Testing Tomorrow's Technology

Application

For

Title 47 USC Part 2, Subpart J, Paragraph 2.907, 2.1043 Equipment Authorization of Certification for an Intentional Radiator per Part 15, Subpart C, Paragraphs 15.207, 15.209 and 15.249

And

Innovation, Science, and Economic Development Canada Certification per RSS-210 Issue 10: License-Exempt Radio Apparatus: Category I Equipment and RSS-Gen Issue 5: General Requirements for Compliance of Radio Apparatus

For

Cognosos, Inc
Model: PCA-10017
FCC ID: 2AKFQ10017
IC: 22165-10017

UST Project: 21-0414a
Issue Date: February 23, 2022

Total Pages in This Report: 32

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

US TECH (Agent Responsible For Test):

By: Alan Ghasiani

Name: 

Title: Consulting Engineer – President

Date: February 23, 2022

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MEASUREMENT TECHNICAL REPORT

Company Name:	Cognosos, Inc
Address:	1100 Spring St NW #300A Atlanta, GA 30309
Model:	PCA-10017
FCC ID:	2AKFQ10017
IC ID:	22165-10017
Date:	February 23, 2022

This report concerns (check one): ☒ Original ☐ Class II Permissive Change

Equipment type: 2.4 GHz ISM Radio Transceiver

Technical Information:

Radio Technology:	Bluetooth 5
Frequency of Operation (MHz):	2402-2480
Output Power (dBm):	+14.0 (rated)
Type of Modulation:	GFSK
Data/Bit Rate (M)bps:	1 Mbps (max)
Antenna Gain (dBi):	+4.7
Software used to program EUT:	Cognosos Telluride
EUT firmware:	vaha0.4.0
Power setting:	default (+14.0 dBm)

Report prepared by:

US Tech

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IC RSS to 15.249 Cross Reference
Confidentiality Request Letter
Test Configuration Photographs
External Photographs
Internal Photographs
Confidential Schematics
Confidential Theory of Operation
Confidential Block Diagram
User Manual
Sample Label
FCC Agency Agreement
Canadian Representative Letter

1 General Information

1.1 Purpose of this Report

This report is prepared as a means of conveying test results and information concerning the suitability of this exact product for public distribution according to the FCC Rules and Regulations Part 15, Section 249.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on January 20, 2022 in good operating condition.

1.3 Product Description

The Equipment under Test (EUT) is the Cognosos, Inc. Model PCA-10017. The EUT is a small battery powered GPS tracking device mounted on the sun visor or rearview mirror of the vehicle being tracked. When the EUT senses motion, then senses a stop, the location of the vehicle is obtained through the GPS receiver. The location and serial number are transmitted to one of the Cognosos gateway towers, over a 433 MHz radio, in tracking mode.

The maximum rated output power for this device is 14.0 dBm
Type of modulation: GFSK
Data Rate: Bluetooth Specification 5.0
Packet Type: Bluetooth Specification 5.0

1.4 Configuration of Tested System

The Test Sample was tested per *ANSI C63.4:2014 and ANSI C63.4:2013, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz* for FCC subpart A Digital equipment Verification requirements and per *ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices* for FCC subpart C Intentional Radiators.

A list of EUT and Peripherals is found in Table 1. A block diagram of the tested system is shown in Figure 1. Test configuration photographs 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 also been fully described and submitted to Industry Canada (ISED), and has been approved under file number 9900A-1.

1.6 Related Submittals

The EUT is subject to the following FCC authorizations:

a) Certification under section 15.207 and 15.209 as a transmitter.
b) SDoC under 15.101 as a digital device.

The SDoC requirement shares many common report elements with the Certification report. Therefore, though this report is mostly intended to provide data for the Certification process, the SDoC authorization report (Parts 15.107 and 15.109) for the EUT is included herein.

Table 1. EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID	CABLES P/D
Tracker/ Cognosos, Inc. (EUT)	PCA-10017	Engineering Sample	Pending: FCC ID: 2AKFQ10017 IC: 22165-10017	P
DC Bench top power supply/ Tek Power	HY1803D	1072531	None	P

U= Unshielded S= Shielded P= Power D= Data

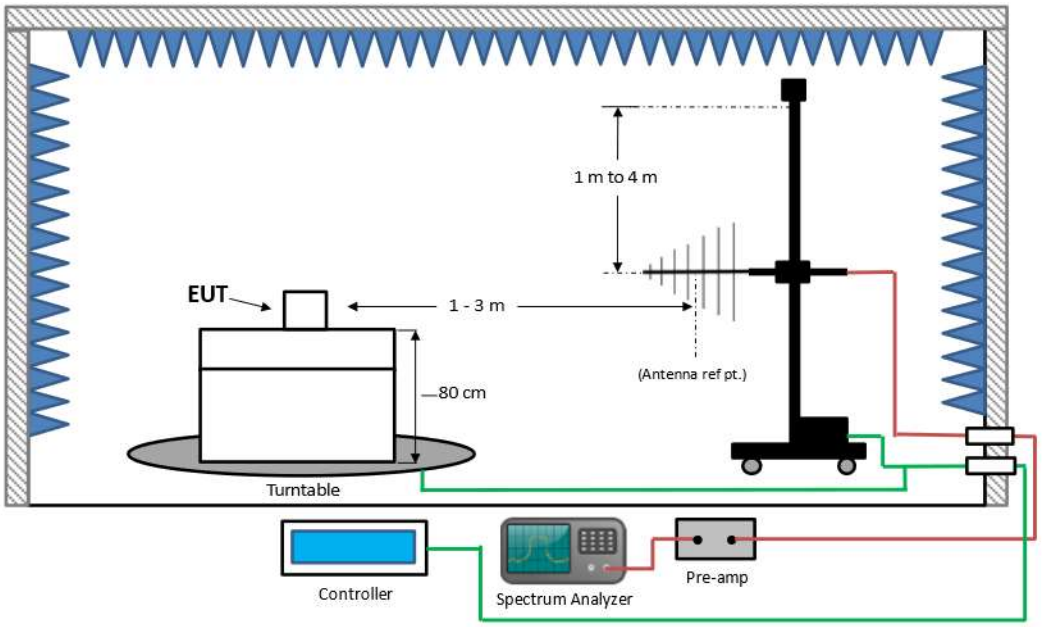

Figure 1. Block Diagram of Test Configuration

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 indicated.

Table 2. Test Instruments

TEST INSTRUMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CALIBRATION DUE DATE
SPECTRUM ANALYZER	AGILENT	E4407B	US41442935	9/02/2022 2 YR.
SPECTRUM ANALYZER	RIGOL	DSA815	DSA8A180300138	1/06/2024 2 YR.
LOOP ANTENNA	ETS LINDGREN	6502	9810-3246	4/06/2022 2 YR.
BICONICAL ANTENNA	EMCO	3110B	9306-1708	8/17/2023 2 YR.
LOG PERIODIC ANTENNA	EMCO	3146	9110-3236	12/13/2023 2 YR.
HORN ANTENNA	AH SYSTEMS	SAS-571	605	2/28/2022 2 YR.
PREAMP 100 KHZ TO 1.3 GHZ	HEWLETT-PACKARD	8447D	1937A02980	6/9/2022
PREAMP 1.0 GHZ TO 26.0 GHZ	HEWLETT-PACKARD	8449B	3008A00914	8/27/2022
LISN X 2	SOLAR ELECTRONICS	9247-50-TS-50-N	955824 AND 955825	6/9/2022
HIGH PASS FILTER	MICROWAVE CIRCUITS	H3R020G2	001DC9528	7/16/2022

Note: 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 physical modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C Intentional Radiator Limits for the transmitter portion of the EUT or the Subpart B Unintentional Radiator Limits (Receiver and Digital Device) Requirements.

2.3 Number of Measurements for Intentional Radiators (15.31(m))

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 below.

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

Because the EUT operates at 2402 MHz to 2480 MHz, 3 test frequencies were used.

2.4 Frequency Range of Radiated Measurements (Part 15.33)

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 5 times the highest internal clock frequency.

2.5 Measurement Detector Function and Bandwidth (CFR 15.35)

The radiated and conducted emissions limits shown herein are based on the parameters outlined 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.

2.5.3 Pulsed Transmitter Averaging

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 be expressed logarithmically in dB.

NOTE: If the transmitter was programmed to transmit at >98% duty cycle, then, wherever applicable (where the detection mode was AVG), the duty cycle factor calculated will be applied.

2.6 Transmitter Duty Cycle (CFR 15.35 (c))

When the radiated emissions limits are expressed in terms of AVERAGE values and pulse operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals as long as the pulse train does not exceed 0.1 seconds. In cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

In this case the Duty Cycle was calculated. The calculation for the Duty Cycle factor is included in the Theory of Operation exhibit.

2.7 EUT Antenna Requirements (CFR 15.203)

An intentional radiator shall be 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 shall be 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
None	Cognosos, Inc.	PCB trace antenna	2.4GHz Inverted F	4.68	trace

2.8 Restricted Bands of Operation (CFR 15.205)

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 2.1.

2.9 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.249(a)(c)) (IC RSS 210, A2.9 (a))

Radiated Radio measurements: the EUT was placed into a continuous transmit mode of operation and a preliminary scan was performed on the EUT to find signal frequencies that were caused by the transmitter part of the product. To obtain the worst case results, the EUT was placed on a table top of a non-conductive table, 80 cm above the ground floor. The EUT was positioned 3 meters away from the receiving antenna during testing (1 meter at frequencies above 6 GHz and if the emissions were less than 6 dB from the noise floor). The EUT was tested in X, Y and Z axes or the position of normal operation to determine the worst case orientation. Radiated measurements below 30 MHz were tested with a RBW = 9 kHz; emissions below 1 GHz were tested with a RBW = 120 kHz and radiated measurements above 1 GHz were measured using a RBW =1 MHz. VBW was set to three times the RBW value.

Table 5. Intentional Radiated Emissions Peak Measurements

Tested By:	Test: Part 15C, Para 15.249			Client: Cognosos Inc.			
IC	Project: 21-0414			Model: PCA-10017			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB/m)**	**Corrected Results (dBuV/m)**	**PK Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**Detection Method**
CH0							
2402.00	76.89	28.35	105.24	114.0	3.0m./VERT	8.8	**PK**
*4804.00	52.64	-6.63	46.01	74.0	3.0m./VERT	28.0	**PK**
~7206.00	39.76	-2.02	37.74	74.0	1.0m./VERT	36.3	**PK**
~9608.00	40.53	-1.65	38.88	74.0	1.0m./VERT	35.1	**PK**
~12010.00	40.04	-0.27	39.77	74.0	1.0m./VERT	34.2	**PK**
~14412.00	40.79	1.47	42.26	74.0	1.0m./VERT	31.7	**PK**
CH19							
2440.00	76.50	104.83	104.83	114.0	3.0m./VERT	9.2	**PK**
*4880.00	50.74	43.57	43.57	74.0	3.0m./VERT	30.4	**PK**
~*7320.00	40.43	39.58	39.58	74.0	1.0m./VERT	34.4	**PK**
~9760.00	42.67	41.53	41.53	74.0	1.0m./VERT	32.5	**PK**
~12200.00	38.80	39.71	39.71	74.0	1.0m./VERT	34.3	**PK**
~14640.00	39.78	3.61	43.39	74.0	1.0m./VERT	30.6	**PK**
CH39							
2480.00	75.75	28.47	104.22	114.0	3.0m./VERT	9.8	**PK**
*4960.00	50.17	-7.06	43.11	74.0	3.0m./VERT	30.9	**PK**
~*7440.00	41.47	-1.97	39.50	74.0	1.0m./VERT	34.5	**PK**
~9920.00	42.55	-1.85	40.70	74.0	1.0m./VERT	33.3	**PK**
~*12400.00	39.68	0.91	40.59	74.0	1.0m./VERT	33.4	**PK**
~14880.00	39.76	1.84	41.60	74.0	1.0m./VERT	32.4	**PK**
No other emissions found less than 20 dB from the applicable limit.							

1. (*) Falls within the restricted bands of CFR 15.205.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. (~) Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).

Sample Calculation at 2402 MHz:

Magnitude of Measured Frequency	76.89	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	28.35	dB/m
Corrected Result	105.24	dBuV/m

Test Date: January 25, 2022
Tested By

Signature:  Name: Ian Charboneau

Table 6. Average Radiated Fundamental & Harmonic Emissions

Tested By:	Test: Part 15C, Para 15.249			Client: Cognosos Inc.			
IC	Project: 21-0414			Model: PCA-10017			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA+DC (dB/m)**	**Corrected Results (dBuV/m)**	**PK Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**Detection Method**
CH0							
2402.00	76.89	0.39	77.28	94.0	3.0m./VERT	16.7	**AVG**
*4804.00	52.64	-34.59	18.06	54.0	3.0m./VERT	35.9	**AVG**
~7206.00	39.76	-29.98	9.78	54.0	1.0m./VERT	44.2	**AVG**
~9608.00	40.53	-29.61	10.92	54.0	1.0m./VERT	43.1	**AVG**
~*12010.00	40.04	-28.23	11.81	54.0	1.0m./VERT	42.2	**AVG**
~14412.00	40.79	-26.49	14.31	54.0	1.0m./VERT	39.7	**AVG**
CH19							
2440.00	76.50	0.37	76.87	94.0	3.0m./VERT	17.1	**AVG**
*4880.00	50.74	-35.13	15.61	54.0	3.0m./VERT	38.4	**AVG**
~*7320.00	40.43	-28.81	11.62	54.0	1.0m./VERT	42.4	**AVG**
~9760.00	42.67	-29.10	13.57	54.0	1.0m./VERT	40.4	**AVG**
~*12200.00	38.80	-27.05	11.75	54.0	1.0m./VERT	42.2	**AVG**
~14640.00	39.78	-24.35	15.43	54.0	1.0m./VERT	38.6	**AVG**
CH39							
2480.00	75.75	0.51	76.26	94.0	3.0m./VERT	17.7	**AVG**
*4960.00	50.17	-35.02	15.15	54.0	3.0m./VERT	38.9	**AVG**
~*7440.00	41.47	-29.93	11.55	54.0	1.0m./VERT	42.5	**AVG**
~9920.00	42.55	-29.81	12.74	54.0	1.0m./VERT	41.3	**AVG**
~*12400.00	39.68	-27.05	12.63	54.0	1.0m./VERT	41.4	**AVG**
~14880.00	39.76	-26.12	13.64	54.0	1.0m./VERT	40.4	**AVG**
No other emissions found less than 20 dB from the applicable limit.							

1. (*) Falls within the restricted bands of CFR 15.205.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. (~) Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).
4. DC correction factor of -27.96 applied

Sample Calculation at 2402 MHz:

Magnitude of Measured Frequency	76.89	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	0.39	dB/m
Corrected Result	77.28	dBuV/m

Test Date: January 25, 2022
Tested By

Signature:  Name: Ian Charboneau

2.10 Band Edge Measurements – (CFR 15.249 (d))

Band Edge measurements are made following the guidelines in FCC KDB Publication No. 558074 with the EUT initially operating on the Lowest Channel and then operating on the Highest Channel within its band of operation. Radiated measurements are performed to demonstrate compliance with the requirement of 15.249(d) that all emissions outside of the band edges be attenuated by at least 50 dB or 15.209 limits, when compared to its highest in-band value (contained in a 100 kHz band).

To capture the band edge, set the Spectrum Analyzer frequency span set to 2 MHz to capture the peak level of the emission operating on the channel closest to the band edge as well as any modulation products falling outside of the authorized band of operation. See figure and calculations following for more detail.

The EUT has different PHY modes of operation for programming purposes:

PHY1	1Mbps	1 MHz BW
PHY2	2Mbps	2 MHz BW
PHY3	125kbps	1 MHz BW
PHY4	500kbps	1MHz BW

Exploratory testing was conducted and it was determined that for field strength measurements the PHY1 mode of operation can be used as the representative mode of operation for all PHY modes. For restricted band, band edge and bandwidth measurements, two PHY modes were used to represent the EUT. PHY1 and PHY2. PHY2 yields a wider bandwidth, PHY1 is used to represent PHY1, 3 & 4. The test results are present herein.

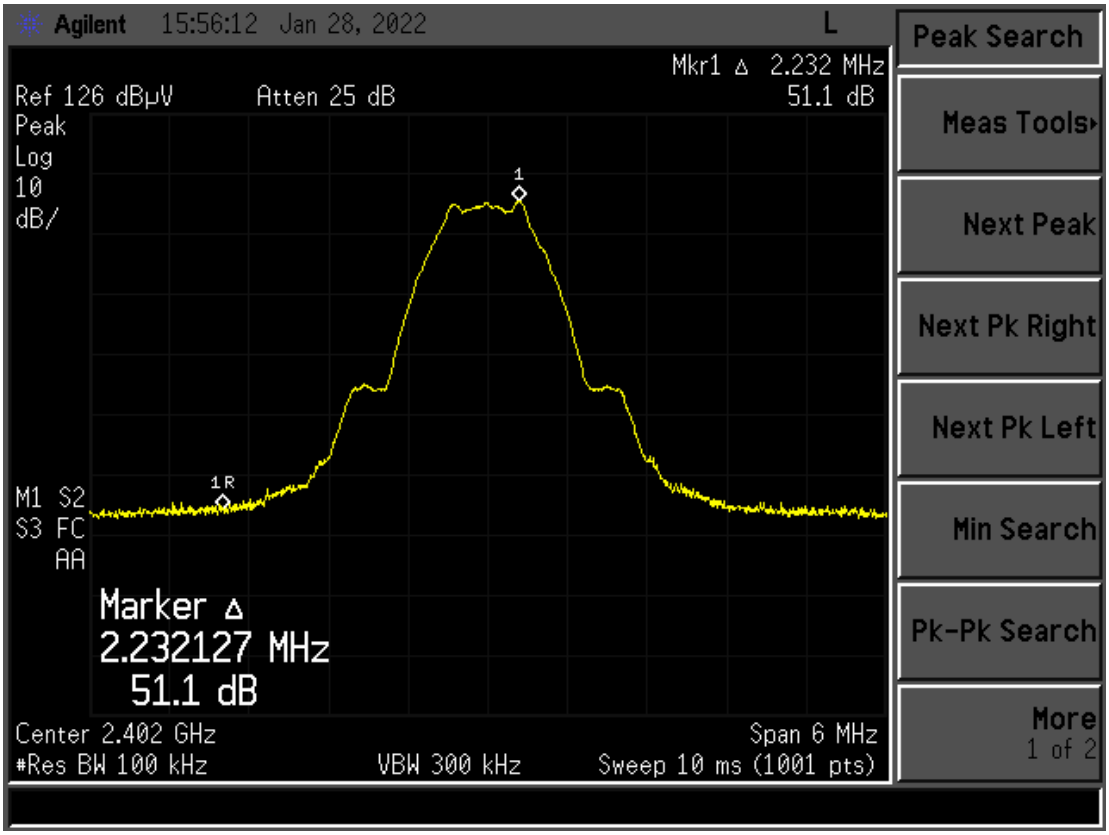

Figure 2. Band Edge Compliance, Low Channel PHY1 Delta – Peak

Low Channel Corrected Measured Value from Table 5	105.24	dBuV
Low Channel Band Edge Delta from Figure 2	-51.10	dB
Calculated Result (PEAK)	54.14	dBuV/m
Band Edge Limit (PEAK)	74.00	dBuV/m
Calculated Result (PEAK)	-54.14	dBuV/m
Band Edge Margin	19.86	dBuV/m
Low Channel Corrected Measured Value from Table 6	77.28	dBuV
Low Channel Band Edge Delta from Figure 2	-51.10	dB
Calculated Result (AVG)	26.18	dBuV/m
Band Edge Limit (AVG)	54.00	dBuV/m
Calculated Result (AVG)	-26.18	dBuV/m
Band Edge Margin	27.82	dBuV/m

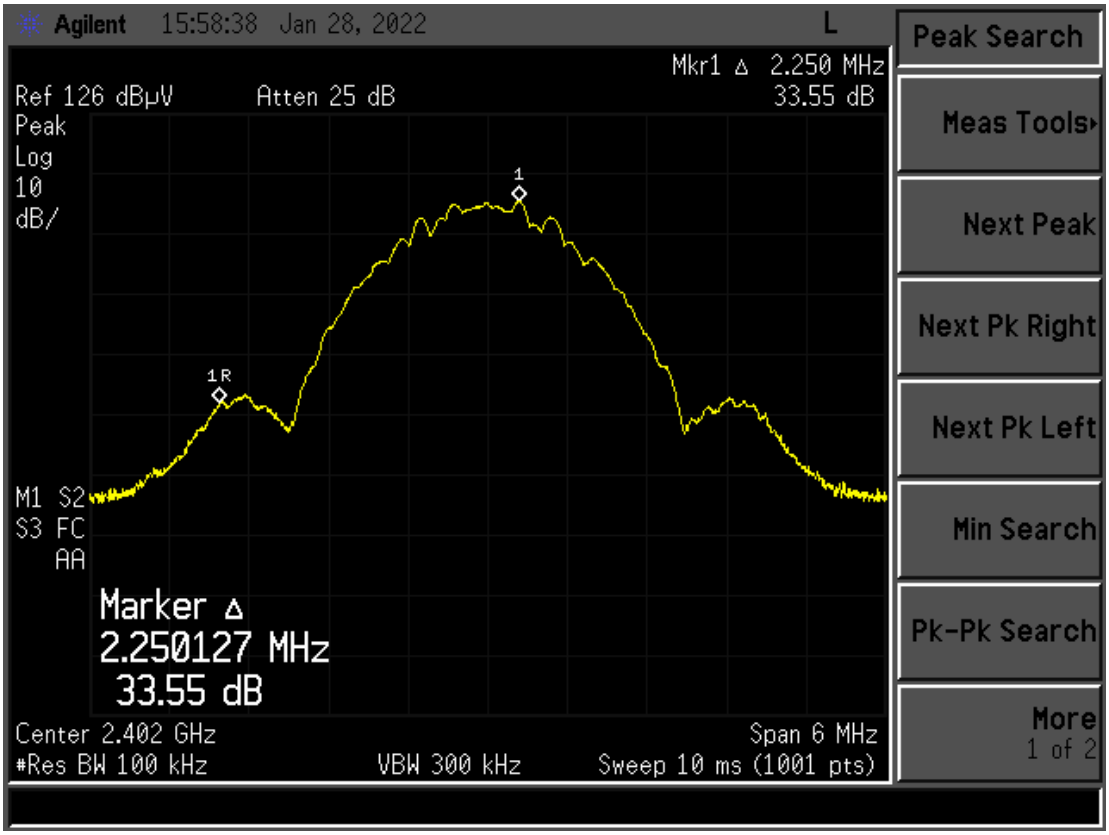

Figure 3. Band Edge Compliance, Low Channel PHY2 Delta – Peak

Low Channel Corrected Measured Value from Table 5	105.24	dBuV
Low Channel Band Edge Delta from Figure 2	-33.55	dB
Calculated Result (PEAK)	71.69	dBuV/m
Band Edge Limit (PEAK)	74.00	dBuV/m
Calculated Result (PEAK)	-71.69	dBuV/m
Band Edge Margin	2.31	dBuV/m
Low Channel Corrected Measured Value from Table 6	77.28	dBuV
Low Channel Band Edge Delta from Figure 2	-33.55	dB
Calculated Result (AVG)	43.73	dBuV/m
Band Edge Limit (AVG)	74.00	dBuV/m
Calculated Result (AVG)	-43.73	dBuV/m
Band Edge Margin	30.27	dBuV/m

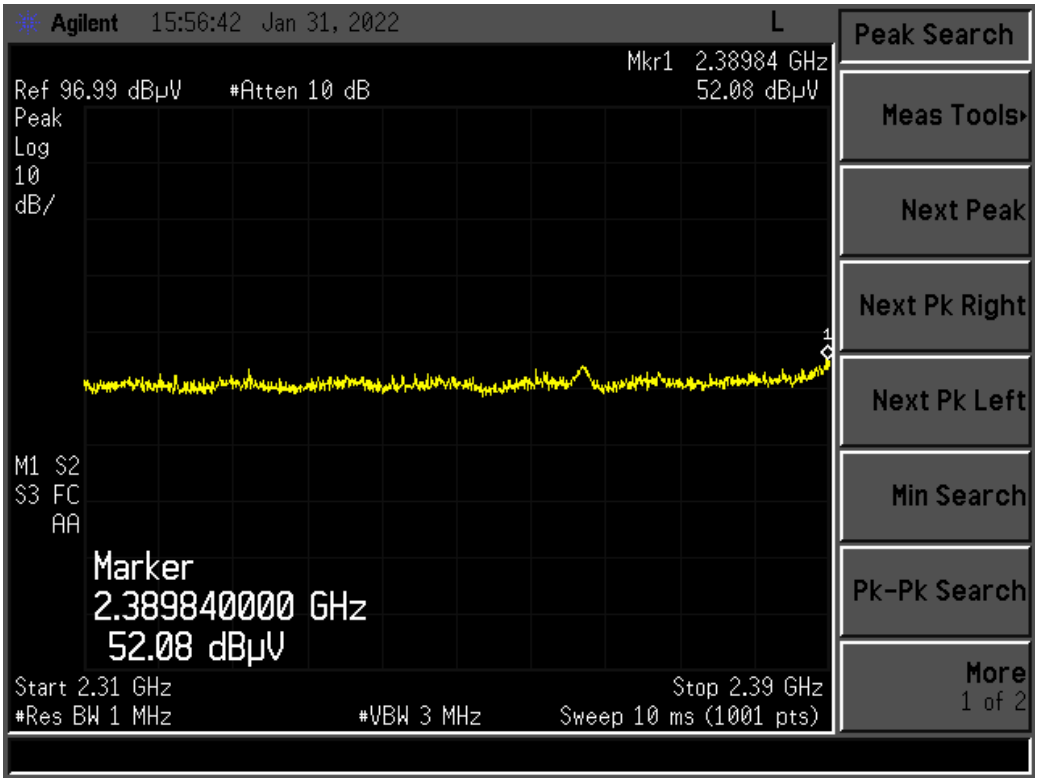

Figure 4. Radiated Restricted Band 2310 MHz to 2390 MHz PHY1, Peak

Table 7. Radiated Restricted Band 2310 MHz to 2390 MHz, Peak

Restricted Band Peak Measurements							
Test: Radiated Emissions				**Client:** Cognosos			
Project: 21-0414				**Model: PCA-10017**			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or AVG**
2364	51.50	-10.21	41.29	54.0	3.0m/VERT	12.71	PK
2389	52.08	-10.21	41.87	54.0	3.0m/VERT	12.10	PK

Note: Peak meets avg limits

Test Date: January 31, 2022
Tested By
Signature: Ian Charboneau Name: Ian Charboneau

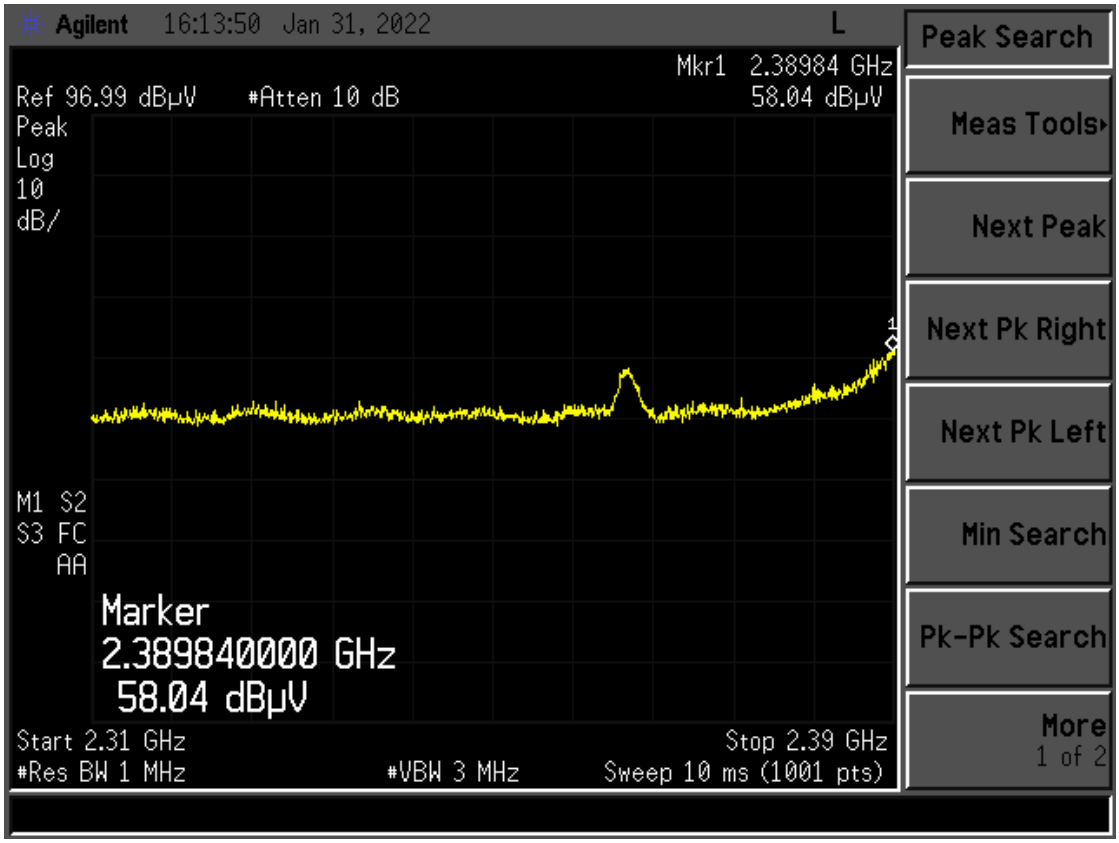

Figure 5. Radiated Restricted Band 2310 MHz to 2390 MHz PHY2, Peak

Table 8. Radiated Restricted Band 2310 MHz to 2390 MHz, Peak

Restricted Band Peak Measurements							
Test: Radiated Emissions				**Client:** Cognosos			
Project: 21-0414				**Model: PCA-10017**			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or AVG**
2363	56.6	-10.21	46.34	54	3.0m/VERT	7.6	PK
2389	58.4	-10.21	48.14	54	3.0m/VERT	5.8	PK

Note: Peak meets avg limits

Test Date: January 31, 2022
Tested By
Signature: Ian Charboneau Name: Ian Charboneau

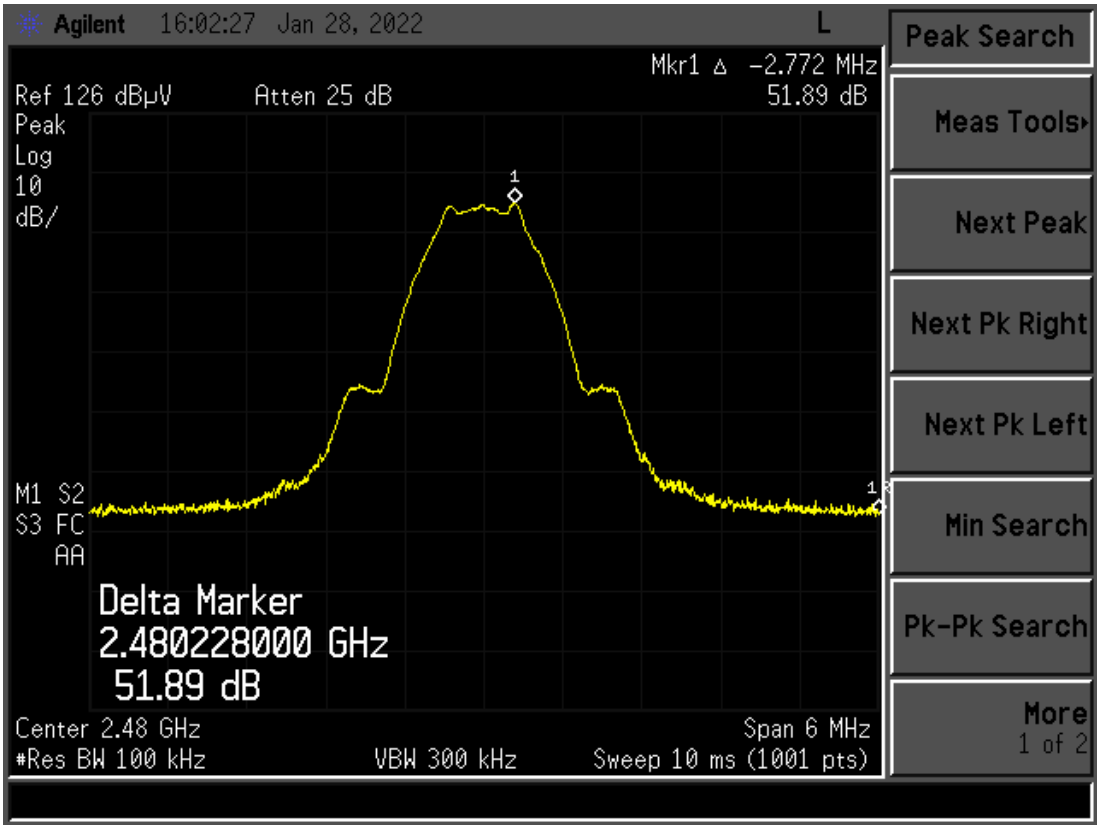

Figure 6. Band Edge Compliance, High Channel PHY1 Delta, Peak

Low Channel Corrected Measured Value from Table 5	104.22	dBuV
Low Channel Band Edge Delta from Figure 2	-51.89	dB
Calculated Result (PEAK)	52.33	dBuV/m
Band Edge Limit (PEAK)	74.00	dBuV/m
Calculated Result (PEAK)	-52.33	dBuV/m
Band Edge Margin	21.67	dBuV/m
Low Channel Corrected Measured Value from Table 6	76.26	dBuV
Low Channel Band Edge Delta from Figure 2	-51.89	dB
Calculated Result (AVG)	24.37	dBuV/m
Band Edge Limit (AVG)	74.00	dBuV/m
Calculated Result (AVG)	-24.37	dBuV/m
Band Edge Margin	49.63	dBuV/m

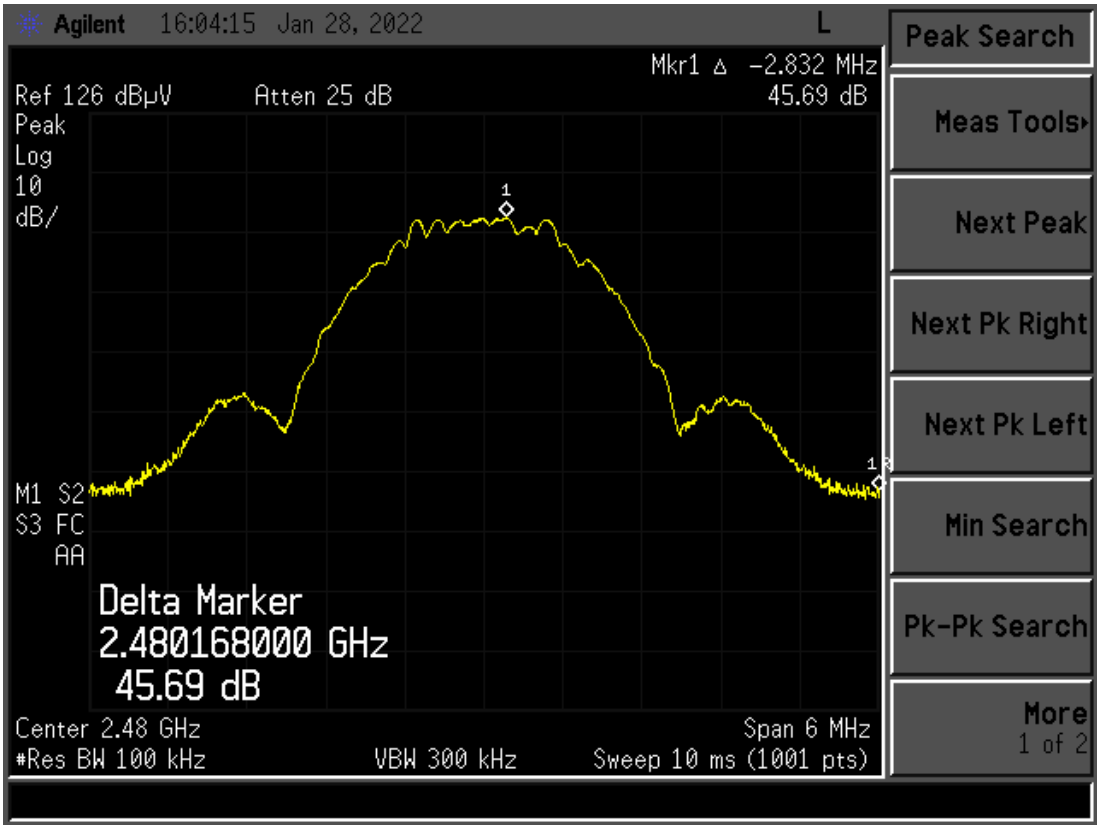

Figure 7. Band Edge Compliance, High Channel PHY2 Delta, Peak

Low Channel Corrected Measured Value from Table 5	104.22	dBuV
Low Channel Band Edge Delta from Figure 2	-45.69	dB
Calculated Result (PEAK)	58.53	dBuV/m
Band Edge Limit (PEAK)	74.00	dBuV/m
Calculated Result (PEAK)	-58.53	dBuV/m
Band Edge Margin	15.47	dBuV/m
Low Channel Corrected Measured Value from Table 6	76.26	dBuV
Low Channel Band Edge Delta from Figure 2	-45.69	dB
Calculated Result (AVG)	30.57	dBuV/m
Band Edge Limit (AVG)	74.00	dBuV/m
Calculated Result (AVG)	-30.57	dBuV/m
Band Edge Margin	43.43	dBuV/m

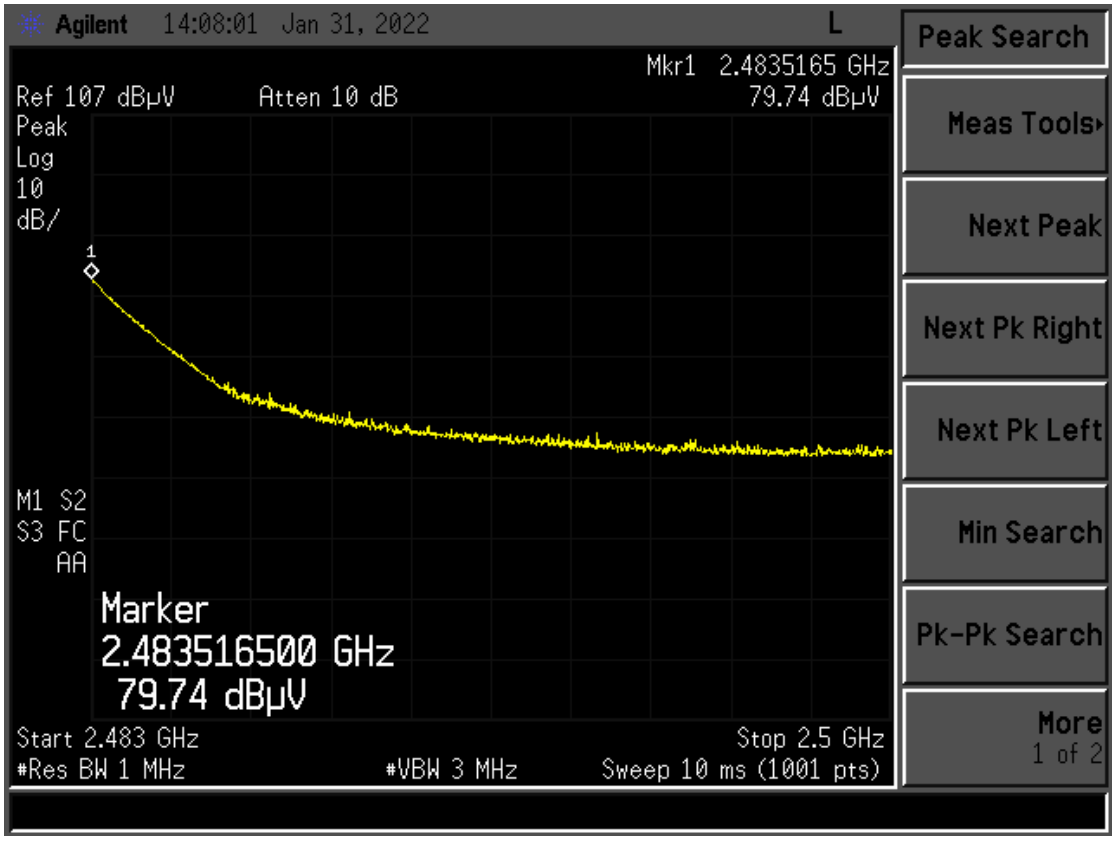

Figure 8. Radiated Restricted Band 2483.5 MHz to 2500 MHz PHY1, Peak

Table 9. Radiated Restricted Band 2483.5 MHz to 2500 MHz, Peak

Restricted Band Peak Measurements							
Test: Radiated Emissions				**Client:** Cognosos			
Project: 22-0414				**Model:** PCA-10017			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP + DC (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or AVG**
2483	79.74	-9.83	69.91	74	3.0m/VERT	4.1	PK
2483	79.74	-37.79	39.42	54	3.0m/VERT	14.6	AVG

Test Date: January 31, 2022
Tested By
Signature: Ian Charboneau Name: Ian Charboneau

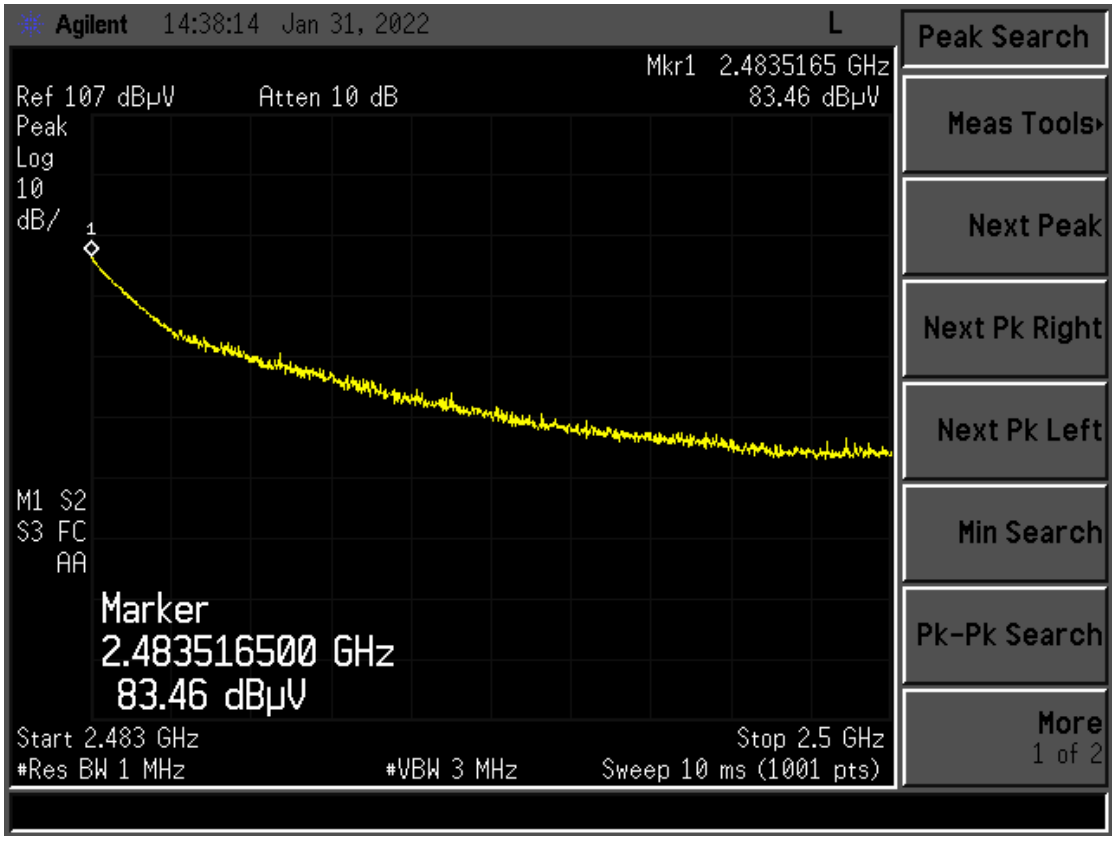

Figure 9. Radiated Restricted Band 2483.5 MHz to 2500 MHz PHY2, Peak

Table 10. Radiated Restricted Band 2483.5 MHz to 2500 MHz, Peak

Restricted Band Peak Measurements							
Test: Radiated Emissions				**Client:** Cognosos			
Project: 21-414				**Model:** PCA-10017			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or AVG**
2483	81.77	-9.83	71.91	74	3.0m/VERT	2.09	PK
2483	81.77	-37.79	43.98	54	3.0m/VERT	10.02	AVG

Test Date: January 31, 2022
Tested By
Signature: Ian Charboneau Name: Ian Charboneau

2.11 Occupied Bandwidth (CFR 2.1049)

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

Table 11. Occupied Bandwidth PHY1

Frequency (MHz)	Occupied Bandwidth (MHz)
2402	1.040
2440	1.035
2480	1.035

Test Date: January 27, 2022
Tested By
Signature: Ian Charboneau Name: Ian Charboneau

Table 12. Occupied Bandwidth PHY2

Frequency (MHz)	Occupied Bandwidth (MHz)
2402	2.075
2440	2.070
2480	2.090

Test Date: January 27, 2022
Tested By
Signature: Ian Charboneau Name: Ian Charboneau

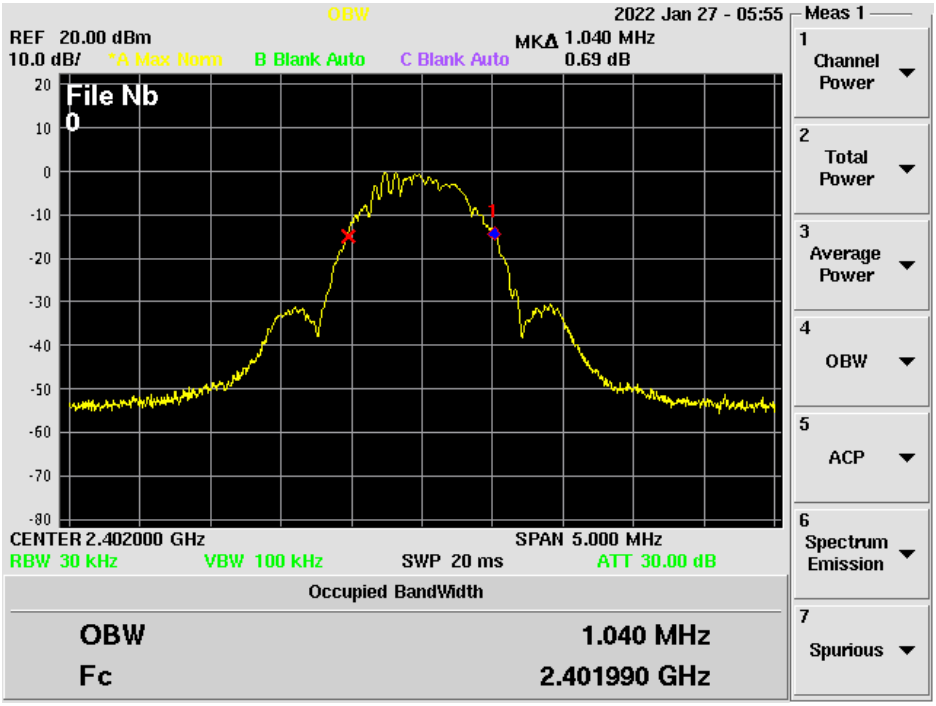

Figure 10. 99% Occupied Bandwidth Low Channel PHY1

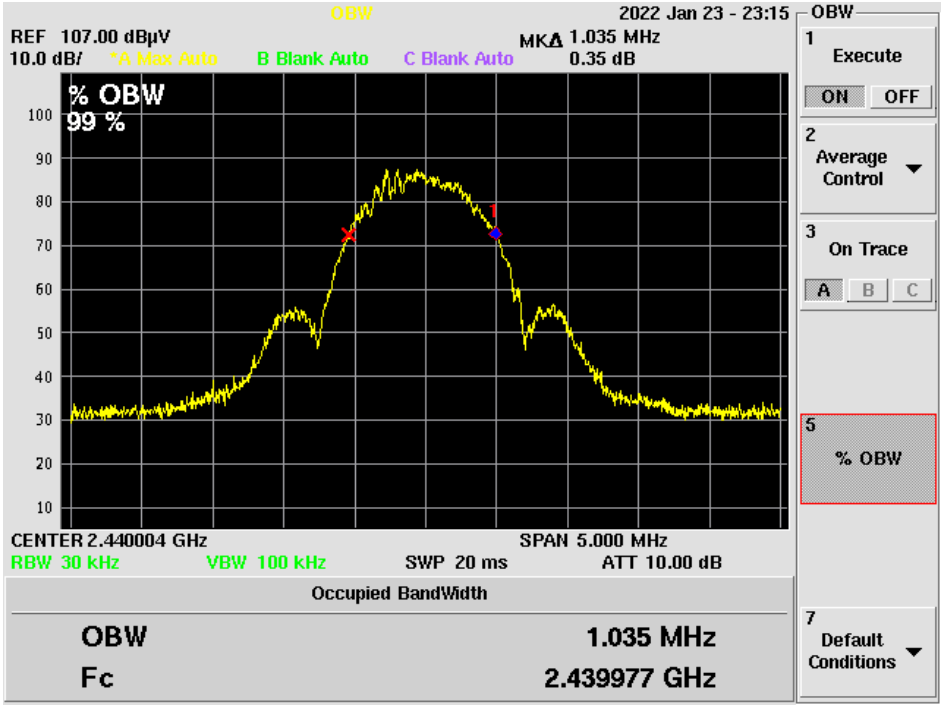

Figure 11. 99% Occupied Bandwidth Mid Channel PHY1

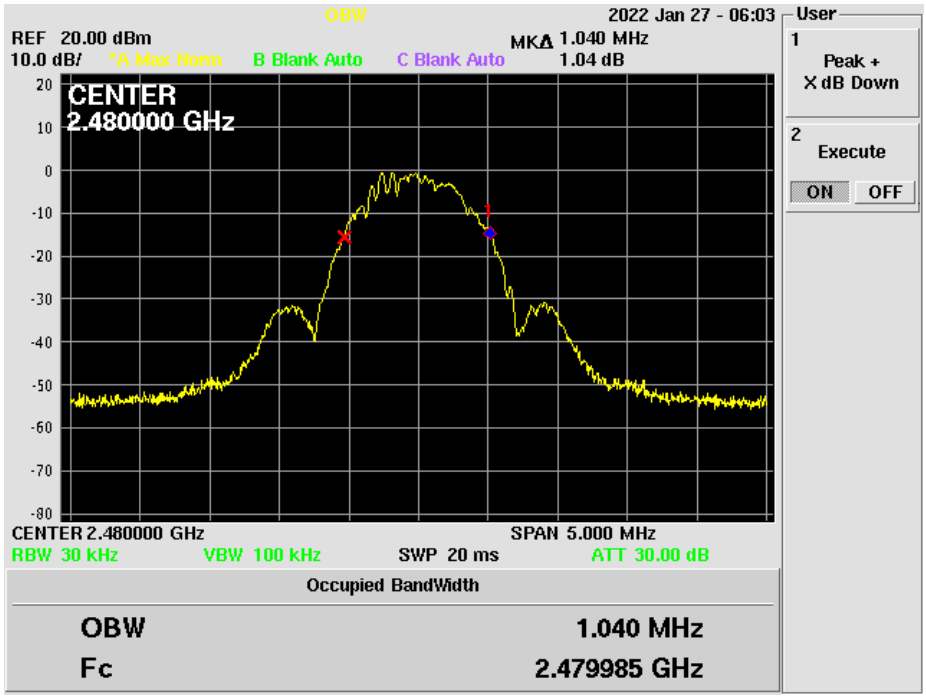

Figure 12. 99% Occupied Bandwidth High Channel PHY1

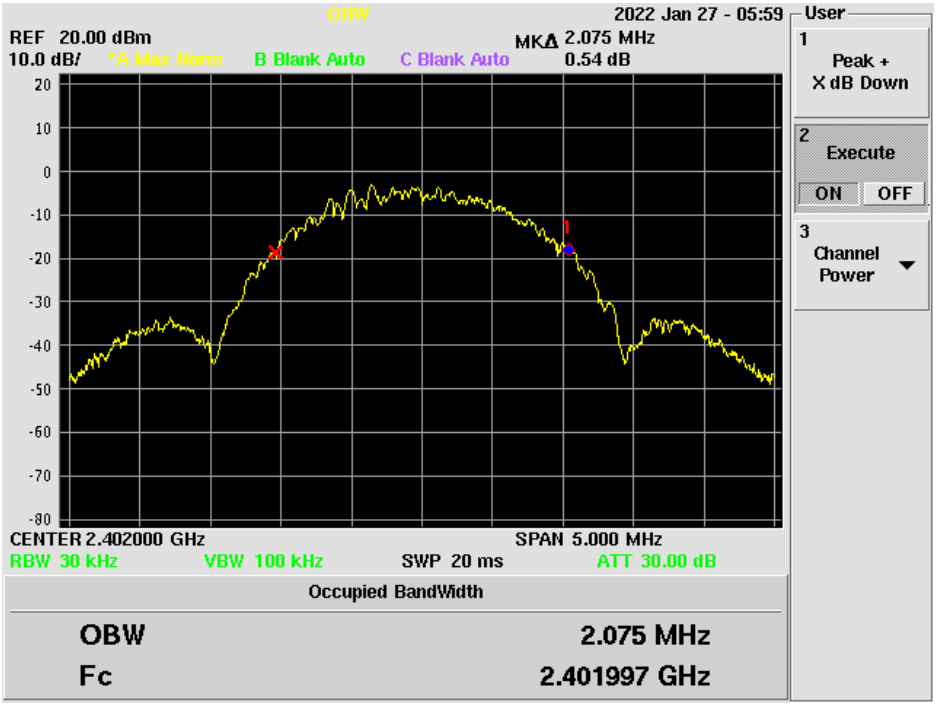

Figure 13. 99% Occupied Bandwidth Low Channel PHY2

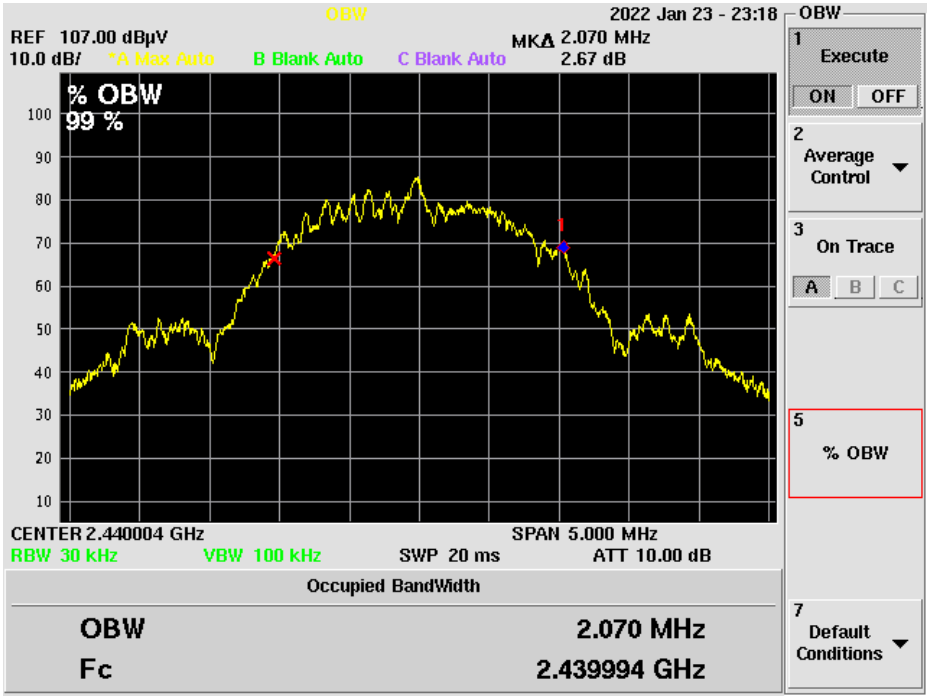

Figure 14. 99% Occupied Bandwidth Mid Channel PHY2

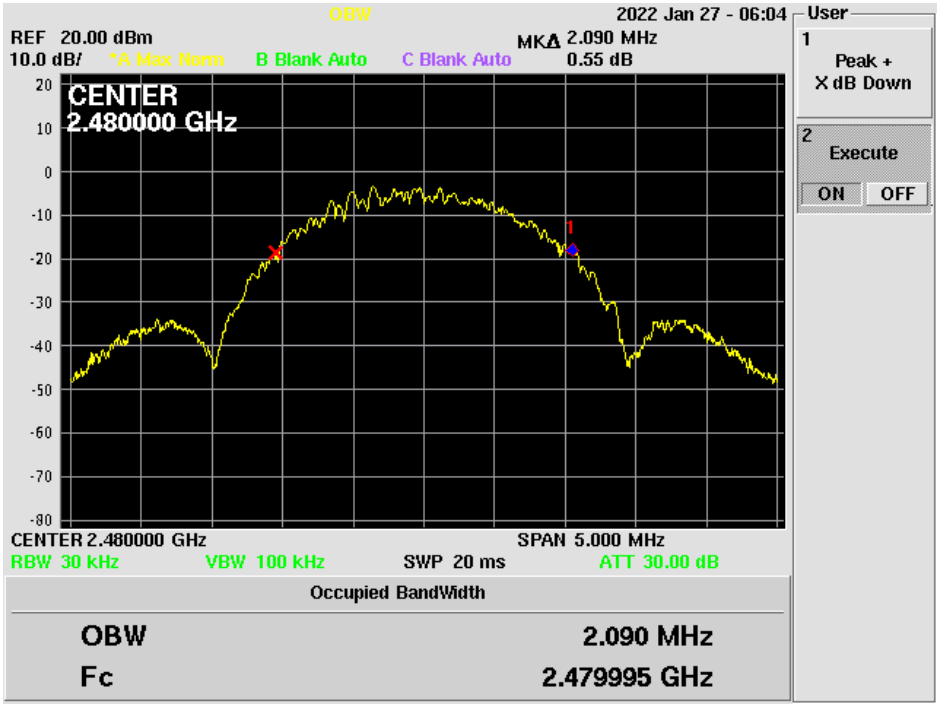

Figure 15. 99% Occupied Bandwidth High Channel PHY2

2.12 Powerline Emissions (CFR 15.207)

The power line conducted voltage emission measurements have been carried out in accordance with CFR 15.207, per ANSI C63.4:2014, Paragraph 7, with a spectrum analyzer connected to a LISN and the EUT placed into a continuous mode of transmission.

Table 13. Transmitter Power Line Conducted Emissions Test Data, Part 15.107

9kHz to 30 MHz with Class B Limits						
Test: Radiated Emissions				**Client:** Cognosos		
Project: 22-0414				**Model:** PCA-10017		
Frequency (MHz)	**Test Data (dBuv)**	**LISN+CL-PA (dB)**	**Results (dBuV)**	**AVG Limits (dBuV)**	**Margin (dB)**	**Detector PK, QP, or AVG**
12 Vdc, Positive						
0.1903	33.43	0.08	33.51	54.0	20.5	**PK**
0.9000	28.75	0.59	29.34	46.0	16.7	**PK**
1.1866	28.04	0.87	28.91	46.0	17.1	**PK**
6.6833	34.79	0.34	35.13	50.0	14.9	**PK**
13.3660	42.04	0.88	42.92	50.0	7.1	**PK**
20.0600	33.93	0.88	34.81	50.0	15.2	**PK**
12 Vdc, Negative						
0.1792	29.79	0.13	29.92	54.0	24.6	**PK**
0.7483	28.42	0.51	28.93	46.0	17.1	**PK**
1.6730	27.75	0.61	28.36	46.0	17.6	**PK**
6.6916	35.21	0.47	35.68	50.0	14.3	**PK**
13.3660	42.48	1.24	43.72	50.0	6.3	**PK**
20.0330	34.22	1.46	35.68	50.0	14.3	**PK**

Sample Calculation at 0.1903 MHz:

Magnitude of Measured Frequency	33.43	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	0.08	dB/m
Corrected Result	33.51	dBuV/m

Test Date: February 4, 2022
Tested By

Signature:  Name: Ian Charboneau

2.13 Intentional Radiator, Radiated Emissions (CFR 15.209)

Radiated emissions disturbance Measurements were performed with an instrument having both peak and quasi-peak detectors over the frequency range of 9 KHz to 12.5 GHz. Measurements of the radiated emissions were made with the receiver antenna at a distance of 3 m from the boundary of the test unit.

The test antenna was varied from 1 m to 4 m in height while watching the analyzers' display for the maximum magnitude of the signal at the test frequency. The antenna polarization (horizontal or vertical) and test sample azimuth were varied during the measurements to find the maximum field strength readings to record.

The worst-case radiated emissions in the range of 9 KHz to 25 GHz are more than 20 dB below the limit.

Table 14. Radiated Emissions, 9 kHz - 30 MHz

9 kHz to 30 MHz, 15.209 limits							
Test: Radiated Emissions				**Client:** Cognosos Inc.			
Project: 21-0414				**Model:** PCA-10017			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or AVG**
Loop X position							
0.009	50.29	13.75	64.04	127.9	3m./ none.	63.9	**PK**
0.15	46.54	12.42	58.96	104.1	3m./ none	45.1	**PK**
0.54	37.71	11.94	49.65	73.0	3m./ none	23.3	**PK**
2.70	32.34	11.66	44.00	69.5	3m./ none.	25.5	**PK**
Loop Y position							
0.009	49.30	13.75	63.05	129.3	3m./ none.	66.3	**PK**
0.15	46.37	12.42	58.79	104.1	3m./ none.	45.3	**PK**
0.54	38.90	11.94	50.84	73.0	3m./ none.	22.1	**PK**
7.18	31.73	11.26	42.99	69.5	3m./ none.	26.6	**PK**
Loop Z position							
0.012	49.04	13.75	62.79	125.7	3m./ none.	62.9	**PK**
0.15	47.55	12.42	59.97	104.1	3m./ none.	44.1	**PK**
0.68	37.75	11.92	49.67	71.0	3m./ none.	21.3	**PK**
2.37	29.09	11.65	40.74	69.5	3m./ none.	28.8	**PK**

Sample Calculation at 0.009 MHz:

Magnitude of Measured Frequency	50.29	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	13.75	dB/m
Corrected Result	64.04	dBuV/m

Test Date: January 1, 2022
Tested By

Signature: Ian Charboneau Name: Ian Charboneau

Table 15. Radiated Emissions other than Fundamental & Harmonics Below 1GHz

>30 MHz 15 2.09 Limits							
Test: Radiated Emissions				**Client:** Cognosos Inc.			
Project: 21-0414				**Model:** PCA-10017			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or AVG**
35.40	41.11	-13.47	27.64	40.0	3.0m./HORZ	12.4	**PK**
100.38	44.17	-15.50	28.67	43.5	3.0m./VERT	14.8	**PK**
145.01	41.40	-14.89	26.51	43.5	3.0m./HORZ	17.0	**PK**
185.44	41.28	-12.70	28.58	43.5	3.0m./VERT	14.9	**PK**
359.78	41.87	-12.96	28.91	46.0	3.0m./VERT	17.1	**PK**
394.46	41.70	-11.87	29.83	46.0	3.0m./HORZ	16.2	**PK**
866.64	41.68	-5.63	36.05	46.0	3.0m./HORZ	9.9	**PK**
881.12	41.60	-6.49	35.11	46.0	3.0m./VERT	10.9	**PK**

Sample Calculation at 35.50 MHz:

Magnitude of Measured Frequency	41.11	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	-13.47	dB/m
Corrected Result	27.64	dBuV/m

Test Date: January 26, 2022
Tested By

Signature:  Name: Ian Charboneau

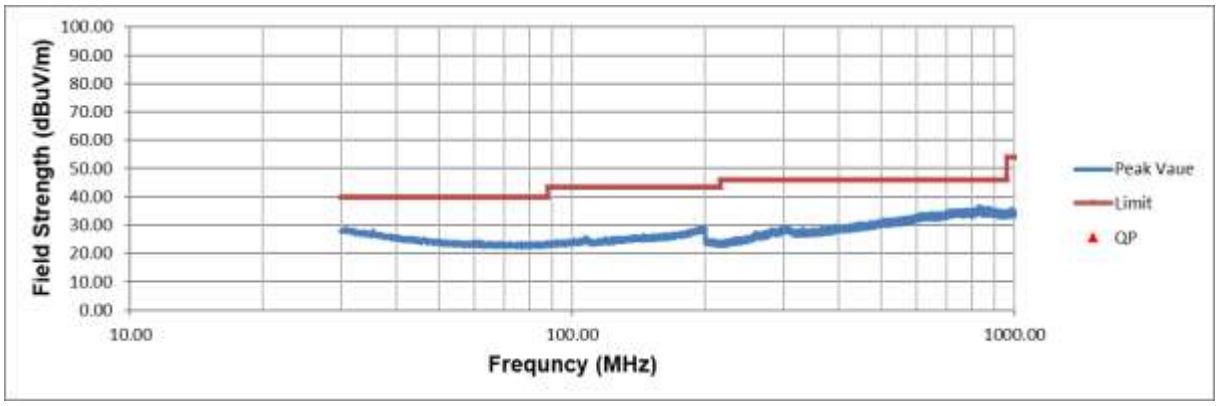

Figure 16. Unintentional Radiated Emissions, 30 MHz – 1000 MHz (Horizontal)

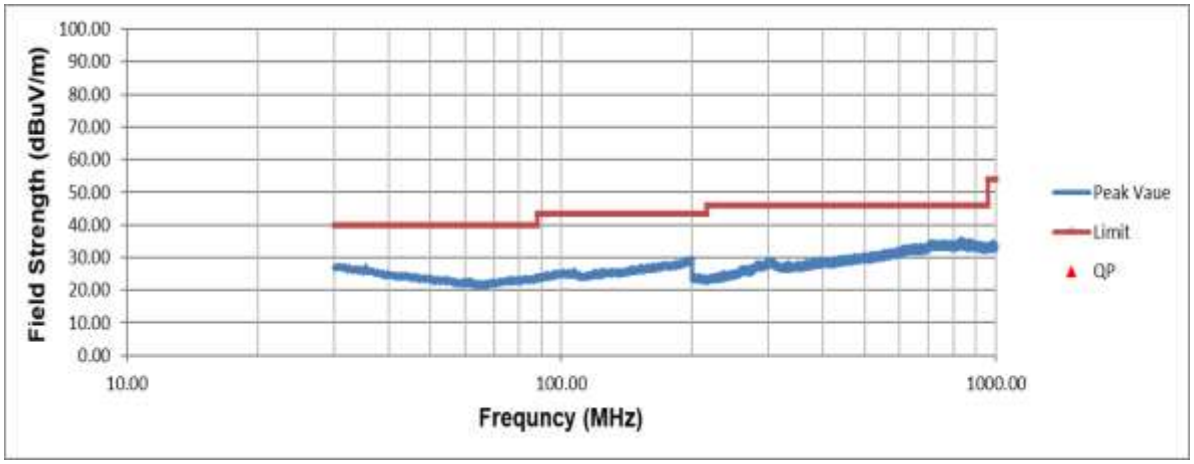

Figure 17. Unintentional Radiated Emissions, 30 MHz – 1000 MHz (Vertical)

Table 16. Radiated Emissions other than Fundamental & Harmonics Above 1GHz

>30 MHz 15 2.09 Limits							
Test: Radiated Emissions				**Client:** Cognosos Inc.			
Project: 21-0414				**Model:** PCA-10017			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or AVG**
1536.00	38.08	-14.60	23.48	54.0	3.0m./VERT	30.5	**PK**
1607.00	52.69	-14.08	38.61	54.0	3.0m./HORZ	15.4	**PK**
4001.00	53.16	-6.57	46.59	54.0	3.0m./VERT	7.4	**PK**
4074.00	51.99	-6.62	45.37	54.0	3.0m./HORZ	8.6	**PK**
7694.00	41.95	-1.95	40.00	54.0	1.0m./HORZ	14.0	**PK**
8846.00	41.83	-1.62	40.21	54.0	1.0m./VERT	13.8	**PK**
15297.00	43.69	0.52	44.21	54.0	1.0m./VERT	9.8	**PK**
15665.00	42.88	0.74	43.62	54.0	1.0m./HORZ	10.4	**PK**

Tested from 1 GHz to 18 GHz

SAMPLE CALCULATION at: 1536 MHz

Magnitude of Measured Frequency	38.08	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	-14.60	dB/m
Corrected Result	23.48	dBuV/m

Test Date: January 26, 2022
Tested By

Signature: Ian Charboneau Name: Ian Charboneau

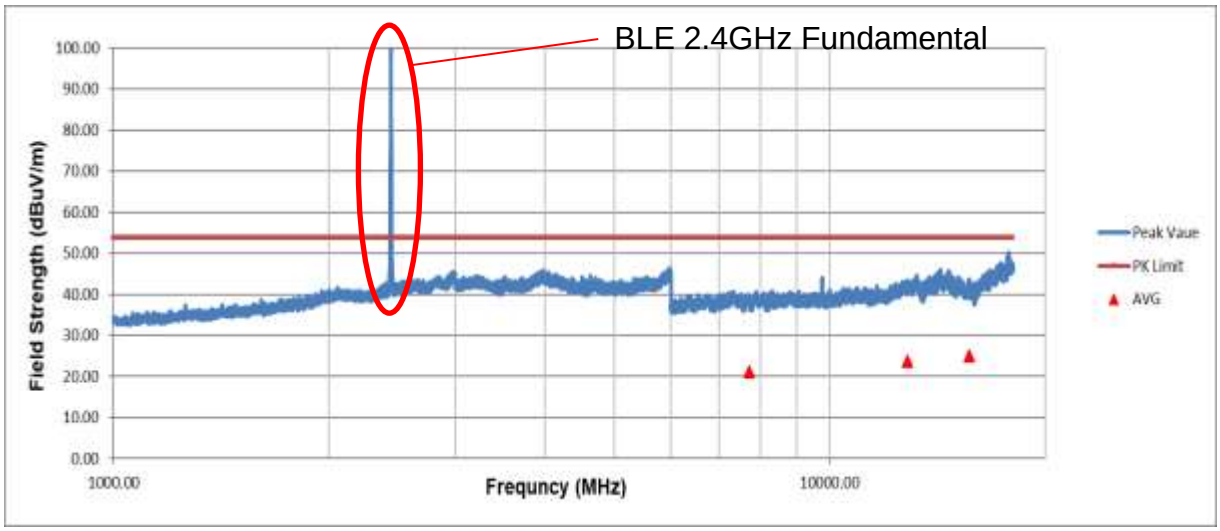

Figure 18. Unintentional Radiated Emissions, 1000 MHz – 18000 MHz (Horizontal)

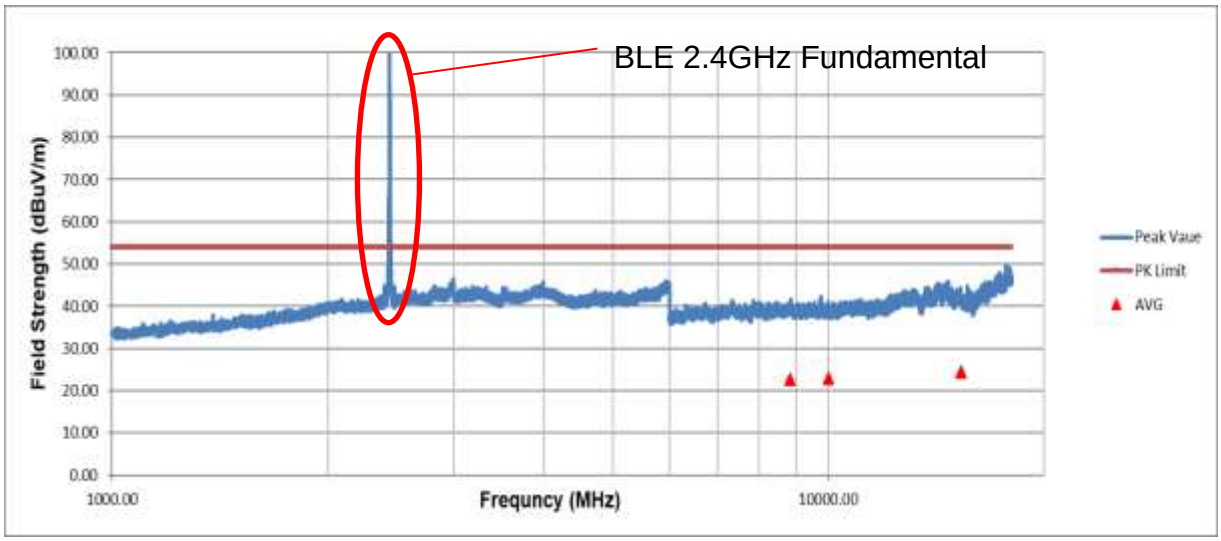

Figure 19. Unintentional Radiated Emissions, 1000 MHz – 18000 MHz (Vertical)

2.14 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%.

2.14.1 Conducted Emissions Measurement Uncertainty

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

2.14.2 Radiated Emissions Measurement Uncertainty

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ± 5.40 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 ± 5.19 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ± 5.08 dB.

The data listed in this test report does have sufficient margin to negate the effects of uncertainty. Therefore, the EUT unconditionally meets this requirement.

END REPORT