Compliance
Test
Services

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

Test Report

Certification

FCC ID	2AJAC-CORE3
IC ID	7848A-CORE3
Equipment Under Test	C4-CORE3
Test Report Serial Number	TR7106_01
Date of Test(s)	January 6, 2022, and January 20, 2022
Report Issue Date	5 April 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 TESTING ilac-MRA

NVLAP LAB CODE 600293-0

Certification of Engineering Report

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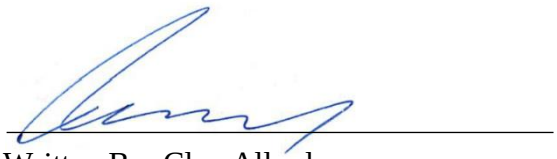
Applicant	Snap One LLC
Manufacturer	Snap One LLC
Brand Name	Control 4
Model Number	C4-CORE3
FCC ID	2AJAC-CORE3
IC ID	7848A-CORE3

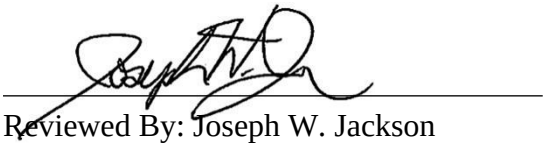
On this 5th day of April 2022, I individually and for Compliance Test Services certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge and are made in good faith.

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

Table of Contents

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	Control 4
Model Number	C4-CORE3
Hardware Version	Rev 4.0
Serial Number / MAC Address	000FFF0C33F3
Rating/power supply	Input: AC 100V-240 VAC,50Hz/60Hz, 0.3A, or PoE +
RCB revision	Rev 4.0
Schematic revision	Rev 4.0
Firmware/Software revision	3.3.0.620746
Dimensions (mm)	29 x 191 x 127
Antenna	Dipole (2.7dBi)

2.2 Description of EUT

The C4-CORE3 is an entertainment and automation controller in a aluminum, and steel enclosure. This product is used as a main or secondary controller in a smart home automation system and runs software that has the capability of controlling many electronic and audio-video devices in a home.

The C4-CORE3 consists of two PCAs, the main motherboard, and a front panel. The main processor is an NXP I.MX8 based I.MX8MQ SOC. The processor is driven by 27.000MHz and 25.000MHz oscillators which are used to produce all system internal clock signals. The core of the processor runs at 1.5Ghz. The processor interfaces to 2 memory types. The DDR4 SDRAM operates at 1600Mhz. The processor also uses an eMMC Flash memory chip with an SDIO/MMC interface. The processor generates up to 4k60p HDMI video output to display an onscreen interface. This video output has a maximum pixel frequency of 594Mhz. The CORE3 has two wireless radios that use external dipole antennas and operate in the 900MHz and 2.4GHz spectrums. An SPI interface on the processor is used for communication the 802.15.4 2.4Ghz radio ZigBee transceiver. A UART is used to communicate to the 900MHz Zwave radio. The RF level to the radio chips is programmed into the firmware from the values that were used during regulatory testing. These levels cannot be changed by the user. During manufacturing testing (tune-up) the level of the RF is measured to verify that the level is within the level tolerance of ± 0.5 dB. A CPU integrated Cortex M4 core is used to control, IR input/outputs as well as the Contacts and Relays. The external RS232 serial ports that share outputs with two of the IR outputs are controlled by integrated CPU UARTs. The additional two external DB9 serial ports use an SPI to UART converter IC.

The C4-CORE3 has an Ethernet/PoE input port, Ethernet switch poutput, HDMI port, SPDIF audio Input/output, USB (3.0) port, and 6 IR ports, and can be powered via its AC mains (100-240, 50/60Hz) input or via the PoE input.

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: Control4 MN: C4-CORE3 MAC: 000FFF0C33F3	Controller	See Section 2.4
BN: Dell MN: XPS SN: n/a	Laptop	Network/Cat 5e Cable (Note 2)

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
Ethernet In/Out/PoE	2	No	No	Ethernet/Network Cat 5e cable
HDMI	1	Yes	No	1 meter
USB	1	Yes	No	USBA extension cable to USB flash drive/1 meter
Serial IR	4	No	No	Two conductor cables with 3.5mm mono connector/2 meters
SPDIF	1	Yes	No	RCA 75 Ohm cable/1 meter

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-CORE3 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

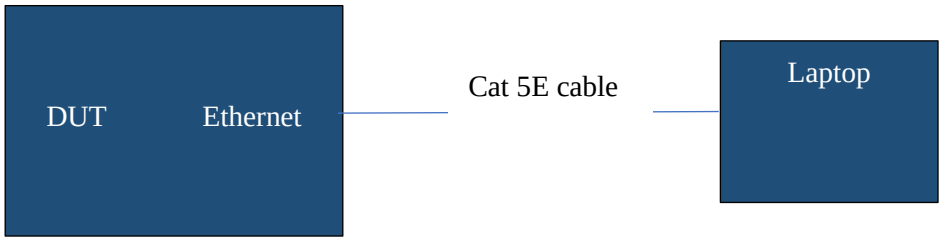


Diagram 1: Test Configuration Block Diagram

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

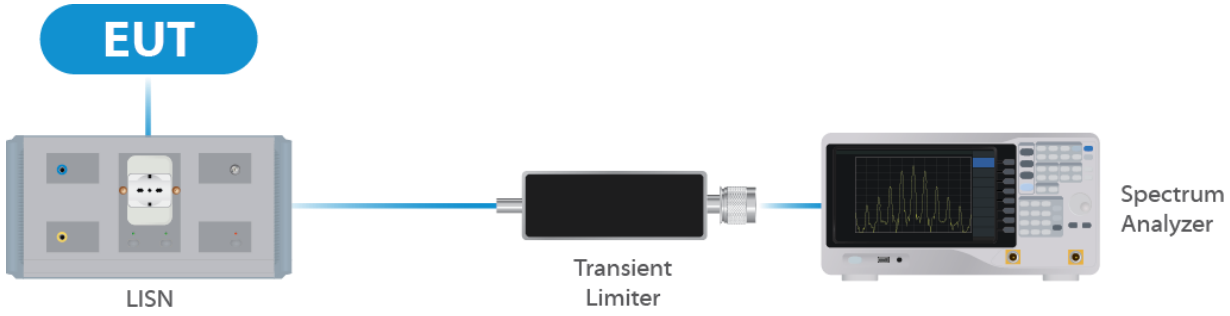


Figure 1: Conducted Emissions Test

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

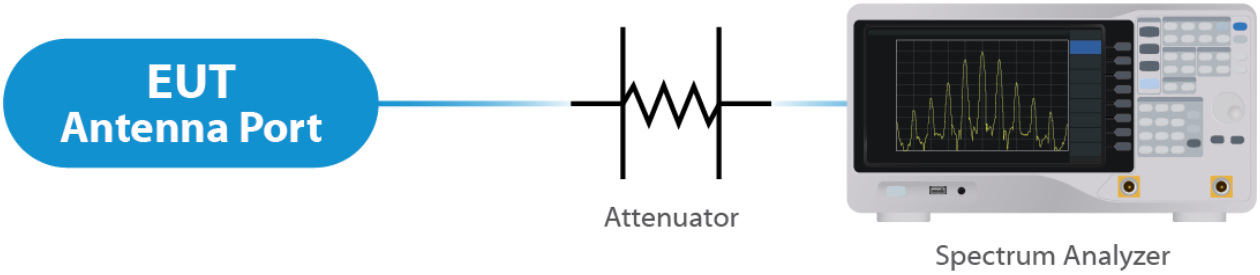


Figure 2: Direct Connect at the Antenna Port Test

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

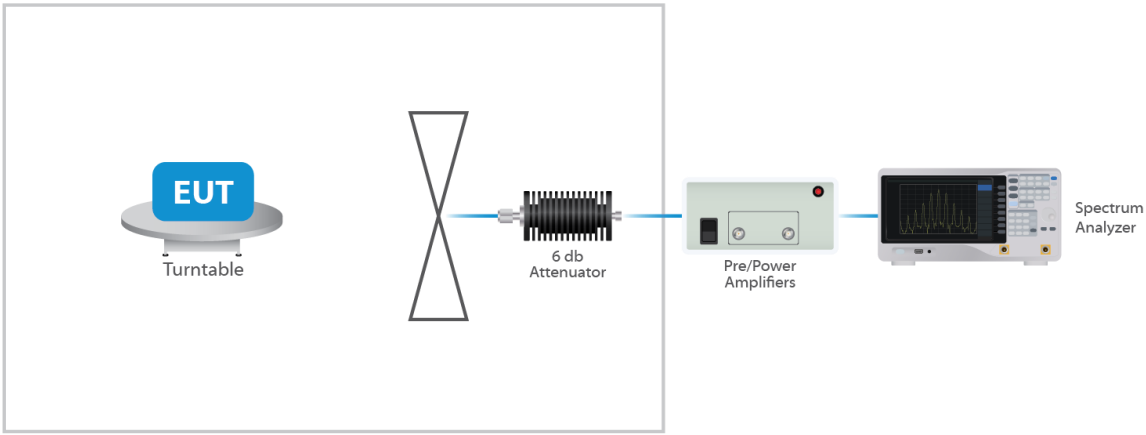


Figure 3: Radiated Emissions Test

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 (± 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 (Hot Lead)

Frequency (MHZ)	Detector	Receiver Measured Level (dBµV)	Correction Factor (dB/m)	Corrected Receiver Level (dBµV)	Limit Class B Limit (dBµV)	Margin (dB)
0.165	QP	37.1	9.5	46.6	65.2	-18.6
0.198	QP	35.1	9.5	44.6	63.7	-19.1
0.906	QP	27.0	9.8	36.7	56.0	-19.3
0.165	AVG	28.9	9.5	38.5	56.2	-17.7
0.198	AVG	25.4	9.5	34.9	53.7	-18.8
0.906	AVG	18.0	9.8	27.8	46.0	-18.2

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

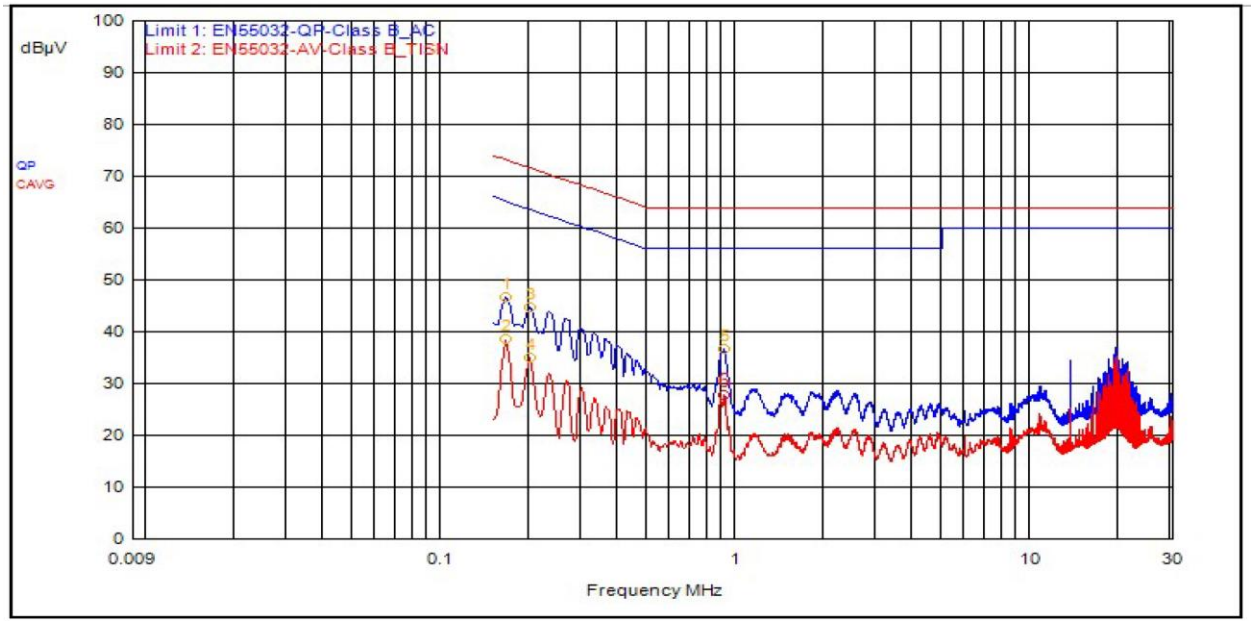
Sample Field Strength Calculation

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 -17.7 dB.



Graph 1: Conducted Emissions Plot – Hot Lead

5.3 Conducted Emissions at Mains Ports Data (Neutral Lead)

Frequency (MHZ)	Detector	Receiver Measured Level (dBµV)	Correction Factor (dB/m)	Corrected Receiver Level (dBµV)	Limit Class B Limit (dBµV)	Margin (dB)
0.165	QP	42.0	9.5	51.5	65.2	-13.7
0.906	QP	31.3	9.8	41.1	56.0	-14.9
0.195	QP	36.3	9.5	45.9	63.8	-17.9
0.165	AVG	34.9	9.5	44.4	55.2	-10.8
0.198	AVG	28.4	9.5	37.9	53.8	-15.9

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

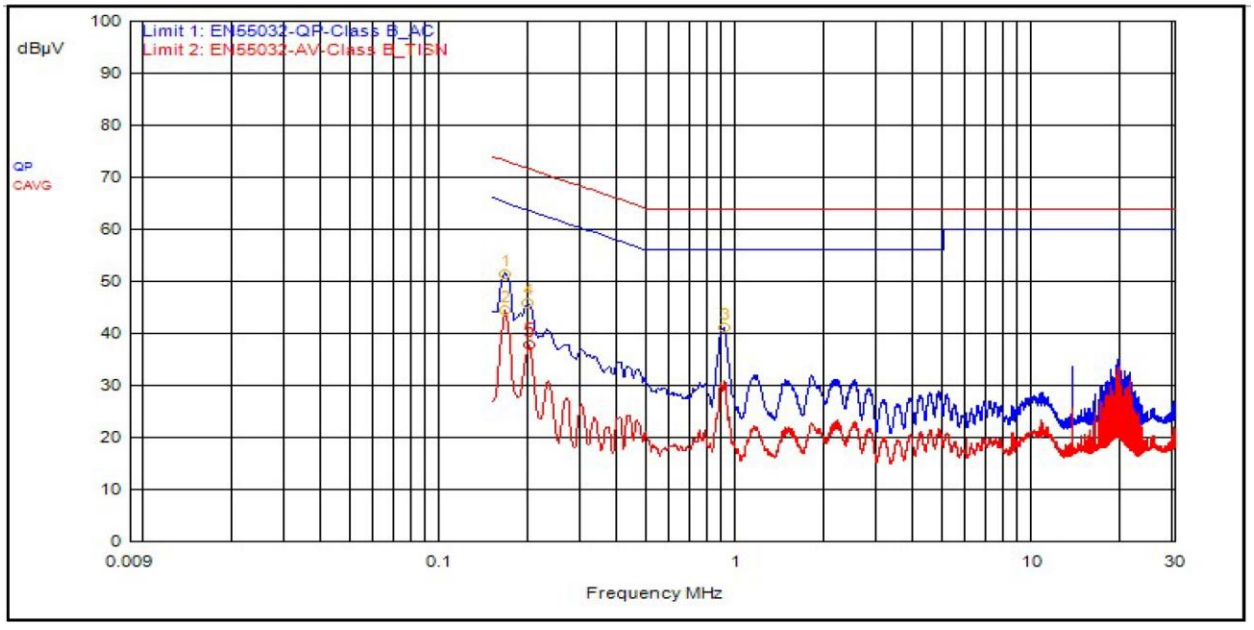
Sample Field Strength Calculation

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 -10.8 dB.



Graph 2: Conducted Emissions Plot – Neutral

5.5 §15.247(a)(2) Emissions Bandwidth

Frequency (MHz)	Emissions 6 dB Bandwidth (MHz)	Emissions 99% Bandwidth (MHz)
2405	1.74	2.22
2440	1.74	2.23
2475	1.74	2.23

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).

5.6 §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	17.8	60.26
2440	17.6	57.54
2470	18.1	64.57
2475	17.9	61.66

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).

5.7 §15.247(d) Spurious Emissions

5.7.1 Conducted Spurious Emissions

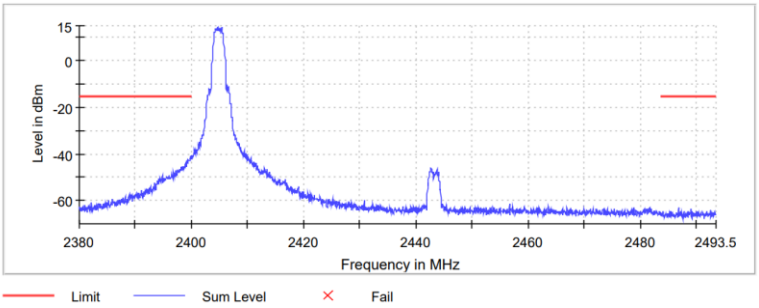
The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The table show the measurement data from spurious emissions noted across the frequency range when transmitting 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.

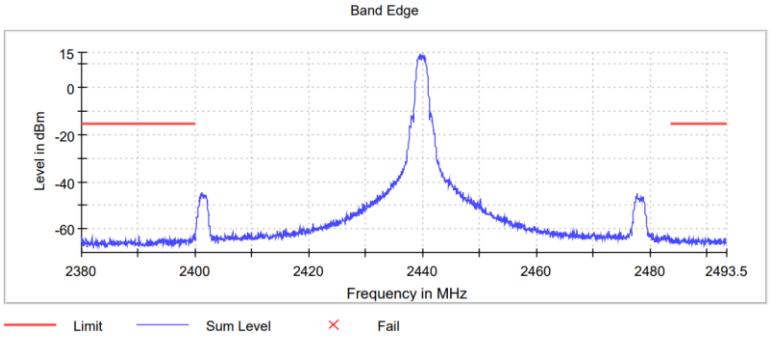
Result

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.

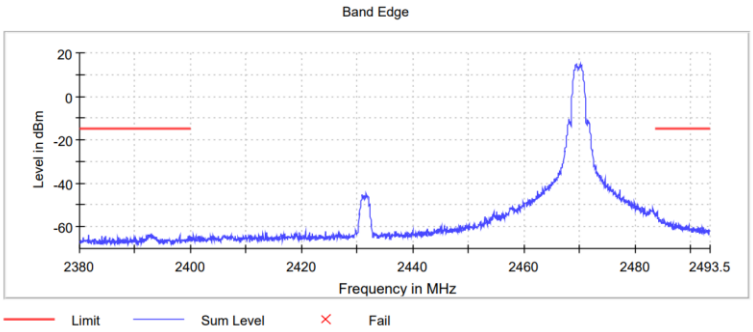
Bande Edge



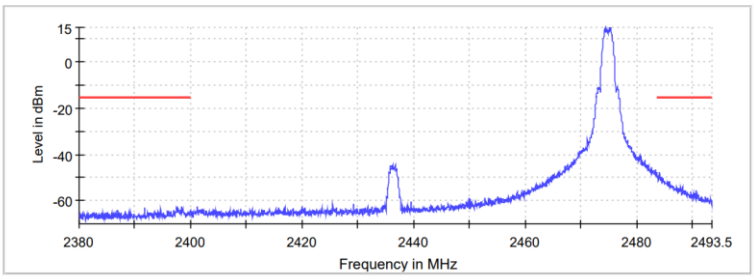
Graph 3: Band Edge Plot (2405MHz)



Graph 4: Band Edge Plot (2440MHz)

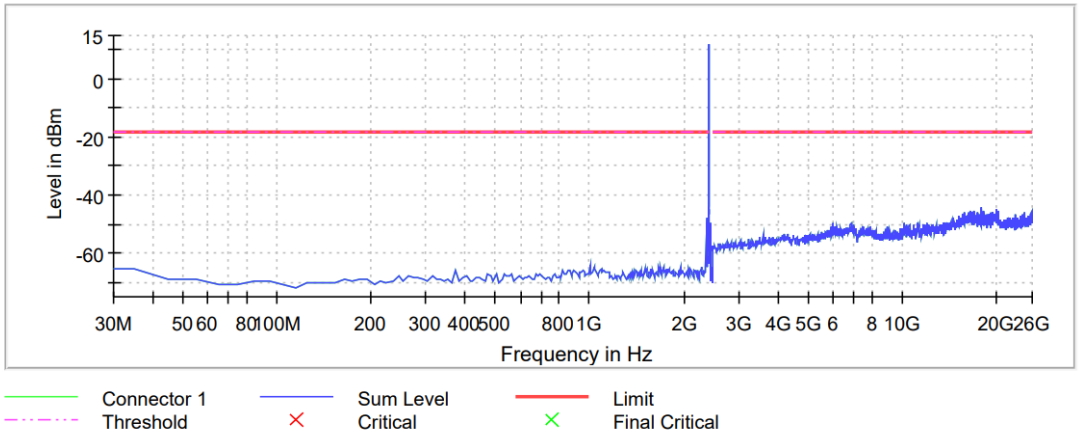


Graph 5: Band Edge Plot (2470MHz)

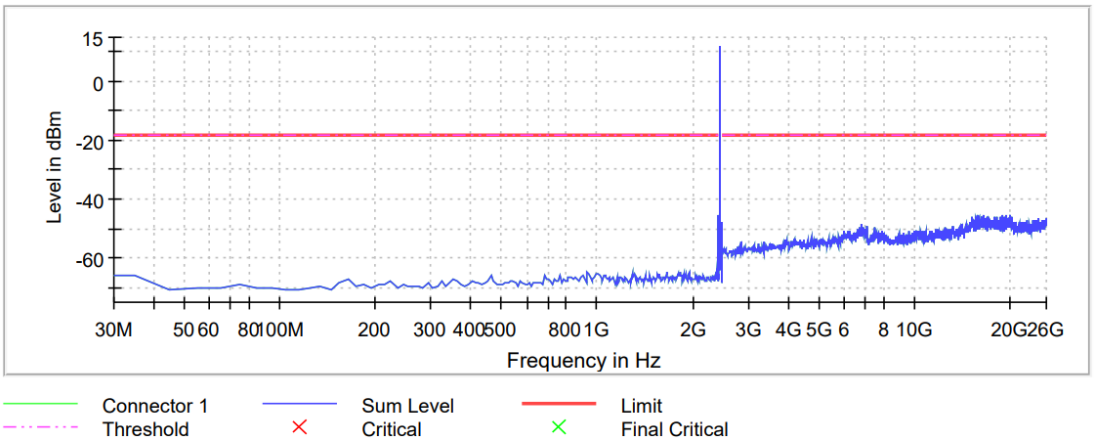


Graph 6: Band Edge Plot (2470MHz)

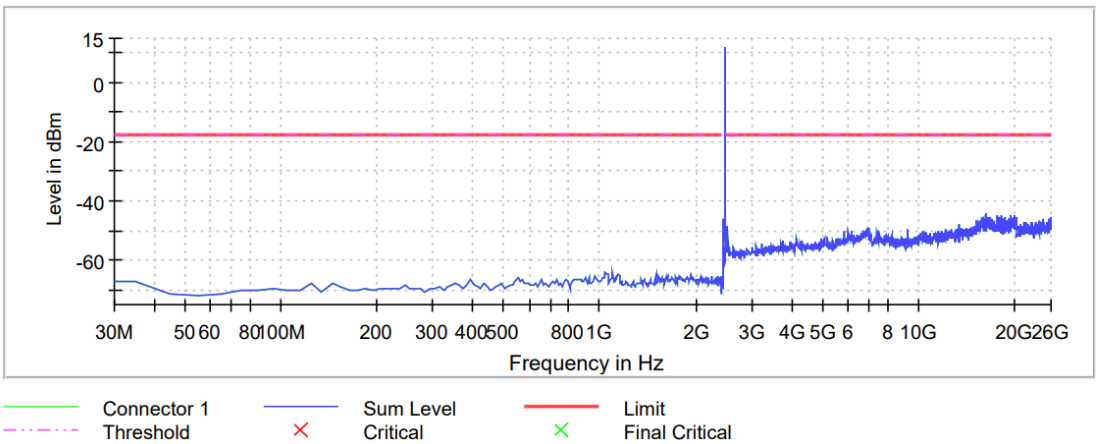
TX Spurious



Graph 7: TX Spurious Emissions (2405MHz)

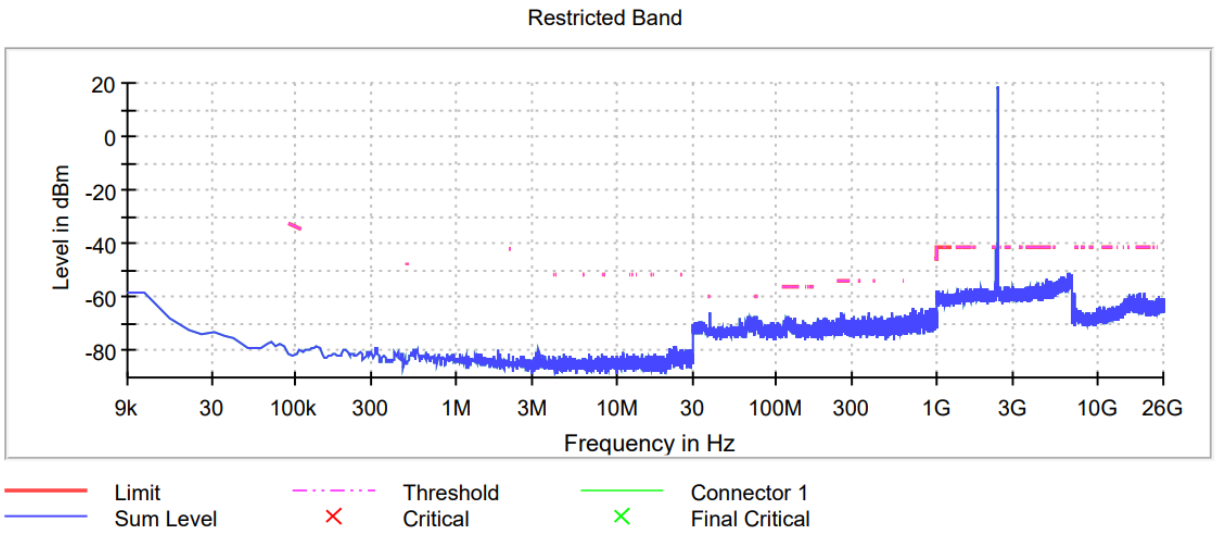


Graph 8: TX Spurious Emissions (2440MHz)



Graph 9: TX Spurious Emissions (2475MHz)

Restricted band Emissions



Graph 10: Restricted Band Emission (2405MHz)

5.7.2 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 bans 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.
4.9386 GHz	47.121	74	-26.879	268	2.812	Vert	-12.206	Peak
7.4079 GHz	49.199	74	-24.801	141	2.321	Vert	-4.926	Peak
4.9386 GHz	38.281	54	-15.719	268	2.812	Vert	-12.206	Avg
7.4079 GHz	38.318	54	-15.682	141	2.321	Vert	-4.926	Avg
4.9409 GHz	42.061	74	-31.939	137	3.307	Hztl	-12.201	Peak
7.411 GHz	47.543	74	-26.457	221	2.812	Hztl	-4.926	Peak
4.9409 GHz	31.088	54	-22.912	137	3.307	Hztl	-12.201	Avg
7.411 GHz	36.244	54	-17.756	221	2.812	Hztl	-4.926	Avg
4.8087 GHz	50.09	74	-23.91	259	2.816	Vert	-11.989	Peak
7.2163 GHz	52.538	74	-21.462	203	2.321	Vert	-5.121	Peak
4.8087 GHz	42.175	54	-11.825	259	2.816	Vert	-11.989	Avg
7.2163 GHz	42.93	54	-11.07	203	2.321	Vert	-5.121	Avg
7.2161 GHz	50.056	74	-23.944	224	3.157	Hztl	-5.13	Peak
7.2161 GHz	39.666	54	-14.334	224	3.157	Hztl	-5.13	Avg
4.8806 GHz	49.924	74	-24.076	265	2.812	Vert	-11.877	Peak
7.318 GHz	52.119	74	-21.881	204	1.808	Vert	-4.961	Peak
4.8806 GHz	41.847	54	-12.153	265	2.812	Vert	-11.877	Avg
7.318 GHz	42.366	54	-11.634	204	1.808	Vert	-4.961	Avg
4.8808 GHz	44.205	74	-29.795	137	2.812	Hztl	-11.879	Peak
7.3172 GHz	45.801	74	-28.199	232	3.307	Hztl	-4.96	Peak
4.8808 GHz	33.53	54	-20.47	137	2.812	Hztl	-11.879	Avg
7.3172 GHz	32.861	54	-21.139	232	3.307	Hztl	-4.96	Avg

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 -11.07 dB.

5.8 §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	4.15	8.0
2440	3.93	8.0
2470	4.38	8.0
2475	4.20	8.0

Result

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

-- End of Test Report --