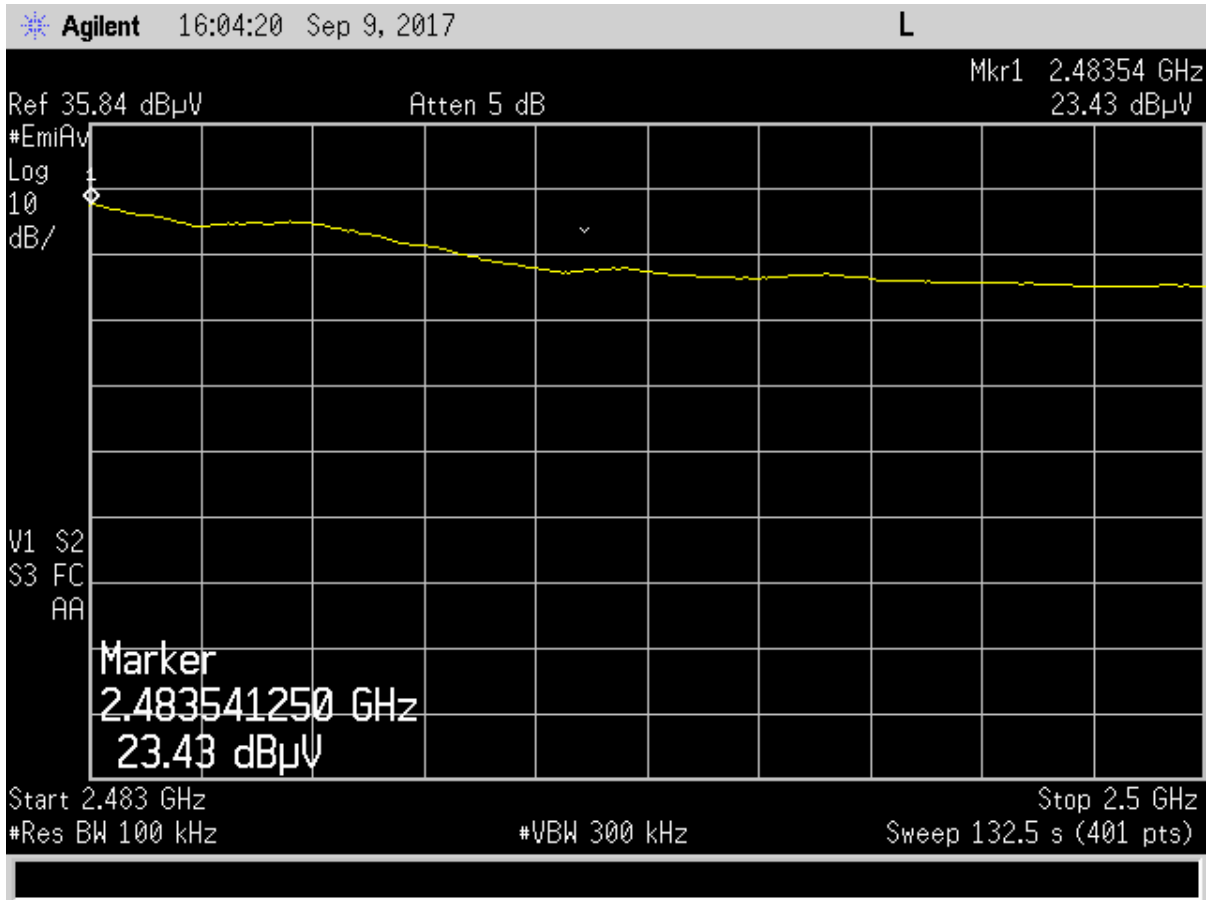


Figure 63. b mode (Dual-Band Antenna) High Channel Restricted Band – Average

Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.54	23.43	-7.96	33.39	48.31	54.0	3.0m./VER T	5.7	AVG

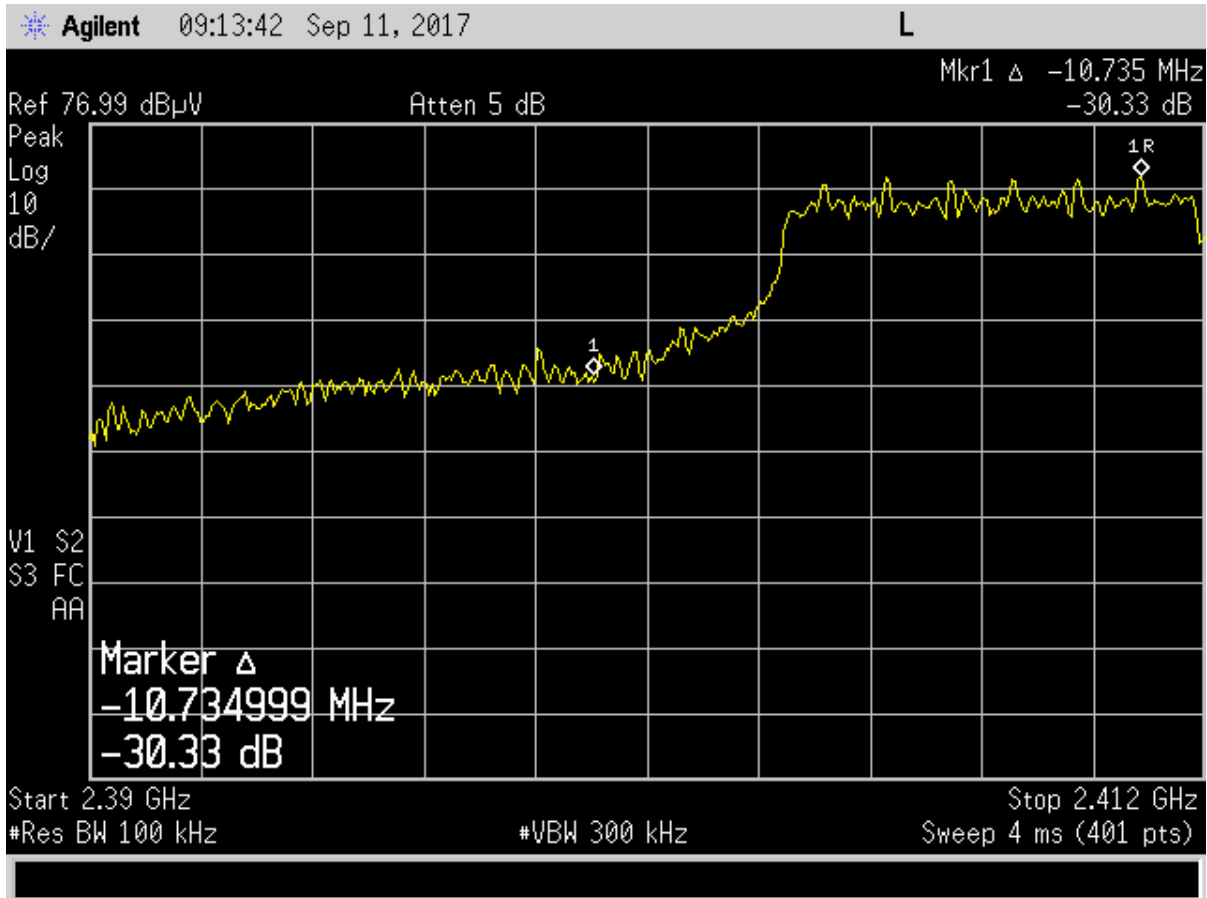


Figure 64. Band Edge Compliance – g mode (Dual-Band Antenna) Low Channel Delta – Peak

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	30.33	dB
Band Edge Limit	20.00	dB
Band Edge Margin	10.33	dB

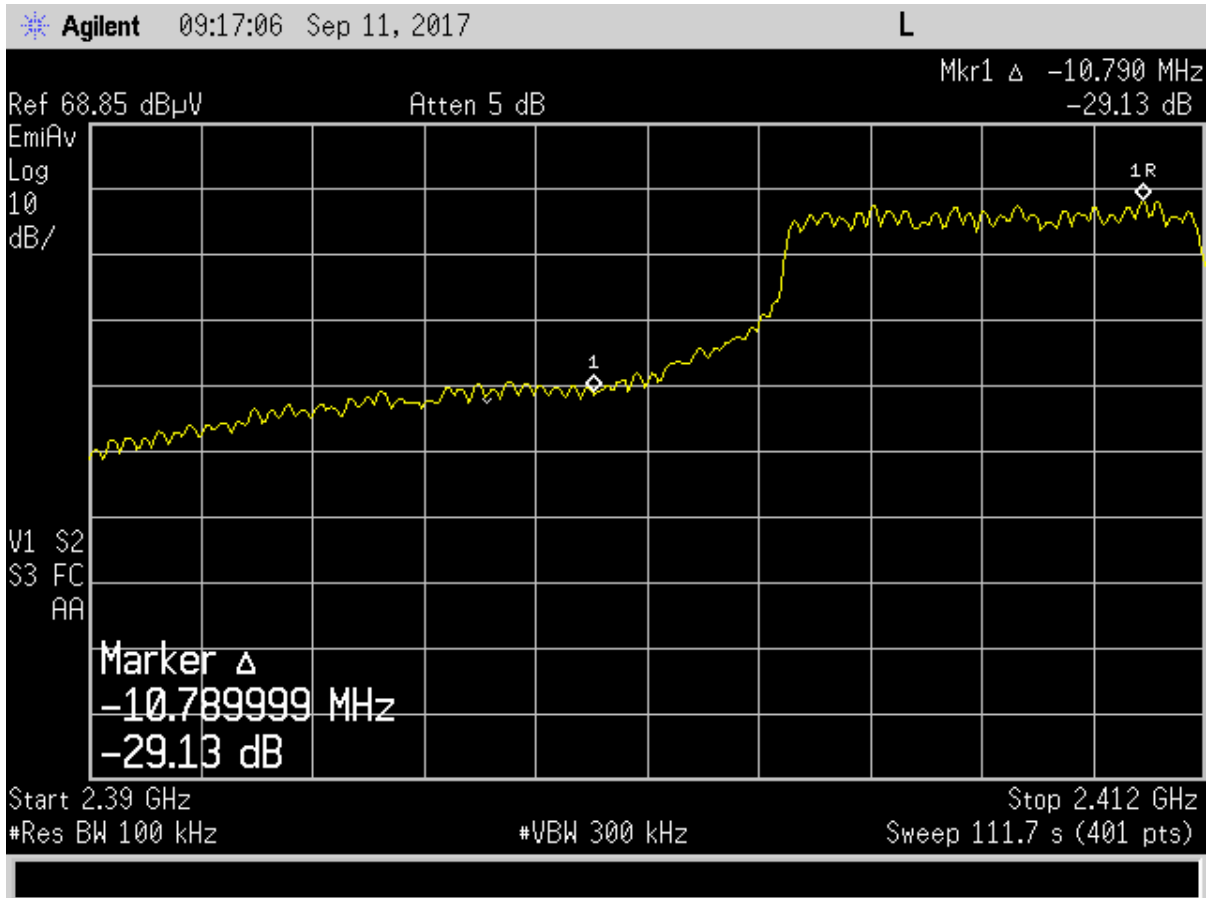


Figure 65. Band Edge Compliance – g mode (Dual-Band Antenna) Low Channel Delta – Average

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	29.13	dB
Band Edge Limit	20.00	dB
Band Edge Margin	9.13	dB

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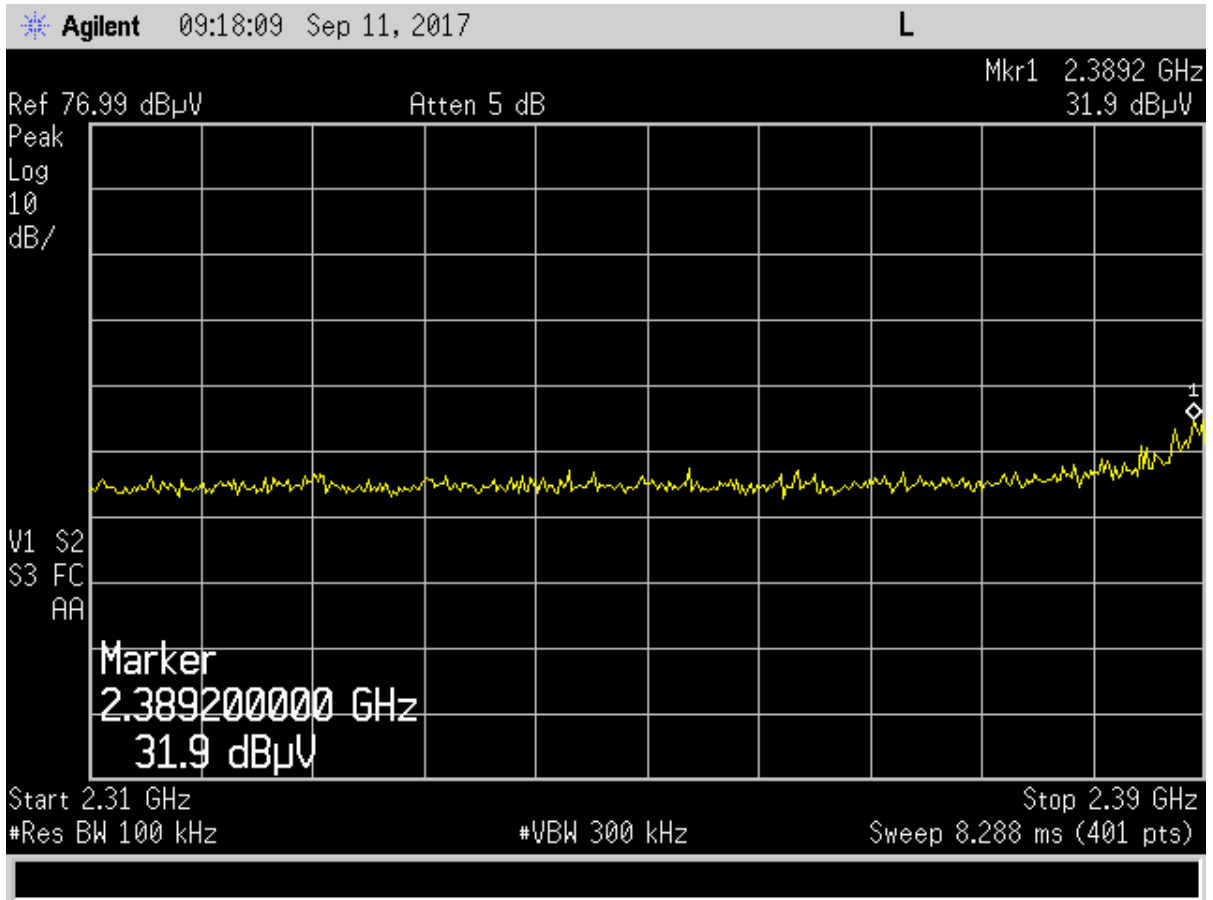


Figure 66. g mode (Dual-Band Antenna) Low Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2389.20	31.90	32.92	64.82	74.0	3.0m./VERT	9.2	PK

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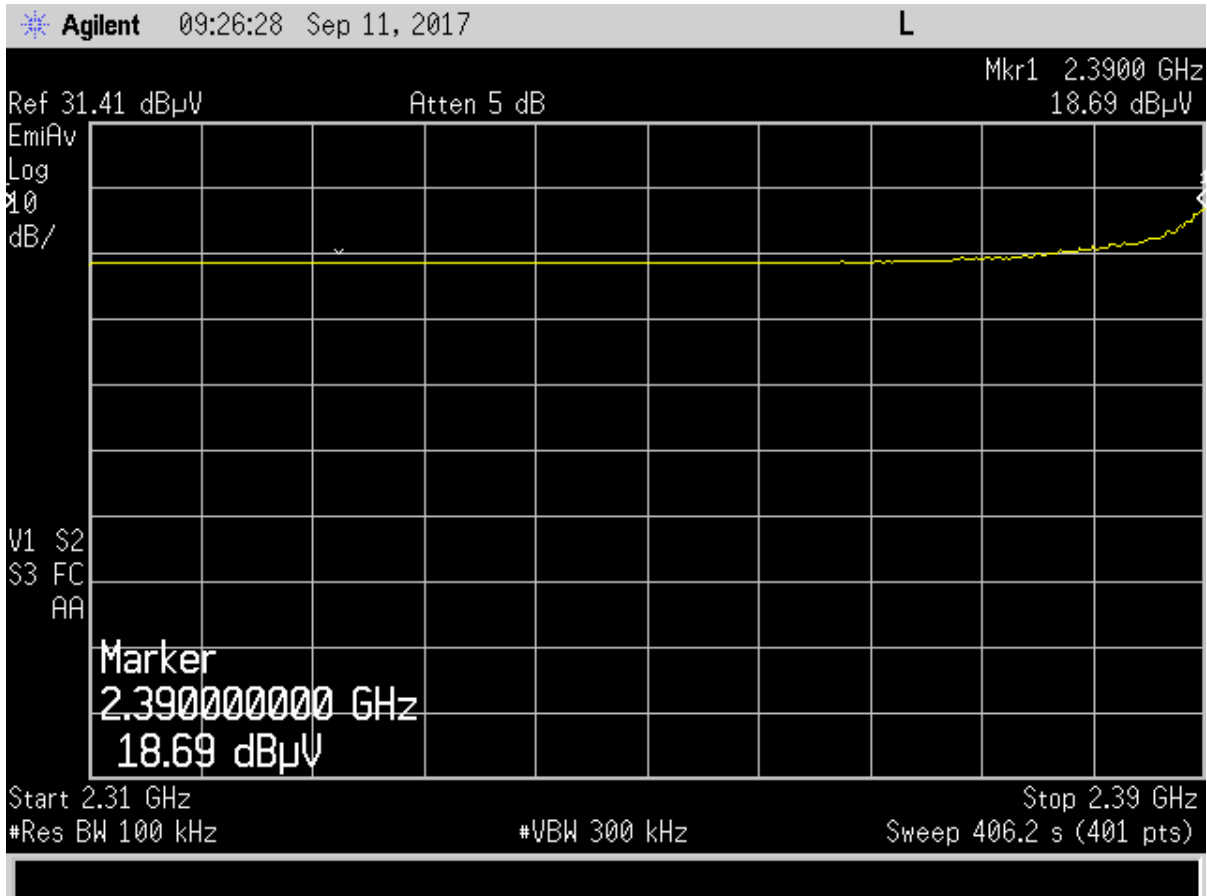


Figure 67. g mode (Dual-Band Antenna) Low Channel Restricted Band – Average

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2390.00	18.69	32.92	51.61	54.0	3.0m./VERT	2.4	AVG

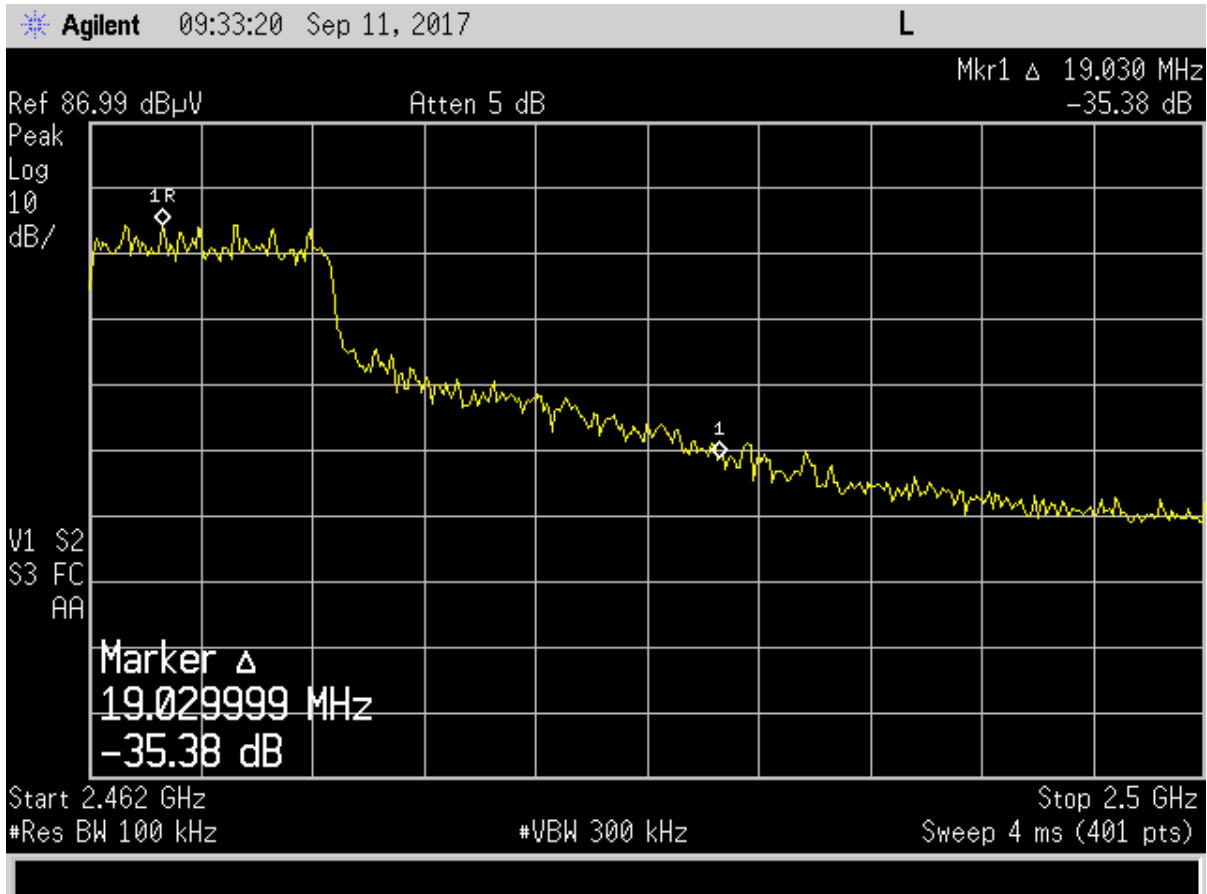


Figure 68. Band Edge Compliance – g mode (Dual-Band Antenna) High Channel Delta – Peak

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	35.38	dB
Band Edge Limit	20.00	dB
Band Edge Margin	15.38	dB

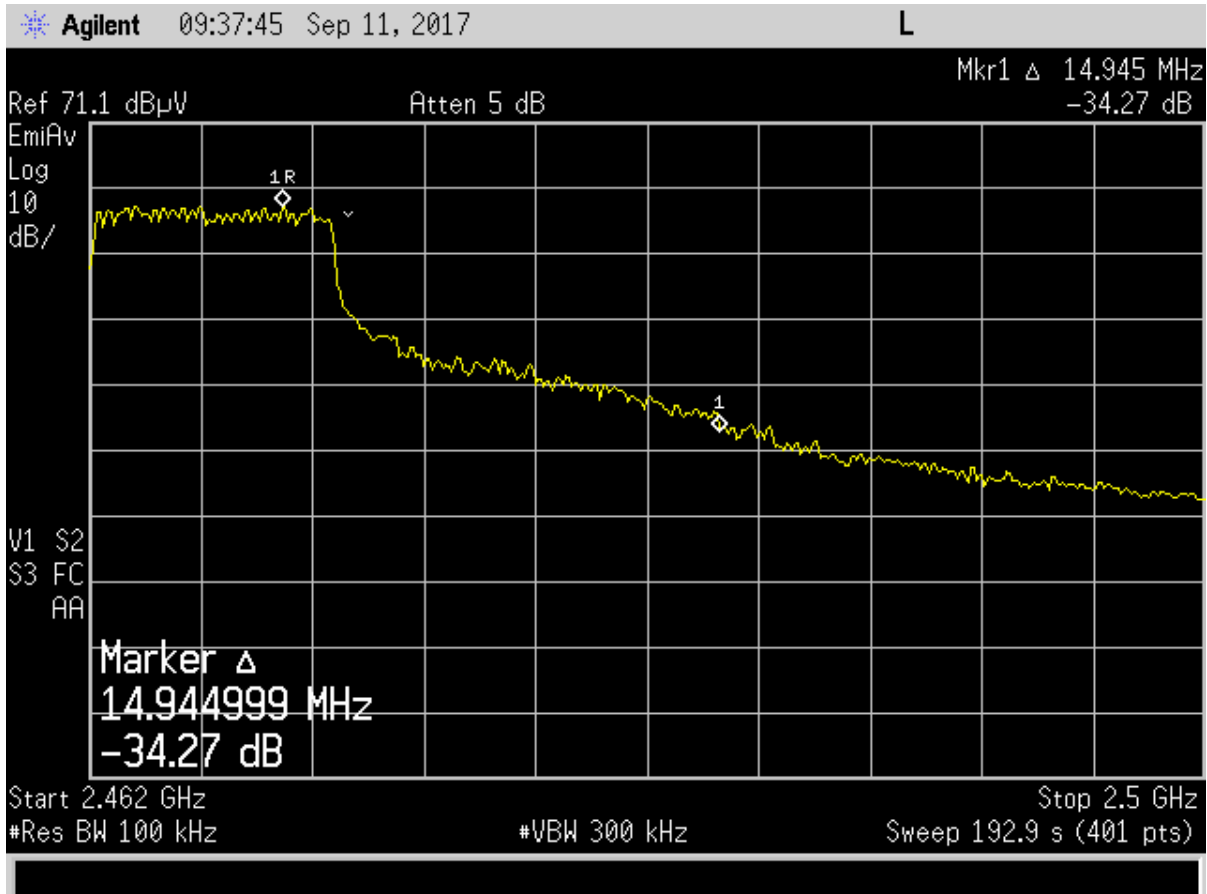


Figure 69. Band Edge Compliance – g mode (Dual-Band Antenna) High Channel Delta – Average

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	34.27	dB
Band Edge Limit	20.00	dB
Band Edge Margin	14.27	dB

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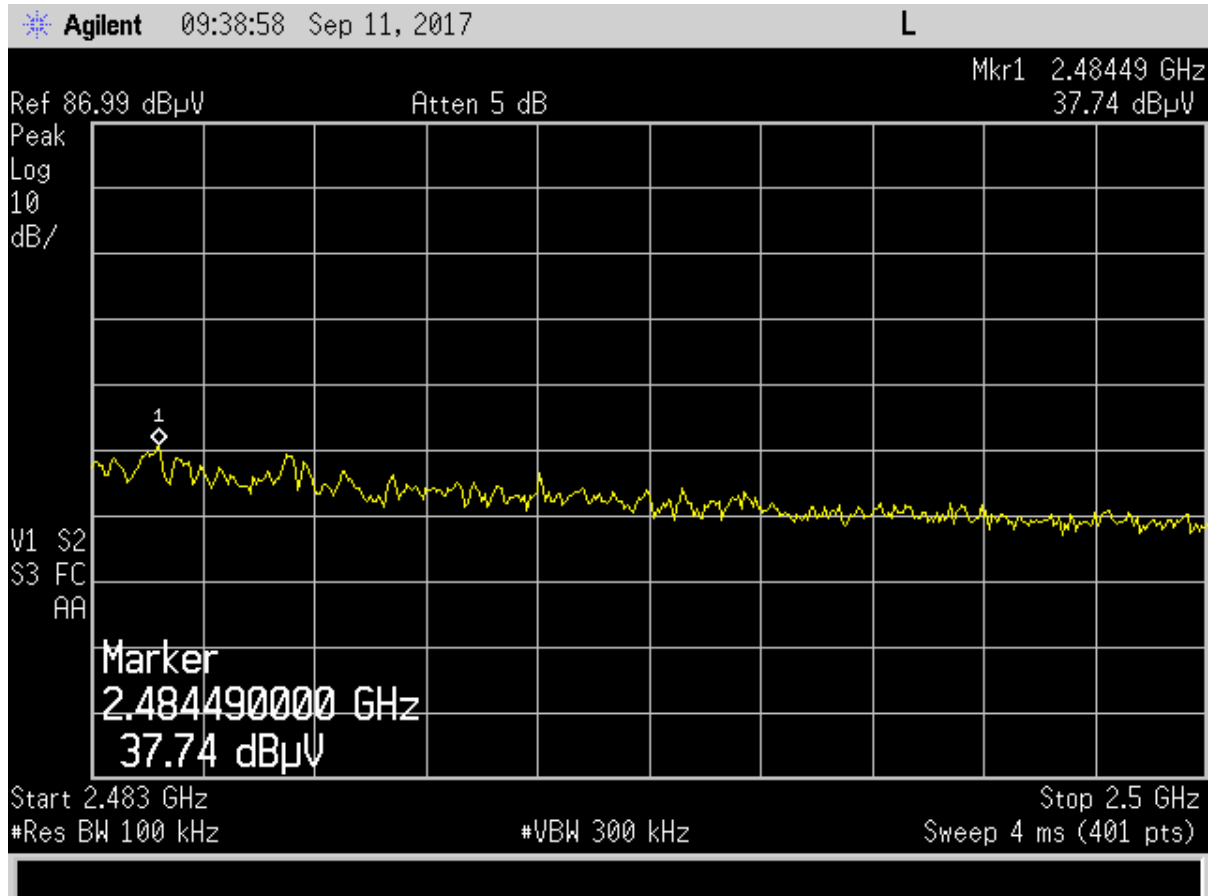


Figure 70. g mode (Dual-Band Antenna) High Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2484.49	37.74	33.39	71.13	74.0	3.0m./VERT	2.9	PK

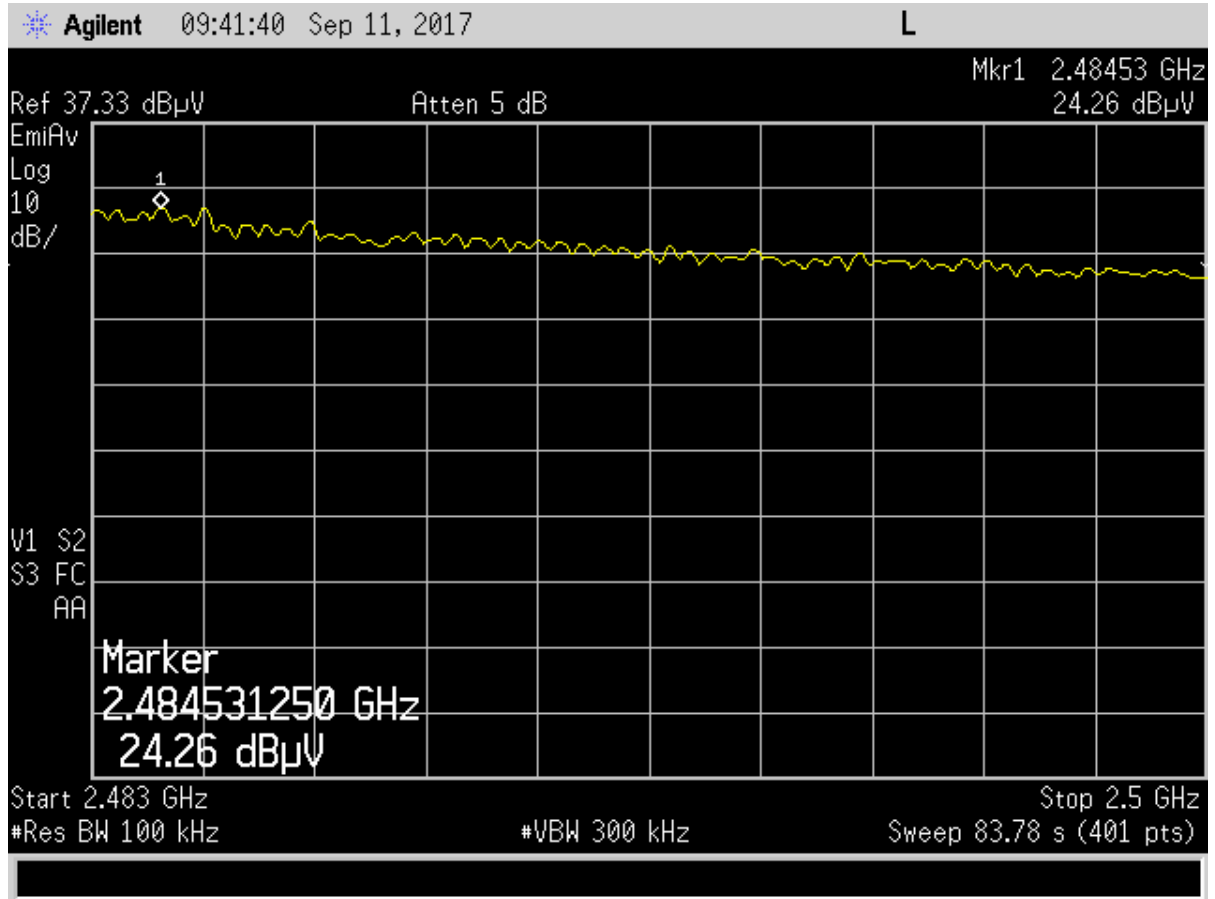


Figure 71. g mode (Dual-Band Antenna) High Channel Restricted Band – Average

Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2484.53	24.26	-7.96	33.39	49.14	54.0	3.0m./VERT	4.86	AVG

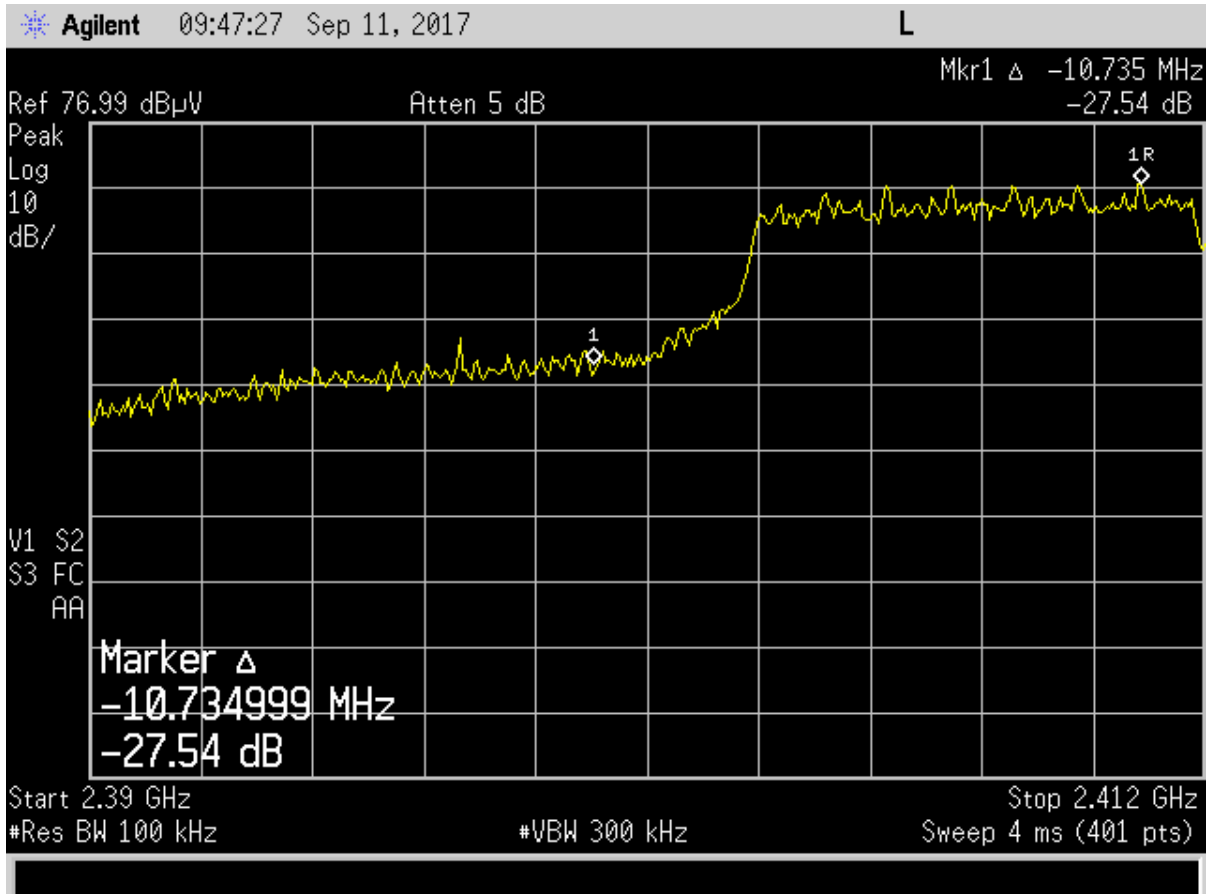


Figure 72. Band Edge Compliance – n mode (Dual-Band Antenna) Low Channel Delta – Peak

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	27.54	dB
Band Edge Limit	20.00	dB
Band Edge Margin	7.54	dB

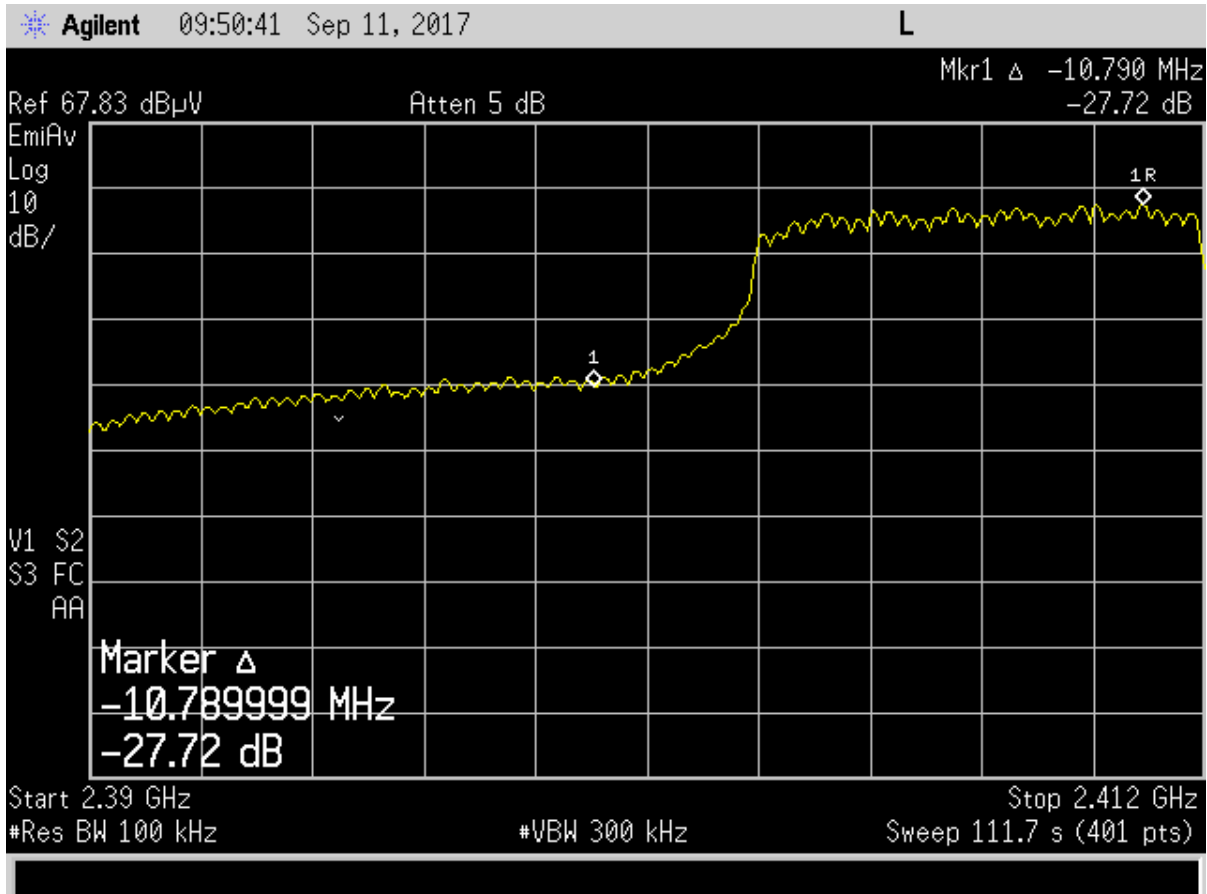


Figure 73. Band Edge Compliance – n mode (Dual-Band Antenna) Low Channel Delta – Average

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	27.72	dB
Band Edge Limit	20.00	dB
Band Edge Margin	17.72	dB

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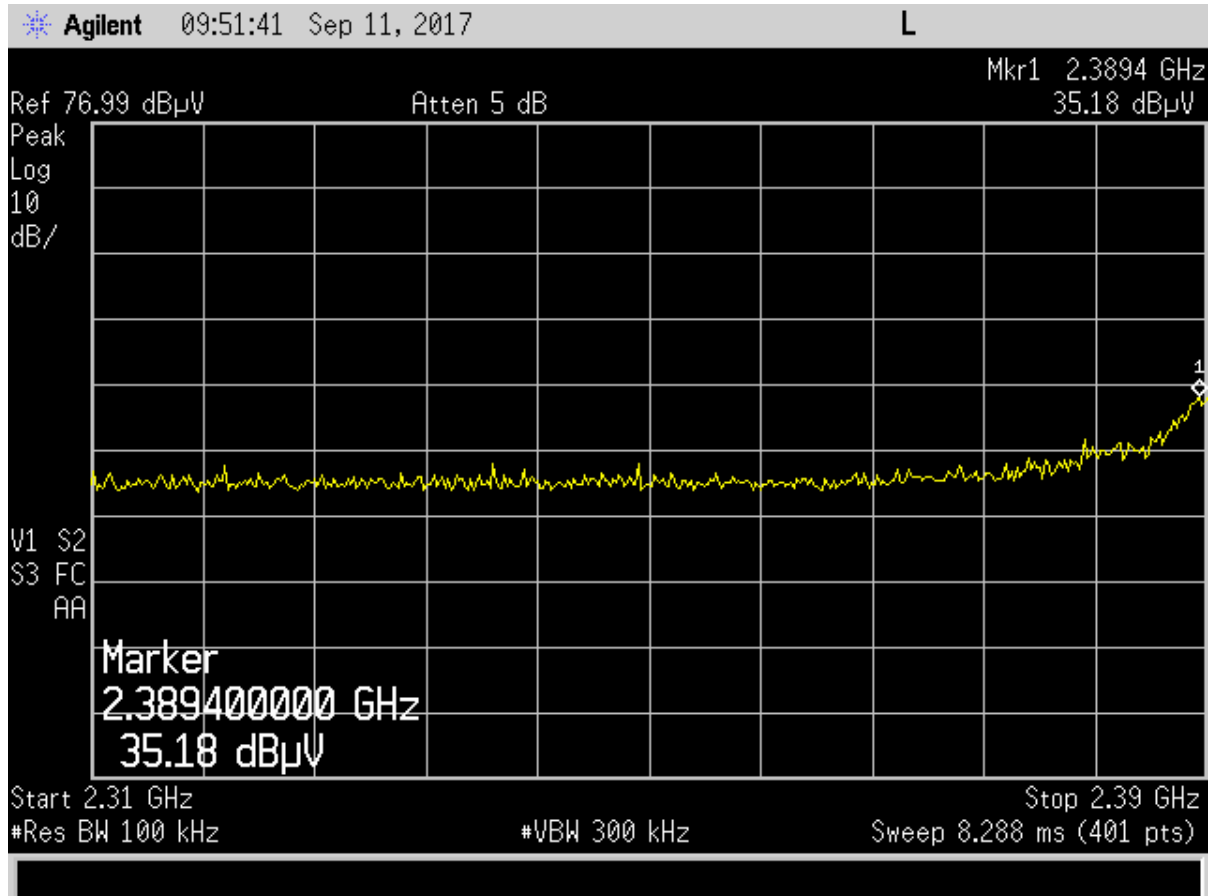


Figure 74. n mode (Dual-Band Antenna) Low Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2389.40	35.18	32.92	68.10	74.0	3.0m./VERT	5.9	PK

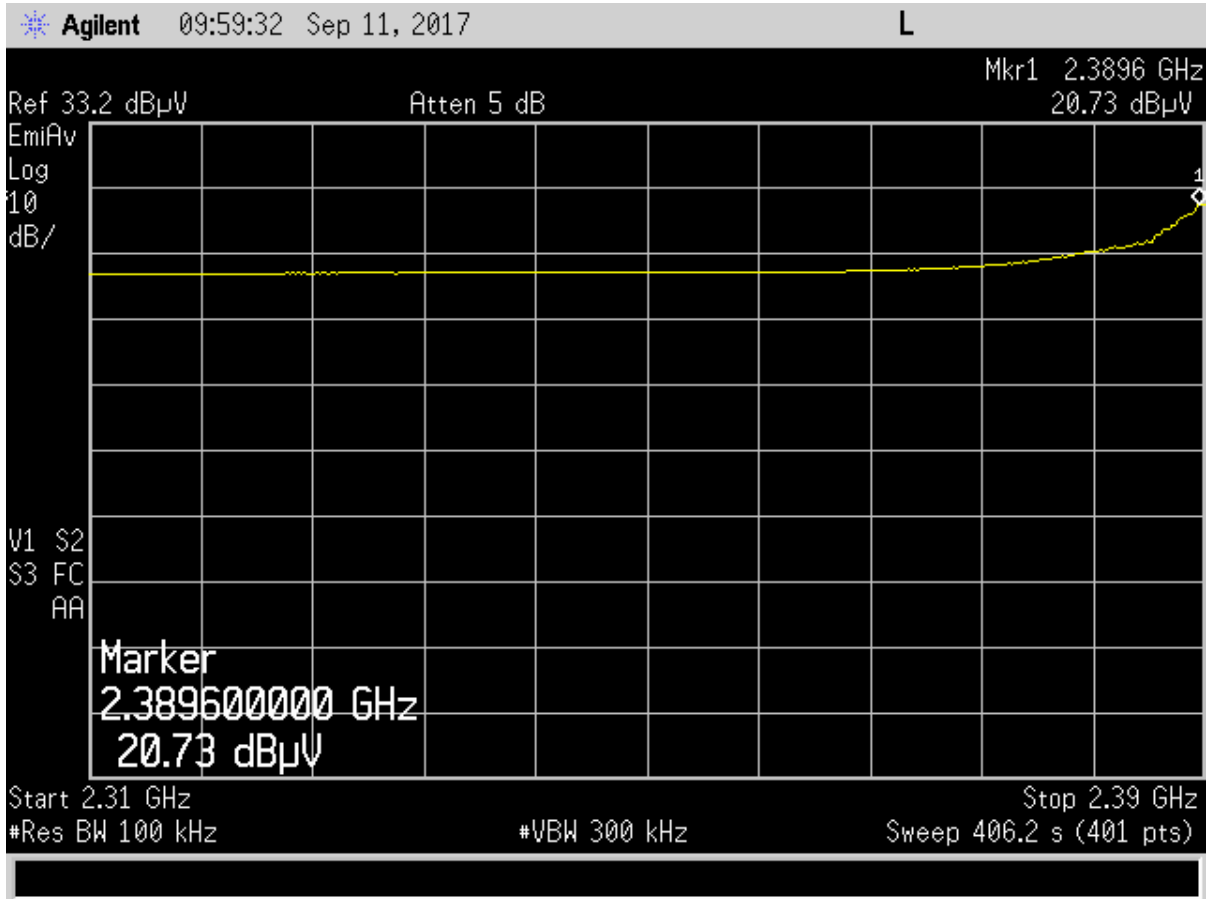


Figure 75. n mode (Dual-Band Antenna) Low Channel Restricted Band – Average

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2389.60	20.73	32.92	53.65	54.0	3.0m./VERT	0.3	AVG

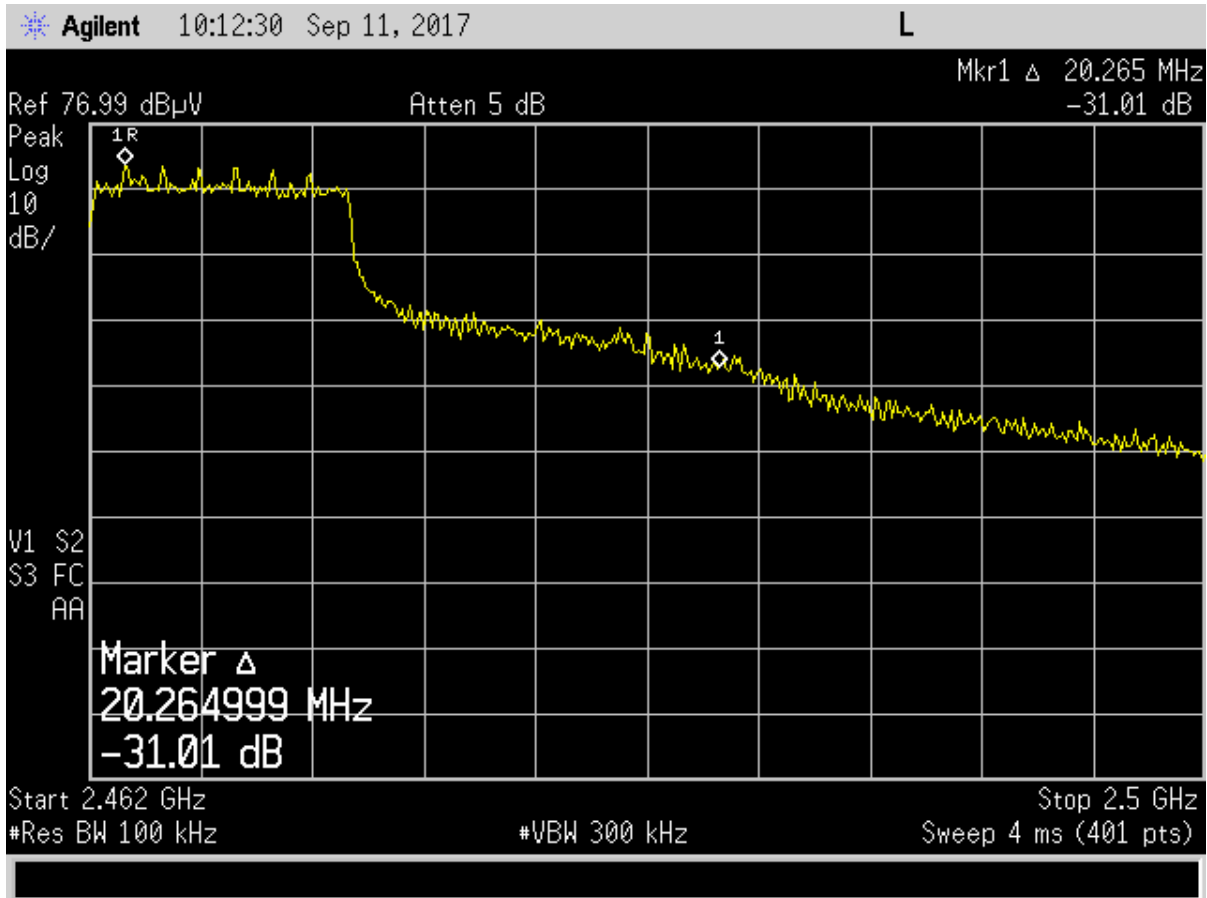


Figure 76. Band Edge Compliance – n mode (Dual-Band Antenna) High Channel Delta – Peak

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	31.01	dB
Band Edge Limit	20.00	dB
Band Edge Margin	11.01	dB

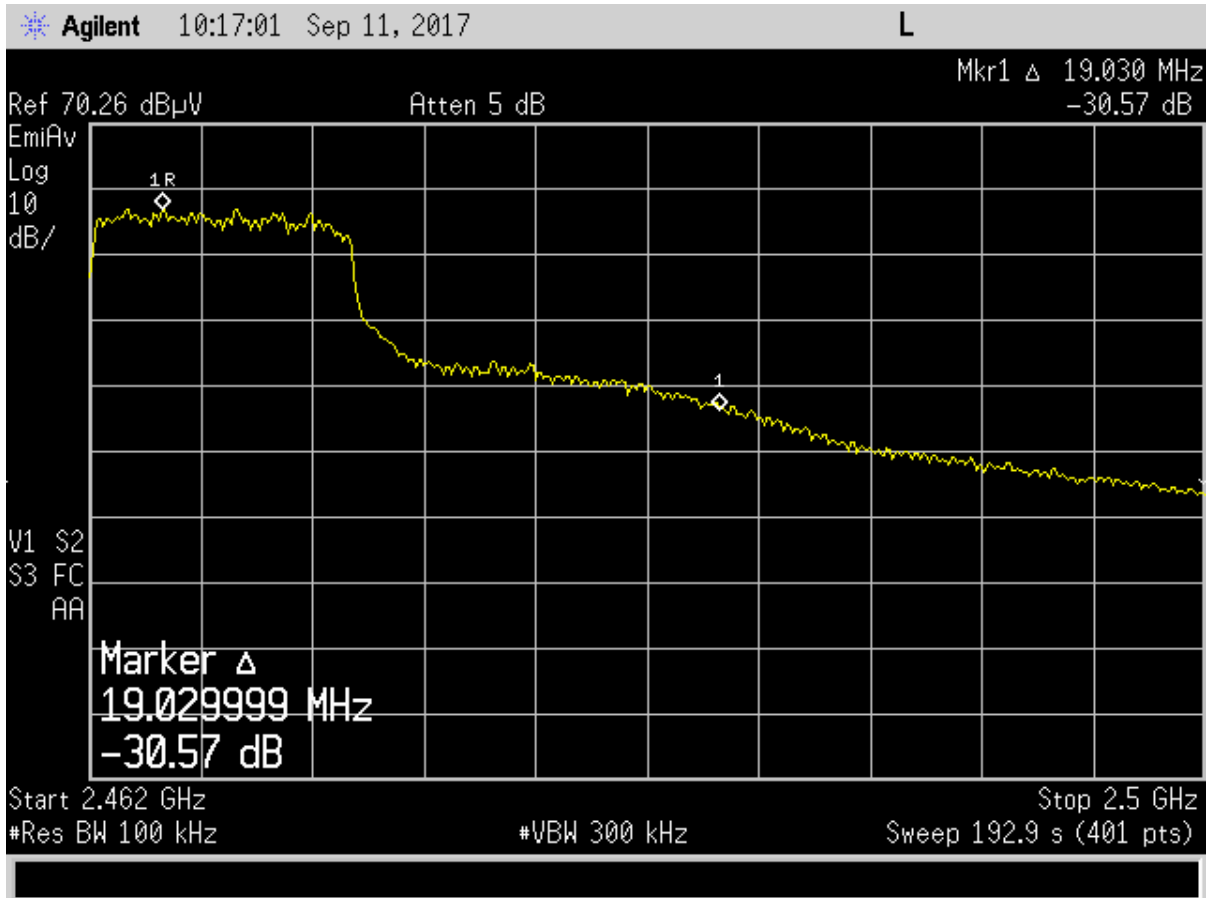


Figure 77. Band Edge Compliance – n mode (Dual-Band Antenna) High Channel Delta - Average

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	30.57	dB
Band Edge Limit	20.00	dB
Band Edge Margin	10.57	dB

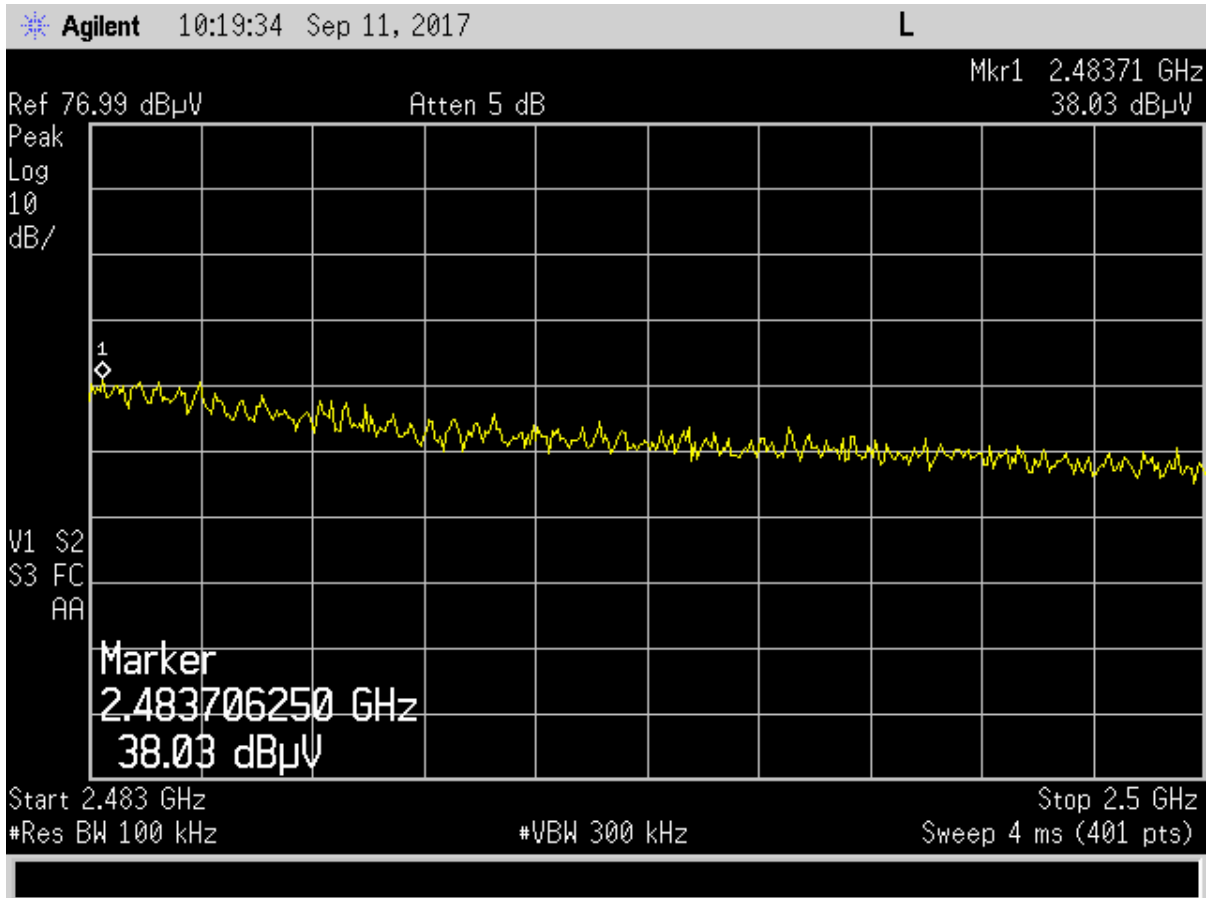


Figure 78. n mode (Dual-Band Antenna) High Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dB μ V)	AF+CA-AMP+DC (dB/m)	Results (dB μ V/m)	Limits (dB μ V/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.71	38.03	33.39	71.42	74.0	3.0m./VERT	2.6	PK

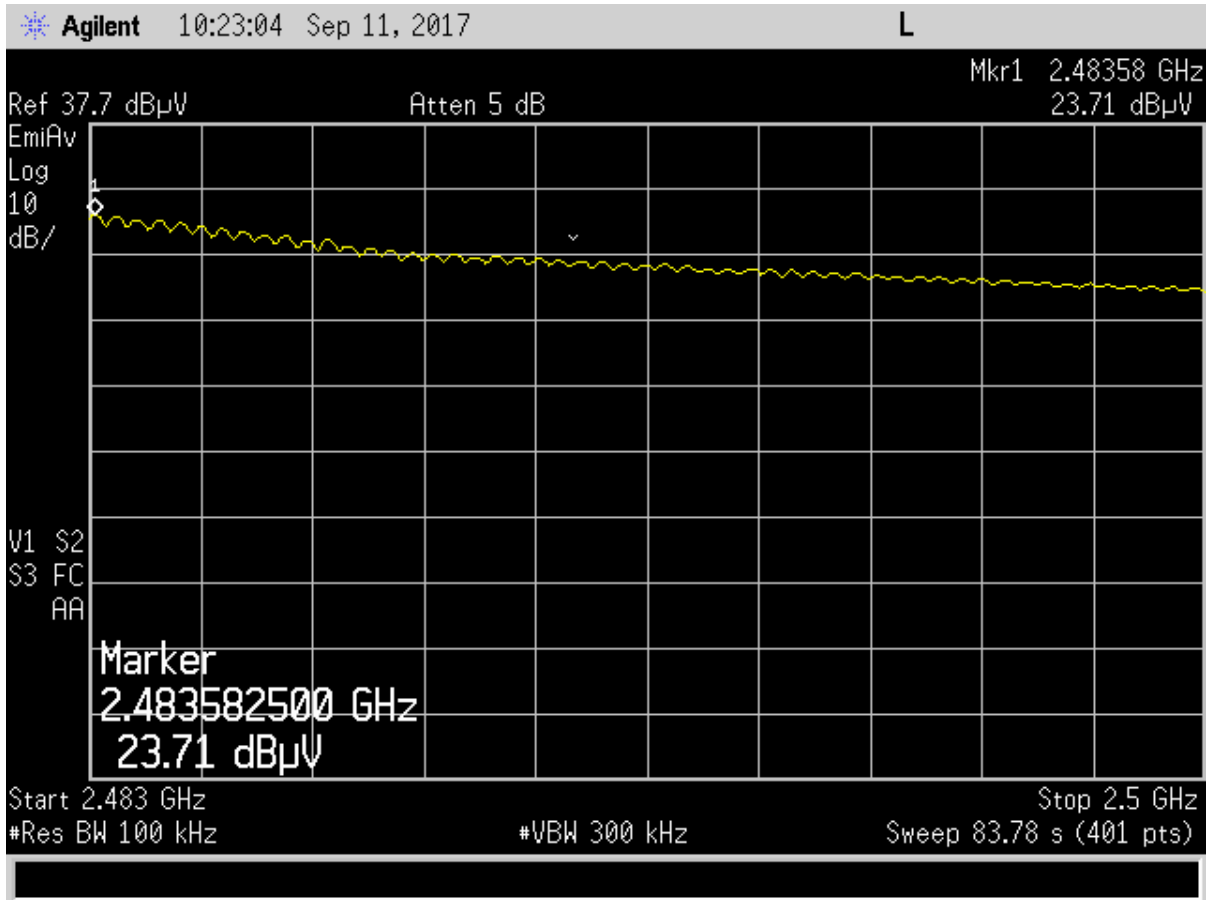


Figure 79. n mode (Dual-Band Antenna) High Channel Restricted Band – Average

Frequency (MHz)	Test Data (dB μ V)	Additional Factor	AF+CA-AMP+DC (dB/m)	Results (dB μ V/m)	Limits (dB μ V/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.58	23.71	-8.00	33.39	49.10	54.0	3.0m./VERT	4.9	AVG

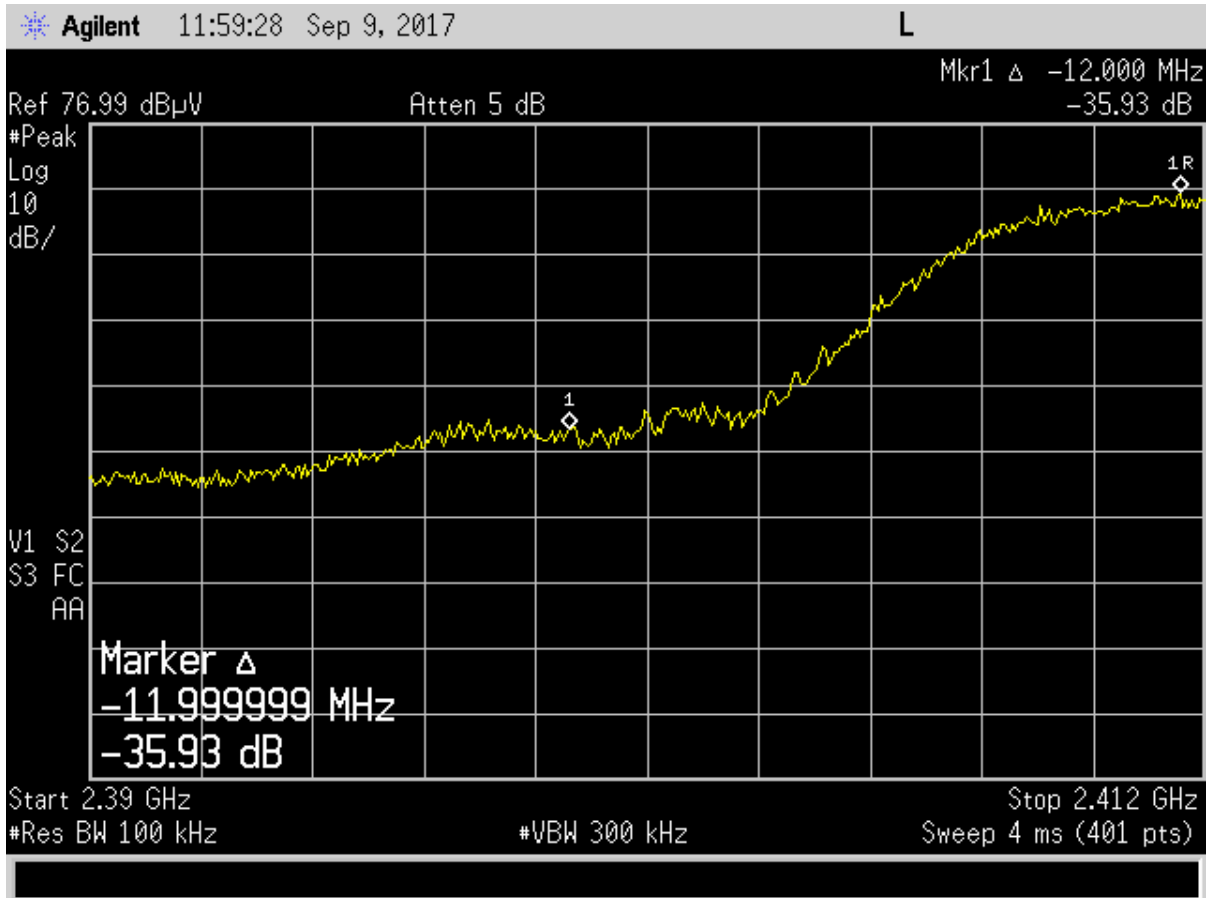


Figure 80. Band Edge Compliance – b mode (Single-Band Antenna) Low Channel Delta – Peak

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	35.93	dB
Band Edge Limit	20.00	dB
Band Edge Margin	15.93	dB

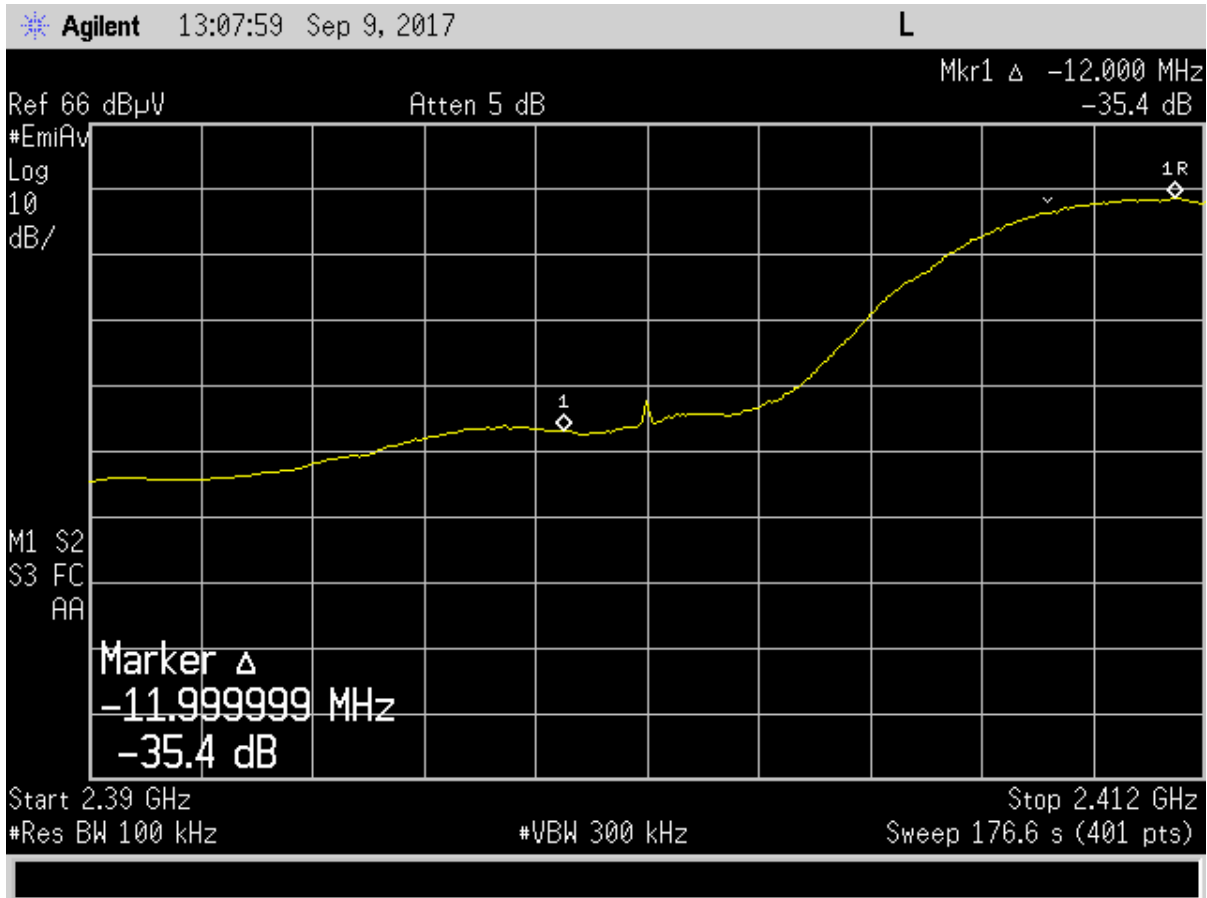


Figure 81. Band Edge Compliance – b mode (Single-Band Antenna) Low Channel Delta – Average

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	35.40	dB
Band Edge Limit	20.00	dB
Band Edge Margin	15.40	dB

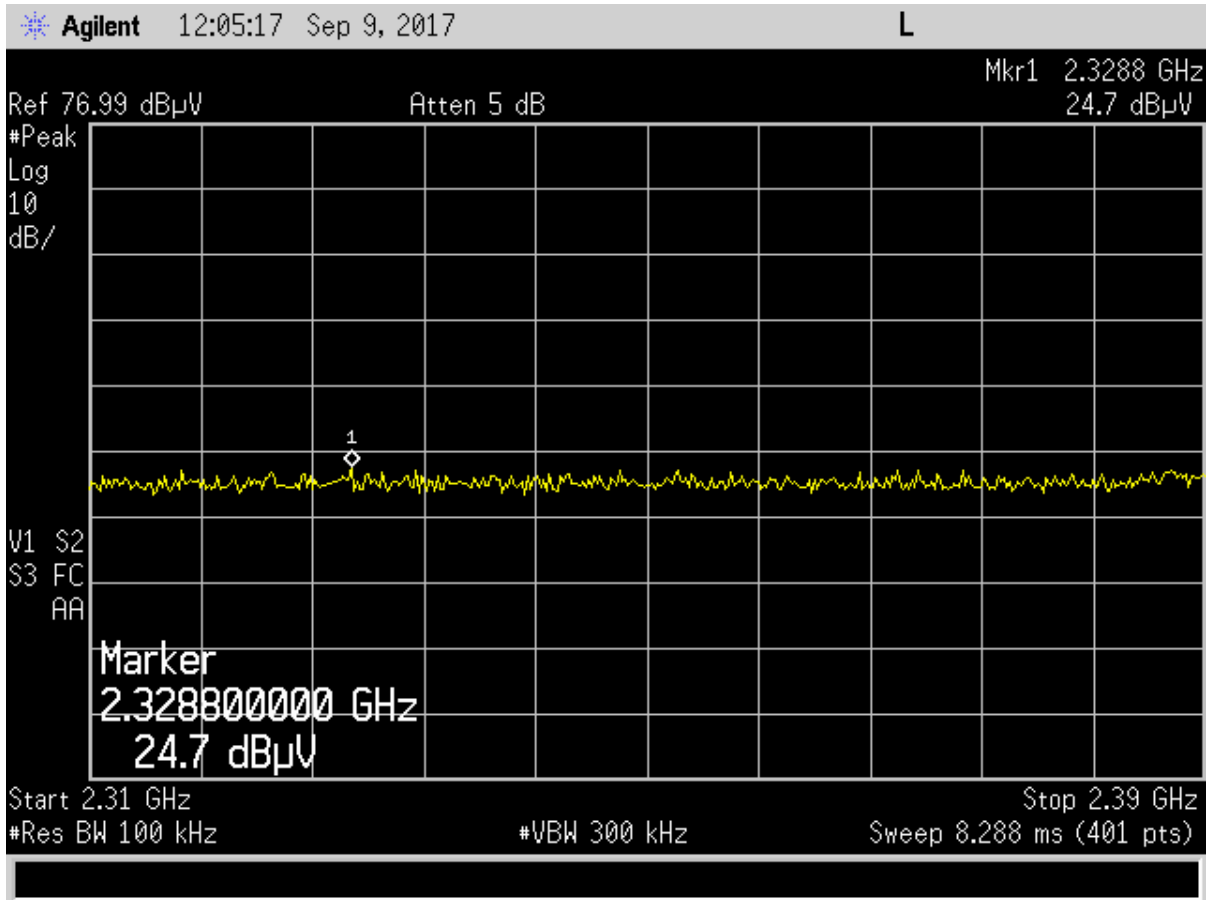


Figure 82. b mode (Single-Band Antenna) Low Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2328.80	24.70	32.92	57.62	74.0	3.0m./VERT	16.4	PK



Figure 83. b mode (Single-Band Antenna) Low Channel Restricted Band – Average

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2387.40	11.55	32.92	44.47	54.0	3.0m./VERT	9.5	AVG



Figure 84. Band Edge Compliance – b mode (Single-Band Antenna) High Channel Delta – Peak

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	37.46	dB
Band Edge Limit	20.00	dB
Band Edge Margin	17.46	dB

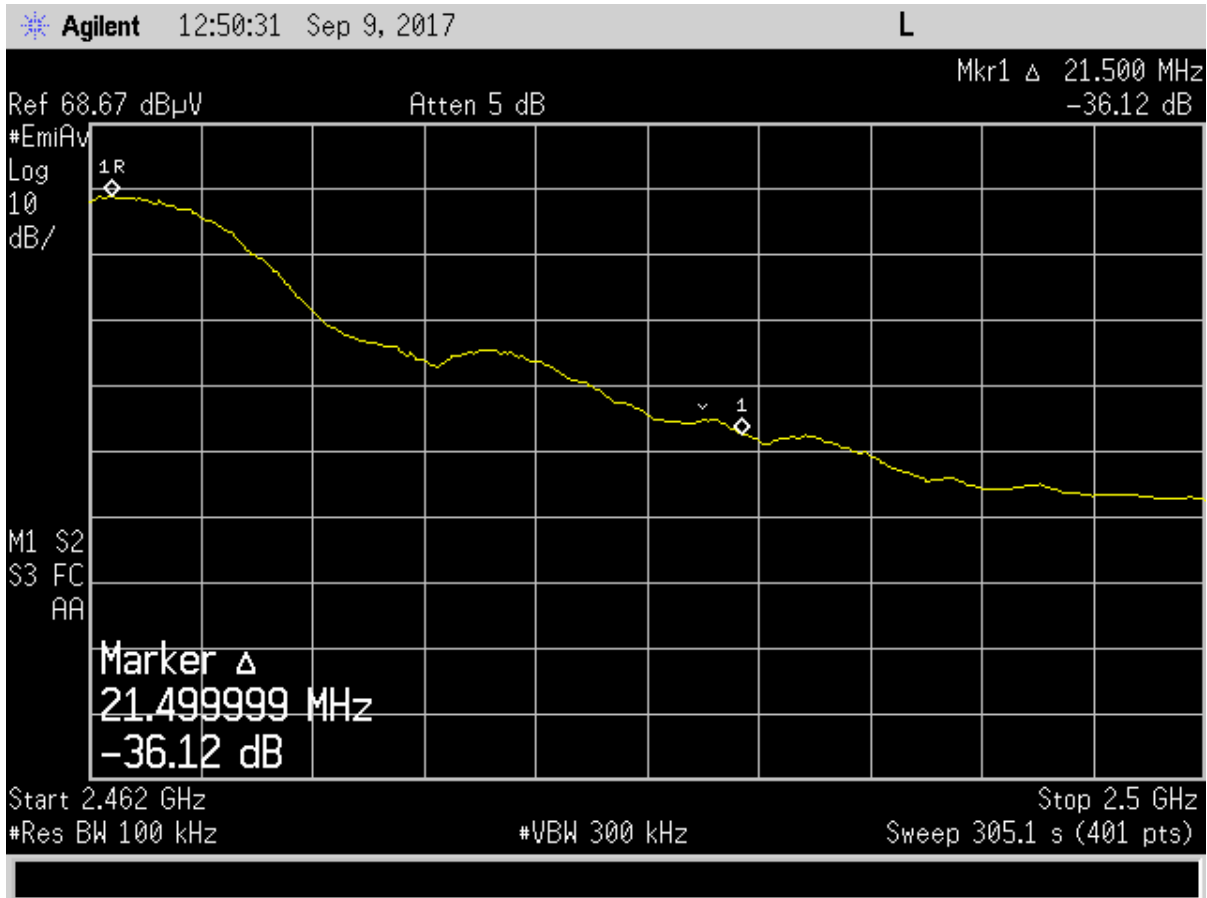


Figure 85. Band Edge Compliance – b mode (Single-Band Antenna) High Channel Delta - Average

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	36.12	dB
Band Edge Limit	20.00	dB
Band Edge Margin	16.12	dB

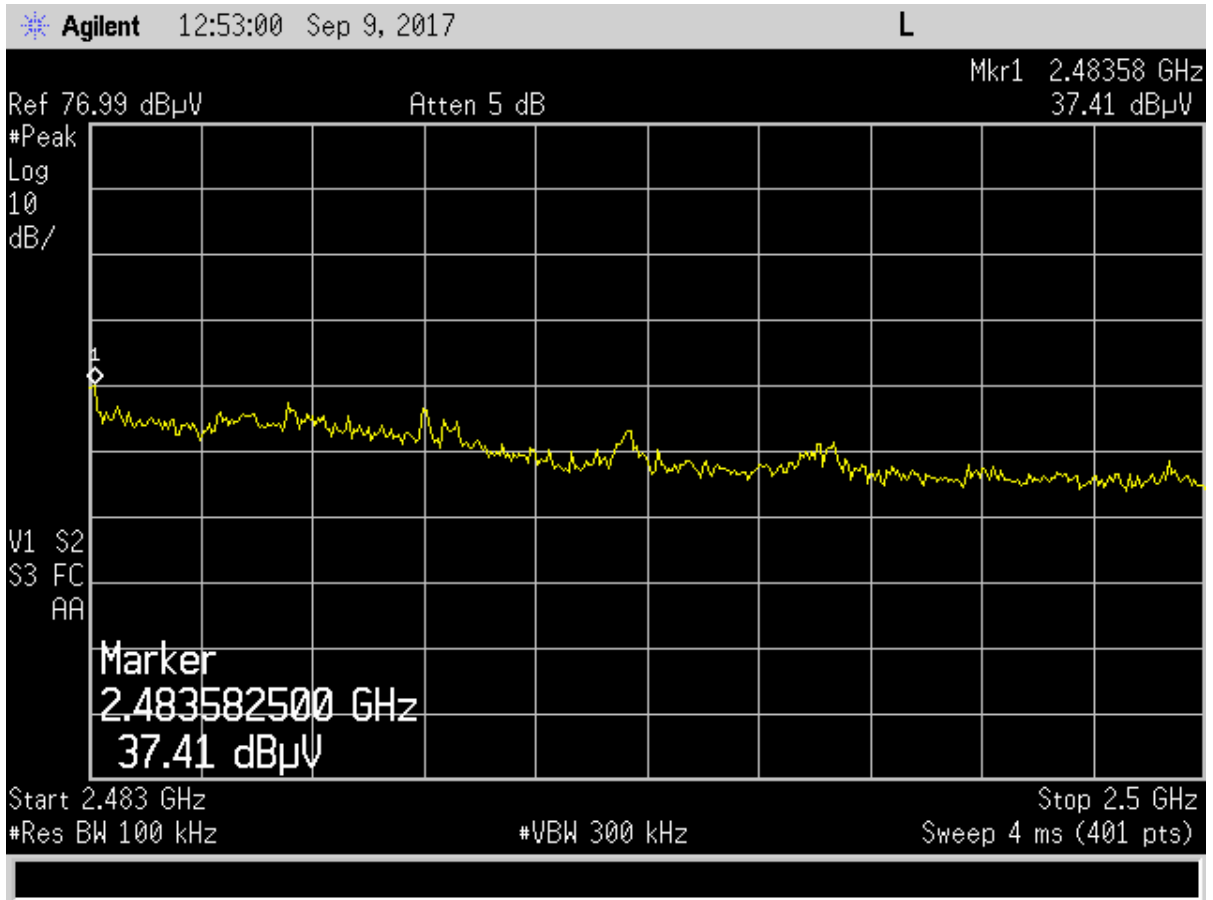


Figure 86. b mode (Single-Band Antenna) High Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.58	37.41	33.39	70.80	74.0	3.0m./VERT	3.2	PK

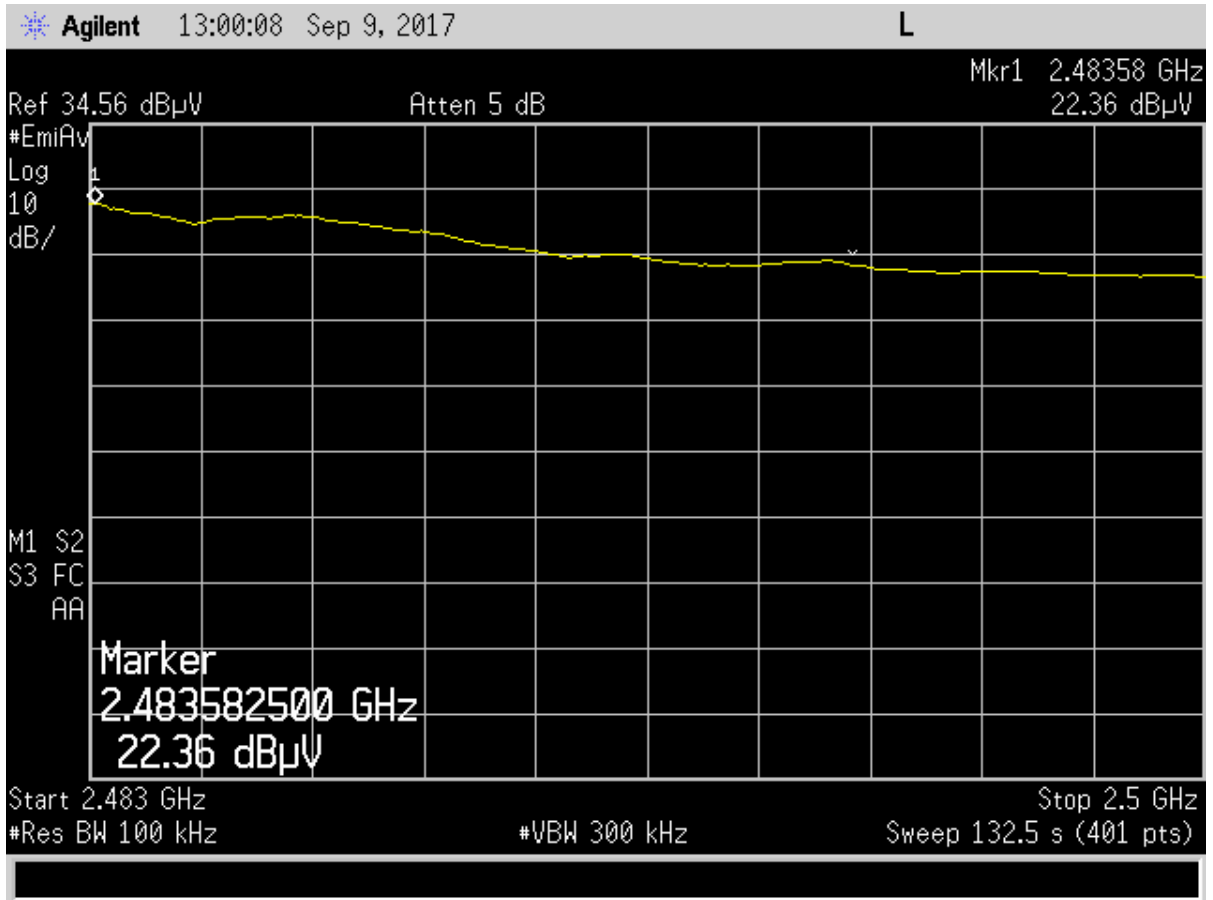


Figure 87. b mode (Single-Band Antenna) High Channel Restricted Band – Average

Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.58	22.36	-7.96	33.39	47.24	54.0	3.0m./VERT	6.8	AVG

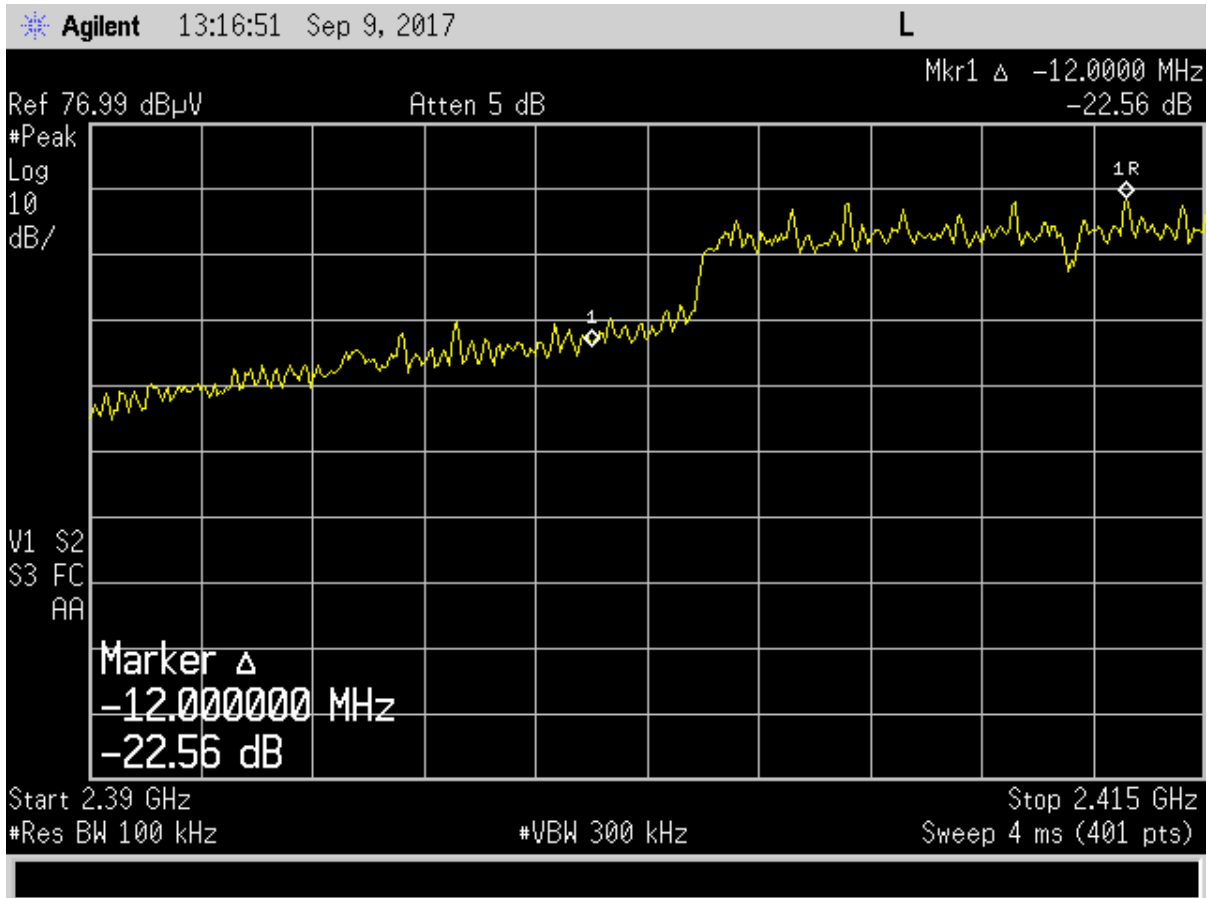


Figure 88. Band Edge Compliance – g mode (Single-Band Antenna) Low Channel Delta – Peak

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	22.56	dB
Band Edge Limit	20.00	dB
Band Edge Margin	2.56	dB

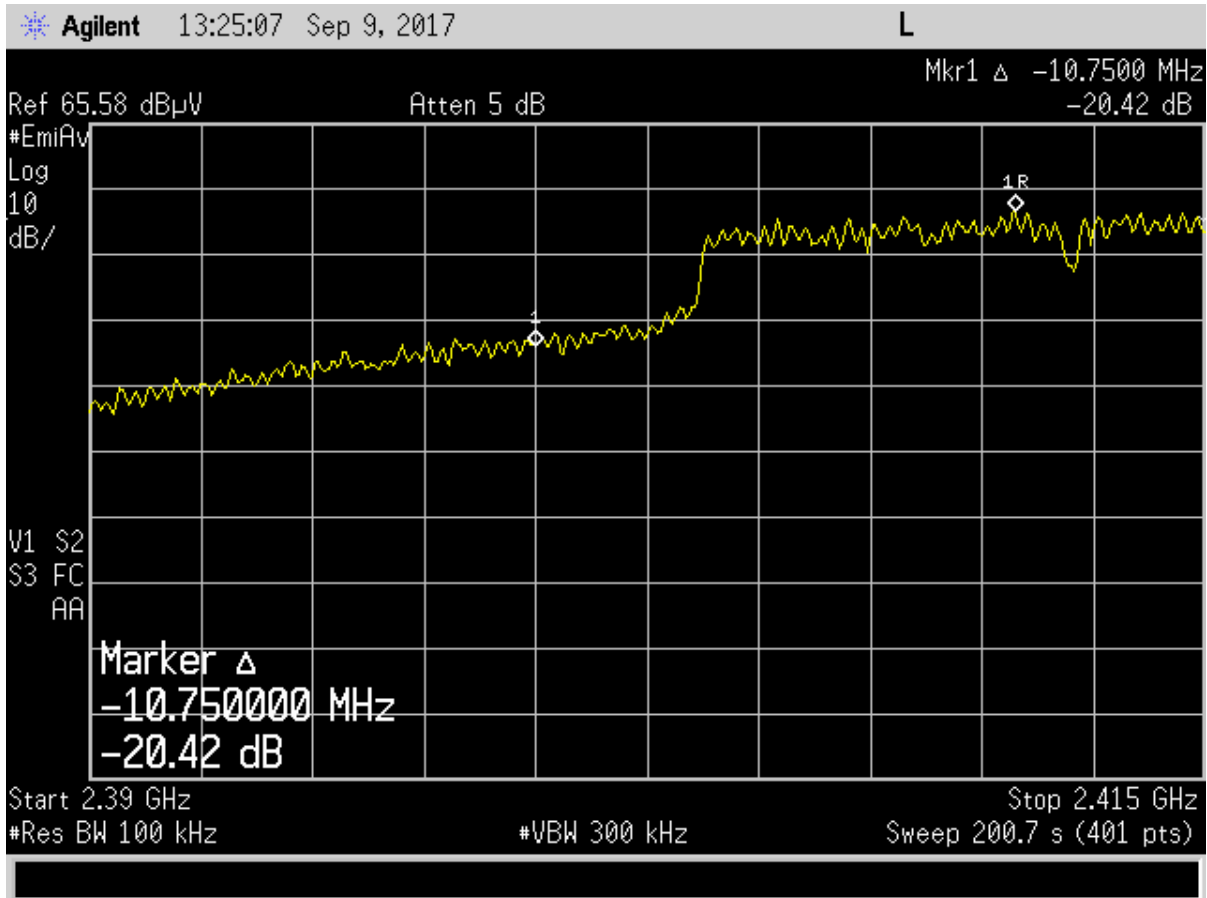


Figure 89. Band Edge Compliance – g mode (Single-Band Antenna) Low Channel Delta – Average

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	20.42	dB
Band Edge Limit	20.00	dB
Band Edge Margin	0.42	dB

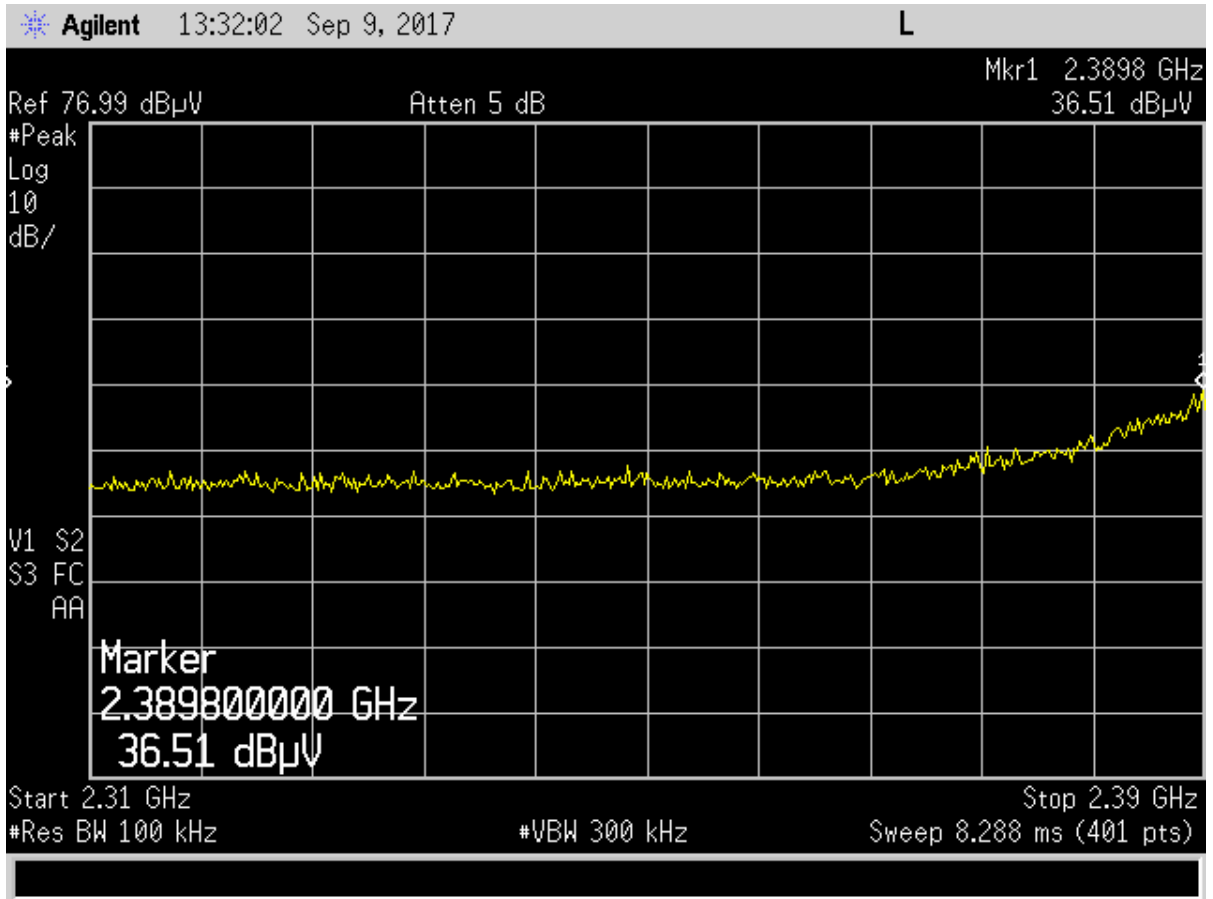


Figure 90. g mode (Single-Band Antenna) Low Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2389.80	36.51	32.92	69.43	74.0	3.0m./VERT	4.6	PK

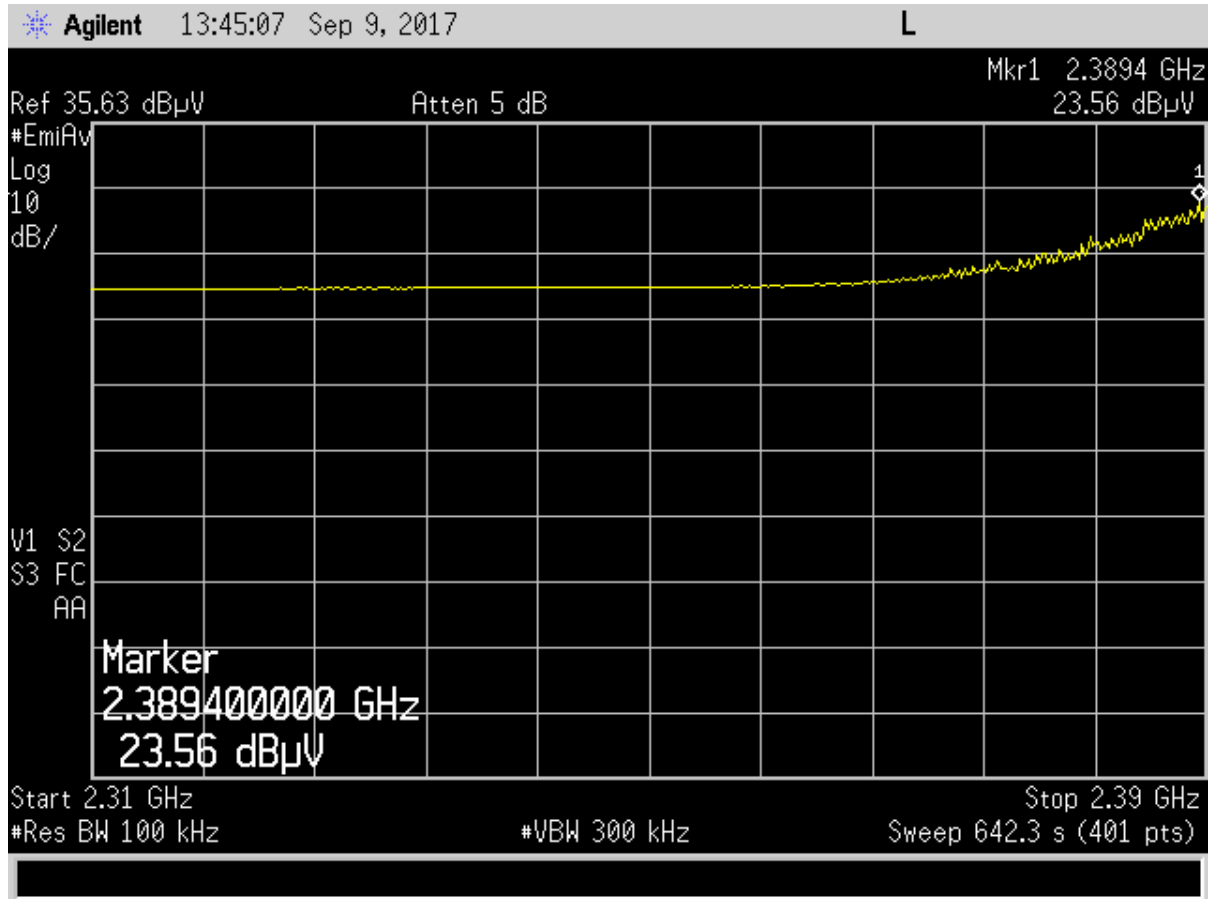


Figure 91. g mode (Single-Band Antenna) Low Channel Restricted Band – Average

Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2389.40	23.56	-7.96	32.92	47.97	54.0	3.0m./VERT	6.0	AVG

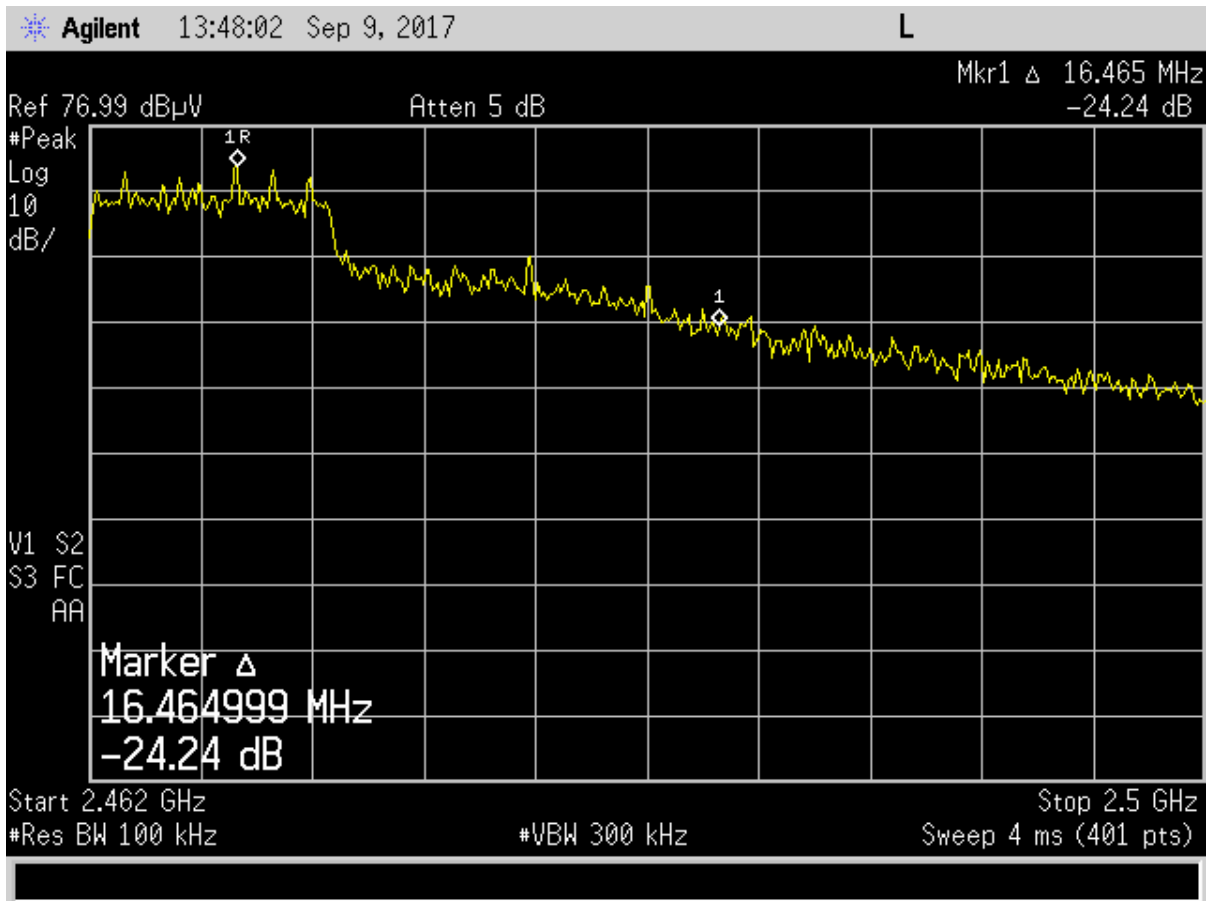


Figure 92. Band Edge Compliance – g mode (Single-Band Antenna) High Channel Delta – Peak

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	24.24	dB
Band Edge Limit	20.00	dB
Band Edge Margin	4.24	dB

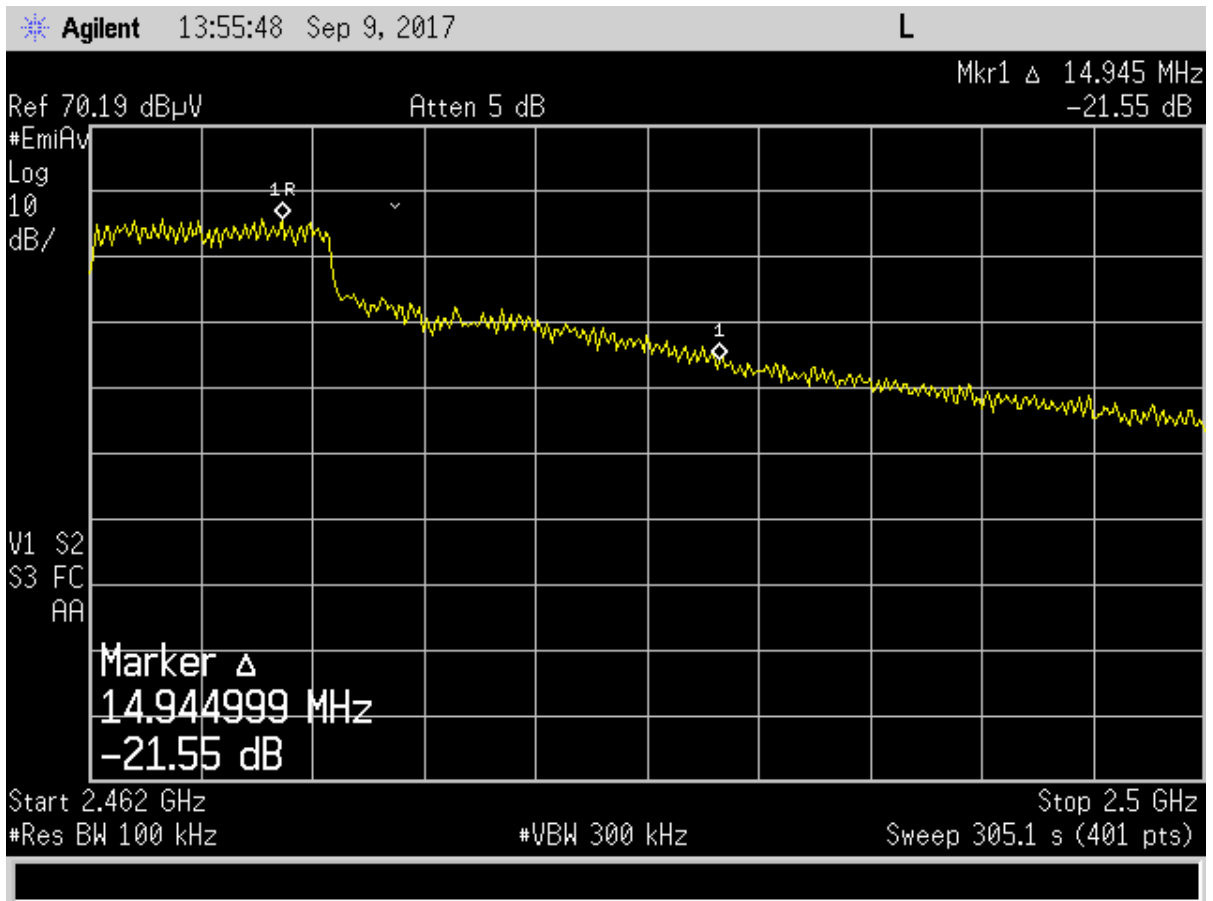


Figure 93. Band Edge Compliance – g mode (Single-Band Antenna) High Channel Delta - Average

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	21.55	dB
Band Edge Limit	20.00	dB
Band Edge Margin	1.55	dB

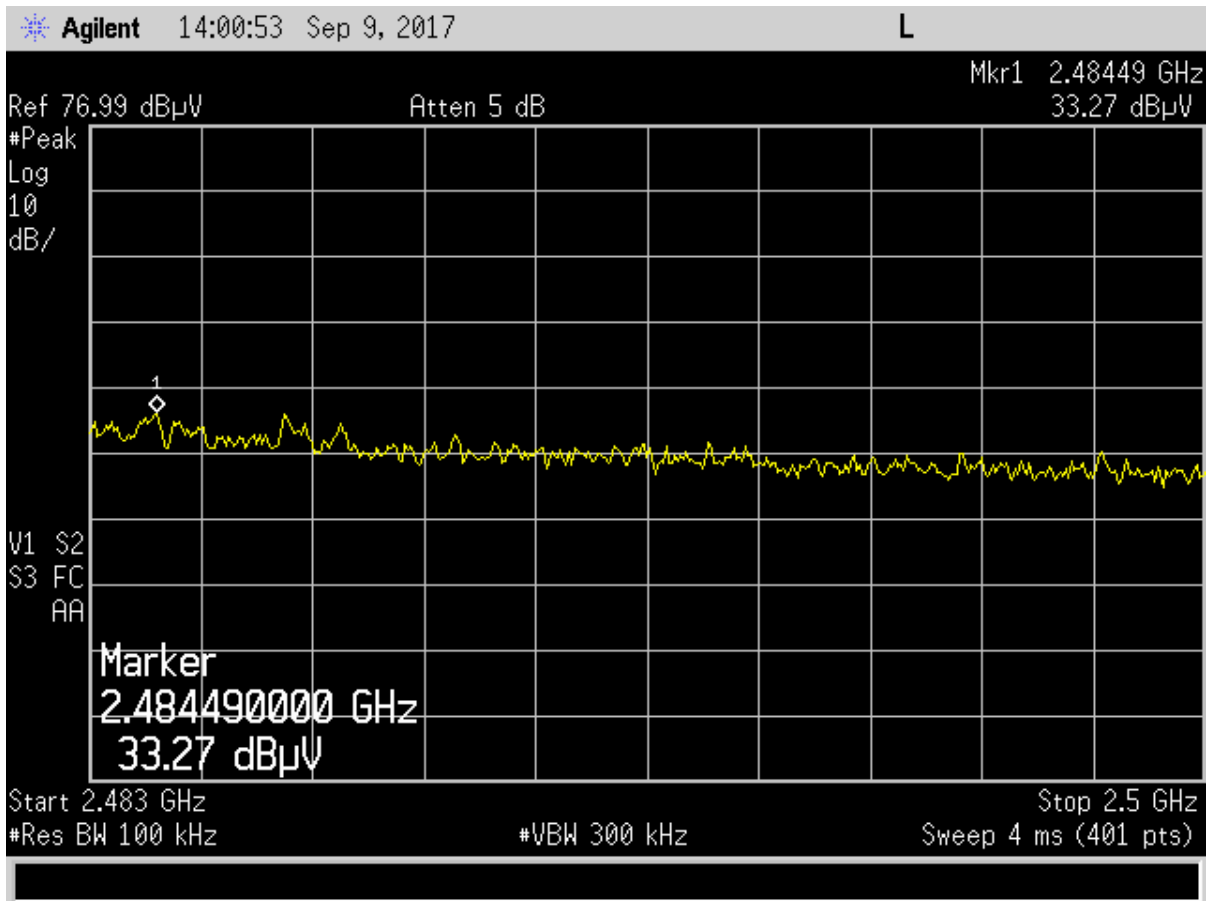


Figure 94. g mode (Single-Band Antenna) High Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2484.49	33.27	33.39	66.66	74.0	3.0m./VERT	7.3	PK

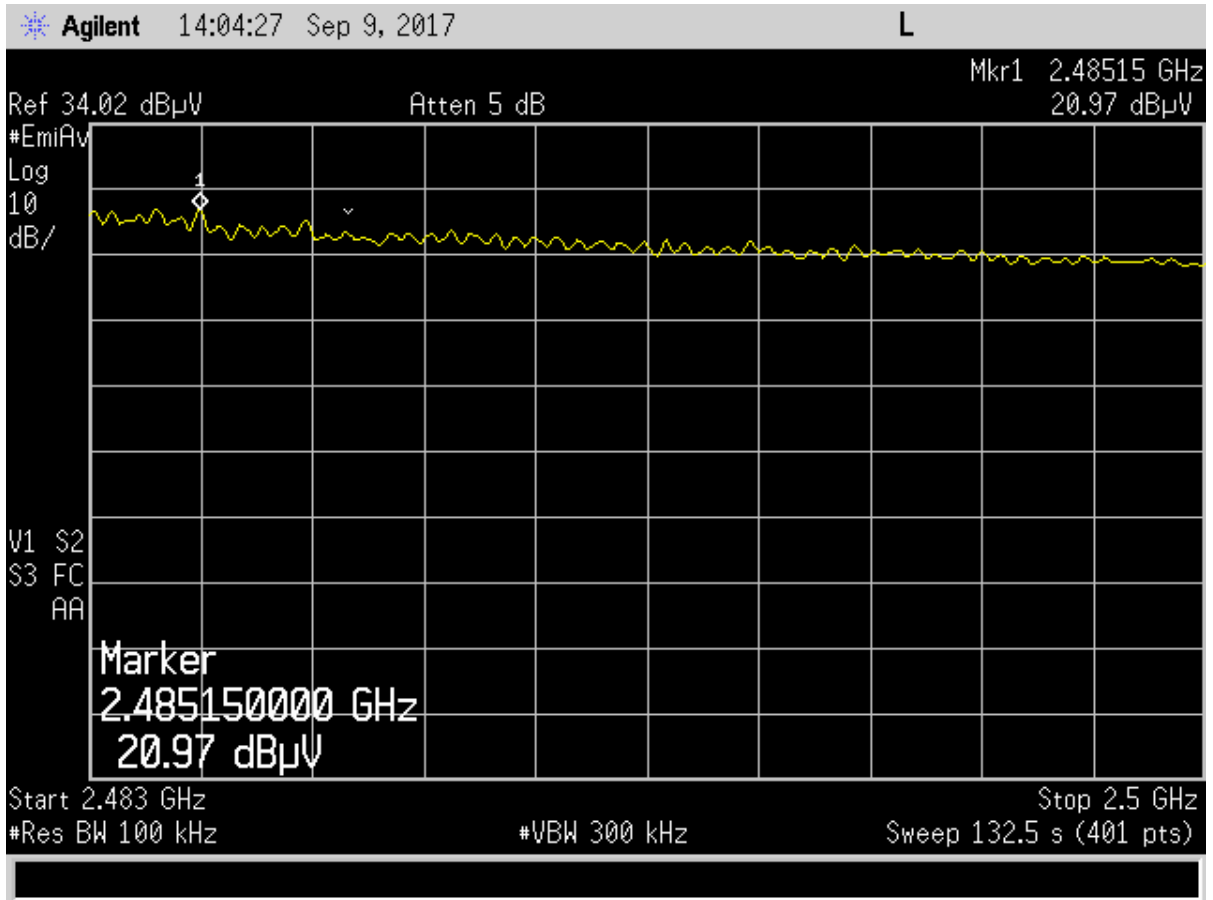


Figure 95. g mode (Single-Band Antenna) High Channel Restricted Band – Average

Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2485.15	20.97	-7.96	33.39	45.85	54.0	3.0m./VER T	8.1	AVG

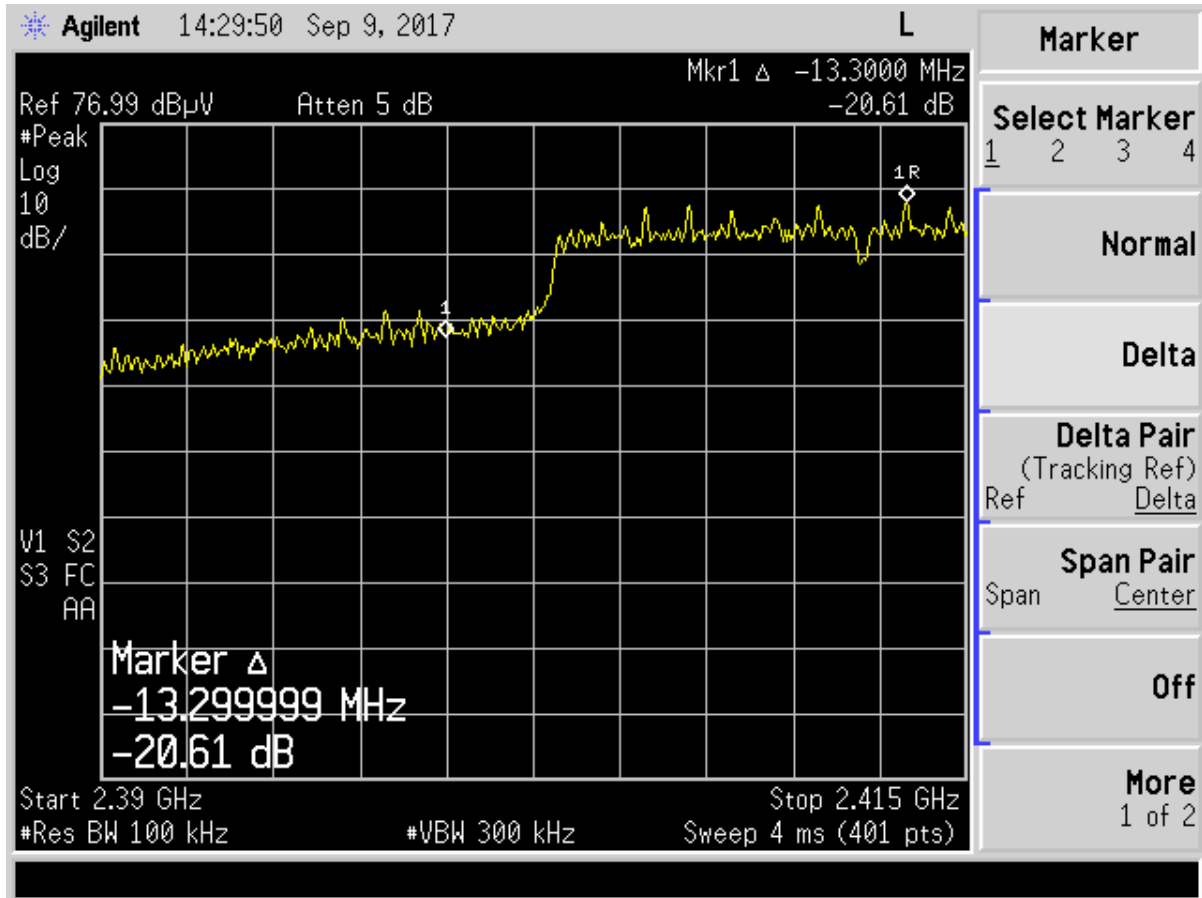


Figure 96. Band Edge Compliance – n mode (Single-Band Antenna) Low Channel Delta – Peak

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	20.61	dB
Band Edge Limit	20.00	dB
Band Edge Margin	0.61	dB

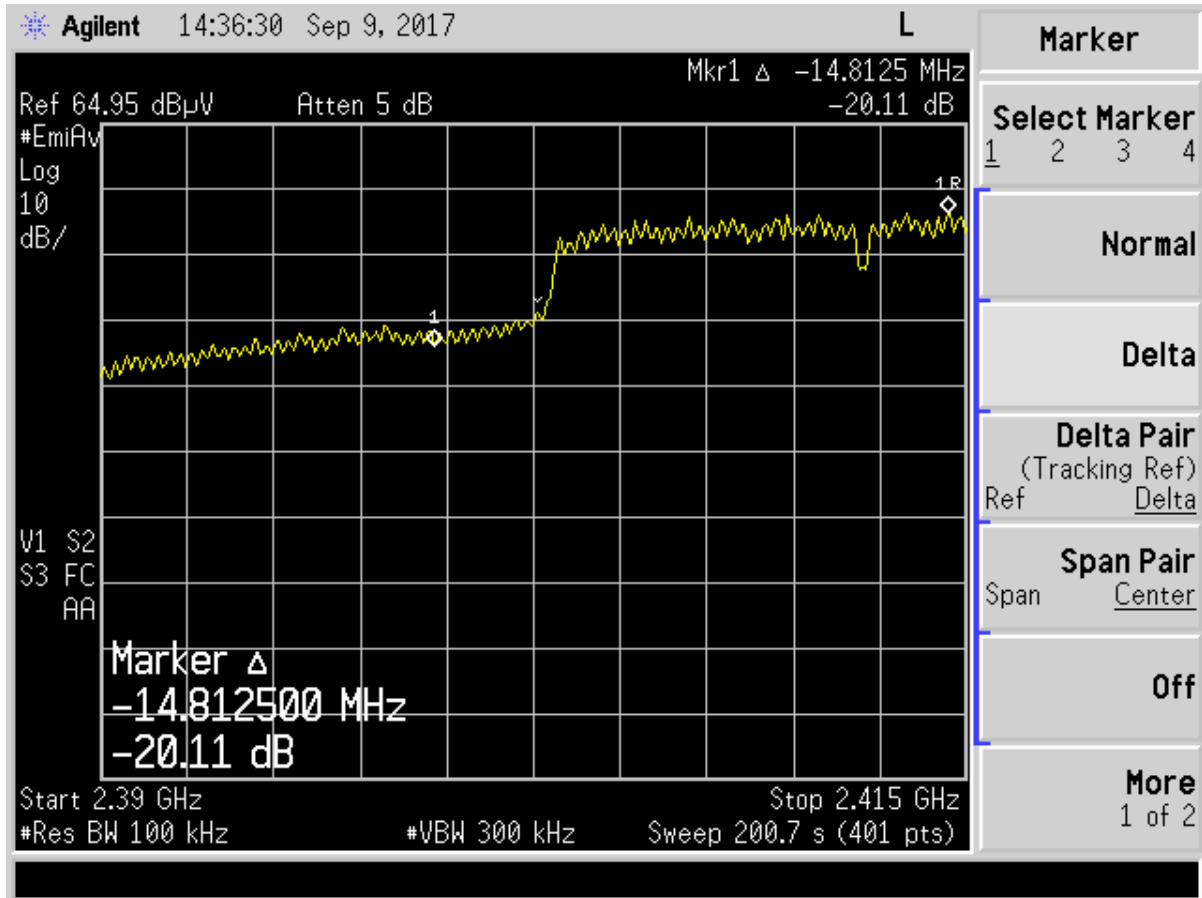


Figure 97. Band Edge Compliance – n mode (Single-Band Antenna) Low Channel Delta – Average

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	20.11	dB
Band Edge Limit	20.00	dB
Band Edge Margin	0.11	dB

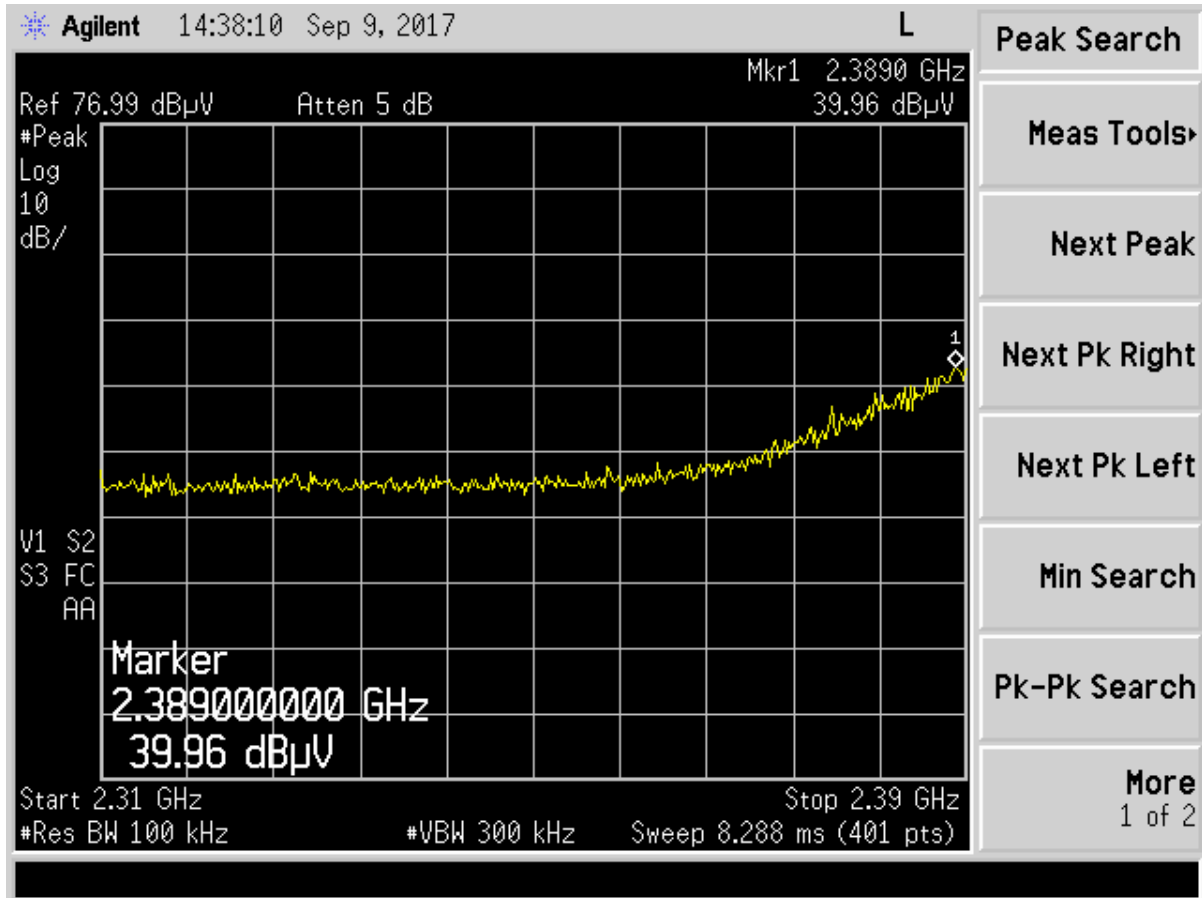


Figure 98. n mode (Single-Band Antenna) Low Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2389.00	39.96	32.92	72.88	74.0	3.0m./VERT	1.1	PK

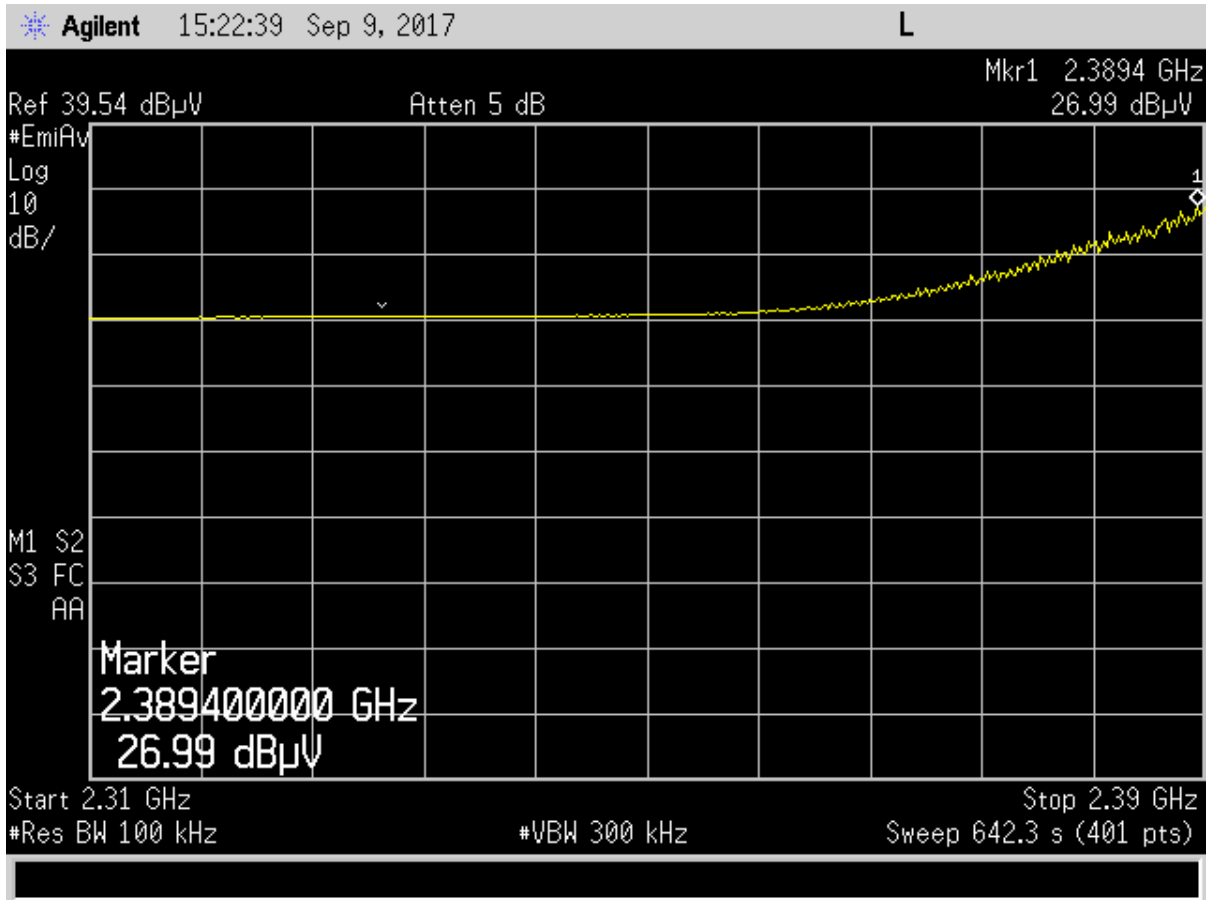


Figure 99. n mode (Single-Band Antenna) Low Channel Restricted Band – Average

Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2389.40	26.99	-7.96	32.92	51.40	54.0	3.0m./VER T	2.6	AVG

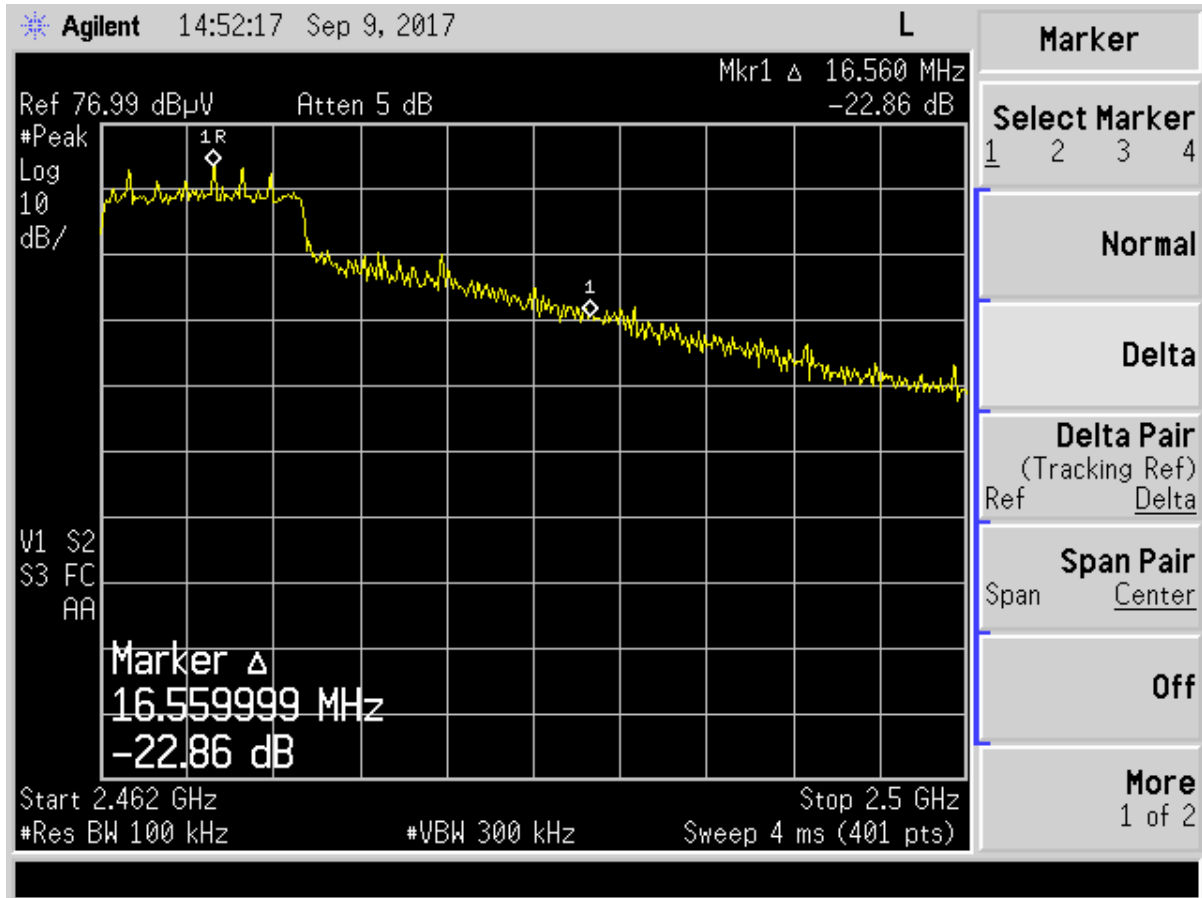


Figure 100. Band Edge Compliance – n mode (Single-Band Antenna) High Channel Delta – Peak

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	22.86	dB
Band Edge Limit	20.00	dB
Band Edge Margin	2.86	dB

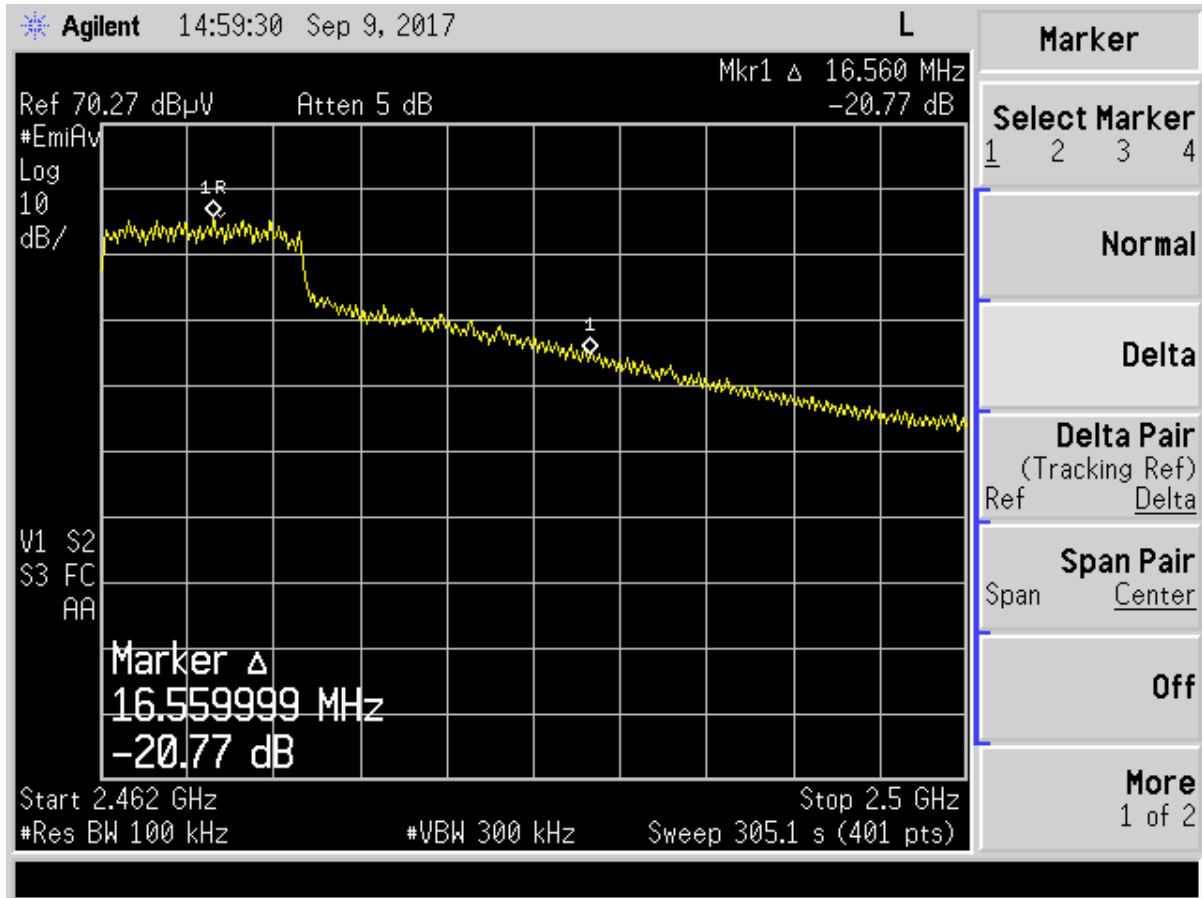


Figure 101. Band Edge Compliance – n mode (Single-Band Antenna) High Channel Delta – Average

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	20.77	dB
Band Edge Limit	20.00	dB
Band Edge Margin	0.77	dB

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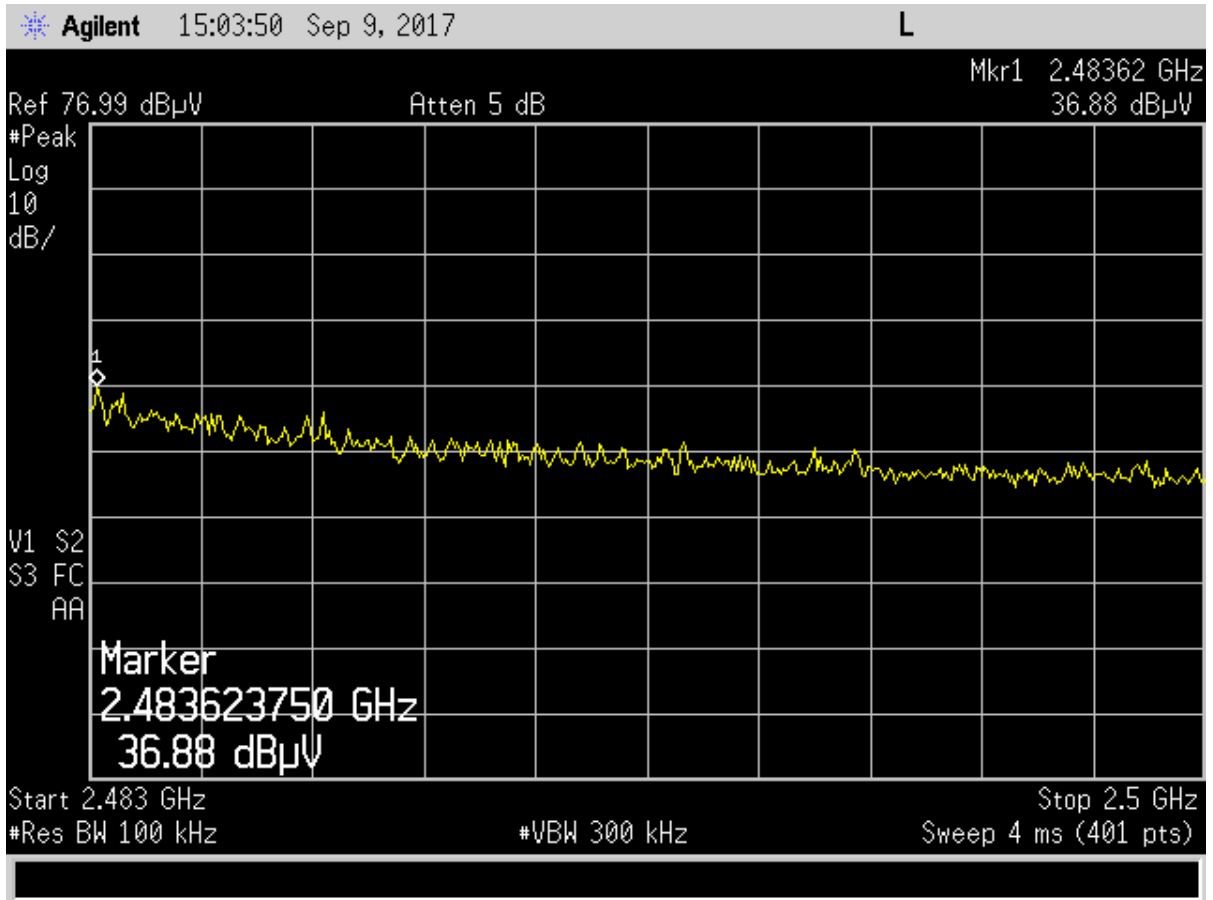


Figure 102. n mode (Single-Band Antenna) High Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.62	36.88	33.39	70.27	74.0	3.0m./VERT	3.7	PK

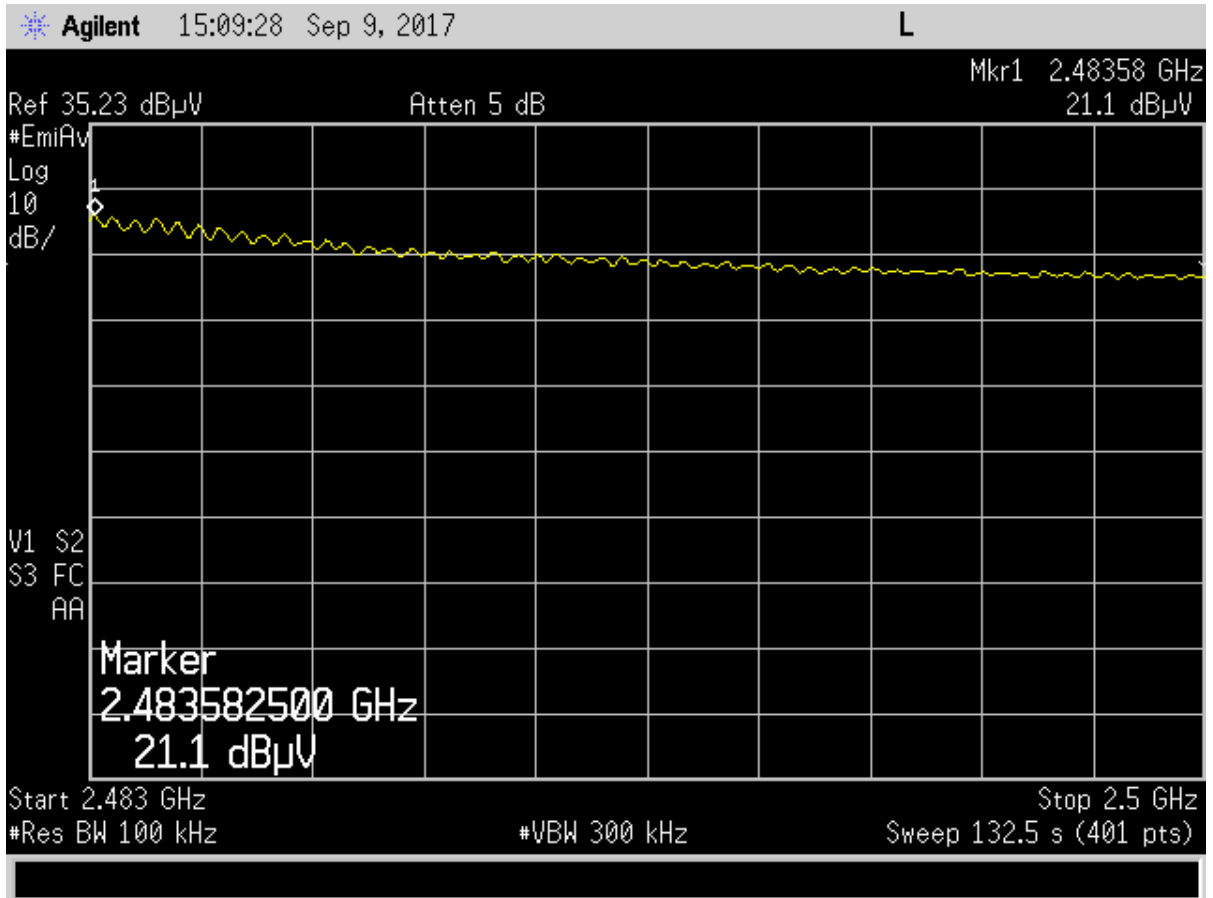


Figure 103. n mode (Single-Band Antenna) High Channel Restricted Band – Average

Frequency (MHz)	Test Data (dB μ V)	Additional Factor	AF+CA-AMP+DC (dB/m)	Results (dB μ V/m)	Limits (dB μ V/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.58	21.10	-7.96	33.39	45.98	54.0	3.0m./VERT	8.0	AVG

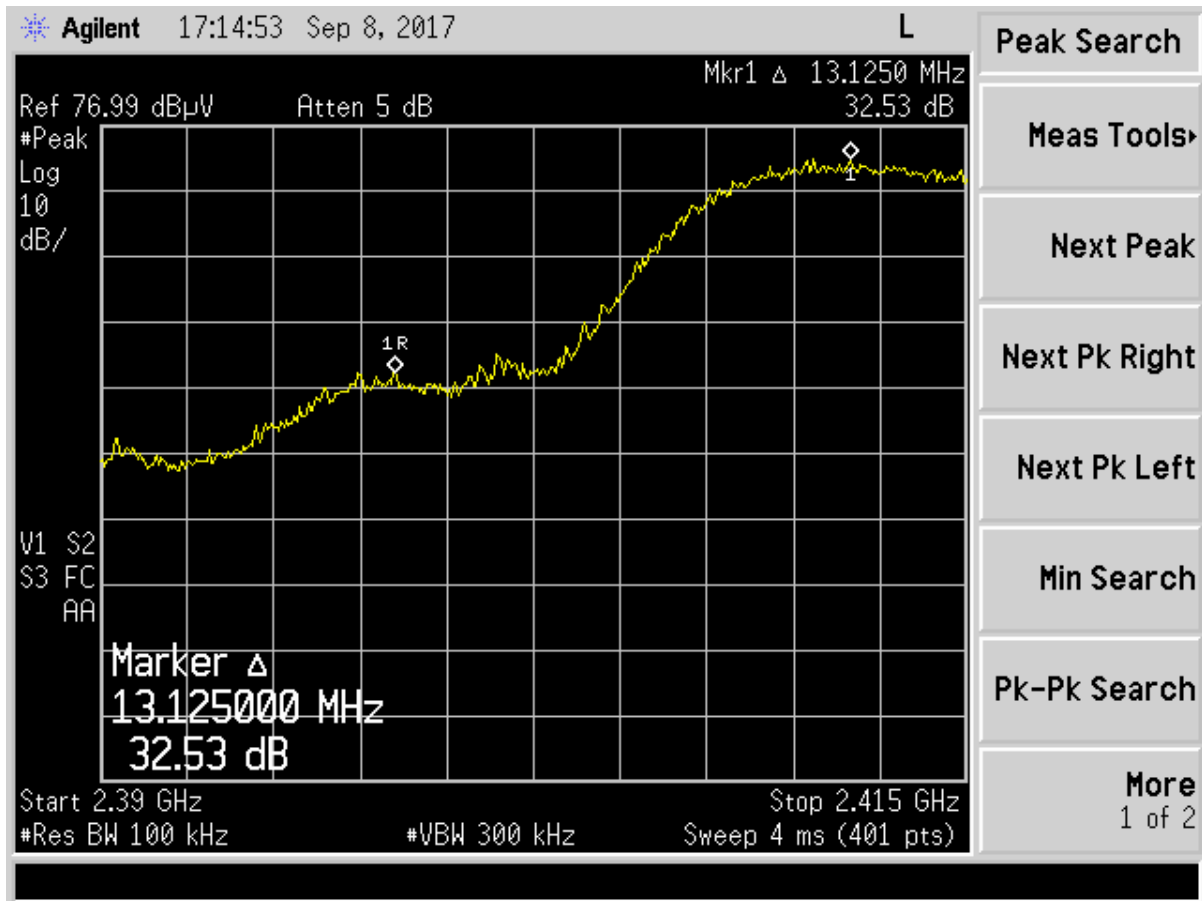


Figure 104. Band Edge Compliance – b mode (Trace Antenna) Low Channel Delta – Peak

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	32.53	dB
Band Edge Limit	20.00	dB
Band Edge Margin	12.53	dB

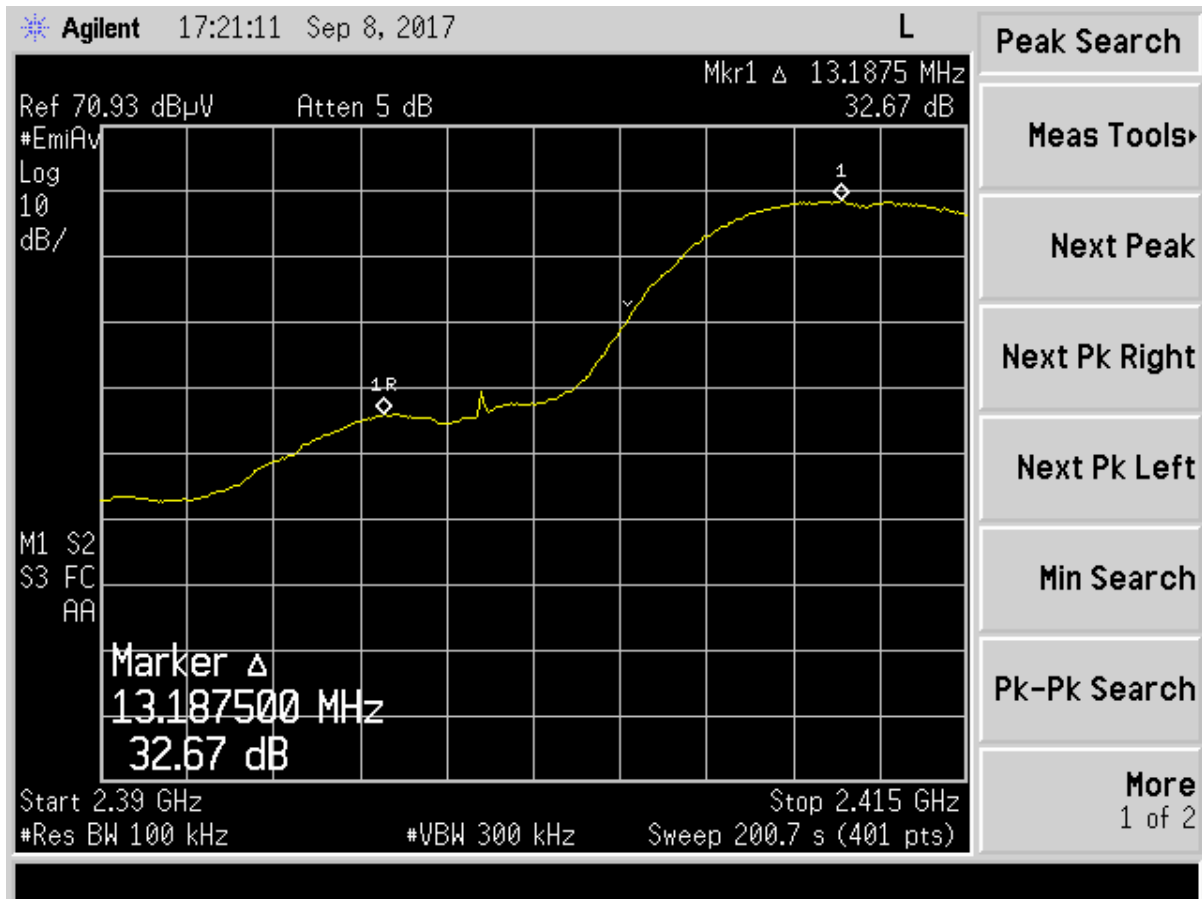


Figure 105. Band Edge Compliance – b mode (Trace Antenna) Low Channel Delta – Average

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	32.67	dB
Band Edge Limit	20.00	dB
Band Edge Margin	12.67	dB

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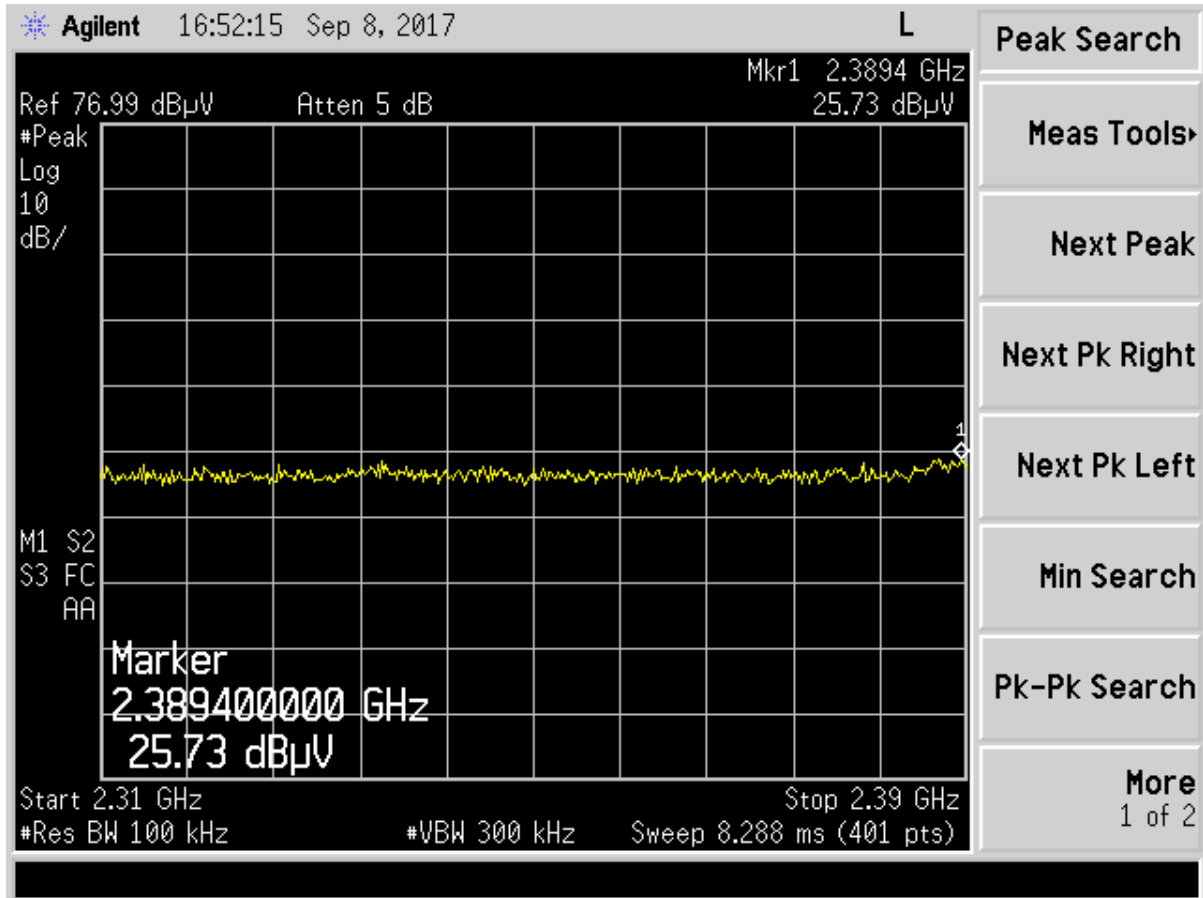


Figure 106. b mode (Trace Antenna) Low Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2389.40	25.73	-0.73	25.00	54.0	3.0m./VERT	29.0	PK

Note: Peak value meets AVG limits.

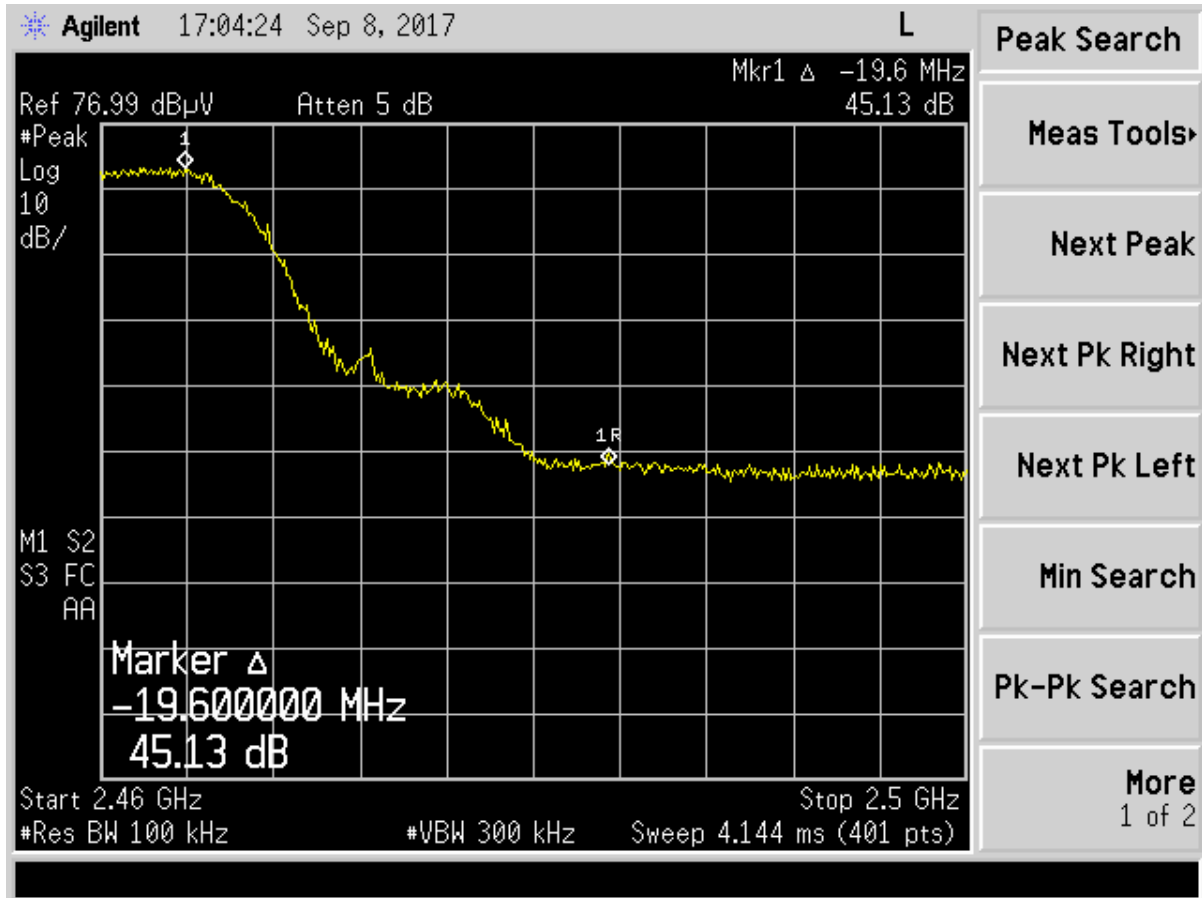


Figure 107. Band Edge Compliance – b mode (Trace Antenna) High Channel Delta – Peak

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	45.13	dB
Band Edge Limit	20.00	dB
Band Edge Margin	25.13	dB

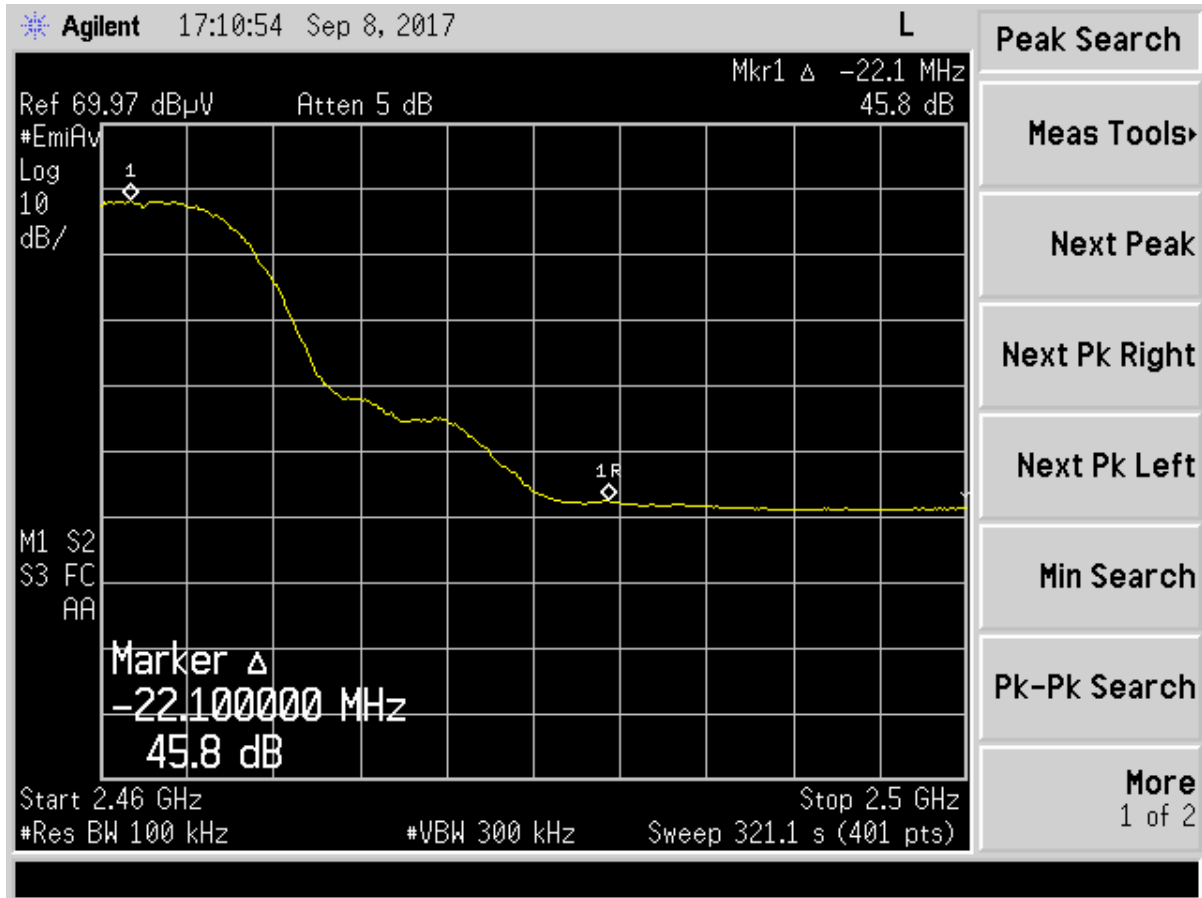


Figure 108. Band Edge Compliance – b mode (Trace Antenna) High Channel Delta – Average

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	45.80	dB
Band Edge Limit	20.00	dB
Band Edge Margin	25.80	dB

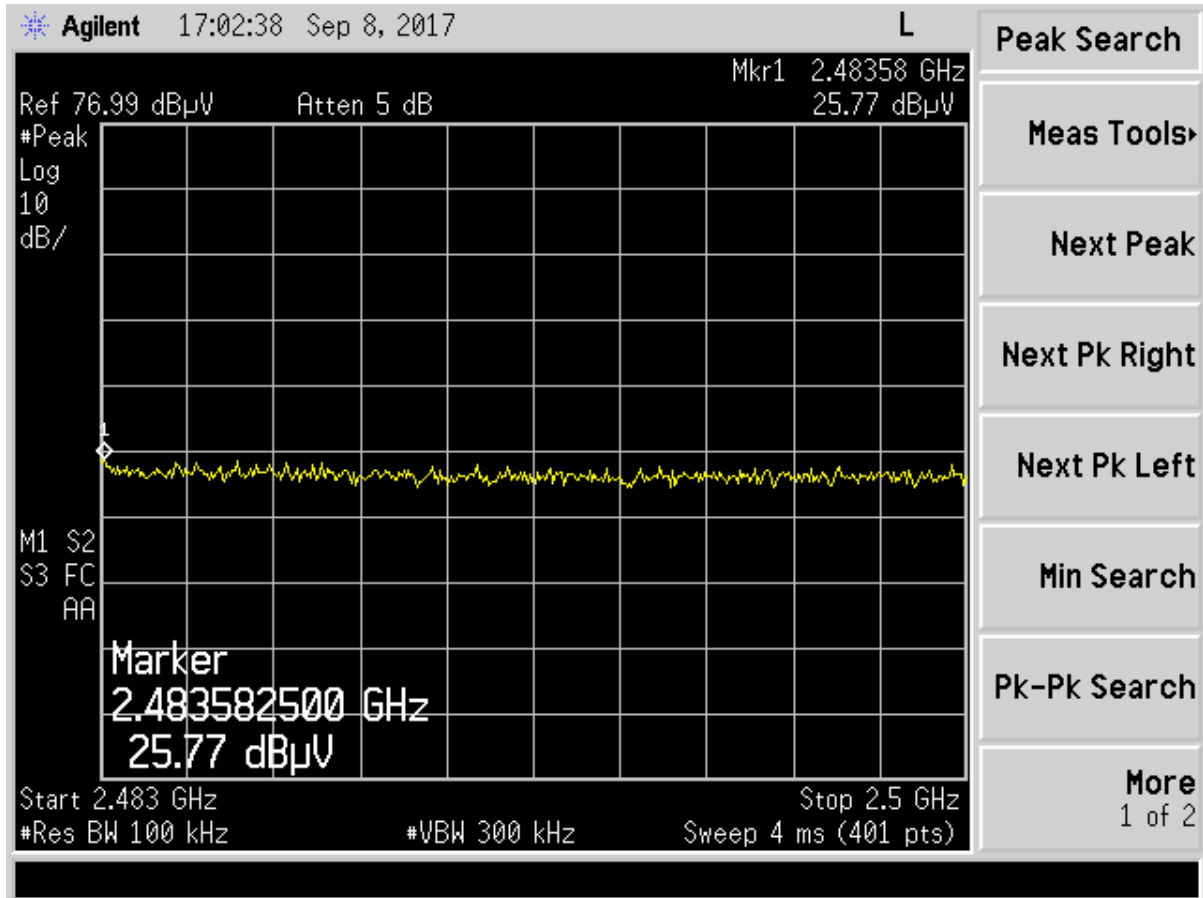


Figure 109. b mode (Trace Antenna) High Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.58	25.77	-0.26	25.51	54.0	3.0m./VERT	28.5	PK

Note: Peak value meets AVG limits.

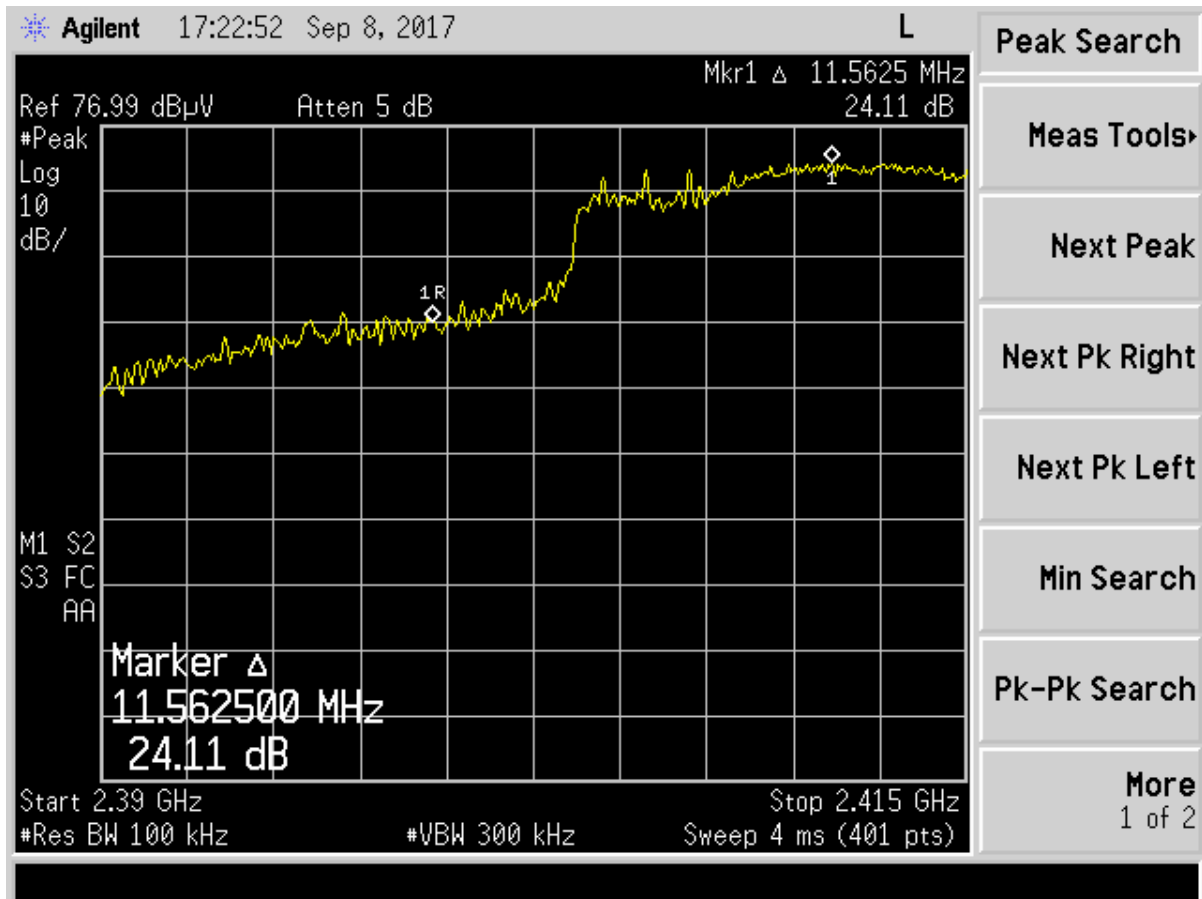


Figure 110. Band Edge Compliance – g mode (Trace Antenna) Low Channel Delta – Peak

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	24.11	dB
Band Edge Limit	20.00	dB
Band Edge Margin	4.11	dB

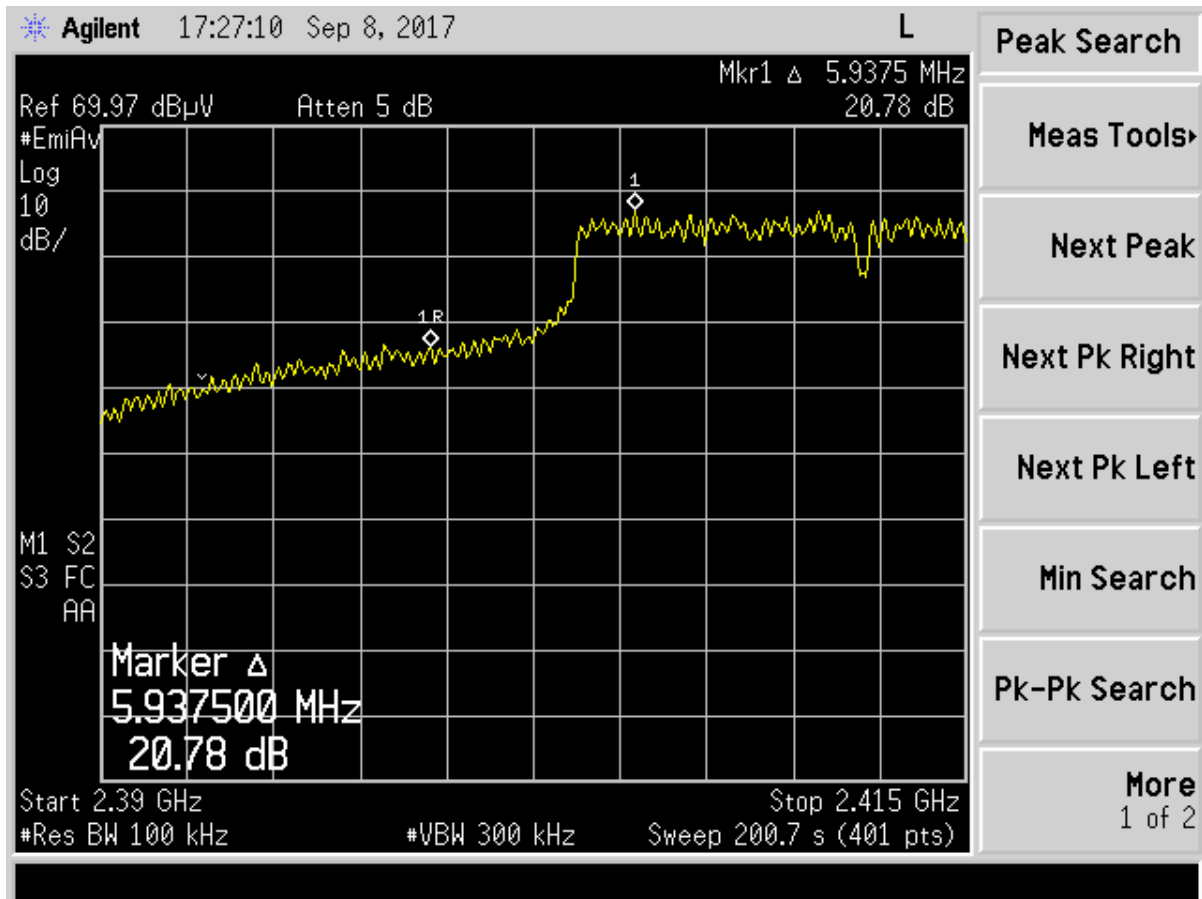


Figure 111. Band Edge Compliance – g mode (Trace Antenna) Low Channel Delta – Average

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	20.78	dB
Band Edge Limit	20.00	dB
Band Edge Margin	0.78	dB

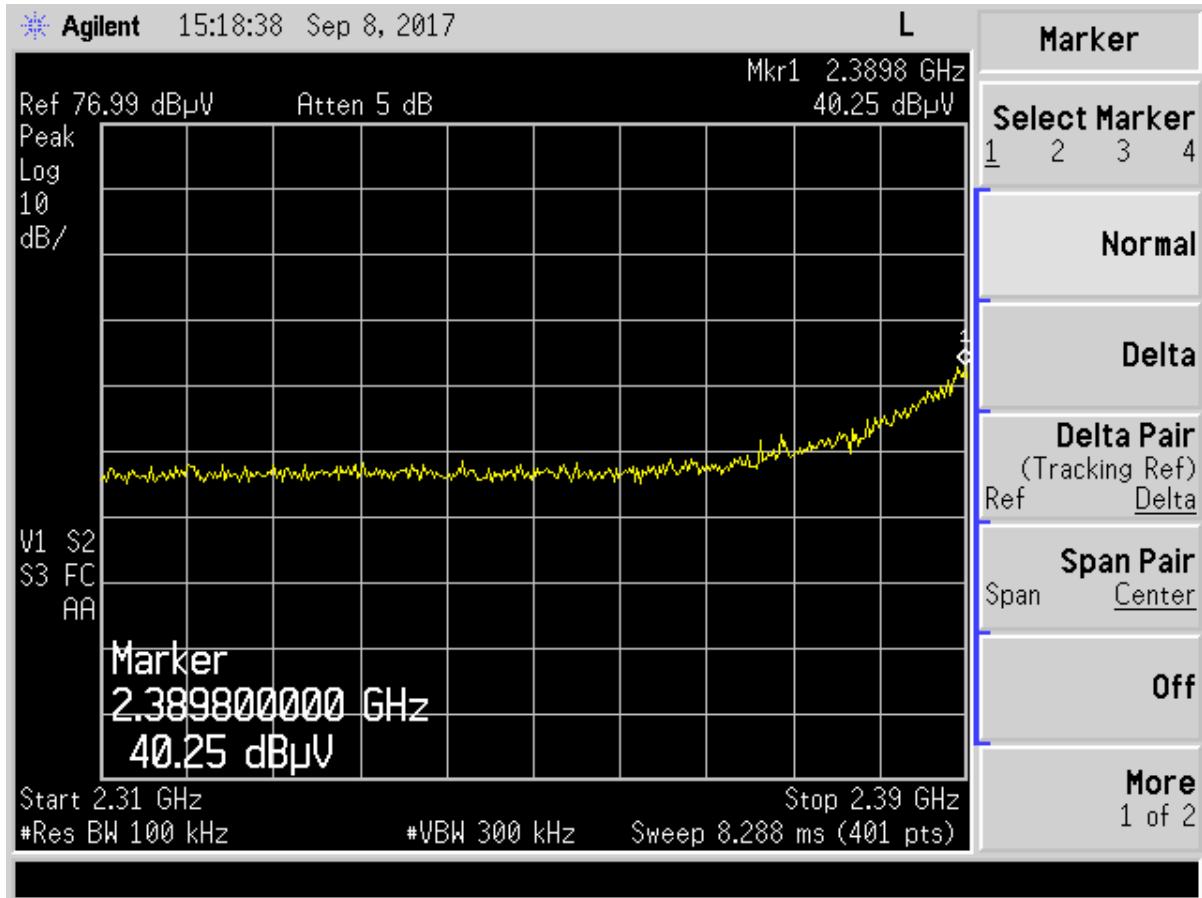


Figure 112. g mode (Trace Antenna) Low Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2389.80	40.25	-0.73	39.52	54.0	3.0m./VERT	14.5	PK

Note: Peak value meets AVG limits.

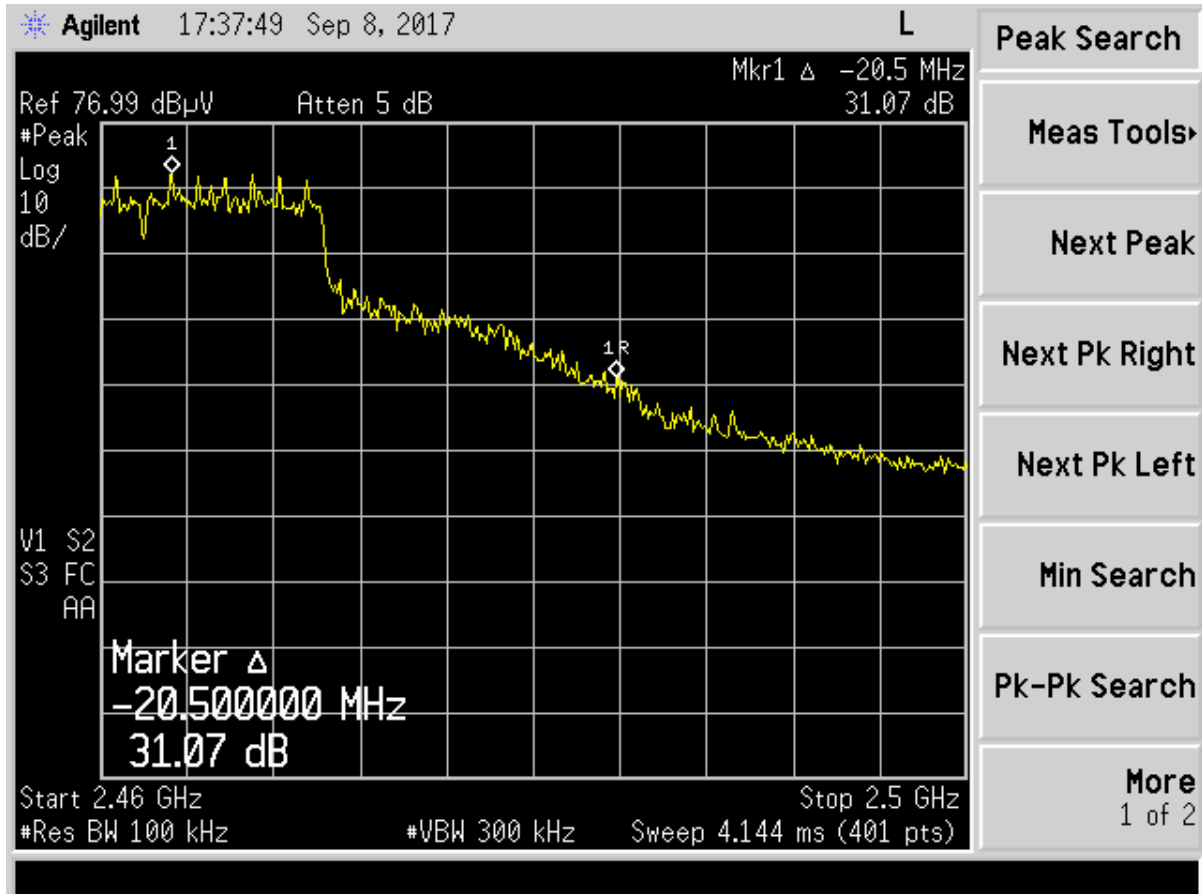


Figure 113. Band Edge Compliance – g mode (Trace Antenna) High Channel Delta – Peak

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	31.07	dB
Band Edge Limit	20.00	dB
Band Edge Margin	11.07	dB

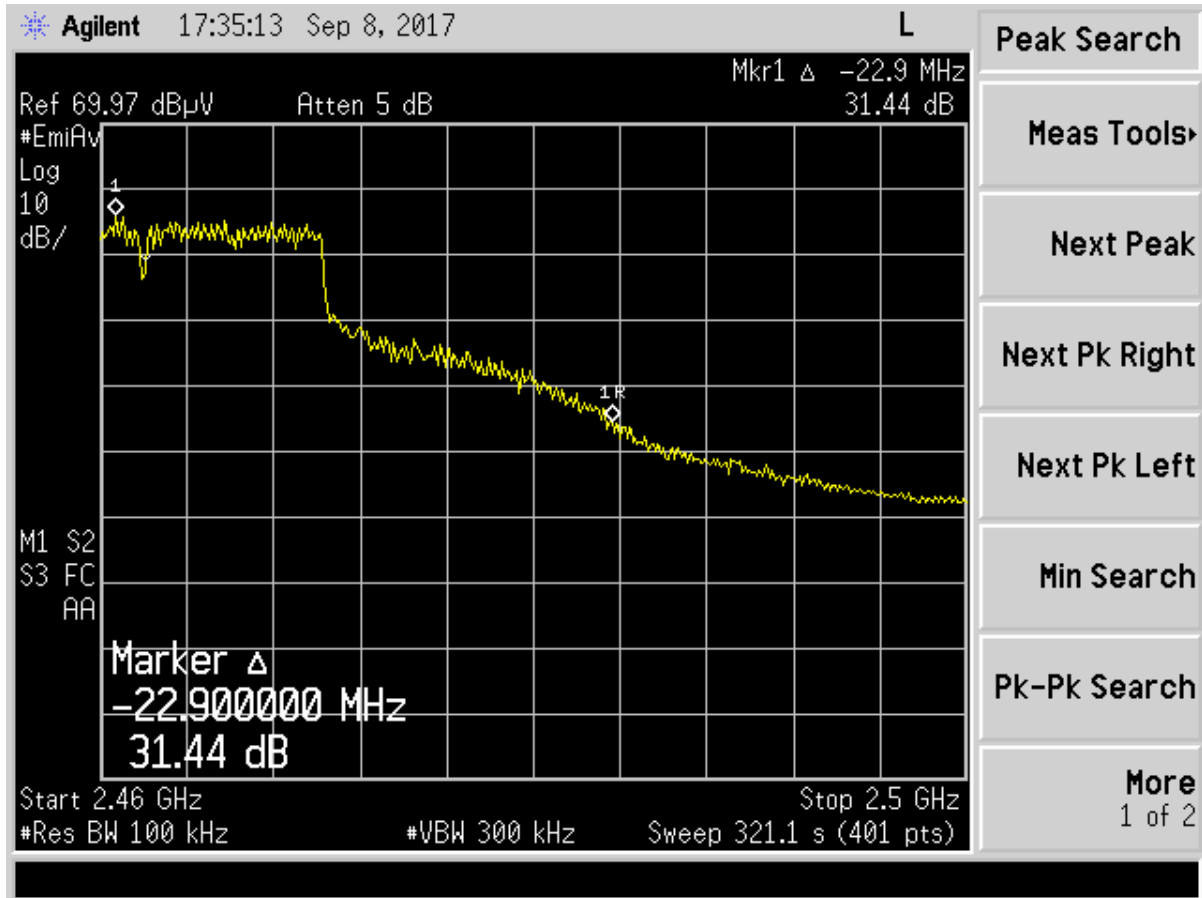


Figure 114. Band Edge Compliance – g mode (Trace Antenna) High Channel Delta - Average

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	31.44	dB
Band Edge Limit	20.00	dB
Band Edge Margin	11.44	dB

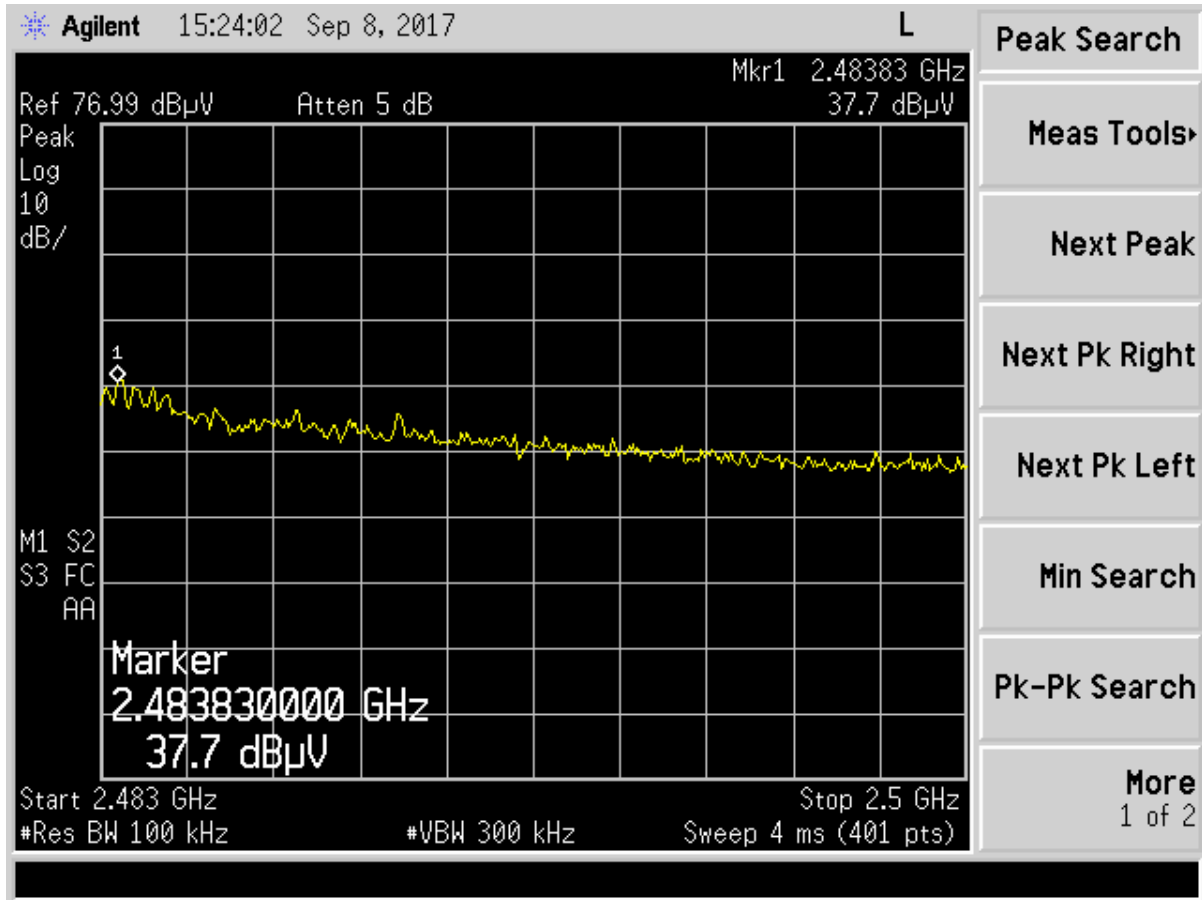


Figure 115. g mode (Trace Antenna) High Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.83	37.70	-0.26	37.44	54.0	3.0m./VERT	16.6	PK

Note: Peak value meets AVG limits.

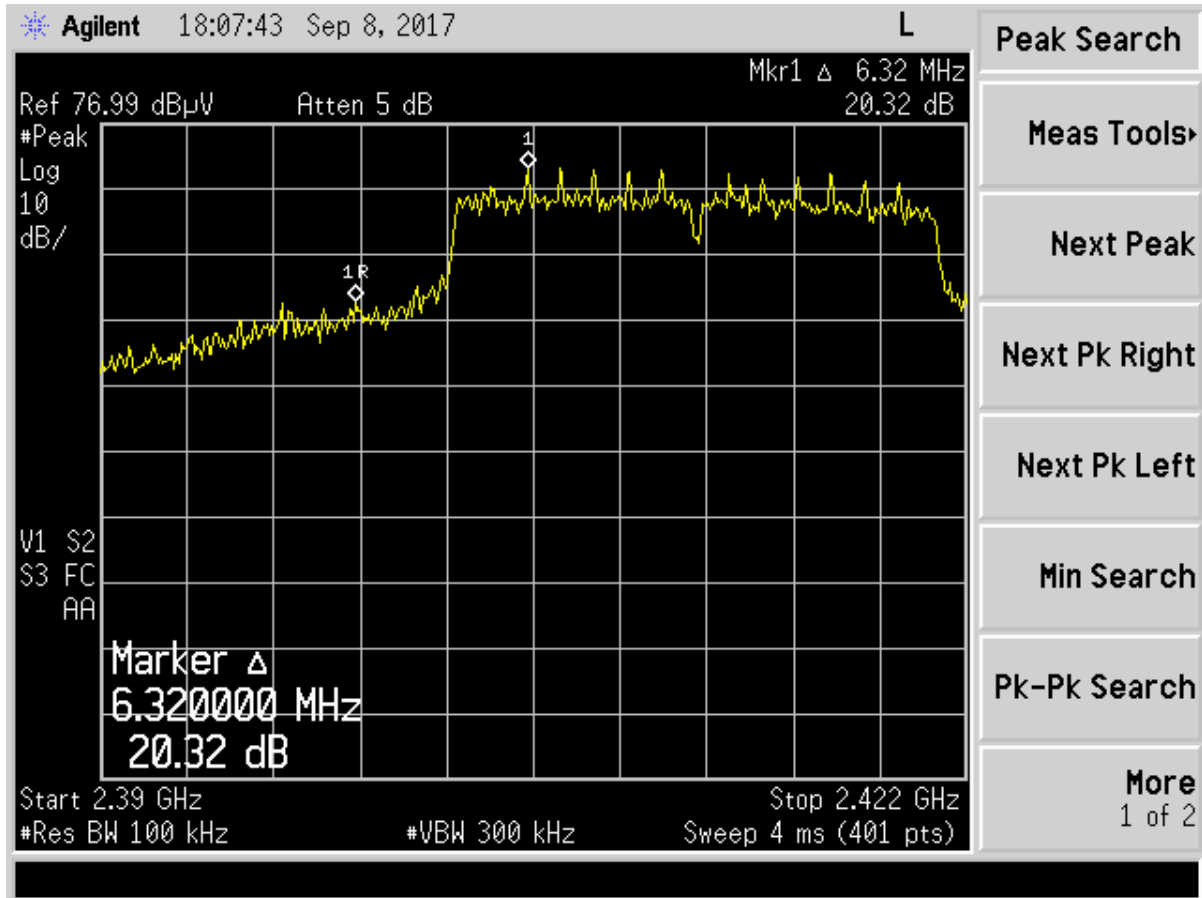


Figure 116. Band Edge Compliance – n mode (Trace Antenna) Low Channel Delta – Peak

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	20.32	dB
Band Edge Limit	20.00	dB
Band Edge Margin	0.32	dB

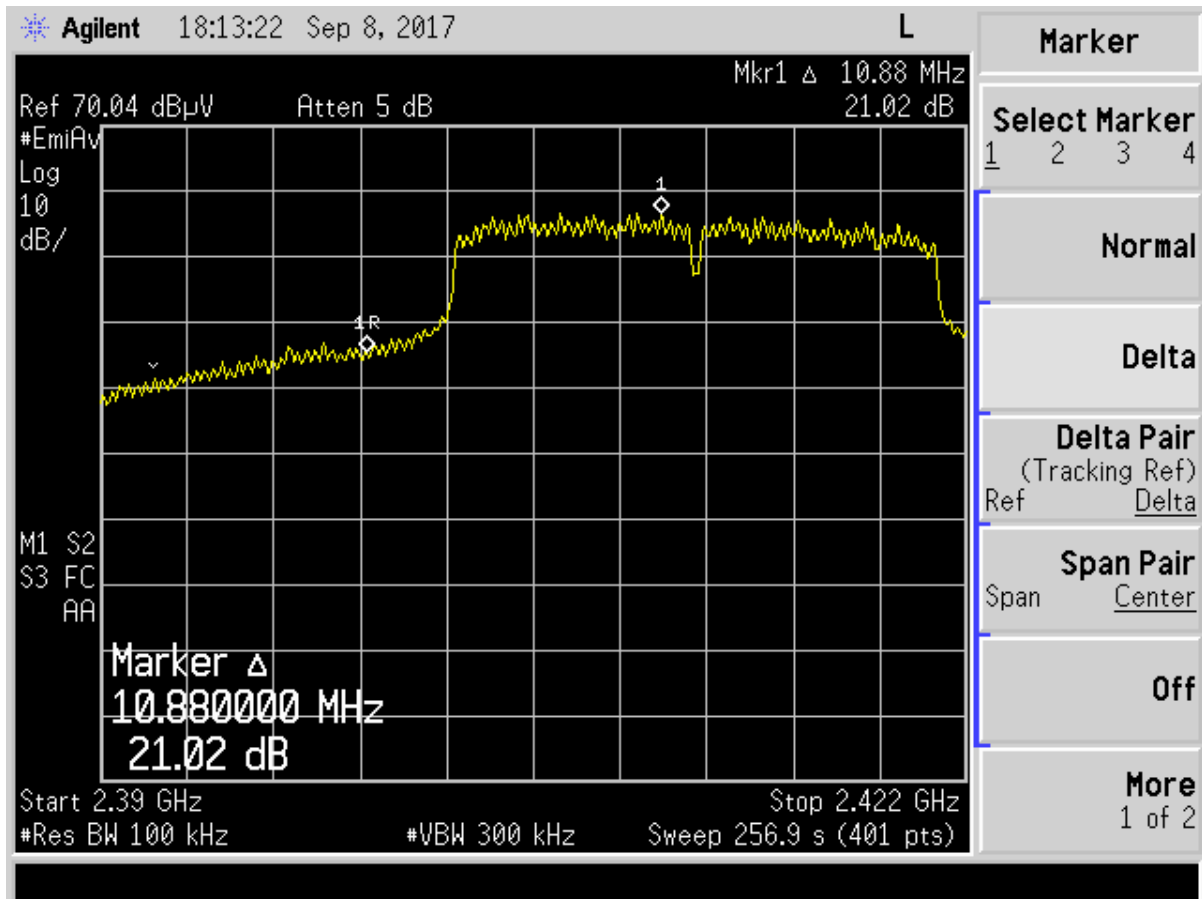


Figure 117. Band Edge Compliance – n mode (Trace Antenna) Low Channel Delta – Average

Lower band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	21.02	dB
Band Edge Limit	20.00	dB
Band Edge Margin	1.02	dB

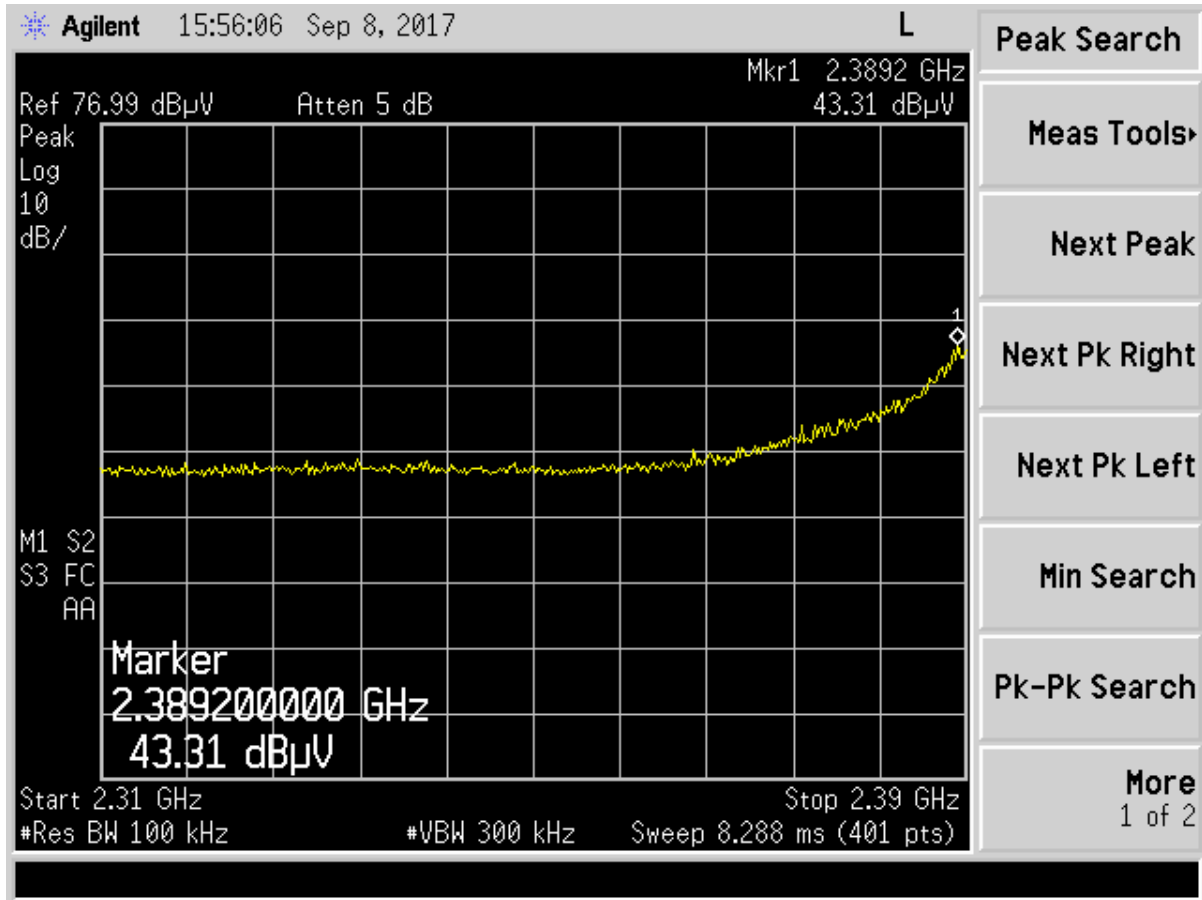


Figure 118. n mode (Trace Antenna) Low Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2389.20	43.31	-0.73	42.58	54.0	3.0m./VERT	11.4	PK

Note: Peak value meets AVG limits.

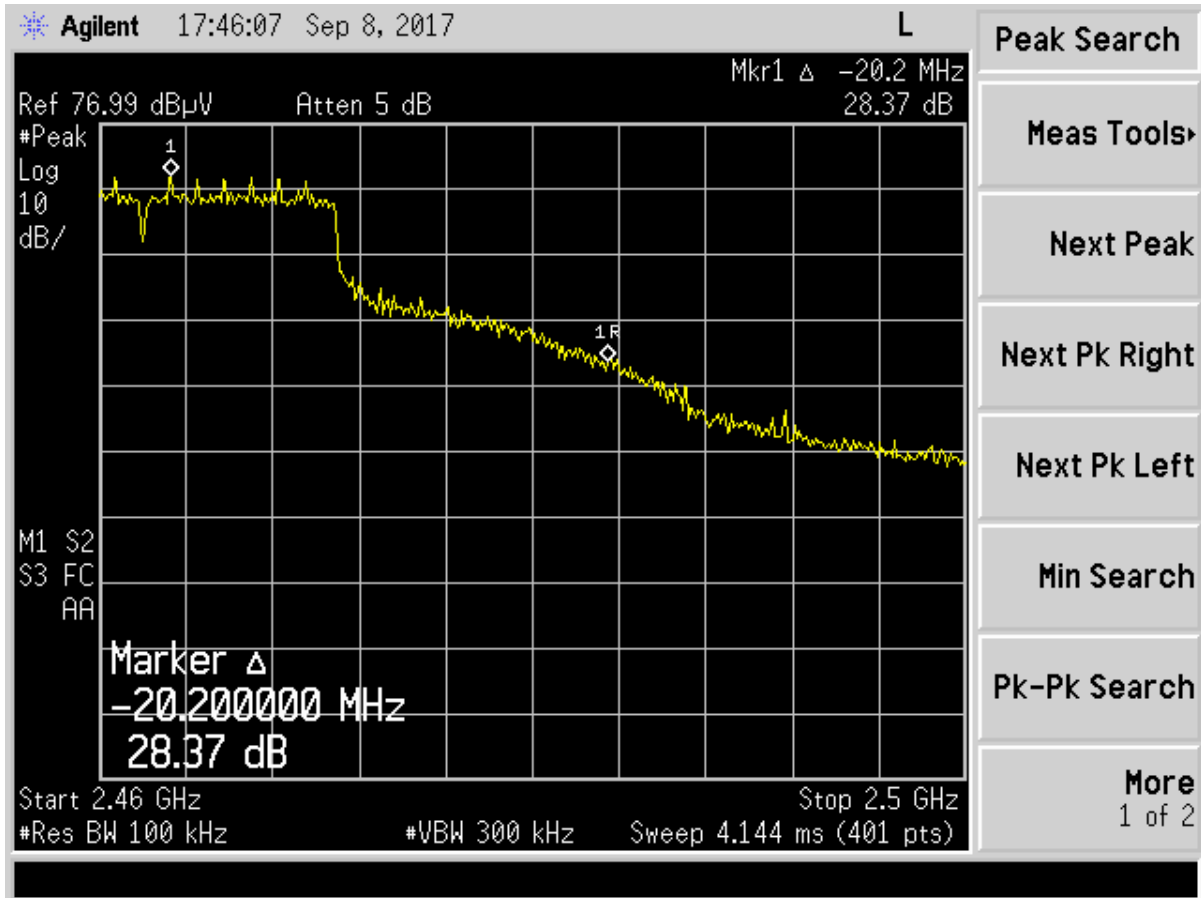


Figure 119. Band Edge Compliance – n mode (Trace Antenna) High Channel Delta – Peak

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	28.37	dB
Band Edge Limit	20.00	dB
Band Edge Margin	8.37	dB

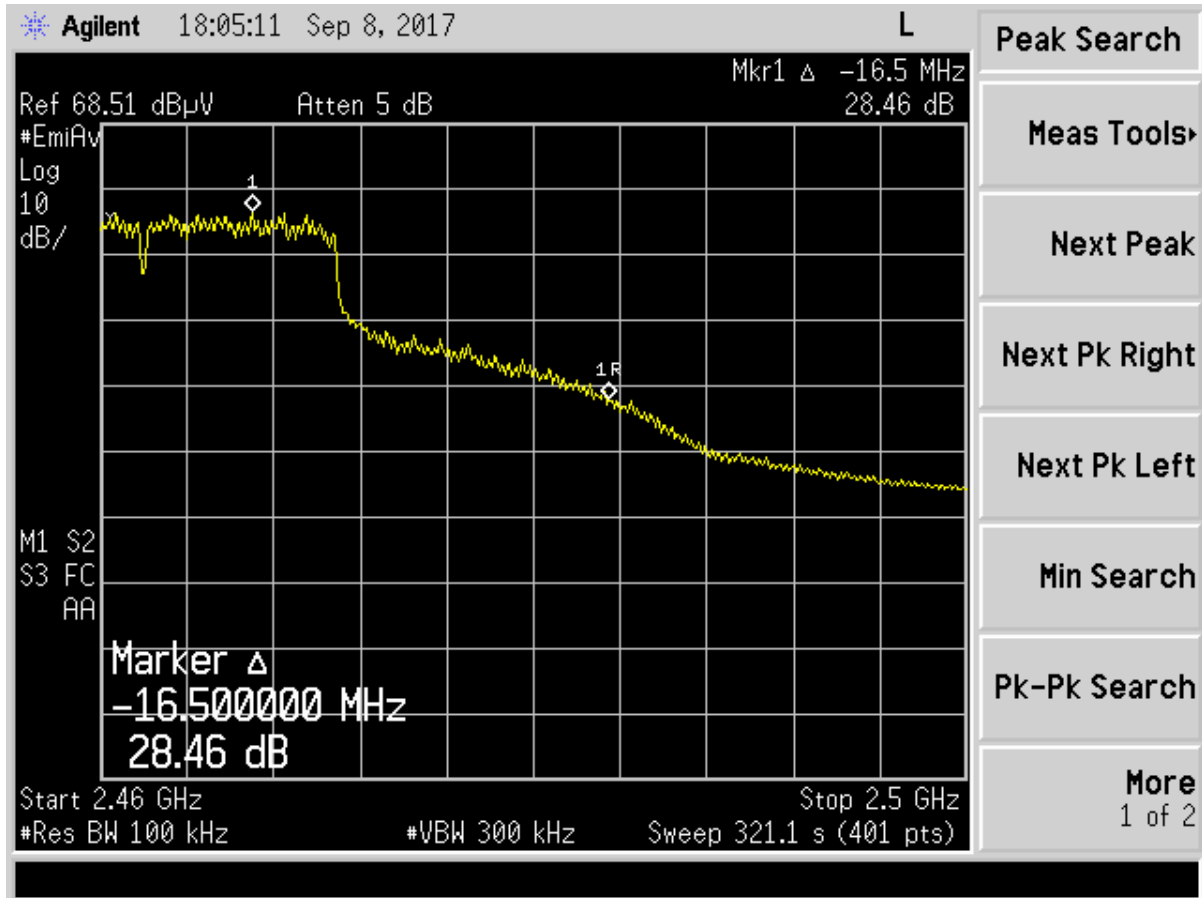


Figure 120. Band Edge Compliance – n mode (Trace Antenna) High Channel Delta – Average

Higher band edge must be 20 dB below the fundamental. This requirement is met.

Measured Result	28.46	dB
Band Edge Limit	20.00	dB
Band Edge Margin	8.46	dB

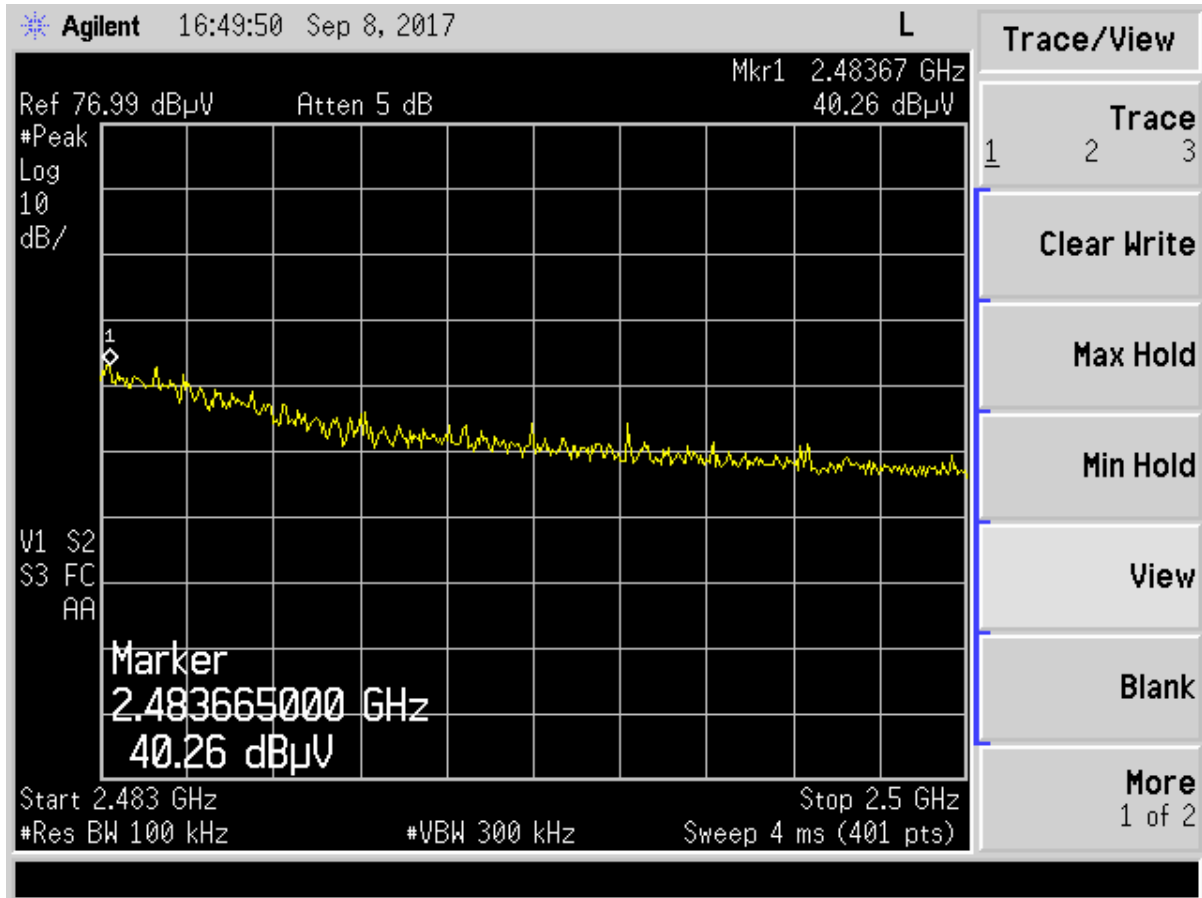


Figure 121. n mode (Trace Antenna) High Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.67	40.26	-0.26	40.00	54.0	3.0m./VERT	14.0	PK

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2.12 Six (6) dB Bandwidth per CFR 15.247(a)(2)


The EUT antenna port was connected to a spectrum analyzer having a 50 Ω input impedance. Measurements were performed per ANSI C63.10-2013, clause 11.8 The RBW was set to 100 kHz and the VBW ≥ RBW. The results of this test are given in the table below and figures below.

Table 23. Six (6) dB Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)	Mode
2412	9.25	0.5	b
2442	9.00	0.5	b
2462	8.50	0.5	b
2412	16.50	0.5	g
2442	16.50	0.5	g
2462	16.00	0.5	g
2412	17.25	0.5	n
2442	16.75	0.5	n
2462	17.25	0.5	n

Test Date: June 29-30, 2017

Tested By

Signature: 

Name: Robert K. Mills

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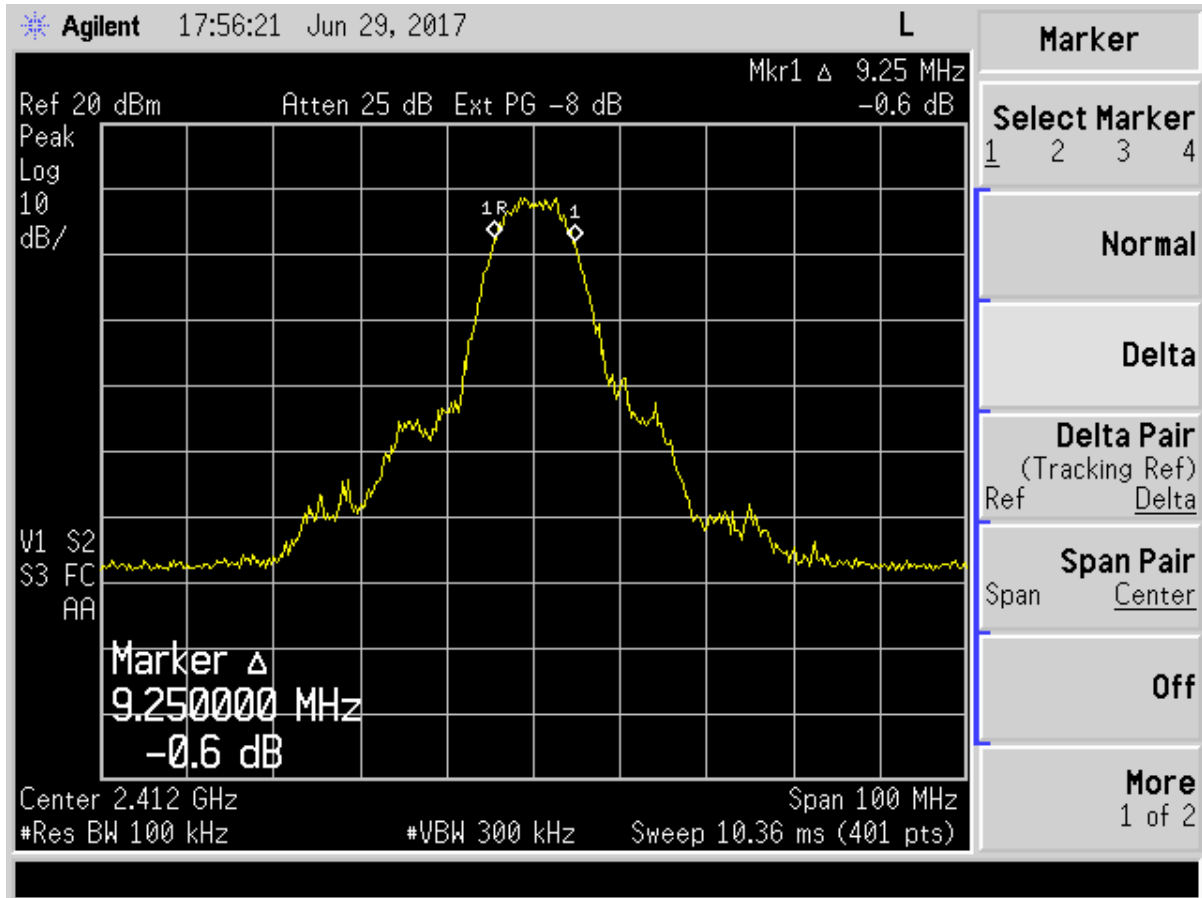


Figure 122. 6 dB Bandwidth b mode Low Channel

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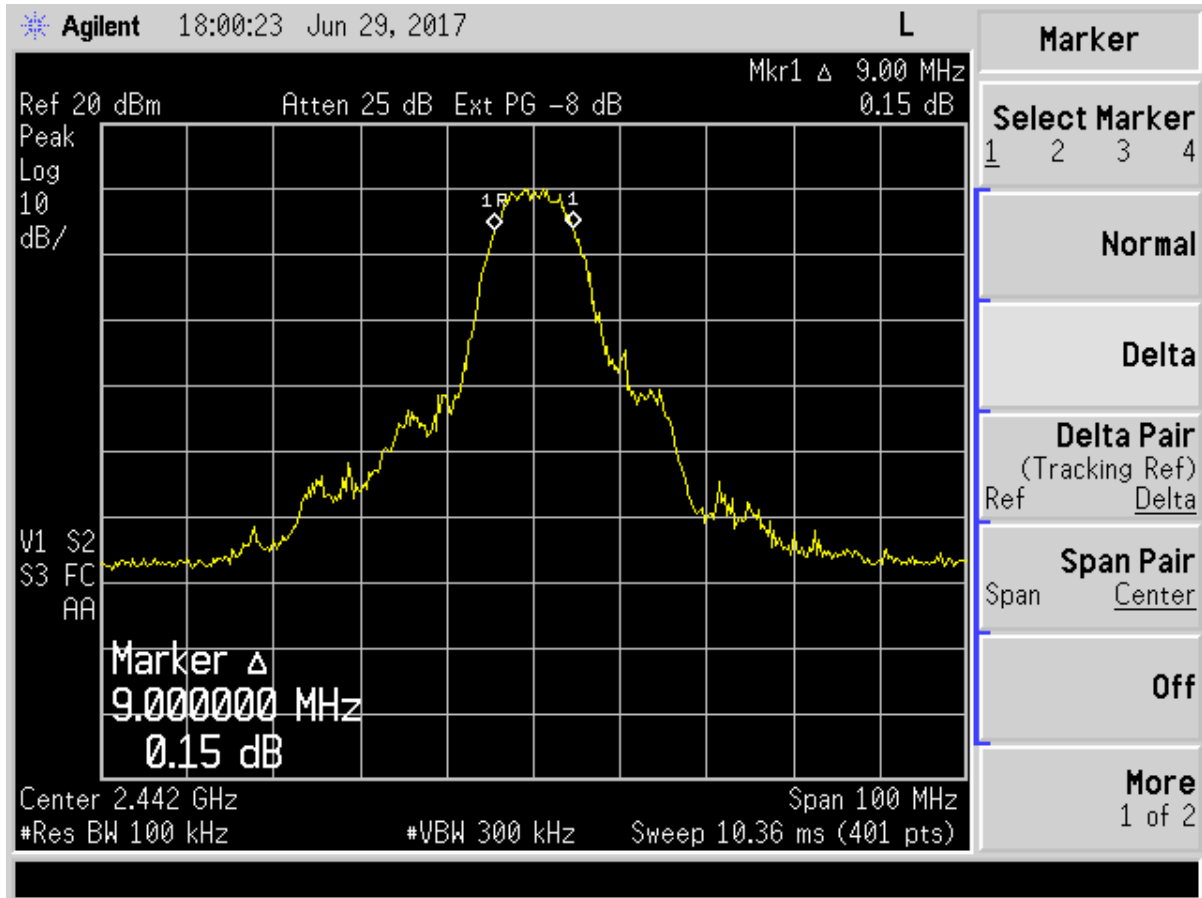


Figure 123. 6 dB Bandwidth b mode Mid Channel

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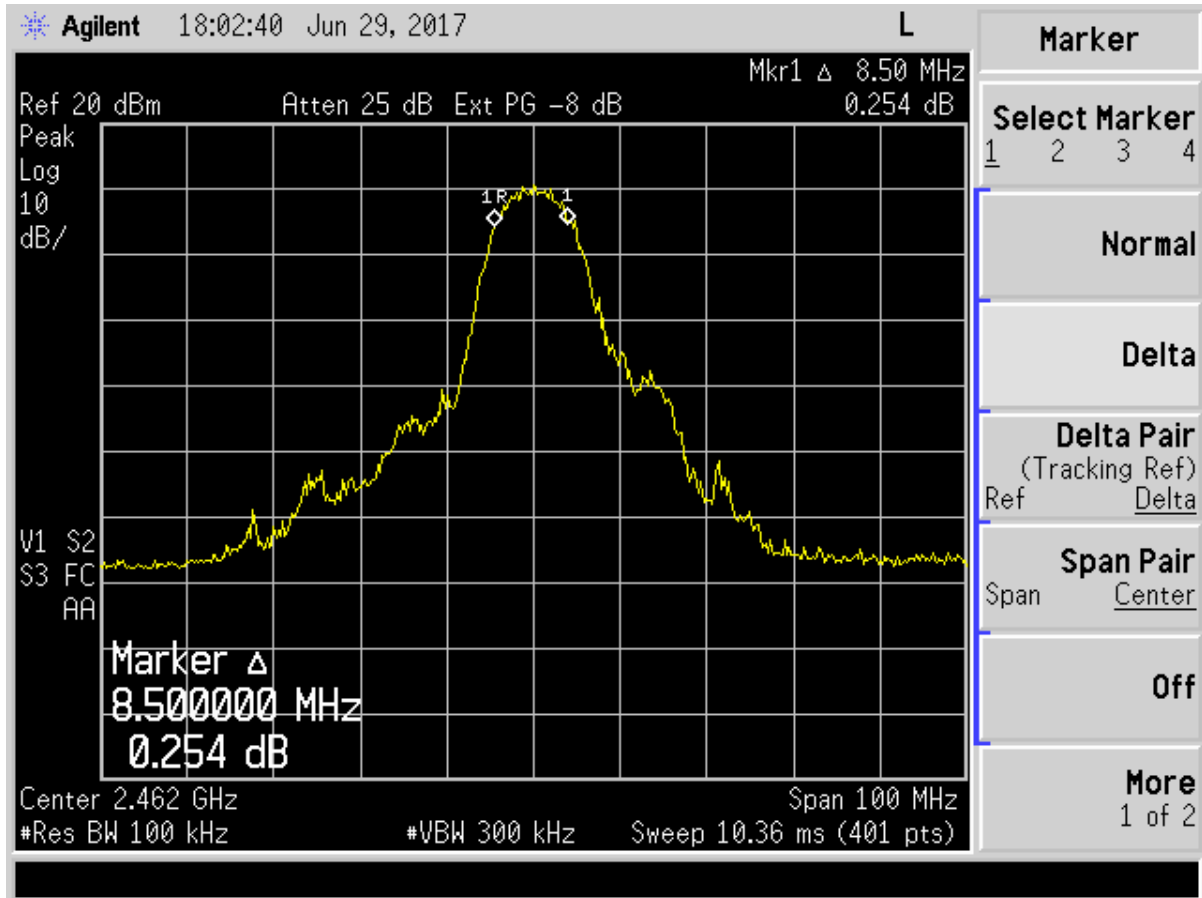


Figure 124. 6 dB Bandwidth b mode High Channel

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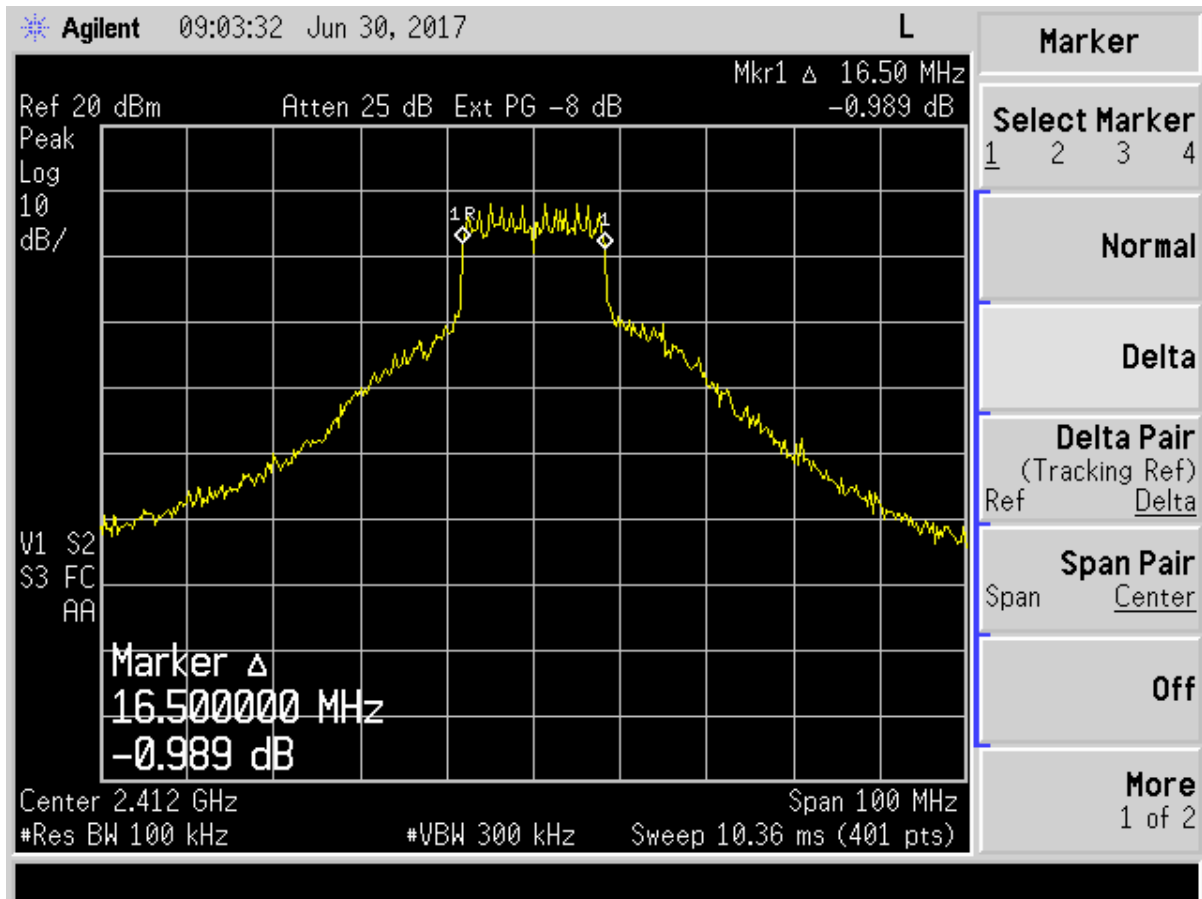


Figure 125. 6 dB Bandwidth g mode Low Channel

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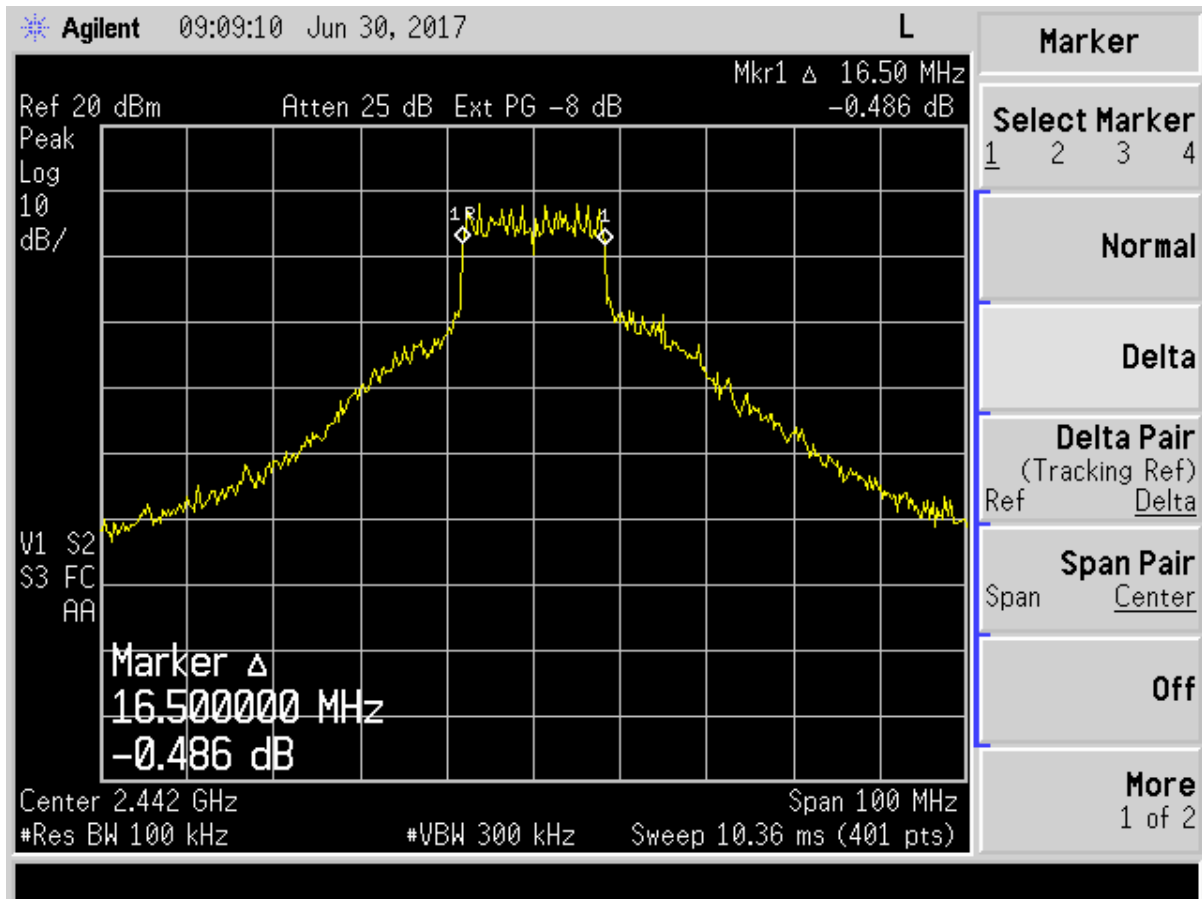


Figure 126.6 dB Bandwidth g mode Mid Channel

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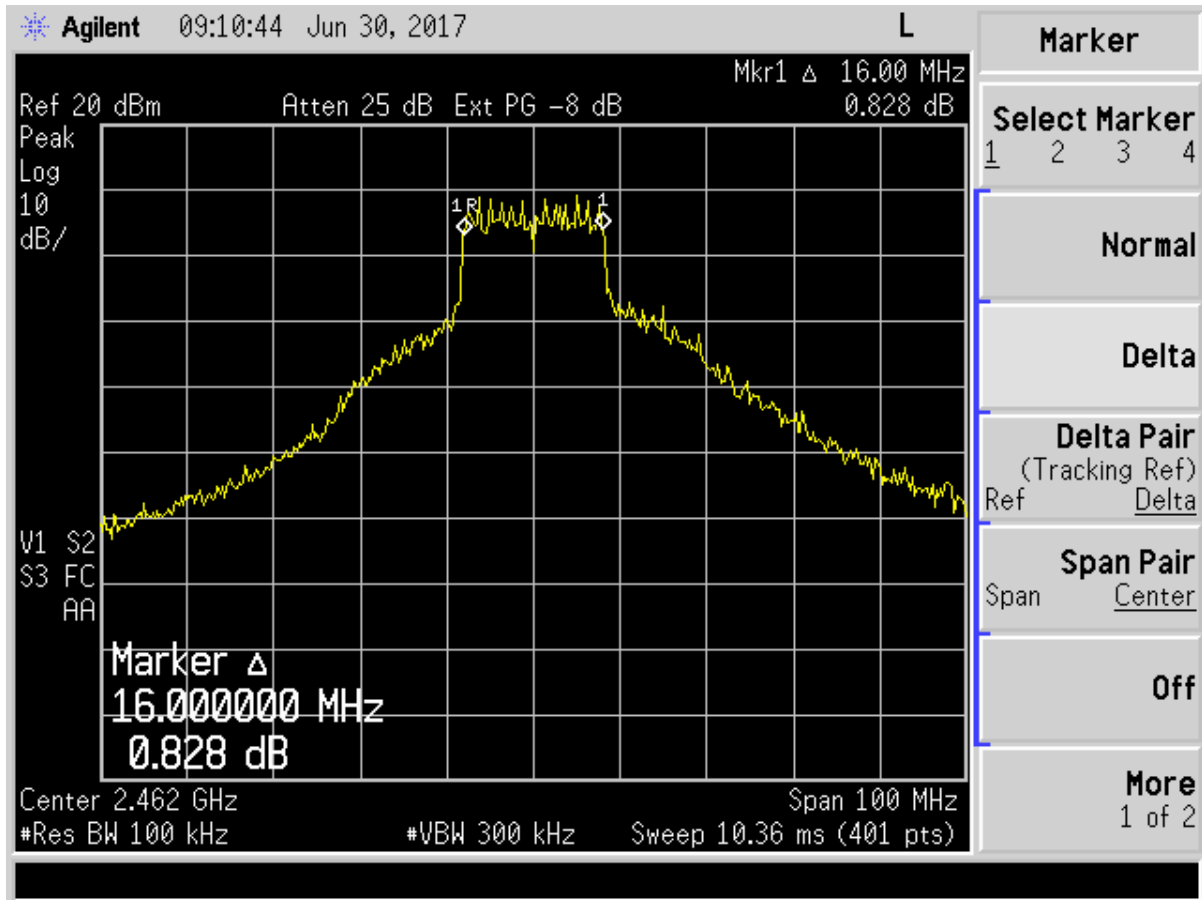


Figure 127. 6 dB Bandwidth g mode High Channel

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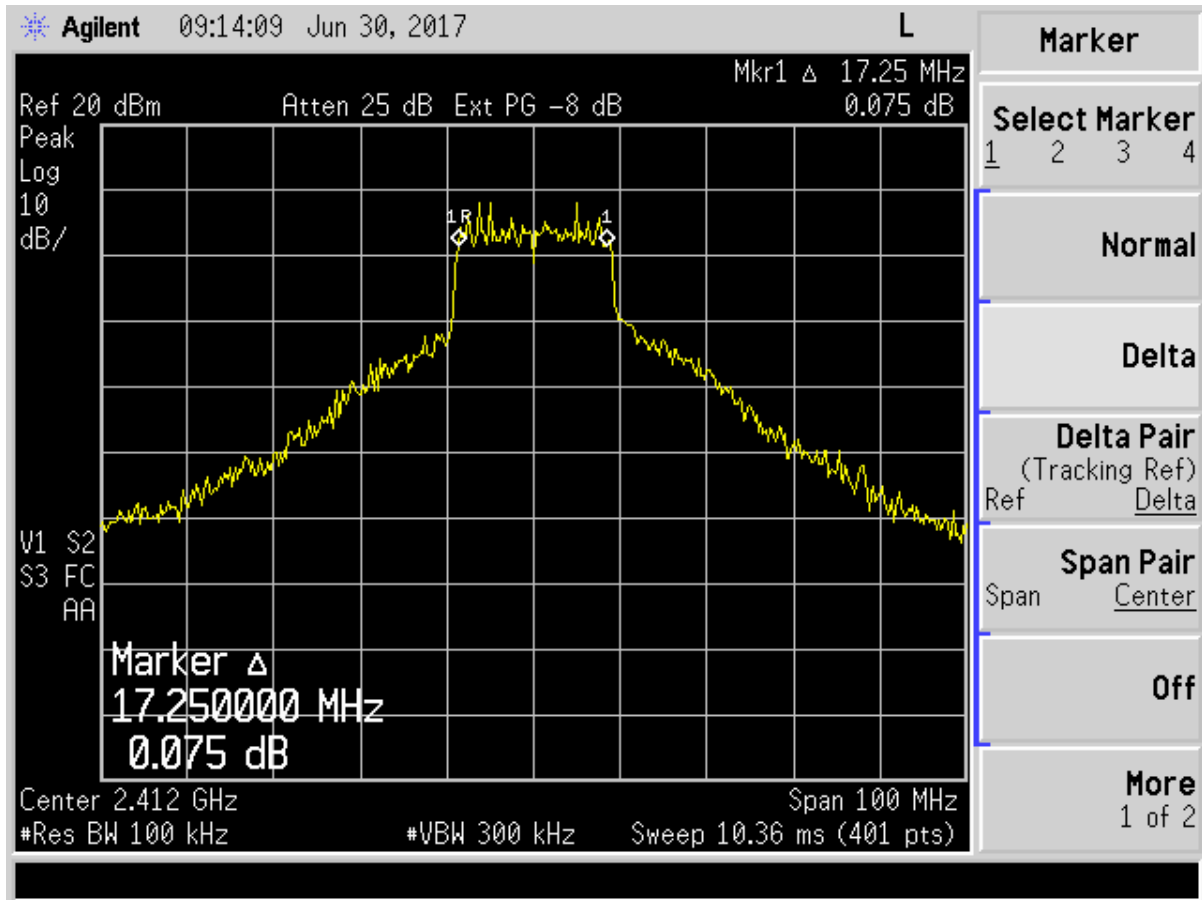


Figure 128. 6 dB Bandwidth n mode Low Channel

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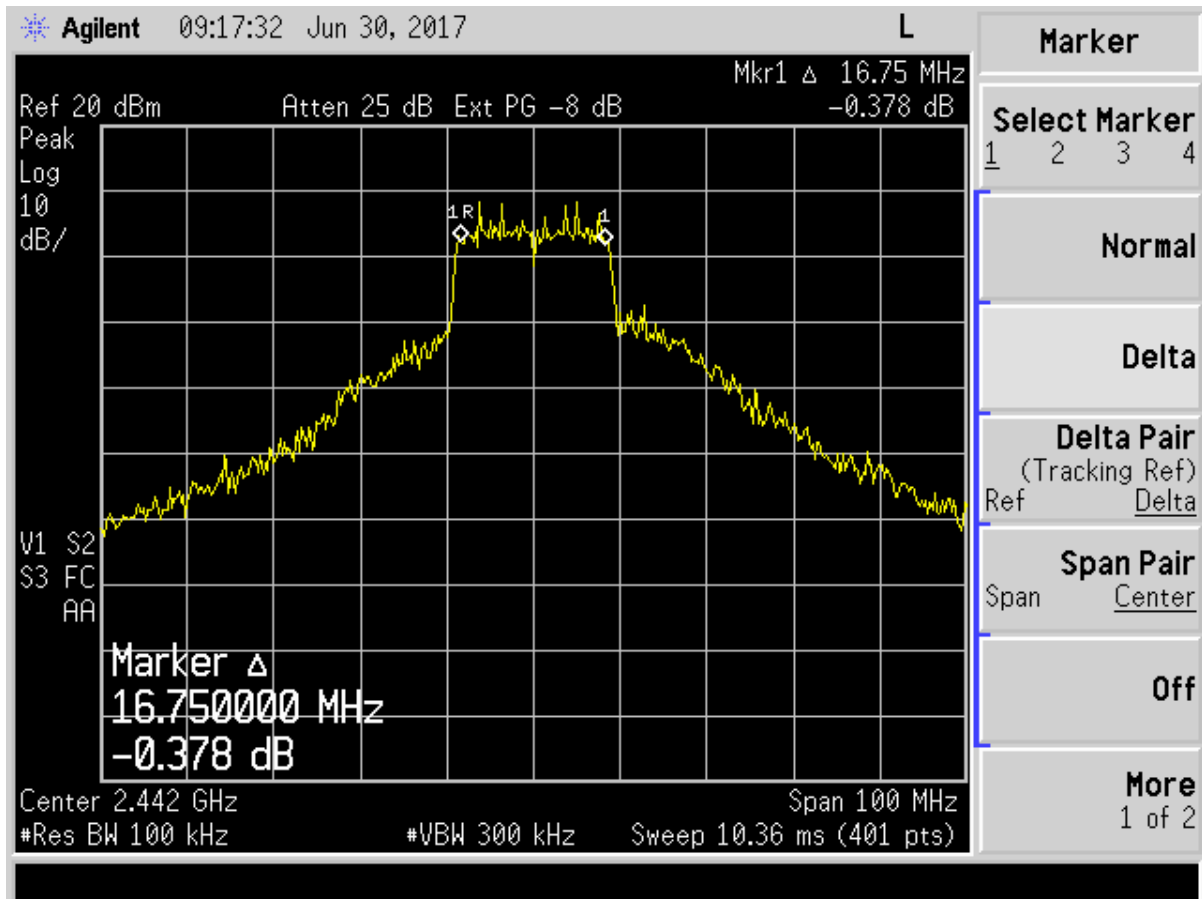


Figure 129. 6 dB Bandwidth n mode Mid Channel

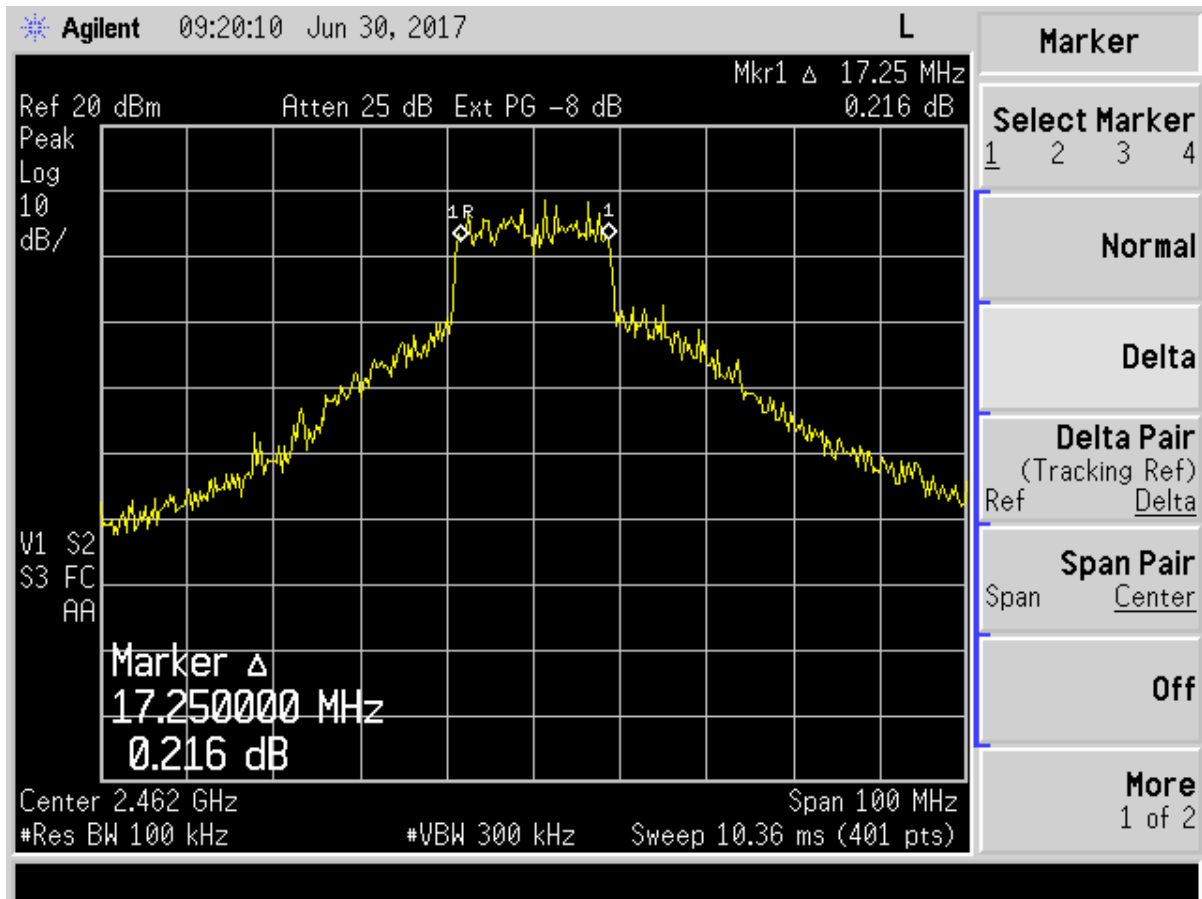


Figure 130. 6 dB Bandwidth n mode High Channel

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2.13 Occupied Bandwidth, 20 dB (99% bandwidth) (RSS-GEN (6.6))

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 v03r05 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 15 and Figures 29 through 31.

Table 24. 99% Occupied Bandwidth

Frequency (MHz)	99% Occupied Bandwidth (MHz)	20 dB Occupied Bandwidth (MHz)	Mode
2412	11.91	13.57	b
2442	11.80	13.48	b
2462	11.65	13.39	b
2412	16.70	17.88	g
2442	16.68	16.65	g
2462	16.60	17.91	g
2412	17.73	19.20	n
2442	17.78	18.93	n
2462	17.78	19.29	n

Test Date: September 14, 2017

Tested By
 Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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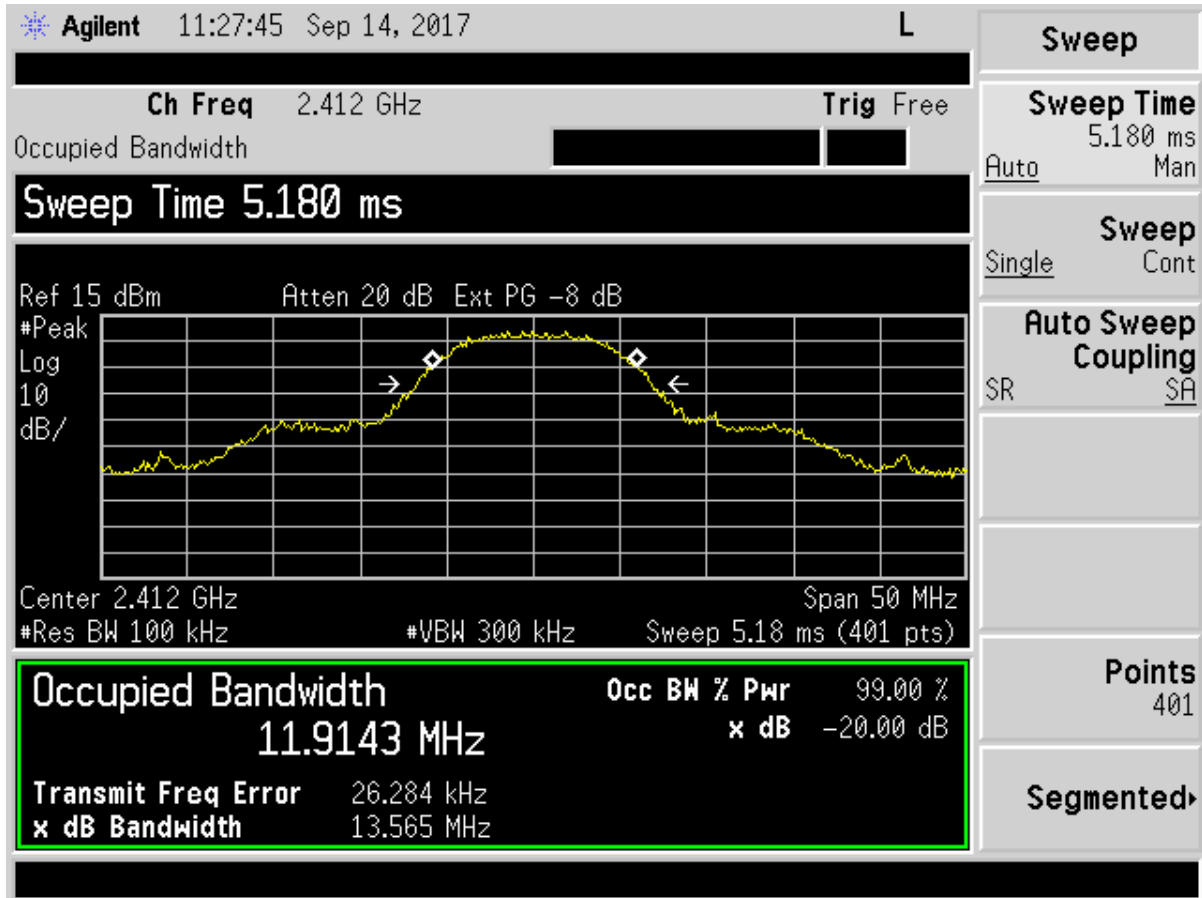


Figure 131. 20 dB Bandwidth – b mode Low Channel

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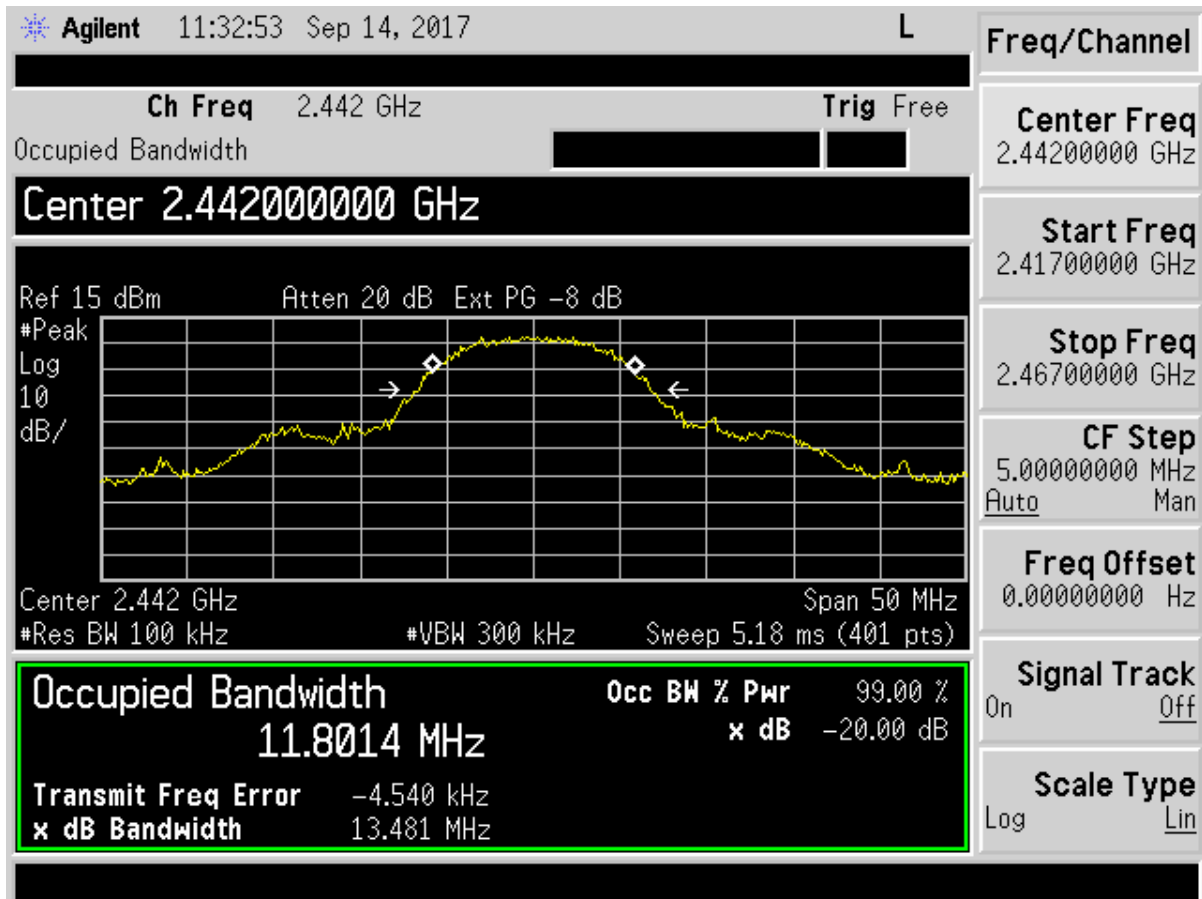


Figure 132. 20 dB Bandwidth – b mode Mid Channel

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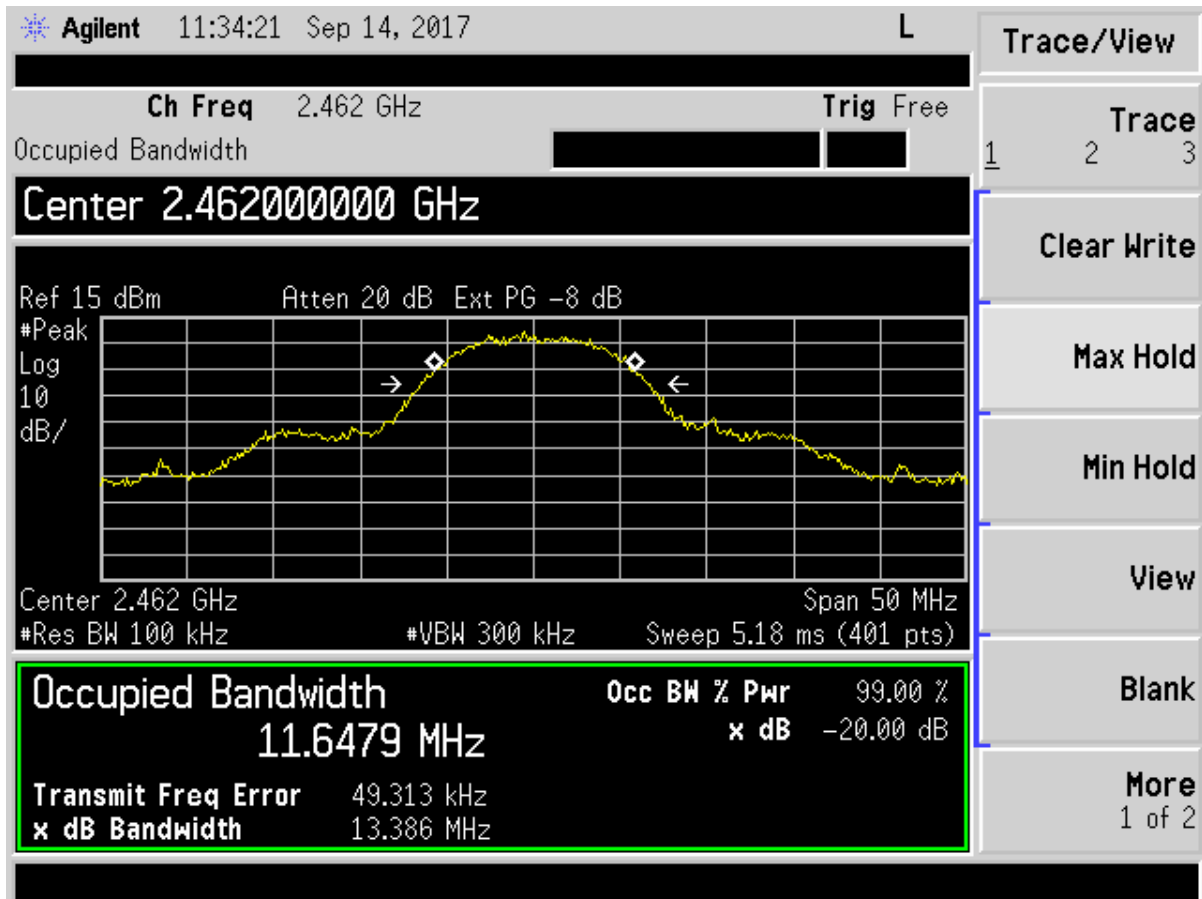


Figure 133. 20 dB Bandwidth – b mode High Channel

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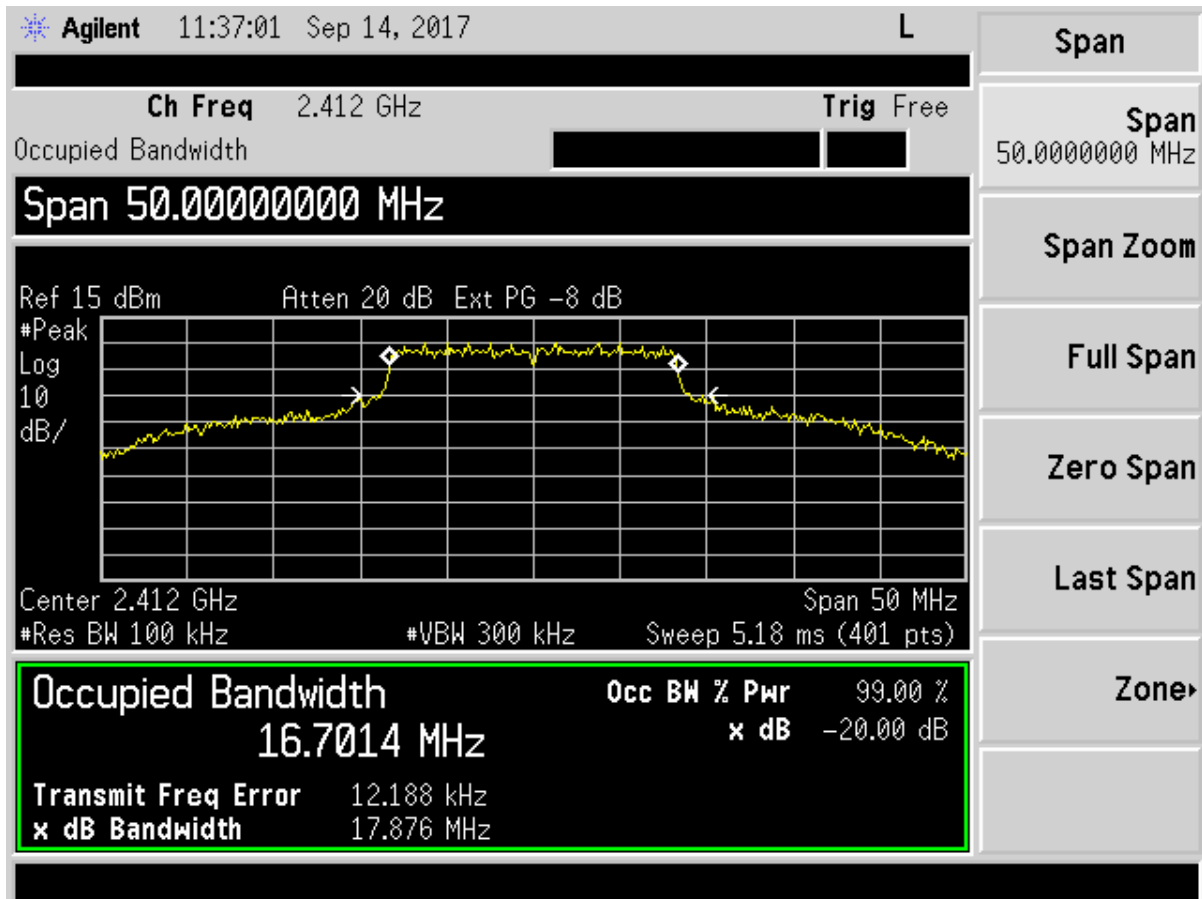


Figure 134. 20 dB Bandwidth – g mode Low Channel

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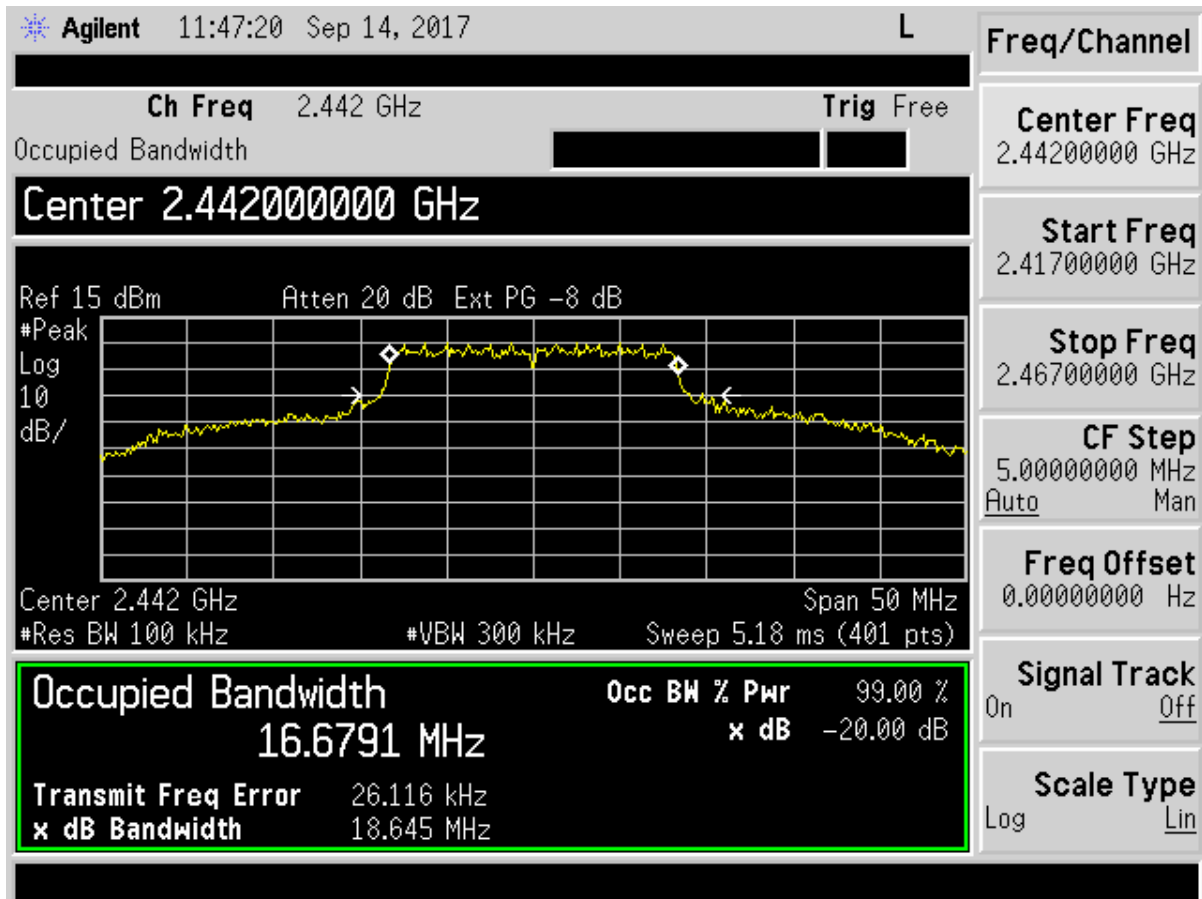


Figure 135. 20 dB Bandwidth – g mode Mid Channel

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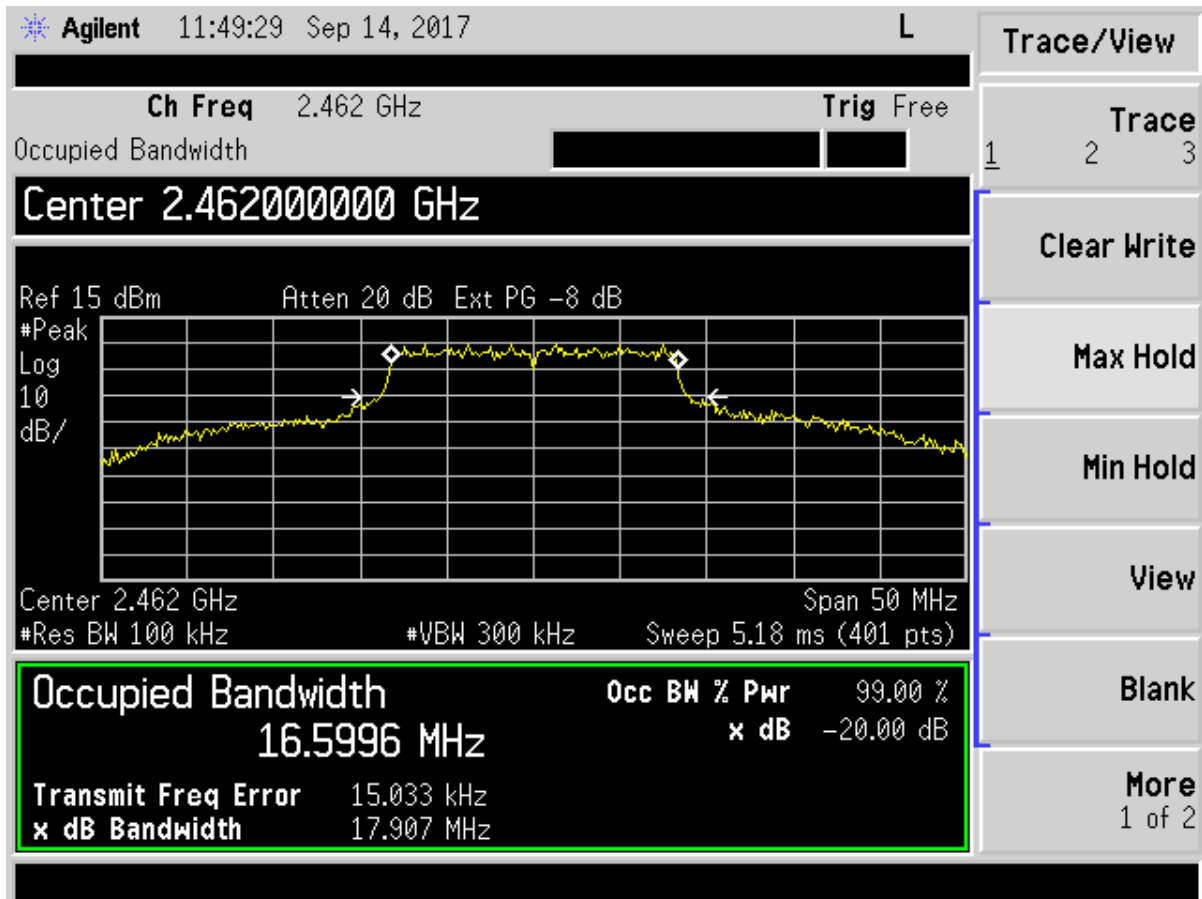


Figure 136. 20 dB Bandwidth – g mode High Channel

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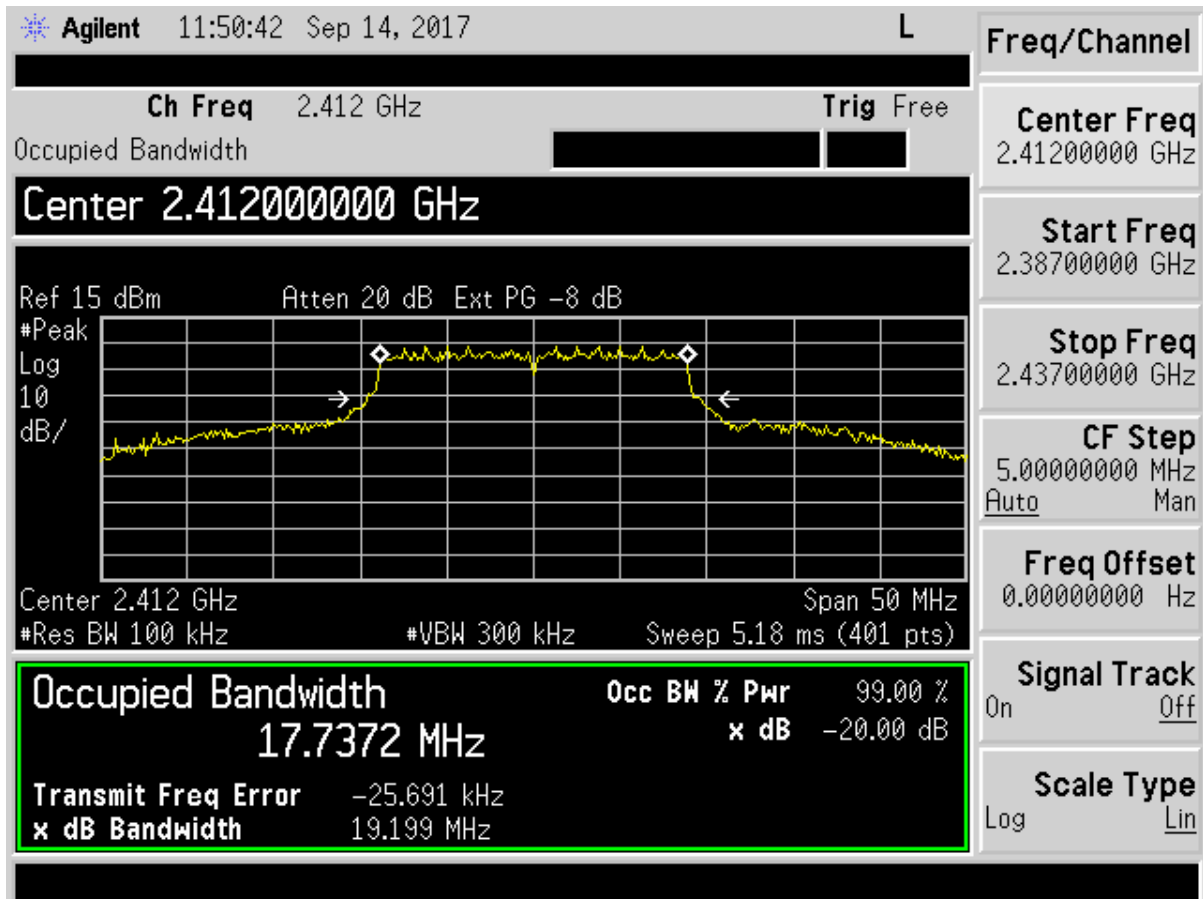


Figure 137. 20 dB Bandwidth – n mode Low Channel

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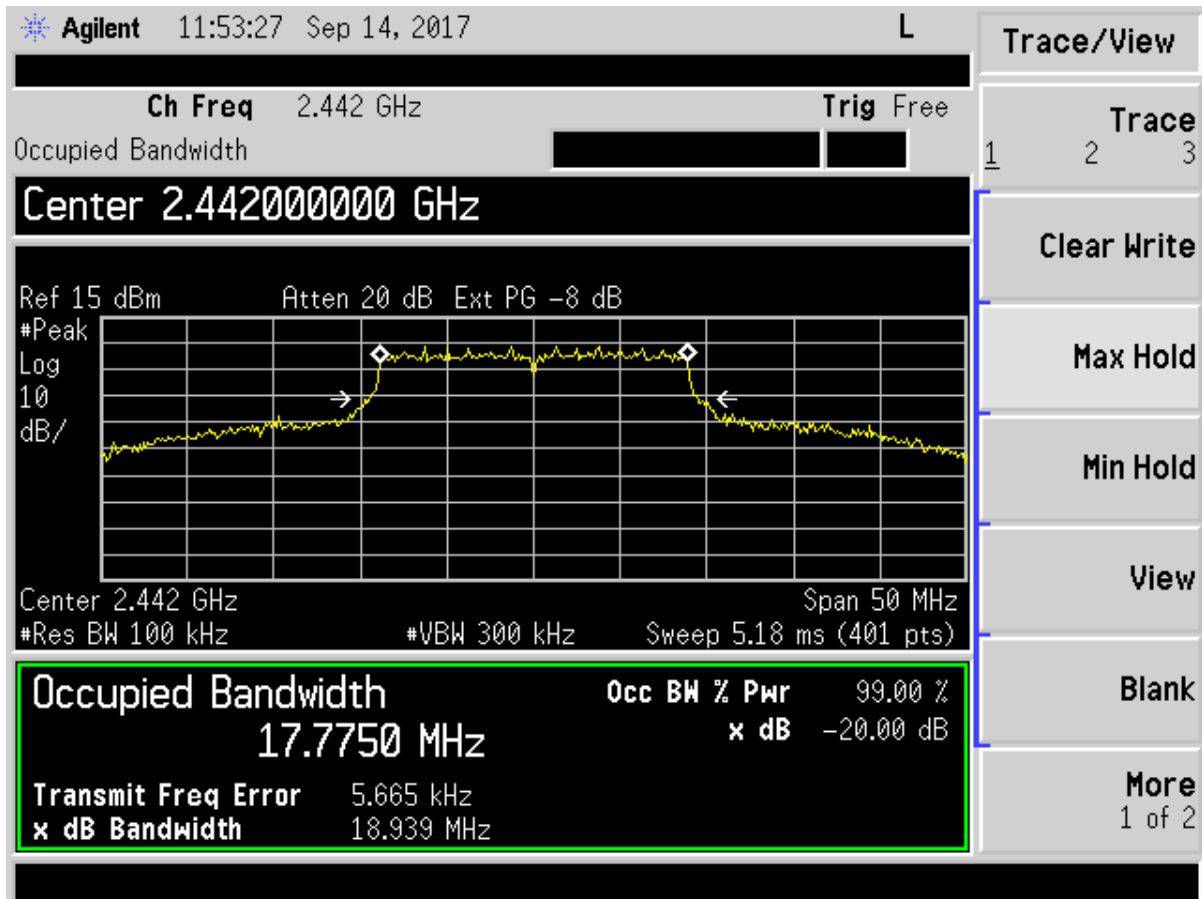


Figure 138. 20 dB Bandwidth – n mode Mid Channel

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15/IC RSS Certification
 O7P-903
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 October 23, 2017
 Inventek Systems
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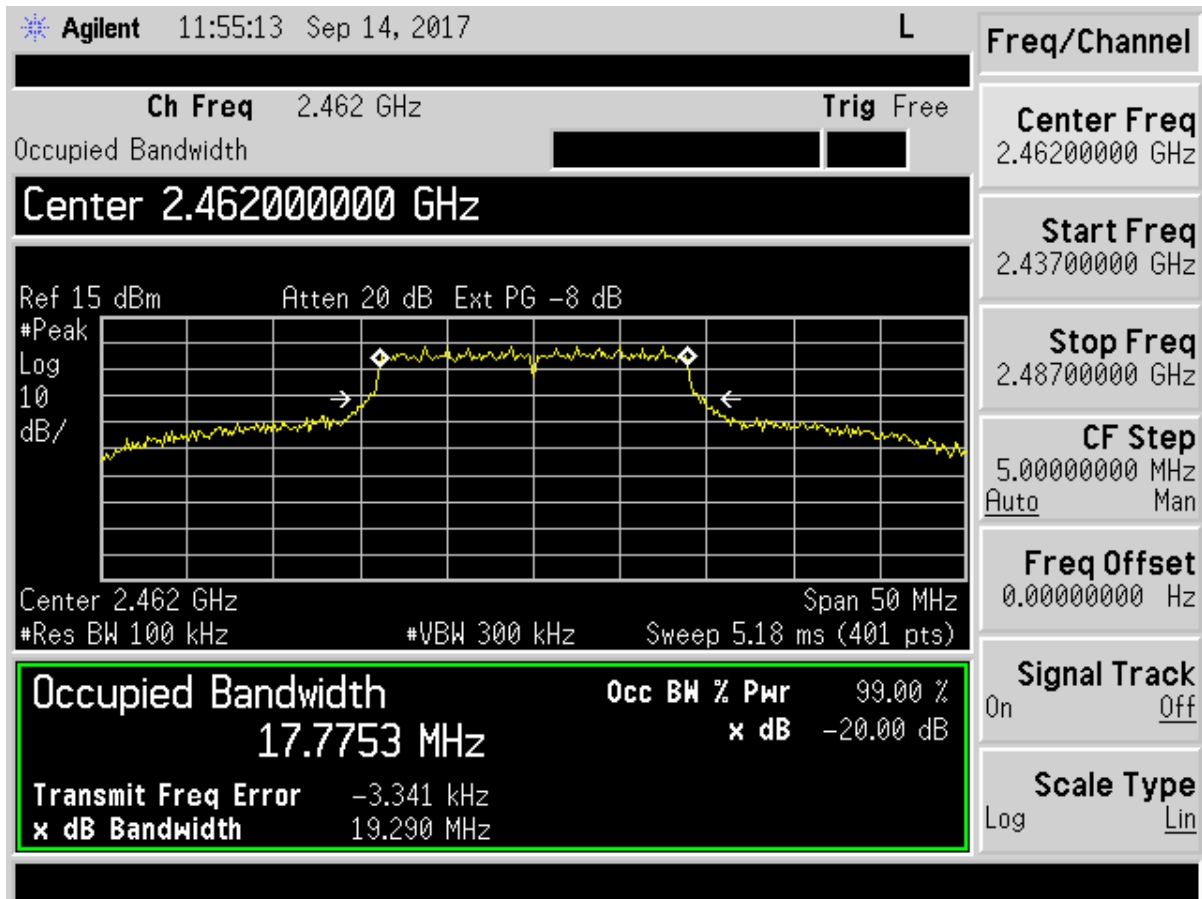


Figure 139. 20 dB Bandwidth – n mode High Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
O7P-903
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2.14 Maximum Peak Conducted Output Power (CFR 15.247 (b) (3))

For the ISM 43903-R48-L54 (2.4 GHz eS-WiFi Module), the transmitter was programmed to operate at a maximum output power across the bandwidth. For this test the output power of the radio was set to 'wl txpwr1 -o -q 74', which is equal to a rated output level of +18.0 dBm. This is the rated level which the EUT was set to in order to meet all test requirements.

Peak power within the band 2400 MHz to 2483.5 MHz was measured per ANSI C63.10-2013 as an Antenna Conducted test with a spectrum analyzer by connecting the spectrum analyzer directly, via a short RF cable, and attenuators to the antenna output terminals on the EUT. The spectrum analyzer was set to a RBW of 1 MHz, and the VBW \geq RBW. The integration method was used. Peak antenna conducted output power is tabulated in the table below.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15/IC RSS Certification
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Table 25. Peak Antenna Conducted Output Power per Part 15.247 (b)(3)

Frequency of Fundamental (MHz)	Raw Test Data dBm	Converted Data (mW)	FCC Limit (mW Maximum)	Mode
2412	20.84	121.34	1000	b
2442	20.29	106.91	1000	b
2462	20.26	106.17	1000	b
2412	20.95	124.45	1000	g
2442	20.92	123.60	1000	g
2462	20.94	124.16	1000	g
2412	20.92	123.60	1000	n
2442	20.74	118.58	1000	n
2462	20.88	122.46	1000	n

Test Date: October 23, 2017

Tested By

Signature: 

Name: Robert K. Mills

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
O7P-903
10147A-903
17-0162
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Inventek Systems
ISM43903

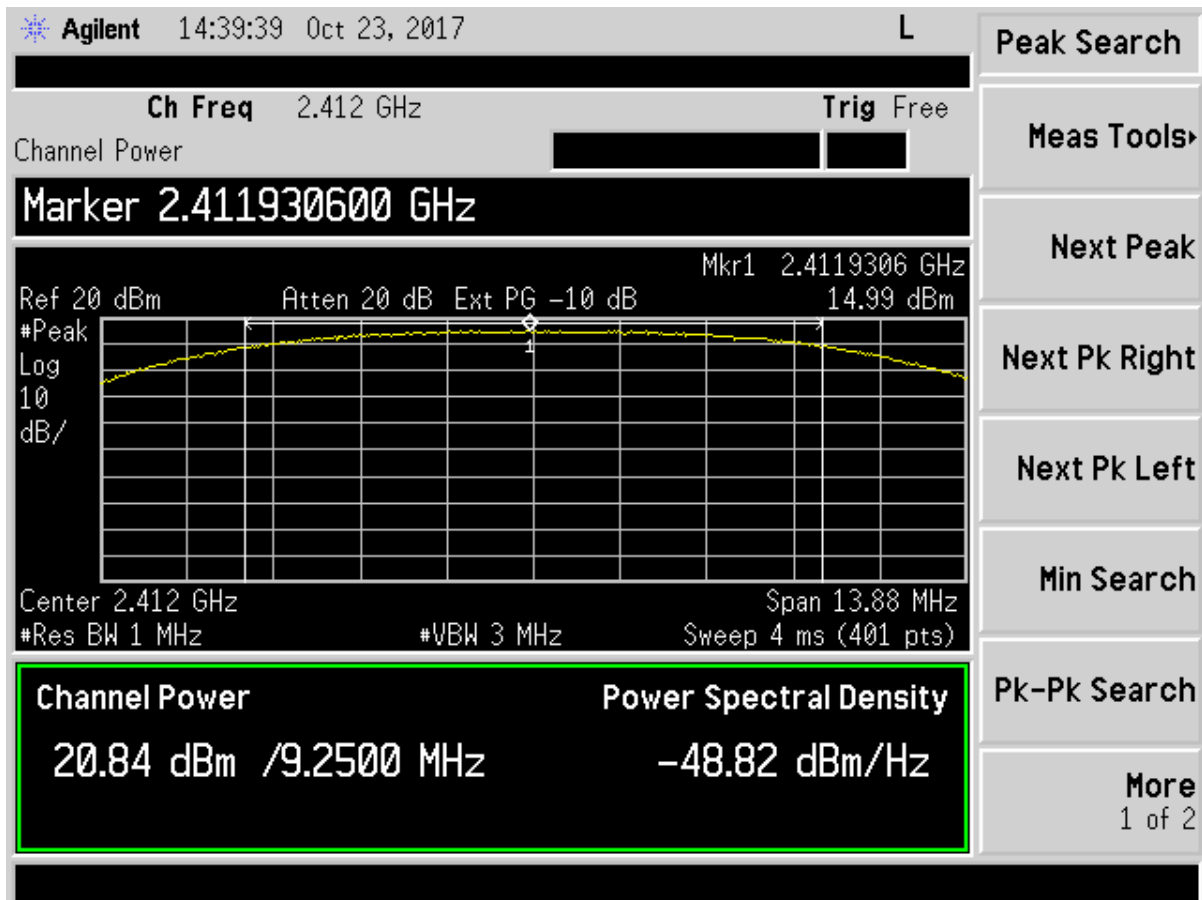


Figure 140. Peak Antenna Conducted Output Power, b mode Low Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
O7P-903
10147A-903
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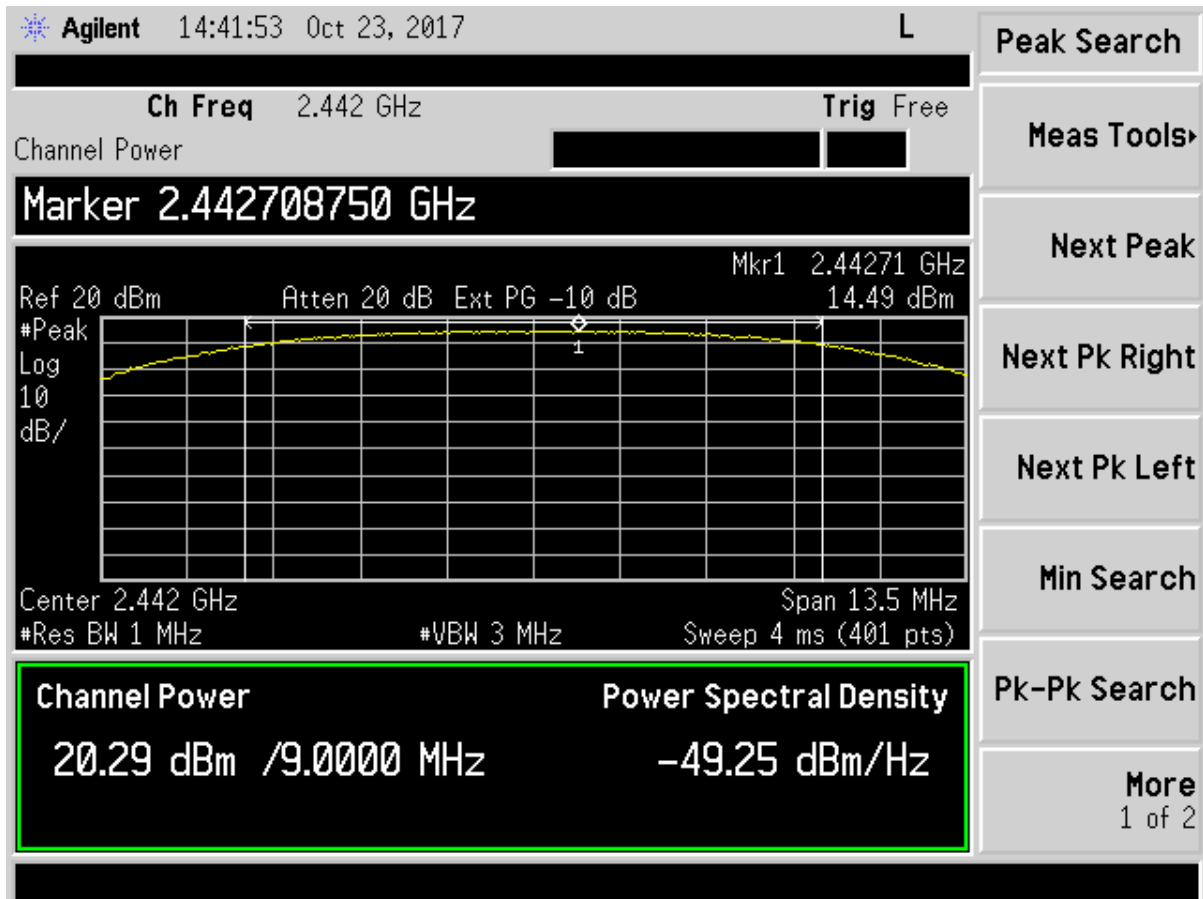


Figure 141. Peak Antenna Conducted Output Power, b mode Mid Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
O7P-903
10147A-903
17-0162
October 23, 2017
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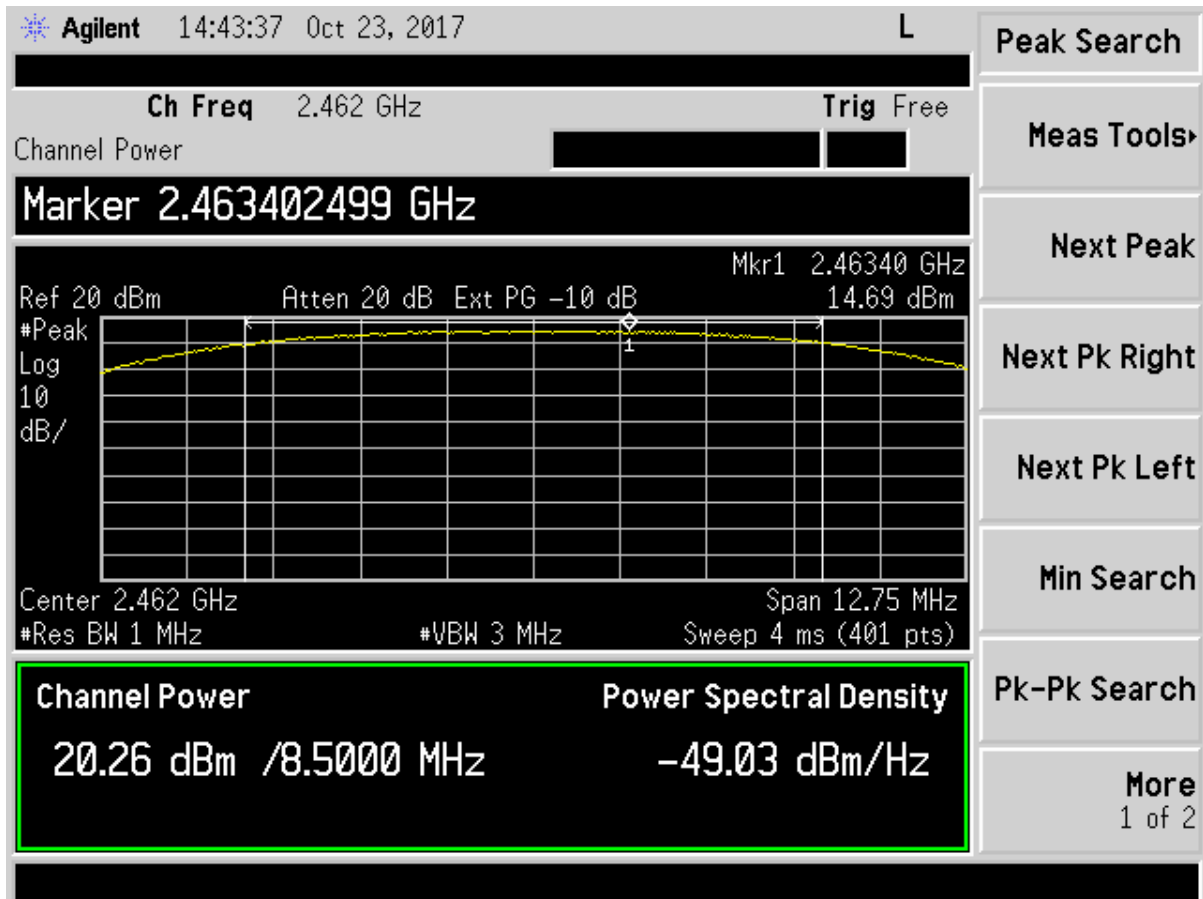


Figure 142. Peak Antenna Conducted Output Power, b mode High Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
O7P-903
10147A-903
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Inventek Systems
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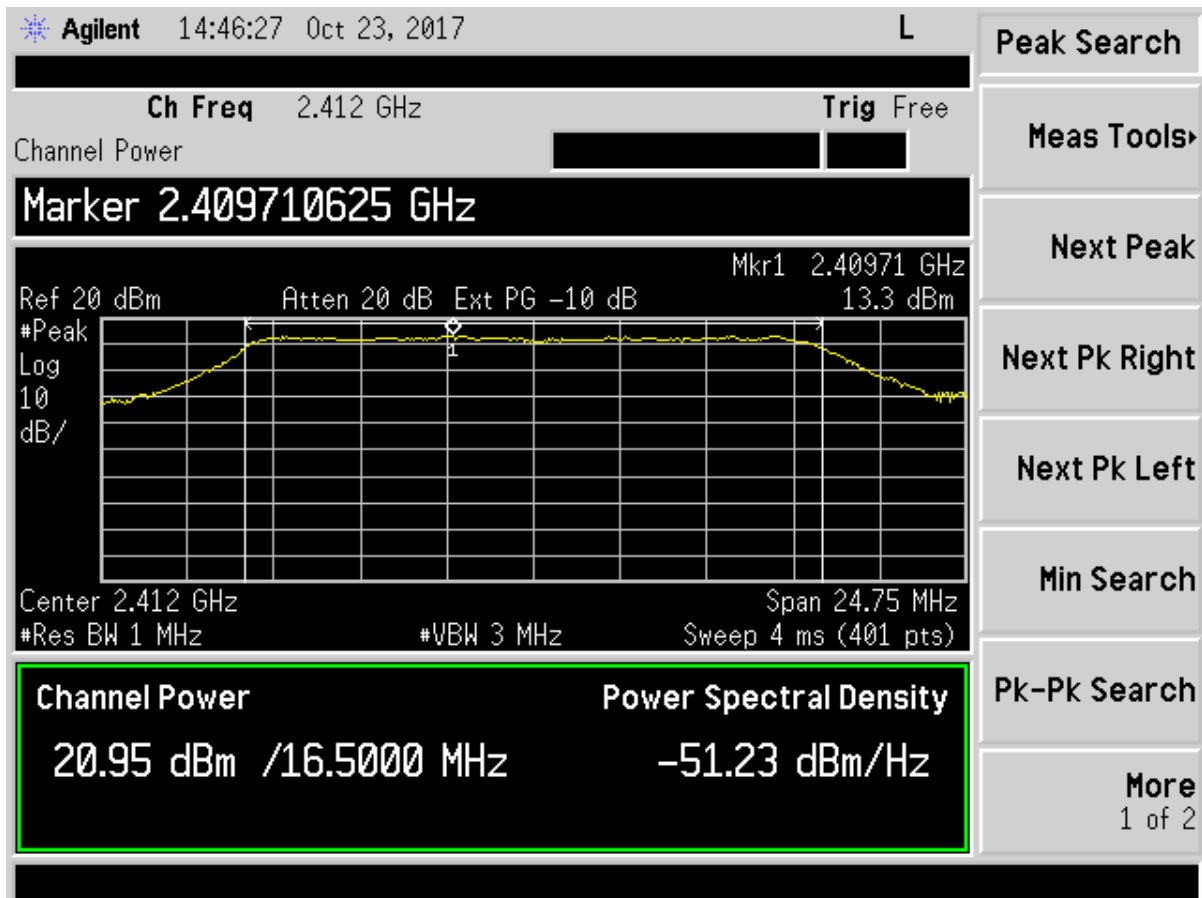


Figure 143. Peak Antenna Conducted Output Power, g mode Low Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
O7P-903
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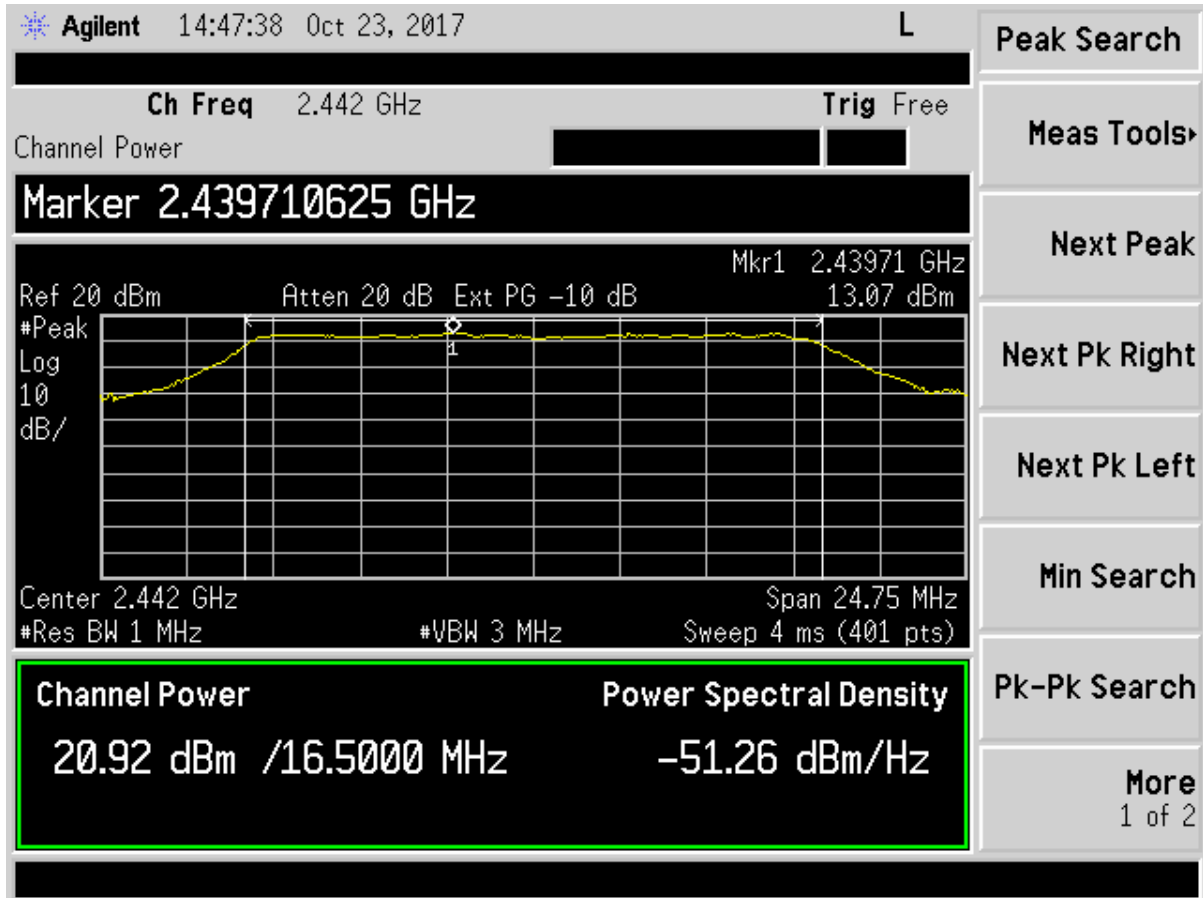


Figure 144. Peak Antenna Conducted Output Power, g mode Mid Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
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10147A-903
17-0162
October 23, 2017
Inventek Systems
ISM43903

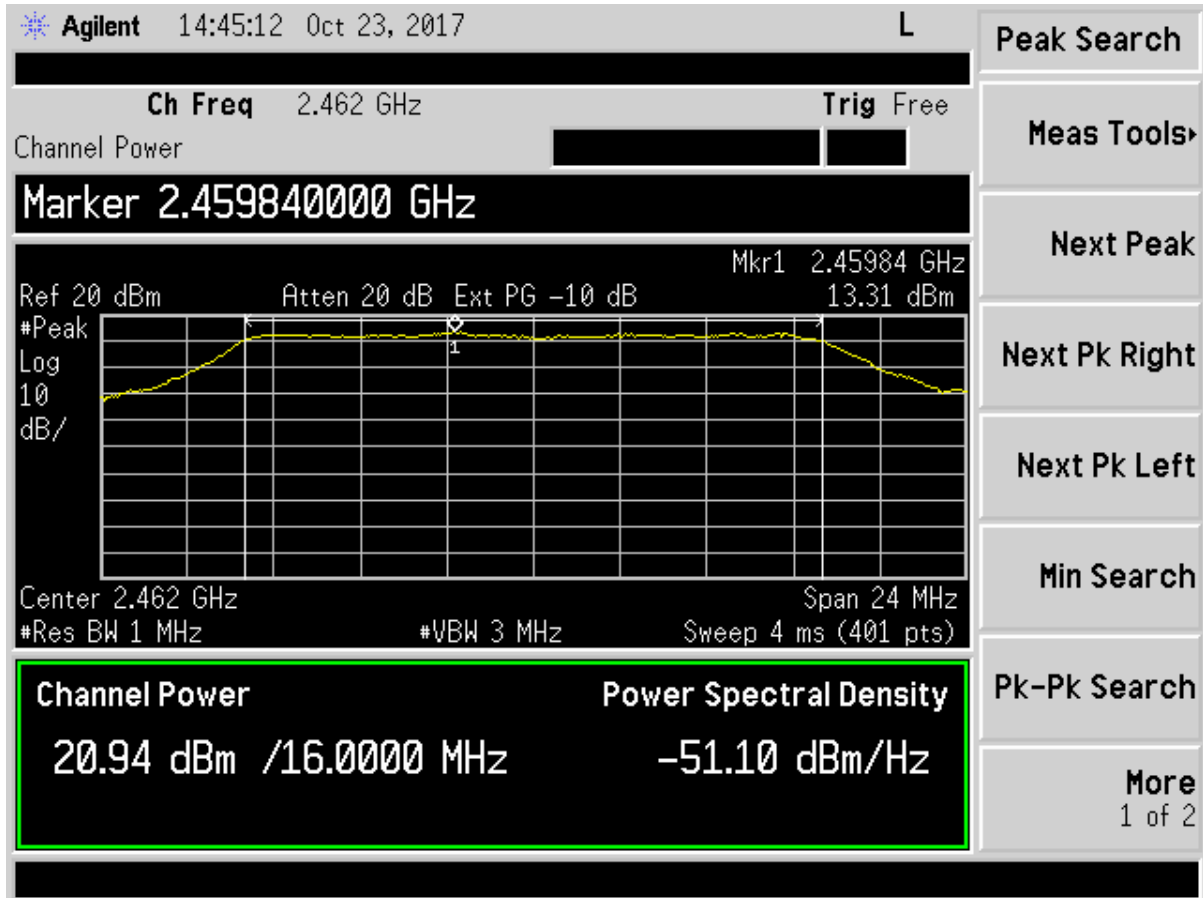


Figure 145. Peak Antenna Conducted Output Power, g mode High Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
O7P-903
10147A-903
17-0162
October 23, 2017
Inventek Systems
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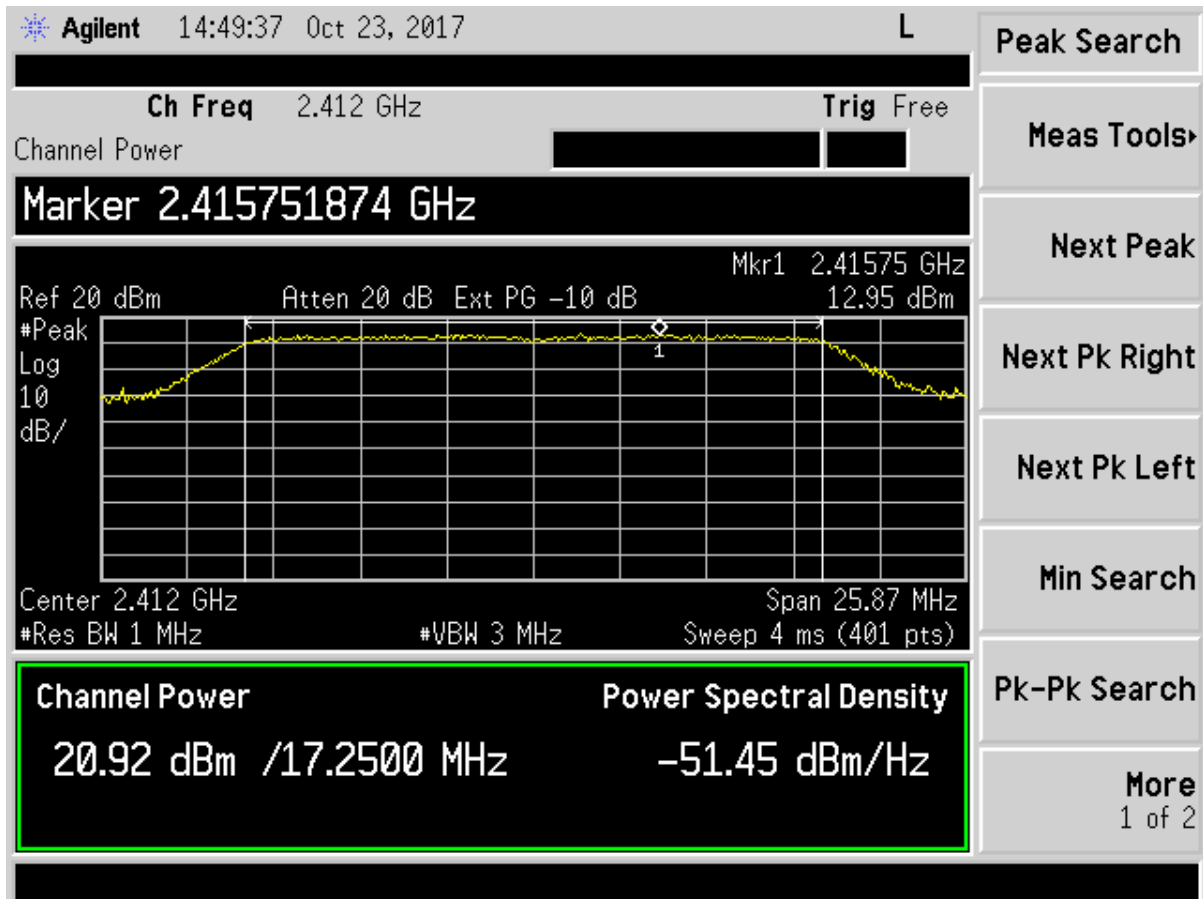


Figure 146. Peak Antenna Conducted Output Power, n mode Low Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
O7P-903
10147A-903
17-0162
October 23, 2017
Inventek Systems
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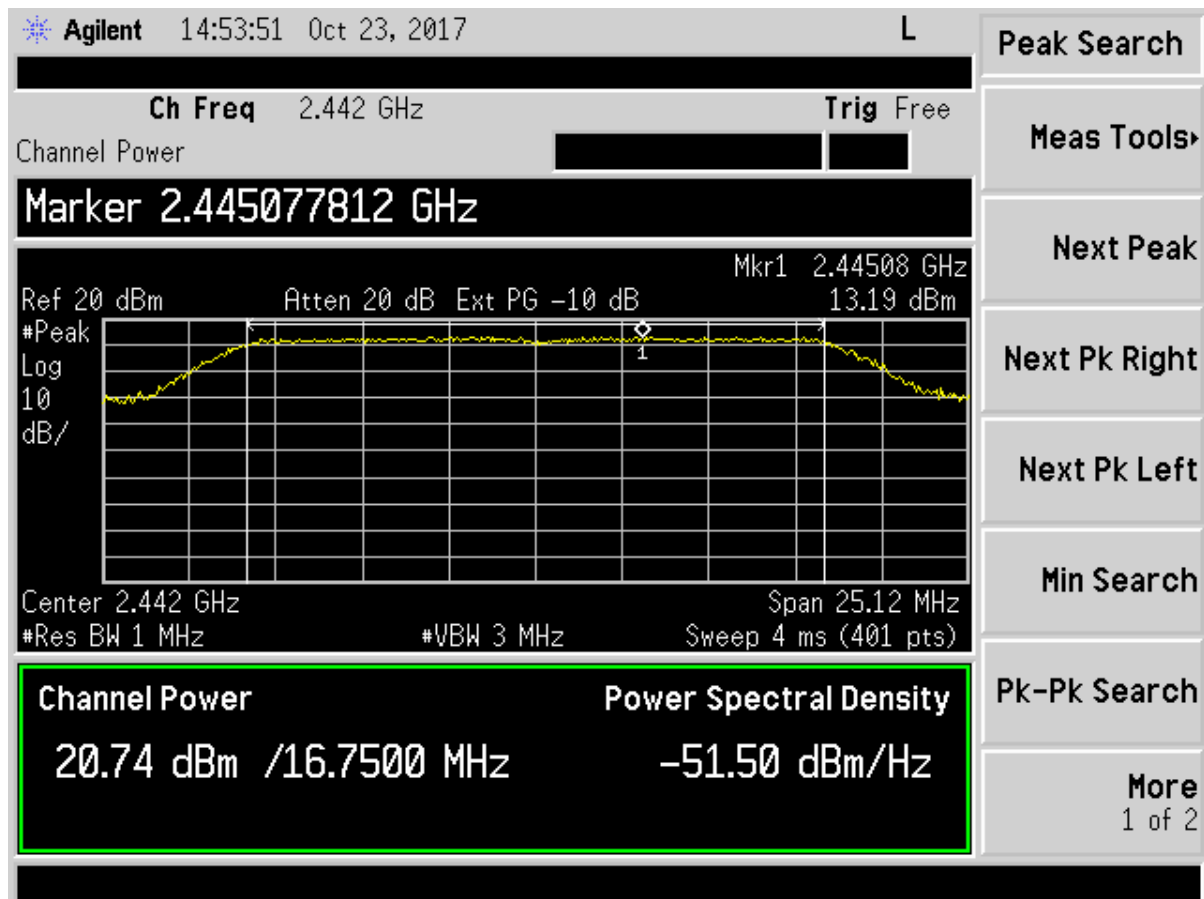


Figure 147. Peak Antenna Conducted Output Power, n mode Mid Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
O7P-903
10147A-903
17-0162
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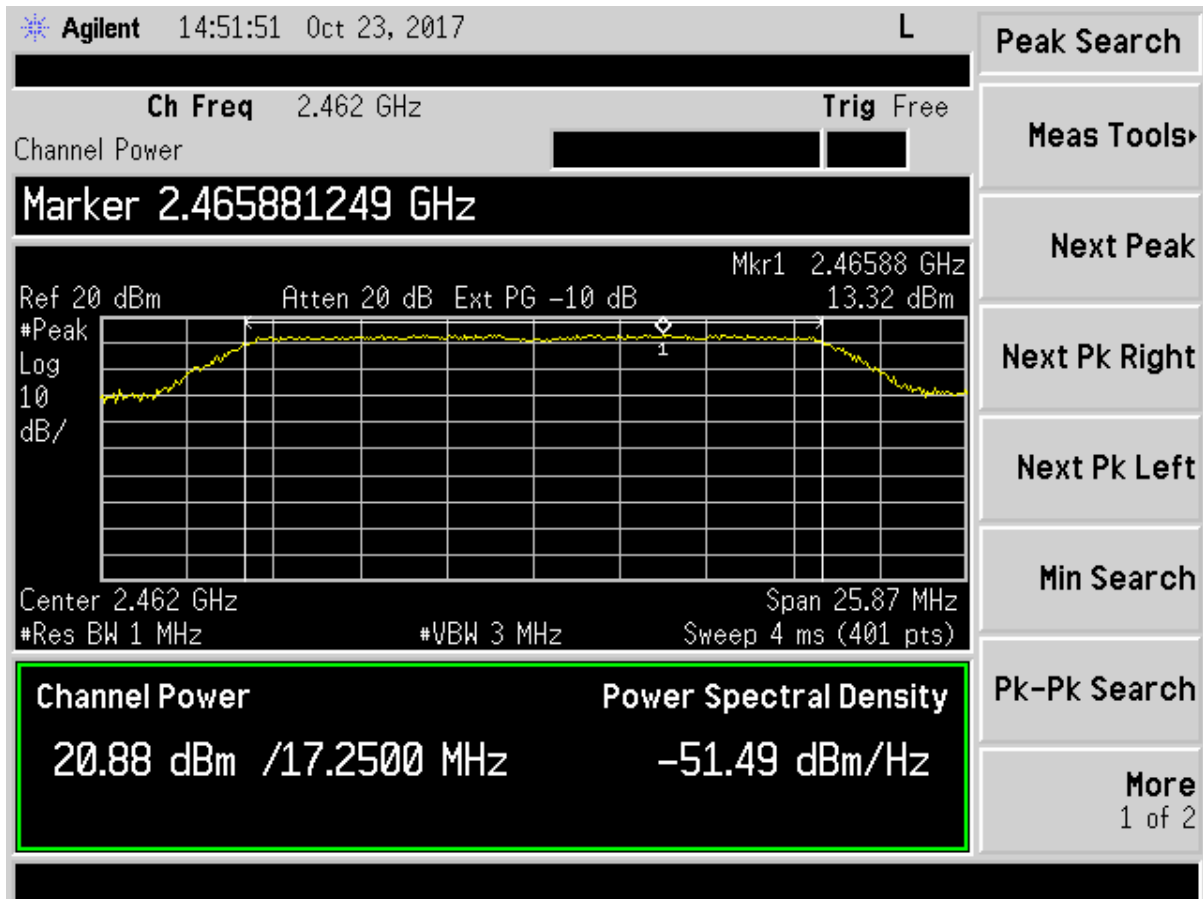


Figure 148. Peak Antenna Conducted Output Power, n mode High Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
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2.15 Power Spectral Density (CFR 15.247(e))

The transmitter was placed into a continuous mode of operation at all applicable frequencies. The measurements were performed per the procedures of ANSI C63.10-2013. The RBW was set to 3 kHz and the Video Bandwidth was set to \geq 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 the table below and figures below. All are less than +8 dBm per 3 kHz band.

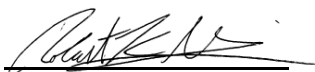
Table 26. Power Spectral Density for Low, Mid and High Bands

Frequency (MHz)	Results (dBm/kHz)	FCC Limit (dBm/3 kHz)	Mode
2412	5.21	+8.0	b
2442	4.40	+8.0	b
2462	4.19	+8.0	b
2412	5.45	+8.0	g
2442	5.10	+8.0	g
2462	4.99	+8.0	g
2412	4.08	+8.0	n
2442	3.92	+8.0	n
2462	3.96	+8.0	n

Test Date: September 14, 2017

Tested By

Signature:



Name: Robert K. Mills

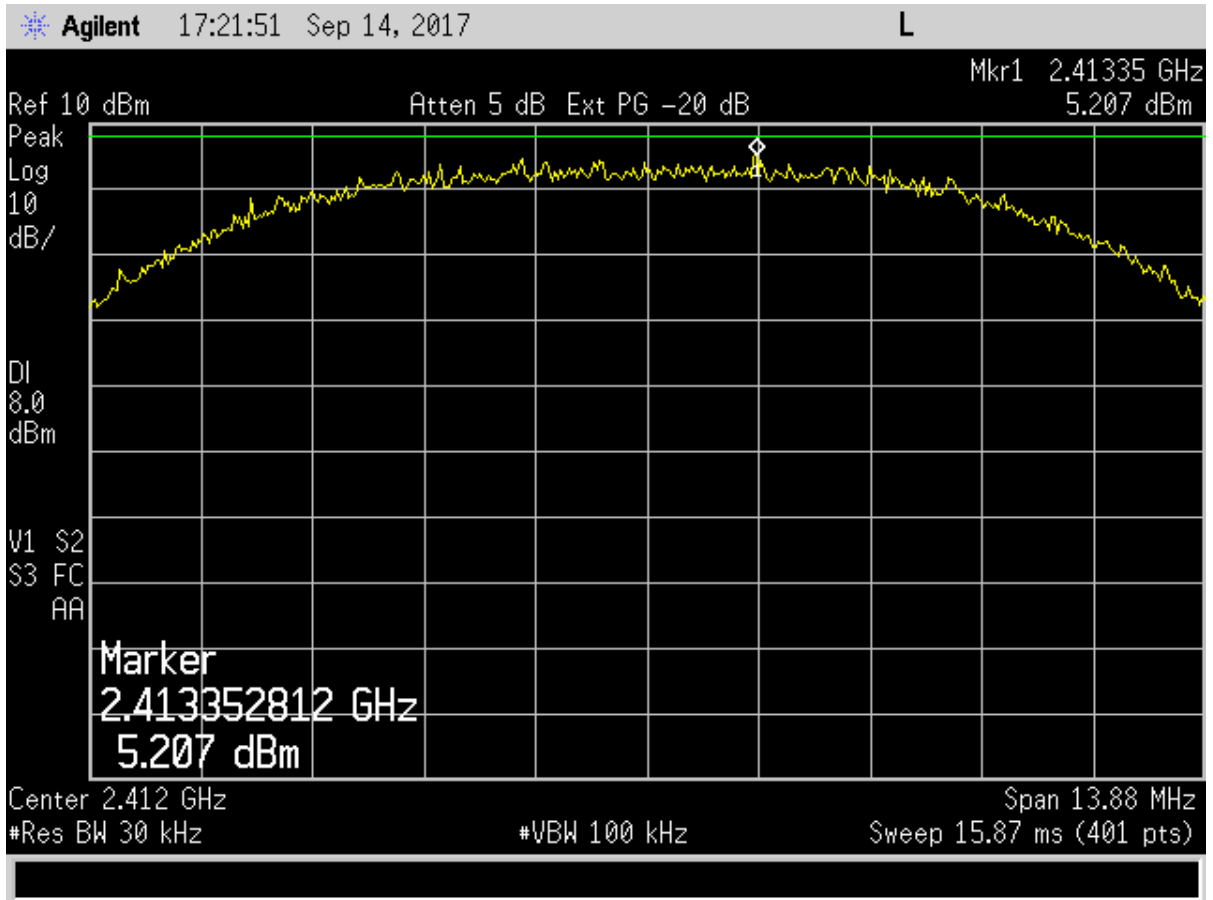


Figure 149. Peak Power Spectral Density - Part 15.247 (e) – b mode Low Channel

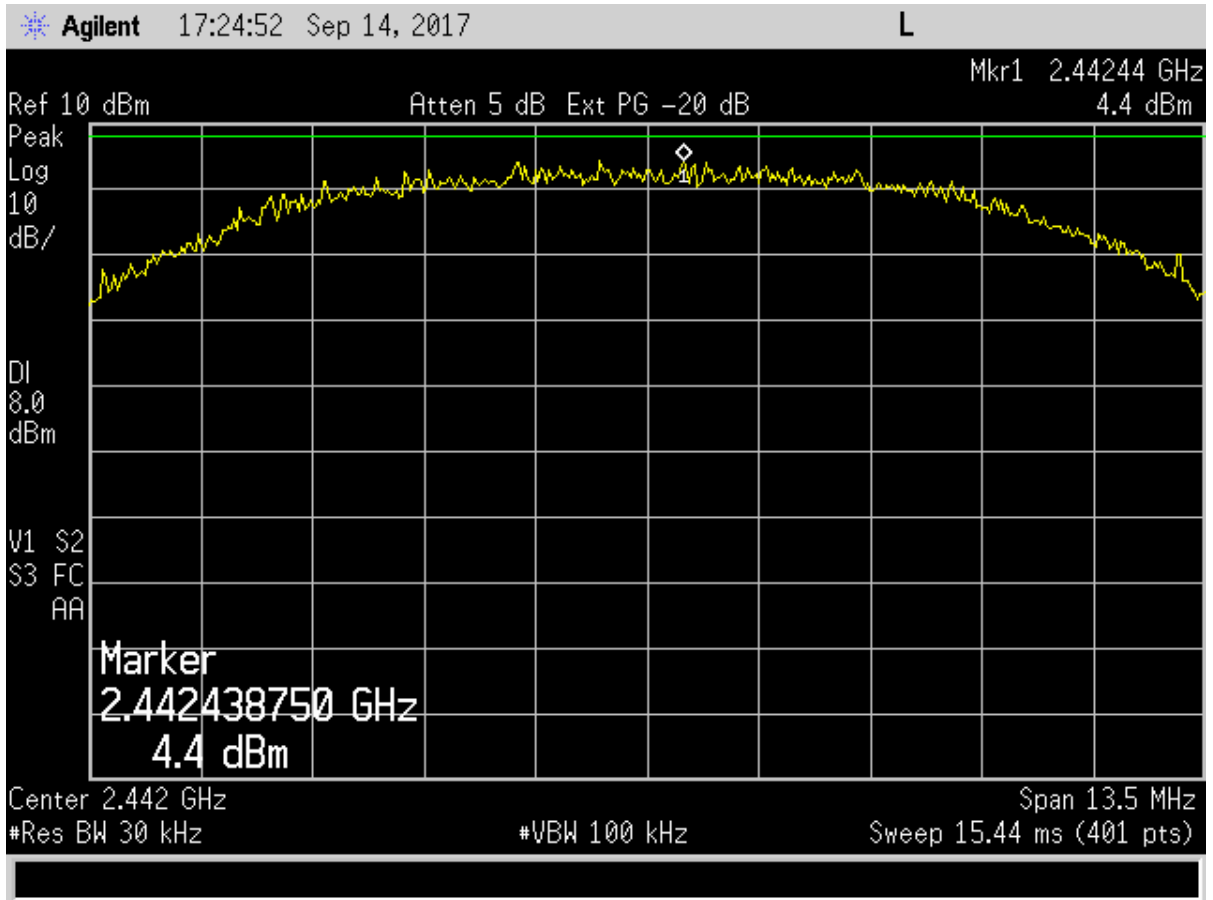


Figure 150. Power Spectral Density - Part 15.247 (e) – b mode Mid Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

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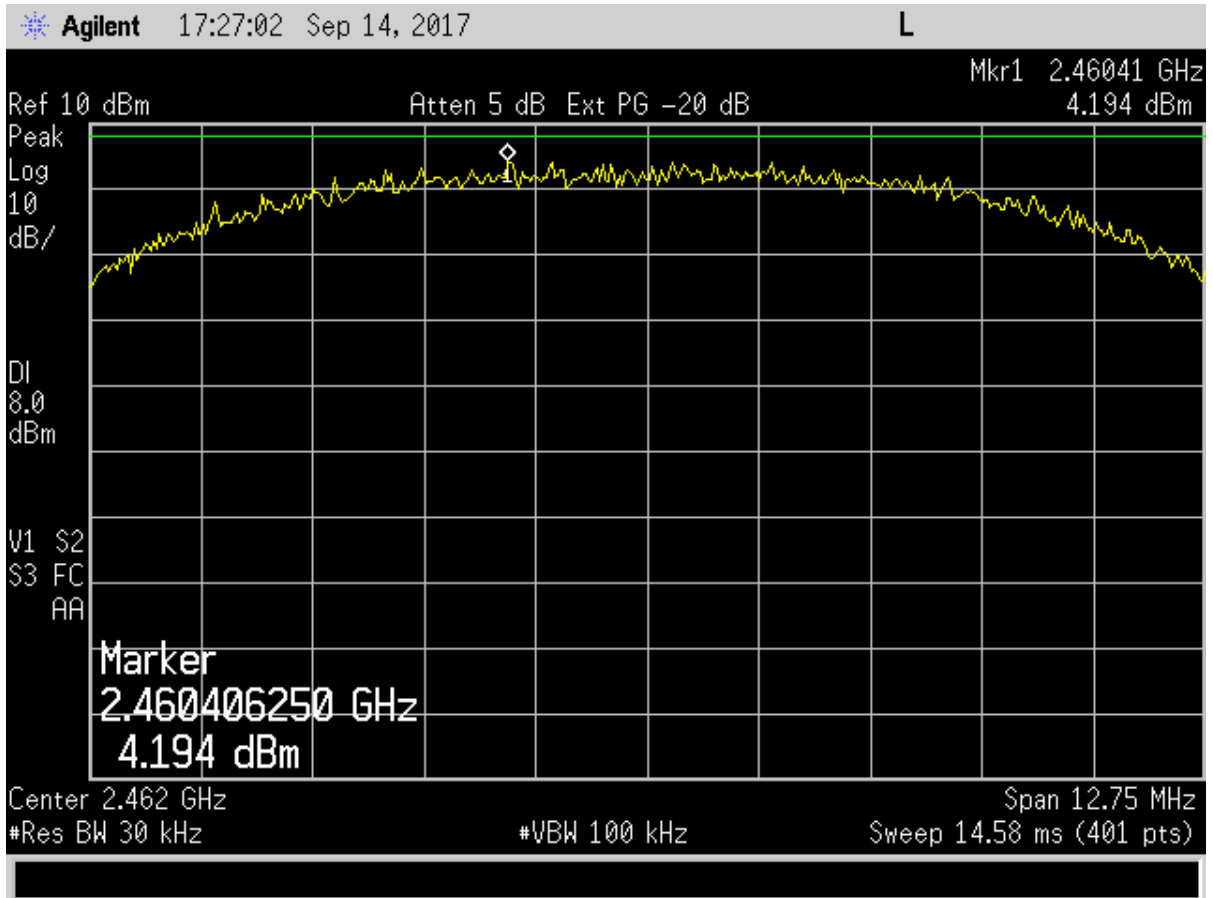


Figure 151. Peak Power Spectral Density - Part 15.247 (e) – b mode High Channel

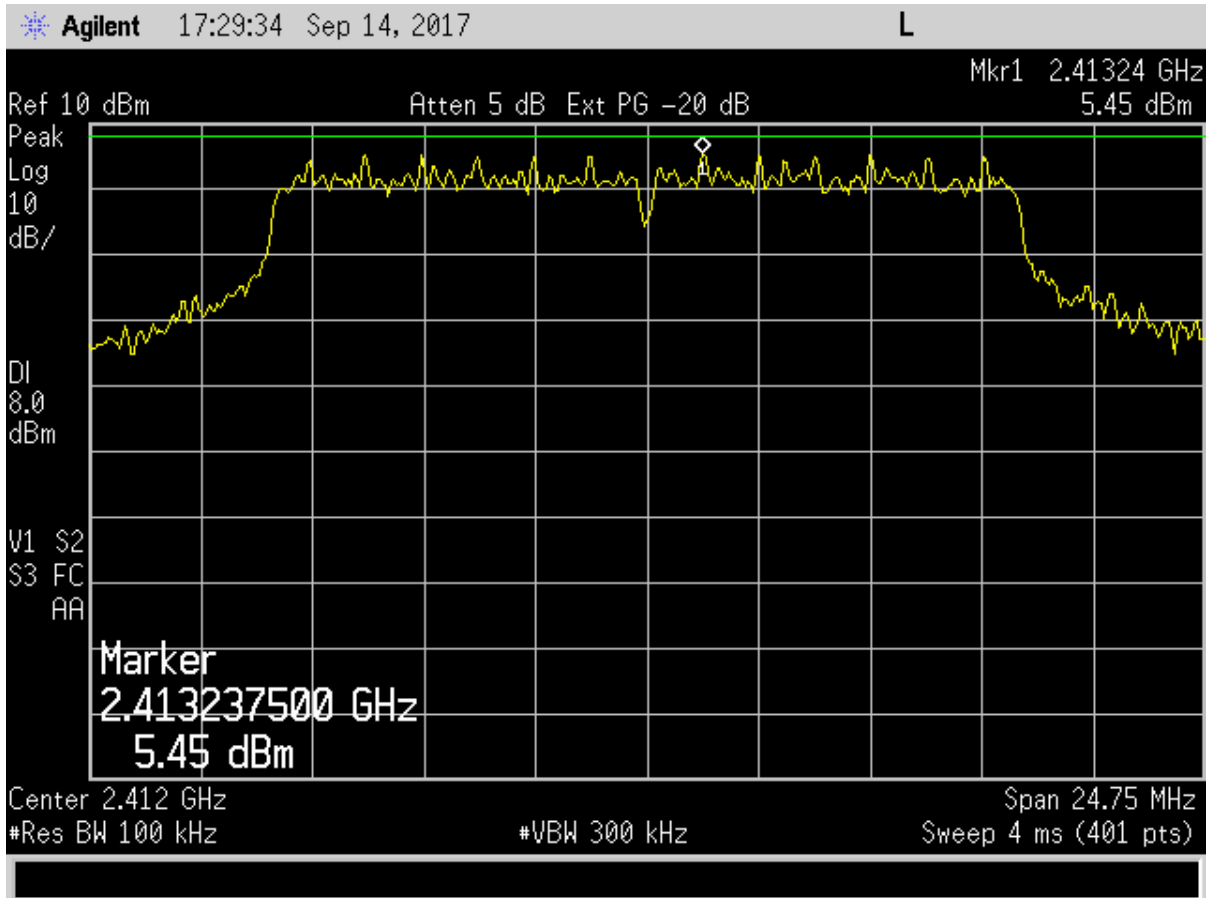


Figure 152. Peak Power Spectral Density – Part 15.247 (e) – g mode Low Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
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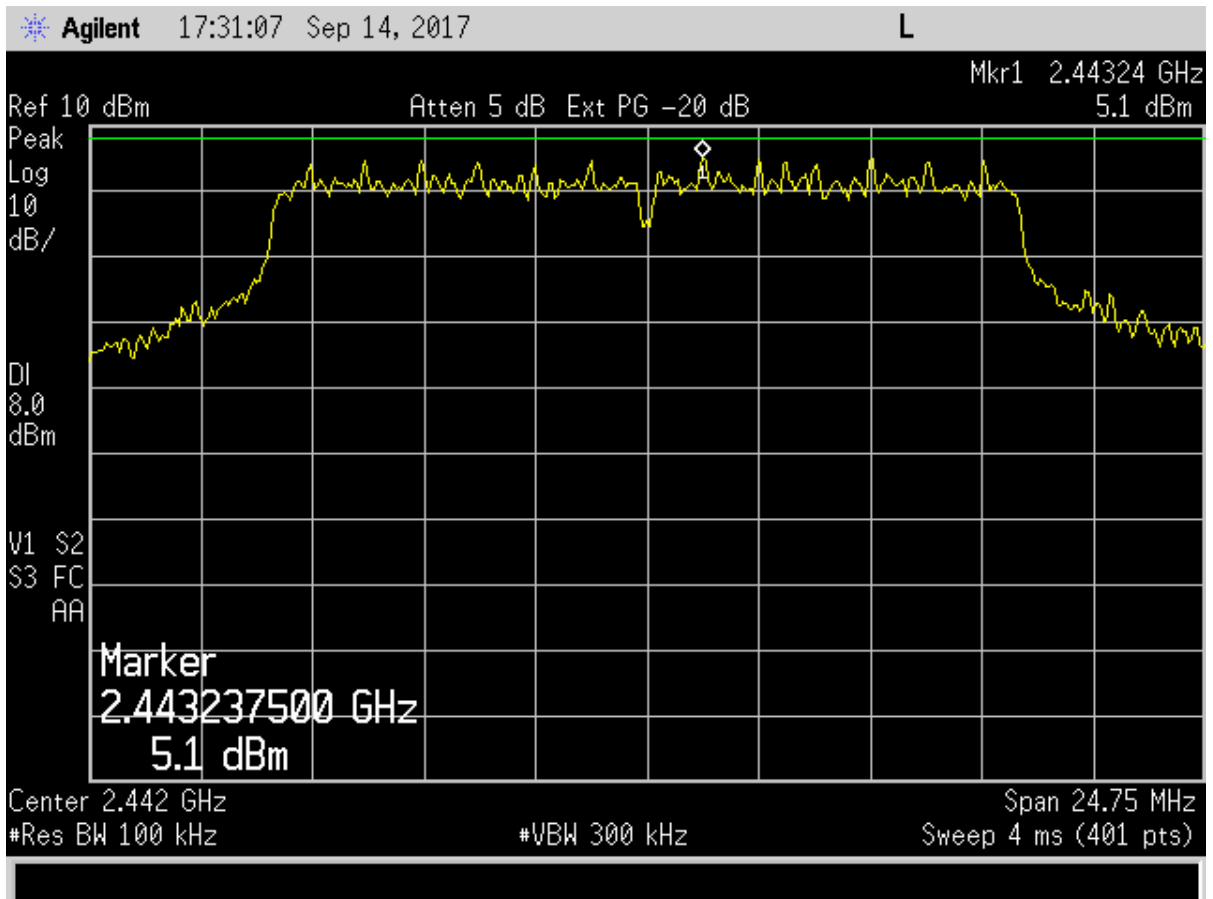


Figure 153. Peak Power Spectral Density – Part 15.247 (e) – g mode Mid Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
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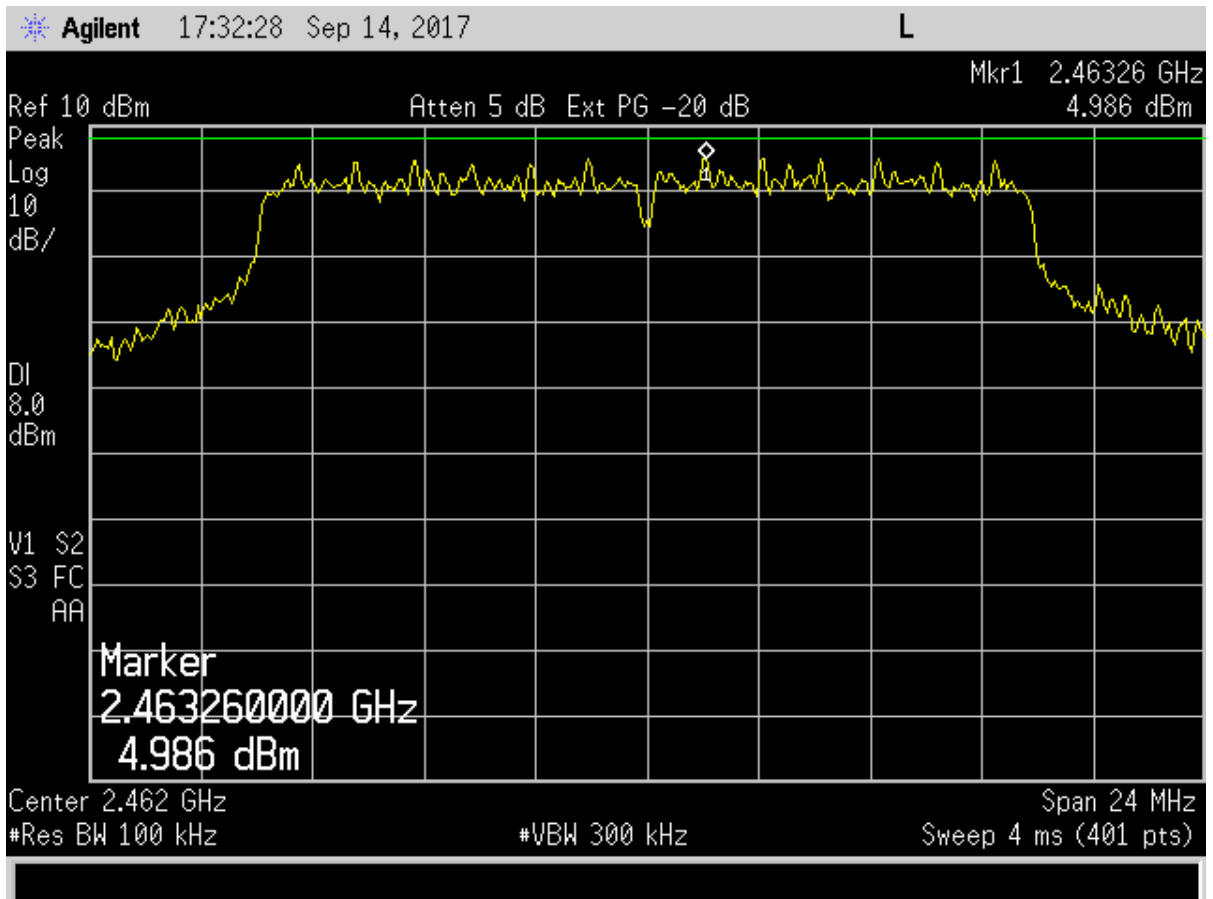


Figure 154. Peak Power Spectral Density – Part 15.247 (e) –g mode High Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
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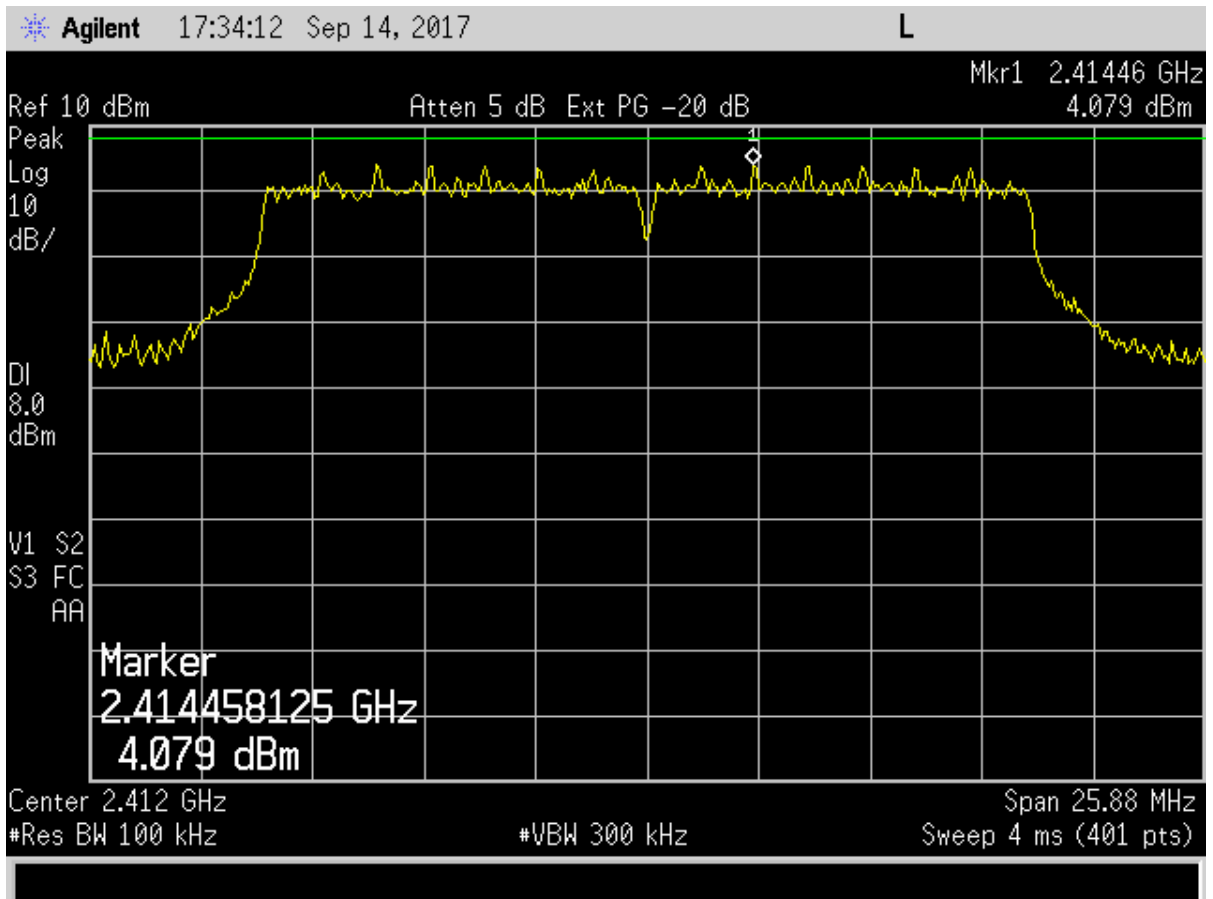


Figure 155. Peak Power Spectral Density – Part 15.247 (e) – n mode Low Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
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Inventek Systems
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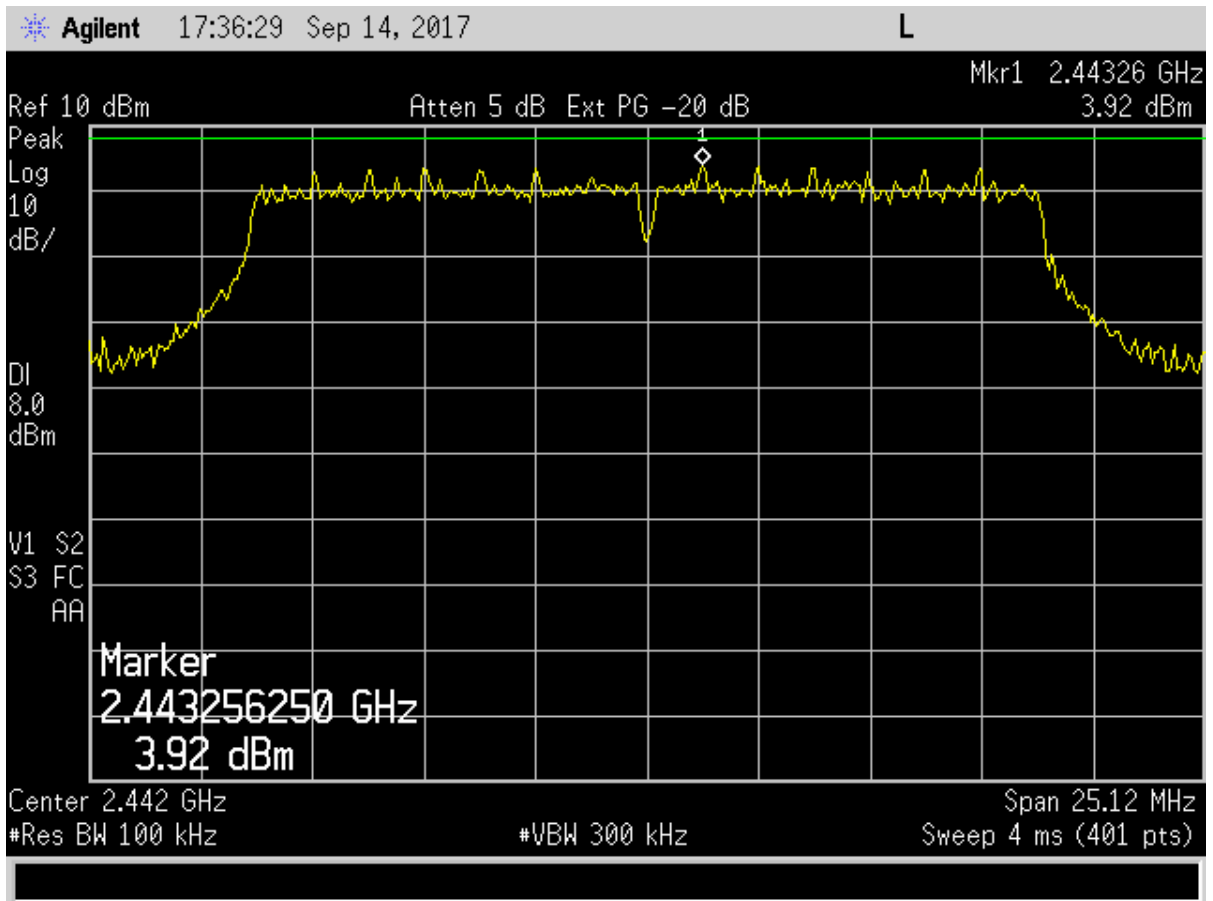


Figure 156. Peak Power Spectral Density – Part 15.247 (e) – n mode Mid Channel

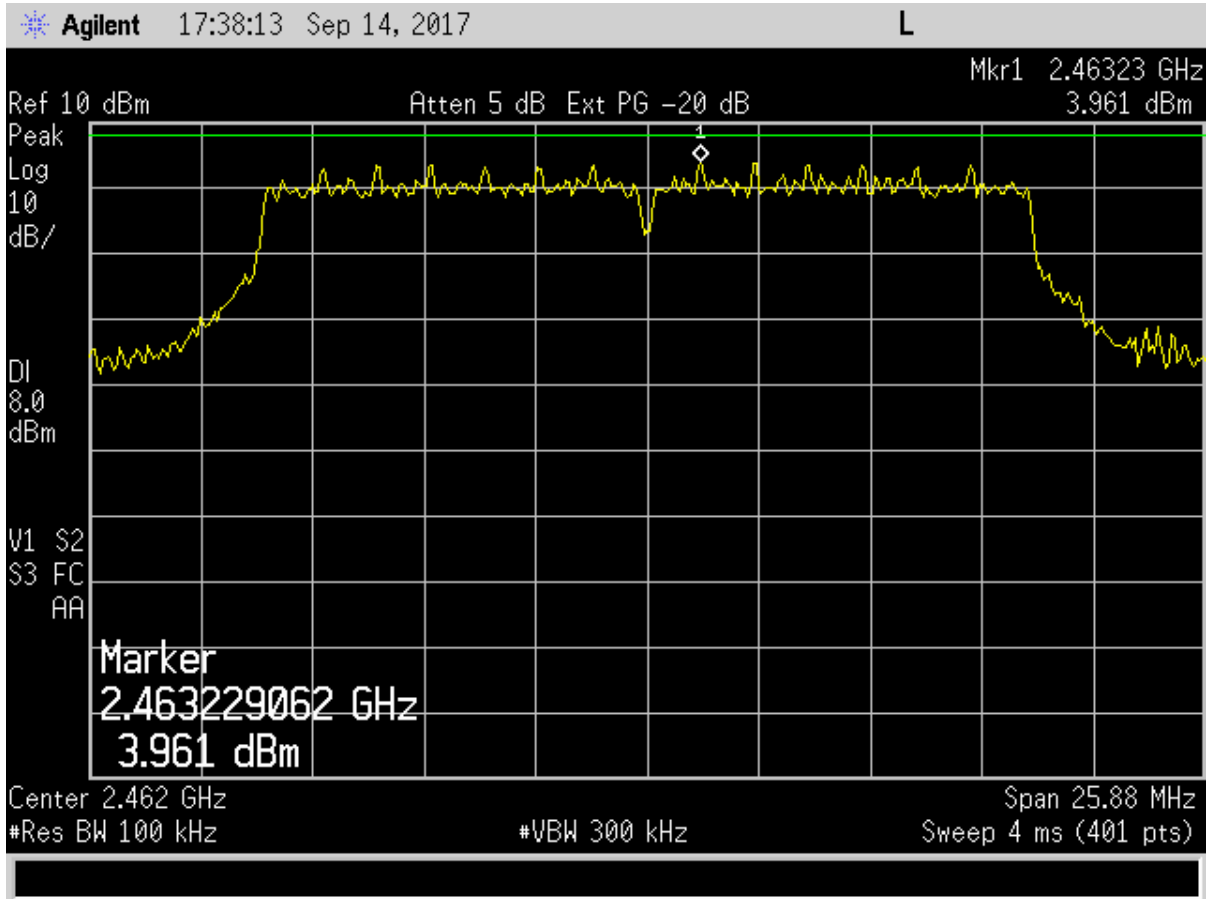


Figure 157. Peak Power Spectral Density – Part 15.247 (e) – n mode High Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

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2.16 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 C63.10:2013, Clause 6.2, with a spectrum analyzer connected to an LISN and the EUT placed into a continuous mode of transmission.

The worst-case results for conducted emissions were determined to be produced when the EUT was operating under continuous transmission. The worst case measurement was 2.2 dB from the applicable limit. All other emissions were at least 3.6 dB from the limit. Those results are given in the table below.

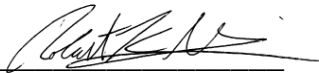
US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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Table 27. Power Line Conducted Emissions

CONDUCTED EMISSIONS 150 kHz to 30 MHz						
Tested By: RKM	Specification Requirement: FCC Part 15.207	Project No.: 17-0162	Manufacturer: Inventek Systems Model: ISM43903			
Frequency (MHz)	Test Data (dBuV)	LISN+CL (dB)	Corrected Results (dBuV)	Avg Limits (dBuV)	Margin (dB)	Detector
Phase @ 120VAC/60Hz						
0.1500	53.26	0.53	53.79	56.0	2.2	QP
0.6558	39.76	0.26	40.02	46.0	6.0	PK
4.1066	37.67	0.33	38.00	46.0	8.0	PK
9.1160	38.28	0.51	38.79	50.0	11.2	PK
10.7160	39.52	1.26	40.78	50.0	9.2	PK
20.0800	28.21	0.80	29.01	50.0	21.0	PK
Neutral @ 120VAC/60Hz						
0.1500	51.92	0.43	52.35	56.0	3.6	QP
0.9925	38.61	0.11	38.72	46.0	7.3	PK
1.2666	38.30	0.15	38.45	46.0	7.5	PK
9.5500	38.98	0.39	39.37	50.0	10.6	PK
12.5500	38.91	1.20	40.11	50.0	9.9	PK
23.5666	27.10	0.81	27.91	50.0	22.1	PK

Test Date: October 23, 2017

Tested By
 Signature: 

Name: Robert K. Mills

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

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2.17 Intentional Radiator, Radiated Emissions (CFR 15.209)

The test data provided herein is to support the verification requirement for radiated emissions coming for the EUT in a transmitting state per 15.209 and were investigated from 9 kHz or the lowest operating clock frequency to 25 GHz and tested as detailed in ANSI C63.10:2013, Clause 6.4-6.6. Data is presented in Table 12.

Radiated emissions within the band of 9 kHz to 30 MHz were investigated using a calibrated Loop Antenna and per the requirements of ANSI C63.10:2013.

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.

The worst case configuration was determined to be the radio module set up with the Dual band antenna. The test data is presented below.

The worst-case radiated emission was 3.8 dB below the specification limit at 32.61 MHz. All other measured signals were at least 6.8 dB below the specification limit. The results are shown in the table below. These results are meant to show that this EUT has met the intentional transmitter requirements of CFR Part 15.209.

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 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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Table 28. EUT with Dual-Band Antenna Spurious Radiated Emissions (150 KHz-30MHz)

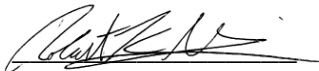
Test By: RKM	Test: FCC Part 15.209			Client: Inventek Systems			
	Project: 17-0162 Class B			Model: ISM43903			
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP/AVG
All emissions were at least 20 dB from the applicable limit.							

No other emissions detected other than those presented in this table and the tables in section 2.10 above.

AF is antenna factor. CL is cable loss. PA is preamplifier gain.

SAMPLE CALCULATION: N/A

Test Date: August 30, 2017

Tested By Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15/IC RSS Certification
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Table 29. b mode Dual-Band Antenna Spurious Radiated Emissions (30 MHz – 1 GHz)

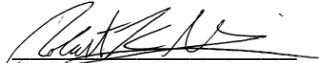
Test By: RKM	Test: FCC Part 15.109/15.209				Client: Inventek Systems			
	Project: 17-0162 Class B				Model: ISM43903			
Frequency (MHz)	Test Data (dBuV)	Additional Factors	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP/AVG
Tested from 30 MHz to 1 GHz, Quasi Peak Limits								
33.32	40.19	-	-12.21	27.98	40.0	3m./HORZ	12.0	PK
32.61	49.69	-	-13.51	36.18	40.0	3m./VERT	3.8	QP
91.10	41.81	-	-16.77	25.04	43.5	3m./VERT	18.5	PK
196.10	44.64	-	-11.77	32.87	43.5	3m./HORZ	10.6	PK
200.08	45.45	-	-13.75	31.70	43.5	3m./HORZ	11.8	PK
212.84	42.35	-	-14.02	28.33	43.5	3m./VERT	15.2	PK
240.40	46.26	-	-14.10	32.16	46.0	3m./HORZ	13.8	PK
241.40	46.33	-	-14.00	32.33	46.0	3m./VERT	13.7	PK
478.80	40.48	-	-8.21	32.27	46.0	3m./VERT	13.7	PK
480.30	40.18	-	-7.91	32.27	46.0	3m./HORZ	13.7	PK
960.20	35.56	-	0.51	36.07	54.0	3m./HORZ	17.9	PK
961.10	35.47	-	-0.59	34.88	54.0	3m./VERT	19.1	PK
All other emissions were greater than 20 dB from the applicable limit.								

AF is antenna factor. CL is cable loss. PA is preamplifier gain.

SAMPLE CALCULATION AT: 33.32 MHz

Magnitude of Measured Frequency	40.19	dBuV
Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	-12.21	dB
Corrected Result	27.98	dBuV/m

Test Date: August 30, 2017

Tested By Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15/IC RSS Certification
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 10147A-903
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Table 30. b mode Dual-Band Antenna Spurious Radiated Emissions (1 GHz – 25 GHz)

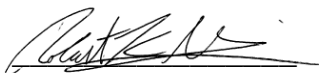
Test By: RKM		Test: FCC Part 15.109/15.209			Client: Inventek Systems			
		Project: 17-0162 Class B			Model: ISM43903			
Frequency (MHz)	Test Data (dBuV)	Additional Factors	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP/AVG
All emissions were at least 20 dB from the applicable limit.								

No other emissions detected other than those presented in this table and the tables in section 2.10 above.

AF is antenna factor. CL is cable loss. PA is preamplifier gain.

SAMPLE CALCULATION: N/A

Test Date: August 30, 2017

Tested By Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15/IC RSS Certification
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Table 31. g mode Dual-Band Antenna Spurious Radiated Emissions (30 MHz – 1 GHz)

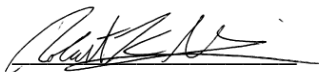
Test By: RKM	Test: FCC Part 15.109/15.209				Client: Inventek Systems			
	Project: 17-0162 Class B				Model: ISM43903			
Frequency (MHz)	Test Data (dBuV)	Additional Factors	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP/AVG
Tested from 30 MHz to 1 GHz, Quasi Peak Limits								
32.47	47.22	-	-13.51	33.71	40.0	3m./VERT	6.3	PK
85.39	37.12	-	-17.80	19.32	40.0	3m./HORZ	20.7	PK
120.20	38.56	-	-15.64	22.92	43.5	3m./HORZ	20.6	PK
120.50	45.82	-	-15.01	30.81	43.5	3m./VERT	12.7	PK
200.84	40.10	-	-13.75	26.35	43.5	3m./HORZ	17.2	PK
213.28	40.55	-	-14.02	26.53	43.5	3m./VERT	17.0	PK
241.00	46.15	-	-14.10	32.05	46.0	3m./HORZ	13.9	PK
241.00	47.41	-	-14.00	33.41	46.0	3m./VERT	12.6	PK
478.80	46.52	-	-7.91	38.61	46.0	3m./HORZ	7.4	PK
481.30	43.07	-	-8.01	35.06	46.0	3m./VERT	10.9	PK
960.10	36.15	-	0.51	36.66	54.0	3m./HORZ	17.3	PK
963.20	36.16	-	-0.59	35.57	54.0	3m./VERT	18.4	PK
All other emissions were greater than 20 dB from the applicable limit.								

AF is antenna factor. CL is cable loss. PA is preamplifier gain.

SAMPLE CALCULATION AT: 32.47 MHz

Magnitude of Measured Frequency	47.22	dBuV
Additional Factor	0.00	dB
<u>+Antenna Factor + Cable Loss+ Amplifier Gain</u>	<u>-13.51</u>	<u>dB</u>
Corrected Result	33.71	dBuV/m

Test Date: August 30, 2017

Tested By Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

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Table 32. g mode Dual-Band Antenna Spurious Radiated Emissions (1 GHz – 25 GHz)

Test By: RKM	Test: FCC Part 15.109/15.209				Client: Inventek Systems			
	Project: 17-0162 Class B				Model: ISM43903			
Frequency (MHz)	Test Data (dBuV)	Additional Factors	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP/AVG
All other emissions were greater than 20 dB from the applicable limit.								

AF is antenna factor. CL is cable loss. PA is preamplifier gain.

SAMPLE CALCULATION AT: N/A

Test Date: August 30, 2017

Tested By Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15/IC RSS Certification
 O7P-903
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 17-0162
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 Inventek Systems
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Table 33. n mode Dual-Band Antenna Spurious Radiated Emissions (30 MHz – 1 GHz)

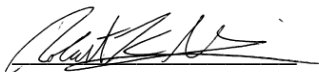
Test By: RKM	Test: FCC Part 15.109/15.209				Client: Inventek Systems			
	Project: 17-0162 Class B				Model: ISM43903			
Frequency (MHz)	Test Data (dBuV)	Additional Factors	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP/AVG
Tested from 30 MHz to 1 GHz, Quasi Peak Limits								
31.31	36.60	-	-11.66	24.94	40.0	3m./HORZ	15.1	PK
32.47	40.55	-	-13.51	27.04	40.0	3m./VERT	13.0	QP
113.20	44.87	-	-15.41	29.46	43.5	3m./VERT	14.0	PK
156.00	39.65	-	-14.12	25.53	43.5	3m./HORZ	18.0	PK
206.32	40.42	-	-14.60	25.82	43.5	3m./VERT	17.7	PK
215.28	41.48	-	-14.68	26.80	43.5	3m./HORZ	16.7	PK
240.40	47.04	-	-14.10	32.94	46.0	3m./HORZ	13.1	PK
241.00	48.20	-	-14.00	34.20	46.0	3m./VERT	11.8	PK
478.80	38.96	-	-7.91	31.05	46.0	3m./HORZ	14.9	PK
481.30	38.69	-	-8.01	30.68	46.0	3m./VERT	15.3	PK
960.10	35.18	-	0.51	35.69	54.0	3m./HORZ	18.3	PK
960.10	36.29	-	-0.59	35.70	54.0	3m./VERT	18.3	PK
All other emissions were greater than 20 dB from the applicable limit.								

AF is antenna factor. CL is cable loss. PA is preamplifier gain.

SAMPLE CALCULATION AT: 31.31 MHz

Magnitude of Measured Frequency	36.60	dBuV
Additional Factor	0.00	dB
<u>+Antenna Factor + Cable Loss+ Amplifier Gain</u>	<u>-11.66</u>	<u>dB</u>
Corrected Result	24.94	dBuV/m

Test Date: August 30, 2017

Tested By Signature: 

Name: Robert K. Mills

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
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 Model:

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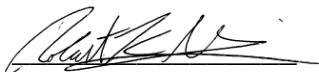
Table 34. n mode Dual-Band Antenna Spurious Radiated Emissions (1 GHz – 25 GHz)

Test By: RKM	Test: FCC Part 15.109/15.209				Client: Inventek Systems			
	Project: 17-0162 Class B				Model: ISM43903			
Frequency (MHz)	Test Data (dBuV)	Additional Factors	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP/AVG
All other emissions were greater than 20 dB from the applicable limit.								

AF is antenna factor. CL is cable loss. PA is preamplifier gain.

SAMPLE CALCULATION AT: N/A

Test Date: August 30, 2017

Tested By Signature: 

Name: Robert K. Mills

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

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2.18 Measurement Uncertainty

The measurement uncertainties given were calculated using the method detailed in CISPR 16-4-2:2011. A coverage factor of $k=2$ was used to give a level of confidence of approximately 95%.

2.18.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ± 2.78 dB.

2.18.2 Radiated Emissions Measurement Uncertainty

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ± 5.3 dB. This value includes all elements of measurement.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ± 5.1 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ± 5.1 dB.

3 Conclusions

The EUT is deemed to have met the requirements of the standards cited within the test report when tested as detailed in the present test report.