

Testing Tomorrow's Technology

**Application
For**

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

And

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

For the

Southern States, LLC

Model Number: ICS/TFDIR Receiver

**FCC ID: 2ADWT-ICSR01
IC: 12660A-ICSR01**

**UST Project: 24-0098
Issue Date: June 18, 2024**

Total Pages: 121

**3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
www.ustech-lab.com**




Testing Tomorrow's Technology

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

US TECH (Agent Responsible For Test):

By: Alan Ghasiani

Name: 

Title: Compliance Engineer – President

Date: June 18, 2024



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MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Southern States, LLC
MODEL: ICS/TFDIR Receiver
FCC ID: 2ADWT-ICSR01
IC: 12660A-ICSR01
DATE: June 18, 2024

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

Equipment type: 2.4 GHz ZigBee Transceiver

Technical:
2403.5 MHz - 2480 MHz
Type of modulation:
O-QPSK
Data/Bit Rate:
Radio 1= 1-11
Antenna Gain: +5.3 dBi (Whip Antenna)
Maximum Output Power: +4 dBm
Software used to program EUT: ReceiverMonitor v0.4
EUT firmware number: version: Receiverv07 DBG
Power setting: client's default max setting

Report prepared by:
US Tech
3505 Francis Circle
Alpharetta, GA30004

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List of Attachments

FCC Agency Agreement
IC Agency Agreement
FCC Application Forms
IC Application Forms
Letter of Confidentiality
Equipment Label(s)
Block Diagram(s)
Schematic(s)

Test Configuration Photographs
External Photographs
Internal Photographs
Theory of Operation
RF Exposure
User's Manual
IC Cross Reference
FCC Modular Approval Letter
IC Modular Approval Letter

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1 General Information

1.1 Purpose of this Report

This report is prepared to convey 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 June 1, 2024 in good operating condition.

1.3 Product Description

The Equipment under Test (EUT) is the Southern States, LLC model ICS/TFDIR Receiver. The EUT is a wireless industrial utility power base station used to monitor utility and power lines. It is designed to work with companion sensors and uses wireless communication for reporting and data transmission. The EUT aggregates current and voltage measurements from three sensors (one for each electric phase) via 2.4 GHz ISM band. The data is streamed via UART to Southern States equipment for access by the installing electric utility. It is a closed system accessible only by the installing utility company.

The EUT incorporates ZigBee technology. This report is an assessment of the ZigBee transmitter compared to FCC Part 15 Subpart C, Part 15.247 limits.

1.4 Configuration of Tested System

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

Digital RF conducted and radiated emissions data below 1 GHz were taken with the measuring receiver (or spectrum analyzer's) resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements performed above 1.0 GHz were made with a RBW of 1 MHz. All measurements are peak unless stated

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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.

The EUT and Peripherals are found in Table 1. 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 been fully described and submitted to Industry Canada (IC) and has been approved under file number 9900A-1.

1.6 Related Submittal(s)/Grant(s)

The EUT is subject to the following FCC Equipment Authorizations:

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

Table 1. EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC/IC ID	CABLES P/D
EUT/ Southern States, LLC	ICS/TFDIR Receiver	Engineering Sample	FCC ID: 2ADWT-ICSR01 (Pending) IC: 12660A-ICSR01 (Pending)	PU
AC Adaptor Meanwell	LRS-150-24	GC20479325	None	PU
Antenna See antenna details	--	--	--	--

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 below.

Table 2. Test Instruments

TEST INSTRUMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CALIBRATION DUE DATE
Spectrum Analyzer	Agilent	E4440A	MY45304803	7/21/2025 2 yr.
Spectrum Analyzer	RIGOL	DSA815	DSA8A180300138	2/22/2026 2 yr.
RF Preamp 100 kHz To 1.3 GHz	Hewlett-Packard	8447D	1937A02980	7/20/2024
Preamp 1.0 GHz To 26.0 GHz	Hewlett-Packard	8449B	3008A00480	3/04/2025
Loop Antenna	ETS Lindgren	6502	9810-3246	7/20/2024 2 yr.
Biconical Antenna	EMCO	3110B	9306-1708	01/13/2025 2yr.
Log Periodic Antenna	EMCO	3146	9110-3236	3/13/2026 2 yr.
Horn Antenna	EMCO	3115	9107-3723	3/13/2025 2 yr.
High Pass Filter	Microwave Circuits	H3R020G2	001DC9528	8/02/2024
LISN X 2	Solar Electronics	9247-50- TS-50-N	955824 and 955825	4/28/2025

Note 1: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

2.2 Modifications to EUT Hardware

No modifications were made by US Tech to bring the EUT into compliance with FCC Part 15.247 or IC RSS-210 requirements.

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2.3 Number of Measurements for Intentional Radiators (15.31(m), RSS-Gen 6.8)

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.

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

If the frequency range over which the EUT operates is greater than 10 MHz, 3 test frequencies will be used.

2.4 Frequency Range of Radiated Measurements (Part 15.33, RSS-Gen 6.13)

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, RSS-Gen 6.9, 6.13)

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

2.5.1 Detector Function and Associated Bandwidth

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

2.5.2 Corresponding Peak and Average Requirements

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

2.6 EUT Antenna Requirements (CFR 15.203, RSS-Gen 6.7)

An intentional radiator is 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 is 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 (x3)	Molex	Dipole	2144150001	+5.3	SMA

All radios use the same antenna.

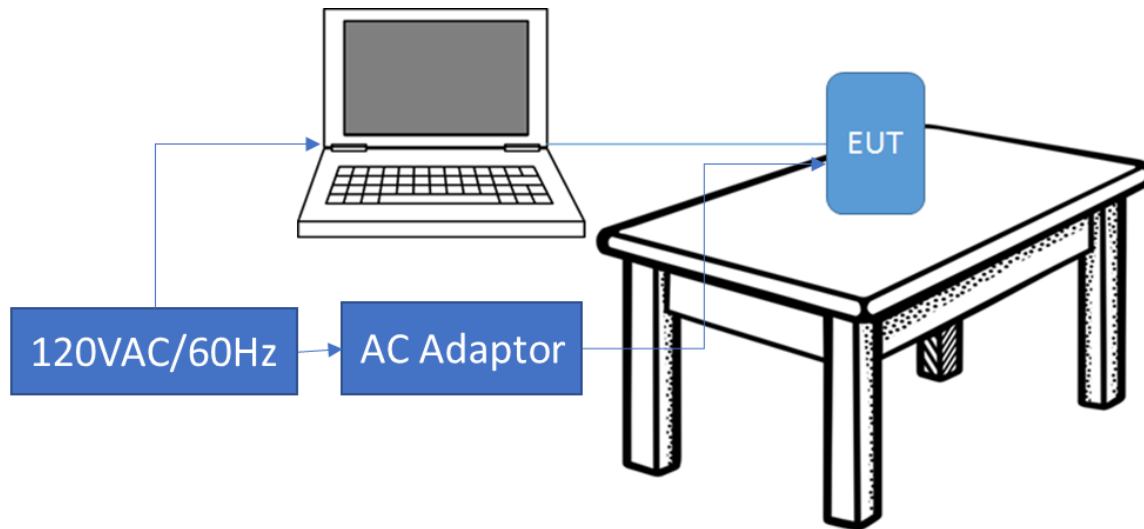


Figure 1. Block Diagram of Test Configuration

Note: PC used to program EUT for intentional spurious emissions

2.7 Restricted Bands of Operation (Part 15.205, RSS-Gen 8.10)

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

2.8 Transmitter Duty Cycle (Part 15.35 (c), RSS-Gen 6.10)

The EUT employs pulse transmission. However, for testing purposes the EUT was programmed to transmit at a rate >98%. The pulse transmission requirements of this subpart were acknowledged 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.

Based on the theory of operation, the EUT duty cycle factor is determined to be -20 dB. See Theory of Operation Exhibit for Duty Cycle details.

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2.9 Antenna Conducted Intentional and Spurious Emissions (CFR 15.209, 15.247(d)) (IC RSS 247, 5.5))

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 generates 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 in the EMC Chamber. The conducted emissions graphs are found in the 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.



Figure 2. Bench Test Setup

Test Date: June 10, 2024

Tested by
Signature: Ian Charboneau

Name: Ian Charboneau

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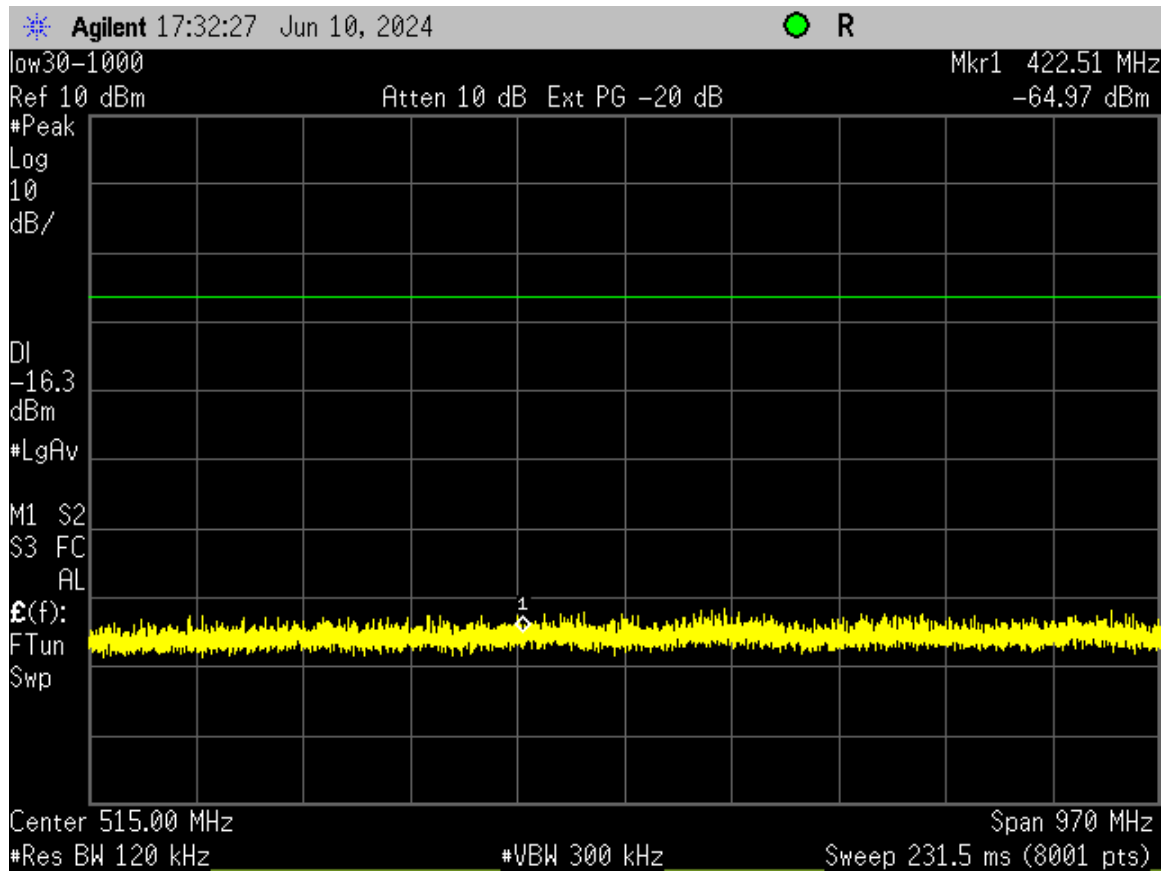


Figure 3. Radio 1, Low, 30-1000 MHz

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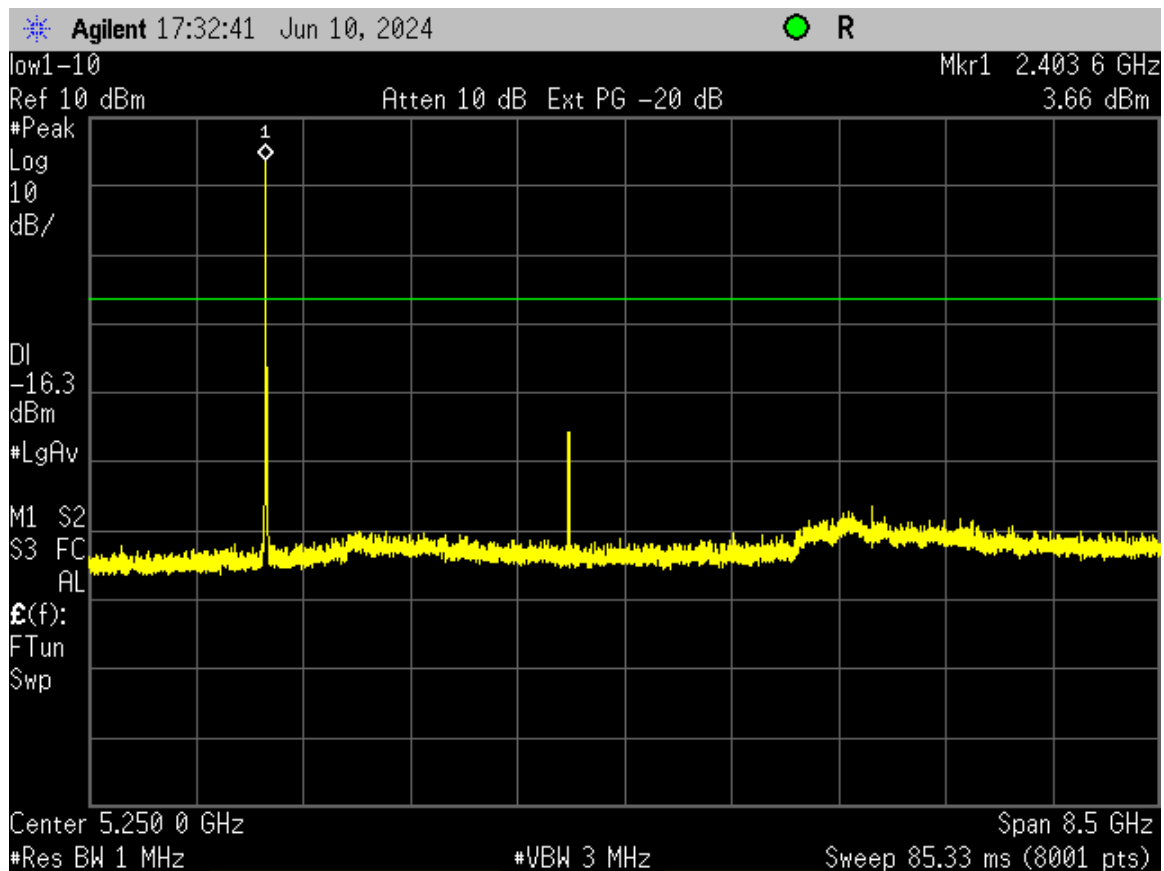


Figure 4. Radio 1, Low, 1-9 GHz

(Note: Intentional Emission seen for radio operating at 2403.5 MHz)

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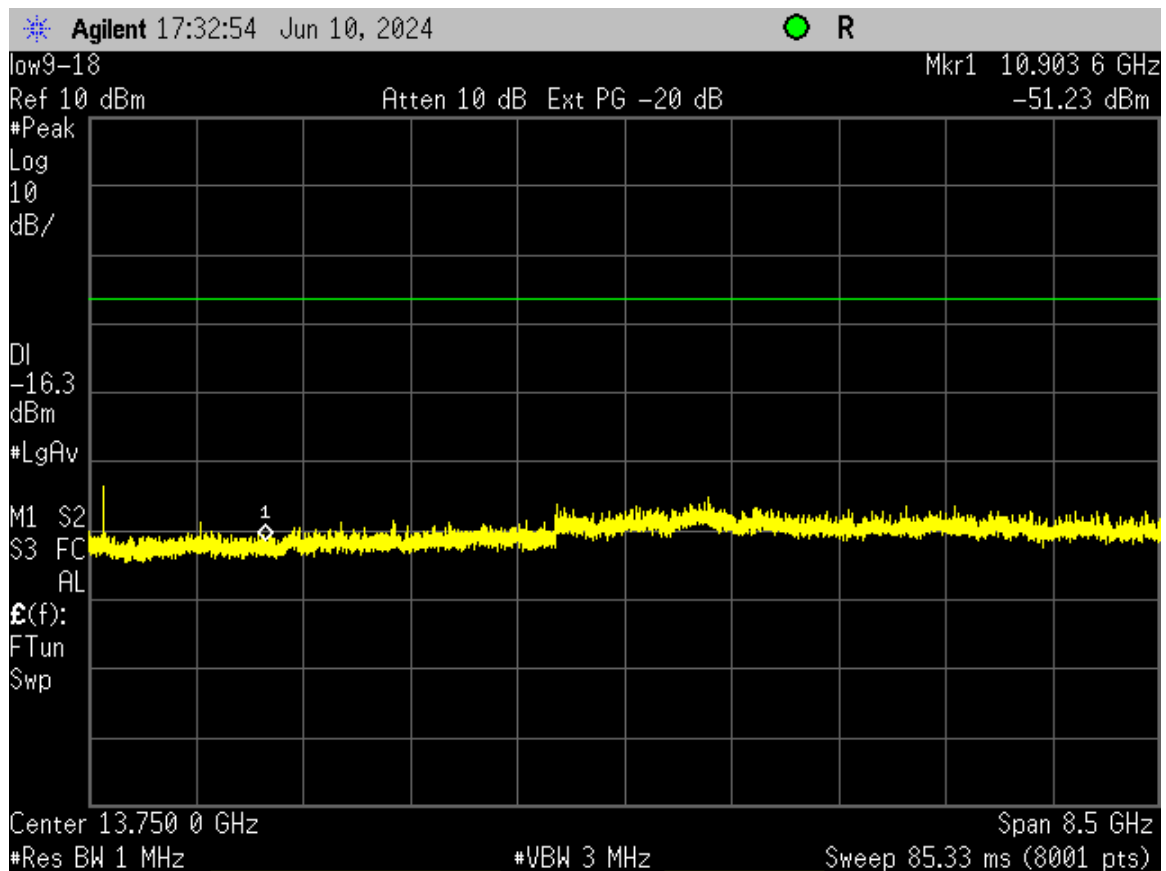


Figure 5. Radio 1, Low, 9-18 GHz

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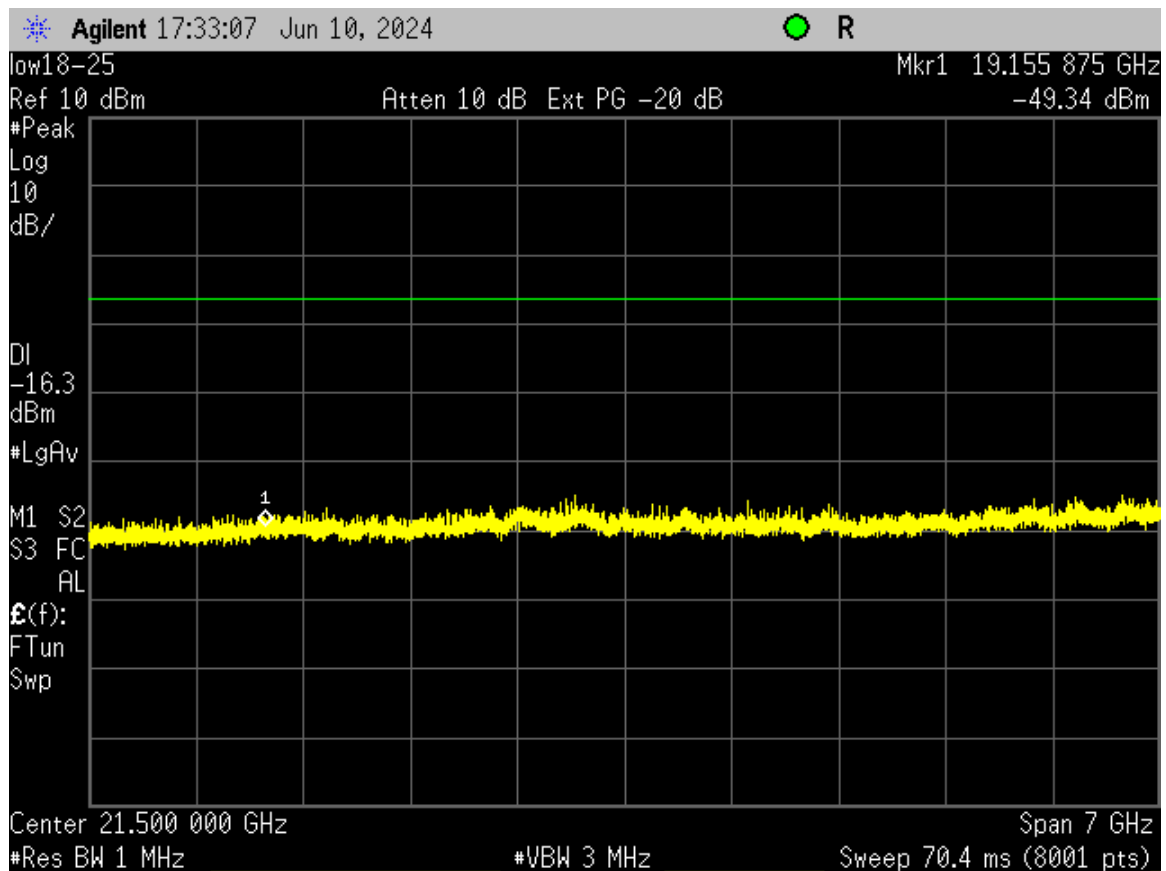


Figure 6. Radio 1, Low, 18-25 GHz

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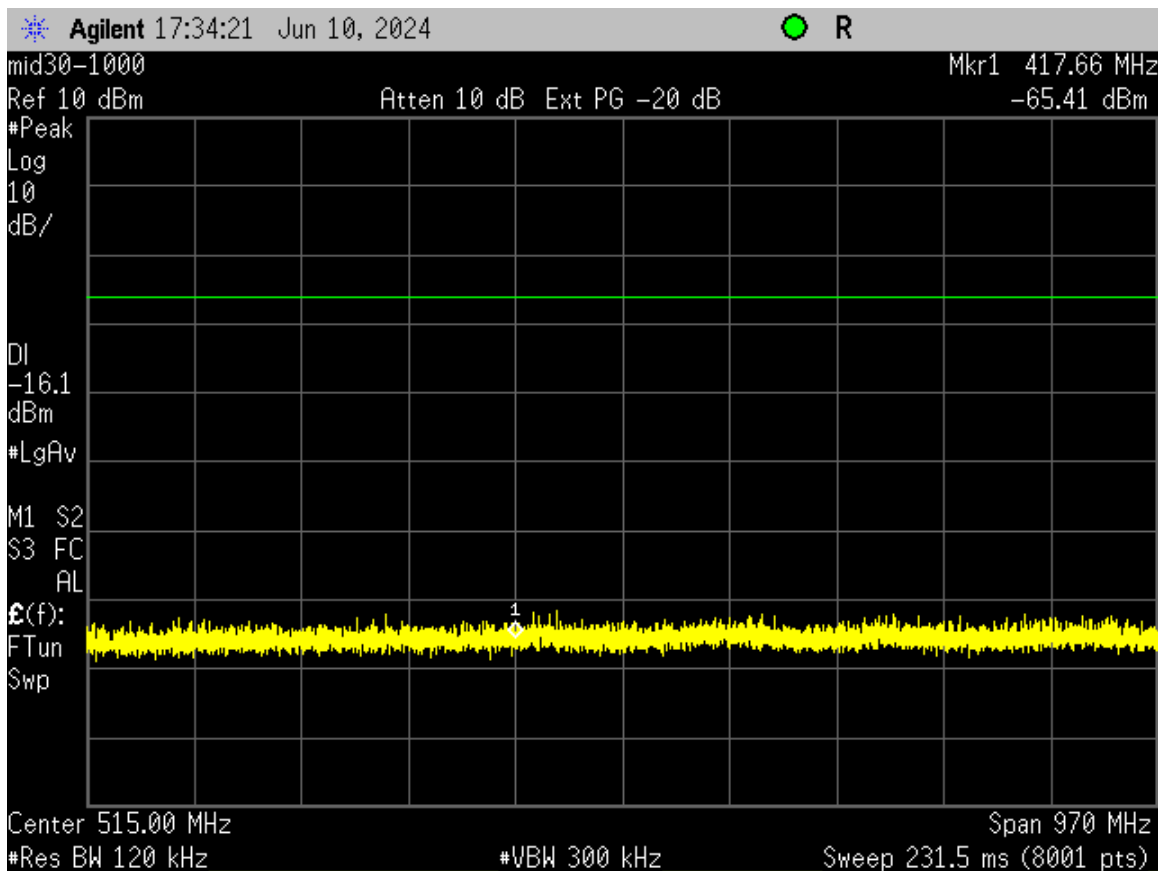


Figure 7. Radio 1, Mid, 30-1000 MHz

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Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

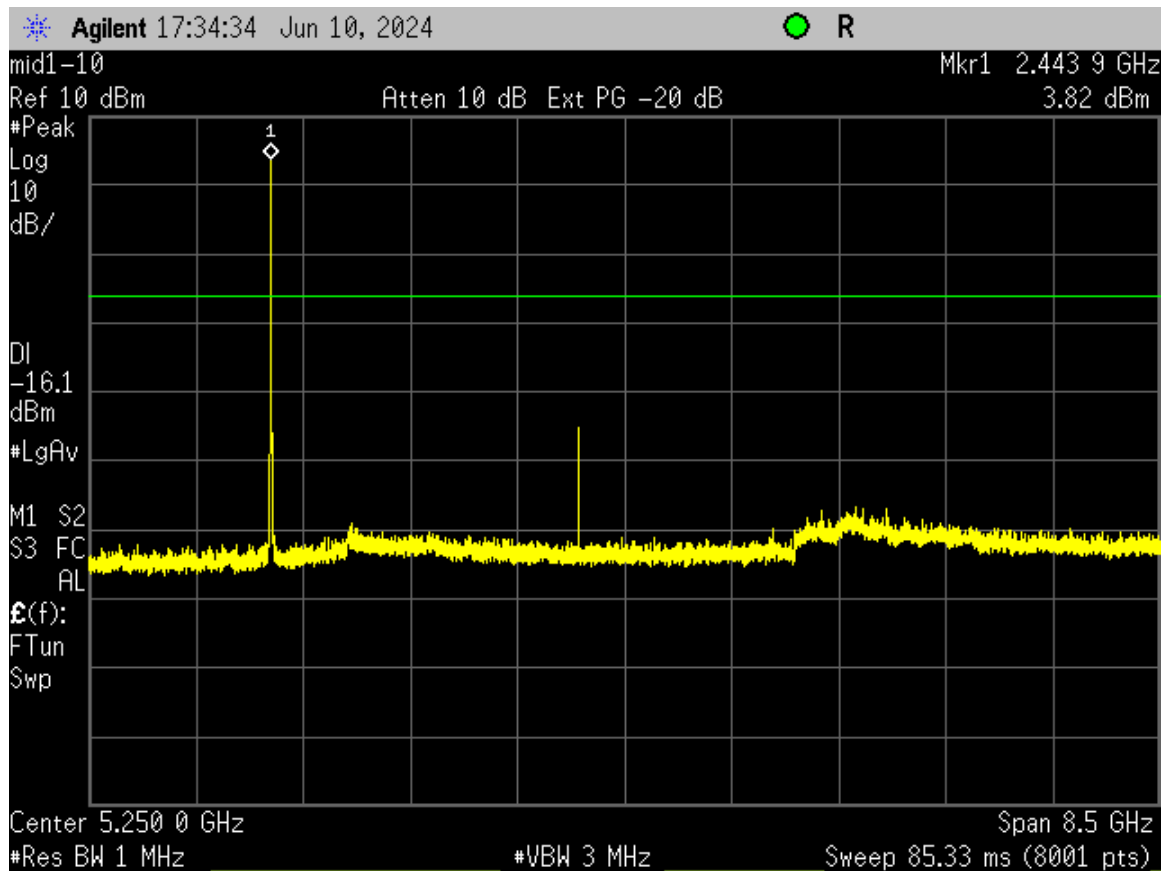


Figure 8. Radio 1, Mid, 1-9 GHz

(Note: Intentional Emission seen for radio operating at 2443.5 MHz)

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

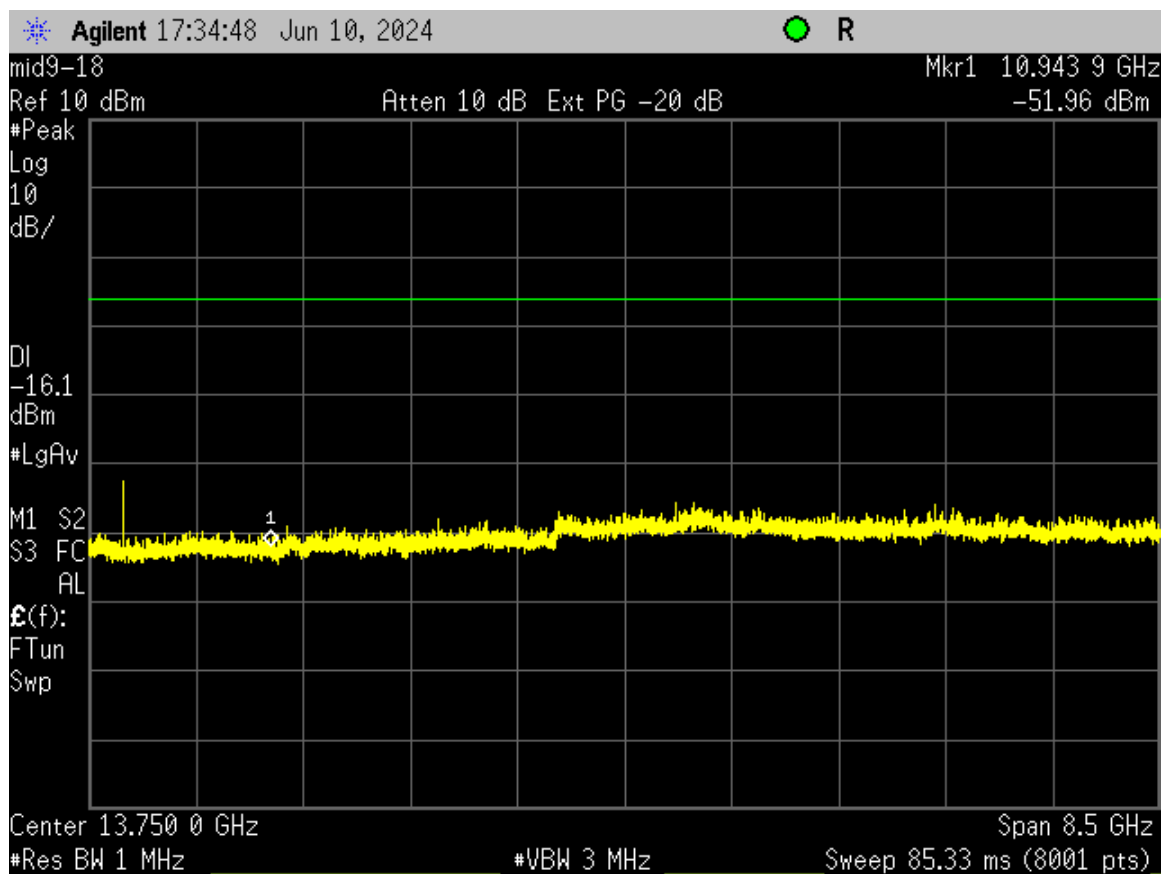


Figure 9. Radio 1, Mid, 9-18 GHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

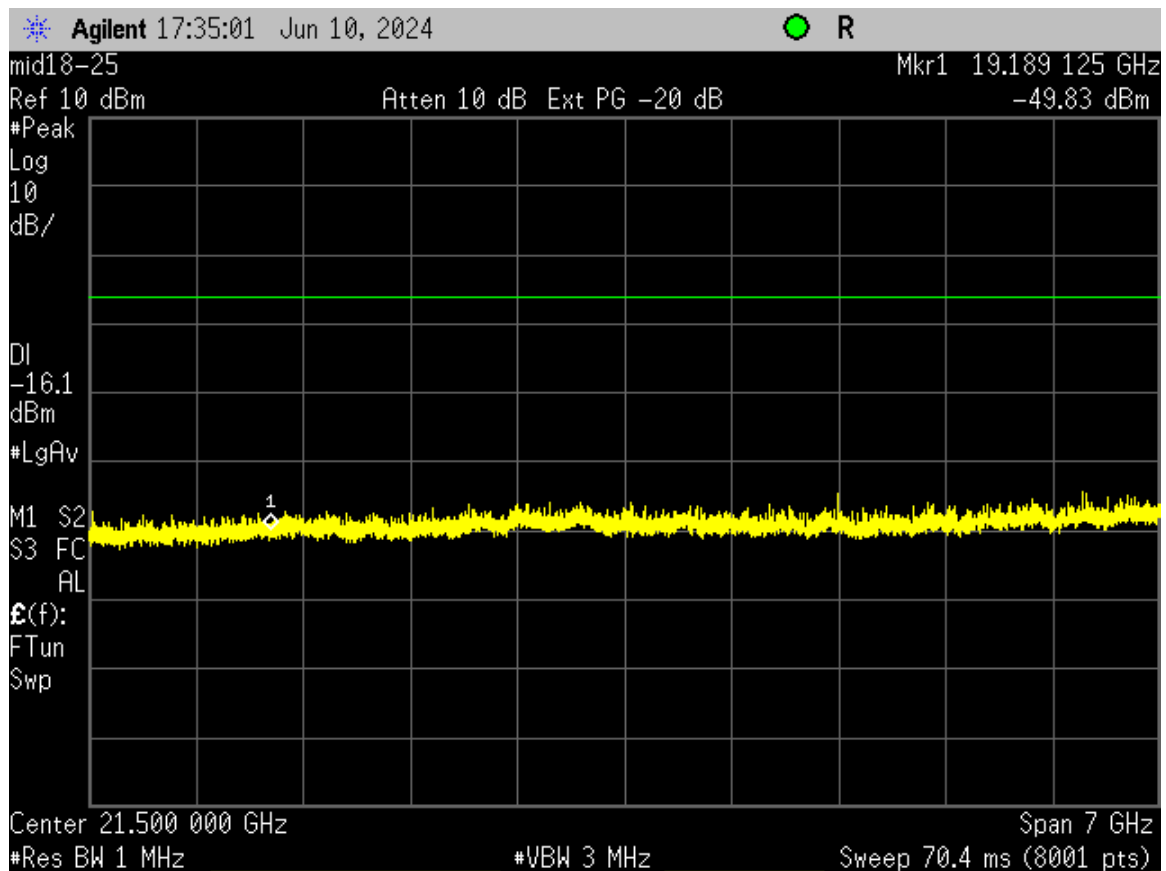


Figure 10. Radio 1, Mid, 18-25 GHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

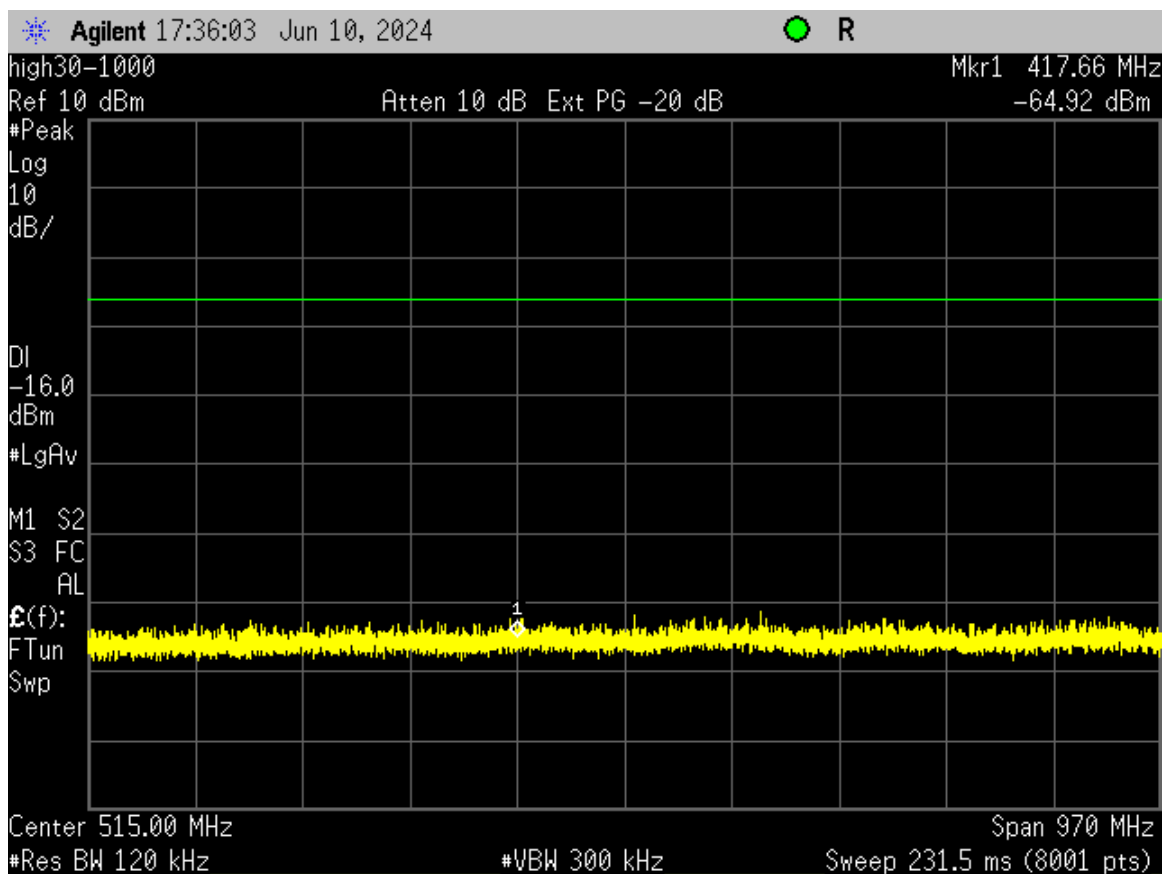


Figure 11. Radio 1, High, 30-1000 MHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

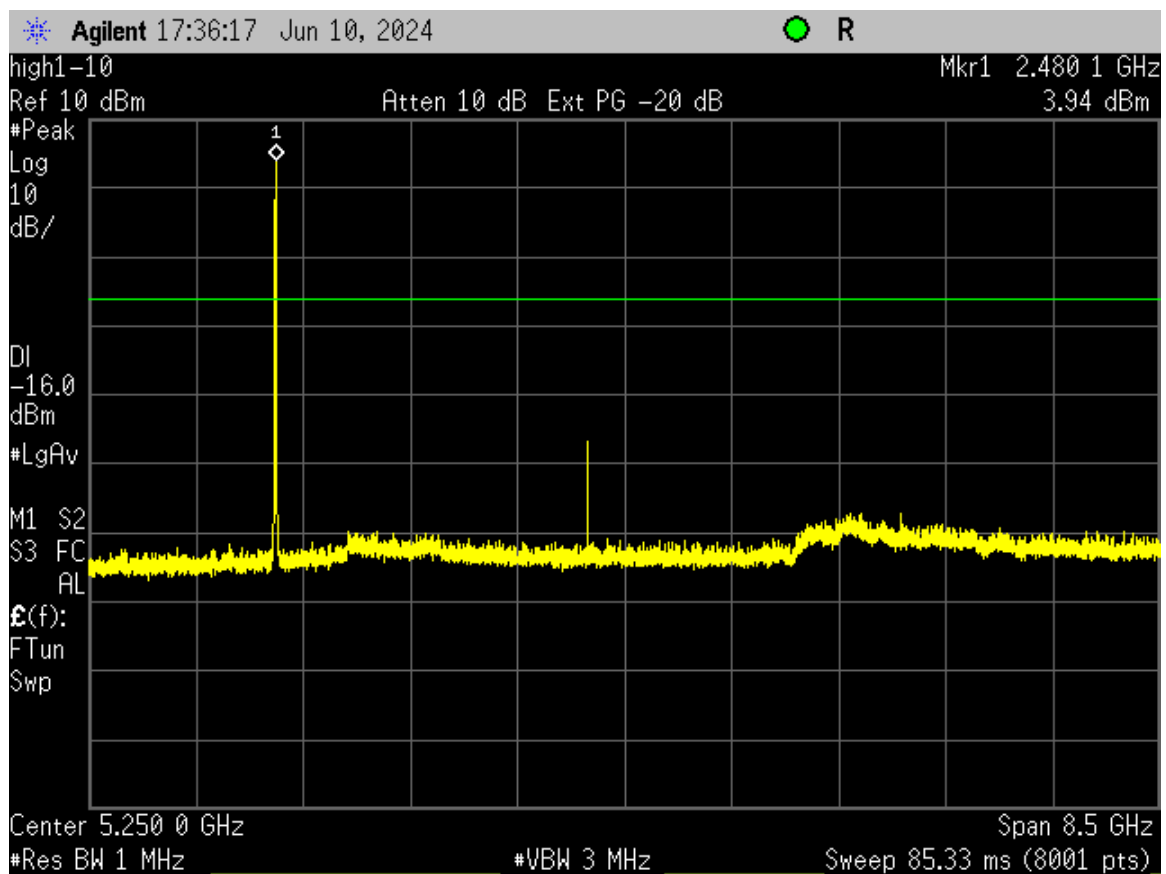


Figure 12. Radio 1, High, 1-9 GHz

(Note: Intentional Emission seen for radio operating at 2480 MHz)

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

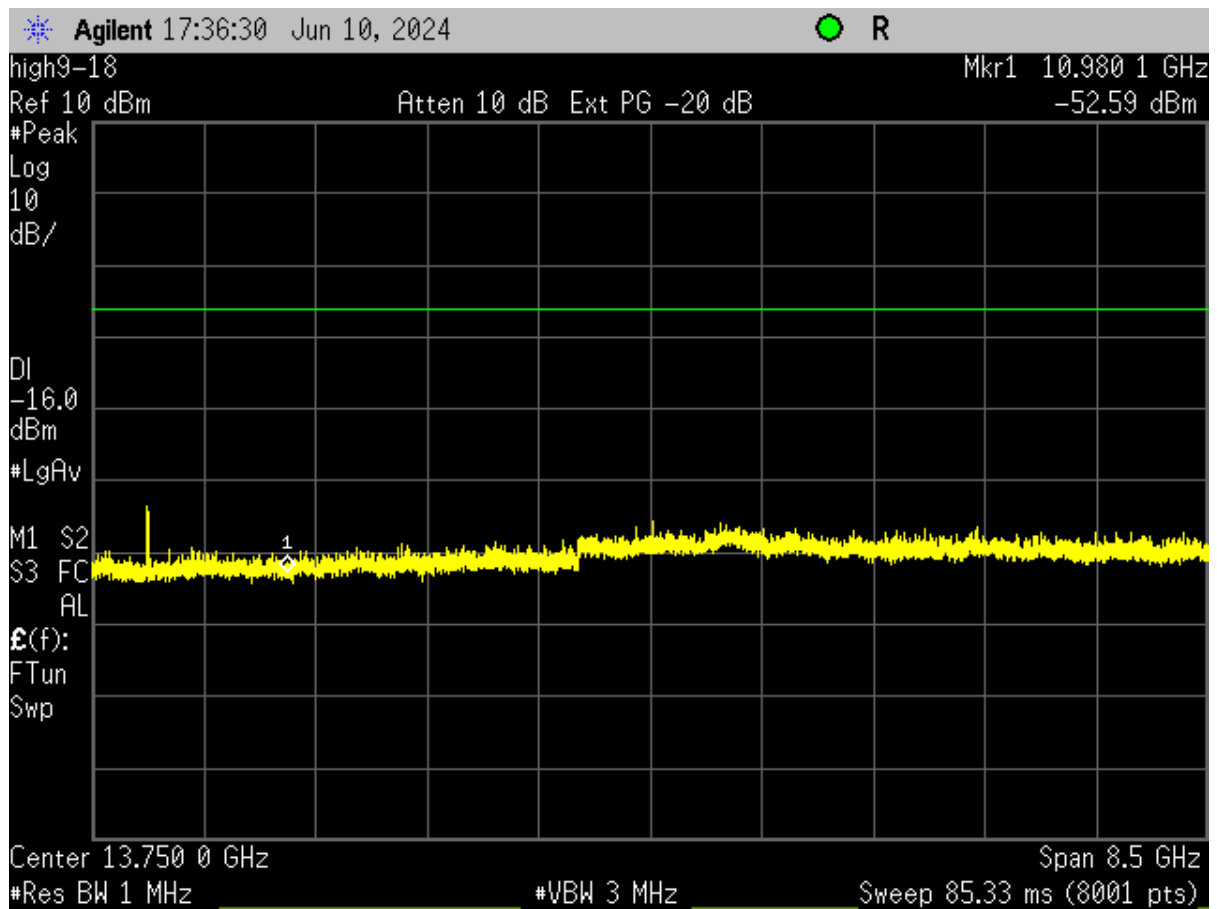
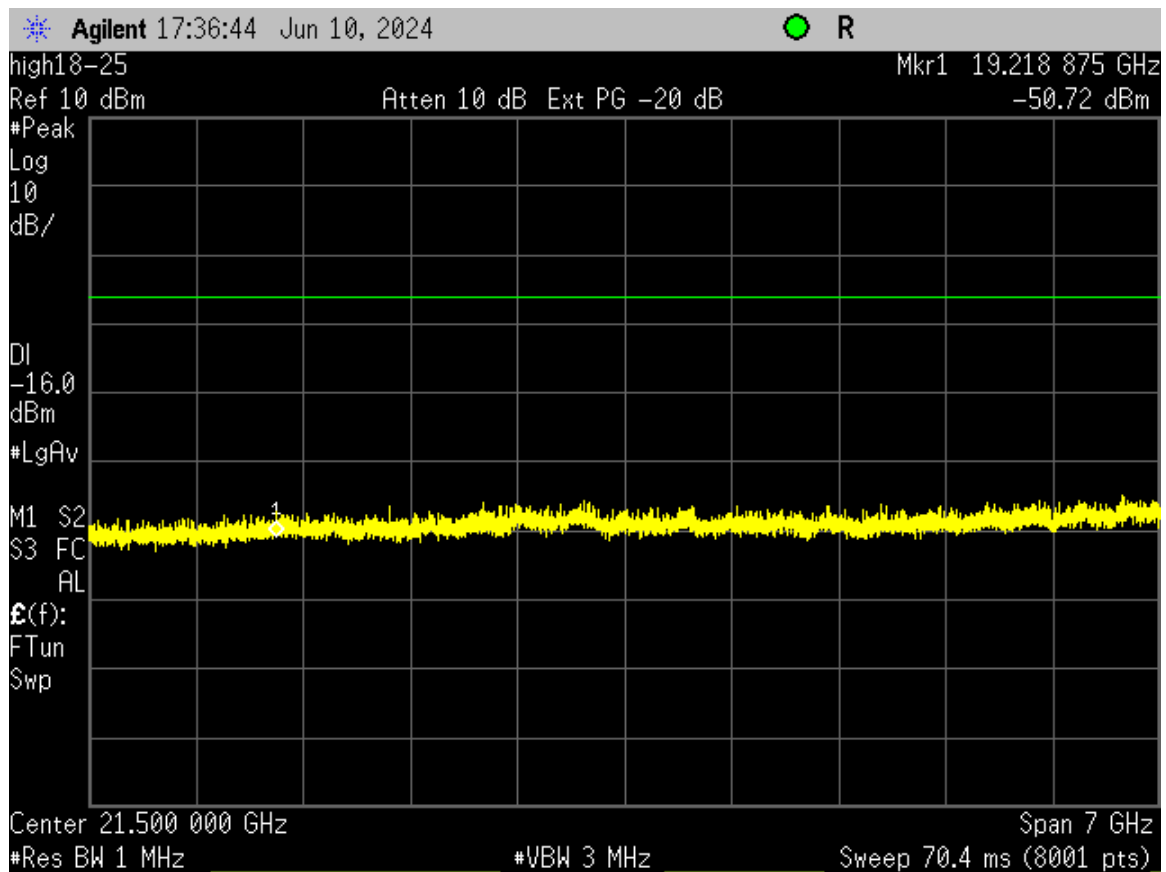


Figure 13. Radio 1, High, 9-18 GHz

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
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US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

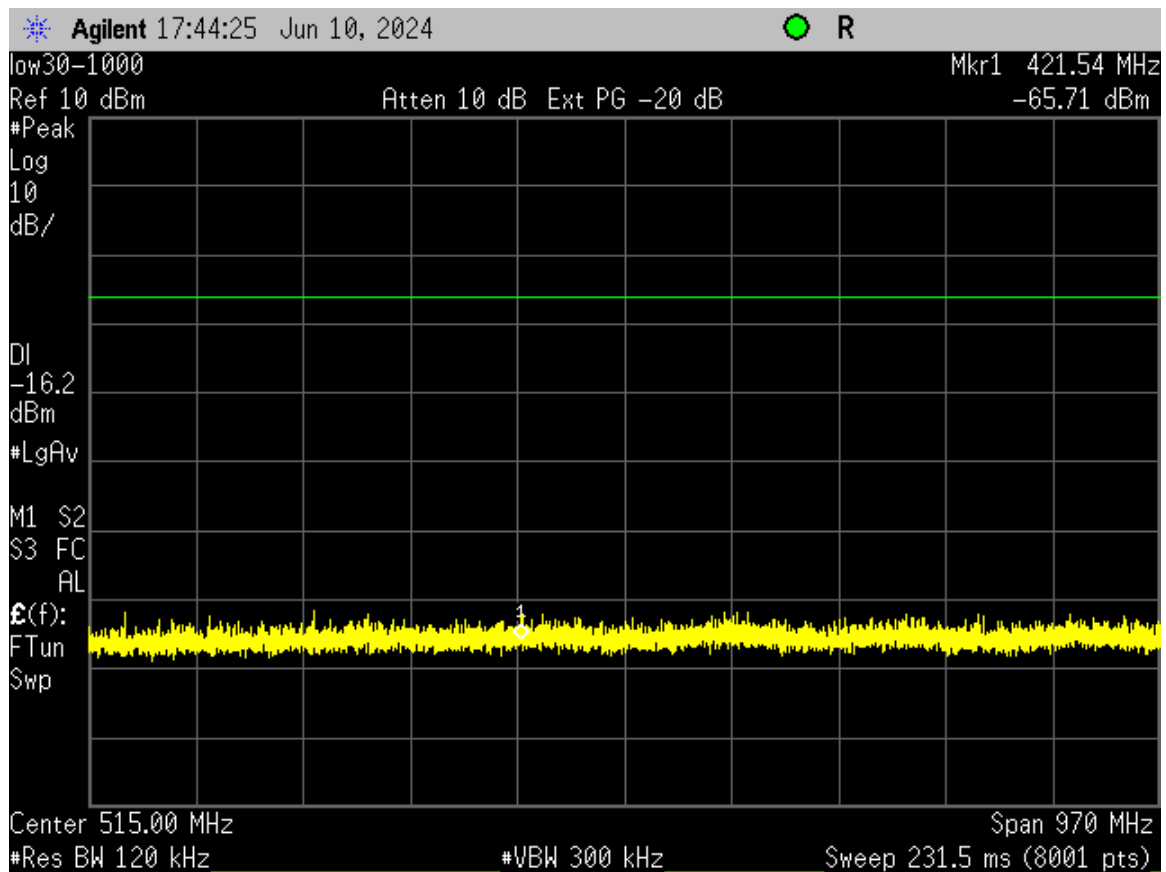


Figure 15. Radio 2, Low, 30-1000 MHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

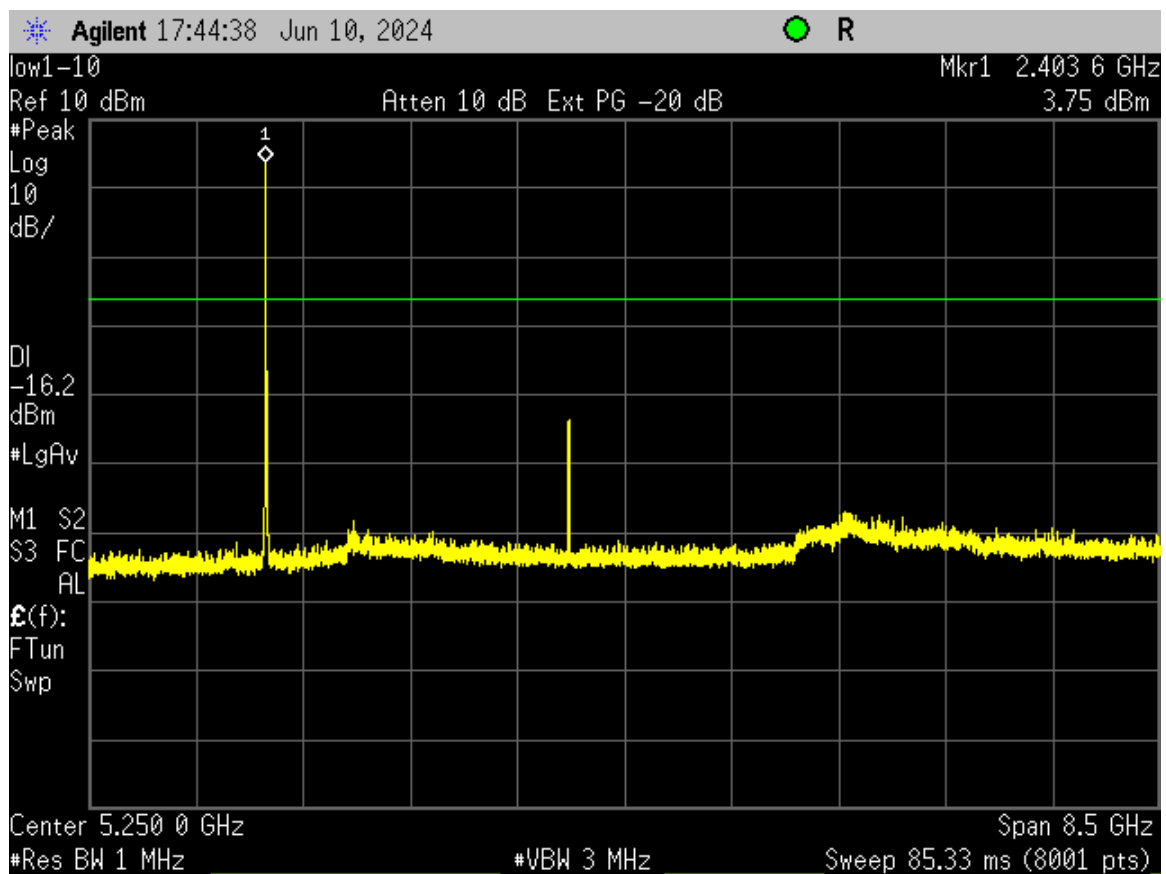
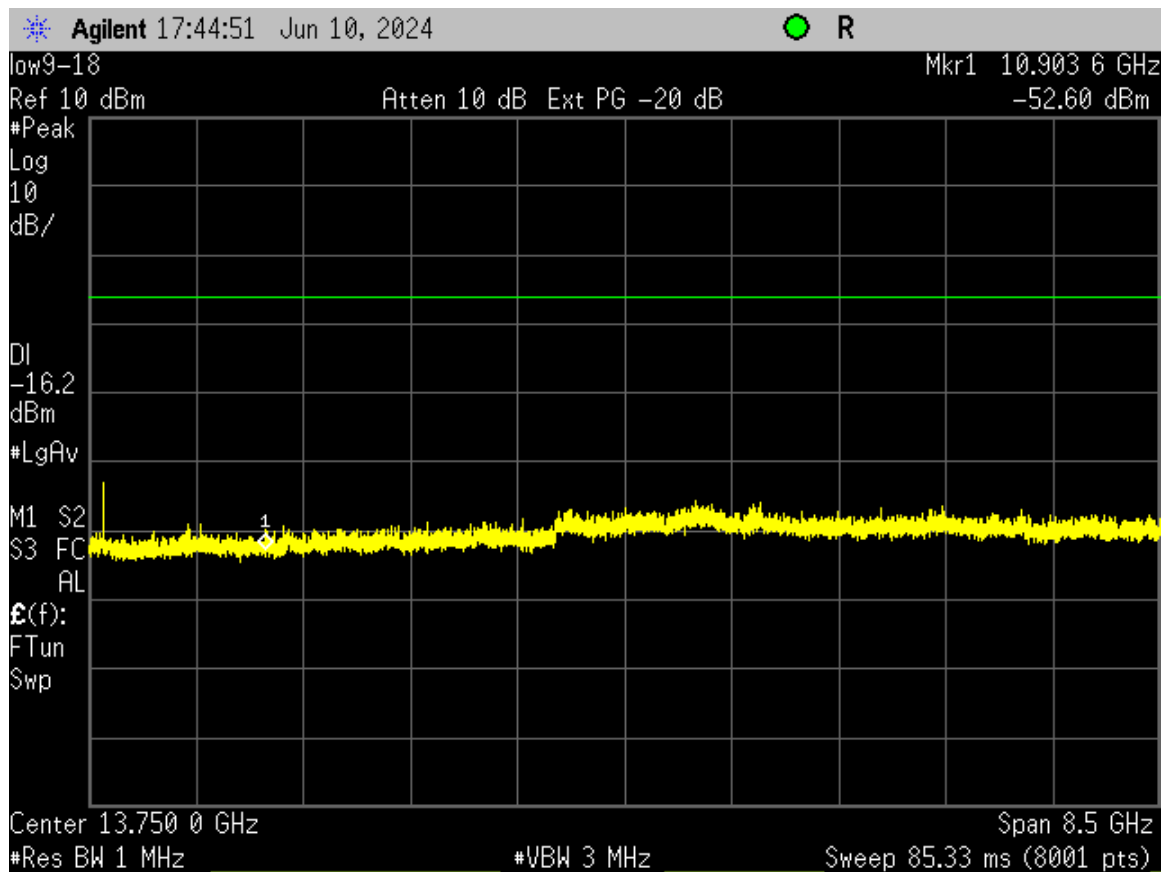


Figure 16. Radio 2, Low, 1-9 GHz

(Note: Intentional Emission seen for radio operating at 2403.5 MHz)

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
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Southern States, LLC
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US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

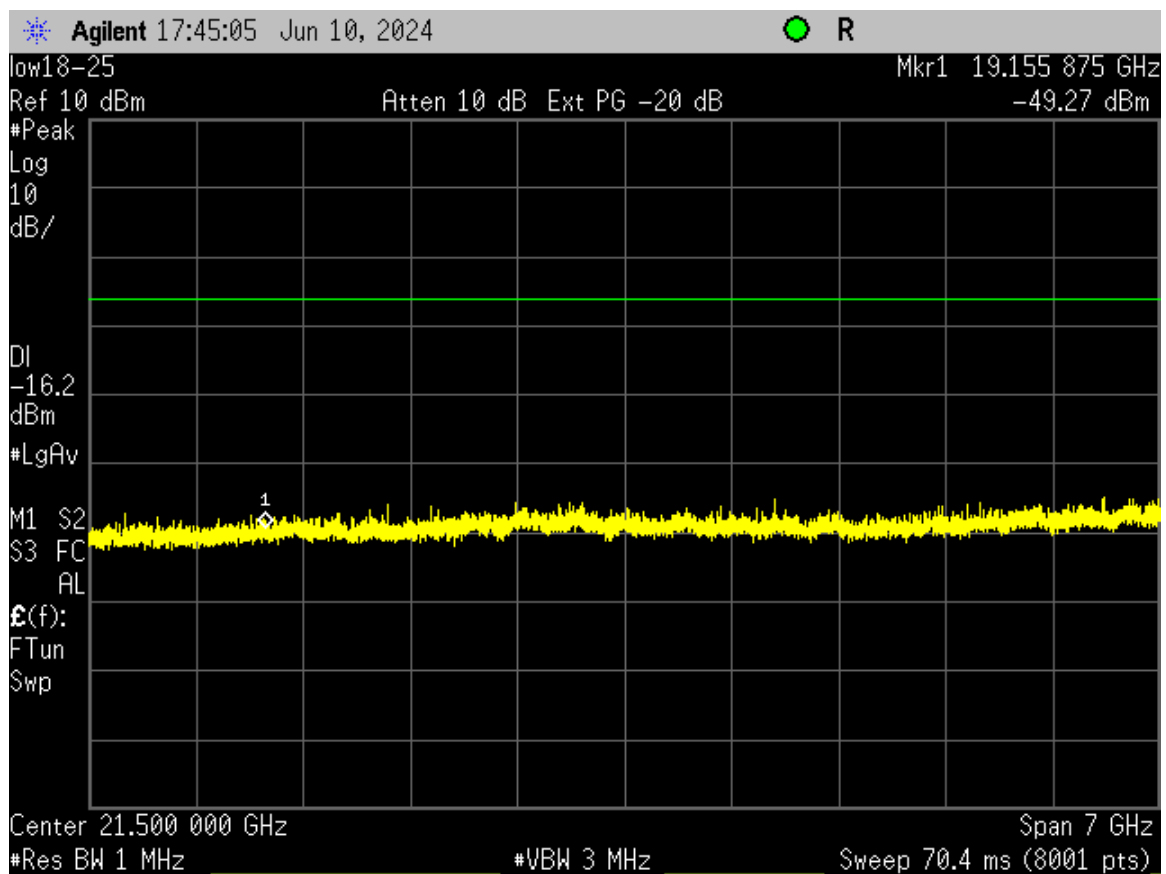


Figure 18. Radio 2, Low, 18-25 GHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

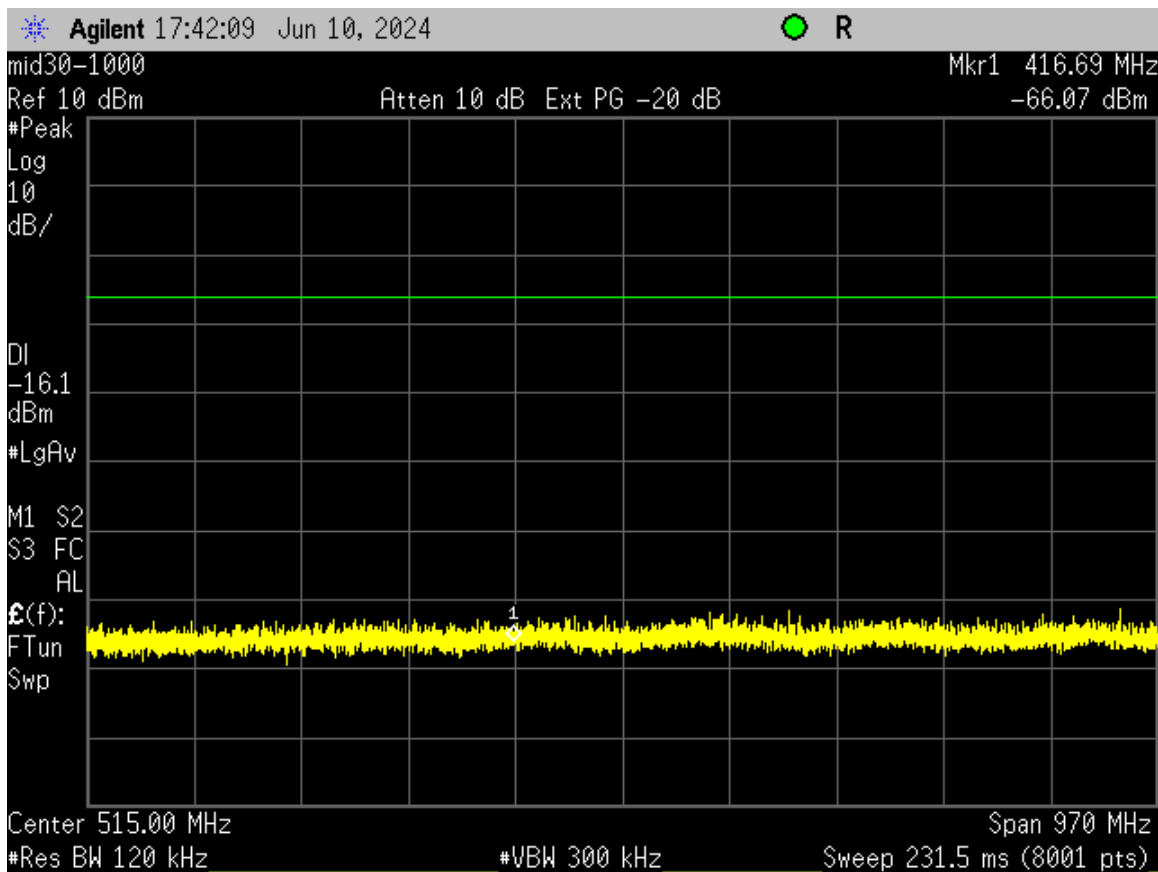


Figure 19. Radio 2, Mid, 30-1000 MHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

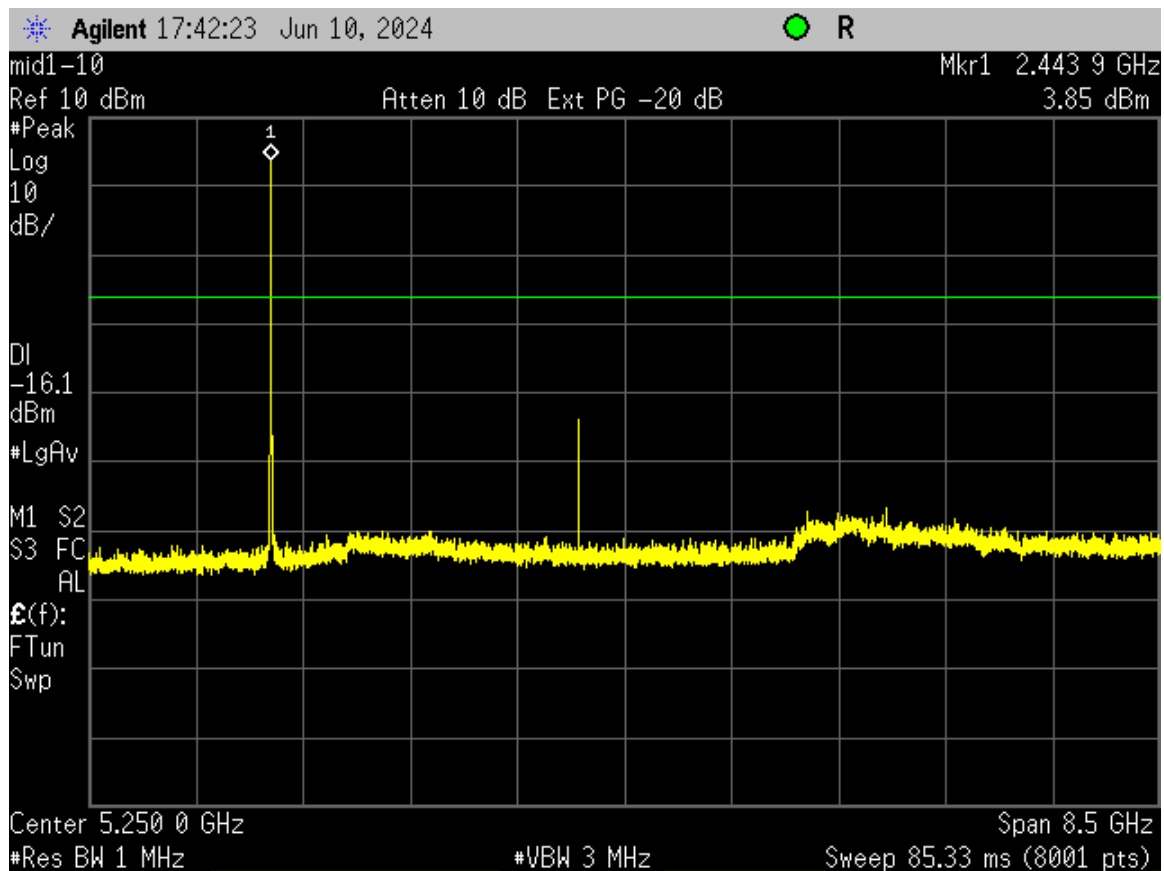


Figure 20. Radio 2, Mid, 1-9 GHz

(Note: Intentional Emission seen for radio operating at 2443.5 MHz)

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

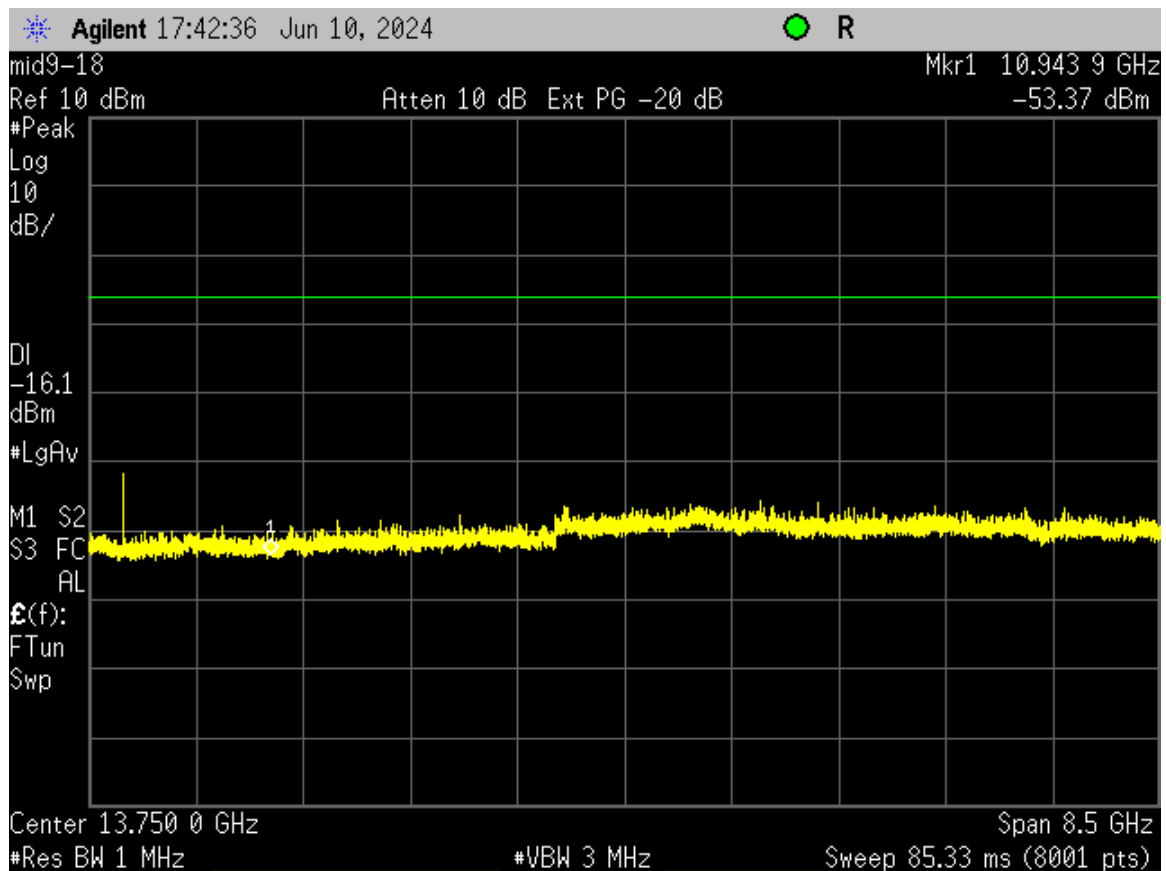


Figure 21. Radio 2, Mid, 9-18 GHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

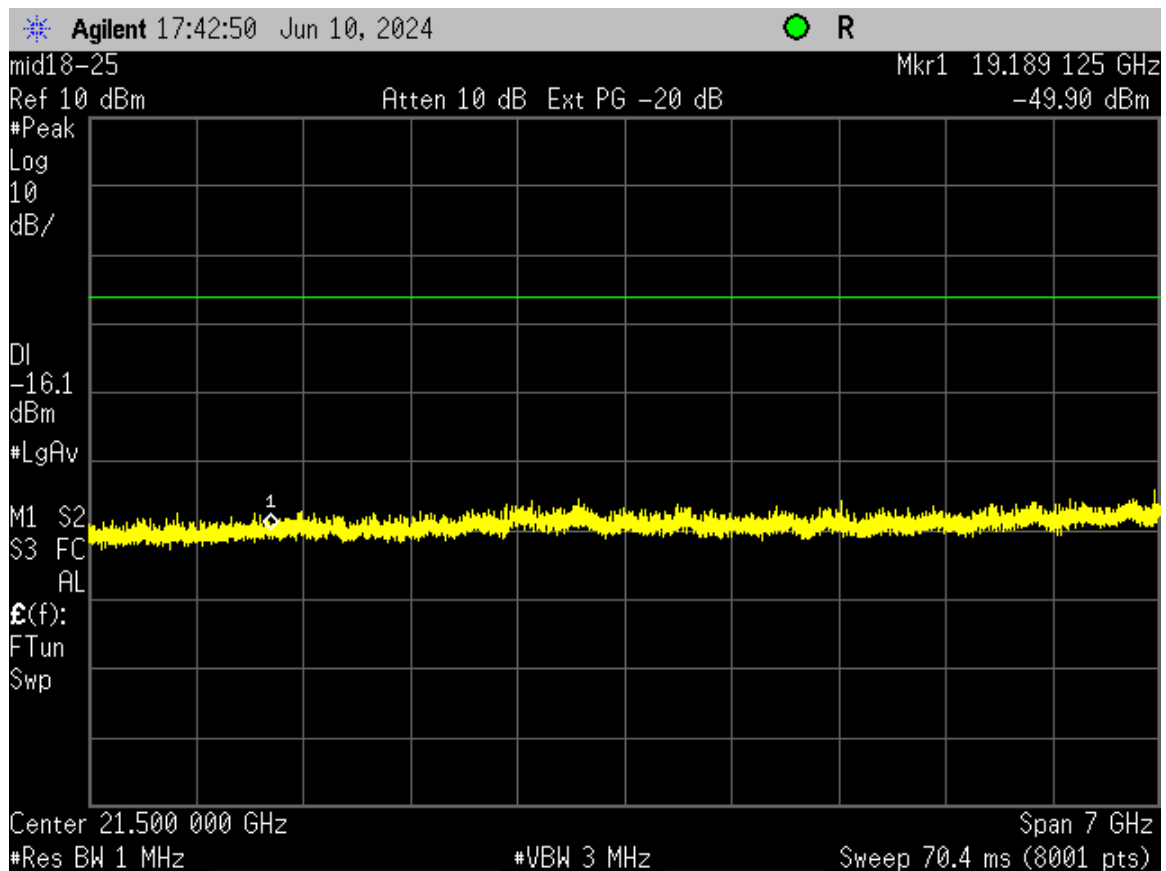


Figure 22. Radio 2, Mid, 18-25 GHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

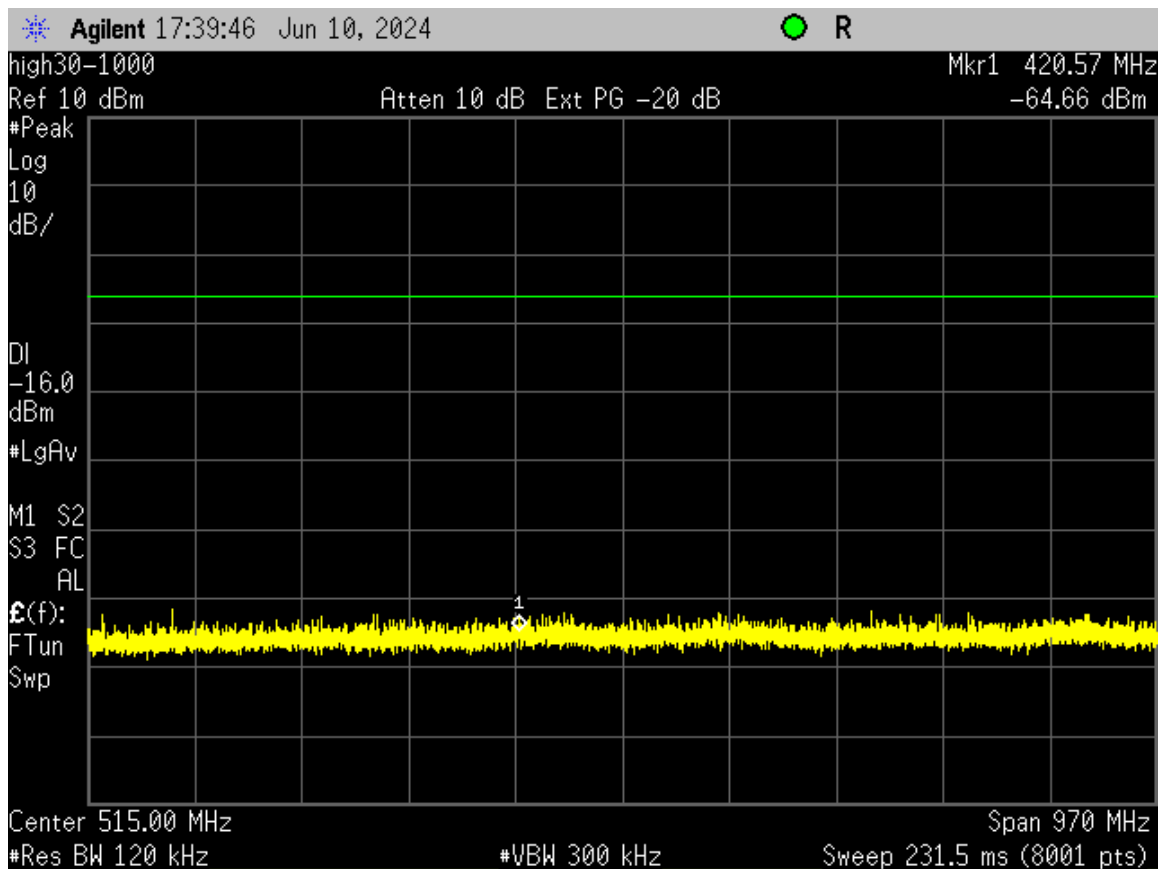


Figure 23. Radio 2, High, 30-1000 MHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

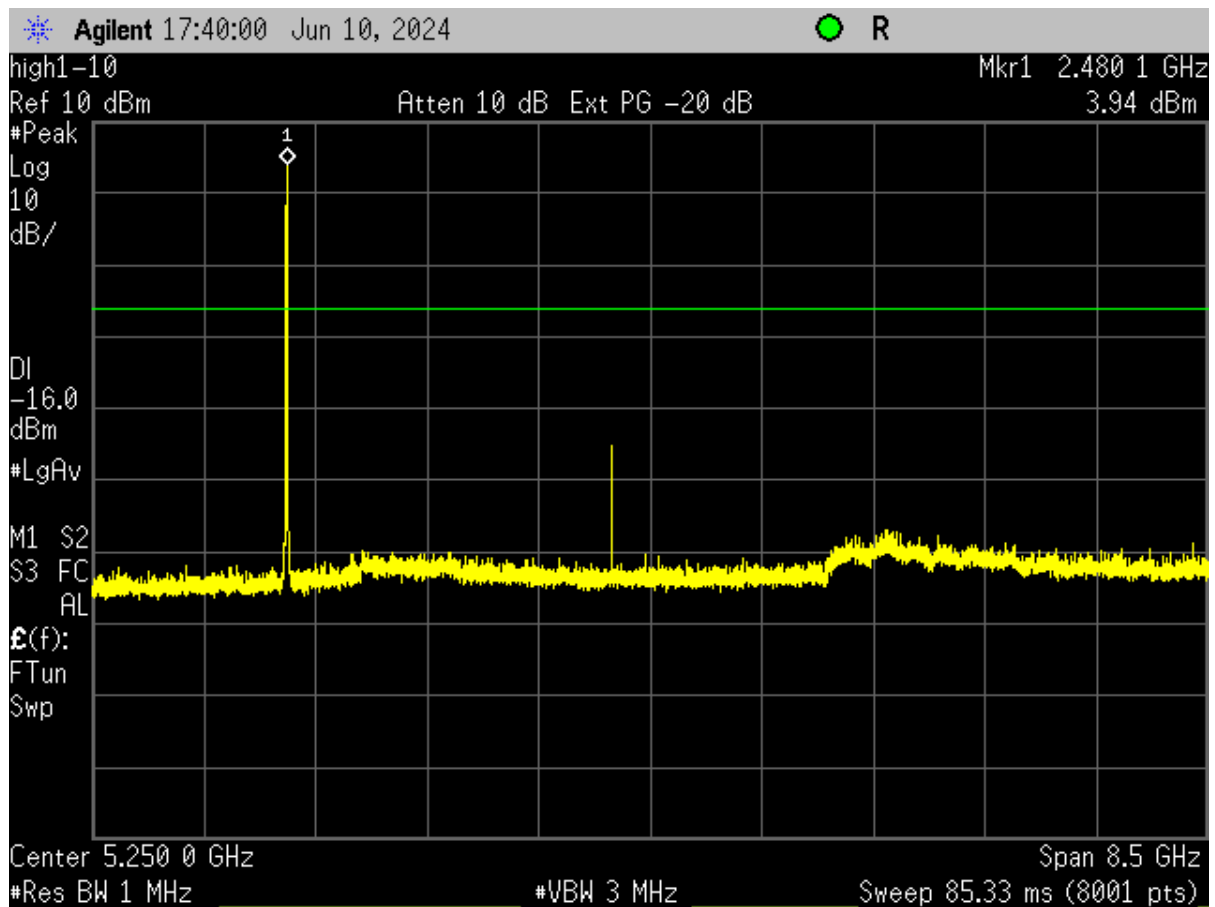


Figure 24. Radio 2, High, 1-9 GHz

(Note: Intentional Emission seen for radio operating at 2480 MHz)

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

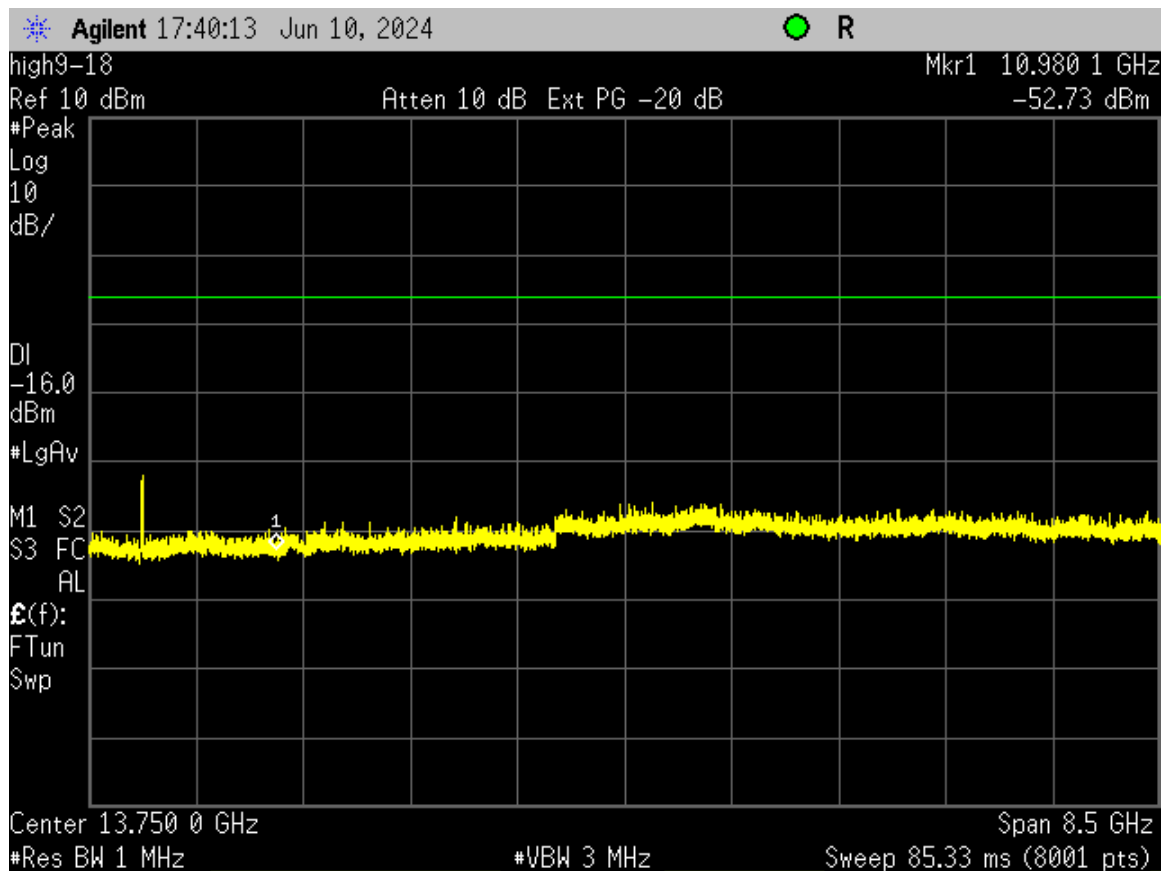


Figure 25. Radio 2, High, 9-18 GHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

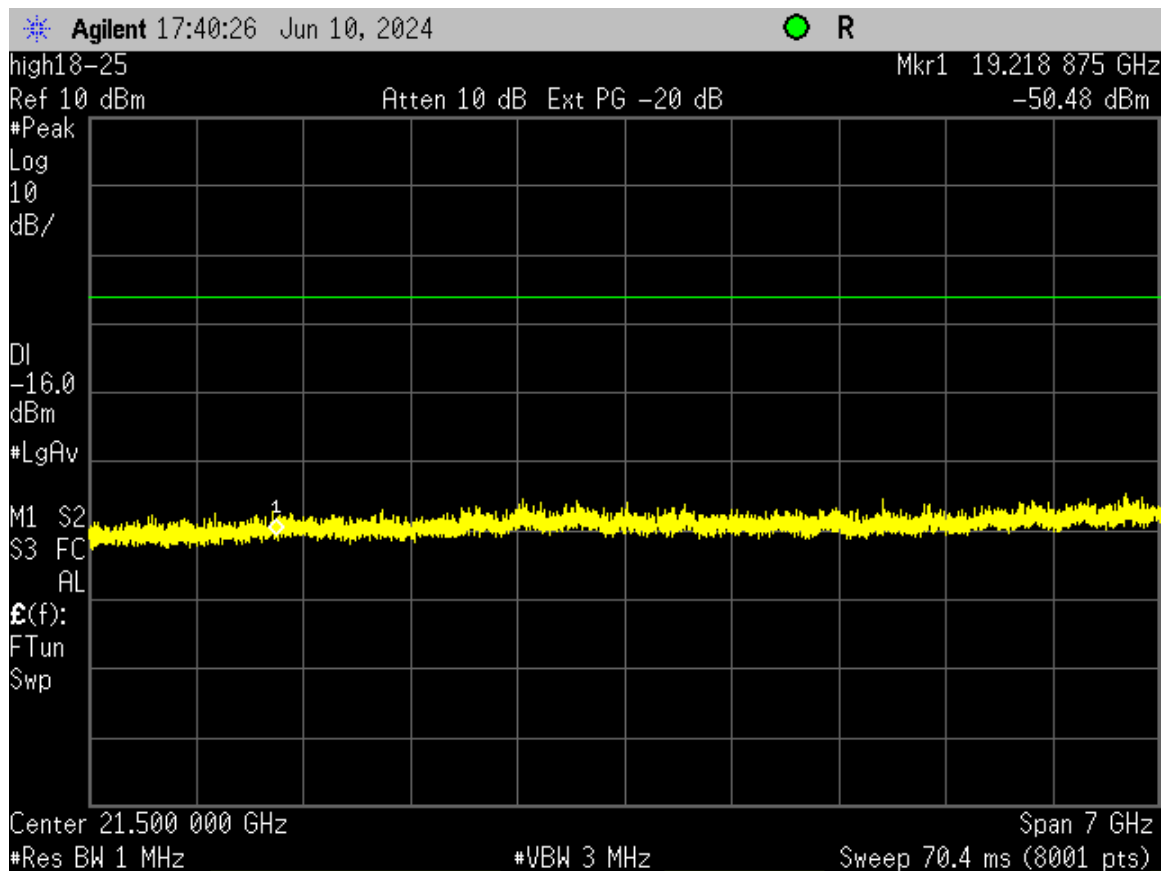


Figure 26. Radio 2, High, 18-25 GHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

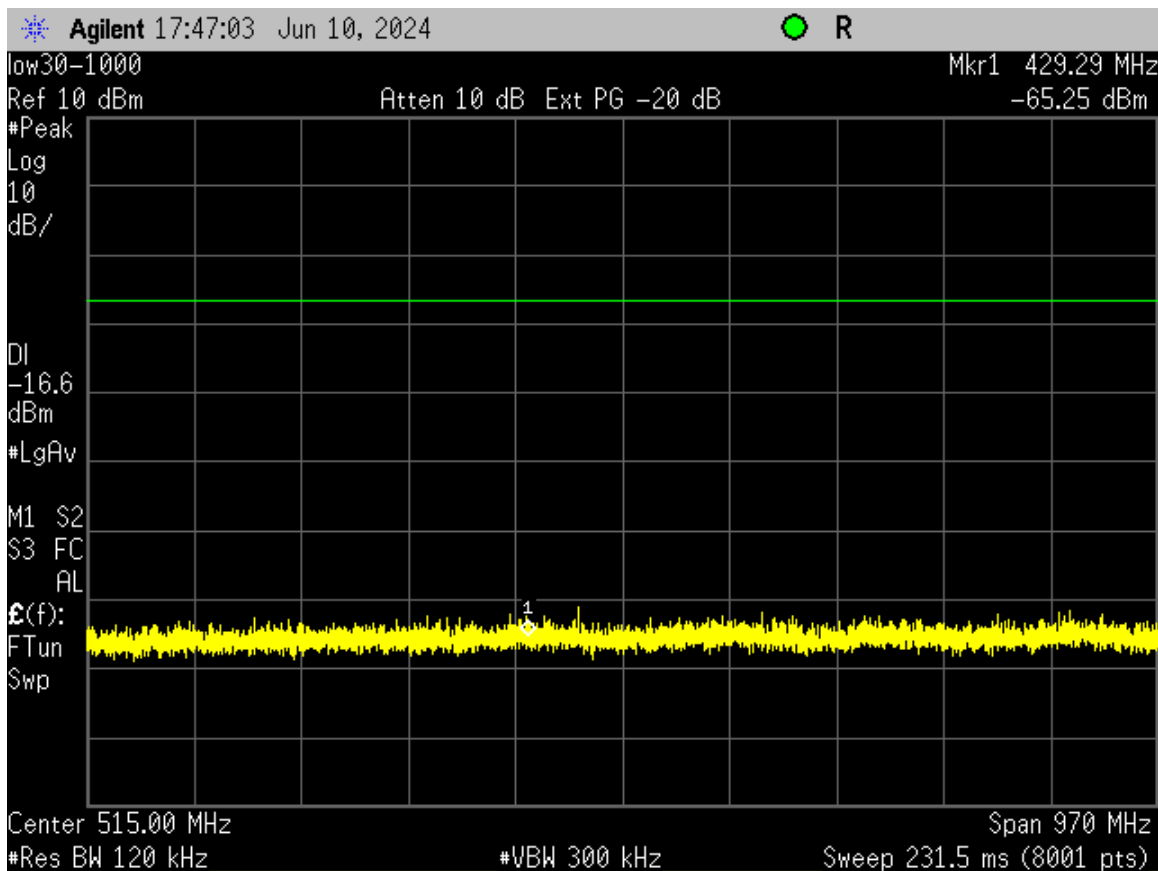


Figure 27. Radio 3, Low, 30-1000 MHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

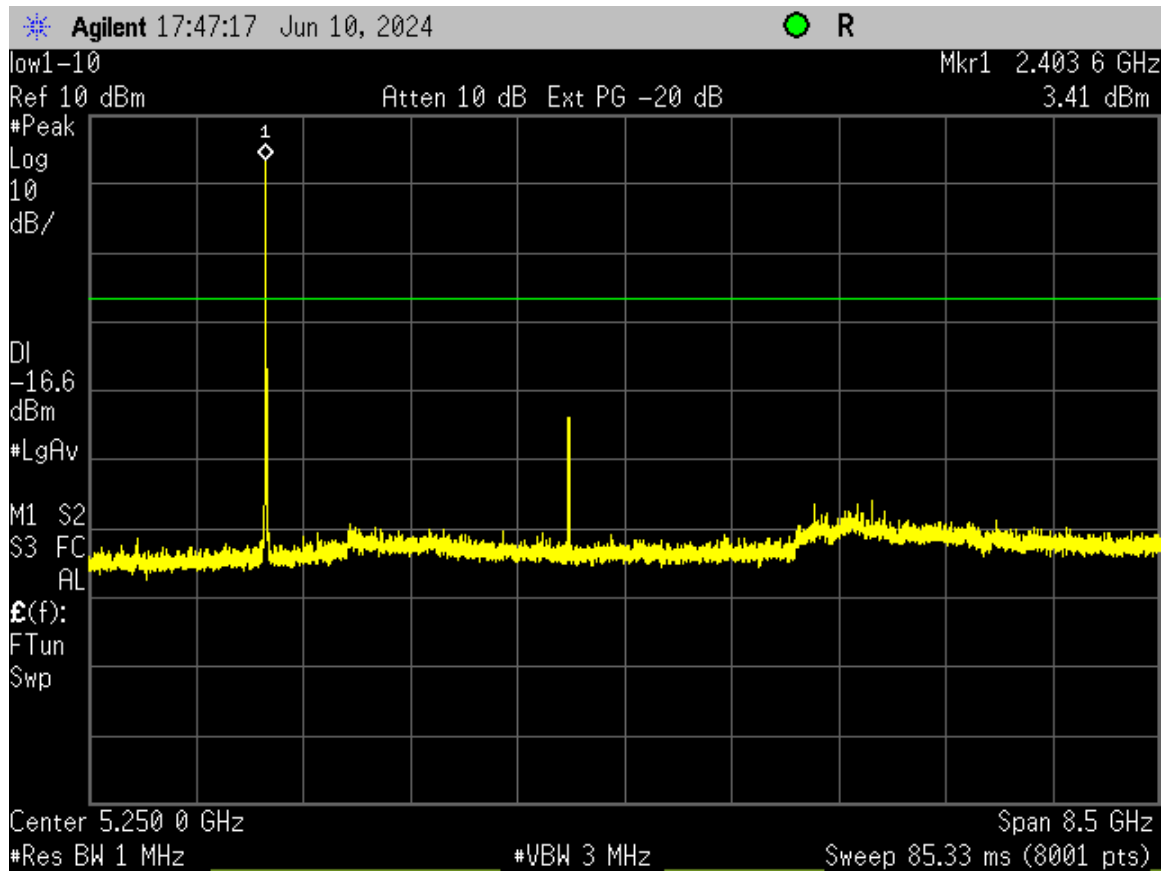


Figure 28. Radio 3, Low, 1-9 GHz

(Note: Intentional Emission seen for radio operating at 2403.5 MHz)

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

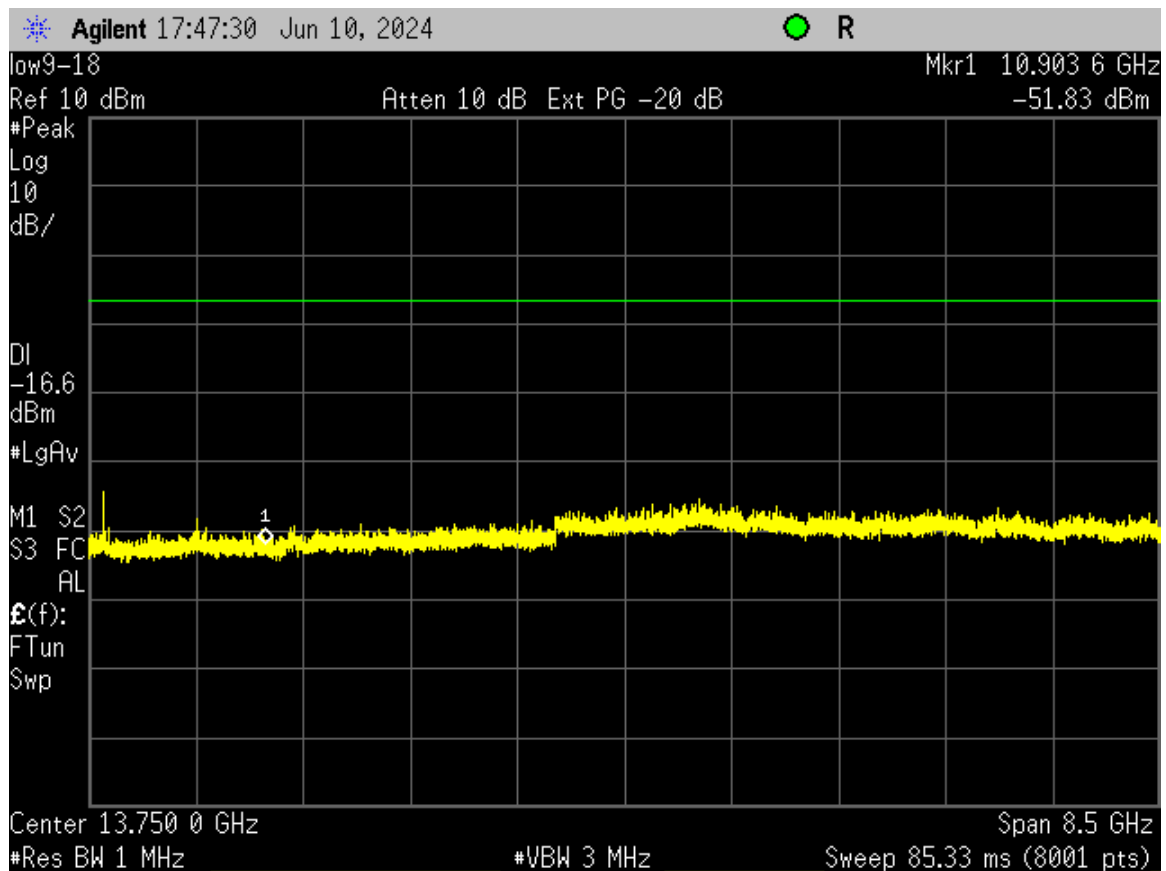


Figure 29. Radio 3, Low, 9-18 GHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
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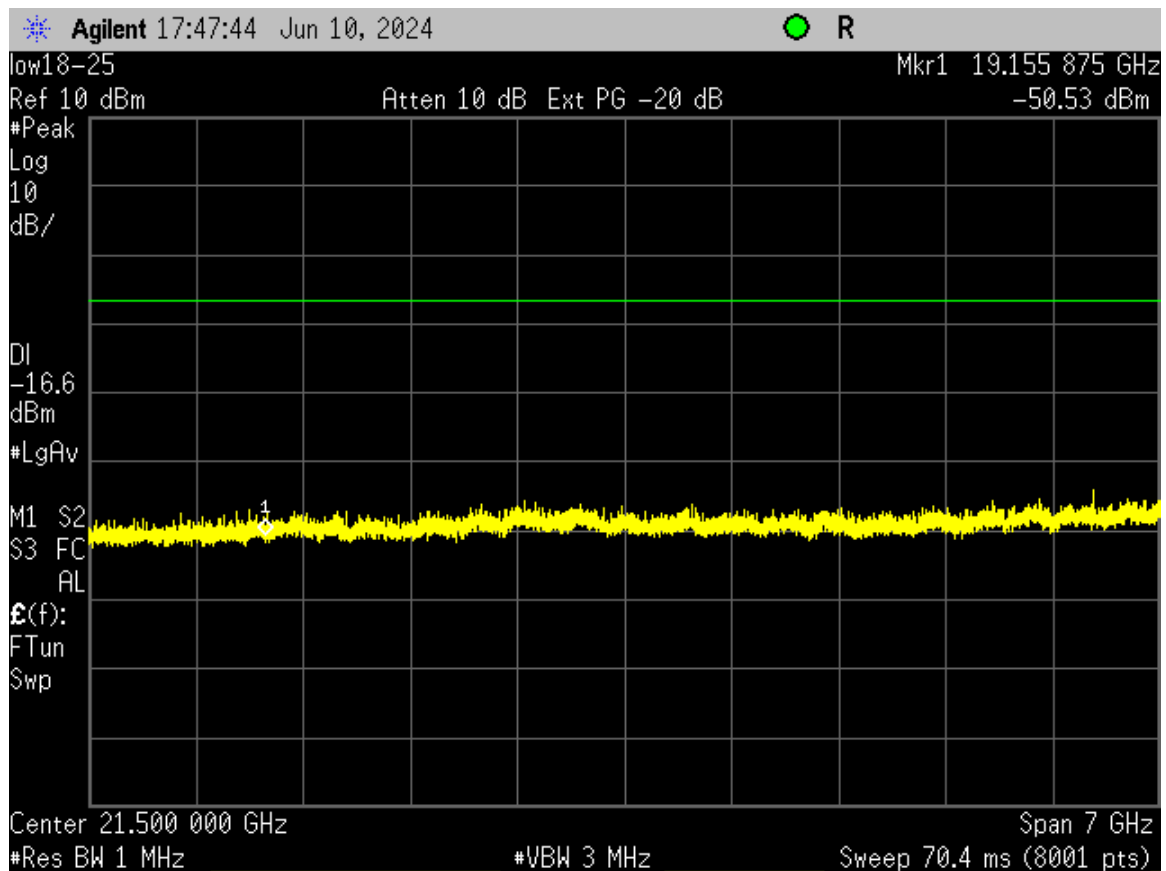


Figure 30. Radio 3, Low, 18-25 GHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

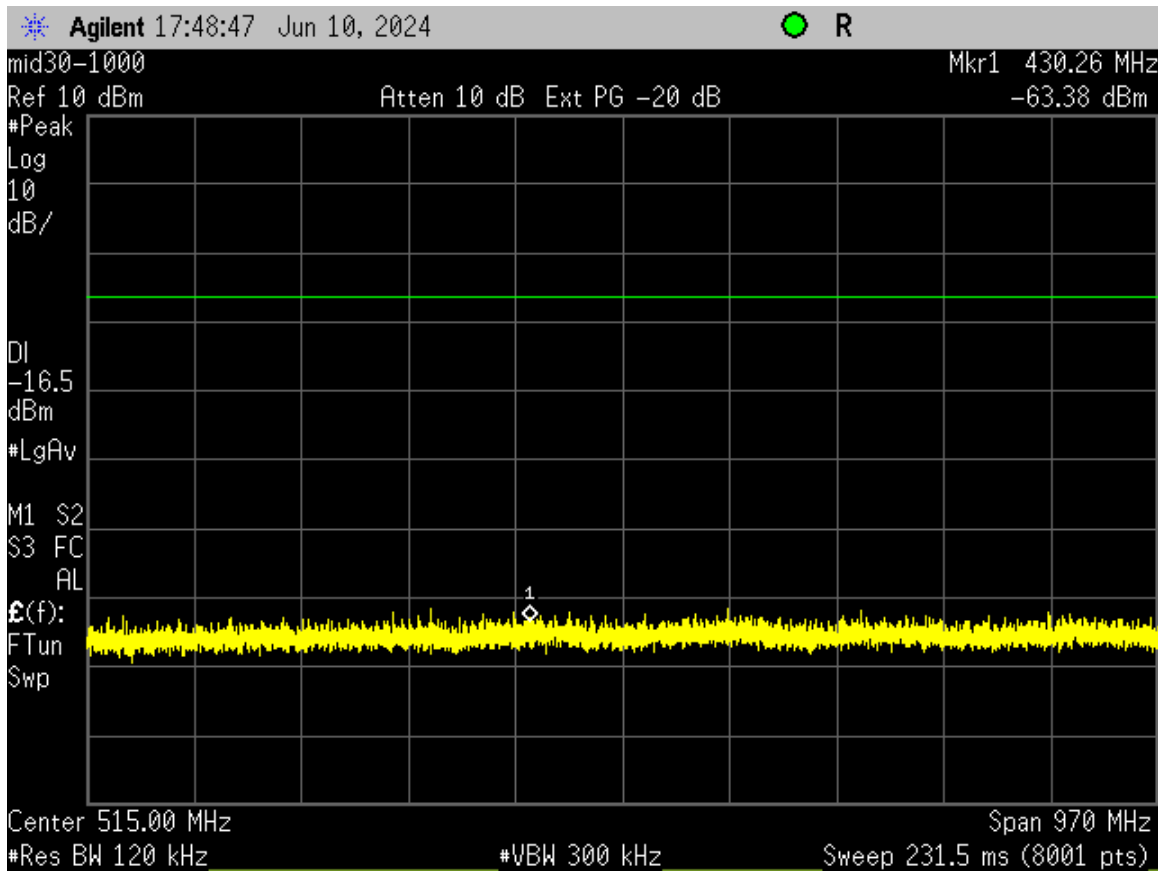


Figure 31. Radio 3, Mid, 30-1000 MHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

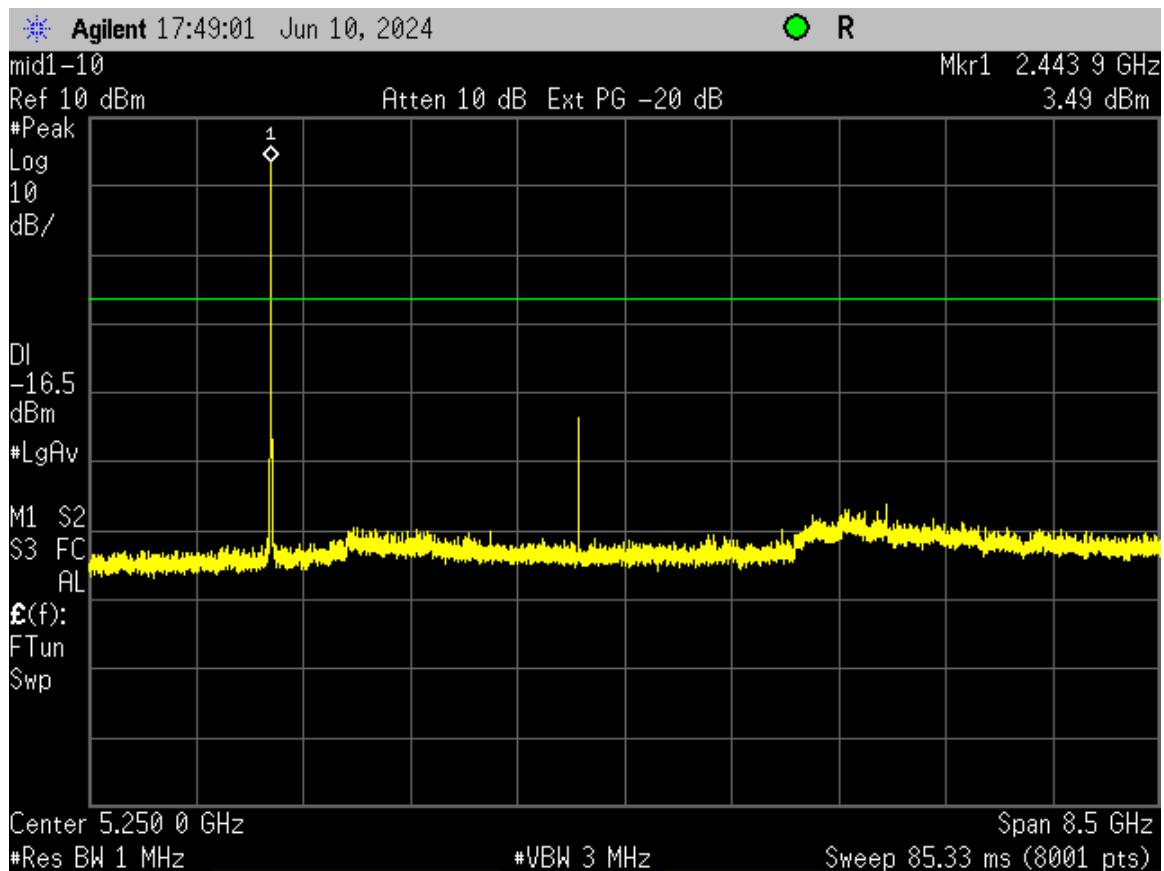


Figure 32. Radio 3, Mid, 1-9 GHz

(Note: Intentional Emission seen for radio operating at 2443.5 MHz)

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

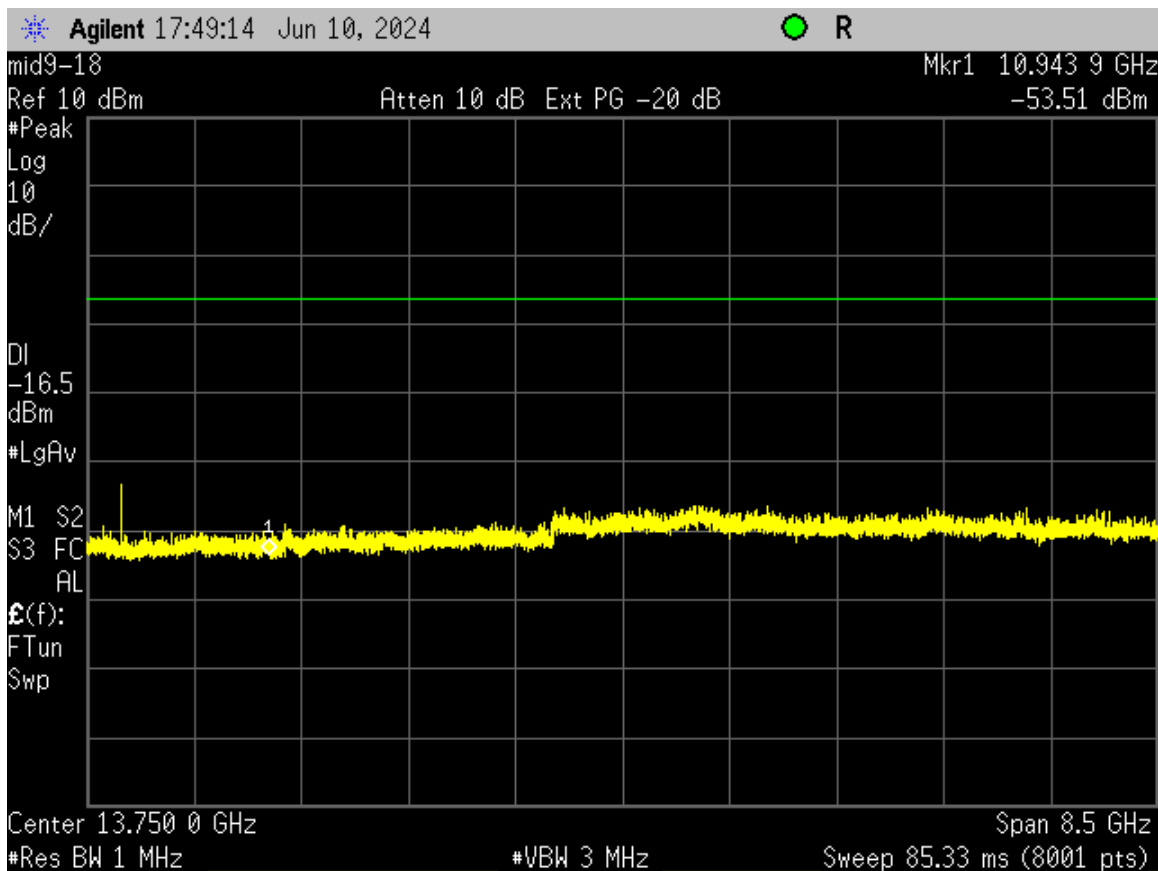


Figure 33. Radio 2, Mid, 9-18 GHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

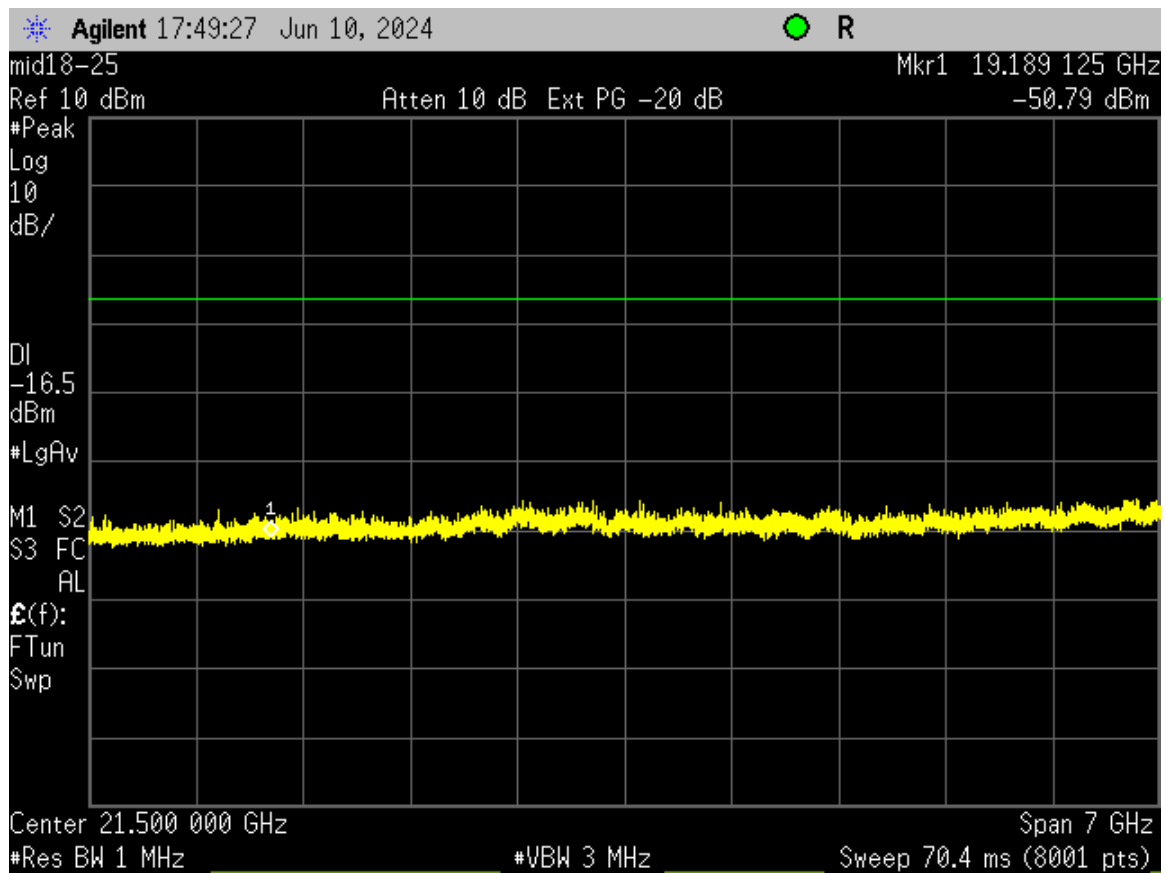


Figure 34. Radio 3, Mid, 18-25 GHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

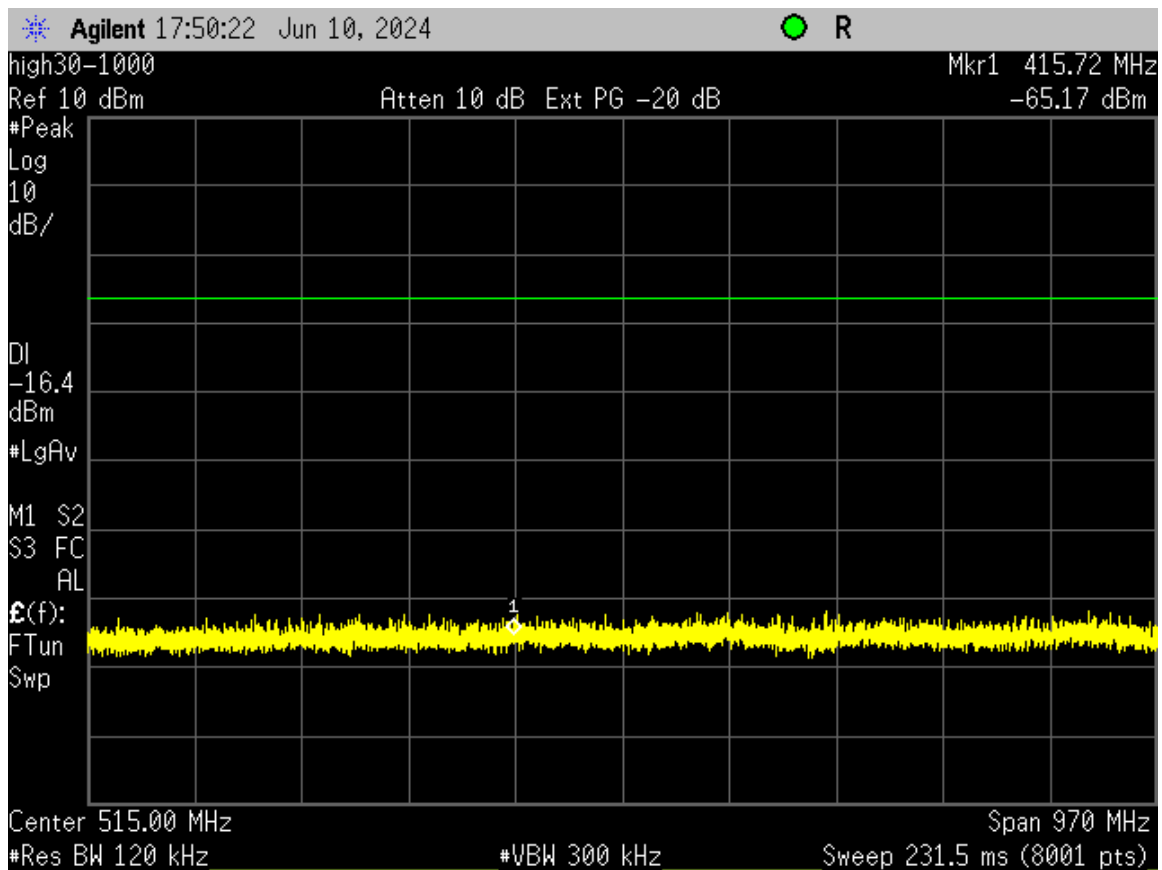


Figure 35. Radio 3, High, 30-1000 MHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

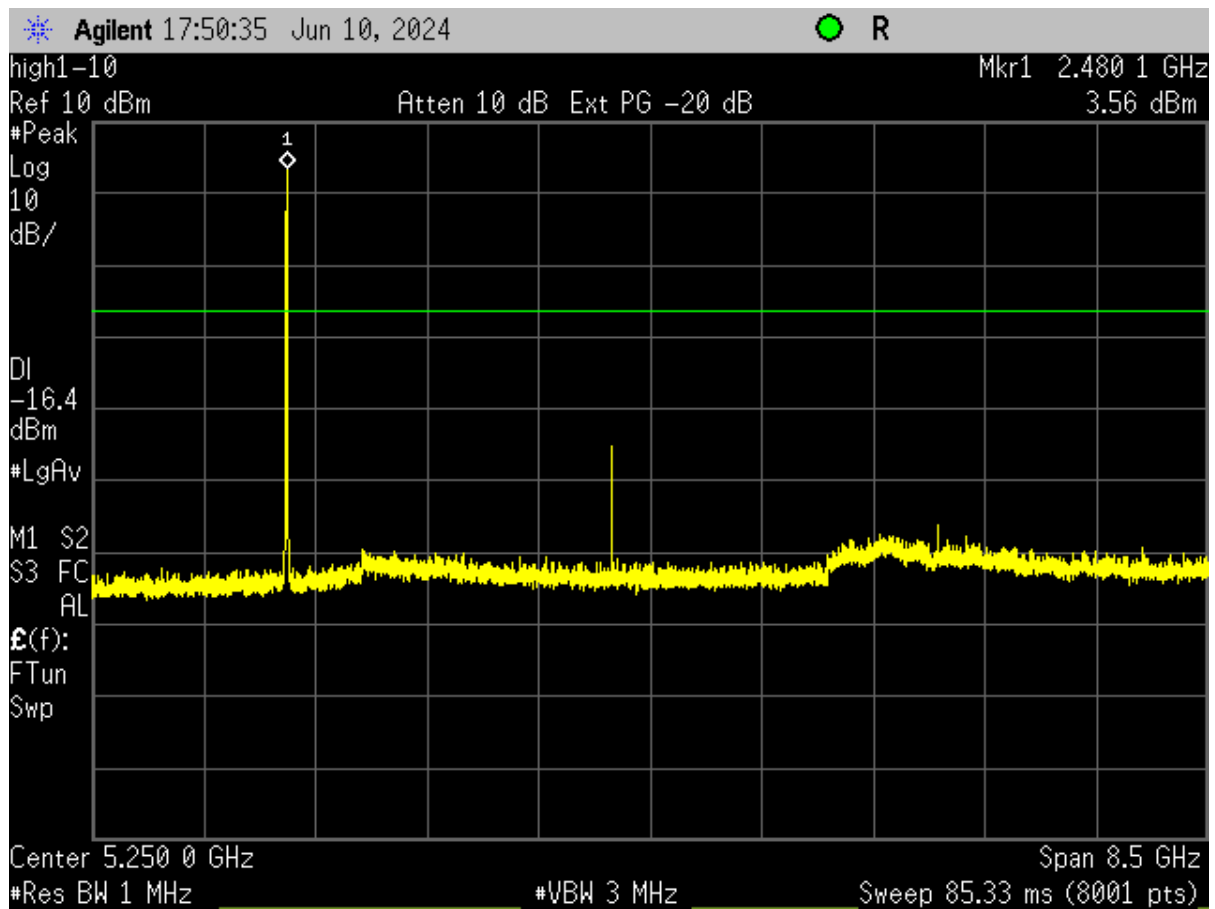


Figure 36. Radio 3, High, 1-9 GHz

(Note: Intentional Emission seen for radio operating at 2480 MHz)

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

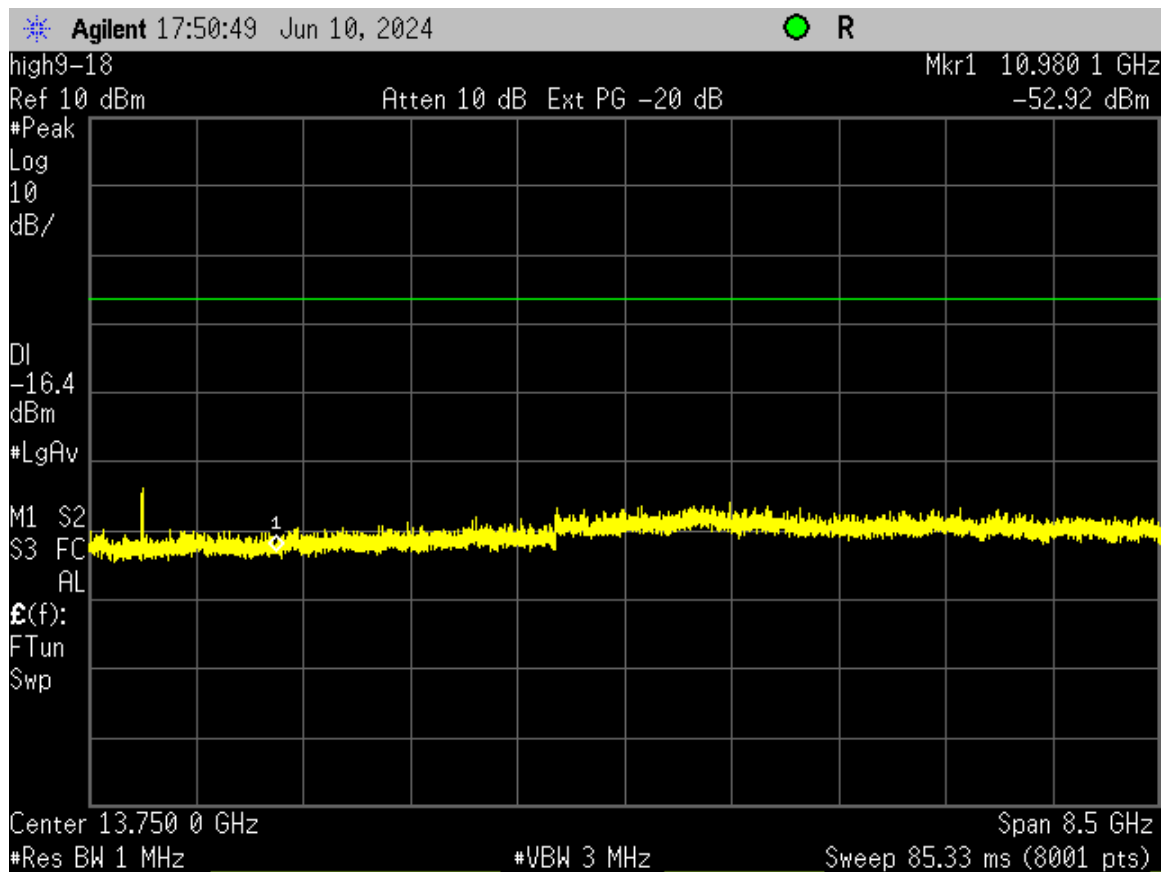


Figure 37. Radio 3, High, 9-18 GHz

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

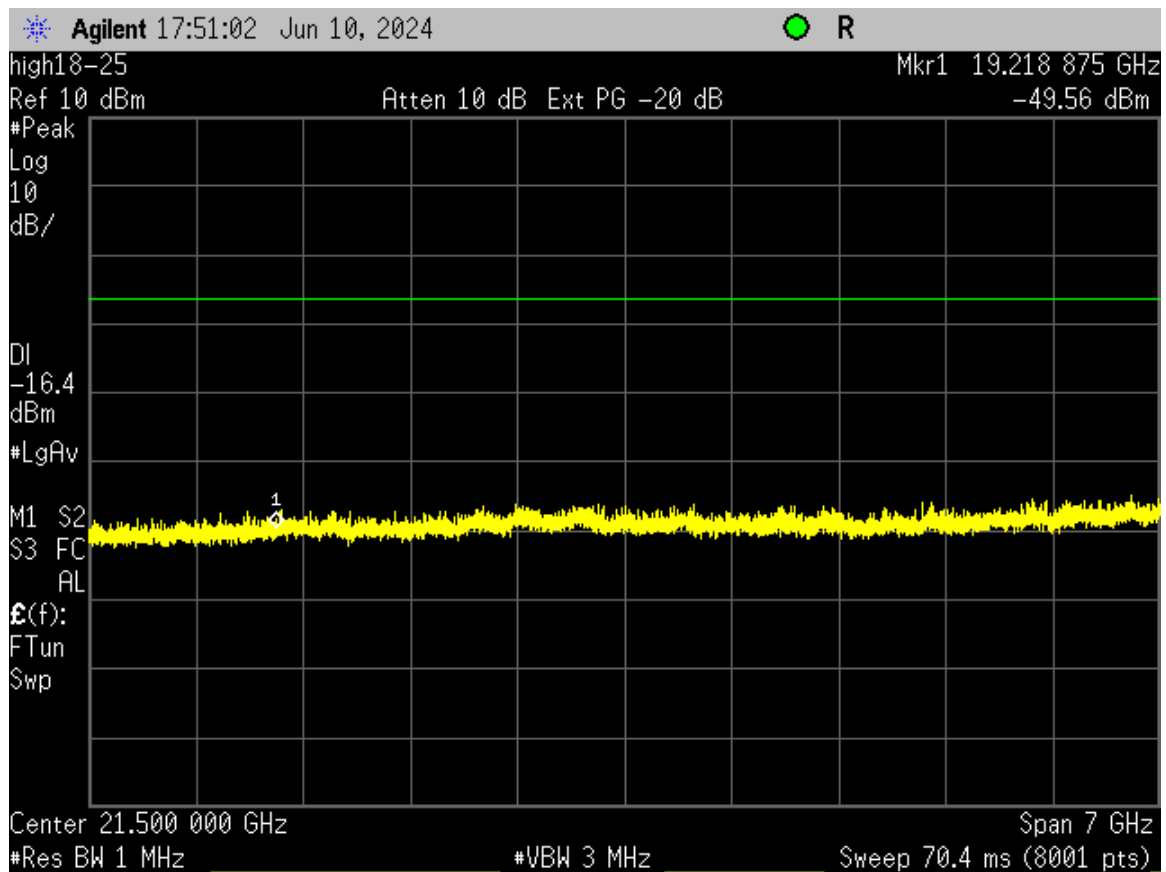


Figure 38. Radio 3, High, 18-25 GHz

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d), RSS-247, 5.5)

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 above 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. Additionally, the EUT was rotated about its Y-axis while monitoring the Spectrum Analyzer display for the 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.

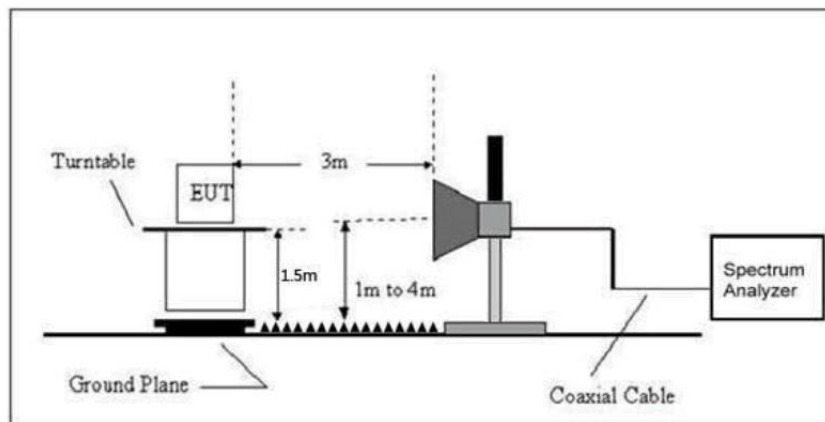


Figure 39. Radiated Emissions Setup (Fundamental and Harmonics)

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

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 June 18, 2024
 Southern States, LLC
 ICS/TFDIR Receiver

Table 5. Radio 1-Peak Radiated Fundamental & Harmonic Emissions

Test: FCC Part 15,247(d)								
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								
2403.50	69.99	0.00	32.11	102.10	--	3.0m./HORZ	--	PK
*4807.00	60.75	0.00	0.47	61.22	74.0	3.0m./HORZ	12.8	PK
7210.50	40.19	0.00	7.85	48.04	74.0	3.0m./HORZ	26.0	PK
Mid Channel – PEAK								
2443.50	70.17	0.00	32.44	102.61	--	3.0m./HORZ	--	PK
*4887.00	61.53	0.00	1.29	62.82	74.0	3.0m./HORZ	11.2	PK
*7330.50	42.85	0.00	8.43	51.27	74.0	3.0m./HORZ	22.7	PK
High Channel– PEAK								
2480.00	71.11	0.00	32.54	103.65	--	3.0m./HORZ	--	PK
*4960.00	57.69	0.00	1.18	58.87	74.0	3.0m./HORZ	15.1	PK
*7440.00	41.30	0.00	7.71	49.01	74.0	3.0m./HORZ	25.0	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
3. The EUT was placed in three orthogonal positions, tested while broadcasting from each antenna, and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was the worst case.

Sample Calculation at 2403.5 MHz:

Magnitude of Measured Frequency	69.99	dBuV
+Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	32.11	dB/m
Corrected Result	102.10	dBuV/m

Test Date: June 4-6, 2024

Tested by
 Signature: 

Name: Ian Charboneau

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
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24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

Table 6. Radio 1-Average Radiated Fundamental & Harmonic Emissions


Test: FCC Part 15,247(d)								
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								
2403.50	66.32	0.00	32.11	98.43	--	3.0m./HORZ	--	AVG
*4807.00	51.05	0.00	0.47	51.53	54.0	3.0m./HORZ	2.5	AVG
7210.50	25.60	0.00	7.85	33.45	54.0	3.0m./HORZ	20.6	AVG
Mid Channel--Average								
2443.50	62.92	0.00	32.44	95.36	--	3.0m./HORZ	--	AVG
*4887.00	51.77	0.00	1.29	53.06	54.0	3.0m./HORZ	.9	AVG
*7330.50	31.54	0.00	8.43	39.97	54.0	3.0m./HORZ	14.0	AVG
High Channel--Average								
2480.00	67.48	0.00	32.54	100.02	--	3.0m./HORZ	--	AVG
*4960.00	48.01	0.00	1.18	49.19	54.0	3.0m./HORZ	4.8	AVG
*7440.00	27.70	0.00	7.71	35.41	54.0	3.0m./HORZ	18.6	AVG

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. The EUT was placed in three orthogonal positions, tested while broadcasting from each antenna, and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was the worst case.

Sample Calculation at 2403.5MHz:

Magnitude of Measured Frequency	66.32	dBuV
+Additional Factor (filter + duty cycle)	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	32.11	dB/m
Corrected Result	98.43	dBuV/m

Test Date: June 4-6, 2024

Tested by
Signature: 

Name: Ian Charboneau

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

FCC Part 15/IC RSS Certification
 2ADWT-ICSR01
 12660A-ICSR01
 24-0098
 June 18, 2024
 Southern States, LLC
 ICS/TFDIR Receiver

Table 7. Radio 2-Peak Radiated Fundamental & Harmonic Emissions

Test: FCC Part 15,247(d)								
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								
2403.50	71.29	0.00	32.11	103.39	--	3.0m./HORZ	--	PK
*4807.00	61.17	0.00	0.47	61.64	74.0	3.0m./HORZ	12.4	PK
7210.50	39.90	0.00	7.85	47.75	74.0	3.0m./HORZ	26.3	PK
Mid Channel – PEAK								
2443.50	70.37	0.00	32.44	102.81	--	3.0m./HORZ	--	PK
*4887.00	62.43	0.00	1.29	63.72	74.0	3.0m./HORZ	10.3	PK
*7330.50	42.83	0.00	8.43	51.26	74.0	3.0m./HORZ	22.7	PK
High Channel– PEAK								
2480.00	71.36	0.00	32.54	103.90	--	3.0m./HORZ	--	PK
*4960.00	59.22	0.00	1.18	60.40	74.0	3.0m./HORZ	13.6	PK
*7440.00	40.92	0.00	7.71	48.62	74.0	3.0m./HORZ	25.4	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
3. The EUT was placed in three orthogonal positions, tested while broadcasting from each antenna, and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was the worst case.

Sample Calculation at 2403.5 MHz:

Magnitude of Measured Frequency	71.29	dBuV
+Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	32.11	dB/m
Corrected Result	103.39	dBuV/m

Test Date: June 4-6, 2024

Tested by
 Signature: 

Name: Ian Charboneau

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

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Table 8. Radio 2-Average Radiated Fundamental & Harmonic Emissions


Test: FCC Part 15,247(d)								
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								
2403.50	67.73	0.00	32.11	99.83	--	3.0m./HORZ	--	AVG
*4807.00	51.15	0.00	0.47	51.63	54.0	3.0m./HORZ	2.4	AVG
7210.50	25.82	0.00	7.85	33.67	54.0	3.0m./HORZ	20.3	AVG
Mid Channel –Average								
2443.50	66.76	0.00	32.44	99.20	--	3.0m./HORZ	--	AVG
*4887.00	52.62	0.00	1.29	53.91	54.0	3.0m./HORZ	.1	AVG
*7330.50	37.52	0.00	8.43	45.95	54.0	3.0m./HORZ	8.1	AVG
High Channel–Average								
2480.00	67.95	0.00	32.54	100.49	--	3.0m./HORZ	--	AVG
*4960.00	49.63	0.00	1.18	50.80	54.0	3.0m./HORZ	3.2	AVG
*7440.00	29.12	0.00	7.71	36.83	54.0	3.0m./HORZ	17.2	AVG

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. The EUT was placed in three orthogonal positions, tested while broadcasting from each antenna, and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was the worst case.

Sample Calculation at 2403.5 MHz:

Magnitude of Measured Frequency	67.73	dBuV
+Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	32.11	dB/m
Corrected Result	99.83	dBuV/m

Test Date: June 4-6, 2024

Tested by
Signature: 

Name: Ian Charboneau

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

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Table 9. Radio 3-Peak Radiated Fundamental & Harmonic Emissions


Test: FCC Part 15,247(d)								
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								
2403.50	68.87	0.00	32.11	100.97	--	3.0m./HORZ	--	PK
*4807.00	60.17	0.00	0.47	60.64	74.0	3.0m./HORZ	13.4	PK
7210.50	39.35	0.00	7.85	47.20	74.0	3.0m./HORZ	26.8	PK
Mid Channel – PEAK								
2443.50	68.98	0.00	32.44	101.42	7--	3.0m./HORZ	--	PK
*4887.00	61.92	0.00	1.29	63.21	74.0	3.0m./HORZ	10.8	PK
*7330.50	43.38	0.00	8.43	51.81	74.0	3.0m./HORZ	22.2	PK
High Channel– PEAK								
2480.00	70.55	0.00	32.54	103.09	--	3.0m./HORZ	--	PK
*4960.00	59.62	0.00	1.18	60.79	74.0	3.0m./HORZ	13.2	PK
*7440.00	41.53	0.00	7.71	49.24	74.0	3.0m./HORZ	24.8	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
3. The EUT was placed in three orthogonal positions, tested while broadcasting from each antenna, and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was the worst case.

Sample Calculation at 2403.5 MHz:

Magnitude of Measured Frequency	68.87	dBuV
+Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	32.11	dB/m
Corrected Result	100.97	dBuV/m

Test Date: June 4-6, 2024

Tested by
Signature: 

Name: Ian Charboneau

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

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Table 10. Radio 3-Average Radiated Fundamental & Harmonic Emissions


Test: FCC Part 15,247(d)								
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								
2403.50	65.35	0.00	32.11	97.46	--	3.0m./HORZ	--	AVG
*4807.00	50.22	0.00	0.47	50.69	54.0	3.0m./HORZ	3.3	AVG
7210.50	27.02	0.00	7.85	34.87	54.0	3.0m./HORZ	19.1	AVG
Mid Channel -Average								
2443.50	65.38	0.00	32.44	97.82	--	3.0m./HORZ	--	AVG
*4887.00	51.67	0.00	1.29	52.96	54.0	3.0m./HORZ	1.0	AVG
*7330.50	31.86	0.00	8.43	40.29	54.0	3.0m./HORZ	13.7	AVG
High Channel-Average								
2480.00	66.95	0.00	32.54	99.49	--	3.0m./HORZ	--	AVG
*4960.00	49.72	0.00	1.18	50.89	54.0	3.0m./HORZ	3.1	AVG
*7440.00	29.27	0.00	7.71	36.97	54.0	3.0m./HORZ	17.0	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. The EUT was placed in three orthogonal positions, tested while broadcasting from each antenna, and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was the worst case.

Sample Calculation at 2403.5 MHz:

Magnitude of Measured Frequency	65.36	dBuV
+Additional Factor	0.00	dB
+Antenna Factor + Cable Loss+ Amplifier Gain	32.11	dB/m
Corrected Result	97.46	dBuV/m

Test Date: June 4-6, 2024

Tested by
Signature: 

Name: Ian Charboneau

2.11 Band Edge and Restricted Band Measurements (CFR 15.247(d), RSS-247, 5.5)

Band Edge measurements are made following the guidelines in ANSI C63.10-2013 Clause 6.10 with the EUT initially operating on the Lowest Channel and then operating on the Highest Channel within its band of operation. Restricted band and band edge tests are performed as radiated measurements. The test instrument used for testing has both Peak and Average detection. In consideration of Clause 5.8 of ANSI C63.10-2013, the EUT was set to its highest rated output power level during testing. The results are collected and presented below.

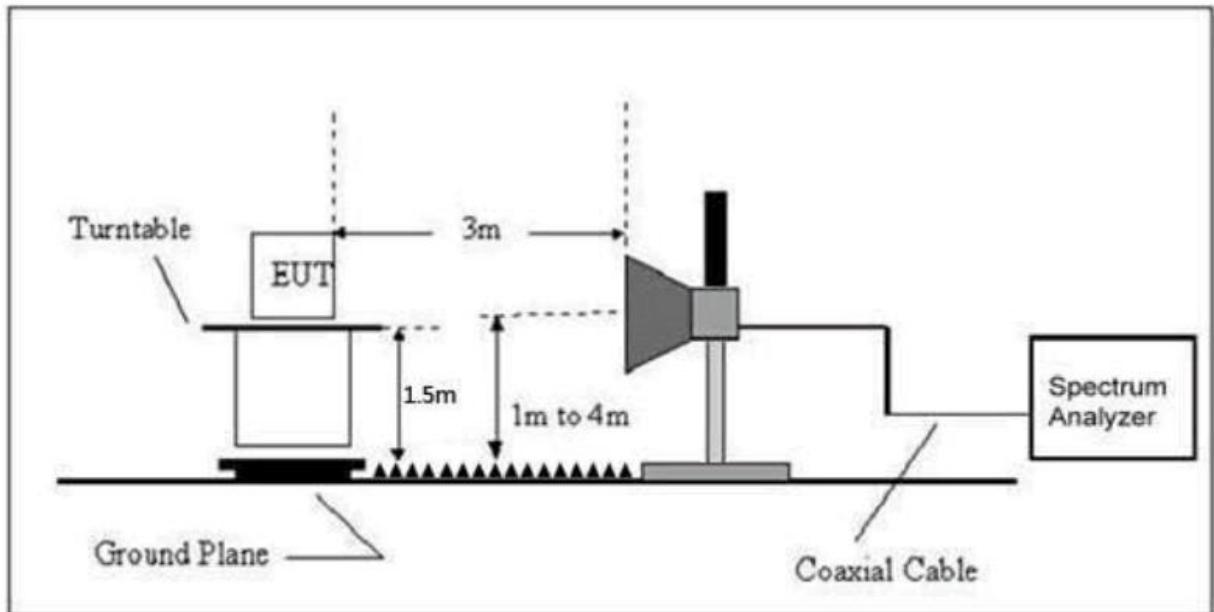


Figure 40. Radiated Emissions Setup

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 FCC ID:
 IC:
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 Customer:
 Model:

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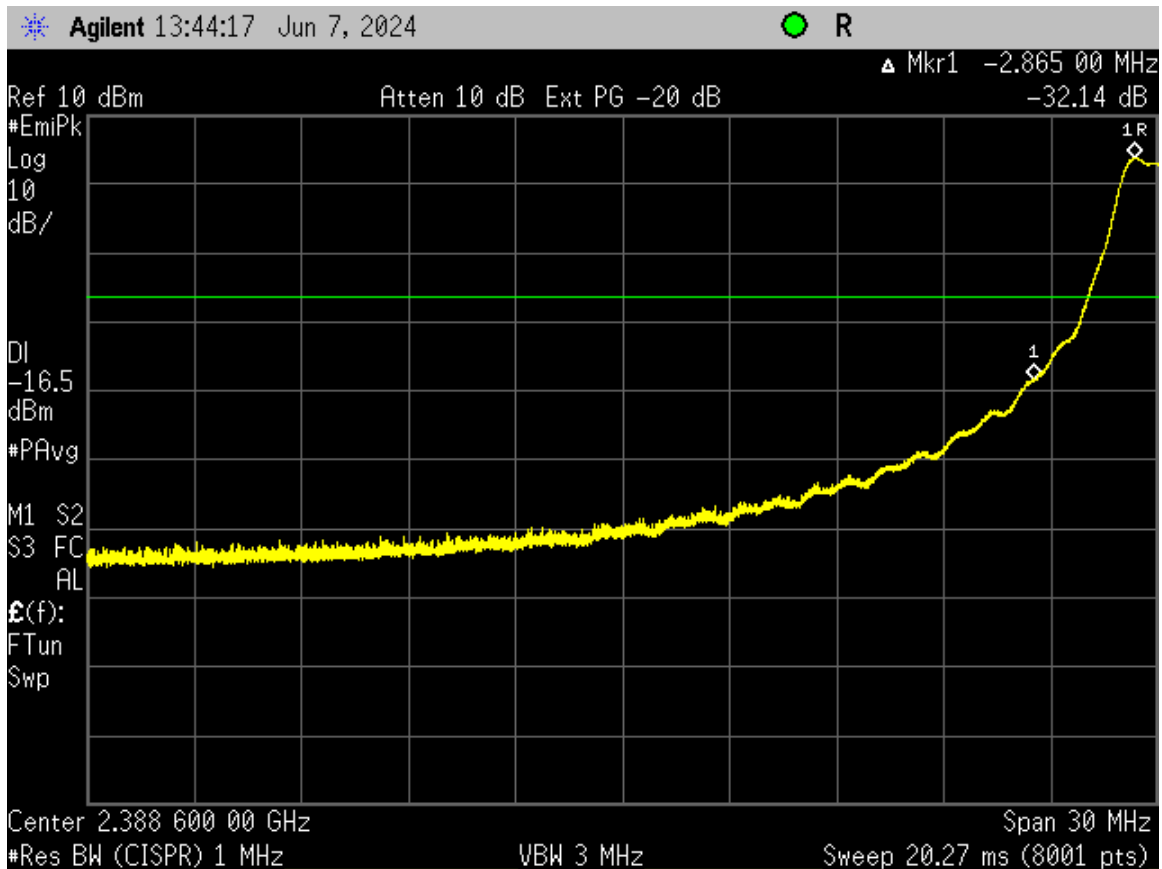


Figure 41. Band Edge Compliance – Radio 1 Low Channel Delta – Peak

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

Measured Result	-32.14	dB
Band Edge Limit	-20.00	dB
Band Edge Margin	12.14	dB

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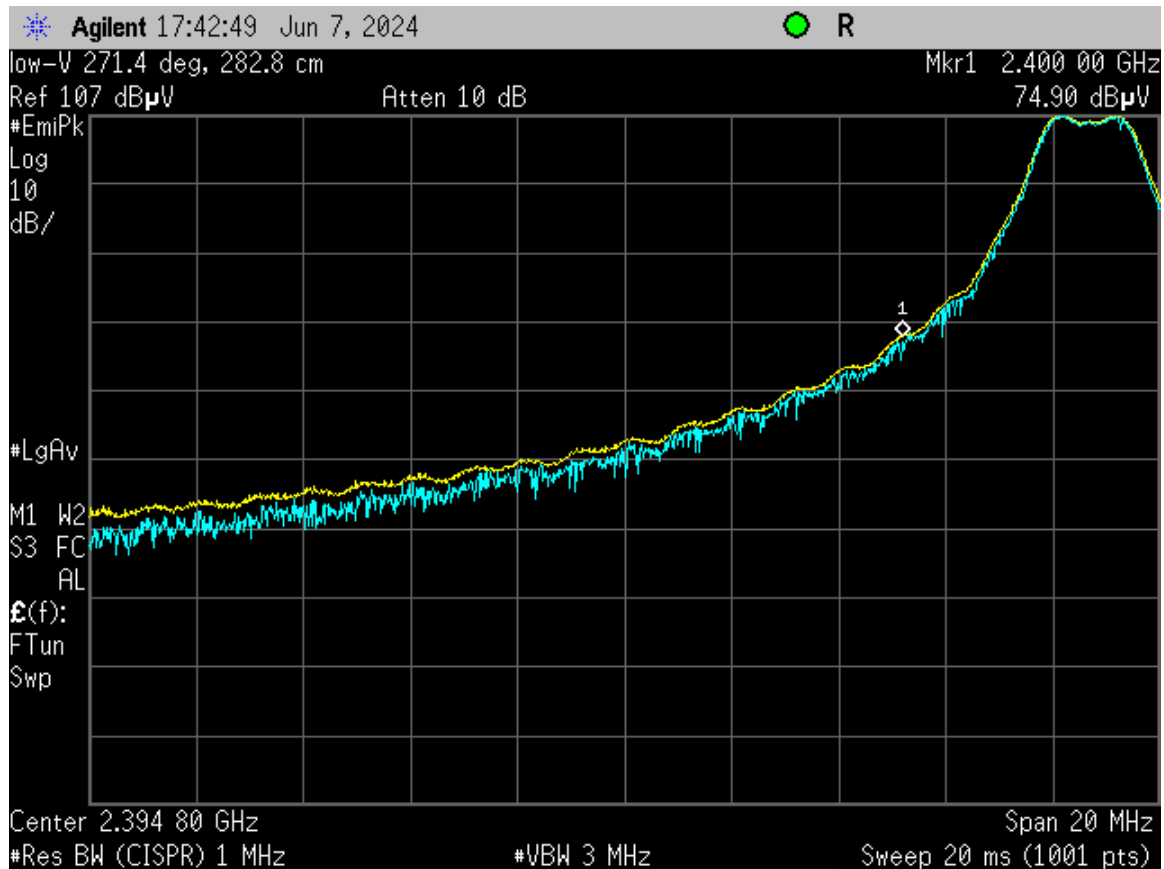


Figure 42. Radio 1 Low Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	Duty-Cycle Correction	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2400.0	74.90	0.00	-5.55	64.45	74.0	3.0m./Vert	9.6	PK
2400.0	74.90	-20.00	-5.55	44.45	54.0	3.0m./Vert	9.6	PK

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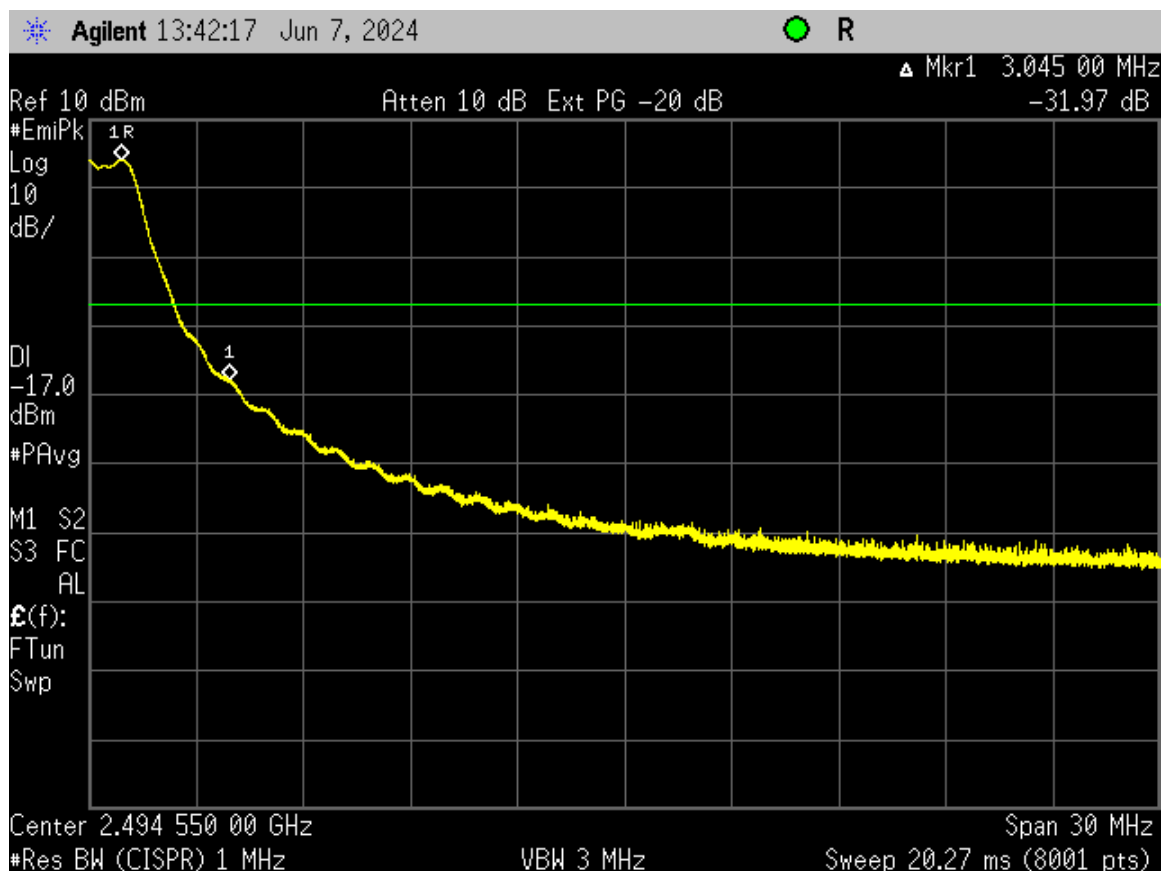


Figure 43. Band Edge Compliance – Radio 1 High Channel Delta – Peak

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

Measured Result	-31.97	dB
Band Edge Limit	-20.00	dB
Band Edge Margin	11.97	dB

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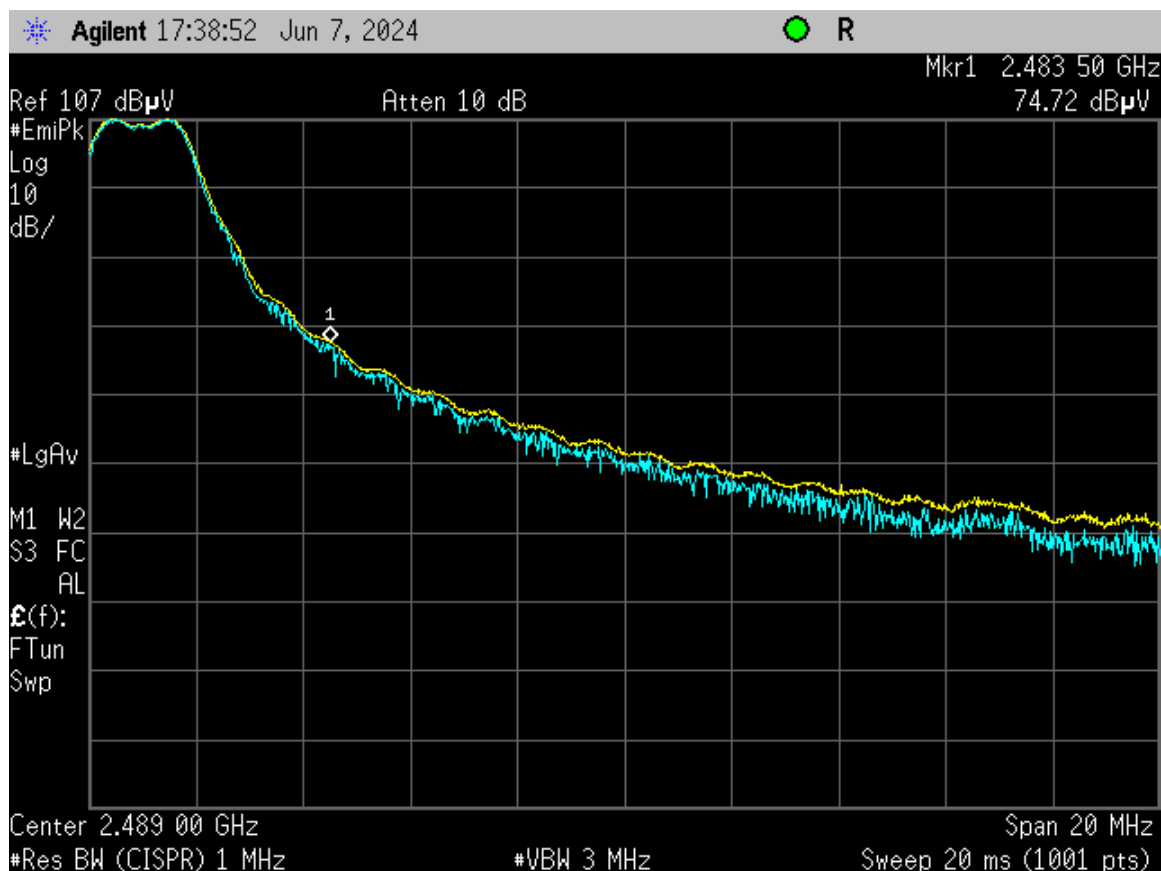


Figure 44. Radio 1 High Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	Duty-Cycle Correction	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.5	74.72	0.00	-5.55	69.17	74.0	3.0m./HORZ	4.8	PK
2483.5	74.72	-20.00	-5.55	49.17	54.0	3.0m./HORZ	4.8	PK

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

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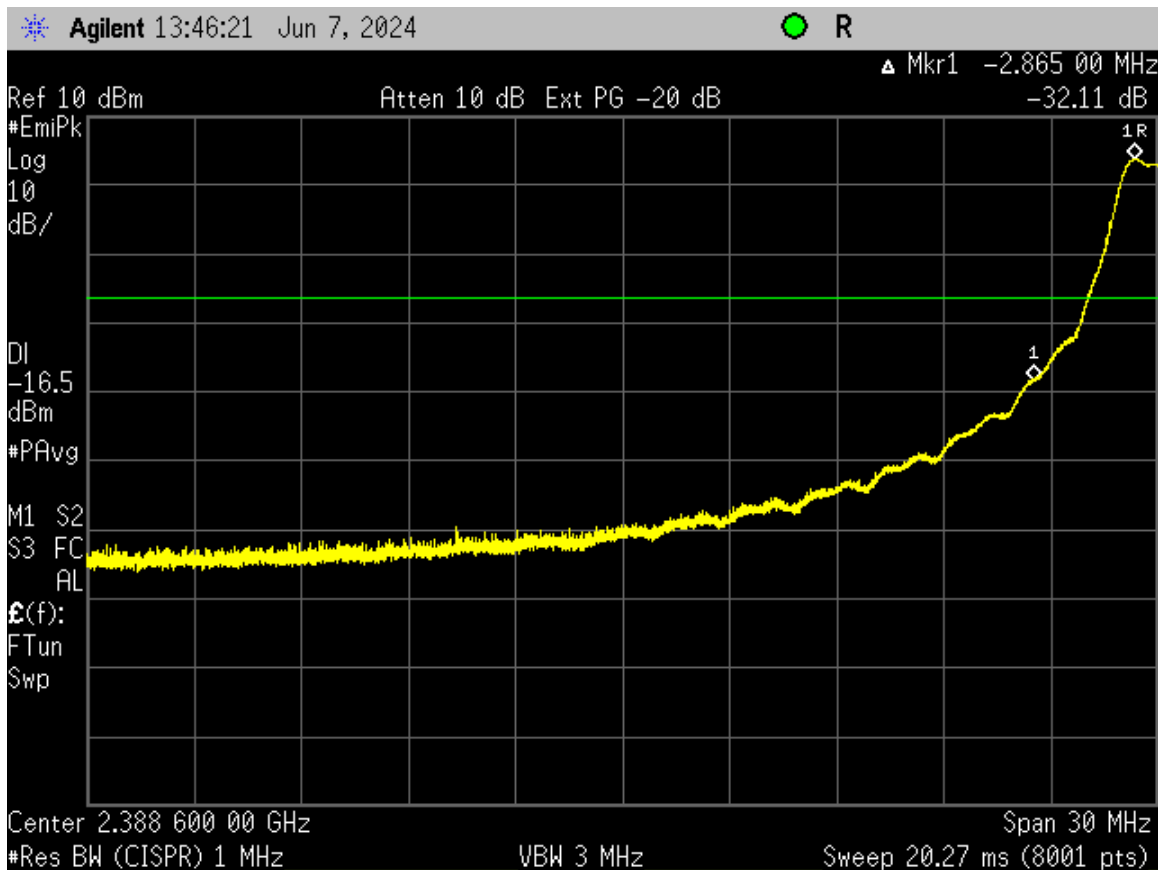


Figure 45. Band Edge Compliance – Radio 2 Low Channel Delta – Peak

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

Measured Result	-32.11	dB
Band Edge Limit	-20.00	dB
Band Edge Margin	12.11	dB

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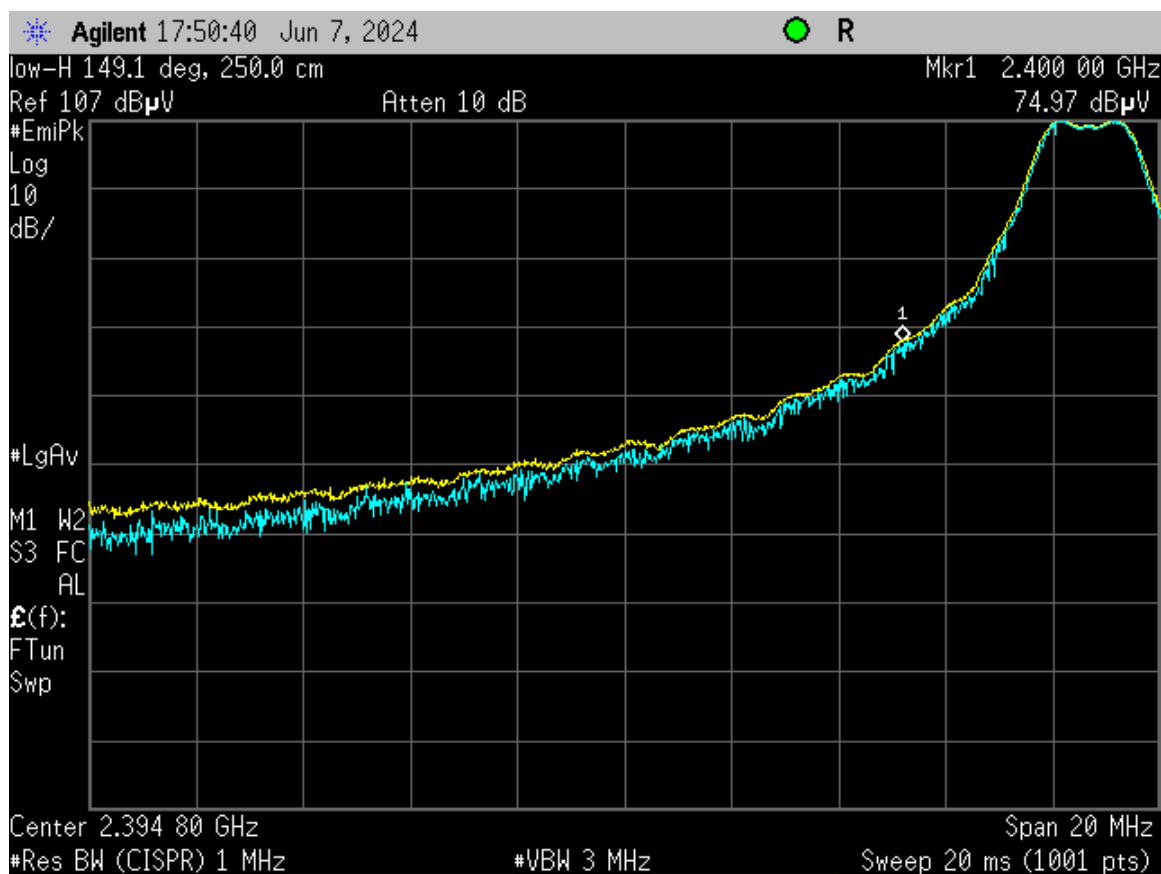


Figure 46. Radio 2 Low Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	Duty-Cycle Correction	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2400.0	74.97	0.00	-5.55	64.52	74.0	3.0m./Vert	9.53	PK
2400.0	74.97	-20.00	-5.55	44.52	54.0	3.0m./Vert	9.53	PK

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

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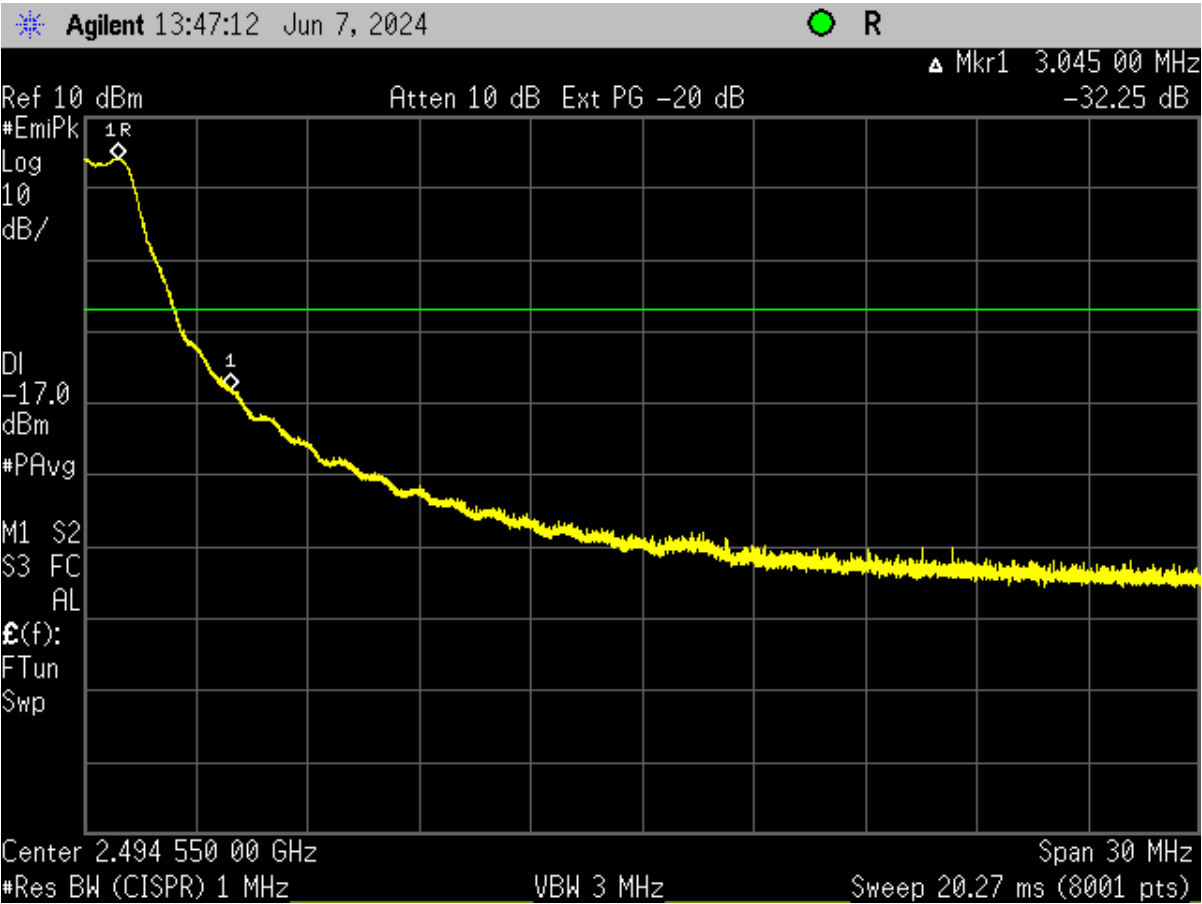


Figure 47. Band Edge Compliance – Radio 2 High Channel Delta – Peak

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

Measured Result	-32.25	dB
Band Edge Limit	-20.00	dB
Band Edge Margin	12.25	dB

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

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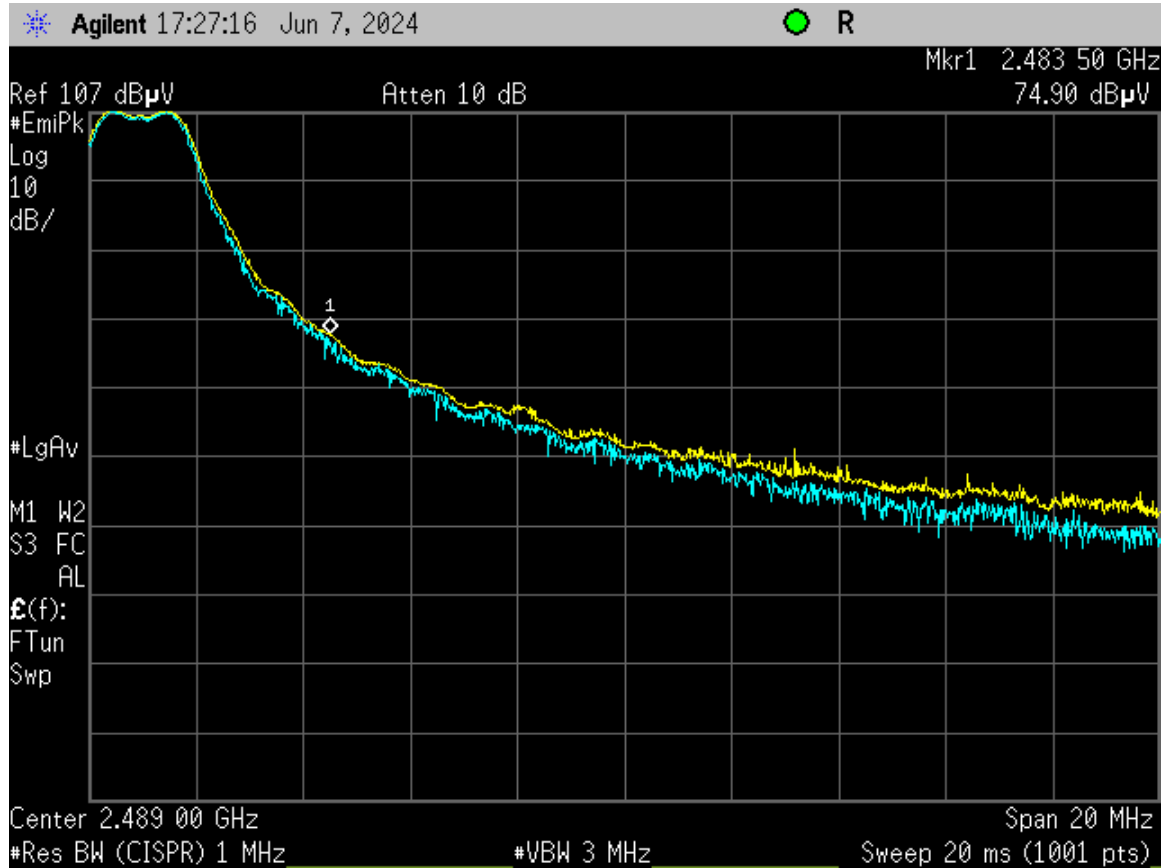


Figure 48. Radio 2 High Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	Duty-Cycle Correction	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.5	74.90	0.00	-5.55	69.35	74.0	3.0m./HORZ	4.62	PK
2483.5	74.90	-20.00	-5.55	49.35	54.0	3.0m./HORZ	4.62	PK

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

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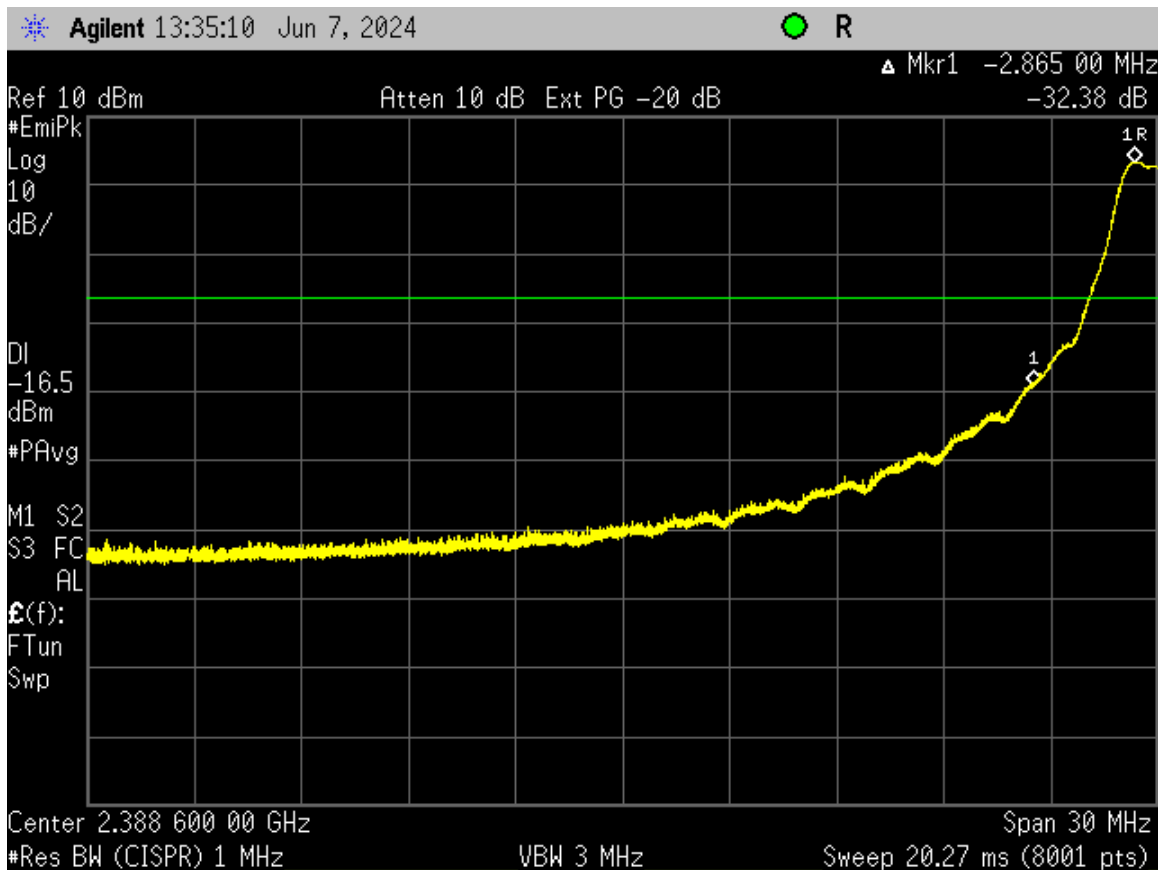


Figure 49. Band Edge Compliance – Radio 3 Low Channel Delta – Peak

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

Measured Result	-32.38	dB
Band Edge Limit	-20.00	dB
Band Edge Margin	12.38	dB

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

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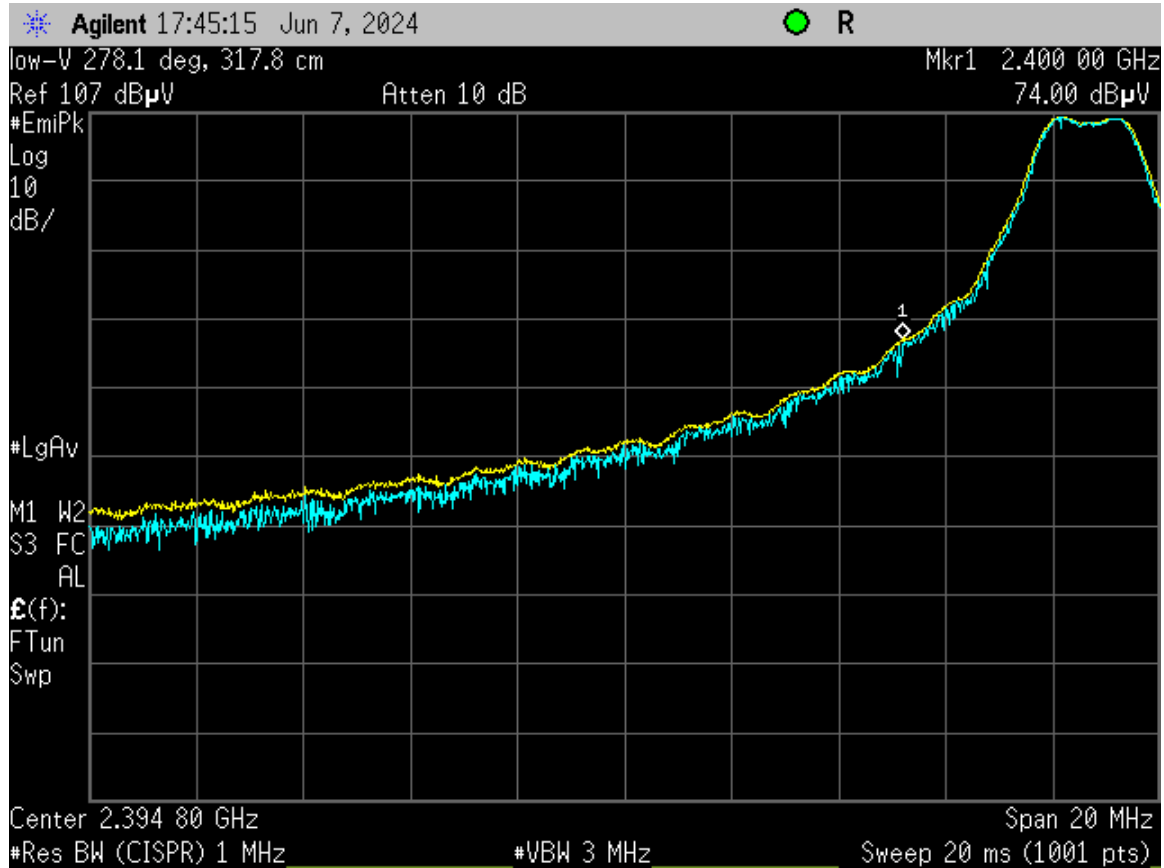


Figure 50. Radio 3 Low Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	Duty-Cycle Correction	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2400.0	74.00	0.00	-5.55	63.55	74.0	3.0m./Vert	10.5	PK
2400.0	74.00	-20.00	-5.55	43.55	54.0	3.0m./Vert	10.5	PK

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Figure 51. Band Edge Compliance – Radio 3 High Channel Delta – Peak

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

Measured Result	-32.28	dB
Band Edge Limit	-20.00	dB
Band Edge Margin	12.28	dB

US Tech Test Report:
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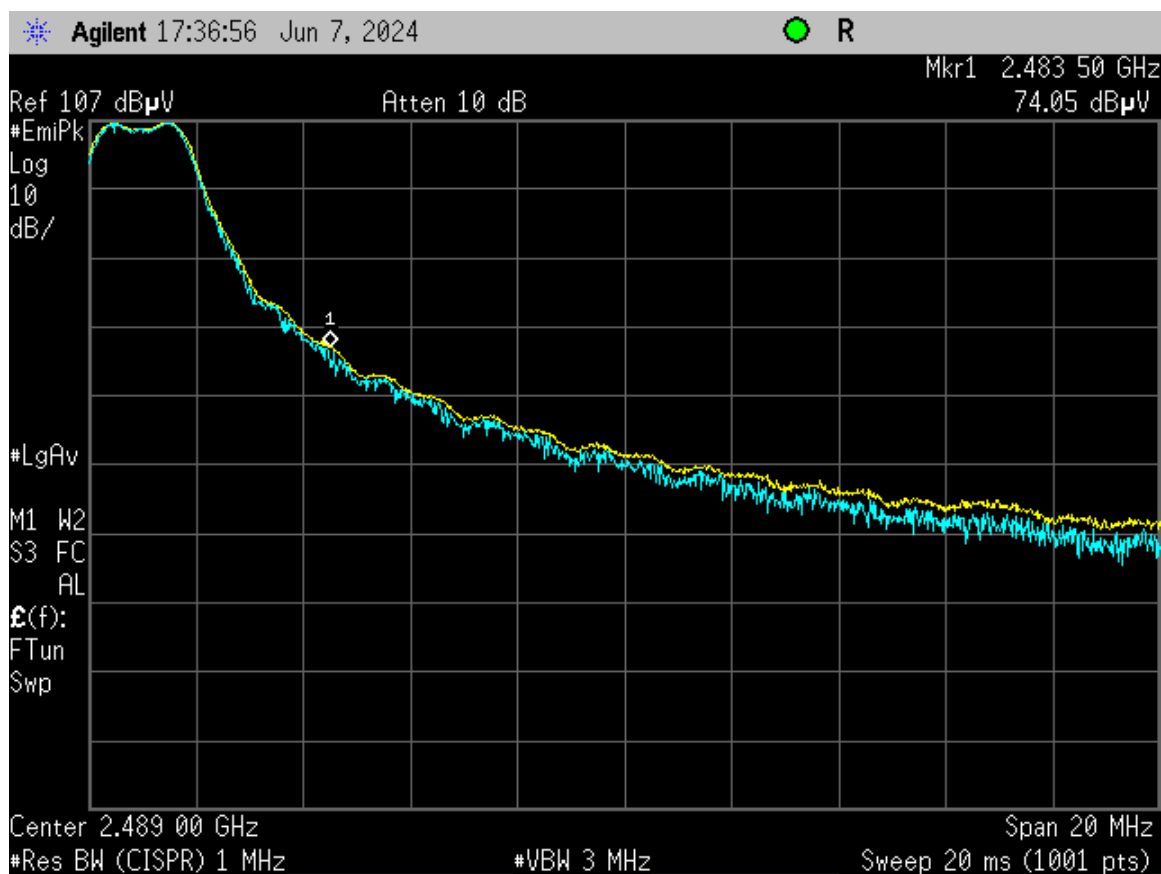


Figure 52. Radio 3 High Channel Restricted Band – Peak

Frequency (MHz)	Test Data (dBuV)	Duty-Cycle Correction	AF+CA-AMP+DC (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector PK/QP/AVG
2483.5	74.05	0.00	-5.55	68.50	74.0	3.0m./HORZ	5.47	PK
2483.5	74.72	-20.00	-5.55	48.50	54.0	3.0m./HORZ	5.47	PK

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

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2.12 Six (6) dB Bandwidth (CFR 15.247(a)(2), RSS-247, 5.2(a))

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



Figure 53. Bench Test Setup

Table 11. Six (6) dB Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)	Radio
2403.5	1.550	0.5	1
2443.5	1.542	0.5	1
2480.0	1.569	0.5	1
2403.5	1.451	0.5	2
2443.5	1.477	0.5	2
2480.0	1.436	0.5	2
2403.5	1.440	0.5	3
2443.5	1.436	0.5	3
2480.0	1.549	0.5	3

Test Date: June 6, 2024

Tested by
Signature: Ian Charboneau

Name: Ian Charboneau

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

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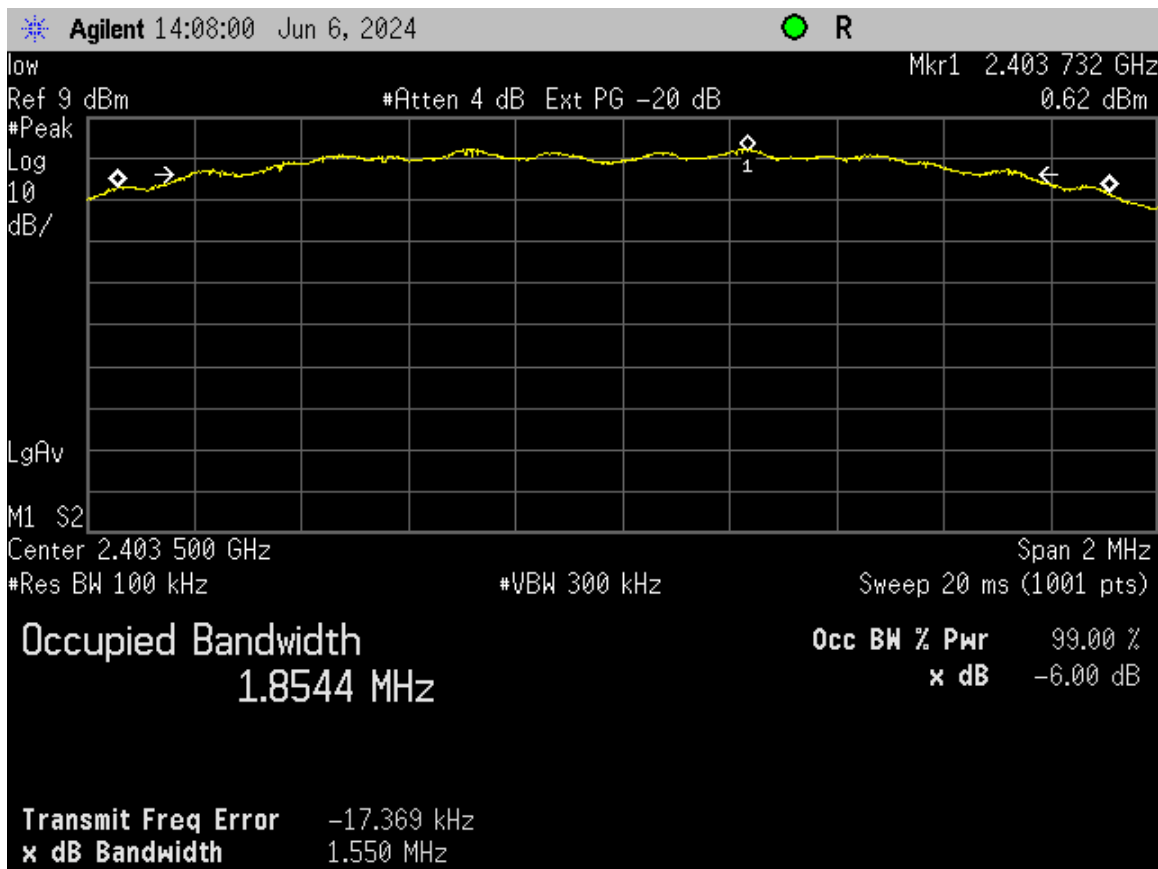


Figure 54. 6 dB Bandwidth Radio 1 Low Channel

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

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24-0098
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ICS/TFDIR Receiver

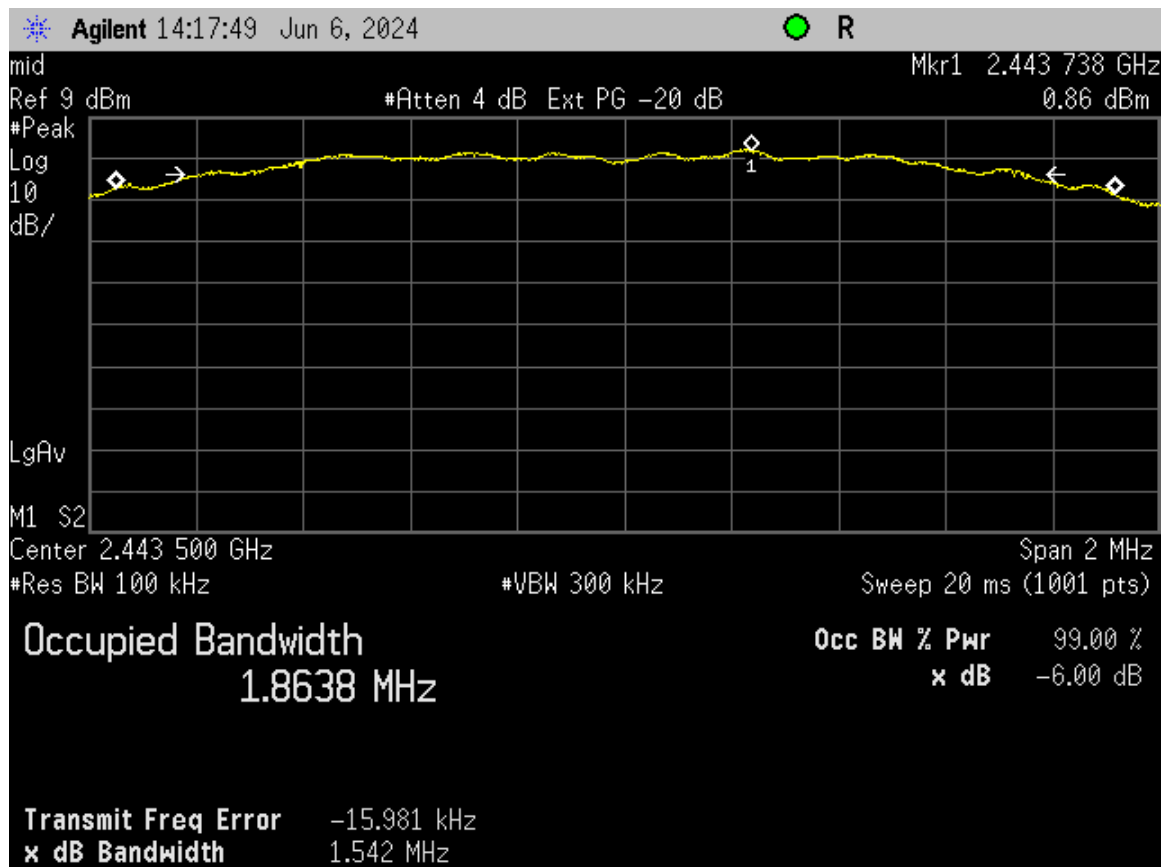


Figure 55. 6 dB Bandwidth Radio 1 Mid Channel

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

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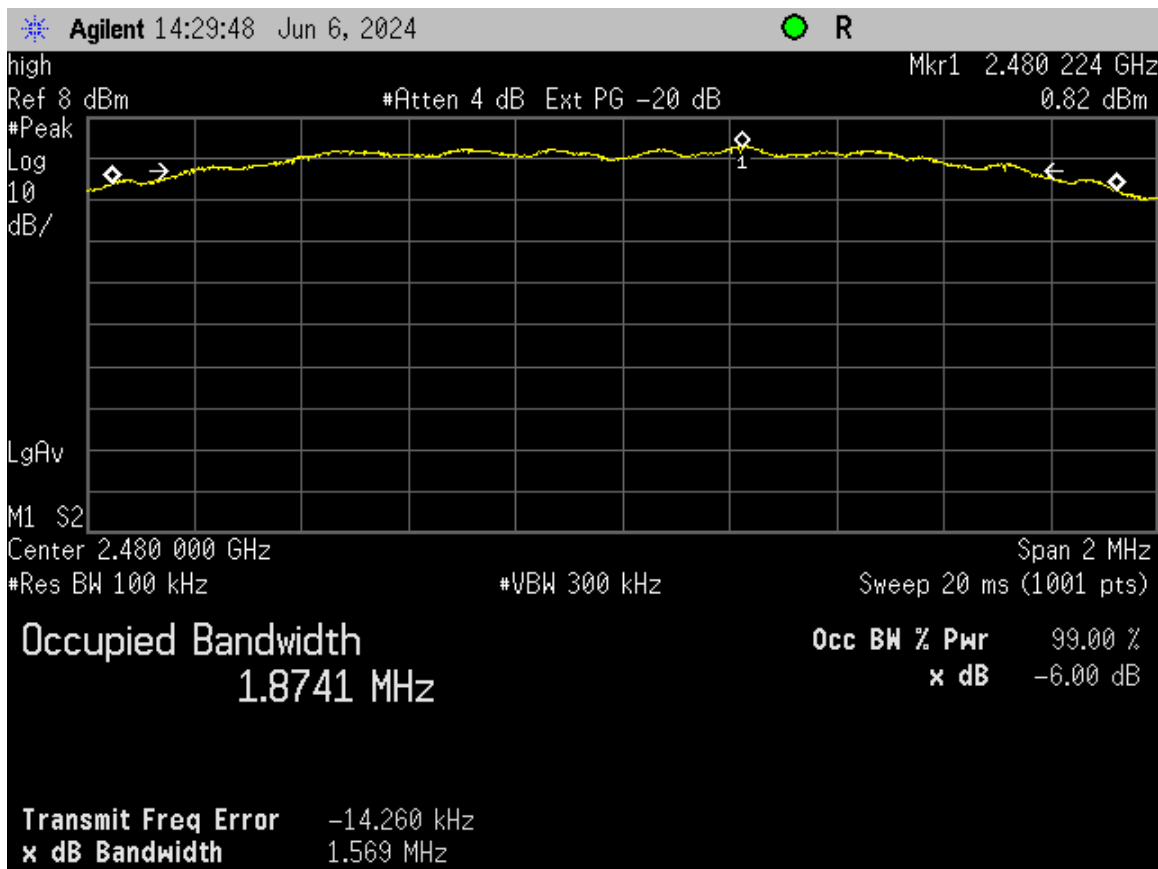


Figure 56. 6 dB Bandwidth Radio 1 High Channel

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

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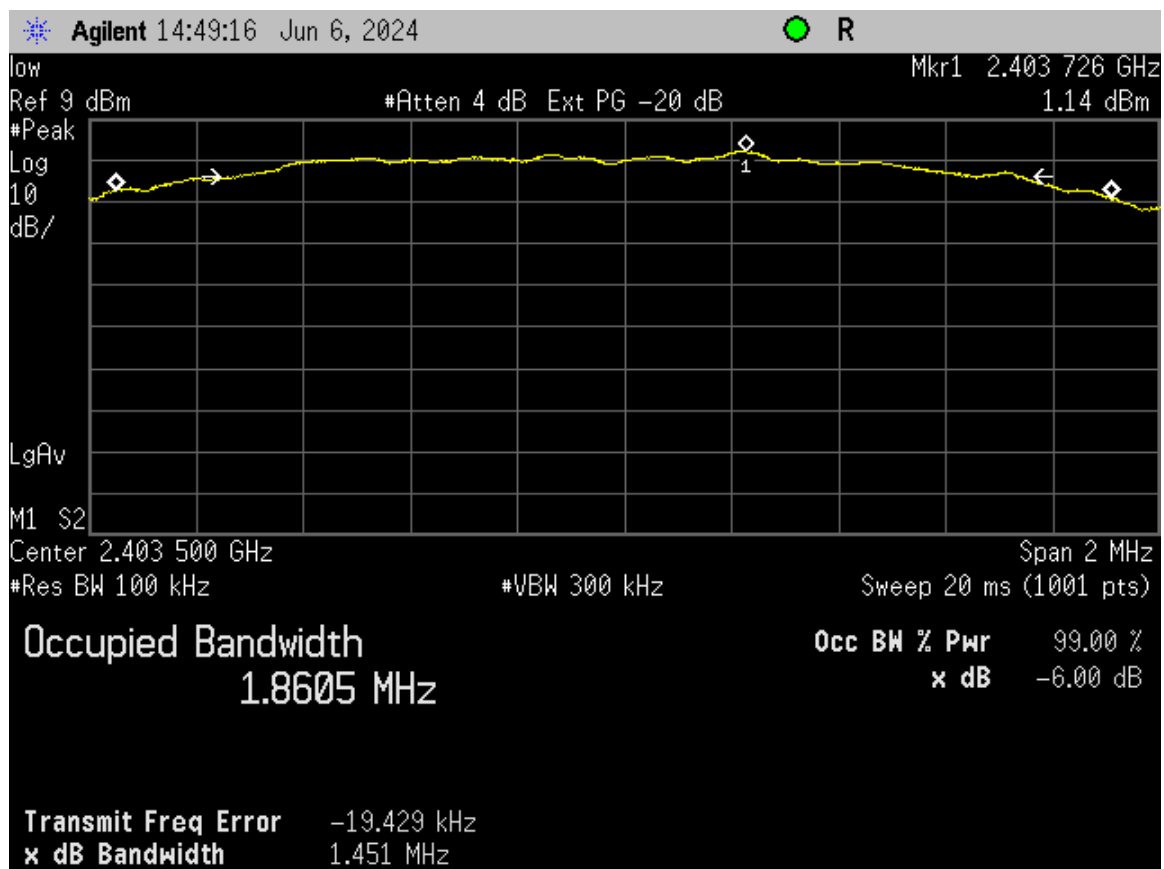


Figure 57. 6 dB Bandwidth Radio 2 Low Channel

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

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Southern States, LLC
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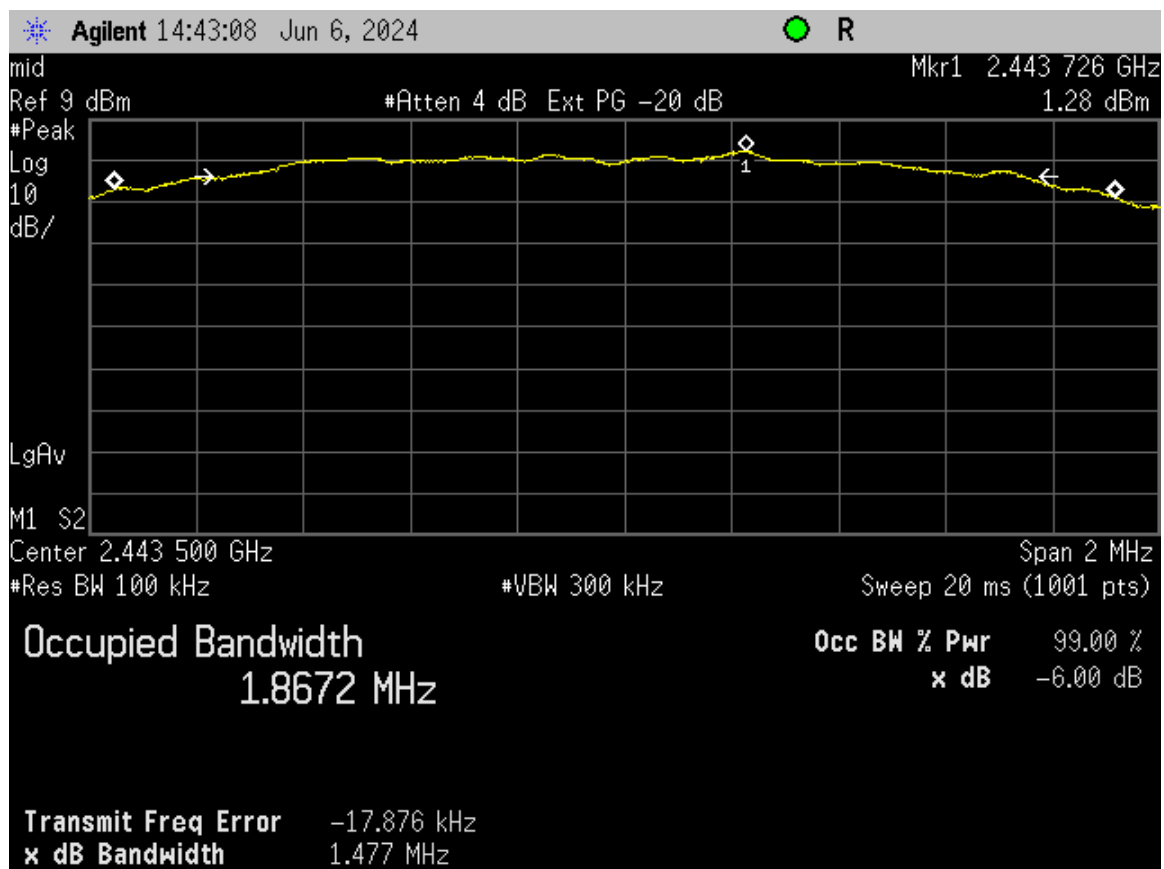


Figure 58. 6 dB Bandwidth Radio 2 Mid Channel

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

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Southern States, LLC
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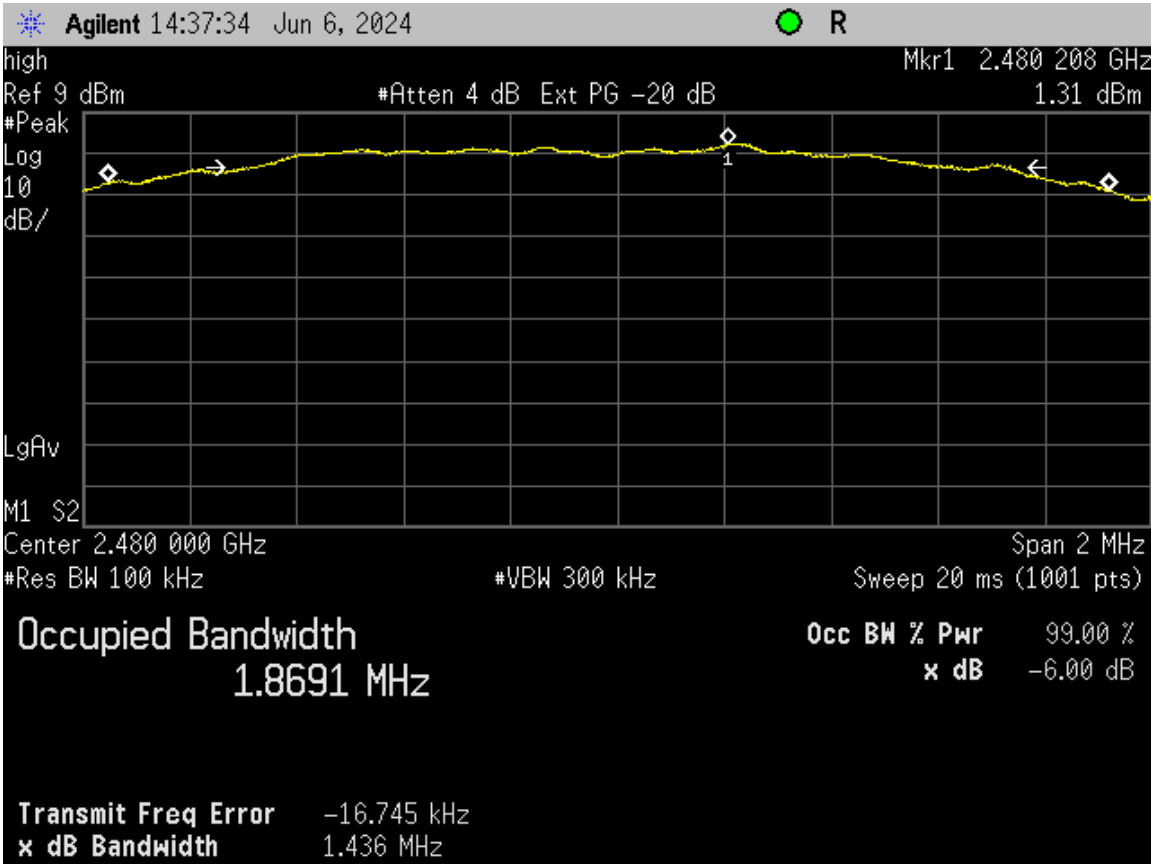


Figure 59. 6 dB Bandwidth Radio 2 High Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

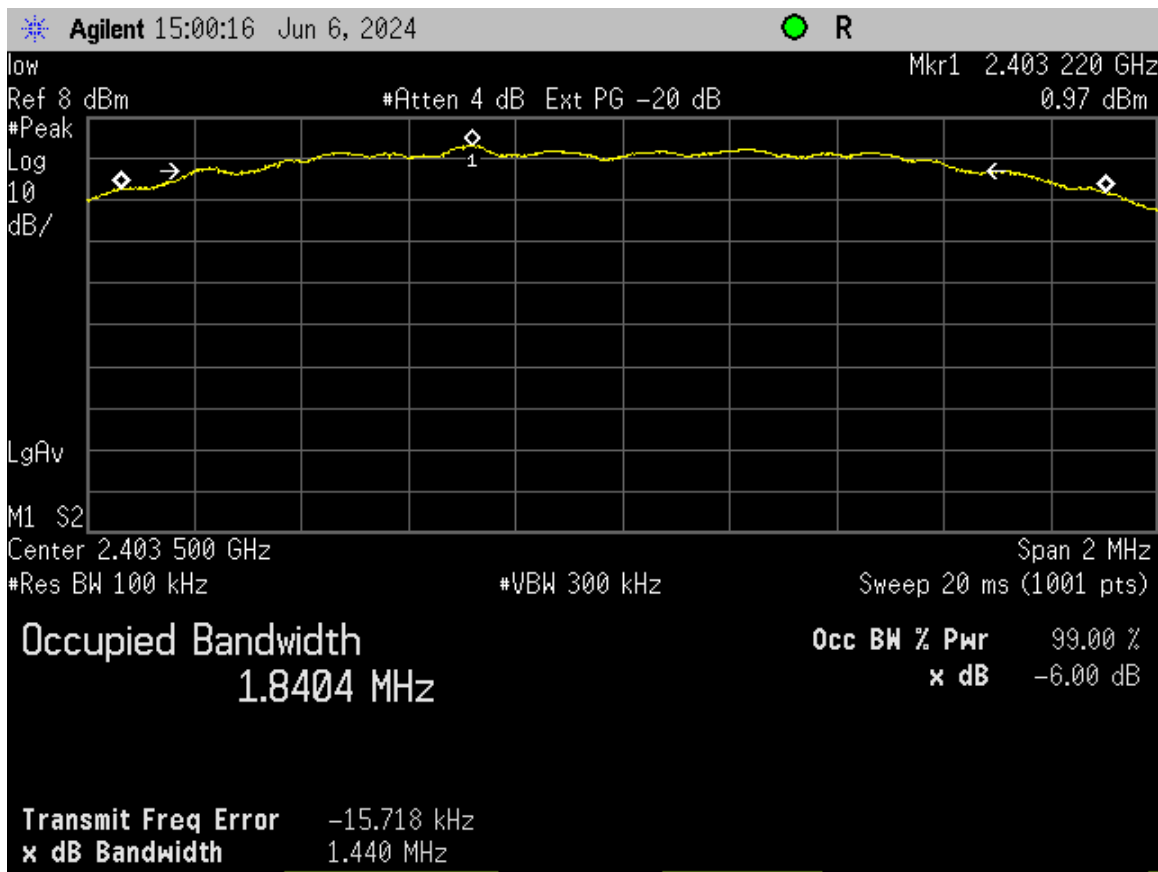


Figure 60. 6 dB Bandwidth Radio 3 Low Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

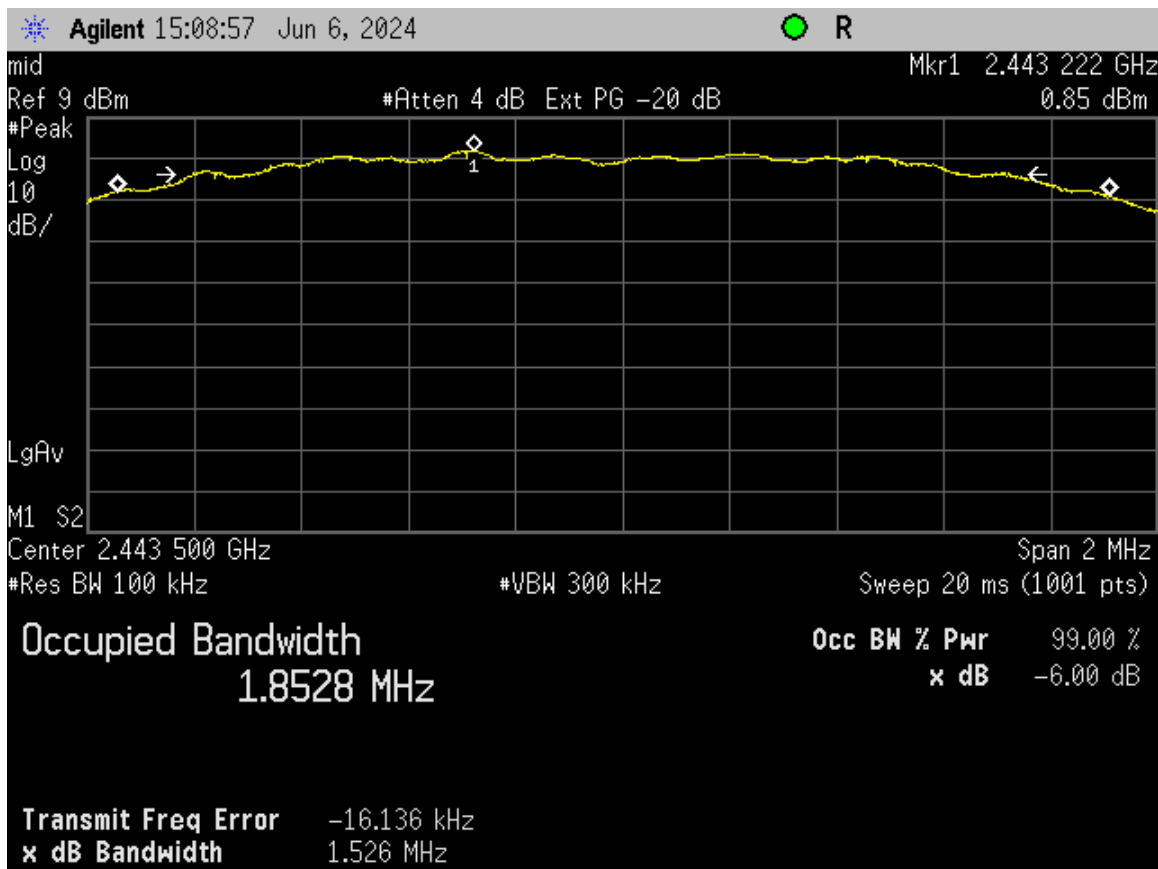


Figure 61. 6 dB Bandwidth Radio 3 Mid Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

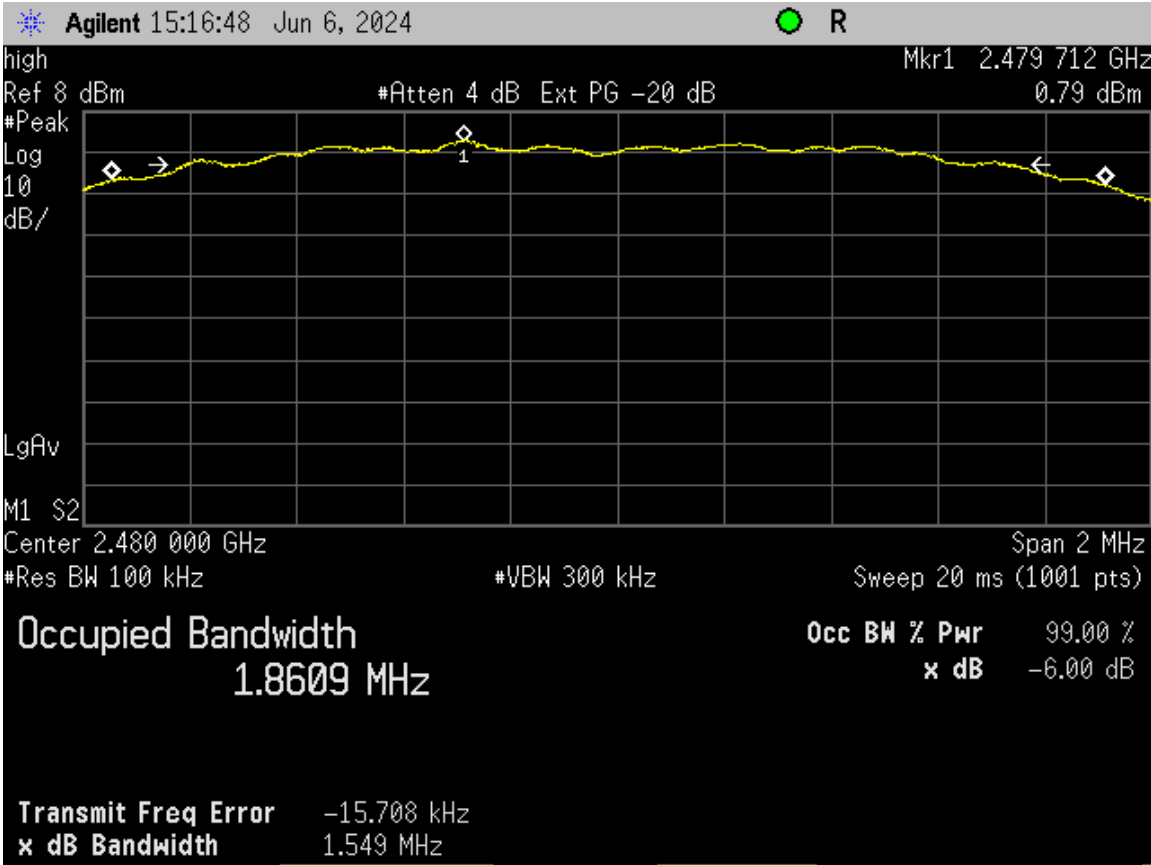


Figure 62. 6 dB Bandwidth Radio 3 High Channel

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

FCC Part 15/IC RSS Certification
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2.13 Occupied Bandwidth, (99% bandwidth) (RSS-GEN (6.6))

The EUT antenna port was connected to a spectrum analyzer having a 50 Ω input impedance. Measurements were performed similar to the method of FCC, KDB Publication No. 558074 v03r05 for a bandwidth of 20 dB. The RBW was set to approximately 1/100 of the manufacturers claimed RBW and with the VBW \geq RBW. The results of this test are given in Table 17 and presented in the figures in section 2.12 above.



Figure 63. Bench Test Setup

Table 12. 99% Occupied Bandwidth

Frequency (MHz)	99% Occupied Bandwidth (MHz)	Radio
2403.5	2.286	1
2443.5	2.300	1
2480.0	2.349	1
2403.5	2.276	2
2443.5	2.301	2
2480.0	2.333	2
2403.5	2.249	3
2443.5	2.279	3
2480.0	2.314	3

Test Date: June 6, 2024

Tested by

Signature: Ian Charboneau

Name: Ian Charboneau

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

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Figure 64. 99% Occupied Bandwidth Radio 1 Low Channel

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

FCC Part 15/IC RSS Certification
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Figure 65. 99% Occupied Bandwidth Radio 1 Mid Channel

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

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Figure 67. 99% Occupied Bandwidth Radio 2 Low Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
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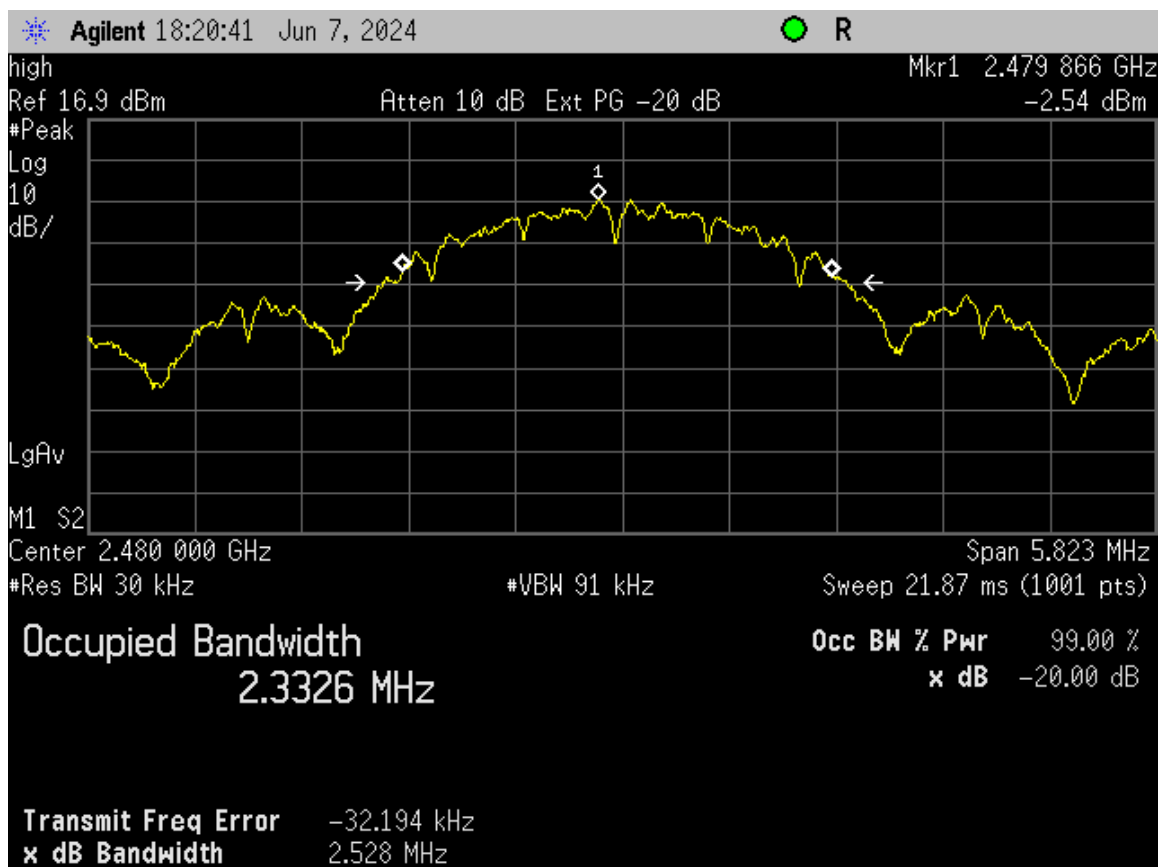


Figure 69. 99% Occupied Bandwidth Radio 2 High Channel

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

FCC Part 15/IC RSS Certification
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Figure 70. 99% Occupied Bandwidth Radio 3 Low Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

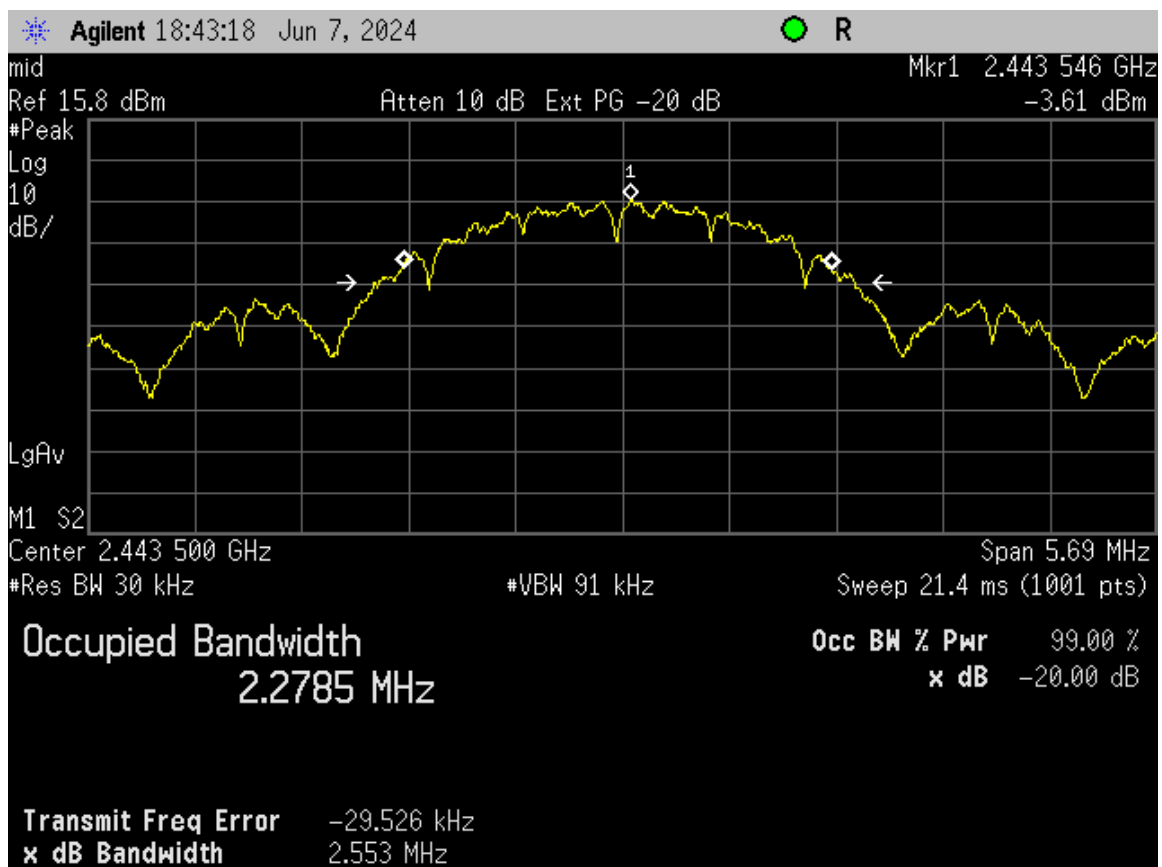


Figure 71. 99% Occupied Bandwidth Radio 3 Mid Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
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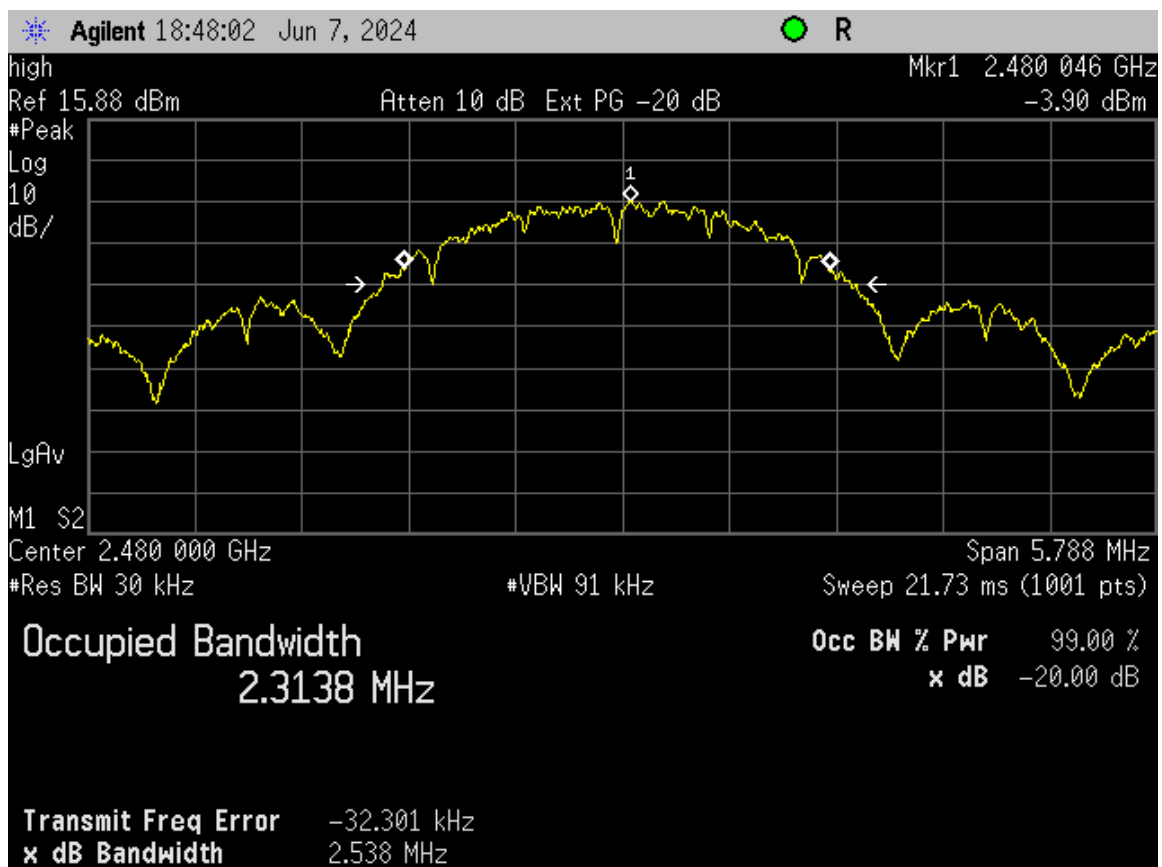


Figure 72. 99% Occupied Bandwidth Radio 3 High Channel

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 the maximum data rate, with 11Mbps for mode B, 54 Mbps for mode G, and MSC-7 for mode N, 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.



Figure 73. Bench Test Setup

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


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Southern States, LLC
ICS/TFDIR Receiver

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)	Radio
2403.5	3.65	2.32	1000	1
2443.5	3.85	2.43	1000	1
2480	3.99	2.51	1000	1
2403.5	3.64	2.31	1000	2
2443.5	3.88	2.44	1000	2
2480	4.03	2.53	1000	2
2403.5	3.21	2.09	1000	3
2443.5	3.46	2.22	1000	3
2480	3.63	2.31	1000	3

Test Date: June 6, 2024

Tested by

Signature: 

Name: Ian Charboneau

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

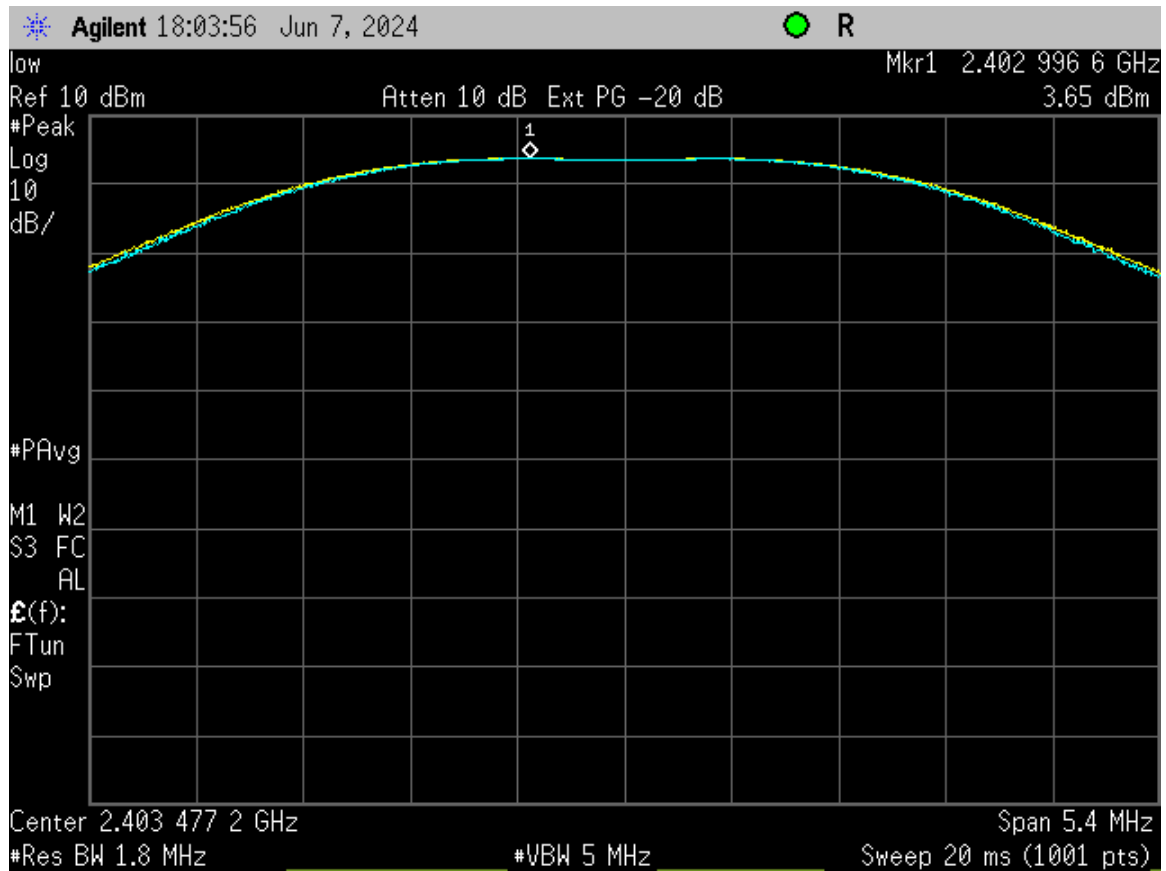


Figure 74. Peak Antenna Conducted Output Power, Radio 1 Low Channel

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

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Figure 75. Peak Antenna Conducted Output Power, Radio 1 Mid Channel

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

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2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
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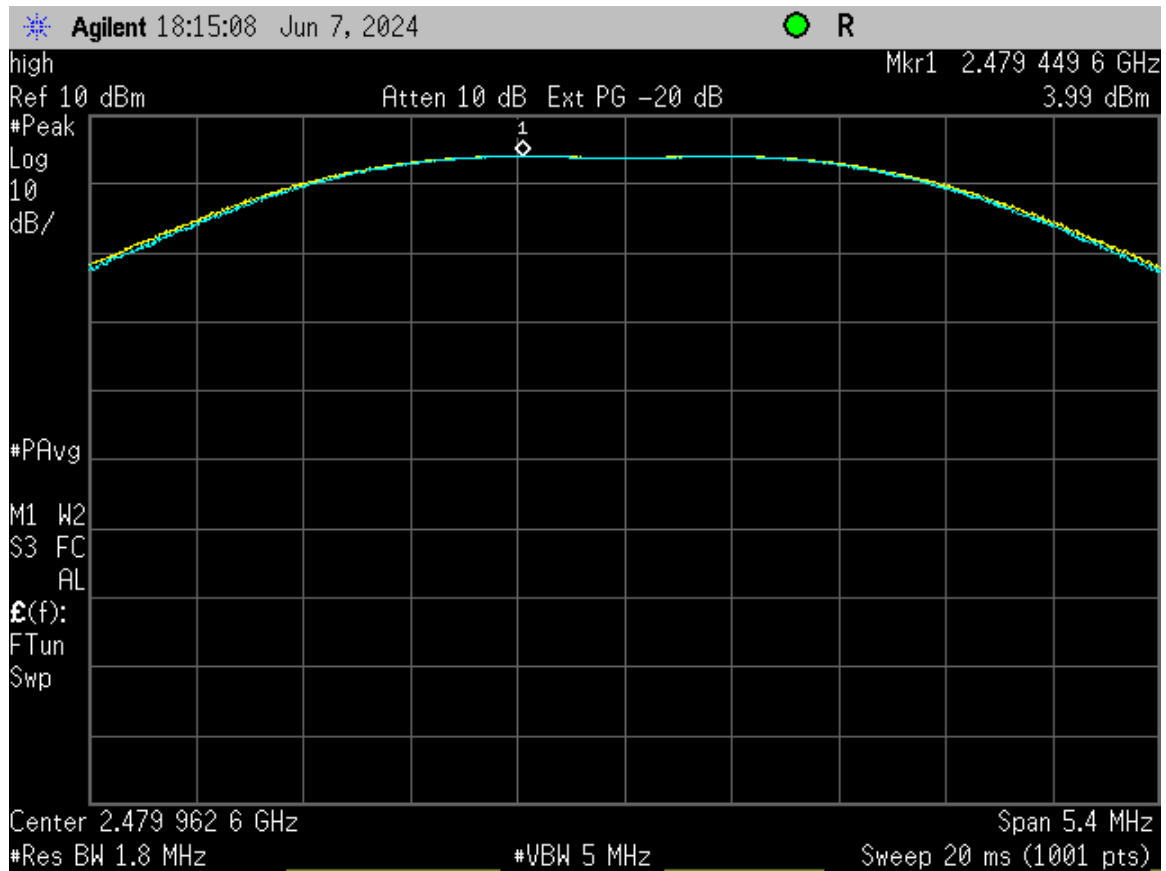


Figure 76. Peak Antenna Conducted Output Power, Radio 1 High Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

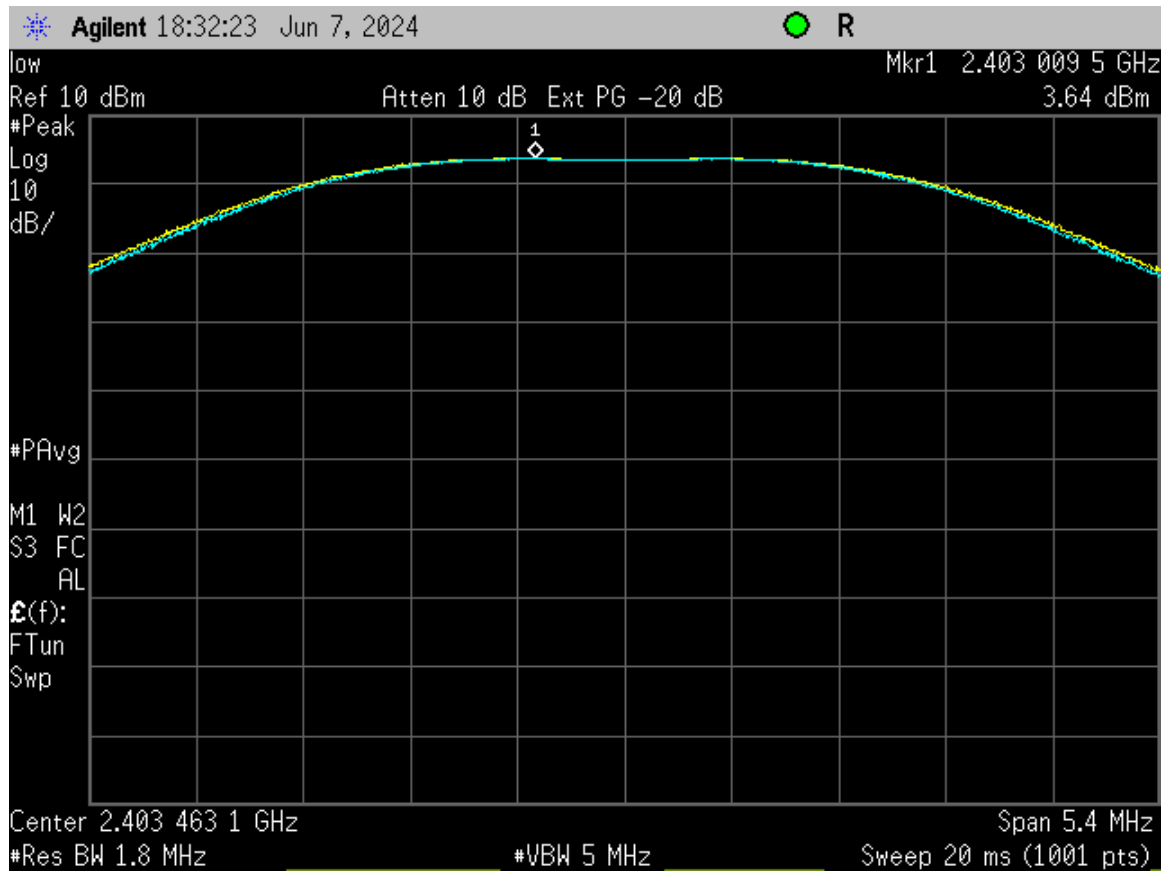


Figure 77. Peak Antenna Conducted Output Power, Radio 2 Low Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

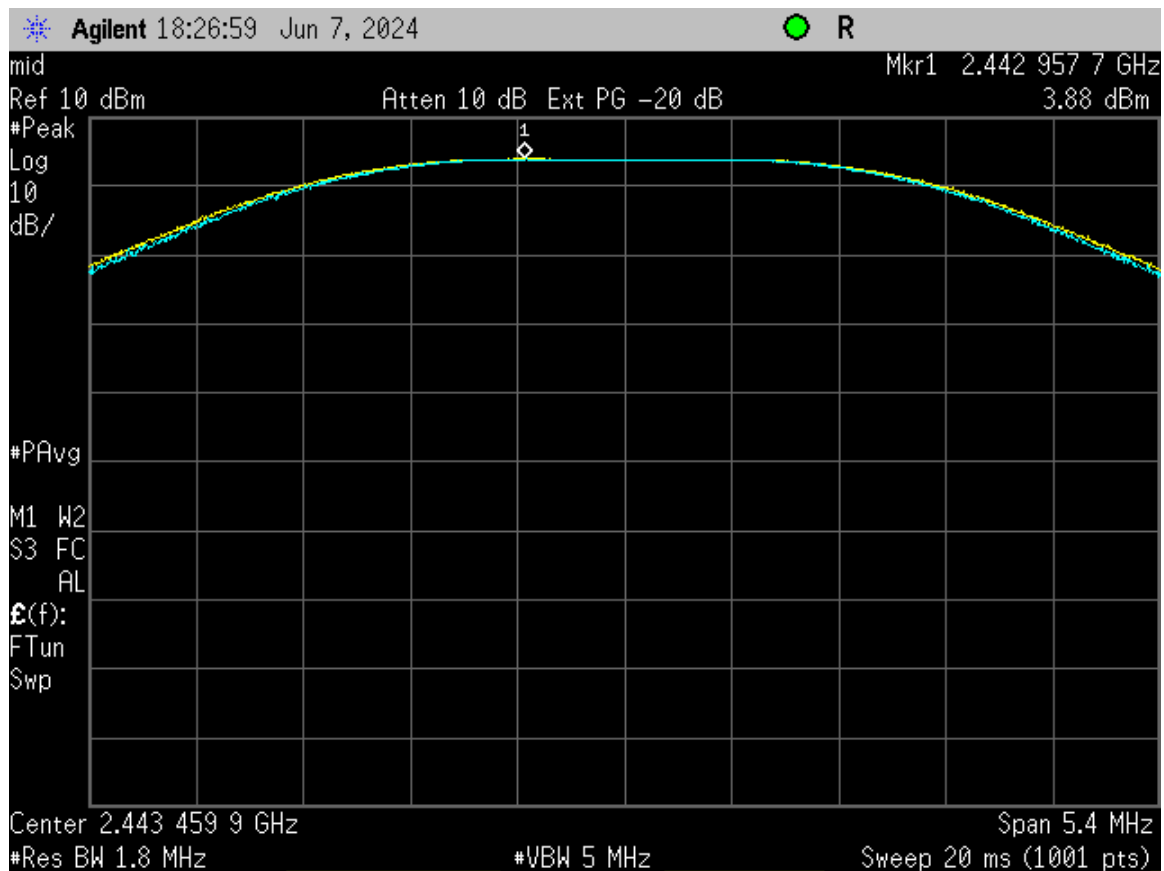


Figure 78. Peak Antenna Conducted Output Power, Radio 2 Mid Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

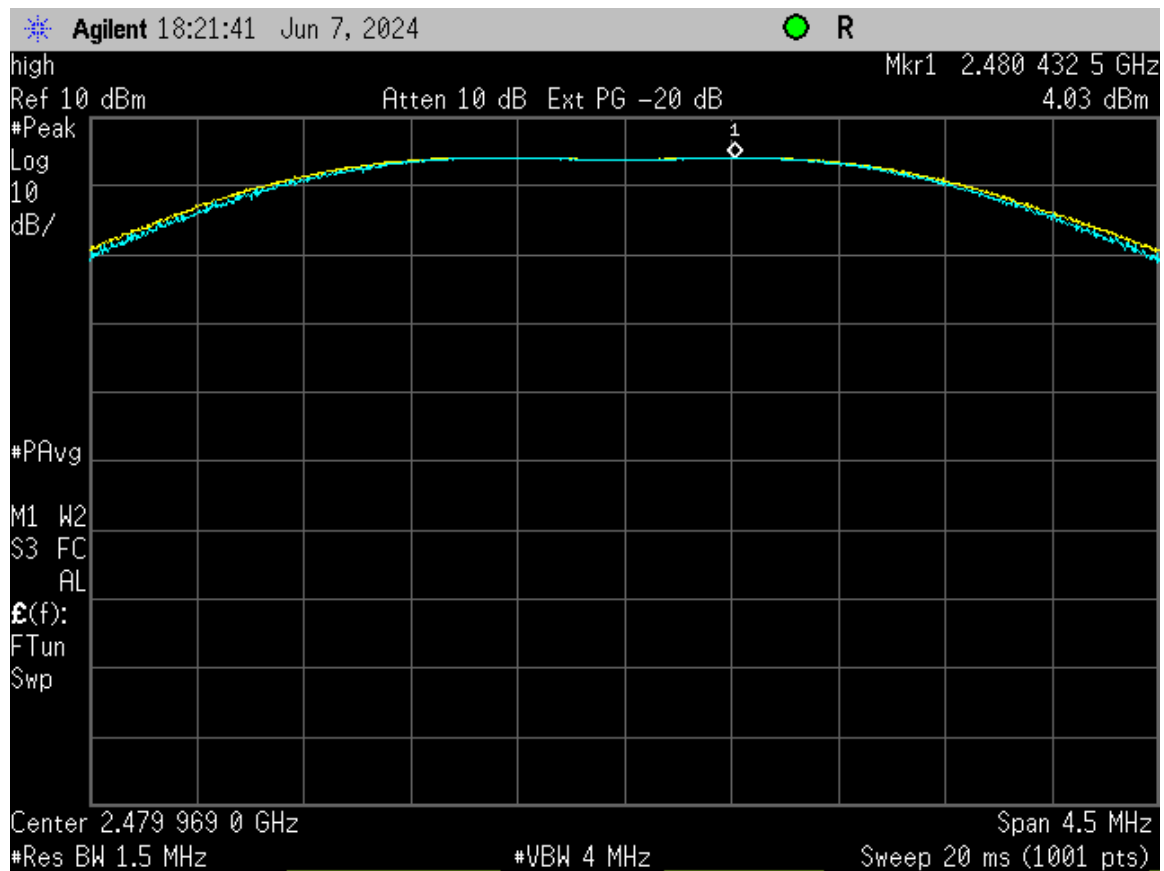


Figure 79. Peak Antenna Conducted Output Power, Radio 2 High Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
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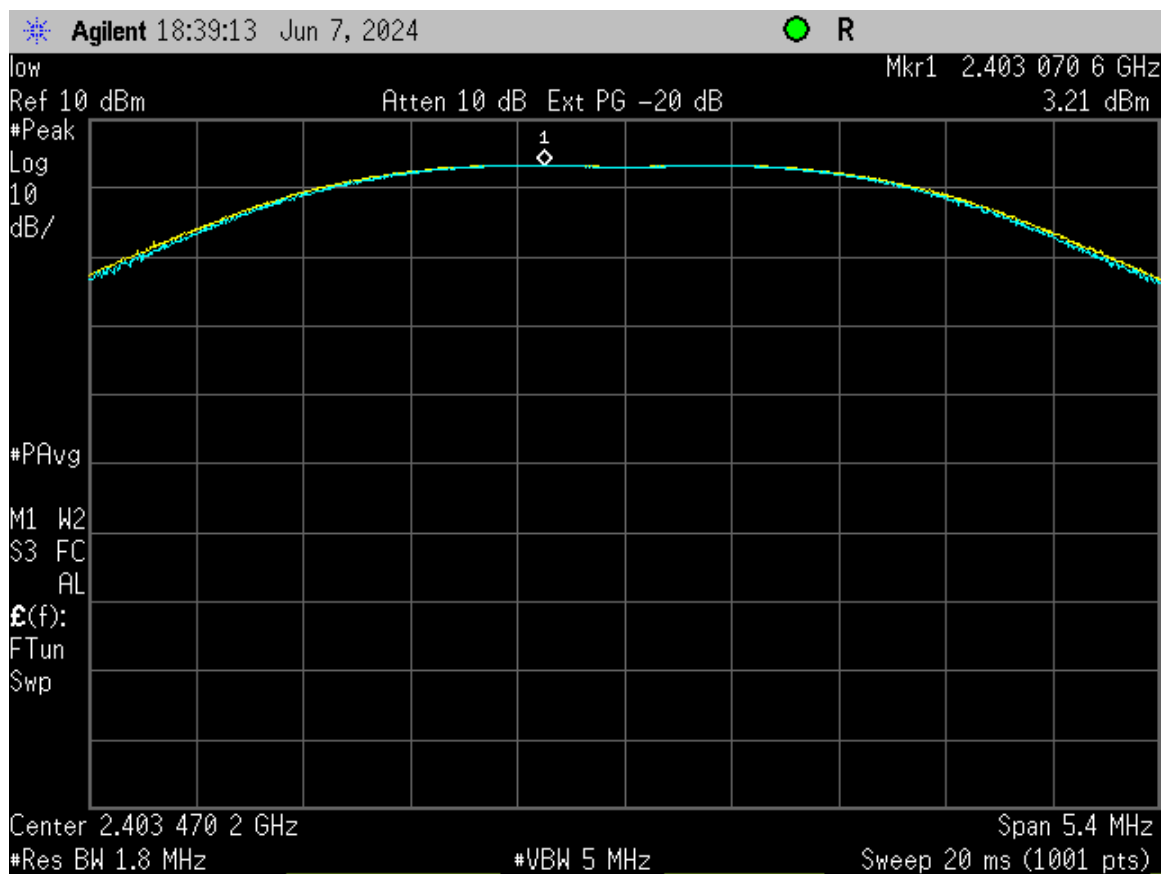


Figure 80. Peak Antenna Conducted Output Power, Radio 3 Low Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
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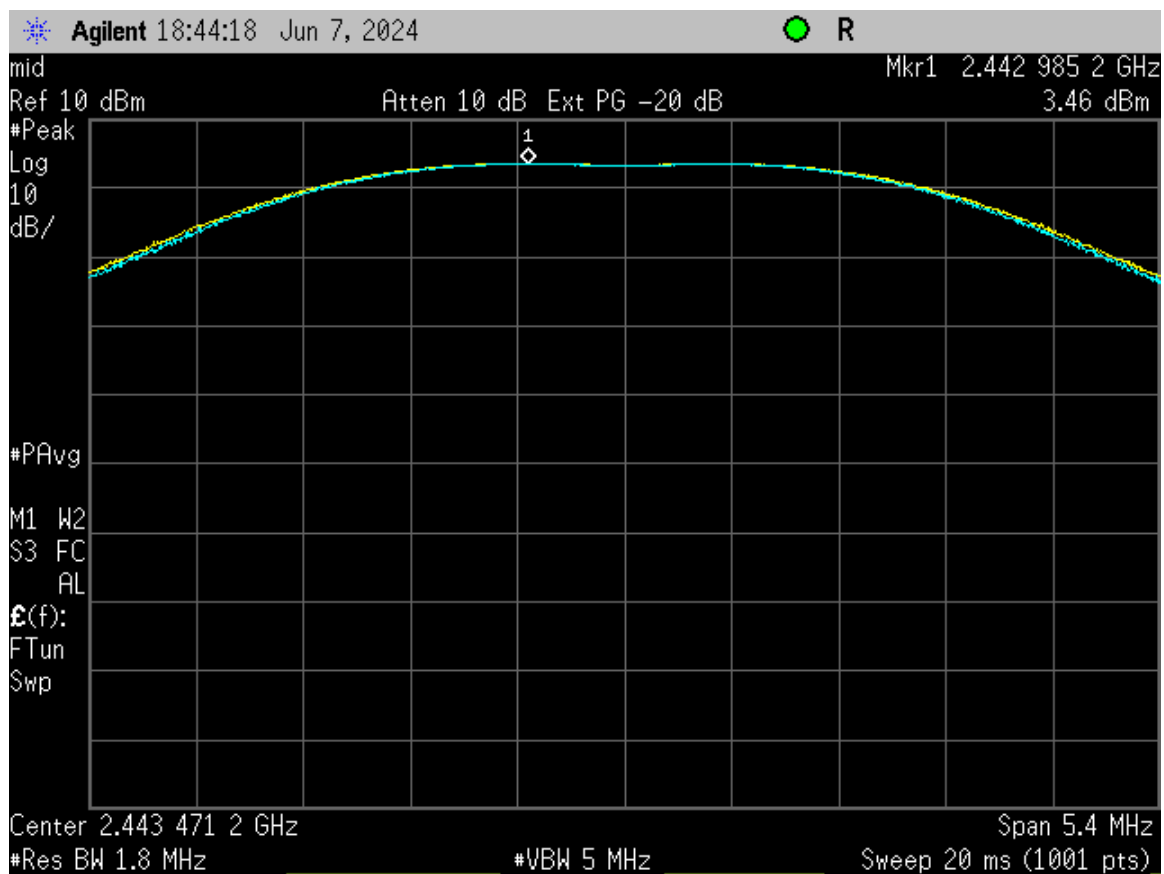


Figure 81. Peak Antenna Conducted Output Power, Radio 3 Mid Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
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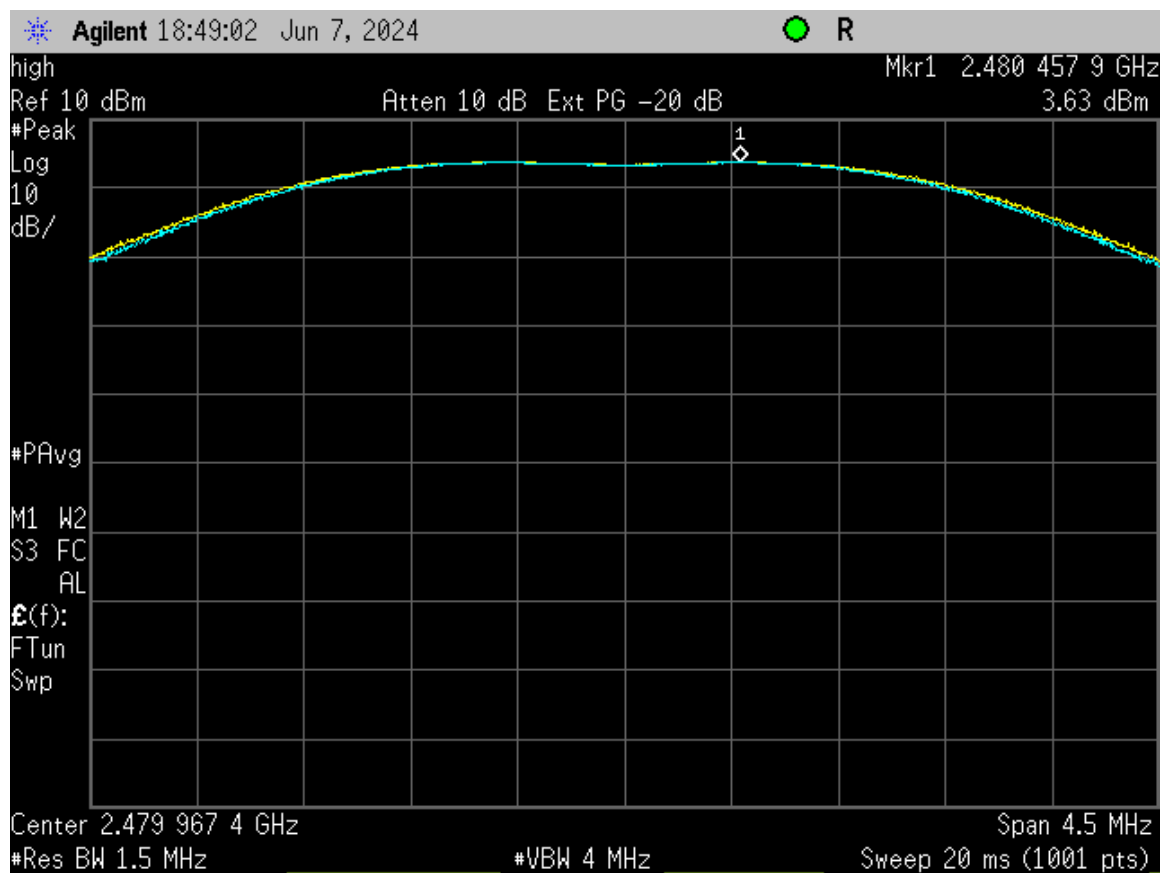


Figure 82. Peak Antenna Conducted Output Power, Radio 3 High Channel

2.15 Power Spectral Density (CFR 15.247(e), RSS-247, 5.2(b))

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 below.



Figure 83. Bench Test Setup

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

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

Frequency (MHz)	Measured Result (dBm/3kHz)	FCC Limit (dBm/3 kHz)	Radio
2403.5	-5.12	+8.0	1
2443.5	-2.89	+8.0	1
2480	-2.75	+8.0	1
2403.5	-2.66	+8.0	2
2443.5	-3.05	+8.0	2
2480	-2.30	+8.0	2
2403.5	-3.43	+8.0	3
2443.5	-3.40	+8.0	3
2480	-3.61	+8.0	3

Note: dBm/Hz correct to dBm/kHz using the following formula, 10 log RBW ref/RBW measured.

Test Date: June 6, 2024

Tested by

Signature: 

Name: Ian Charboneau

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
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24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

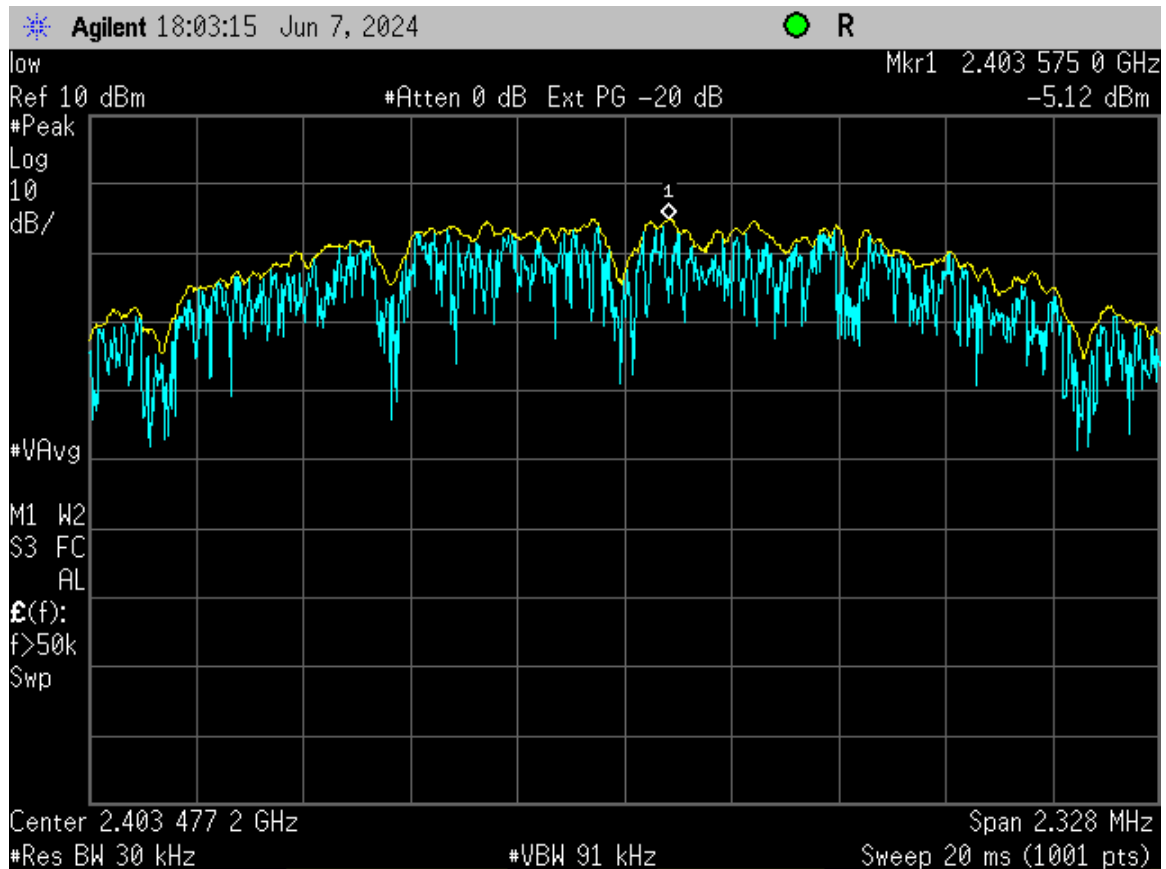


Figure 84. Power Spectral Density, Radio 1 Low Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
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24-0098
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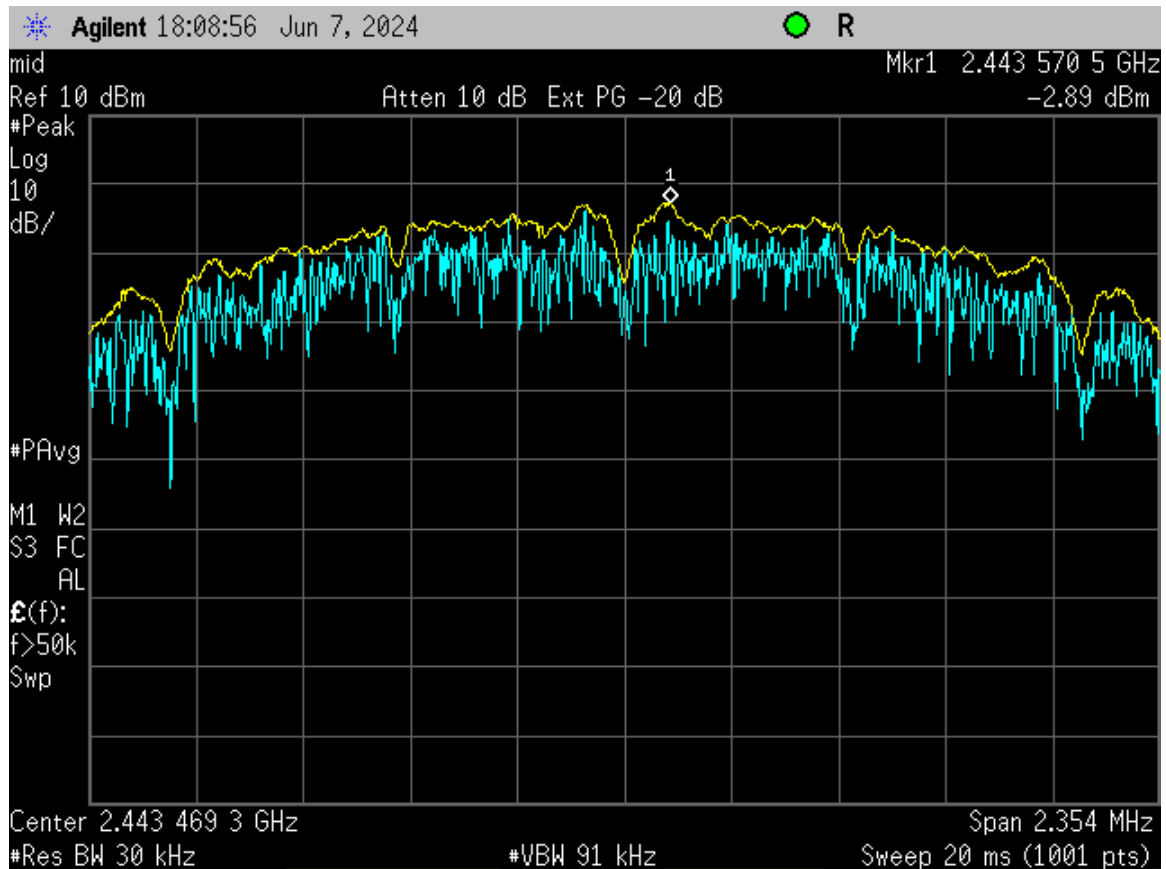


Figure 85. Power Spectral Density, Radio 1 Mid Channel

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

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2ADWT-ICSR01
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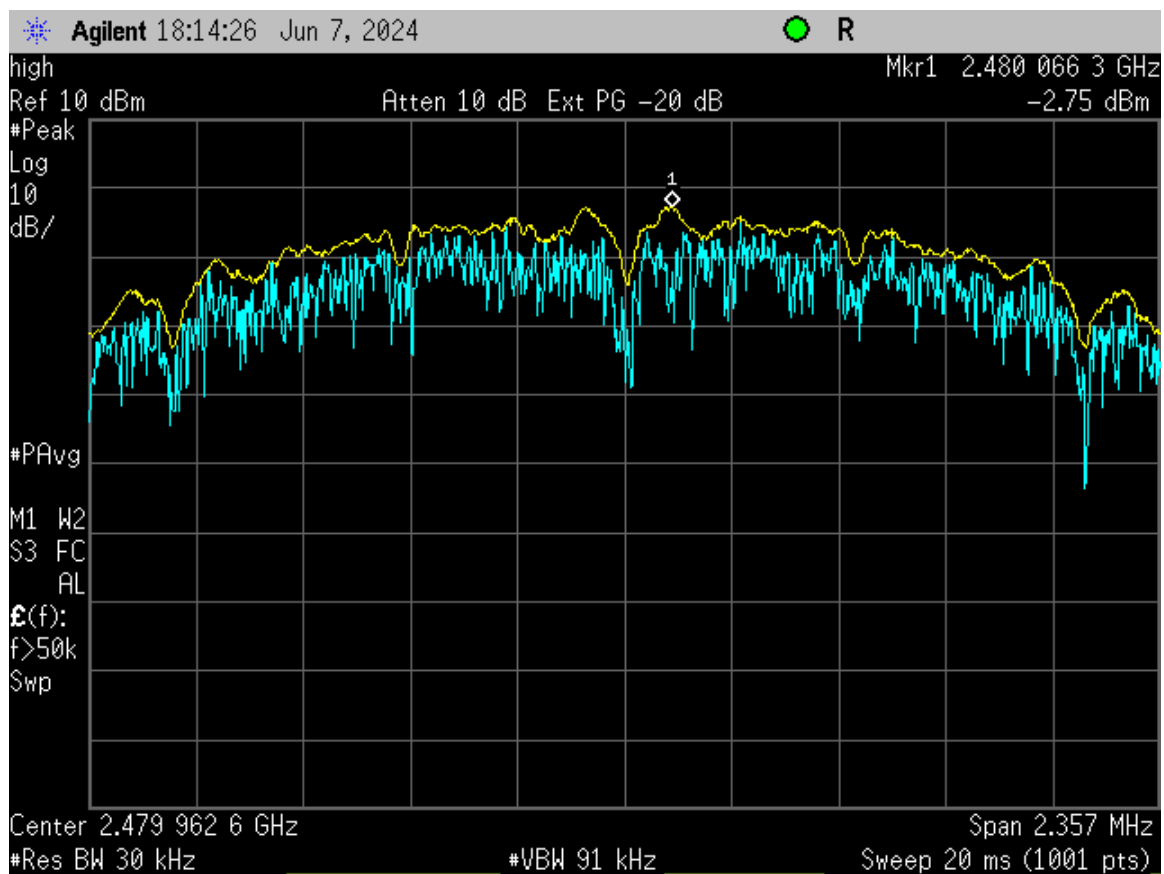


Figure 86. Power Spectral Density, Radio 1 High Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
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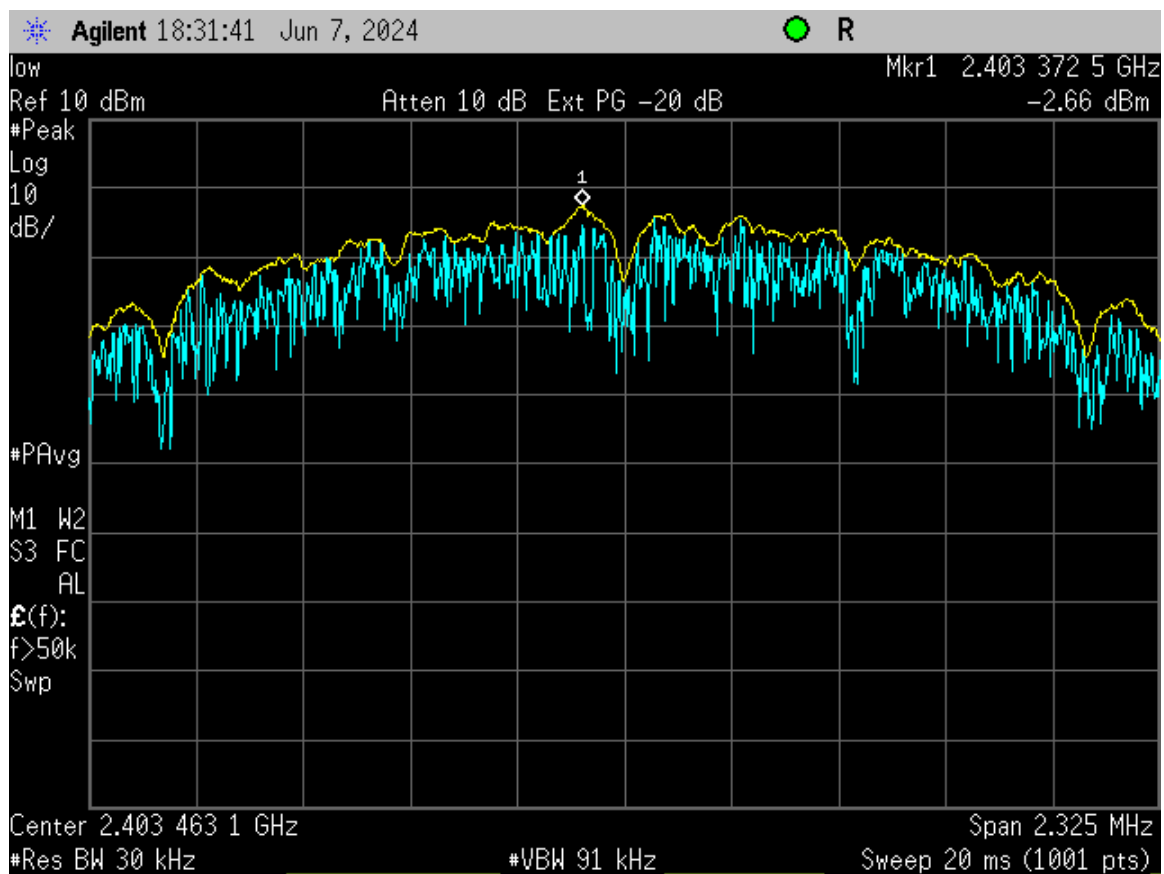


Figure 87. Power Spectral Density, Radio 2 Low Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
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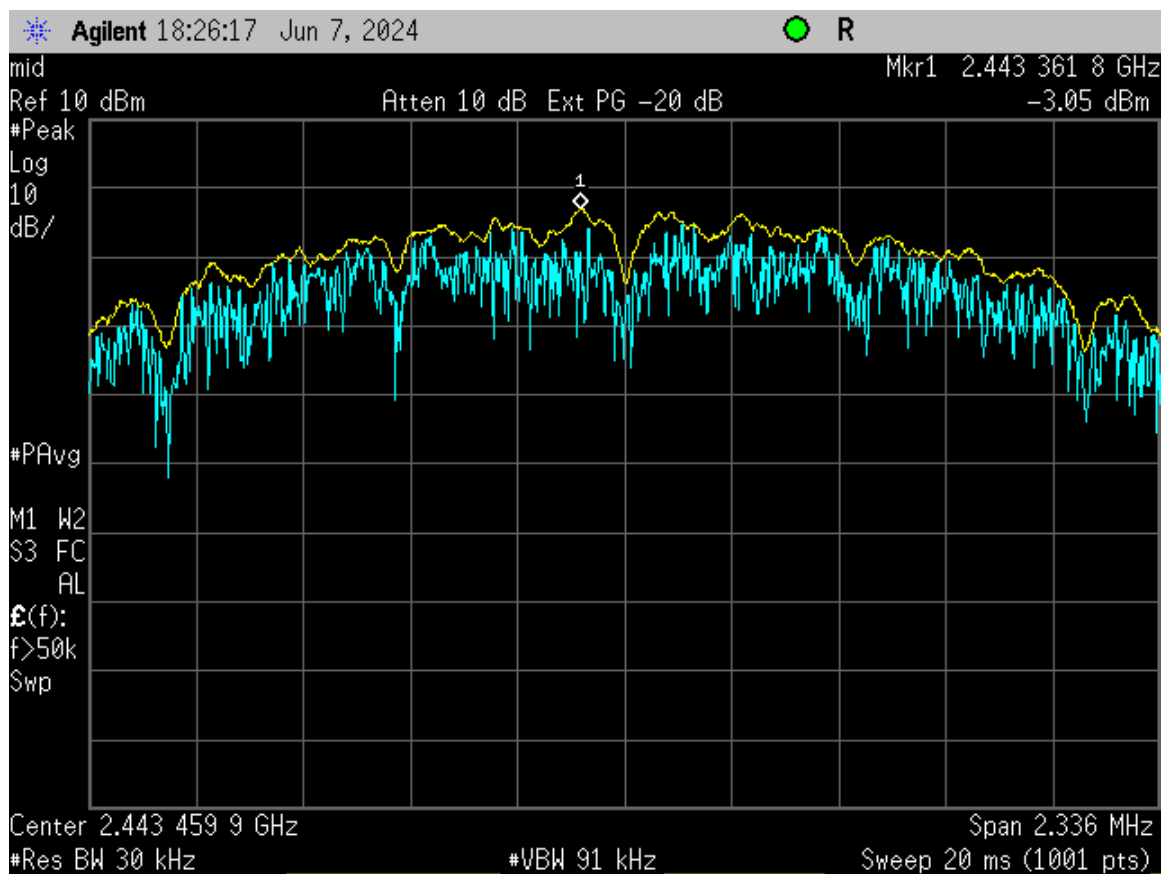


Figure 88. Power Spectral Density, Radio 2 Mid Channel

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

FCC Part 15/IC RSS Certification
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Figure 89. Power Spectral Density, Radio 2 High Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
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Southern States, LLC
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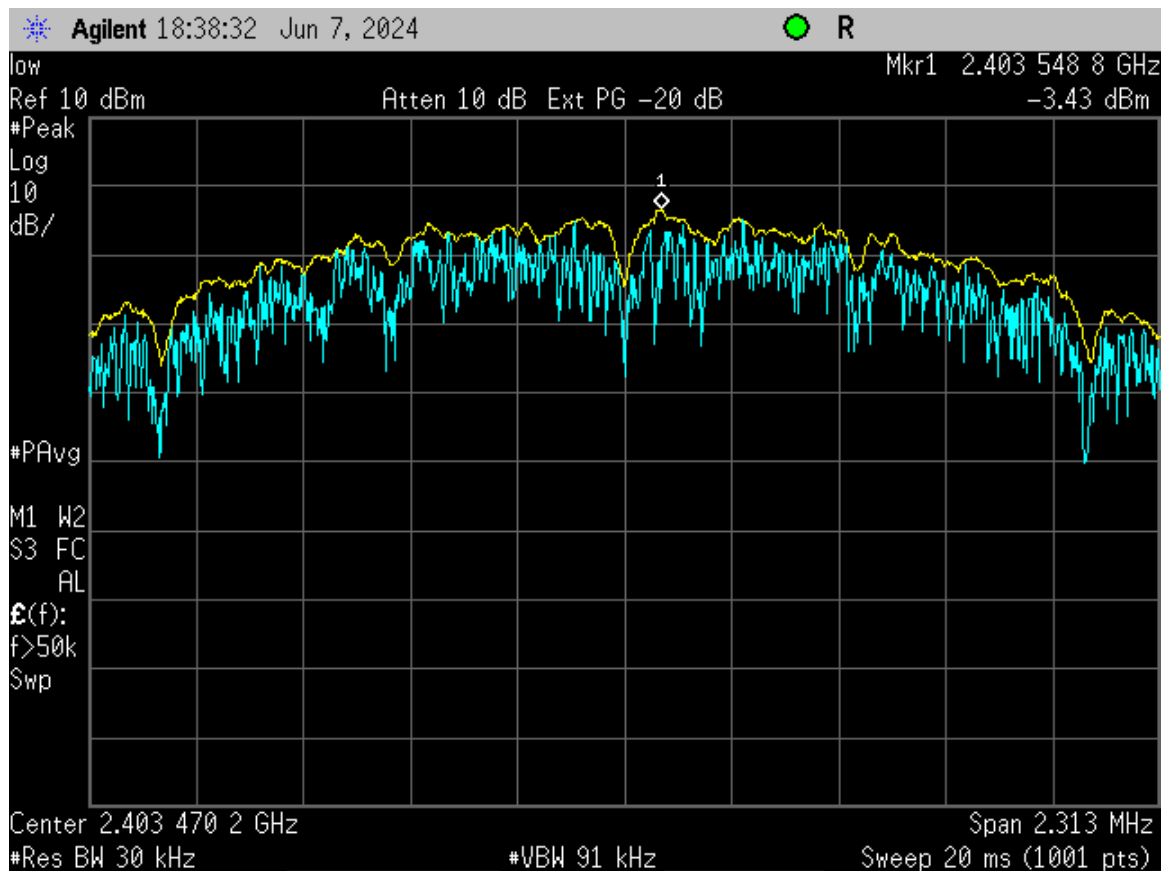


Figure 90. Power Spectral Density, Radio 3 Low Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
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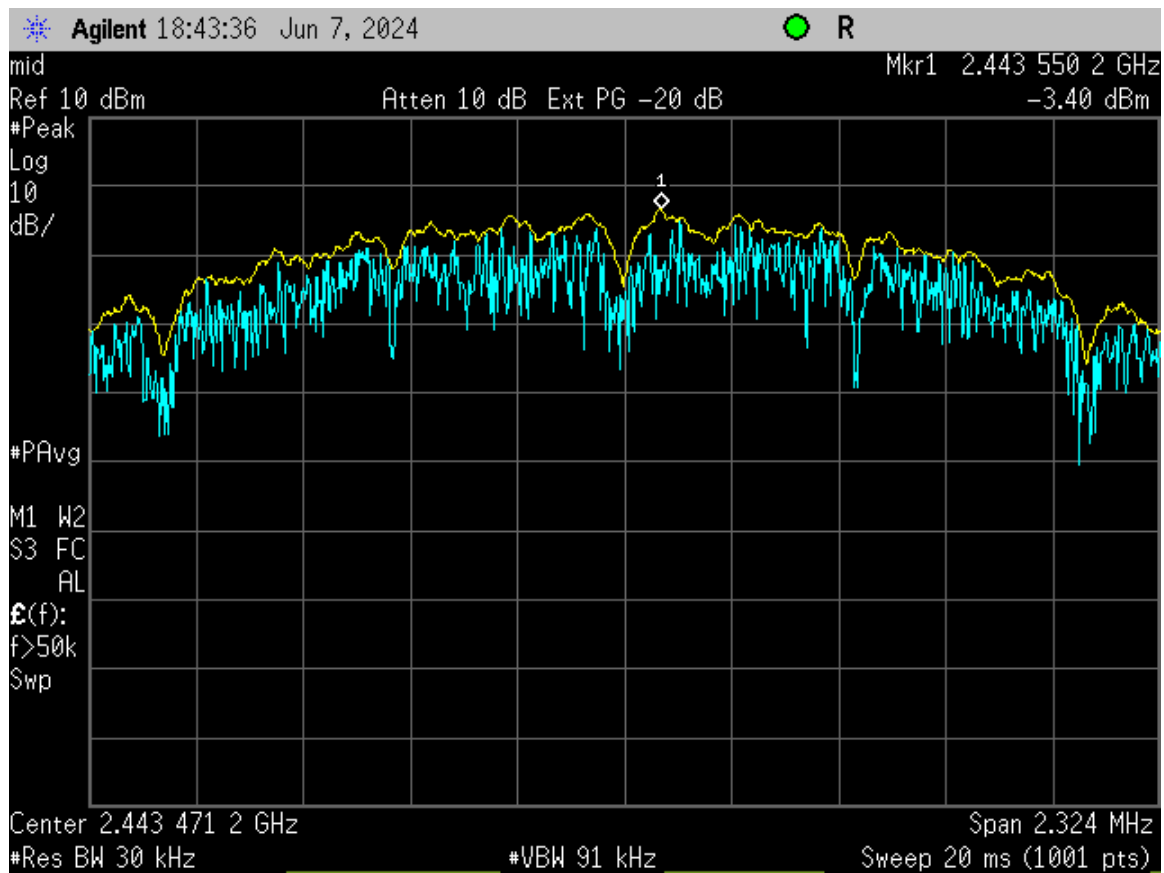


Figure 91. Power Spectral Density, Radio 3 Mid Channel

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
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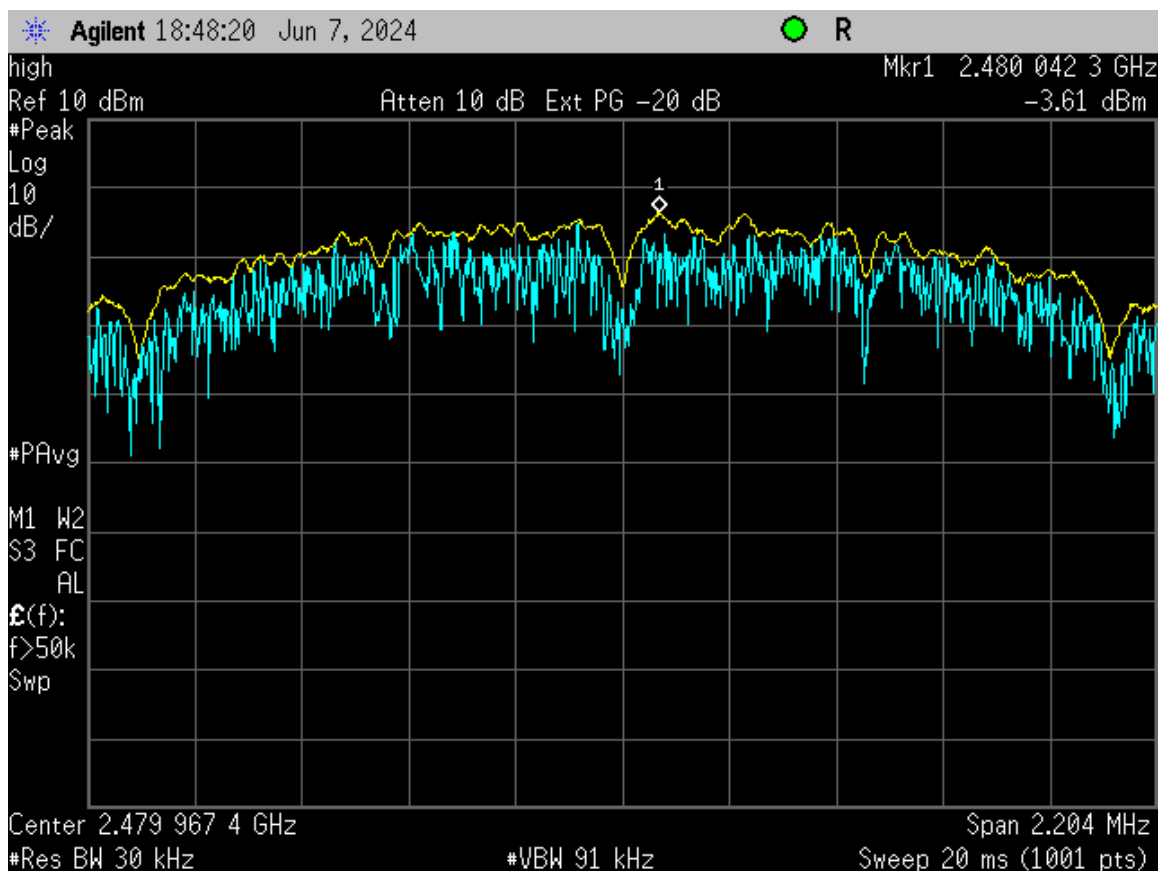


Figure 92. Power Spectral Density, Radio 3 High Channel

2.16 Intentional Radiator Power Lines Conducted Emissions (CFR 15.207, RSS-Gen 8.8)

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 8.23 dB from the applicable limit. All other emissions were at least 13.3 dB from the limit. Those results are given in the table below.

Table 15. Power Line Conducted Emissions

Conducted Emissions 150 kHz to 30 MHz						
Frequency (MHz)	Test Data (dBuV)	LISN+CL (dB)	Corrected Results (dBuV)	AVG Limits (dBuV)	Margin (dB)	Detector
Phase @ 120 Vac / 60Hz						
0.151	41.84	0.27	42.11	56	13.89	PK
0.543	37.32	0.45	37.77	46	8.23	PK
1.61	31.94	0.42	32.36	46	13.64	PK
6.24	30.01	0.4	30.41	50	19.59	PK
11.58	44.74	0.61	45.35	60*	14.65	QP
11.58	24.22	0.61	24.83	50	25.17	AVG
12.33	51.82	0.77	52.59	60*	7.41	PK
12.33	21.02	0.77	21.79	50	28.21	AVG
19.75	48.45	1.06	49.51	60*	10.49	PK
19.75	19.6	1.06	20.66	50	29.34	AVG
Neutral @ 120 Vac / 60Hz						
0.232	41.95	0.32	42.27	56	13.73	PK
0.529	42.82	0.73	43.55	46	2.45	PK
1.00	35.53	0.29	35.82	46	10.18	PK
6.11	35.27	0.58	35.85	50	14.15	PK
11.68	49.9	0.88	50.78	60*	9.22	QP
11.68	35.82	0.88	36.70	50	13.3	AVG
20.13	49.82	1.45	51.27	60*	8.73	PK
20.13	22.08	1.45	23.53	50	26.47	AVG

Note(*): Indicates Quasi-peak Limit

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Southern States, LLC
ICS/TFDIR Receiver

Sample Calculation At: 0.151 MHz

Magnitude of Measured Frequency	41.84	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	0.27	dB
Corrected Result	42.11	dBuV

Test Date: June 11, 2024

Tested by

Signature: Ian Charboneau

Name: Ian Charboneau

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
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2.17 Intentional Radiator, Radiated Emissions (CFR 15.209, RSS-Gen, 8.9)

The test data provided 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.

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 360 degrees and raising and lowering the receiving antenna between 1 to 4 meters as a part of the measurement procedure.

The worst-case radiated emission was greater than 20.0 dB below the specification limit. The results are shown in the table following. These results are meant to show that this EUT has met the intentional transmitter requirements of CFR Part 15.209.

For collocation compliance, all radios were on and transmitting during testing. Emissions recorded are representative of worst-case collocated operation.

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Test Report Number:
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Customer:
Model:

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

Test: FCC Part 15.209							
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP/AVG
21.5*	40.92	9.23	50.15	70*	3m/x	19.85	PK
21.5*	37.10	9.23	46.33	50	3m/x	3.67	QP
All other emissions were more than 20 dB below the applicable limit.							

Note(*):Emission is not in restricted Band, sufficiently attenuated below Fundamental

AF = antenna factor.


CL = cable loss.

PA = preamplifier gain.

Sample Calculation: N/A

Test Date: June 6, 2024

Tested by

Signature: 

Name: Ian Charboneau

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

FCC Part 15/IC RSS Certification
2ADWT-ICSR01
12660A-ICSR01
24-0098
June 18, 2024
Southern States, LLC
ICS/TFDIR Receiver

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

Test: FCC Part 15.209							
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP/AVG
62.65	47.83	-15.24	32.59	40.0	3m./HORZ	7.4	PK
92.75	50.01	-15.10	34.91	43.5	3m./HORZ	8.6	PK
144.25	43.99	-11.87	32.12	43.5	3m./HORZ	11.4	PK
191.60	44.93	-9.75	35.17	43.5	3m./HORZ	8.3	PK
31.9	46.20	-11.27	34.93	40.0	3m./VERT	5.1	PK
35.15	48.15	-11.91	36.25	40.0	3m./VERT	3.8	PK
38.15	48.62	-12.21	36.42	40.0	3m./VERT	3.6	PK
59.5	52.47	-15.85	36.61	40.0	3m./VERT	3.4	PK
62.65	52.31	-15.84	36.47	40.0	3m./VERT	3.5	QK
90.15	48.64	-14.47	34.17	43.5	3m./VERT	9.3	PK
120.35	51.07	-12.58	38.49	43.5	3m./VERT	5.0	PK
184.9	48.05	-9.69	38.36	43.5	3m./VERT	5.1	PK
486.43	38.09	-6.63	31.46	46.0	3m./VERT	14.5	PK
590.22	37.06	-5.08	31.97	46.0	3m./VERT	14.0	PK
746.36	39.69	-2.64	37.05	46.0	3m./VERT	8.9	PK
878.01	34.48	-1.35	33.13	46.0	3m./VERT	12.9	PK

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

Sample Calculation At: 62.65MHz

Magnitude of Measured Frequency	47.83	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	-15.24	dB
Corrected Result	32.59	dBuV/m

Test Date: June 6, 2024

Tested by
Signature: 

Name: Ian Charboneau

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

FCC Part 15/IC RSS Certification
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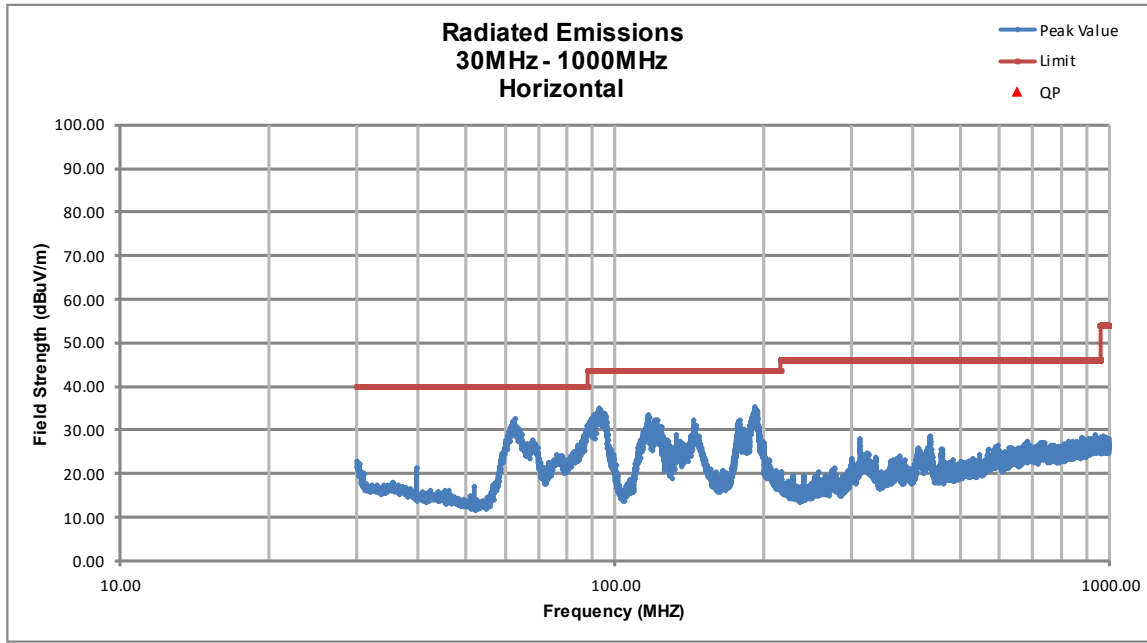


Figure 93. Radiated Emission, 30 MHz - 1000 MHz – Horizontal

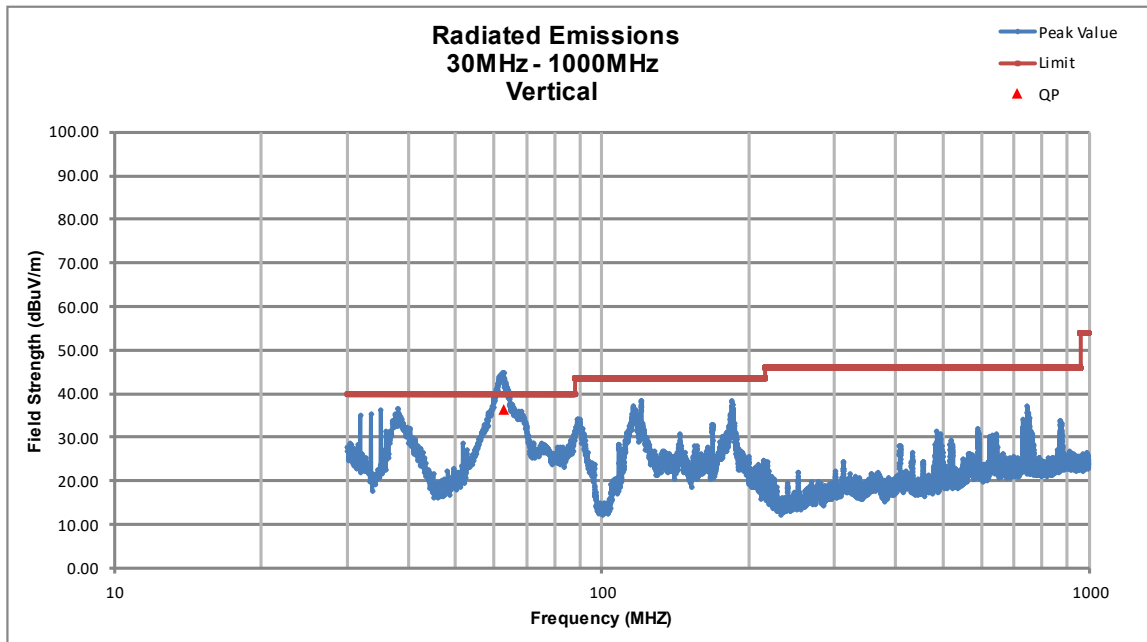


Figure 94. Radiated Emissions, 30 MHz - 1000 MHz – Vertical

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: FCC Part 15.209							
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP/AVG
Except for Fundamental and Harmonics emissions, all other emissions are more than 20 dB below the applicable limit.							

Test Date: June 6, 2024

Tested by

Signature: 

Name: Ian Charboneau

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

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2.18 Measurement Uncertainty

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

2.18.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ± 2.85 dB.

2.18.2 Radiated Emissions Measurement Uncertainty

For a measurement distance of 3m, the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ± 5.2 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 ± 5.2 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ± 5.2 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.