H.B. Compliance Solutions

Intentional Radiator Test Report

For the

X-Media Tech, Inc.

WiLinq

Tested under

The FCC Rules contained in Title 47 of the CFR, Part 15.247

Digitally Transmitting Sequence

March 04, 2024

Prepared for:

X-Media Tech, Inc.

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Plano, TX 75093

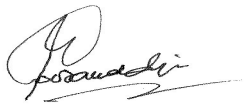
Prepared By:

H.B. Compliance Solutions

5005 S. Ash Avenue, Suite # A-10

Tempe, Arizona 85282

Reviewed By:



Hoosamuddin Bandukwala

Cert # ATL-0062-E

Engineering Statement: The measurements shown in this report were made in accordance with the procedure indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurement made, the equipment tested is capable of operation in accordance with the requirements of Part 15 of the FCC Rules under normal use and maintenance. All results contained herein relate only to the sample tested.

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Report Status Sheet

Revision #	Report Date	Reason for Revision
Ø	March 04, 2024	Initial Issue

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EXECUTIVE SUMMARY

1. Testing Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15.247. All tests were conducted using measurement procedure from ANSI C63.10-2013 and FCC Guidance document 558074 D01 v05r02 April 02, 2019.

Test Name	Test Method/Standard	Result	Comments
Unintentional Radiated Emissions	15.209	Pass	
A/C Powerline Conducted Emissions	15.207	N/A	Battery Powered Device
Occupied Bandwidth	15.247(a)(2)	Pass	
Peak Output Power	15.247(b)	Pass	
Conducted Spurious Emissions	15.247(d)	Pass	
Radiated Spurious Emissions & Restricted Band	15.247(d), 15.209(a), 15.205	Pass	
Emissions at Band Edges	15.247(d), 15.209(a), 15.205	Pass	
Power Spectral Density	15.247(e)	Pass	

EQUIPMENT CONFIGURATION

1. Overview

H.B Compliance Solutions was contracted by X-Media Tech to perform testing on the WiLinq under the purchase order number 257524.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the X-Media Tech, WiLinq.

The tests were based on FCC Part 15 Rules. The tests described in this document were formal tests as described with the objective of the testing was to evaluate compliance of the Equipment Under Test (EUT) to the requirements of the aforementioned specifications. GROM Audio should retain a copy of this document and it should be kept on file for at least five years after the manufacturing of the EUT has been permanently discontinued. The results obtained relate only to the item(s) tested.

Product Name:	WiLinq
Model(s) Tested:	WLQ1
FCC ID:	2AJFZ-ROXW
Supply Voltage Input:	Primary Power: 5 VDC (USB)
Frequency Range:	802.11b/g/n20: 2412MHz – 2462MHz
No. of Channels:	11
Necessary Bandwidth	N/A
Type(s) of Modulation:	802.11b : DSSS (DBPSK, DQPSK, QPSK) 802.11g/n (HT20): OFDM, (64QAM, 16QAM, QPSK, BPSK)
Range of Operation Power:	0.272W
Emission Designator:	N/A
Channel Spacing(s)	None
Test Item:	Pre-Production
Type of Equipment:	Portable
Antenna Requirement (§15.203):	Type of Antenna: Chip Antenna Gain of Antenna: 2dBi
Environmental Test Conditions:	Temperature: 15-35°C Humidity: 30-60% Barometric Pressure: 860-1060 mbar
Modification to the EUT:	None
Evaluated By:	Staff at H.B. Compliance Solutions
Test Date(s):	02/12/2024 till 02/27/2024

2. Test Facility

All testing was performed at H.B. Compliance Solutions. This facility is located at 5005 S. Ash Avenue, Suite # A-10, Tempe AZ-85282. All equipment used in making physical determination is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a GTEM chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at H.B. Compliance Solutions.

Test facility H.B. Compliance Solutions is an ANAB accredited test site. The ANAB certificate number is L2458. The scope of accreditation can be found on ANAB website www.anab.org

3. Description of Test Sample

The GROM Audio, WiLinq is a plug and play device used in automotives to convert wired Android deices to wireless.

4. Equipment Configuration

Ref. ID	Name / Description	Model Number	Serial Number
# 1	WiLinq (Sample #1 – For Conducted Testing)	WLQ1	-
# 2	WiLinq (Sample #2 – For Radiated Testing)	WLQ1	-

Table 1. Equipment Configuration

5. Support Equipment

All support equipment supplied is listed in the following Support Equipment List.

Ref ID	Name / Description	Manufacturer	Model #	Serial #
# 3	CP2102 USB to TTL/UART	-	-	-
# 4	Laptop Computer	Acer	Swift SF314-52	-

Table 2. Support Equipment

6. Ports and Cabling Information

Ref ID	Port name on the EUT	Cable Description	Qty.	Length (m)	Shielded? (Y/N)	Termination Box ID & Port ID
# 5	USB C	USB C to USB A	1	0.1	N	# 4
# 6	TTL/UART	3 Wire	1	0.2	N	# 3 / # 4

Table 3. Ports and Cabling Information

7. Method of Monitoring EUT Operation

A test receiver will be used to monitor the data transmission from the EUT.

8. Mode of Operation

To support FCC testing, a test firmware was provided to allow configuration of the data rates, transmission channel, and power level for worst case emissions. Pretesting was performed across all operational modes to determine the data rate for each that provided the worst case-emissions.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2422
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

Table 4. Operational Channels for 802.11b/g/n

Operational Mode	Data Rates	Worst Case used for Testing
802.11b	1/2/5/11 Mbps	1 Mbps
802.11g	6/9/12/18/24/36/48/54 Mbps	6 Mbps
802.11n (20 MHz)	6.5/13/19.5/26/39/52/58.5/65 Mbps (MSC0-MSC7)	6.5 Mbps (MSC0)

Table 5. Data rates for Operational WIFI modes

9. Modifications

9.1 Modifications to EUT

No modifications were made to the EUT

9.2 Modifications to Test Standard

No Modifications were made to the test standard.

10. Disposition of EUT

The test sample including all support equipment submitted to H.B Compliance Solutions for testing will be returned to X-Media Tech, Inc at the completion of testing & certification.

Criteria for Un-Intentional Radiators

1. Radiated Emissions

Test Requirement(s):	§15.109	**Test Engineer(s):**	Evan L.
Test Results:	Pass	**Test Date(s):**	Feb 12, 2024

Test Procedures:

The final radiated emissions test was performed using the parameters described above as worst case. That final test was conducted at a facility that meets the ANSI C63.4 NSA requirements. The frequency range noted in the data sheets was scanned/tested at that facility. Emissions were maximized as specified, by varying table azimuth, antenna height, and manipulating cables.

Using the mode of operation and configuration noted within this report, a final radiated emissions test was performed. The frequency range investigated (scanned), is also noted in this report. Radiated emissions measurements were made at the EUT azimuth and antenna height such that the maximum radiated emissions level will be detected. This requires the use of a turntable and an antenna positioner. The preferred method of a continuous azimuth search is utilized for frequency scans of the EUT field strength with both polarities of the measuring antenna. A calibrated, linearly polarized antenna was positioned at the specified distance from the periphery of the EUT.

> *Note: The specified distance is the horizontal separation between the closest periphery of the EUT and the center of the axis of the elements of the receiving antenna. However, if the receiving antenna is a log-periodic array, the specified distance shall be the distance between the closest periphery of the EUT and the front-to-back center of the array of elements.*

Tests were made with the antenna positioned in both the horizontal and vertical polarization planes. The measurement was varied in height above the conducting ground plane to obtain the maximum signal strength. Though specified in the report, the measurement distance shall be 3 meters. At any measurement distance, the antenna height was varied from 1 meter to 4 meters. These height scans apply for both horizontal and vertical polarization, except that for vertical polarization the minimum height of the center of the antenna shall be increased so that the lowest point of the bottom of the antenna clears the ground surface by at least 25 cm.

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
30 MHz to 1 GHz	120 kHz	120 kHz	N/A
1 GHz to 11 GHz	1MHz	N/A	1MHz
Measurements were made using the bandwidths and detectors specified. The video filter was at least as wide as the IF bandwidth of the measuring receiver.			

Table 6. Radiated Emissions – Measurement Bandwidth

Emissions Tests Calculations

In the case of indoor measurements, radiated emissions measurements are made by the manipulation of correction factors using TILE4 software. This is done automatically by the software during the final measurement process.

In both cases, the level of the Field Strength of the interfering signal is calculated by adding the Antenna Factor, Cable Factor and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

FS = RA + AF + (CF –AG)

Where: FS = Field Strength

RA = Receiver (indicated) Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

This laboratory uses an approach of combining the CF and AG using an end-to-end measurement of the entire cabling system, including the test cable, any in-line amplifiers, attenuators, or transient protection networks, all measured in-situ.

For a sample calculation, assume a receiver reading of 52.5 dBuV is obtained. With an antenna factor of 7.4 and a combined cable factor (CF + AG) of -27.9:

FS = 52.5 + 7.4 + (-27.9) = 32 dBuV/m

FS = 32 dBuV/m

If desired, this can be converted into its corresponding level in uV/m:

FS = 10^((32 dBuV/m)/20) = 39.8 uV/m

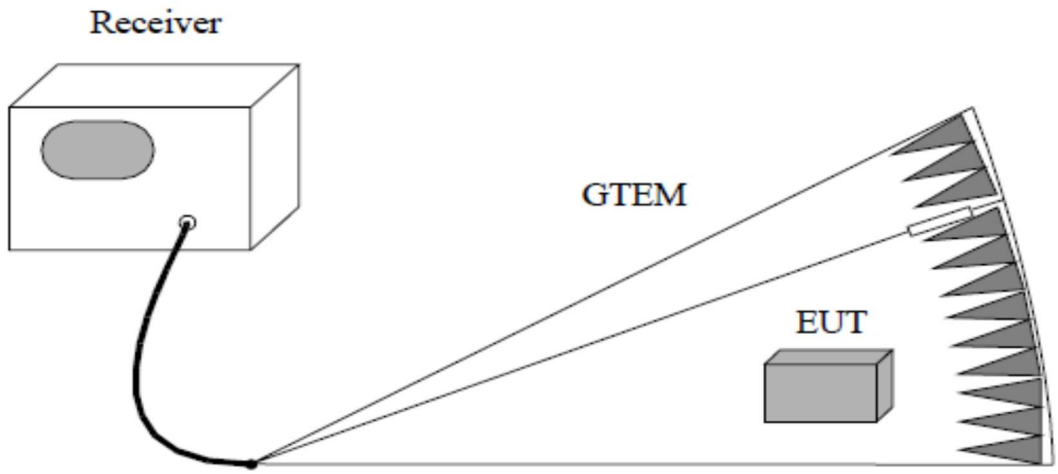
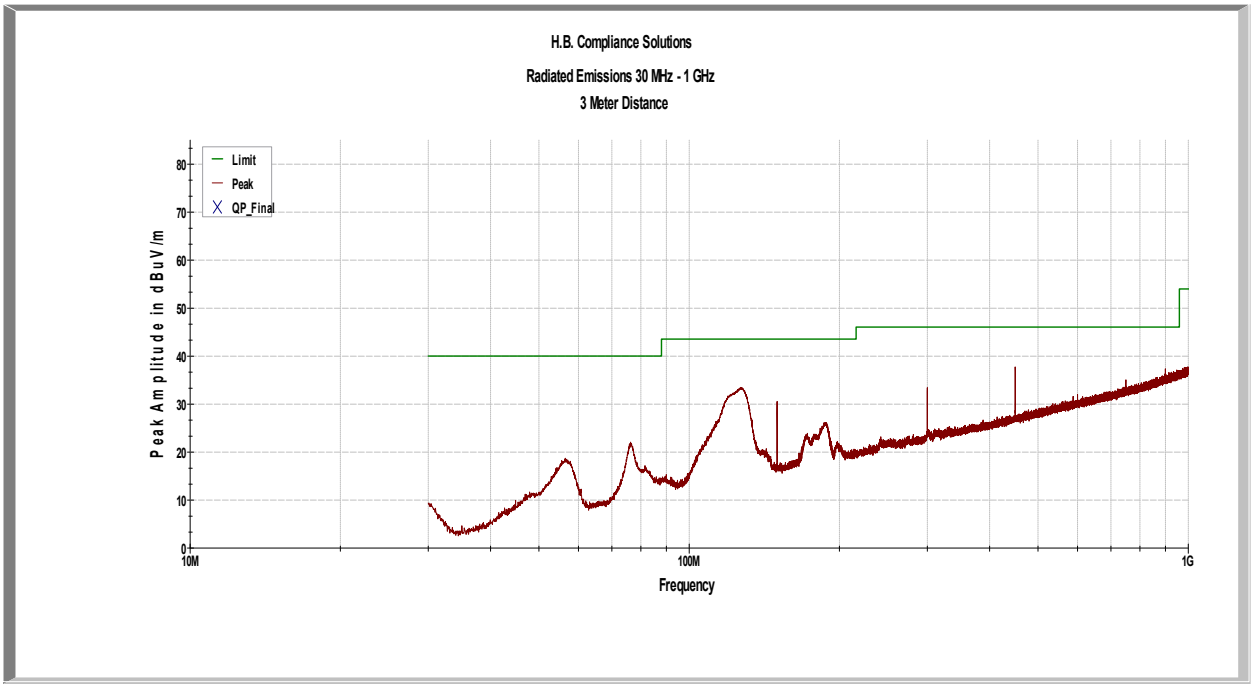


Figure 1. Radiated Emissions Test Setup (30MHz – 1GHz)



Plot 1 – Radiated Emissions – 30MHz to 1GHz

Frequency (MHz)	Measured Level	Detector	Limit (dBuV)	Margin (dB)
76.32	22.04	Peak	40.0	-17.96
126.81	33.48	Peak	43.52	-10.04
150.04	30.55	Peak	43.52	-12.97
300.00	33.41	Peak	46.02	-12.61
450.06	37.74	Peak	46.02	-8.28

Table 7. Final Measurement Results for Radiated Emissions

1. Occupied Bandwidth

Test Requirement(s):	15.247(a)(2), ANSI C63.10	**Test Engineer(s):**	Sean E.
Test Results:	Pass	**Test Date(s):**	Feb 20, 2024

Test Procedure:

As required by 47 CFR 15.247(a)(2) System using digital modulation techniques may operate in the 902-928MHz, 2400 – 2483.5MHz, and 5725 – 5850MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Customer provided a test mode internal to the EUT to control the RF modulation, and frequency channel. The EUT was connected through an attenuator to a Spectrum Analyzer. The measured highest peak power was set relative to zero dB reference. The RBW of the Spectrum Analyzer was set to 100kHz and VBW>RBW. Measurements were carried out at the low, mid and high channels of the TX band at the output terminals of the EUT.

Test Setup:

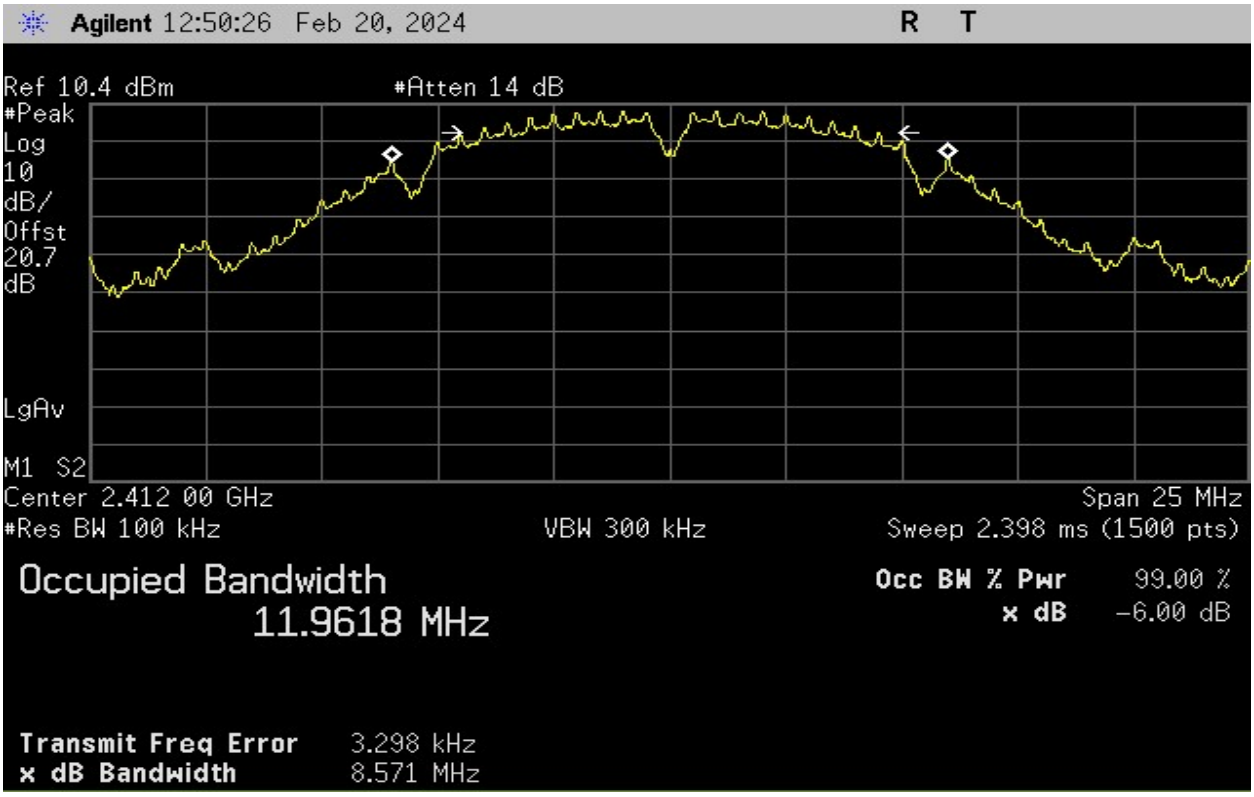
Figure 2. Occupied Bandwidth Test Setup

Test Results:

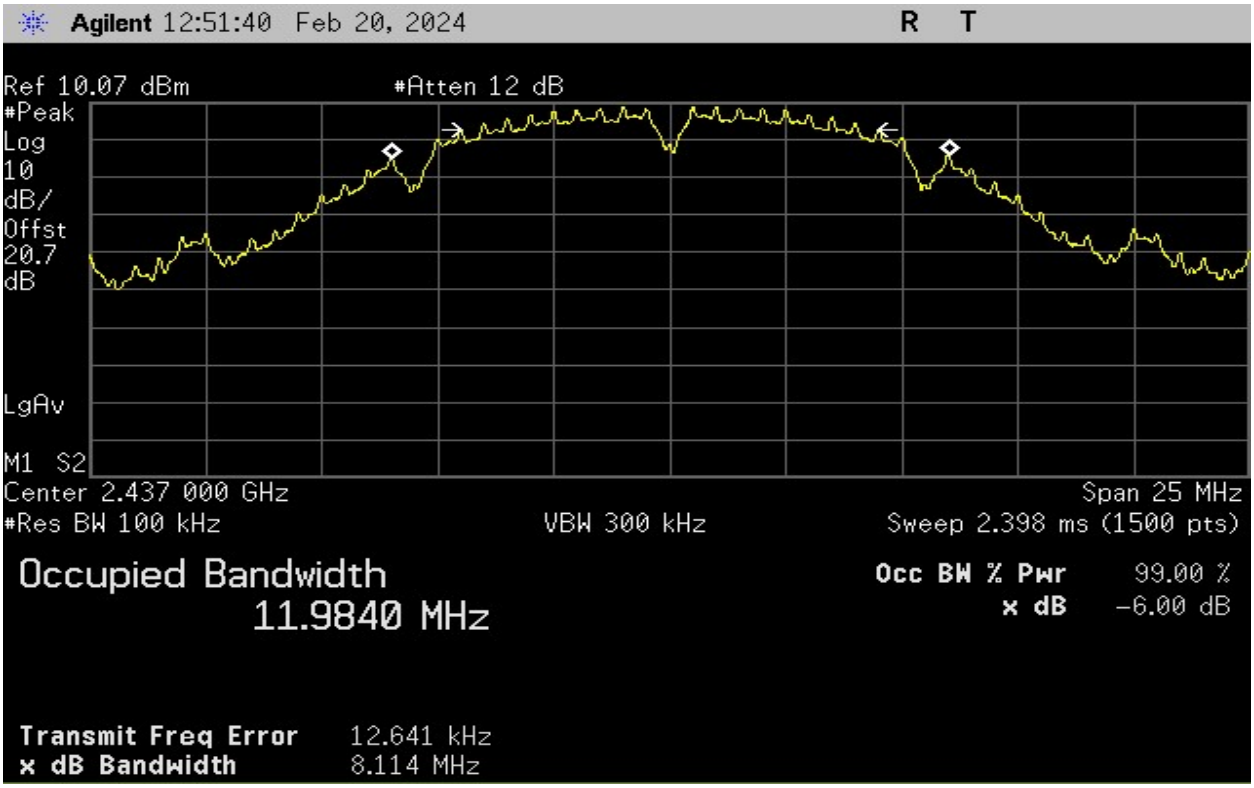
Operational Mode	Frequency (MHz)	Recorded Measurement	Specification Limit
802.11b	2412	8.57 MHz	≥ 500 KHz
	2437	8.11 MHz	≥ 500 KHz
	2462	9.04 MHz	≥ 500 KHz
802.11g	2412	15.20 MHz	≥ 500 KHz
	2437	15.20 MHz	≥ 500 KHz
	2462	15.18 MHz	≥ 500 KHz
802.11n (20 MHz)	2412	16.01 MHz	≥ 500 KHz
	2437	16.01 MHz	≥ 500 KHz
	2462	15.79 MHz	≥ 500 KHz

Table 8. Occupied Bandwidth Summary, WIFI Test Results

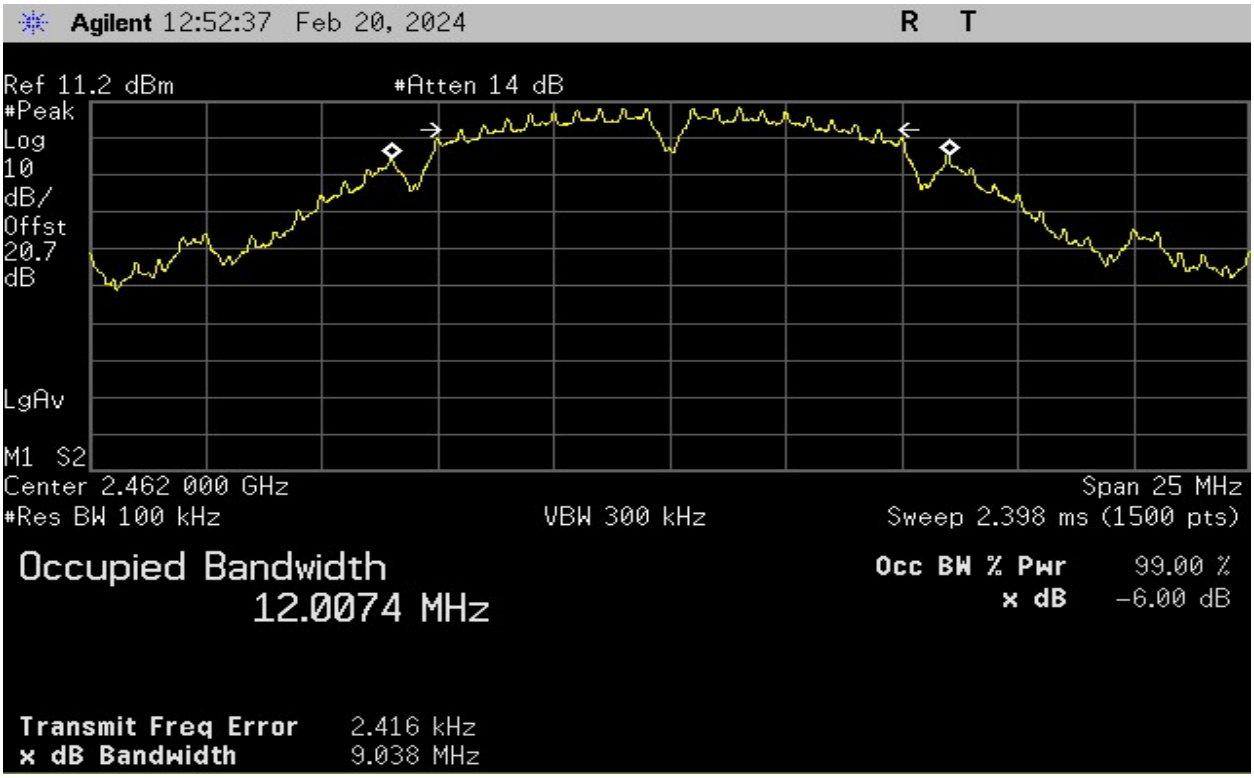
The following pages show measurements of Occupied Bandwidth plots:



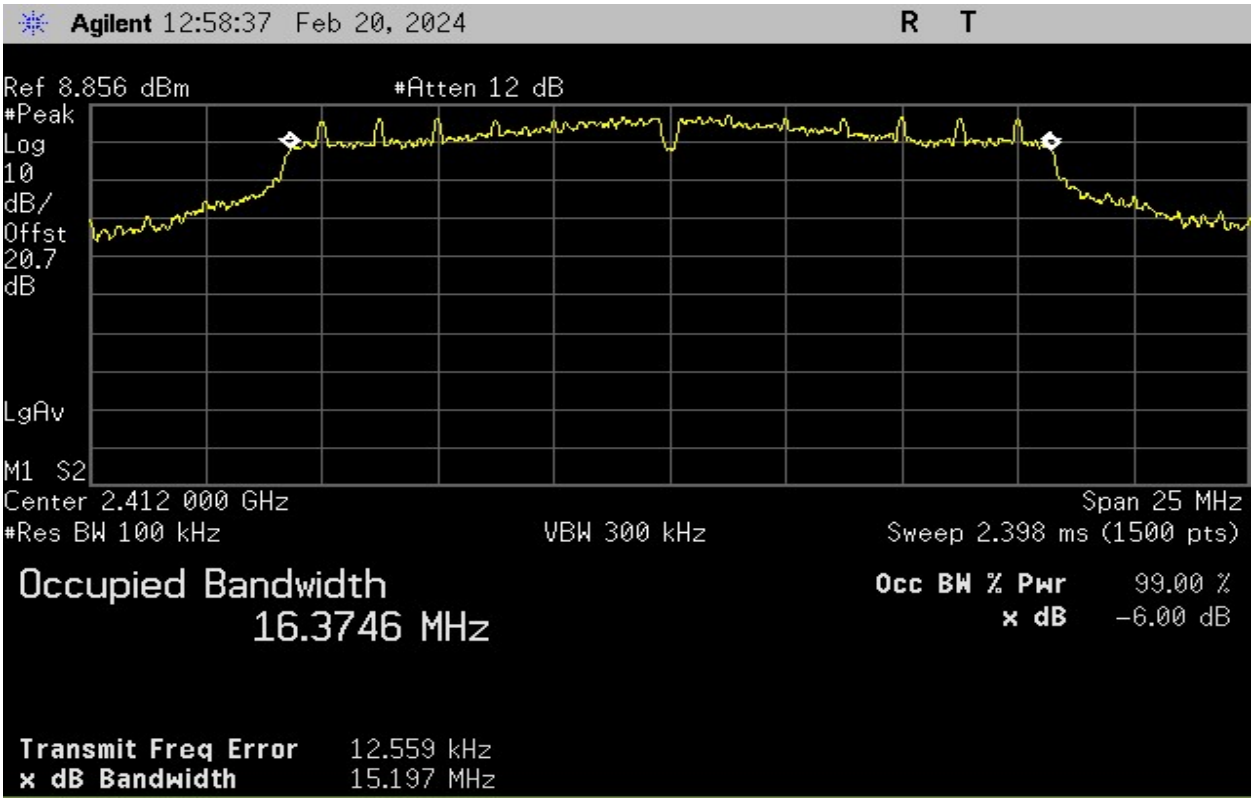
Plot 2 – 802.11b Lowest Channel – 6dB BW



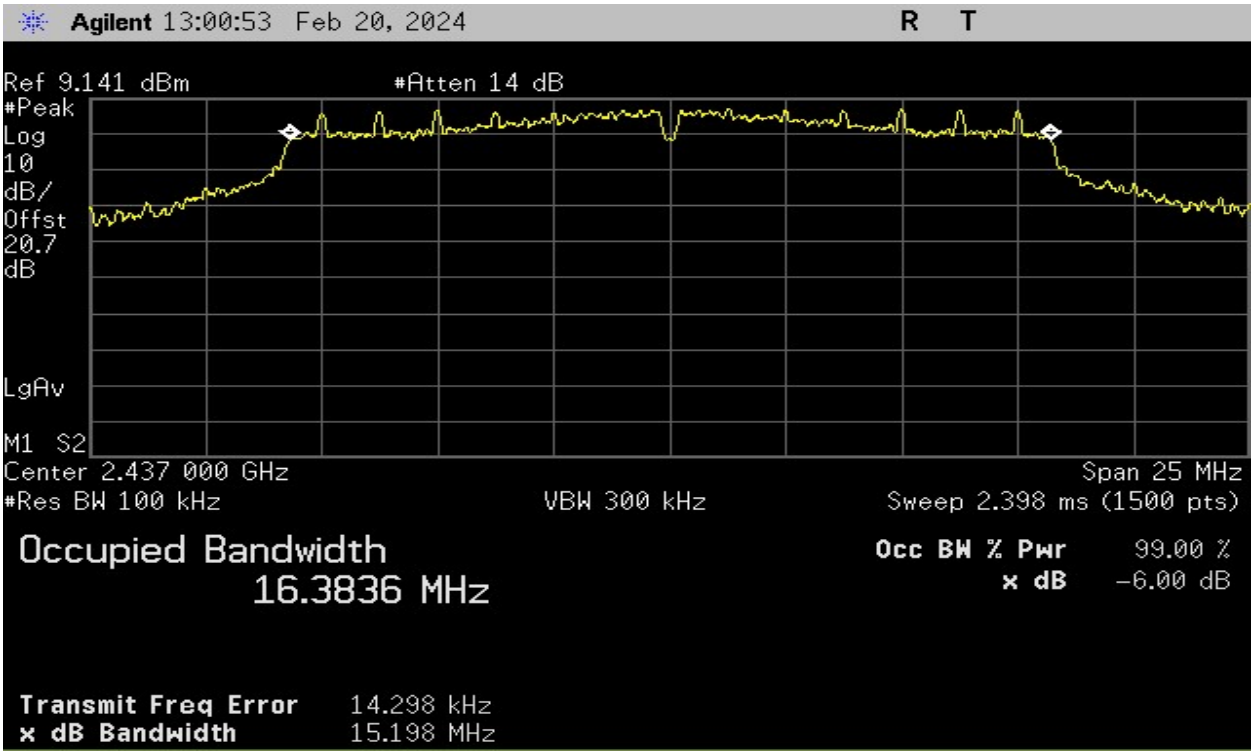
Plot 3 – 802.11b Middle Channel – 6dB BW



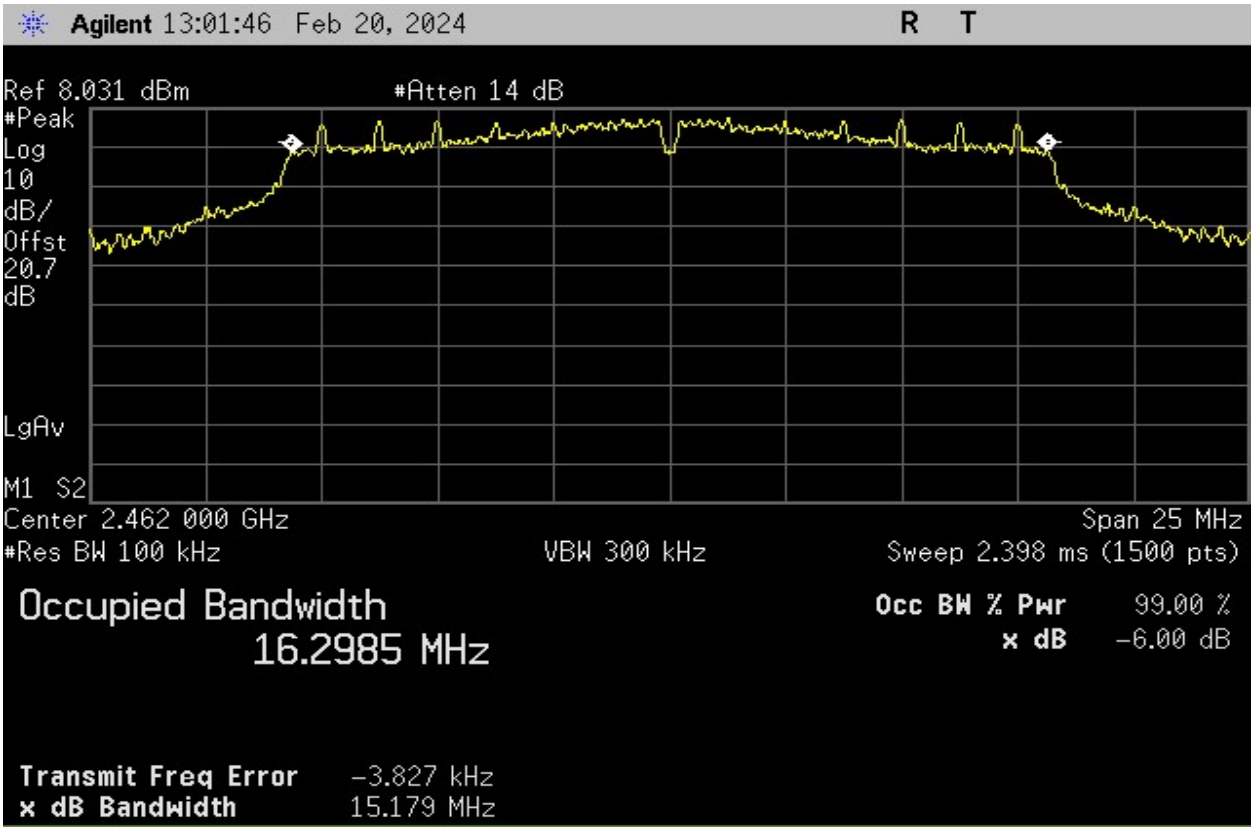
Plot 4 – 802.11b Highest Channel – 6dB BW



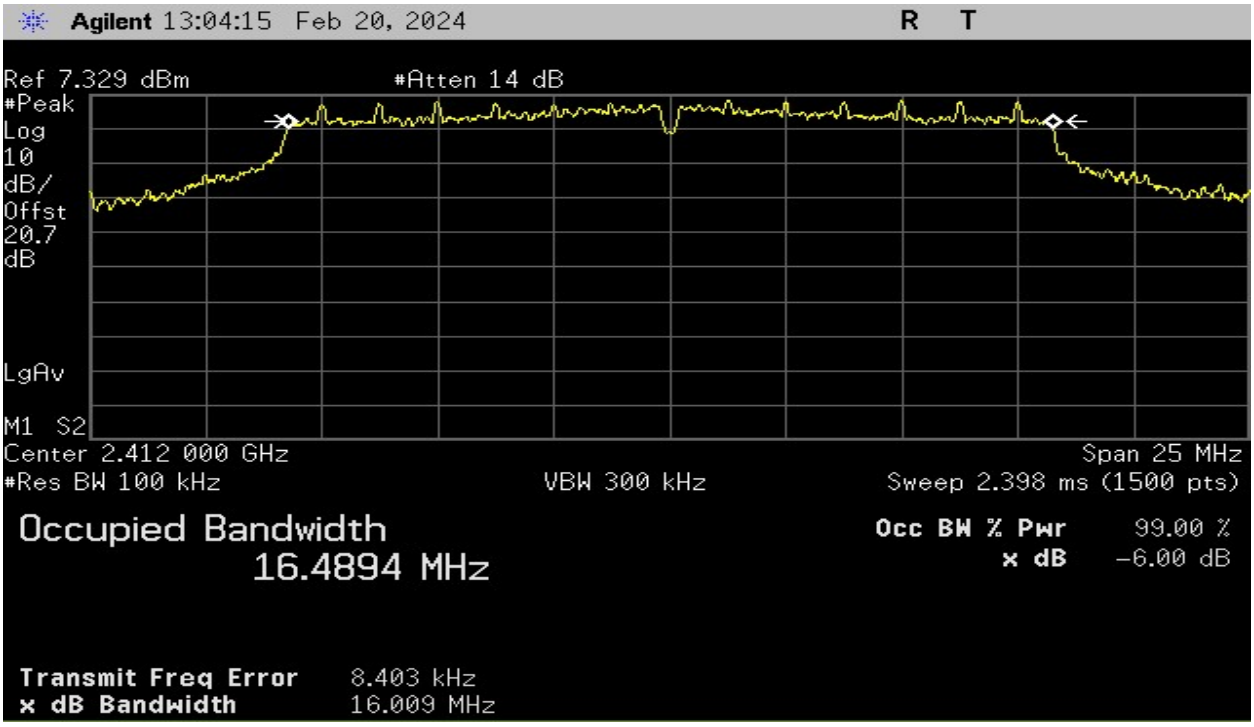
Plot 5 – 802.11g Lowest Channel – 6dB BW



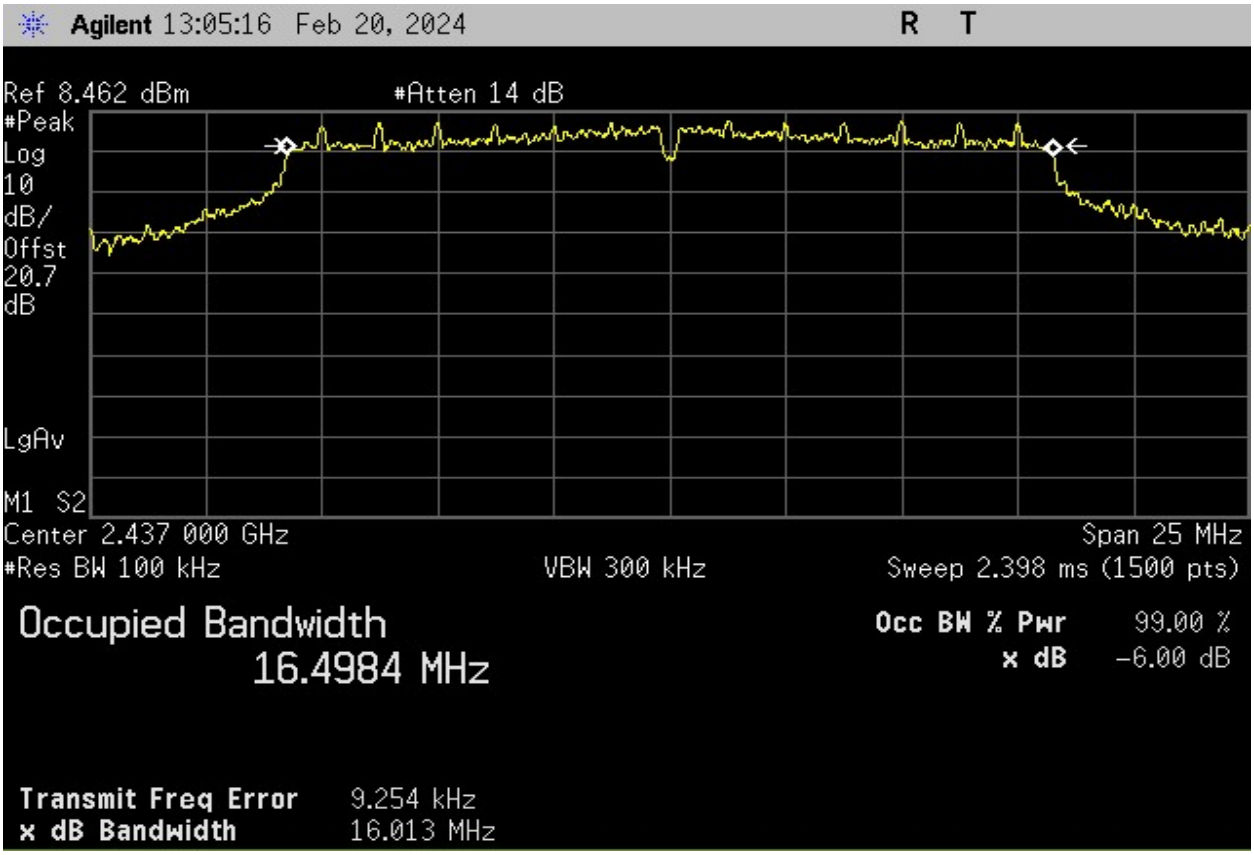
Plot 6 – 802.11g Middle Channel – 6dB BW



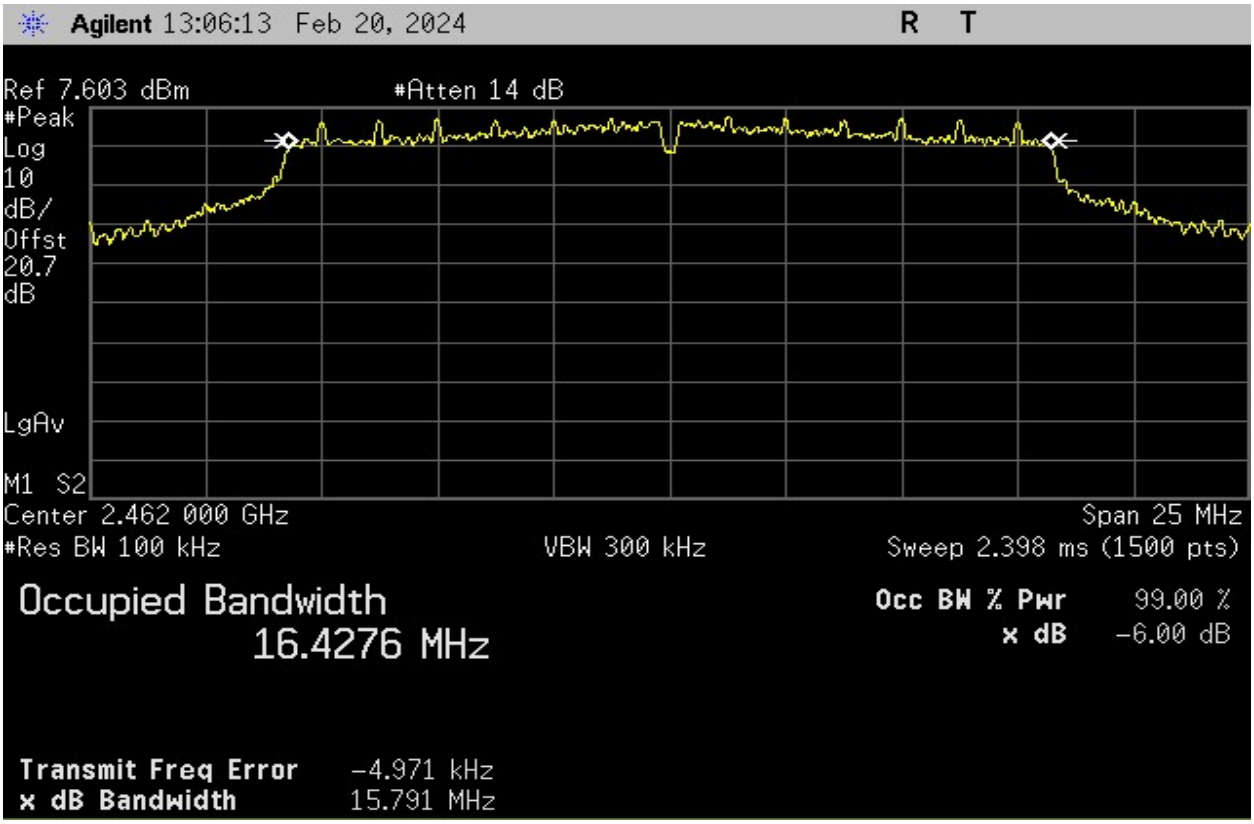
Plot 7 – 802.11g Highest Channel – 6dB BW



Plot 8 – 802.11n (20 MHz) Lowest Channel – 6dB BW



Plot 9 – 802.11n (20 MHz) Middle Channel – 6dB BW



Plot 10 – 802.11n (20 MHz) Highest Channel – 6dB BW

2. RF Power Output

Test Requirement(s):	§15.247(b)(3)	Test Engineer(s):	Sean E.
Test Results:	Pass	Test Date(s):	Feb 20, 2024

Test Procedures: As required by 47 CFR 15.247(b)(3), RF Power output measurements were made at the RF output terminals of the EUT

Customer provided a test mode internal to the EUT to control the RF modulation, and frequency channel. For testing the WIFI Channels, the EUT was connected through an attenuator to a Wideband Power Sensor capable of making power measurements. Measurements were made at the low, mid, and high channels of the entire frequency band.

Test Setup:

Figure 3. RF Power Test Setup – WIFI

Test Results:

Operational Mode	Frequency (MHz)	Conducted Power (dBm)	Conducted Power (Watts)	Specification Limit
802.11b	2412	19.79	0.0953	1W
	2437	20.25	0.1059	1W
	2462	20.69	0.1172	1W
802.11g	2412	23.42	0.2198	1W
	2437	24	0.2512	1W
	2462	24.35	0.2723	1W
802.11n (20 MHz)	2412	23.72	0.2355	1W
	2437	24.32	0.2704	1W
	2462	24.35	0.2723	1W

Table 9. RF Power Output, WIFI Test Results

3. Conducted Spurious Emissions

Test Requirement(s):	§15.247(c)	**Test Engineer(s):**	Sean E.
Test Results:	Pass	**Test Date(s):**	Feb 21, 2024

Test Procedures:

As required by 47 CFR 15.247(c): In any 100kHz bandwidth the frequency band in which the spread spectrum or digitally modulation intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either and RF conducted or a radiated measurement. Conducted spurious emissions at antenna terminal measurements were made at the RF output antenna terminal of the EUT.

Customer provided a test mode internal to the EUT to control the RF modulation, and frequency channel. The EUT was connected through an attenuator to a Spectrum Analyzer with RBW set to 100kHz and VBW ≥ RBW. The Spectrum Analyzer was set to sweep from 30MHz up to 10th harmonic of the fundamental or 40GHz whichever is the lesser. Measurements were made at the low, mid and high frequency of the transmit band.

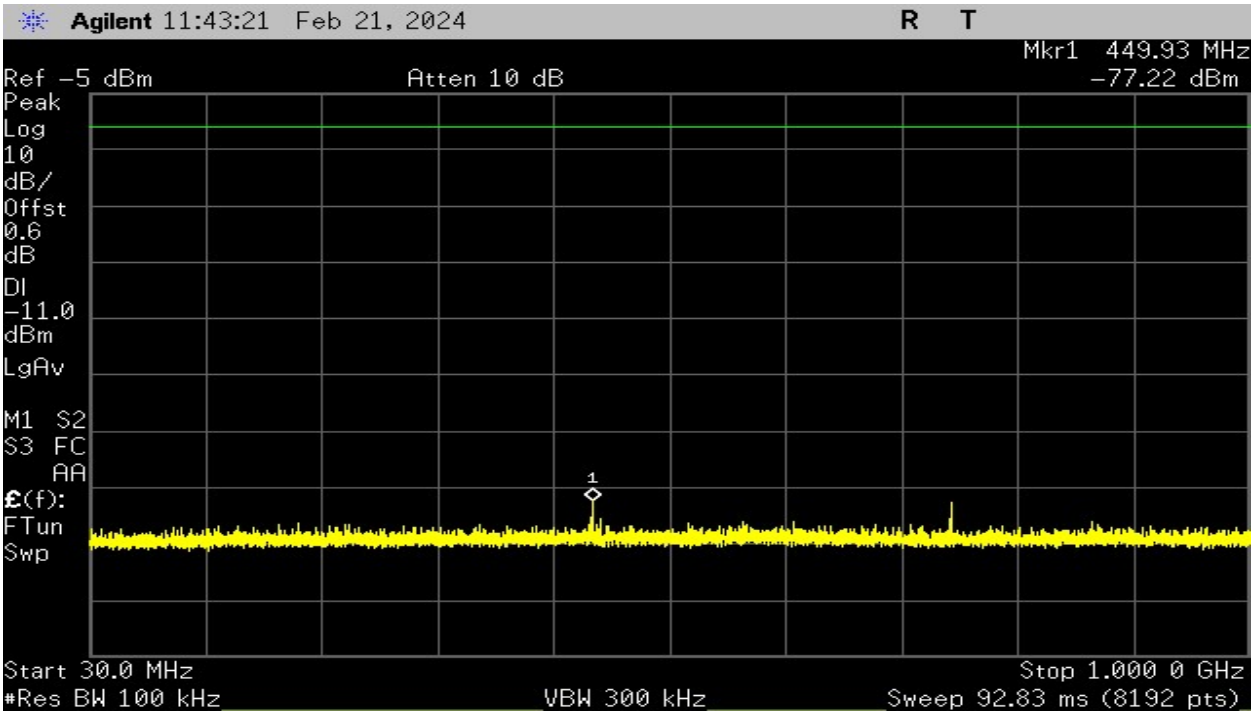
Test Setup:

Figure 4. Conducted Spurious Emissions Test Setup

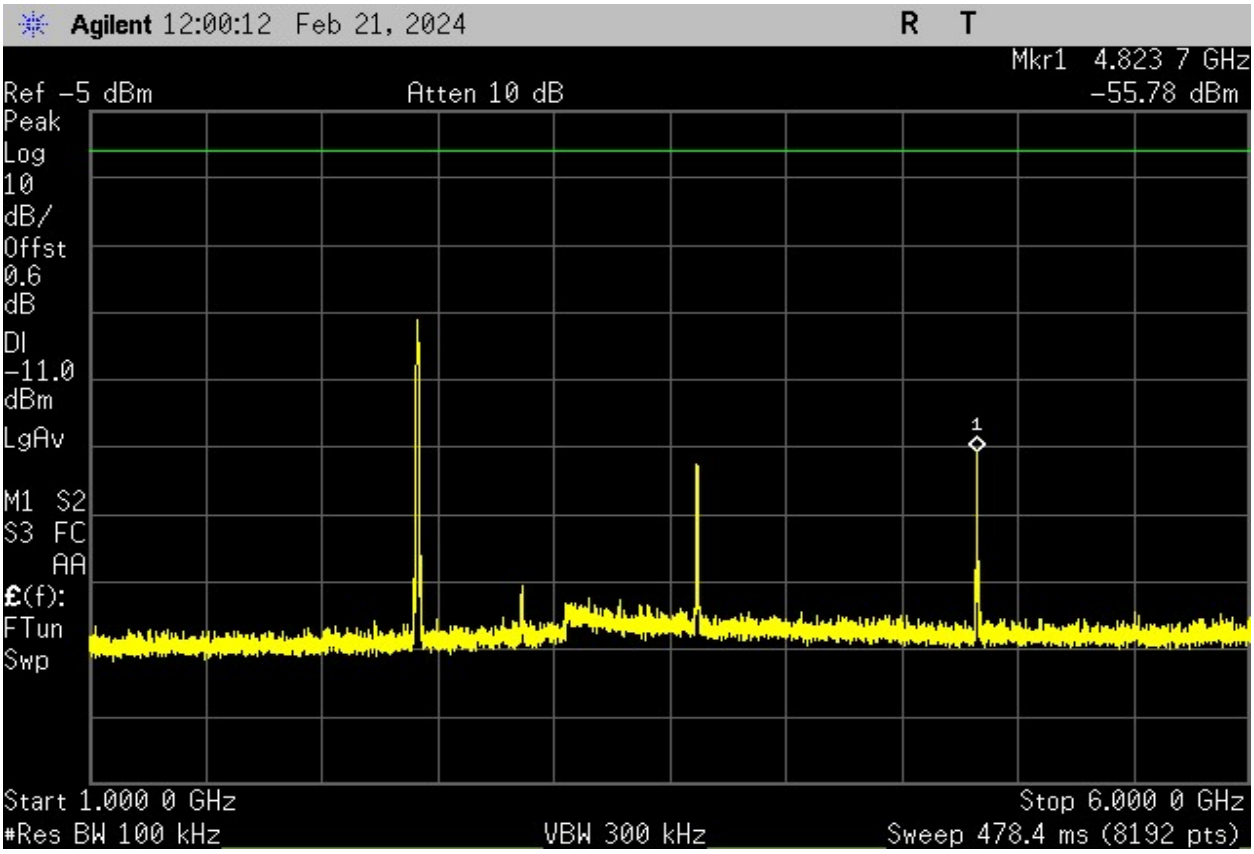
Test Results:

Operational Mode	Transmit Frequency (MHz)	Measured Frequency (GHz)	Measured Level (dBm)	Limit (dBm)
802.11b	2412	4.824	-55.79	-11.0
		7.240	-49.83	-11.0
	2437	4.874	-53.82	-11.0
		7.310	-49.83	-11.0
	2462	4.924	-48.35	-11.0
		7.390	-45.17	-11.0
802.11g	2412	3.618	-60.58	-14.0
		7.230	-51.50	-14.0
	2437	3.651	-61.16	-14.0
		7.300	-52.83	-14.0
	2462	4.923	-60.07	-14.0
		7.380	-50.17	-14.0
802.11n (20 MHz)	2412	3.616	-60.17	-14.5
		7.230	-51.50	-14.5
	2437	3.657	-61.86	-14.5
		7.300	-52.83	-14.5
	2462	4.921	-59.55	-14.5
		7.390	-50.17	-14.5

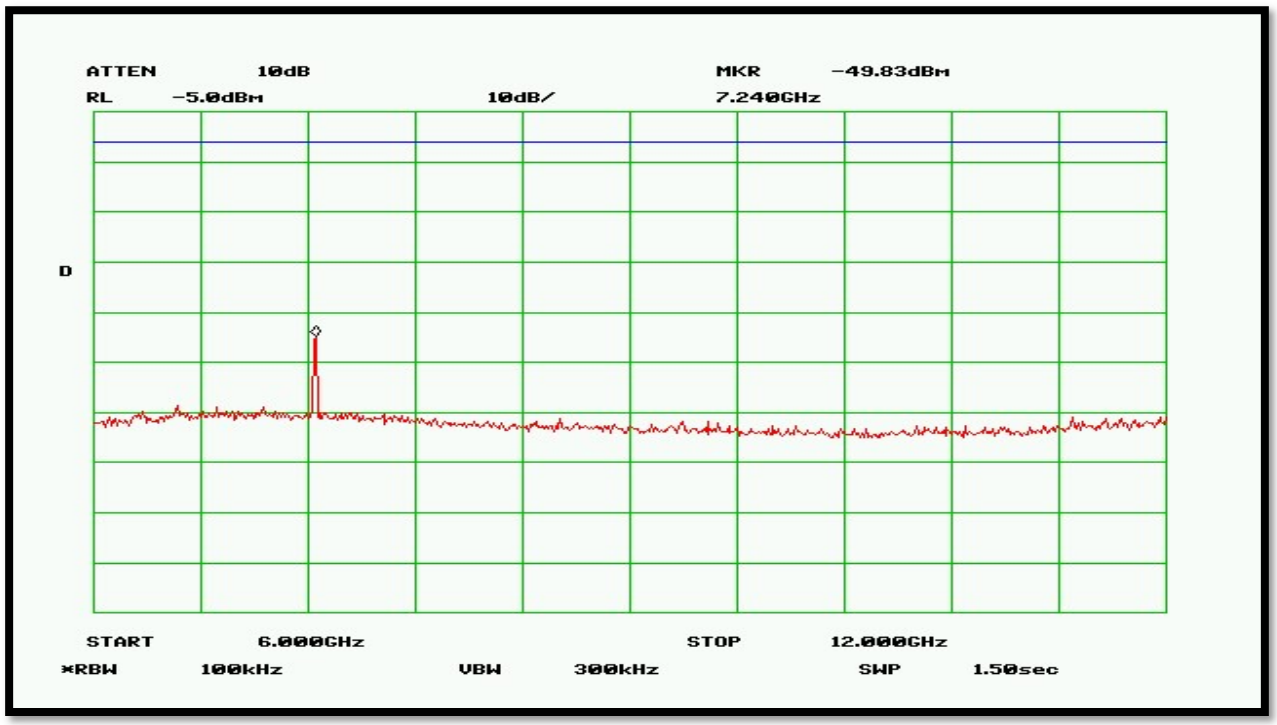
Table 10. Conducted Spurious Emissions, WIFI Test Results



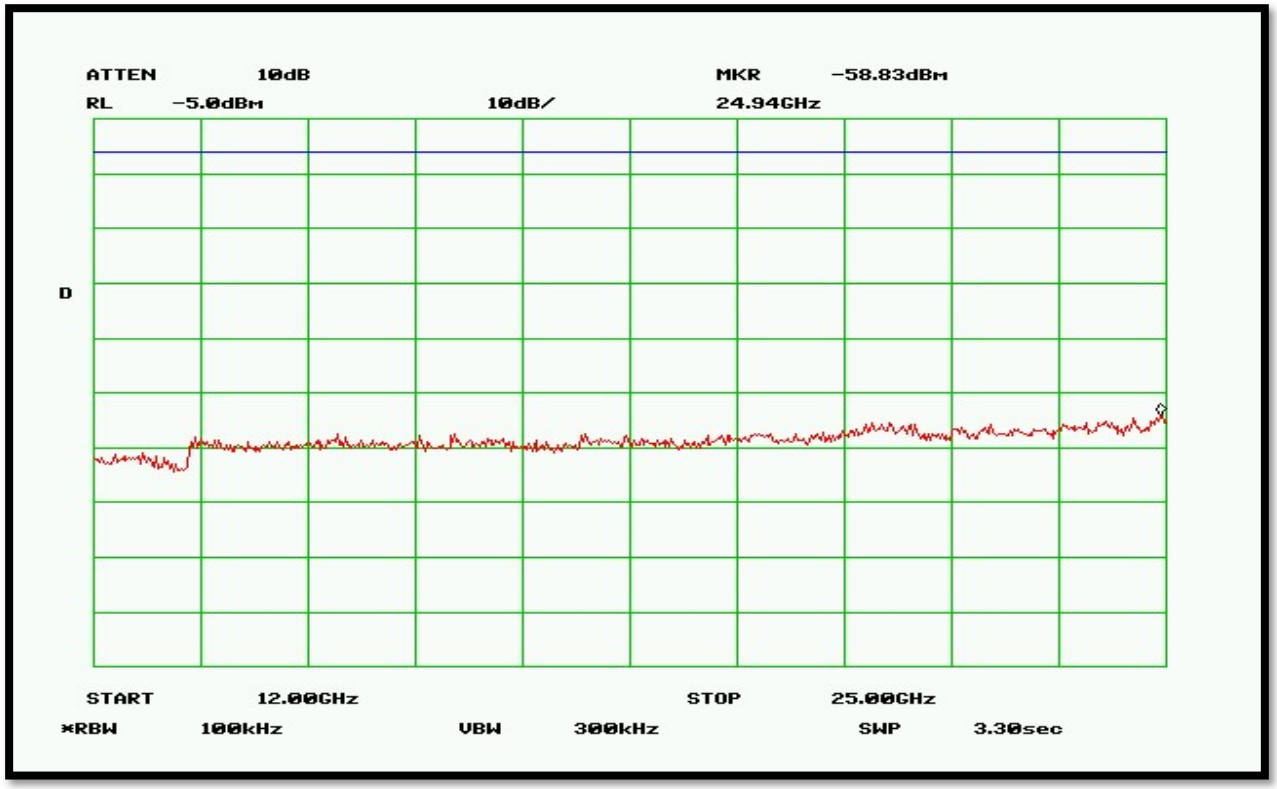
Plot 11 – 802.11b Lowest Channel – 30MHz to 1000MHz



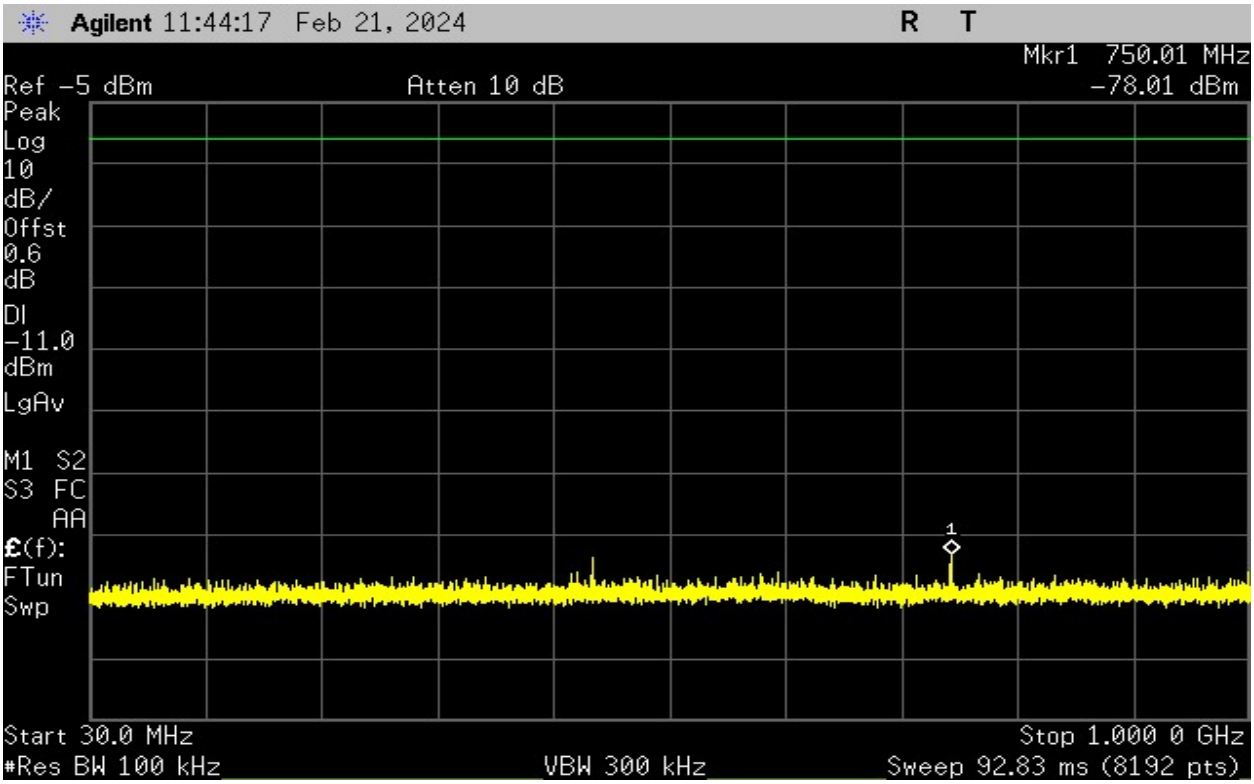
Plot 12 – 802.11b Lowest Channel – 1GHz to 6GHz



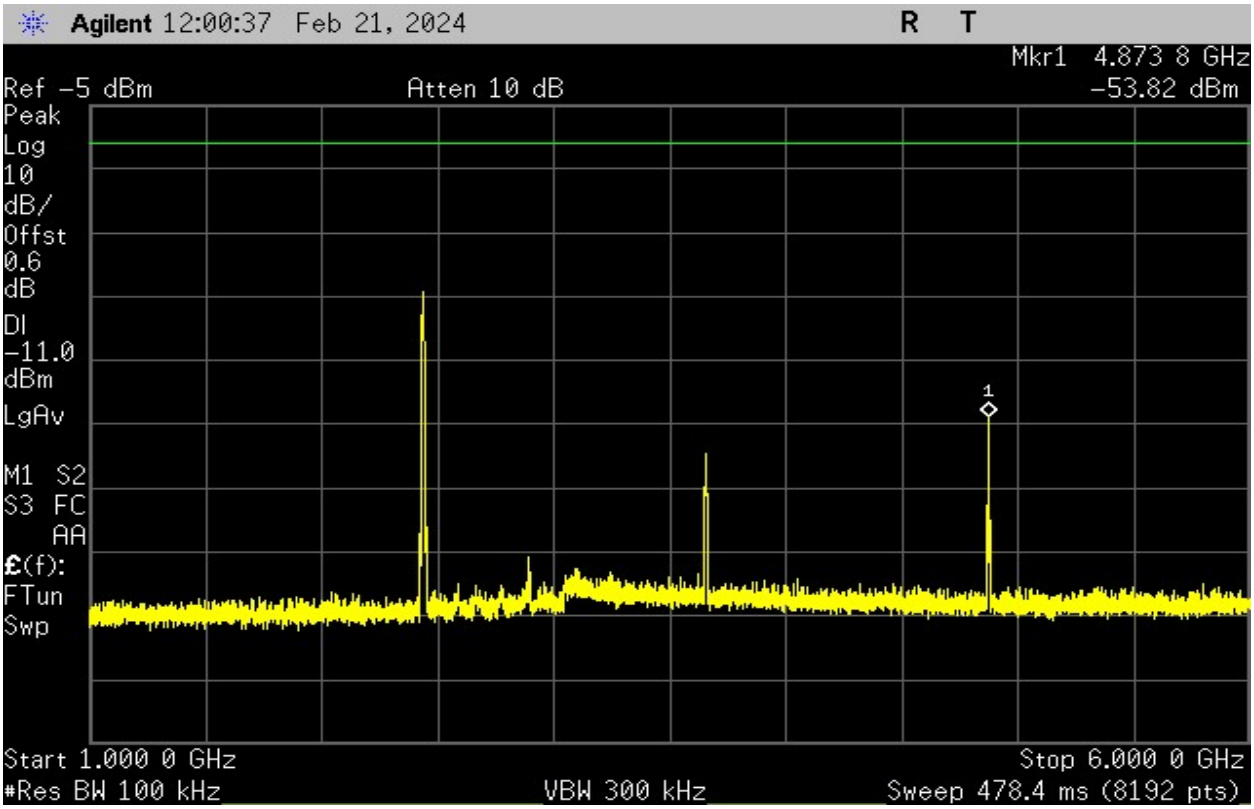
Plot 13 – 802.11b Lowest Channel – 6GHz to 12GHz



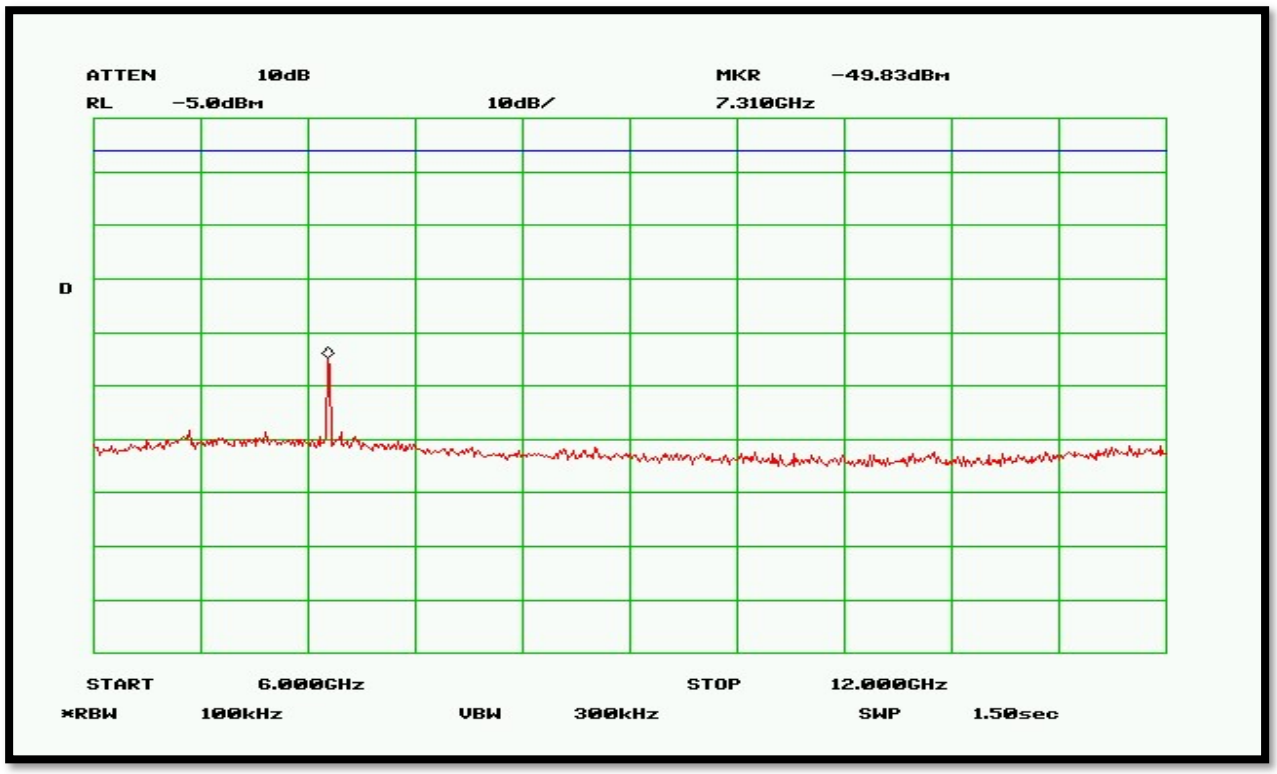
Plot 14 – 802.11b Lowest Channel – 12GHz to 25GHz



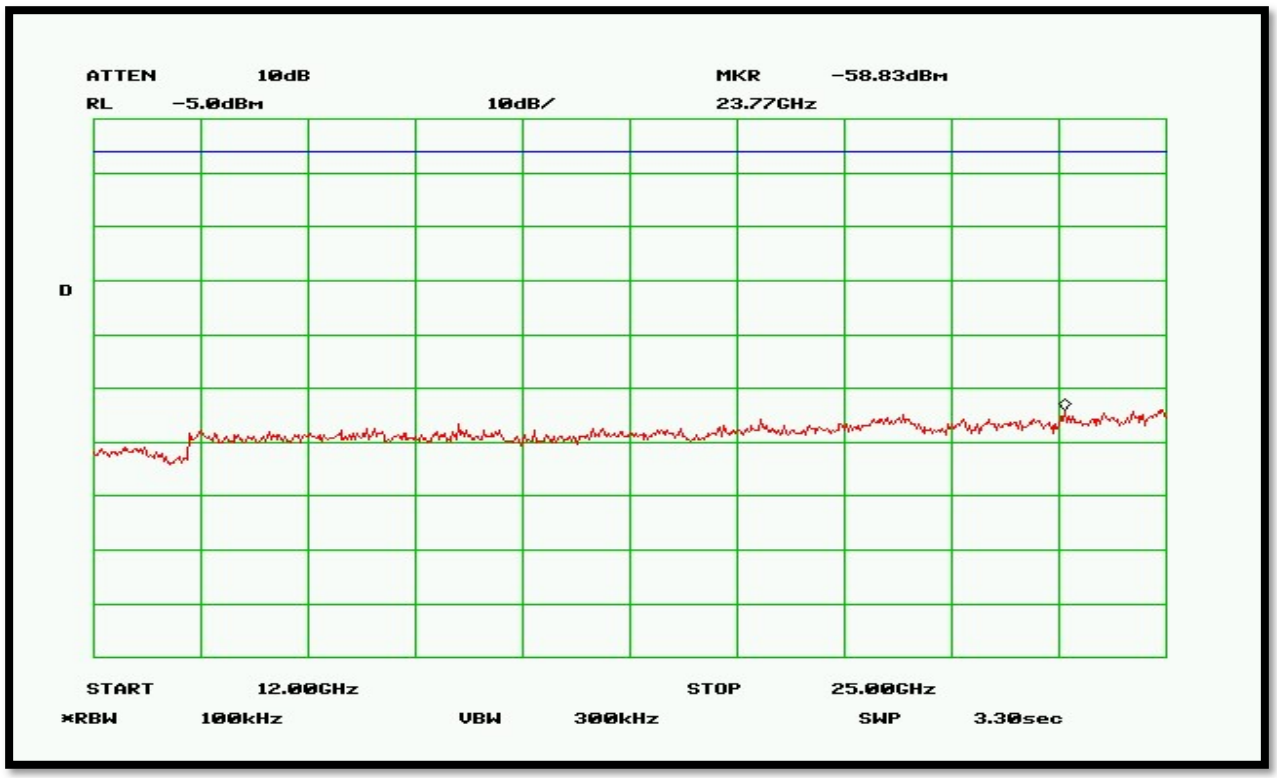
Plot 15 – 802.11b Middle Channel - 30MHz to 1000MHz



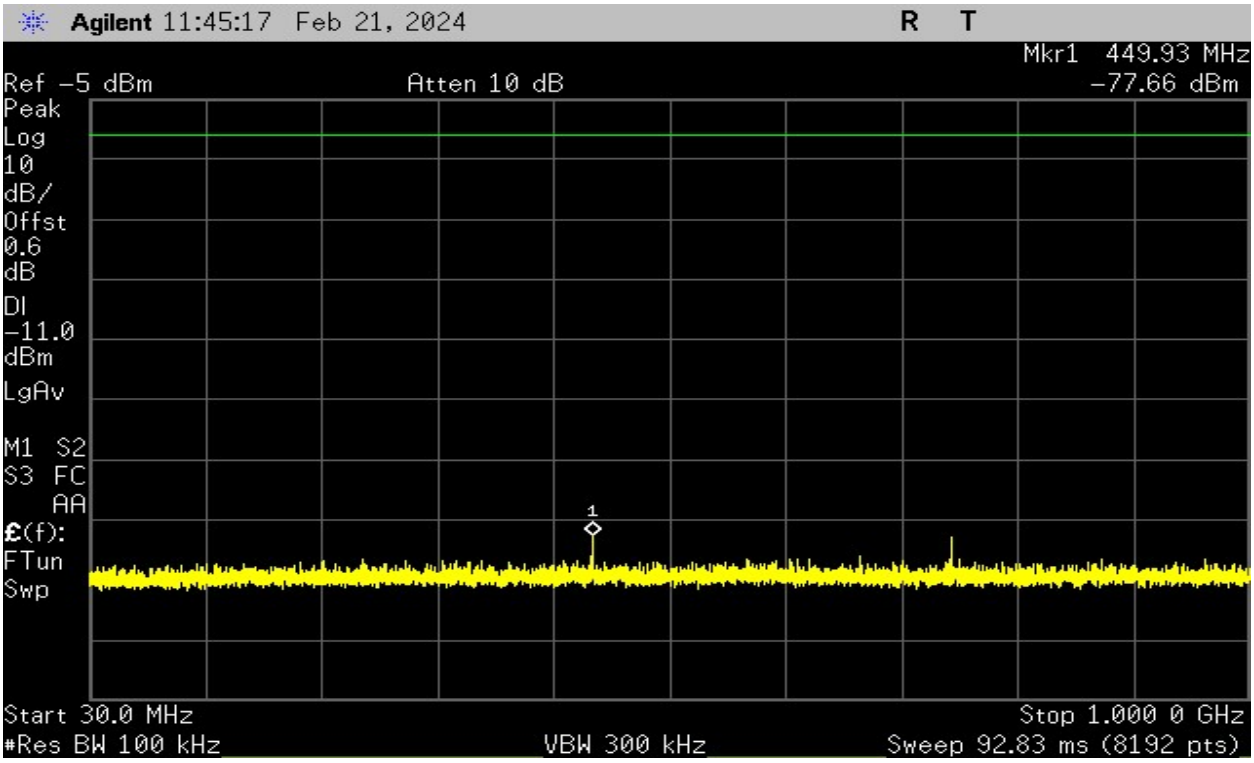
Plot 16 – 802.11b Middle Channel - 1GHz to 6GHz



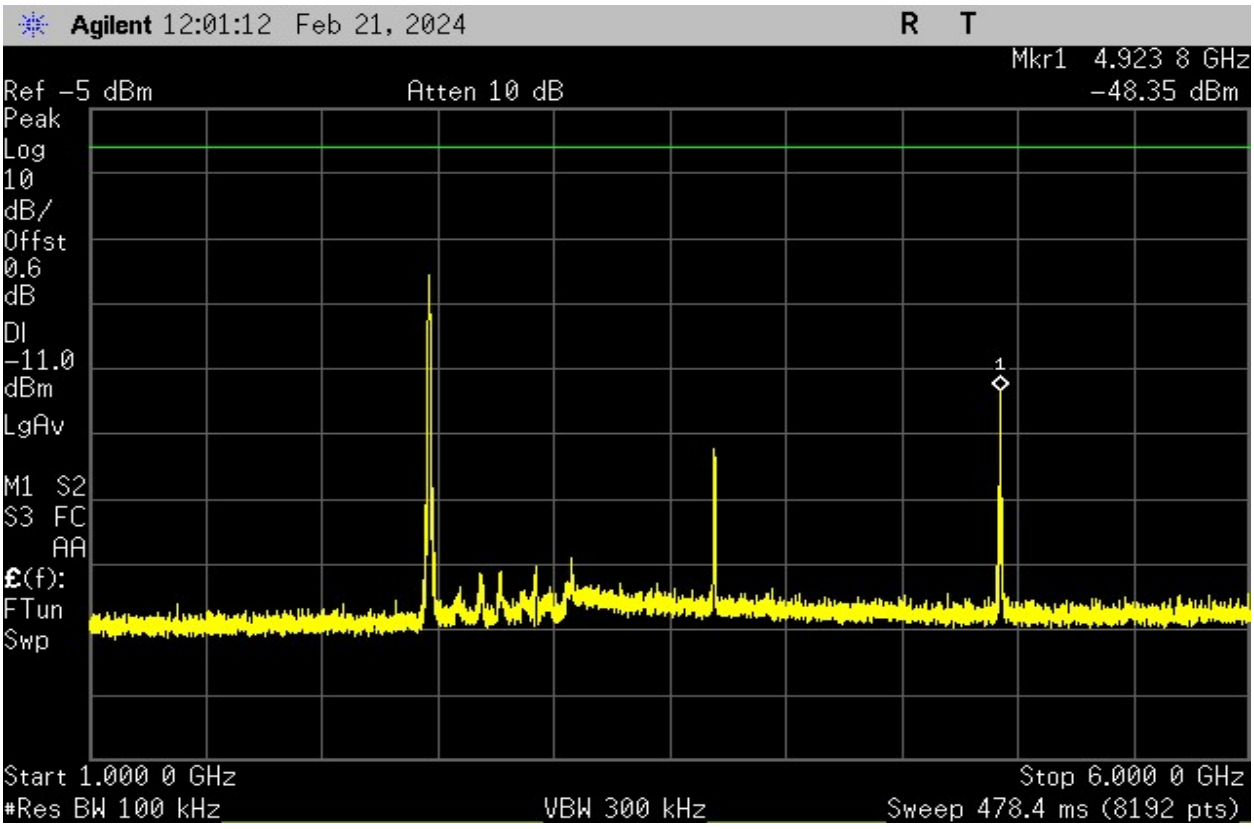
Plot 17 – 802.11b Middle Channel - 6GHz to 12GHz



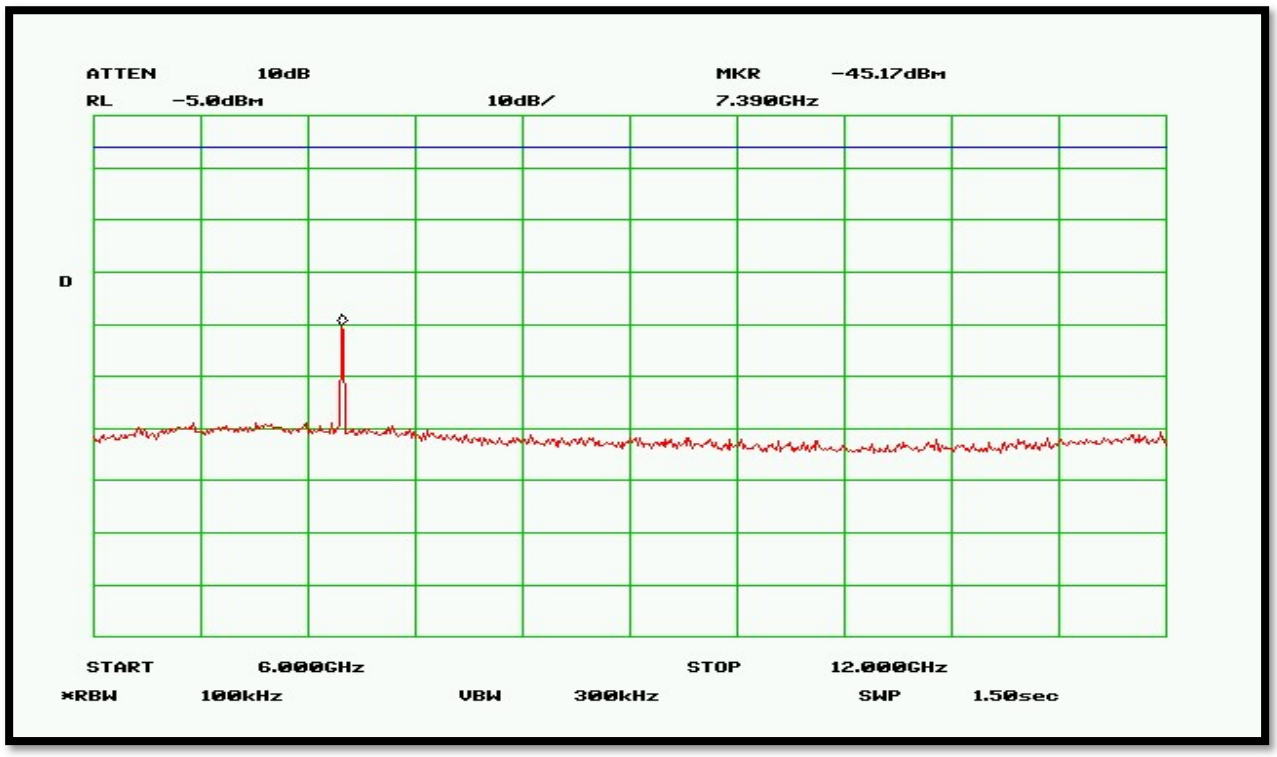
Plot 18 – 802.11b Middle Channel - 12GHz to 25GHz



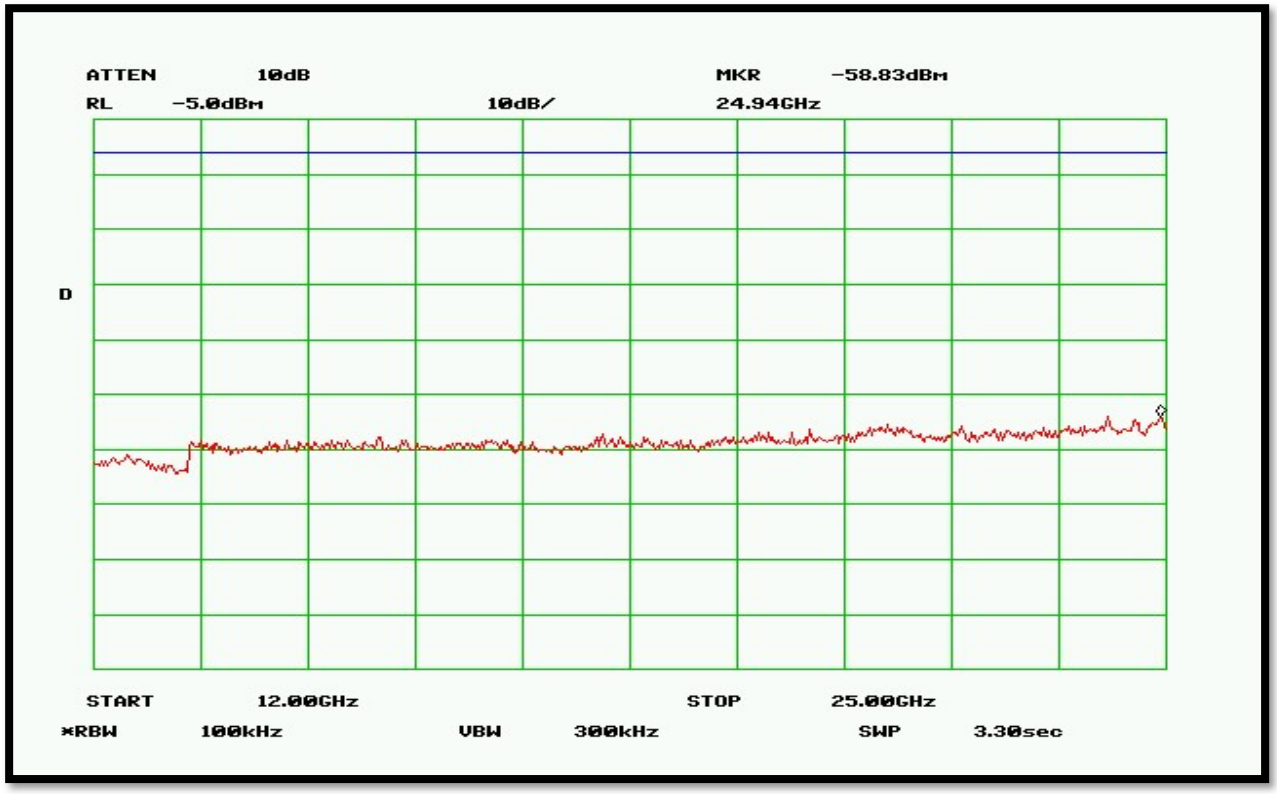
Plot 19 – 802.11b Highest Channel – 30MHz to 1000MHz



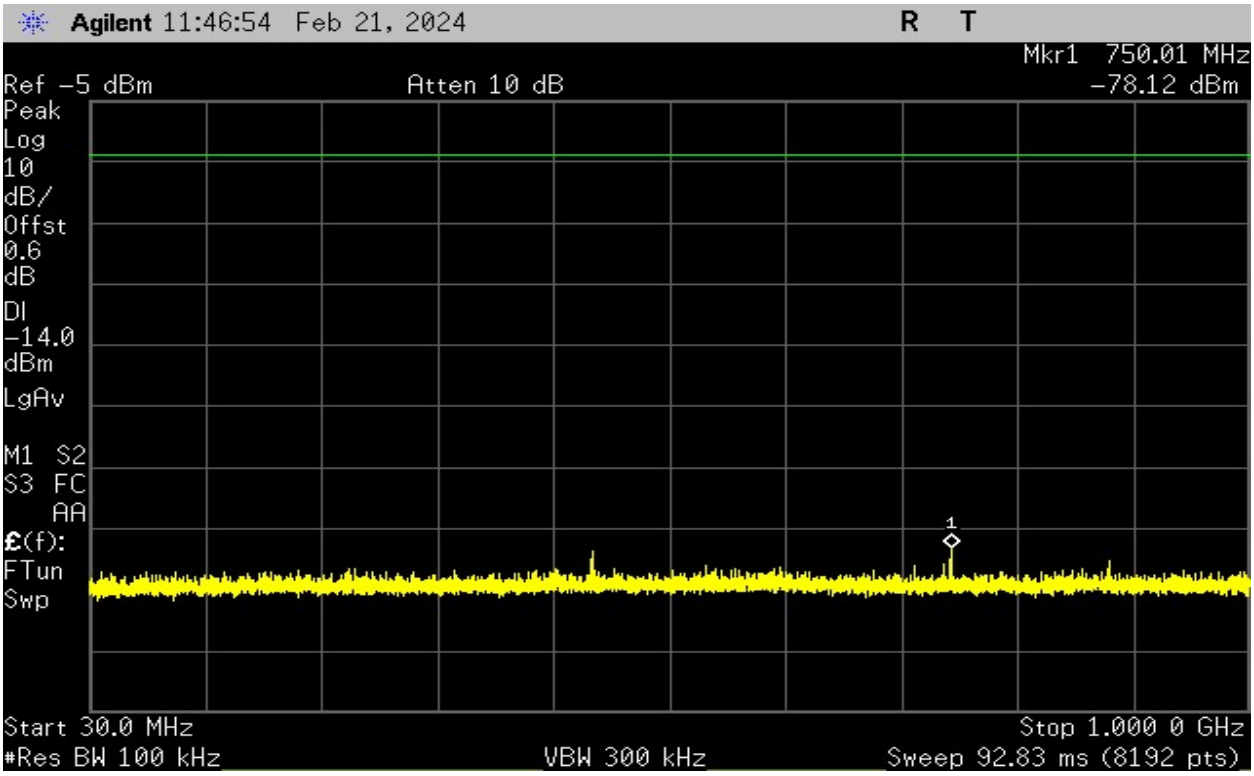
Plot 20 – 802.11b Highest Channel – 1GHz to 6GHz



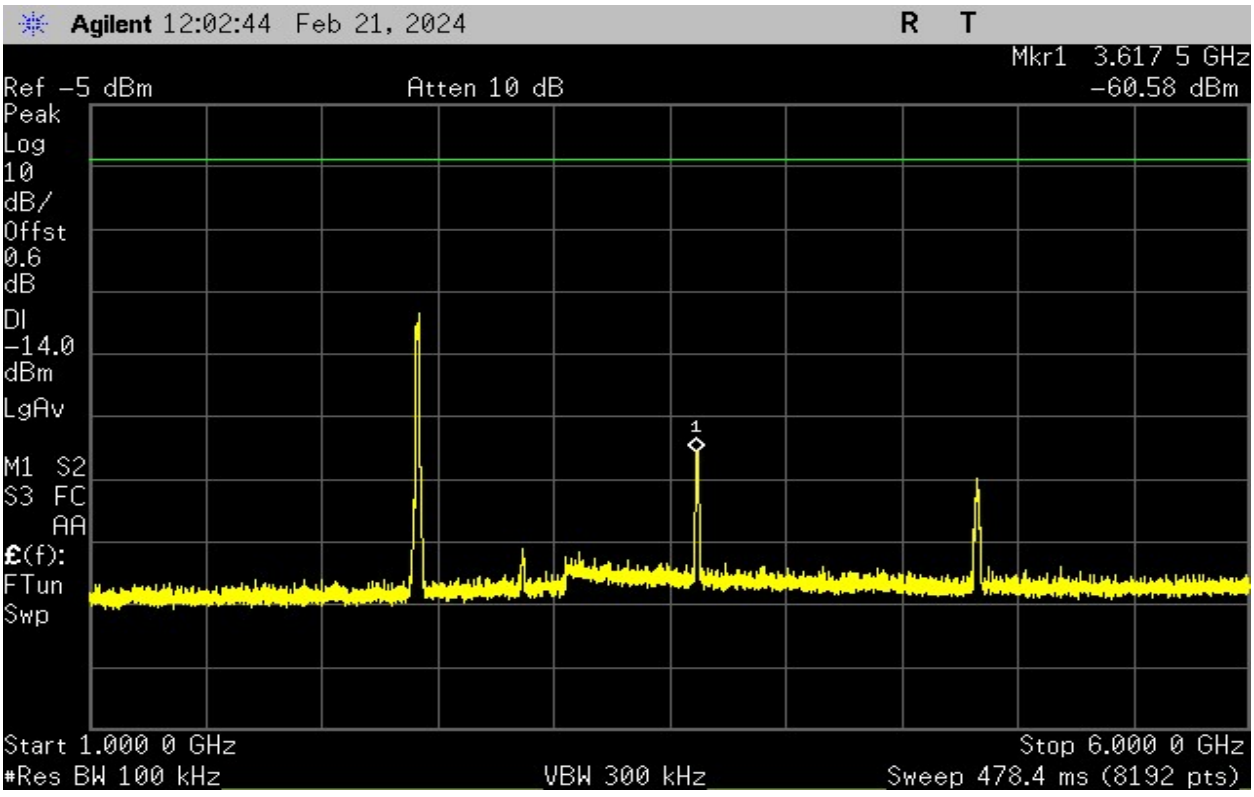
Plot 21 – 802.11b Highest Channel – 6GHz to 12GHz



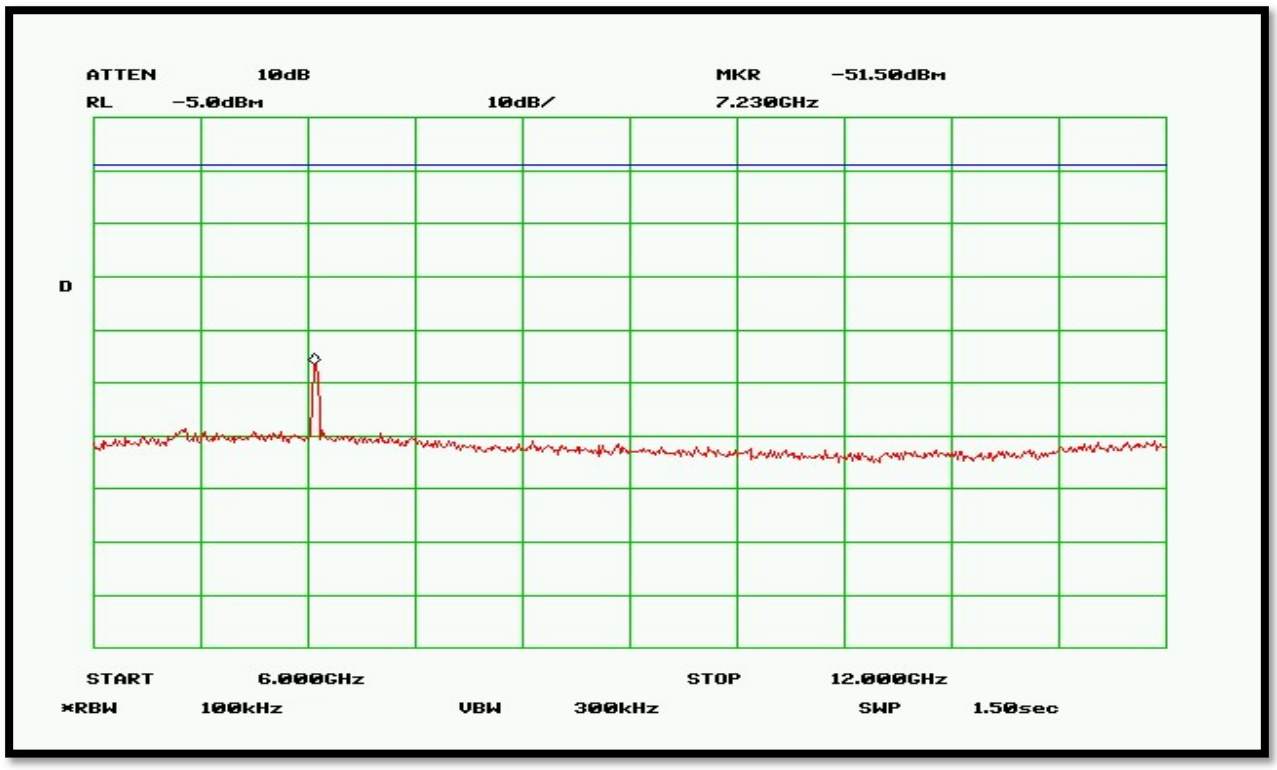
Plot 22 – 802.11b Highest Channel – 12GHz to 25GHz



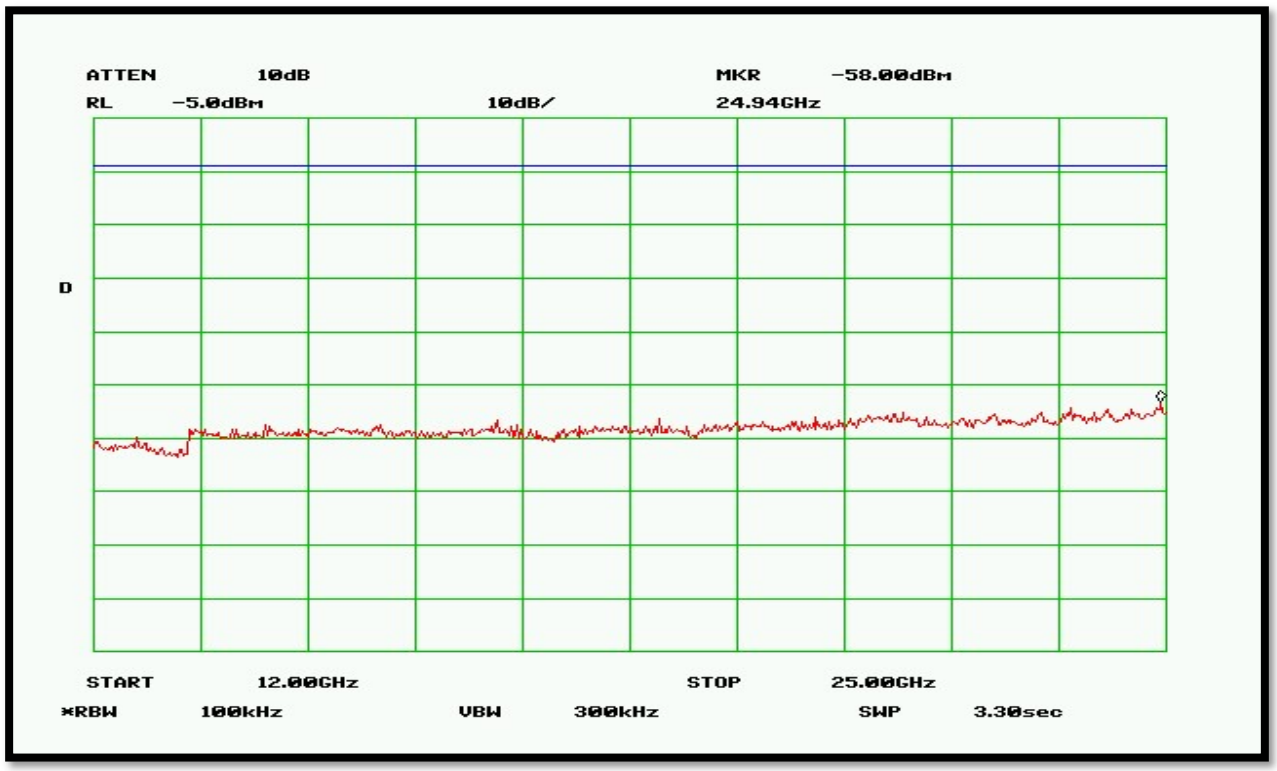
Plot 23 – 802.11g Lowest Channel – 30MHz to 1000MHz



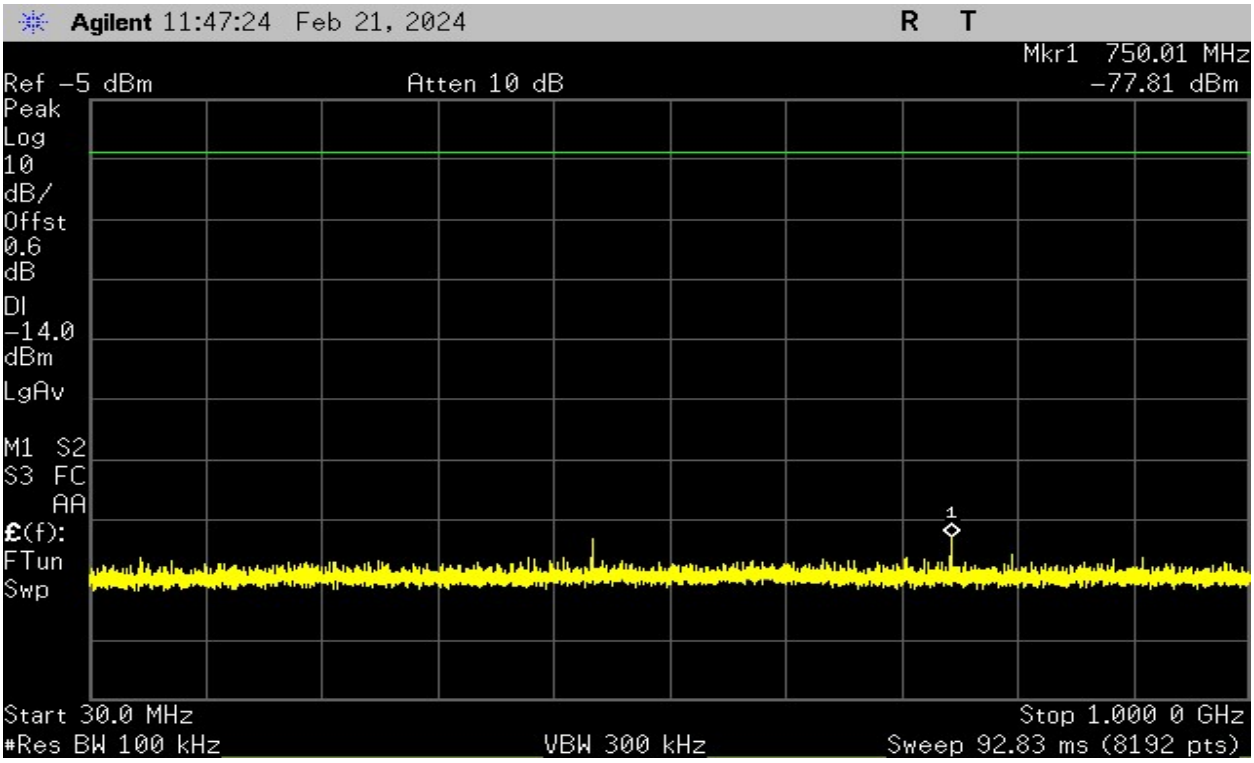
Plot 24 – 802.11g Lowest Channel – 1GHz to 6GHz



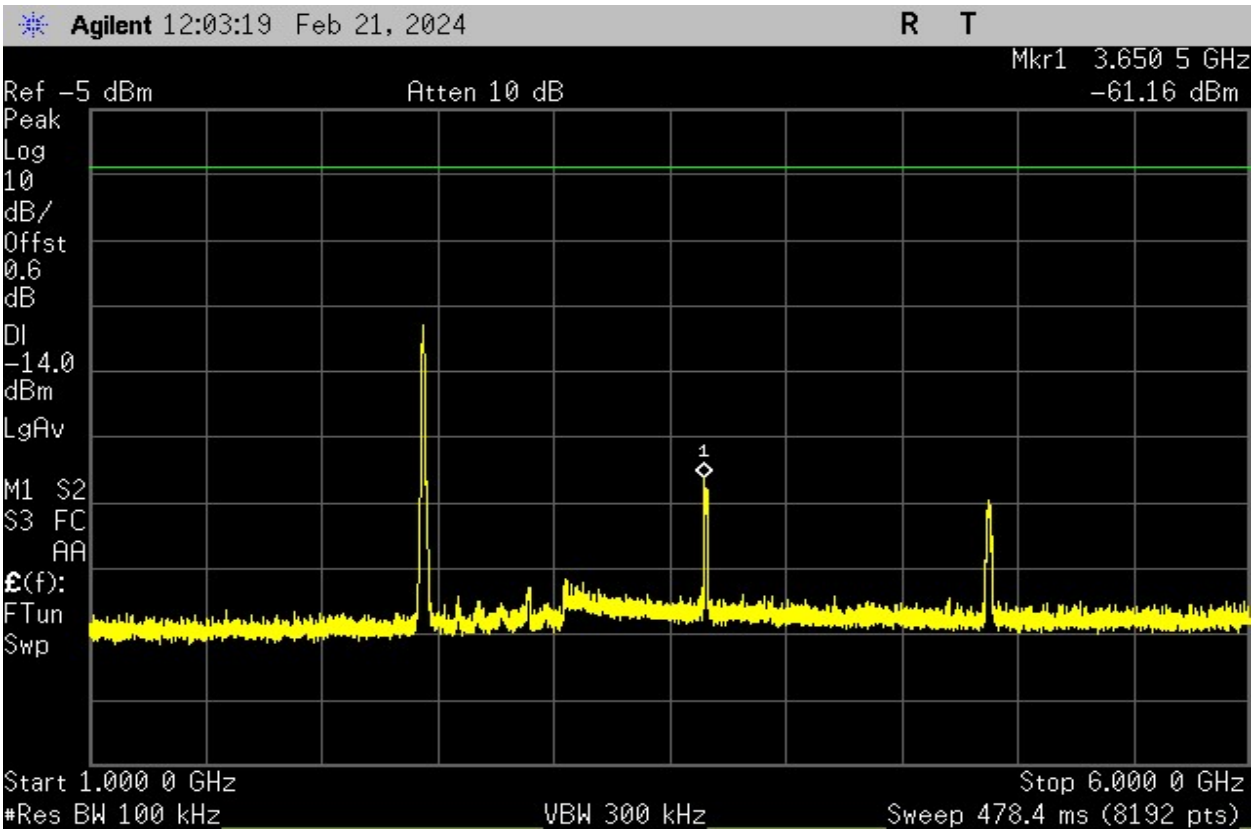
Plot 25 – 802.11g Lowest Channel – 6GHz to 12GHz



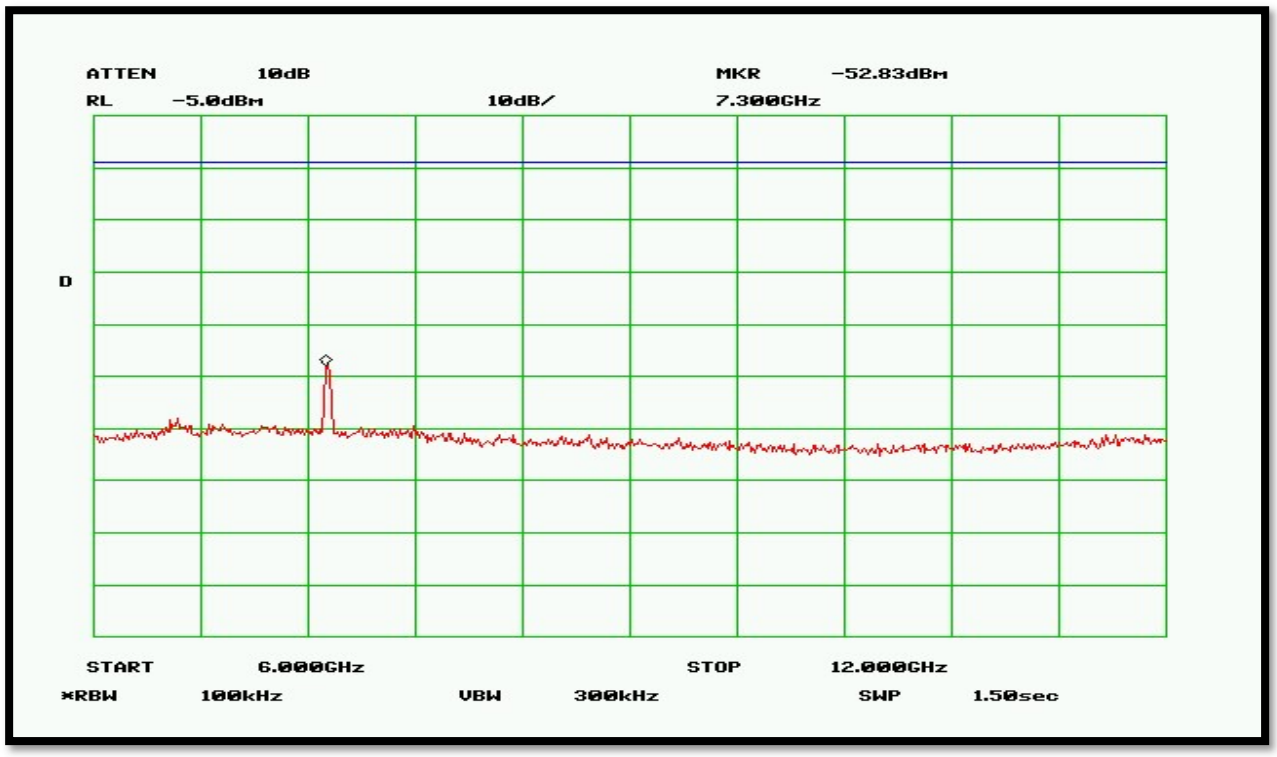
Plot 26 – 802.11g Lowest Channel – 12GHz to 25GHz



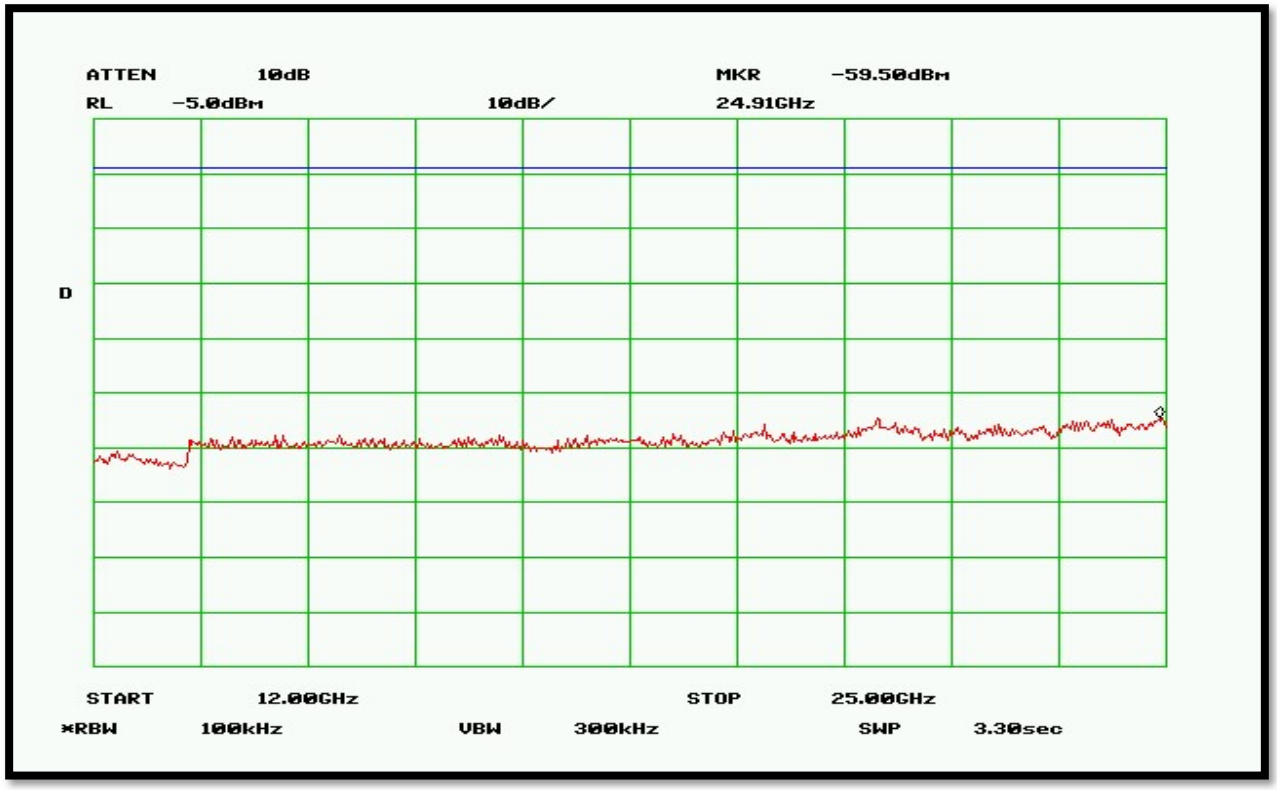
Plot 27 – 802.11g Middle Channel - 30MHz to 1000MHz



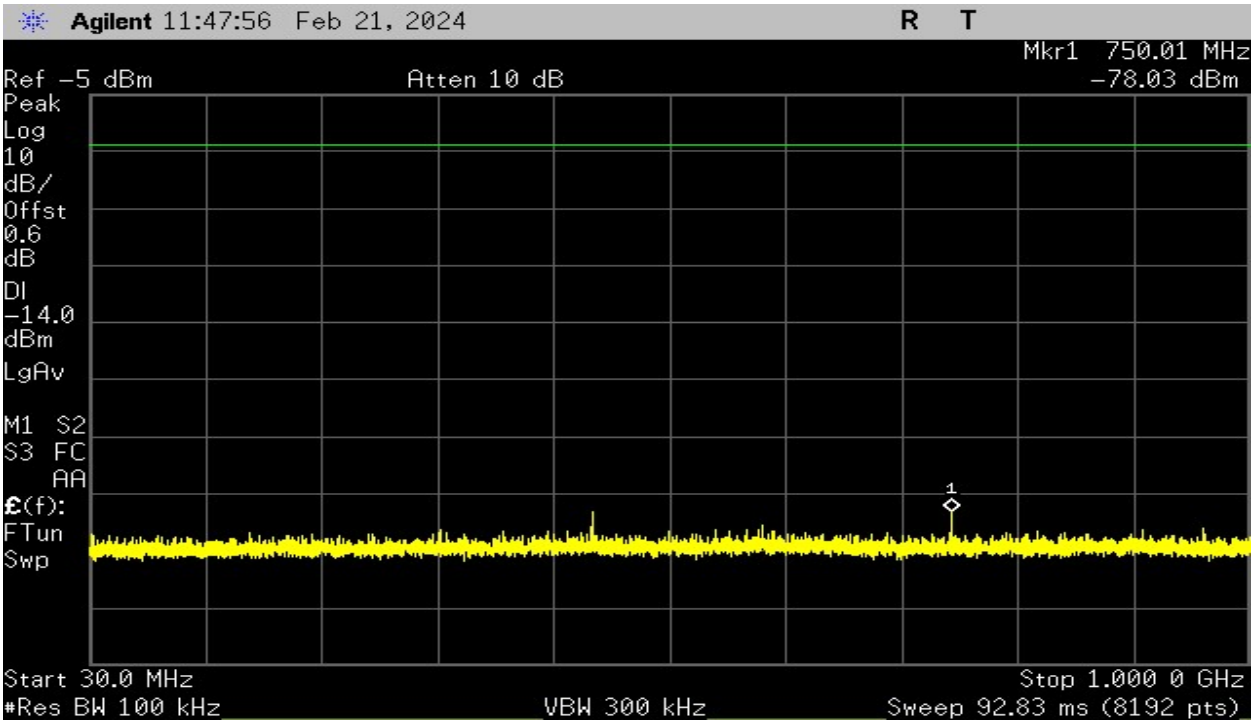
Plot 28 – 802.11g Middle Channel - 1GHz to 6GHz



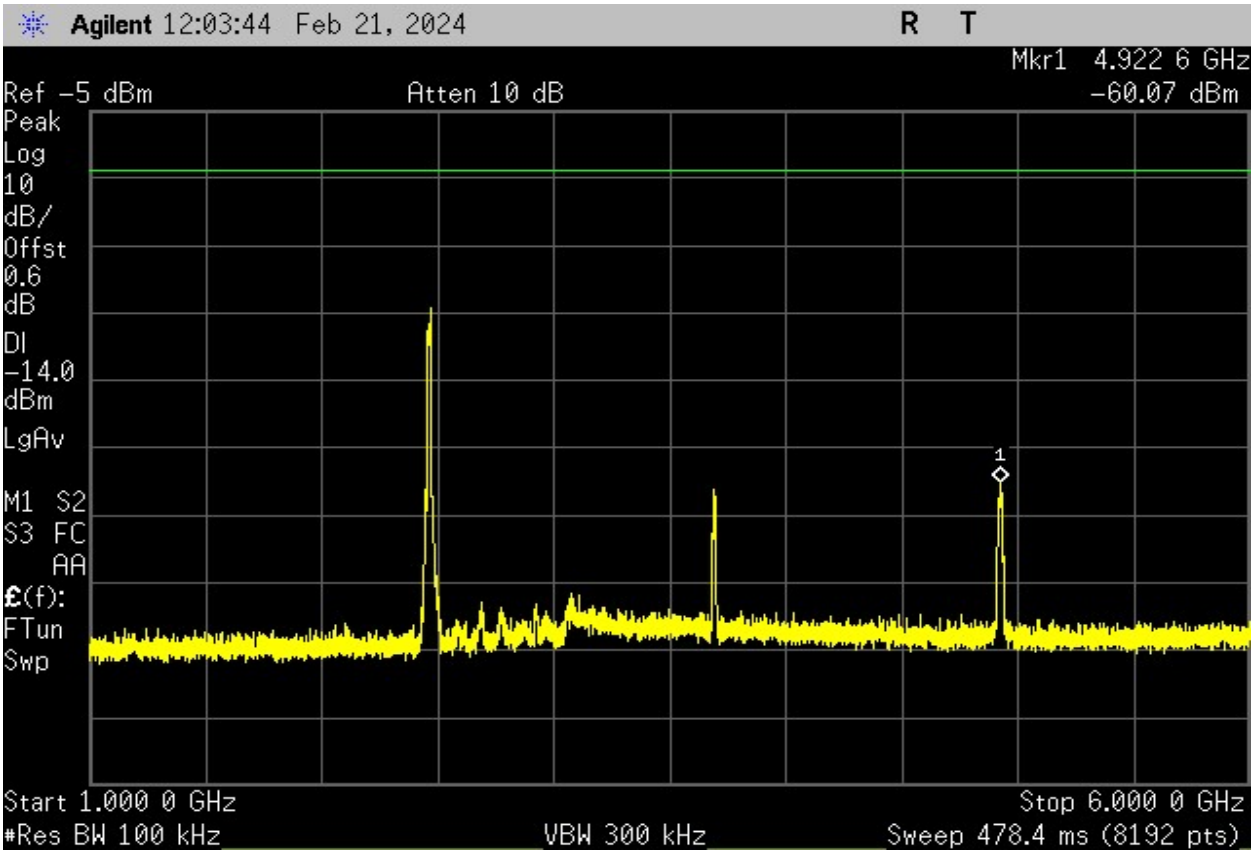
Plot 29 – 802.11g Middle Channel - 6GHz to 12GHz



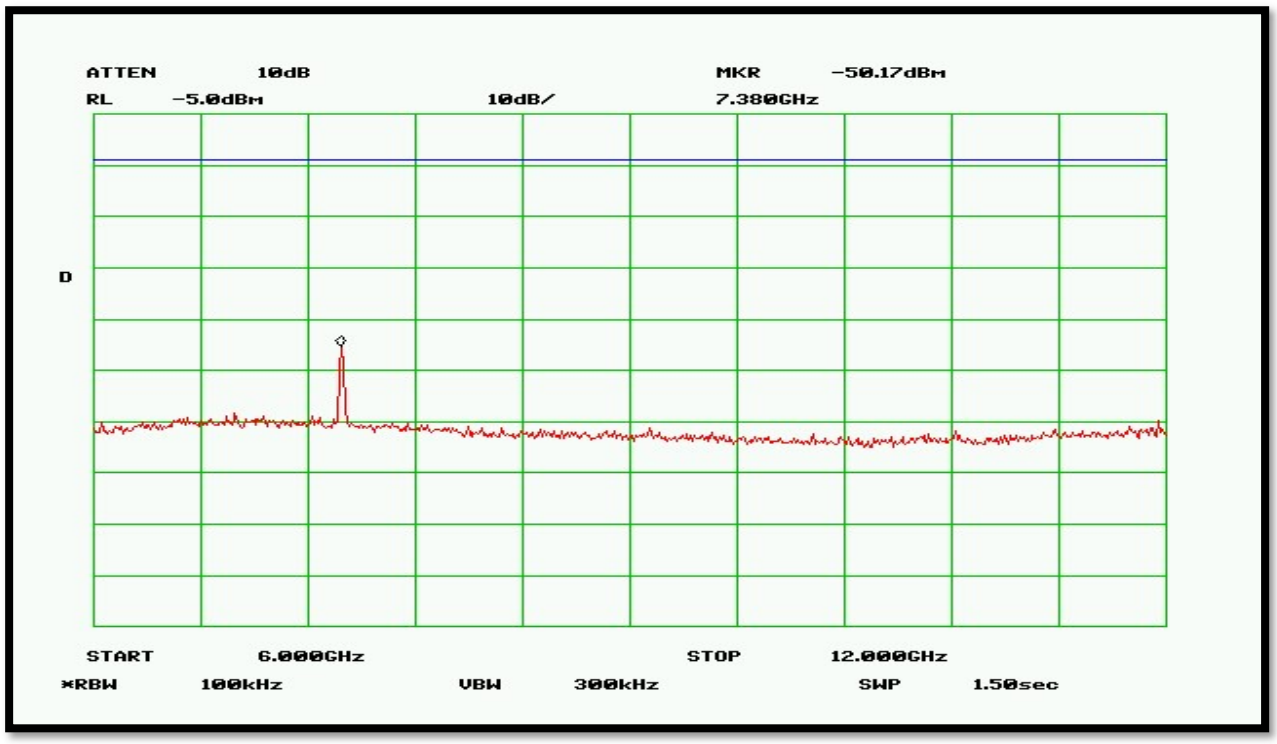
Plot 30 – 802.11g Middle Channel - 12GHz to 25GHz



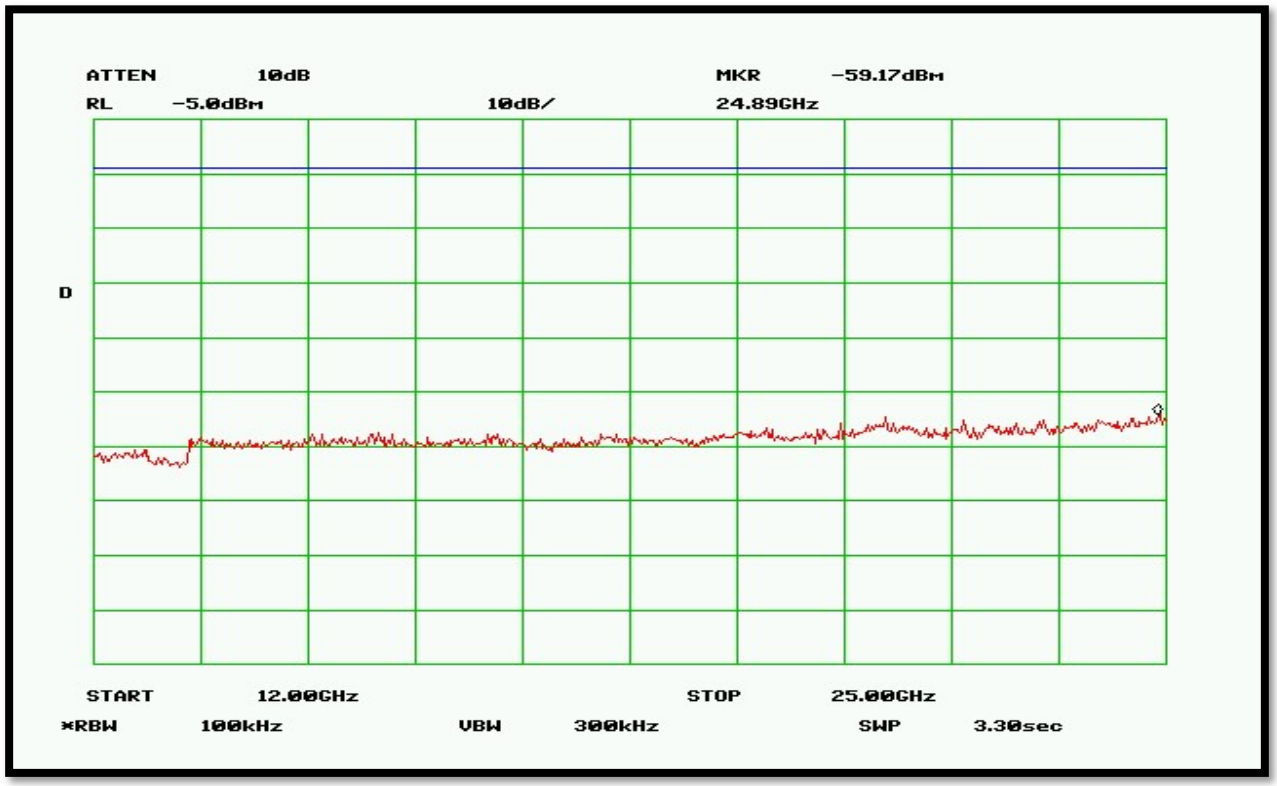
Plot 31 – 802.11g Highest Channel – 30MHz to 1000MHz



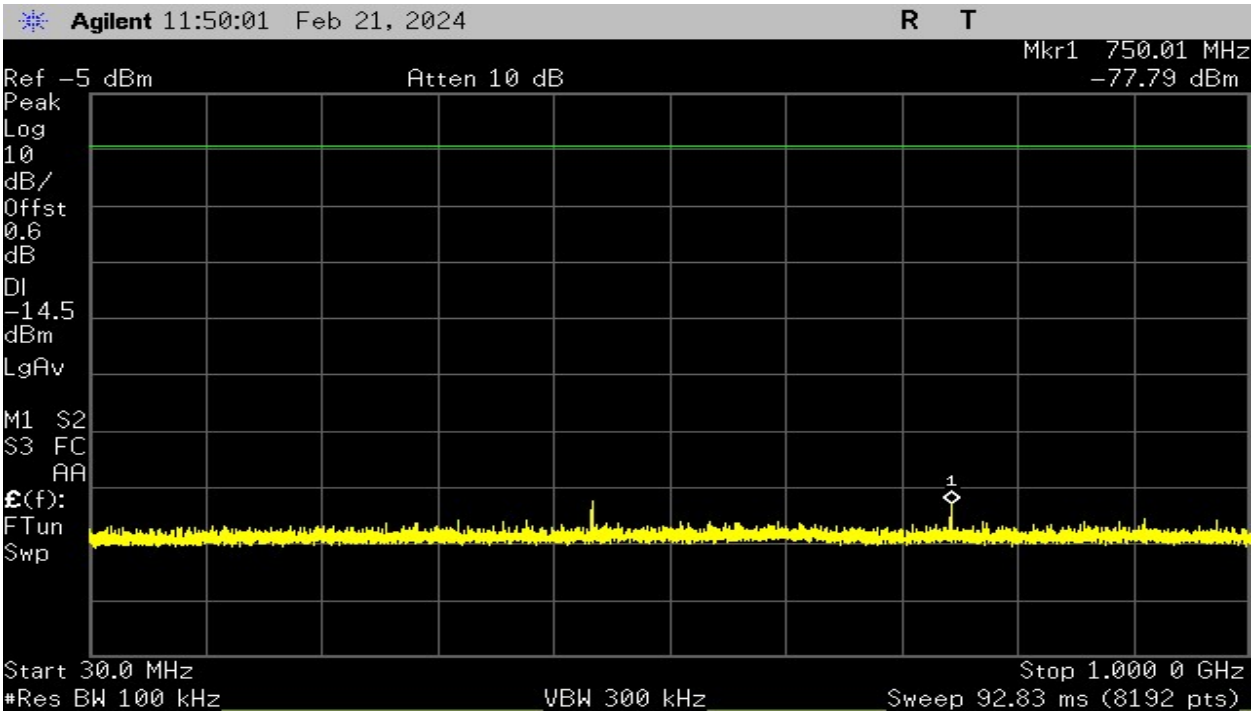
Plot 32 – 802.11g Highest Channel – 1GHz to 6GHz



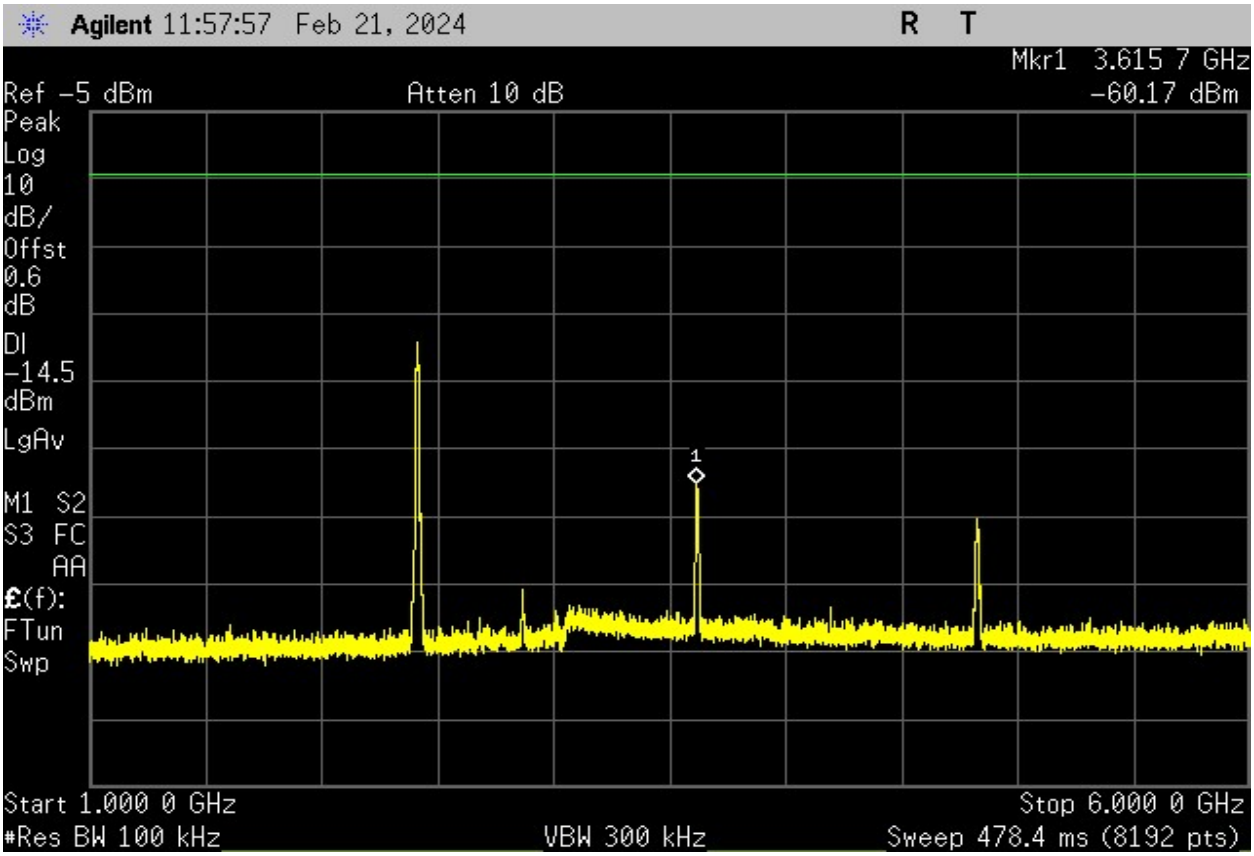
Plot 33 – 802.11g Highest Channel – 6GHz to 12GHz



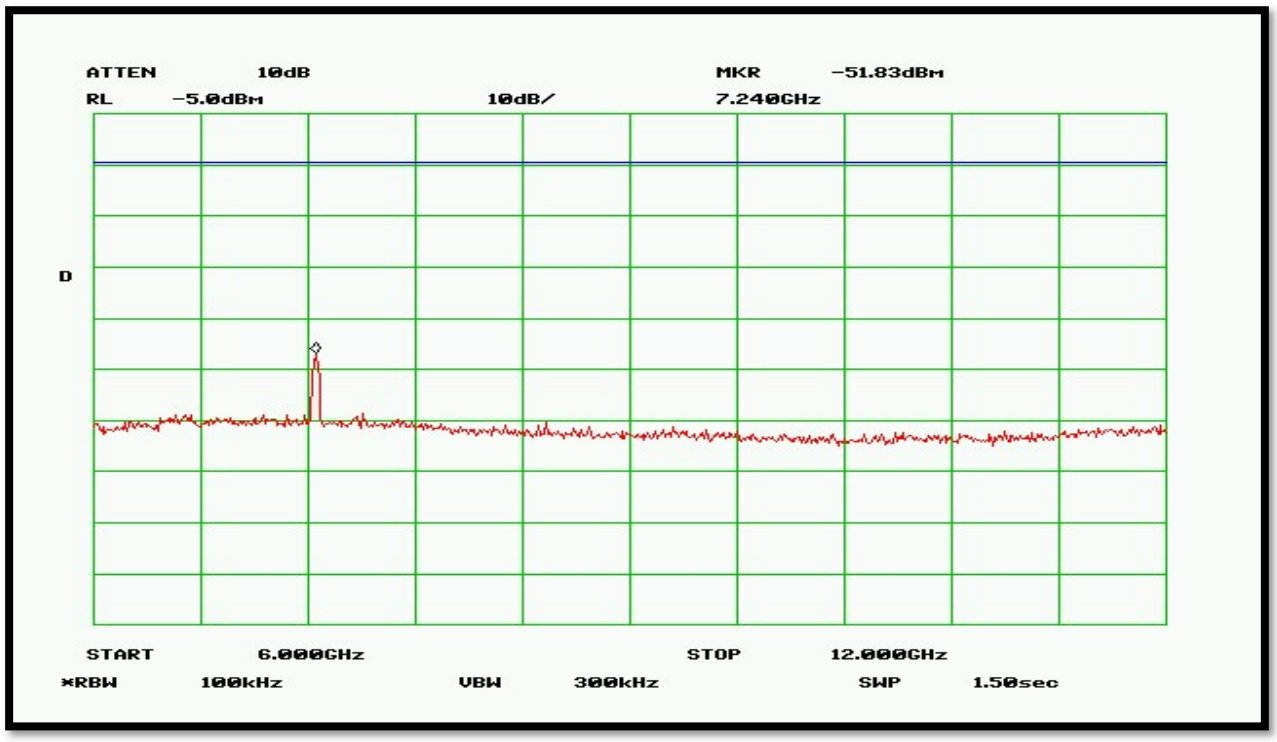
Plot 34 – 802.11g Highest Channel – 12GHz to 25GHz



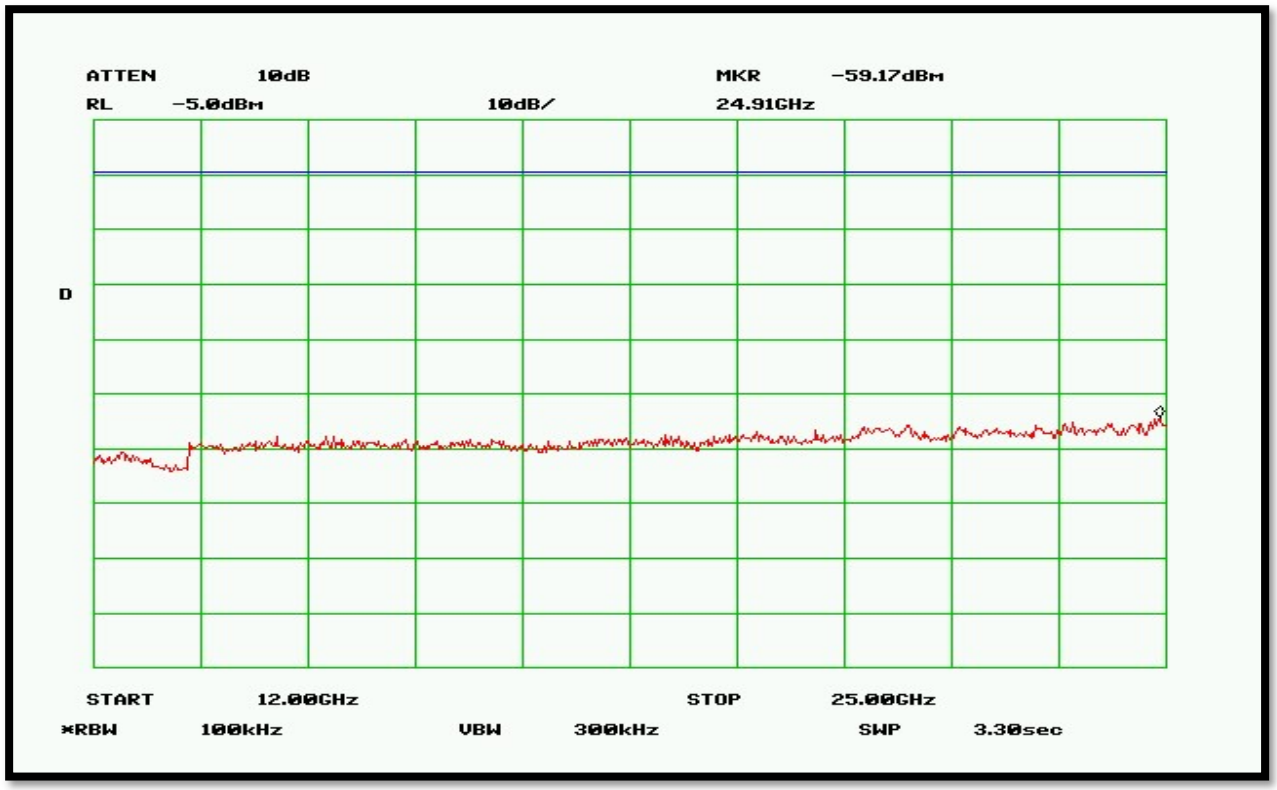
Plot 35 – 802.11n (20 MHz) Lowest Channel – 30MHz to 1000MHz



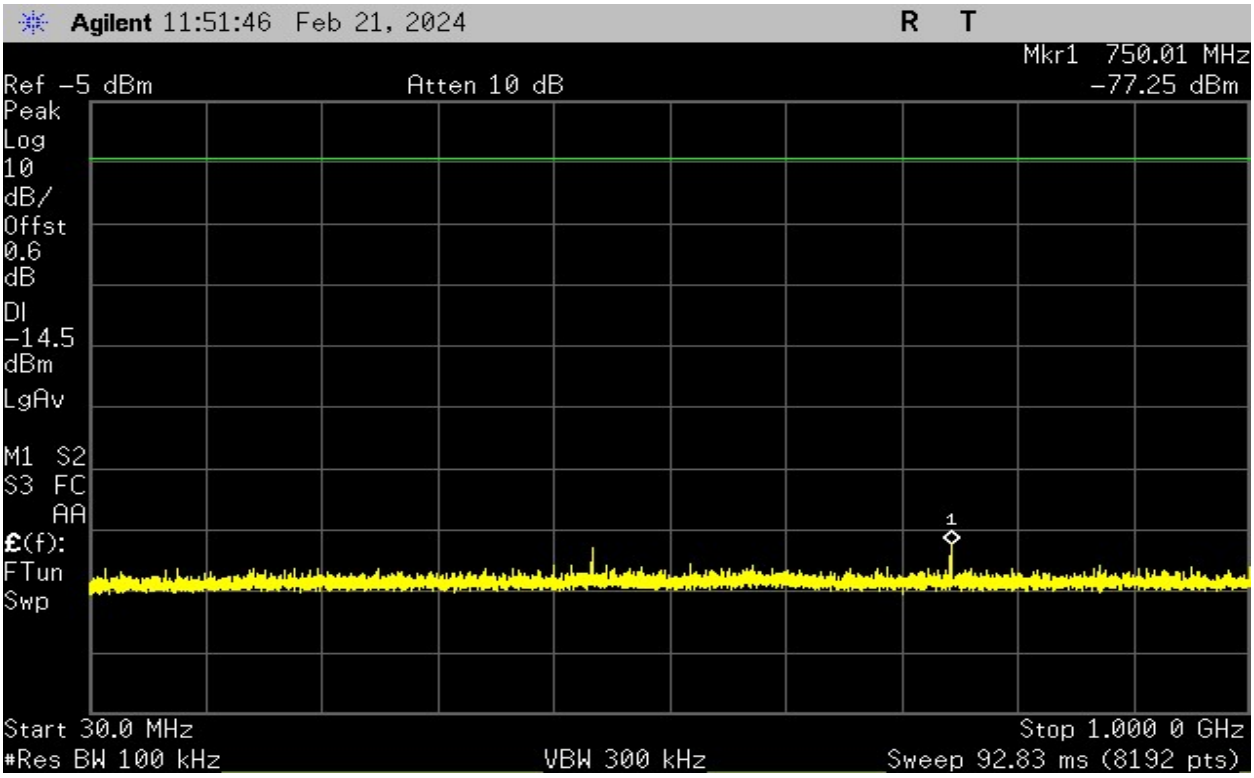
Plot 36 – 802.11n (20 MHz) Lowest Channel – 1GHz to 6GHz



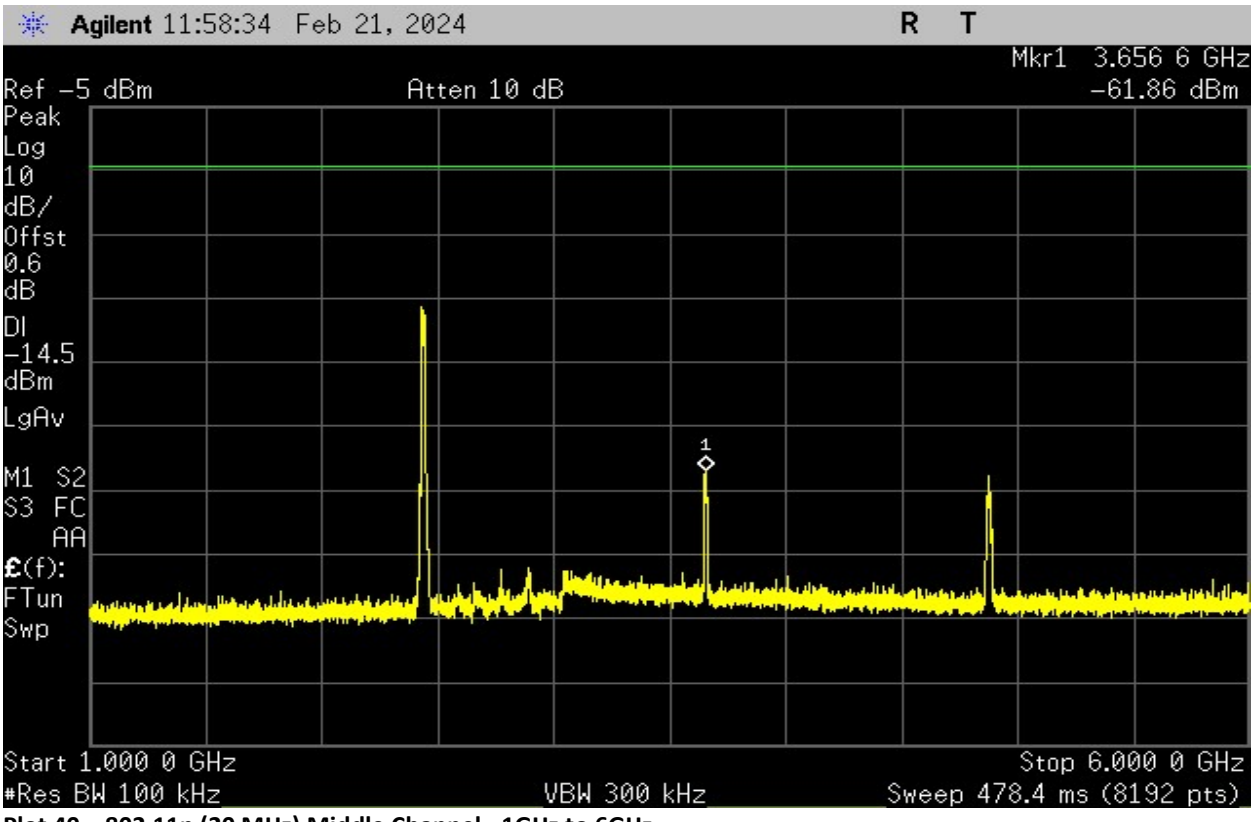
Plot 37 – 802.11n (20 MHz) Lowest Channel – 6GHz to 12GHz



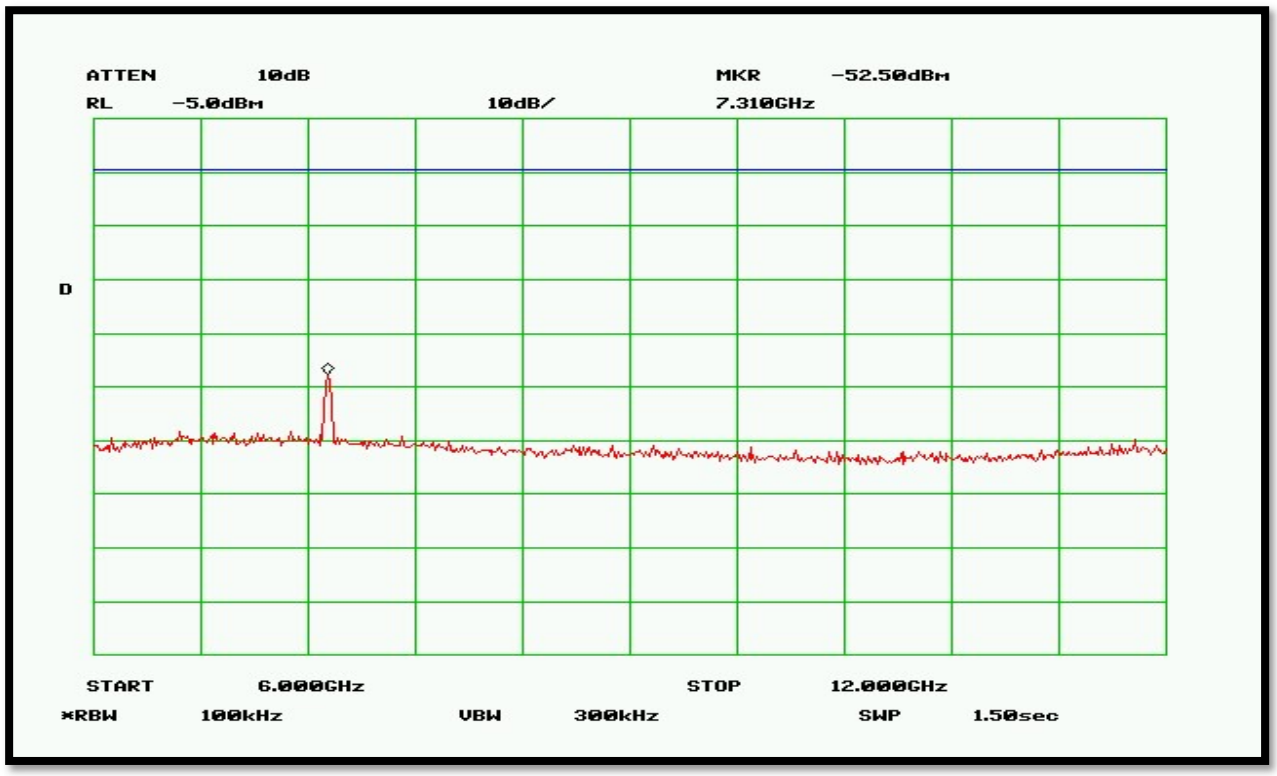
Plot 38 – 802.11n (20 MHz) Lowest Channel – 12GHz to 25GHz



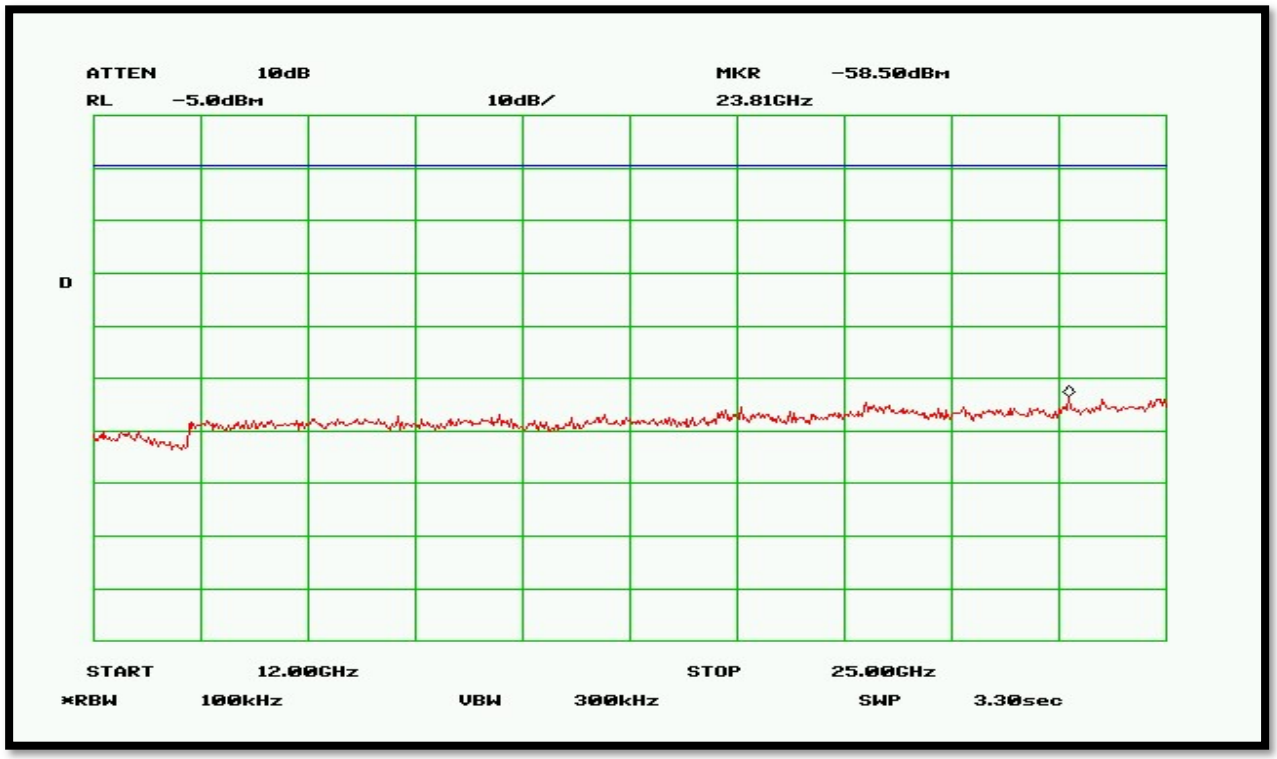
Plot 39 – 802.11n (20 MHz) Middle Channel - 30MHz to 1000MHz



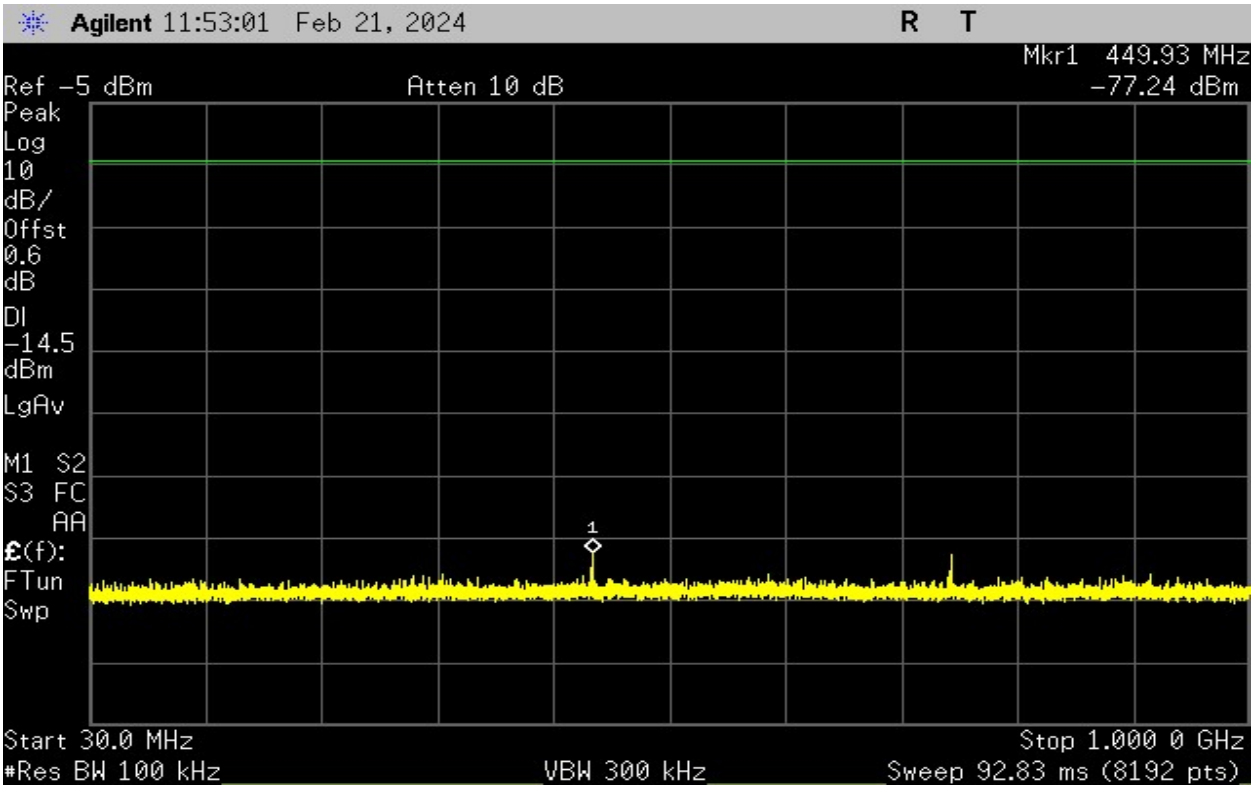
Plot 40 – 802.11n (20 MHz) Middle Channel - 1GHz to 6GHz



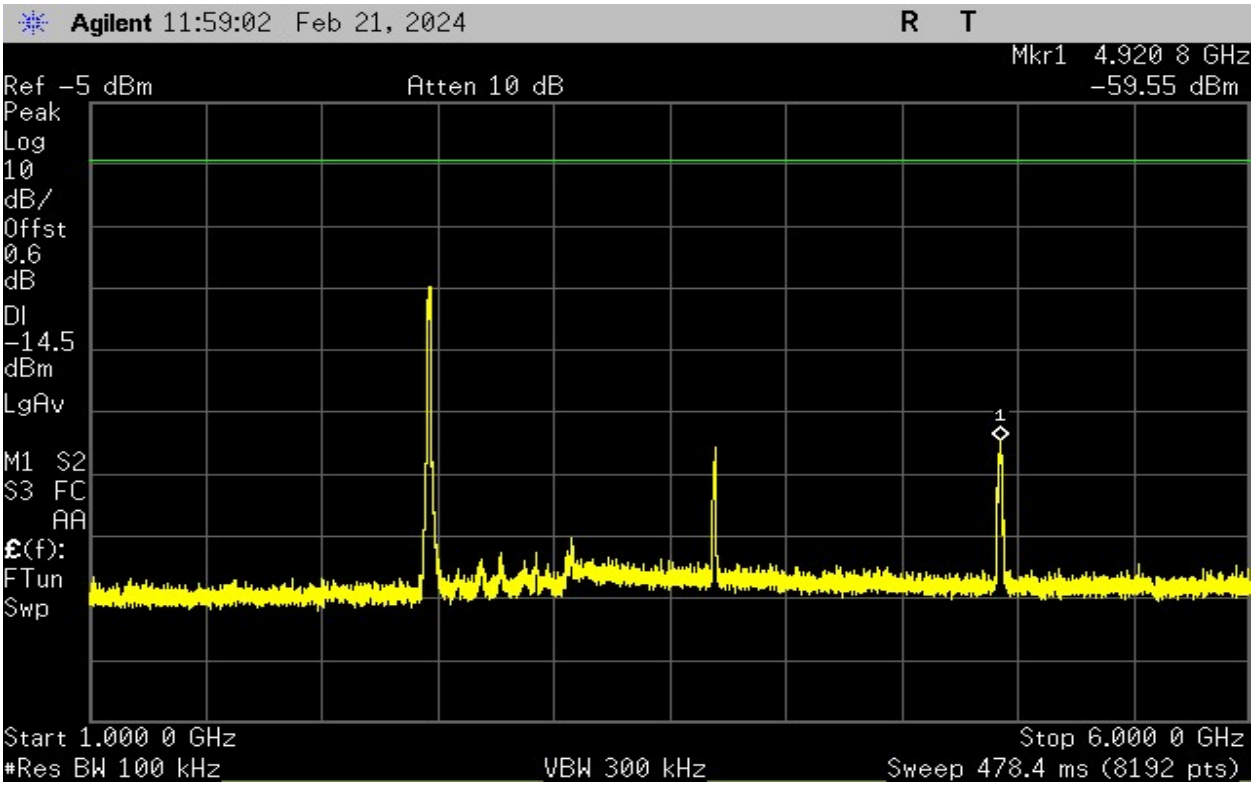
Plot 41 – 802.11n (20 MHz) Middle Channel - 6GHz to 12GHz



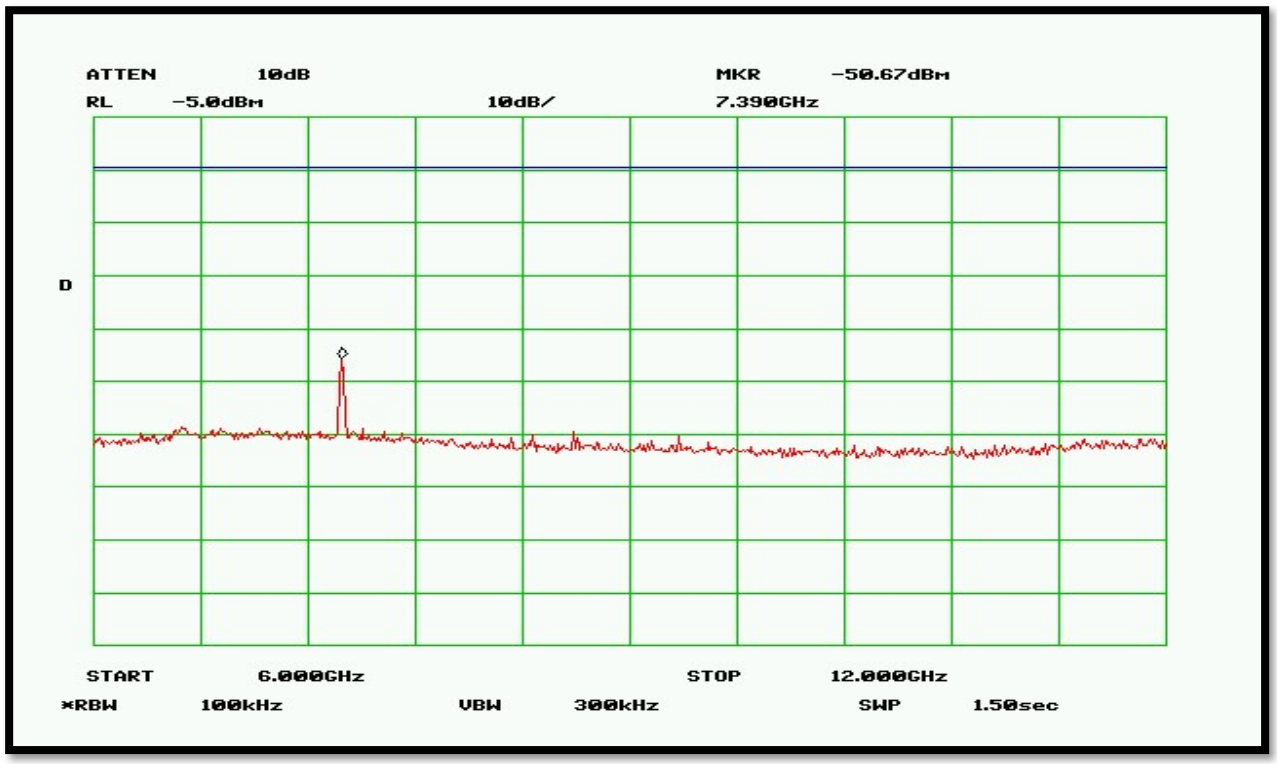
Plot 42 – 802.11n (20 MHz) Middle Channel - 12GHz to 25GHz



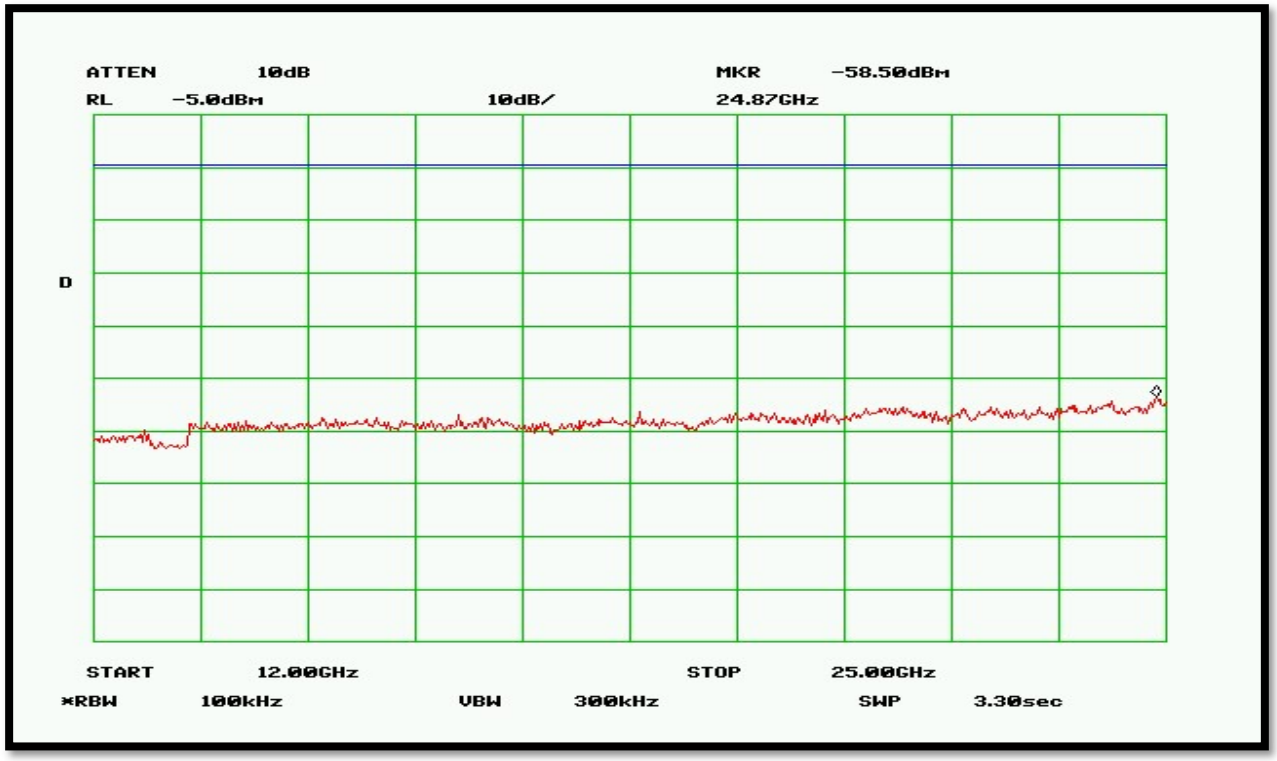
Plot 43 – 802.11n (20 MHz) Highest Channel – 30MHz to 1000MHz



Plot 44 – 802.11n (20 MHz) Highest Channel – 1GHz to 6GHz



Plot 45 – 802.11n (20 MHz) Highest Channel – 6GHz to 12GHz



Plot 46 – 802.11n (20 MHz) Highest Channel – 12GHz to 25GHz

4. Radiated Spurious Emissions and Restricted Band

Test Requirement(s):	§15.247(d), 15.209(a), 15.205	**Test Engineer(s):**	Sean E.
Test Results:	Pass	**Test Date(s):**	Feb 27, 2024

Test Procedures: As required by 47 CFR 15.247, Radiated spurious measurements were made in accordance with the procedures of the FCC Guidance Document 558074 D01 and ANSI C63.10.

The EUT was placed on a non-reflective table inside a 3-meter open area test site. The EUT was set on continuous transmit.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The frequency range up to the 10th harmonic was investigated included all the restricted band frequencies include 2483.5MHz. Measurement 10dB below the limits were not reported.

To get a maximum emission level from the EUT, the EUT was rotated throughout the X-axis, Y-axis and Z-axis. Worst case is X-axis

Detector Setting	Resolution Bandwidth	Video Bandwidth	Span
Peak	1MHz	3MHz	As necessary
Average	1MHz	10Hz	0 Hz

Table 11. Analyzer Settings

Test Setup:

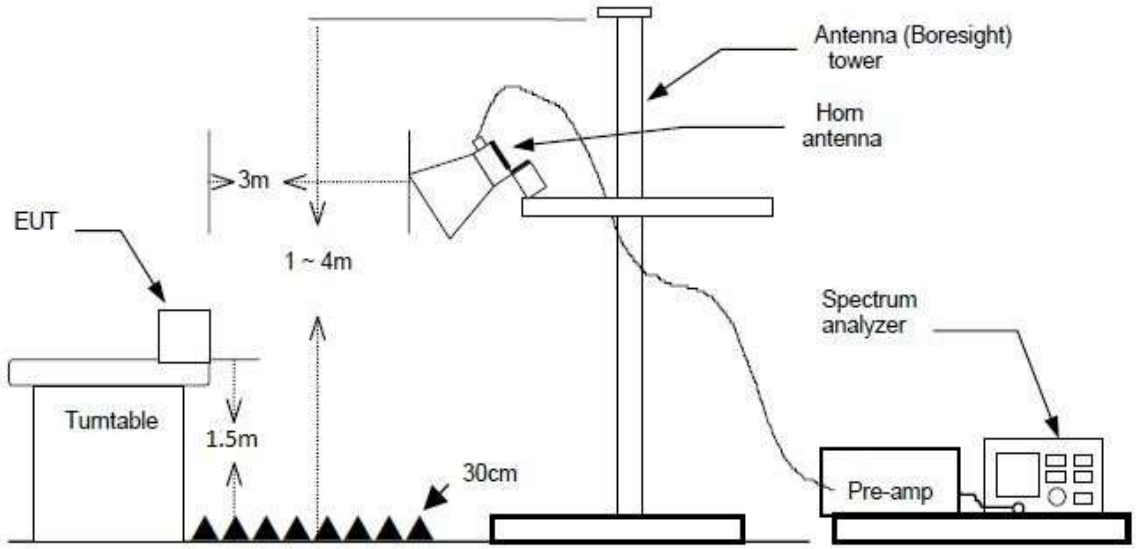


Figure 5. Radiated Emission Above 1GHz Test Setup

Test Result:

Transmit Frequency (MHz)	Measured Frequency (MHz)	Peak Amplitude (dBuV/m)	Peak Limit (dBuV/m)	Average Amplitude (dBuV/m)	Average Limit (dBuV/m)
2412	2412	98.29	Fundamental	Fundamental	Fundamental
	4824*	48.22	74.0	-	54.0
	7236	49.57	78.29	-	58.29
2437	2437	98.66	Fundamental	Fundamental	Fundamental
	4874*	48.36	74.0	-	54.0
	7311*	48.76	74.0	-	54.0
2462	2462	99.70	Fundamental	Fundamental	Fundamental
	4924*	48.45	74.0	-	54.0
	7386*	43.70	74.0	-	54.0

Table 12 - Spurious Radiated Emission Data – 802.11b Operation Mode

Transmit Frequency (MHz)	Measured Frequency (MHz)	Peak Amplitude (dBuV/m)	Peak Limit (dBuV/m)	Average Amplitude (dBuV/m)	Average Limit (dBuV/m)
2412	2412	101.59	Fundamental	Fundamental	Fundamental
	4824*	47.76	74.0	-	54.0
2437	2437	102.09	Fundamental	Fundamental	Fundamental
	4874*	47.57	74.0	-	54.0
2462	2462	100.59	Fundamental	Fundamental	Fundamental
	4924*	47.64	74.0	-	54.0

Table 13 - Spurious Radiated Emission Data – 802.11g Operation Mode

Transmit Frequency (MHz)	Measured Frequency (MHz)	Peak Amplitude (dBuV/m)	Peak Limit (dBuV/m)	Average Amplitude (dBuV/m)	Average Limit (dBuV/m)
2412	2412	100.55	Fundamental	Fundamental	Fundamental
	4824*	47.56	74.0	-	54.0
2437	2437	102.64	Fundamental	Fundamental	Fundamental
	4874*	47.24	74.0	-	54.0
2462	2462	100.96	Fundamental	Fundamental	Fundamental
	4924*	47.46	74.0	-	54.0

Table 14 – Spurious Radiated Emission Data – 802.11n (20 MHz) Operation Mode

NOTE: There were no detectable emissions above the 2nd or 3rd harmonic dependent on operational mode.

6. Emissions At Band Edges

Test Requirement(s):	§15.247(d)	**Test Engineer(s):**	Sean E.
Test Results:	Pass	**Test Date(s):**	Feb 20, 2024

Test Procedures: As required by 47 CFR 15.247, Band edge radiated emissions measurements were made at the RF antenna output terminals of the EUT using the marker-delta method.

Customer provided a test mode internal to the EUT to control the RF modulation, and frequency channel. The EUT output was connected directly to the spectrum analyzer through an attenuator. The EUT was set up at maximum power, first on the lowest operating channel, then on the highest operating channel of the transmit band.

Detector Setting	Resolution Bandwidth	Video Bandwidth	Sweep Time
Peak	100 kHz	300 kHz	Auto

Table 15 – Analyzer settings

Test Setup:

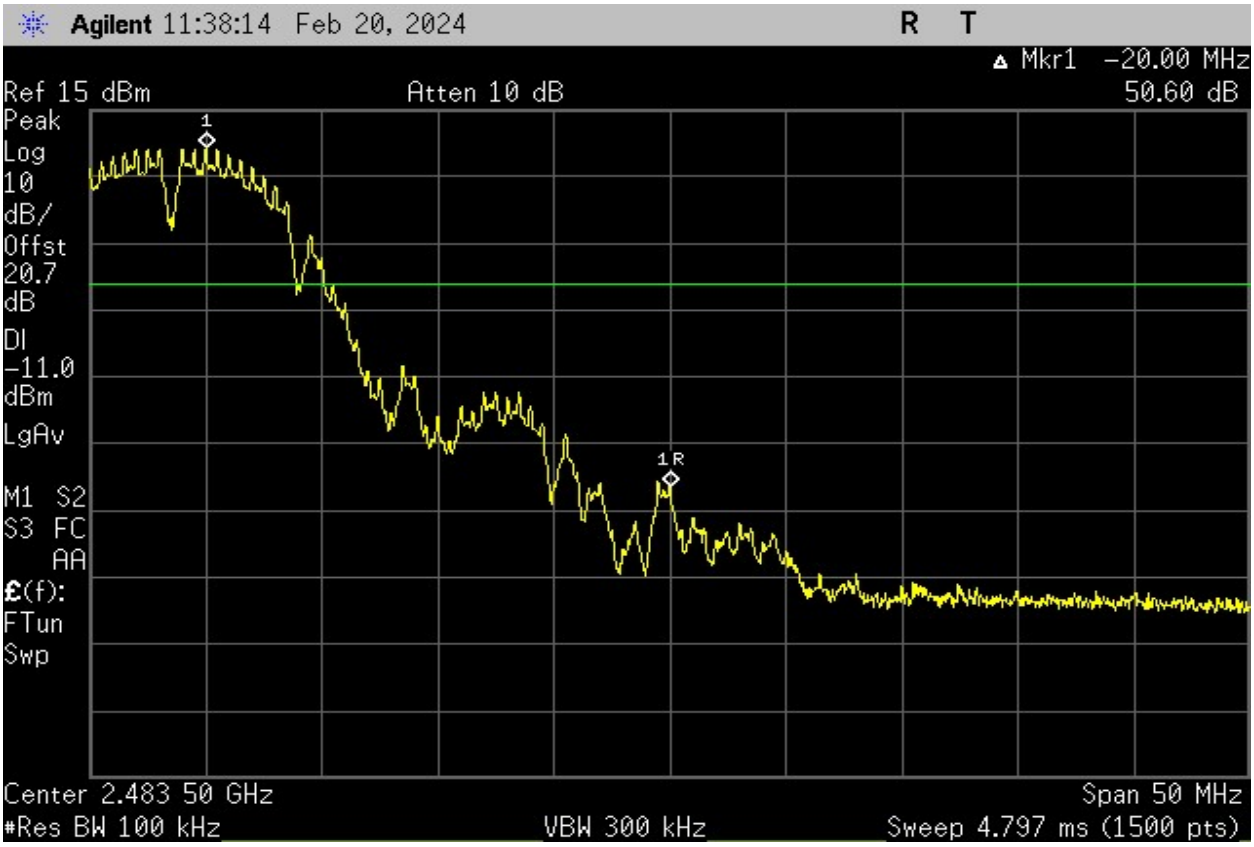
Figure 6. Band Edge Test Setup

Test Results:

Operational Mode	Frequency (MHz)	Measured Level (dBm)	Detector	Limit
802.11b	2400	-46.62	Peak	-20dBc
	2483.5	-50.60	Peak	-20dBc
802.11g	2400	-31.73	Peak	-20dBc
	2483.5	-44.21	Peak	-20dBc
802.11n (20 MHz)	2400	-30.47	Peak	-20dBc
	2483.5	-41.90	Peak	-20dBc

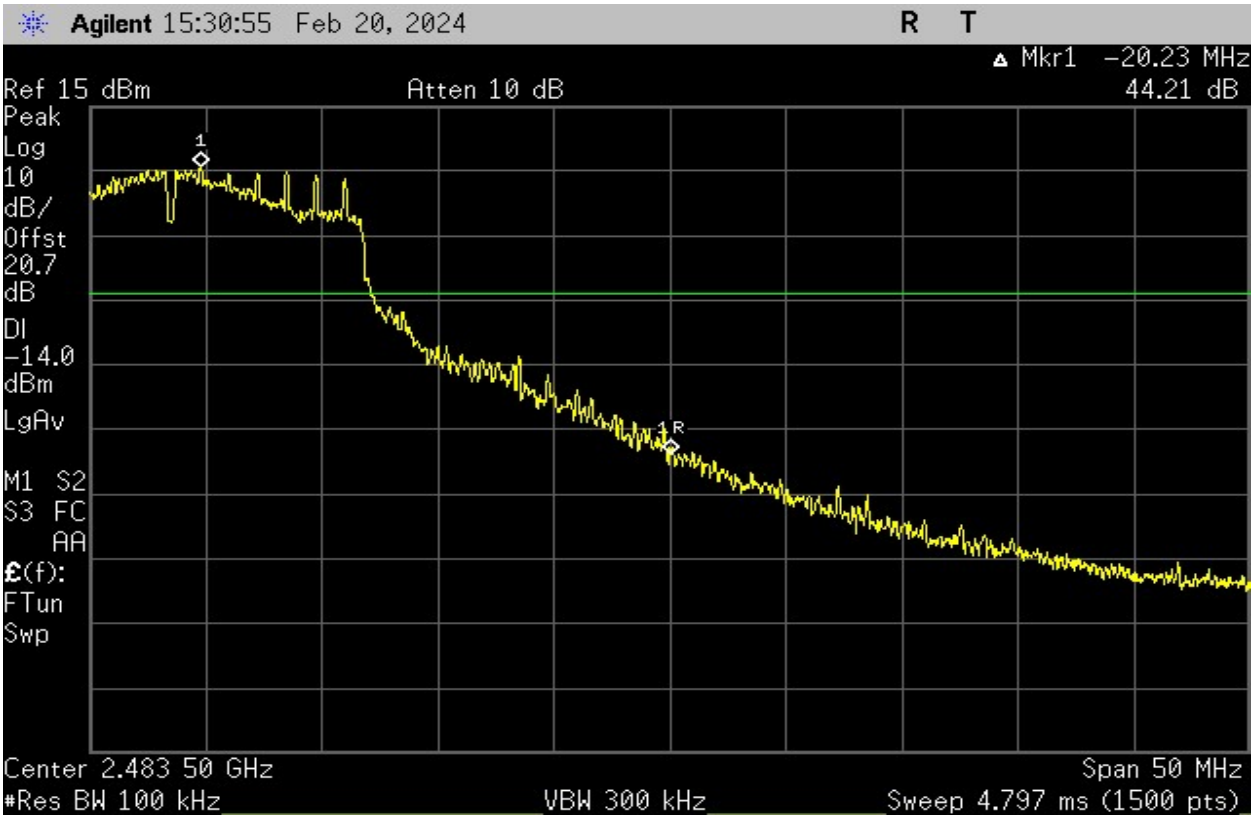
Table 16 – Band Edge Emissions Summary – WIFI

Plot 47 – 802.11b Lowest Channel – Band Edge



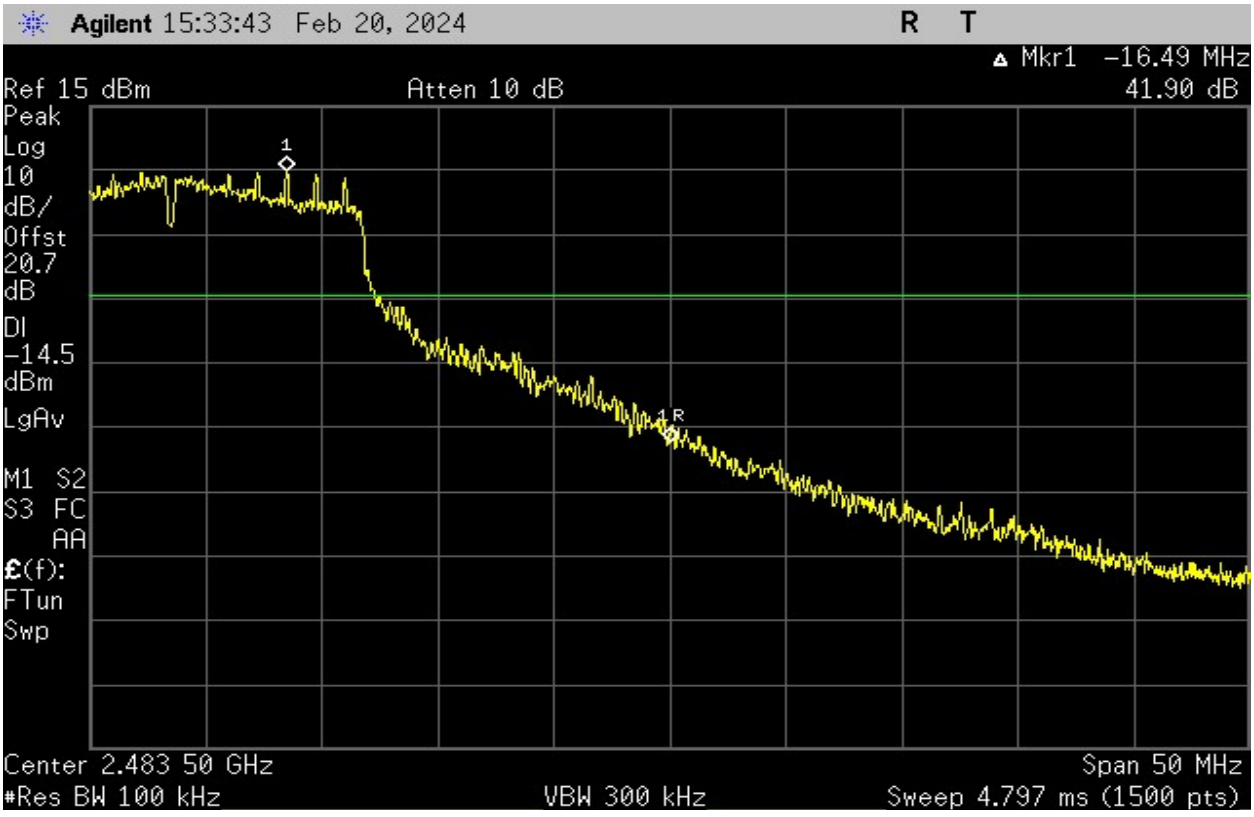
Plot 48 – 802.11b Highest Channel – Band Edge

Plot 49 – 802.11g Lowest Channel – Band Edge



Plot 50 – 802.11g Highest Channel – Band Edge

Plot 51 – 802.11n (20 MHz) Lowest Channel – Band Edge



Plot 52 – 802.11n (20 MHz) Highest Channel – Band Edge

7. Power Spectral Density

Test Requirement(s):	§15.247(f), ANSI C63.10	Test Engineer(s):	Sean E.
Test Results:	Pass	Test Date(s):	Feb 20, 2024

Test Procedures: As required by 47 CFR 15.247(d), For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3kHz band during any time interval of continuous transmission. Power spectral density measurements were made at the RF antenna output terminals of the EUT using the DTS methods section 8.4 was used for DTS mode.

The EUT output was connected directly to the spectrum analyzer through an attenuator. The measurements were made at the RF antenna output terminals of the EUT.

Detector Setting	Resolution Bandwidth	Sweep Time	Span
Peak	3KHz	Auto	As Necessary

Table 17 – Analyzer settings

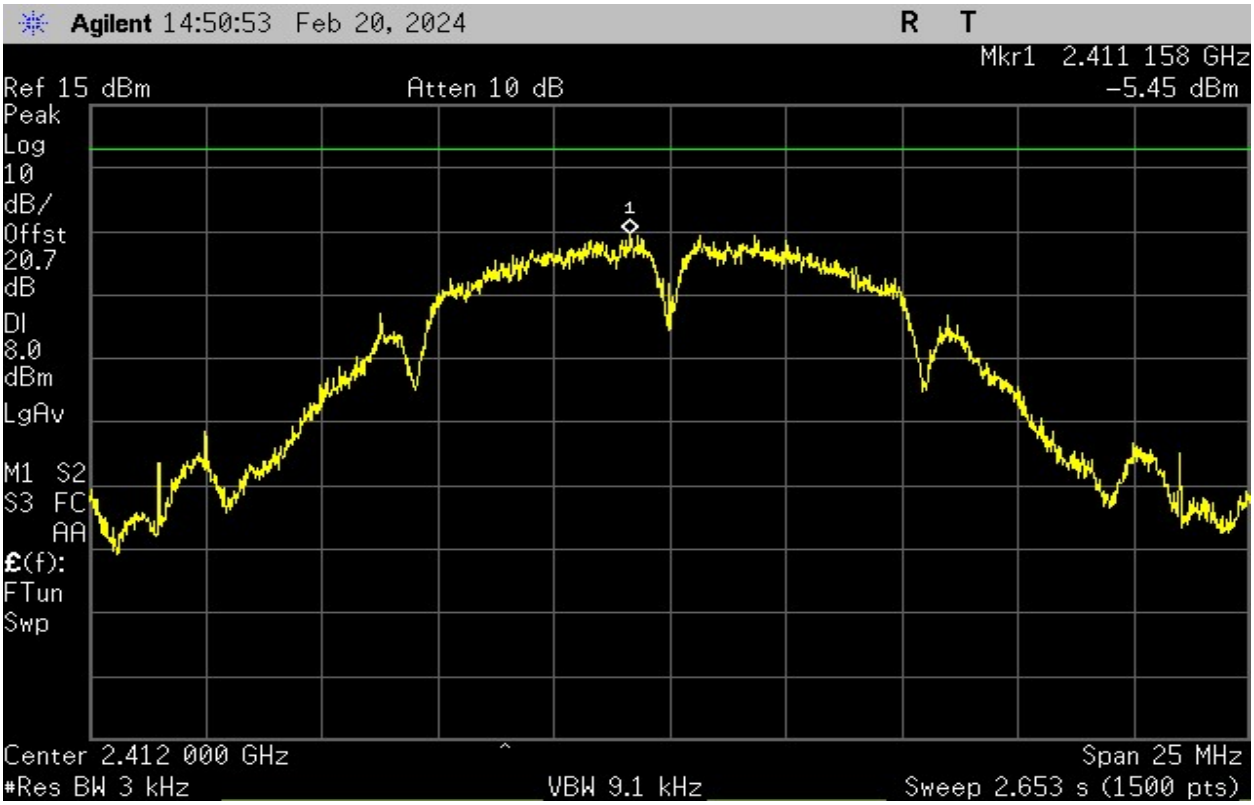
Test Setup:

Figure 7. Power Spectral Density Test Setup

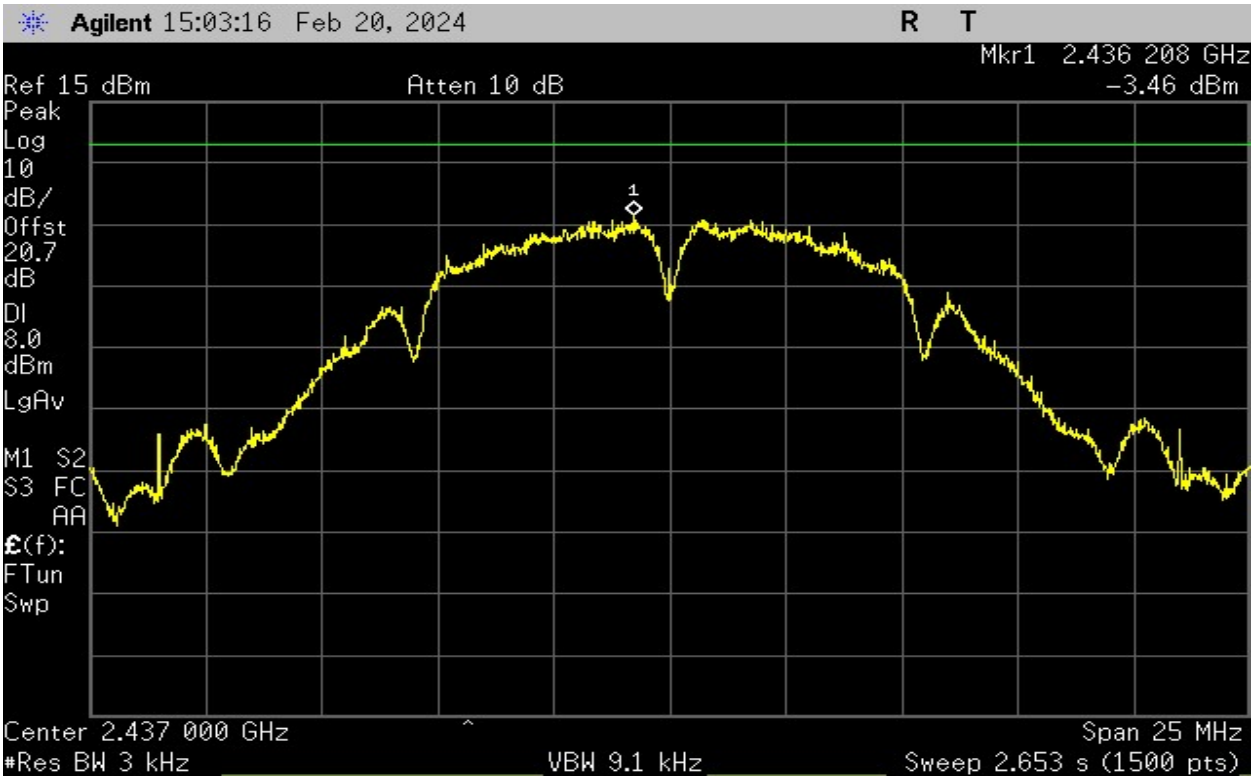
Test Results:

Operational Mode	Frequency (MHz)	Measured Level (dBm)	Limit
802.11b	2412	-5.45	8 dBm
	2437	-3.46	8 dBm
	2462	-3.80	8 dBm
802.11g	2412	-6.56	8 dBm
	2437	-7.73	8 dBm
	2462	-6.95	8 dBm
802.11n (20 MHz)	2412	-6.71	8 dBm
	2437	-5.95	8 dBm
	2462	-6.76	8 dBm

Table 18 – Power Spectral Density – WIFI Test Results

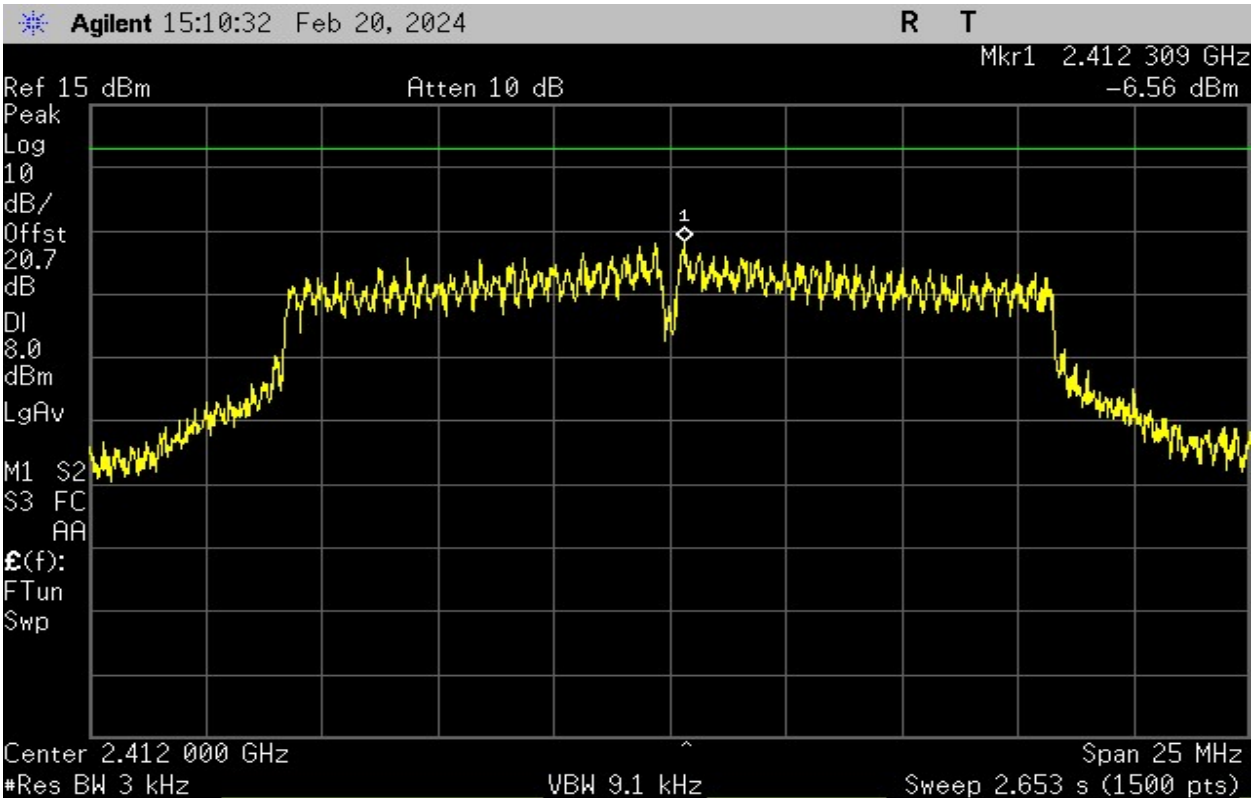


Plot 53 – 802.11b Lowest Channel - Power Spectral Density

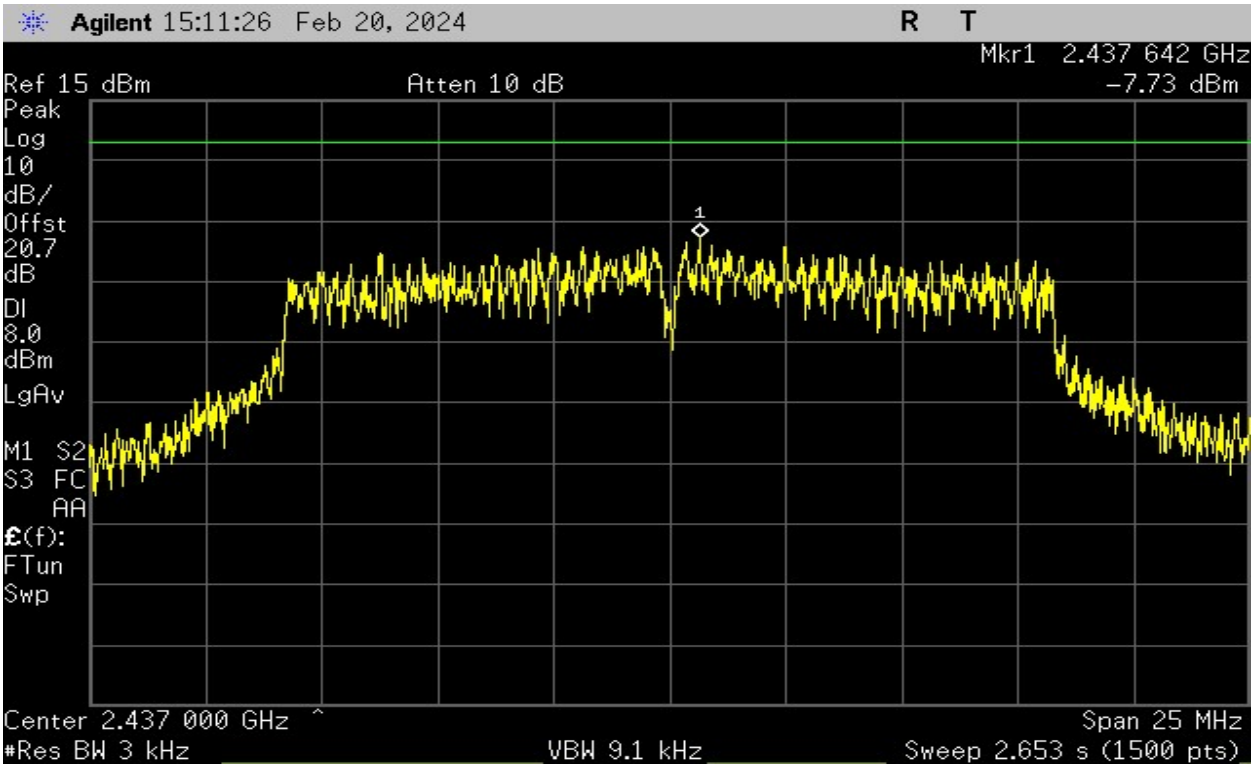


Plot 54 – 802.11b Middle Channel - Power Spectral Density

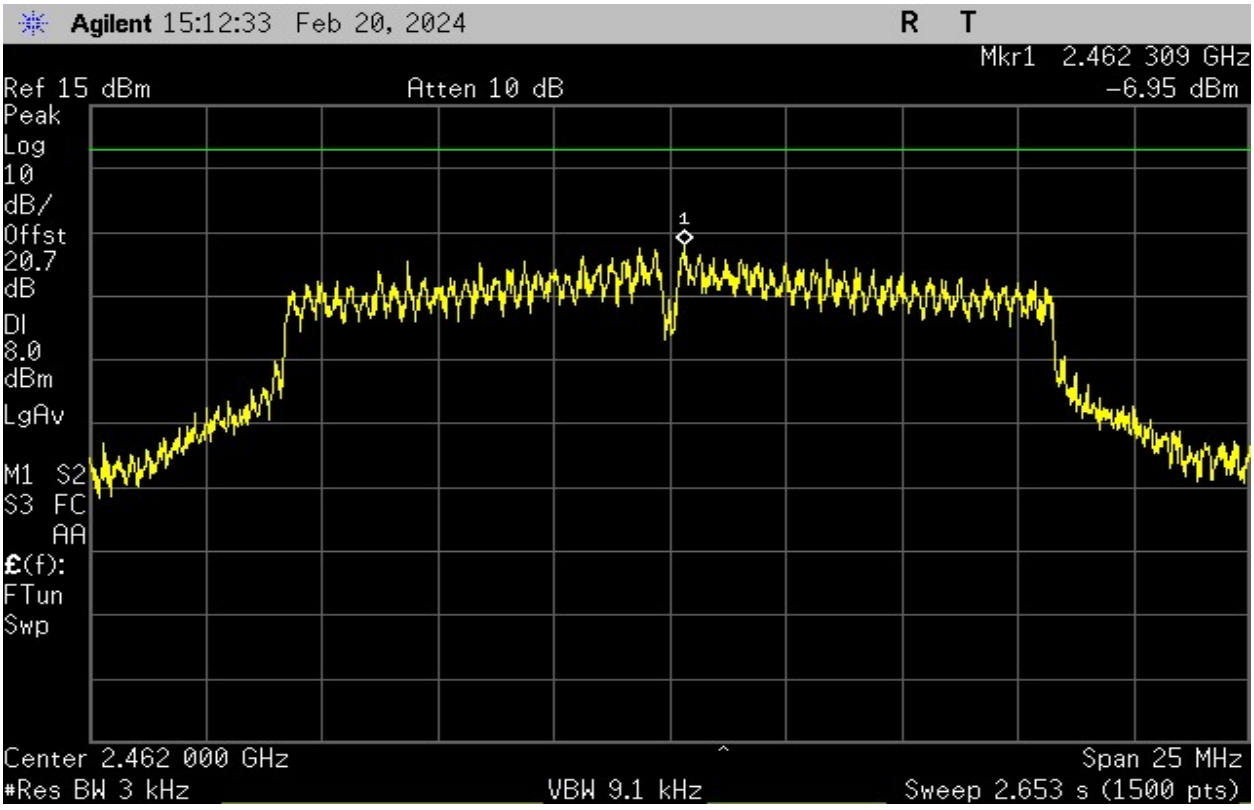
Plot 55 – 802.11b Highest Channel - Power Spectral Density



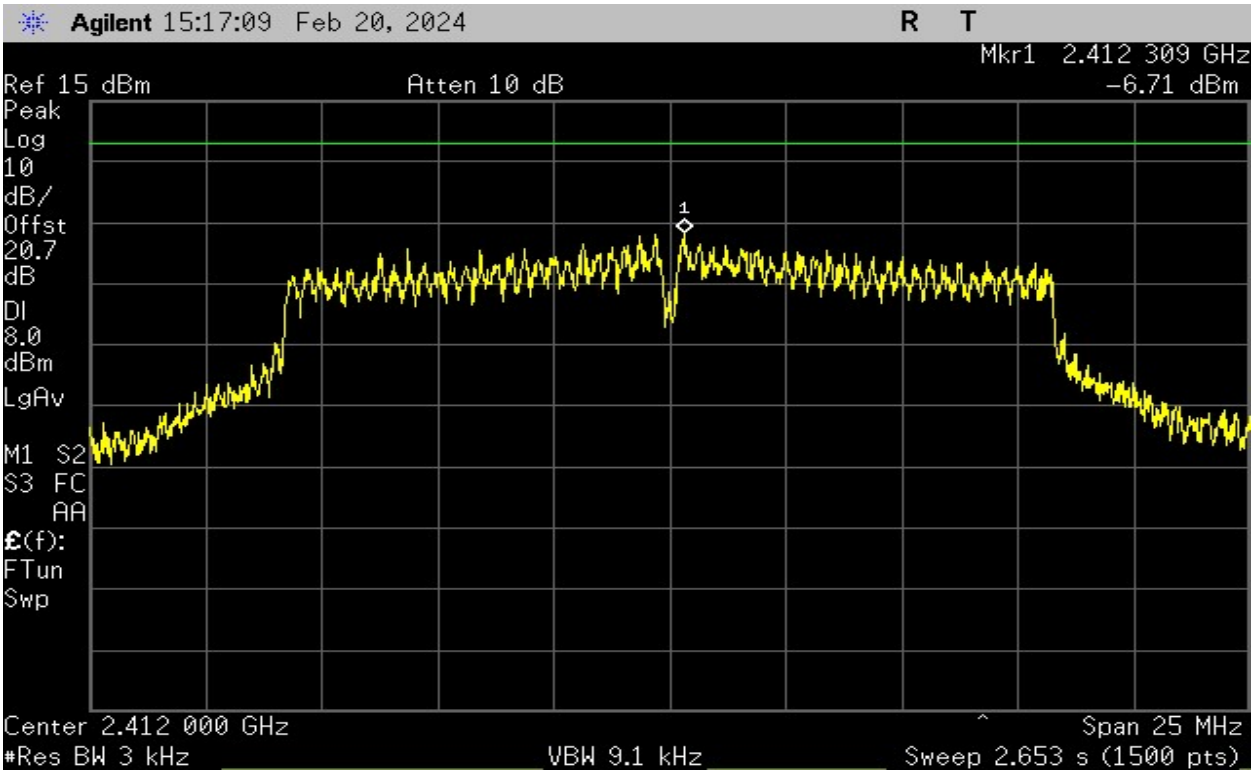
Plot 56 – 802.11g Lowest Channel - Power Spectral Density



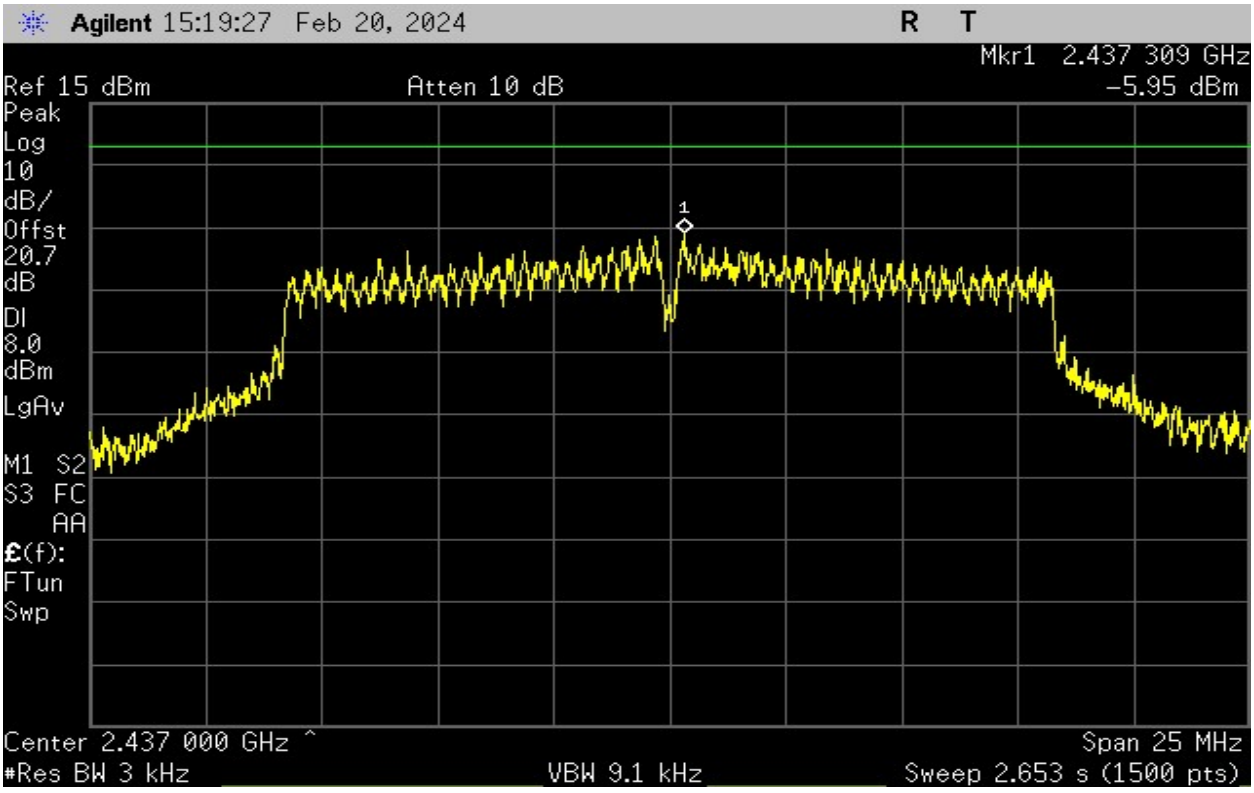
Plot 57 – 802.11g Middle Channel - Power Spectral Density



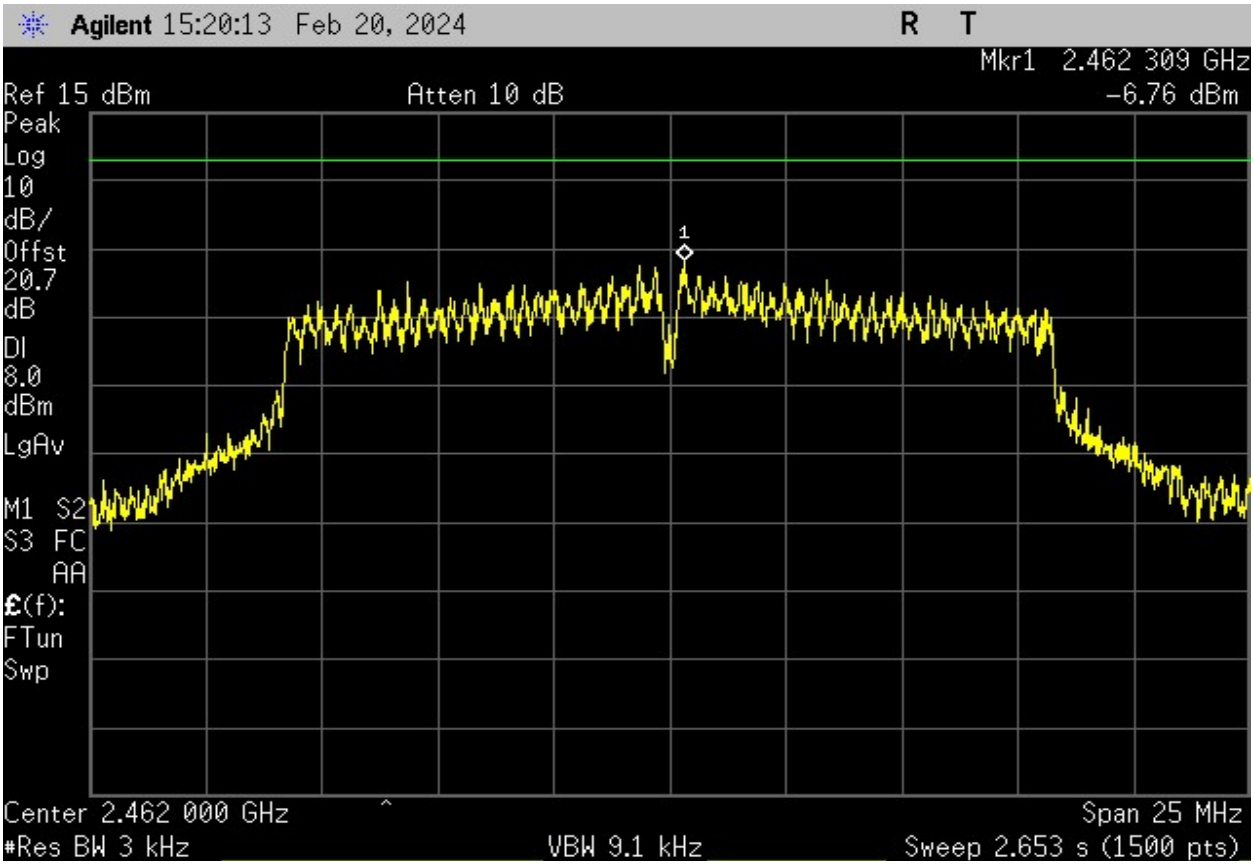
Plot 58 – 802.11g Highest Channel - Power Spectral Density



Plot 59 – 802.11n (20 MHz) Lowest Channel - Power Spectral Density



Plot 60 – 802.11n (20 MHz) Middle Channel - Power Spectral Density



Plot 61 – 802.11n (20 MHz) Highest Channel - Power Spectral Density

8. Test Equipment

Equipment	Manufacturer	Model	Serial #	Last Cal Date	Cal Due Date
Spectrum Analyzer	Agilent	E4443A	US41420164	Jun-01-23	Jun-01-24
EMI Test Receiver	Rhode & Schwarz	ESMI26	840607/005	Nov-15-23	Nov-15-24
High Pass Filter	Mini-Circuits	VHF-3100+	1048	Verified	
Spectrum Analyzer	Hewlett Packard	8666B	2747A05264	Feb-01-24	Feb-01-25
Attenuator 20dB	Weinschel	41-20-12	86332	Verified	
Horn Antenna	Com-Power	AHA-118	711150	Jan-09-23	Jan-09-25
Antenna	EMCO	GTEM 5417	1063	Verified	
USB Wideband Power Sensor	Agilent	U2021XA	MY54210014	Nov-15-23	Nov-15-24
Spectrum Analyzer	Hewlett Packard	8563E	3821A09316	May-02-23	May-02-24
Spectrum Analyzer	Hewlett Packard	8595EM	3801A00177	May-02-23	May-02-24
Two Line V-Network – LISN	Teseq	NNB 51	43198	Jan-12-23	Jan-12-25

Table 19 – Test Equipment List

***Statement of Traceability:** Test equipment is maintained and calibrated on a regular basis. All calibrations have been performed by a 17025 accredited test facility, traceable to National Institute of Standards and Technology (NIST)

9. Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. These measurements figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2. Instrumentation measurement uncertainty has **not** been taken into account to determine compliance.

The following measurement uncertainty values have been calculated as show in the table below:

Measured Parameter	Measurement Unit	Frequency Range	Expanded Uncertainty
Conducted Emissions (AC Power)	dBuV or dBuA	150kHz – 30MHz	± 4.3dB
Radiated Emission below 30MHz	dBuV/m	9kHz-30MHz	± 2.96dB
Radiated Emissions below 1GHz	dBuV/m	30 – 1000MHz	± 5.6dB
Radiated Emissions above 1GHz	dBuV/m	1 – 26.5GHz	± 4.1dB

The reported expanded uncertainty has been estimated at a 95% confidence level (k=2)

END OF TEST REPORT