Compliance Testing, LLC
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Test Report

Prepared for: Honeywell International

Model: A781-310 + FMPA

Description: A781 Satcom Transceiver and FMPA SDU

Serial Number: 740, 318

FCC ID: K6KFMPA

To

FCC Part 87

Date of Issue: January 4, 2018

On the behalf of the applicant:	**Honeywell International** **400 Maple Grove Rd** **Ottawa, Ontario K2V 1B8**
Attention of:	**Dennis Teske** **Phone: (613) 595-7935** **Email: dennis.teske@honeywell.com**

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Project No: p17a0016

Greg Corbin

Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	November 13, 2017	Greg Corbin	Original Document
2.0	December 19, 2017	Amanda Reed	Updated FCC ID
3.0	December 22, 2017	Greg Corbin	Removed reference to C2PC on page 5, Added tables with numerical data for frequency stability on pages 19 and 20.

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ILAC / A2LA

Compliance Testing, LLC, has been 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 joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted in the table below

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

Testing Certificate Number: **2152.01**

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TESTING CERT
#2152.01

FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

Standard Test Conditions Engineering Practices
Except as noted herein, the following conditions and procedures were observed during the testing:

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2, Sub-part J, Sections 2.947, 2.1033(c), 2.1041, 2.1046, 2.1047, 2.1051, 2.1053, 2.1055, 2.1057 and the following individual Parts: FCC Part 87.
Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (ºC)	**Humidity (%)**	**Pressure (mbar)**
22.1 – 24.8	25.1 – 30.2	961 – 971

EUT Description
Model: A781-310 + FMPA
Description: A781 Satcom Transceiver and FMPA SDU
Software: LI-4394.21028, Version: J00, DO-178B Level D (A781-310)
LI-1394-12212, Version A00, DO-178B Level D (FMPA)
Serial Number: 740 (A781-310)
318 (FMPA)

Additional Information:
The EUT is a SATCOM transceiver (A781-310) + a power amplifier (FMPA SDU) that operates from 1626.5 – 1660.5 MHz.
It has 3 types of emissions, BPSK, QPSK, QAM that are defined in the Table below.

Type of Service	Data Rate (kbps)	Symbol Rate (ksym/sec)	Modulation Type	FCC Emission Designator
Classic R/T	0.6	0.6	Pi/2 BPSK	840HG1D
Classic R/T	1.2	1.2	Pi/2 BPSK	1K68G1D
Classic R/T	10.5	5.25	Aviation QPSK	10K5G1D
Classic C	8.4	4.2	Aviation QPSK	6K80G1E
Swiftbroadband	33.6	16.8	QPSK	25K0G7W
Swiftbroadband	67.2	33.6	QPSK	50K0G7W
Swiftbroadband	134.4	67.2	QPSK	100KG7W
Swiftbroadband	302.4	151.2	QPSK	200KG7W
Swiftbroadband	134.4	33.6	QAM	50K0D7W
Swiftbroadband	268.8	67.2	QAM	100KD7W
Swiftbroadband	604.8	151.2	QAM	200KD7W

EUT Operation during Tests
The manufacturer was present during the test and controlled the EUT via a custom GUI to set the type of service, data rate, and power levels.
All data was recorded at the FMPA output with the Satcom transceiver connected to the FMPA input.

Test Results Summary

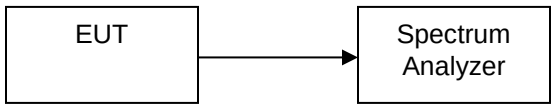
Specification	Test Name	Pass, Fail, N/A	Comments
2.1046, 87.131	Carrier Output Power (Conducted)	Pass	
2.1051, 87.139(i)(1)	Unwanted Emissions (Transmitter Conducted)	Pass	
2.1053	Field Strength of Spurious Radiation	Pass	
2.1049, 87.139(i)(3)	Emission Masks (Occupied Bandwidth)	Pass	See FCC waiver for allowable variance
2.1047	Audio Low Pass Filter (Voice Input)	N/A	The EUT does not contain an audio input
2.1047	Audio Frequency Response	N/A	The EUT does not contain an audio input
2.1047	Modulation Limiting	N/A	The EUT does not contain an audio input
2.1055, 87.133(a)	Frequency Stability (Temperature Variation)	Pass	
2.1055, 87.133(a)	Frequency Stability (Voltage Variation)	Pass	

Carrier Output Power (Conducted)
Engineer: Greg Corbin
Test Date: 11/7/2017

Test Procedure

The Equipment Under Test (EUT) was connected directly to a spectrum analyzer with the RBW set to 1 MHz and the VBW set to 3 X RBW which set the RBW greater than the transmit signal ensuring there was no signal suppression while measuring a modulated signal. The peak readings were taken for each modulation type and the result was then compared to the limit.

Test Setup



BPSK Transmitter Peak Output Power

Tuned Frequency (MHz)	Measured Power (dBm)	Measured Power (W)	Limit (W)	Result
1626.5	45.01	31.696	60	Pass
1643.5	44.95	31.261	60	Pass
1660.5	44.96	31.333	60	Pass

QPSK Transmitter Peak Output Power

Tuned Frequency (MHz)	Measured Power (dBm)	Measured Power (W)	Limit (W)	Result
1626.5	45.07	32.167	60	Pass
1643.5	45.03	31.842	60	Pass
1660.5	45.04	31.915	60	Pass

QAM Transmitter Peak Output Power

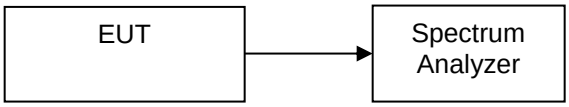
Tuned Frequency (MHz)	Measured Power (dBm)	Measured Power (W)	Limit (W)	Result
1626.5	45.07	32.167	60	Pass
1643.5	45.03	31.842	60	Pass
1660.5	45.04	31.915	60	Pass

Conducted Spurious Emissions
Engineer: Greg Corbin
Test Date: 11/7/2017

Test Procedure

The EUT was connected directly to a spectrum analyzer to verify that the UUT met the requirements for spurious emissions. The RBW was set according to the requirements of 87139 (i)(1). The power was corrected for the measurement RBW bandwidth. The dBc limit, the DLNA rejection, and corrected power were summed together to determine the necessary dBm value of the EUT to provide a system rejection greater than the FCC limit. This necessary value was compared to the measured value to ensure compliance to the specification, which is expressed as the margin. A negative value indicates a passing result.

Test Setup



BPSK 1626.5 MHz Conducted Spurious Emissions

Frequency (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	44.89	-10.11	-48.2	-38.09
1525 to 1559	-203	0.004	120	44.89	-38.11	-44.2	-6.09
1559 to 1585	-155	1	111	45.01	1.01	-17.6	-18.61
1585 to 1605	-143	1	95	45.01	-2.99	-16.6	-13.61
1605 to1610	-117	1	62	45.01	-9.99	-15.6	-5.61
1610 to 1610.6	-95	1	40	45.01	-9.99	-17.7	-7.71
1610.6 to 1613.8	-49	1	40	45.01	36.01	-15.5	-51.51
1613.8 to 1614	-95	1	40	45.01	-9.99	-17.1	-7.11
1614 to 1620	-70	0.004	30	44.89	4.89	-33.2	-38.09
1620 to 1624.5	-70	0.004	20	44.89	-5.11	-32.5	-27.39
1624.5 to 1625.5	-70	0.004	10	44.89	-15.11	-29.4	-14.29
1625.5 to 1626.5	-70	0.004	1.3	44.89	-23.81	-29.1	-5.29
1626.5 to 1660	-70	0.004	0.8	44.89	-24.31	-30.3	-5.99
1660 to 1670	-19.5	0.02	0.8	44.91	26.21	-30.2	-56.41
1670 to 1735	-60	0.004	0.8	44.89	-14.31	-39.2	-24.89
1735 to 1865	-105	0.004	50	44.89	-10.11	-48.6	-38.49
1865 to 3250	-105	0.004	20	44.89	-40.11	-48.7	-8.59
3250 to 3330	-105	0.004	50	44.89	-10.11	-33.9	-23.79
3330 to 4000	-105	0.004	40	44.89	-20.11	-47.7	-27.59
4000 to 12000	-105	0.004	50	44.89	-10.11	-25.3	-15.19
12000 to 18000	-70	0.004	15	44.89	-10.11	-33.8	-23.69

BPSK 1643.5 MHz Conducted Spurious Emissions

Frequency (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	44.90	-10.10	-41.3	-31.20
1525 to 1559	-203	0.004	120	44.90	-38.10	-44.5	-6.40
1559 to 1585	-155	1	111	44.95	0.95	-19.2	-20.15
1585 to 1605	-143	1	95	44.95	-3.05	-17.1	-14.05
1605 to1610	-117	1	62	44.95	-10.05	-16	-5.95
1610 to 1610.6	-95	1	40	44.95	-10.05	-16.5	-6.45
1610.6 to 1613.8	-49	1	40	44.95	35.95	-16.2	-52.15
1613.8 to 1614	-95	1	40	44.95	-10.05	-16.5	-6.45
1614 to 1620	-70	0.004	30	44.90	4.90	-36.3	-41.20
1620 to 1624.5	-70	0.004	20	44.90	-5.10	-38.3	-33.20
1624.5 to 1625.5	-70	0.004	10	44.90	-15.10	-37.9	-22.80
1625.5 to 1626.5	-70	0.004	1.3	44.90	-23.80	-37.6	-13.80
1626.5 to 1660	-70	0.004	0.8	44.90	-24.30	-29.3	-5.00
1660 to 1670	-19.5	0.02	0.8	44.92	26.22	-30.4	-56.62
1670 to 1735	-60	0.004	0.8	44.90	-14.30	-38.9	-24.60
1735 to 1865	-105	0.004	50	44.90	-10.10	-47.5	-37.40
1865 to 3250	-105	0.004	20	44.90	-40.10	-48.2	-8.10
3250 to 3330	-105	0.004	50	44.90	-10.10	-19.6	-9.50
3330 to 4000	-105	0.004	40	44.90	-20.10	-23.1	-3.00
4000 to 12000	-105	0.004	50	44.90	-10.10	-23.3	-13.20
12000 to 18000	-70	0.004	15	44.90	-10.10	-42.5	-32.40

BPSK 1660.5 MHz Conducted Spurious Emissions

Frequency (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	44.87	-10.13	-48.2	-38.07
1525 to 1559	-203	0.004	120	44.87	-38.13	-44.7	-6.57
1559 to 1585	-155	1	111	44.96	0.96	-18.3	-19.26
1585 to 1605	-143	1	95	44.96	-3.04	-15.5	-12.46
1605 to1610	-117	1	62	44.96	-10.04	-17.1	-7.06
1610 to 1610.6	-95	1	40	44.96	-10.04	-17.8	-7.76
1610.6 to 1613.8	-49	1	40	44.96	35.96	-16.3	-52.26
1613.8 to 1614	-95	1	40	44.96	-10.04	-17.2	-7.16
1614 to 1620	-70	0.004	30	44.87	4.87	-38.3	-43.17
1620 to 1624.5	-70	0.004	20	44.87	-5.13	-35.1	-29.97
1624.5 to 1625.5	-70	0.004	10	44.87	-15.13	-37	-21.87
1625.5 to 1626.5	-70	0.004	1.3	44.87	-23.83	-37.7	-13.87
1626.5 to 1660	-70	0.004	0.8	44.87	-24.33	-30.9	-6.57
1660 to 1670	-19.5	0.02	0.8	44.89	26.19	-23.1	-49.29
1670 to 1735	-60	0.004	0.8	44.87	-14.33	-38.3	-23.97
1735 to 1865	-105	0.004	50	44.87	-10.13	-47	-36.87
1865 to 3250	-105	0.004	20	44.87	-40.13	-48.5	-8.37
3250 to 3330	-105	0.004	50	44.87	-10.13	-22.2	-12.07
3330 to 4000	-105	0.004	40	44.87	-20.13	-47.8	-27.67
4000 to 12000	-105	0.004	50	44.87	-10.13	-31	-20.87
12000 to 18000	-70	0.004	15	44.87	-10.13	-42	-31.87

QPSK 1626.5 MHz Conducted Spurious Emissions

Frequency (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	44.6	-10.40	-48.80	-38.40
1525 to 1559	-203	0.004	120	44.6	-38.40	-46.70	-8.30
1559 to 1585	-155	1	111	45.07	1.07	-21.20	-22.27
1585 to 1605	-143	1	95	45.07	-2.93	-20.00	-17.07
1605 to1610	-117	1	62	45.07	-9.93	-19.20	-9.27
1610 to 1610.6	-95	1	40	45.07	-9.93	-20.10	-10.17
1610.6 to 1613.8	-49	1	40	45.07	36.07	-19.20	-55.27
1613.8 to 1614	-95	1	40	45.07	-9.93	-20.10	-10.17
1614 to 1620	-70	0.004	30	44.6	4.60	-38.00	-42.60
1620 to 1624.5	-70	0.004	20	44.6	-5.40	-33.70	-28.30
1624.5 to 1625.5	-70	0.004	10	44.6	-15.40	-32.00	-16.60
1625.5 to 1626.5	-70	0.004	1.3	44.6	-24.10	-29.70	-5.60
1626.5 to 1660	-70	0.004	0.8	44.6	-24.60	-29.40	-4.80
1660 to 1670	-19.5	0.02	0.8	44.6	25.90	-32.40	-58.30
1670 to 1735	-60	0.004	0.8	44.6	-14.60	-40.60	-26.00
1735 to 1865	-105	0.004	50	44.6	-10.40	-43.50	-33.10
1865 to 3250	-105	0.004	20	44.6	-40.40	-47.70	-7.30
3250 to 3330	-105	0.004	50	44.6	-10.40	-24.00	-13.60
3330 to 4000	-105	0.004	40	44.6	-20.40	-47.60	-27.20
4000 to 12000	-105	0.004	50	44.6	-10.40	-32.10	-21.70
12000 to 18000	-70	0.004	15	44.6	-10.40	-36.10	-25.70

QPSK 1643.5 MHz Conducted Spurious Emissions

Frequency (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	44.66	-10.34	-43.6	-33.26
1525 to 1559	-203	0.004	120	44.66	-38.34	-46.1	-7.76
1559 to 1585	-155	1	111	45.03	1.03	-21.6	-22.63
1585 to 1605	-143	1	95	45.03	-2.97	-18.9	-15.93
1605 to1610	-117	1	62	45.03	-9.97	-19.5	-9.53
1610 to 1610.6	-95	1	40	45.03	-9.97	-18.9	-8.93
1610.6 to 1613.8	-49	1	40	45.03	36.03	-19.3	-55.33
1613.8 to 1614	-95	1	40	45.03	-9.97	-19.8	-9.83
1614 to 1620	-70	0.004	30	44.66	4.66	-38.9	-43.56
1620 to 1624.5	-70	0.004	20	44.66	-5.34	-40.2	-34.86
1624.5 to 1625.5	-70	0.004	10	44.66	-15.34	-40.1	-24.76
1625.5 to 1626.5	-70	0.004	1.3	44.66	-24.04	-38.7	-14.66
1626.5 to 1660	-70	0.004	0.8	44.66	-24.54	-28.8	-4.26
1660 to 1670	-19.5	0.02	0.8	44.70	26.00	-33.6	-59.60
1670 to 1735	-60	0.004	0.8	44.66	-14.54	-38.5	-23.96
1735 to 1865	-105	0.004	50	44.66	-10.34	-47.3	-36.96
1865 to 3250	-105	0.004	20	44.66	-40.34	-47.9	-7.56
3250 to 3330	-105	0.004	50	44.66	-10.34	-23	-12.66
3330 to 4000	-105	0.004	40	44.66	-20.34	-47.9	-27.56
4000 to 12000	-105	0.004	50	44.66	-10.34	-25.9	-15.56
12000 to 18000	-70	0.004	15	44.66	-10.34	-37.4	-27.06

QPSK 1660.5 MHz Conducted Spurious Emissions

Frequency (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	44.70	-10.30	-43.8	-33.50
1525 to 1559	-203	0.004	120	44.70	-38.30	-42	-3.70
1559 to 1585	-155	1	111	45.04	1.04	-17.4	-18.44
1585 to 1605	-143	1	95	45.04	-2.96	-17.2	-14.24
1605 to1610	-117	1	62	45.04	-9.96	-17.5	-7.54
1610 to 1610.6	-95	1	40	45.04	-9.96	-18.3	-8.34
1610.6 to 1613.8	-49	1	40	45.04	36.04	-16.4	-52.44
1613.8 to 1614	-95	1	40	45.04	-9.96	-17.2	-7.24
1614 to 1620	-70	0.004	30	44.70	4.70	-38.9	-43.60
1620 to 1624.5	-70	0.004	20	44.70	-5.30	-38.5	-33.20
1624.5 to 1625.5	-70	0.004	10	44.70	-15.30	-39.2	-23.90
1625.5 to 1626.5	-70	0.004	1.3	44.70	-24.00	-37.3	-13.30
1626.5 to 1660	-70	0.004	0.8	44.70	-24.50	-31.6	-7.10
1660 to 1670	-19.5	0.02	0.8	44.71	26.01	-22	-48.01
1670 to 1735	-60	0.004	0.8	44.70	-14.50	-39.6	-25.10
1735 to 1865	-105	0.004	50	44.70	-10.30	-43	-32.70
1865 to 3250	-105	0.004	20	44.70	-40.30	-43	-2.70
3250 to 3330	-105	0.004	50	44.70	-10.30	-22.4	-12.10
3330 to 4000	-105	0.004	40	44.70	-20.30	-42.7	-22.40
4000 to 12000	-105	0.004	50	44.70	-10.30	-25.6	-15.30
12000 to 18000	-70	0.004	15	44.70	-10.30	-37.5	-27.20

QAM 1626.5 MHz Conducted Spurious Emissions

Frequency (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	44.35	-10.65	-47.50	-36.85
1525 to 1559	-203	0.004	120	44.35	-38.65	-47.05	-8.40
1559 to 1585	-155	1	111	45.07	1.07	-21.10	-22.17
1585 to 1605	-143	1	95	45.07	-2.93	-19.30	-16.37
1605 to1610	-117	1	62	45.07	-9.93	-19.10	-9.17
1610 to 1610.6	-95	1	40	45.07	-9.93	-19.40	-9.47
1610.6 to 1613.8	-49	1	40	45.07	36.07	-18.80	-54.87
1613.8 to 1614	-95	1	40	45.07	-9.93	-19.50	-9.57
1614 to 1620	-70	0.004	30	44.35	4.35	-39.70	-44.05
1620 to 1624.5	-70	0.004	20	44.35	-5.65	-33.60	-27.95
1624.5 to 1625.5	-70	0.004	10	44.35	-15.65	-30.00	-14.35
1625.5 to 1626.5	-70	0.004	1.3	44.35	-24.35	-27.40	-3.05
1626.5 to 1660	-70	0.004	0.8	44.35	-24.85	-30.10	-5.25
1660 to 1670	-19.5	0.02	0.8	44.20	25.50	-32.90	-58.40
1670 to 1735	-60	0.004	0.8	44.35	-14.85	-42.20	-27.35
1735 to 1865	-105	0.004	50	44.35	-10.65	-48.10	-37.45
1865 to 3250	-105	0.004	20	44.35	-40.65	-48.00	-7.35
3250 to 3330	-105	0.004	50	44.35	-10.65	-24.50	-13.85
3330 to 4000	-105	0.004	40	44.35	-20.65	-47.60	-26.95
4000 to 12000	-105	0.004	50	44.35	-10.65	-36.30	-25.65
12000 to 18000	-70	0.004	15	44.35	-10.65	-34.10	-23.45

QAM 1643.5 MHz Conducted Spurious Emissions

Frequency (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	44.41	-10.59	-47.9	-37.31
1525 to 1559	-203	0.004	120	44.41	-38.59	-46.3	-7.71
1559 to 1585	-155	1	111	45.03	1.03	-19	-20.03
1585 to 1605	-143	1	95	45.03	-2.97	-19	-16.03
1605 to1610	-117	1	62	45.03	-9.97	-17.5	-7.53
1610 to 1610.6	-95	1	40	45.03	-9.97	-19.4	-9.43
1610.6 to 1613.8	-49	1	40	45.03	36.03	-19.6	-55.63
1613.8 to 1614	-95	1	40	45.03	-9.97	-18.2	-8.23
1614 to 1620	-70	0.004	30	44.41	4.41	-39.2	-43.61
1620 to 1624.5	-70	0.004	20	44.41	-5.59	-40	-34.41
1624.5 to 1625.5	-70	0.004	10	44.41	-15.59	-40.2	-24.61
1625.5 to 1626.5	-70	0.004	1.3	44.41	-24.29	-39.6	-15.31
1626.5 to 1660	-70	0.004	0.8	44.41	-24.79	-29.1	-4.31
1660 to 1670	-19.5	0.02	0.8	44.32	25.62	-33.5	-59.12
1670 to 1735	-60	0.004	0.8	44.41	-14.79	-38.8	-24.01
1735 to 1865	-105	0.004	50	44.41	-10.59	-48.7	-38.11
1865 to 3250	-105	0.004	20	44.41	-40.59	-47.6	-7.01
3250 to 3330	-105	0.004	50	44.41	-10.59	-23	-12.41
3330 to 4000	-105	0.004	40	44.41	-20.59	-47.9	-27.31
4000 to 12000	-105	0.004	50	44.41	-10.59	-30.1	-19.51
12000 to 18000	-70	0.004	15	44.41	-10.59	-33.4	-22.81

QAM 1660.5 MHz Conducted Spurious Emissions

Frequency (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	44.62	-10.38	-47.9	-37.52
1525 to 1559	-203	0.004	120	44.62	-38.38	-46.3	-7.92
1559 to 1585	-155	1	111	45.04	1.04	-21	-22.04
1585 to 1605	-143	1	95	45.04	-2.96	-19.4	-16.44
1605 to1610	-117	1	62	45.04	-9.96	-19.4	-9.44
1610 to 1610.6	-95	1	40	45.04	-9.96	-21	-11.04
1610.6 to 1613.8	-49	1	40	45.04	36.04	-19.2	-55.24
1613.8 to 1614	-95	1	40	45.04	-9.96	-19.9	-9.94
1614 to 1620	-70	0.004	30	44.62	4.62	-40.4	-45.02
1620 to 1624.5	-70	0.004	20	44.62	-5.38	-39.9	-34.52
1624.5 to 1625.5	-70	0.004	10	44.62	-15.38	-40.2	-24.82
1625.5 to 1626.5	-70	0.004	1.3	44.62	-24.08	-38.3	-14.22
1626.5 to 1660	-70	0.004	0.8	44.62	-24.58	-31.1	-6.52
1660 to 1670	-19.5	0.02	0.8	44.55	25.85	-21.9	-47.75
1670 to 1735	-60	0.004	0.8	44.62	-14.58	-41.5	-26.92
1735 to 1865	-105	0.004	50	44.62	-10.38	-47.6	-37.22
1865 to 3250	-105	0.004	20	44.62	-40.38	-47.9	-7.52
3250 to 3330	-105	0.004	50	44.62	-10.38	-23.4	-13.02
3330 to 4000	-105	0.004	40	44.62	-20.38	-47.3	-26.92
4000 to 12000	-105	0.004	50	44.62	-10.38	-30.3	-19.92
12000 to 18000	-70	0.004	15	44.62	-10.38	-34.2	-23.82

Refer to Annex A for Conducted Spurious Emission Plots.

Field Strength of Spurious Radiation
Engineer: Greg Corbin
Test Date: 11/8/2017

Test Procedure

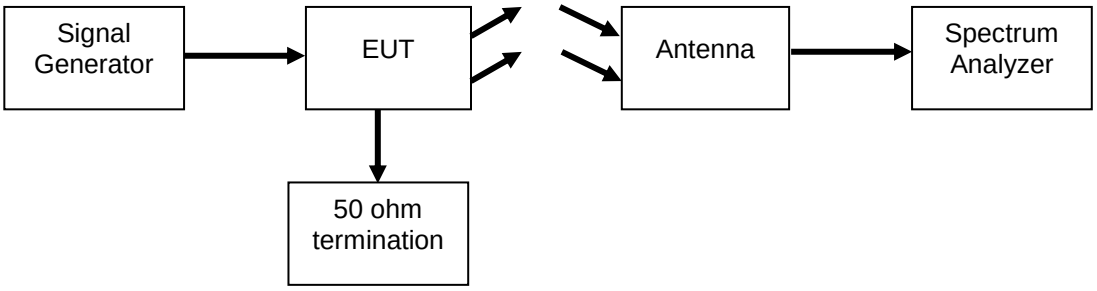
The EUT was tested in a semi-anechoic chamber with the turntable set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360 degrees with the antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure that the signal levels were maximized. All cable and antenna correction factors were input into the spectrum analyzer ensuring an accurate measurement in ERP/EIRP with the resultant power in dBm. A signal generator was used to provide a CW signal. The EUT output was terminated into a 50 Ohm non-radiating load.

The RBW was set to 100 kHz for measurements below 1 GHz and 1 MHz for measurements above 1 GHz.
The VBW was set to 3 times the RBW.

The following formula was used for calculating the limits:

Radiated Spurious Emissions Limit = P1 – (43+ 10Log(P2)) = -13dBm
P1 = power in dBm
P2 = power in Watts

Test Setup



Test Results

All emissions were below –13 dBm.

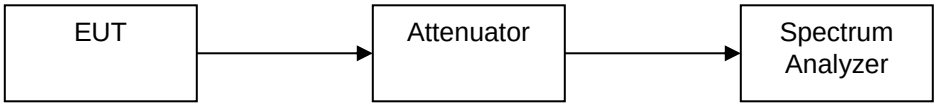
Refer to Annex B for the Radiated Spurious Emissions test data.

Emission Masks (Occupied Bandwidth)
Engineer: Greg Corbin
Test Date: 11/9/2017

Test Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT meets the required emissions mask. A reference level plot is provided to verify that the peak power was established prior to testing the mask. The transmitter is digital modulation therefore no data input is required to measure the emission mask. The RBW was set as close as possible to 1% of the occupied bandwidth to ensure accurate readings.

Test Setup



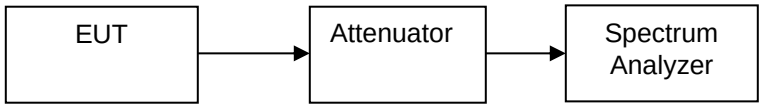
Refer to Annex C for Emission Mask Test data.

Frequency Stability (Temperature Variation)
Engineer: Greg Corbin
Test Date: 11/8/2017

Test Procedure

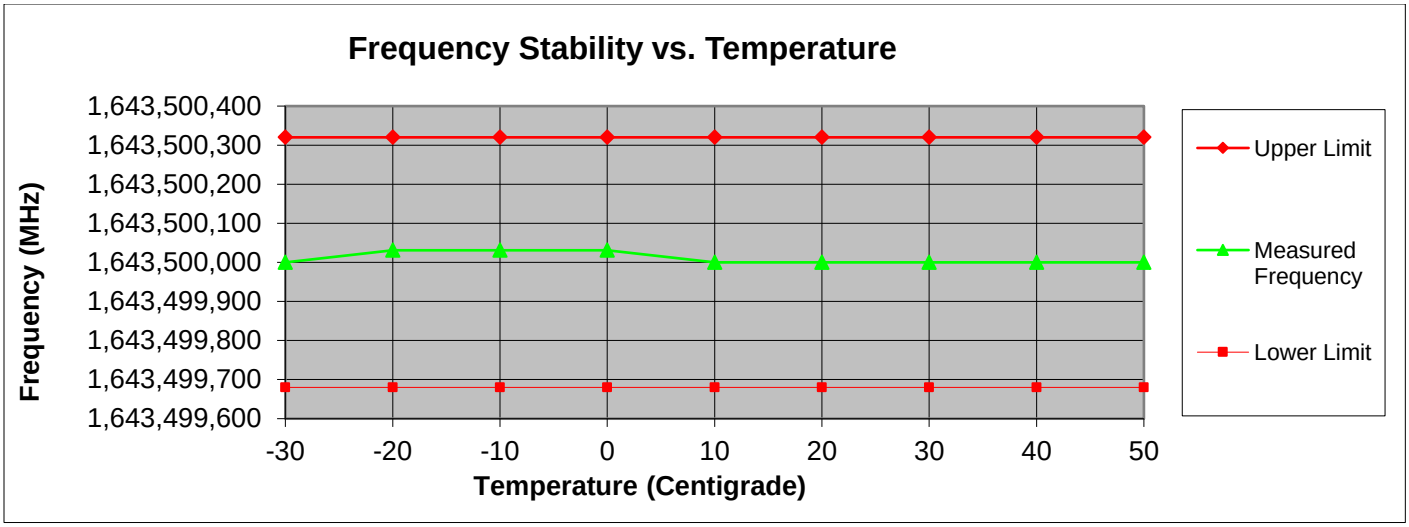
The EUT was placed in an environmental test chamber and the RF output was connected directly to a frequency counter. The temperature was varied from -30ºC to 50ºC in 10ºC increments. After a sufficient time for temperature stabilization the RF output frequency was measured.

Test Setup



Tuned Frequency (Hz)	Frequency Tolerance (Hz)	Temperature centigrade	Measured Frequency (Hz)	Upper Limit (Hz)	Lower Limit (Hz)	Upper Margin (Hz)	Lower Margin (Hz)
1,643,500,000	320	-30	1,643,500,000	1,643,500,320	1,643,499,680	-320	320
1,643,500,000	320	-20	1,643,500,031	1,643,500,320	1,643,499,680	-289	351
1,643,500,000	320	-10	1,643,500,031	1,643,500,320	1,643,499,680	-289	351
1,643,500,000	320	0	1,643,500,031	1,643,500,320	1,643,499,680	-289	351
1,643,500,000	320	10	1,643,500,000	1,643,500,320	1,643,499,680	-320	320
1,643,500,000	320	20	1,643,500,000	1,643,500,320	1,643,499,680	-320	320
1,643,500,000	320	30	1,643,500,000	1,643,500,320	1,643,499,680	-320	320
1,643,500,000	320	40	1,643,500,000	1,643,500,320	1,643,499,680	-320	320
1,643,500,000	320	50	1,643,500,000	1,643,500,320	1,643,499,680	-320	320

Measurement Results



Frequency Stability (Voltage Variation)
Engineer: Greg Corbin
Test Date: 11/8/2017

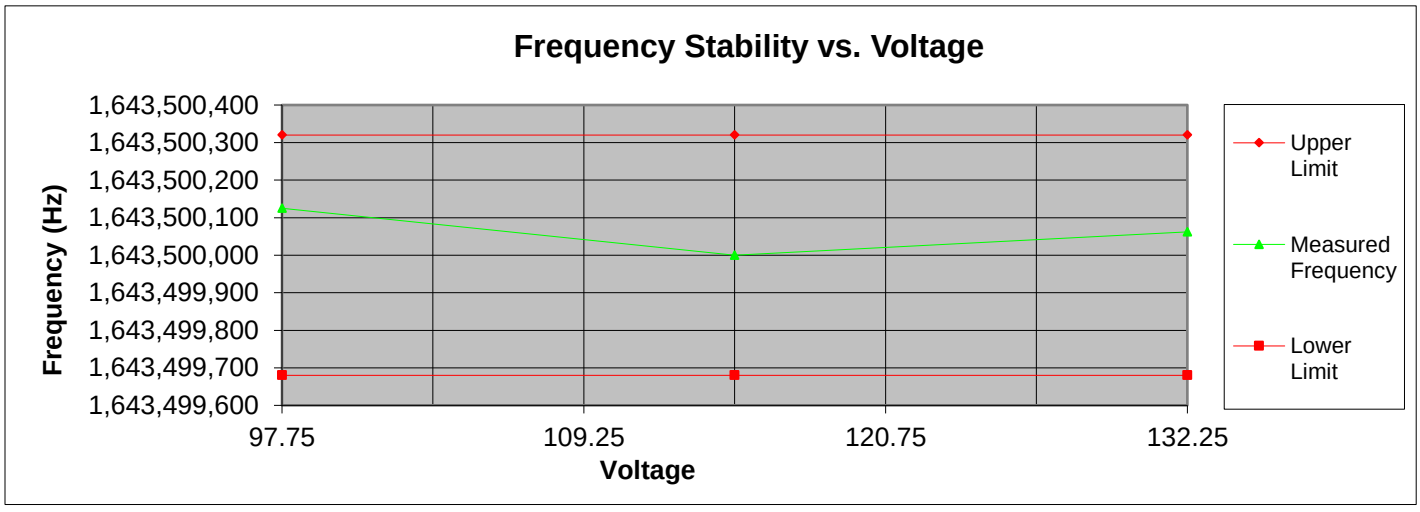
Test Procedure

The EUT was placed in a temperature chamber at 20±5°C and connected directly to a spectrum analyzer. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value and the RF output was measured. The nominal voltage is 115 VAC 400 Hz.

Tuned Frequency HZ	Frequency Tolerance Hz	Upper Limit (MHz)	Lower Limit (MHz)	Nominal Voltage	Measured Voltage	Measured Frequency Hz	Upper Margin Hz	Lower Margin Hz
1,643,500,000	320	1,643,500,320	1,643,499,680	115.00	97.75	1,643,500,125	-195	445
1,643,500,000	320	1,643,500,320	1,643,499,680	115.00	115.00	1,643,500,000	-320	320
1,643,500,000	320	1,643,500,320	1,643,499,680	115.00	132.25	1,643,500,062	-258	382

Test Setup

Test Results



Necessary Bandwidth and Emission Bandwidth
Engineer: Greg Corbin
Test Date: 11/9/2017

BPSK
Modulation = 840HG1D
Necessary Bandwidth Calculation:

Signal States (S)	=		2
Data Rate (D)		=	0.6
Constant Factor (K)	=		0.7
Necessary Bandwidth (B_N), kHz	=		$2*D*K / LOG_2(S)$

Modulation = 1K68G1D
Necessary Bandwidth Calculation:

Signal States (S)	=		2
Data Rate (D)		=	1.2
Constant Factor (K)	=		0.7
Necessary Bandwidth (B_N), kHz	=		$2*D*K / LOG_2(S)$

QPSK
Modulation = 6K80G1E
Necessary Bandwidth Calculation:

Signal States (S)	=		4
Data Rate (D)		=	8.4
Constant Factor (K)	=		0.81
Necessary Bandwidth (B_N), kHz	=		$2*D*K / LOG_2(S)$

Modulation = 10K5G1D
Necessary Bandwidth Calculation:

Signal States (S)	=		4
Data Rate (D)		=	10.5
Constant Factor (K)	=		1
Necessary Bandwidth (B_N), kHz	=		$2*D*K / LOG_2(S)$

Modulation = 25K0G7W
Necessary Bandwidth Calculation:

Signal States (S)	=		4
Data Rate (D)		=	33.6
Constant Factor (K)	=		0.74
Necessary Bandwidth (B_N), kHz	=		$2*D*K / LOG_2(S)$

Modulation = 40K0G1E
Necessary Bandwidth Calculation:

Signal States (S)	=		4
Data Rate (D)		=	134.4
Constant Factor (K)	=		0.74
Necessary Bandwidth (B_N), kHz	=		$2*D*K / LOG_2(S)$

Modulation = 50K0G7W
Necessary Bandwidth Calculation:

Signal States (S)	=		4
Data Rate (D)		=	67.2
Constant Factor (K)	=		0.74
Necessary Bandwidth (B_N), kHz	=		$2*D*K / LOG_2(S)$

Modulation = 100KG7W
Necessary Bandwidth Calculation:

Signal States (S)	=		4
Data Rate (D)		=	134.4
Constant Factor (K)	=		0.74
Necessary Bandwidth (B_N), kHz	=		2*D*K / LOG_2(S)

Modulation = 200KG7W
Necessary Bandwidth Calculation:

Signal States (S)	=		4
Data Rate (D)		=	302.4
Constant Factor (K)	=		0.66
Necessary Bandwidth (B_N), kHz	=		2*D*K / LOG_2(S)

QAM
Modulation = 50K0D7W
Necessary Bandwidth Calculation:

Signal States (S)	=		16
Data Rate (D)		=	134.4
Constant Factor (K)	=		0.74
Necessary Bandwidth (B_N), kHz	=		2*D*K / LOG_2(S)

Modulation = 40K0G1E
Necessary Bandwidth Calculation:

Signal States (S)	=		16
Data Rate (D)		=	134.4
Constant Factor (K)	=		0.6
Necessary Bandwidth (B_N), kHz	=		2*D*K / LOG_2(S)

Modulation = 100KD7W
Necessary Bandwidth Calculation:

Signal States (S)	=		16
Data Rate (D)		=	268.8
Constant Factor (K)	=		0.74
Necessary Bandwidth (B_N), kHz	=		2*D*K / LOG_2(S)

Modulation = 200KD7W
Necessary Bandwidth Calculation:

Signal States (S)	=		16
Data Rate (D)		=	604.8
Constant Factor (K)	=		0.66
Necessary Bandwidth (B_N), kHz	=		2*D*K / LOG_2(S)

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	ARA	DRG-118/A	i00271	6/16/16	6/16/18
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	6/9/17	6/9/18
Data Logger	Fluke	Hydra Data Bucket	i00343	5/25/17	5/25/18
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	8/3/16	8/3/18
EMI Analyzer	Agilent	E7405A	i00379	2/22/17	2/22/18
Spectrum Analyzer	Textronix	RSA5126A	i00424	5/3/17	5/3/18
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	8/15/16	8/15/19
Preamplifier for 1-18GHz horn antenna	Miteq	AFS44 00101 400 23-10P-44	i00509	N/A	N/A

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT