

Intentional Radiator Test Report

Applicable Requirements:
FCC CFR 47 Part 15, Subpart C – Intentional Radiators

Equipment Under Test: MOD915A
Model Number: 2AKREMOD100915
Serial Number: N/S
Prepared for: Aivaka
1791 Dalton Place
San Jose, CA 95124

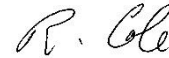
Tested by: Bob Cole

Prepared by: Amy Jones



Verified and Approved by: Bob Cole

Authorized Signatory



EMCE Engineering, Inc.
1726 Ringwood Ave.
San Jose, CA 95131



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ACCREDITATION PROGRAM FOR THE SPECIFIC SCOPE
OF ACCREDITATION UNDER LAB CODE #: 200092-0

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REPORT # 4283	REPORT BODY	EXHIBITS			TOTAL # OF PAGES:
		1	2	3	
# OF PAGES	20	4	3	1	28

Test Report Revision History

Report Format	Report Version	Description	Issue Date
EMCE-TRF-FCC_C	1.0	Original Release	Feb. 18, 2016
EMCE-TRF-FCC_C	2.0	Updated Template (Obsolete)	Aug. 09, 2016

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1.0 ADMINISTRATIVE INFORMATION

Test Laboratory:	EMCE Engineering 47610 Kato Road Fremont, CA 94538 USA
NVLAP Lab Testing Code :	200092-0
FCC Test Site Facility :	US5291
Applicant Company Name :	Aivaka
Applicant Contact Name :	Ahmad B. Dowlatabadi
Application Purpose :	Original
Applied Requirements :	FCC CFR 47 Part 15, Subpart C – Intentional Radiators
Test Procedure :	ANSI C63.4 2014
Test Report Number :	4283
Test Report Issue Date :	4-12-2017
Test Report Prepared By :	Amy Jones
Test Report Reviewed By :	Bob Cole
Approved By (CTO) :	Bob Cole
Receipt of EUT :	3-13-2017
Date of Testing :	3-14-2017 - 4-9-2017
Tested By :	Bob Cole
EUT Description :	ISM 915MHz Radio module
Product Name :	MOD915A
Model Number :	2AKREMOD100915
Serial Number :	N/S
RF Operating Frequency (ies) :	915 MHz – ISM Band
Antenna Type(s) :	Monopole
Rated RF Output Power :	2.24 dBm / 0.0017 W
Modulation :	N/A
Emission Designator :	
Additional Models covered by this report :	N/A

Additional Items Provided:

Spare Batteries	N/A
Battery Charging Device	N/A – Supply Power is a Non-rechargeable Battery
External Power Supply or AC Adapter	N/A – Supply Power is a Non-rechargeable Battery
Test Jig or Interface Box	N/A
RF Test Fixture (for integrated Antennas)	N/A
Host System	N/A
User Manual	Received and Reviewed
Technical Documentation	Received and Reviewed

2.0 EUT AND ACCESSORY INFORMATION

Setup of EUT

Power to EUT: 3.7 V Unprotected Lithium Ion Flat-top Battery
Grounding of EUT: N/A
Software: N/A

No Support Equipment was used.

Support Equipment				
Description	Model Number	Serial Number	Manufacturer	Power Cable Description
N/A				
Cable Description				
From	To	Length (Meters)	Shielded (Y/N)	Ferrite Loaded (Y/N)
N/A				

3.0 SUMMARY OF TEST RESULTS

FCC Test Standard	Description	Pass / Fail
FCC CFR 47 PART 15 Subpart C – Intentional Radiators		
§15.203	Antenna Requirement	Pass
§15.209 (a)(1), §15.231 (b)	Radiated Emissions: General Requirements, Fundamental Field Strength Requirements	Pass
§15.231 (c)	Emission Bandwidth	Pass
§15.231 (a)(2)	Transmitter Deactivation	Pass
§15.231 (d)	Band Edge	N/A
§15.207 (a)	Conducted Emissions	N/A
FCC CFR 47 - PART 2 - Subpart J – Equipment Authorization Procedures - Certification.		
§2.1055	Frequency Stability	Pass

PASS The EUT passed that particular test.
 FAIL The EUT failed that particular test.
 N/A Not Applicable

4.0 MODIFICATIONS

There were no modifications installed by EMCE Engineering. Any modifications installed previous to testing by the Manufacturer will be incorporated in each production model sold or leased.

5.0 TEST RESULTS

Test results are recorded on tabular data sheets and show final corrected values compared to the specification limit. Sample calculations show how the antenna factors, cable losses, amplifier gain, etc. are combined in the automatic analyzer program to produce the final corrected values shown on the graphs and data sheets. The Test Procedure was not deviated from during the testing.

5.1 Antenna Requirement

Requirement:

FCC PART 15 Section 15.203

An intentional radiator shall be designed to ensure that no other 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.

Test Date: 3-14-2017

Tested By: Bob Cole

Results: **PASS**

The antenna is integrated on the PCB with no consideration for replacement. The EUT is compliant to this requirement. Photographs of the EUT are located in Exhibit 1 of this report.

5.2 Radiated Emissions

Requirement(s):

General Requirements - Limit (FCC PART 15 Section 15.209(a)(1))

Frequency of Emission (MHz)	Field Strength		Measurement Distance (Meters)
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	
0.009-0.49	2400/F(kHz)		300
0.49-1.705	24000/F(kHz)		30
1.705-30	30		30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
> 960	500	54	3

Field Strength Requirements (FCC PART 15 Section 15.231(b))

Fundamental Frequency (MHz)	Field Strength of Fundamental (mV/m) @ 3 meters	Field Strength of Spurious /Unwanted Emissions ($\mu\text{V/m}$) @ 3 meters
40.66-40.70	Changes per Standard	225
70-130	1,250	125
130-174	1,250-3,750	125-375*
174-260	3,750	375
260-470	3,750-12,500	375-1,250*
>470	12,500	1,250

- Use linear interpolation to find value.

The frequencies within the restricted bands follow the general limits, as listed above.

Procedures:

1.	All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR and Average detectors, are reported. All other emissions were relatively insignificant.
2.	"Ave" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3.	Conducted Emissions Measurement Uncertainty All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is $\pm 3.5\text{dB}$.

Environmental Conditions	
Temperature	24° C
Relative Humidity	45%
Atmospheric Pressure	1010mbar

Test Date: 3-14-2017

Tested By: Bob Cole

Results: **PASS**

Test Location: EMCE Engineering • 47610 Kato Road • Fremont, CA 94538 •

Customer: **Aivaka**
Specification: **15.231 Limits - 3M**
Work Order #: **4283**
Test Type: **Radiated Scan**
Equipment: **Radio Module**
Manufacturer: **Aivaka**
Model: **2AKREMOD100915**
S/N:

Date: 3/14/2017
Time: 12:29:12
Sequence#: 1
Tested By: Bob Cole

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
Sunol Sciences JB6 Antenna	1090	06/14/2016	06/14/2017	701
EMCO 3115 Horn	9065-5057	10/10/2016	10/10/2017	608
HP 8447D PreAmp	2443A03587	02/15/2017	02/15/2018	008
HP 8449B Preamp	3008A02190	02/15/2017	02/15/2018	749
FSV40-B160 Signal Analyzer	101468	06/20/2016	07/20/2017	755
EMITest Measurement Software	v4.01 Build 195	05/01/2014	05/01/2017	610

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Radio Module*	Aivaka	2AKREMOD100915	

Support Devices:

Function	Manufacturer	Model #	S/N
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Test Conditions / Notes:

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Transducer Legend:

T1=8447 Pre-Amp Asset 377	T2=A.H. SAS-200/571 Horn
T3=8449B Preamp	T4=25' LMR #001

Ext Attn: 0 dB

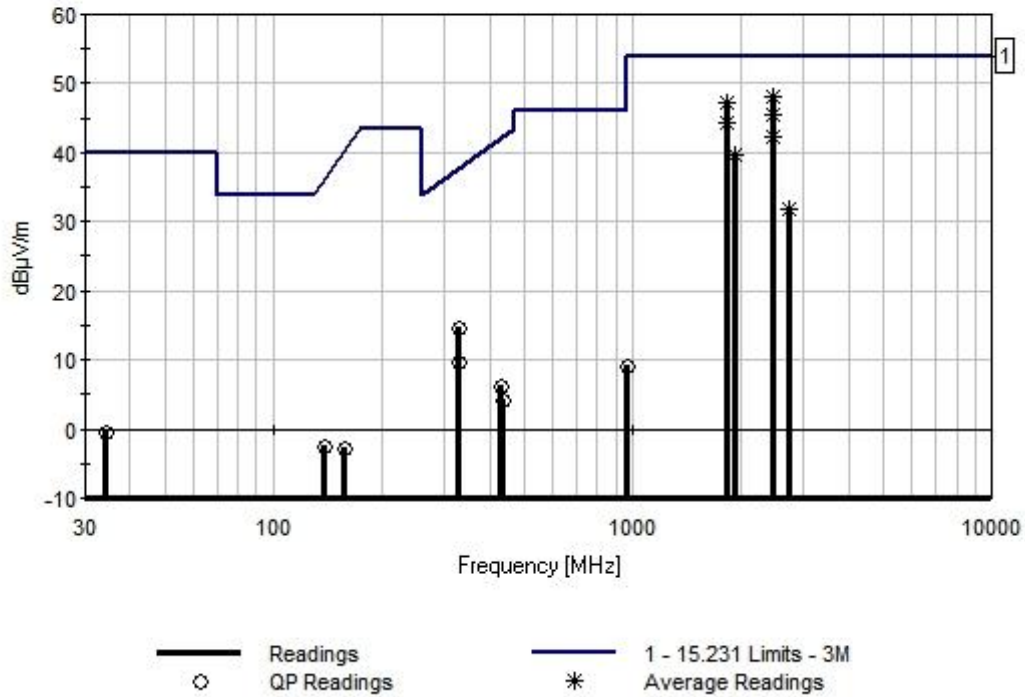
Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	2470.000M Ave	47.7	+0.0	+29.3	+30.2	+1.4	+0.0 219	48.2	54.0	-5.8	Vert 211
2	1830.000M Ave	47.4	+0.0	+28.3	+29.8	+1.2	+0.0 97	47.1	54.0	-6.9	Vert 209
3	2475.000M Ave	45.1	+0.0	+29.3	+30.2	+1.4	+0.0 73	45.6	54.0	-8.4	Vert 274
4	1830.000M Ave	44.5	+0.0	+28.3	+29.8	+1.2	+0.0 126	44.2	54.0	-9.8	Horiz 209
5	2453.000M Ave	41.9	+0.0	+29.2	+30.2	+1.4	+0.0 252	42.3	54.0	-11.8	Vert 185
6	1930.000M Ave	39.7	+0.0	+28.4	+29.8	+1.3	+0.0 88	39.6	54.0	-14.4	Vert 249
7	2745.000M Ave	30.6	+0.0	+29.8	+30.3	+1.6	+0.0 129	31.7	54.0	-22.3	Horiz 250
8	327.890M QP	41.4	+27.0	+0.0	+0.0	+0.2	+0.0 112	14.6	37.7	-23.1	Horiz 100
9	326.830M QP	36.4	+27.0	+0.0	+0.0	+0.2	+0.0 158	9.6	37.7	-28.1	Vert 176
10	430.520M QP	33.0	+26.9	+0.0	+0.0	+0.3	+0.0 169	6.4	42.1	-35.7	Vert 134
11	432.100M QP	30.8	+26.9	+0.0	+0.0	+0.3	+0.0 293	4.2	42.2	-38.0	Horiz 108
12	138.700M QP	24.2	+26.7	+0.0	+0.0	+0.1	+0.0 180	-2.4	36.1	-38.5	Vert 108
13	33.956M QP	26.6	+27.0	+0.0	+0.0	+0.1	+0.0 203	-0.3	40.0	-40.3	Vert 100
14	157.780M QP	24.0	+26.7	+0.0	+0.0	+0.1	+0.0 231	-2.6	40.3	-42.9	Vert 137
15	960.380M QP	35.0	+26.8	+0.0	+0.0	+0.9	+0.0 68	9.1	54.0	-45.0	Horiz 123

EMCE Engineering Date: 3/14/2017 Time: 12:29:12 Aivaka WO#: 4283
15.231 Limits - 3M Test Distance: 3 Meters Sequence#: 1 Ext ATTN: 0 dB



5.3 Emission Bandwidth

Limit:

FCC PART 15 Section 15.231(c)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency.

Procedures:

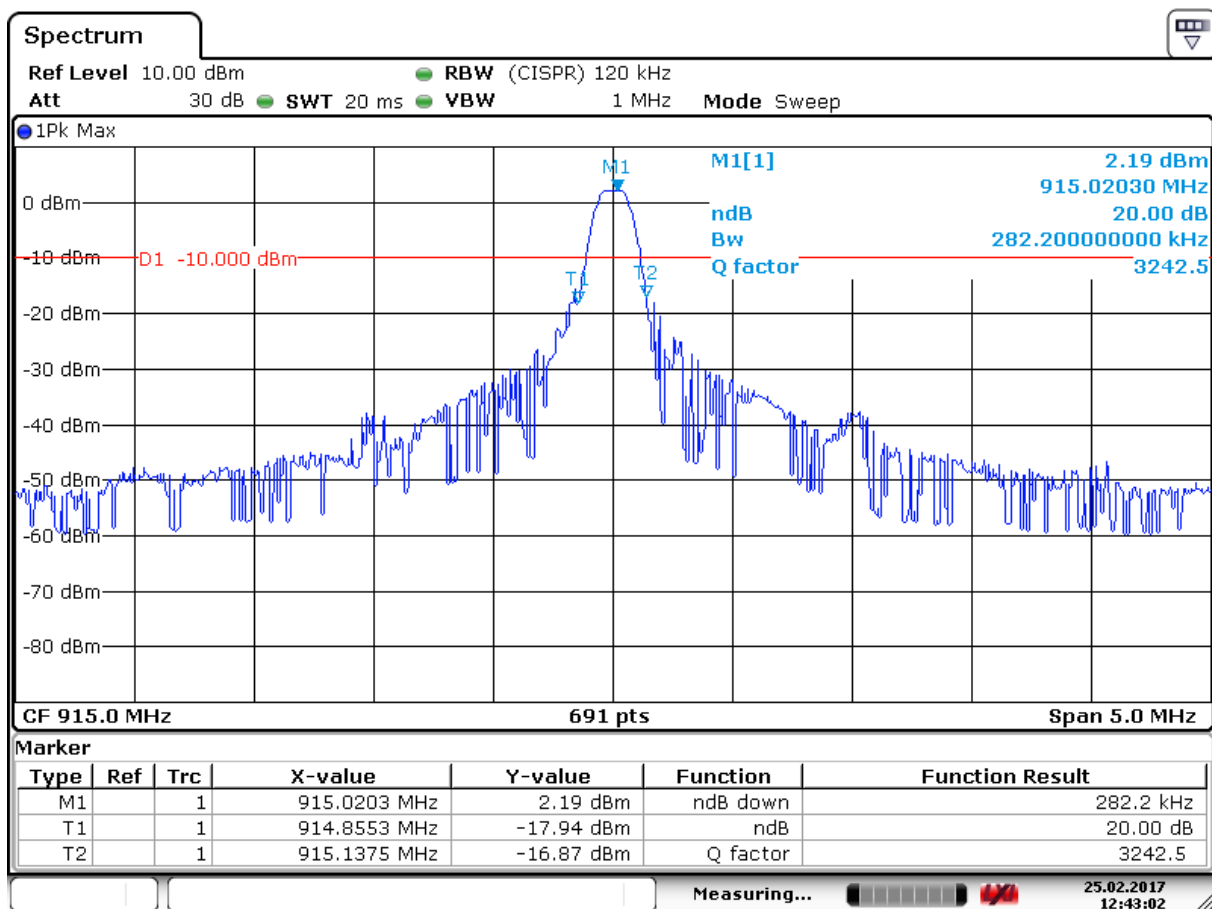
The bandwidth of the emission was measured according to 47 CFR §15.231. Measurement was taken with spectrum analyzer. The spectrum analyzer bandwidth and span was set to read in hertz.

Environmental Conditions	
Temperature	24° C
Relative Humidity	45%
Atmospheric Pressure	1010mbar

Test Date: 3-14-2017

Tested By: Bob Cole

Results: **PASS**



Date: 25.FEB.2017 12:43:01

5.4 Transmitter Deactivation

Limit:

FCC PART 15 Section 15.231(a)(2)

A transmitter activated automatically shall cease transmission within 5 seconds of activation.

Procedures:

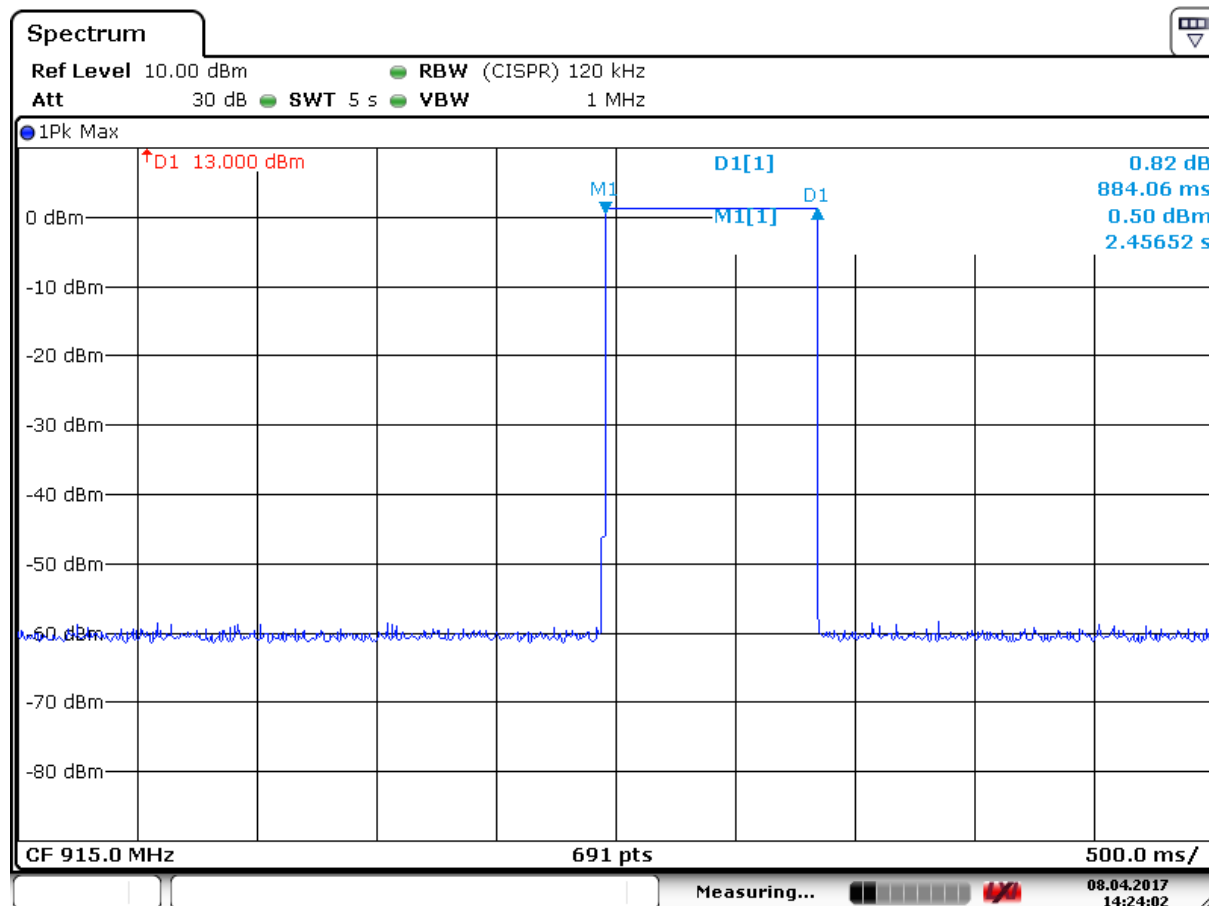
Connect the antenna port of the EUT to the spectrum analyzer via an Attenuator.

Use the following settings on the Spectrum Analyzer:

RBW	120 KHz
VBW	1 MHz
Detector	Peak
Span	Zero
Trace Mode	Max Hold

1. Set sweep time to encompass more than 5 seconds after signal activation.
2. Place Analyzer marker at start of transmitter activation.
3. Place marker 5 seconds after activation.
4. Check to see if transmitter ceased operation.

Environmental Conditions	
Temperature	24° C
Relative Humidity	45%
Atmospheric Pressure	1010mbar



Date: 8 APR 2017 14:24:02

Test Date: 4-8-2017

Tested By: Bob Cole

Results: **PASS**

The transmitter ceased operation.

5.5 Band Edge

Requirement(s):

FCC CFR Title 47 Part 15 Subpart C Section 15.231(d)

For devices operating within the frequency band 40.66-40.70 MHz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be $\pm 0.01\%$. This frequency tolerance shall be maintained for a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Procedures:

N/A

Environmental Conditions	
Temperature	24° C
Relative Humidity	45%
Atmospheric Pressure	1010mbar

Test Date: 3-14-2017

Tested By: Bob Cole

Results: **N/A**

The EUT does not operate in the frequency bands of 40.66-40.70 MHz. Requirement §15.231(d) is non-applicable.

5.6 Conducted Emissions

Requirement(s):

FCC CFR Title 47 Section 15.207(a)

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Limit:

Frequency of Emission (MHz)	Conducted Limit (dB μ V)		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*	
0.5-5	56	46		
5-30	60	50		

Procedures:

N/A

Test Date: 3-14-2017

Tested By: Bob Cole

Results: N/A

Environmental Conditions	
Temperature	24° C
Relative Humidity	45%
Atmospheric Pressure	1010mbar

The EUT is powered by a 3.7 V Unprotected Lithium Ion Flat-top Battery, and does not plug into the power mains. Requirement § 15.207(a) is non-applicable.

5.7 Frequency Stability

Requirement(s):

FCC CFR Title 47 Section 2.1055

Limits:

Frequency Stability versus Temperature:

The Frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20°C to $+50^{\circ}\text{C}$ at normal supply voltage.

Reference Frequency: 914.999975 MHz

Temperature (°C)	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Deviation (Limit: 0.01%)	Pass/Fail
50	914.999888	87	<0.01	Pass
40	914.999895	80	<0.01	Pass
30	914.999858	117	<0.01	Pass
20	Reference (914.999975 MHz)			
10	914.999871	104	<0.01	Pass
0	914.999901	74	<0.01	Pass
-10	914.999870	105	<0.01	Pass
-20	914.999844	131	<0.01	Pass

Frequency Stability versus Input Voltage:

The Frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$, the frequency of the transmitter was measured at 85% and at 115% of the rated power supply voltage at 20°C environmental temperature.

Carrier Frequency: 914.999975 MHz at 20°C at 3.7V

Measured Voltage $\pm 15\%$ of nominal (DC)	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Deviation (Limit: 0.01%)	Pass/Fail
4.25	914.999992	17	<0.01	Pass
5.75	914.999994	19	<0.01	Pass

Procedures:

Procedures:

Frequency Stability was measured according to 47 CFR §2.1055. Measurement was taken with spectrum analyzer. The spectrum analyzer bandwidth and span was set to read in hertz. A voltmeter was used to monitor when varying the voltage.

Limit: $\pm 0.01\%$ of 915 MHz = 915.00 Hz

Environmental Conditions	
Temperature	24° C
Relative Humidity	45%
Atmospheric Pressure	1010mbar

Test Date: 3-14-2017

Tested By: Bob Cole

Results: **PASS**

6.0 TEST EQUIPMENT

Calibration of Measuring Equipment

The EMI Receiver (spectrum analyzer) is calibrated by an ISO 17025 Accredited calibration laboratory on an annual basis. The laboratory provides certification accredited to ISO 17025. Antenna factors are measured on an annual basis by an ISO 17025 Accredited Antenna Calibration Facility. Cable losses as well as amplifier gains are swept at least every month to verify accurate values.

Equipment Calibration Data

Equipment	Serial Number	Last Calibration Date	Calibration Due Date
Omega-IBTHXBP	14490199	7/8/2016	7/8/2017
Schaffner-NSG435	5892	7/8/2016	7/8/2017
Fluke-87	64920001	6/28/2016	6/28/2017
Sunol Sciences-JB1	A061416	6/27/2016	6/27/2017
EMCO-3816-2	9809-1089	8/12/2016	8/12/2017
Rohde & Schwarz- FSV40	101424	6/20/2016	6/20/2017
Sunol Sciences-JB6	A042610	6/15/2016	6/15/2017
A. H. Systems-SAS- 571	236	6/13/2016	6/13/2017

Test Facility

All Testing was performed at:

47610 Kato Road
Fremont, CA 94538

A computer controlled spectrum analyzer with quasi-peak adapter, and printer were used for gathering and recording test data.

Attachment 1

NVLAP DOCUMENTATION

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200092-0

Universal Compliance Labs dba EMCE Engineering
Fremont, CA

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*

Electromagnetic Compatibility & Telecommunications

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communiqué dated January 2009).*

2016-12-28 through 2017-12-31

Effective Dates

A handwritten signature in blue ink, reading "Dana S. Laman".

For the National Voluntary Laboratory Accreditation Program

END OF REPORT