

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-247Digital Transmission Systems (DTSs), Frequency Hopping Systems
(FHSS) and License-Exempt Local Area Network (LE-LAN) Devices**

For the

Matrix Design Group, LLC

**Model Number: RM-10002705
(2.4 GHz WiFi Module)**

**FCC ID: USKRM-10002705
IC: 11898A-10002705**

**UST Project: 18-0382
Issue Date: February 6, 2019**

Total Pages: 126

**3505 Francis Circle Alpharetta, GA 30004
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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: Alan Ghasiani

Title: Compliance Engineer – President

Date: February 6, 2019



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MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Matrix Design Group, LLC

MODEL: RM-10002705

FCC ID: USKRM-10002705

IC: 11898A-10002705

DATE: February 6, 2019

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

If yes, defer until: _____ N/A
date

agrees to notify the Commission by N/A
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

US Tech
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List of Attachments

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	Canadian Rep Letter

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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 December 14, 2018 in good operating condition.

1.3 Product Description

The Equipment Under Test (EUT) is the Matrix Design Group, LLC Model RM-10002705 radio module. The EUT contains three onboard radio chipsets, 802.15.4 (ZigBee), WiFi (802.11b,g,n) and 433MHz chipsets. Each has its own RF antenna port and antenna. The radio chips are co-located on a single board but will not transmit simultaneously. This three chipset radio module is designed for use in host products that perform the following tasks: atmospheric monitoring sensor devices. These devices will collect data and send the data wireless to base stations or hubs using the radio module wireless capabilities.

For this test report only the WiFi radio was tested. The other two radio test results are reported in separate test reports.

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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 v05 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:

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

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Table 1. Supporting Equipment

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC/IC ID	CABLES P/D
Dell (Laptop)	Latitude E6510	266BYN1	Unknown	-
Dell (Power Supply Adapter)	PA-1900-02D	CND	Not Applicable	2.0 m UP
Antenna See antenna details	FXP70	--	--	--

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

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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	8/17/2020
SPECTRUM ANALYZER	DSA815	RIGOL	DSA8A18030 0138	10/11/2019
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	10/25/2019
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	1937A02980	3/7/2019
PREAMP 1.0 GHz to 26.0 GHz	8449B	HEWLETT-PACKARD	3008A00480	2/28/2019
LOOP ANTENNA	SAS-200/562	A. H. Systems	142	1/22/2020 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	11/28/2020 2 yr
HIGH PASS FILTER	H3R020G2	MICROWAVE CHIRCUITS	001DC9528	3/08/2019
LISN x 2	9247-50-TS-50-N	SOLAR ELECTRONICS	955824 and 955825	3/19/2019
DC POWER SUPPLY	HY1803D	TEKPOWER	1072531	Verified Before Use
DC POWER SUPPLY	TP3005T	TEKPOWER	218311	Verified Before Use

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

(*)= used for power line conducted emissions testing

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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 were used.

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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.

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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
Antenna	Matrix Design Group, LLC	Trace	FXP70	+1.5	U.FL

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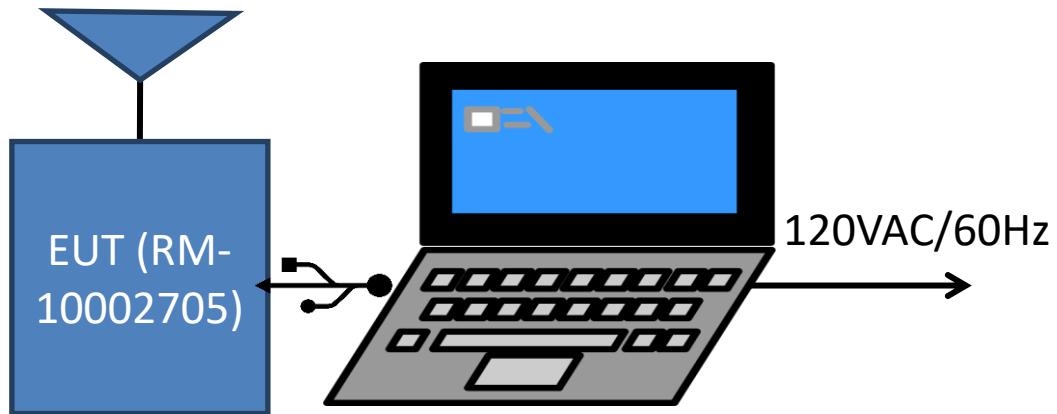


Figure 1. Block Diagram of Test Configuration

Note: The laptop is used for programming the radio module only.

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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 (Part15.35 (c))

The EUT employs pulse transmission however for testing purpose the EUT was programmed to transmit at a rate >98%. The pulse transmission requirements of this subpart were acknowledge and considered during testing.

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

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 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.

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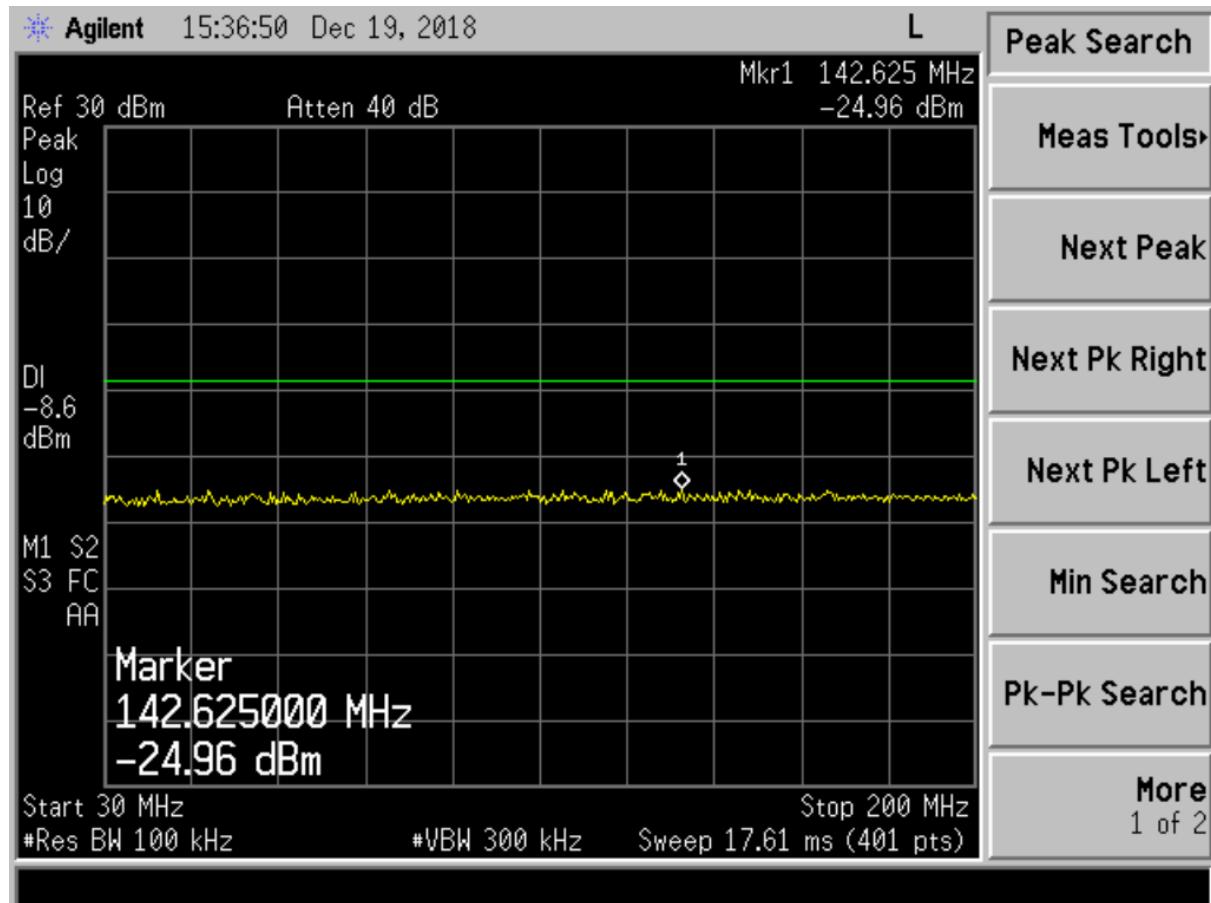


Figure 2. 802.11b, Channel 1, 30 - 200 MHz

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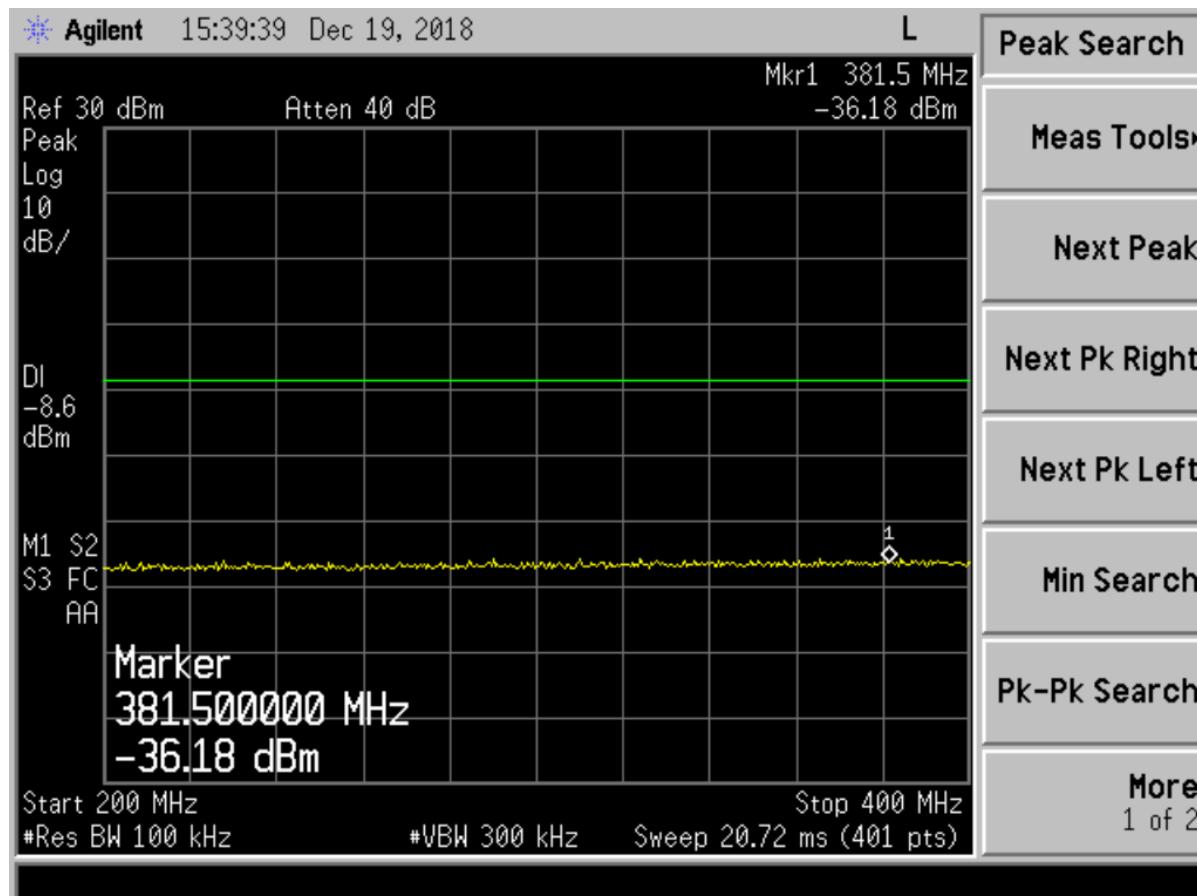


Figure 3. 802.11b, Channel 1, 200 - 400 MHz

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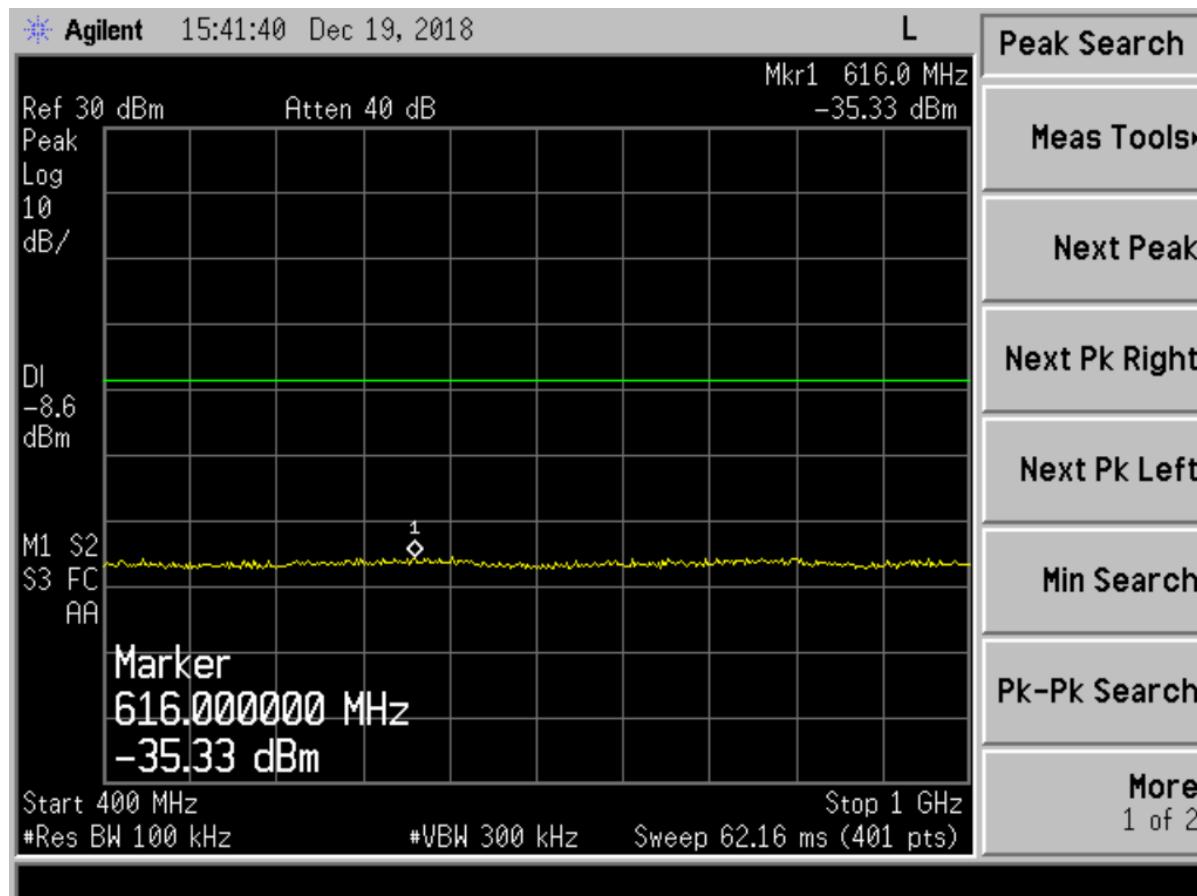


Figure 4. 802.11b, Channel 1, 400 - 1000 MHz

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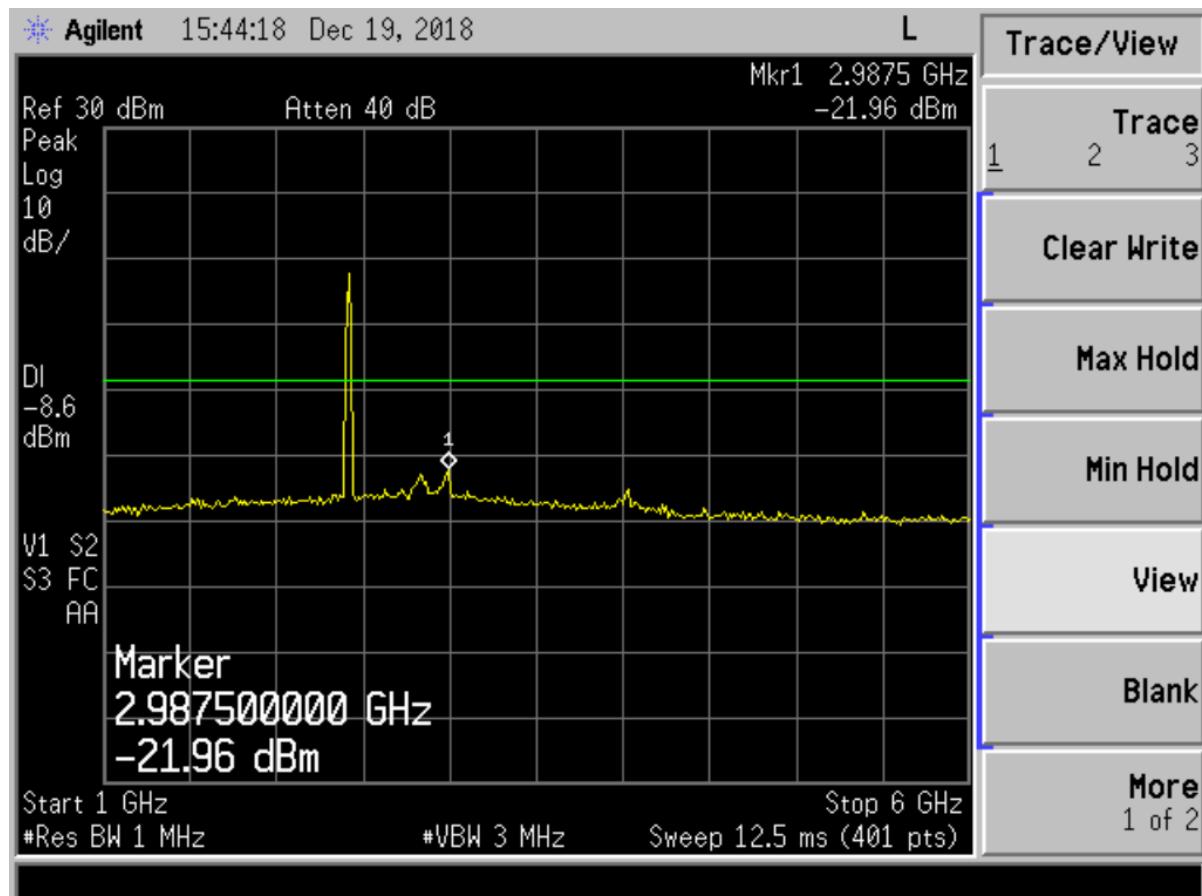


Figure 5. 802.11b, Channel 1, 1 – 6 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

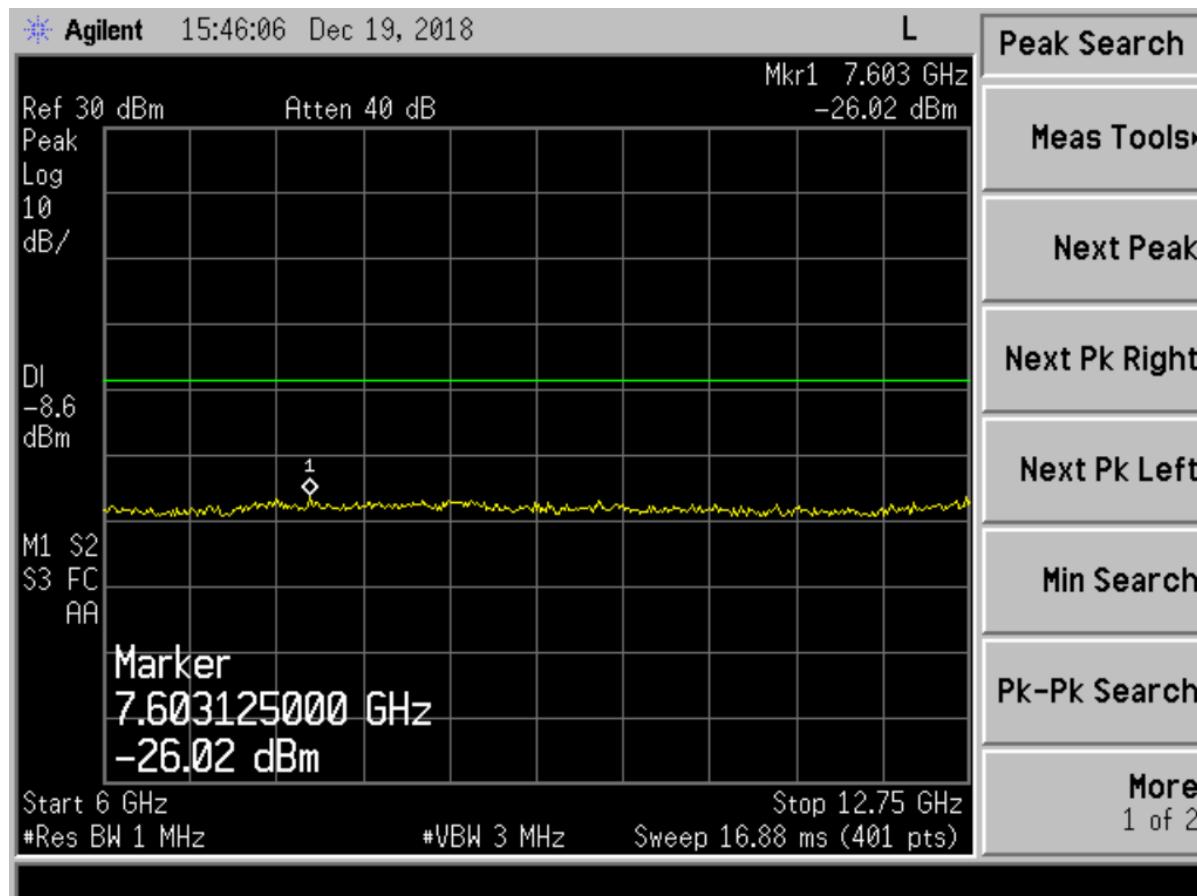


Figure 6. 802.11b, Channel 1, 6 – 12.75 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

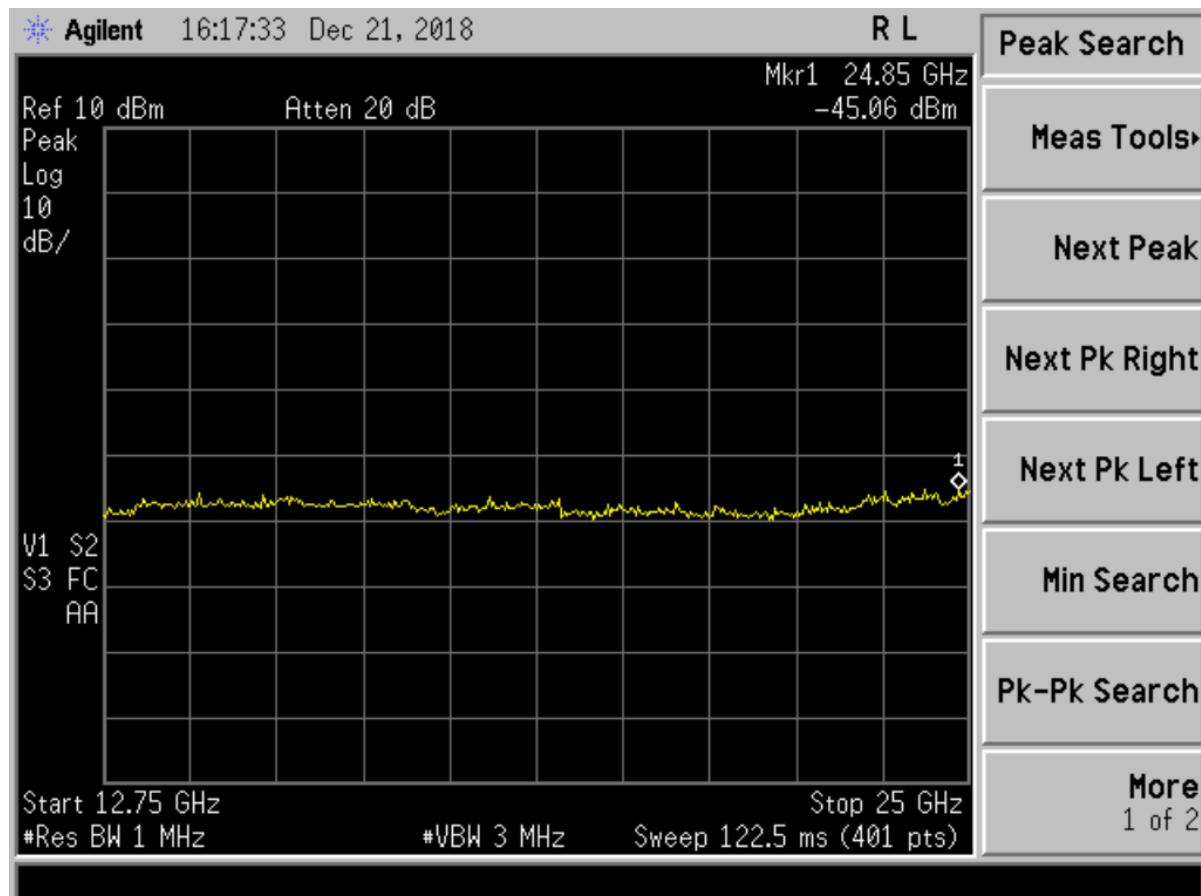


Figure 7. 802.11b, Channel 1, 12.75 – 25 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

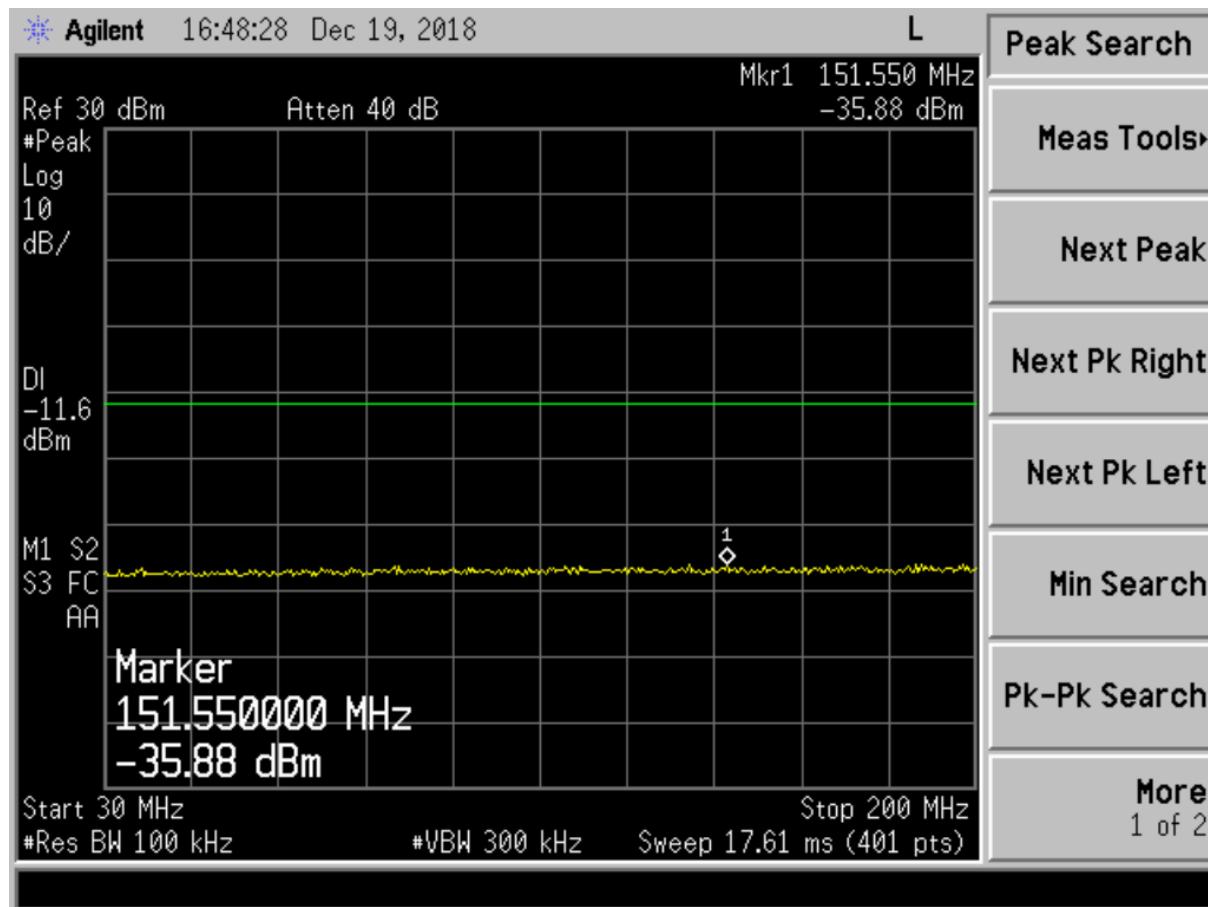


Figure 8. 802.11b, Channel 6, 30 - 200 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

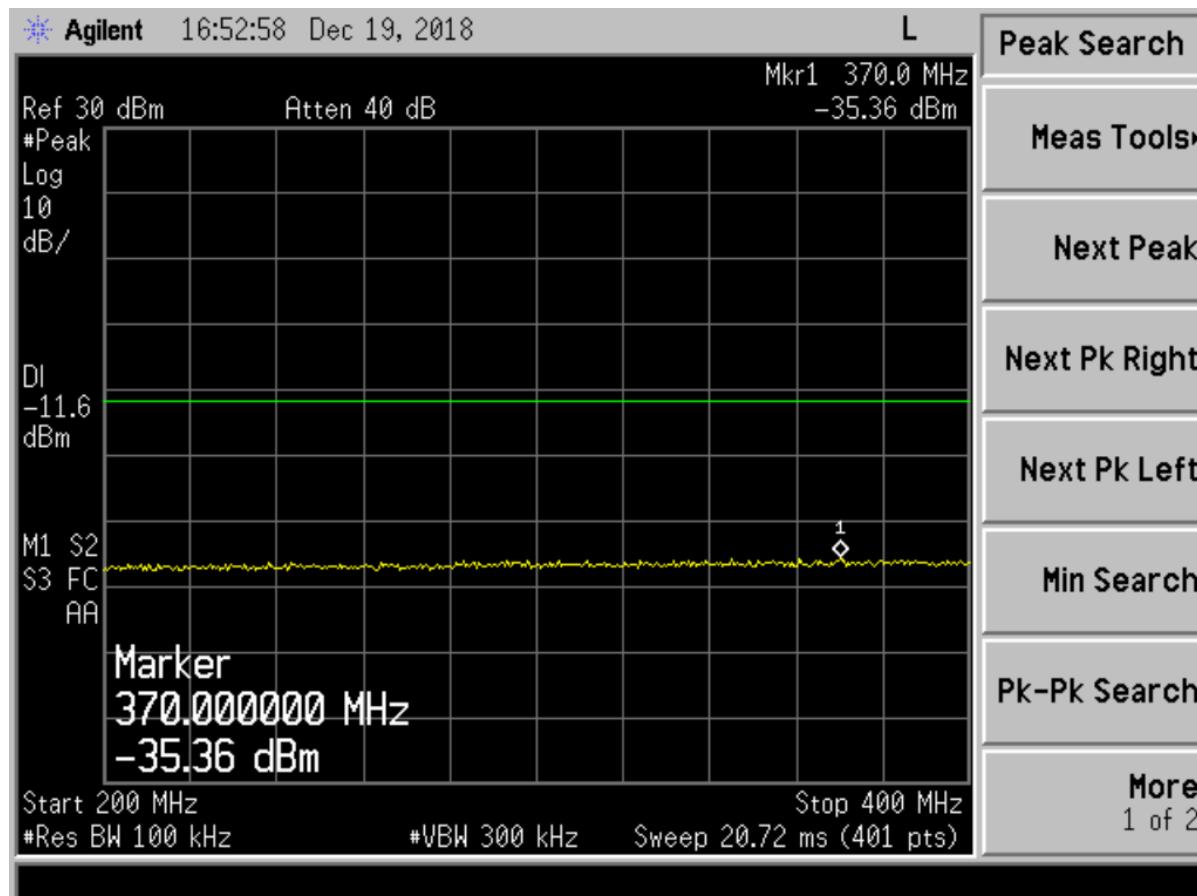


Figure 9. 802.11b, Channel 6, 200 - 400 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

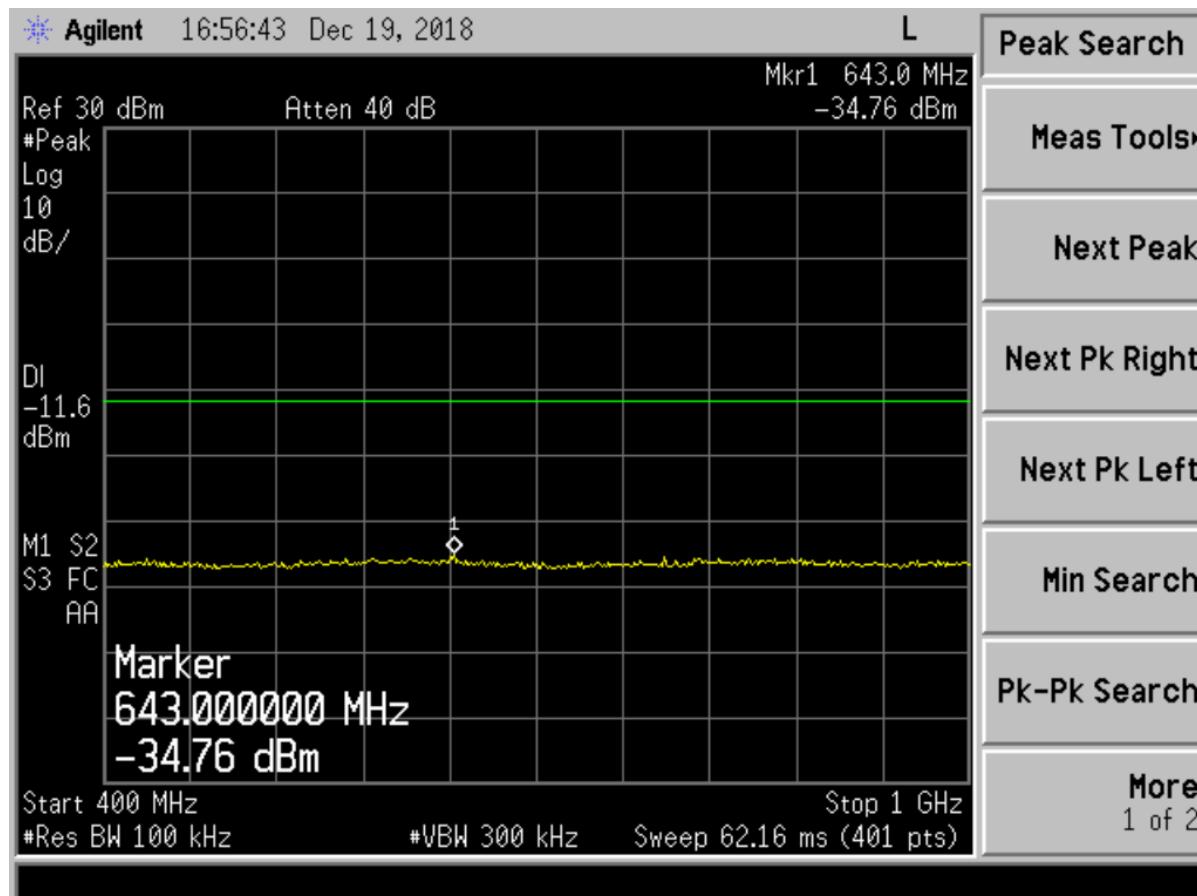


Figure 10. 802.11b, Channel 6, 400 - 1000 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

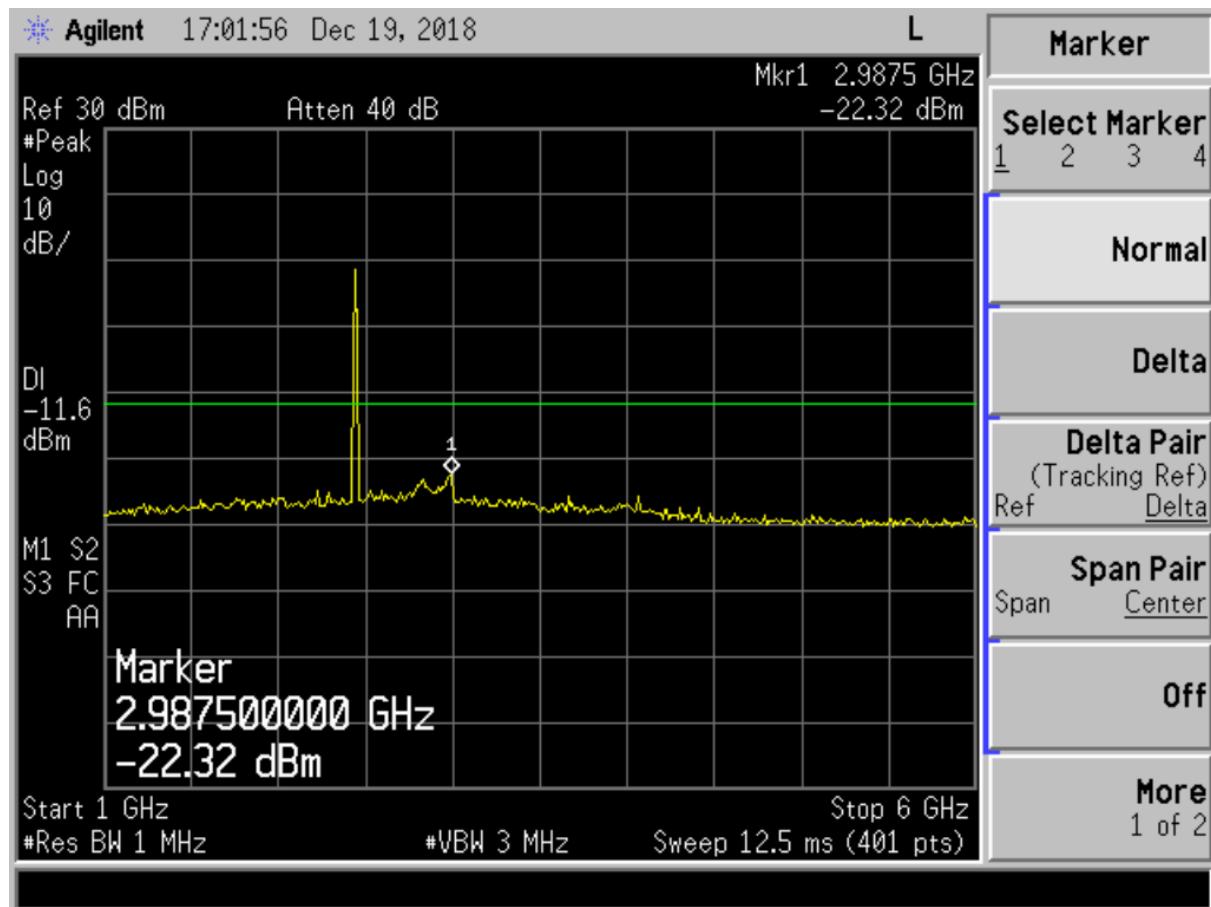


Figure 11. 802.11b, Channel 6, 1 – 6 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

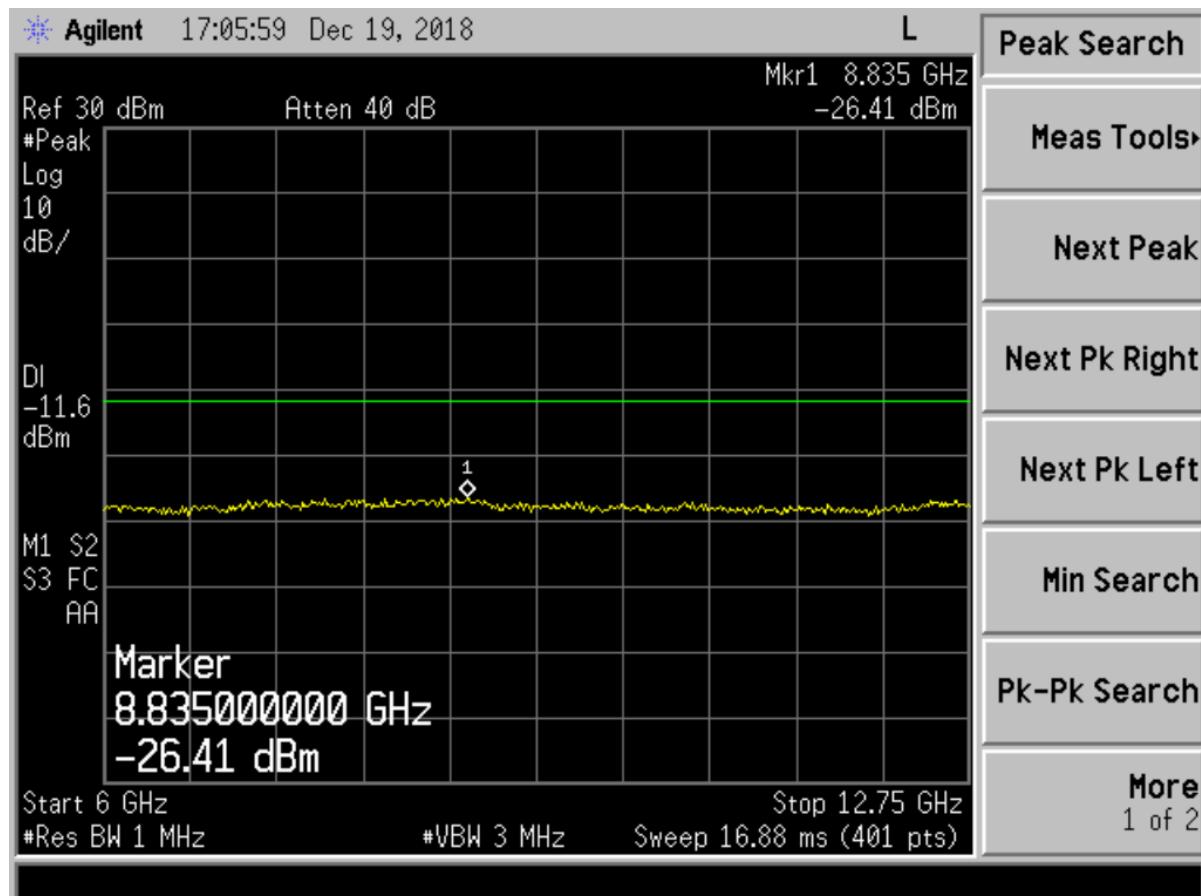


Figure 12. 802.11b, Channel 6, 6 – 12.75 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

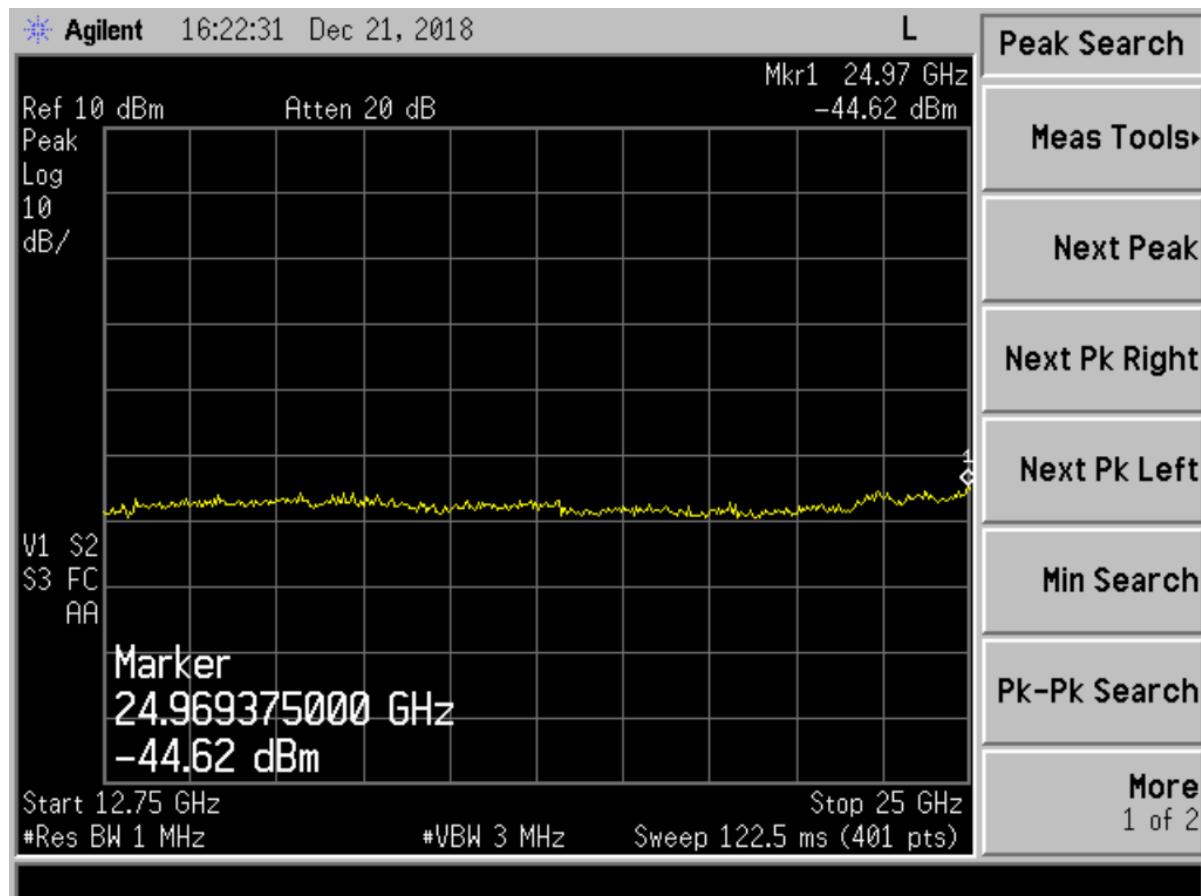


Figure 13. 802.11b, Channel 6, 12.75 – 25 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

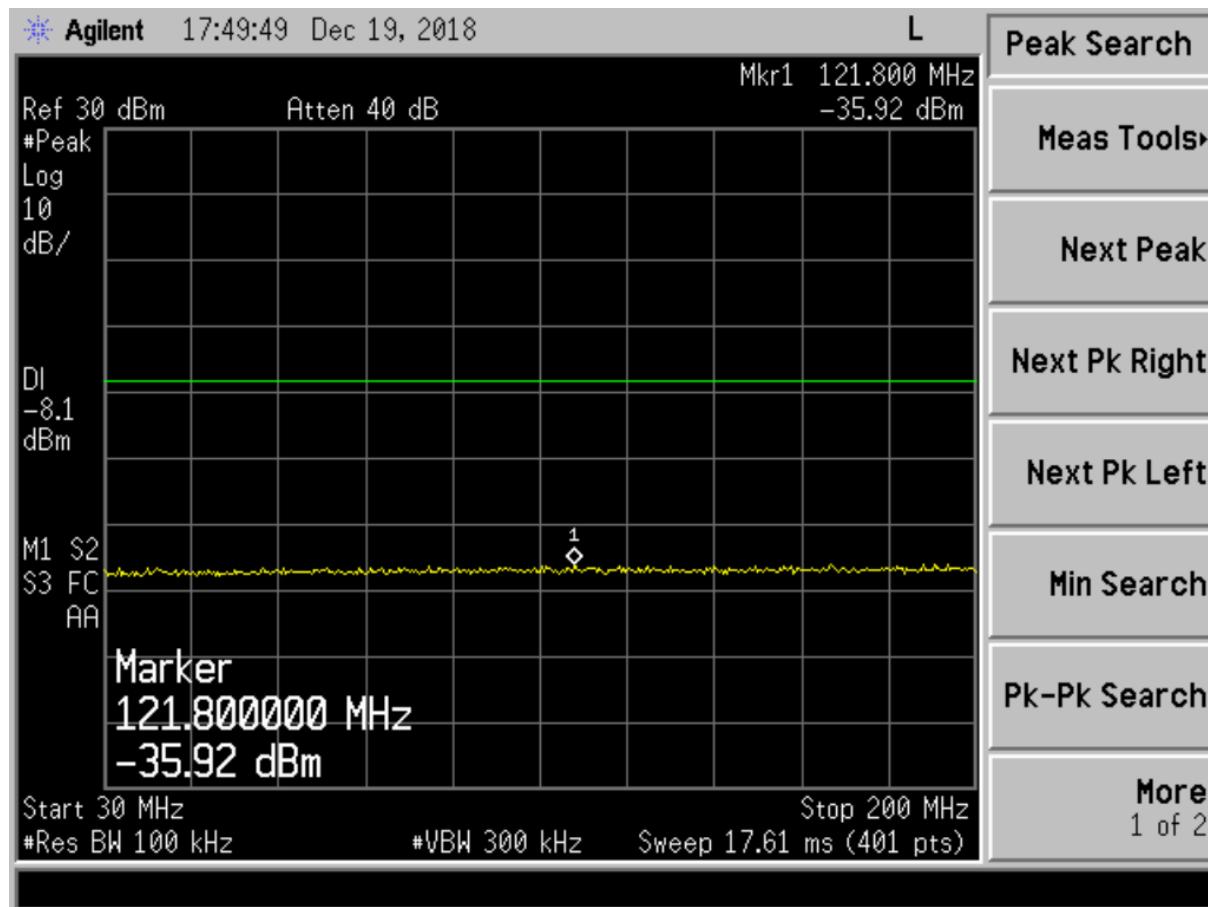


Figure 14. 802.11b, Channel 11, 30 - 200 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

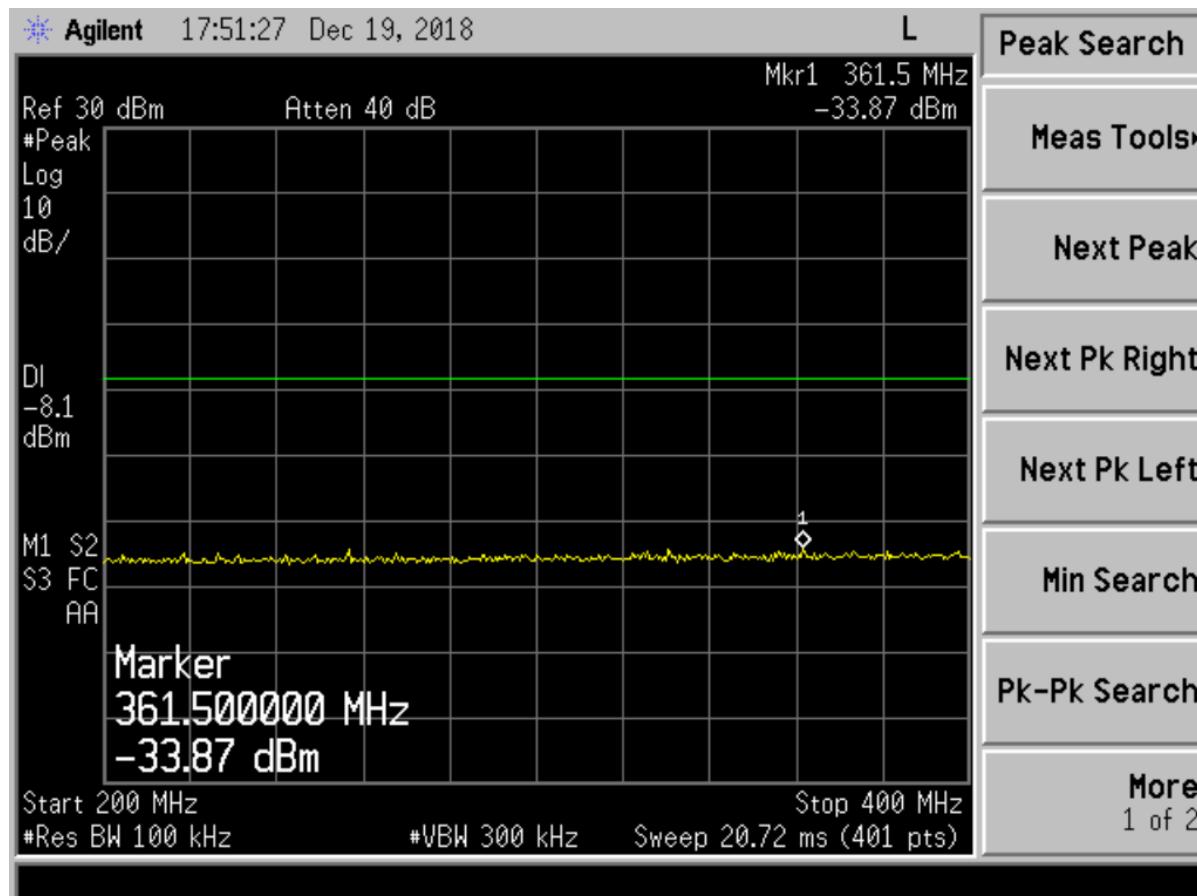


Figure 15. 802.11b, Channel 11, 200 - 400 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

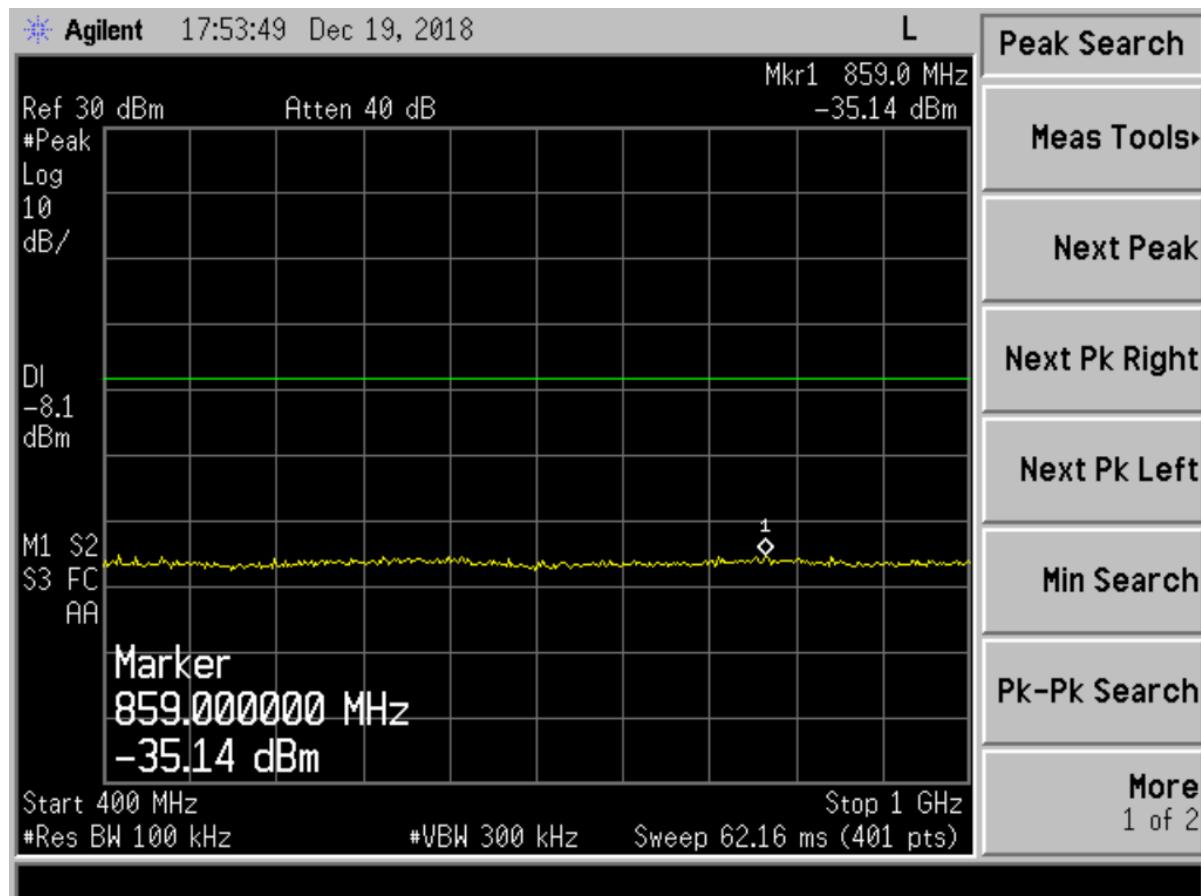


Figure 16. 802.11b, Channel 11, 400 - 1000 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

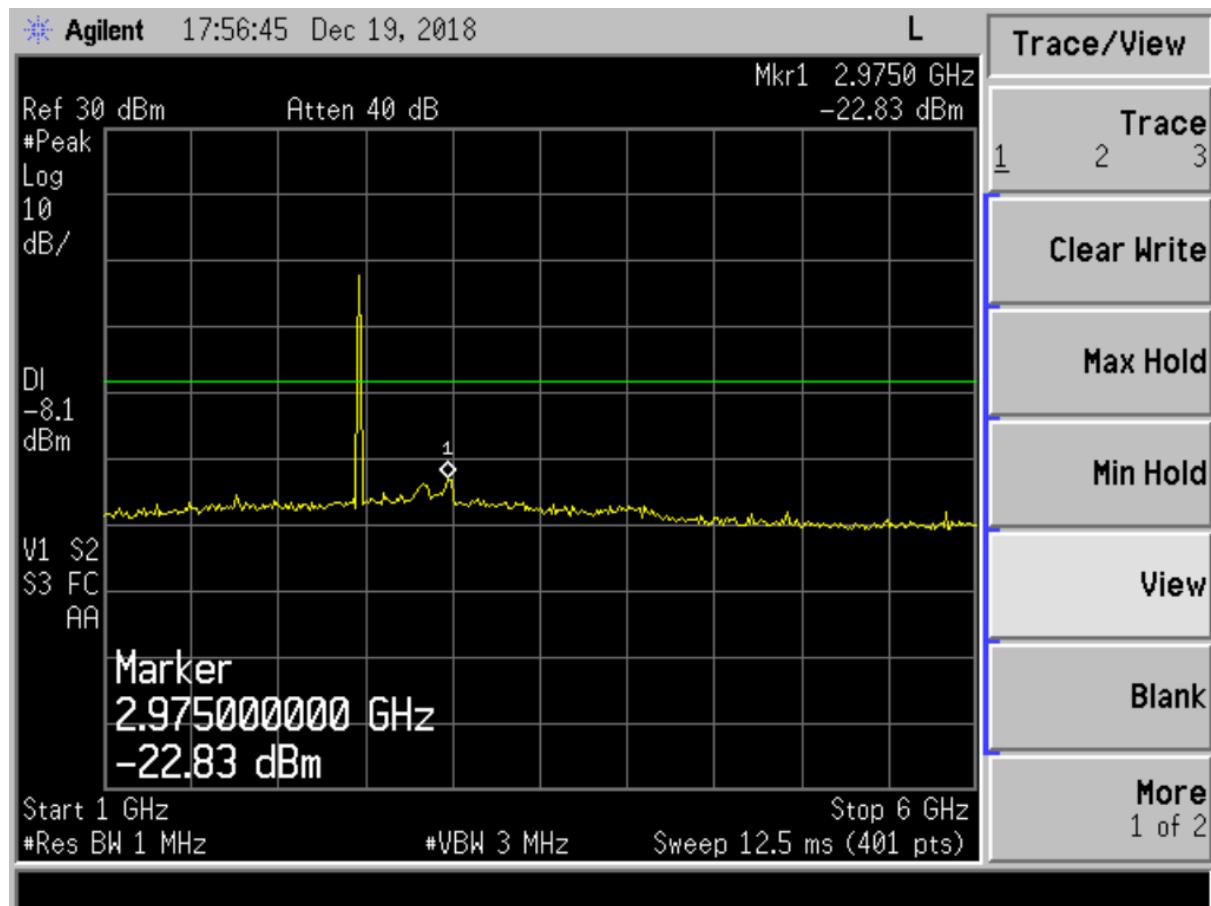


Figure 17. 802.11b, Channel 11, 1 – 6 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

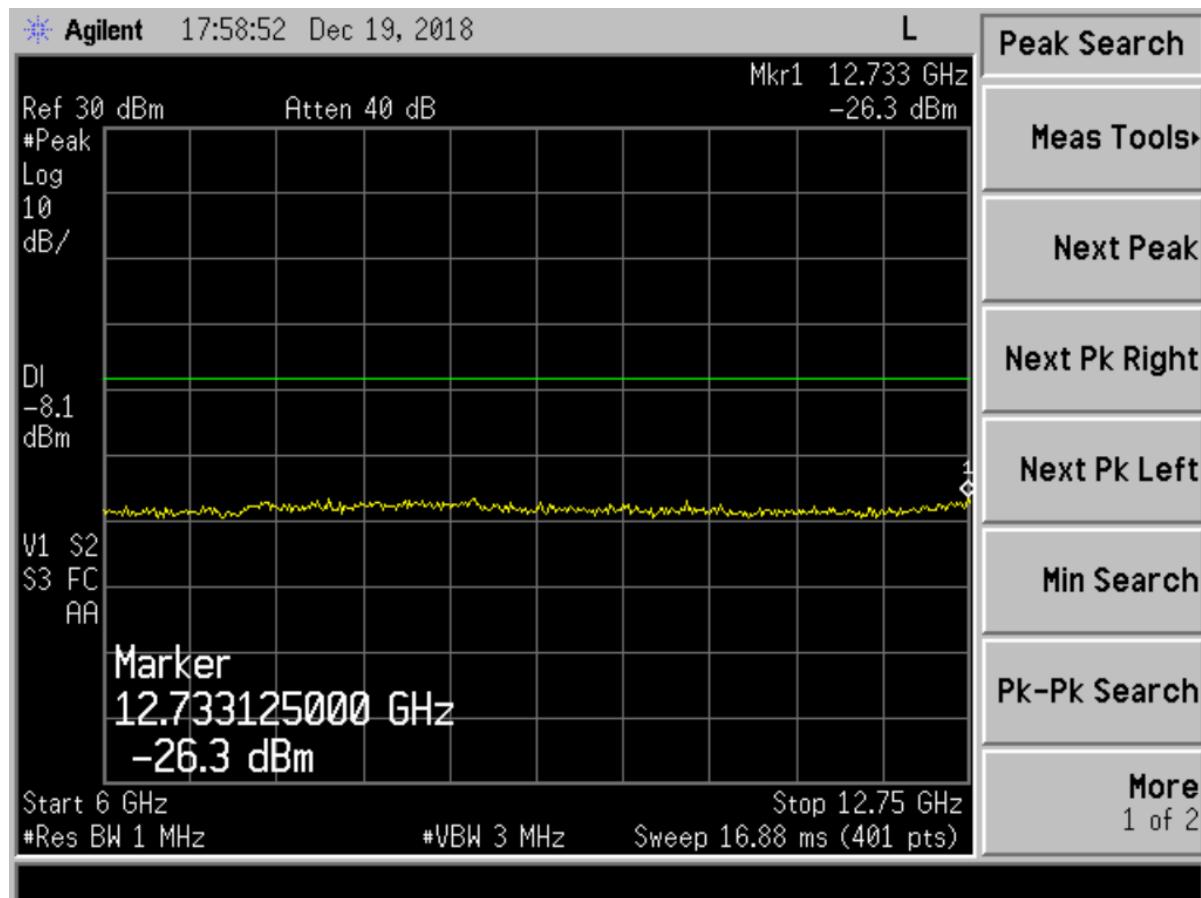


Figure 18. 802.11b, Channel 11, 6 – 12.75 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

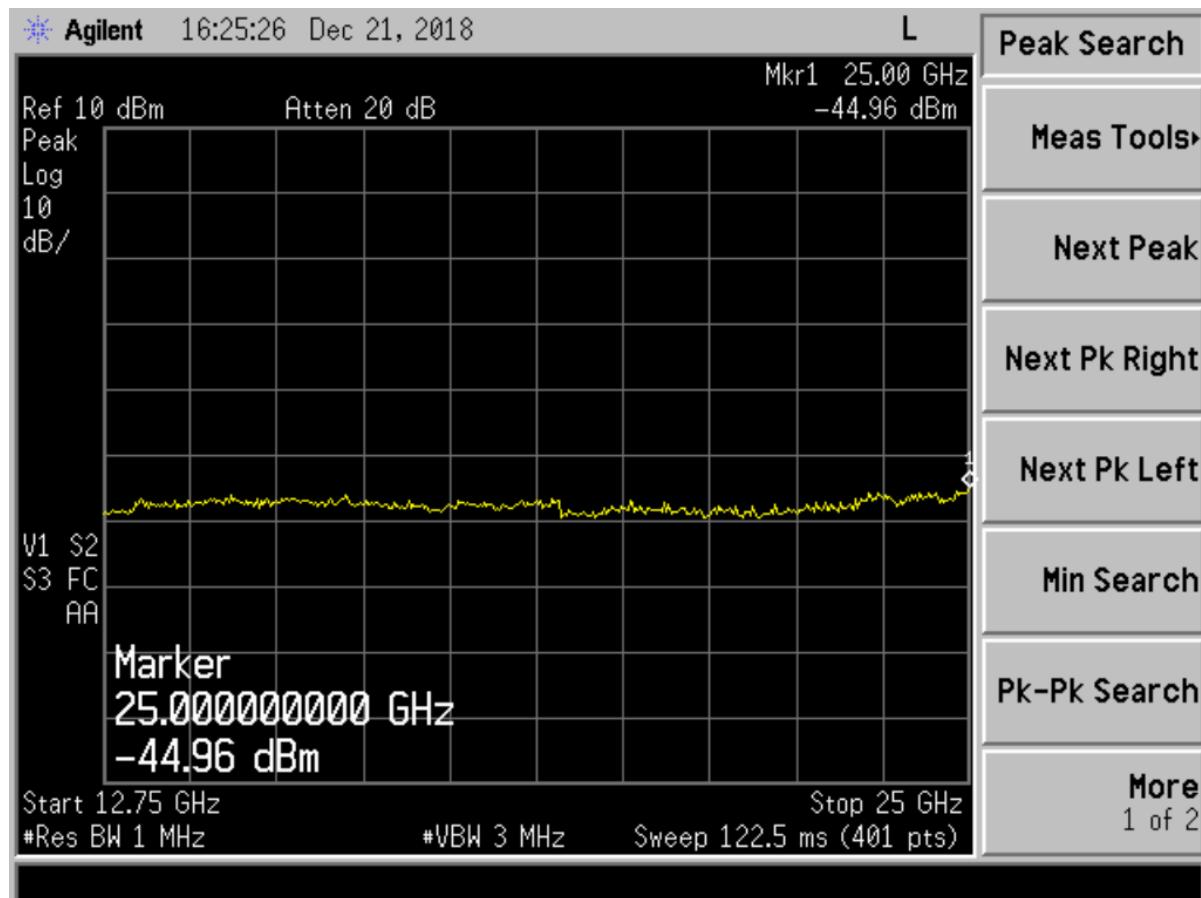


Figure 19. 802.11b, Channel 11, 12.75 - 25 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

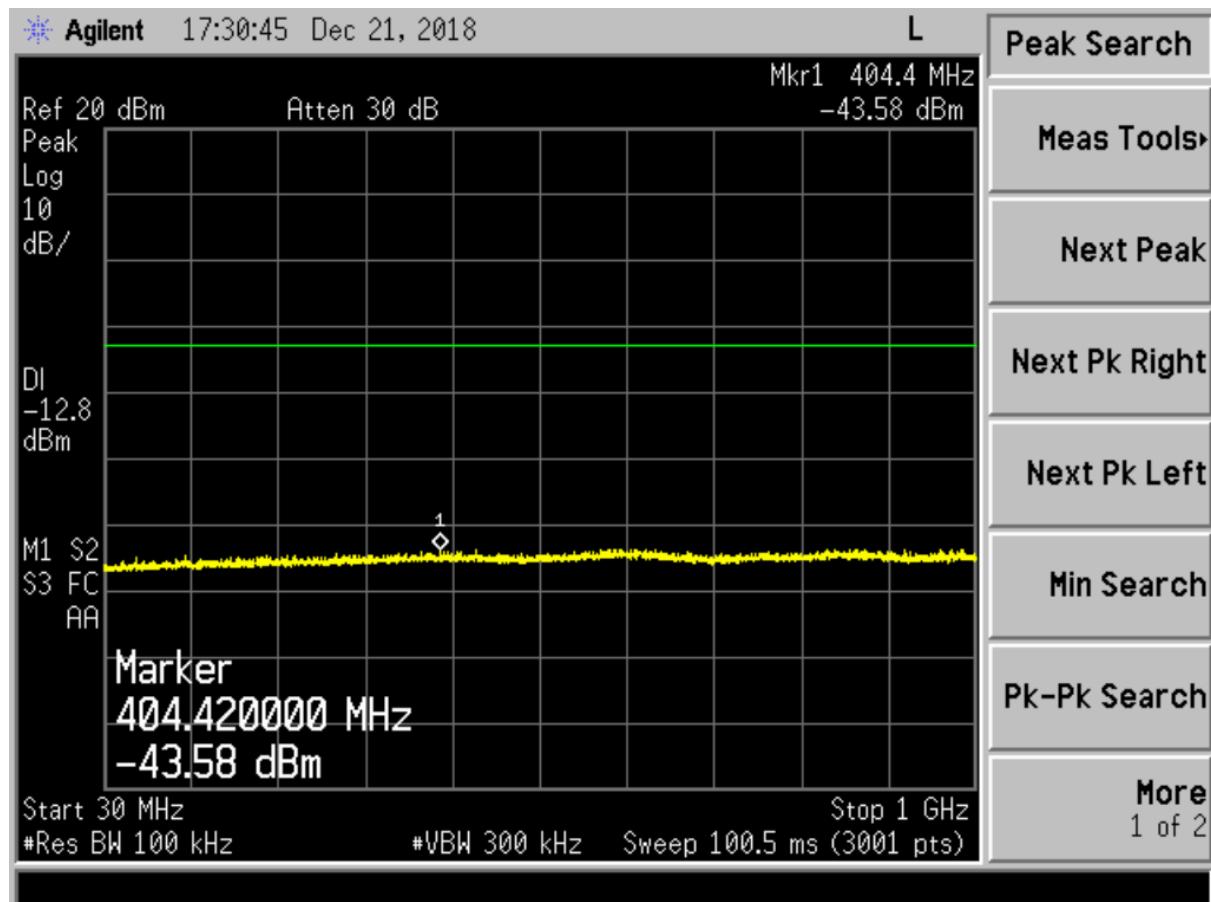


Figure 20. 802.11g, Channel 1, 30 - 1000 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

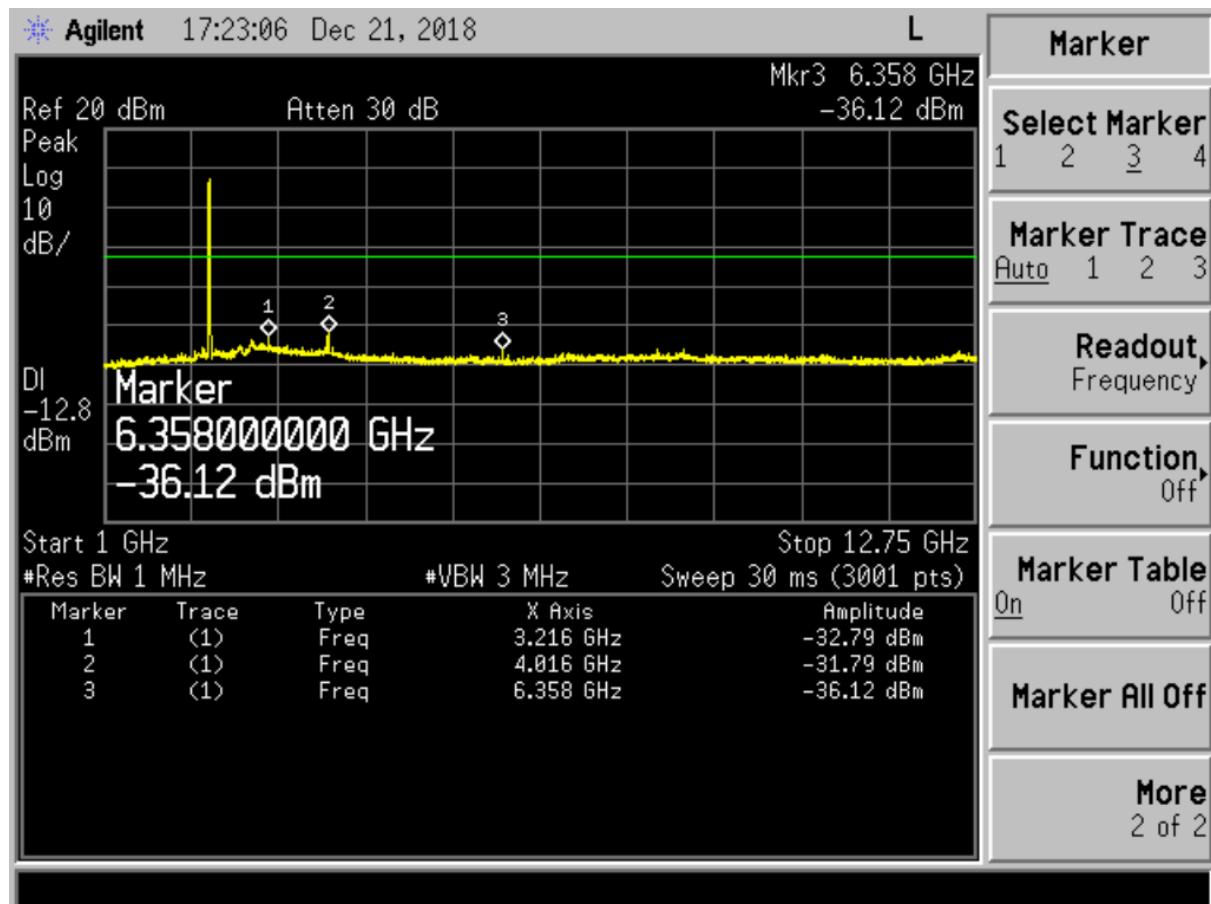


Figure 21. 802.11g, Channel 1, 1 – 12.75 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

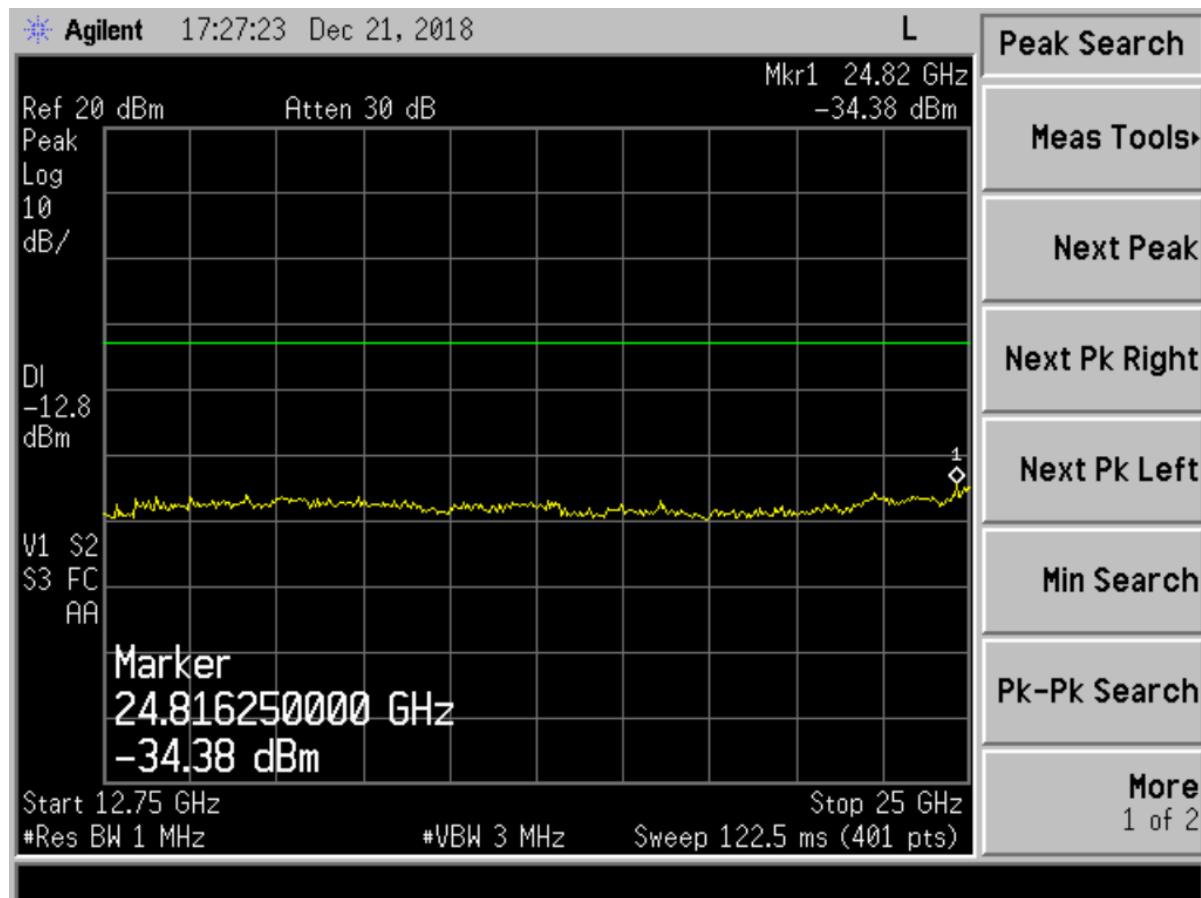


Figure 22. 802.11g, Channel 1, 12.75 – 25 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

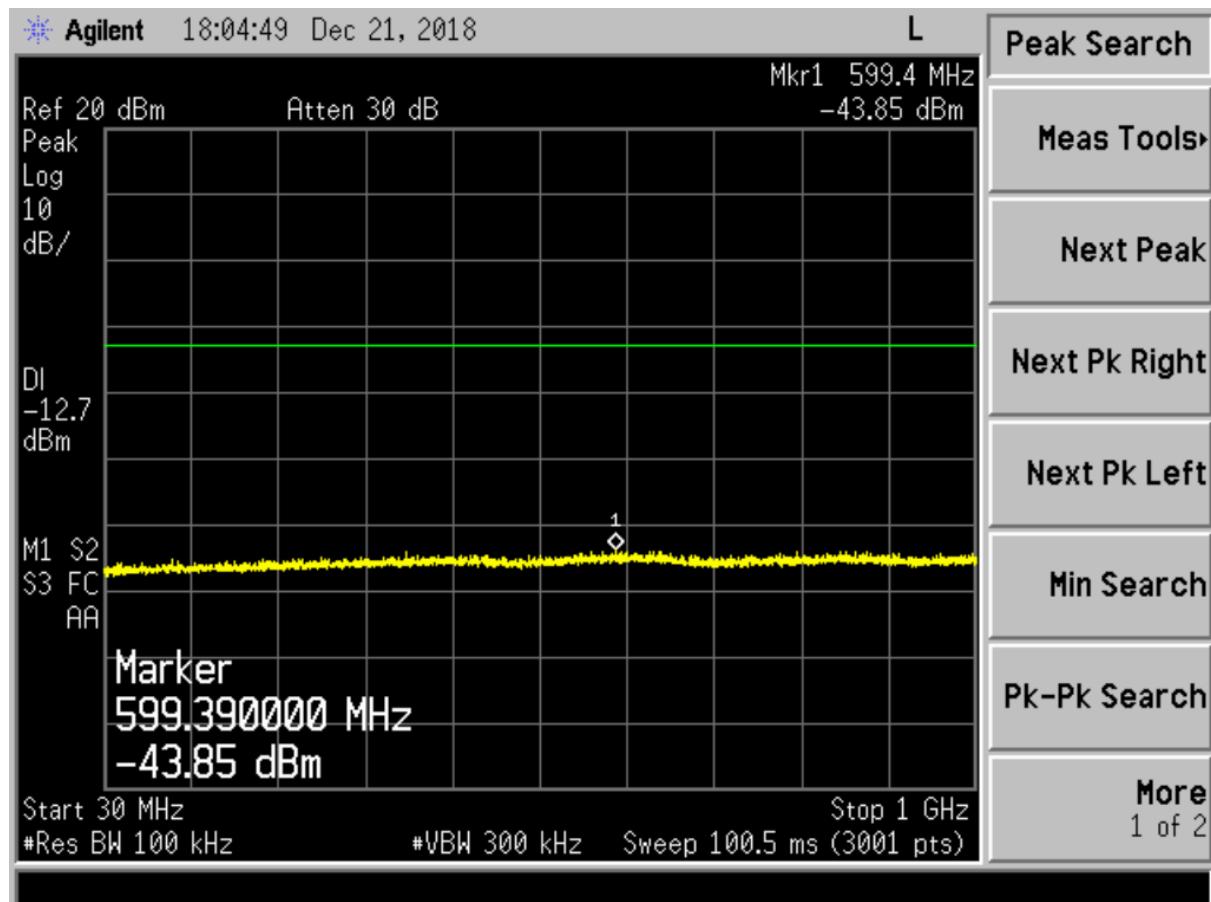


Figure 23. 802.11g, Channel 6, 30 - 1000 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

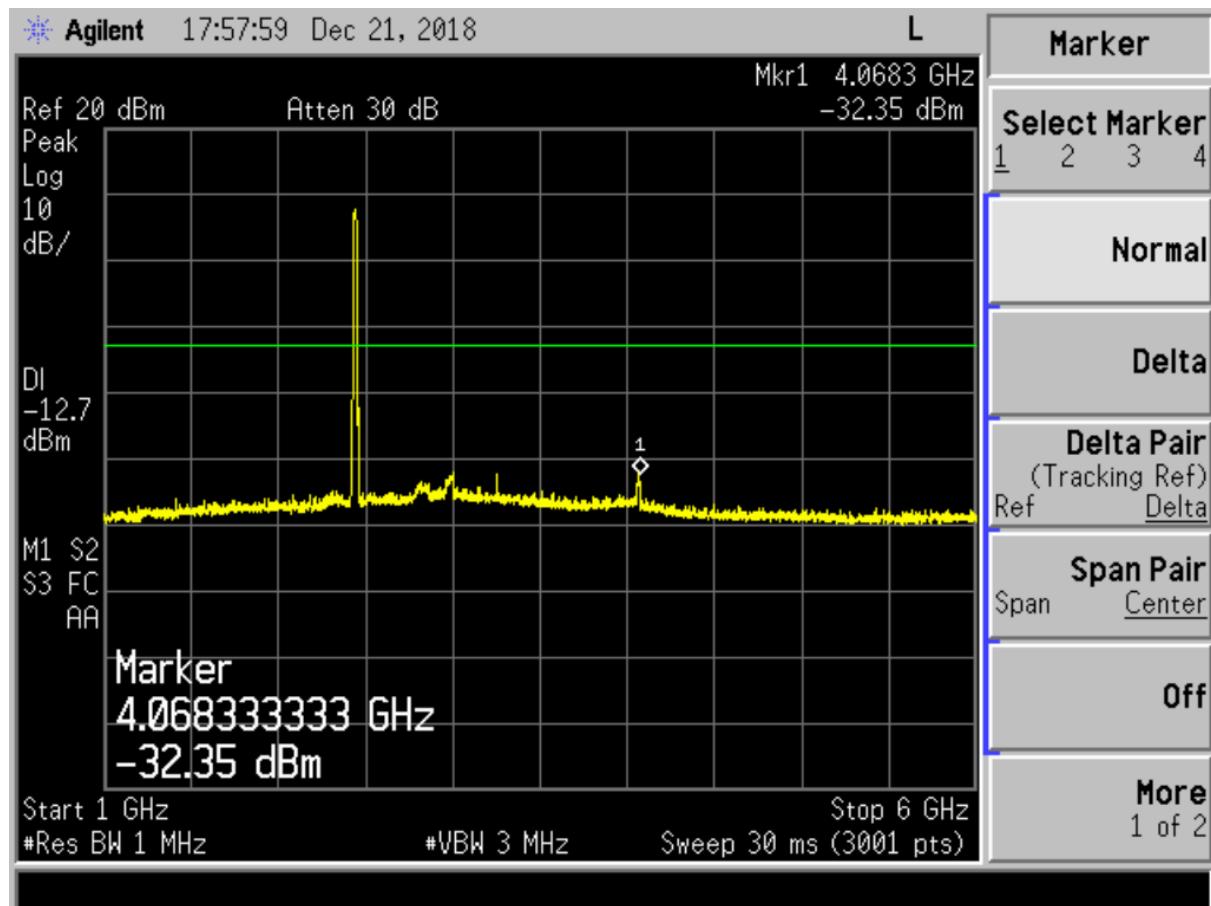


Figure 24. 802.11g, Channel 6, 1 – 6 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

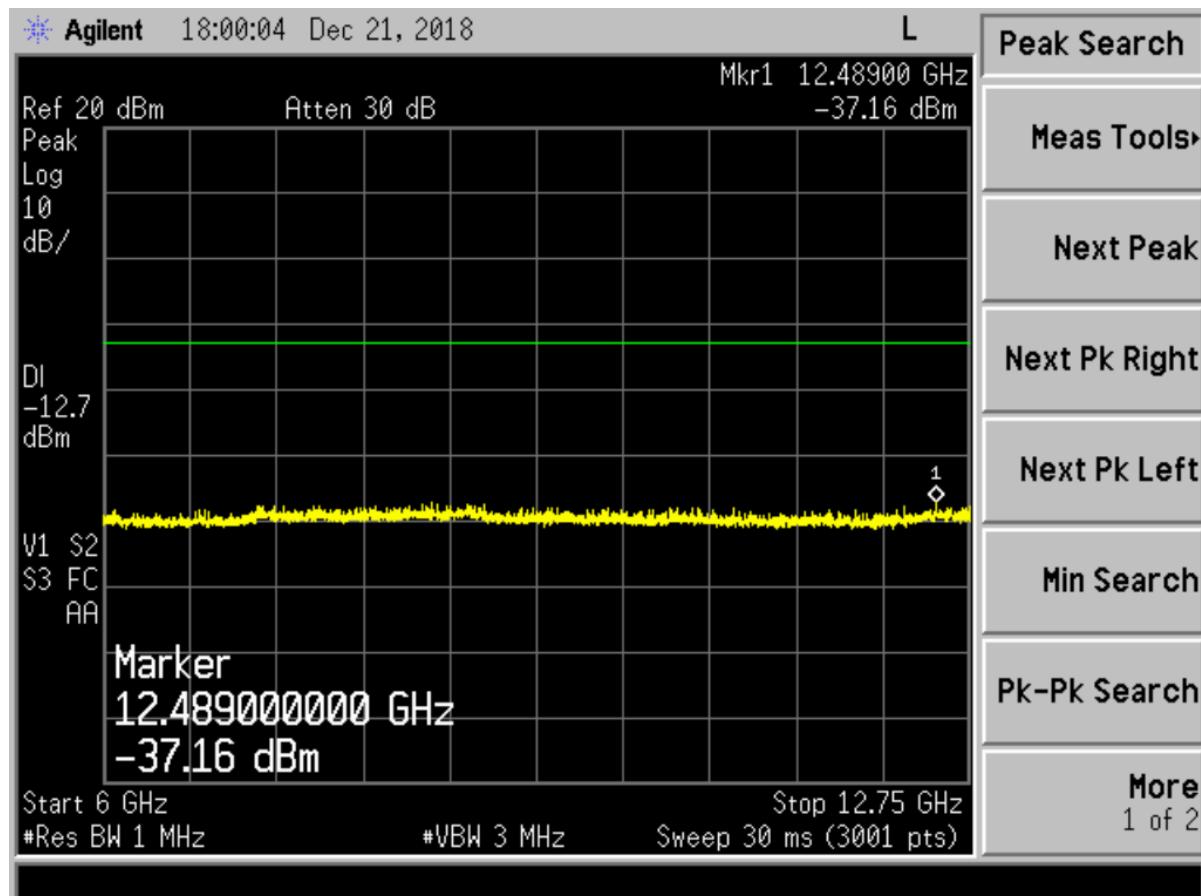


Figure 25. 802.11g, Channel 6, 6 – 12.75 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

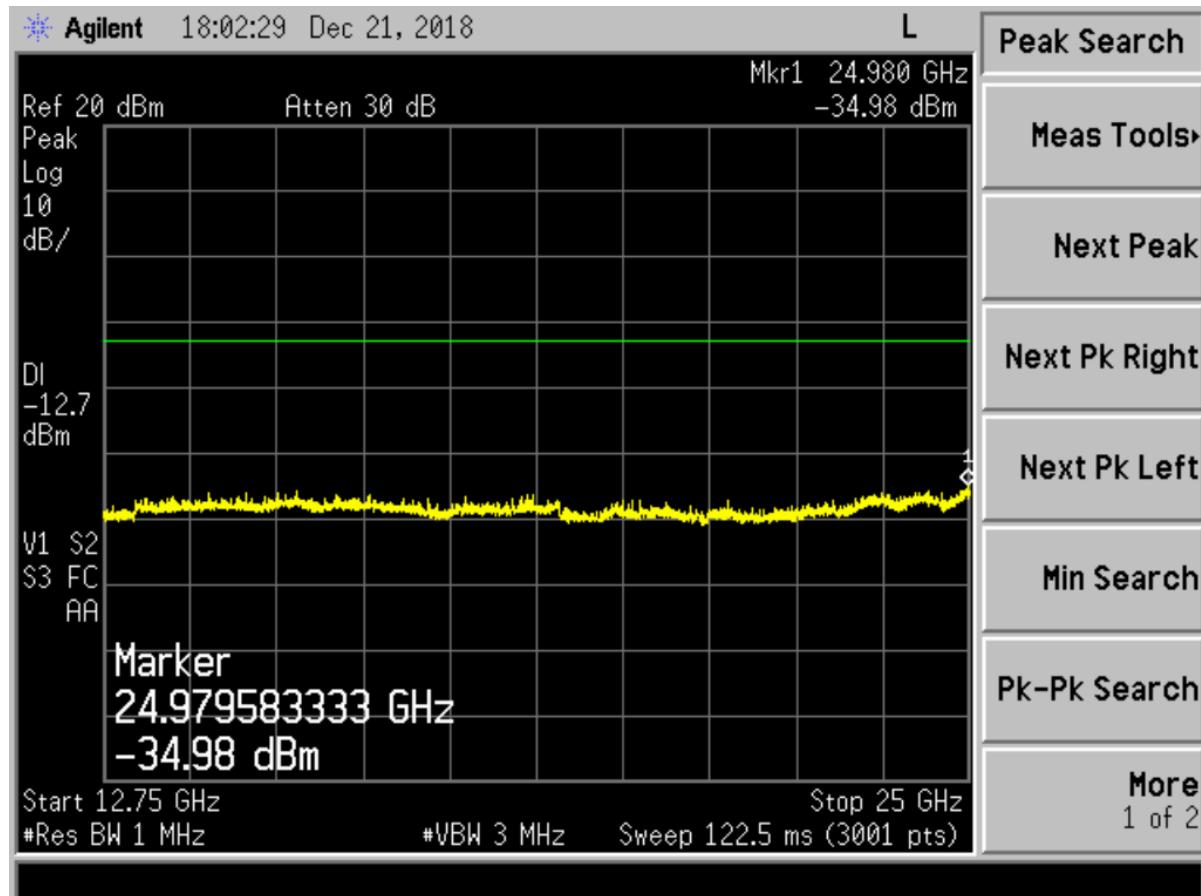


Figure 26. 802.11g, Channel 6, 12.75 - 25 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

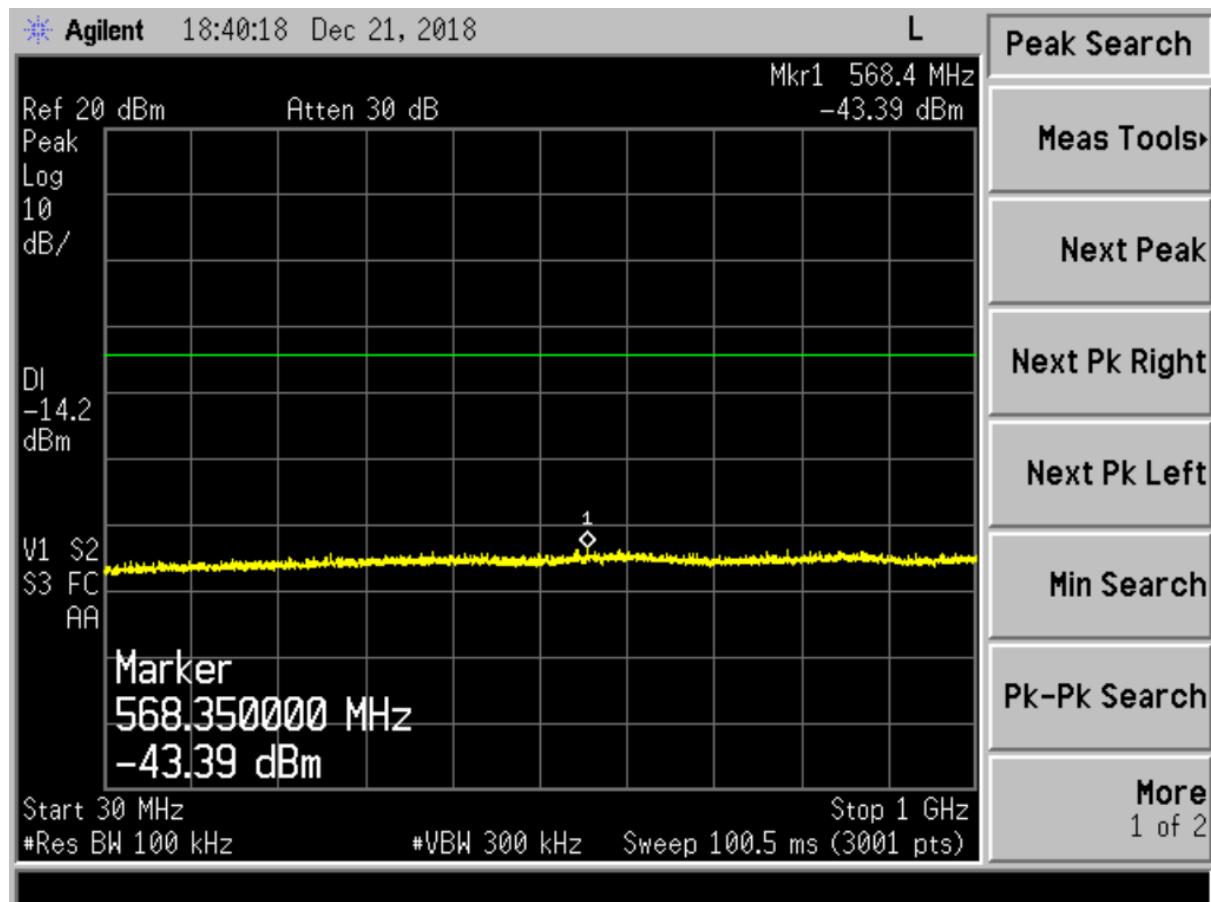


Figure 27. 802.11g, Channel 11, 30 - 1000 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

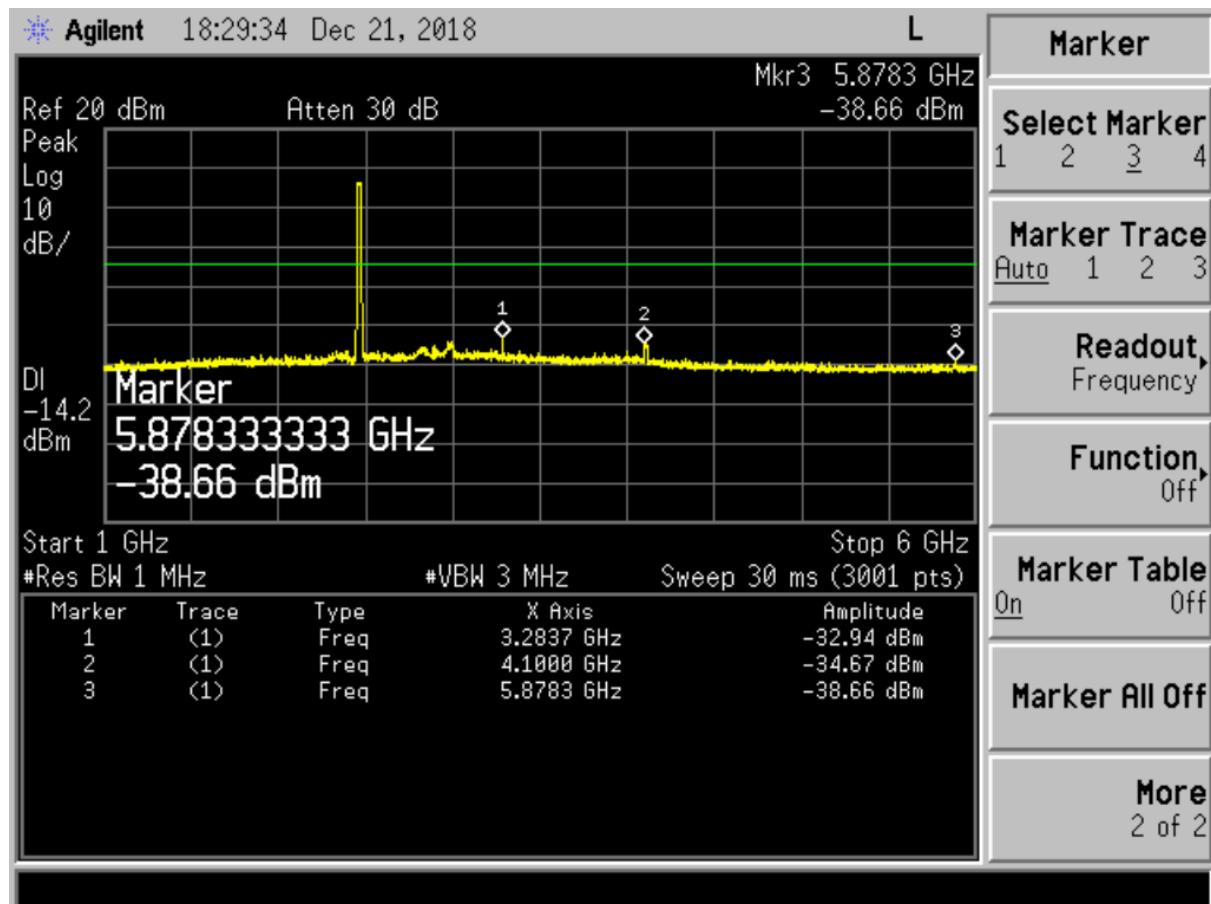


Figure 28. 802.11g, Channel 11, 1 – 6 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

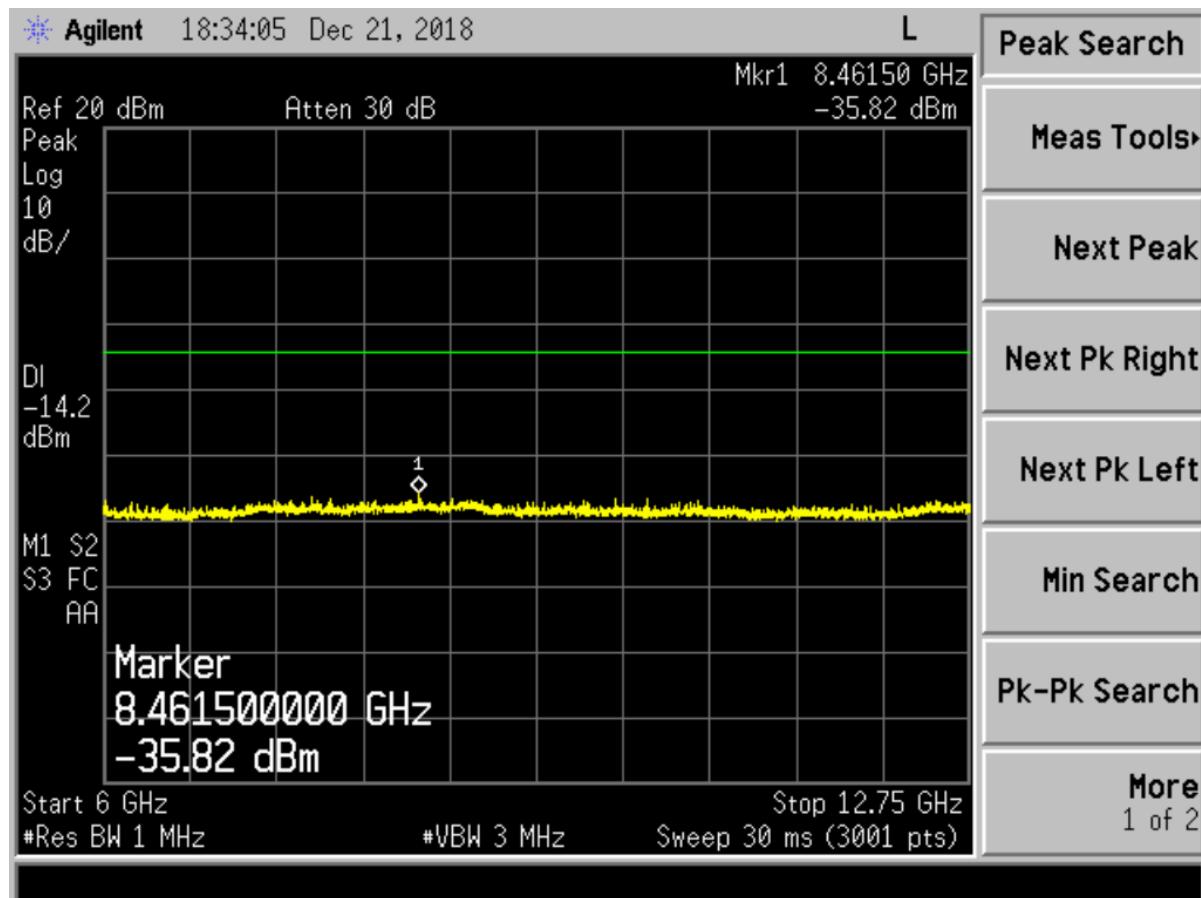


Figure 29. 802.11g, Channel 11, 6 – 12.75 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

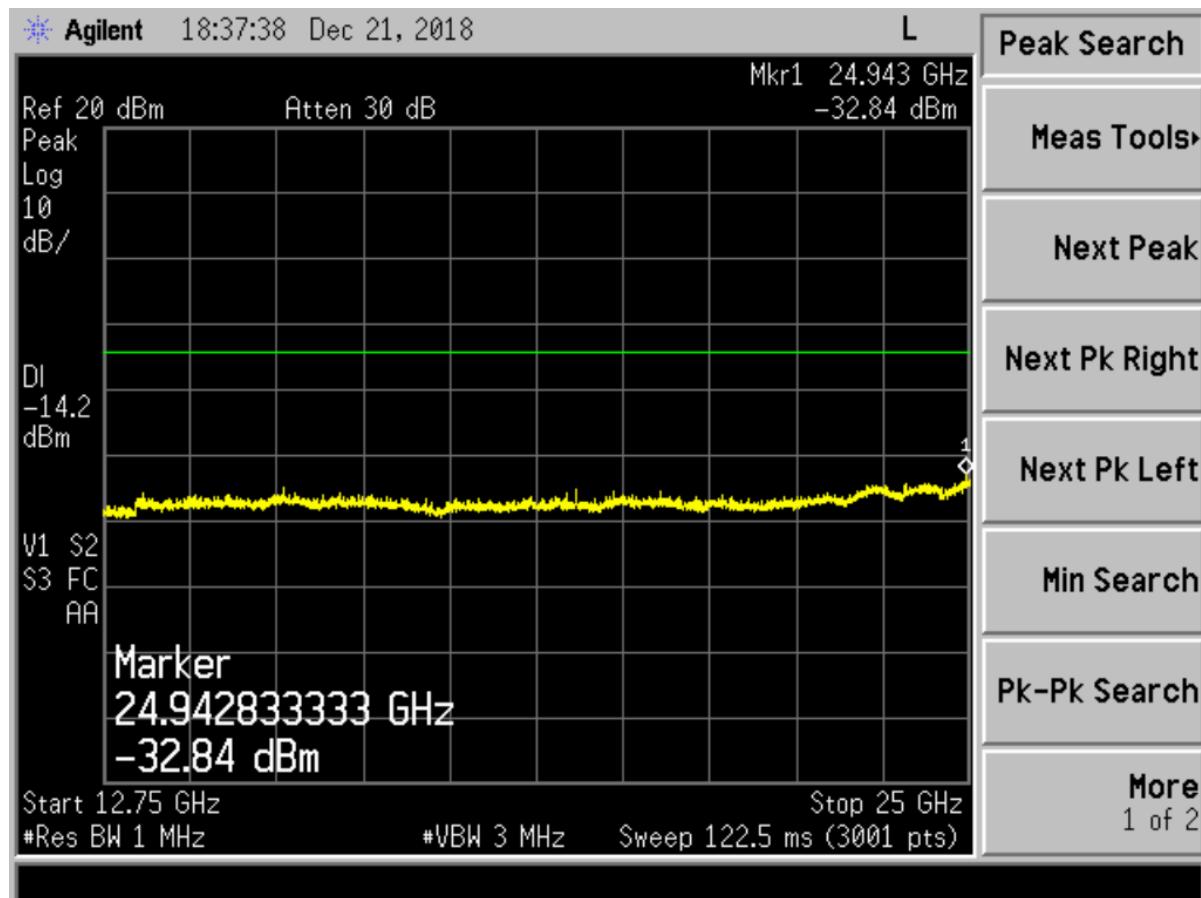


Figure 30. 802.11g, Channel 11, 12.75 – 25 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

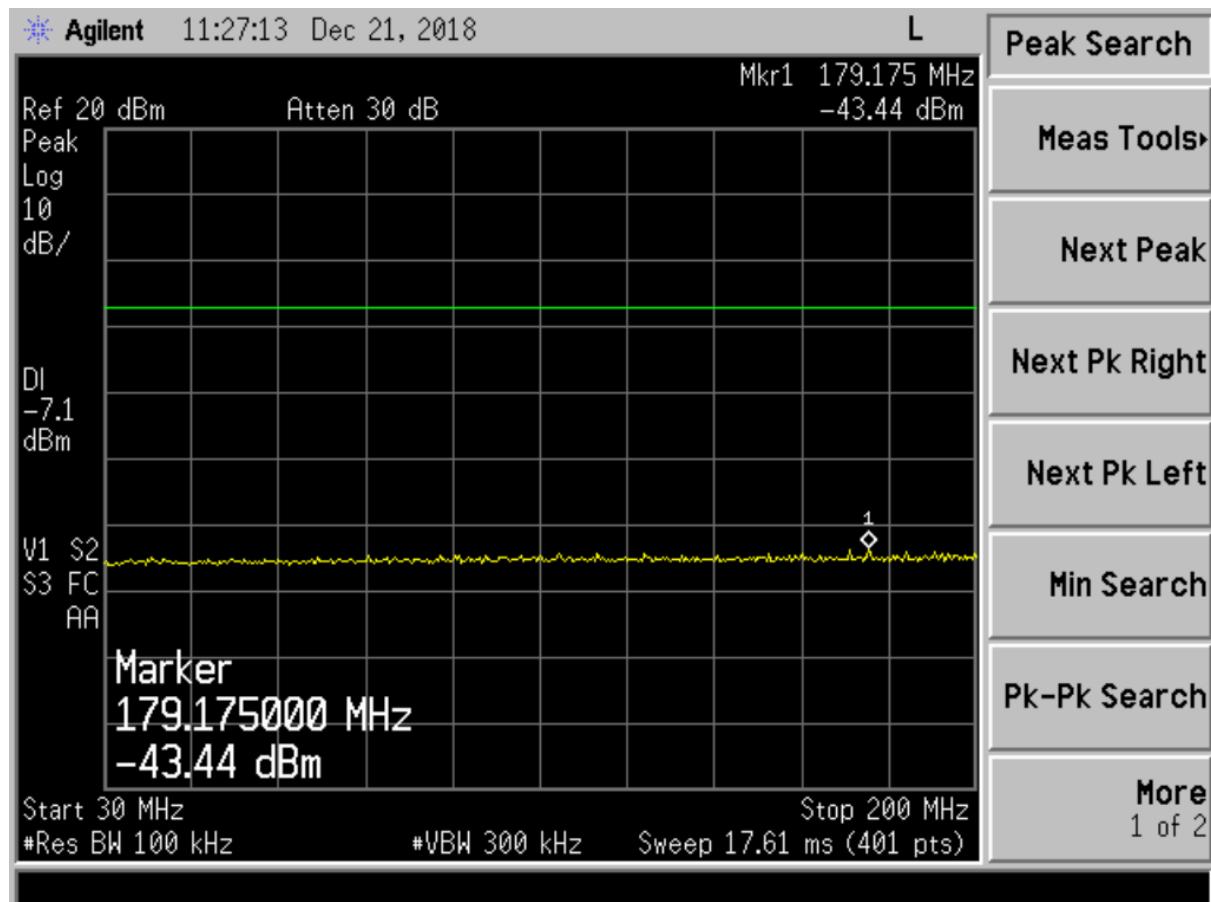


Figure 31. 802.11n, Channel 1, 30 - 200 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

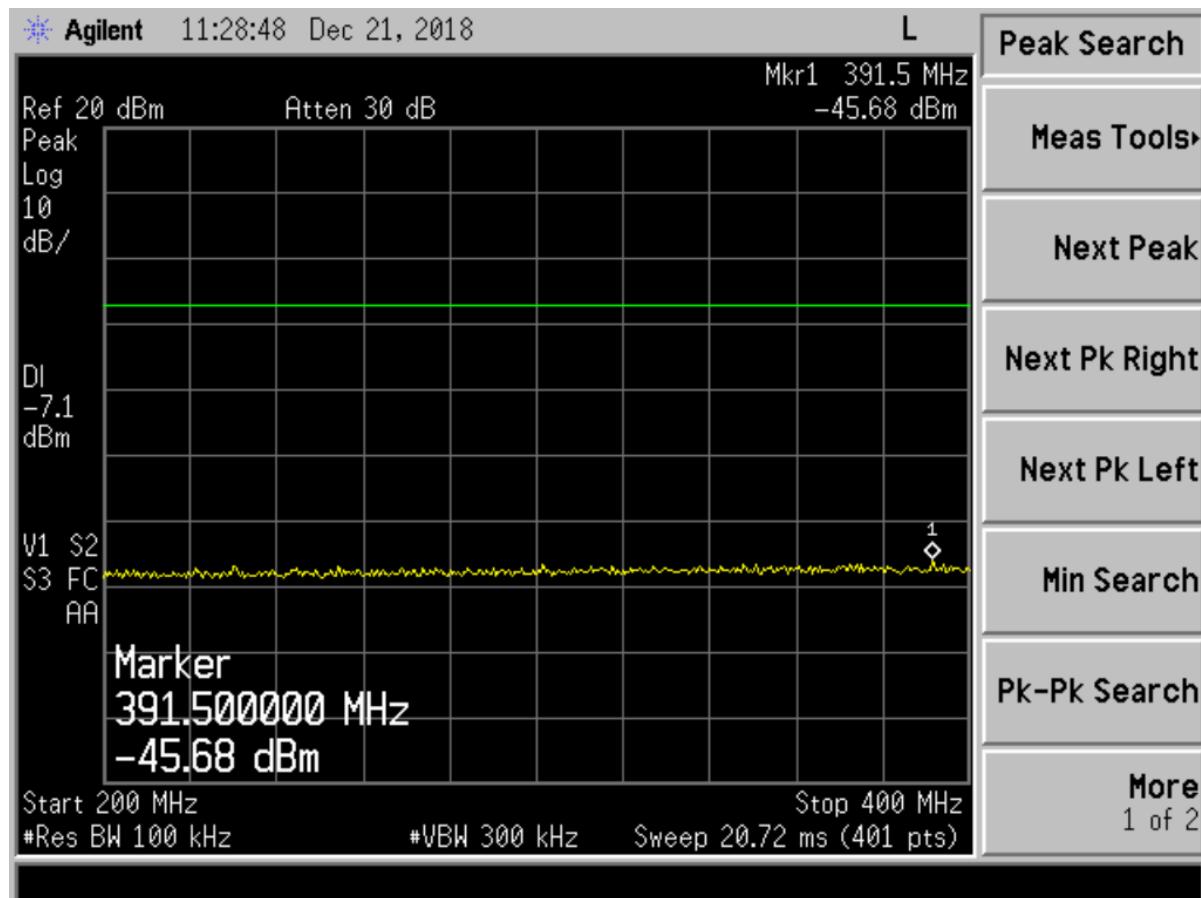


Figure 32. 802.11n, Channel 1, 200 - 400 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

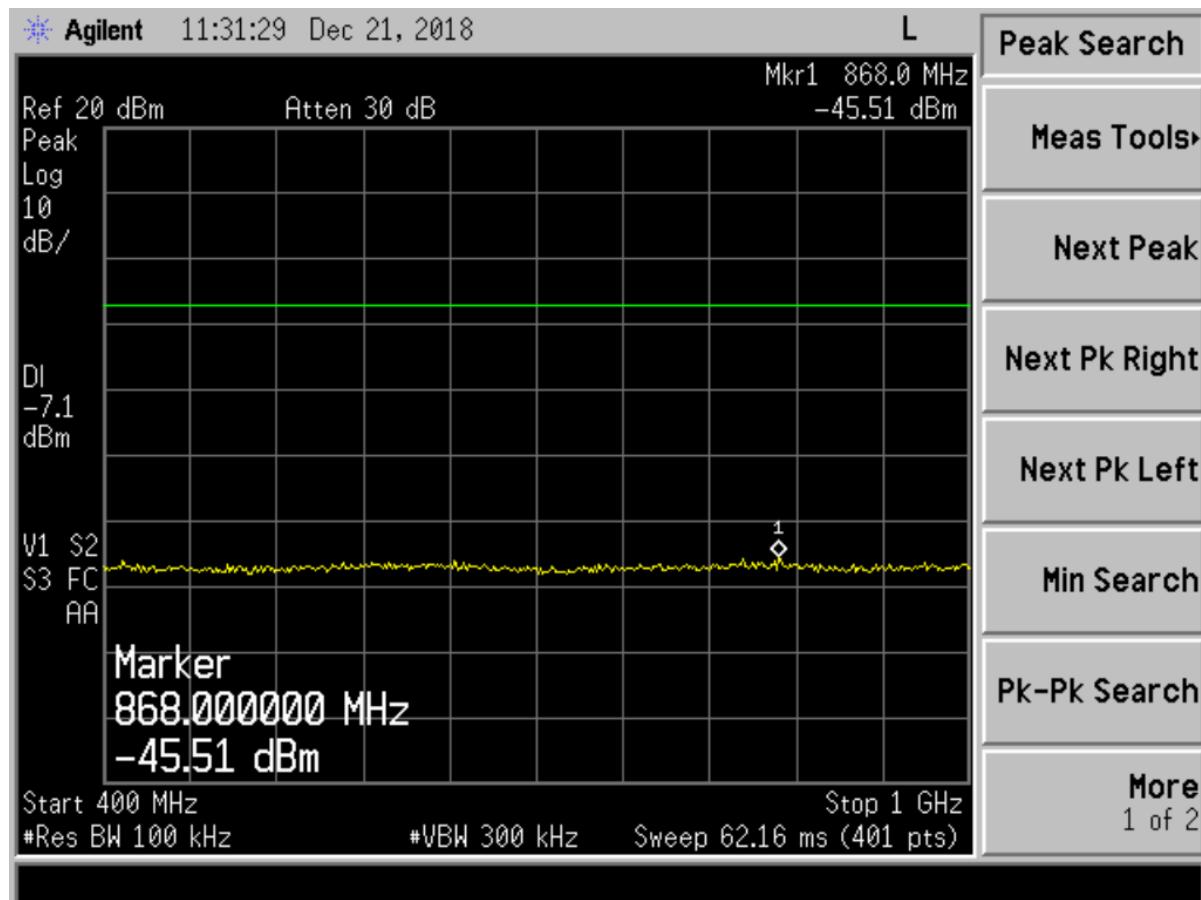


Figure 33. 802.11n, Channel 1, 400 - 1000 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

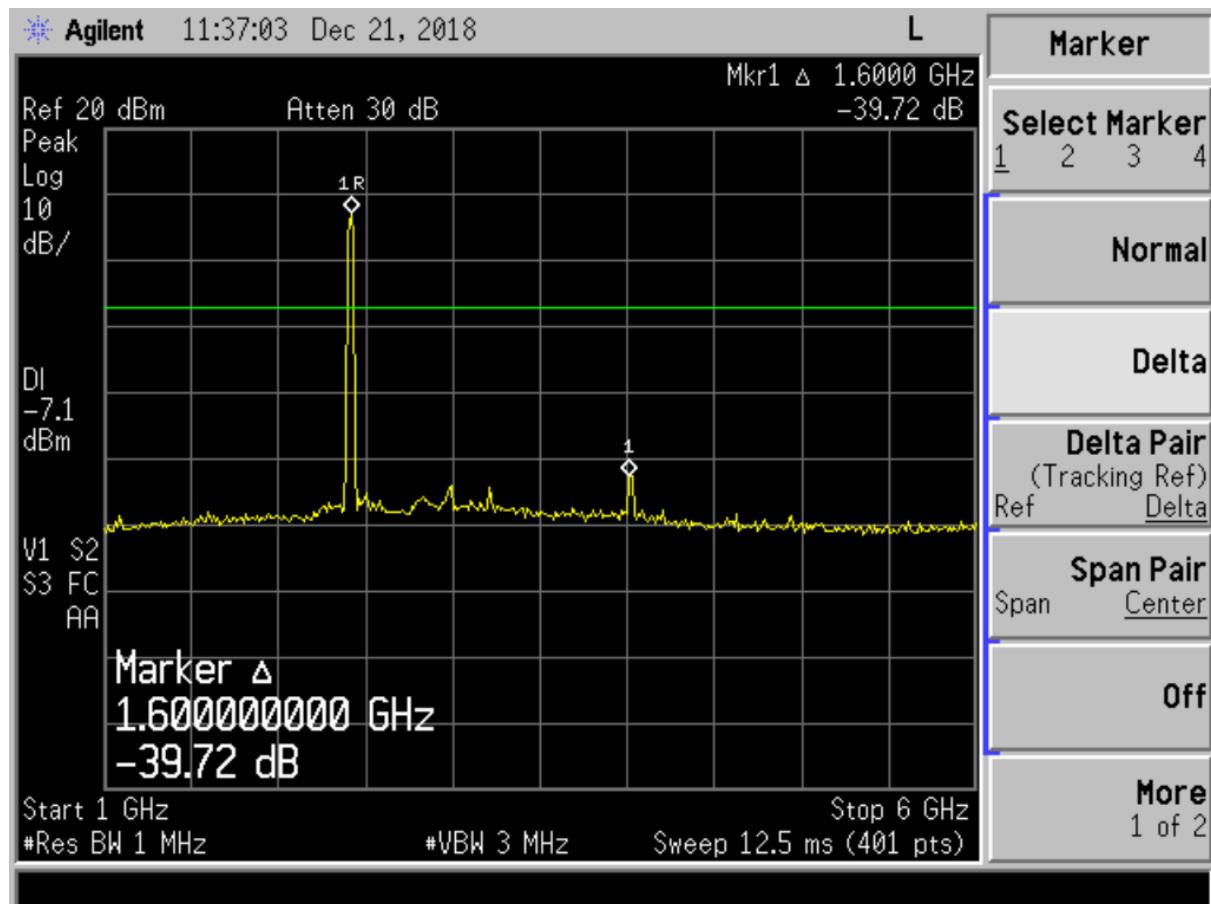


Figure 34. 802.11n, Channel 1, 1 - 6 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

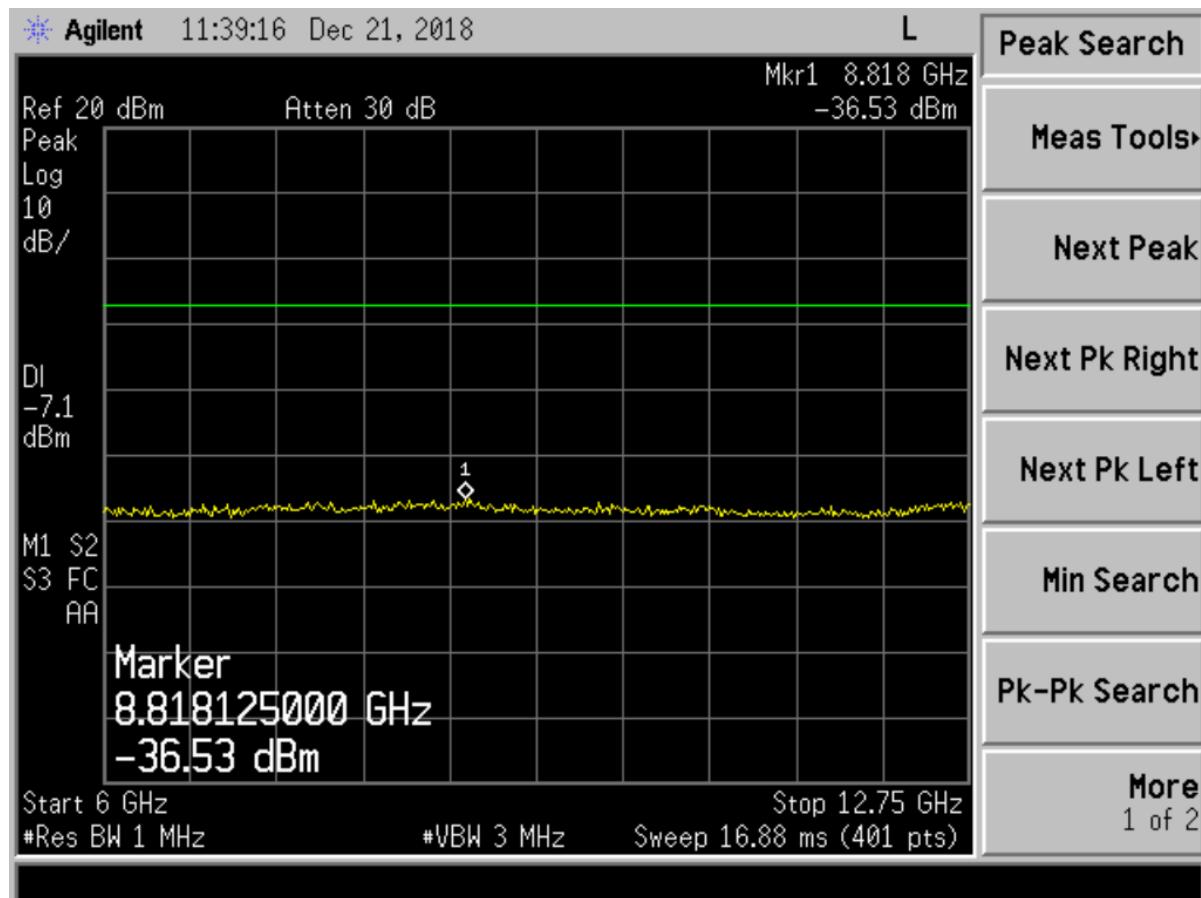


Figure 35. 802.11n, Channel 1, 6 – 12.75 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

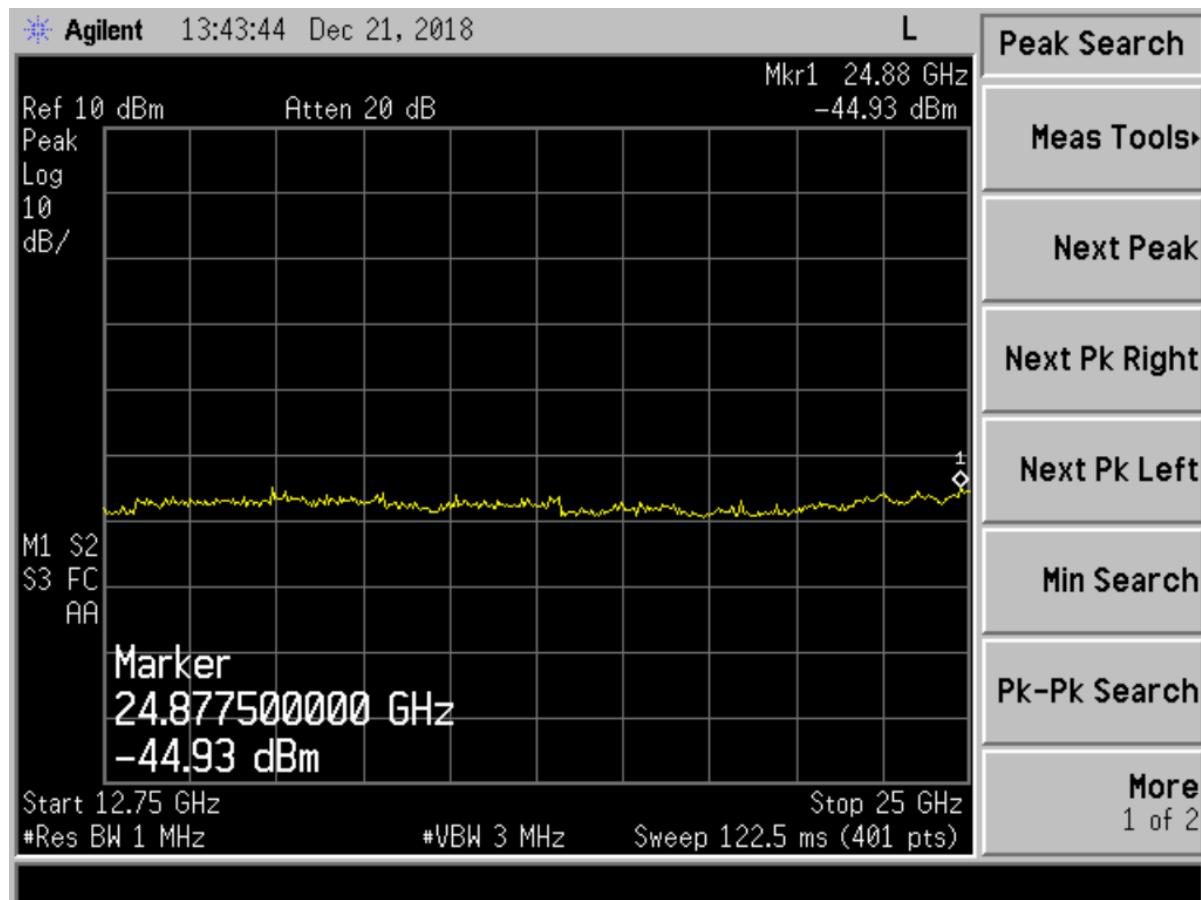


Figure 36. 802.11n, Channel 1, 12.75 - 25 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

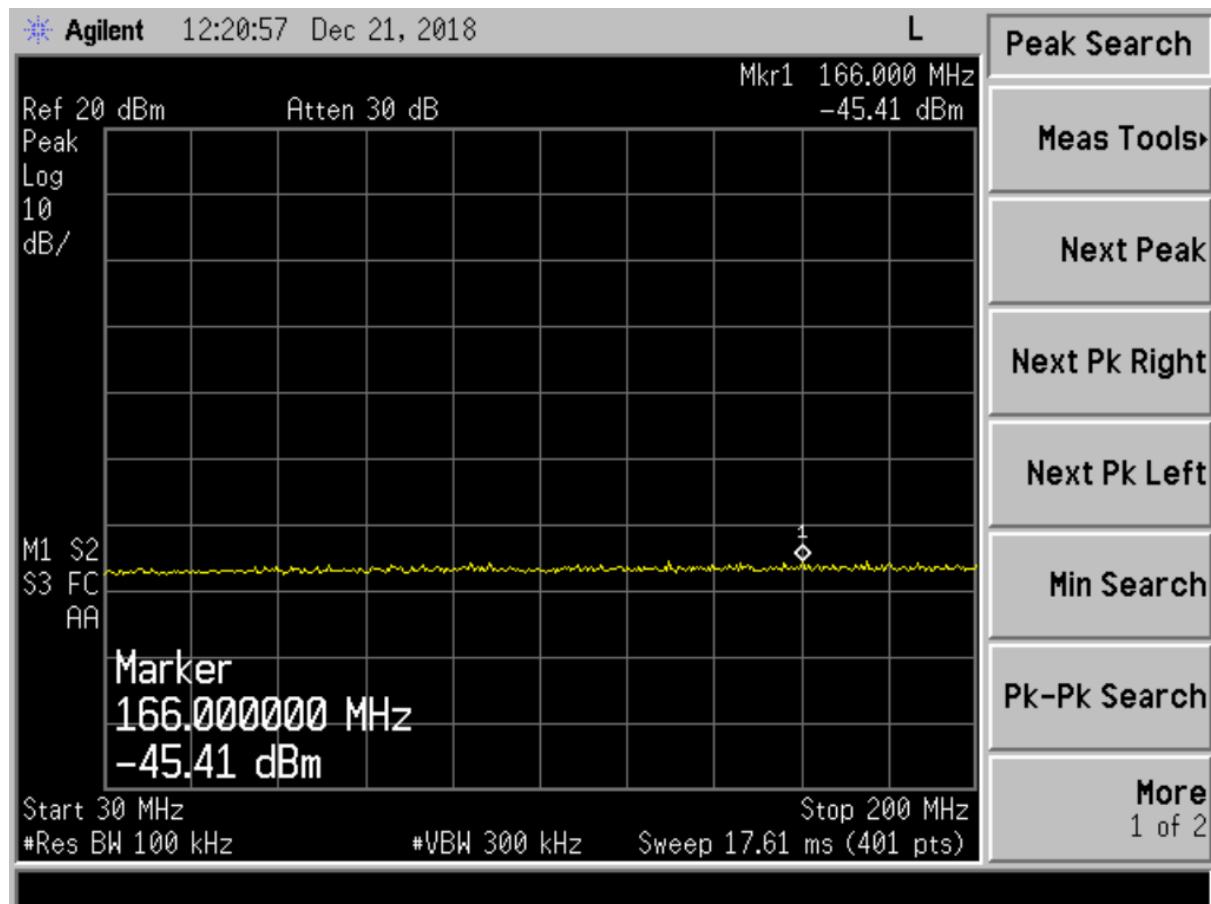


Figure 37. 802.11n, Channel 6, 30 - 200 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

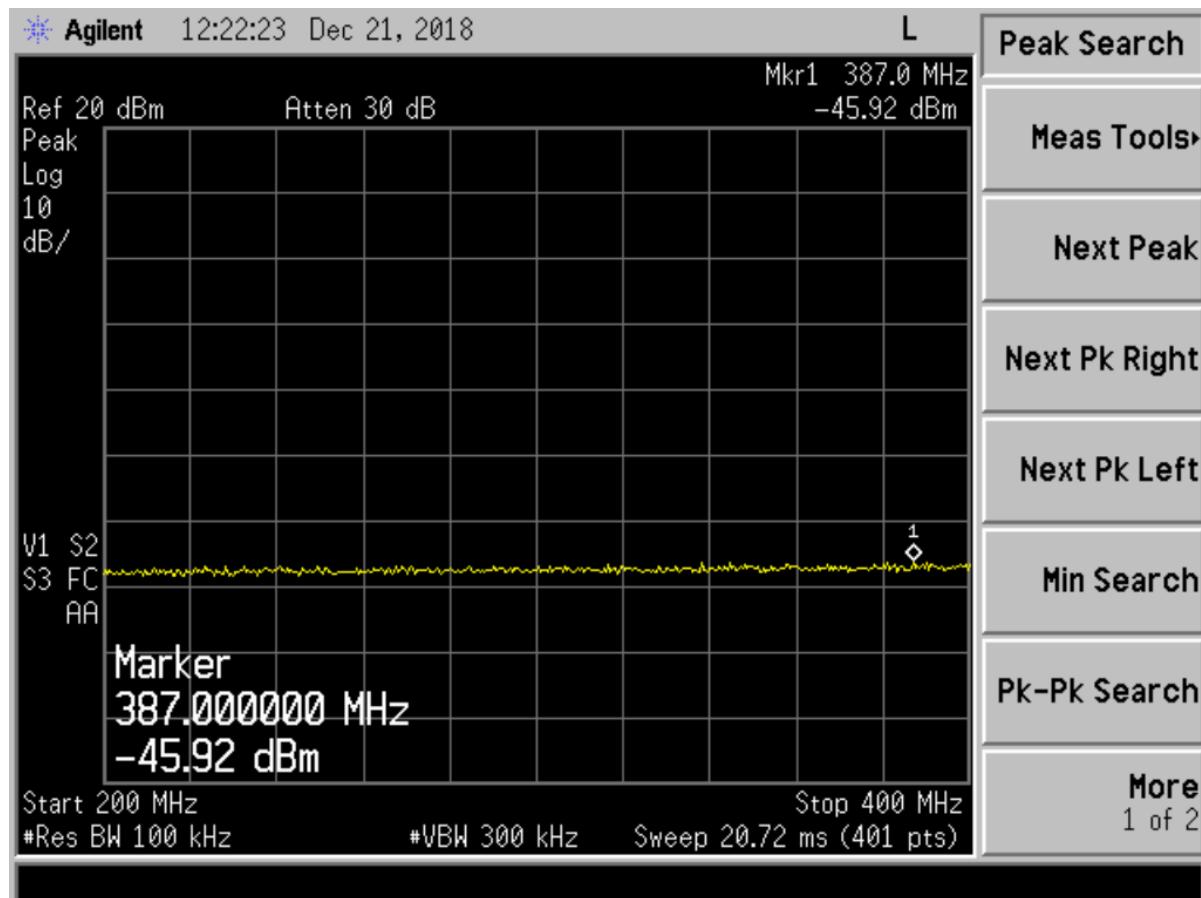


Figure 38. 802.11n, Channel 6, 200 - 400 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

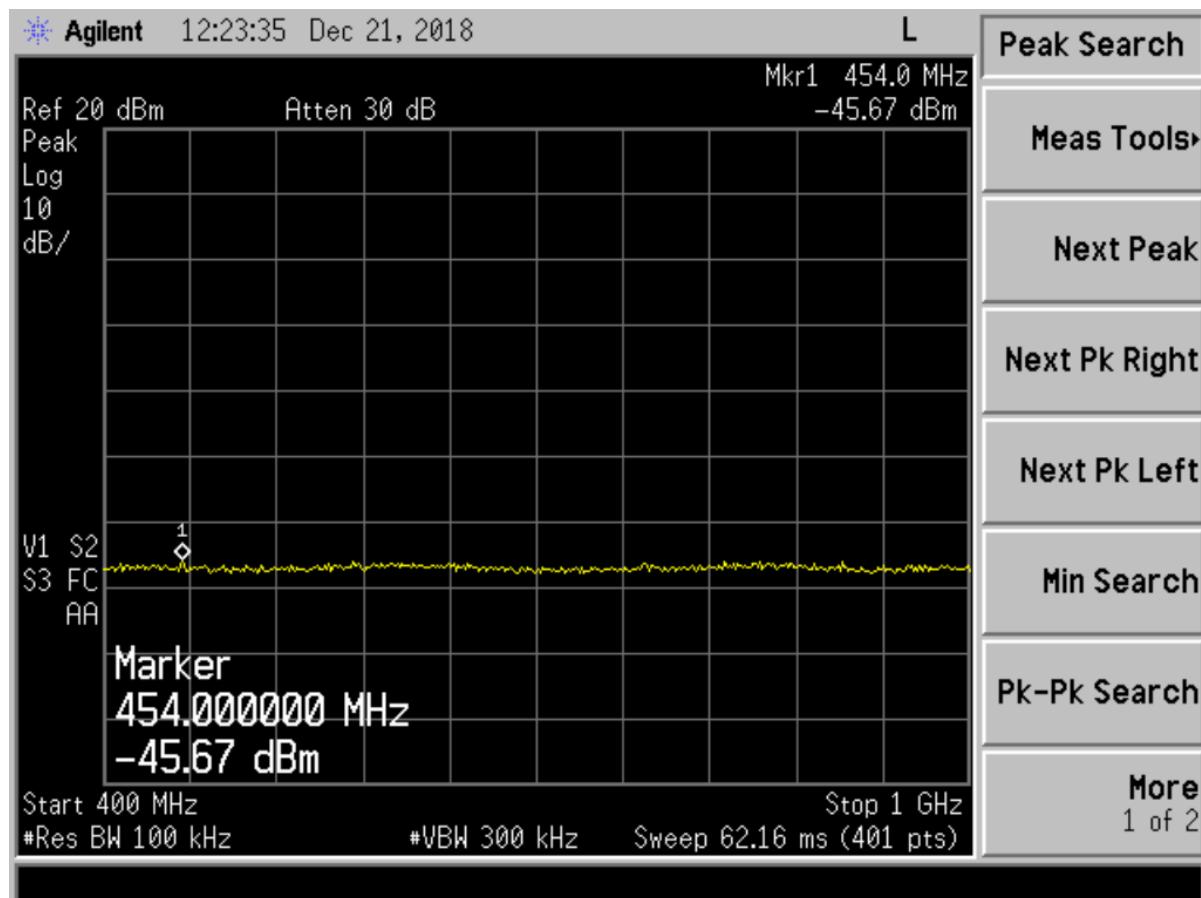


Figure 39. 802.11n, Channel 6, 400 - 1000 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

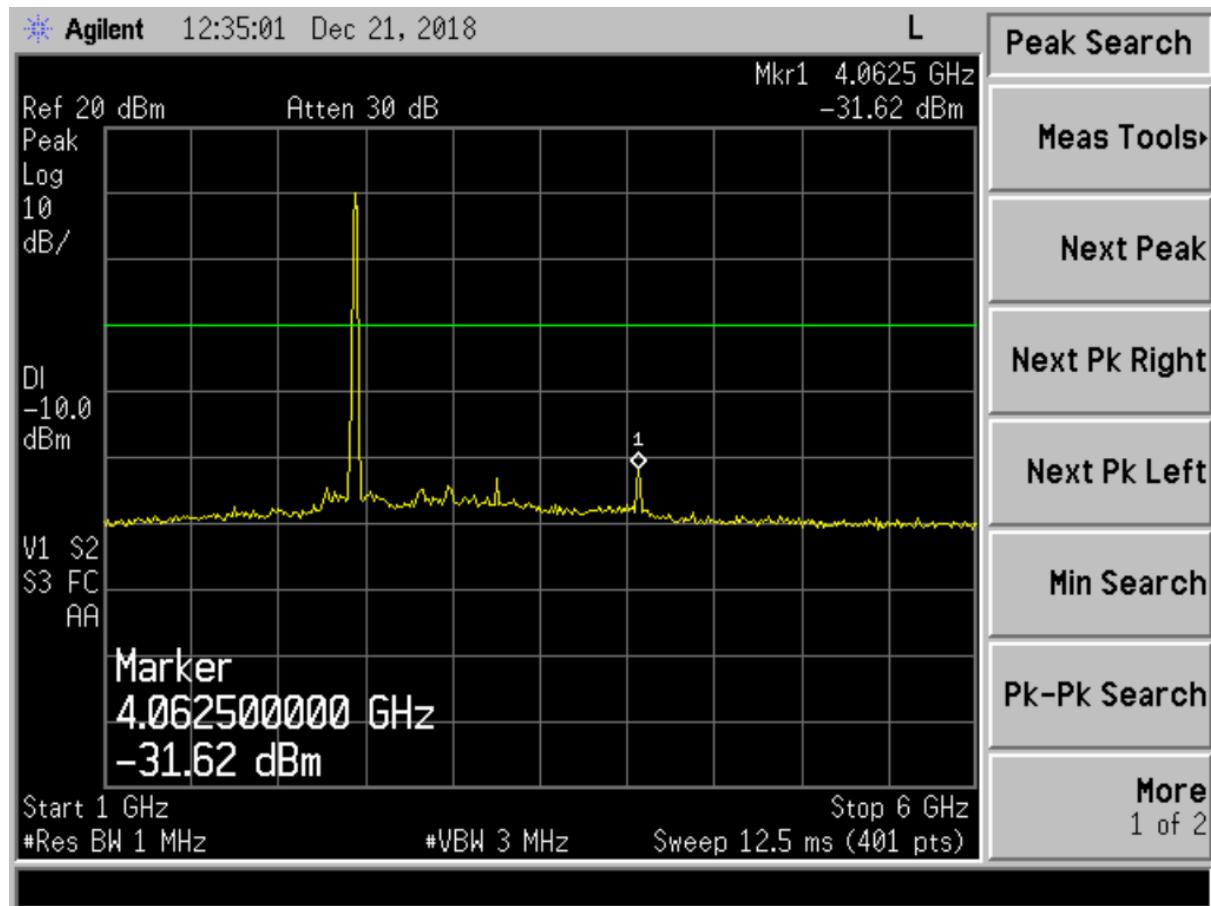


Figure 40. 802.11n, Channel 6, 1 – 6 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

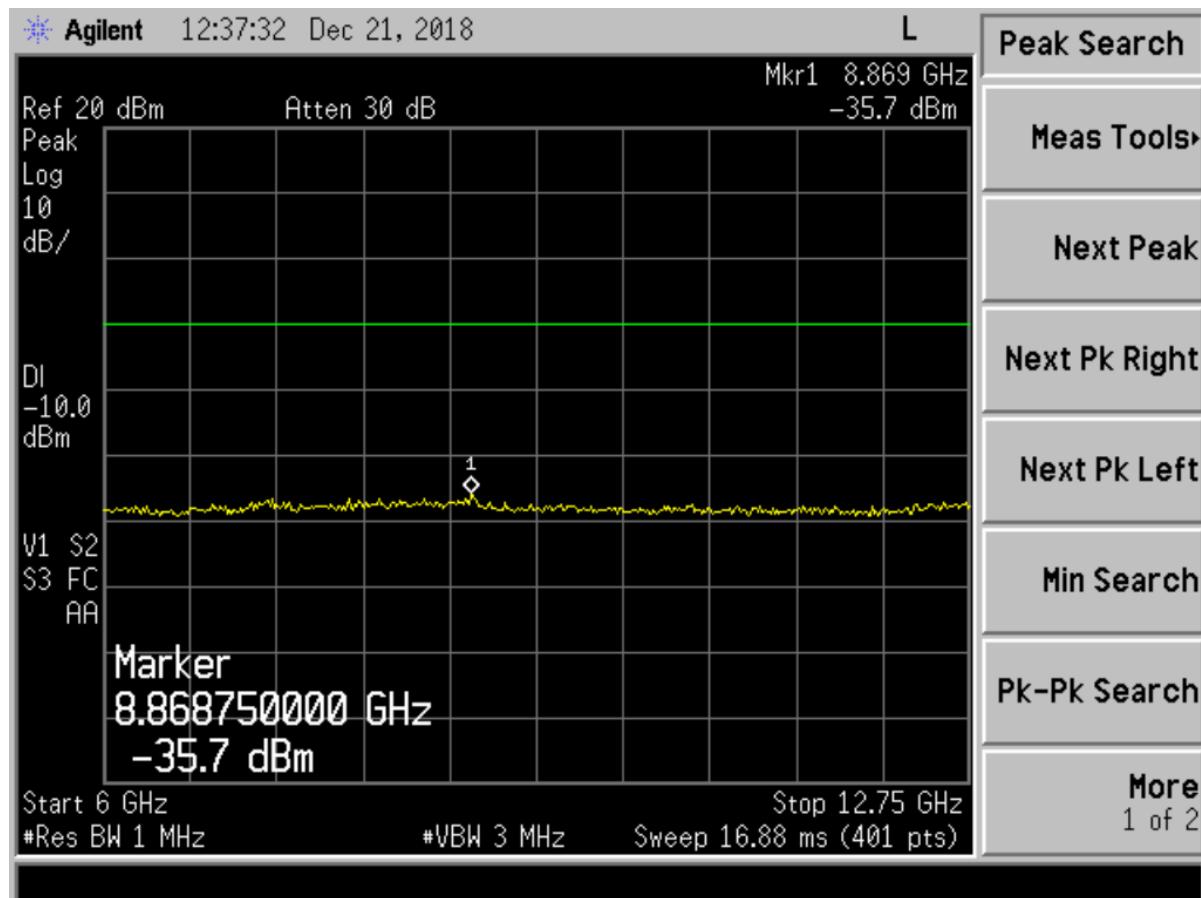


Figure 41. 802.11n, Channel 6, 6 – 12.75 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

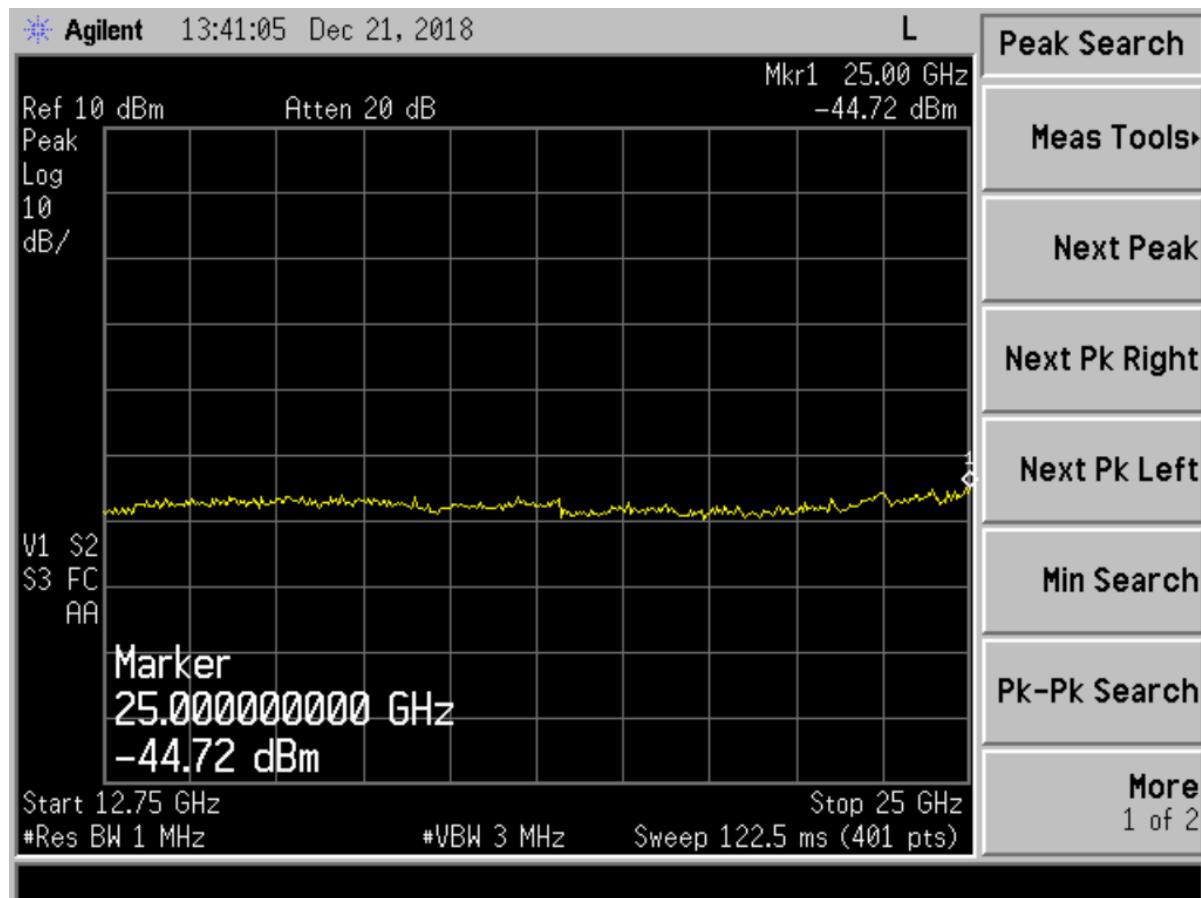


Figure 42. 802.11n, Channel 6, 12.75 – 25 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

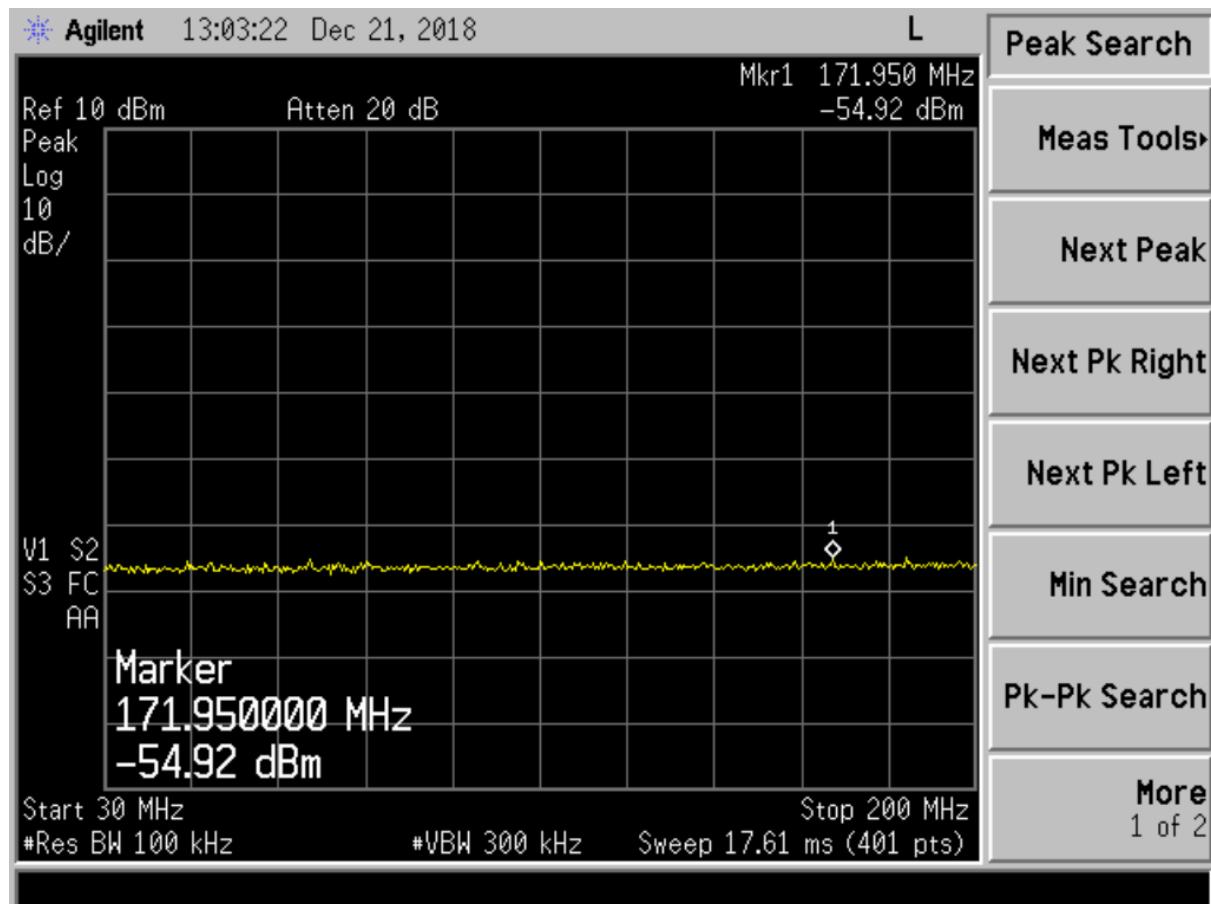


Figure 43. 802.11n, Channel 11, 30 - 200 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

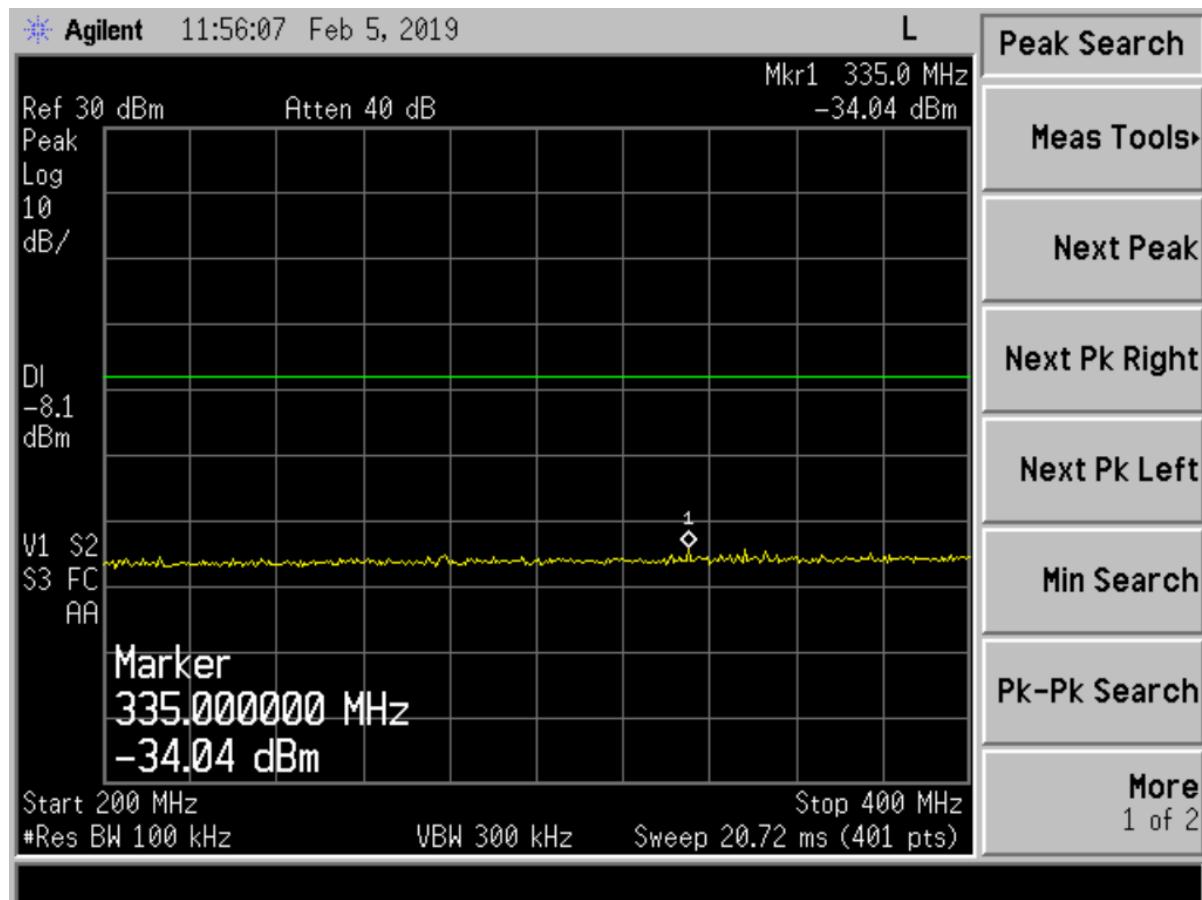


Figure 44. 802.11n, Channel 11, 200 - 400 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

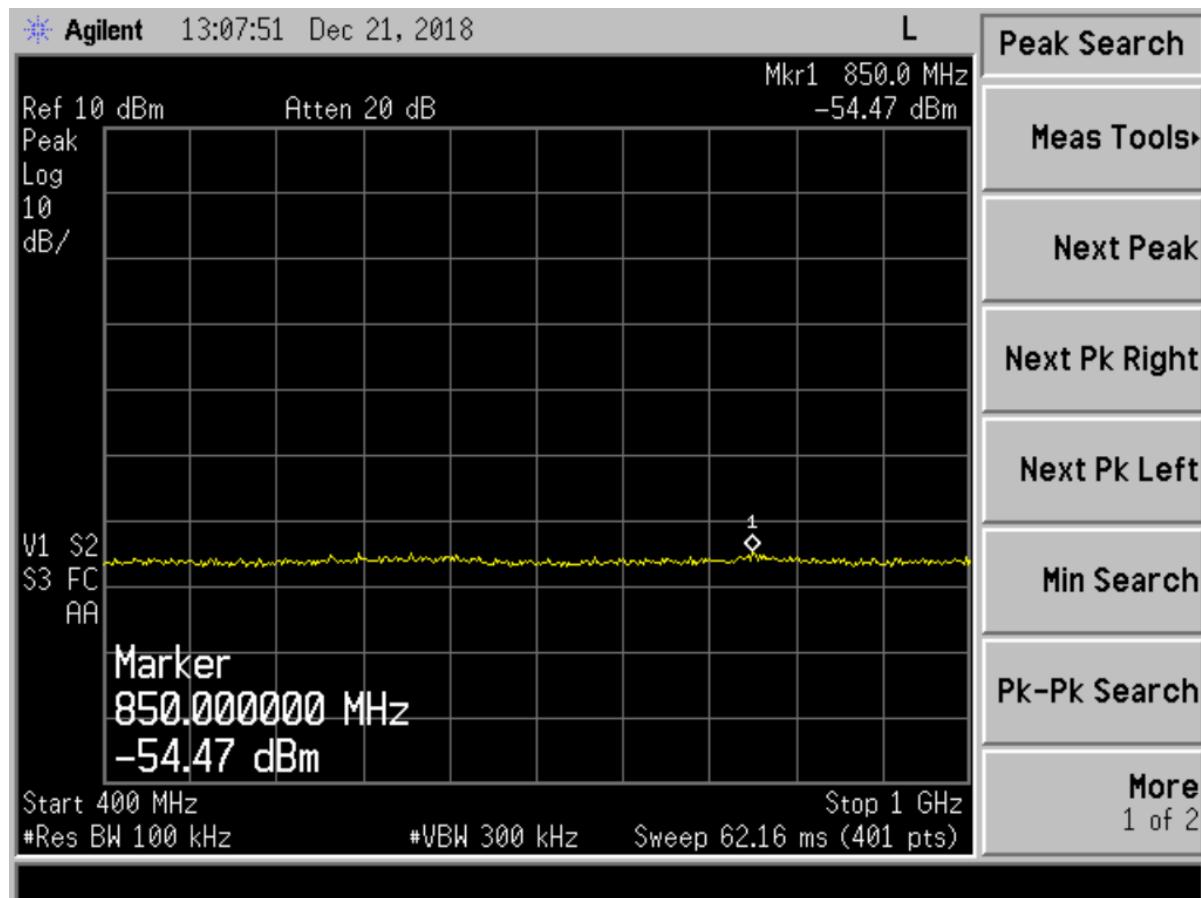


Figure 45. 802.11n, Channel 11, 400 - 1000 MHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

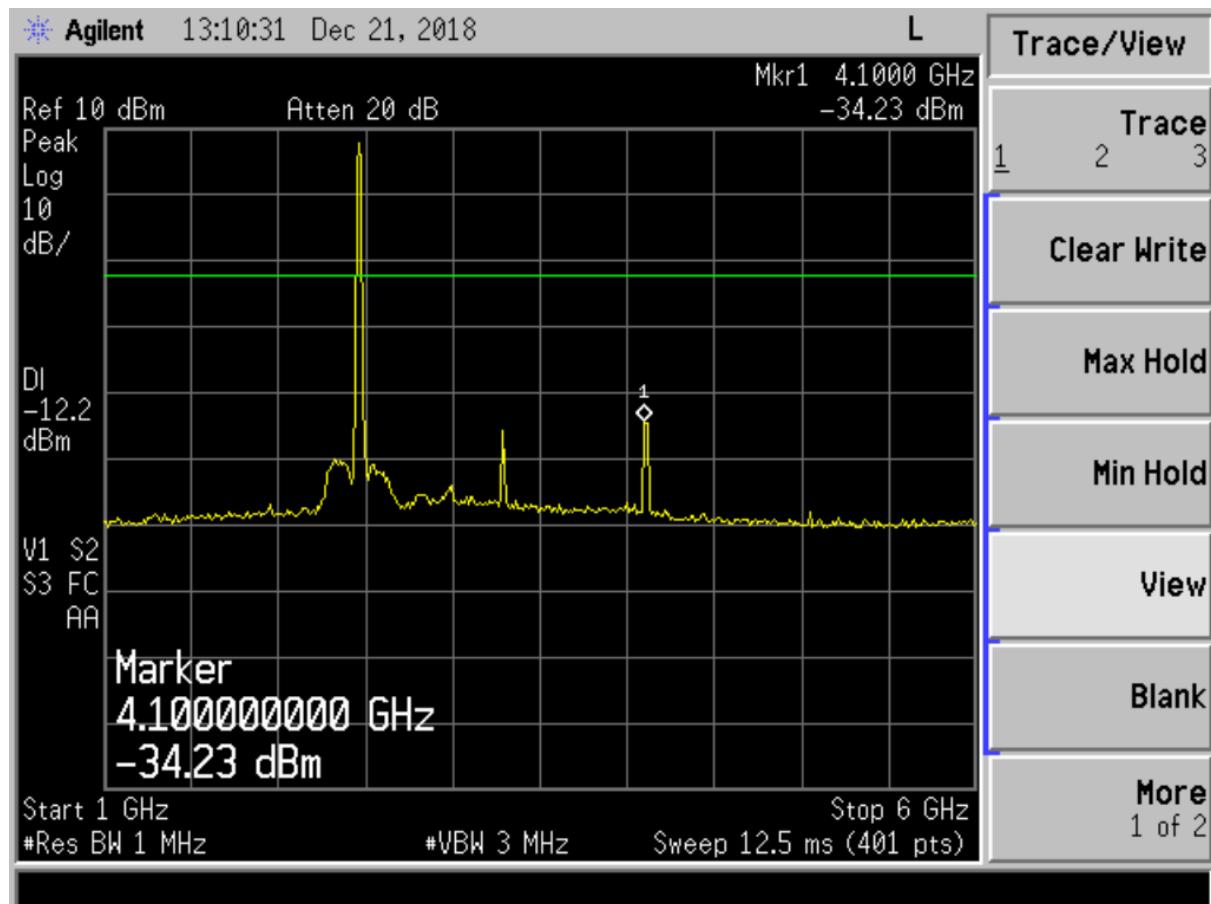


Figure 46. 802.11n, Channel 11, 1 – 6 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

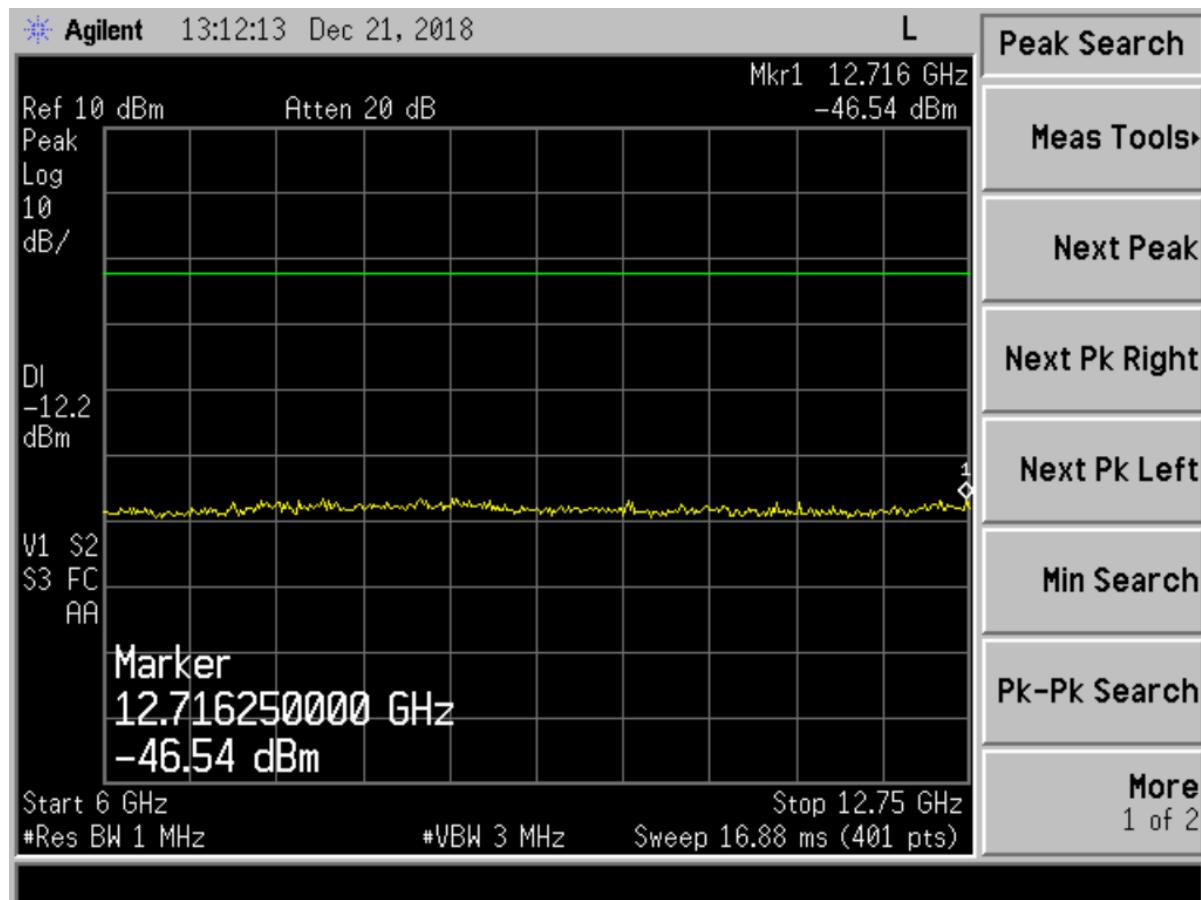


Figure 47. 802.11n, Channel 11, 6 – 12.75 GHz

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

FCC Part 15/IC RSS Certification
USKRM-10002705
11898A-10002705
18-0382
February 6, 2019
Matrix
RM-10002705

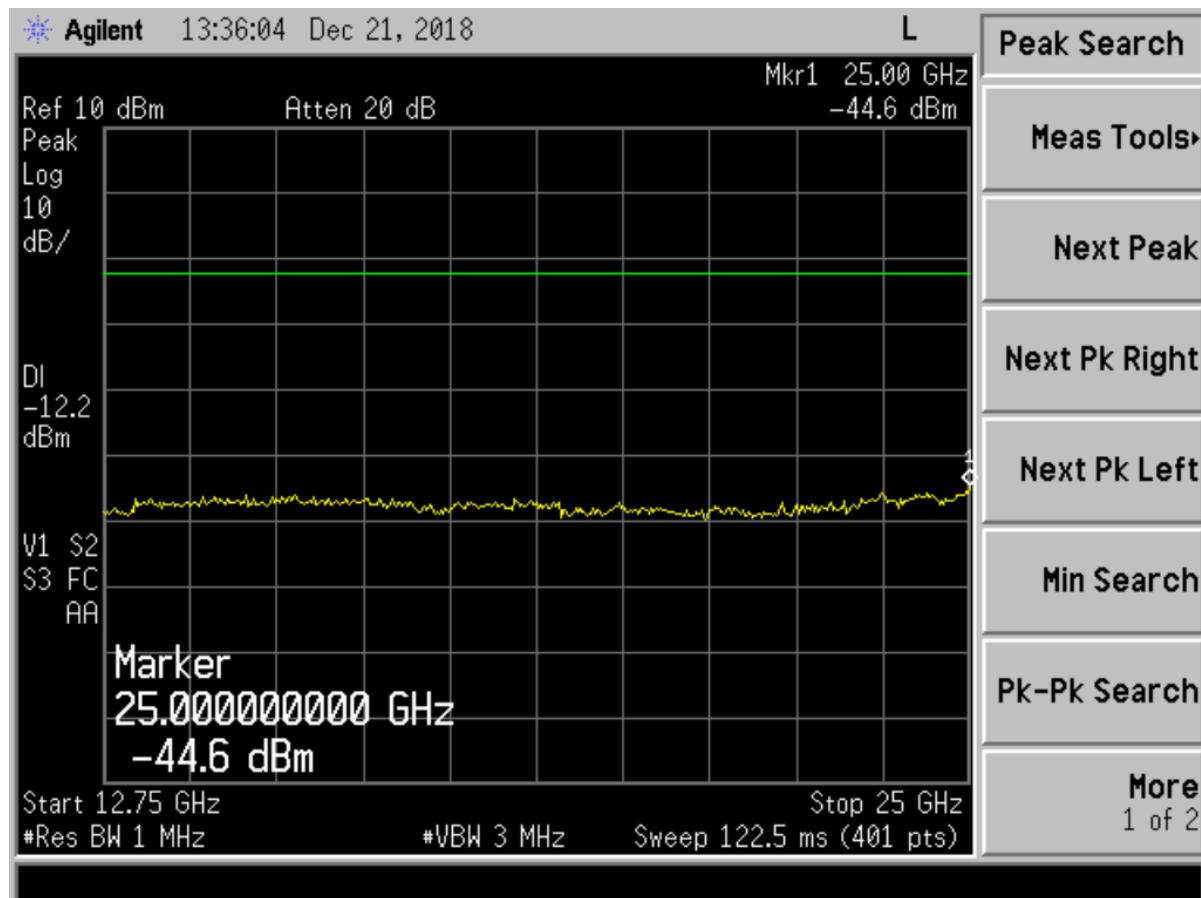


Figure 48. 802.11n, Channel 11, 12.75 – 25 GHz

US Tech Test Report:	FCC Part 15/IC RSS Certification
FCC ID:	USKRM-10002705
IC:	11898A-10002705
Test Report Number:	18-0382
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Customer:	Matrix
Model:	RM-10002705

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.

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 \geq 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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 IC:
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 Customer:
 Model:

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 USKRM-10002705
 11898A-10002705
 18-0382
 February 6, 2019
 Matrix
 RM-10002705

Table 5. B Mode - Peak Radiated Fundamental & Harmonic Emissions

Tested By: AF	Test: FCC Part 15,247(d)			Client: Matrix Design Group LLC				
	Project: 18-0382			Model: RM-10002705				
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								
2412.00	76.02	0.00	34.05	109.16	--	3.0m./HORZ	--	PK
*4824.00	66.20	0.00	4.57	70.77	74.0	3.0m./HORZ	3.2	PK
*7236.00	55.69	0.00	11.25	57.44	74.0	1.0m./HORZ	16.6	PK
Mid Channel - PEAK								
2437.00	75.11	0.00	34.05	110.74	--	3.0m./HORZ	--	PK
*4874.00	54.89	0.00	6.46	61.35	74.0	3.0m./HORZ	12.6	PK
*7311.00	61.17	0.00	16.52	68.19	74.0	1.0m./HORZ	5.8	PK
High Channel - PEAK								
2462.00	74.36	0.00	34.42	108.78	--	3.0m./HORZ	--	PK
*4924.00	55.10	0.00	7.64	62.74	74.0	3.0m./HORZ	11.3	PK
*7386.00	60.75	0.00	15.51	66.76	74.0	3.0m./HORZ	7.2	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 2412.00 MHz:

Magnitude of Measured Frequency	76.02	dBuV
+Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	34.05	dB/m
Corrected Result	109.16	dBuV/m

Test Date: December 18, 2018

Tested By Afzal Fazal
 Signature: _____

Name: Afzal Fazal

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

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 USKRM-10002705
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Table 6. B Mode - Average Radiated Fundamental & Harmonic Emissions

Tested By: AF	Test: FCC Part 15,247(d) Project: 18-0382				Client: Matrix Design Group, LLC Model: RM-10002705			
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								
2412.00	69.83	0.00	32.85	102.68	--	3.0m./HORZ	--	AVG
*4824.00	48.89	0.00	4.57	53.46	54.0	3.0m./HORZ	0.5	AVG
*7236.00	45.68	0.00	11.25	47.43	54.0	1.0m./HORZ	6.6	AVG
Mid Channel-Average								
2437.00	68.02	0.00	34.05	102.07	--	3.0m./HORZ	--	AVG
*4874.00	40.73	0.00	6.46	47.19	54.0	3.0m./HORZ	6.8	AVG
*7311.00	46.05	0.00	16.52	53.07	54.0	1.0m./HORZ	0.9	AVG
High Channel-Average								
2462.00	67.93	0.00	34.42	102.35	--	3.0m./HORZ	--	AVG
*4924.00	41.25	0.00	7.64	48.89	54.0	3.0m./HORZ	5.1	AVG
*7386.00	46.22	0.00	15.51	52.23	54.0	3.0m./HORZ	1.8	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 2412.00MHz:

Magnitude of Measured Frequency	69.83	dBuV
+Additional Factor (filter + duty cycle)	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	32.85	dB/m
Corrected Result	102.68	dBuV/m

Test Date: December 18, 2018

Tested By

Signature: Afzal Fazal

Name: Afzal Fazal

Note: The transmitter was programmed to transmit at >98% during all testing.

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

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USKRM-10002705
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RM-10002705

Table 7. G Mode - Peak Radiated Fundamental & Harmonic Emissions

Tested By: AF	Test: FCC Part 15,247(d) Project: 18-0382			Client: Matrix Design Group, LLC Model: RM-10002705				
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								
2412.00	73.73	0.00	32.85	106.58	--	3.0m./HORZ	--	PK
*4824.00	49.64	0.00	4.57	51.51	74.0	3.0m./HORZ	22.5	PK
*7236.00	50.93	0.00	11.25	52.68	74.0	1.0m./HORZ	21.3	PK
Mid Channel – PEAK								
2437.00	76.40	0.00	34.05	110.45	--	3.0m./HORZ	--	PK
*4874.00	46.47	0.00	6.46	52.93	74.0	3.0m./HORZ	21.1	PK
*7311.00	50.86	0.00	16.52	57.88	74.0	1.0m./HORZ	16.1	PK
High Channel- PEAK								
2462.00	74.48	0.00	34.42	108.90	--	3.0m./HORZ	--	PK
*4924.00	46.95	0.00	7.64	54.59	74.0	3.0m./HORZ	19.4	PK
*7386.00	50.94	0.00	15.51	56.95	74.0	3.0m./HORZ	17.0	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 2412.00 MHz:

Magnitude of Measured Frequency	73.73	dBuV
+Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	32.85	dB/m
Corrected Result	106.58	dBuV/m

Test Date: December 19, 2018

Tested By

Signature: Afzal Fazal

Name: Afzal Fazal

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

FCC Part 15/IC RSS Certification
USKRM-10002705
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Matrix
RM-10002705

Table 8. G Mode - Average Radiated Fundamental & Harmonic Emissions

Tested By: AF	Test: FCC Part 15,247(d)			Client: Matrix Design Group, LLC				
	Project: 18-0382			Model: RM-10002705				
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								
2412.00	60.31	0.00	32.85	93.16	--	3.0m./HORZ	--	AVG
*4824.00	31.70	0.00	4.57	36.27	54.0	3.0m./HORZ	17.7	AVG
*7236.00	35.74	0.00	11.25	37.49	54.0	1.0m./HORZ	16.5	AVG
Mid Channel-Average								
2437.00	62.48	0.00	34.05	96.53	--	3.0m./HORZ	--	AVG
*4874.00	31.99	0.00	6.46	38.45	54.0	3.0m./HORZ	15.5	AVG
*7311.00	35.76	0.00	16.52	42.78	54.0	1.0m./HORZ	11.2	AVG
High Channel-Average								
2462.00	60.27	0.00	34.42	94.69	--	3.0m./HORZ	--	AVG
*4924.00	31.42	0.00	7.64	39.06	54.0	3.0m./HORZ	14.9	AVG
*7386.00	35.95	0.00	15.51	41.96	54.0	3.0m./HORZ	12.0	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 2412.00 MHz:

Magnitude of Measured Frequency	60.31	dBuV
+Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	32.85	dB/m
Corrected Result	93.16	dBuV/m

Test Date: December 19, 2018

Tested By

Signature: Afzal Fazal

Name: Afzal Fazal

Note: The transmitter was programmed to transmit at >98% during all testing.

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

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Table 9. N Mode – Peak Radiated Fundamental & Harmonic Emissions

Tested By: AF	Test: FCC Part 15,247(d)			Client: Matrix Design Group, LLC				
	Project: 18-0382			Model: RM-10002705				
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								
2412.00	70.75	0.00	32.85	103.60	--	3.0m./HORZ	--	PK
*4824.00	46.04	0.00	4.57	50.61	74.0	3.0m./HORZ	23.4	PK
*7236.00	47.85	0.00	11.25	49.60	74.0	1.0m./HORZ	24.4	PK
Mid Channel - PEAK								
2437.00	70.49	0.00	34.05	104.54	--	3.0m./HORZ	--	PK
*4874.00	45.11	0.00	6.46	51.57	74.0	3.0m./HORZ	22.4	PK
*7311.00	48.58	0.00	15.66	56.63	74.0	3.0m./HORZ	17.4	PK
High Channel- PEAK								
2462.00	70.19	0.00	34.42	104.61	--	3.0m./HORZ	--	PK
*4924.00	44.92	0.00	7.64	52.56	74.0	3.0m./HORZ	21.4	PK
*7386.00	49.25	0.00	15.51	55.26	74.0	3.0m./HORZ	18.7	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 2412.00 MHz:

Magnitude of Measured Frequency	70.75	dBuV
+Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	32.85	dB/m
Corrected Result	103.60	dBuV/m

Test Date: December 20, 2018

Tested By

Signature: Afzal Fazal

Name: Afzal Fazal

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

Tested By: AF	Test: FCC Part 15,247(d)			Client: Matrix Systems				
	Project: 18-0382			Model: RM-10002705				
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								
2412.00	36.45	0.00	32.85	69.30	--	3.0m./HORZ	--	AVG
*4824.00	31.94	0.00	4.57	36.51	54.0	3.0m./HORZ	17.5	AVG
7236.00	35.55	0.00	11.25	37.31	54.0	1.0m./HORZ	16.7	AVG
Mid Channel -Average								
2437.00	35.96	0.00	34.05	70.01	--	3.0m./HORZ	--	AVG
*4874.00	31.73	0.00	6.46	38.19	54.0	3.0m./HORZ	15.8	AVG
*7311.00	35.59	0.00	16.52	42.61	54.0	1.0m./HORZ	11.4	AVG
High Channel-Average								
2462.00	35.80	0.00	34.42	70.22	--	3.0m./HORZ	--	AVG
*4924.00	31.66	0.00	7.64	39.30	54.0	3.0m./HORZ	14.7	AVG
*7386.00	35.99	0.00	15.51	42.00	54.0	3.0m./HORZ	12.0	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 2412.00 MHz:

Magnitude of Measured Frequency	36.45	dBuV
+Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	32.85	dB/m
Corrected Result	69.30	dBuV/m

Test Date: December 20, 2018

Tested By

Signature: Afzal Fazal

Name: Afzal Fazal

Note: The transmitter was programmed to transmit at >98% during all testing.

US Tech Test Report:
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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. Radiated 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.

The screen shots are presented below.

Test Date: February 5, 2019

Tested By

Signature: Afzal Fazal

Name: Afzal Fazal

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

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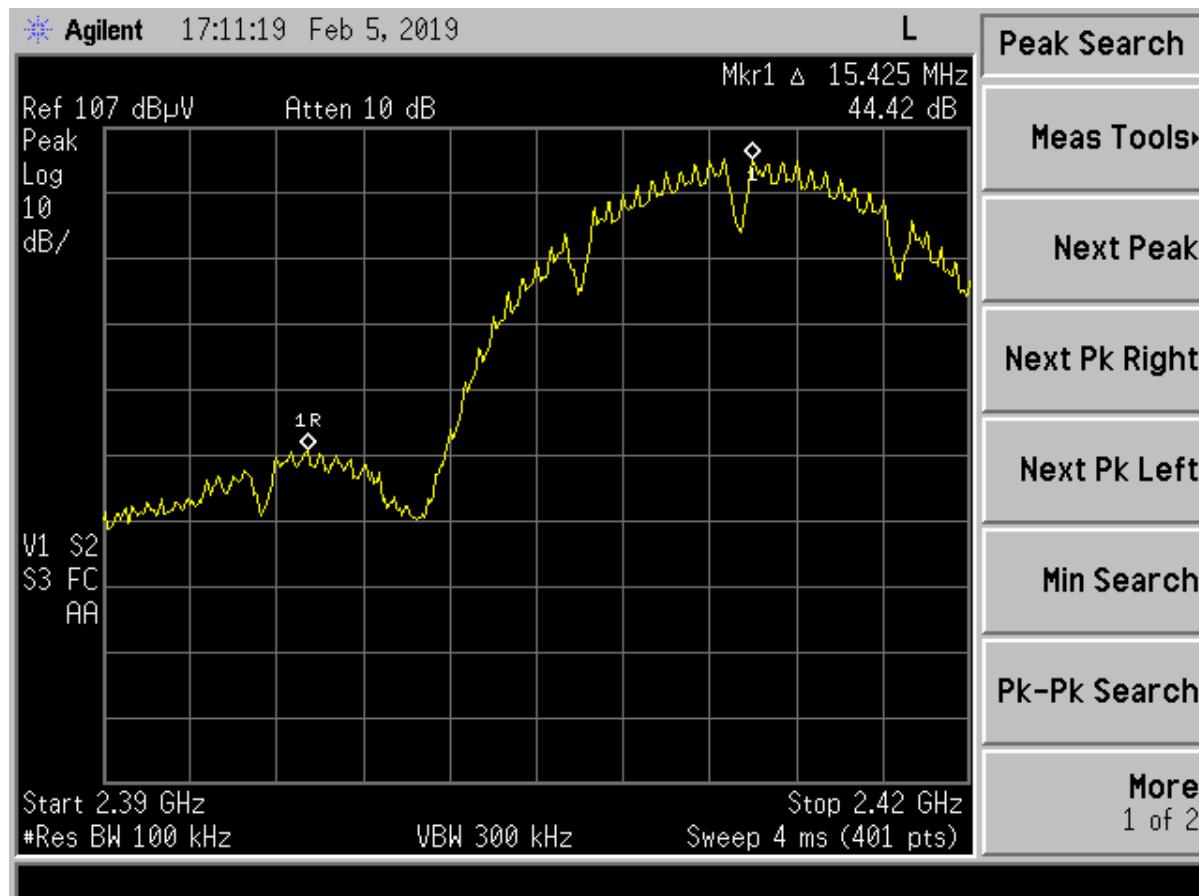


Figure 49. Band Edge Compliance – B Mode Low Channel Delta - Peak

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

Measured Result	44.42	dB
Band Edge Limit	20.00	dB
Band Edge Margin	24.42	dB

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Customer:
Model:

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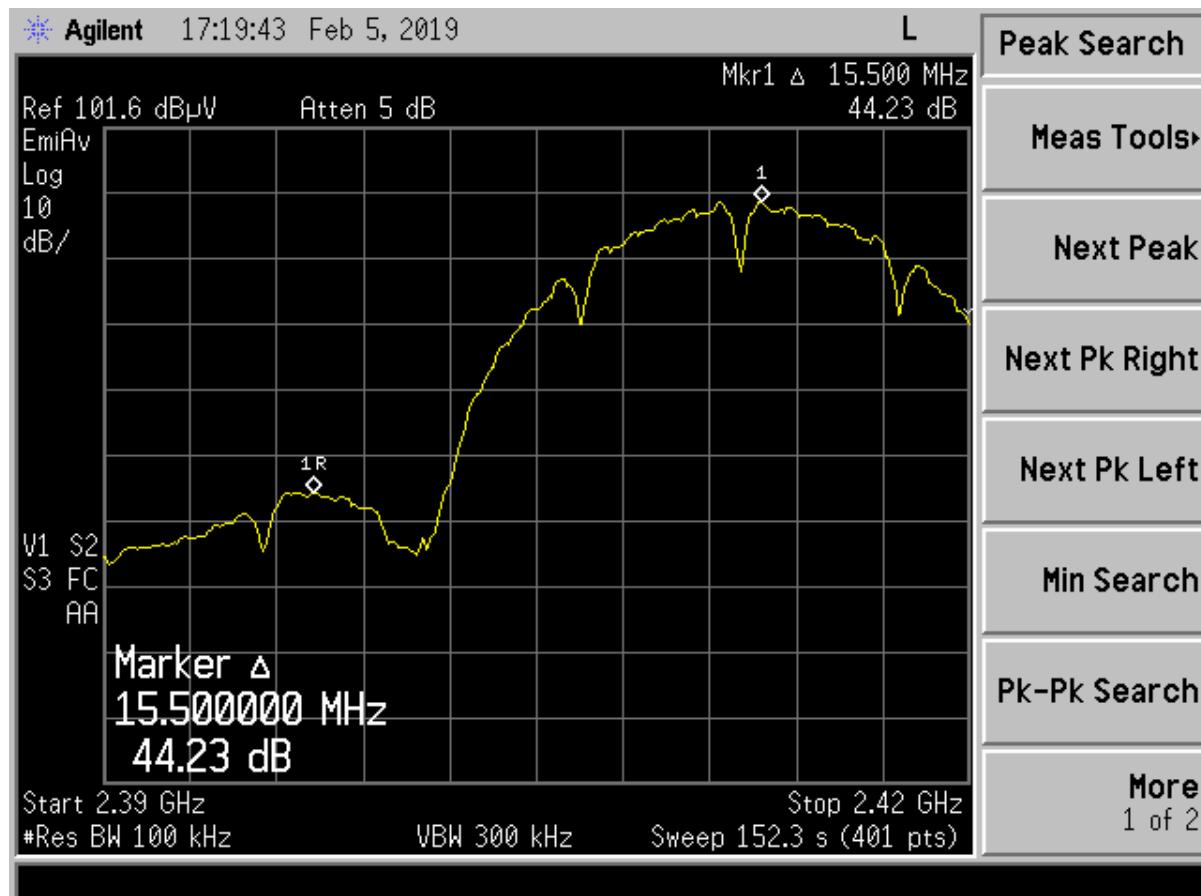


Figure 50. Band Edge Compliance – B Mode Low Channel Delta – Average

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

Measured Result	44.23	dB
Band Edge Limit	20.00	dB
Band Edge Margin	24.23	dB

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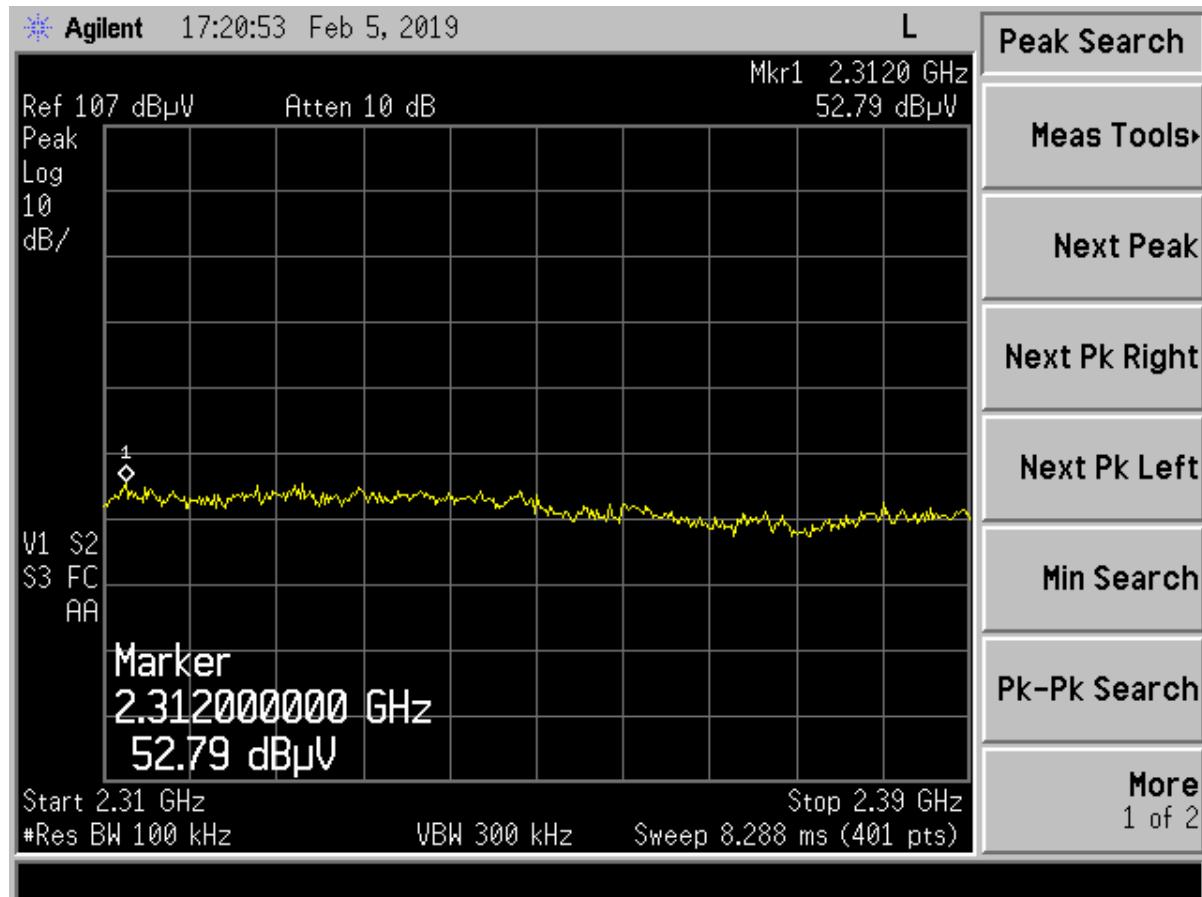


Figure 51. B Mode Low Channel Restricted Band - Peak

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
2312.00	52.79	-2.93	50.13	74.0	3.0m./HORZ	23.9	PK

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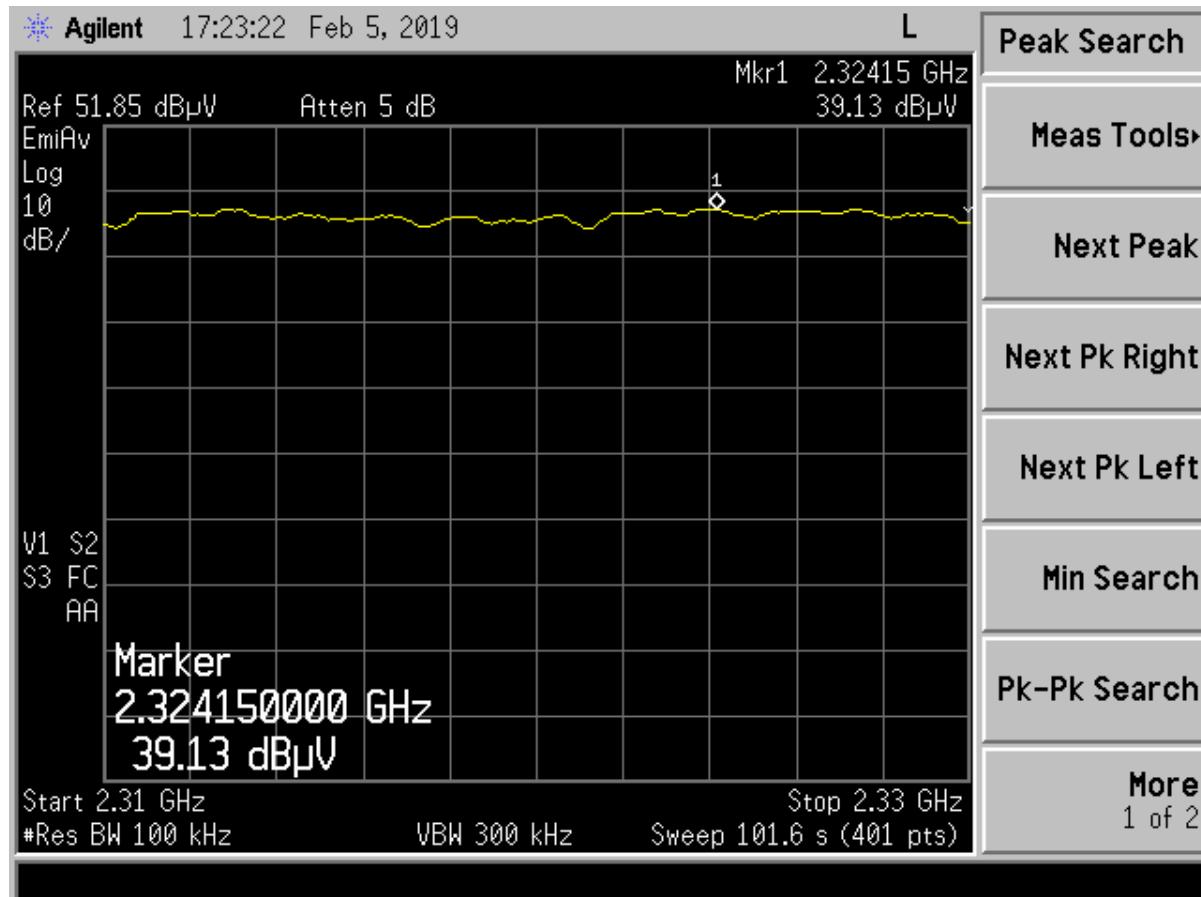


Figure 52. B Mode Low Channel Restricted Band- Average

Frequency (MHz)	Test Data (dB _u V)	AF+CA-AMP+DC (dB/m)	Results (dB _u V/m)	Limits (dB _u V/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2324.15	39.13	-2.93	36.50	54.0	3.0m./HORZ	17.5	AVG

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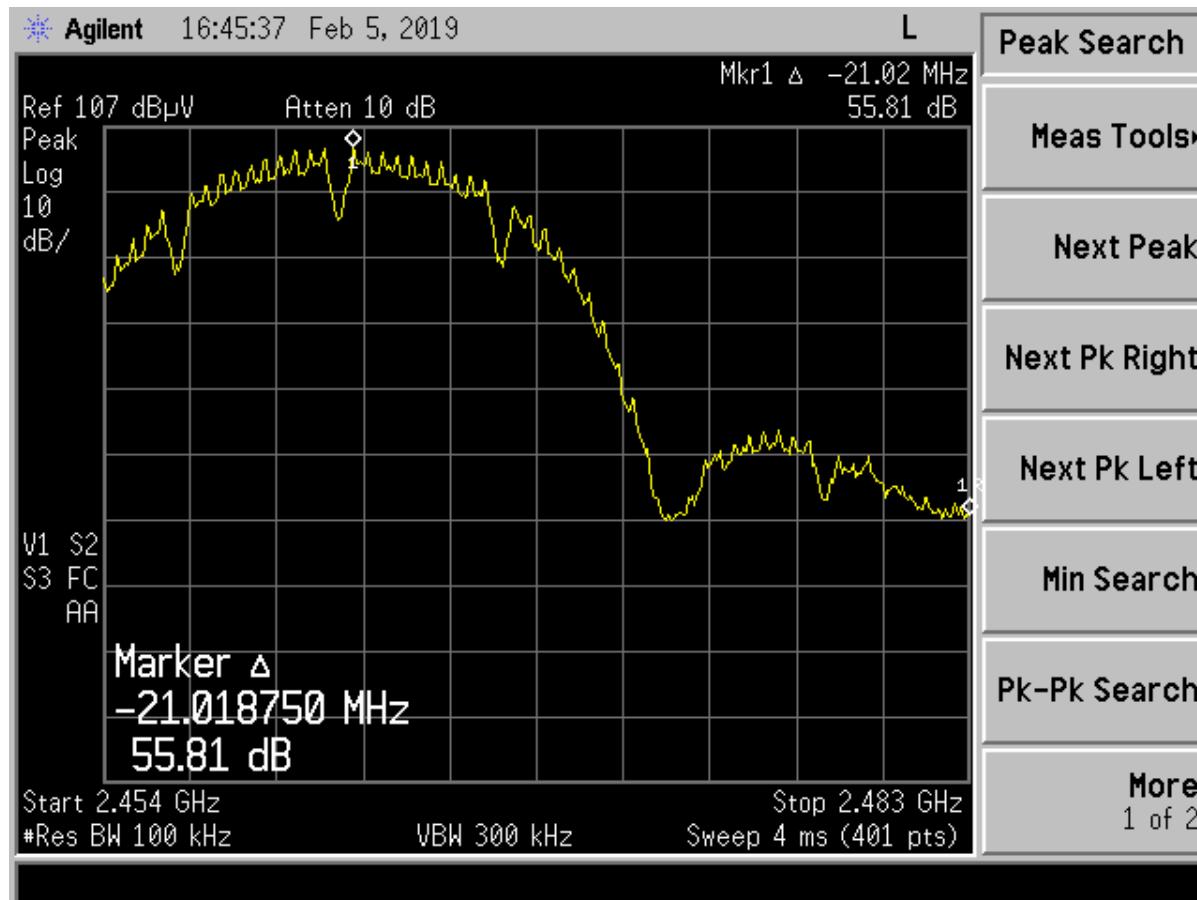


Figure 53. Band Edge Compliance – B Mode High Channel Delta - Peak

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

Measured Result	55.81	dB
Band Edge Limit	20.00	dB
Band Edge Margin	35.81	dB

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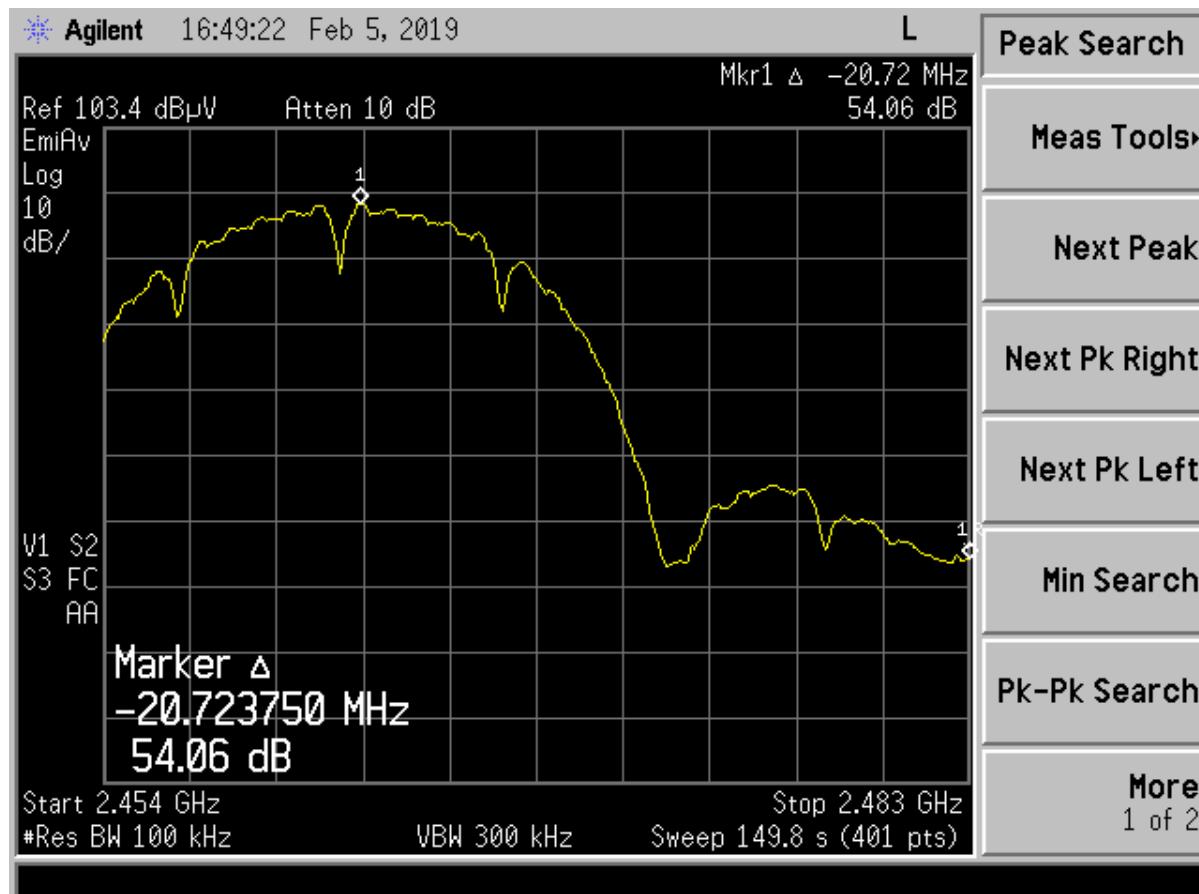


Figure 54. Band Edge Compliance – B Mode High Channel Delta - Average

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

Measured Result	54.06	dB
Band Edge Limit	20.00	dB
Band Edge Margin	34.06	dB

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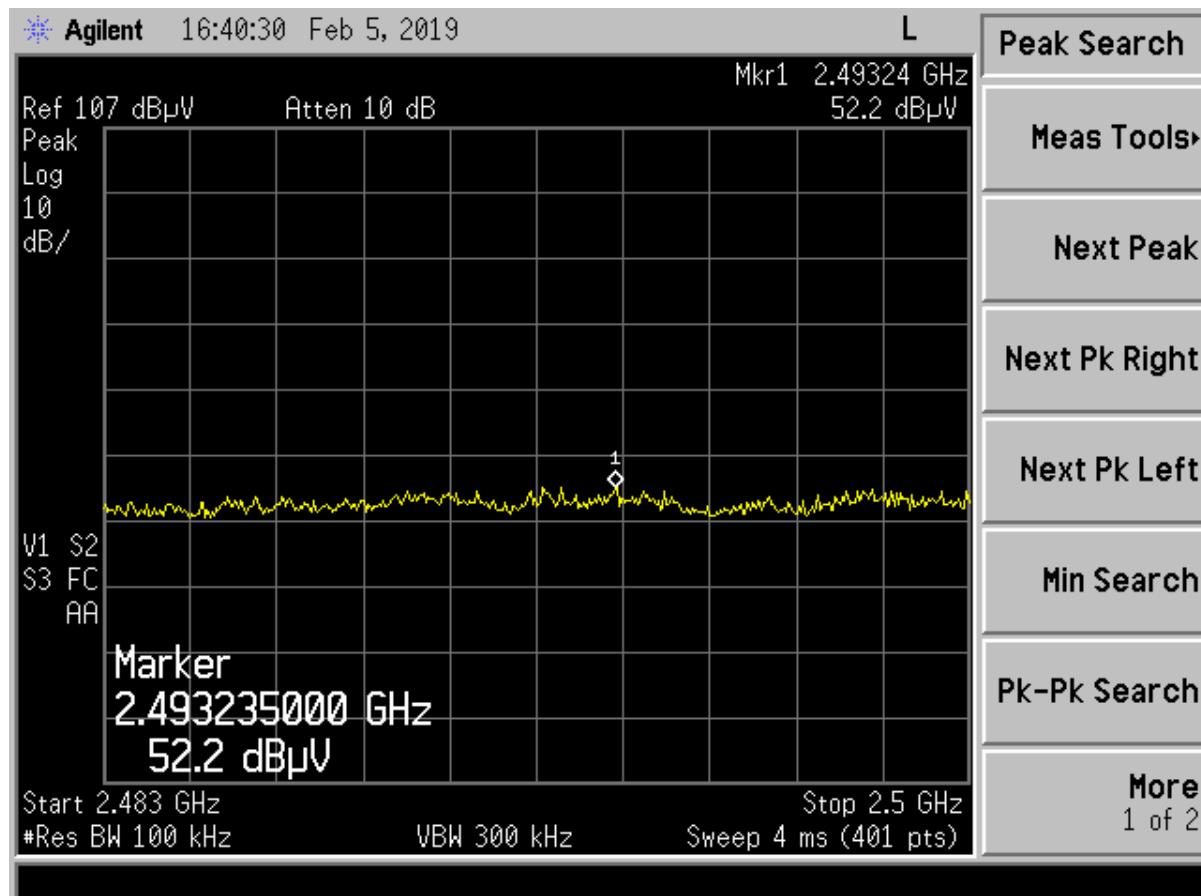


Figure 55. B Mode High Channel Restricted Band –Peak

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
2493.24	52.20	-1.63	50.57	74.0	3.0m./HORZ	23.4	PK

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Issue Date:
Customer:
Model:

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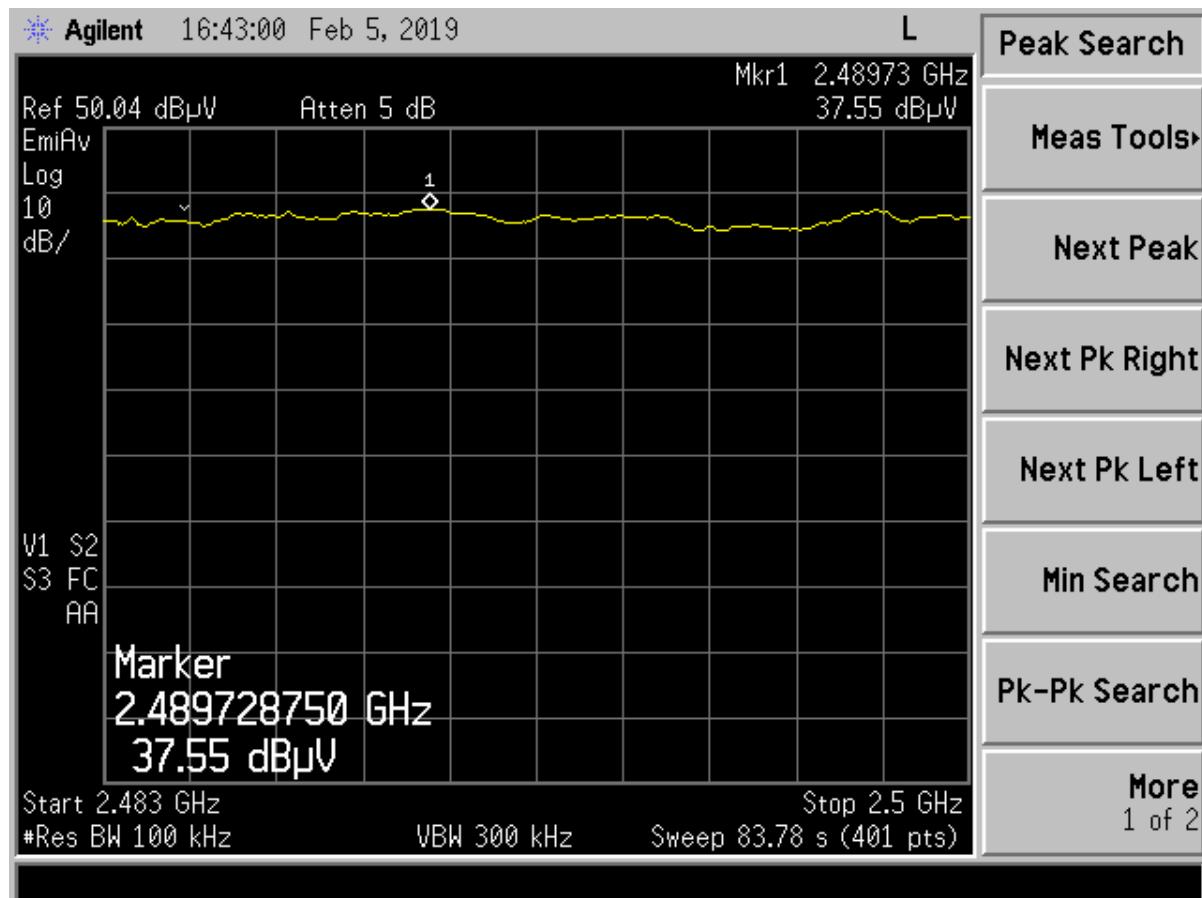


Figure 56. B Mode High Channel Restricted Band –Average

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
2489.73	37.55	-1.63	35.92	54.0	3.0m./HORZ	18.1	AVG

US Tech Test Report:
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Test Report Number:
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Customer:
Model:

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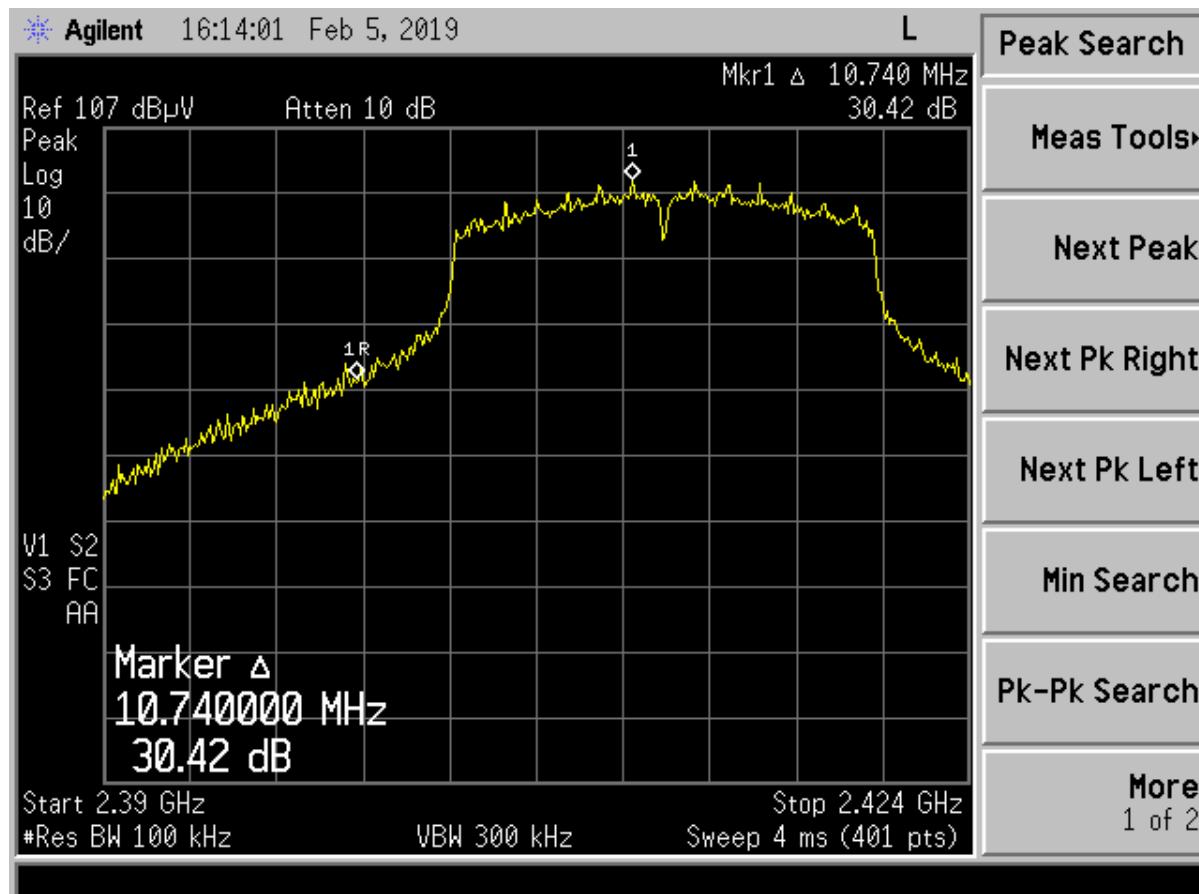


Figure 57. Band Edge Compliance – G Mode Low Channel Delta – Peak

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

Measured Result	30.42	dB
Band Edge Limit	20.00	dB
Band Edge Margin	10.42	dB

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Test Report Number:
Issue Date:
Customer:
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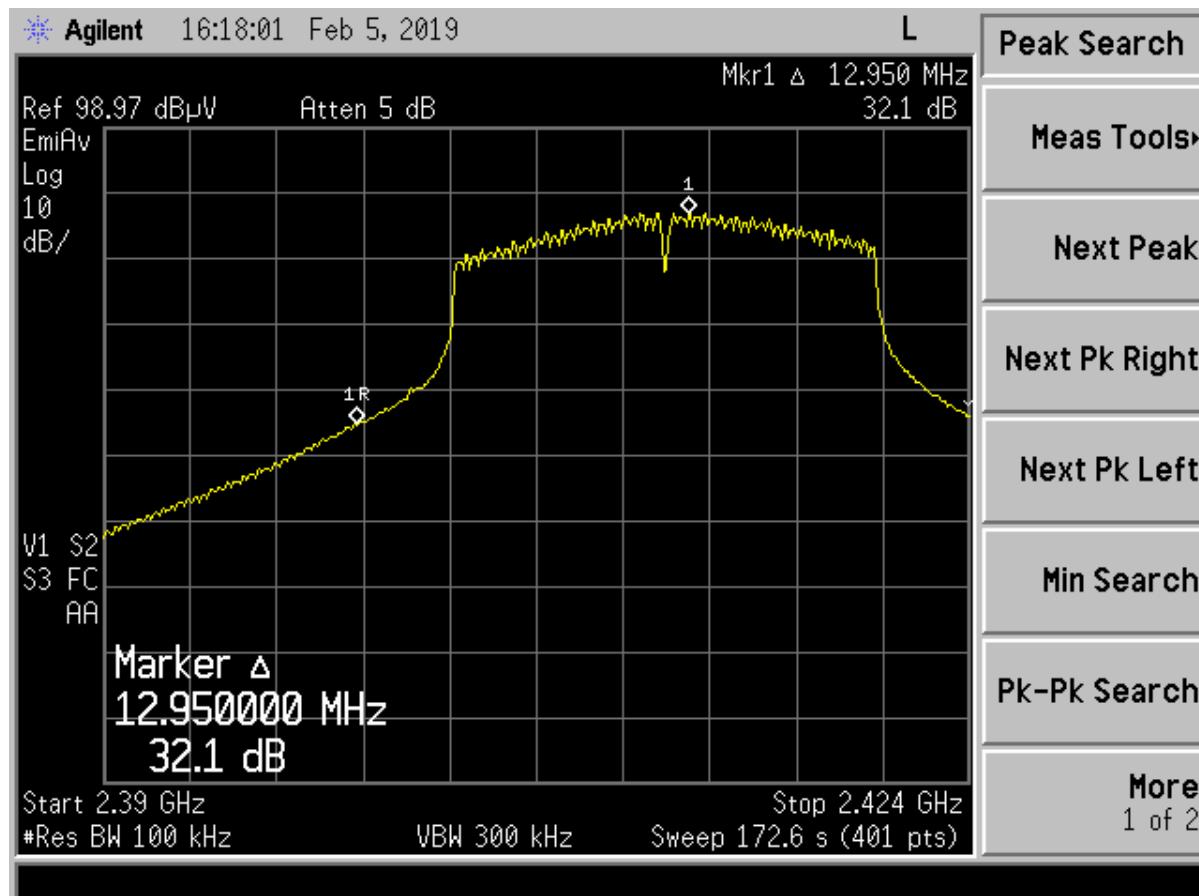


Figure 58. Band Edge Compliance – G Mode Low Channel Delta –Average

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

Measured Result	32.10	dB
Band Edge Limit	20.00	dB
Band Edge Margin	12.10	dB

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

FCC Part 15/IC RSS Certification
USKRM-10002705
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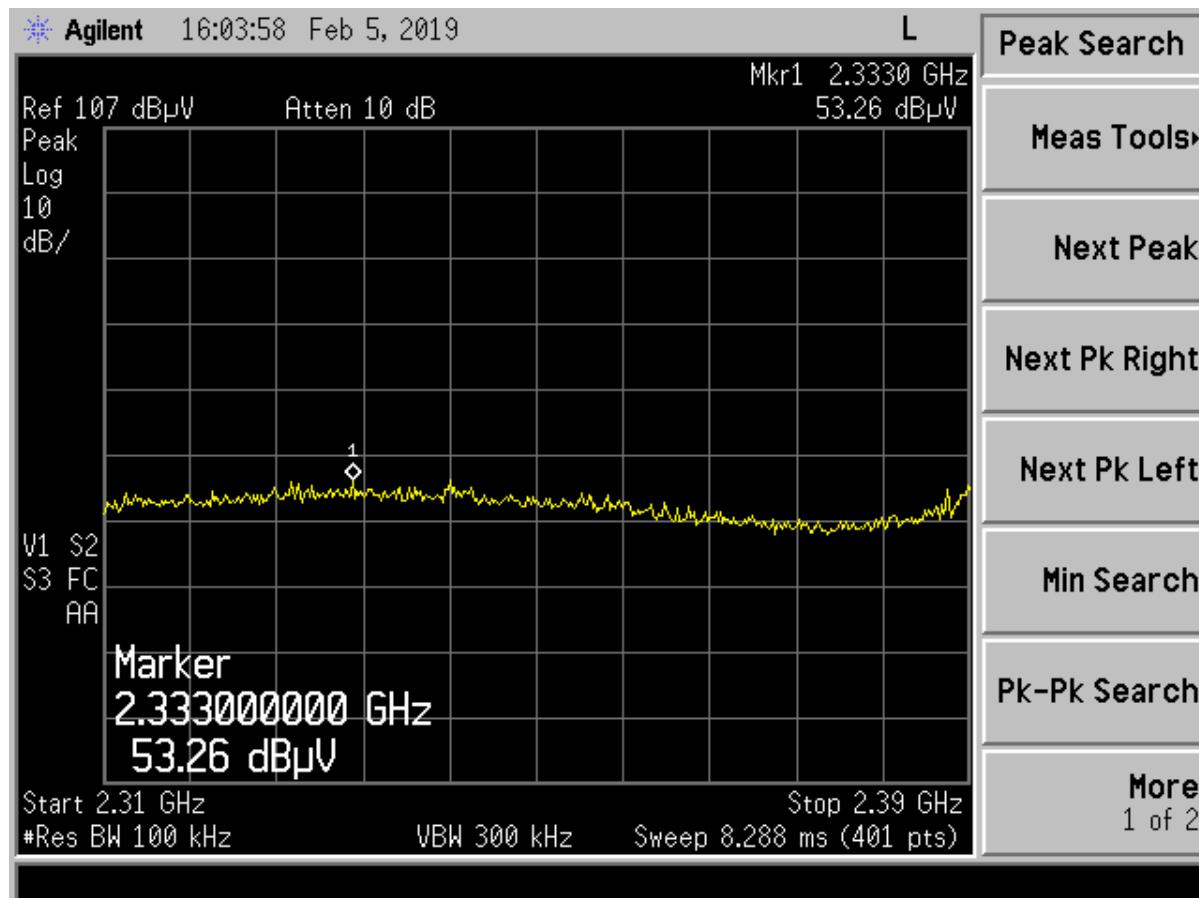


Figure 59. G Mode Low Channel Restricted Band – Peak

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
2330.00	53.26	-2.93	50.63	74.0	3.0m./HORZ	23.4	PK

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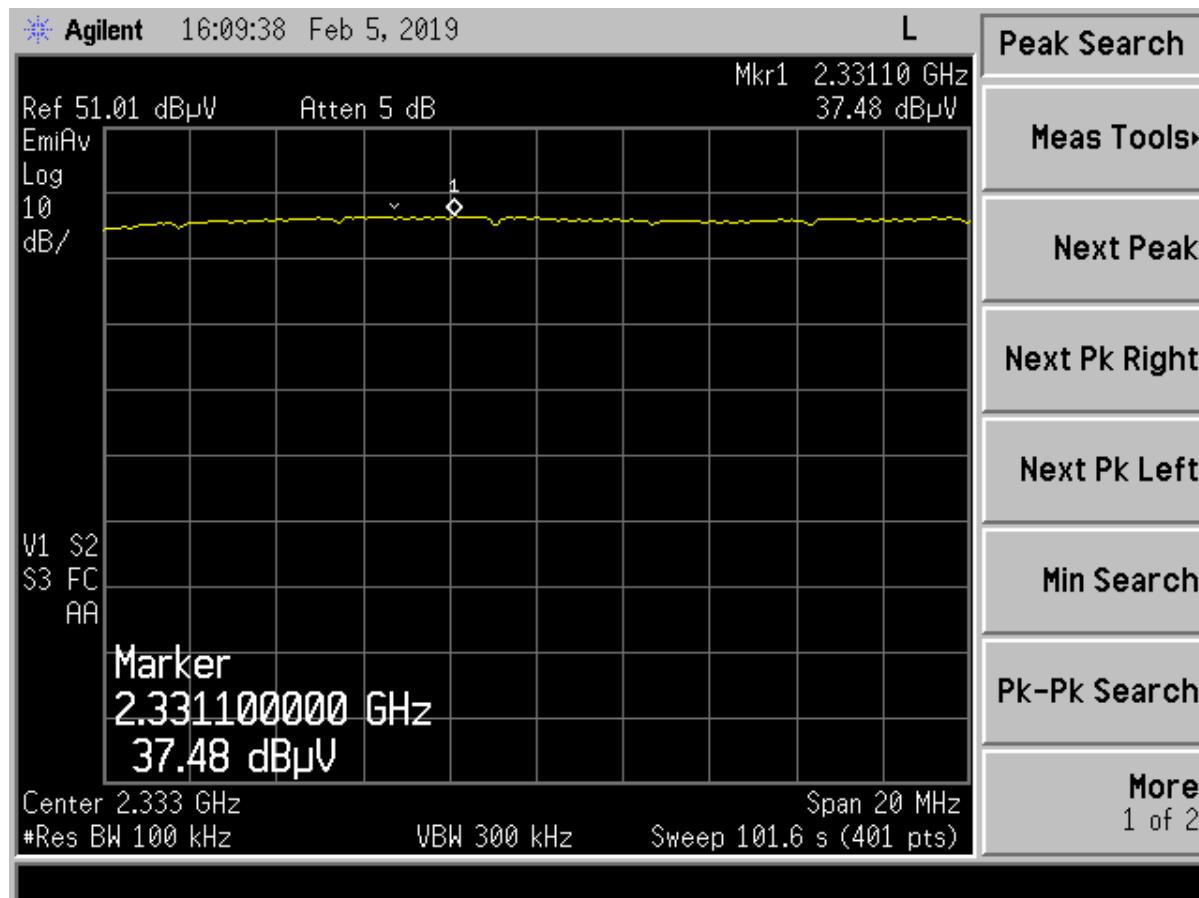


Figure 60. G Mode Low Channel Restricted Band – Average

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
2331.10	37.48	-2.93	34.85	54.0	3.0m./HORZ	19.1	AVG

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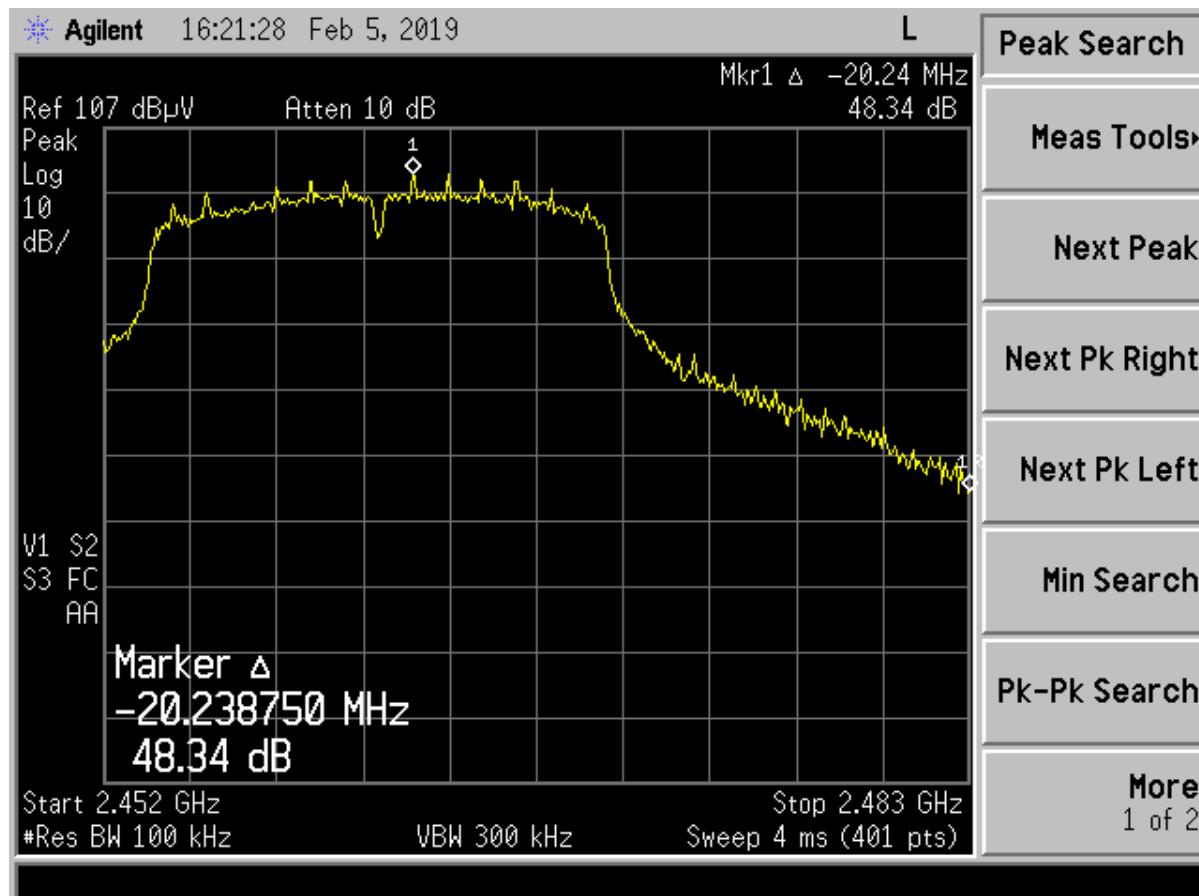


Figure 61. Band Edge Compliance – G Mode High Channel Delta – Peak

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

Measured Result	48.34	dB
Band Edge Limit	20.00	dB
Band Edge Margin	28.34	dB

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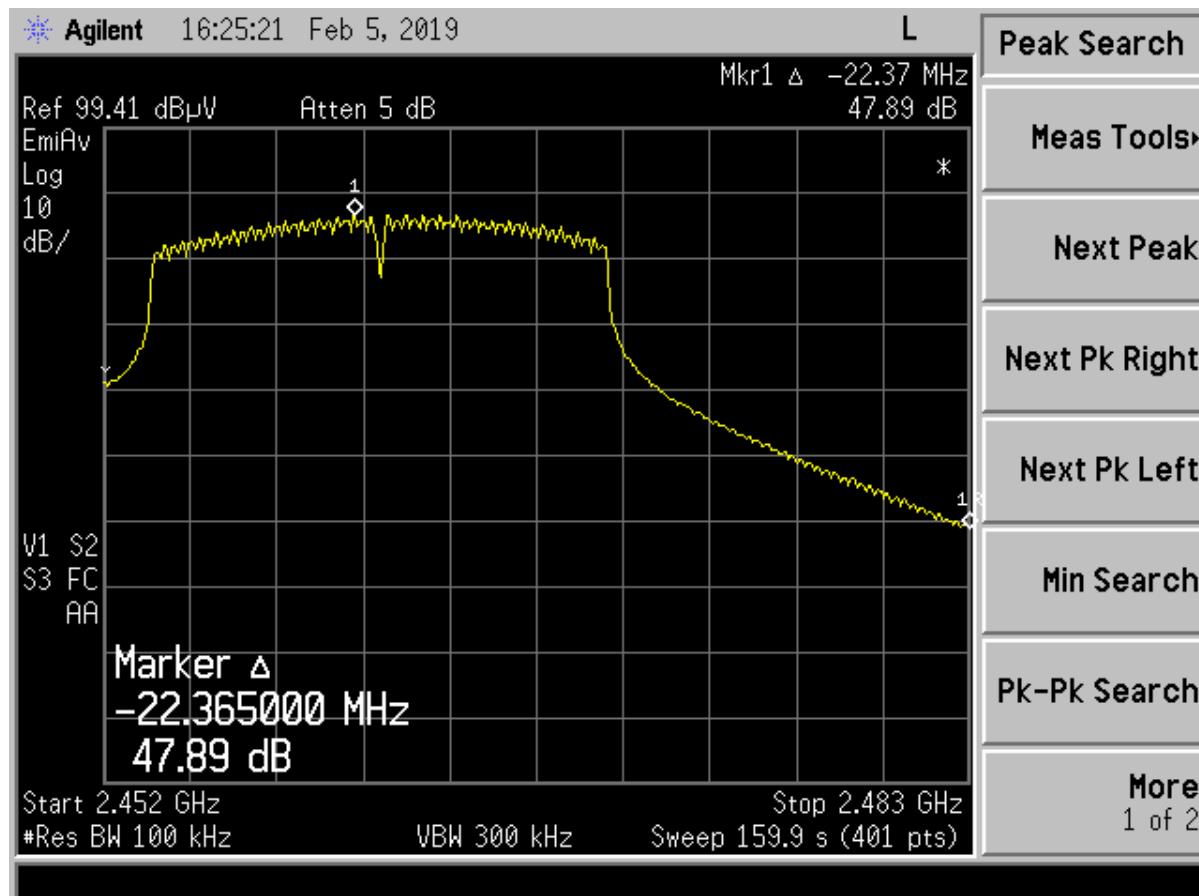


Figure 62. Band Edge Compliance – G Mode High Channel Delta – Average

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

Measured Result	47.89	dB
Band Edge Limit	20.00	dB
Band Edge Margin	27.89	dB

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Customer:
Model:

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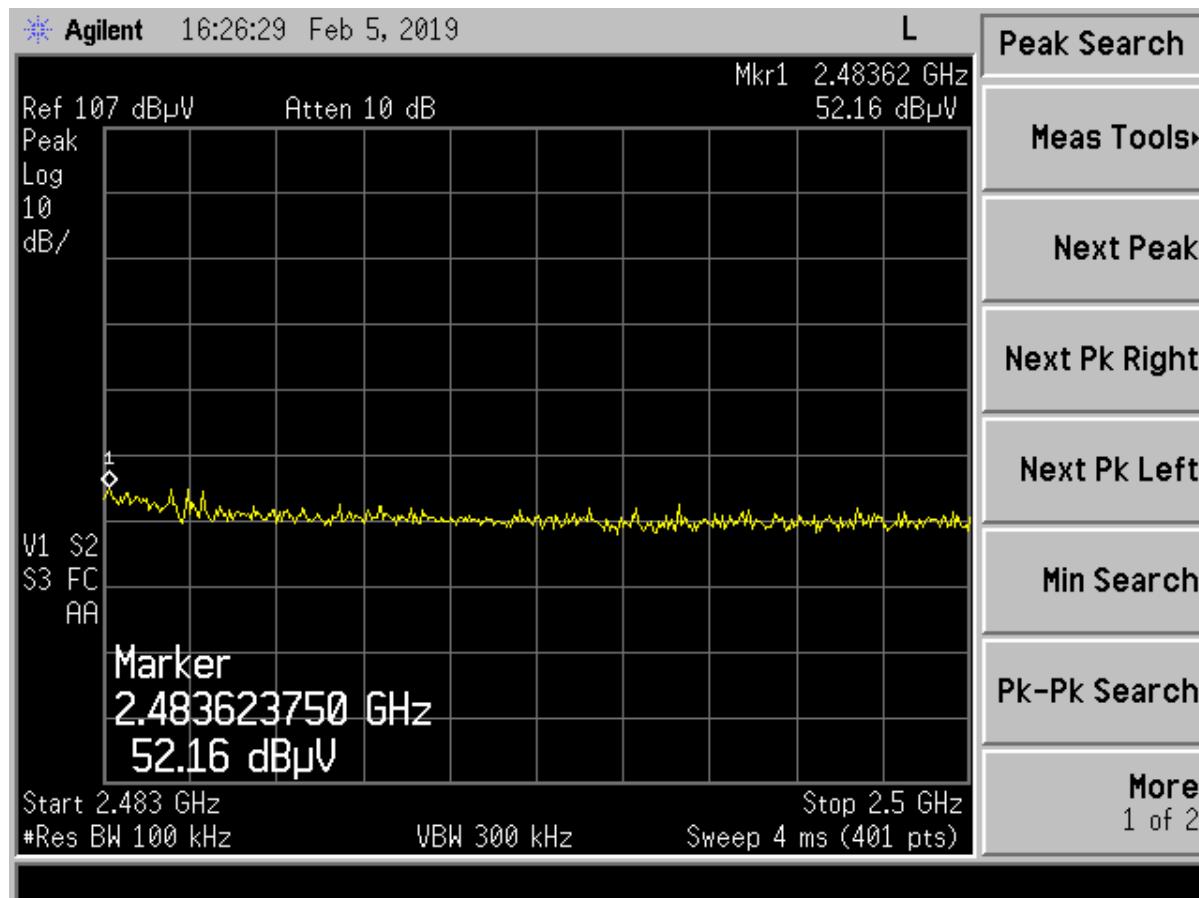


Figure 63. G Mode High Channel Restricted Band – Peak

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	52.16	-1,63	32.30	74.0	3.0m./HORZ	23.5	PK

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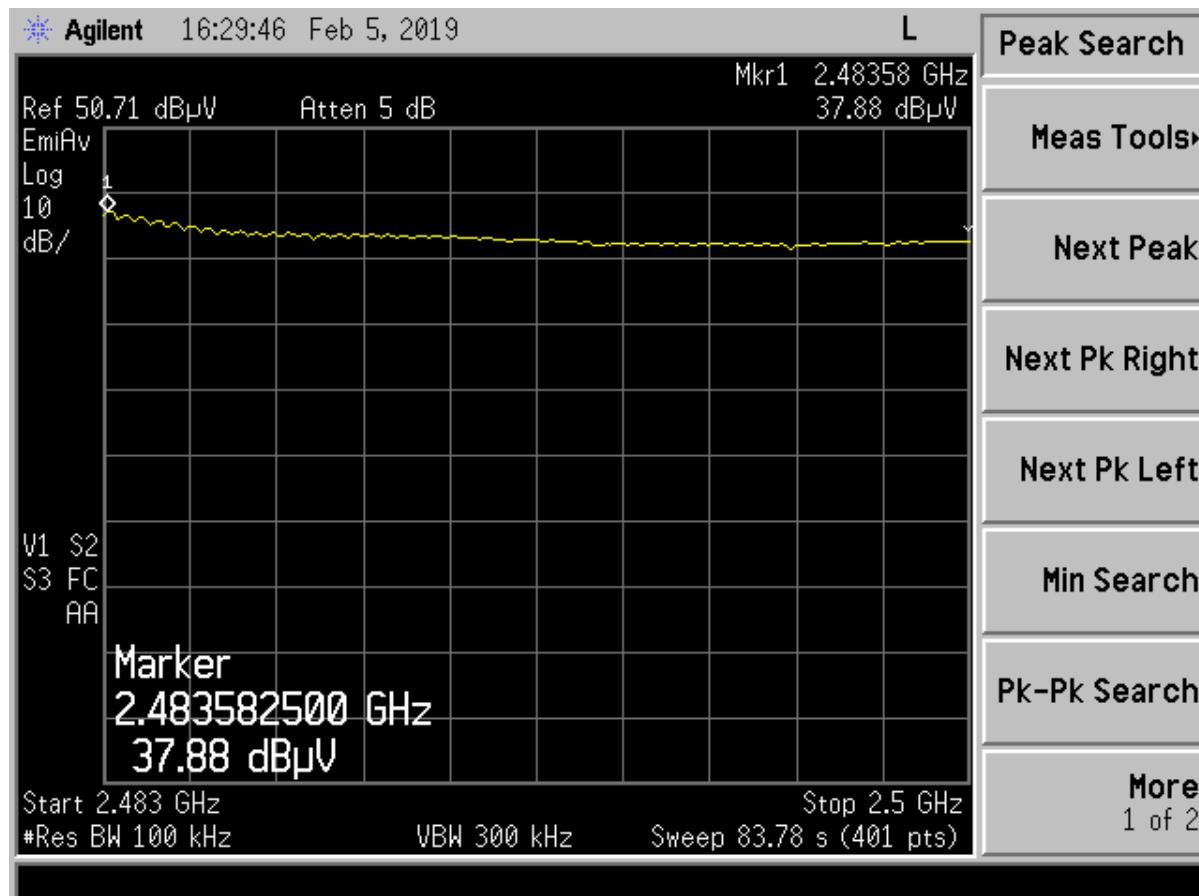


Figure 64. G Mode High Channel Restricted Band – Average

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
2483.58	37.88	-1.63	36.25	54.0	3.0m./HORZ	17.7	AVG

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RM-10002705

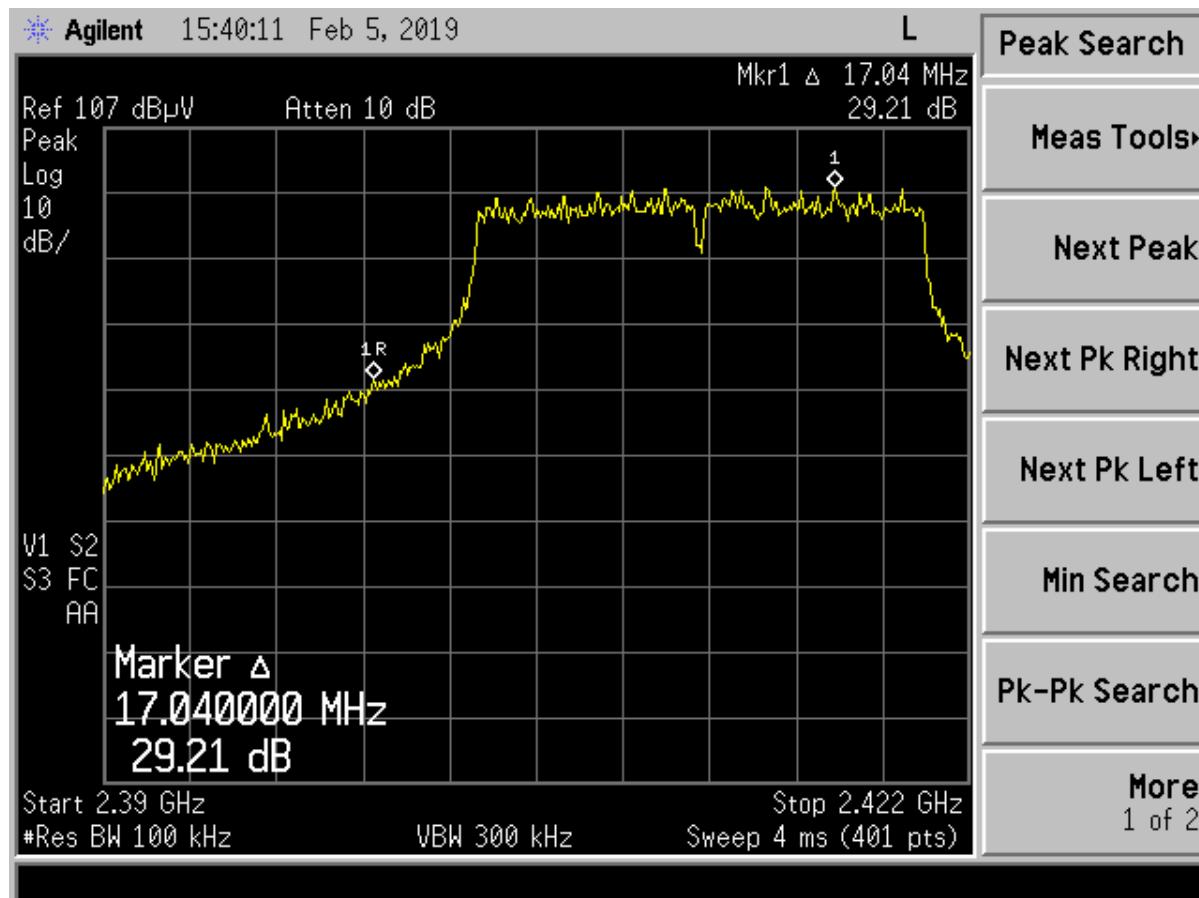


Figure 65. Band Edge Compliance – N Mode Low Channel Delta – Peak

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

Measured Result	29.21	dB
Band Edge Limit	20.00	dB
Band Edge Margin	9.21	dB

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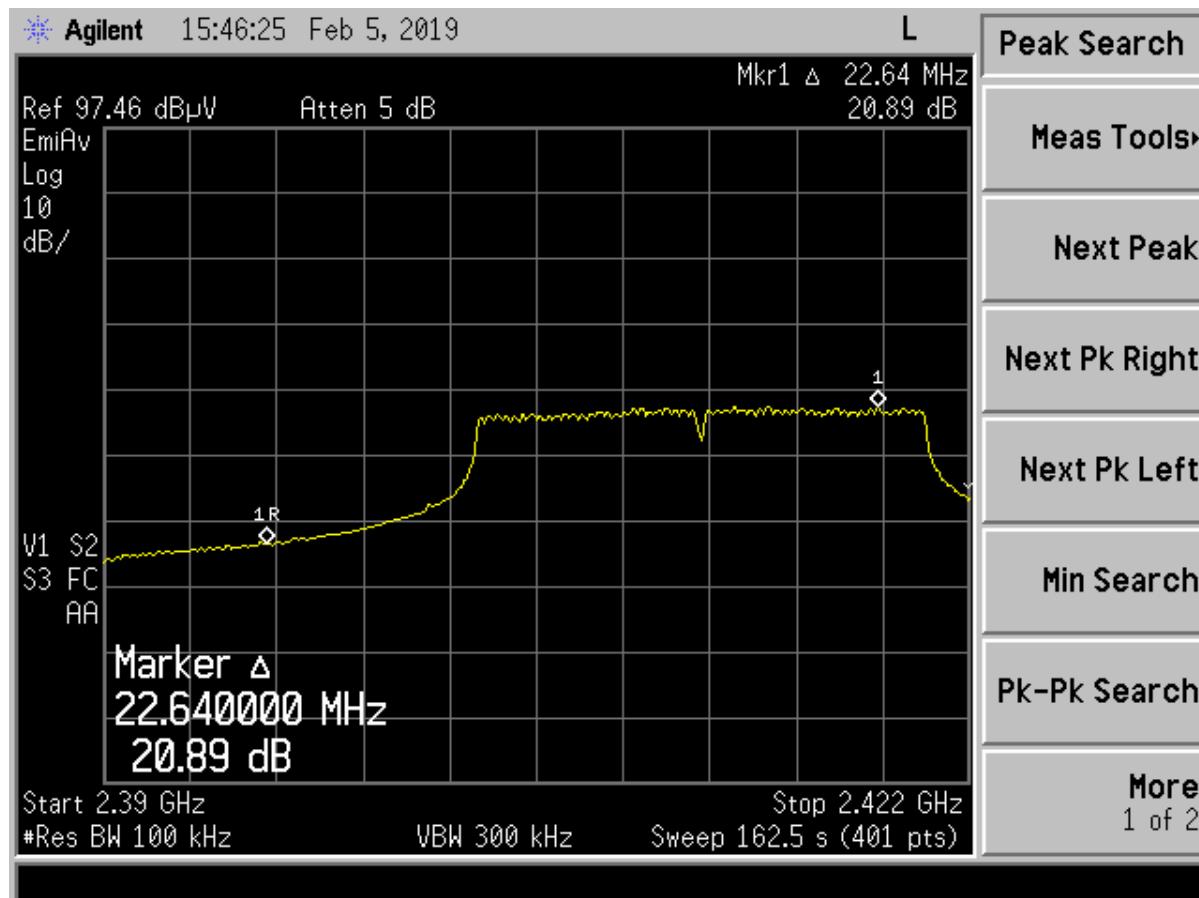


Figure 66. Band Edge Compliance – N Mode Low Channel Delta –Average

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

Measured Result	20.89	dB
Band Edge Limit	20.00	dB
Band Edge Margin	0.89	dB

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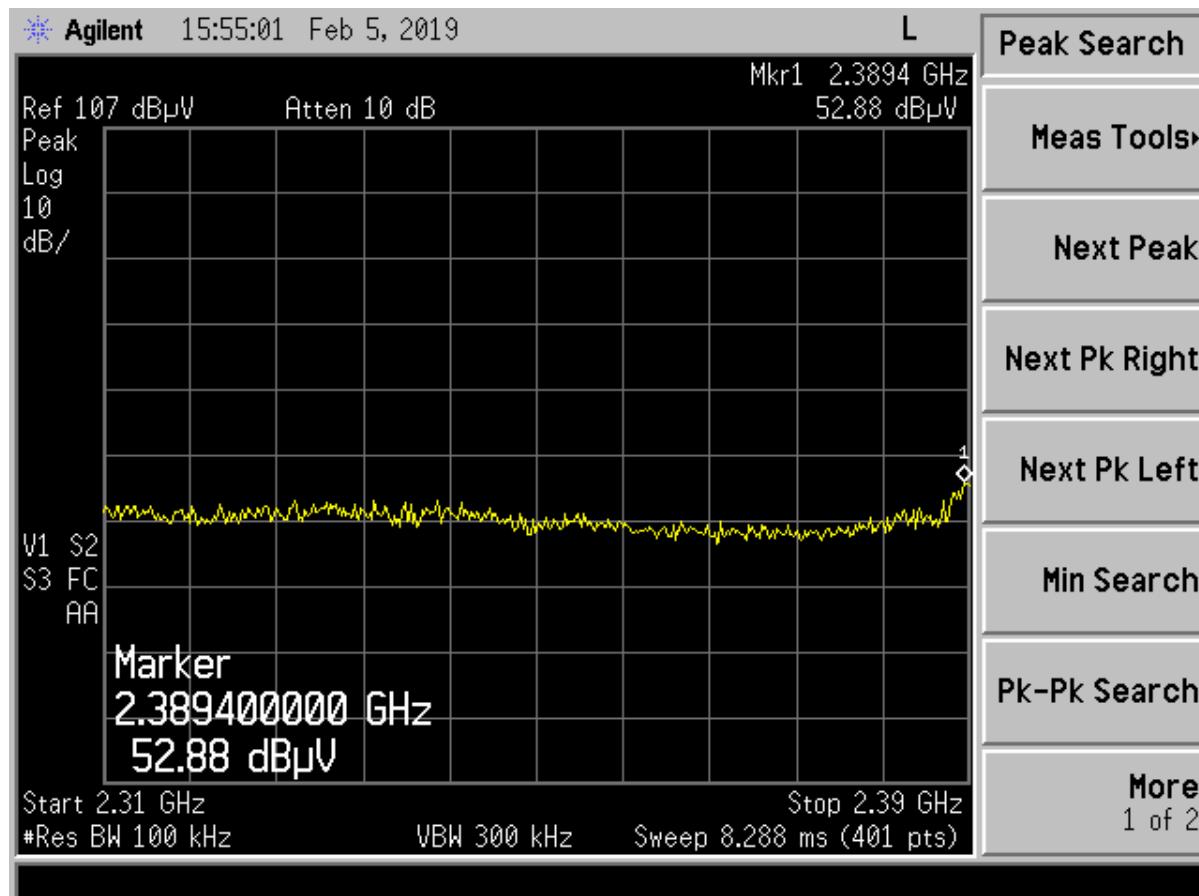


Figure 67. N Mode Low Channel Restricted Band – Peak

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	52.88	-2.93	49.95	74.0	3.0m./HORZ	24.0	PK

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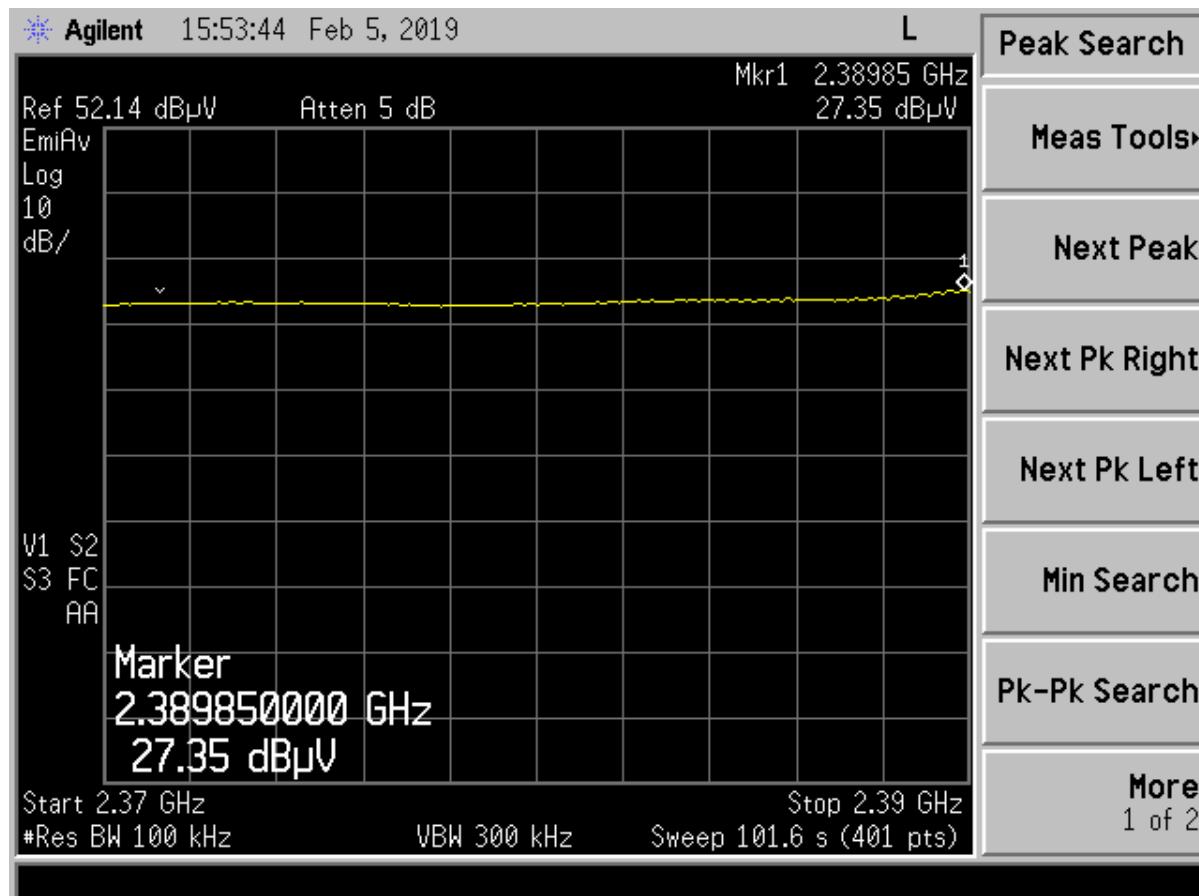


Figure 68. N Mode Low Channel Restricted Band – Average

Frequency (MHz)	Test Data (dBµV)	AF+CA-AMP+DC (dB/m)	Results (dBµV/m)	Limits (dBµV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2389.85	27.35	-2.93	24.42	54.0	3.0m./HORZ	29.6	AVG

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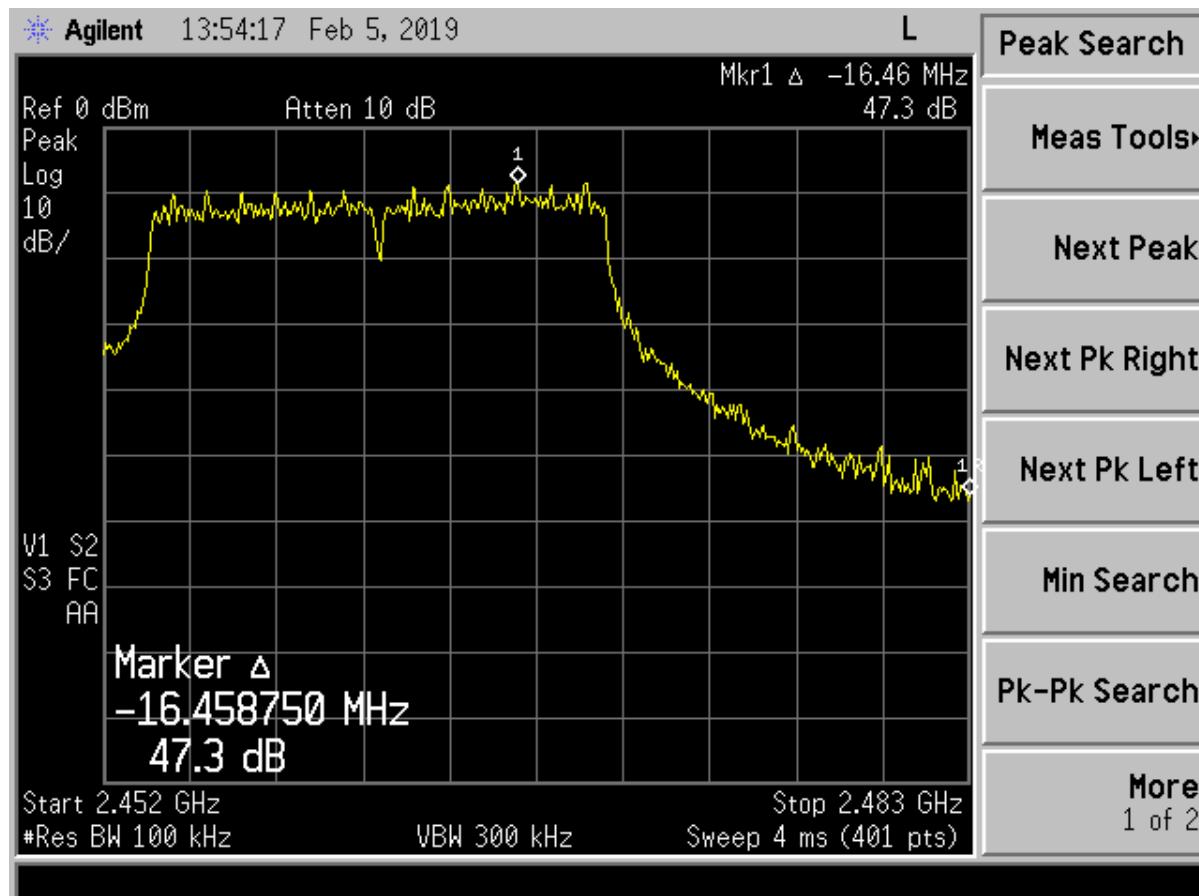


Figure 69. Band Edge Compliance – N Mode High Channel Delta – Peak

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

Measured Result	47.30	dB
Band Edge Limit	20.00	dB
Band Edge Margin	27.30	dB

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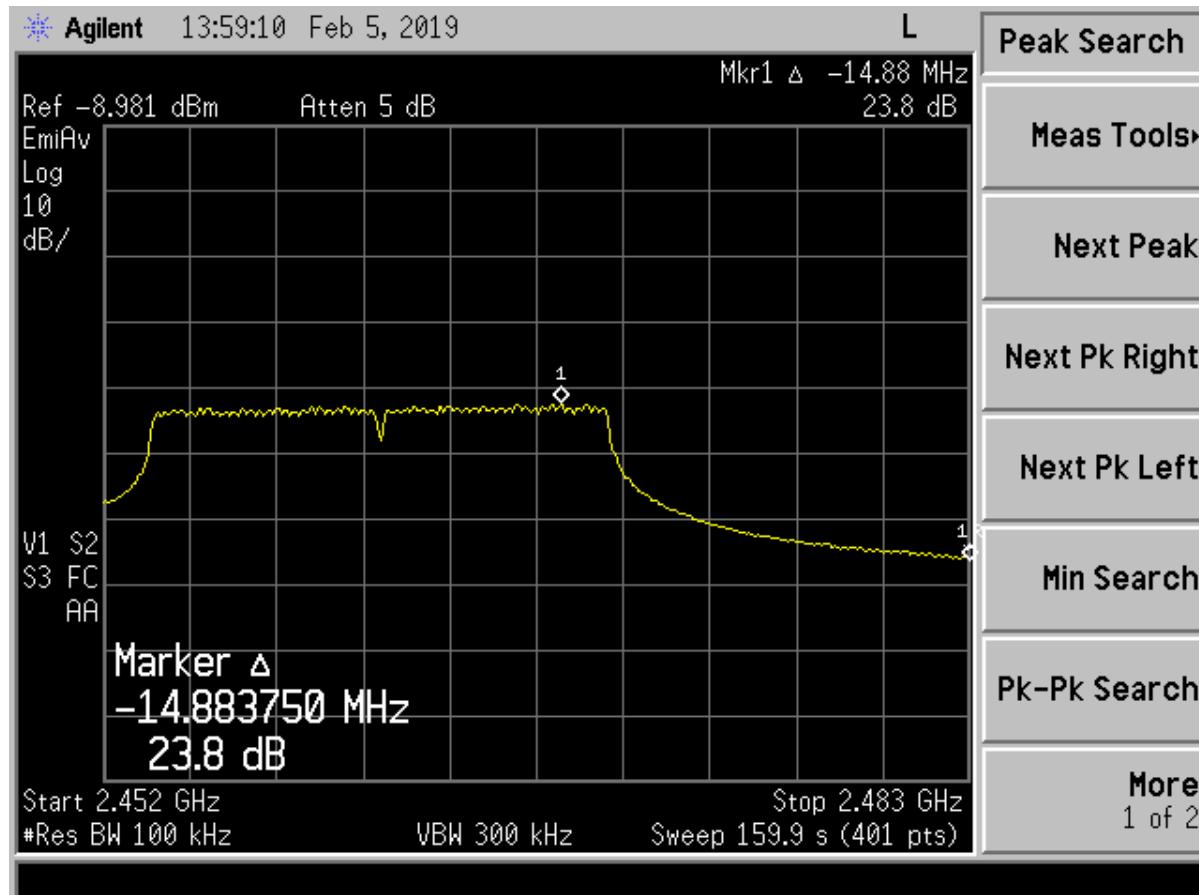


Figure 70. Band Edge Compliance – N Mode High Channel Delta - Average

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

Measured Result	23.80	dB
Band Edge Limit	20.00	dB
Band Edge Margin	3.80	dB

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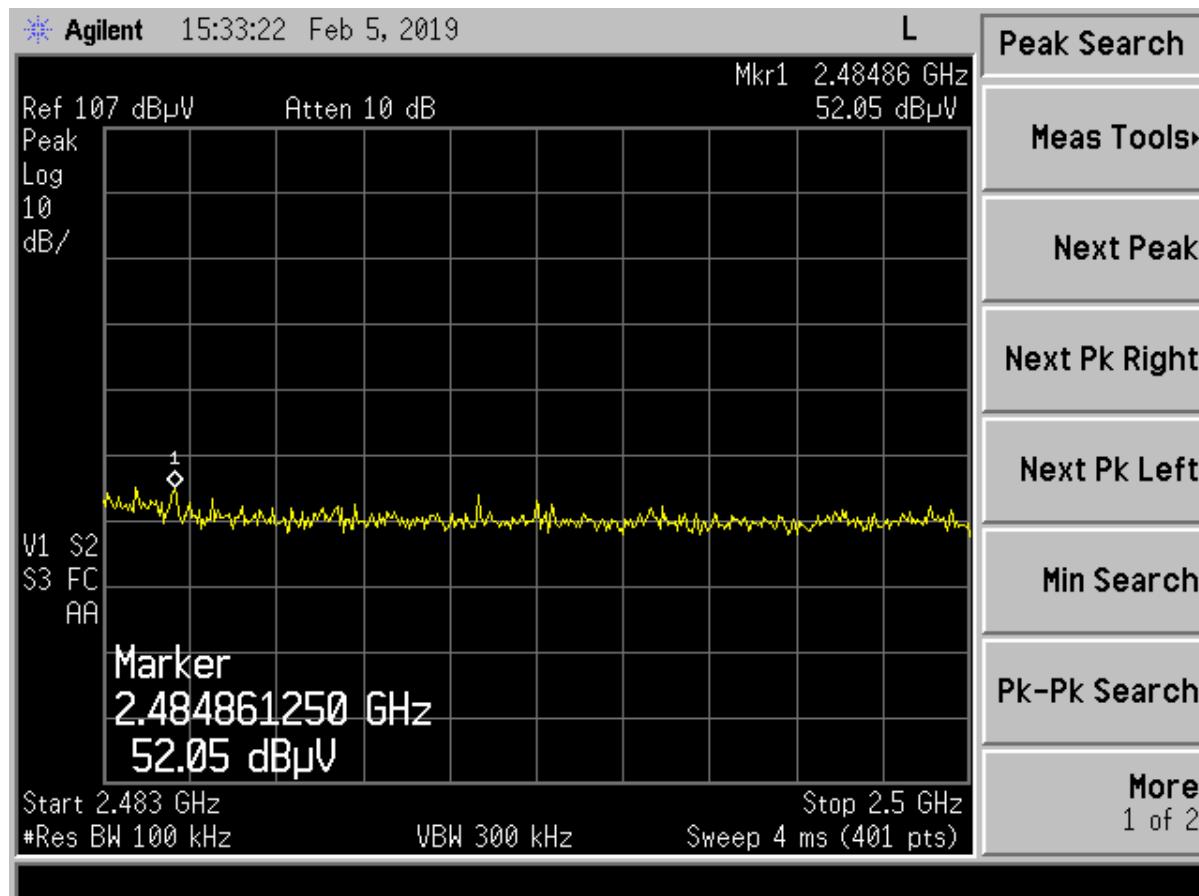


Figure 71. N Mode High Channel Restricted Band – Peak

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
2484.86	52.05	-1,63	50.42	74.0	3.0m./HORZ	23.6	PK

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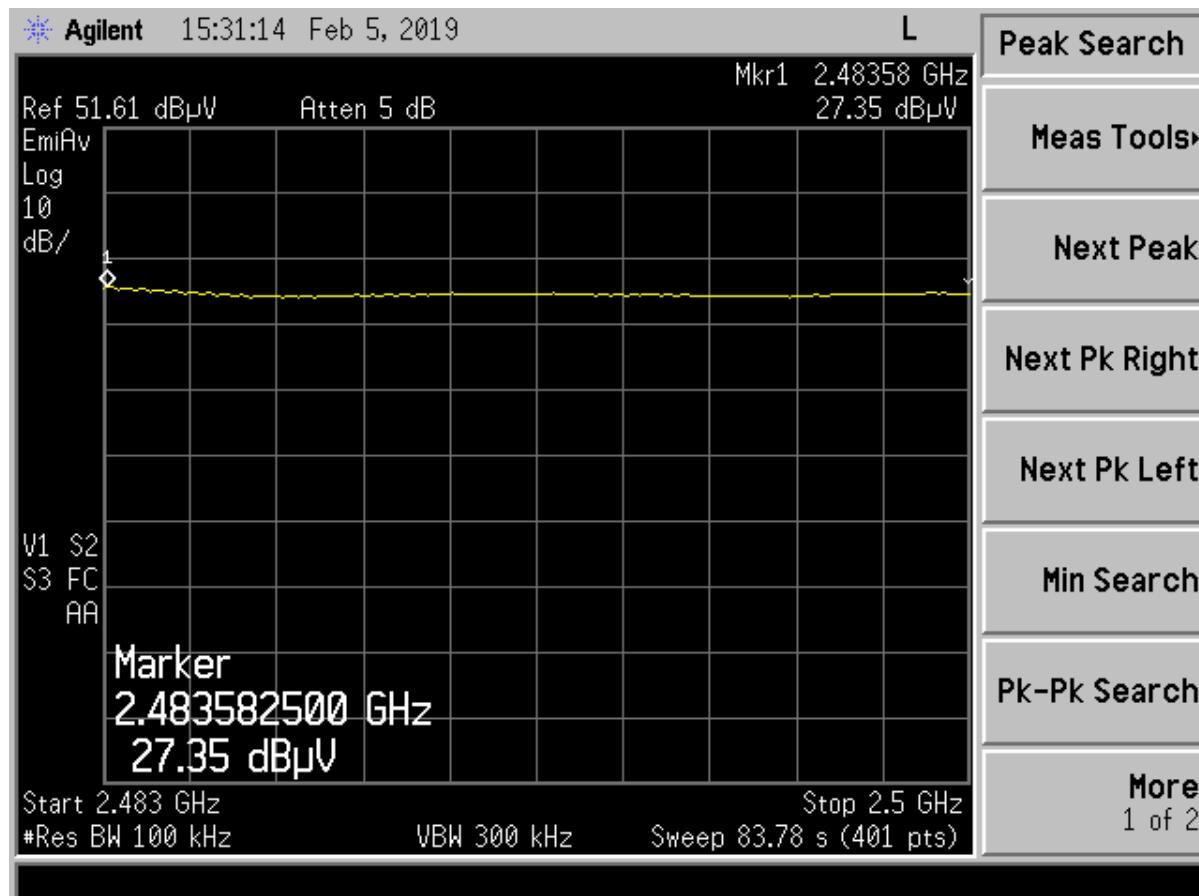


Figure 72. N Mode High Channel Restricted Band – Average

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
2483.58	27.35	-1.63	25.72	54.0	3.0m./HORZ	28.3	AVG

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Issue Date:	February 6, 2019
Customer:	Matrix
Model:	RM-10002705

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

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

Table 11. Six (6) dB Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)	Mode
2412	9.100	0.5	b
2437	9.078	0.5	b
2462	9.101	0.5	b
2412	15.076	0.5	g
2437	15.623	0.5	g
2462	14.679	0.5	g
2412	16.439	0.5	n
2437	16.458	0.5	n
2462	16.476	0.5	n

Test Date: February 4, 2019

Tested By

Signature: Mark Afrozzi

Name: Mark Afrozzi

US Tech Test Report:
FCC ID:
IC:
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Customer:
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Figure 73. 6 dB Bandwidth b Mode Low Channel

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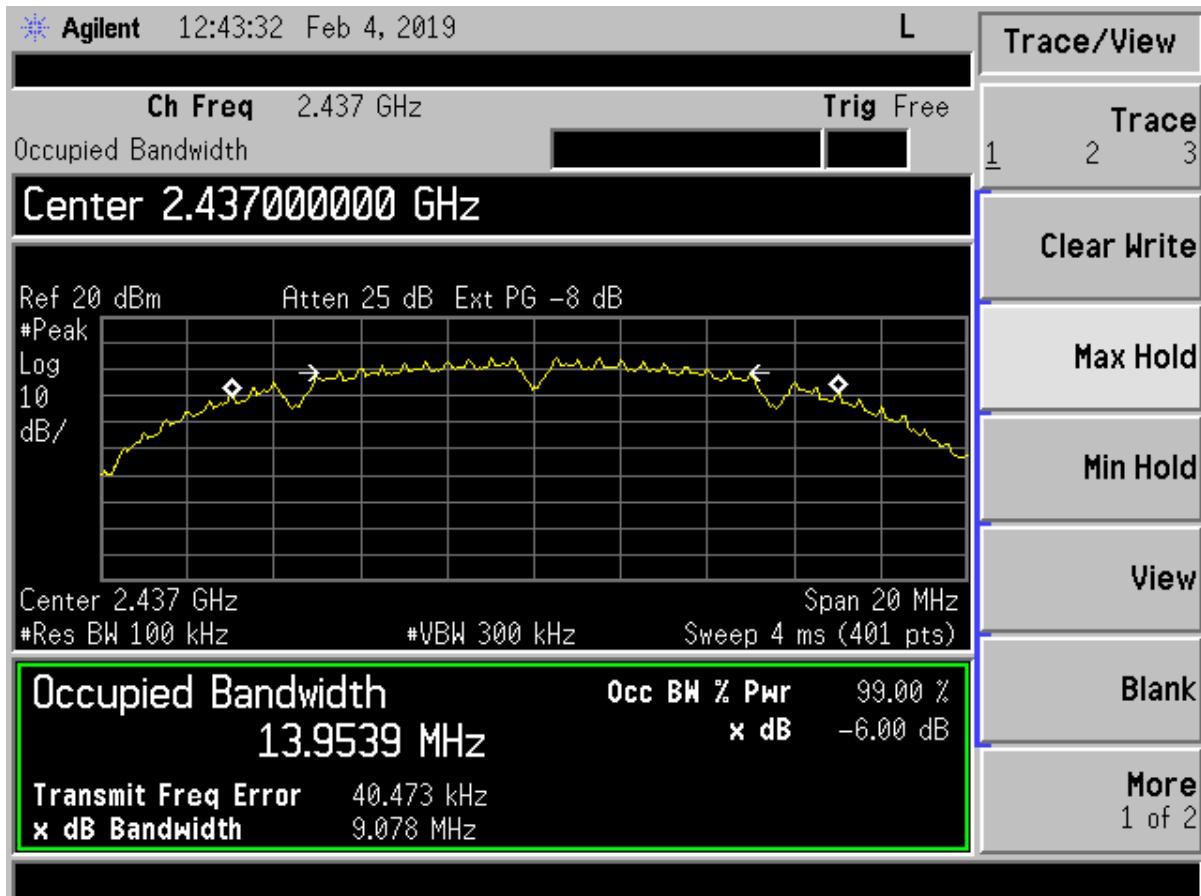


Figure 74. 6 dB Bandwidth b Mode Mid Channel

US Tech Test Report:
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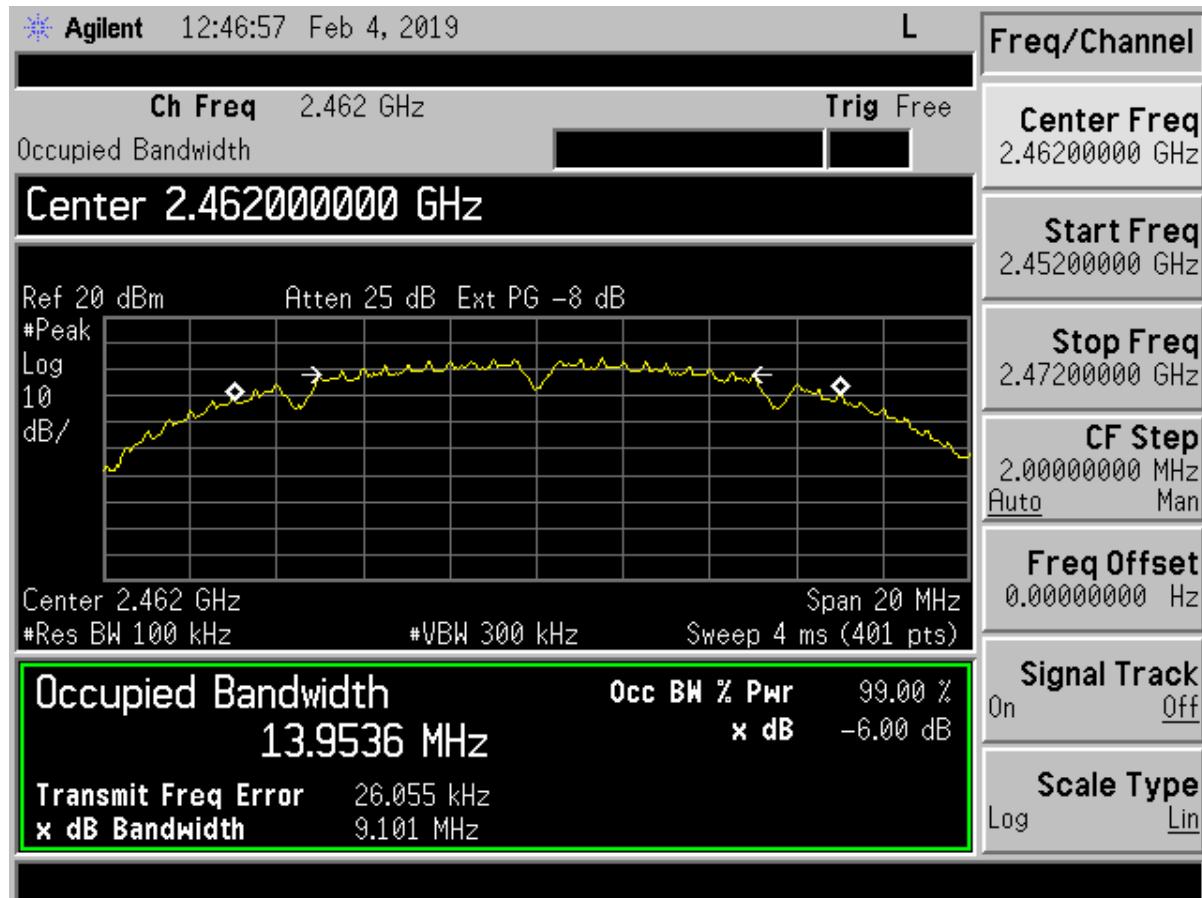


Figure 75. 6 dB Bandwidth b Mode High Channel

US Tech Test Report:
FCC ID:
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Model:

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RM-10002705

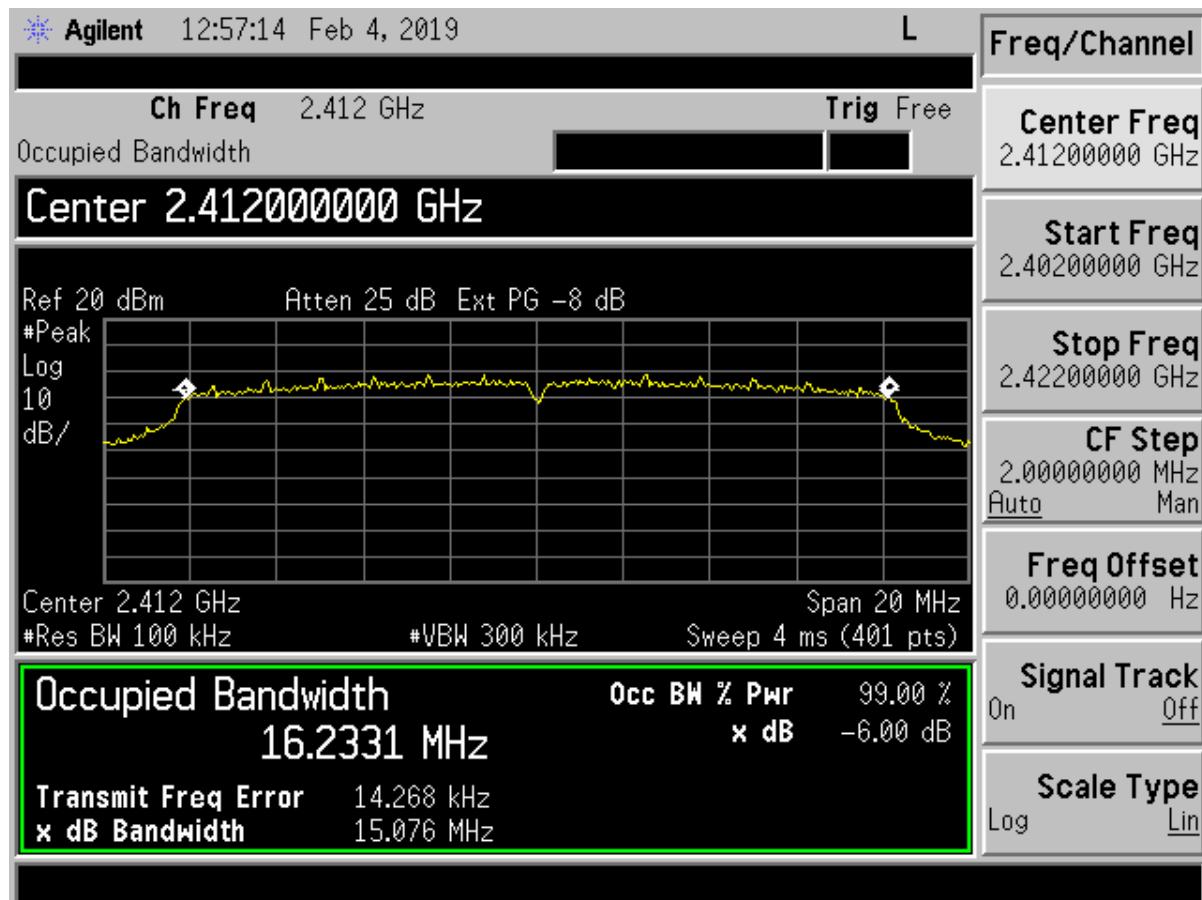


Figure 76. 6 dB Bandwidth g Mode Low Channel

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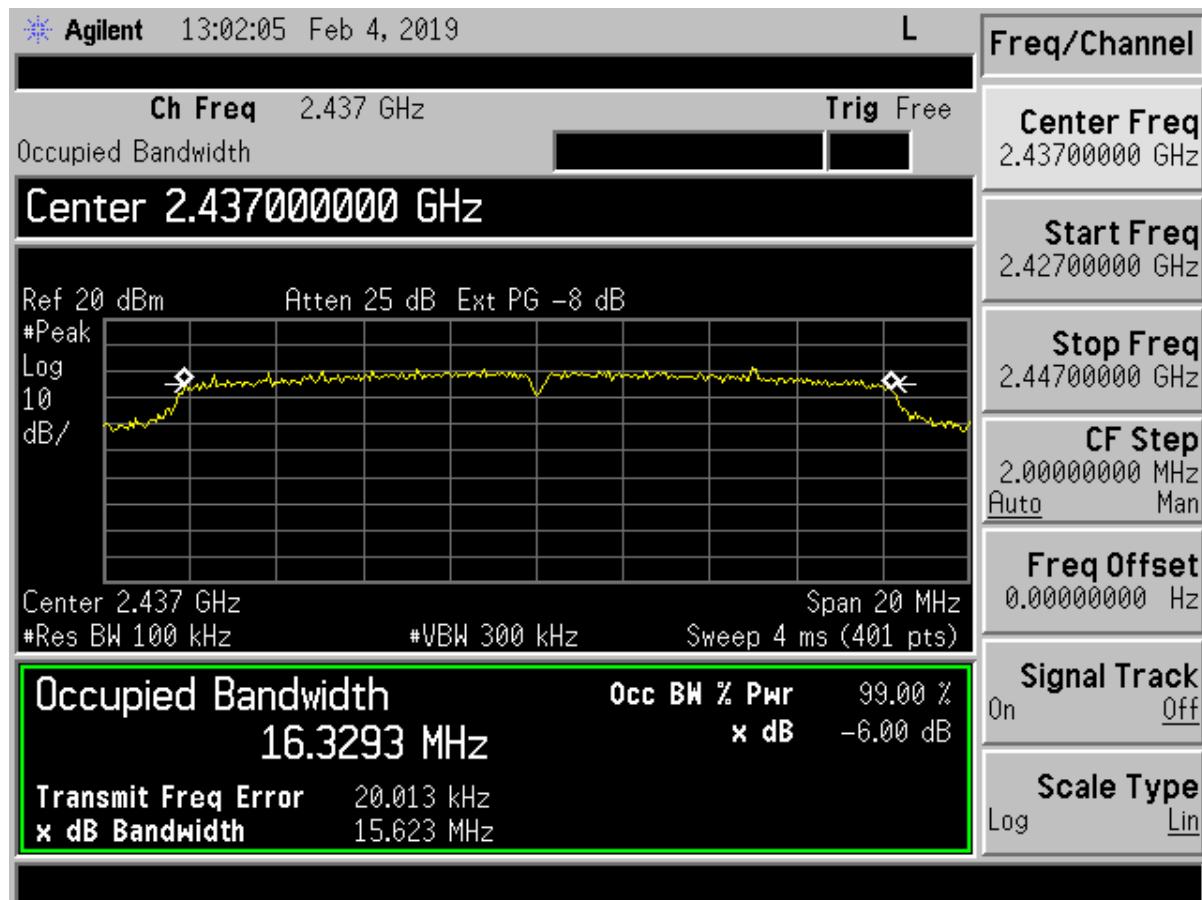


Figure 77. 6 dB Bandwidth g Mode Mid Channel

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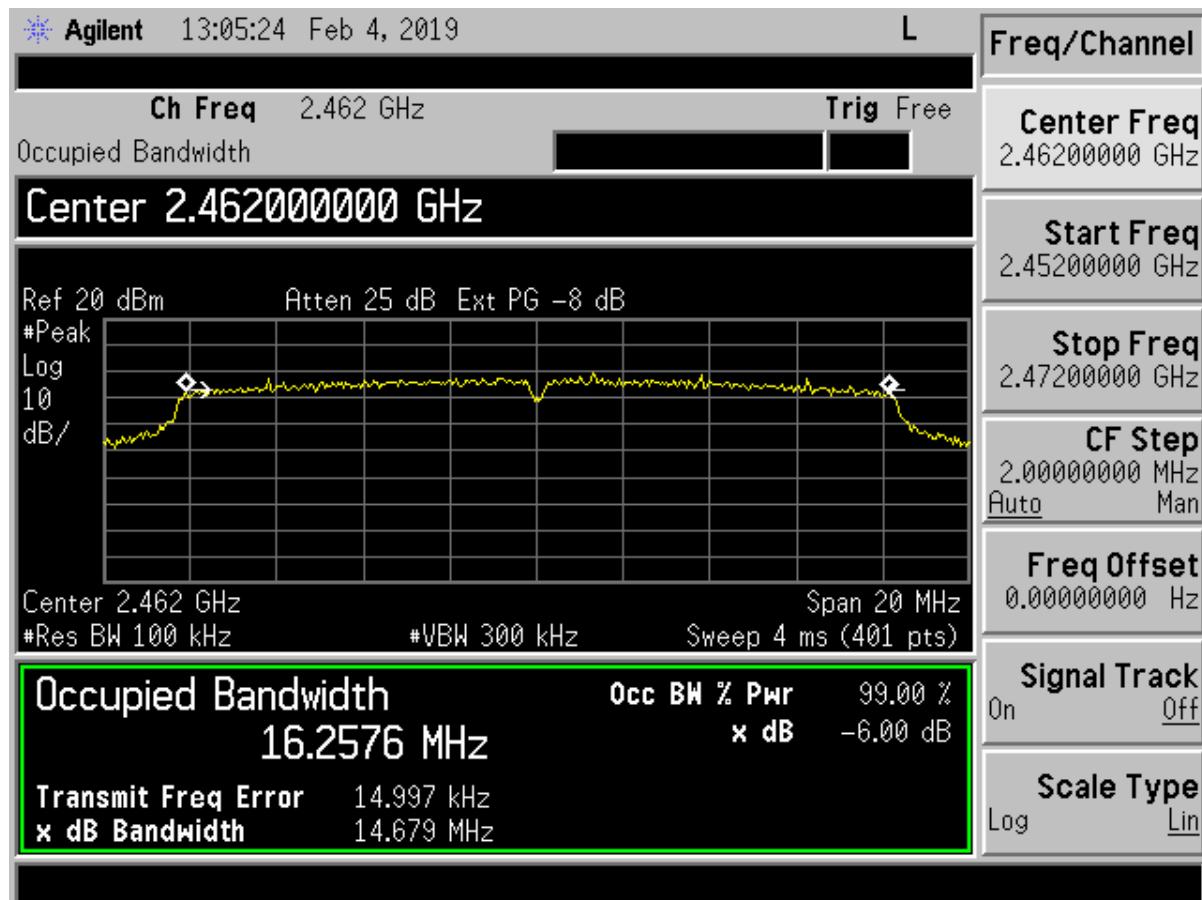


Figure 78. 6 dB Bandwidth g Mode High Channel

US Tech Test Report:
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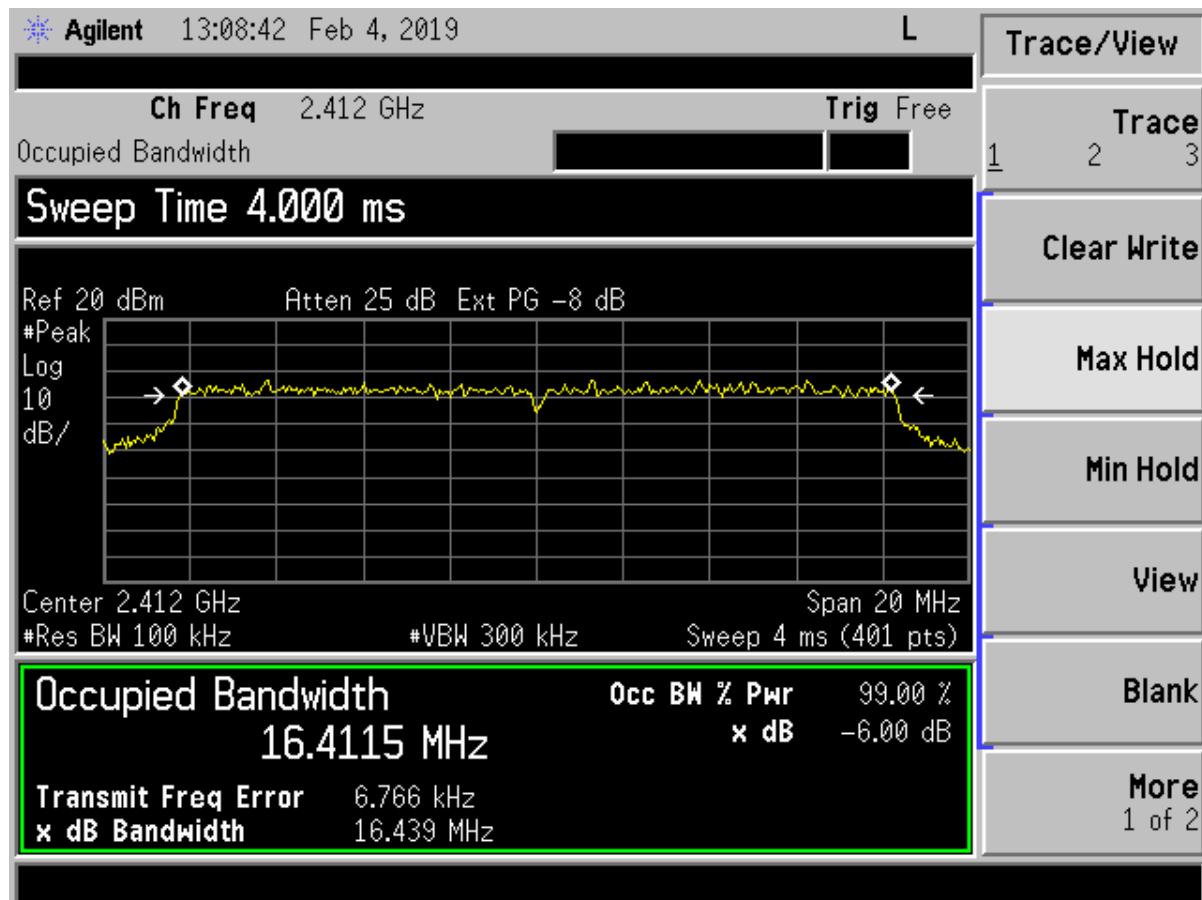


Figure 79. 6 dB Bandwidth n Mode Low Channel

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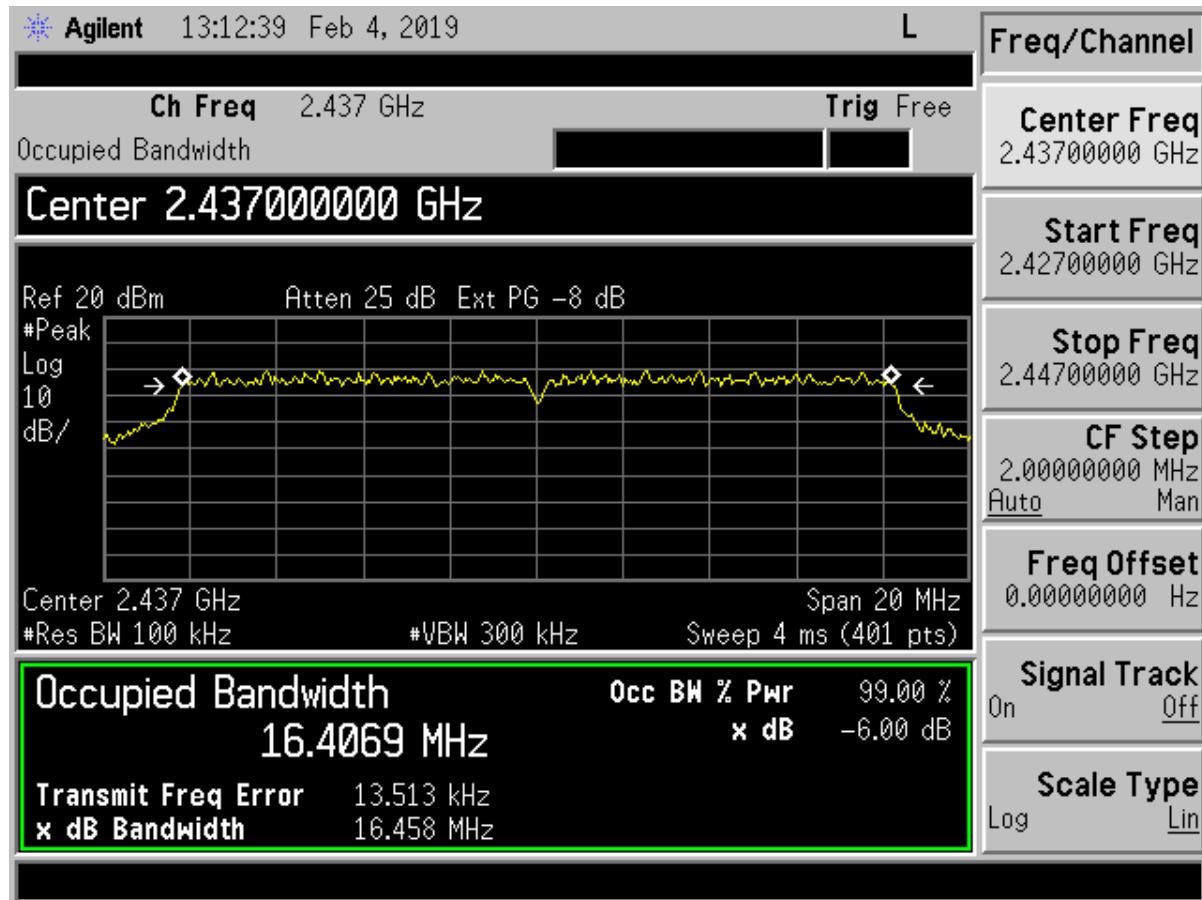


Figure 80. 6 dB Bandwidth n Mode Mid Channel

US Tech Test Report:
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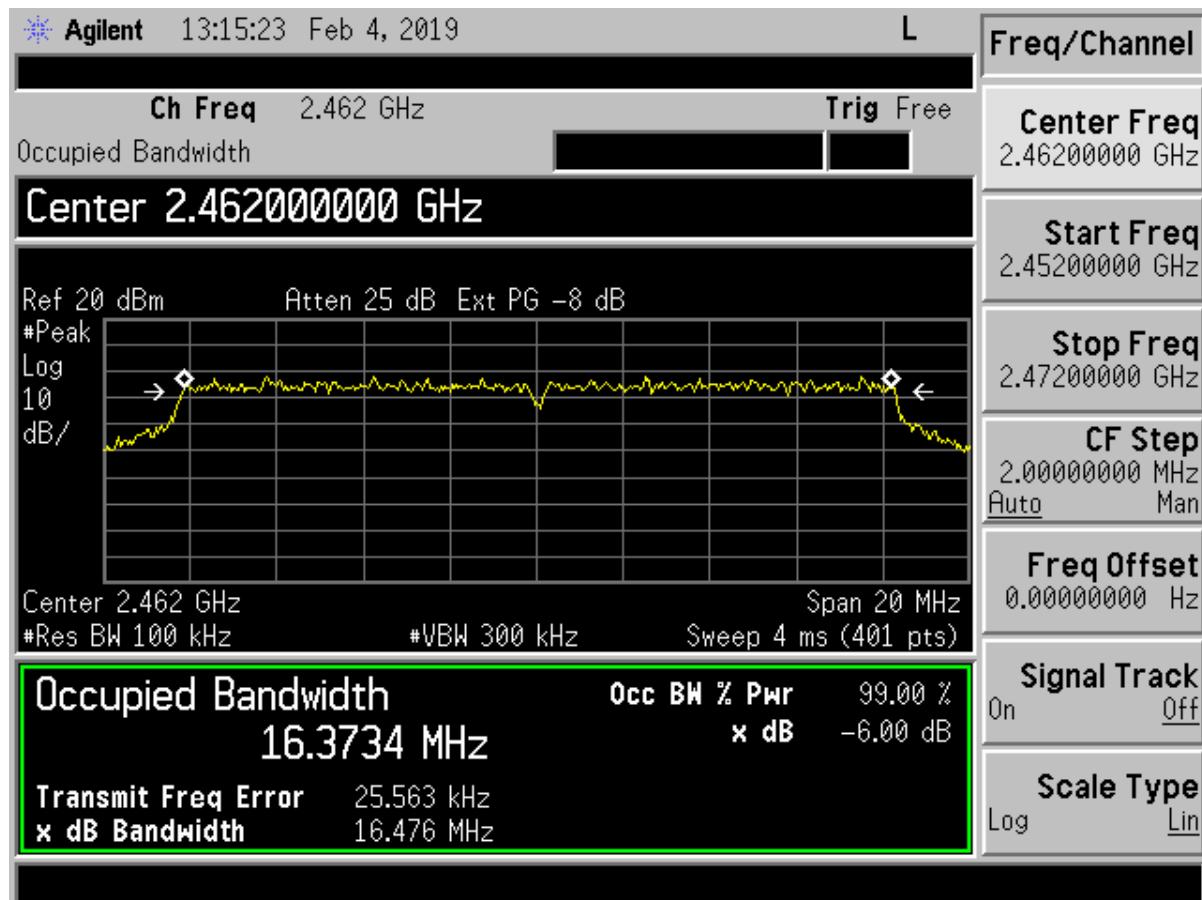


Figure 81. 6 dB Bandwidth n Mode High Channel

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

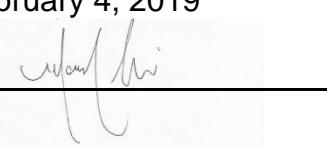
The EUT antenna port was connected to a spectrum analyzer having a 50Ω input impedance. Measurements were performed similar to the method of FCC, KDB Publication No. 558074 v05 for a bandwidth of 20 dB. The RBW was set to approximately 1/100 of the manufacturers claimed RBW and with the VBW \geq RBW. The results of this test are given in Table 17 and presented in the figures in section 2.12 above.

Table 12. 99% Occupied Bandwidth

Frequency (MHz)	99% Occupied Bandwidth (MHz)	Mode
2412	14.114	b
2437	14.103	b
2462	14.081	b
2412	16.887	g
2437	16.820	g
2462	16.886	g
2412	17.682	n
2437	17.768	n
2462	17.667	n

Test Date: February 4, 2019

Tested By

Signature: 

Name: Mark Afroosi

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

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

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 **20** see example script used: tx_80211b/g/n_start.bat 4343WA1 12(com#) 1(ch#) **20**(pwr#). This is the 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.

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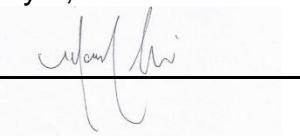
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Table 13. Peak Antenna Conducted Output Power per Part 15.247 (b)(3)

Frequency of Fundamental (MHz)	Raw Test Data dBm	Converted Data (mW)	FCC Limit (mW Maximum)	Mode
2412	14.26	26.70	1000	b
2437	16.01	39.90	1000	b
2462	15.29	33.80	1000	b
2412	14.24	26.50	1000	g
2437	18.61	72.60	1000	g
2462	15.63	36.60	1000	g
2412	8.33	6.80	1000	n
2437	11.83	15.20	1000	n
2462	10.69	11.70	1000	n

Test Date: February 4, 2019

Tested By

Signature: 

Name: Mark Afrooz

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

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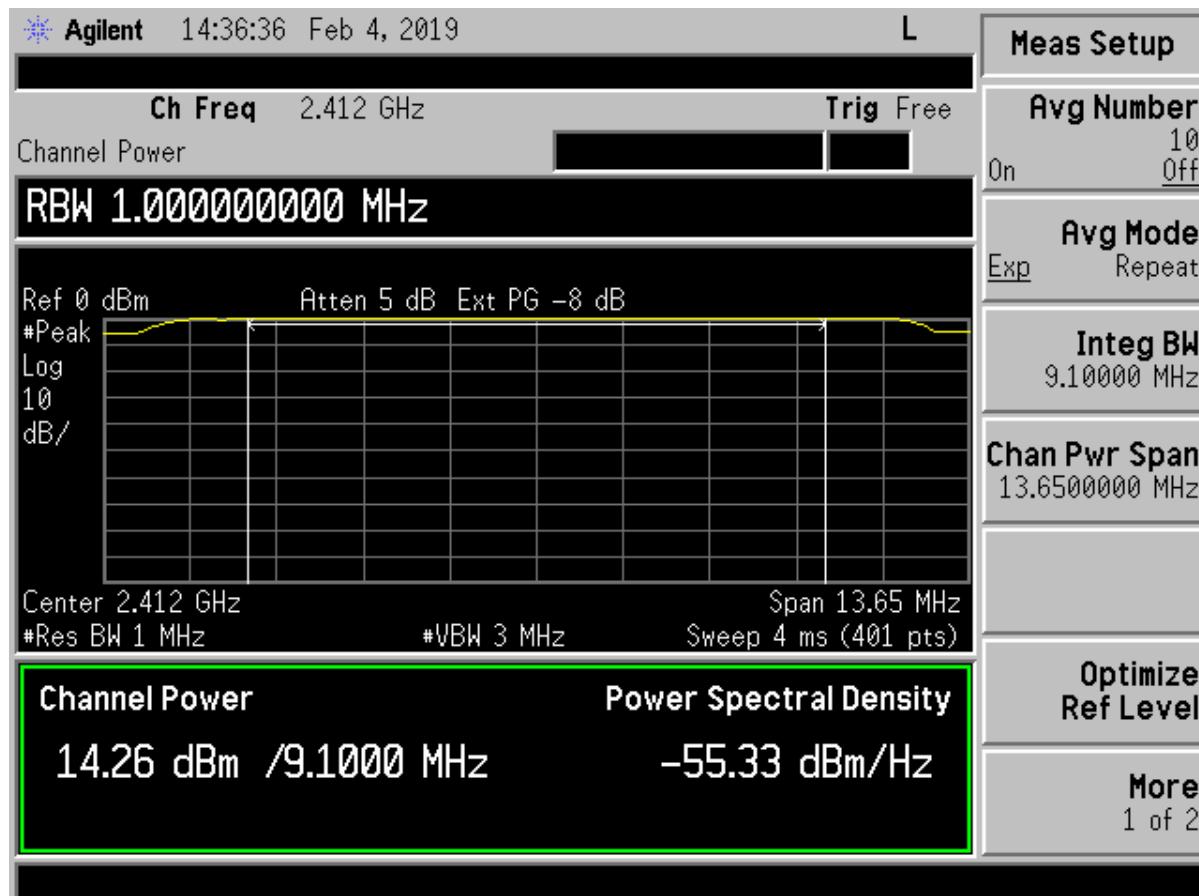


Figure 82. Peak Antenna Conducted Output Power, b Mode Low Channel

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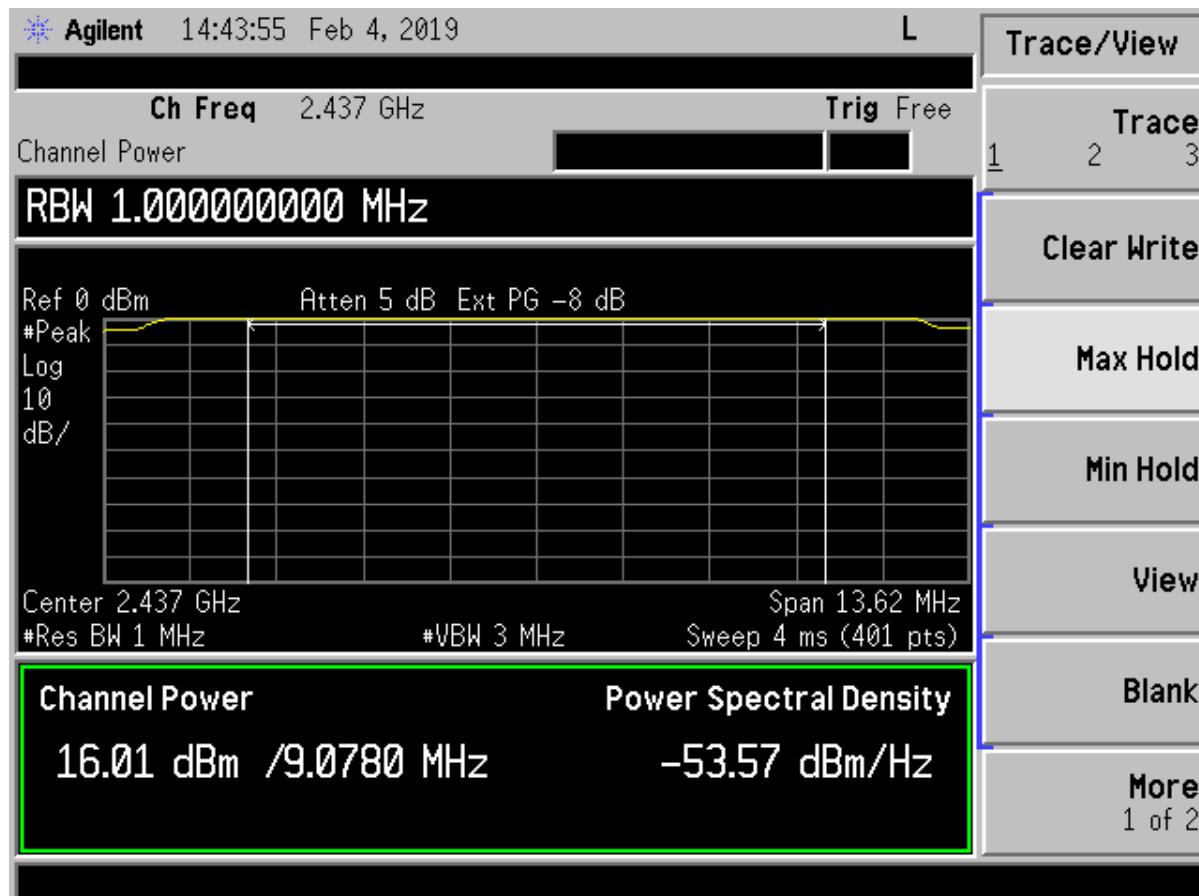


Figure 83. Peak Antenna Conducted Output Power, b Mode Mid Channel

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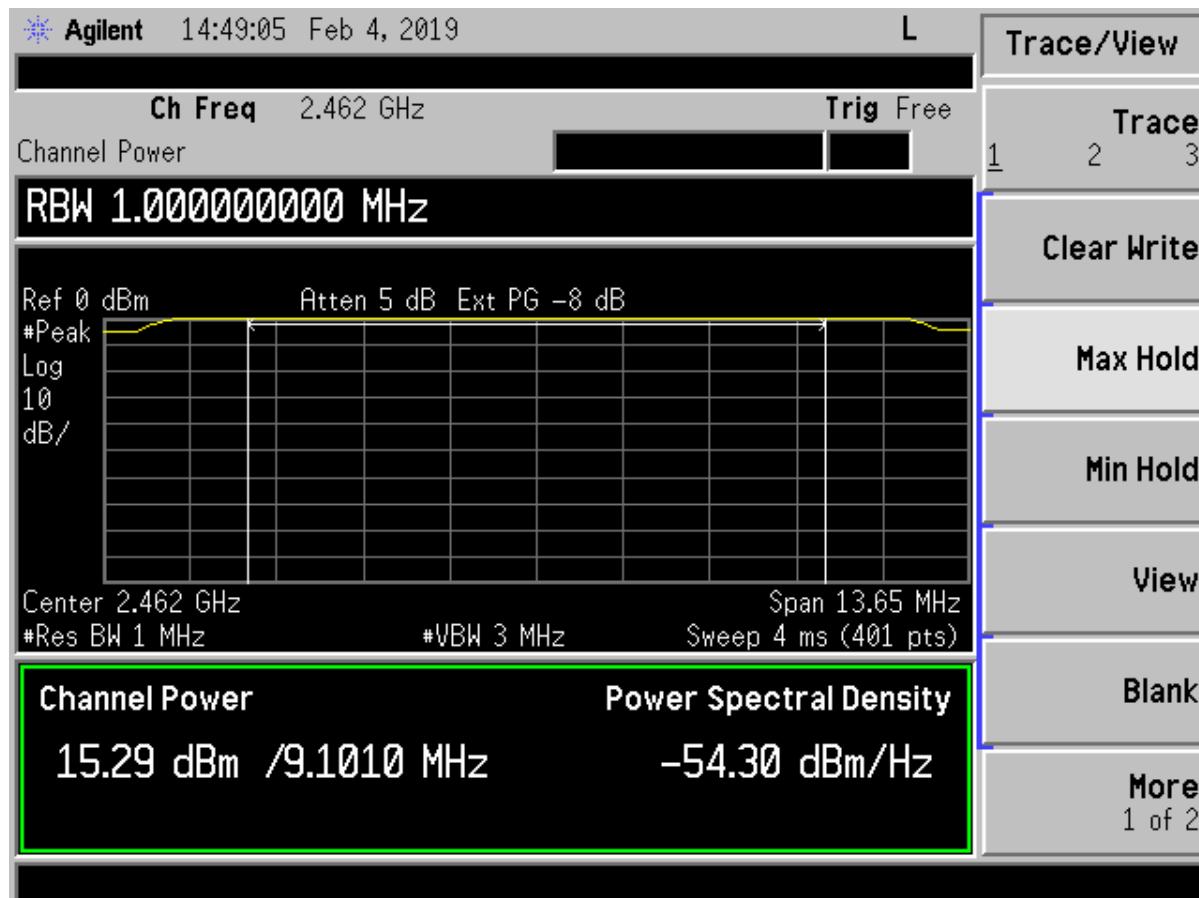


Figure 84. Peak Antenna Conducted Output Power, b Mode High Channel

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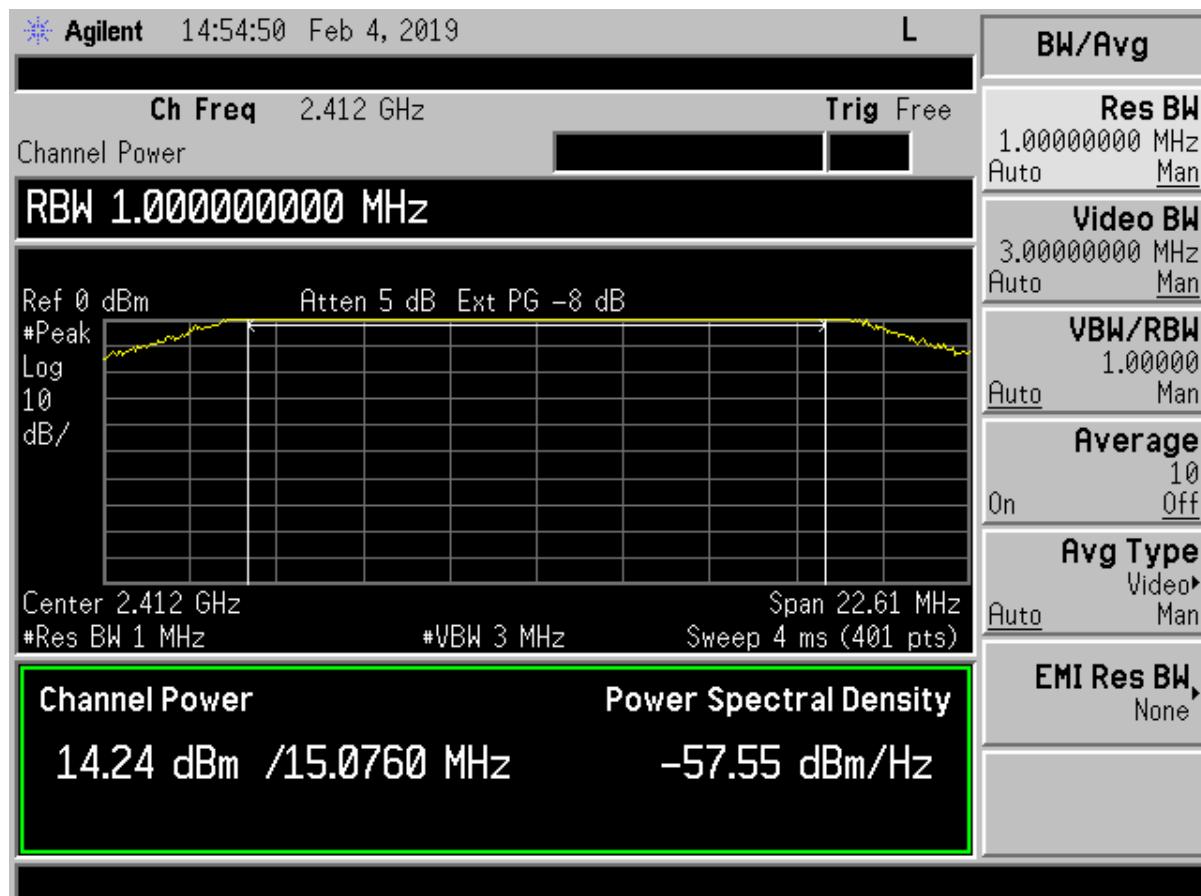


Figure 85. Peak Antenna Conducted Output Power, g Mode Low Channel

US Tech Test Report:
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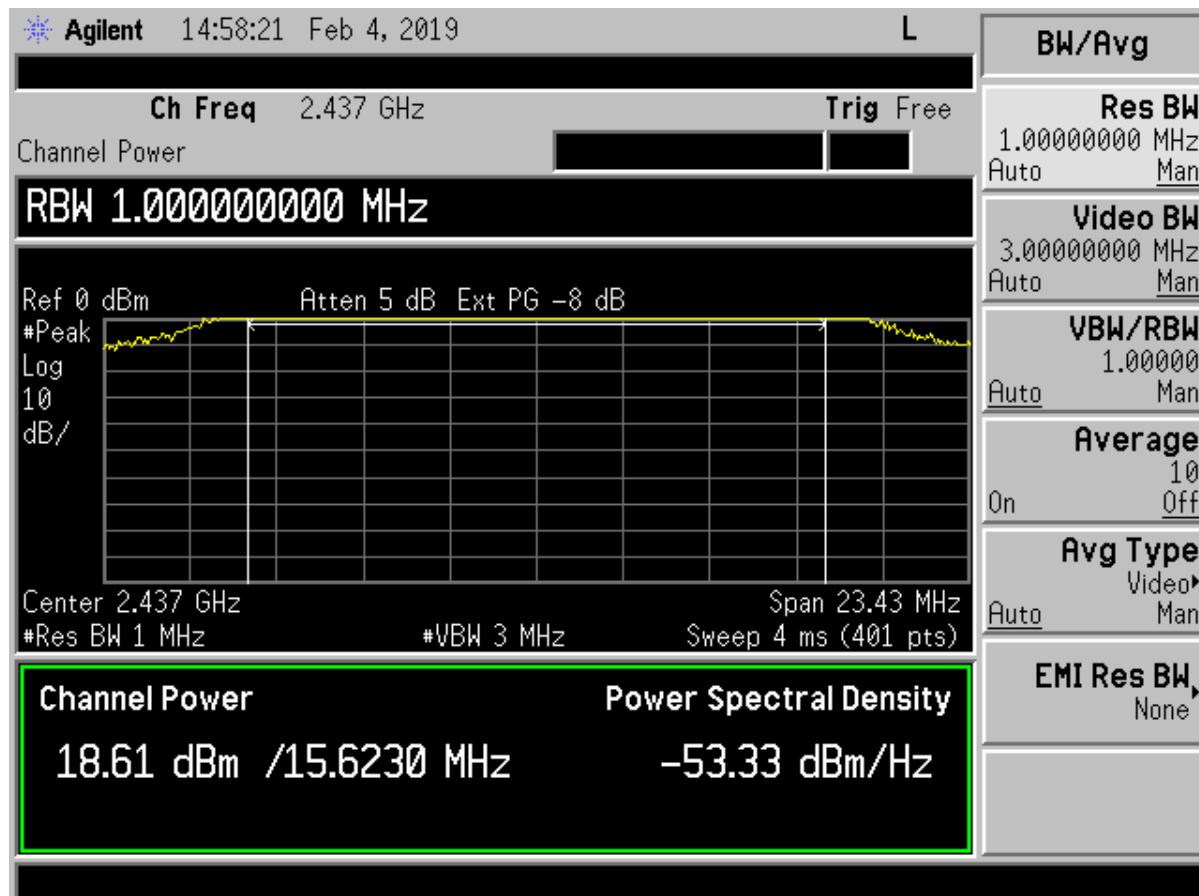


Figure 86. Peak Antenna Conducted Output Power, g Mode Mid Channel

US Tech Test Report:
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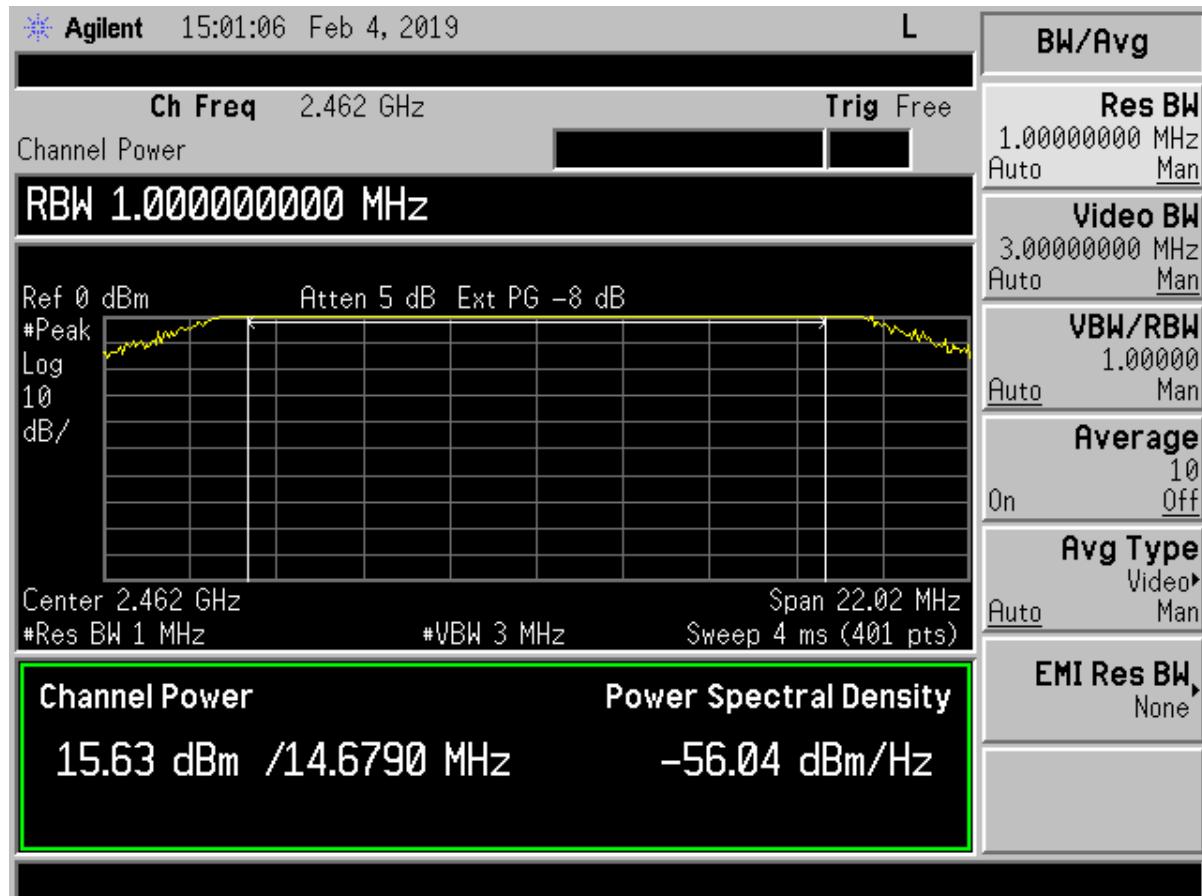


Figure 87. Peak Antenna Conducted Output Power, g Mode High Channel

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FCC ID:
IC:
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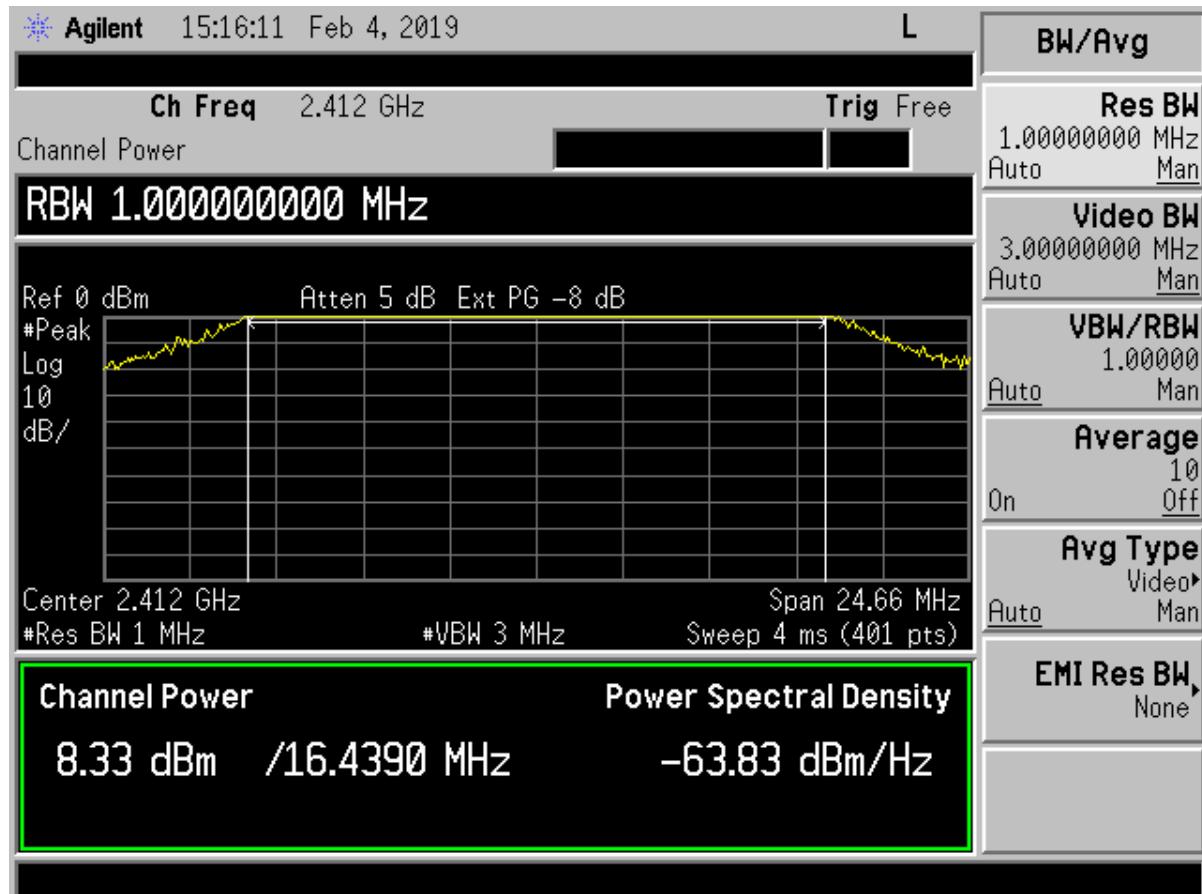


Figure 88. Peak Antenna Conducted Output Power, n Mode Low Channel

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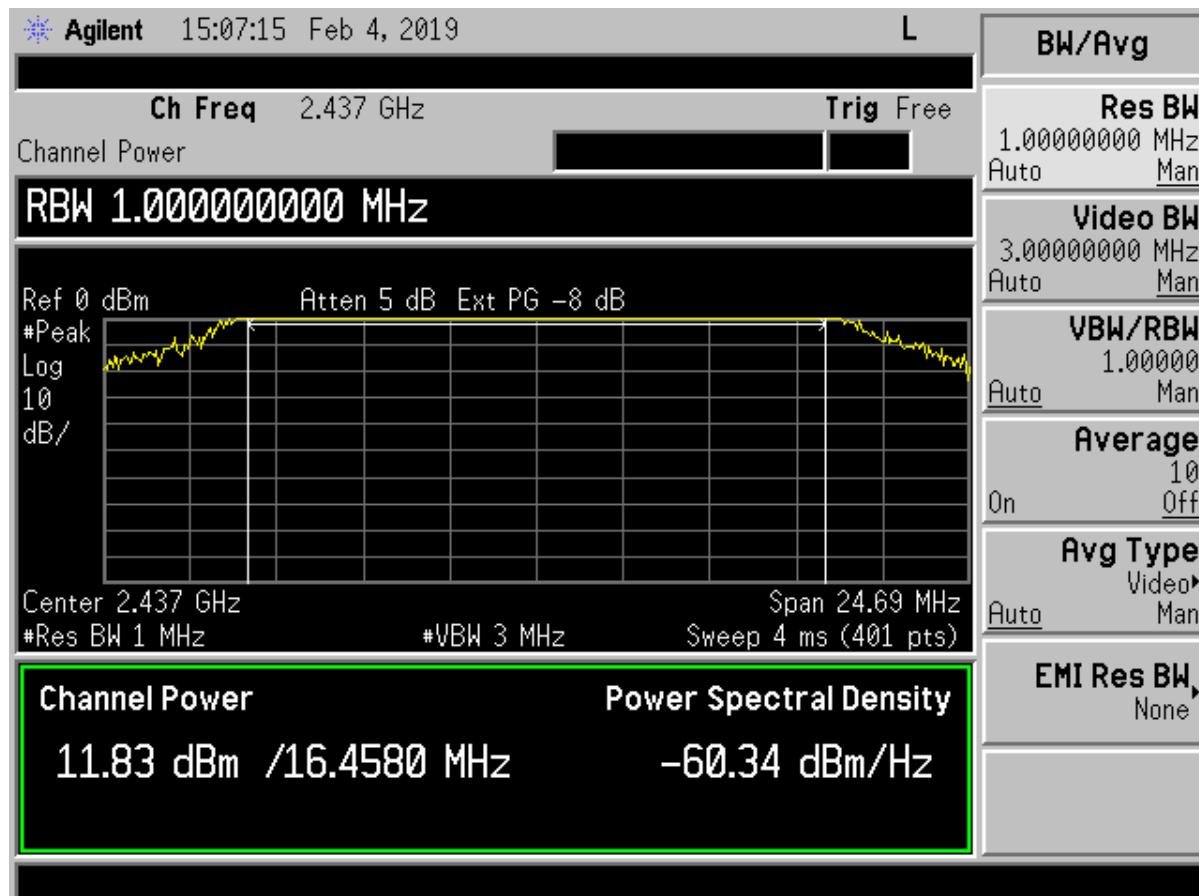


Figure 89. Peak Antenna Conducted Output Power, n Mode Mid Channel

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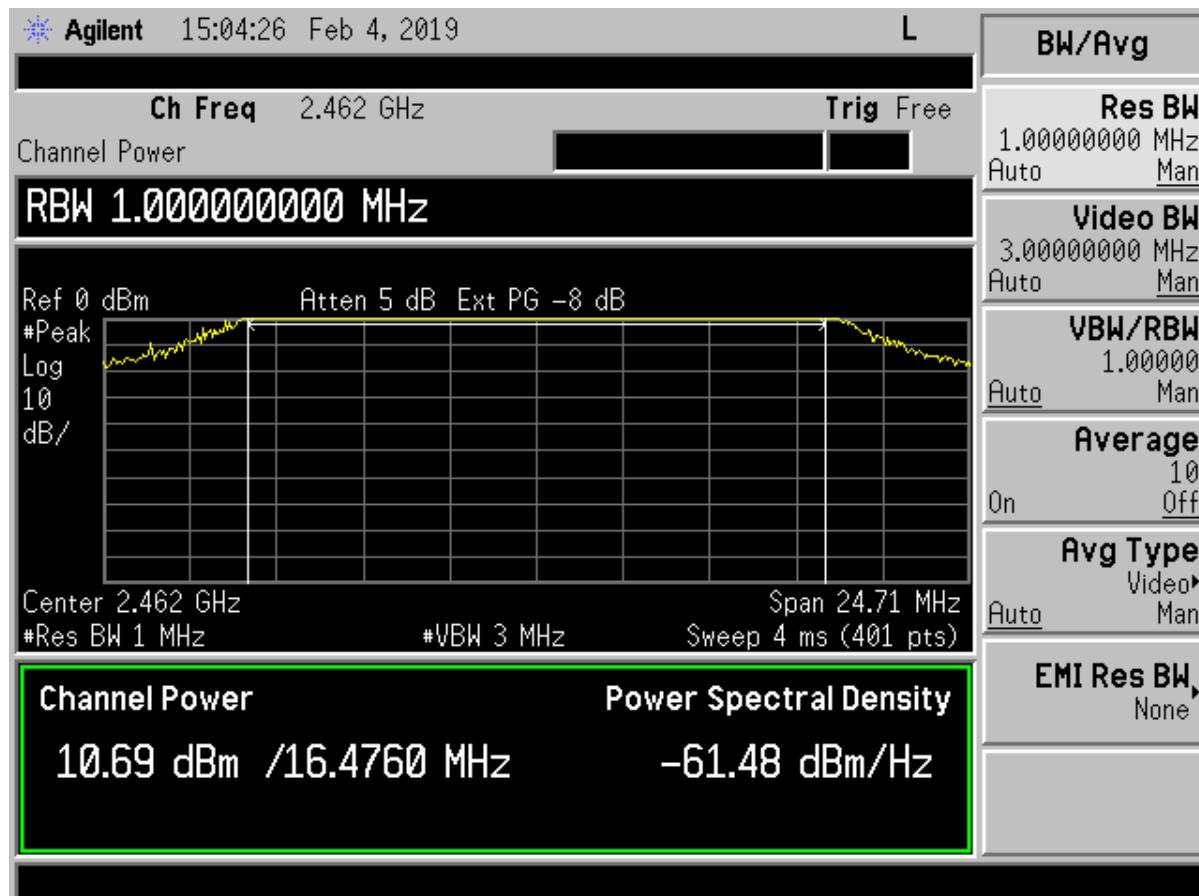


Figure 90. Peak Antenna Conducted Output Power, n Mode High Channel

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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. SEE figures above.

Note: dBm/Hz correct to dBm/kHz using the following formula, $10 \log \frac{RBW_{ref}}{RBW_{measured}}$.

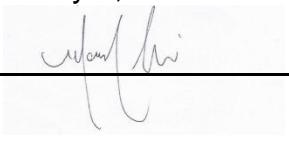
Table 14. Power Spectral Density for Low, Mid and High Bands

Frequency (MHz)	Results (dBm/kHz)	FCC Limit (dBm/3 kHz)	Mode
2412	-20.5	+8.0	b
2437	-18.8	+8.0	b
2462	-19.2	+8.0	b
2412	-22.8	+8.0	g
2437	-18.5	+8.0	g
2462	-21.2	+8.0	g
2412	-29.0	+8.0	n
2437	-25.5	+8.0	n
2462	-26.7	+8.0	n

Sample Calculation: $-55.33 \text{ dB/Hz} + (10 \log (3000/1)) = -20.5 \text{ dB/3kHz}$

Test Date: February 4, 2019

Tested By

Signature: 

Name: Mark Afrooz

US Tech Test Report:	FCC Part 15/IC RSS Certification
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Model:	RM-10002705

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 1.7 dB from the applicable limit. All other emissions were at least 1.8 dB from the limit. Those results are given in the table below.

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Table 15. Power Line Conducted Emissions

CONDUCTED EMISSIONS 150 kHz to 30 MHz						
Tested By: AF	Specification Requirement: FCC Part 15.207		Project No.: 18-0382	Manufacturer: Matrix Design Group, LLC Model: RM-10002705		
Frequency (MHz)	Test Data (dBuV)	LISN+CL (dB)	Corrected Results (dBuV)	Limits (dBuV)	Margin (dB)	Detector
Phase @ 120VAC/60Hz						
0.1500	38.76	0.51	39.27	56.0	16.7	PK
0.6543	31.76	0.14	31.90	46.0	14.1	PK
4.0200	44.13	0.21	44.34	46.0	1.7	QP
4.0200	36.25	0.21	36.46	46.0	9.5	AVG
7.3250	46.74	0.30	47.04	50.0	3.0	QP
7.3250	33.49	0.30	33.79	50.0	16.2	AVG
11.6800	44.99	0.46	45.45	50.0	4.5	QP
11.6800	32.92	0.46	33.38	50.0	16.6	AVG
23.6300	43.07	0.73	43.80	50.0	6.2	PK
Neutral @ 120VAC/60Hz						
0.1550	37.53	0.58	38.11	55.7	17.6	PK
0.5432	29.56	0.29	29.85	46.0	16.2	PK
3.9800	43.87	0.36	44.23	46.0	1.8	QP
3.9800	33.65	0.36	34.01	46.0	12.0	AVG
6.5820	45.77	0.43	46.20	50.0	3.8	QP
6.5820	32.96	0.43	33.39	50.0	16.6	AVG
13.4500	44.17	0.70	44.87	50.0	5.1	QP
13.4500	34.49	0.70	35.19	50.0	14.8	AVG
28.9030	42.67	1.10	43.77	50.0	6.2	PK

Test Date: January 4, 2019

Tested By

Signature:

Name: Afzal Fazal

US Tech Test Report:	FCC Part 15/IC RSS Certification
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Test Report Number:	18-0382
Issue Date:	February 6, 2019
Customer:	Matrix
Model:	RM-10002705

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 9kHz 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 the table below.

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 measurements were taken via B Mode at mid-channel 6 frequency.

The worst-case radiated emission was 6.5 dB below the specification limit at 8565 MHz. All other measured signals were at least 6.6 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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Customer:	Matrix
Model:	RM-10002705

Table 16. Spurious Radiated Emissions (150 KHz-30MHz)

Test By: AF	Test: FCC Part 15.209			Client: Matrix Design Group, LLC			
	Project: 18-0382 Class B			Model: RM-10002705			
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 below 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: January 4, 2019

Tested By

Signature: Afzal Fazal

Name: Afzal Fazal

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

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Table 17. Spurious Radiated Emissions (30 MHz – 1 GHz)

Test By: AF	Test: FCC Part 15.109/15.209				Client: Matrix Design Group, LLC			
	Project: 17-0382 Class B				Model: RM-10002705			
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								
65.53	49.18	-	-17.54	31.64	40.0	3m./HORZ	8.4	QP
93.60	49.50	-	-16.68	32.82	43.5	3m./HORZ	10.7	QP
232.74	44.68	-	-13.48	31.20	46.0	3m./HORZ	14.8	PK
66.69	51.41	-	-18.14	33.27	40.0	3m./VERT	6.7	QP
94.44	50.36	-	-15.91	34.45	43.5	3m./VERT	9.0	QP
203.96	44.92	-	-14.05	30.87	43.5	3m./VERT	12.6	PK
502.44	43.35	-	-6.15	37.20	46.0	3m./VERT	8.8	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: 65.53 MHz

Magnitude of Measured Frequency	49.18	dBuV
Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	-17.54	dB
Corrected Result	31.64	dBuV/m

Test Date: January 4, 2019

Tested By

Signature: Afzal Fazal

Name: Afzal Fazal

US Tech Test Report:

FCC ID:

IC:

Test Report Number:

Issue Date:

Customer:

Model:

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Table 18. Spurious Radiated Emissions (1 GHz – 25 GHz)

Test By: AF		Test: FCC Part 15.109/15.209			Client: Matrix Design Group LLC			
		Project: 17-0382 Class B			Model: RM-10002705			
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								
1237.50	50.04	-	-6.30	43.74	54.0	3.0m./VERT	10.3	PK
1237.50	49.06	-	-6.33	42.73	54.0	3.0m./HORZ	11.3	PK
8565.00	40.23	-9.50	16.78	47.51	54.0	1.0m./VERT	6.5	PK
8446.88	41.16	-9.50	15.71	47.37	54.0	1.0m./HORZ	6.6	PK

All other emissions were more than 20 dB below the applicable limit.

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

SAMPLE CALCULATION AT: 1237.50 MHz

Magnitude of Measured Frequency	50.04	dBuV
Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	-6.30	dB
Corrected Result	43.74	dBuV/m

Test Date: January 4, 2019

Tested By

Signature: Afzal Fazal

Name: Afzal Fazal

US Tech Test Report:	FCC Part 15/IC RSS Certification
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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.