



Compliance
Test
Services

623 E. 100 S.
Salt Lake City, UT 84102

Test Report Certification

FCC ID	2AJAC-CORE5
IC ID	7848A-CORE5
Equipment Under Test	C4-CORE5
Test Report Serial Number	TR7803_02
Date of Test(s)	November 16 through November 22, 2022
Report Issue Date	20 January 2023

Test Specification	Applicant
47 CFR FCC Part 15, Subpart C RSS-GEN	Snap One LLC 1800 Continental Blvd., Suite 200-300 Charlotte NC 28273 U.S.A.



NVLAP LAB CODE 600293-0



Certification of Engineering Report

This report has been prepared by Compliance Test Services (CTS) to document compliance of the device described below with the requirement of Federal Communication Commissions (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

Applicant	Snap One LLC
Manufacturer	Snap One LLC
Brand Name	Control 4
Model Number	C4-CORE5
FCC ID	2AJAC-CORE5
IC ID	7848A-CORE5

On this 20th day of January 2023, I individually and for Compliance testing Services certify that the statements made in this engineering report are true, complete and correct to the best of my knowledge and are made in good faith.

Although NVLAP has accredited the CTS testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the U.S. federal government.

Compliance testing Services

Written By: Clay Allred

Reviewed By: Joseph W. Jackson



Revision History		
Revision	Description	Date
01	Original Report Release	9 January 2023
02	Updated antenna and added FCC and ISED site identifier	20 January 2023



Table of Contents

1	Client Information.....	5
1.1	Applicant.....	5
1.2	Manufacturer.....	5
2	Equipment Under Test (EUT).....	6
2.1	Identification of EUT.....	6
2.2	Description of EUT.....	6
2.3	EUT and Support Equipment.....	7
2.4	Interface Ports on EUT.....	8
2.5	Operating Environment.....	8
2.6	Operating Modes.....	9
2.7	EUT Exercise Software.....	9
2.8	Block Diagram of Test Configuration.....	9
2.9	Modification Incorporated/Special Accessories on EUT.....	9
2.10	Deviation, Opinions Additional Information or Interpretations from Test Standard.....	9
3	Test Specification, Method and Procedures.....	10
3.1	Test Specification.....	10
3.2	Methods & Procedures.....	10
3.3	FCC Part 15, Subpart C.....	10
3.4	Results.....	11
3.5	Test Location.....	11
4	Test Equipment.....	12
4.1	Conducted Emissions at Mains Ports.....	12
4.2	Direct Connect at the Antenna Port Tests.....	13
4.3	Radiated Emissions.....	14
4.4	Equipment Calibration.....	14
4.5	Measurement Uncertainty.....	15
5	Test Results.....	16
5.1	§15.203 Antenna Requirements.....	16
5.2	Conducted Emissions at Mains Ports Data.....	17
5.3	§15.247(a)(2).....	19
5.4	§15.247(b)(3) Maximum Average Output Power.....	21
5.5	§15.247(d) Spurious Emissions.....	22
5.6	§15.247(e) Maximum Average Power Spectral Density.....	25



1 Client Information

1.1 Applicant

Company	Snap One LLC 1800 Continental Blvd., Suite 200-300 Charlotte NC 28273 U.S.A.
Contact Name	Roger Midgley
Title	Principle Compliance Manager

1.2 Manufacturer

Company	Snap One LLC 1800 Continental Blvd., Suite 200-300 Charlotte NC 28273 U.S.A.
Contact Name	Roger Midgley
Title	Principle Compliance Manager



2 Equipment Under Test (EUT)

2.1 Identification of EUT

Brand Name	Snap One LLC
Model Number	C4-CORE5
Hardware Version	Rev 4.0
Serial Number / MAC Address	ST21520017036F13, 000FFF0C3313
Rating/power supply	Input: AC 100V-240 VAC,50Hz/60Hz, Max 18W, Idle 9W, and PoE+
RCB revision	Rev 4.0
Schematic revision	Rev 4.0
Firmware/Software revision	3.3.0.618634
Dimensions (mm)	42 x 442 x 252

2.2 Description of EUT

The C4-CORE5 is a home entertainment controller, used to control home entertainment and home automation which features five independent audio outputs – three digital coaxial, three unbalanced stereo analog, one HDMI Out, wireless Zigbee and Z-wave communications, IR, serial, contacts and relays, and IP control. It also features a USB 3.0 connection for connection to external hard drives and a gigabit LAN port. It is powered via the AC mains and an internal 100-240Vac, 50/60Hz power supply.

The highest internal clocks or internal clock frequency on the EUT is the 2.4 GHz Zigbee wireless clock, and the internal system clock of 1.6 GHz.

This report covers the circuitry of the device subject to FCC Part 15, Subpart C. The circuitry of the device subject to FCC Part 15 Subpart B was found to be compliant and is covered under a separate Compliance Test Services test report.



2.3 EUT and Support Equipment

The EUT and support equipment used during the test are listed below.

Brand Name Model Number Serial Number	Description	Name of Interface Ports / Interface Cables
BN: Snap One LLC MN: C4-CORE5 SN: ST21520017036F13	Home Entertainment Controller	EUT
BN: Control4 MN: C4-EA3 SN: N/A	Controller	Network/Cat 5e Cable
BN: Samsung MN: UN43NU6900BXZA SN:09643CPMB13335K	4K TV	HDMI, Blue Jeans Cable
BN: Unifi MN: USW-Lite-8-PoE SN: 245A4C7BAD51	Network switch + PoE Injector	Network/Cat 5e Cable

Notes: (1) EUT

(2) Interface port connected to EUT (See Section 2.4)

The support equipment listed above was not modified in order to achieve compliance with this standard.



2.4 Interface Ports on EUT

Name of Ports	No. of Ports Fitted to EUT	Shielded Cable	Ferrite Core Installed	Cable Description/Length
Contact	1	No	No	Phoenix Contact connector w/12 unshielded conductors/1 meter
Relay	1	No	No	Phoenix Contact connector w/12 unshielded conductors/1 meter
Ethernet	1	No	No	Cat 5e/5 meters
HDMI Out	1	Yes	No	1 meter
USB (3.0)	1	Yes	No	USBA extension cable to USB flash drive/1 meter
Serial	2	No	No	Shielded cable with DB9 connectors/1 meter
IR Sensors	8	No	No	IR transmitters with unshielded cables with mono jacks/2 meters
Digital In	1	Yes	No	Cables with RCA connector/1 meter
Digital Out	3	Yes	No	Cables with RCA connector/1 meter
Analog Audio In (Left and Right)	2	Yes	No	Cables with RCA connector/1 meter
Analog Audio Out (Left and Right)	2	Yes	No	Cables with RCA connector/1 meter
802.15.4 Antenna	1	--	--	RP-SMA connectors direct to antenna
Z-Wave Antenna	1	--	--	RP-SMA connectors direct to antenna

2.5 Operating Environment

Power Supply	120V
AC Mains Frequency	60Hz
Temperature	22 – 24 °C
Humidity	20 – 27 %
Barometric Pressure	1019 mBar



2.6 Operating Modes

The C4-CORE5 was connected to a personal computer laptop and tested using test software in order to enable a constant duty cycle greater or equal to 98% the Zwave radio. The Zigbee radio was also enabled to ensure emissions during simultaneous transmission were compliant. The measurements within this report are corrected to reference a 100% duty cycle.

2.7 EUT Exercise Software

EUT firmware version 3.3.0.618634 was used to operate the transmitter using a constant transmit mode.

2.8 Block Diagram of Test Configuration

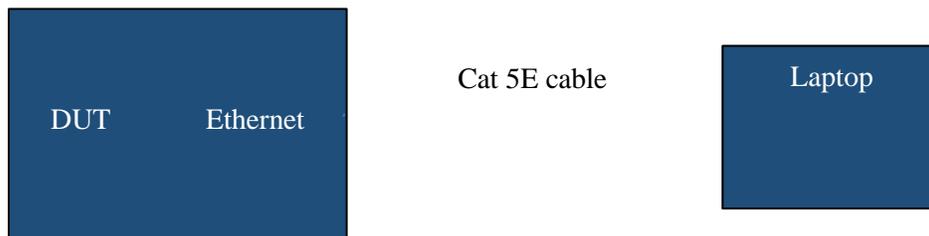


Diagram 1: Test Configuration Block Diagram

2.9 Modification Incorporated/Special Accessories on EUT

There were no modifications made to the EUT during testing to comply with the specification.

2.10 Deviation, Opinions Additional Information or Interpretations from Test Standard

There were no deviations, opinions, additional information or interpretations from the test specification.



3 Test Specification, Method and Procedures

3.1 Test Specification

Title	47 CFR FCC Part 15, Subpart C 15.203, 15.207 and 15.247 Limits and methods of measurement of radio interference characteristics of radio frequency devices.
Purpose of Test	The tests were performed to demonstrate initial compliance

3.2 Methods & Procedures

3.2.1 47 CFR FCC Part 15 Section 15.203

See test standard for details.

3.2.2 47 CFR FCC Part 15 Section 15.207

See test standard for details.

3.2.3 47 CFR FCC Part 15 Section 15.247

See test standard for details.

3.3 FCC Part 15, Subpart C

3.3.1 Summary of Tests

FCC Section	ISED Section	Environmental Phenomena	Frequency Range (MHZ)	Result
15.203	N/A	Antenna requirements	Structural Requirement	Compliant
15.207	RSS-Gen	Conducted Disturbance at Mains Port	0.15 to 30	Compliant
15.247(a)	RSS-247 § 5.2	Bandwidth Requirement	2400 to 2483.5	Compliant
15.247(b)	RSS-247 § 5.4	Peak Output Power	2400 to 2483.5	Compliant
15.247(d)	RSS-247 § 5.4	Antenna Conducted Spurious Emissions	0.009 to 25000	Compliant
15.209 / 15.247(d)	RSS-247 § 5.4	Radiated Spurious Emissions	0.009 to 25000	Compliant
15.247(e)	RSS-247 § 5.2	Peak Power Spectral Density	2400 to 2483.5	Compliant

The testing was performed according to the procedures in ANSI C63.10-2013, KDB 558074 and 47 CFR Part 15.



3.4 Results

In the configuration tested, the EUT complied with the requirements of the specification.

3.5 Test Location

Testing was performed at the Compliance Test Services Draper location at 427 West 12800 South, Draper, UT 84020. Compliance Test Services is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Code 600293-0 which is effective until December 31, 2023. FCC Designation number: US5357 and ISED CAB identifier: US0231.



4 Test Equipment

4.1 Conducted Emissions at Mains Ports

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
EMI Receiver	AFJ	FFT3010	6754	12/8/2021	12/8/2022
LISN	AFJ	LS16C/10	6749	12/6/2021	12/6/2023
Cat6 ISN	Teseq	ISN T8-Cat6	2971	1/30/2022	1/30/2023
ISN	Teseq	ISN T800	2974	6/27/2022	6/27/2023
LISN	Com-Power	LIN-120C	2612	1/6/2022	1/6/2023
AC Power Source	Laplace Instruments	AC1000A	2857	N/A	N/A
Test Software	-	Revision 1	3107	N/A	N/A

Table 1: List of equipment used for Conducted Emissions Testing at Mains Port

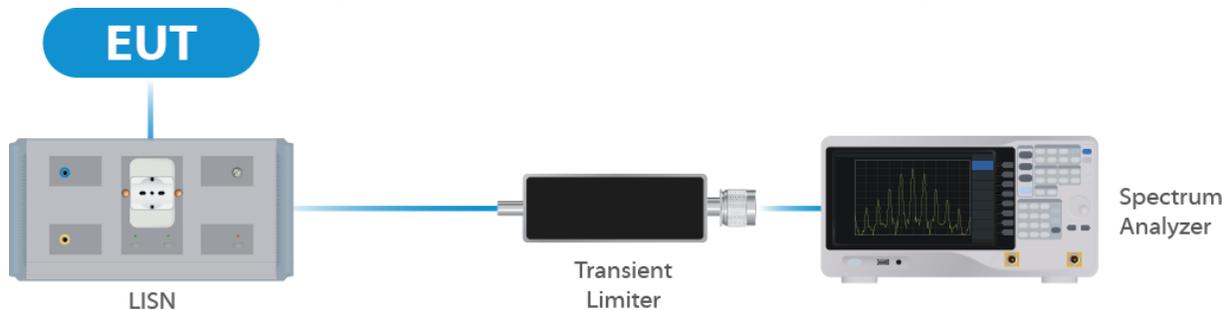


Figure 1: Conducted Emissions Test



4.2 Direct Connect at the Antenna Port Tests

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer	R&S	FSV40	2861	1/03/2022	1/03/2023
Signal Generator	R&S	SMB100A	2864	N/A	N/A
Vector Signal Generator	R&S	SMBV100A	2873	N/A	N/A
Switch Extension	R&S	OSP-B157WX	2867	1/03/2022	1/03/2023

Table 2: List of equipment used for Direct Connect at the Antenna Port

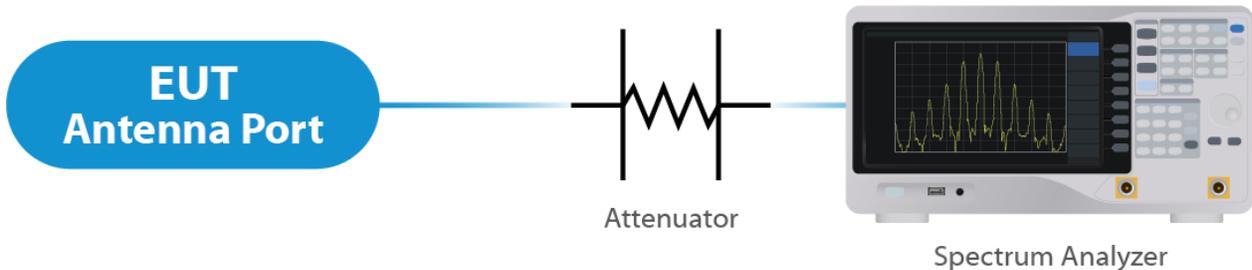


Figure 2: Direct Connect at the Antenna Port Test



4.3 Radiated Emissions

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
EMI Receiver	Keysight	N9038A	2778	1/4/2022	1/4/2023
Pre-Amplifier 9 kHz – 1 GHz	Sonoma Instruments	310N	2889	10/7/2021	11/7/2022
Broadband Antenna	Scwarzbeck	VULB 9163	3062	9/13/2022	9/13/2024
Broadband Antenna	Scwarzbeck	VULB 9163	3071	6/08/2022	6/22/2024
Double Ridge Horn Antenna	Scwarzbeck	BBHA 9120D	3065	9/22/2022	9/22/2024
Log Periodic	Scwarzbeck	STLP 9129	3068	11/16/2020	11/16/2022
15 - 40 GHz Horn Antenna	Scwarzbeck	BBHA 9170	2487	6/09/2022	6/09/2024
1 – 18 GHz Amplifier	Com-Power	PAM 118A	3833	10/7/2021	11/7/2022
Test Software	-	Revision 1	3108	N/A	N/A

Table 3: List of equipment used for Radiated Emissions

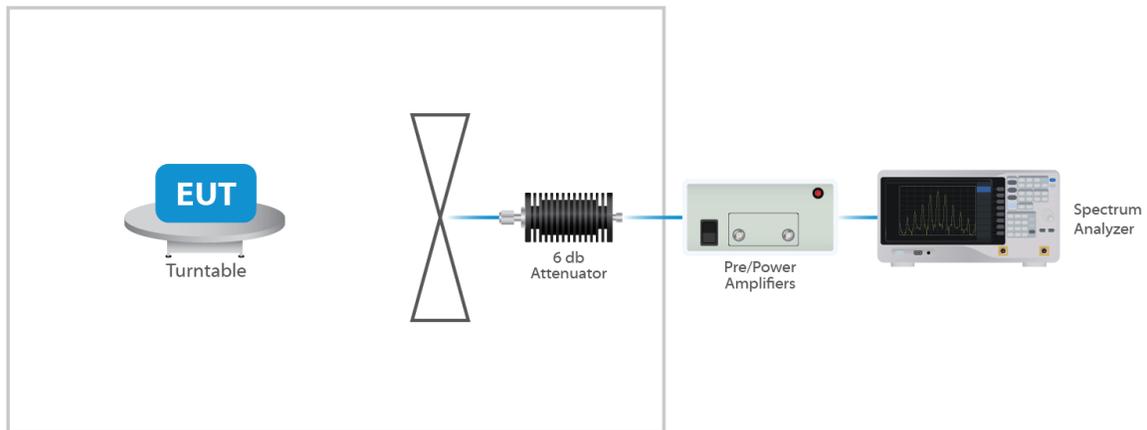


Figure 3: Radiated Emissions Test

4.4 Equipment Calibration

All applicable equipment is calibrated using either an independent calibration laboratory or Compliance testing Services personnel at intervals defined in ANSI C63.4:2014 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and is available for examination upon request.



4.5 Measurement Uncertainty

Test	Uncertainty (\pm dB)	Confidence (%)
Conducted Emissions	1.44	95
Radiated Emissions (9 kHz to 30 MHz)	2.50	95
Radiated Emissions (30 MHz to 1 GHz)	3.95	95
Radiated Emissions (1 GHz to 18 GHz)	5.56	95
Radiated Emissions (18 GHz to 40 GHz)	5.16	95
Direct Connect Tests	K Factor	Value
Emissions Bandwidth	2	2.0%
Output Power	2	1.0 dB
Peak Power Spectral Density	2	1.3 dB
Band Edge	2	0.8 dB
Transmitter Spurious Emissions	2	1.8 dB



5 Test Results

5.1 §15.203 Antenna Requirements

The EUT uses a Dipole antenna. The Maximum gain of the antenna is 2 dBi as noted in the datasheet provided by the manufacturer. The antenna is user replaceable and contains a reverse SMA connector to ensuring a standard connector may not be used.

Results

The EUT complied with the specification



5.2 Conducted Emissions at Mains Ports Data

5.2.1 AC Mains Neutral Lead

Frequency (MHZ)	Detector	Receiver Measured Level (dBµV)	Correction Factor (dB/m)	Corrected Receiver Level (dBµV)	Limit Class B Limit (dBµV)	Margin (dB)
13.56	Quasi-Peak (Note 2)	47.2	9.9	57.1	60	-2.9
10.61	Quasi-Peak (Note 2)	30.8	9.9	40.6	60	-19.4
0.150	Quasi-Peak (Note 2)	35.5	9.5	45	66	-21.0
15.23	Quasi-Peak (Note 2)	24.5	9.9	34.2	60	-25.7
0.261	Quasi-Peak (Note 2)	17.6	9.6	27.2	61.4	-34.2

Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

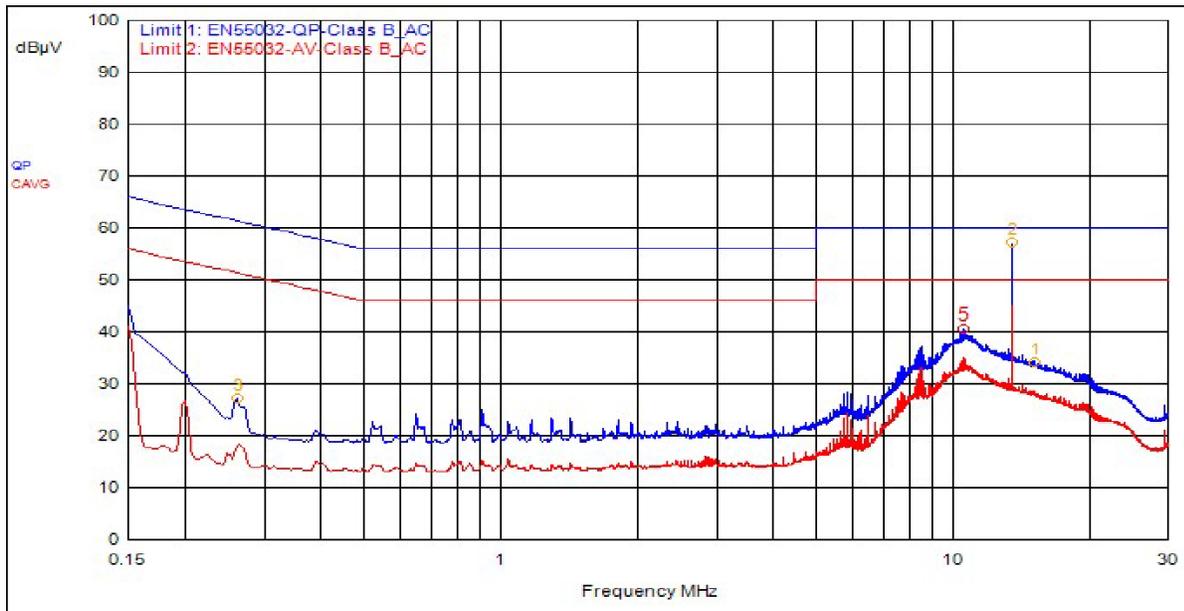
Sample Field Strength Calculation

Correction Factor = LISN Insertion Loss + Cable Insertion Loss + Transient Limiter Insertion Loss

Conducted Emissions Amplitude = Receiver Reading + Correction Factor

Result

The EUT complied with the specification limit by a margin of -2.9 dB.



Graph 1: Conducted Emissions Plot - Neutral



5.2.2 AC Mains Line Lead

Frequency (MHZ)	Detector	Receiver Measured Level (dBµV)	Correction Factor (dB/m)	Corrected Receiver Level (dBµV)	Limit Class B Limit (dBµV)	Margin (dB)
13.56	Quasi-Peak (Note 2)	47.1	9.9	57	60	-3.0
10.71	Quasi-Peak (Note 2)	30.1	9.9	40	60	-20.0
0.156	Quasi-Peak (Note 2)	30.9	9.5	40.5	65.7	-25.2
29.38	Quasi-Peak (Note 2)	17.4	10.2	27.6	60	-32.4
0.390	Quasi-Peak (Note 2)	14.6	9.6	24.2	58.1	-33.8
0.198	Average (Note 2)	17.1	9.5	26.6	53.7	-27.0

Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

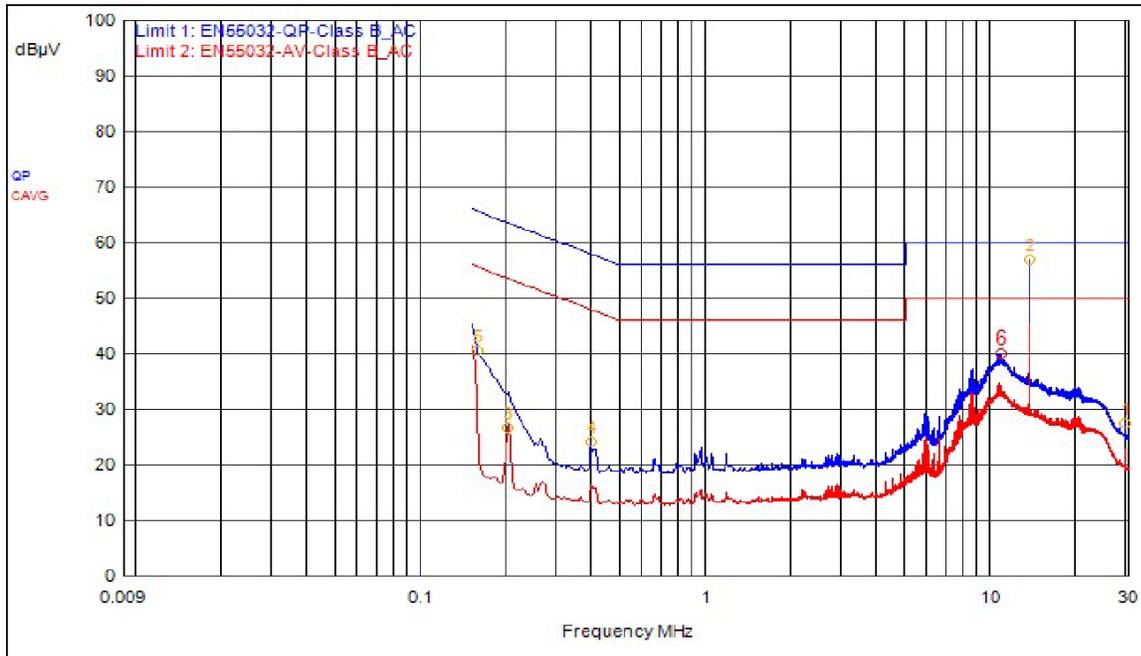
Sample Field Strength Calculation

Correction Factor = LISN Insertion Loss + Cable Insertion Loss + Transient Limiter Insertion Loss

Conducted Emissions Amplitude = Receiver Reading + Correction Factor

Result

The EUT complied with the specification limit by a margin of -3.0 dB.



Graph 2: Conducted Emissions Plot – Line 1

Result

The EUT complied with the specification limit.

5.3 §15.247(a)(2)

Frequency (MHz)	Emissions 6 dB Bandwidth (MHz)
911.8	0.938
919.8	0.938

Result

In the configuration tested, the 6 dB bandwidth was greater than 500 kHz; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots below).



10:45:16 PM 11/18/2022

Graph 1: 912 MHz 6dB Emissions Bandwidth



10:47:46 PM 11/18/2022

Graph 2: 920MHz 6dB Emissions Bandwidth



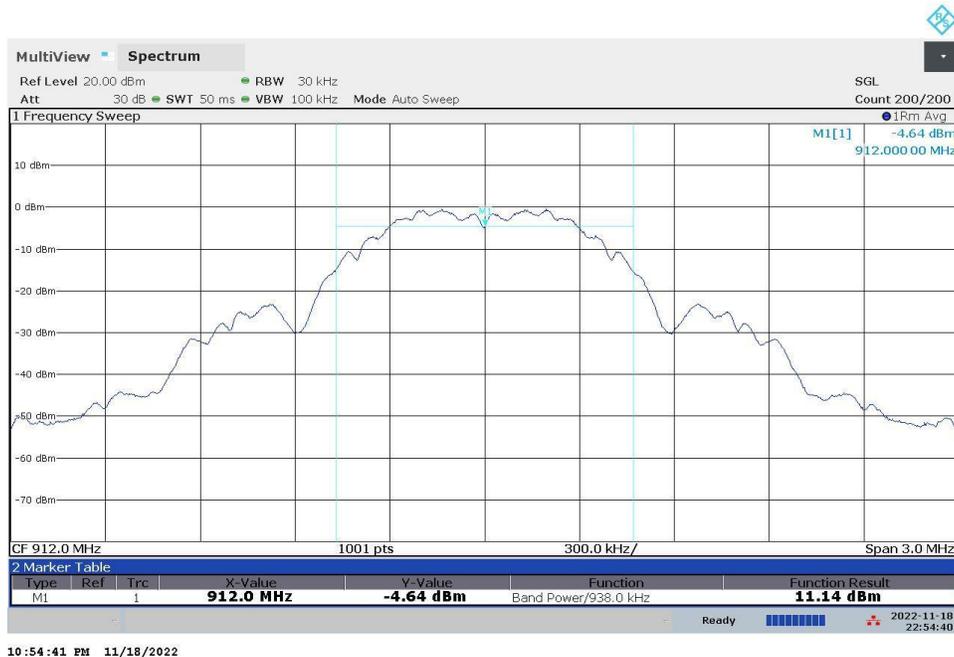
5.4 §15.247(b)(3) Maximum Average Output Power

The maximum average RF conducted output power measured for this device was 11.14 dBm or 13.0 mW. The limit is 30 dBm or 1 Watt when using antennas with 6 dBi or less gain. The antenna has a gain of 2.0 dBi.

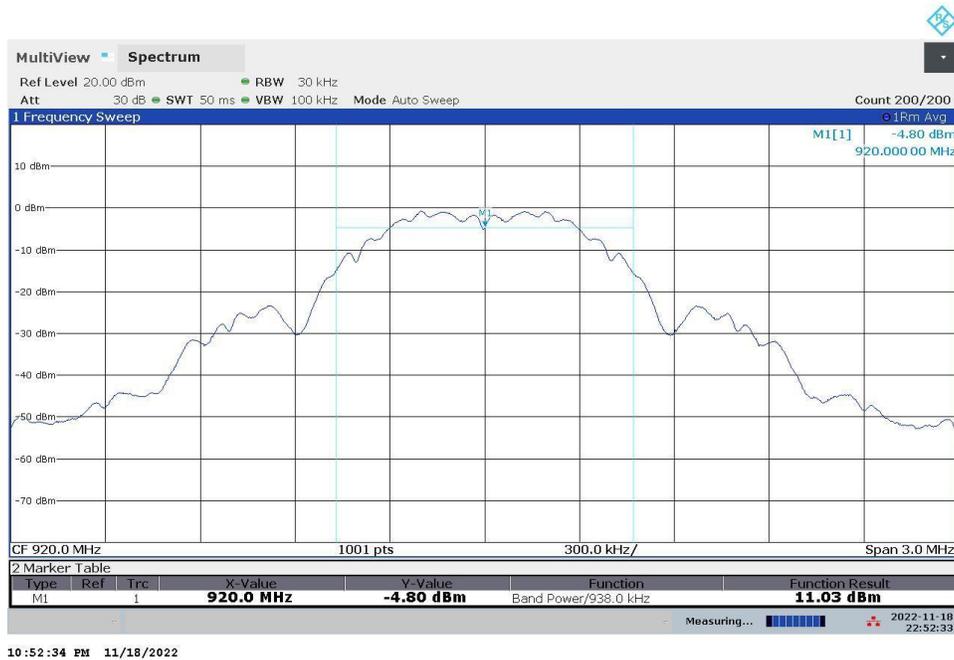
Frequency (MHz)	Measured Output Power (dBm)	Output Power (mW)
912	11.14	13.00
920	11.03	12.68

Result

In the configuration tested, the maximum average RF output power was less than 1 watt; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots below).



Graph 3: 912MHz Maximum Average Output Power



Graph 4: 920MHz Maximum Average Output Power

5.5 §15.247(d) Spurious Emissions

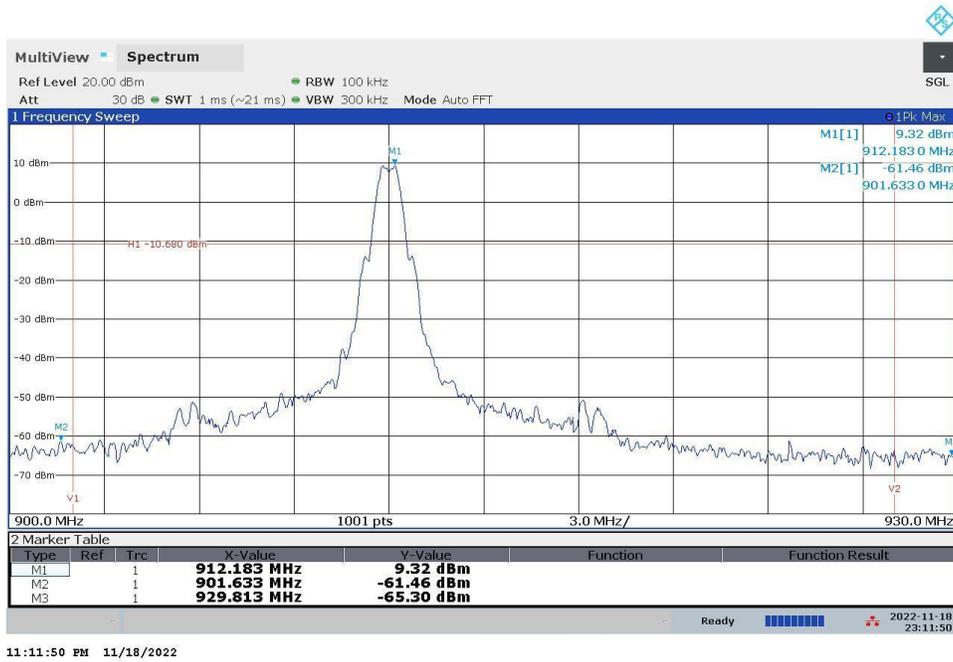
5.5.1 Conducted Spurious Emissions

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The table show the measurement data from spurious emissions noted across the frequency range when transmitting at the lowest frequency, middle frequency and upper frequency. Shown below are plots with the EUT tuned to the upper and lower channels. These demonstrate compliance with the provisions of this section at the band edges.

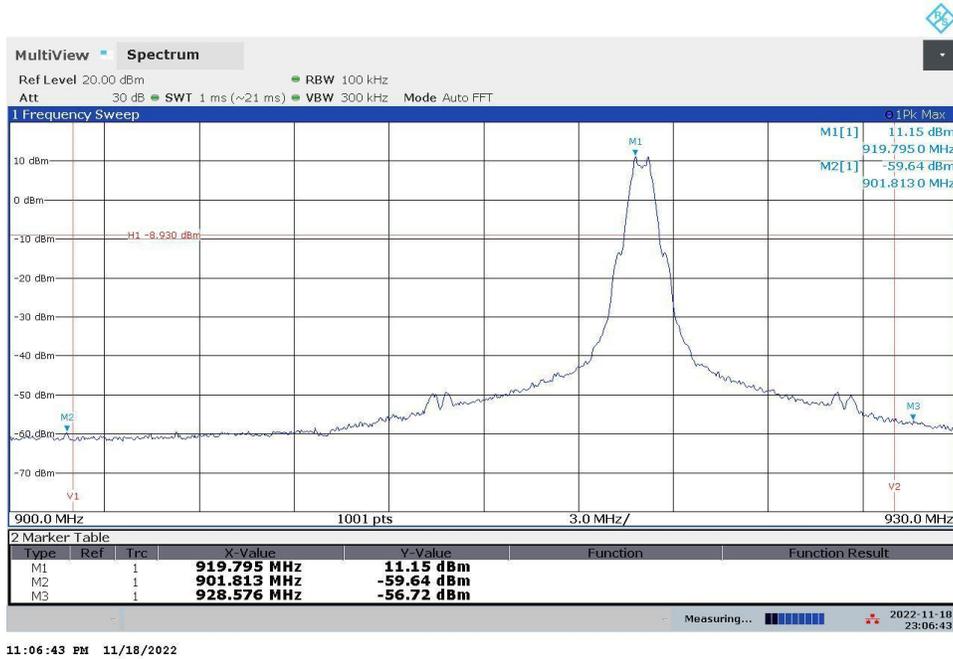
The emissions must be attenuated 30 dB below the highest power spectral density level measured within the authorized band as measured with a 100 kHz RBW. The highest power measured power spectral density was 2.3 dBm; therefore, the criteria is $2.3 - 30 = -27.7$ dBm.

Result

Conducted spurious emissions were attenuated 30 dB or more below the fundamental; therefore, the EUT complies with the specification.



Graph 5: Lower Band Edge Plot



Graph 6: Upper Band Edge Plot



5.5.2 Radiated Spurious Emissions in the Restricted Bands of §15.205

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental emissions was investigated to measure any radiated emissions in the restricted bands. The following tables show measurements of any emissions that fell into the restricted bands of §15.205. The tables show the worst-case emissions measured from the EUT. For frequencies above 18.0 GHz, a measurement distance of 1 meter was used. The noise floor was a minimum of 6 dB below the limits. The emissions in the restricted bands must meet the limits specified in §15.209. Tabular data for each of the spurious emissions is shown below for each of the units. Plots of the band edges are also shown.

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin	Azimuth (°)	Height	Pol.	Meas. Time	RBW (Hz)	Detector	Correction (dB)
40.894 MHz	31.019	40	-8.981	260	1.131	Vertical	15	120000	QP	-12.729
703.56 MHz	26.819	46	-19.181	119	2.03	Vertical	15	120000	QP	-4.161
516.13 MHz	39.694	46	-6.306	308	1.67	Horizontal	15	120000	QP	-6.78
911.77 MHz	98.371	46	52.371	117	1.128	Horizontal	15	120000	QP	0.103
1.8236 GHz	45.042	74	-28.958	212	2.906	Vertical	5	1000000	Peak	-8.963
1.8236 GHz	37.986	54	-16.014	212	2.906	Vertical	5	1000000	Average	-8.963
1.8231 GHz	40.538	74	-33.462	155	2.389	Horizontal	5	1000000	Peak	-8.965
1.8231 GHz	29.67	54	-24.33	155	2.389	Horizontal	5	1000000	Average	-8.965

Table 7: Transmitting at the Lowest Frequency

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin	Azimuth (°)	Height	Pol.	Meas. Time	RBW (Hz)	Detector	Correction (dB)
40.292 MHz	24.415	40	-15.585	5	4	Vertical	15	120000	QP	-12.881
58.113 MHz	32.079	40	-7.921	131	1	Vertical	15	120000	QP	-12.927
516.049999 MHz	35.6	46	-10.4	53	1.133	Vertical	15	120000	QP	-6.782
920.22 MHz	97.38	46	51.38	231	1.129	Vertical	15	120000	QP	0.438
516.049999 MHz	38.899	46	-7.101	287	1.67	Horizontal	15	120000	QP	-6.782
919.76 MHz	94.687	46	48.687	46	2.061	Horizontal	15	120000	QP	0.421
1.8404 GHz	44.14	74	-29.86	203	2.91	Vertical	5	1000000	Peak	-8.91
1.8404 GHz	36.523	54	-17.477	203	2.91	Vertical	5	1000000	Average	-8.91



Frequency	Level (dBμV/m)	Limit (dBμV/m)	Margin	Azimuth (°)	Height	Pol.	Meas. Time	RBW (Hz)	Detector	Correction (dB)
1.8404 GHz	41.633	74	-32.367	153	2.57	Horizontal	5	100000	Peak	-8.91
1.8404 GHz	33.263	54	-20.737	153	2.57	Horizontal	5	100000	Average	-8.91

Table 8: Transmitting at the Highest Frequency

Result

All emissions in the restricted bands of §15.205 met the limits specified in §15.209; therefore, the EUT complies with the specification.

5.6 §15.247(e) Maximum Average Power Spectral Density

The maximum average power spectral density conducted from the intentional radiator of the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. Results of this testing are summarized.

Frequency (MHz)	Measurement (dBm)	Criteria (dBm)
912	-9.4	8.0
920	-9.45	8.0

Result

The maximum average power spectral density was less than the limit of 8 dBm; therefore, the EUT complies with the specification.



10:58:01 PM 11/18/2022

Graph7: 912MHz Lowest Channel 3 kHz PSD Plot



10:59:06 PM 11/18/2022

Graph8: 920MHz High Channel 3 kHz PSD Plot



-- End of Test Report --