

Company: SensThys Inc.

Test of: SensArray+

To: FCC Subpart C 15.247 (FHSS), ISSED RSS-247

Report No.: TIME01-U2_Master Rev A

MASTER TEST REPORT



MASTER TEST REPORT



Test of: SensThys, Inc. SensArray+

To: FCC Subpart C 15.247 (FHSS), ISSED RSS-247

Test Report Serial No.: TIME01-U2_Master Rev A

This report supersedes: NONE

As a result of the 6 Mbyte FCC file size limitation potentially large test reports require to be split into smaller components. This document is the Master document controlling Addendum reports as listed below. This Master document combined with the Addendums demonstrate compliance with the standard

Master Document Number	Addendum Reports
TIME01-U2_Master	TIME01-U2_Conducted
	TIME01-U2_Radiated

Applicant: SensThys
21060 Homestead Road
Cupertino, California 95014
USA

Product Function: Integrated RFID reader

Issue Date: 5th September 2017

This Test Report is Issued Under the Authority of:

MiCOM Labs, Inc.
575 Boulder Court
Pleasanton California 94566
USA
Phone: +1 (925) 462-0304
Fax: +1 (925) 462-0306
www.micomlabs.com



MiCOM Labs is an ISO 17025 Accredited Testing Laboratory



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1. ACCREDITATION, LISTINGS & RECOGNITION

1.1. TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025:2005. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-01.pdf>



Accredited Laboratory

A2LA has accredited

MICOM LABS

Pleasanton, CA

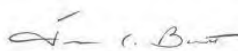
for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 4th day of February 2016.



Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2017

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.



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1.2. RECOGNITION

MiCOM Labs, Inc has widely recognized wireless testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA countries. MiCOM Labs test reports are accepted globally.

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	US0159 Listing #: 4143A-2 4143A-3
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	APEC MRA 2	RCB 210
	VCCI	--	--	A-0012
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

EU MRA – European Union Mutual Recognition Agreement.

NB – Notified Body

APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement. Recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.

Phase I - recognition for product testing

Phase II – recognition for both product testing and certification

1.3. PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065:2012. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-02.pdf>



United States of America – Telecommunication Certification Body (TCB)
Industry Canada – Certification Body, CAB Identifier – US0159
Europe – Notified Body (NB), NB Identifier - 2280
Japan – Recognized Certification Body (RCB), RCB Identifier - 210



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2. DOCUMENT HISTORY

Released Document History				
Master Revision/Date	Addendum Revision	Release	Date	Comments
Rev A /	Conducted	Rev A	5 th September 2017	Initial Release
	Radiated	Rev A	5 th September 2017	Initial Release

In the above table the latest report revision will replace all earlier versions.

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3. TEST RESULT CERTIFICATE

Manufacturer: SensThys 21060 Homestead Road Cupertino 95014 California USA	Tested By: MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Model(s): SensArray and SensArray+	Telephone: +1 925 462 0304
Type Of Equipment: Integrated RFID reader and antenna	Fax: +1 925 462 0306
S/N's: 54:10:EC:55:54:FB	
Test Date(s): 23 rd August to 24 th August 2017	Website: www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC Subpart C 15.247, ISSED RSS-247	EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs, Inc.

Gordon Hurst
President & CEO MiCOM Labs, Inc.



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4. REFERENCES AND MEASUREMENT UNCERTAINTY

4.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
I	A2LA	August 2017	R105 - Requirement's When Making Reference to A2LA Accreditation Status
II	ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
III	ANSI C63.4	2014	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IV	CISPR 32	2015	Electromagnetic compatibility of multimedia equipment - Emission requirements
V	ETSI TR 100 028	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
VI	FCC 47 CFR Part 15, Subpart B	2014	Title 47: Telecommunication PART 15—RADIO FREQUENCY DEVICES, SubPart B; Unintentional Radiators
VII	FCC 47 CFR Part 15.247	2016	Radio Frequency Devices; Subpart C – Intentional Radiators
VIII	FCC Public Notice DA 00-705	March 2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
IX	ICES-003	Issue 6 Jan 2016; Updated April 2017	Spectrum Management and Telecommunications; Interference-Causing Equipment Standard. Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement.
X	M 3003	Edition 3 Nov.2012	Expression of Uncertainty and Confidence in Measurements
XI	RSS-247 Issue 2	Feb 2017	Digital Transmission Systems (DTSs), Frequency Hopping System (FHSs) and Licence-Exempt Local Area Network (LE-LEN) Devices
XII	RSS-Gen Issue 4	November 2014	General Requirements and Information for the Certification of Radiocommunication Equipment
XIII	FCC 47 CFR Part 2.1033	2016	FCC requirements and rules regarding photographs and test setup diagrams.

4.2. Test and Uncertainty Procedure

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.



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5. PRODUCT DETAILS AND TEST CONFIGURATIONS

5.1. Technical Details

Details	Description
Purpose:	Test of the SensThys SensArray+ to FCC Subpart C 15.247, ISED RSS-247.
Applicant:	SensThys 21060 Homestead Road Cupertino California 95014 USA
Manufacturer:	SensThys
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Test report reference number:	TIME01-U2_Master
Date EUT received:	23 rd August 2017
Standard(s) applied:	FCC Subpart C 15.247 (DTS), ISED RSS-247
Dates of test (from - to):	23 rd - 24 th August 2017
No of Units Tested:	2
Product Family Name:	SensArray
Model(s):	SensArray and SensArray+
Location for use:	Indoors
Frequency Band:	902 - 928 MHz;
Type of Modulation:	RFID FHSS
EUT Modes of Operation:	250 PR-ASK; 300 PR-ASK; 40 DSB-AFK; 400 DSB-AFK;
Declared Nominal Output Power	+30.00 dBm
Transmit/Receive Operation:	Transceiver – Full Duplex
Rated Input Voltage and Current:	POE: 48 Vdc
Operating Temperature Range:	Client Declared Range -20°C to 55°C
ITU Emission Designator:	250 PR-ASK 64K0A1D 300 PR-ASK 65K0A1D 40 DSB-AFK 83K0A1D 400 DSB-AFK 390K0A1D
Equipment Dimensions:	10 x 0.83 x 10 in
Weight:	1.75 lbs
Hardware Rev:	1.0.0
Software Rev:	1.0.1

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5.2. Scope Of Test Program

SensThys SensArray and SensArray+

The scope of the test program was to test the SensThys SensArray and SensArray+ configurations in the frequency ranges 902 - 928 MHz; for compliance against the following specification:

FCC Subpart C 15.247 (DTS)

Radio Frequency Devices; Subpart C – Intentional Radiators

Industry Canada RSS-247

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

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5.3. Equipment Model(s) and Serial Number(s)

Type	Description	Manufacturer	Model	Serial no.	Delivery Date
EUT	RFID Reader	TIMES-7	S131311	54:10:EC:55:54:FB	23 rd August 2017
EUT	RFID Reader	TIMES-7	S131311	54:10:EC:55:52:41	23 rd August 2017

5.4. Antenna Details

Type	Manufacturer	Model	Gain (dBi)	BF Gain	Dir BW	X-Pol	Frequency Band (MHz)
external	Alien	ALR-8696	5.5	-	360	-	902 - 928
external	Alien	ALR-8697	5.5	-	360	-	902 - 928
external	Alien	ALR-8698	8.0	-	360	-	902 - 928
external	Alien	ALR-A0501-F	3.0	-	360	-	902 - 928
external	Alien	ALR-A1001	5.5	-	360	-	902 - 928
external	Alien	ALR-0501	3.0	-	360	-	902 - 928
integral	SensThys	integral	5.5	-	360	-	902 - 928
external	Times-7	A5010	5.5	-	360	-	902 - 928

Client declared similarity between antenna models – NOTE: these antennas were Not Tested

BF Gain - Beamforming Gain
Dir BW - Directional BeamWidth
X-Pol - Cross Polarization

By similarity

Tested Model	Manufacturer	Untested by Similarity	Tested
Integral Antenna	SensThys		Yes
	Times-7	A5010	No
	Alien Technology	ALR-A1001	No
ALR-A0501-F	Alien Technology		Yes
	Alien Technology	ALR-0501	No
ALR-8698	Alien Technology		Yes
	Alien Technology	ALR-8696	No
	Alien Technology	ALR-8697	No



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5.5. Cabling and I/O Ports

Port Type	Max Cable Length	# of Ports	Screened	Conn Type	Data Type	Bit Rate (Mbit/s)
Ethernet	20 ft	1	No	RJ45	POE IN (DATA)	10/100
Ethernet	20 ft	2	No	RJ45	POE OUT(DATA)	10/100
dc Jack	--	4	No	Wire terminal	dc	Not Applicable

5.6. Test Configurations

Results for the following configurations are provided in this report:

Operational Mode(s)	Data Rate kBit/s	Channel Frequency (MHz)		
		Low	Mid	High
902 - 928 MHz				
250 PR-ASK	250	902.75	915.25	927.25
300 PR-ASK	300	902.75	915.25	927.25
40 DSB-AFK	40	902.75	915.25	927.25
400 DSB-AFK	400	902.75	915.25	927.25

5.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE

5.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. NONE



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6. TEST SUMMARY

List of Measurements

Test Header	Result	Data Link
Conducted Results	Test Report TIME01-U2_Conducted	
20 dB & 99% Bandwidth	Complies	
Frequency Hopping Tests	Complies	
Number of Hopping Channels	Complies	
Channel Separation	Complies	
Dwell Time	Complies	
Channel Occupancy	Complies	
Output Power	Complies	
Conducted Emissions	Complies	
Conducted Unwanted Spurious Emissions	Complies	
Conducted Band-Edge Emissions	Complies	
Radiated Emissions	Test Report TIME01-U2_Radiated	
Radiated Emissions	Complies	
TX Spurious & Restricted Band Emissions	Complies	
Restricted Edge & Band-Edge Emissions	Complies	

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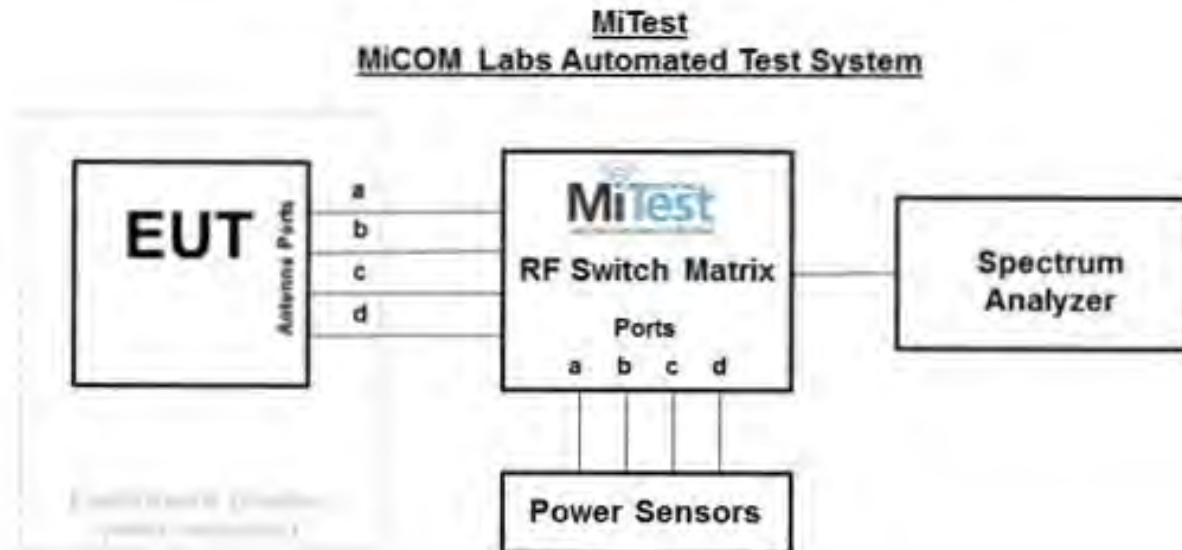
7. TEST EQUIPMENT CONFIGURATION(S)

7.1. Conducted

Conducted RF Emission Test Set-up(s)

The following tests were performed using the conducted test set-up shown in the diagram below.

1. 20 dB & 99% Bandwidth
2. Number of Channels
3. Channel Spacing
4. Dwell Time & Channel Occupancy
5. Conducted Output Power
6. Conducted Spurious Emissions
7. Conducted Spurious Band-Edge Emissions



Conducted Test Measurement Setup



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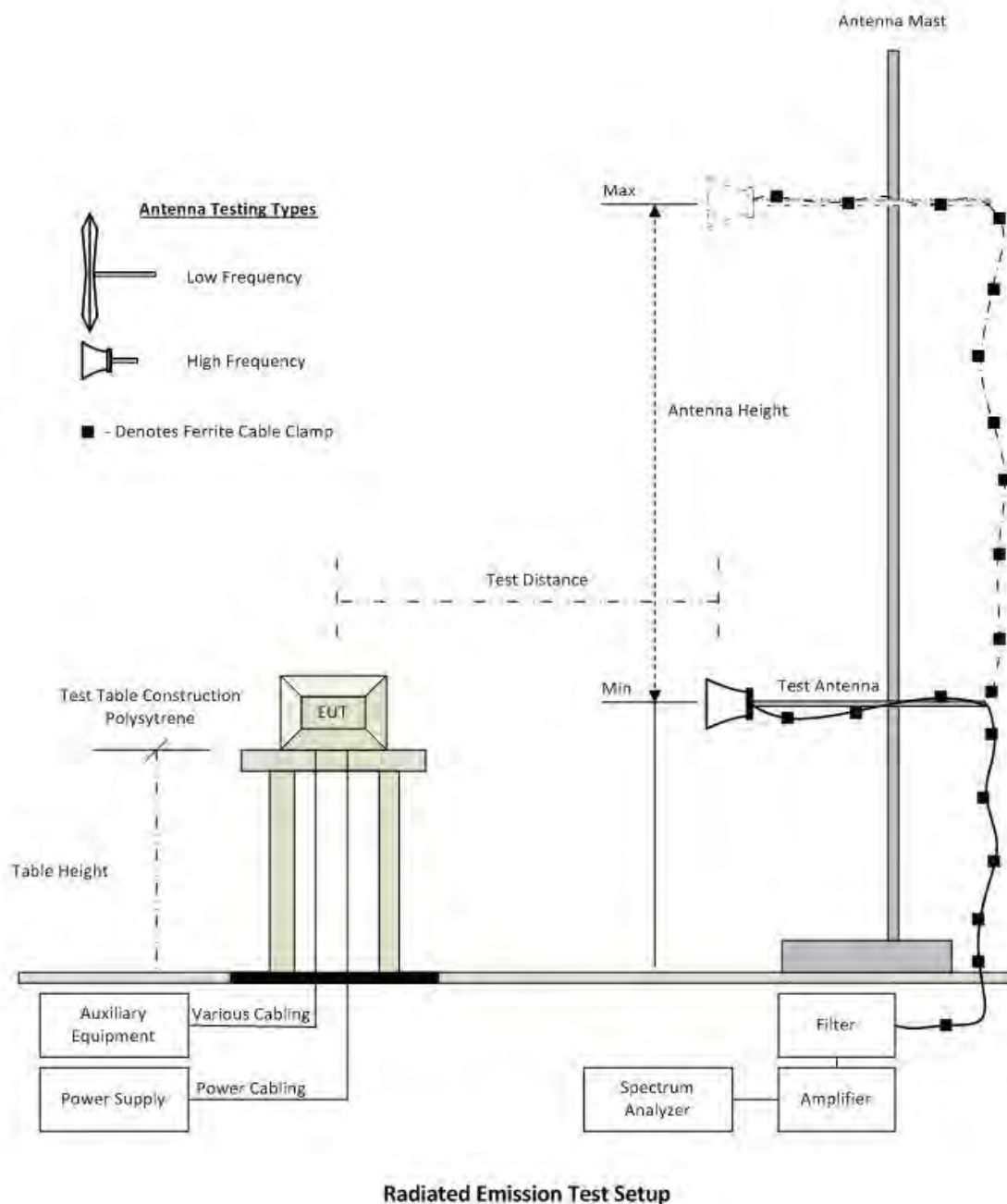
A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
127	Power Supply	HP	6674A	US36370530	Cal when used
158	Barometer/Thermometer	Control Company	4196	E2846	30 Nov 2017
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	2 May 2018
381	4x4 RF Switch Box	MiCOM Labs	MiTest RF Switch Box	MIC002	2 Oct 2017
398	MiTest RF Conducted Test Software	MiCOM	MiTest ATS	Version 4.1	Not Required
419	Laptop with Labview Software	Lenova	W520	TS02	Not Required
420	USB to GPIB Interface	National Instruments	GPIB-USB HS	1346738	Not Required
440	USB Wideband Power Sensor	Boonton	55006	9178	25 Sep 2017
442	USB Wideband Power Sensor	Boonton	55006	9181	6 Oct 2017
445	PoE Injector	D-Link	DPE-101GL	QTAH1E2000625	Not Required
493	USB Wideband Power Sensor	Boonton	55006	9634	10 Mar 2018
494	USB Wideband Power Sensor	Boonton	55006	9726	10 Mar 2018
74	Environmental Chamber Chamber 3	Tenney	TTC	12808-1	29 Sep 2017
RF#2 GPIB#1	GPIB cable to Power Supply	HP	GPIB	None	Not Required
RF#2 SMA#1	EUT to Mitest box port 1	Flexco	SMA Cable port1	None	2 Oct 2017
RF#2 SMA#2	EUT to Mitest box port 2	Flexco	SMA Cable port2	None	2 Oct 2017
RF#2 SMA#3	EUT to Mitest box port 3	Flexco	SMA Cable port3	None	2 Oct 2017
RF#2 SMA#4	EUT to Mitest box port 4	Flexco	SMA Cable port4	None	2 Oct 2017
RF#2 SMA#SA	Mitest box to SA	Flexco	SMA Cable SA	None	2 Oct 2017
RF#2 USB#1	USB Cable to Mitest Box	Dynex	USB Cable	None	Not Required

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7.2. Radiated Emissions - 3m Chamber

The following tests were performed using the radiated test set-up shown in the diagram below.
Radiated emissions below 1GHz.
Radiated Emissions above 1GHz.



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A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	30 Nov 2017
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CU101	04R08507	Not Required
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	2 May 2018
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	30 Oct 2017
342	2.4 GHz Notch Filter	EWT	EWT-14-0203	H1	30 Oct 2017
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	9 Oct 2017
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	10 Oct 2017
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	9 Oct 2017
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
416	Gigabit ethernet filter	ETS-Lingren	Gigafoil 260366	None	Not Required
447	MiTest Rad Emissions Test Software	MiCOM	Test Software Version 1.0	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	30 Oct 2017
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	30 Oct 2017
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	30 Oct 2017
480	Cable - Bulkhead to Amp	SRC Haverhill	157-3050360	480	30 Oct 2017
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-3050787	481	30 Oct 2017
482	Cable - Amp to Antenna	SRC Haverhill	157-3051574	482	30 Oct 2017

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8. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by [MiTest](#). [MiTest](#) is an automated test system developed by MiCOM Labs. [MiTest](#) is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.



The MiCOM Labs "[MiTest](#)" Automated Test System" (Patent Pending)

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575 Boulder Court
Pleasanton, California 94566, USA
Tel: +1 (925) 462 0304
Fax: +1 (925) 462 0306
www.micomlabs.com