Testing Tomorrow's Technology

Class 2 Permissive Change Test Report

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

And

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

For the

Emerson Digital Cold Chain, Inc

Model: PSASII-03

FCC ID: WPEPSASII-03
IC ID: 8031A-PSASII03

UST Project: 21-0335

Issue Date: November 24, 2021

Total Pages: 17

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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: Compliance Engineer – President

Date: November 24, 2021

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MEASUREMENT TECHNICAL REPORT

Company Name:	Emerson Digital Cold Chain, Inc
Address:	7121 Fairway Dr. Suite #400 Palm Beach Gardens, FL 33418
Model:	PSASII-03
FCC ID:	WPEPSASII-03
IC ID:	8031A-PSASII03
Date:	November 24, 2021

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

Equipment type: 900 MHz Radio Transceiver

Technical Information:

Radio Technology:	non-FHSS
Frequency of Operation (MHz):	902-928
Output Power (dBm):	+2.4 dBm
Type of Modulation:	FSK
Data/Bit Rate:	N/A
Antenna Gain (dBi):	5.0 dBi (max)
Software used to program EUT:	N/A
EUT firmware:	BusyBox v.1.24.1
Power setting:	+2.6 dBm (N. America)

Report prepared by:

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Cover Letter
ISED Agency Agreement
Test Configuration Photographs
Letter of Confidentiality
Permissive Change Letter

1 General Information

1.1 Purpose of this Report

The purpose of this report is to file for a Class II permissive change for the following reasons:

- Addition of external antenna
  - MFG: Data Alliance or equivalent
  - Part Number: A9D5SRA or equivalent
  - 5 dBi Gain & 1.8 dBi Gain
  - Dipole Type
  - Omni directional

Due to the changes above, the equipment was re-evaluated for continued compliance with Part 15.247, 15.209 and RSS-247 requirements. The following tests were performed:

- Intentional Radiated emissions
- Spurious Radiated emissions

All other tests were deemed to be not affected by the changes. The test data has been collected and is presented herein for consideration.

1.2 Characterization of Test Sample

The samples used for testing were received by US Tech on October 28, 2021 in good operating condition.

1.3 Product Description

The Equipment under Test (EUT) is the Emerson Digital Cold Chain, Inc. model PSASII-03. The EUT is a 900 MHz band radio transceiver used to communicate with other Emerson Digital Cold Chain, Inc products. This product may be sold with the following options:

1. PSASII-03 with 900 MHz Reader (CGTX) radio module and WiFi module (FCC ID: NCMOCG2101; IC: 2734A-CG2101)

2. PSASII-03 with 900 MHz Reader (CGTX) radio module and cellular module (FCC ID: XMR201903EG25G; IC: 10224A-201903EG25G)

3. PSASII-03 with 900 MHz Reader (CGTX) radio module with both WiFi module and cellular module (FCC ID: NCMOCG2101; IC: 2734A-CG2101 and FCC ID: XMR201903EG25G; IC: 10224A-201903EG25G)

The WiFi and cellular modules are certified radio modules used per their grant requirements.

The EUT is declared to be a 902-928 MHz band radio, using FSK modulation with an output power setting of +2.6 dBm for N. America.

The EUT has been tested in the configuration which incorporates all three modules and had all three modules exercising during testing to ensure compliance as a co-located radio product during unwanted spurious emissions testing.

1.4 Configuration of Tested System

The Test Sample was tested per *ANSI C63.10:2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices* for the intentional radiator aspect of the device and *ANSI C63.4:2014, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2014)* for the unintentional radiator aspect of the device as well as FCC subpart B and C of Part 15 and per FCC KDB Publication number 558074 v05r02 for Digital Transmission Systems Operating Under section 15.247.

Per FCC Parts 15.107 and 15.109, digital RF conducted and radiated emissions below 1 GHz were measured with the spectrum analyzer's resolution bandwidth (RBW) adjusted to 9 kHz and 120 kHz, respectively. All measurements performed above 1 GHz were made with a RBW of 1 MHz. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was set to 3 times the RBW or as required per the standard throughout the evaluation process.

A list of EUT and Peripherals is found in Table 1, following. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are provided in separate Appendices.

1.5 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA 30004. This site has been fully described and registered with the FCC. Its designation number is 186022. Additionally, this site has also been fully described

and submitted to Industry Canada (IC), and has been approved under file number 9900A-1 and ISED CAB # US0031.

Table 1. EUT and Peripherals

EUT MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC/IC ID	CABLES P/D
Radio device/Emerson Digital Cold Chain, Inc.	PSASII-03	Engineering Sample	FCC ID: WPEPSASII-03 IC: 8031A-PSASII03	P
PERIPHERAL MANUFACTURER	**MODEL NUMBER**	**SERIAL NUMBER**	**FCC/IC ID**	**CABLES P/D**
Power Adapter/ Phihong USA	PSA12A-120	None	None	P
Antenna See antenna details	--	--	--	--

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

Table 2. Details of I/O Cables Attached to EUT

DESCRIPTION OF CABLE	DETAILS OF CABLE			CABLE LENGTH
Power Cable	**Manufacturer**		**Part Number**	1.5 m
	Phihong USA		PSA12A-120	
	Shield Type	**Shield Termination**	**Back-shell**	
	N/A	N/A	N/A	

Shield Type
N/A = None
F = Foil
B = Braided
2B = Double Braided
CND = Could Not Determine

Shield Termination
N/A = None
360 = 360 Degrees
P = Pigtail/Drain Wire
CND = Could Not Determine
MU = Metal Unshielded

Back-shell
N/A = Not Applicable
PS = Plastic Shielded
PU = Plastic Unshielded
MS = Metal Shielded

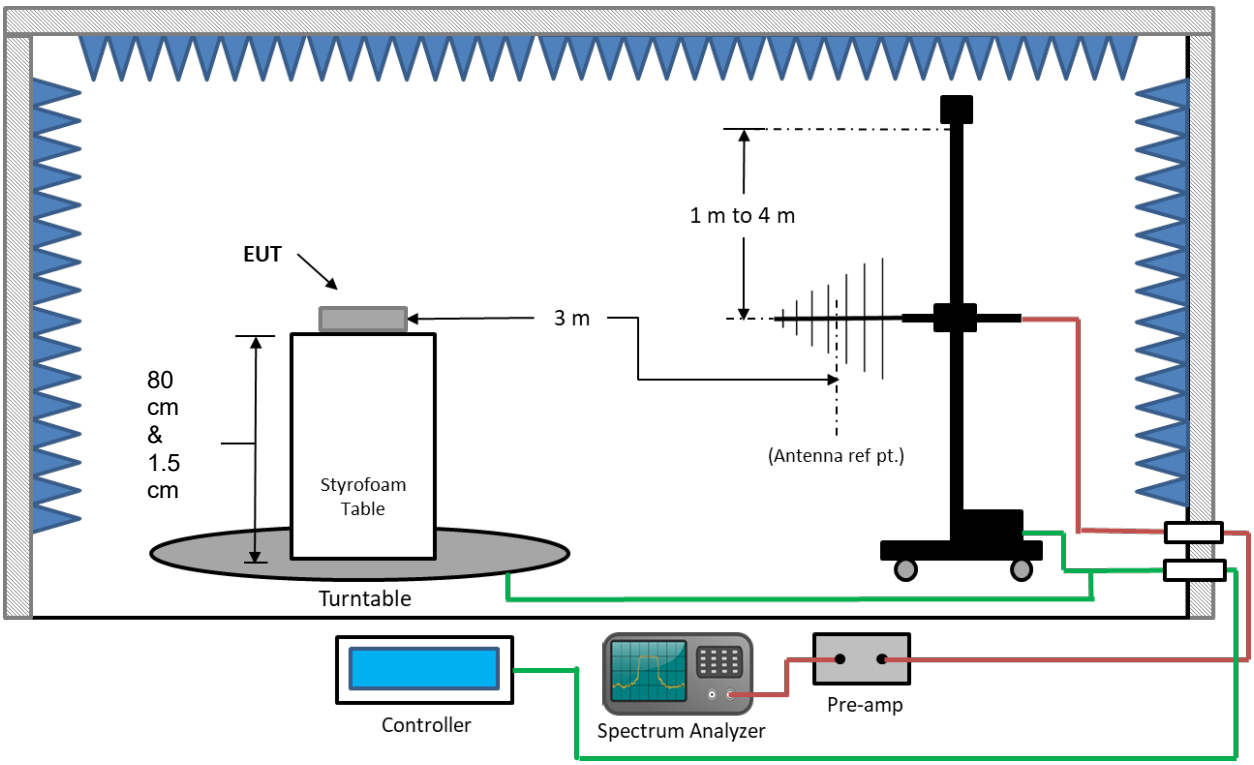


Figure 1. EUT Test Configuration Diagram

2 Tests and Measurements

2.1 Test Equipment

The table below lists test equipment used to evaluate this product.

Table 3. Test Instruments

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	CALIBRATION DUE DATE
SPECTRUM ANALYZER	E4407B	AGILENT	US41442935	9/02/2022 2 yr.
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	1937A02980	6/09/2022
PREAMP 1.0 GHz to 26.0 GHz	8449B	HEWLETT-PACKARD	3008A00914	2/28/2022
BICONICAL ANTENNA	3110B	EMCO	9306-1708	8/17/2023 2 yr.
LOG PERIODIC ANTENNA	3146	EMCO	9305-3600	6/03/2023 2 yr
HORN ANTENNA	3115	EMCO	9107-3723	2/03/2023 2 yr.
HIGH PASS FILTER	VHF-1320 15542	MINI-CIRCUITS, INC.	3 0843	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 modifications were made by US Tech to bring the EUT into compliance with FCC Part 15.247 and RSS-247 requirements.

2.3 Intentional Radiator, Radiated Emissions (CFR 15.247(d)) (IC RSS 247(5.5))

For intentional radiated measurements, the EUT was set into a continuous transmission mode. Below 1 GHz, the RBW of the measuring instrument was set equal to 120 kHz. Measurements above 1 GHz were measured using a RBW = 1 MHz, with a VBW ≥ 3 x RBW. For measurements collected using Peak detection that fail to meet either Quasi-peak or Average limits, the respective detection method was used to repeat the measurement to determine pass/fail. The measurement of each signal detected was maximized by rotating the turntable 360° clockwise and counterclockwise and raising and lowering the receive antenna between 1 and 4 meters in height while monitoring the ever changing spectrum analyzer display with Trace A in the Max-Hold mode and Trace B in the Clear-Write mode for the largest signal visible. The emission from the EUT was measured and recorded when both maxima were simultaneously satisfied.

2.3.1 EUT Worst Case Test Configuration

On the test site, the EUT was placed on top of a polystyrene table 80 cm above the ground plane for measurements below 1 GHz and 150 cm above the ground plane for measurements above 1 GHz. Testing was conducted inside a semi-anechoic test chamber. The EUT was tested in the configuration of typical use, which is with the EUT on the table top with the antenna in the vertical position. See test configuration photographs for additional details.

Table 4. Radiated Fundamental and Harmonic Emissions

Test: FCC Part 15.247 & RSS 247

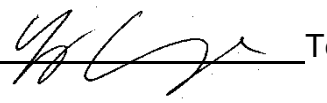
Frequency (MHz)	Test Data (dBuV)	Additional Factor	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	Detector
902.57	77.27	0.0	21.15	98.42	--	3m./VERT	--	**PK**
915.06	77.68	0.0	21.08	98.76	--	3m./VERT	--	**PK**
927.86	76.54	0.0	21.08	97.62	--	3m./VERT	--	**PK**
1830.77	64.26	0.0	-11.99	52.27	54.0	3.0m./VERT	1.7	**PK**
3661.76	57.20	0.0	-7.41	49.79	54.0	3.0m./VERT	4.2	**PK**
4575.47	51.49	0.0	-7.87	43.62	54.0	3.0m./VERT	10.4	**PK**
5492.35	52.58	0.0	-5.97	46.61	54.0	3.0m./VERT	7.4	**PK**
1805.83	66.79	0.0	-12.10	54.69	*74.0	3.0m./VERT	19.3	**PK**
1805.83	51.14	0.0	-12.10	39.04	54.0	3.0m./VERT	15.0	**PK**
3610.50	57.76	0.0	-7.64	50.12	54.0	3.0m./VERT	3.9	**PK**
4514.40	51.76	0.0	-7.50	44.26	54.0	3.0m./VERT	9.7	**PK**
5417.38	52.92	0.0	-6.30	46.62	54.0	3.0m./VERT	7.4	**PK**
1855.83	63.76	0.0	-11.99	51.77	54.0	3.0m./VERT	2.2	**PK**
3710.26	51.83	0.0	-6.87	44.96	54.0	3.0m./VERT	9.0	**PK**
4639.65	51.83	0.0	-7.80	44.03	54.0	3.0m./VERT	10.0	**PK**
5565.53	51.77	0.0	-6.16	45.61	54.0	3.0m./VERT	8.4	**PK**

(*)= Peak limit applied.

Sample Calculation at 902.57 MHz:

Magnitude of Measured Frequency	77.27	dBuV
+Additional Factor	0.00	dB
+Antenna Factor + Cable Loss - Amplifier Gain	21.15	dB/m
Corrected Result	98.42	dBuV/m

Test Date: November 10, 2021

Signature:  Test Engineer: George Yang

2.4 Intentional Radiator, Radiated Emissions (CFR 15.209 & RSS 247)

The test data provided herein is to support the verification requirement for unwanted radiated emissions coming from the EUT in a transmitting state per 15.209 and was investigated from 9 kHz or the lowest operating clock frequency to 10 GHz or to the tenth harmonic of the highest fundamental frequency. The EUT was put into a continuous transmit mode of operation and tested as detailed in ANSI C63.10:2013, Clause 6.4.6. Data is presented in the table below.

The measurement bandwidths for each frequency scan that was evaluated were set as follows:

Frequency Span	RBW / VBW
9 kHz – 150 kHz	300 Hz / 1 kHz
150 kHz – 30 MHz	9 kHz / 30 kHz
30 MHz – 1 GHz	120 kHz / 300 kHz
Above 1 GHz	1 MHz / 3 MHz

The EUT was placed into a mode representative of normal operation and spurious emissions measurements were performed.

Emissions measurements below 30 MHz were not re-evaluated for this permissive change request due to the nature of the change. Emissions in the range were deem not be effected by the change proposed. The EUT was evaluated for spurious emissions above 30 MHz up to 10x the fundamental frequency.

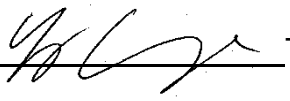
Table 5. Spurious Radiated Emissions (30 MHz – 1 GHz)

Test: FCC Part 15.209 & RSS 247							
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**Detector PK / QP**
200.00	41.53	-11.87	29.66	43.5	3m./HORZ	13.8	**QP**
207.98	52.15	-15.79	36.36	43.5	3m./HORZ	7.1	**QP**
222.02	48.18	-16.23	31.95	46.0	3m./HORZ	14.1	**QP**
411.44	46.28	-11.78	34.50	46.0	3m./HORZ	11.5	**QP**
59.64	51.19	-17.44	33.75	40.0	3m./VERT	6.2	**QP**
200.00	43.62	-12.07	31.55	43.5	3m./VERT	12.0	**QP**
200.12	56.51	-15.88	40.63	43.5	3m./VERT	2.9	**QP**
798.44	45.29	-6.69	38.60	46.0	3m./VERT	7.4	**QP**
863.04	45.88	-6.52	39.36	46.0	3m./VERT	6.6	**QP**
All other emissions were more than 20 dB below the applicable limit.							

Sample Calculation at 200.00 MHz:

Magnitude of Measured Frequency	41.53	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	-11.87	dB/m
Corrected Result	29.66	dBuV/m

Test Date: November 11, 2021

Signature:  Test Engineer: George Yang

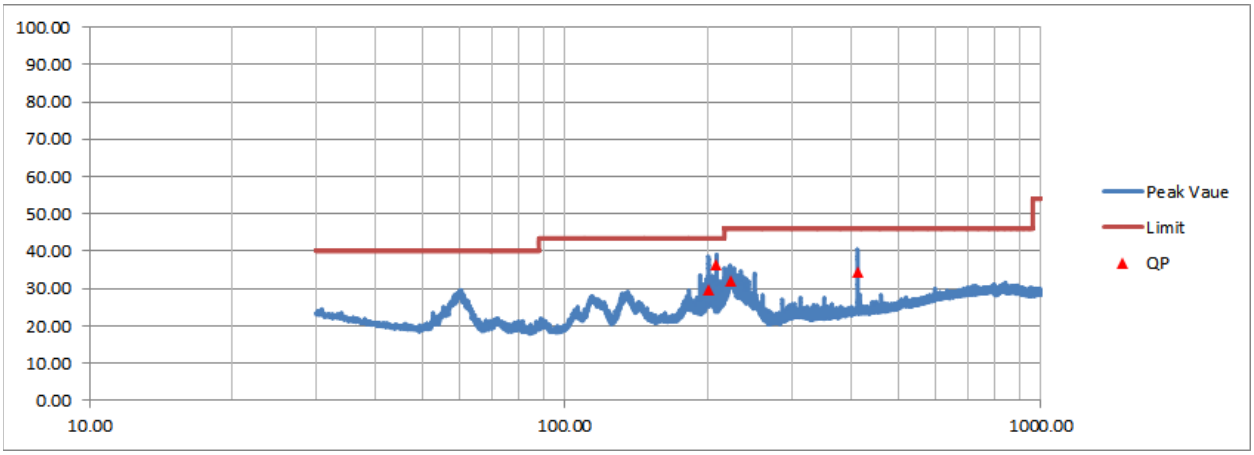


Figure 2. Radiated Emissions, Horizontal Polarity

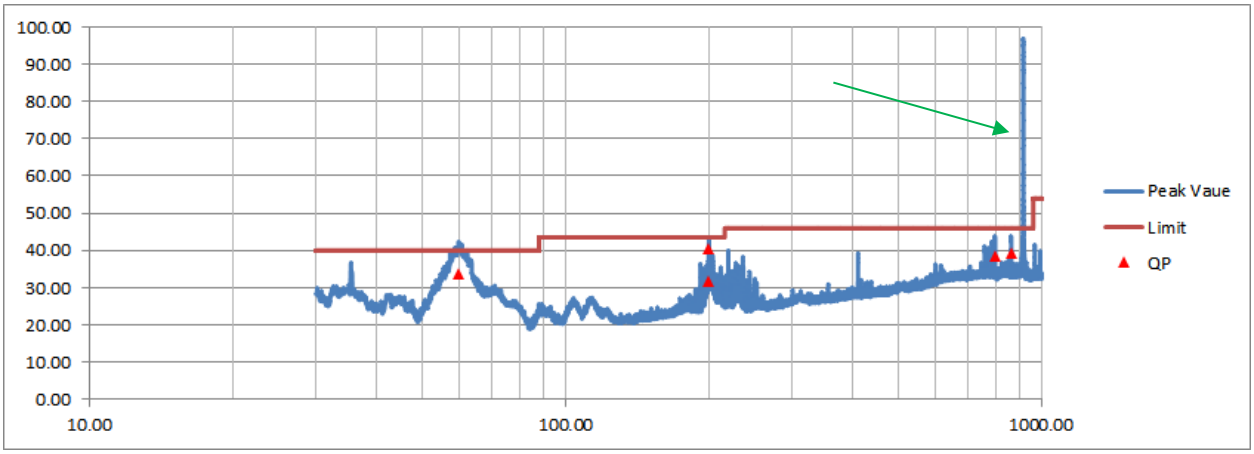


Figure 3. Radiated Emissions, Vertical Polarity

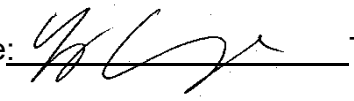
Note: Large Emissions identified above is the fundamental signal of the 900 MHz radio.

Table 6. Spurious Radiated Emissions (1 GHz – 10 GHz)

Test: FCC Part 15.209							
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**Detector PK / QP**
All spurious emissions were more than 20 dB below the applicable limit.							

Sample Calculation: N/A

Test Date: November 11, 2021

Signature:  Test Engineer: George Yang

2.5 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%.

2.5.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ±2.78 dB.

2.5.2 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 ±5.3 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 ±5.1 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna (Above 1000 MHz) is ±5.1 dB.

3 Conclusions

The EUT continues to meet the compliance requirements. The emissions levels are all under the limits and there is no increase RF output power. No other hardware changes have been made to the original product other than the changes cited in paragraph 1.1 above. All other original test results continue to be representative of the equipment.