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Test Report

Prepared for: Fender Musical Instruments Corporation

Model: Wireless Module

Description: Fender PCB Assembly including the BT Radio Module: PN 7710068000 FMA BT-FTSW-USB; BT Module: FreeWings FW3817-30

Serial Number: N/A

FCC ID: XQW-FMAPR4475
IC: 8690A-FMAPR4475

To

FCC Part 15.247

And

IC RSS-247

Date of Issue: February 15, 2017

On the behalf of the applicant:	**Fender Musical Instruments Corporation** **17600 N. Perimeter Drive** **Suite 100** **Scottsdale, AZ 85255**
Attention of:	**Larry Clauss, Principal Engineer** **Ph: (480)845-5203** **E-Mail: lclauss@fender.com**

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Project No: p1690028

Alex Macon
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	October 18, 2016	Alex Macon	Original Document
2.0	February 15, 2017	Alex Macon	Updated Standard dates on page 8. Included antenna gain information on page 6 Updated Annex A to include

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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 to the 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 below.

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

Testing Certificate Number: **2152.01**

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FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

The applicant has been cautioned as to the following

15.21 - Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) - Special Accessories

Equipment marked to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.10-2009 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (ºC)	**Humidity (%)**	**Pressure (mbar)**
23.2 – 24.8	28.9 – 34.6	966-2 – 968.3

EUT Description
Model: Wireless Module
Description: Fender PCB Assembly including the BT Radio Module: PN 7710068000 FMA BT-FTSW-USB; BT Module: FreeWings FW3817-30
Firmware: N/A
Software: BlueMod
Serial Number: N/A
Additional Information:
The EUT was powered using an external test board connected to a laptop for control purposes
The antenna used on the device is an F type antenna with a nominal gain of 0.54dBi

EUT Operation during Tests
The EUT was controlled using manufacturer supplied software, BlueMod.

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Test board	N/A	FWDEV-V05	N/A

Cables: None

Modifications: None

15.203: Antenna Requirement:

X	The antenna is permanently attached to the EUT
	The antenna uses a unique coupling
	The EUT must be professionally installed
	The antenna requirement does not apply

Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Peak Output Power	Pass	
15.247(b)	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Emissions At Band Edges	Pass	
15.247(a)(2)	Occupied Bandwidth	Pass	
15.247(e)	Transmitter Power Spectral Density	Pass	
15.207	A/C Powerline Conducted Emissions	N/A	Device is a module

References	Description
CFR47, Part 15, Subpart B	Unintentional Radiators
CFR47, Part 15, Subpart C	Intentional Radiators
ANSI C63.10-2013	American National standard for testing Unlicensed Wireless Devices
ANSI C63.4-2014	Method and Measurements of Radio-Noise Emissions from low-Voltage Electrical and Electronic Equipment in the range 9kHz to 40GHz.
ISO/IEC 17025:2005	General requirements for the Competence of Testing and Calibrations Laboratories
KDB 558074 D01 v03r05	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under §15.247

Conducted Output Power
Engineer: Alex Macon
Test Date: 9/28/16

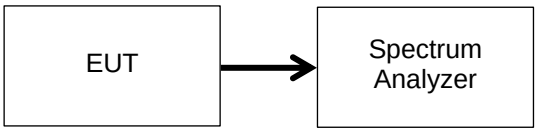
Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

RBW = 1-5% of the OBW, not to exceed 1MHz
VBW ≥ 3 x RBW
RMS Detector
Number of points in sweep ≥ 2 x span / RBW
Trace average at least 100 traces in power averaging mode
Sweep = auto
Span = 1.5 x EBW

The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. The RF output power was measured using the spectrum analyzer's channel power function

Test Setup



Transmitter Output Power

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
2402	-2.40	1 W (30 dBm)	Pass
2440	7.42	1 W (30 dBm)	Pass
2480	7.56	1 W (30 dBm)	Pass

Conducted RF Measurements (15.209)
Engineer: Alex Macon
Test Date: 9/28/16

Test Procedure

Antenna-port conducted measurements were performed as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands for 15.209.

The following offsets were added to the measurements:
The maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level
A maximum ground reflection factor to the EIRP level, 6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000MHz.

The following equations were used to determine the field strength from the conducted values.
E[dBµV/m] = EIRP[dBm] - 20 log(d[meters]) + 104.77, where E = field strength and d = 3m
E[dBµV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

The Spectrum Analyzer was set to the following:

The Spectrum Analyzer was set to the following for emissions > 1000MHz:

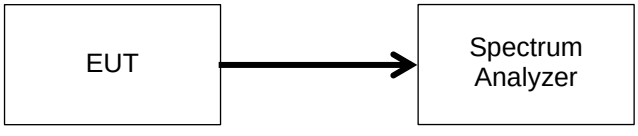
a. RBW = 1 MHz
b. VBW ≥ 3 MHz
c. Detector = Peak.
d. Sweep time = auto
e. Trace mode = max hold
    1. Note: For emissions where the peak exceeded that of the average 15.209 emission limit the following was performed.
f. RBW = 1 MHz
g. VBW ≤ RBW/100 (i.e., 10 kHz) but not less than 10 Hz

For emissions below 1000MHz the Spectrum Analyzer settings were as follows:

a. RBW = 100 kHz
b. VBW ≥ 300 kHz
c. Detector = Peak
d. Sweep time = auto
e. Trace mode = max hold

The EUT was connected to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was investigated.

Test Setup



See Annex A for test data

Radiated Spurious Emissions
Engineer: Alex Macon
Test Date: 9/30/16

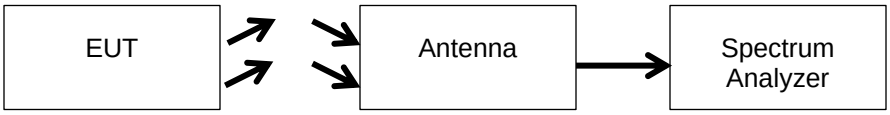
Test Procedure
Radiated Spurious Emissions: 30 – 1000 MHz

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The output of the transmitter was connected to a non-radiating balance load. The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized.

All emissions from 30 MHz to 1 GHz were examined.
Measured Level includes antenna and receiver cable correction factors.
Correction factors were input into the spectrum analyzer before recording “Measured Level”.

RBW = 100 KHz
VBW = 300 KHz
Detector – Quasi Peak

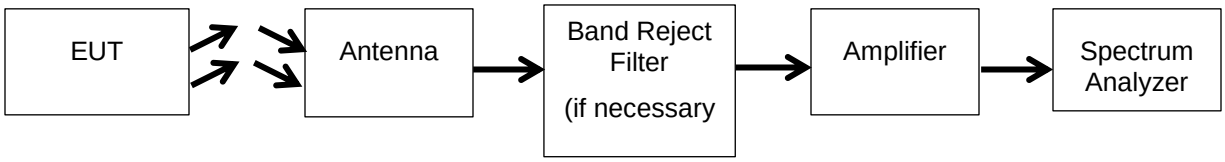
Test Setup



Test Procedure for
Radiated Spurious Emissions above 1 GHz

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The output of the transmitter was connected to a non-radiating balance load. The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized.

Test Setup



See Annex B for test data

Conducted Spurious Emissions
Engineer: Alex Macon
Test Date: 9/28/16

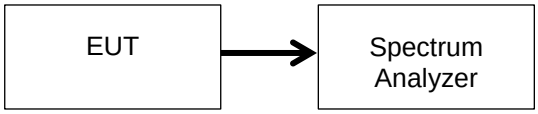
Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

RBW = 100 kHz
VBW ≥ 3 x RBW
Peak Detector
Trace mode = max hold
Sweep = auto couple
Frequency Range = 30MHz – 10th Harmonic of the fundamental

The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. The trace was allowed to stabilize. All emission were investigated to insure they were attenuated from the peak fundamental by at least 20dB. If the average power levels were measured then the out-of-band emissions needed to be attenuated by 30dB. In addition emissions were investigated at the band edges to insure all out-of-band emissions were attenuated 20 or 30dB as necessary.

Test Setup



See Annex C for test results

DTS Bandwidth
Engineer: Alex Macon
Test Date: 9/28/16

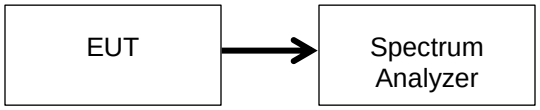
Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

RBW = 100 kHz
VBW ≥ 3 x RBW
Peak Detector
Trace mode = max hold
Sweep = auto couple
Span = 1.5 x EBW

The EUT was set to transmit at the lowest, middle and highest channels of the band at the maximum power levels. The maximum width of the emission that was determined by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that were attenuated by 6db and this value was used to determine the width of the carrier. Alternatively the spectrum analyzer's automatic bandwidth capability was used.

Test Setup



6 dB Occupied Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (kHz)	Specification Limit (kHz)	Result
2402	502.30	≥ 500	Pass
2440	513.09	≥ 500	Pass
2480	513.77	≥ 500	Pass

99% Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (kHz)	Result
2402	927.14	Pass
2440	957.59	Pass
2480	937.55	Pass

Transmitter Power Spectral Density (PSD)
Engineer: Alex Macon
Test Date: 9/28/16

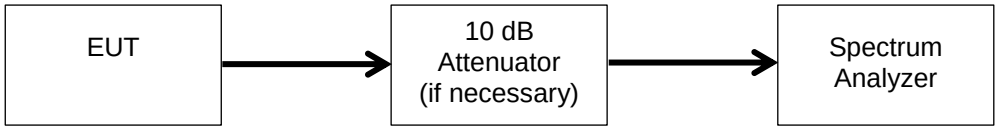
Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

DTS channel center frequency
Span 1.5 x DTS bandwidth
RBW =3 kHz ≤ RBW ≤ 100 kHz
VBW ≥ 3 x RBW
Peak Detector
Sweep time = auto couple
Trace mode = max hold

The EUT was set to transmit at the lowest, middle and highest channels of the band at the maximum power levels. Once the trace has stabilize the peak marker was used to determine the peak power spectral density.

Test Setup



PSD Summary

Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
2402	-15.58	8	Pass
2440	-5.26	8	Pass
2480	-4.95	8	Pass

A/C Powerline Conducted Emission

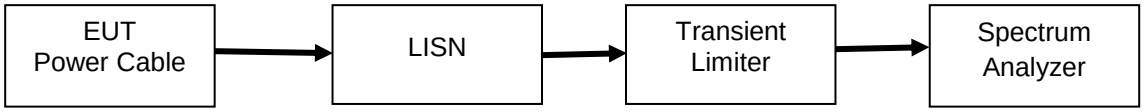
Engineer: Alex Macon

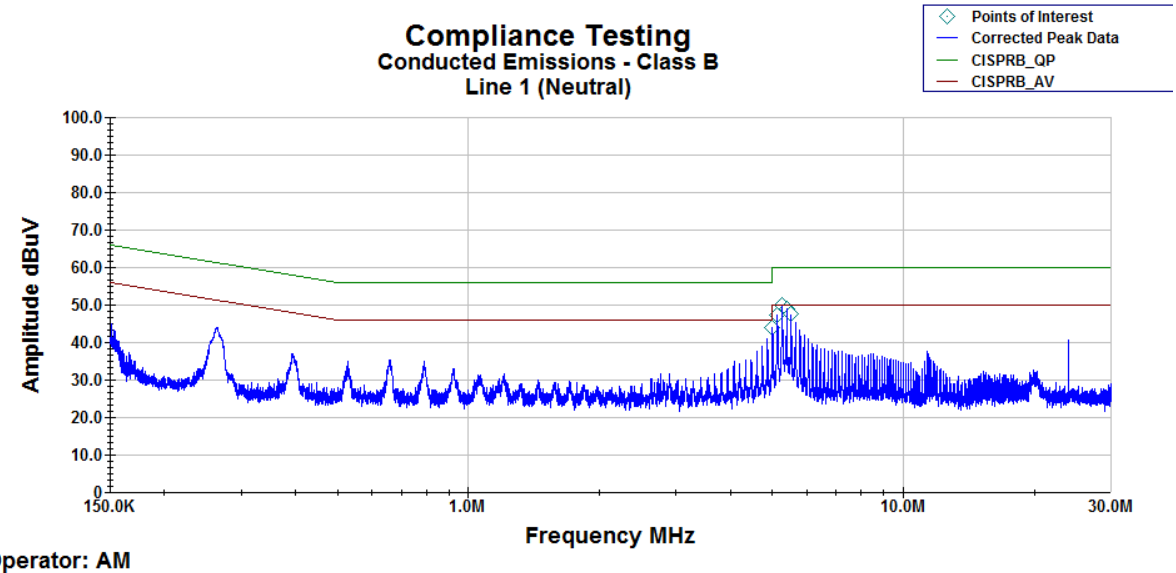
Test Date: 10/27/16

Test Procedure

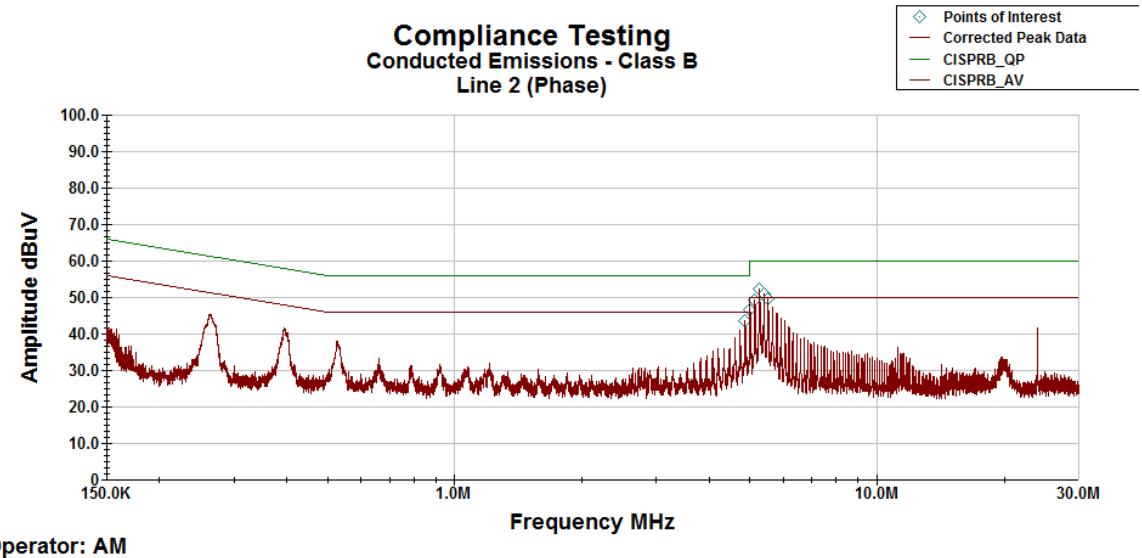
The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.
The module was tested within a host due to construction restraints.

Test Setup





Operator: AM
Conducted_TX_p16a0017.til **Job #: p16a0017**



Operator: AM
Conducted_TX_p16a0017.til **Job #: p16a0017**

Line 1 Neutral Avg Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	Avg Margin (dB)
4.9946 MHz	31.69	0.00	0.100	10.200	41.987	46.000	-4.013
4.9955 MHz	31.55	0.00	0.100	10.200	41.850	46.000	-4.150
5.1271 MHz	35.03	0.00	0.106	10.200	45.340	50.000	-4.660
5.2579 MHz	37.82	0.00	0.110	10.200	48.130	50.000	-1.870
5.39 MHz	36.55	0.00	0.110	10.200	46.860	50.000	-3.140
5.5198 MHz	33.06	0.00	0.110	10.200	43.370	50.000	-6.630

Line 2 Phase Avg Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	Avg Margin (dB)
4.8664 MHz	31.82	0.00	0.100	10.200	42.120	56.000	-13.880
4.9966 MHz	34.79	0.00	0.100	10.200	45.090	56.000	-10.910
5.1288 MHz	37.57	0.00	0.106	10.200	47.876	60.000	-12.124
5.261 MHz	40.46	0.00	0.110	10.200	50.770	60.000	-9.230
5.3914 MHz	40.75	0.00	0.110	10.200	51.060	60.000	-8.940
5.5236 MHz	39.30	0.00	0.110	10.200	49.610	60.000	-10.390

Line 1 Neutral QP Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	QP Margin (dB)
4.9946 MHz	33.100	0.000	0.100	10.200	43.400	56.000	-12.600
4.9955 MHz	32.930	0.000	0.100	10.200	43.230	56.000	-12.770
5.1271 MHz	36.560	0.000	0.106	10.200	46.866	60.000	-13.134
5.2579 MHz	39.390	0.000	0.110	10.200	49.700	60.000	-10.300
5.39 MHz	38.060	0.000	0.110	10.200	48.370	60.000	-11.630
5.5198 MHz	34.690	0.000	0.110	10.200	45.000	60.000	-15.000

Line 2 Phase QP Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	QP Margin (dB)
4.8664 MHz	31.82	0.00	0.100	10.200	42.120	56.000	-13.880
4.9966 MHz	34.79	0.00	0.100	10.200	45.090	56.000	-10.910
5.1288 MHz	37.57	0.00	0.106	10.200	47.876	60.000	-12.124
5.261 MHz	40.46	0.00	0.110	10.200	50.770	60.000	-9.230
5.3914 MHz	40.75	0.00	0.110	10.200	51.060	60.000	-8.940
5.5236 MHz	39.30	0.00	0.110	10.200	49.610	60.000	-10.390

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
Horn Antenna, Amplified	ARA	MWH-1826/B	i00273	4/22/15	4/22/18
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	5/26/16	5/26/17
Voltmeter	Fluke	87III	i00319	4/11/16	4/11/19
Spectrum Analyzer	Agilent	E4407B	i00331	10/19/16	10/19/17
Data Logger	Fluke	Hydra Data Bucket	i00343	4/5/16	4/5/17
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	8/3/16	8/3/18
AC Power Source	Behlman	BL 6000	i00362	Verified on:10/27/16	
EMI Analyzer	Agilent	E7405A	i00379	2/11/16	2/11/17
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	8/15/16	8/15/19
LISN	COM-Power	LI-125A	i00446	4/29/16	4/29/18
LISN	COM-Power	LI-125A	i00448	4/29/16	4/29/18
PSA Spectrum Analyzer	Agilent	E4445A	i00471	8/30/16	8/30/17
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