



MEASUREMENT REPORT

FCC PART 15.247 802.11b/g/n WLAN

Applicant Name:

Seowon Intech Co., Ltd
69, LS-ro
115beon-gil, Gunpo-si,
Gyeonggi-do, 15809 Korea

Date of Testing:

02/11/2022 ~ 02/28/2022

Test Report Issue Date:

06/17/2022

Test Site/Location:

PCTEST Lab. Yongin-Si, Gyeonggi-do, South Korea

Test Report Serial No.:

1M2202090014-03.V7M

FCC ID:

V7MESLCTGA

APPLICANT:

Seowon Intech Co., Ltd

Application Type:

Certification

Model:

SLC-150T42GA

EUT Type:

LTE Indoor CPE

Frequency Range:

2412 – 2462MHz

Modulation Type:

CCK/DSSS/OFDM

FCC Classification:

Digital Transmission System (DTS)

Test Procedure(s):

ANSI C63.10-2013, KDB 558074 D01 v05r02,
KDB 662911 D01 v02r01

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013 and KDB 558074 D01 v05r02. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.



Prepared by

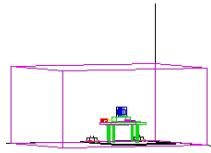
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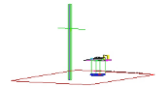
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Mode	Tx Frequency (MHz)	ANT1				ANT2				MIMO			
		Avg Conducted		Peak Conducted		Avg Conducted		Peak Conducted		Avg Conducted		Peak Conducted	
		Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
802.11b	2412 - 2462	30.48	14.84	95.50	19.80	30.83	14.89	103.28	20.14	58.21	17.65	112.98	20.53
802.11g	2412 - 2462	15.63	11.94	76.03	18.81	14.83	11.71	71.94	18.57	29.85	14.75	134.28	21.28
802.11n	2412 - 2462	15.24	11.83	73.96	18.69	15.52	11.91	78.52	18.95	30.55	14.85	133.66	21.26

EUT Overview

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.


1.2 PCTEST Korea Test Location

These measurement tests were conducted at the PCTEST Korea CO., LTD. facility located at 13, Heungdeok 1-ro, Giheung-gu, Yongin-si, Gyeonggi-do, 16954, South Korea. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

Measurements were performed at PCTEST Korea located in Yongin-si, Gyeonggi-do, 16954, South Korea.

- PCTEST is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation(A2LA) with Certificate number 2041.04 for Specific Absorption Rate (SAR), and Electromagnetic Compatibility (EMC) & Telecommunications testing for FCC and Innovation, Science, and Economic Development Canada rules.
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISSED Standards (RSS).
- PCTEST Korea facility is accredited, designated, and recognized in accordance with the provision of Radio Wave Act and International Standard ISO/IEC 17025:2017 under the National Radio Research Agency.
 - Designation Number / CABID: KR0169
 - Test Firm Registration Number of FCC: 417945
 - Test Firm Registration Number of ISSED: 26168

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Seowon Intech LTE Indoor CPE FCC ID: V7MESLCTGA**. The test data contained in this report pertains only to the emissions due to the EUT's WLAN (DTS) transmitter.

Test Device Serial No.: 00003, 00004

2.2 Device Capabilities

This device contains the following capabilities:

LTE Band 48, 2.4GHz WIFI (802.11b/g/n), UNII 5GHz (802.11a/n/ac)

Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

Table 2-1. Frequency/ Channel Operations

Note: The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak per the guidance of Section 6.0 b) of ANSI C63.10-2013 and KDB 558074 D01 v05r02. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Maximum Achievable Duty Cycles				
802.11 Mode/Band		ANT1	ANT2	MIMO
		Duty Cycle [%]	Duty Cycle [%]	Duty Cycle [%]
2.4GHz	b	98.9	99.4	98.9
	g	93.3	94.3	95.3
	n	95.5	94.7	93.8

Table 2-2. Measured Duty Cycles

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The device employs MIMO technology. Below are the possible configurations.

WiFi Configurations		SISO		SDM		CDD	
		ANT1	ANT2	ANT1	ANT2	ANT1	ANT2
2.4GHz	11b	✓	✓	✗	✗	✓	✓
	11g	✓	✓	✗	✗	✓	✓
	11n	✓	✓	✓	✓	✓	✓

Table 2-3. Frequency / Channel Operations

✓ = Support ; ✗ = NOT Support

SISO = Single Input Single Output

SDM = Spatial Diversity Multiplexing – MIMO function

CDD = Cyclic Delay Diversity - 2Tx Function

Data Rates Supported: 1Mbps, 2Mbps, 5.5Mbps, 11Mbps (b)
6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps (g)
6.5/7.2Mbps, 13/14.4Mbps, 19.5/21.7Mbps, 26/28.9Mbps, 39/43.3Mbps,
52/57.8Mbps, 58.5/65Mbps, 65/72.2Mbps (n)
13/14.4Mbps, 26/28.9Mbps, 39/43.3Mbps, 52/57.8Mbps, 78/86.7Mbps,
104/115.6Mbps, 117/130Mbps, 130/144.4Mbps (MIMO n)

This device supports simultaneous transmission operation, which allows for two SISO channels to operate independent of one another in the 2.4GHz and 5GHz bands simultaneously on each antenna. The following tables show the worst case configurations determined during testing. The data for these configurations is contained in the UNII test report.

Configuration 1: ANT1 transmitting in 2.4GHz mode and ANT2 in 5GHz mode

Description	2.4 GHz Emission	5 GHz Emission
Antenna	1	2
Channel	6	100
Operating Frequency (MHz)	2437	5500
Data Rate (Mbps)	1	6
Mode	b	a

Table 2-4. Config-1 (ANT1 2.4GHz & ANT2 5GHz)

Configuration 2: ANT1 transmitting in 5GHz mode and ANT2 in 2.4GHz mode

Description	2.4 GHz Emission	5 GHz Emission
Antenna	2	1
Channel	6	100
Operating Frequency (MHz)	2437	5500
Data Rate (Mbps)	1	6
Mode	b	a

Table 2-5. Config-2 (ANT1 5GHz & ANT2 2.4GHz)

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2.3 Test Configuration

The EUT was tested per the guidance of KDB 558074 D01 v05r02. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, and 7.2, 7.3, 7.4, 7.5, and 7.6 for antenna port conducted emissions test setups.

2.4 Antenna Description

Following antenna was used for the testing.

Frequency [GHz]	Antenna 1 Gain [dBi]	Antenna 2 Gain [dBi]	Directional Antenna Gain [dBi]
2.4	1.89	1.77	4.84


Table 2-6. Antenna Peak Gain

2.5 Software and Firmware

The test was conducted with firmware version 2.20.701 installed on the EUT.

2.6 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 558074 D01 v05r02 were used in the measurement of the EUT.

Deviation from measurement procedure.....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 10'x16'x9' shielded enclosure. The shielded enclosure is manufactured by SY cooperation Enclosures. The line-conducted facility is located inside a 7m x 3.66m x 2.7m shielded enclosure. The shielded enclosure is manufactured by AP Americas. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is an ETS Lindgren Model LPRX-4X30 (100dB Attenuation, 14kHz-18GHz) and the two EMI/RFI filters are ETS Lindgren Model LRW-2030-S1 (100dB Minimum Insertion Loss, 14kHz – 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.9. The EMI Receiver mode of the ESW43 was used to perform AC line conducted emissions testing. Automated test software was used to perform the AC line conducted emissions testing. Automated measurement software utilized is Rohde & Schwarz EMC32, Version 10.20.01.

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3.3 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.


For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33 depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 414788 D01.

3.4 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.”

- The antennas of the EUT are **permanently attached**.
- There are no provisions for connections to an external antenna.

Conclusion:

The EUT unit complies with the requirement of §15.203.

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (\pm dB)
Conducted Bench Top Measurements	1.20
Line Conducted Disturbance	3.07
Radiated Disturbance (<1GHz)	3.01
Radiated Disturbance (>1GHz)	5.56
Radiated Disturbance (>18GHz)	3.16

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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Com-Power	AL-130R	Active Loop Antenna	2020-10-29	Biennial	2022-10-28	10160045
Fairview Microwave	FM2CP1122-10	Coupler	2021-07-07	Annual	2022-07-06	1946
Keysight Technologies	N9030B	PXA Signal Analyzer	2021-05-01	Annual	2022-04-30	MY57142018
Mini-Circuits	BW-N10W5+	Attenuator	2021-07-06	Annual	2022-07-05	1607
Rohde & Schwarz	TS-PR18	Preamplifier	2021-07-08	Annual	2022-07-07	102141
Rohde & Schwarz	TS-PR1840	Preamplifier	2021-07-07	Annual	2022-07-06	100049
Rohde & Schwarz	ENV216	Two-Line V-Network	2021-05-24	Annual	2022-05-23	101319
Rohde & Schwarz	FSW43	Signal & Spectrum Analyzer	2022-01-18	Annual	2023-01-17	101250
Rohde & Schwarz	ESW43	EMI TEST Receiver	2021-07-06	Annual	2022-07-05	101761
Rohde & Schwarz	TS-SFUNIT-Rx	Shielded Filter Unit	2022-01-19	Annual	2023-01-18	102151
Schwarzbeck	VULB9162	Broadband TRILOG Antenna	2021-07-13	Biennial	2023-07-12	9162-217
Sunol Sciences	DRH-118	Horn Antenna	2021-07-14	Biennial	2023-07-13	A102416-1

Table 6-1. Annual Test Equipment Calibration Schedule

Note:

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

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7.0 TEST RESULTS

7.1 Summary

Company Name: Seowon Intech Co., Ltd

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FCC Classification: Digital Transmission System (DTS)

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	RSS-247 [5.2]	6dB Bandwidth	> 500kHz	CONDUCTED	PASS	Section 7.2
15.247(b)(3)	RSS-247 [5.4]	Transmitter Output Power	< 1 Watt		PASS	Sections 7.3
15.247(e)	RSS-247 [5.2]	Transmitter Power Spectral Density	< 8dBm / 3kHz Band		PASS	Section 7.4
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions	≥ 20dBc		PASS	Sections 7.5, 7.6
15.205 15.209	RSS-Gen [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-Gen [8.9])	RADIATED	PASS	Sections 7.7, 7.8
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits (RSS-Gen[8.8])	LINE CONDUCTED	PASS	Section 7.9

Table 7-1. Summary of Test Results

Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
- 4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "WLAN Automation," Version 3.5.
- 5) For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Chamber Automation," Version 1.3.1.

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7.2 6dB Bandwidth Measurement

§15.247(a.2); RSS-247 [5.2]

Test Overview and Limit

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the transmitter antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated and the worst case configuration results are reported in this section.

The minimum permissible 6dB bandwidth is 500 kHz.

Test Procedure Used

ANSI C63.10-2013 – Section 11.8.2 Option 2
KDB 558074 D01 v05r02 – Section 8.2

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 100kHz
3. VBW $\geq 3 \times$ RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



Figure 7-1. Test Instrument & Measurement Setup

Test Notes

None

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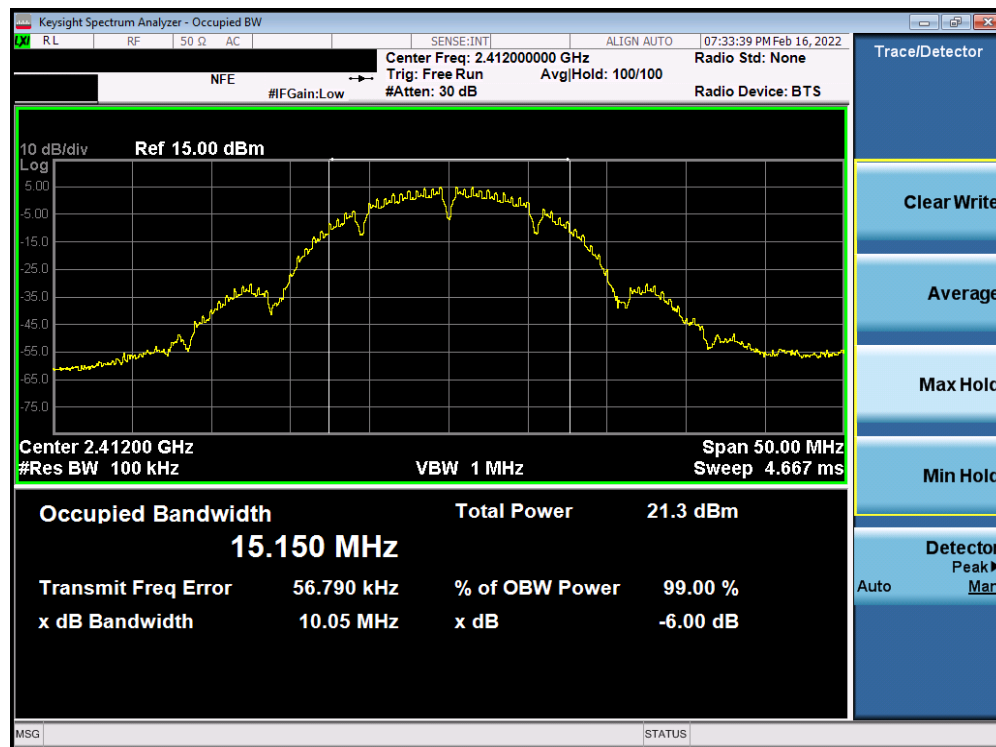
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SISO Antenna-1 6 dB Bandwidth Measurements

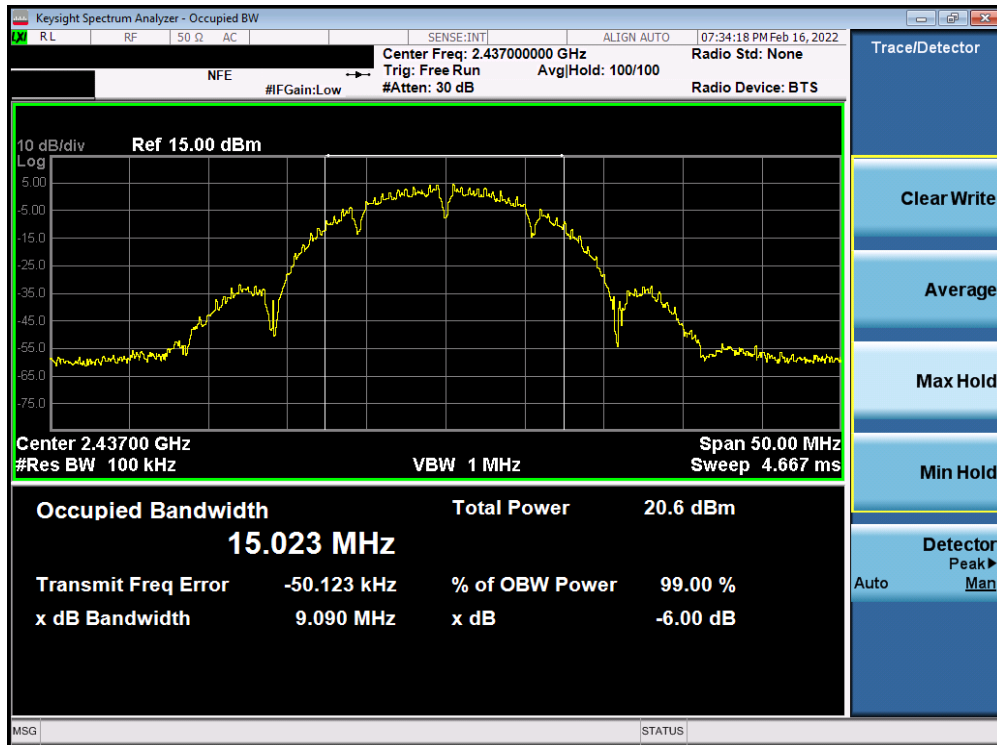
Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
2412	1	b	1	10.053	0.500
2437	6	b	1	9.090	0.500
2462	11	b	1	9.119	0.500
2412	1	g	6	16.36	0.500
2437	6	g	6	16.36	0.500
2462	11	g	6	16.35	0.500
2412	1	n	6.5/7.2 (MCS0)	17.61	0.500
2437	6	n	6.5/7.2 (MCS0)	17.63	0.500
2462	11	n	6.5/7.2 (MCS0)	16.96	0.500

Table 7-2. Conducted Bandwidth Measurements SISO ANT1

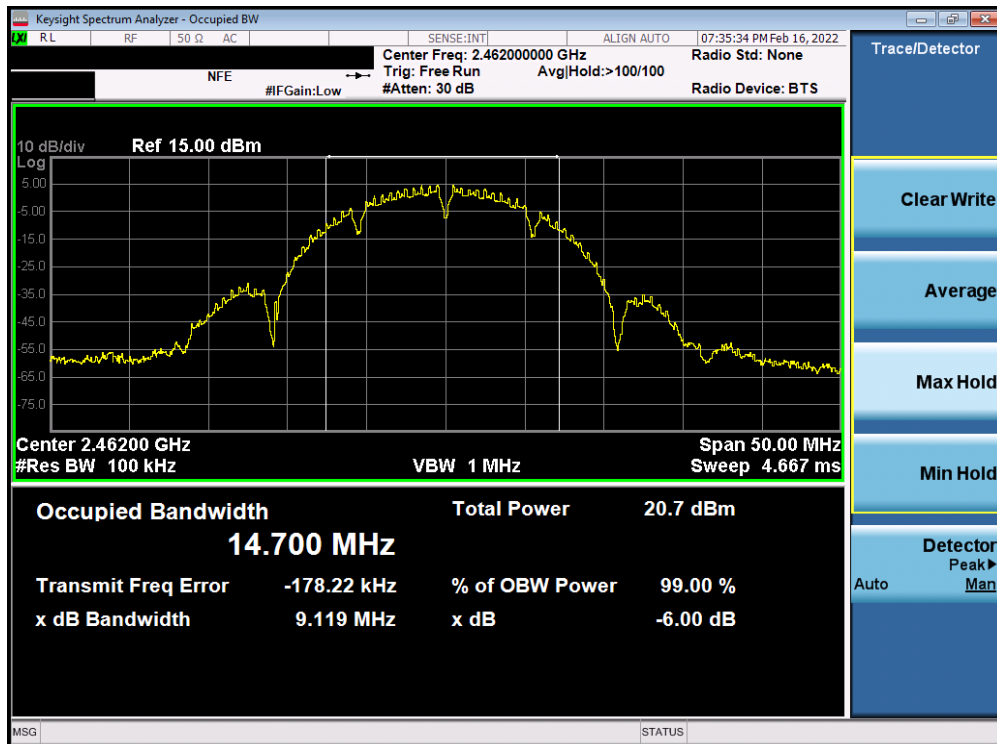


Plot 7-1. 6dB Bandwidth Plot SISO ANT1 (802.11b - Ch. 1)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 15 of 106

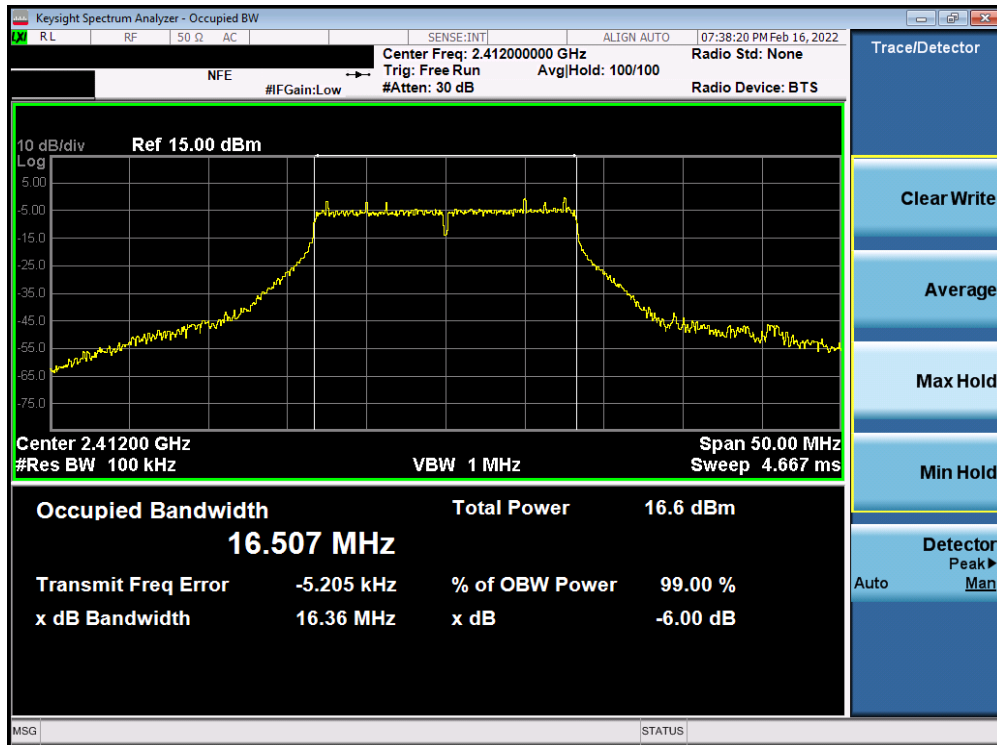


Plot 7-2. 6dB Bandwidth Plot SISO ANT1 (802.11b – Ch. 6)

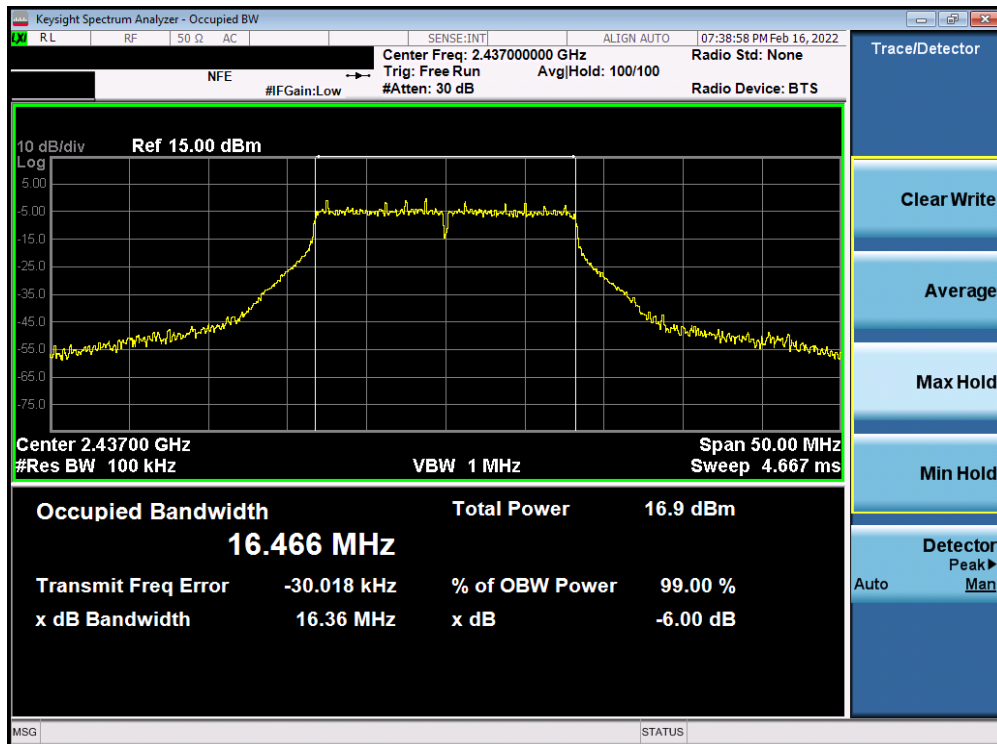


Plot 7-3. 6dB Bandwidth Plot SISO ANT1 (802.11b – Ch. 11)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 16 of 106

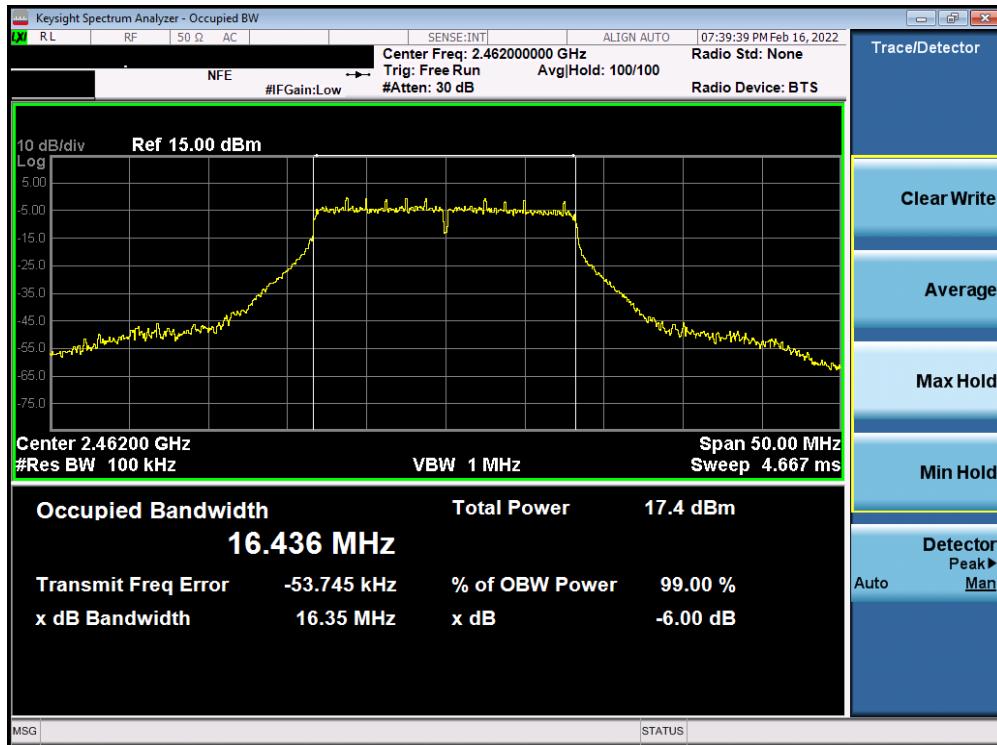


Plot 7-4. 6dB Bandwidth Plot SISO ANT1 (802.11g – Ch. 1)

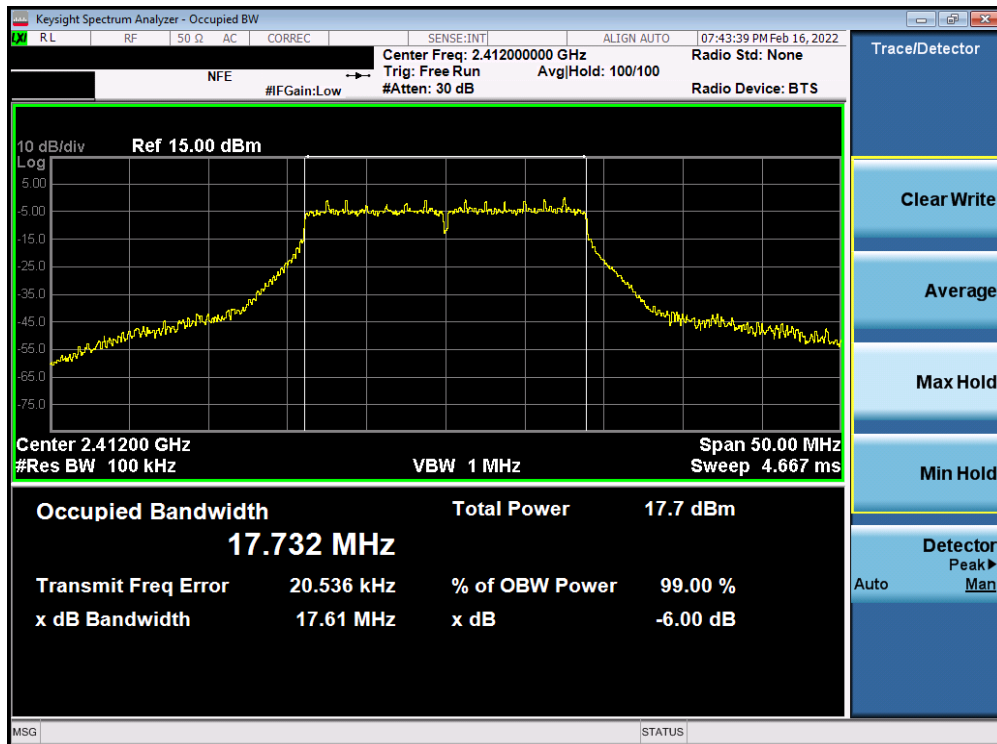


Plot 7-5. 6dB Bandwidth Plot SISO ANT1 (802.11g – Ch. 6)


FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 17 of 106

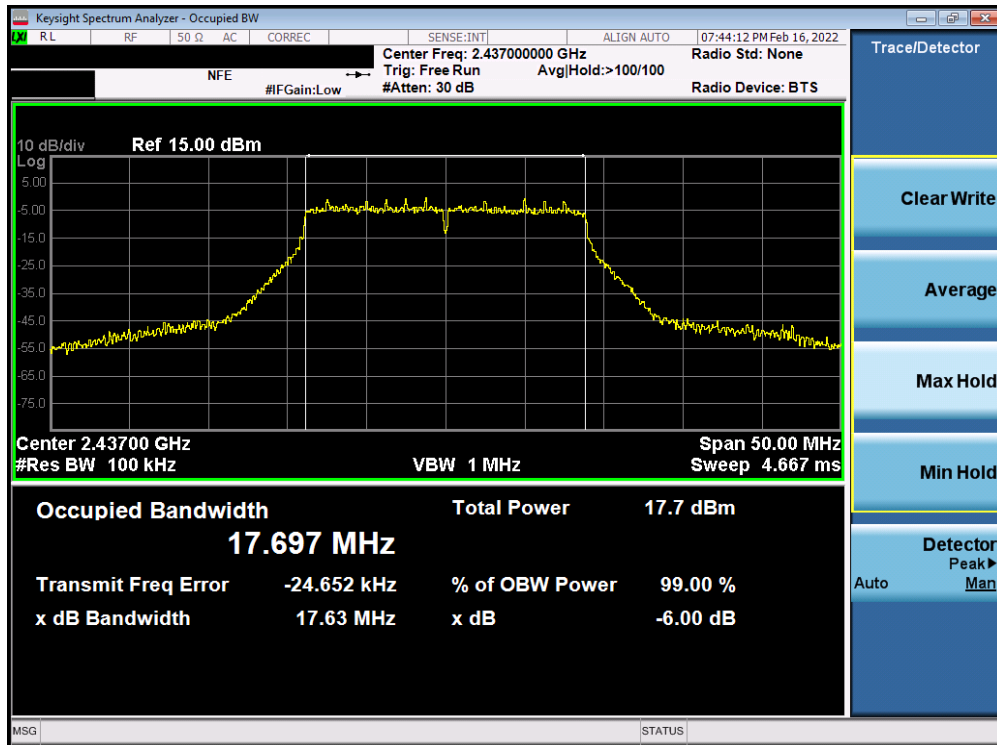


Plot 7-6. 6dB Bandwidth Plot SISO ANT1 (802.11g – Ch. 11)

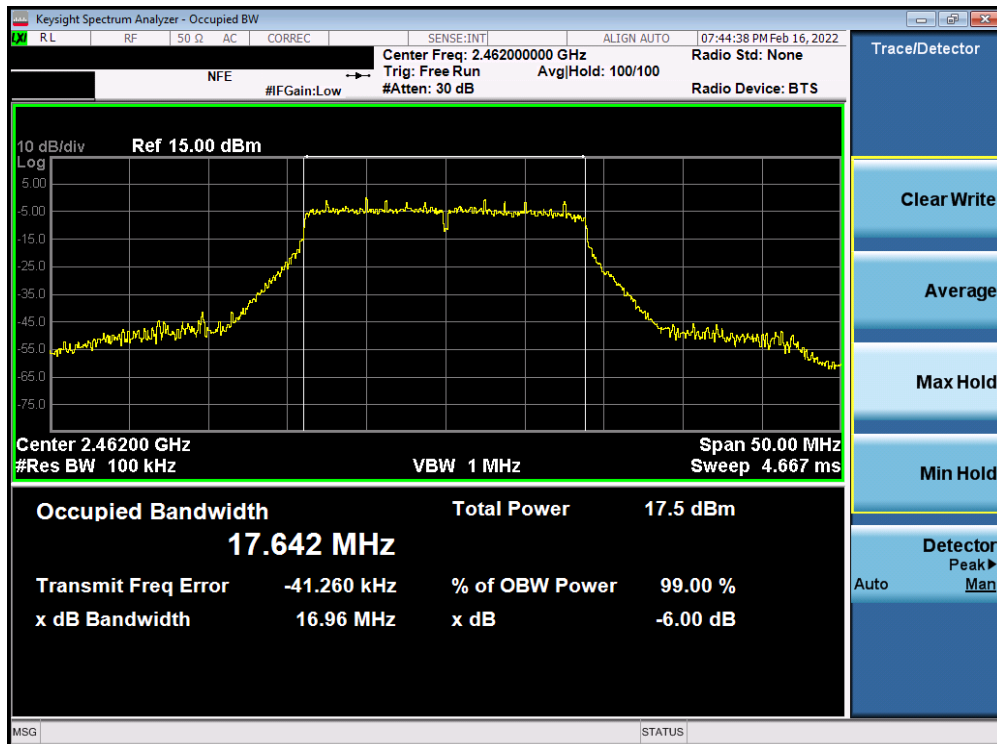


Plot 7-7. 6dB Bandwidth Plot SISO ANT1 (802.11n (2.4GHz) – Ch. 1)


FCC ID: V7MESLCTGA		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 18 of 106



Plot 7-8. 6dB Bandwidth Plot SISO ANT1 (802.11n (2.4GHz) – Ch. 6)



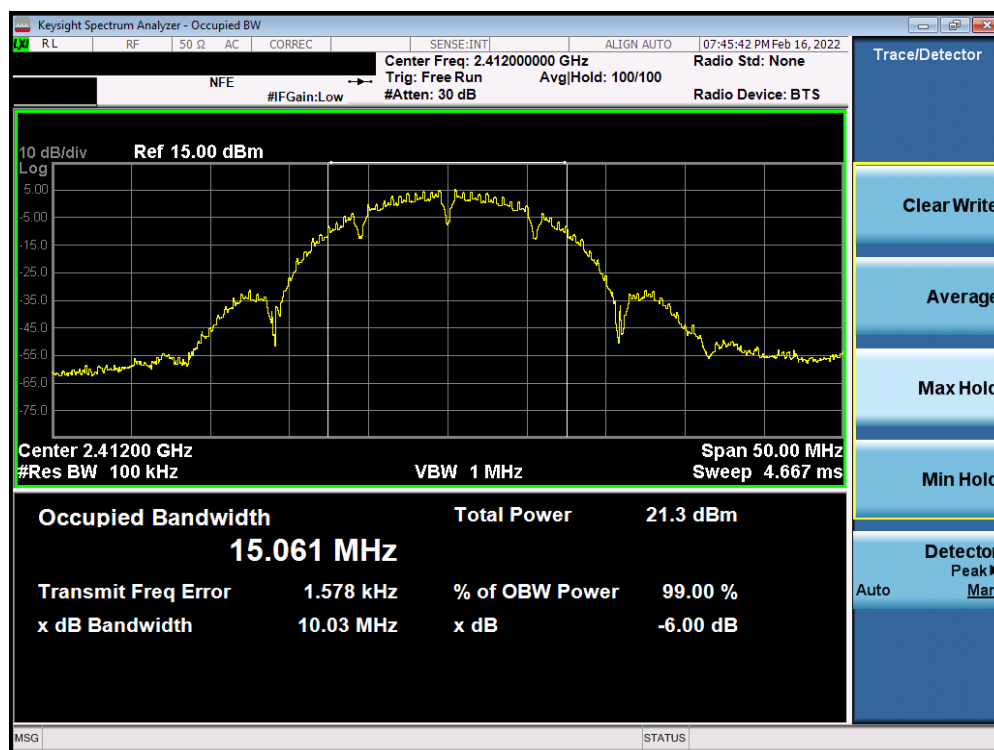
Plot 7-9. 6dB Bandwidth Plot SISO ANT1 (802.11n (2.4GHz) – Ch. 11)

FCC ID: V7MESLCTGA		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 19 of 106

SISO Antenna-2 6 dB Bandwidth Measurements

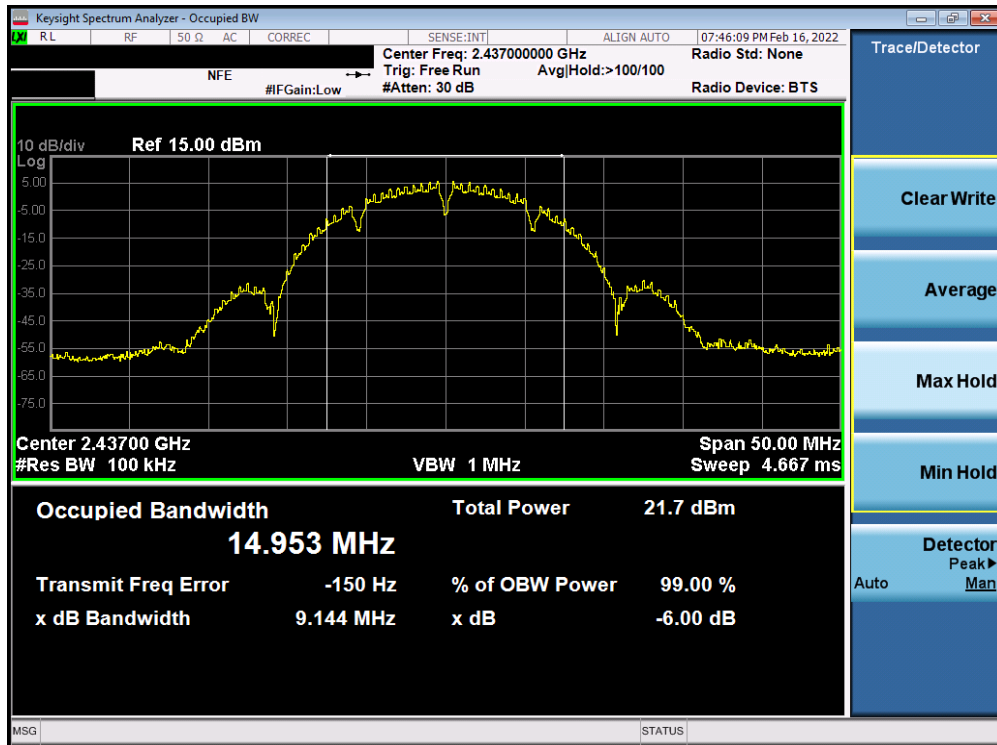
Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
2412	1	b	1	10.031	0.500
2437	6	b	1	9.144	0.500
2462	11	b	1	9.575	0.500
2412	1	g	6	16.37	0.500
2437	6	g	6	16.37	0.500
2462	11	g	6	16.34	0.500
2412	1	n	6.5/7.2 (MCS0)	17.61	0.500
2437	6	n	6.5/7.2 (MCS0)	17.61	0.500
2462	11	n	6.5/7.2 (MCS0)	17.15	0.500

Table 7-3. Conducted Bandwidth Measurements SISO ANT2



Plot 7-10. 6dB Bandwidth Plot SISO ANT2 (802.11b – Ch. 1)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 20 of 106

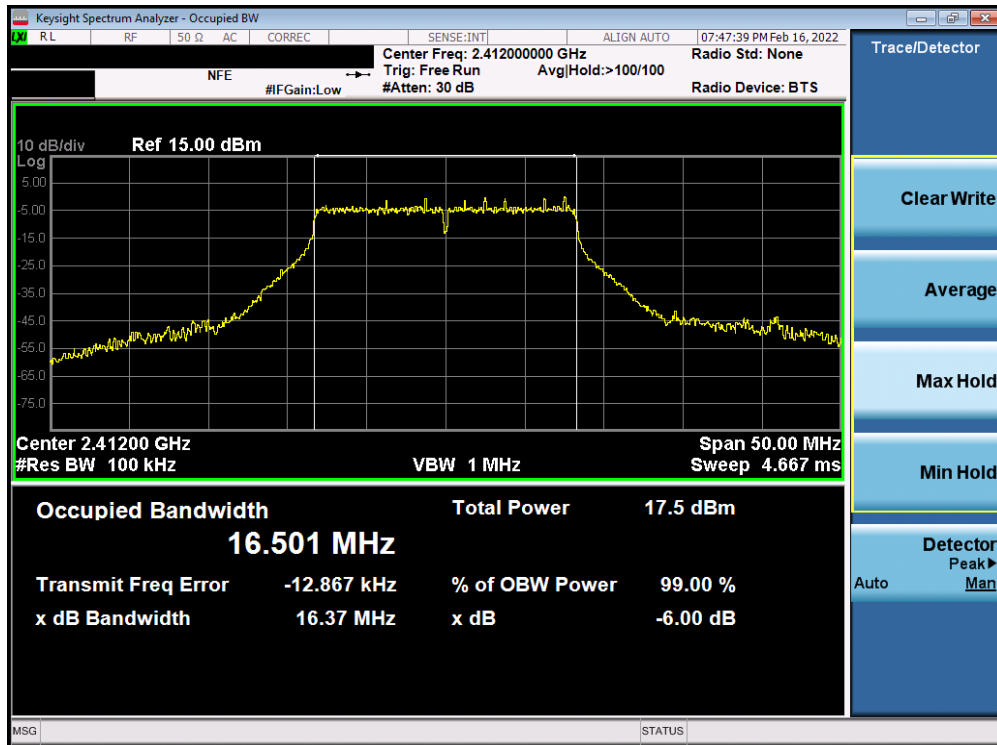


Plot 7-11. 6dB Bandwidth Plot SISO ANT2 (802.11b – Ch. 6)

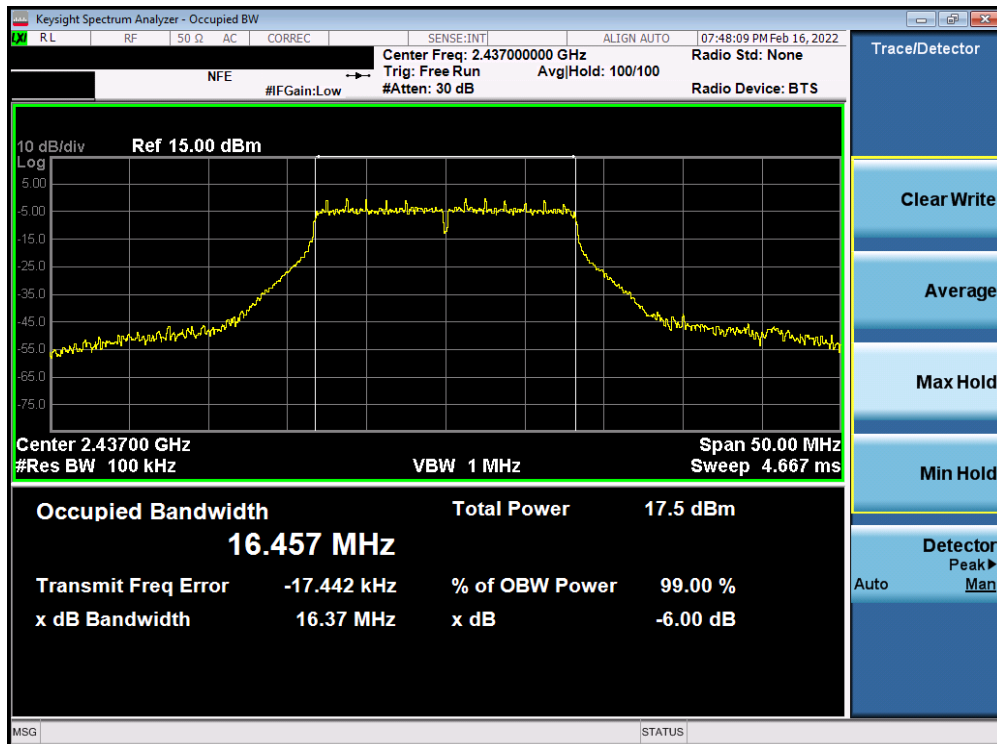


Plot 7-12. 6dB Bandwidth Plot SISO ANT2 (802.11b – Ch. 11)

FCC ID: V7MESLCTGA		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 21 of 106

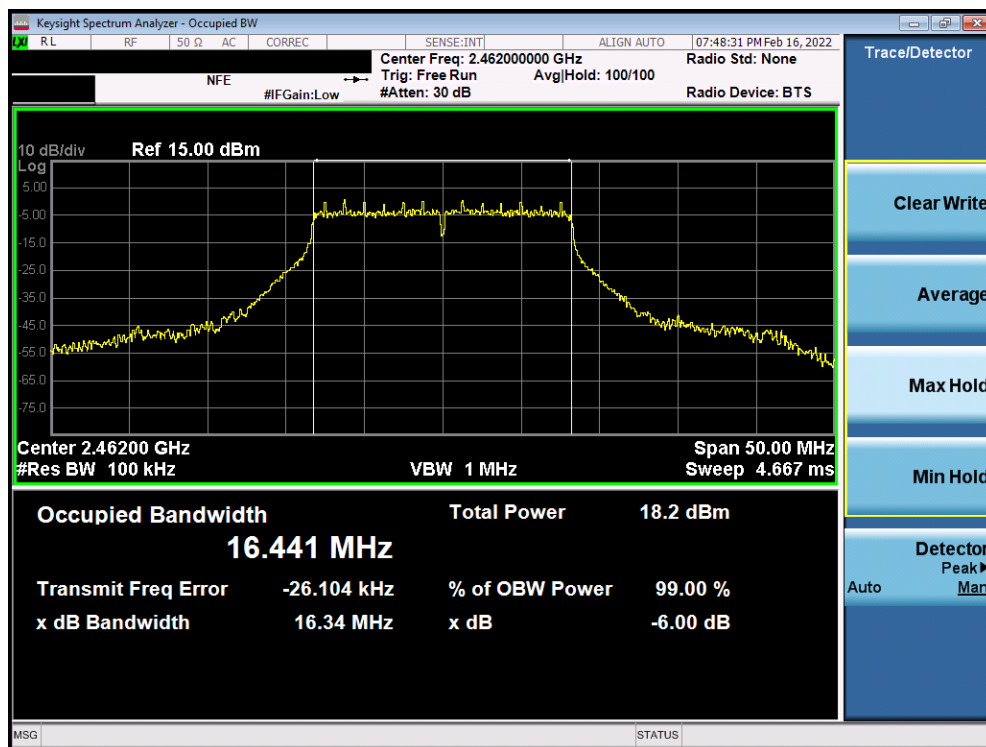


Plot 7-13. 6dB Bandwidth Plot SISO ANT2 (802.11g – Ch. 1)

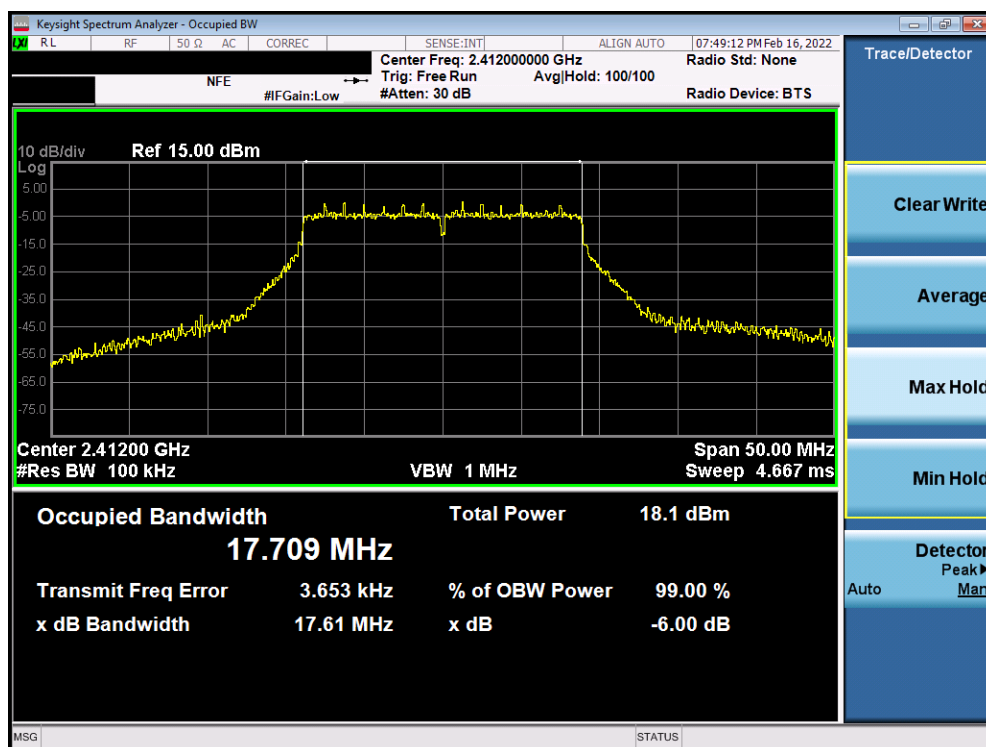


Plot 7-14. 6dB Bandwidth Plot SISO ANT2 (802.11g – Ch. 6)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 22 of 106

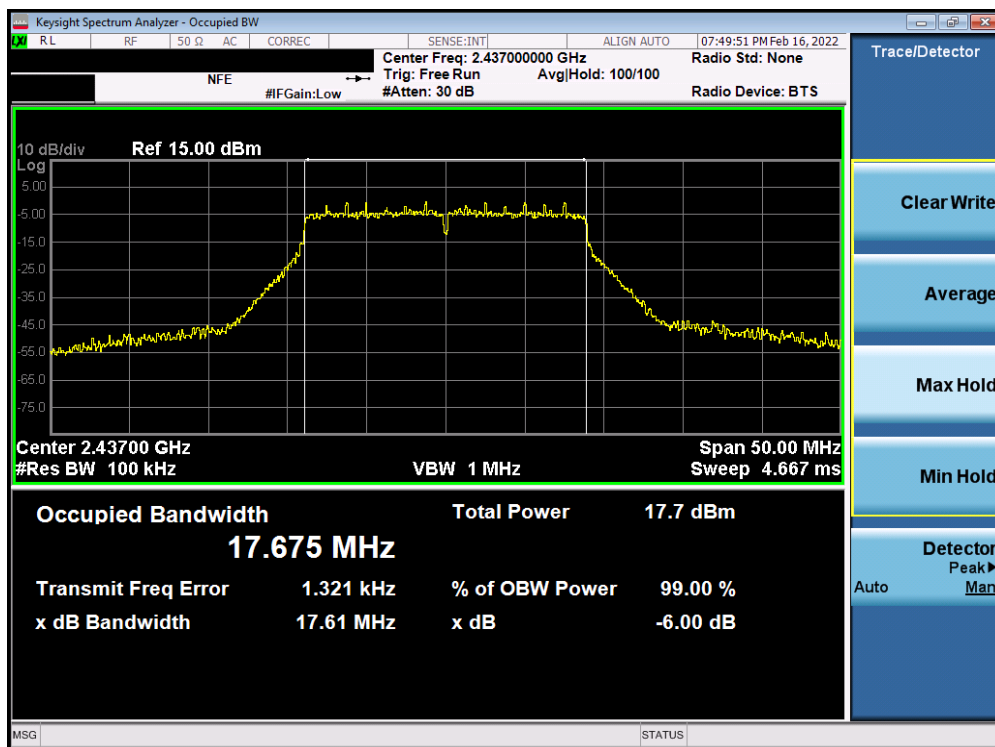


Plot 7-15. 6dB Bandwidth Plot SISO ANT2 (802.11g – Ch. 11)

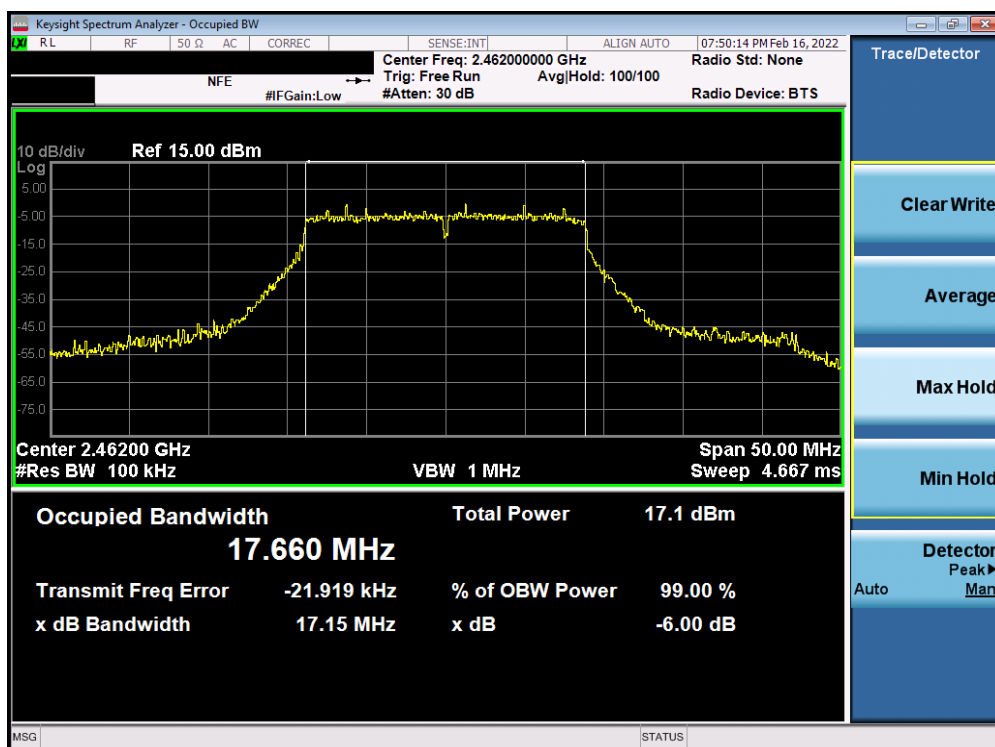


Plot 7-16. 6dB Bandwidth Plot SISO ANT2 (802.11n (2.4GHz) – Ch. 1)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 23 of 106



Plot 7-17. 6dB Bandwidth Plot SISO ANT2 (802.11n (2.4GHz) – Ch. 6)



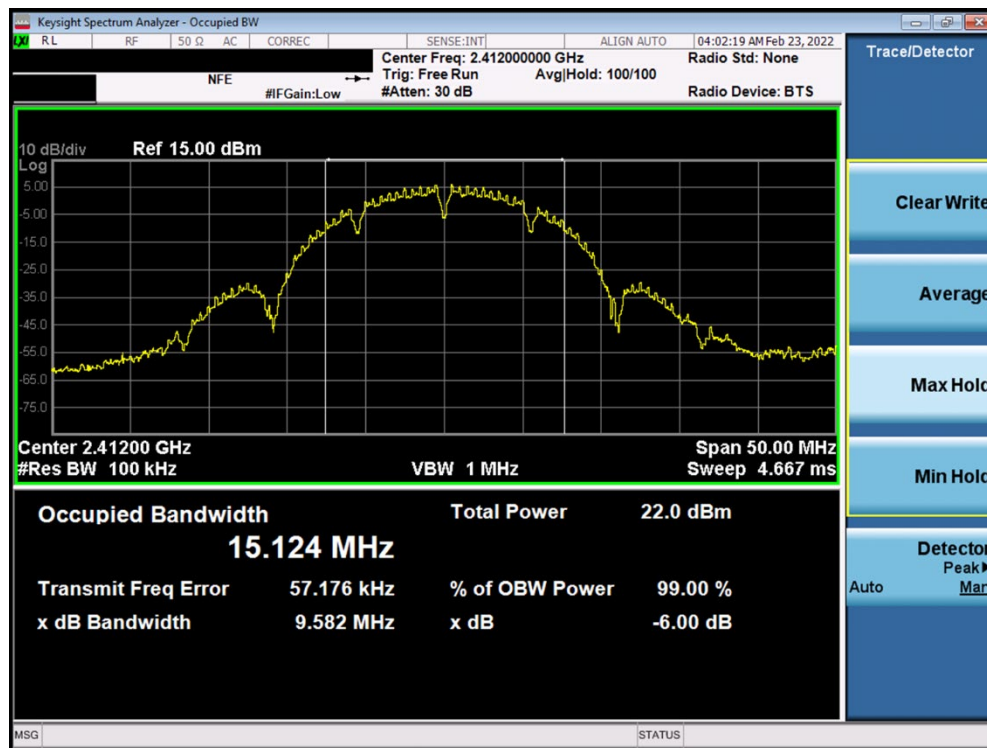
Plot 7-18. 6dB Bandwidth Plot SISO ANT2 (802.11n (2.4GHz) – Ch. 11)

FCC ID: V7MESLCTGA		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 24 of 106

MIMO 6 dB Bandwidth Measurements

Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Antenna-1 6dB Bandwidth [MHz]	Antenna-2 6dB Bandwidth [MHz]	Minimum Bandwidth [MHz]
2412	1	b	1	9.58	10.12	0.500
2437	6	b	1	9.58	9.58	0.500
2462	11	b	1	9.12	10.04	0.500
2412	1	g	6	16.37	16.34	0.500
2437	6	g	6	16.37	16.36	0.500
2462	11	g	6	16.34	16.38	0.500
2412	1	n	6.5/7.2 (MCS0)	17.58	17.55	0.500
2437	6	n	6.5/7.2 (MCS0)	17.62	17.63	0.500
2462	11	n	6.5/7.2 (MCS0)	16.64	17.59	0.500

Table 7-4. Conducted Bandwidth Measurements MIMO



Plot 7-19. 6dB Bandwidth Plot MIMO ANT1 (802.11b - Ch. 1)


FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 25 of 106

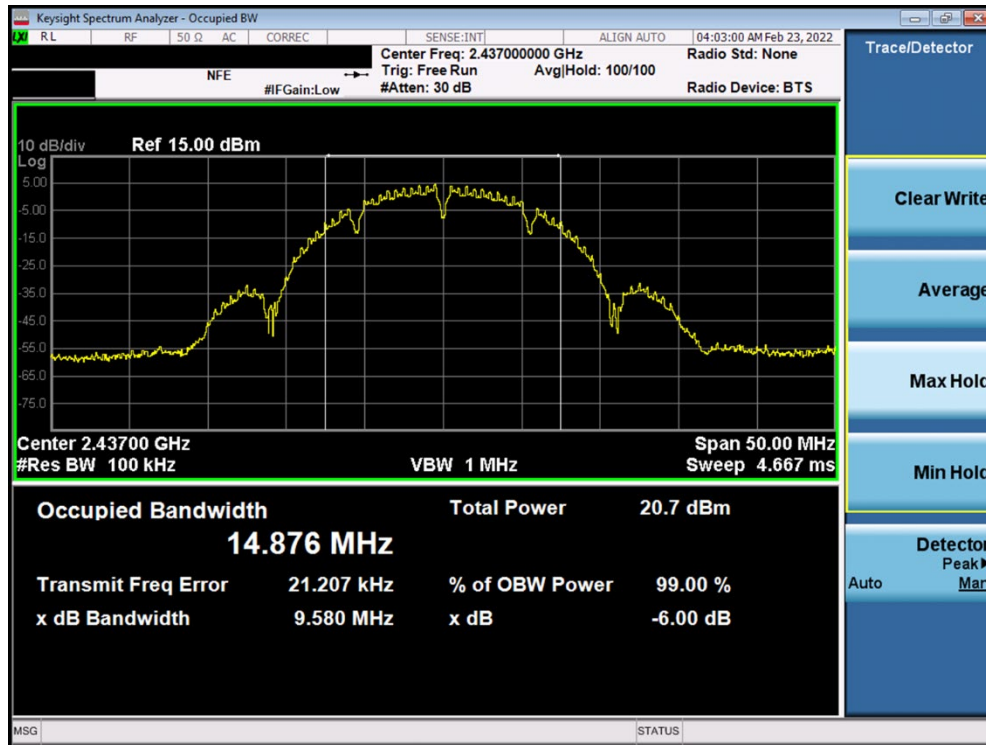


Plot 7-20. 6dB Bandwidth Plot MIMO ANT2 (802.11b – Ch. 1)



Plot 7-21. 6dB Bandwidth Plot MIMO ANT1 (802.11b – Ch. 6)

FCC ID: V7MESLCTGA		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 26 of 106

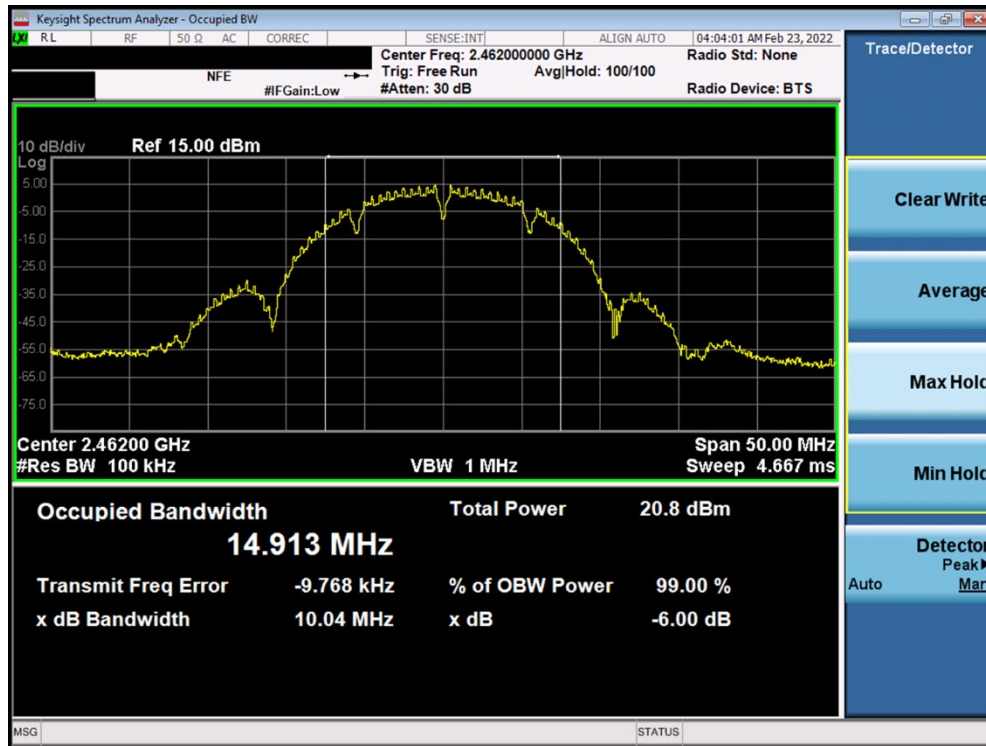


Plot 7-22. 6dB Bandwidth Plot MIMO ANT2 (802.11b – Ch. 6)

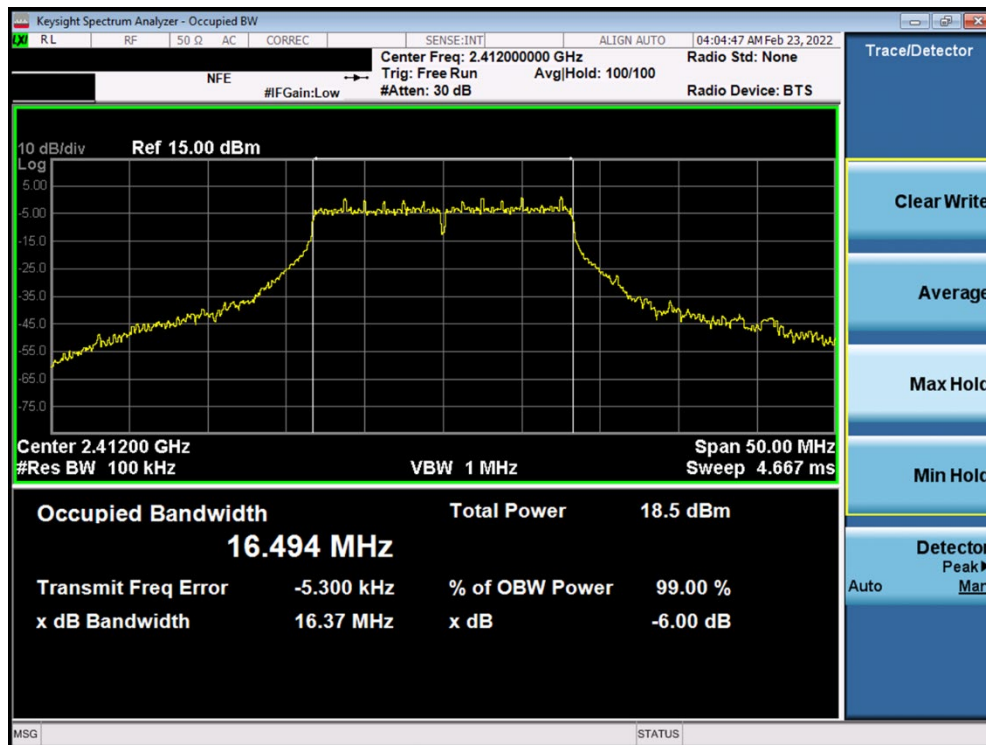


Plot 7-23. 6dB Bandwidth Plot MIMO ANT1 (802.11b – Ch. 11)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 27 of 106

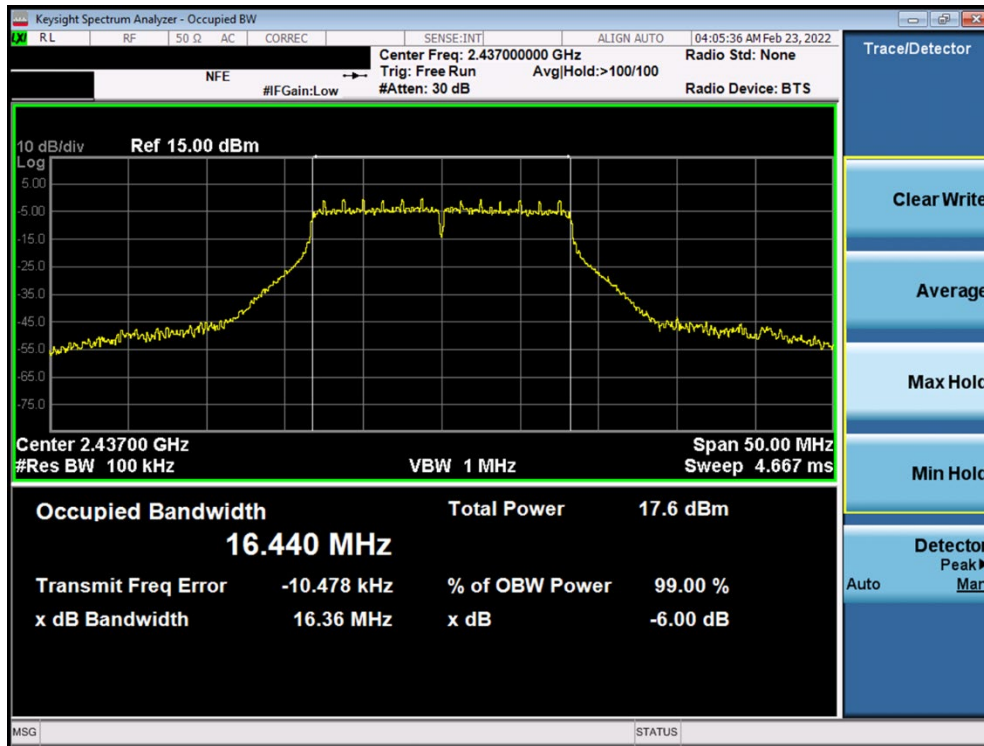


Plot 7-24. 6dB Bandwidth Plot MIMO ANT2 (802.11b – Ch. 11)

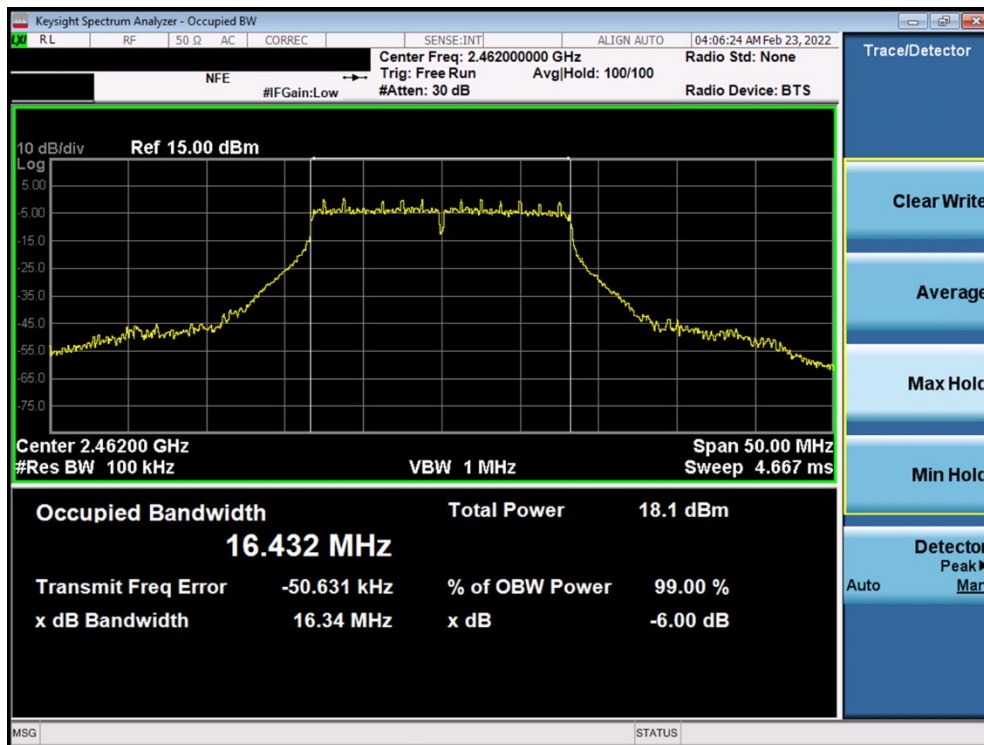


Plot 7-25. 6dB Bandwidth Plot MIMO ANT1 (802.11g – Ch. 1)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 28 of 106

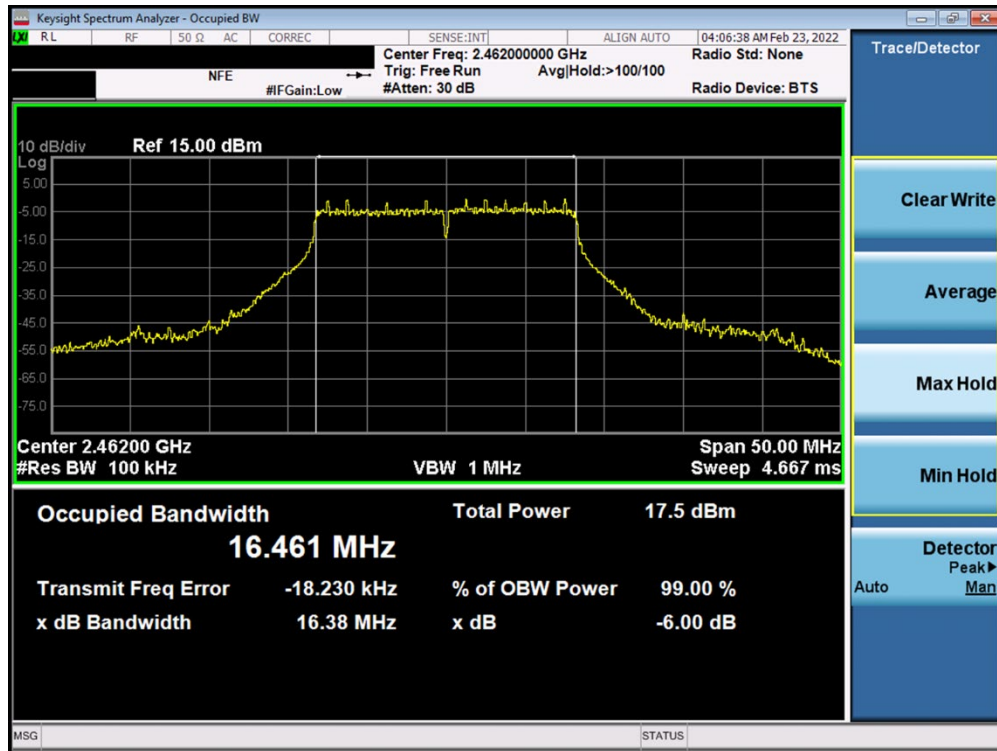


Plot 7-28. 6dB Bandwidth Plot MIMO ANT2 (802.11g – Ch. 6)

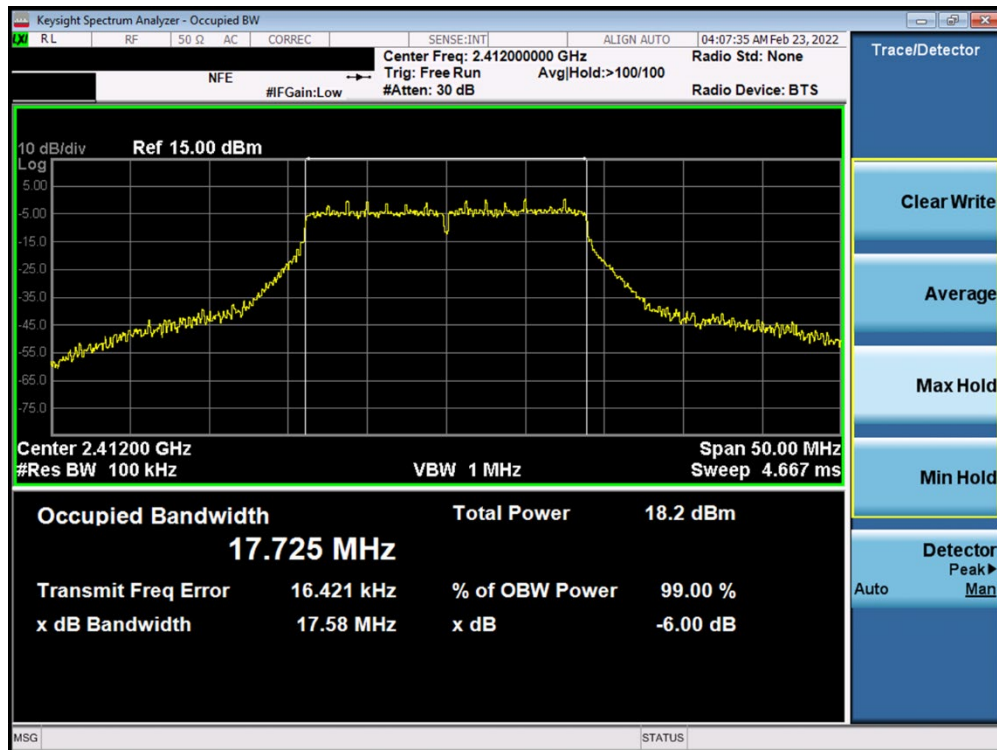


Plot 7-29. 6dB Bandwidth Plot MIMO ANT1 (802.11g – Ch. 11)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 30 of 106



Plot 7-30. 6dB Bandwidth Plot MIMO ANT2 (802.11g – Ch. 11)

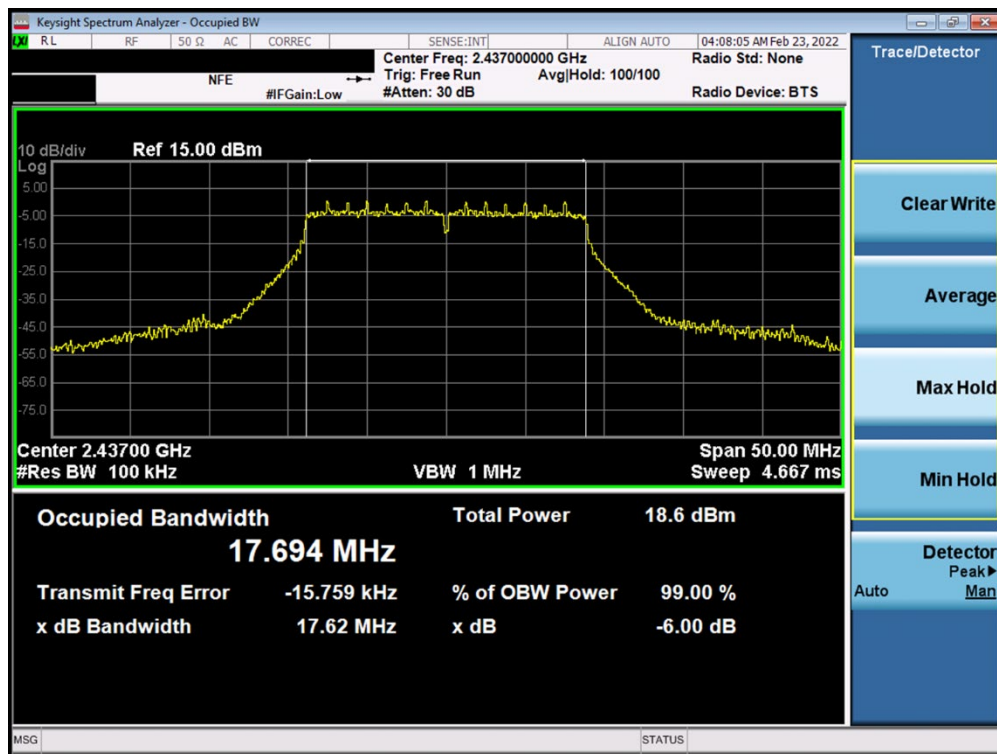


Plot 7-31. 6dB Bandwidth Plot MIMO ANT1 (802.11n (2.4GHz) – Ch. 1)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 31 of 106

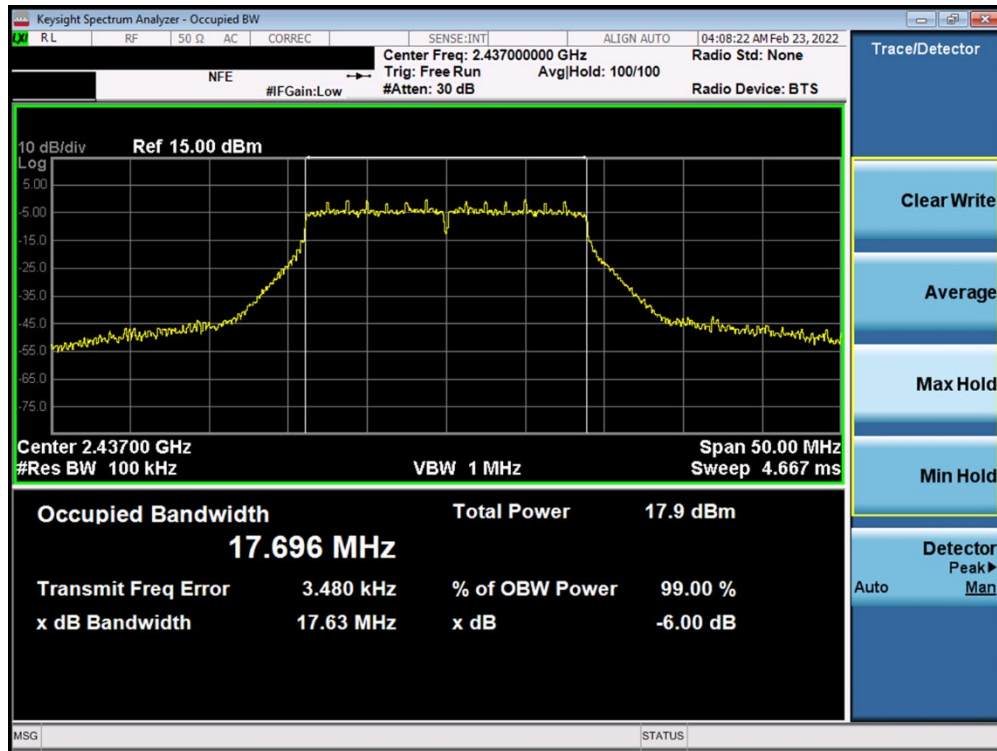


Plot 7-32. 6dB Bandwidth Plot MIMO ANT2 (802.11n (2.4GHz) – Ch. 1)

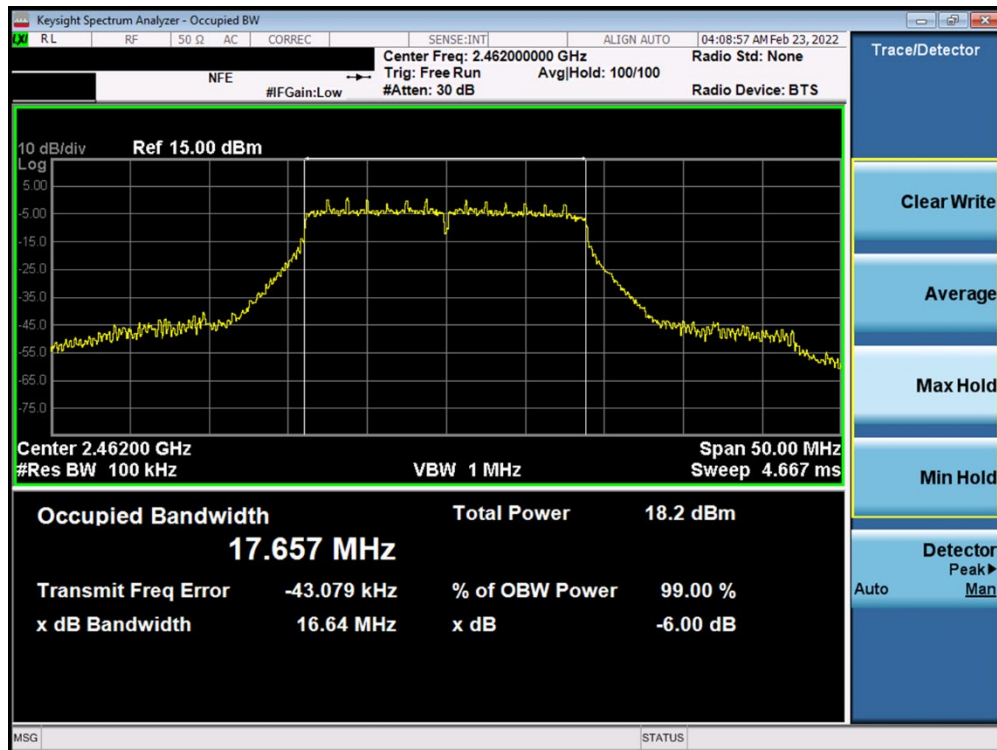


Plot 7-33. 6dB Bandwidth Plot MIMO ANT1 (802.11n (2.4GHz) – Ch. 6)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 32 of 106

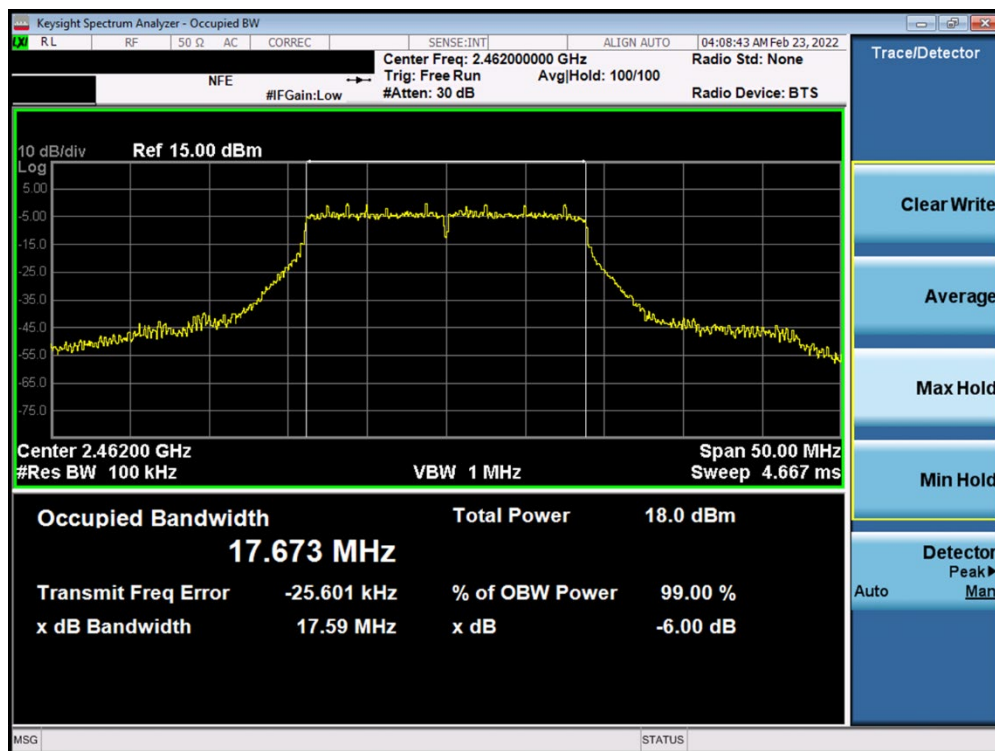


Plot 7-34. 6dB Bandwidth Plot MIMO ANT2 (802.11n (2.4GHz) – Ch. 6)



Plot 7-35. 6dB Bandwidth Plot MIMO ANT1 (802.11n (2.4GHz) – Ch. 11)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 33 of 106



Plot 7-36. 6dB Bandwidth Plot MIMO ANT1 (802.11n (2.4GHz) – Ch. 11)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 34 of 106

7.3 Output Power Measurement

§15.247(b.3); RSS-247 [5.4]

Test Overview and Limits

A transmitter antenna terminal of EUT is connected to the input of an RF power sensor. Measurement is made using a broadband power meter capable of making peak and average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

The maximum permissible conducted output power is 1 Watt.

Test Procedure Used

ANSI C63.10-2013 – Section 11.9.1.3 PKPM1 Peak Power Method
KDB 558074 D01 v05r02 – Section 8.3.1.3 PKPM1 Peak-reading Power Meter Method
ANSI C63.10-2013 – Section 11.9.2.3.2 Method AVGPM-G
KDB 558074 D01 v05r02 – Section 8.3.2.3 Measurement using a Power Meter (PM)
ANSI C63.10-2013 – Section 14.2 Measure-and-Sum Technique
KDB 662911 D01 v02r01 – Section E)1) Measure-and-Sum Technique

Test Settings

Method PKPM1 (Peak Power Measurement)

Peak power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

Method AVGPM-G (Average Power Measurement)

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

Test Setup

The EUT and measurement equipment were set up as shown in the diagrams below.



Figure 7-2. Test Instrument & Measurement Setup for Power Meter Measurements

Test Notes

None

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE	Page 35 of 106

2.4GHz	Freq [MHz]	Channel	Detector	IEEE Transmission Mode			Conducted Power Limit [dBm]	Conducted Power Margin [dB]
				802.11b	802.11g	802.11n		
	2412	1	AVG	14.84	11.68	11.58	30.00	-15.16
			PEAK	19.80	18.22	18.35	30.00	-10.20
	2437	6	AVG	14.70	11.94	11.83	30.00	-15.30
			PEAK	19.70	18.18	18.69	30.00	-10.30
	2462	11	AVG	14.56	11.92	11.70	30.00	-15.44
			PEAK	19.71	18.81	18.14	30.00	-10.29

Table 7-5. Conducted Output Power Measurements SISO ANT1

2.4GHz	Freq [MHz]	Channel	Detector	IEEE Transmission Mode			Conducted Power Limit [dBm]	Conducted Power Margin [dB]
				802.11b	802.11g	802.11n		
	2412	1	AVG	14.59	11.71	11.91	30.00	-15.41
			PEAK	19.55	18.21	18.65	30.00	-10.45
	2437	6	AVG	14.88	11.62	11.57	30.00	-15.12
			PEAK	19.04	17.85	18.28	30.00	-10.96
	2462	11	AVG	14.89	11.21	11.56	30.00	-15.11
			PEAK	20.14	18.57	18.95	30.00	-9.86

Table 7-6. Conducted Output Power Measurements SISO ANT2

2.4GHz	Freq [MHz]	Channel	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]
				ANT1	ANT2	MIMO		
	2412	1	AVG	15.46	13.47	17.59	30.00	-12.41
			PEAK	18.41	16.39	20.53	30.00	-9.47
	2437	6	AVG	15.18	13.97	17.63	30.00	-12.37
			PEAK	18.03	16.87	20.50	30.00	-9.50
	2462	11	AVG	15.11	14.11	17.65	30.00	-12.35
			PEAK	18.05	16.91	20.53	30.00	-9.47

Table 7-7. Conducted Output Power Measurements MIMO (802.11b)

2.4GHz	Freq [MHz]	Channel	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]
				ANT1	ANT2	MIMO		
	2412	1	AVG	12.43	10.93	14.75	30.00	-15.25
			PEAK	18.71	17.53	21.17	30.00	-8.83
	2437	6	AVG	12.11	11.30	14.73	30.00	-15.27
			PEAK	18.57	17.94	21.28	30.00	-8.72
	2462	11	AVG	11.84	11.50	14.68	30.00	-15.32
			PEAK	18.28	18.00	21.15	30.00	-8.85

Table 7-8. Conducted Output Power Measurements MIMO (802.11g)

FCC ID: V7MESLCTGA		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 1M2202090014-03.V7M	Test Dates: 02/11/2022 ~ 02/28/2022	EUT Type: LTE Indoor CPE		Page 36 of 106

2.4GHz	Freq [MHz]	Channel	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]
				ANT1	ANT2	MIMO		
	2412	1	AVG	12.07	10.35	14.30	30.00	-15.70
			PEAK	18.36	16.88	20.69	30.00	-9.31
	2437	6	AVG	11.92	10.92	14.46	30.00	-15.54
			PEAK	18.57	17.86	21.24	30.00	-8.76
	2462	11	AVG	11.91	11.76	14.85	30.00	-15.15
			PEAK	18.28	18.21	21.26	30.00	-8.74

Table 7-9. Conducted Output Power Measurements MIMO (802.11n)

Note:

Per ANSI C63.10-2013 and KDB 662911 D01 v02r01 Section E)1), the conducted powers at Antenna 1 and Antenna 2 were first measured separately during MIMO transmission as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

Sample MIMO Calculation:

At 2412MHz the average conducted output power was measured to be 11.92 dBm for Antenna-1 and 10.92 dBm for Antenna-2.

$$\text{Antenna 1} + \text{Antenna 2} = \text{MIMO}$$

$$(11.92 \text{ dBm} + 10.92 \text{ dBm}) = (15.56 \text{ mW} + 12.36 \text{ mW}) = 27.92 \text{ mW} = 14.46 \text{ dBm}$$

FCC ID: V7MESLCTGA		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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7.4 Power Spectral Density

§15.247(e); RSS-247 [5.2]

Test Overview and Limit

The peak power density is measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated and the worst case configuration results are reported in this section.

The maximum permissible power spectral density is 8 dBm in any 3 kHz band.

Test Procedure Used

ANSI C63.10-2013 – Section 11.10.2 Method PKPSD

KDB 558074 D01 v05r02 – Section 8.4 DTS Maximum Power Spectral Density level in the fundamental emission

ANSI C63.10-2013 – Section 14.3.2.2 Measure-and-Sum Technique

KDB 662911 D01 v02r01 – Section E)2) Measure-and-Sum Technique

Test Settings

1. Analyzer was set to the center frequency of the DTS channel under investigation
2. Span = 1.5 times the DTS channel bandwidth
3. RBW = 10kHz
4. VBW = 1MHz
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



Figure 7-3. Test Instrument & Measurement Setup

Test Notes

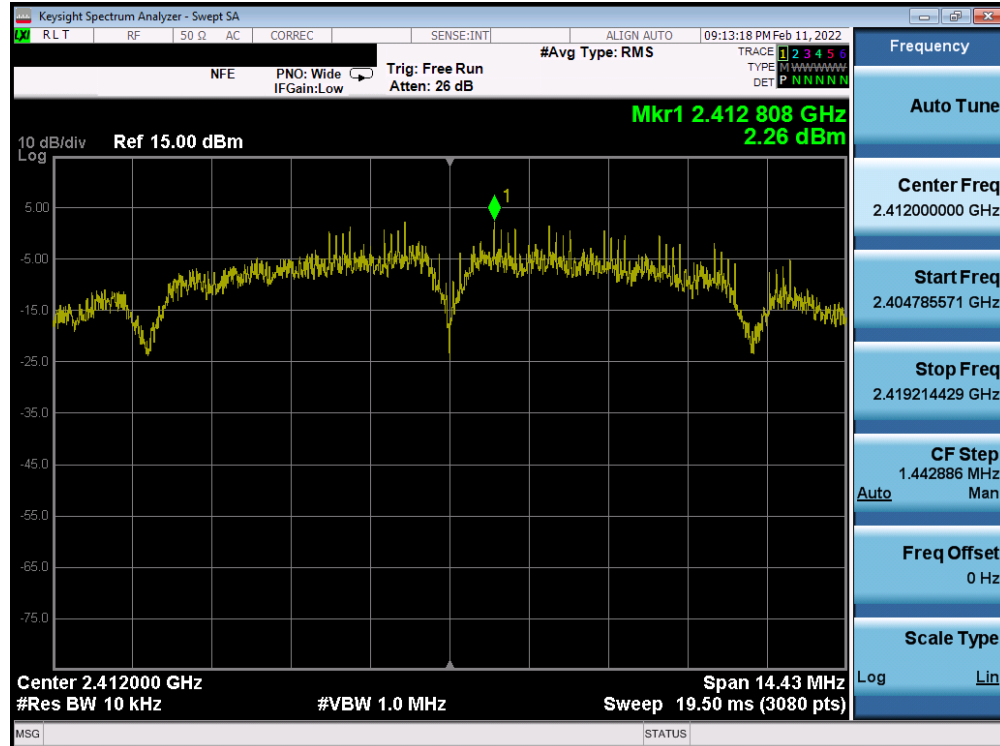
None

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SISO Antenna-1 Power Spectral Density Measurements

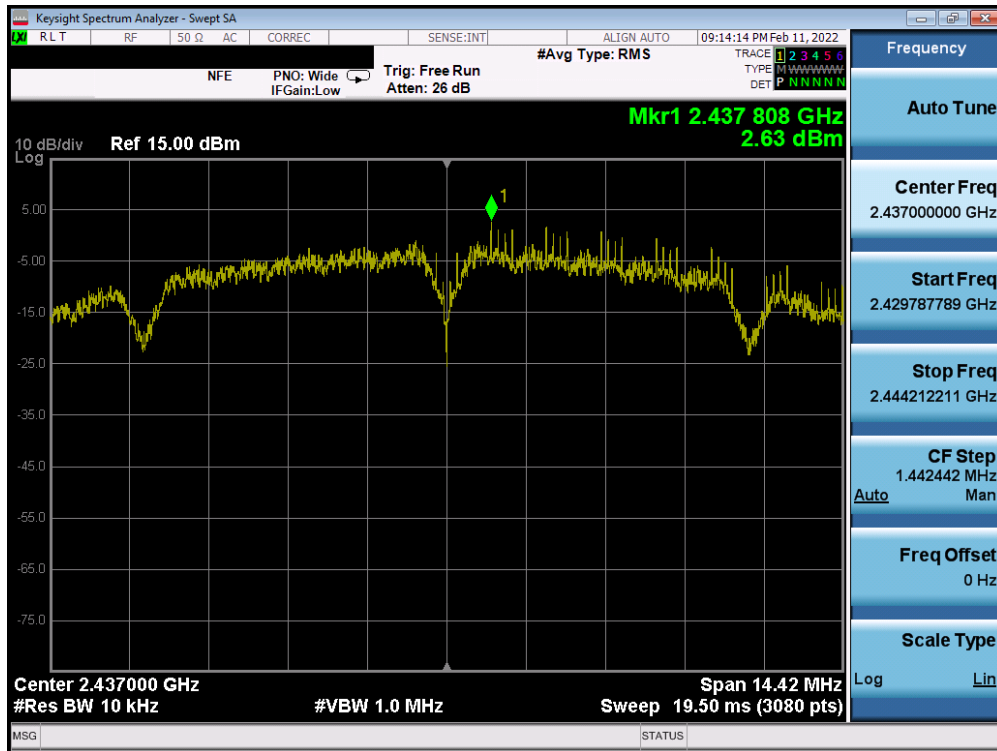
Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Power Spectral Density [dBm]	Maximum Permissible Power Density [dBm / 3kHz]	Margin [dB]	Pass / Fail
2412	1	b	1	2.26	8.00	-5.74	Pass
2437	6	b	1	2.63	8.00	-5.37	Pass
2462	11	b	1	-1.39	8.00	-9.39	Pass
2412	1	g	6	-8.01	8.00	-16.01	Pass
2437	6	g	6	-7.80	8.00	-15.80	Pass
2462	11	g	6	-7.60	8.00	-15.60	Pass
2412	1	n	6.5/7.2 (MCS0)	-8.14	8.00	-16.14	Pass
2437	6	n	6.5/7.2 (MCS0)	-6.89	8.00	-14.89	Pass
2462	11	n	6.5/7.2 (MCS0)	-7.80	8.00	-15.80	Pass

Table 7-10. Conducted Power Density Measurements SISO ANT1

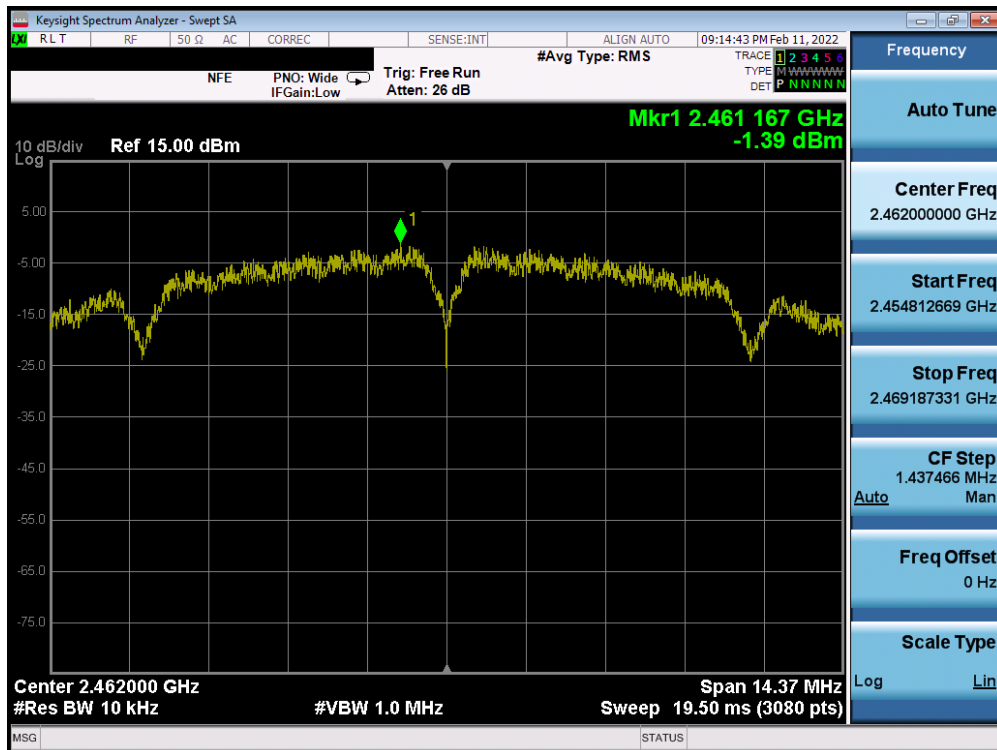


Plot 7-37. Power Spectral Density Plot SISO ANT1 (802.11b – Ch. 1)

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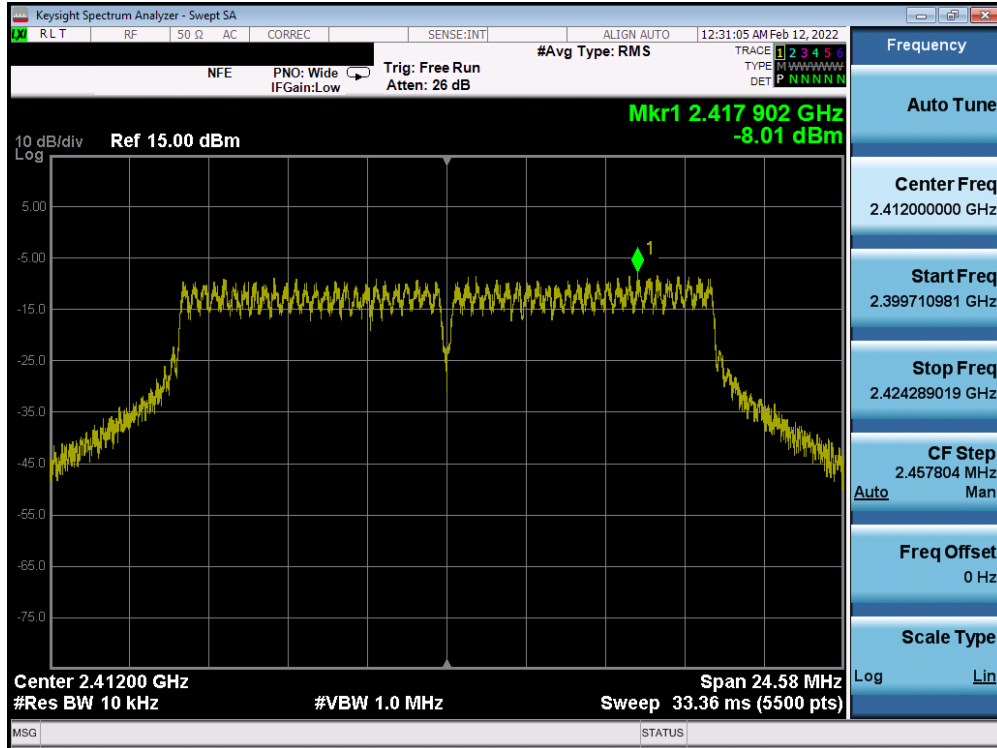


Plot 7-38. Power Spectral Density Plot SISO ANT1 (802.11b – Ch. 6)

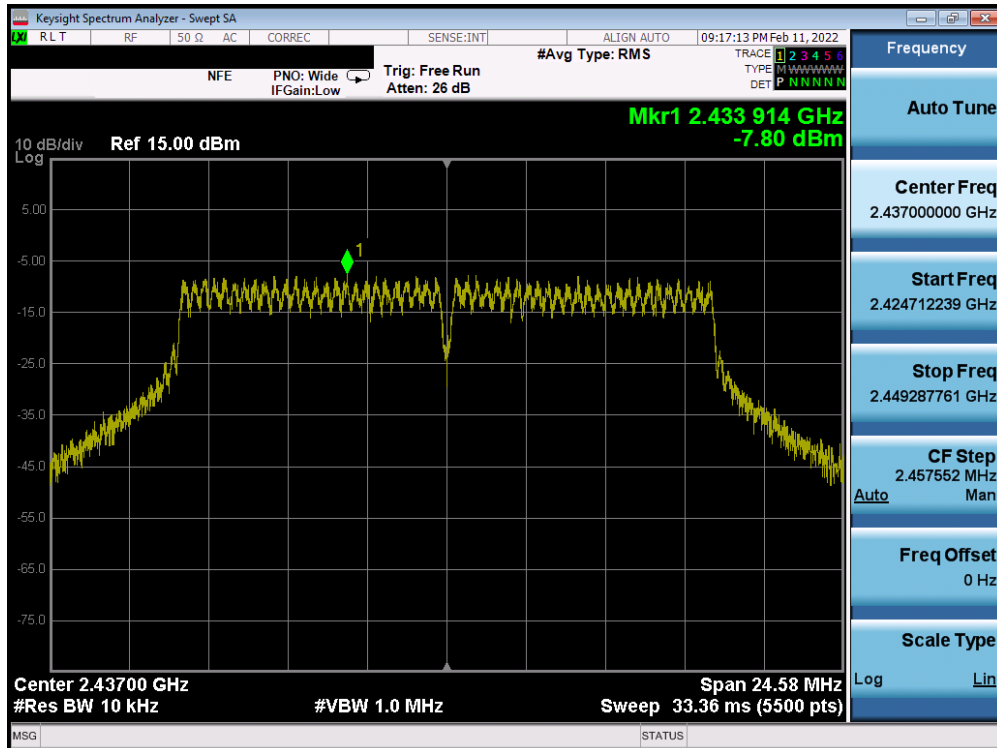


Plot 7-39. Power Spectral Density Plot SISO ANT1 (802.11b – Ch. 11)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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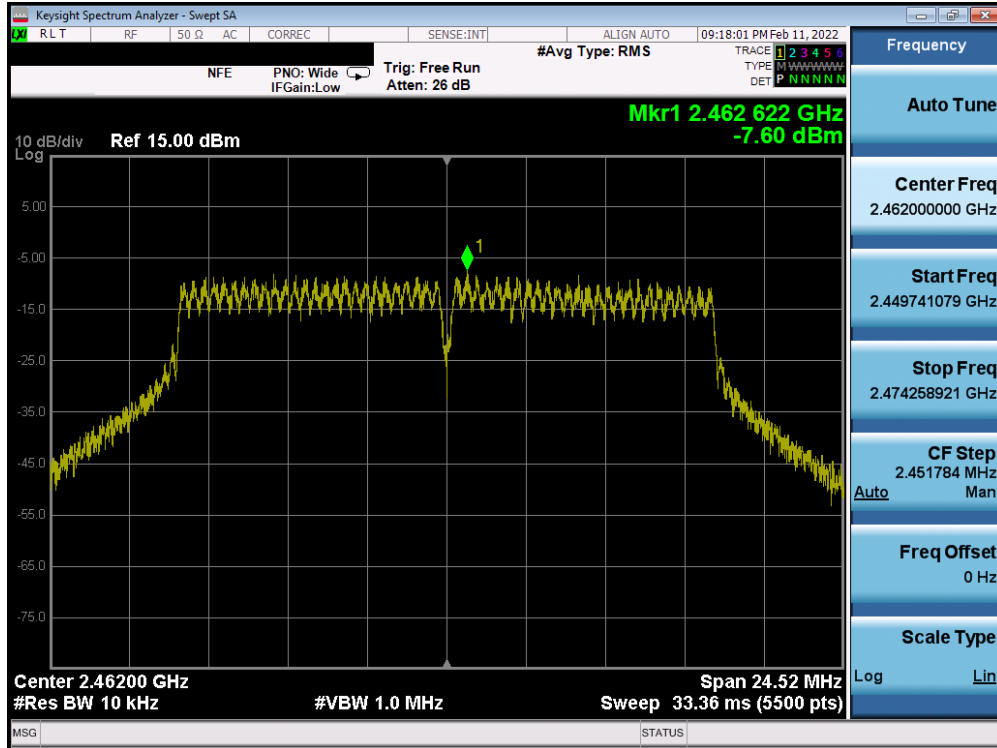


Plot 7-40. Power Spectral Density Plot SISO ANT1 (802.11g – Ch. 1)

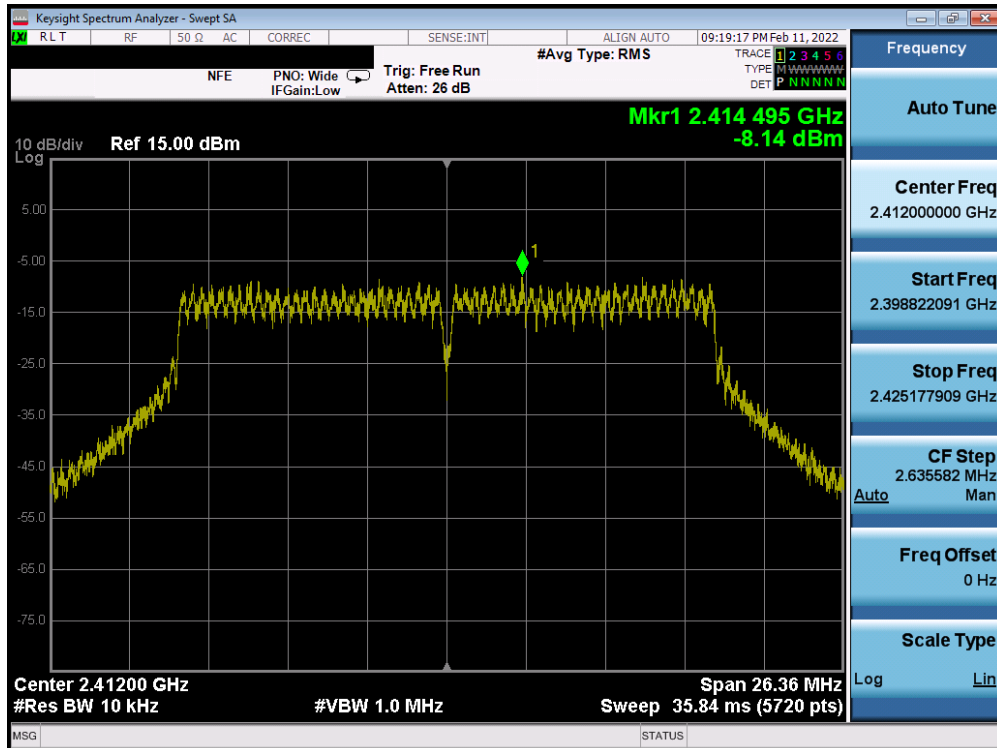


Plot 7-41. Power Spectral Density Plot SISO ANT1 (802.11g – Ch. 6)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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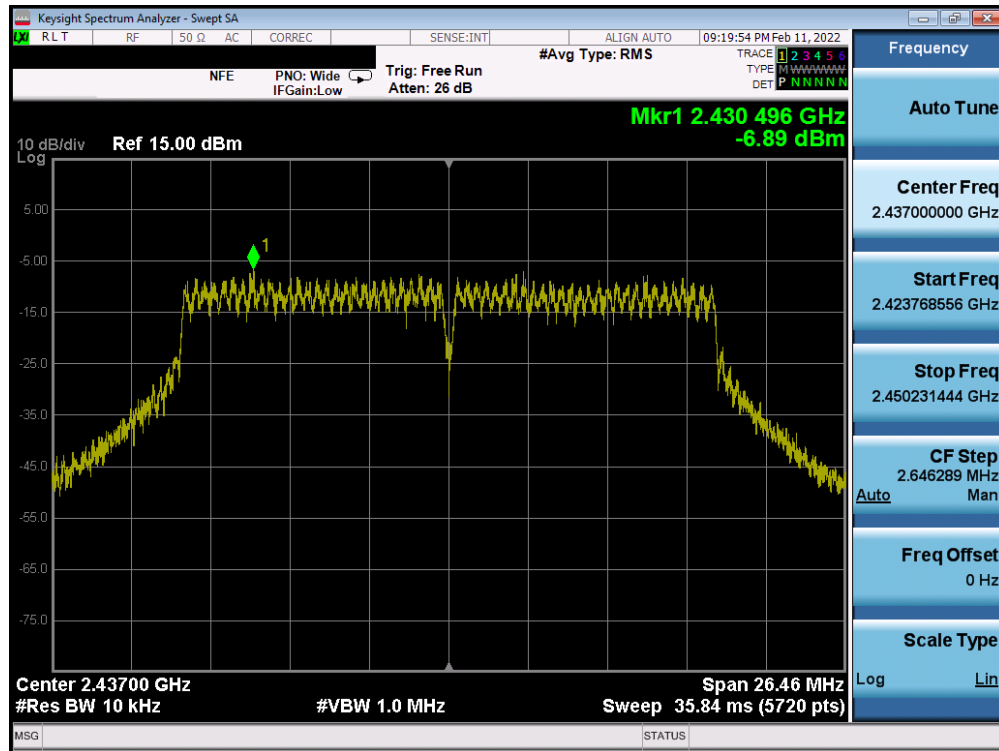


Plot 7-42. Power Spectral Density Plot SISO ANT1 (802.11g – Ch. 11)

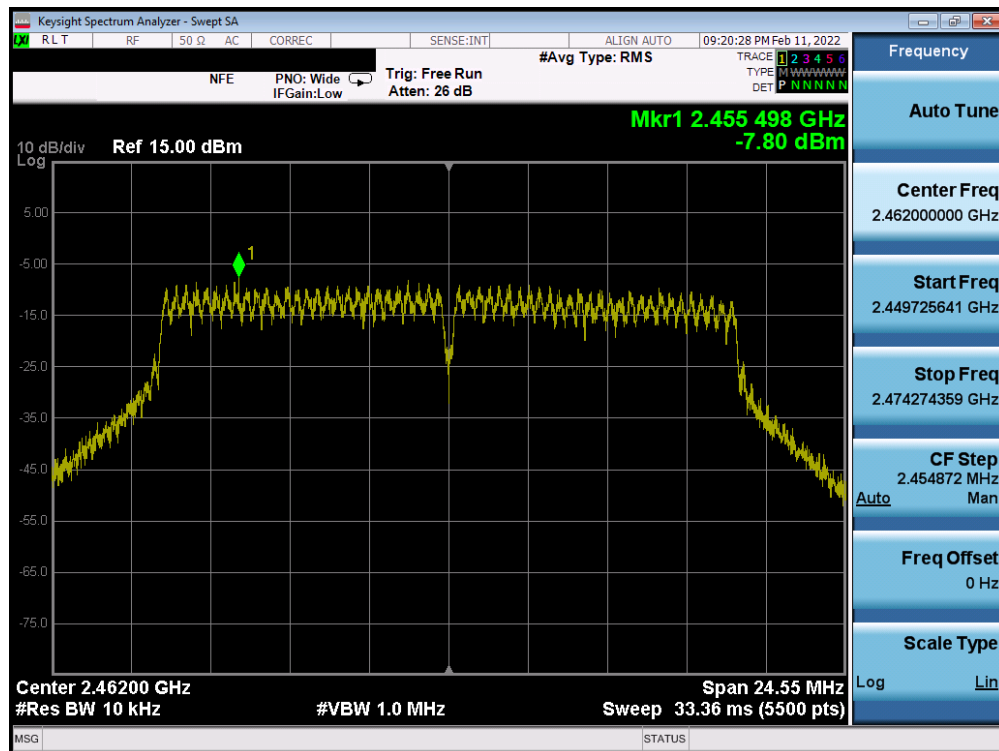


Plot 7-43. Power Spectral Density Plot SISO ANT1 (802.11n (2.4GHz) – Ch. 1)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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Plot 7-44. Power Spectral Density Plot SISO ANT1 (802.11n (2.4GHz) – Ch. 6)



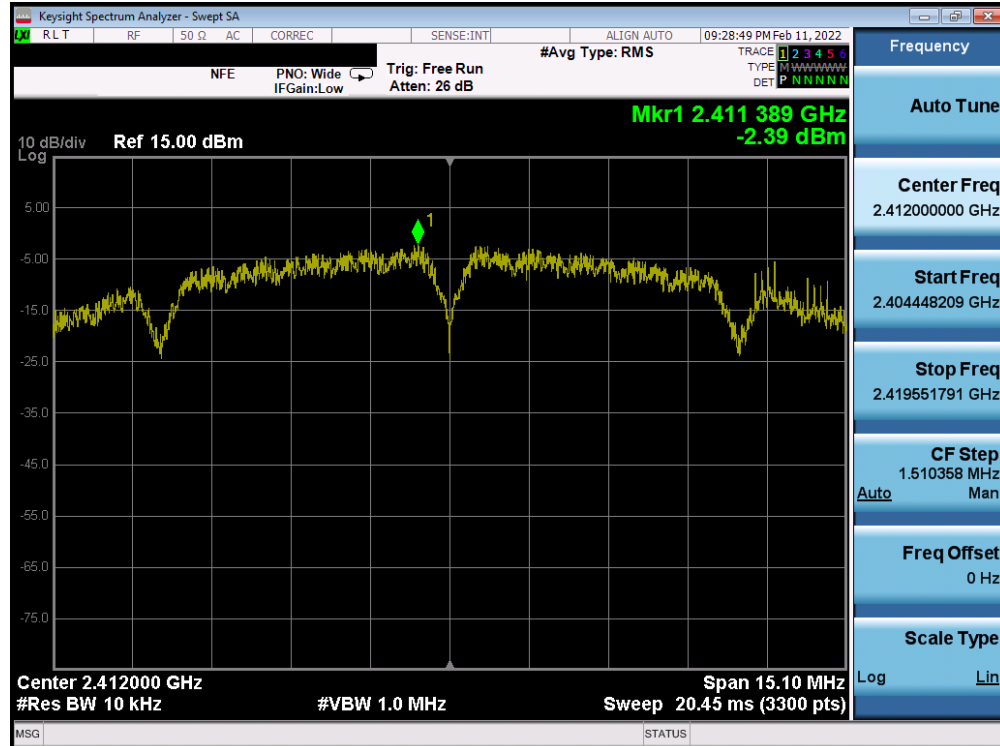
Plot 7-45. Power Spectral Density Plot SISO ANT1 (802.11n (2.4GHz) – Ch. 11)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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SISO Antenna-2 Power Spectral Density Measurements

Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Power Spectral Density [dBm]	Maximum Permissible Power Density [dBm / 3kHz]	Margin [dB]	Pass / Fail
2412	1	b	1	-2.39	8.00	-10.39	Pass
2437	6	b	1	2.21	8.00	-5.79	Pass
2462	11	b	1	2.93	8.00	-5.07	Pass
2412	1	g	6	-7.21	8.00	-15.21	Pass
2437	6	g	6	-7.45	8.00	-15.45	Pass
2462	11	g	6	-6.91	8.00	-14.91	Pass
2412	1	n	6.5/7.2 (MCS0)	-7.59	8.00	-15.59	Pass
2437	6	n	6.5/7.2 (MCS0)	-8.07	8.00	-16.07	Pass
2462	11	n	6.5/7.2 (MCS0)	-9.95	8.00	-17.95	Pass

Table 7-11. Conducted Power Density Measurements SISO ANT2

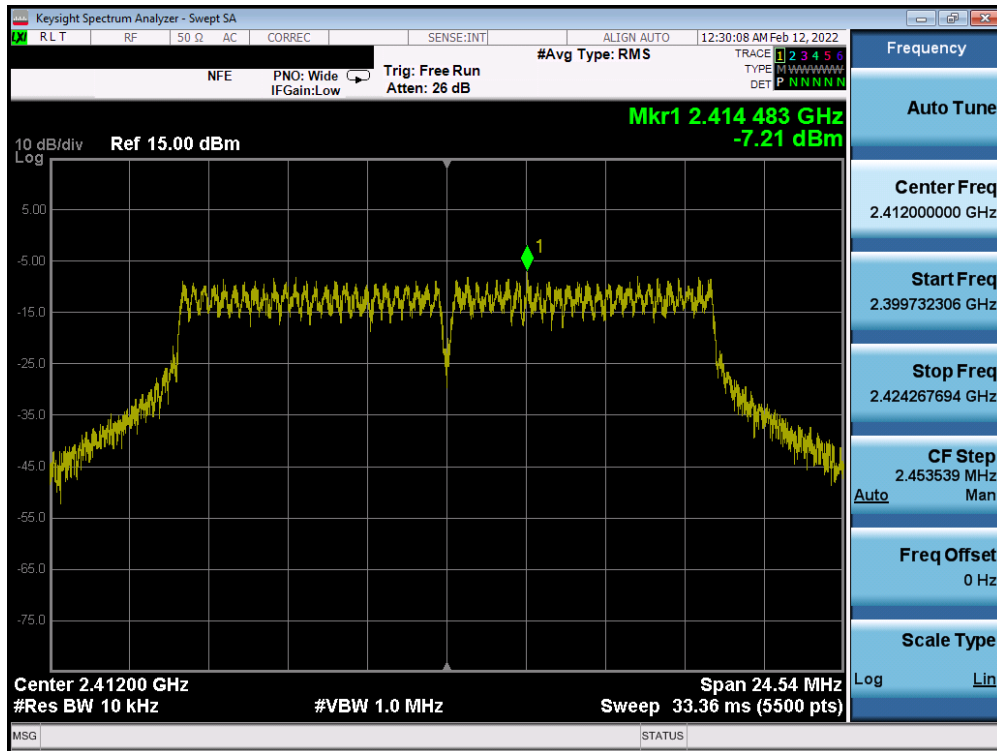


Plot 7-46. Power Spectral Density Plot SISO ANT2 (802.11b - Ch. 1)

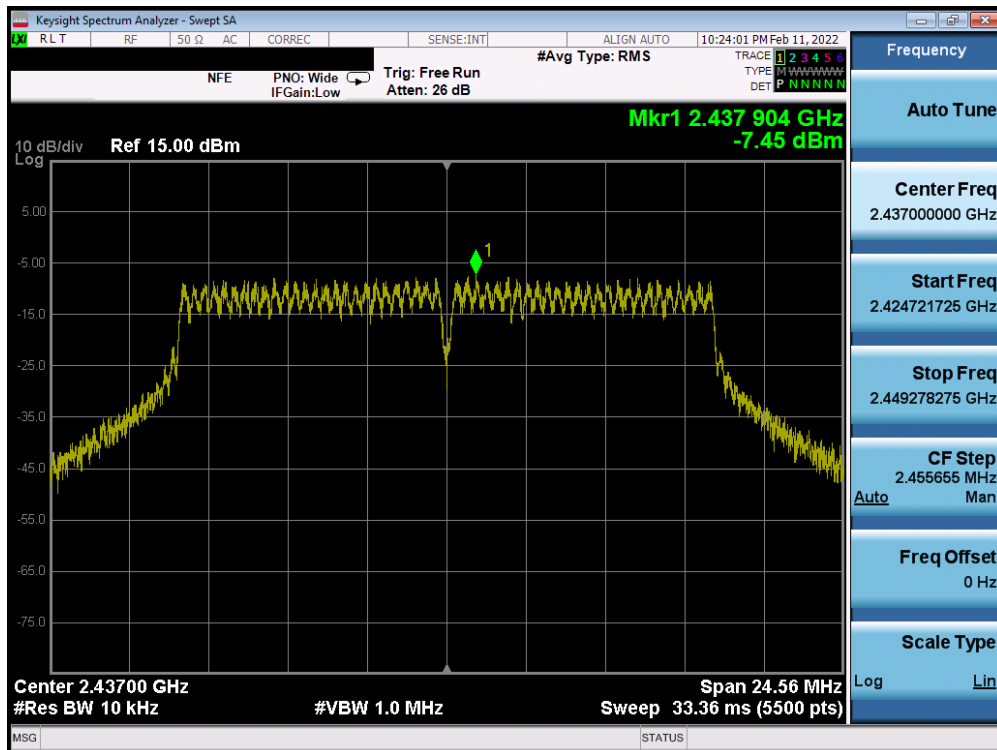
FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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Plot 7-49. Power Spectral Density Plot SISO ANT2 (802.11g – Ch. 1)



Plot 7-50. Power Spectral Density Plot SISO ANT2 (802.11g – Ch. 6)

FCC ID: V7MESLCTGA	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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