

Honeywell International, Inc.

ADDEDNUM TO EMC TEST REPORT 98388-8

Radar RDR-4000 Transmitter/Receiver (TR-1)
Model: 930-2000-1E0

Tested to The Following Standards:

FCC Part 2 / 87 Subpart F

Report No.: 98388-8A

Date of issue: December 19, 2016



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:

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Customer Reference Number: 6400330163

Project Number: 98388

DATE OF EQUIPMENT RECEIPT:

August 22, 2016

DATE(S) OF TESTING:

August 22 - 25, 2016

Revision History

Original: Testing of the Radar RDR-4000 Transmitter/Receiver (TR-1), Model: 930-2000-1E0 tested to FCC Part 2 / 87 Subpart F.

Addendum A: Corrections to reported output power to account for insertion loss of the drive assembly. The purpose of this report is to demonstrate continued compliance with the identified product after product modifications.

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
EMITest Immunity	5.03.02

SITE FILE REGISTRATION NUMBERS

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Bothell	US0081	SL2-IN-E-1145R	3082C-1	318736	A-0148

SUMMARY OF RESULTS

Standard / Specification: FCC Part(s) 2 / 87 Subpart F

Test Procedure	Description	Modifications	Results
2.1046 / 87.131	RF Power Output	NA ¹	Pass
2.1047	Modulation Characteristics		NA ²
2.1049 / 87.135	Occupied Bandwidth	NA ¹	Pass
2.1051 / 87.139	Spurious Emissions at Antenna Terminals	NA ¹	Pass
2.1053 / 87.139	Field Strength of Spurious Radiation	NA ¹	Pass
2.1055 / 87.133	Frequency Stability	NA ¹	Pass

NA¹ = Not applicable.

NA² = 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
Radar RDR-4000 Transmitter/Receiver (TR-1)	Honeywell International Inc.	930-2000-1E0	TR04810

Support Equipment:

Device	Manufacturer	Model #	S/N
Computer	Dell	Precision 340	
Monitor	Planar	996-0520-00	
Mouse	Dell	IntelliMouse 1.3A	
Keyboard	Dell	SK-8110	
5 Port 10/100 Switch	Linksys	SD205	
DC Power Supply	HP	6291A	
WX Radar Processor RP-1	Honeywell International Inc.	930-1003-001	RP01805
30-Inch Antenna Drive	Honeywell International Inc.	930.3001-001	DA02633
30-Inch Antenna Drive	Honeywell International Inc.	930.3001-001	DA02633
Control Panel PP-1B	Korry	114100-102	1141AA0011
Gimbal Drive to SMA Adaptor	Honeywell International Inc.	652-4423-001	
Load Box	Honeywell International Inc.	710-0389-001	
ENV Test Harness	Honeywell International Inc.	014-1113-001	
30-Inch Antenna Cloud	Honeywell International Inc.	617-6359-001	

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Modulation Type(s):	Doppler Pulse Radar, pulse rate 200pps, pulse width 5.2μS
Antenna Type(s) and Gain:	30 inch flat plate slotted array, 35dBi
Antenna Connection Type:	Removable Waveguide
Nominal Input Voltage:	115VAC to the processor unit which supplies 200Vdc to the EUT
Firmware / Software used for Test:	Honeywell Monitoring Software NgrSimRITS 20151209
Temperature Range	-40°C to +60°C

FCC PART(S) 2 / 87 SUBPART F

2.1046 / 87.131 RF Power Output

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford
Test Method:	TIA 603-C (2004)	Test Date(s):	8/24/2016 to 8/25/2016
Configuration:	1		
Test Setup:	Firmware power setting: Max Power Software: Honeywell Monitoring Software NgrSimRITS 20151209 Protocol / Modulation: Doppler Pulse Radar Test Mode: UUT is continuously transmitting. Center frequency: 9.356 GHz Test Setup: The EUT is sitting inside the temperature chamber and the antenna connector is attached to the Power sensor through a cable and 2 attenuators. The EUT is connected to the support equipment outside the chamber through the EMI Harness.		

Environmental Conditions			
Temperature (°C)	23	Relative Humidity (%):	37

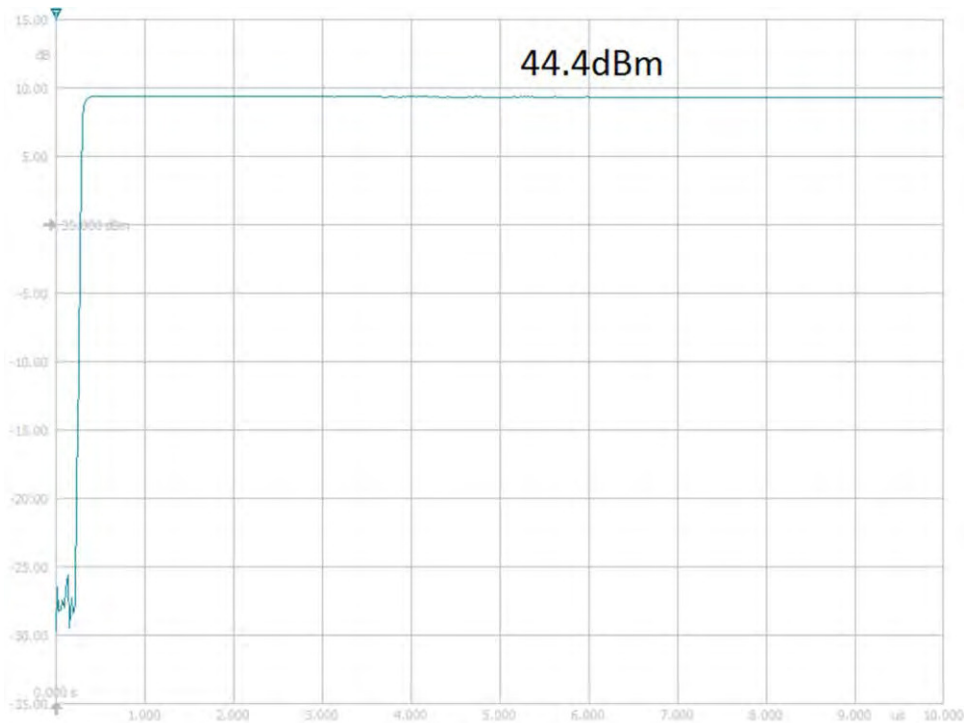
Test Equipment					
Asset# / Serial#	Description	Manufacturer	Model	Cal Date	Cal Due
03478	Power Sensor	Rohde & Schwarz	NRP-Z81	2/9/2016	2/9/2018
P05748	Attenuator	Pasternack	PE7004-20	4/11/2016	4/11/2018
P06932	Attenuator	Weinschel	46-3-34	1/4/2016	1/4/2018
P06867	Cable	Astrolab	32026-29080-29080-84	10/16/2015	10/16/2017
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

Test Data Summary

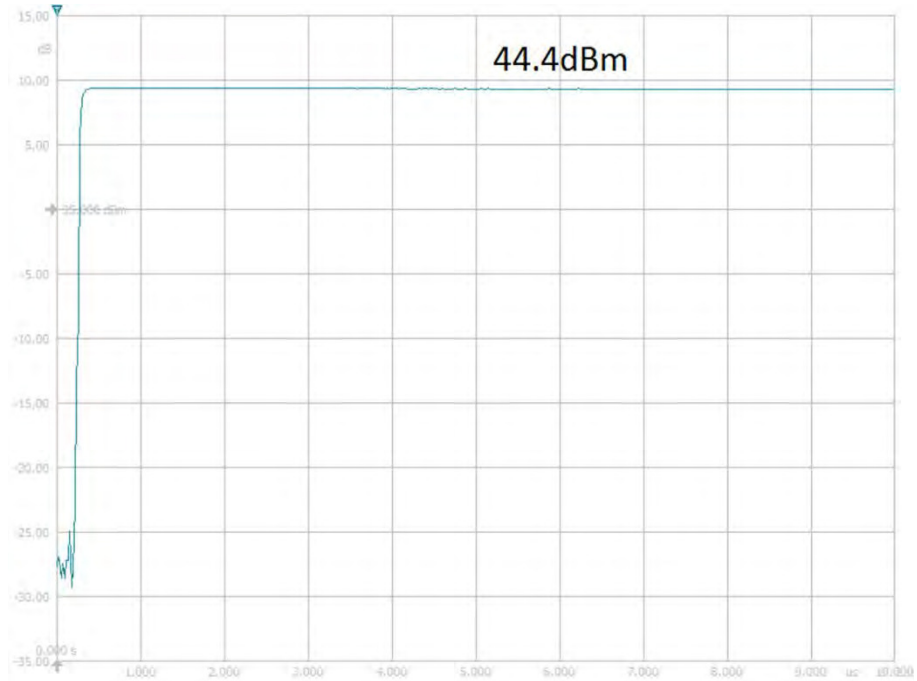
Temperature (°C)	Voltage	Power at DA Assembly (dBm)	Power at Transmitter (dBm)	Power Watts	Limit Watts	Results
-40	V _{Nominal}	44.6	46.8	48.1	None	Pass
-30	V _{Nominal}	44.5	46.7	47.0	None	
-20	V _{Nominal}	44.4	46.6	45.9	None	
-10	V _{Nominal}	44.5	46.7	47.0	None	
0	V _{Nominal}	44.3	46.5	44.9	None	
10	V _{Nominal}	44.3	46.5	44.9	None	
20	V _{Minimum}	44.4	46.6	45.9	None	
20	V _{Nominal}	44.4	46.6	45.9	None	
20	V _{Maximum}	44.4	46.6	45.9	None	
30	V _{Nominal}	44.3	46.5	44.9	None	
40	V _{Nominal}	44.3	46.5	44.9	None	
50	V _{Nominal}	44.2	46.4	43.9	None	
60	V _{Nominal}	43.8	46.0	40.0	None	

Power output was measured at the output of the antenna drive assembly, DA02633. The manufacturer's reported insertion loss of the antenna drive assembly is 2.22 dB (see appendix A).

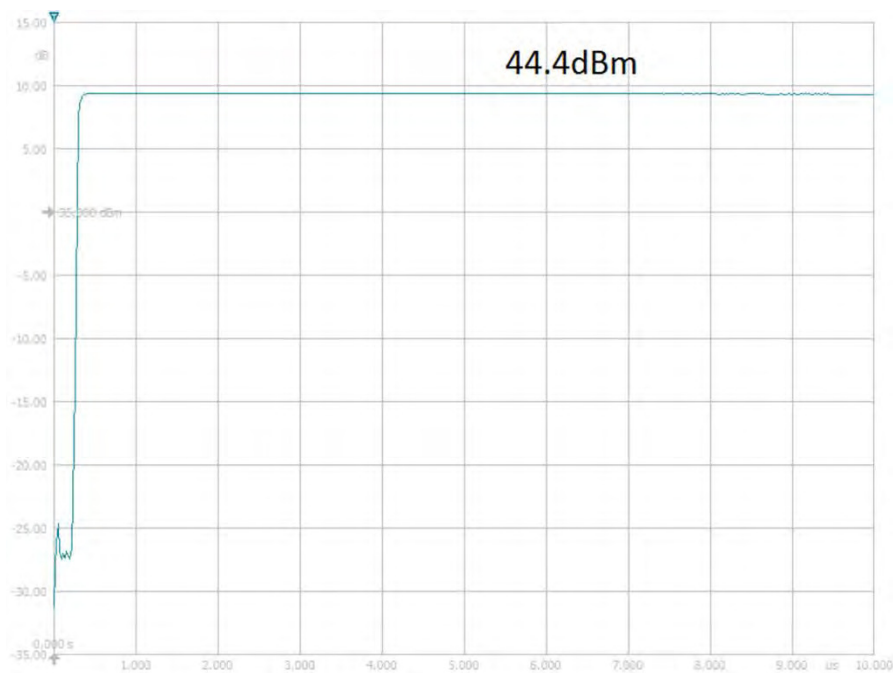
Test Plots



Low Voltage at DA02663 output



Nominal Voltage at DA02663 output



High Voltage at DA02663 output

Test Setup Photo(s)



2.1049 / 87.135 Occupied Bandwidth

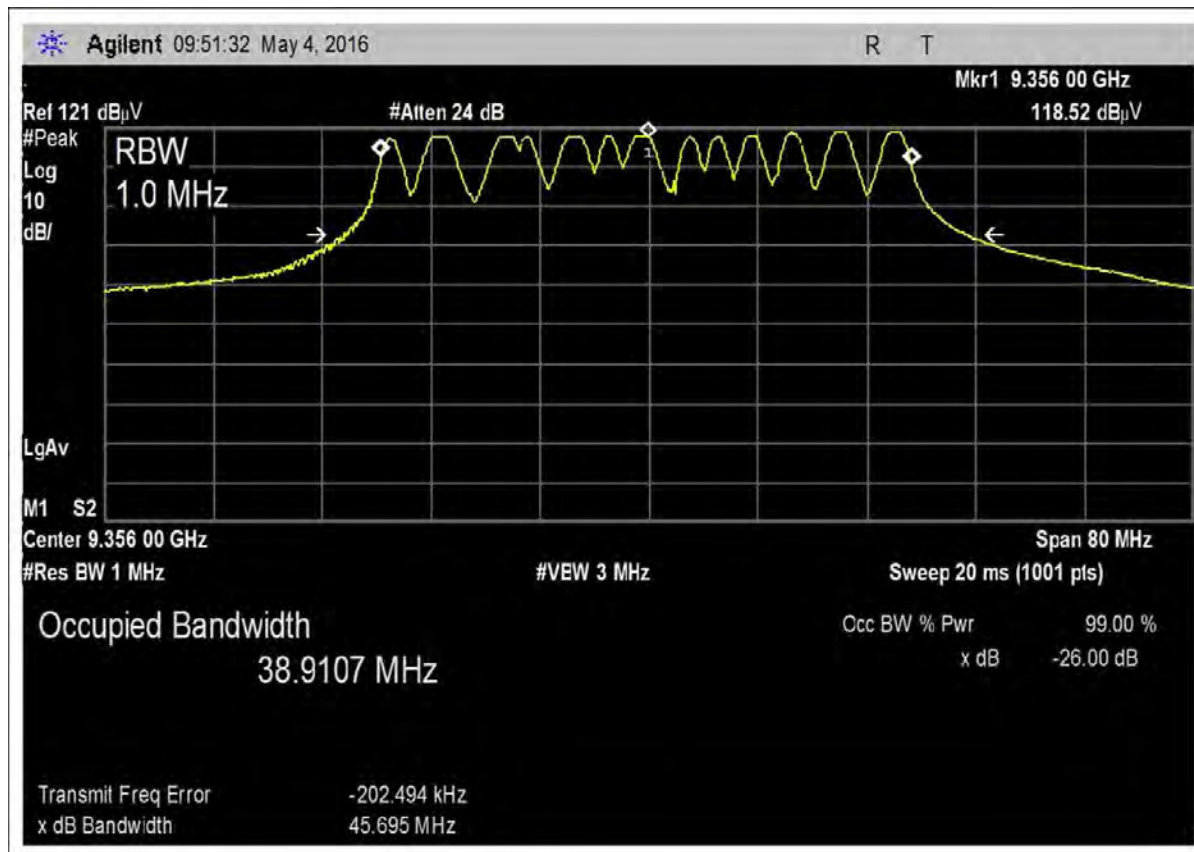
Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford
Test Method:	FCC CFR 47, Part 2.1049	Test Date(s):	8/23/2016
Configuration:	1		
Test Setup:	Firmware power setting: Max Power Software: Honeywell Monitoring Software NgrSimRITS 20151209 Protocol / Modulation: Doppler Pulse Radar Test Mode: UUT is continuously transmitting. Test Setup: The EUT is sitting on an 80cm test table. The EUT is connected to the support equipment outside the chamber through the EMI Harness. The antenna terminal is connected to the spectrum analyzer through 2 cables and 2 attenuators.		

Environmental Conditions			
Temperature (°C)	25	Relative Humidity (%):	33

Test Equipment					
Asset# / Serial#	Description	Manufacturer	Model	Cal Date	Cal Due
P05305	Cable	Andrews	ETSI-50T	2/15/2016	2/15/2018
2673	Spectrum Analyzer	Agilent	E4446A	10/12/2015	10/12/2017
P05748	Attenuator	Pasternack	PE7004-20	4/11/2016	4/11/2018
P06540	Cable	Andrews	Heliac	10/29/2015	10/29/2017
P06932	Attenuator	Weinschel	46-3-34	1/4/2016	1/4/2018

Test Data Summary					
Frequency (GHz)	Antenna Port	Modulation	Measured (MHz)	Limit	Results
9.356	1	Doppler Pulse	38.91	None	Pass

Test Plot



Note: The Agilent time stamp is a default setting.

Test Setup Photo(s)



2.1051 / 87.139 Spurious Emissions at Antenna Terminals

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford
Test Method:	TIA 603-C (2004)	Test Date(s):	8/23/2016
Configuration:	1		
Test Setup:	Frequency range tested: 9k-40GHz Firmware power setting: Max Power Software: Honeywell Monitoring Software NgrSimRITS 20151209 Protocol / Modulation: Doppler Pulse Radar Test Mode: UUT is continuously transmitting. Test Setup: The EUT is sitting on an 80cm test table. The EUT is connected to the support equipment outside the chamber through the EMI Harness. The antenna terminal is connected to the spectrum analyzer through 2 cables and 2 attenuators. Measurements reported are at the output of the antenna drive assembly.		

Environmental Conditions			
Temperature (°C)	25	Relative Humidity (%):	35

Test Equipment Radiated					
Asset# / Serial#	Description	Manufacturer	Model	Cal Date	Cal Due
P05748	Attenuator	Pasternack	PE7004-20	4/11/2016	4/11/2018
P06867	Cable	Astrolab	32026-29080-29080-84	10/16/2015	10/16/2017
P05305	Cable	Andrews	ETSI-50T	2/15/2016	2/15/2018
P06540	Cable	Andrews	Heliac	10/29/2015	10/29/2017
P06932	Attenuator	Weinschel	46-3-34	1/4/2016	1/4/2018
02673	Spectrum Analyzer	Agilent	E4446A	10/12/2015	10/12/2017
02763-69	Waveguide	Andrew	Multiple	4/5/2016	4/5/2018
P06503	Cable	Astrolab	32026-29801-29801-36	4/28/2016	4/28/2018
P06678	Cable	Astrolab	32026-29801-29801-144	9/18/2014	9/18/2016
02764-70	Waveguide	Andrew	Multiple	4/5/2016	4/5/2018

Test Data Summary

Highest Measured Power:	46.6	dBm
Measurement Distance:	Antenna Conducted	

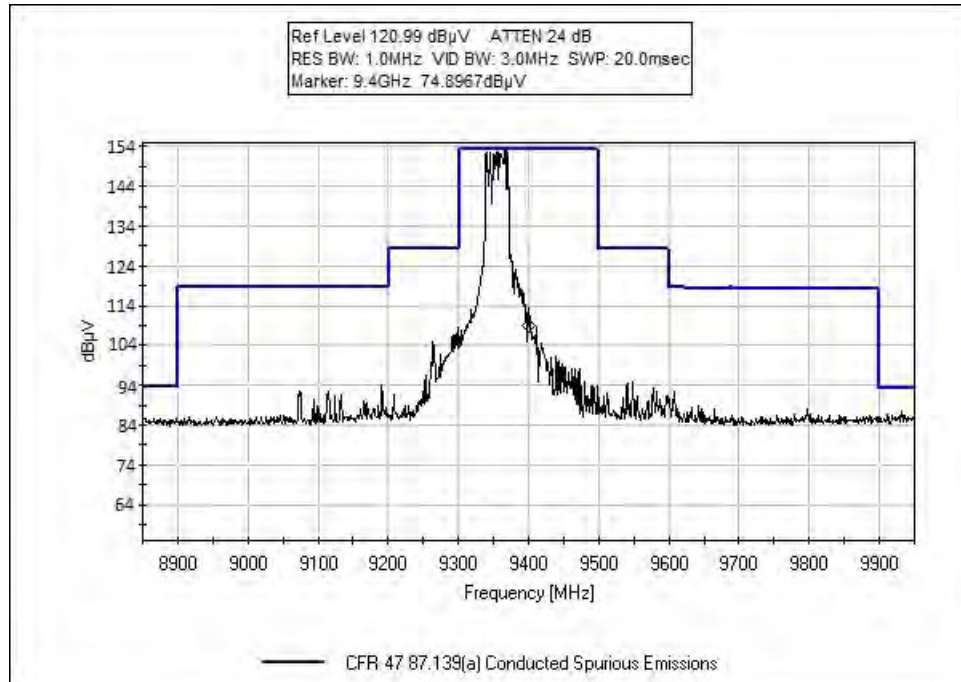
Limit Definition:

Frequency Range	Limit (dBc)	Limit Calculation
9kHz - 40GHz	59.6	$43+10*\text{LOG}(P)$

Frequency (MHz)	Reference Level (dBm)	Measured (dBc)	Margin
9995.987	-16.6	63.2	-3.6
10007.000	-16.6	63.2	-3.6
9977.969	-16.8	63.4	-3.8
18747.750	-18.2	64.8	-5.2
18739.740	-20.0	65.6	-7.0
9976.462	-20.7	67.3	-7.7
18732.730	-23.5	70.1	-10.5
17312.180	-24.1	70.7	-11.1
16599.580	-24.2	70.8	-11.2
18726.730	-24.4	71.0	-11.4
8704.002	-27.3	73.9	-14.3
18705.710	-30.0	76.6	-17.0
18693.690	-30.1	76.7	-17.1
37557.050	-31.4	78.0	-18.4
37286.780	-32.2	78.8	-19.2
37469.960	-32.6	79.2	-19.6
37291.780	-32.6	79.2	-19.6
37522.010	-32.7	79.3	-19.7
37249.740	-32.7	79.3	-19.7
37490.980	-32.8	79.4	-19.8
37978.470	-32.8	79.4	-19.8

Continued

Frequency (MHz)	Reference Level (dBm)	Measured (dBc)	Margin
37227.720	-33.0	79.6	-19.8
37106.600	-33.2	79.8	-20.0
37509.000	-33.2	79.8	-20.2
37891.380	-33.3	79.9	-20.2
38374.860	-33.5	80.1	-20.3
37913.400	-33.6	80.2	-20.5
36911.400	-34.1	80.7	-20.6
18682.680	-34.4	81.0	-21.1
9986.662	-35.0	81.6	-21.4
18737.740	-35.5	82.1	-22.0
18753.750	-41.7	88.3	-22.5
18773.770	-43.1	89.7	-28.7
18757.760	-43.4	90.0	-30.1
24967.960	-47.0	93.6	-30.4
24895.890	-47.1	93.7	-34.0
25014.010	-47.1	93.7	-34.1



Emissions Mask

Test Setup Photo(s)



Below 18GHz



Above 18GHz

2.1053 / 87.139 Field Strength of Spurious Radiation

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford
Test Method:	TIA 603-C (2004)	Test Date(s):	8/22/2016 to 8/23/2016
Configuration:	1		
Test Setup:	Frequency range tested: 9k-40GHz Firmware power setting: Max Power Software: Honeywell Monitoring Software NgrSimRITS 20151209 Protocol / Modulation: Doppler Pulse Radar Test Mode: UUT is continuously transmitting. Test Setup: The EUT is sitting on an 80cm test table. The EUT is connected to the support equipment outside the chamber through the EMI Harness. The antenna terminal terminated into a characteristic load.		

Environmental Conditions			
Temperature (°C)	25	Relative Humidity (%):	35

Test Equipment Radiated					
Asset# / Serial#	Description	Manufacturer	Model	Cal Date	Cal Due
03540	Preamp	HP	83017A	4/30/2015	4/30/2017
01467	Horn Antenna-ANSI C63.5 Calibration	EMCO	3115	8/12/2015	8/12/2017
P05305	Cable	Andrews	ETSI-50T	2/15/2016	2/15/2018
P06540	Cable	Andrews	Helix	10/29/2015	10/29/2017
P06935	Cable	Astrolab	32026-29801-29801-18	3/11/2016	3/11/2018
02673	Spectrum Analyzer	Agilent	E4446A	10/12/2015	10/12/2017
02741	Active Horn Antenna	Miteq	AMFW-5F-12001800-20-10P	1/14/2015	1/14/2017
02742	Active Horn Antenna	Miteq	AMFW-5F-18002650-20-10P	1/14/2015	1/14/2017
02763-69	Waveguide	Andrew	Multiple	4/5/2016	4/5/2018
P06503	Cable	Astrolab	32026-29801-29801-36	4/28/2016	4/28/2018
P06678	Cable	Astrolab	32026-29801-29801-144	9/18/2014	9/18/2016
02743	Active Horn Antenna	Miteq	AMFW-5F-260400-33-8P	1/14/2015	1/14/2017
02764-70	Waveguide	Andrew	Multiple	4/5/2016	4/5/2018
02307	Preamp	HP	8447D	2/15/2016	2/15/2018
01994	Biconilog Antenna	Chase	CBL6111C	3/11/2016	3/11/2018
P05505	Attenuator	Mini-Circuits	NAT-6	3/31/2016	3/31/2018
P05360	Cable	Belden	RG214	12/1/2014	12/1/2016
P05963	Cable	Belden	RG-214	2/15/2016	2/15/2018
00052	Loop Antenna	EMCO	6502	4/8/2016	4/8/2018

Test Data Summary

Highest Measured Power:	46.8	dBm
Measurement Distance:	3	meters

Limit Definition:

Frequency Range	Limit (dBc)	Limit Calculation
9kHz - 40GHz	59.8	$43+10*\text{LOG}(P)$

Frequency (MHz)	Reference Level (dBm)	Measured (dBc)	Margin	Antenna Polarity
9978.300	-19.0	65.0	-6.0	Vertical
28035.700	-20.8	66.8	-7.8	Vertical
9986.700	-21.6	67.6	-8.6	Vertical
28067.190	-22.1	68.1	-9.1	Vertical
8707.000	-23.0	69.0	-10.0	Vertical
28121.700	-25.0	71.0	-12.0	Vertical
9996.700	-25.2	71.2	-12.2	Vertical
9350.000	-25.8	71.8	-12.8	Vertical
10002.000	-28.7	74.7	-15.7	Vertical
37445.000	-29.7	75.7	-16.7	Vertical
0.017	-29.9	75.9	-16.9	Vertical
9671.700	-30.7	76.7	-17.7	Vertical
0.150	-32.0	78.0	-19.0	Vertical
39915.000	-32.8	78.8	-19.8	Vertical
26.478	-39.4	85.4	-26.4	Vertical
18681.500	-41.1	87.1	-28.1	Vertical
18747.710	-42.4	88.4	-29.4	Vertical
48.035	-43.9	89.9	-30.9	Vertical
19315.000	-45.9	91.9	-32.9	Vertical
6907.000	-46.0	92.0	-33.0	Vertical
18710.600	-47.1	93.1	-34.1	Vertical
10880.000	-50.4	96.4	-37.4	Vertical
9133.000	-50.5	96.5	-37.5	Vertical
9114.000	-51.2	97.2	-38.2	Vertical
9606.000	-51.7	97.7	-38.7	Vertical
352.090	-53.7	99.7	-40.7	Vertical

Continued

Frequency (MHz)	Reference Level (dBm)	Measured (dBc)	Margin	Antenna Polarity
9265.000	-53.7	99.7	-40.7	Vertical
119.066	-54.4	100.4	-41.4	Vertical
2440.000	-54.5	100.5	-41.5	Vertical
580.688	-55.2	101.2	-42.2	Vertical
703.912	-56.4	102.4	-43.4	Vertical
17582.000	-56.4	102.4	-43.4	Vertical
40.668	-56.8	102.8	-43.8	Vertical
400.200	-59.6	105.6	-46.6	Vertical
14400.000	-59.6	105.6	-46.6	Vertical
95.432	-59.9	105.9	-46.9	Vertical
5.860	-60.8	106.8	-47.8	Vertical
9548.000	-61.1	107.1	-48.1	Vertical
191.950	-61.2	107.2	-48.2	Vertical
240.070	-65.2	111.2	-52.2	Vertical
53.856	-66.3	112.3	-53.3	Vertical
64.020	-70.1	116.1	-57.1	Vertical

Test Setup Photo(s)



Below 1GHz



Below 1GHz



Above 1GHz



Above 1GHz

2.1055 / 87.133 Frequency Stability

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	S. Pittsford
Test Method:	TIA 603-C (2004)	Test Date(s):	8/24/2016 to 8/25/2016
Configuration:	1		
Test Setup:	Firmware power setting: Max Power Software: Honeywell Monitoring Software NgrSimRITS 20151209 Protocol / Modulation: Doppler Pulse Radar Test Mode: UUT is continuously transmitting. Test Setup: The EUT is sitting inside the temperature chamber and the antenna connector is attached to the spectrum analyzer through a cable and 2 attenuators. The EUT is connected to the support equipment outside the chamber through the EMI Harness. The EUT was only able to transmit a modulated signal therefore highest and lowest frequencies in the bandwidth were used to calculate the mean frequency.		

Environmental Conditions			
Temperature (°C)	24	Relative Humidity (%):	38

Test Equipment					
Asset# / Serial#	Description	Manufacturer	Model	Cal Date	Cal Due
2673	Spectrum Analyzer	Agilent	E4446A	10/12/2015	10/12/2017
P05748	Attenuator	Pasternack	PE7004-20	4/11/2016	4/11/2018
P06932	Attenuator	Weinschel	46-3-34	1/4/2016	1/4/2018
P06867	Cable	Astrolab	32026-29080-29080-84	10/16/2015	10/16/2017
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

Test Data Summary

Temperature (°C)	Voltage	Frequency (GHz)	Deviation (PPM)	Limit (PPM)	Results
-40	V _{Nominal}	9.35578	5.87869	1250	Pass
-30	V _{Nominal}	9.35580	3.20656	1250	
-20	V _{Nominal}	9.35583	0.00000	1250	
-10	V _{Nominal}	9.35585	1.60328	1250	
0	V _{Nominal}	9.35586	3.20656	1250	
10	V _{Nominal}	9.35583	0.00000	1250	
20	V _{Minimum}	9.35581	2.67213	1250	
20	V _{Nominal}	9.35583	0.00000	1250	
20	V _{Maximum}	9.35579	4.27541	1250	
30	V _{Nominal}	9.35574	9.61967	1250	
40	V _{Nominal}	9.35575	9.08524	1250	
50	V _{Nominal}	9.35575	9.08524	1250	
60	V _{Nominal}	9.35577	6.41311	1250	
Nominal Frequency:		9.35583			

Parameter Definitions

Measurements performed at input voltage V_{Nominal} ± 15%.

Parameter	Value
V _{Nominal} :	115 VAC
V _{Minimum} :	97.75 VAC
V _{Maximum} :	132.25VAC

Test Setup Photo(s)



SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

APPENDIX A

Manufacturer Provided Information

The manufacturer provides the following insertion loss measurements on the antenna drive assembly, DA02633. Measurements were performed using a network analyzer and appropriate adapters.

DA Insertion Loss:

Frequency (MHz)	Loss (dB)
8702.5	4.12
9355.3	2.22
10008.0	2.82

