

October 5, 2021

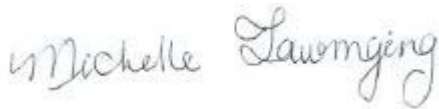
Neology, Inc
13520 Evening Creek Drive N., Suite 460
San Diego, CA 92128

Dear Dave Missimer,

Enclosed is the EMC Wireless test report for compliance testing of the Neology, Inc, RFID Reader 7204 , tested to the requirements of Title 47 of the Code of Federal Regulations (CFR), Part 90 Subpart M for Land Mobile Radio Services.

Thank you for using the services of Eurofins Electrical and Electronic Testing NA, Inc. If you have any questions regarding these results or if Eurofins Electrical and Electronic Testing NA, Inc. can be of further service to you, please feel free to contact me.

Sincerely yours,
Eurofins Electrical and Electronic Testing NA, Inc.

A handwritten signature in cursive script that reads "Michelle Tawmging".

Michelle Tawmging
Documentation Department

Reference: (\Neology, Inc\WIR110053-FCC90M Rev. 3)

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Electromagnetic Compatibility Criteria Test Report

For the

**Neology, Inc
RFID Reader 7204**

Tested under

**The FCC Verification Rules
Contained in Title 47 of the CFR, Part 90, Subpart M
for Private Land Mobile Radio Services**

Report: WIR110053-FCC90M Rev. 3

October 5, 2021

**Prepared For:
Neology, Inc
13520 Evening Creek Drive N., Suite 460
San Diego, CA 92128**

**Prepared By:
Eurofins Electrical and Electronic Testing NA, Inc.
914 West Patapsco Ave.,
Baltimore MD 21230**

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October 5, 2021



Donald Salguero
WIR Laboratory Engineer

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 90, Subpart M of the FCC Rules under normal use and maintenance.



Michael Griffiths
Manager, Wireless Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
0	August 17, 2021	Initial issue.
1	August 25, 2021	Implemented Customer-Requested Revisions.
2	September 14, 2021	Updated Overview Table and Typo Fix on Frequency Stability Section.
3	October 5, 2021	RF Exposure Section Updated

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List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dBμA	Decibels above one microamp
dBμV	Decibels above one microvolt
dBμA/m	Decibels above one microamp per meter
dBμV/m	Decibels above one microvolt per meter
DC	Direct Current
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EUT	Equipment Under Test
<i>f</i>	Frequency
FCC	Federal Communications Commission
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μH	microhenry
μ	microfarad
μs	microseconds
NEBS	Network Equipment-Building System
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts per meter
VCP	Vertical Coupling Plane

Executive Summary

Testing Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 90, Subpart M. All tests were conducted using measurement procedure ANSI TIA/EIA-603-A-2004.

Title 47 of the CFR, Part 90, Subpart M, and FCC 04-265 Reference and Test Description	Compliance / Comments
90.205 RF Power Output	Compliant
90.209 Bandwidth Limitation	Compliant
90.210 Occupied Bandwidth (Emission Mask)	Compliant
90.210 Spurious at Antenna Port	Compliant
90.210 Field Strength Spurious Emissions	Compliant
90.213 Frequency Stability	Compliant
90.214 Transient Frequency Behavior	Not Applicable. EUT operates on 900MHz band,
90.221 Adjacent Channel power	Not Applicable. EUT operates on 900MHz band,
2.1091 RF Exposure	Compliant

Equipment Configuration

Equipment Configuration

Overview

Eurofins Electrical and Electronic Testing NA, Inc. was contracted by Neology, Inc to perform testing on the RFID Reader 7204 under purchase order number 5990-00.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Neology, Inc, RFID Reader 7204 .

An EMC Wireless evaluation to determine compliance of the RFID Reader 7204 with the requirements of Part 90, Subpart M, was conducted. (All references are to the most current version of Title 47 of the Code of Federal Regulations in effect). In accordance with §2.1033, the following data is presented in support of the Certification of the RFID Reader 7204 . Neology, Inc should retain a copy of this document and it should be kept on file for at least five years after the manufacturing of the EUT has been **permanently** discontinued. The results obtained relate only to the item(s) tested.

Model(s) Tested:	RFID Reader 7204	
Model(s) Covered:	RFID Reader 7204	
EUT Specifications:	Primary Power Source: 110-240V AC/DC converter; 18-30V DC side	
	FCC ID: 2AKNF7204	
	Type of Modulations:	DSB-ASK or PR-ASK
	Max Peak and Output Power:	Conducted: 34.77dBm ERP: 44.30dBm
	Equipment Code:	TNB
	EUT Frequency Ranges:	902.75-903.25 MHz 911.25-920.25 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature (15-35° C):	
	Relative Humidity (30-60%):	
	Barometric Pressure (860-1060 mbar):	
Evaluated by:	Donald Salguero	
Report Date(s):	August 25, 2021	

Test Site

All testing was performed at Eurofins Electrical and Electronic Testing NA, Inc., 914 West Patapsco Ave., Baltimore MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at Eurofins Electrical and Electronic Testing NA, Inc..

Description of Test Sample

The Neology, Inc RFID Reader 7204 , Equipment Under Test (EUT), is a four port RFID reader is a multi-protocol, multi-regional Radio Frequency Identification (RFID) system that operates in the 902-928MHz UHF frequency band. All antenna ports operate sequentially with only one port transmitting at a given time from a single transmit source. The RF path is internally switched between selected ports. Product is typically used in vehicle applications to acquire transponder information from target vehicle from one or more antennas and is professionally installed. Product is both FCC Part90 and Part15 capable/certified.

Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.32 dB	2	95%
RF Power Conducted Spurious Emissions	±2.25 dB	2	95%
RF Power Radiated Emissions	±3.01 dB	2	95%

Table 1. Uncertainty Calculations Summary

Support Equipment

Neology, Inc supplied support equipment necessary for the operation and testing of the RFID Reader 7204 . All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name/Description	Manufacturer	Model Number	*Customer Supplied Calibration Data
	AC/DC power converter	CUI, Inc.	PDRC-75-24-2	NA
	Laptop	Dell, Inc.	To be supplied	NA
	RF Antenna	Neology, Inc.		NA
	RFID Reader 7204	Neology, Inc.	7204	NA

Table 2. Support Equipment

Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Desc. or reason for none	QTY	Length as tested (m)	Max Length (m)	Shielded?	Termination Box ID & Port Name
-	18-30V	DC power cable	1	-	100	Yes	-
-	Antenna 4 symbol	RF coaxial cable	1	-	-	Yes	-
-	Ethernet symbol	Ethernet data cable	1	-	100	Yes	-
-	Antenna 3 symbol	RF coaxial cable	1	-	-	Yes	-
-	I/O symbol	product synchronization	1	-	-	Yes	-
-	Antenna 2 symbol	RF coaxial cable	1	-	-	Yes	-
-	AUX	unused (for diagnostic/test or additional I/O if needed)	0	-	-	Yes	-
-	Antenna 1 symbol	RF coaxial cable	1	-	-	Yes	-

Table 3. Ports and Cabling

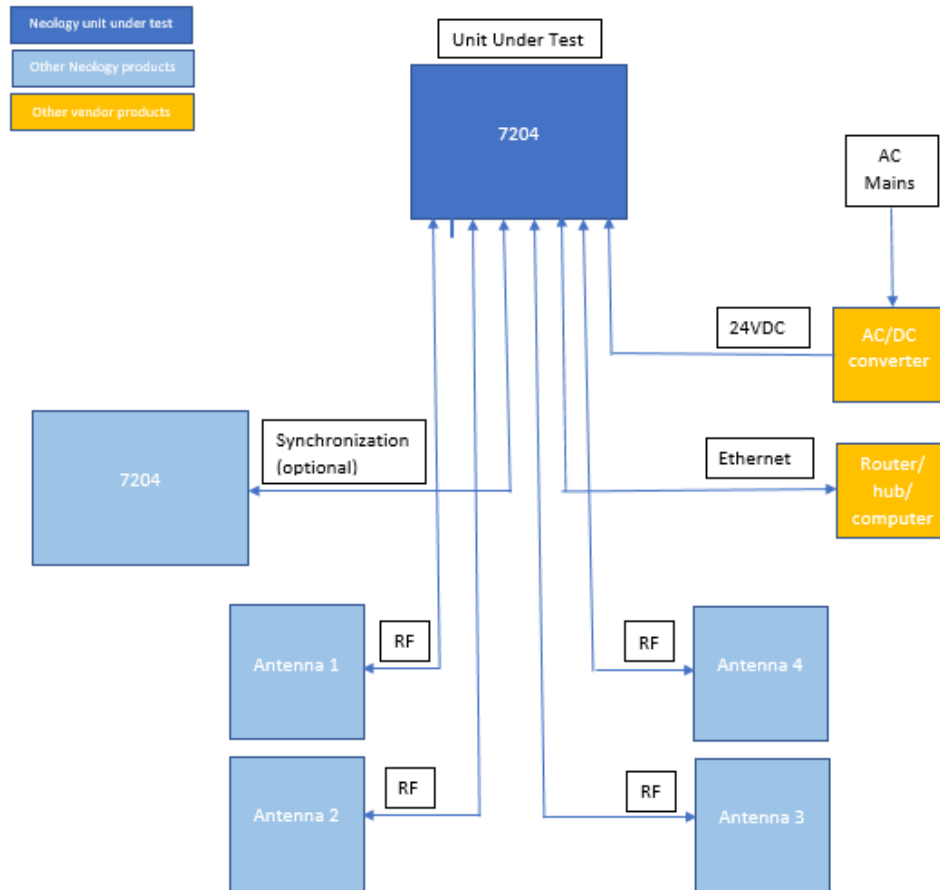


Figure 1. Block Diagram of Test Configuration

Mode of Operation

The product is a UHF Wireless radio which supports communications over eight different wireless protocols. Each protocol uses amplitude shift keying modulation but the data rates and encoding will vary by protocol. The device has two operational modes: STANDBY where RF transmission is disabled, and ACTIVE where RF transmissions are produced continuously. The product is designed for worldwide regulatory compliance. Under FCC it supports both unlicensed Part15.247 operation with frequency hopping, and licensed Part90.231 operation with fixed frequency.. Normal product operation is with ACTIVE mode. Specific antenna and protocol usage must be configured. Neology will provide appropriate instruction and utilities to ease transition between selections.

Method of Monitoring EUT Operation

The product has an external LED to indicate RF transmissions. If this LED is off, no RF transmissions are occurring. If this LED is on solid, then RF transmissions are occurring but there is not a 2 way communication with another device. If this LED is on and flickering off and on, then RF transmissions are occurring with an external device. In addition, the product will be supplied with a GUI application which can display status of RF activity.

Modifications

Modifications to EUT

No modifications were made to the EUT.

Modifications to Test Standard

No modifications were made to the test standard.

Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Neology, Inc upon completion of testing.

Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility RF Power Output Requirements

RF Power Output

Test Requirement(s): §90.205 Power and antenna height limits.

(l) 902-928 MHz. LMS systems operating pursuant to subpart M of this part in the 902-927.25 MHz band will be authorized a maximum of 30 watts ERP. LMS equipment operating in the 927.25-928 MHz band will be authorized a maximum of 300 watts ERP. ERP must be measured as peak envelope power. Antenna heights will be as specified in §90.353(h).

Test Procedures: As required by 47 CFR 2.1046, *RF power output measurements* were made at the RF output terminals using a Spectrum Analyzer. Procedure 5.2.3.3 from ANSI C63.26-2015 was used to perform the measurements.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer via an attenuator to measure the Peak power. The EUT power was adjusted enough to produce maximum output power as specified in the owner's manual. Measurements were made at the low, mid and high channels.

Test Results: Equipment is **compliant** with 47CFR 2.1046 and 90.205.

While the EUT does have 4 RF ports, they are controlled by a RF switch, and they never transmit at the same time. It was found that 'Port 2' exhibits the worst case/higher emissions. Data shown belongs to worst case output on 'Port 2'

Test Engineer(s): Donald Salguero

Test Date(s): August 11, 2021

Band	Center Frequency (MHz)	Output Power (dBm)	Antenna Gain (dBi)	ERP (dBm)	ERP (W)	Limit (W)
FCC Part90 dense	911.25	33.45	13.00	44.30	26.92	30
	915.75	33.34	13.00	44.19	26.24	30
	920.25	33.15	13.00	44.00	25.12	30
FCC Part90 lowband	902.75	33.40	13.00	44.25	26.61	30
	903.25	33.42	13.00	44.27	26.73	30

Table 4. Output Power_13dBi Antenna

Band	Center Frequency (MHz)	Output Power (dBm)	Antenna Gain (dBi)	ERP (dBm)	ERP (W)	Limit (W)
FCC Part90 dense	911.25	31.45	15.00	44.30	26.92	30
	915.75	31.33	15.00	44.18	26.18	30
	920.25	31.15	15.00	44.00	25.12	30
FCC Part90 lowband	902.75	31.43	15.00	44.28	26.79	30
	903.25	31.43	15.00	44.28	26.79	30

Table 5. Output Power_15dBi Antenna

Band	Center Frequency (MHz)	Output Power (dBm)	Antenna Gain (dBi)	ERP (dBm)	ERP (W)	Limit (W)
FCC Part90 dense	911.25	34.77	9.50	42.12	16.29	30
	915.75	34.59	9.50	41.94	15.63	30
	920.25	34.44	9.50	41.79	15.10	30
FCC Part90 lowband	902.75	34.69	9.50	42.04	16.00	30
	903.25	34.70	9.50	42.05	16.03	30

Table 6. Output Power_9.5dBi Antenna

Electromagnetic Compatibility Occupied Bandwidth Requirements

Occupied Bandwidth

Test Requirement(s): §2.1049 and §90.209

The 99% Occupied bandwidth is the frequency bandwidth of the signal power at the 99% channel power of occupied bandwidth when resolution bandwidth should be approximately 1% to 5% of the occupied bandwidth (OBW). These measurements shall also be performed at normal test conditions.

The maximum authorized bandwidth shall be 12 MHz for non-multilateration LMS operations in the band 909.75-921.75 MHz and 2 MHz in the band 902.00-904.00 MHz. The maximum authorized bandwidth for multilateration LMS operations shall be 5.75 MHz in the 904.00-909.75 MHz band; 2 MHz in the 919.75-921.75 MHz band; 5.75 MHz in the 921.75-927.25 MHz band and its associated 927.25-927.50 MHz narrowband forward link; and 8.00 MHz if the 919.75-921.75 MHz and 921.75-927.25 MHz bands and their associated 927.25-927.50 MHz and 927.50-927.75 MHz narrowband forward links are aggregated.

Test Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made at the RF output terminals using a Spectrum Analyzer. The procedures of ANSI C63.26 - 2015 Section 5.4.3 and 5.4.4 were used.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer via attenuator. The measured highest Average Power was set relative to zero dB reference. The RBW of the Spectrum Analyzer was set to at least 1% of the channel bandwidth. The EUT power was adjusted at the maximum output power level. Measurements were carried out at the low, mid and high channels of the TX band.

Test Results: Equipment is **compliant** with Section 2.1049 and 90.209
While the EUT does have 4 RF ports, they are controlled by a RF switch, and they never transmit at the same time. It was found that 'Port 2' exhibits the worst case/higher emissions. Data shown belongs to worst case output on 'Port 2'

Test Engineer(s): Donald Salguero

Test Date(s): August 11, 2021

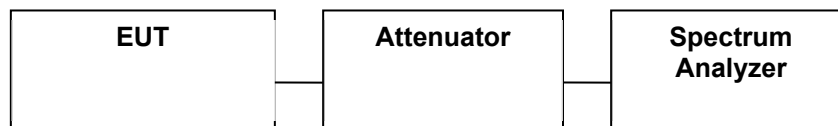


Figure 2. Occupied Bandwidth Test Setup

Protocol	Band	Center Frequency (MHz)	25dB Bandwidth (kHz)	99% Bandwidth (kHz)
ISOC	FCC Part90 Dense	911.25	161.89	157.6158
		915.75	161.883	157.682
		920.25	162.172	157.8306
	FCC Part90 Lowband	902.75	161.08	157.6258
		903.25	160.885	157.3462
ISOB	FCC Part90 Dense	911.25	124.398	123.8493
		915.75	124.338	123.3072
		920.25	124.277	123.9401
	FCC Part90 Lowband	902.75	123.833	122.6657
		903.25	117.779	123.4037
ISOB_80K	FCC Part90 Dense	911.25	501.99	536.7281
		915.75	502.145	537.0839
		920.25	502.767	536.6356
	FCC Part90 Lowband	902.75	501.643	528.1311
		903.25	500.997	526.7267
ISO10374	FCC Part90 Dense	911.25	1.738	4.2838
		915.75	1.724	4.9182
		920.25	1.696	5.7799
	FCC Part90 Lowband	902.75	1.729	3.5116
		903.25	1.689	3.147
Flex	FCC Part90 Dense	911.25	29.081	32.5656
		915.75	29.021	30.4151
		920.25	29.023	30.8619
T21	FCC Part90 Dense	911.25	763.517	781.9221
		915.75	764.322	784.2748
		920.25	763.889	784.0234
PS111	FCC Part90 Dense	915.75	512.392	496.5895
ASTMV6	FCC Part90 Dense	915.75	3,308	2,697.90

Table 7. OBW - Results

Transmit Spectrum Mask**Test Requirement(s): §2.1049 and §90.210**

(k) Emission Mask K:

(3) Other transmitters. For all other transmitters authorized under subpart M that operate in the 902-928 MHz band, the peak power of any emission shall be attenuated below the power of the highest emission contained within the licensee's sub-band in accordance with the following schedule:

(i) On any frequency within the authorized bandwidth: Zero dB.

(ii) On any frequency outside the licensee's sub-band edges: $55 + 10 \log(P)$ dB, where (P) is the highest emission (watts) of the transmitter inside the licensee's sub-band.

(4) In the 902-928 MHz band, the resolution bandwidth of the instrumentation used to measure the emission power shall be 100 kHz, except that, in regard to paragraph (2) of this section, a minimum spectrum analyzer resolution bandwidth of 300 Hz shall be used for measurement center frequencies with 1 MHz of the edge of the authorized subband. The video filter bandwidth shall not be less than the resolution bandwidth.

(5) Emission power shall be measured in peak values.

Test Procedures: RBW=100 kHz, VBW=3xRW were used to take transmit spectrum mask measurements.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer via attenuator. The measured highest Average Power was set relative to zero dB reference. The EUT power was adjusted at the maximum output power level. Measurements were carried out at the low, mid and high channels of the TX band.

Test Results: Equipment is **compliant** with Section 2.1049 and 90.210 The EUT does not exceed the Transmit Spectrum limit.

Test Engineer(s): Donald Salguero

Test Date(s): August 2, 2021

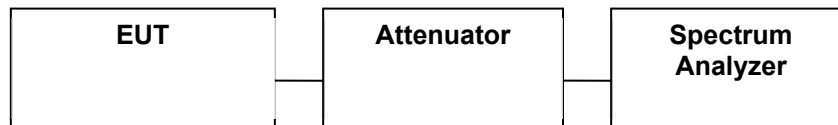


Figure 3. Transmit Spectrum Mask Test Setup

Electromagnetic Compatibility Spurious Emissions at Antenna Terminal Requirements

Spurious Emissions at Antenna Terminals

Test Requirement(s): §2.1051 and §90.210

(k) Emission Mask K:

(3) Other transmitters. For all other transmitters authorized under subpart M that operate in the 902-928 MHz band, the peak power of any emission shall be attenuated below the power of the highest emission contained within the licensee's sub-band in accordance with the following schedule:

(i) On any frequency within the authorized bandwidth: Zero dB.

(ii) On any frequency outside the licensee's sub-band edges: $55 + 10 \log(P)$ dB, where (P) is the highest emission (watts) of the transmitter inside the licensee's sub-band.

(4) In the 902-928 MHz band, the resolution bandwidth of the instrumentation used to measure the emission power shall be 100 kHz, except that, in regard to paragraph (2) of this section, a minimum spectrum analyzer resolution bandwidth of 300 Hz shall be used for measurement center frequencies with 1 MHz of the edge of the authorized subband. The video filter bandwidth shall not be less than the resolution bandwidth.

(5) Emission power shall be measured in peak values.

Test Procedures:

As required by 47 CFR 2.1051, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a Spectrum Analyzer. Test procedures from ANSI C63.26-2015, clause 5.7 were used.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer and a Power Meter to monitor the output power level. The Spectrum Analyzer was set to sweep 30 MHz and up to 10th harmonic of the fundamental or 40GHz whichever is the lesser. Measurements were made at the low, mid and high channels.

Test Results:

Equipment is **compliant** with Section 2.1051 and 90.210(M) with FCC 04-265.

Test Engineer(s):

Donald Salguero

Test Date(s):

August 2, 2021

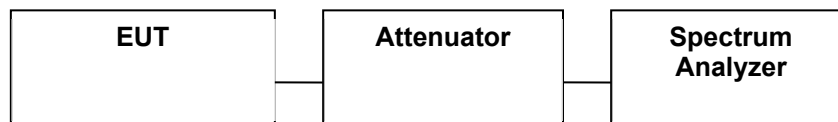


Figure 4. Spurious Emissions at Antenna Terminals Test Setup

Electromagnetic Compatibility Radiated Emissions Requirements

Radiated Emissions

Test Requirement(s): §2.1053 and §90.210

(k) Emission Mask K:

(3) Other transmitters. For all other transmitters authorized under subpart M that operate in the 902-928 MHz band, the peak power of any emission shall be attenuated below the power of the highest emission contained within the licensee's sub-band in accordance with the following schedule:

(i) On any frequency within the authorized bandwidth: Zero dB.

(ii) On any frequency outside the licensee's sub-band edges: $55 + 10 \log(P)$ dB, where (P) is the highest emission (watts) of the transmitter inside the licensee's sub-band.

(4) In the 902-928 MHz band, the resolution bandwidth of the instrumentation used to measure the emission power shall be 100 kHz, except that, in regard to paragraph (2) of this section, a minimum spectrum analyzer resolution bandwidth of 300 Hz shall be used for measurement center frequencies with 1 MHz of the edge of the authorized subband. The video filter bandwidth shall not be less than the resolution bandwidth.

(5) Emission power shall be measured in peak values.

Test Procedures: As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* were made in accordance with the procedures of ANSI C63.26-2015

Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber. The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360° and the receiving antenna scanned from 1-4m in order to capture the maximum emission. A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated. The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10th or 40GHz, whichever was the lesser, were investigated.

Test Results: Limit for emissions above 1GHz is 70.2 dBμV/m Equipment is **compliant** with Section 2.1053 and 90.210.

Test Engineer(s): Donald Salguero

Test Date(s): August 4, 2021

Electromagnetic Compatibility Frequency Stability Requirements

Frequency Stability

Test Requirement(s): §2.1055 and §90.213

The EUT must be tested within the -30 to +50° C range. Voltage variation will be set to +,- 15%, ±2.5 PPM

Test Procedures: As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Directional Coupler through a Spectrum Analyzer and Power Meter. Test procedures followed ANSI/TIA 603-D: 2010 clause 3.2.2

The EUT was placed in the Environmental Chamber and support equipments are outside the chamber on a table. The EUT was set to transmit a CW signal corresponding to the low, mid and high Channels for 10MHz Bandwidth. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations. The frequency drift was investigated for every 10^C increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30 to 50^C.

Voltage supplied to EUT is 120 VAC reference temperature was done at 20^C. The voltage was varied by ± 15 % of nominal.

Test Results: Equipment is **compliant** with Section 2.1055 and 90.213.

Test Engineer(s): Donald Salguero

Test Date(s): August 11, 2021

Temperature (°C)	Center Frequency (MHz)	Maximum deviation from frequency at 20°C (ppm)	Limit (ppm)
50	920.24745	0.924	2.5
40	920.24915	0.924	2.5
30	920.2483	0	2.5
20	920.2483	0	2.5
10	920.24915	0.924	2.5
0	920.2483	0	2.5
-10	920.2475	0.869	2.5
-20	920.2475	0.869	2.5
-30	920.24625	2.228	2.5
Voltage (AC)	Center Frequency (MHz)	Maximum deviation from frequency at 20°C (ppm)	Limit (ppm)
102	920.2463	2.173	2.5
138	920.2475	0.869	2.5

Table 8. Frequency Stability - FCC_Part90_Dense High Channel

Temperature (°C)	Center Frequency (MHz)	Maximum deviation from frequency at 20°C (ppm)	Limit (ppm)
50	911.2483	0.055	2.5
40	911.24915	0.878	2.5
30	911.2483	0.055	2.5
20	911.24835	0	2.5
10	911.2483	0.055	2.5
0	911.2483	0.055	2.5
-10	911.2475	0.933	2.5
-20	911.2475	0.933	2.5
-30	911.24625	2.305	2.5
Voltage (AC)	Center Frequency (MHz)	Maximum deviation from frequency at 20°C (ppm)	Limit (ppm)
102	911.2483	0.055	2.5
138	911.2492	0.933	2.5

Table 9. Frequency Stability - FCC_Part90_Dense Low Channel

Temperature (°C)	Center Frequency (MHz)	Maximum deviation from frequency at 20°C (ppm)	Limit (ppm)
50	903.2483	0	2.5
40	903.2483	0	2.5
30	903.24915	0.941	2.5
20	903.2483	0	2.5
10	903.2483	0	2.5
0	903.2483	0	2.5
-10	903.2483	0	2.5
-20	903.2475	0.886	2.5
-30	903.2475	0.886	2.5
Voltage (AC)	Center Frequency (MHz)	Maximum deviation from frequency at 20°C (ppm)	Limit (ppm)
102	903.2491	0.886	2.5
138	903.2495	1.329	2.5

Table 10. Frequency Stability - FCC_Part90_lowband High Channel

Temperature (°C)	Center Frequency (MHz)	Maximum deviation from frequency at 20°C (ppm)	Limit (ppm)
50	902.74915	0.942	2.5
40	902.7483	0	2.5
30	902.7483	0	2.5
20	902.7483	0	2.5
10	902.7483	0	2.5
0	902.7483	0	2.5
-10	902.7483	0	2.5
-20	902.7475	0.886	2.5
-30	902.7475	0.886	2.5
Voltage (AC)	Center Frequency (MHz)	Maximum deviation from frequency at 20°C (ppm)	Limit (ppm)
102	902.7475	0.886	2.5
138	902.7488	0.554	2.5

Table 11. Frequency Stability - FCC_Part90_lowband Low Channel

RF Exposure Requirements

RF Exposure Requirements: **§1.1307(b)(1) and §1.1307(b)(2):** Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

RF Radiation Exposure Limit: **§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

FCC									
Frequency (MHz)	Con. Pwr. (dBm)	Con. Pwr. (mW)	Ant. Gain (dBd)	Ant. Gain numeric	Pwr. Density (mW/cm ²)	Limit (mW/cm ²)	Margin	Distance (cm)	Result
911.25	31.45	1396.368	12.85	19.275	0.6075	0.6075	0	59.3771	Pass

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Asset	Equipment	Manufacturer	Model	Calibration Date	Calibration Due Date
1T4612	Spectrum Analyzer	Agilent Technologies	E4407B	3/4/2020	9/4/2021
1T4409	EMI Receiver	Rohde & Schwarz	ESIB7	1/21/2021	1/21/2022
1T4753	Antenna - Bilog	Sunol Sciences	JB6	12/21/2020	6/21/2022
1T4757	Antenna; Horn	ETS-Lindgren	3117	6/29/2020	12/29/2021
1T8743	Preamplifier	A.H. Systems, Inc.	PAM-0118P	Func Verify	Func Verify
1T4300B	Semi-Anechoic 3m Chamber sVSWR	EMC TEST SYSTEMS	NONE	8/16/2019	8/16/2021
1T4300	SEMI-ANECHOIC CHAMBER (NSA)	EMC TEST SYSTEMS	NONE	8/16/2019	8/16/2021
2T4505	Temperature Chamber	Test Equity	115	1/11/2021	1/11/2022

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

Certification & User's Manual Information

Certification Label & User's Manual Information

Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

- (a) The various types of radio communication transmitting devices described throughout this chapter.
- (b) *The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.*
- (c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.
- (d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

- (a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:
 - (1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or
 - (2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.
- (d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

- (e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:
- (i) *Compliance testing;*
 - (ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;
 - (iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;
 - (iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or
 - (v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.
- (e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.
- (f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a provision that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart M — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

- (a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.¹ *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.*
- (b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant, whichever is applicable.

§ 2.902 Certification.

- (a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.
- (b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

¹ In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.

§ 2.948 Description of measurement facilities.

- (a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.
 - (1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.
 - (i) *If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.*
 - (ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.
 - (2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

§ 15.19 Labeling requirements.

(a) *In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:*

- (1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

- (2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

- (3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

- (4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.
- (5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

§ 15.21 Information to user.

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 15.105 Information to the user.

- (a) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

End of Report