

Honeywell International Inc.

EMC TEST REPORT FOR
Weather Radar System
Model: RDR-7000

Tested to The Following Standards:

FCC Part 2 / 87 Subpart F

Report No.: 102584-12

Date of issue: March 10, 2020



Test Certificate # 803.01

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 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:

Honeywell International Inc.
15001 NE 36th Street
Redmond, WA 98052

Representative: Glenn Wildberger
Customer Reference Number: A000411782

DATE OF EQUIPMENT RECEIPT:**DATE(S) OF TESTING:****REPORT PREPARED BY:**

Terri Rayle
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 102584

February 5, 2020

February 5-18, 2020

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, 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.

A handwritten signature in black ink that reads "Steve Behm".

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
Canyon Park Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.12
EMITest Immunity	5.03.10

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Japan
Canyon Park, Bothell, WA	US0081	US1022	A-0136
Brea, CA	US0060	US1025	A-0136
Fremont, CA	US0082	US1023	A-0136
Mariposa, CA	US0103	US1024	A-0136

*CKC's list of NIST designated countries can be found at: <https://standards.gov/cabs/designations.html>

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	Pass
2.1047	Modulation Characteristics	NA	NA1
2.1049 / 87.135	Occupied Bandwidth	NA	Pass
2.1051 / 87.139	Spurious Emissions at Antenna Terminals	NA	NA2
2.1053 / 87.139	Field Strength of Spurious Radiation	NA	Pass
2.1055 / 87.133	Frequency Stability	NA	Pass

NA = Not Applicable

NA1 = Not applicable because the EUT does not employ any modulation types outlined in the rules.

NA2 = Not applicable because the EUT does not have a 50ohm antenna port.

ISO/IEC 17025 Decision Rule

The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

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
Weather Radar System	Honeywell International Inc.	RDR-7000	ART7K00036

Support Equipment:

Device	Manufacturer	Model #	S/N
RDR-7000 Qual Test System	Honeywell International Inc.	69004296-003	203
RDR-7000 EMC Qual Cable	Honeywell International Inc.	69004379-004 Rev A	001
RDR-7000 Control Room EMC Interface Cable	Honeywell International Inc.	69004379-003 Rev A	002
Power Supply	HP	6434B	1140A01946

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
Weather Radar System	Honeywell International Inc.	RDR-7000	ART7K00036

Support Equipment:

Device	Manufacturer	Model #	S/N
RDR-7000 Qual Test System	Honeywell International Inc.	69004296-003	203
RDR-7000 EMC Qual Cable	Honeywell International Inc.	69004379-004 Rev A	001
RDR-7000 Control Room EMC Interface Cable	Honeywell International Inc.	69004379-003 Rev A	002
Power Supply	HP	6434B	1140A01946
WX Antenna (12 inch)	Honeywell International Inc.	FP-7000 (PN 69003831-001R)	FP7K00005

Configuration 3

Equipment Tested:

Device	Manufacturer	Model #	S/N
Weather Radar System	Honeywell International Inc.	RDR-7000	ART7K00036

Support Equipment:

Device	Manufacturer	Model #	S/N
RDR-7000 Qual Test System	Honeywell International Inc.	69004296-003	203
RDR-7000 EMC Qual Cable	Honeywell International Inc.	69004379-004 Rev A	001
RDR-7000 Control Room EMC Interface Cable	Honeywell International Inc.	69004379-003 Rev A	002
Power Supply	HP	6434B	1140A01946
WX Antenna (18 inch)	Honeywell International Inc.	FP-7000 (PN 69003832-001R)	FP7K00012

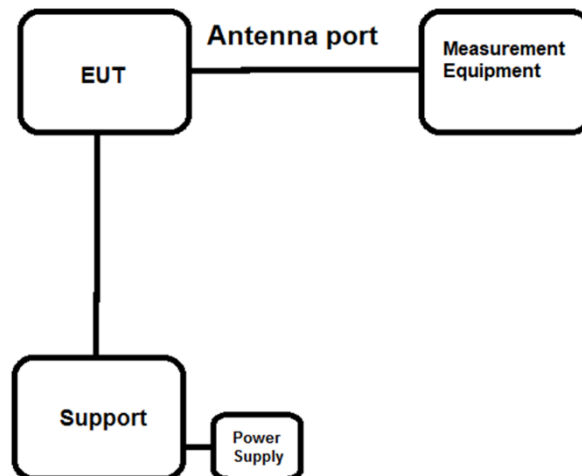
General Product Information:

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:	12 inch flat plate slotted array, 27.5dBi 18 inch flat plate slotted array, 30.7dBi
Antenna Connection Type:	Removable Waveguide
Nominal Input Voltage:	28VDC The manufacturer declares the EUT ceases to function beyond 22-30.3VDC
Firmware / Software used for Test:	Honeywell Monitoring Software NgrSimRITS SWT69003810-000 Rev A
Temperature Range	-55°C to +70°C

Block Diagram(s) of Test Setup

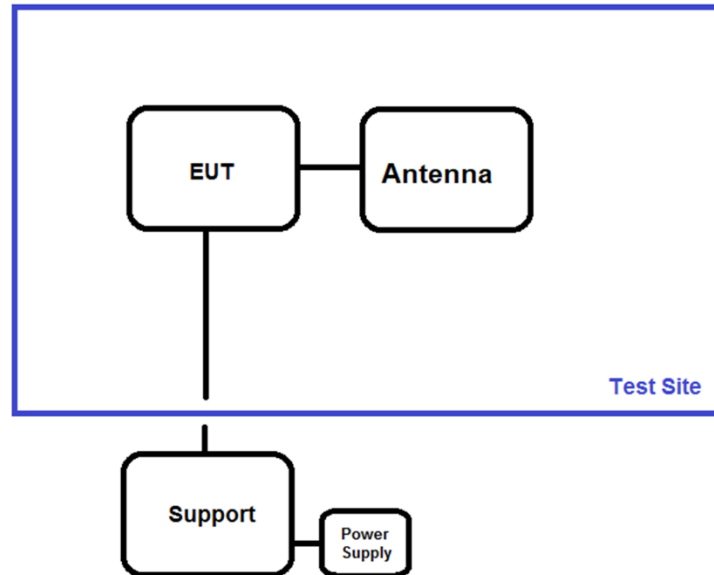
Conducted Measurement Tests Setup

Test Setup Block Diagram



Radiated Tests Setup

Test Setup Block Diagram



FCC PART(S) 2 / 87

2.1046 / 87.131 RF Power Output

Test Setup/Conditions			
Test Location:	Bothell Lab C3/Bothell Lab B2	Test Engineer:	M. Atkinson
Test Method:	TIA-603E	Test Date(s):	2/6/2020 to 2/17/2020
Configuration:	1, 2, and 3		
Test Setup:	Center frequency: Fundamental, 9.38 to 9.44GHz EUT is continuously transmitting pulses signals in normal operation. For radiated measurements, the EUT is sitting on a foam table mounted on a fixture, transmitting with antenna connected (investigated both 12 inch and 18 inch EUT antennas). Investigated several orientations of EUT base and antenna, worst case reported. Final power measurements collected with peak power meter using antenna substitution method. Voltage variations and temperature variations performed at manufacturer specified extremes. For temperature testing, the EUT is sitting inside the temperature chamber and a temporary waveguide to SMA-connector fixture is used to take relative measurements with the peak power meter through appropriate cables/directional coupler/attenuators. The relative measurements are then corrected to correspond to the radiated measurement performed in the chamber. The EUT is connected to the support equipment located remotely with EMI Harness. Radiated Measurements performed with Configuration 2 and 3. Temperature Testing performed with Configuration 1		

Environmental Conditions			
Temperature (°C)	20-24	Relative Humidity (%):	25-45

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/18/2019	11/18/2021
01318	Multimeter	Fluke	Fluke 85	7/22/2019	7/22/2021
03029	Thermometer, Digital Infrared	Fluke	566	2/20/2019	2/20/2021
P01905	Directional Coupler	NARDA	3004-30	4/22/2019	4/22/2021
02757	Temperature Chamber	Bemco	F100/350-8	12/20/2018	12/20/2020
P06011	Cable	Andrew	Heliac	10/1/2018	10/1/2020
03477	Power Sensor	Rohde & Schwarz	NRP-Z81	11/7/2019	11/7/2020
02673	Spectrum Analyzer	Agilent	E4446A	2/22/2019	2/22/2021
P06540	Cable	Andrews	Heliac	8/23/2019	8/23/2021
P06515	Cable	Andrews	Heliac	6/29/2018	6/29/2020
01467	Horn Antenna	EMCO	3115	7/5/2019	7/5/2021
P06219	Attenuator	Narda	768-10	4/13/2018	4/13/2020
P05747	Attenuator	Pasternack	PE7004-20	5/18/2018	5/18/2020
03718	Signal Generator	Anritsu	68369B	5/1/2019	5/1/2021
02374	Horn Antenna	Electrometrics	RGA-60	7/5/2019	7/5/2021
P07486	Cable	Andrews	FSJ1	8/27/2018	8/27/2020

Test Data Summary (12 inch antenna, declared antenna gain = 27.5dBi)					
Temperature (°C)	Voltage	Calculated Power Conducted (dBm) (using 27.5dBi)	Calculated Power Conducted (W) (using 27.5dBi gain)	Limit Watts	Results
-55	V _{Nominal}	42.7	18.6	63W	Pass
-50	V _{Nominal}	43.1	20.4		
-40	V _{Nominal}	43.2	20.9		
-30	V _{Nominal}	43.1	20.4		
-20	V _{Nominal}	42.5	17.8		
-10	V _{Nominal}	43.2	20.9		
0	V _{Nominal}	44.2	26.3		
10	V _{Nominal}	43.5	22.4		
20	V _{Minimum}	44.2	26.3		
20	V _{Nominal}	44.4	27.5		
20	V _{Maximum}	44.2	26.3		
30	V _{Nominal}	44.4	27.5		
40	V _{Nominal}	44.4	27.5		
50	V _{Nominal}	44.7	29.5		
60	V _{Nominal}	44.1	25.7		
70	V _{Nominal}	43.7	23.4		

Note: Manufacturer declares 63W limit from previous authorization.

Test Data Summary (18 inch antenna, declared antenna gain = 30.7dBi)					
Temperature (°C)	Voltage	Calculated Power Conducted (dBm) (using 30.7dBi)	Calculated Power Conducted (W) (using 30.7dBi gain)	Limit Watts	Results
-55	V _{Nominal}	41.0	12.6	63W	Pass
-50	V _{Nominal}	41.4	13.8		
-40	V _{Nominal}	41.5	14.1		
-30	V _{Nominal}	41.4	13.8		
-20	V _{Nominal}	40.8	12.0		
-10	V _{Nominal}	41.5	14.1		
0	V _{Nominal}	42.5	17.8		
10	V _{Nominal}	41.8	15.1		
20	V _{Minimum}	42.5	17.8		
20	V _{Nominal}	42.7	18.6		
20	V _{Maximum}	42.5	17.8		
30	V _{Nominal}	42.7	18.6		
40	V _{Nominal}	42.7	18.6		
50	V _{Nominal}	43.0	20.0		
60	V _{Nominal}	42.4	17.4		
70	V _{Nominal}	42.0	15.8		

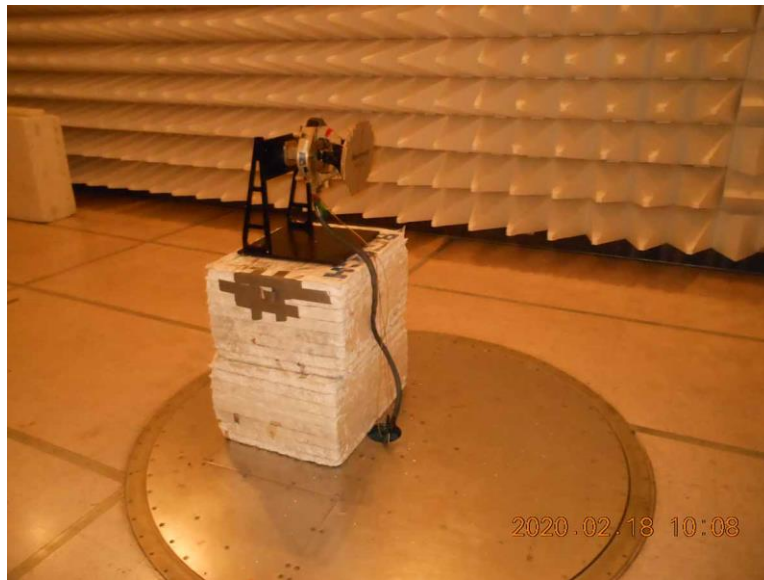
Note: Manufacturer declares 63W limit from previous authorization.

Parameter Definitions

Measurements performed at input voltage according to manufacturer specification.

Parameter	Value
V _{Nominal} :	28VDC
V _{Minimum} :	22VDC
V _{Maximum} :	30.3VDC

Test Setup Photo(s)



Radiated Test Setup, 12inch



Radiated Test Setup 18inch



Temperature Chamber Setup, EUT



View of Outside of Temperature Chamber Setup, Power

2.1049 / 87.135 Occupied Bandwidth

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Harrison
Test Method:	TIA-603E	Test Date(s):	2/5/2020
Configuration:	1		
Test Setup:	Center frequency: Fundamental, 9.38 to 9.44GHz EUT is continuously transmitting pulses signals in normal operation. The EUT has a temporary waveguide to SMA-connector fixture it used to take relative measurements with through appropriate cables/directional coupler/attenuators connected to Spectrum Analyzer. The EUT is connected to the support equipment located remotely with EMI Harness.		

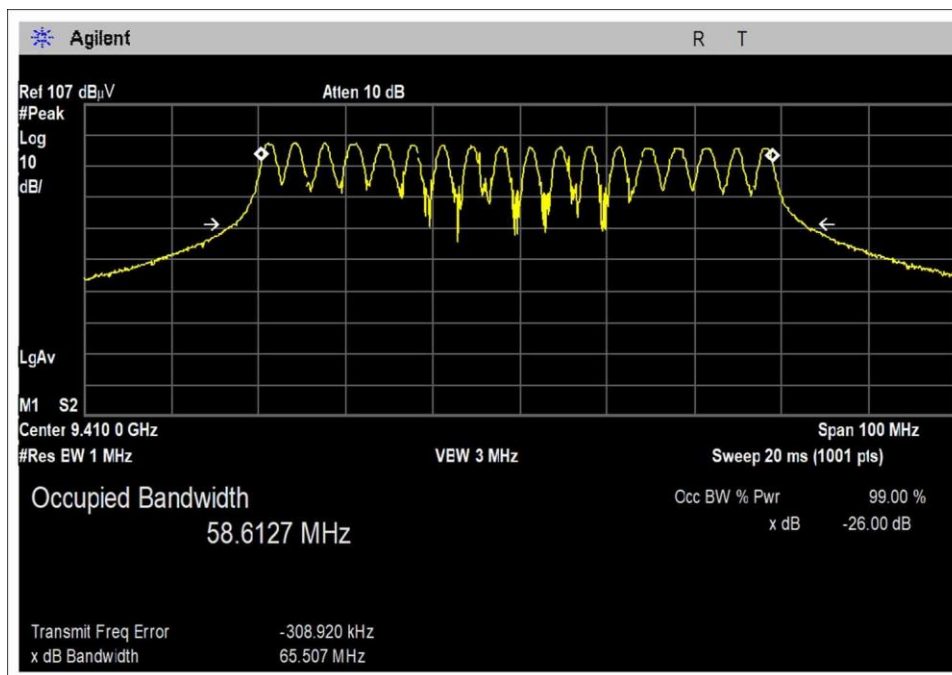
Environmental Conditions			
Temperature (°C)	22	Relative Humidity (%):	35

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02673	Spectrum Analyzer	Agilent	E4446A	2/22/2019	2/22/2021
P01905	Directional Coupler	NARDA	3004-30	4/22/2019	4/22/2021
P06540	Cable	Andrews	Heliac	8/23/2019	8/23/2021
P06515	Cable	Andrews	Heliac	6/29/2018	6/29/2020

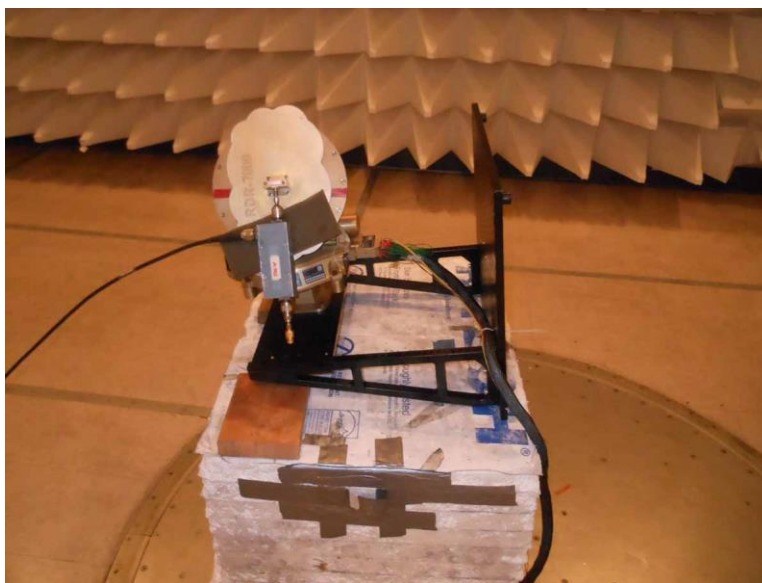
Test Data Summary					
Frequency (GHz)	Antenna Port	Modulation	Measured (MHz) (99%)	Limit (MHz)	Results
9.410 (center)	1	Doppler Pulse	58.6	65.5	Pass

Note: No authorized bandwidth (ABW) limit specified. Assuming ABW = measured 26dB BW or higher = 65.5MHz

Test Data



Test Setup Photo



2.1053 / 87.139 Field Strength of Spurious Radiation

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Atkinson
Test Method:	TIA-603E	Test Date(s):	2/6/2020 to 2/18/2020
Configuration:	2 and 3		
Test Setup:	Frequency: 9kHz-100GHz EUT is continuously transmitting pulses signals in normal operation. The EUT is sitting on a foam table mounted on a fixture, transmitting with antenna connected. Investigated both 12 inch and 18 inch EUT antennas, worst case reported unless otherwise listed. Investigated several orientations of UUT base and antenna, worst case reported. The radiated emissions were performed with antenna attached since the EUT does not have a true 50ohm antenna port to collect corrected conducted measurements with. Note: No emissions observed within 20dB of the limit above 20GHz		

Environmental Conditions			
Temperature (°C)	20-24	Relative Humidity (%):	25-45

Test Equipment Radiated					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02673	Spectrum Analyzer	Agilent	E4446A	2/22/2019	2/22/2021
P06540	Cable	Andrews	Heliac	8/23/2019	8/23/2021
P06515	Cable	Andrews	Heliac	6/29/2018	6/29/2020
01467	Horn Antenna	EMCO	3115	7/5/2019	7/5/2021
P06219	Attenuator	Narda	768-10	4/13/2018	4/13/2020
P05747	Attenuator	Pasternack	PE7004-20	5/18/2018	5/18/2020
P07504	Cable	TMS	CLU40-KMKM-02.00F	1/17/2019	1/17/2021
P07211	Cable	H & S	32026-29801-29801-18	8/7/2019	8/7/2021
02763-69	Waveguide	Andrew	Multiple	4/23/2018	4/23/2020
02742	Active Horn Antenna	Miteq	AMFW-5F-18002650-20-10P	10/16/2018	10/16/2020
P06678	Cable	Astrolab	32026-29801-29801-144	3/13/2018	3/13/2020
02764-70	Waveguide	Andrew	Multiple	4/23/2018	4/23/2020
00052	Loop Antenna	EMCO	6502	5/7/2018	5/7/2020
P05305	Cable	Andrews	ETSI-50T	9/6/2019	9/6/2021
P05360	Cable	Belden	RG214	2/3/2020	2/3/2022
P06123	Attenuator	Aeroflex	18N-6	4/5/2019	4/5/2021
03628	Biconilog Antenna	ETS	3142E	6/11/2019	6/11/2021
P07620	Low Pass Filter	Mini-Circuits	VLF-7200+	2/7/2020	2/7/2022
02347	Horn Antenna	OML	M19HWA	3/6/2019	3/6/2021
02348	Horn Antenna	OML	M12HWA	3/6/2019	3/6/2021
02349	Horn Antenna	OML	M08HWA	3/6/2019	3/6/2021

Test Data Summary

Limit applied: 87.139 (a):

- (1) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth the attenuation must be at least 25 dB;
- (2) When the frequency is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth the attenuation must be at least 35 dB.
- (3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth the attenuation for aircraft station transmitters must be at least 40 dB
(not considered aeronautical station transmitter)

Measured Radiated Power = 73.4dBm (EIRP)

Assume ABW = 65.5MHz

Outside the emission mask, there must be attenuated by 40dB. 73.4dBm-40 = 33.4dBm.

Outside of the emission mask, using the following relation:

$$P(\text{dBm}) - 20\text{LOG}(d) + G + 104.77 = E(\text{dBuV}/m)$$

Where G = 0

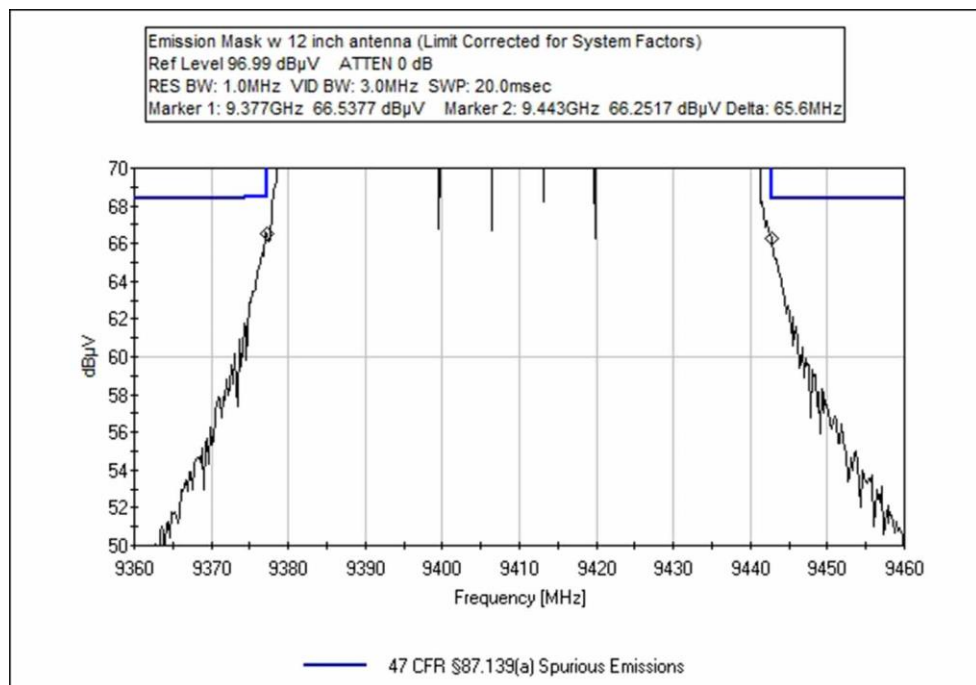
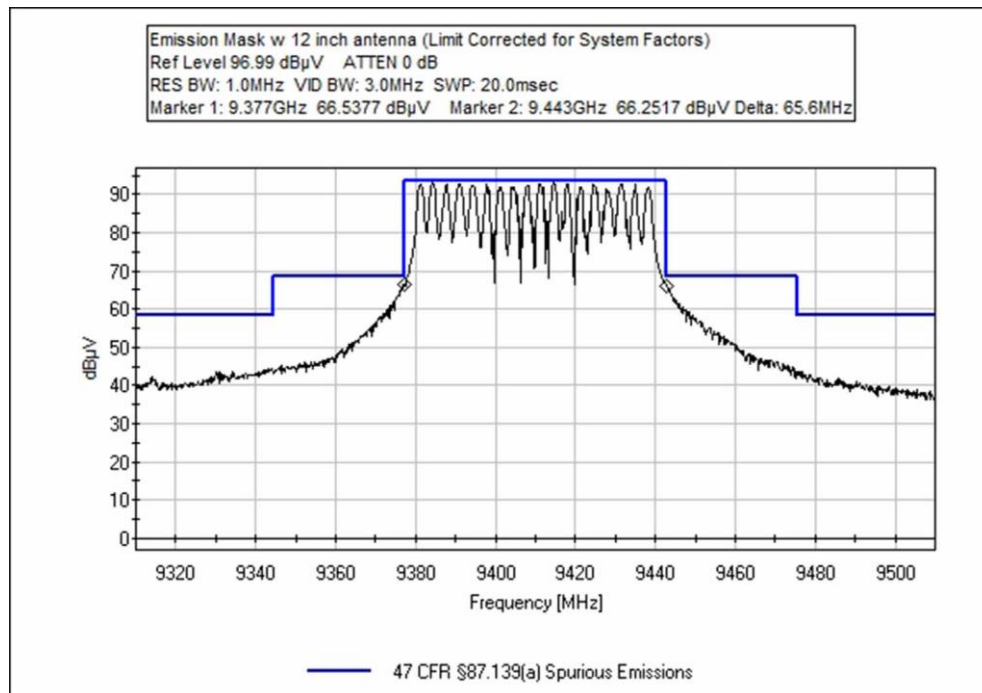
D = 3m

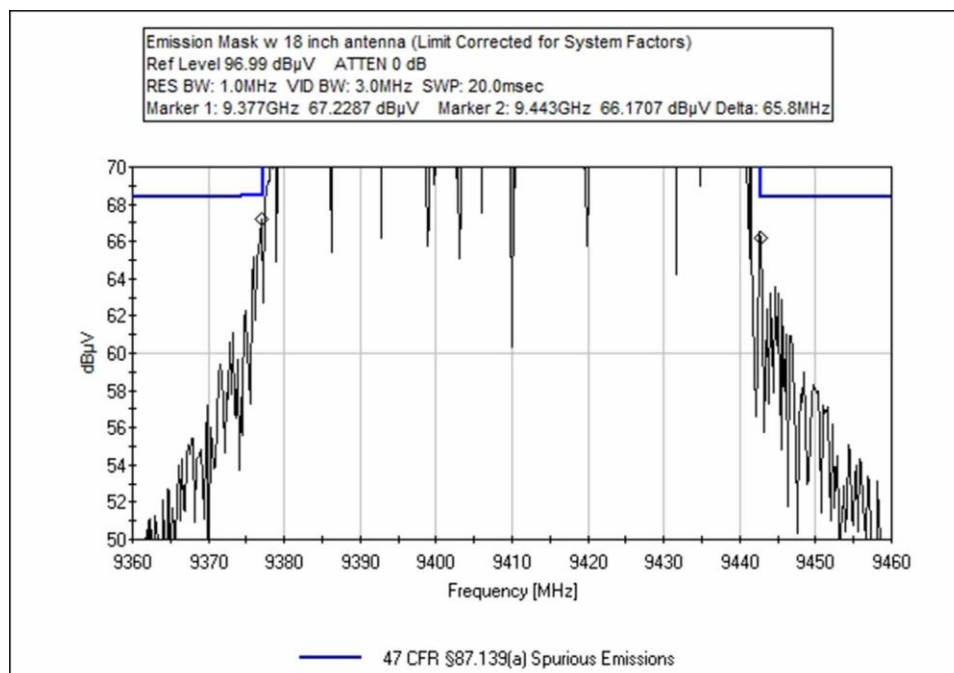
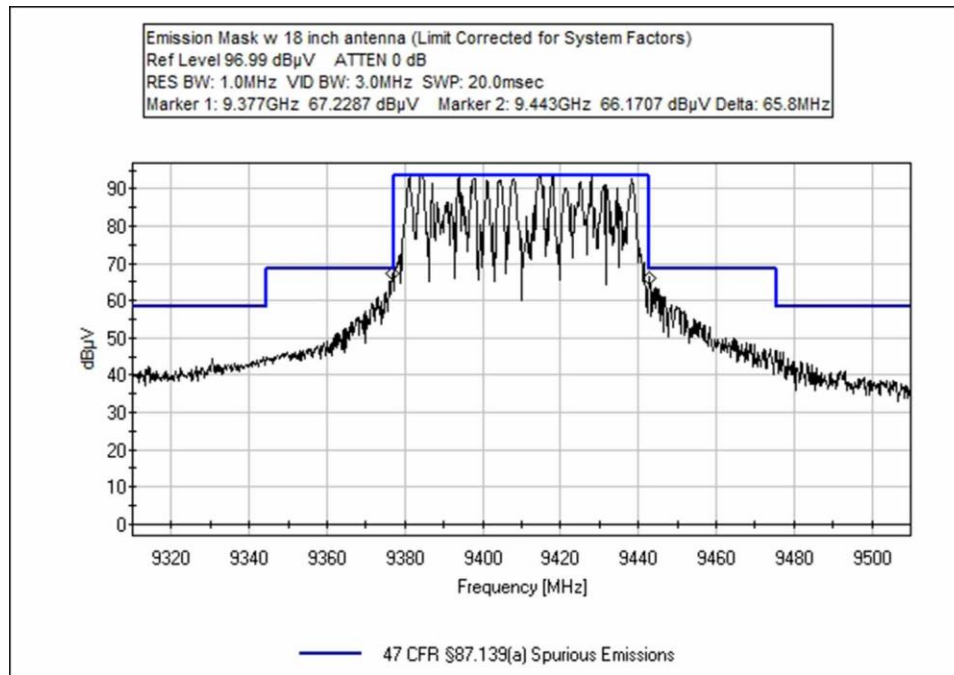
$$E(\text{dBuV}/m) = 128.6\text{dBuV}$$

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

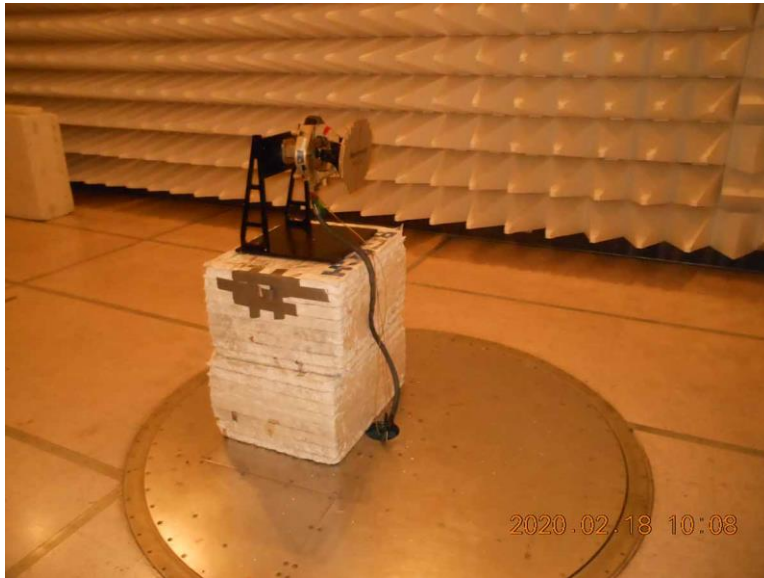
Mode	Frequency (MHz)	Measured (dBμV/m at 3m)	Limit (dBμV/m at 3m)	Margin (dB)	Results
Radiated Emissions Outside of Mask					
Transmitting	73.6	27.4	128.6	-101.2	Pass
Transmitting	96	41.7	128.6	-86.9	
Transmitting	176.5	34.9	128.6	-93.7	
Transmitting	1270	74.5	128.6	-54.1	
Transmitting	1886	76.8	128.6	-51.8	
Transmitting	9869	95.3	128.6	-33.3	
Transmitting	18768.1	86.1	128.6	-42.5	
Transmitting	28284.2	55.7	128.6	-72.9	
Mode	Frequency (MHz)	Measured (dBμV/m at 3m)	Limit (dBμV/m at 3m)	Margin (dB)	Results
Radiated Emissions Mask Below					
Transmitting (12inch antenna)	9377.2	141.6	143.6	-2.0	Pass
Transmitting (12inch antenna)	9442.8	141.5	143.6	-2.1	
Transmitting (18inch antenna)	9377.0	142.3	143.6	-1.3	
Transmitting (18inch antenna)	9442.8	141.4	143.6	-2.2	

Test Data

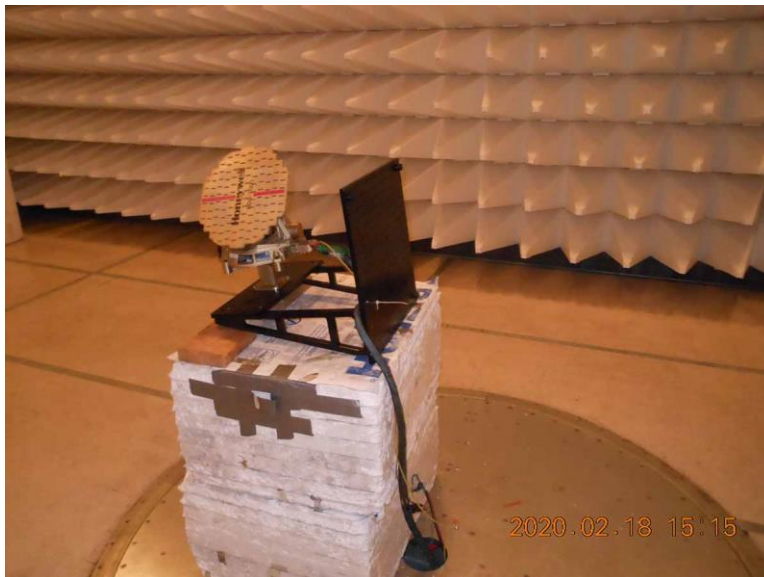




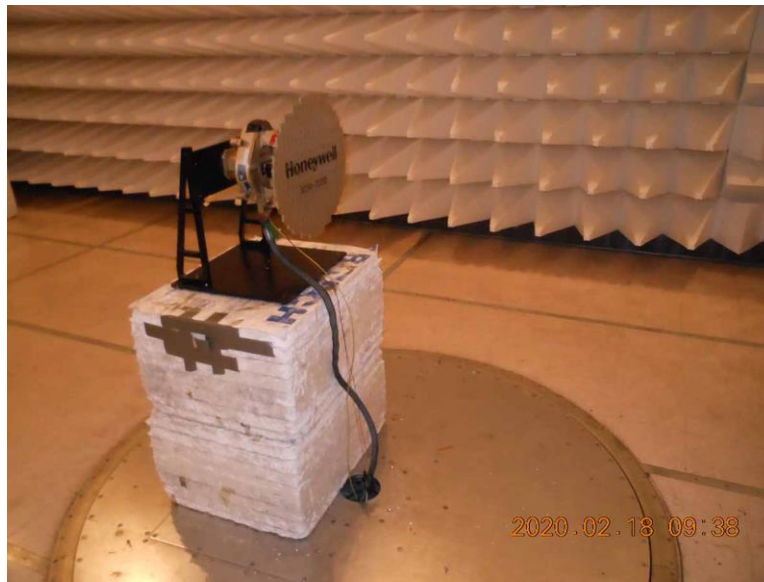
Test Setup Photo(s)



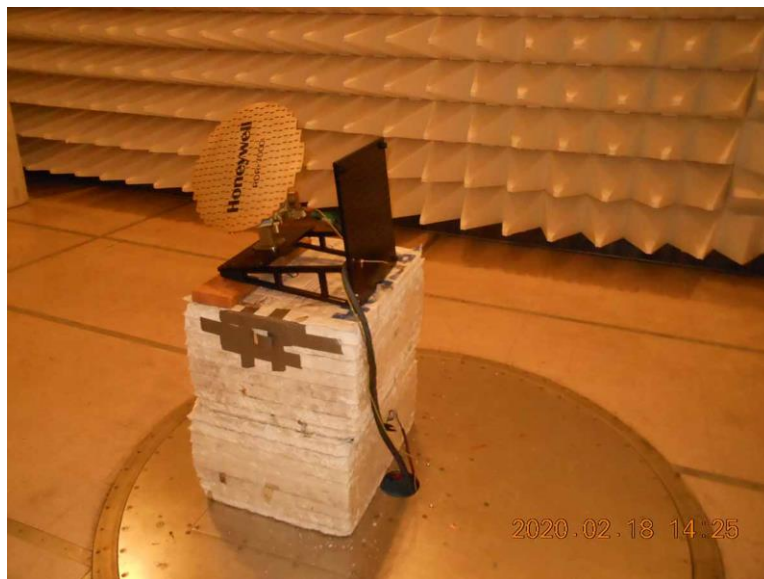
Radiated Emissions 12inch View #1



Radiated Emissions 12inch View #2



Radiated Emissions 18inch View #1



Radiated Emissions 18inch View #2

2.1055 / 87.133 Frequency Stability

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	M. Atkinson
Test Method:	TIA-603E	Test Date(s):	2/11/2020 to 2/12/2020
Configuration:	1		
Test Setup:	Test Mode: EUT is continuously transmitting. The EUT is sitting inside the temperature chamber and a temporary waveguide to SMA-connector fixture is attached to the spectrum analyzer for a relative measurement through a directional coupler. Voltage variations and temperature range performed to manufacturer specified extremes. 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)	22-24°C	Relative Humidity (%):	25-45

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/18/2019	11/18/2021
01318	Multimeter	Fluke	Fluke 85	7/22/2019	7/22/2021
03029	Thermometer, Digital Infrared	Fluke	566	2/20/2019	2/20/2021
P01905	Directional Coupler	NARDA	3004-30	4/22/2019	4/22/2021
02757	Temperature Chamber	Bemco	F100/350-8	12/20/2018	12/20/2020
P06011	Cable	Andrew	Heliac	10/1/2018	10/1/2020

Test Data Summary					
Temperature (°C)	Voltage	Frequency (GHz)	Deviation (PPM)	Limit (PPM)	Results
-55	V _{Nominal}	9409.825	7	1250	Pass
-50	V _{Nominal}	9409.800	10	1250	
-40	V _{Nominal}	9409.770	13	1250	
-30	V _{Nominal}	9409.564	35	1250	
-20	V _{Nominal}	9409.540	37	1250	
-10	V _{Nominal}	9410.010	13	1250	
0	V _{Nominal}	9409.880	1	1250	
10	V _{Nominal}	9409.900	1	1250	
20	V _{Minimum}	9409.571	34	1250	
20	V _{Nominal}	9409.890	0	1250	
20	V _{Maximum}	9409.525	39	1250	
30	V _{Nominal}	9409.790	11	1250	
40	V _{Nominal}	9409.890	0	1250	
50	V _{Nominal}	9409.730	17	1250	
60	V _{Nominal}	9409.820	7	1250	
70	V _{Nominal}	9409.695	21	1250	
Nominal Frequency:		9409.890			

Parameter Definitions

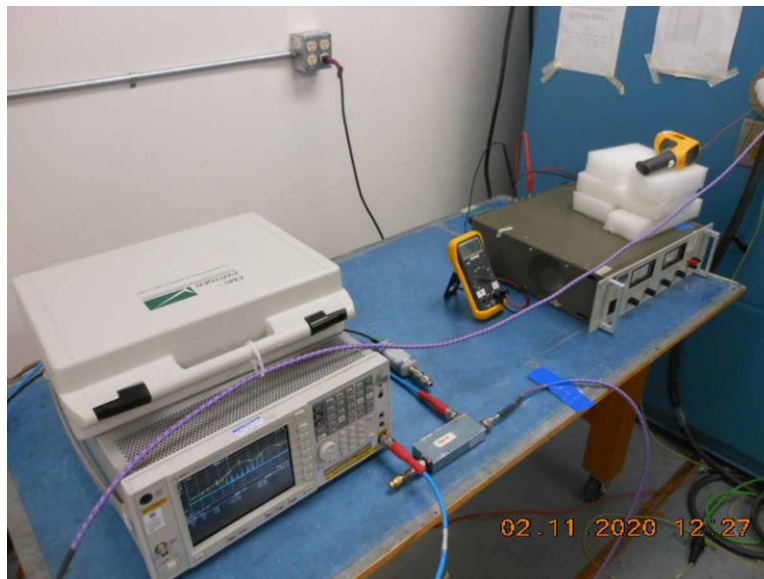
Measurements performed at input voltage according to manufacturer specification.

Parameter	Value
V _{Nominal} :	28VDC
V _{Minimum} :	22VDC
V _{Maximum} :	30.3VDC

Test Setup Photo(s)



Temperature Chamber Setup, EUT



View of Outside of Temperature Chamber Setup