

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	TR7029_02
Date of Test(s)	January 6, 2022, and January 20, 2022
Report Issue Date	25 May 25, 2022

Test Specification	Applicant
47 CFR FCC Part 15, Subpart C ICES-003, Issue 7	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 25th day of May 2022, I individually and for Compliance Test 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 Compliance Test Services 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 Test Services

Written By: Clay Allred

Reviewed By: Joseph W. Jackson



Revision History		
Revision	Description	Date
01	Original Report Release	5 April 2022
02	Updated to Include Test plots Annex reference after PSD, Power and BW	25 May 2022



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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 to constant duty cycle greater or equal to 98% of the Zigbee transceiver. The Zwave 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

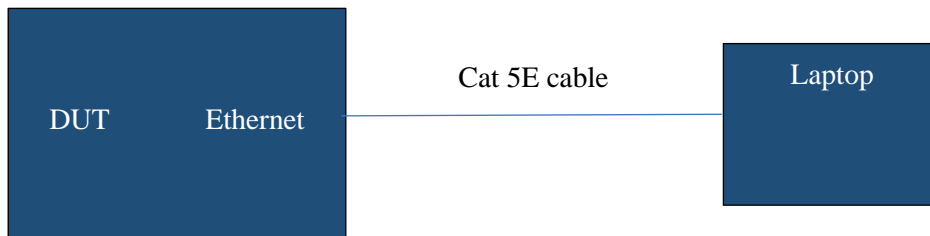


Diagram 1: Test Configuration Block Diagram

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 15.207

See test standard for details.

3.2.2 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 40000	N/A
15.247(d)	RSS-247 § 5.4	Radiated Spurious Emissions	0.009 to 40000	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. Where applicable, KDB 662911 was followed to sum required measurements.



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, 2022.

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	CTS-6754	12/8/2021	12/8/2022
LISN	AFJ	LS16C/10	CTS-6749	12/6/2021	12/6/2023
Cat6 ISN	Teseq	ISN T8-Cat6	CTS-2971	1/30/2022	1/30/2023
ISN	Teseq	ISN T800	CTS-2974	6/4/2021	6/4/2022
LISN	Com-Power	LIN-120C	CTS-2612	1/6/2022	1/6/2023
AC Power Source	Laplace Instruments	AC1000A	CTS-2857	N/A	N/A
Test Software	CTS	Revision 1	CTS-3107	N/A	N/A

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

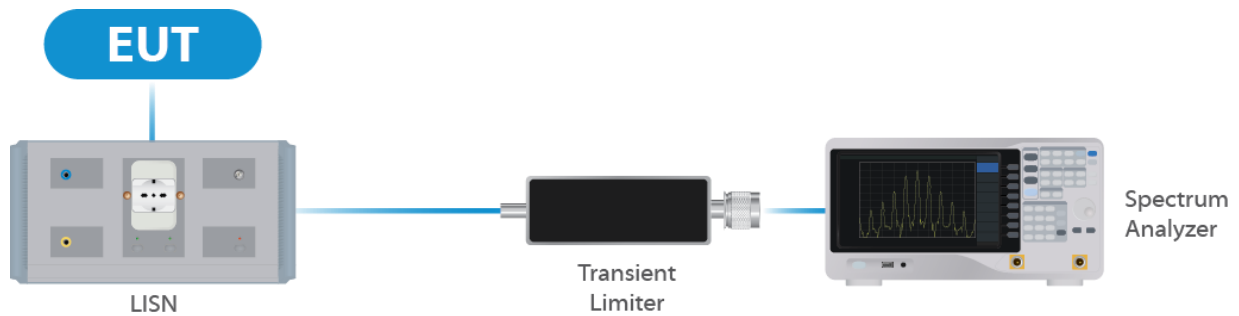


Figure 1: Conducted Emissions Test



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
Spectrum Analyzer	R&S	FSV40	CTS-2861	1/3/2022	1/3/2023
Signal Generator	R&S	SMB100A	CTS-2864	N/A	N/A
Vector Signal Generator	R&S	SMBV100A	CTS-2873	N/A	N/A
Switch Extension	R&S	OSP-B157WX	CTS-2867	1/3/2022	1/3/2023
Switch Extension	R&S	OSP-150W	CTS-2870	1/3/2022	1/3/2023

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

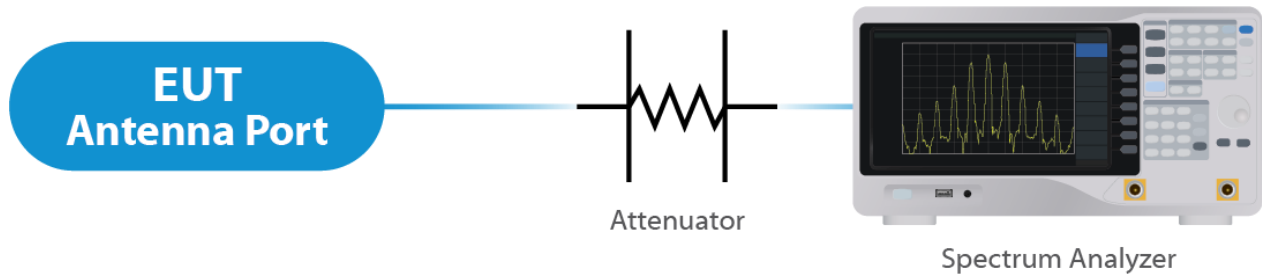


Figure 2: Direct Connect at the Antenna Port Test



4.3 Radiated Emissions

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
EMI Receiver	Keysight	N9038A	CTS-2778	6/21/2021	6/21/2022
Pre-Amplifier 9 kHz – 1 GHz	Sonoma Instruments	310N	CTS-2889	10/7/2021	10/7/2022
Broadband Antenna	Scwarzbeck	VULB 9163	CTS-3062	8/28/2020	8/27/2022
Broadband Antenna	Scwarzbeck	VULB 9163	CTS-3071	5/19/2020	5/19/2022
Double Ridge Horn Antenna	Scwarzbeck	BBHA 9120D	CTS-3065	7/8/2021	7/8/2022
Log Periodic	Scwarzbeck	STLP 9129	CTS-3068	11/16/2020	11/16/2022
15 - 40 GHz Horn Antenna	Scwarzbeck	BBHA 9170	CTS-2487	5/21/2020	5/21/2022
1 – 18 GHz Amplifier	Com-Power	PAM 118A	CTS-3833	10/7/2021	10/7/2022
Test Software	CTS	Revision 1	CTS-3108	N/A	N/A

Table 3: List of equipment used for Radiated Emissions

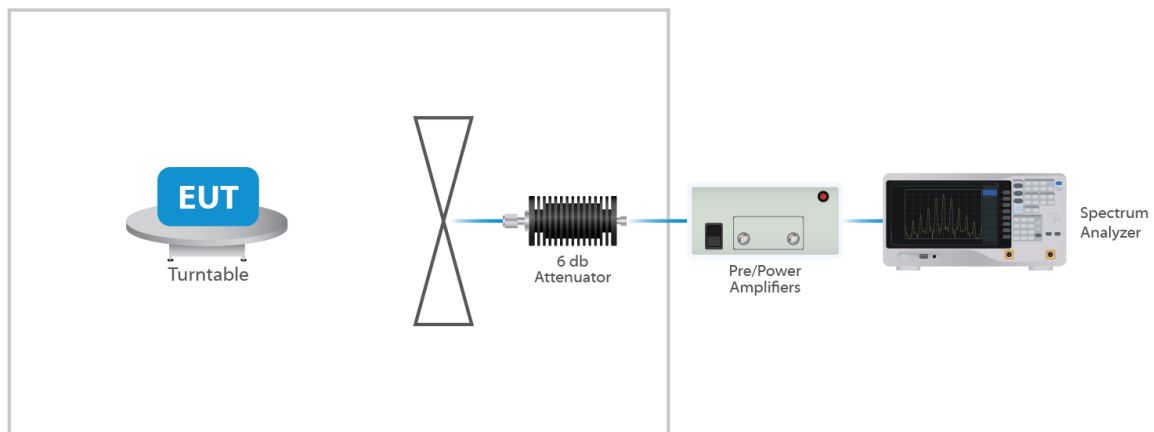


Figure 3: Radiated Emissions Test



4.4 Equipment Calibration

All applicable equipment is calibrated using either an independent calibration laboratory or Compliance Test 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
Asymmetric Mode Conducted Emissions	3.61	95
Shielded CDN Conducted Emissions	3.33	95
Radiated Emissions (30 MHz to 1 GHz)	4.38	95
Radiated Emissions (1 GHz to 17 GHz)	4.37	95

5 Test Results

5.1 §15.203 Antenna Requirements

The EUT uses an external dipole antenna. The Maximum gain of the antenna is 2.7 dBi. The antenna is user replaceable.

Results

The EUT complied with the specification



5.2 Conducted Emissions at Mains Ports Data

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.

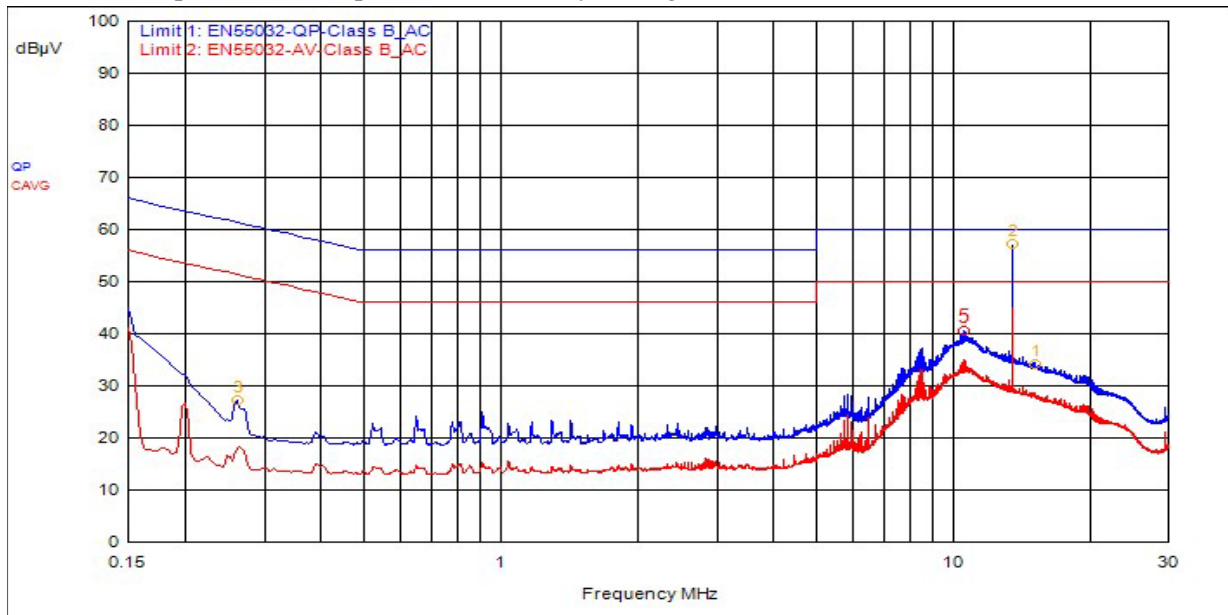
Sample Field Strength Calculation

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



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.

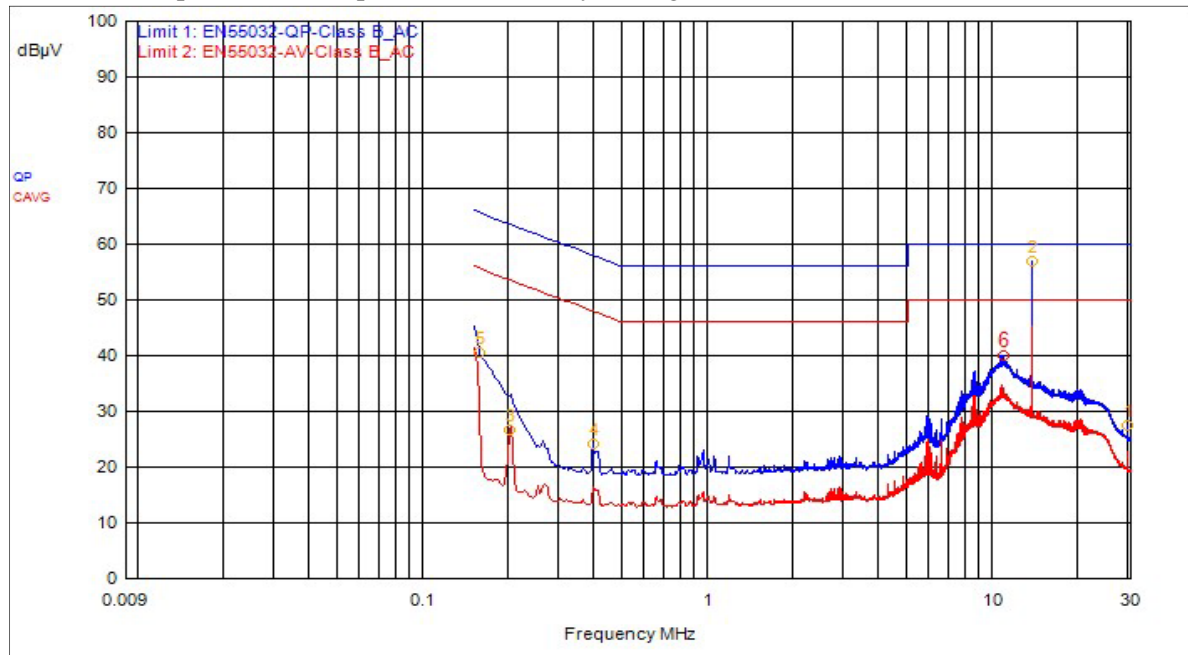
Sample Field Strength Calculation

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



5.3 §15.247(a)(2) Emissions Bandwidth

Frequency (MHz)	Emissions 6 dB Bandwidth (MHz)	Emissions 99% Bandwidth (MHz)
2405	1.703	2.22
2440	1.703	2.23
2475	1.703	2.24

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 within the Annex).

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

The maximum average RF conducted output power measured for this device was 14.4 dBm or 27.54 mW. The limit is 30 dBm or 1 Watt when using antennas with 6 dBi or less gain. The antenna has a gain of 2.7 dBi.

Frequency (MHz)	Measured Output Power (dBm)	Output Power (mW)
2405	13.8	23.99
2440	14.4	27.54
2475	13.4	21.88

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 plot within the Annex).



5.5 §15.247(d) Spurious Emissions

5.5.1 Conducted Spurious Emissions

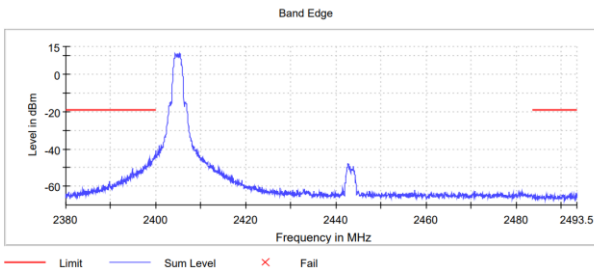
The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The table show the measurement data from spurious emissions noted across the frequency range when transmitting at the lowest frequency, middle frequency and upper frequency. Shown below and within the Annex are plot(s) 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.

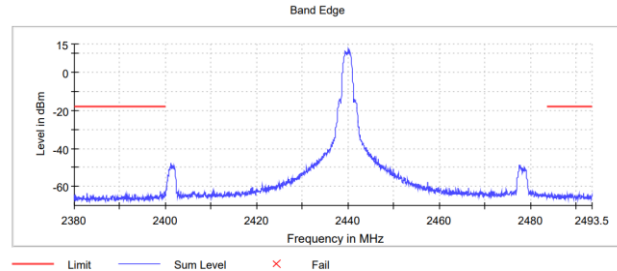
Result

Conducted spurious emissions were attenuated 30 dB or more below the fundamental; therefore, the EUT complies with the specification. Please see associated annex for full data set.

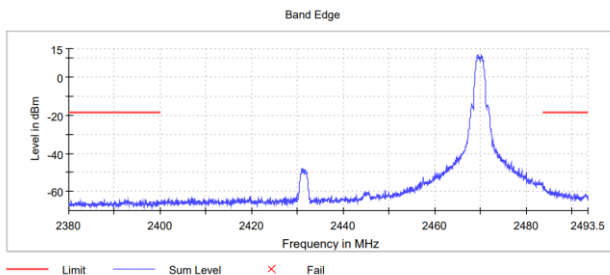
Bande Edge



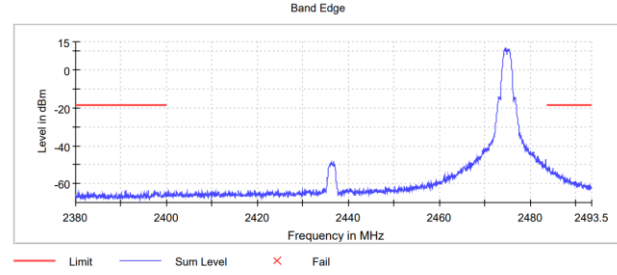
Graph 3: Band Edge Plot (2405MHz)



Graph 4: Band Edge Plot (2440MHz)



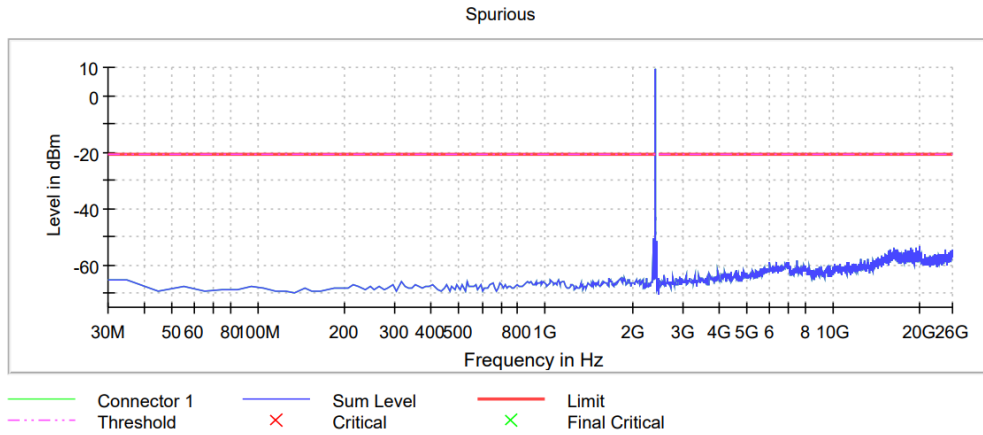
Graph 5: Band Edge Plot (2470MHz)



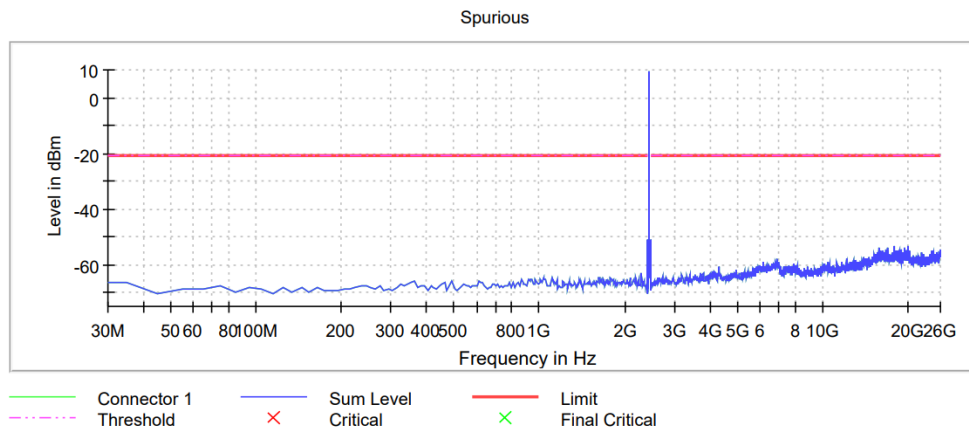
Graph 6: Band Edge Plot (2470MHz)



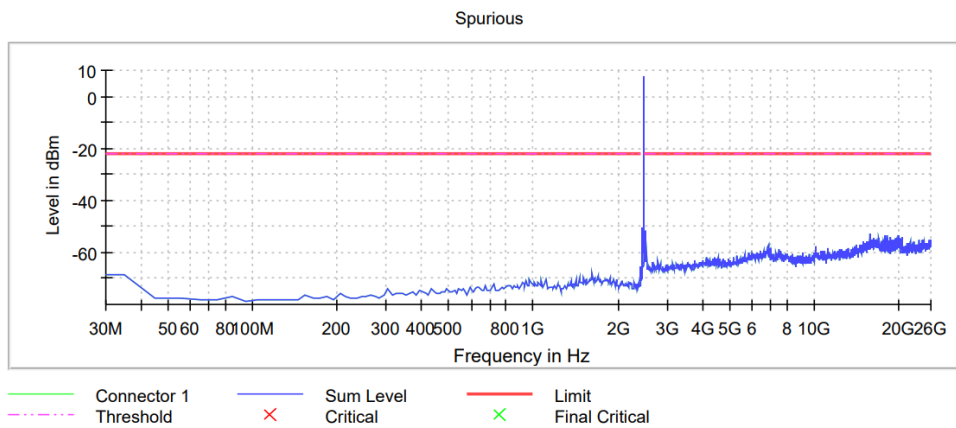
TX Spurious



Graph 7: TX Spurious Emissions (2405MHz)



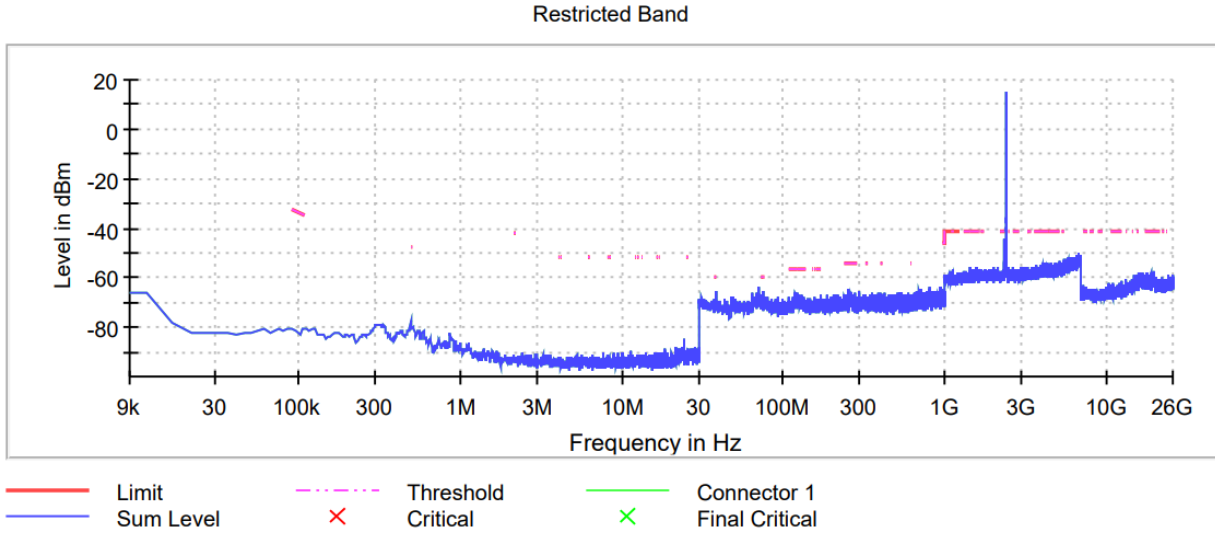
Graph 8: TX Spurious Emissions (2440MHz)



Graph 9: TX Spurious Emissions (2475MHz)



Restricted band Emissions



Graph 10: Restricted Band Emission (2405MHz)



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.

Result

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

Radiated Spurious Emissions per 15.209

Freq.	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Cor. (dB)	Det.
17.1014 GHz	44.984	74	-29.016	98	1.5	Vert	-5.486	Peak
22.5978 GHz	46.192	74	-27.808	307	1.5	Vert	-5.381	Peak
17.1011 GHz	32.249	54	-21.751	98	1.5	Vert	-5.486	Avg
22.5978 GHz	33.312	54	-20.688	307	1.5	Vert	-5.381	Avg
17.1 GHz	45.087	74	-28.913	185	1.5	Hztl	-5.484	Peak
22.597 GHz	46.244	74	-27.756	289	1.5	Hztl	-5.384	Peak
17.1 GHz	32.055	54	-21.945	185	1.5	Hztl	-5.484	Avg
22.597 GHz	33.261	54	-20.739	289	1.5	Hztl	-5.384	Avg
7.216 GHz	50.767	74	-23.233	250	2.725	Vert	7.963	Peak
11.02 GHz	54.792	74	-19.208	277	4	Vert	14.129	Peak
14.979 GHz	58.705	74	-15.295	204	1.682	Vert	15.947	Peak
7.216 GHz	38.177	54	-15.823	250	2.725	Vert	7.963	Avg
11.02 GHz	41.869	54	-12.131	277	4	Vert	14.129	Avg
14.979 GHz	45.109	54	-8.891	204	1.682	Vert	15.947	Avg
15.078 GHz	58.002	74	-15.998	162	1.692	Hztl	15.74	Peak
16.944 GHz	59.35	74	-14.65	81	2.191	Hztl	18.438	Peak
15.078 GHz	44.414	54	-9.586	162	1.692	Hztl	15.74	Avg
16.944 GHz	46.47	54	-7.53	81	2.191	Hztl	18.438	Avg
4.8813 GHz	45.374	74	-28.626	121	3.811	Vert	1.609	Peak
14.954 GHz	58.303	74	-15.697	13	2.036	Vert	15.79	Peak
16.791 GHz	59.435	74	-14.565	313	2.734	Vert	17.55	Peak
4.8813 GHz	31.938	54	-22.062	121	3.811	Vert	1.609	Avg



Freq.	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Cor. (dB)	Det.
14.954 GHz	44.903	54	-9.097	13	2.036	Vert	15.79	Avg
16.791 GHz	45.79	54	-8.21	313	2.734	Vert	17.55	Avg
14.5901 GHz	58.409	74	-15.591	77	2.915	Hztl	15.852	Peak
16.7835 GHz	58.955	74	-15.045	4	1.847	Hztl	17.511	Peak
14.5901 GHz	45.032	54	-8.968	77	2.915	Hztl	15.852	Avg
16.7835 GHz	45.78	54	-8.22	4	1.847	Hztl	17.511	Avg
4.7995 GHz	44.369	74	-29.631	49	1.643	Vert	1.204	Peak
13.604 GHz	58.932	74	-15.068	130	3.798	Vert	15.641	Peak
16.933 GHz	59.642	74	-14.358	161	2.186	Vert	18.498	Peak
4.7995 GHz	31.345	54	-22.655	49	1.643	Vert	1.204	Avg
13.604 GHz	45.271	54	-8.729	130	3.798	Vert	15.641	Avg
16.933 GHz	46.663	54	-7.337	161	2.186	Vert	18.498	Avg
11.075 GHz	55.225	74	-18.775	116	3.268	Hztl	15.641	Peak
14.373 GHz	58.824	74	-15.176	319	2.191	Hztl	18.498	Peak
11.075 GHz	41.727	54	-12.273	116	3.268	Hztl	15.641	Avg
14.373 GHz	44.828	54	-9.172	319	2.191	Hztl	18.498	Avg
30.482 MHz	25.896	30 ¹	-4.104	298	2.352	Vert	-11.795	QP
40.825 MHz	25.187	30 ¹	-4.813	102	3.847	Vert	-11.176	QP
54.256 MHz	25.423	30 ¹	-4.577	102	3.42	Vert	-12.081	QP
178.51 MHz	24.79	33.5 ¹	-8.71	204	1.311	Vert	-15.738	QP

¹: Tested at 10m

Sample Field Strength Calculation

Level = Receiver Reading + Correction Factor

Correction Factor = Antenna Factor + Cable Factor - Amplifier

Margin = Level - Limit

Result

The EUT complied with the specification limit by a margin of -4.1 dB.



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)
2405	1.147	8.0
2440	1.791	8.0
2470	0.739	8.0

Result

The maximum average power spectral density was less than the limit of 8 dBm; therefore, the EUT complies with the specification (see spectrum analyzer plots within the Annex).



-- End of Test Report --