Itron, Inc.

TEST REPORT FOR

AMR Transceiver Device for Communicating with Utility Meters
Model: IMR

Tested o The Following Standards:

FCC Part 101 Subpart C

Report No.: 99119-5

Date of issue: November 23, 2016

ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Itron, Inc.
2111 N. Molter Road
Liberty Lake, WA 99019

REPRESENTATIVE: Jay Hocomb
Customer Reference Number:

REPORT PREPARED BY:

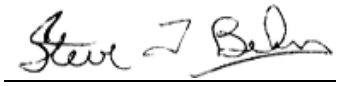
Dianne Dudley
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 99119

DATE OF EQUIPMENT RECEIPT: November 2016
DATE(S) OF TESTING: November 2016

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
22116 23rd Drive S.E., Suite A
Bothell, WA 98021-4413

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.02

Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Bothell	US0081	SL2-IN-E-1145R	3082C-1	US1022	A-0148

SUMMARY OF RESULTS

Standard / Specification: FCC Part 101 Subpart C

Test Procedure	Description	Modifications	Results
101.107	Frequency Tolerance	NA	Pass
101.109	Bandwidth	NA	Pass
101.111	Emissions Limitations	NA	Pass
101.113	Peak Power	NA	Pass
2.1047	Modulation	NA	NA[1]

NA = Not applicable

NA[1] = Not applicable because the EUT does not employ any modulation types outlined in the rules.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR transceiver device for communicating with utility meters	Itron, Inc	IMR	00000005

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	M6300	9KG4MF1
AC Adapter for Laptop	Dell	NADP-130AB D	NA

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Modulation Type(s):	OOK
Antenna Type(s) and Gain:	Internal PIFA 1dBi
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	120VAC, 60Hz
Firmware / Software used for Test:	DSP Firmware 5.71 / MC3 Test v4.0.2.2
Temperature Range	-20C to 50C

FCC Part 101 Subpart C

101.107 Frequency Stability

Test Setup/Conditions			
Test Location:	Bothell Lab Bench 2	Test Engineer:	M. Atkinson
Test Method:	FCC CFR 47 Part 101.107, TIA-604D	Test Date(s):	10/14/16
Configuration:	1		
Test Setup	Frequency Range: 952-959.85MHz Frequency tested: 952, 959.84MHz Firmware power setting: Max Power EUT Firmware: 5.71 Protocol /MCS/Modulation: OOK Antenna type: Internal PIFA Antenna Gain: 1.0 dBi Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting Test Setup: EUT is inside temperature chamber transmitting through a temporary antenna connector and is attached directly to the spectrum analyzer. Modifications Added: None		

Environmental Conditions			
Temperature (ºC)	20-24	Relative Humidity (%):	32-45

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02871	Spectrum Analyzer	Agilent	E4440A	8/25/2015	8/25/2017
P06678	Cable	Astrolab	32026-29801-29801-144	9/19/2016	9/19/2018
P06242	Attenuator	Weinschel	54A-10	3/28/2016	3/28/2018
02757	Temperature Chamber	Bemco	F100/350-8	2/5/2015	2/5/2017
03029	Thermometer, Digital Infrared	Fluke	566	1/29/2015	1/29/2017
01315	AC Power Supply	PPS	N/A	11/16/2015	11/16/2017

Test Data Summary					
Temperature (ºC)	**Voltage**	**Frequency (MHz)**	**Frequency Tolerance (%)**	**Limit (%)**	**Results**
-30	$V_{Nominal}$	952.0004	0.00004	0.00015	Pass
-20	$V_{Nominal}$	952.0006	0.00003	0.00015	
-10	$V_{Nominal}$	952.0007	0.00001	0.00015	
0	$V_{Nominal}$	952.0010	0.00002	0.00015	
10	$V_{Nominal}$	952.0008	0.00000	0.00015	
20	$V_{Minimum}$	952.0008	0.00000	0.00015	
20	$V_{Nominal}$	952.0008	0.00000	0.00015	
20	$V_{Maximum}$	952.0008	0.00000	0.00015	
30	$V_{Nominal}$	952.0008	0.00000	0.00015	
40	$V_{Nominal}$	952.0008	0.00000	0.00015	
50	$V_{Nominal}$	952.0008	0.00000	0.00015	
Nominal Frequency:		952.0008			

Test Data Summary					
Temperature (ºC)	**Voltage**	**Frequency (MHz)**	**Frequency Tolerance (%)**	**Limit (%)**	**Results**
-30	$V_{Nominal}$	959.8445	0.00004	0.00015	Pass
-20	$V_{Nominal}$	959.8445	0.00004	0.00015	
-10	$V_{Nominal}$	959.8448	0.00000	0.00015	
0	$V_{Nominal}$	959.8450	0.00002	0.00015	
10	$V_{Nominal}$	959.8450	0.00002	0.00015	
20	$V_{Minimum}$	959.8448	0.00000	0.00015	
20	$V_{Nominal}$	959.8448	0.00000	0.00015	
20	$V_{Maximum}$	959.8448	0.00000	0.00015	
30	$V_{Nominal}$	959.8448	0.00000	0.00015	
40	$V_{Nominal}$	959.8448	0.00000	0.00015	
50	$V_{Nominal}$	959.8448	0.00000	0.00015	
Nominal Frequency:		959.8448			

Note: Test was performed with frequency settings that were available at the time of testing at the lab and are representative of the low and high channels of operation.

Parameter Definitions:

Measurements performed at input voltage Vnominal ± 15%.

Parameter	Value
$V_{Nominal}$:	115VAC
$V_{Minimum}$:	97VAC
$V_{Maximum}$:	133VAC

Test Data

101.109 Bandwidth

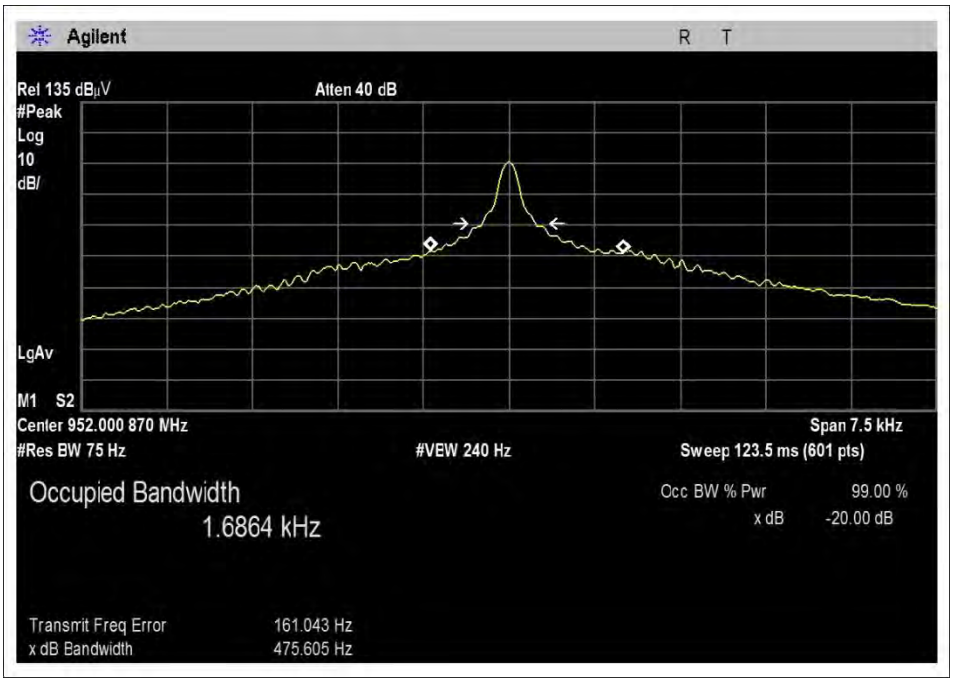
Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Atkinson
Test Method:	FCC CFR 47 Part 101.109, TIA-604D	Test Date(s):	10/10/16
Configuration:	1		
Test Setup:	Frequency Range: 952-959.85MHz Frequency tested: 952, 959.84MHz Firmware power setting: Max Power EUT Firmware: 5.71 Protocol /MCS/Modulation: OOK Antenna type: Internal PIFA Antenna Gain: 1.0 dBi Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting Test Setup: EUT is transmitting through a temporary antenna connector and is attached directly to the spectrum analyzer. Multiple modulation tones investigated, only worst case reported. Modifications Added: None		

Environmental Conditions			
Temperature (ºC)	20-24	Relative Humidity (%):	32-45

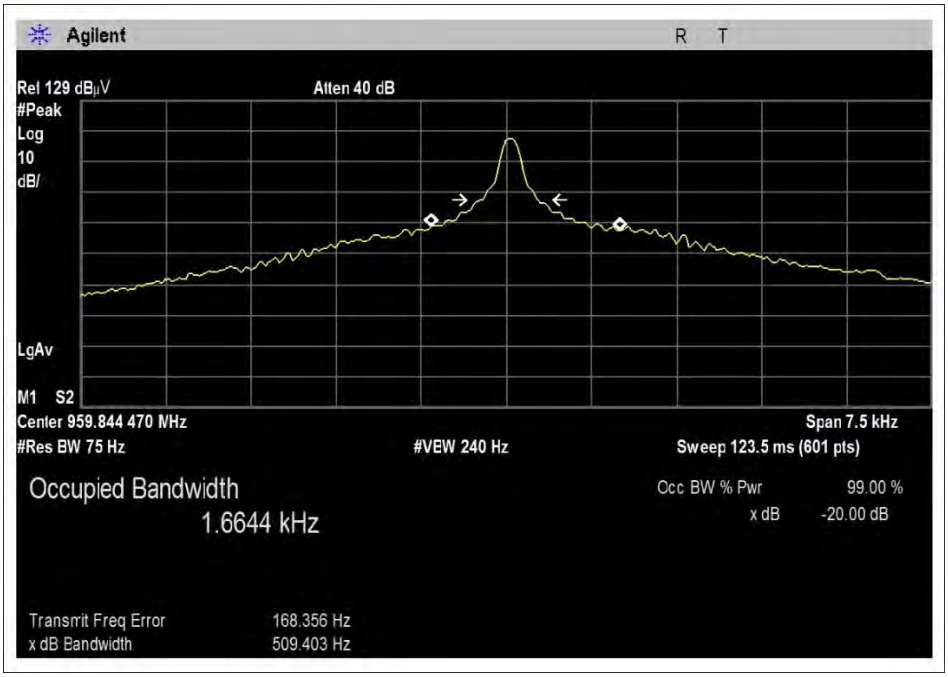
Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02871	Spectrum Analyzer	Agilent	E4440A	8/25/2015	8/25/2017
P06678	Cable	Astrolab	32026-29801-29801-144	9/19/2016	9/19/2018
P06242	Attenuator	Weinschel	54A-10	3/28/2016	3/28/2018

Test Data Summary				
Frequency (MHz)	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
952.0	OOK	0.4756	<12.5	Pass
959.84	OOK	0.5094	<12.5	Pass

Plot(s)



Low



High

Test Setup Photo(s)

101.111 Emissions Limitations Conducted

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Atkinson
Test Method:	FCC CFR 47 Part 101.111, TIA-604D	Test Date(s):	10/6/16 to 10/12/16
Configuration:	1		
Test Setup:	Frequency Range: 952-959.85MHz Frequency tested: 9kHz-10GHz Firmware power setting: Max Power EUT Firmware: 5.71 Protocol /MCS/Modulation: OOK Antenna type: Internal PIFA Antenna Gain: 1.0 dBi Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting Test Setup: EUT is transmitting through a temporary antenna connector and is attached directly to the spectrum analyzer. Multiple modulation tones investigated, only worst case reported. Modifications Added: None		

Environmental Conditions			
Temperature (ºC)	20-24	Relative Humidity (%):	32-45

Test Equipment Radiated					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02871	Spectrum Analyzer	Agilent	E4440A	8/25/2015	8/25/2017
P06503	Cable	Astrolab	32026-29801-29801-36	4/28/2016	4/28/2018
P06242	Attenuator	Weinschel	54A-10	3/28/2016	3/28/2018

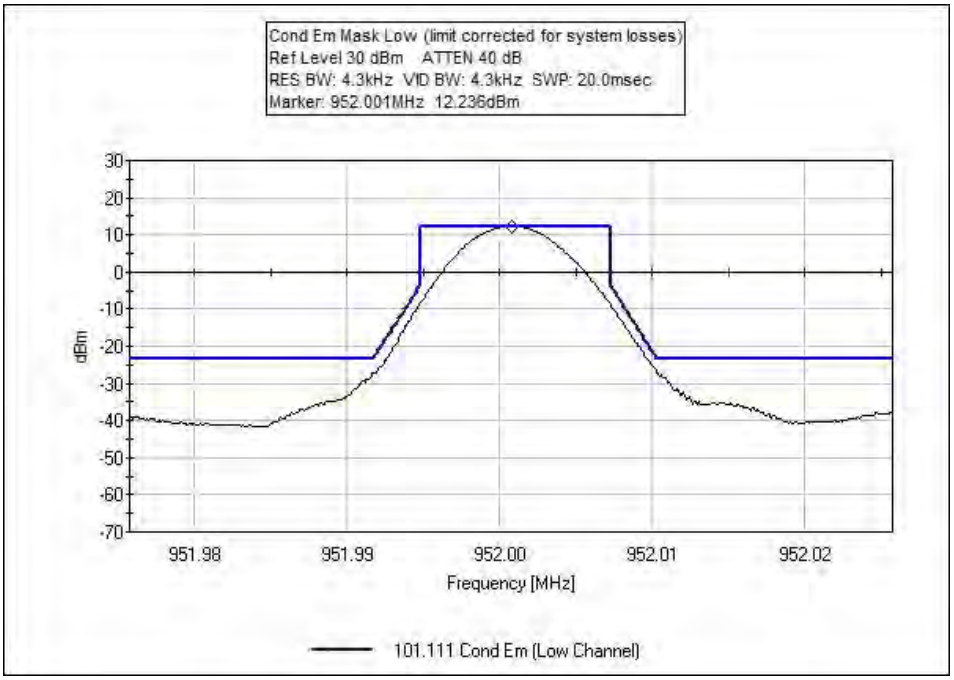
Test Data Summary

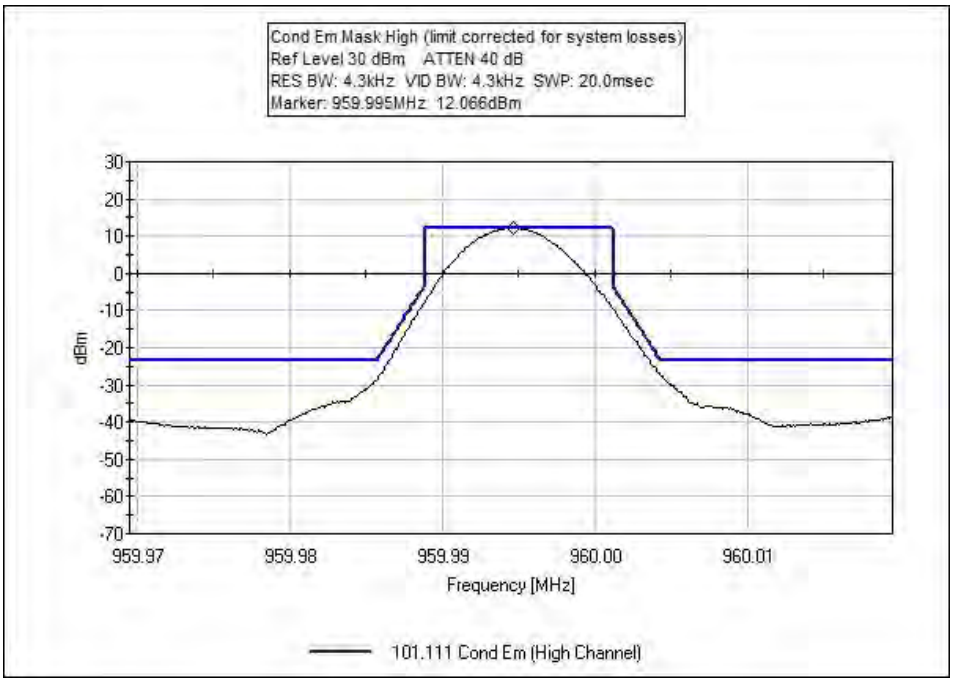
Limit applied: Part 101.111 (a) (2) (i)
Max Power – (35 + 0.8(P – 50) + 10Log10 B) down to -13dBm

P = Percent removed from the center frequency of the transmitter bandwidth.
B = Authorized bandwidth in MHz

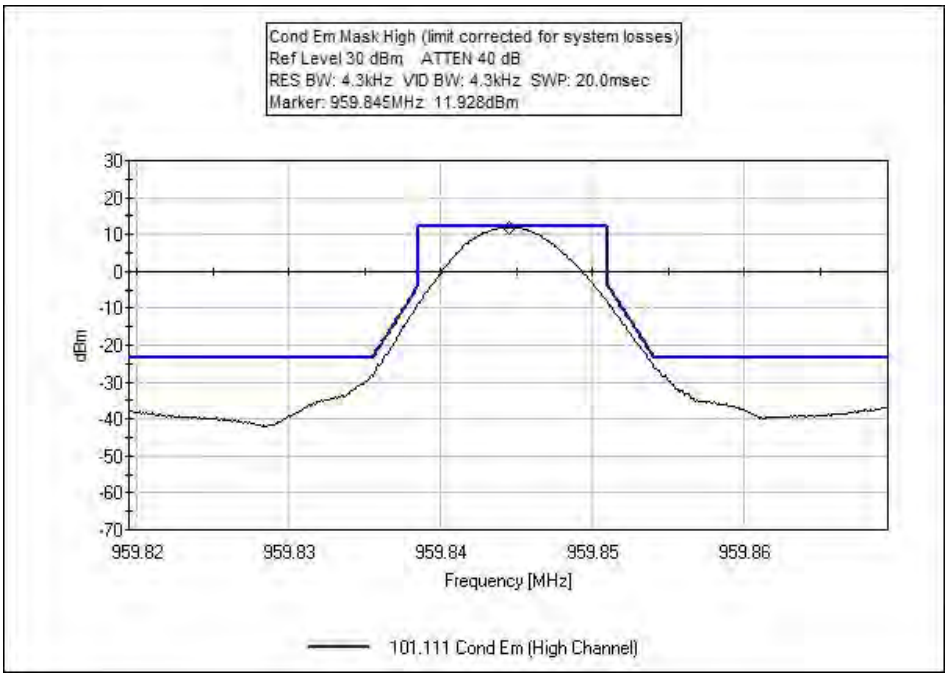
Frequency (MHz)	Measured (dBm)	Limit (dBm)	Margin (dB)	Results
959.854	-12.3	-9.6	-2.7	Pass
952.01	-14.7	-11	-3.7	Pass
959.851	0.5	4.7	-4.2	Pass
959.838	-0.1	4.8	-4.9	Pass
952.007	0.9	5.8	-4.9	Pass
951.995	-0.2	4.7	-4.9	Pass
959.836	-13	-8	-5	Pass
951.992	-15.4	-10.1	-5.3	Pass
2856	-26.8	-13	-13.8	Pass
2880	-33.8	-13	-20.8	Pass

Plot(s)





Emissions Mask



Test Setup Photo(s)

101.111 Emissions Limitations Radiated

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Atkinson
Test Method:	FCC CFR 47 Part 101.111, TIA-604D	Test Date(s):	10/6/16 to 10/12/16
Configuration:	1		
Test Setup:	Frequency Range: 952-959.85MHz Frequency tested: 9kHz-10GHz Firmware power setting: Max Power EUT Firmware: 5.71 Protocol /MCS/Modulation: OOK Antenna type: Internal PIFA Antenna Gain: 1.0 dBi Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting Test Setup: EUT has temporary antenna connector and is connected to termination. Multiple modulation tones investigated, only worst case reported. Modifications Added: None		

Environmental Conditions			
Temperature (ºC)	20 to 24	Relative Humidity (%):	32 to 45

Test Equipment Radiated					
Asset# #	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02871	Spectrum Analyzer	Agilent	E4440A	8/25/2015	8/25/2017
P06540	Cable	Andrews	Heliax	10/29/2015	10/29/2017
P05305	Cable	Andrews	ETSI-50T	2/15/2016	2/15/2018
03540	Preamp	HP	83017A	4/30/2015	4/30/2017
01467	Horn Antenna	EMCO	3115	8/12/2015	8/12/2017
P06935	Cable	Astrolab	32026-29801-29801-18	3/11/2016	3/11/2018
03170	High Pass Filter	SMI	HM1155-11SS	12/17/2015	12/17/2017
00052	Loop Antenna	EMCO	6502	4/8/2016	4/8/2018

Test Data Summary

Limit applied: Part 101.111 (a) (2) (i)
Max Power – (35 + 0.8(P – 50) + 10Log10 B) down to -13dBm (EIRP)

P = Percent removed from the center frequency of the transmitter bandwidth.
B = Authorized bandwidth in MHz

Conversion to EIRP limit (dBuV/m at 3m) = Power Limit (dBm) – 20Log10(3) + 107

Note: The limit and measurements were recorded and corrected for dBµV/m at 3m using correction factors based on known measurement system losses.

Frequency (MHz)	Measured (dBµV/m at 3m)	Limit (dBµV/m at 3m)	Margin (dB)	Results
1904	51.9	84.5	-28.2	Pass
0.202	56.3	84.5	-32.6	Pass
0.05	51.2	84.5	-33.3	Pass
2856	43.5	84.5	-37.2	Pass
3808	43.4	84.5	-37.8	Pass
8639.93	47.3	84.5	-39.1	Pass
2879.97	46.7	84.5	-39.4	Pass
4760	39	84.5	-41	Pass
7680.01	45.4	84.5	-41	Pass
9599.93	45.1	84.5	-41.1	Pass
7616	37.8	84.5	-41.6	Pass
8569.05	37.7	84.5	-41.7	Pass
1919.94	43.5	84.5	-41.9	Pass
6720.01	42.9	84.5	-42.7	Pass
9520.75	35.9	84.5	-43.3	Pass
1072	42.8	84.5	-45.5	Pass
4800.01	42.6	84.5	-46.7	Pass
5712	34.8	84.5	-46.8	Pass
5760.01	41.8	84.5	-47.8	Pass
3839.99	41.2	84.5	-48.6	Pass
6664	34	84.5	-49.1	Pass
19.743	36.7	84.5	-49.7	Pass
1333	35.4	84.5	-50.5	Pass
266.7	32.7	84.5	-51.8	Pass
27.511	31.3	84.5	-53.2	Pass
973.8	31.1	84.5	-53.4	Pass
549	31.1	84.5	-53.4	Pass
2.978	30.6	84.5	-53.9	Pass
50.4	30.3	84.5	-54.2	Pass

Test Setup Photo(s)

9kHz-1GHz

1-10GHz

101.113 Transmitter Power Limitations

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Atkinson
Test Method:	FCC CFR 47 Part 101.113, TIA-604D	Test Date(s):	10/7/16
Configuration:	1		
Test Setup:	Frequency Range: 952-959.85MHz Frequency tested: 952, 959.84MHz Firmware power setting: Max Power EUT Firmware: 5.71 Protocol /MCS/Modulation: OOK Antenna type: Internal PIFA Antenna Gain: 1.0 dBi Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting Test Setup: EUT is transmitting through a temporary antenna connector and is attached directly to the spectrum analyzer. Multiple modulation tones investigated, only worst case reported. Modifications Added: None		

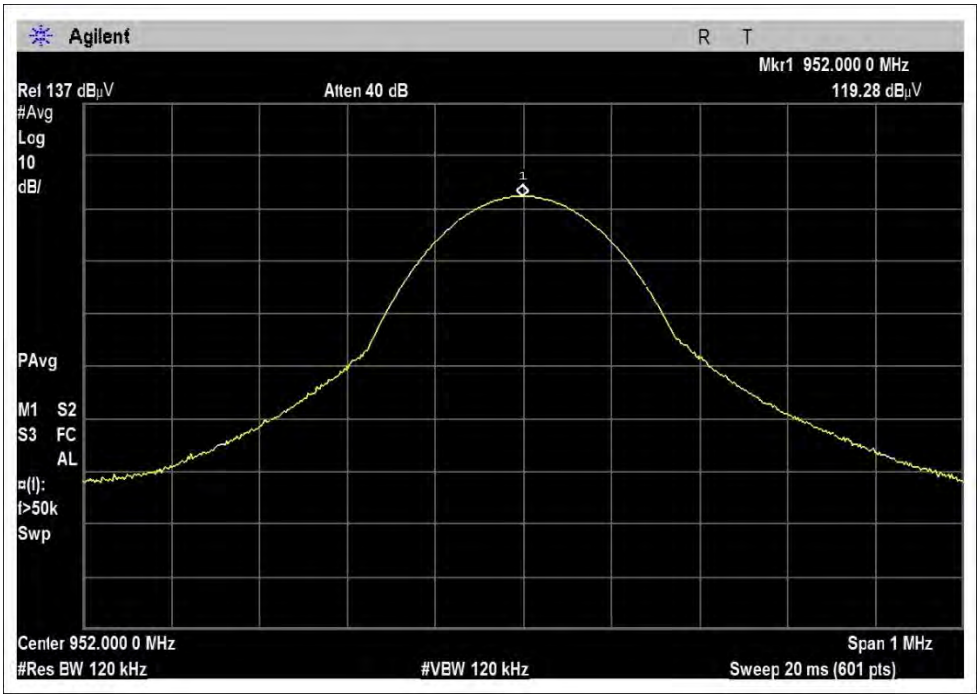
Environmental Conditions			
Temperature (ºC)	20-24	Relative Humidity (%):	32-45

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02871	Spectrum Analyzer	Agilent	E4440A	8/25/2015	8/25/2017
P06503	Cable	Astrolab	32026-29801-29801-36	4/28/2016	4/28/2018
P06242	Attenuator	Weinschel	54A-10	3/28/2016	3/28/2018

Test Data Summary						
Frequency (MHz)	**Measured, before correction (dBm)**	**Correction Factors (dB)**	**Corrected Power (dBm)**	**Power Watts**	**Limit Watts**	**Results**
952.0	12.3	10.3	22.6	0.182	25	Pass
959.84	12.3	10.3	22.6	0.182	25	

Note: The conducted measurements were recorded in dBuV and converted into dBm using a conversion factor for known system impedance of 50 ohms.

Plot(s)



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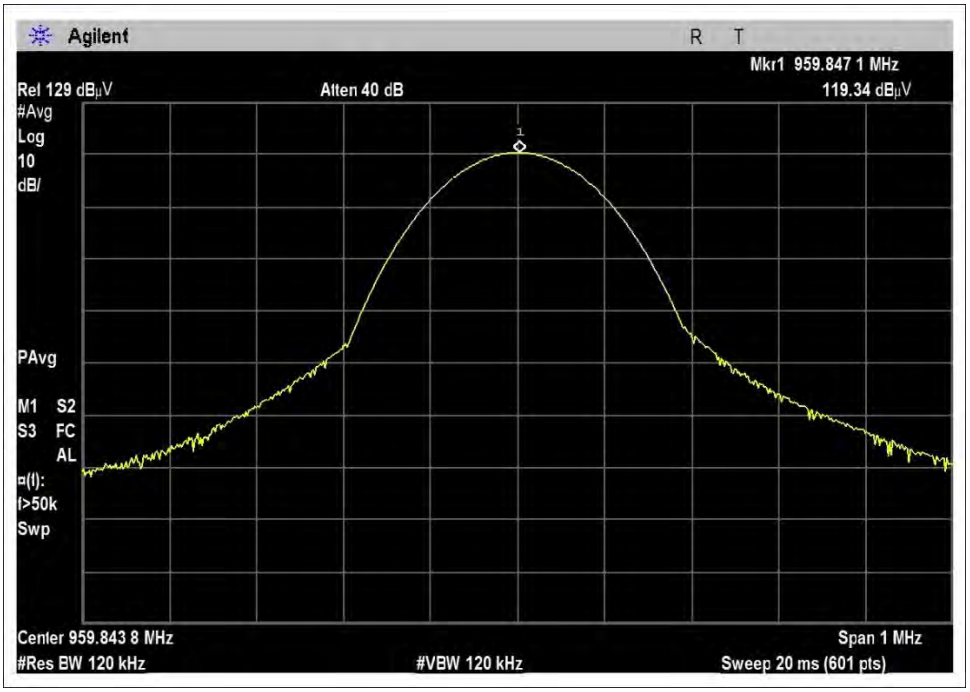

High

Test Setup Photo(s)