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TEST REPORT

SCOPE OF WORK
EMC TESTING – SENSUS

REPORT NUMBER
103382409BOX-020

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EMISSIONS TEST REPORT

(COMPLIANCE TO TESTS PERFORMED)

Report Number: 103382409BOX-020
Project Number: G103382409

Report Issue Date: 10/17/2018

Model(s) Tested: SENSUS
Model(s) Partially Tested: None
Model(s) Not Tested but declared equivalent by the client: None

Standards: CFR47 FCC Part 15 Subpart C:2018 Section 15.225,
CFR47 FCC Part 15 Subpart B:2018,
ISED RSS-210 Issue 9 August 2016 (Amendment), Annex B.6,
ISED RSS-Gen Issue 5 April 2018,
ISED ICES-003 Issue 6 April 2017
(Class II Permissive Change)

Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
Fiber Mountain, Inc.
700 W Johnson Avenue
Cheshire, CT 06410
USA

Report prepared by

Vathana Ven / EMC Staff Engineer

Report reviewed by

Kouma Sinn / EMC Staff Engineer

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Table of Contents

1 Introduction and Conclusion 4
2 Test Summary 4
3 Client Information 5
4 Description of Equipment Under Test and Variant Models 5
5 System Setup and Method 6
6 Fundamental Radiated Emissions 7
7 Transmitter Spurious Emissions Below 30MHz 14
8 Transmitter Spurious Emissions Above 30MHz 20
9 Receiver Spurious Emissions Above 30MHz 26
10 Revision History 34

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test	--
5	System Setup and Method	--
6	Fundamental Radiated Emissions FCC Part 15 Subpart C:2018 15.225(a), (b), (c), (d) ISED RSS-210 Issue 9 August 2016 (Amendment), Annex B.6 (a), (b), (c)	Pass
7	Transmitter Spurious Emissions Below 30MHz FCC Part 15 Subpart C:2018 15.209, 15.225(d) ISED RSS-210 Issue 9 August 2016 (Amendment), Annex B.6 (d)	Pass
8	Transmitter Spurious Emissions Above 30MHz FCC Part 15 Subpart C:2018 15.209, 15.225(d) ISED RSS-210 Issue 9 August 2016 (Amendment), Annex B.6 (d)	Pass
--	Receiver Spurious Emissions Below 30MHz FCC Part 15 Subpart B:2018 15.109 ISED RSS-Gen Issue 5 April 2018, Section 7.3	N/A*
9	Receiver Spurious Emissions Above 30MHz FCC Part 15 Subpart B:2018 15.109, CFR47 FCC Part 15 Subpart B:2018 ISED ICES-003 Issue 6 April 2017, ISED RSS-Gen Issue 5 April 2018, Section 7.3	Pass
--	20dB Bandwidth FCC Part 15 Subpart C:2018 15.215 ISED RSS-210 Issue 9 August 2016 (Amendment), Annex B.6 (d) ISED RSS-Gen Issue 5 April 2018, Section 6.7	Not performed**
--	Frequency Stability FCC Part 15 Subpart C:2018 15.225(e) ISED RSS-210 Issue 9 August 2016 (Amendment), Annex B.6 ISED RSS-Gen Issue 5 April 2018, Section 6.11	Not performed**
--	AC Mains Conducted Emissions FCC Part 15 Subpart C:2018 15.207 ISED RSS-Gen Issue 5 April 2018, Section 8.8, ISED ICES-003 Issue 6 April 2017	Not performed**
10	Revision History	--

* - No limits below 30 MHz
** - Limited testing was performed for Class II Permissive change based on original report 103382409BOX-010

3 Client Information

This EUT was tested at the request of:

Client: Fiber Mountain, Inc.
700 W Johnson Avenue
Cheshire, CT 06410
USA

Contact: David Stone
Telephone: 203-806-4048
Fax: None
Email: david@fibermountain.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Fiber Mountain, Inc.
700 W Johnson Avenue
Cheshire, CT 06410
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Sensus	Fiber Mountain, Inc.	SENSUS	5781328101429

Receive Date:	10/11/2018
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
The Sensus Fiber Port Aggregator chassis contains one management module and two fiber patching modules. An Ethernet interface provides management functions into the chassis to communicate with the onboard processor to enable LEDs to provide alarm and status information. It is powered by redundant 100-240 Vac internal power supplies by detachable cords for indoor use only or by Power Over Ethernet. The device is not containing the laser, but the fiber optic connections can be connect to external equipment which contains Class 1 or Class 1M laser.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
100-240 VAC	0.5 Amps	50/60 Hz	1

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Transmit mode
2	Receive/Idle mode

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	None

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

5 System Setup and Method

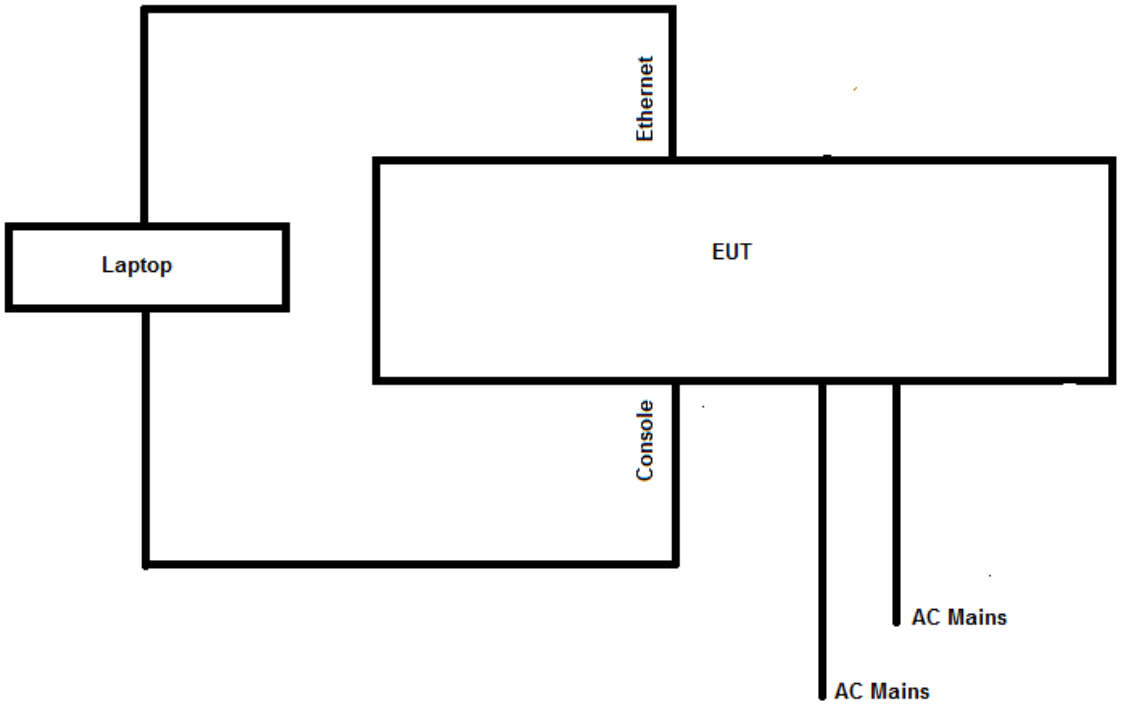
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
--	AC Mains	2	None	None	AC Mains
--	AC Mains	2	None	None	AC Mains
--	Ethernet Cable	10	No	None	Laptop
--	Console Cable	10+	No	None	Laptop
--	RJ 45 Loopback	3	None	None	EUT

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
HP Laptop	HP	TPN-C125	BOX1712180907

5.1 Method:

Configuration as required by CFR47 FCC Part 15 Subpart C:2018 Section 15.225, ISED RSS-210 Issue 9 August 2016 (Amendment), Annex B.6, ISED RSS-Gen Issue 5 April 2018, ANSI C63.10-2013, and ANSI C63.4:2014.

5.2 EUT Block Diagram:



6 Fundamental Radiated Emissions

6.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.225, ISED RSS-210. ANSI C63.10, and ANSI C63.4.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)} = 39.8\ \mu V/m$

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
BAR1	Digital 4 Line Barometer	Mannix	0ABA116	BAR1	04/30/2018	04/30/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/22/2018	03/22/2019
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2018	07/25/2019
ETS003'	9kHz-30MHz Active Loop Antenna	ETS Lindgren	6502	00143396	06/19/2018	06/19/2019

Software Utilized:

Name	Manufacturer	Version
None	--	--

6.3 Results:

The sample tested was found to Comply.

§15.225 Operation within the band 13.110-14.010 MHz.

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

Notes: The limit for ISED RSS-210 are identical to FCC Part 15.225.

6.4 Setup Photograph:

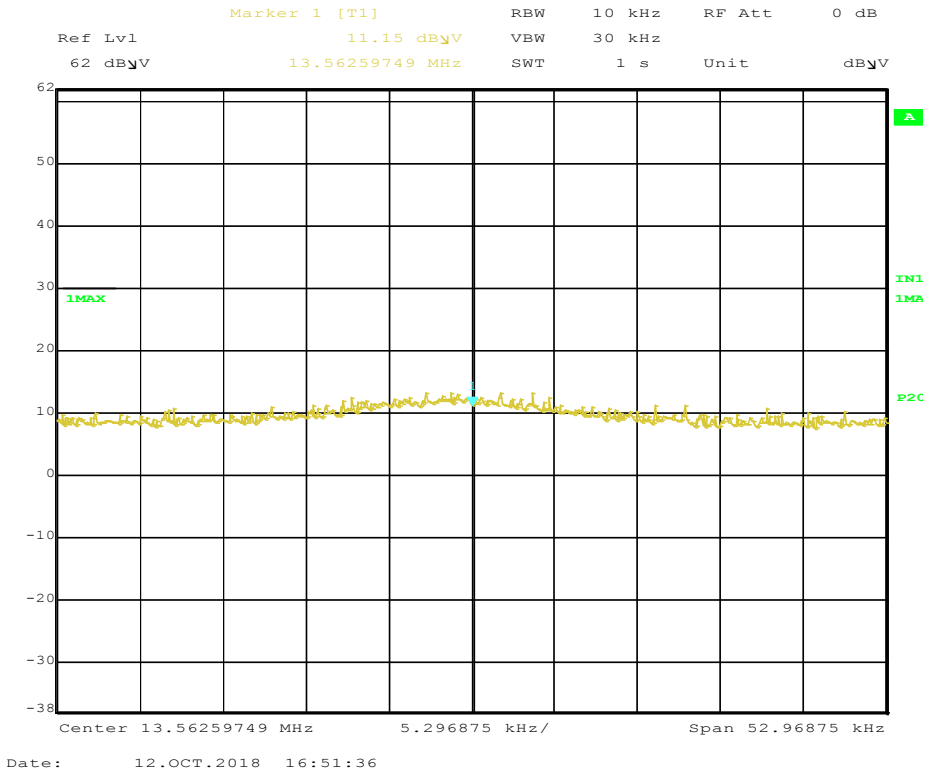
X-axis

Y-axis

Z-axis

6.5 Plots/Data:

Fundamental Radiated Field Strength



Radiated Emissions

Company: Fiber Mountain
Model #: SENSUS
Serial #: 5781328101429
Engineers: Vathana Ven
Project #: G103382409 Date(s): 10/12/18
Standard: FCC Part 15 Subpart C 15.225
Receiver: R&S ESI (145-128) 03-22-2019
PreAmp: NONE.

Antenna & Cables: N Bands: N, LF, HF, SHF
Antenna: ETS003_E field__6-19-19.txt ETS003_E field__6-19-19.txt
Cable(s): 145-416__7-25-19.txt CBLBNC7_1-10-19.txt
Location: 10M Barometer: BAR1 Filter: NONE
Temp/Humidity/Pressure: 20 deg C 42% 990 mB
Limit Distance (m): 30
Test Distance (m): 3

PreAmp Used? (Y or N): N Voltage/Frequency: 120VAC 60Hz Frequency Range: Fundamental frequency

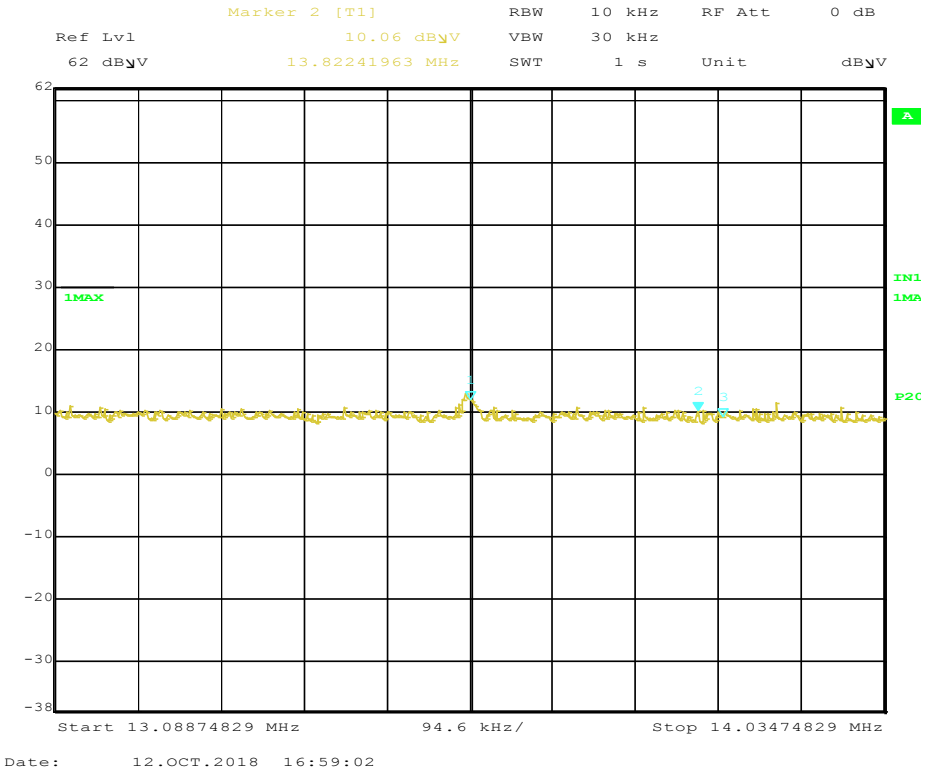
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Antenna on X-axis													
PK	X-axis	13.562	12.91	10.64	0.87	0.00	40.00	-15.58	84.00	-99.58	10/30 kHz		
Antenna on Y-axis													
PK	Y-axis	13.562	10.86	10.64	0.87	0.00	40.00	-17.63	84.00	-101.63	10/30 kHz		
Antenna on Z-axis													
PK	Z-axis	13.560	11.37	10.64	0.87	0.00	40.00	-17.12	84.00	-101.12	10/30 kHz		

Notes: Test was performed at 3 meters.

Out of Band Radiated Spurious Field Strength



Radiated Emissions

Company: Fiber Mountain
Model #: SENSUS
Serial #: 5781328101429
Engineers: Vathana Ven
Project #: G103382409 Date(s): 10/12/18
Standard: FCC Part 15 Subpart C 15.225
Receiver: R&S ESI (145-128) 03-22-2019 Limit Distance (m): 30
PreAmp: NONE. Test Distance (m): 3

Antenna & Cables: N Bands: N, LF, HF, SHF
Antenna: ETS003_E field__6-19-19.txt ETS003_E field__6-19-19.txt
Cable(s): 145-416__7-25-19.txt CBLBNC7_1-10-19.txt
Location: 10M Barometer: BAR1 Filter: NONE
Temp/Humidity/Pressure: 20 deg C 42% 990 mB

PreAmp Used? (Y or N): N Voltage/Frequency: 120VAC 60Hz Frequency Range: Fundamental frequency

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Out of band emissions													
PK	V	13.822	9.62	10.62	0.88	0.00	40.00	-18.88	84.00	-102.88	10/30 kHz		

Notes: Test was performed at 3 meters.

Test Personnel:	Vathana Ven VJV	Test Date:	10/12/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 47CFR Part 15.225 ISED RSS-210	Limit Applied:	See Report Section 6.3
Input Voltage:	120VAC 60Hz	Ambient Temperature:	20 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	42 %
		Atmospheric Pressure:	900 mbars

Deviations, Additions, or Exclusions: None

7 Transmitter Spurious Emissions Below 30MHz

7.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.225, ISED RSS-210. ANSI C63.10, and ANSI C63.4.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)} = 39.8\ \mu V/m$

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
BAR1'	Digital 4 Line Barometer	Mannix	0ABA116	BAR1	04/30/2018	04/30/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/22/2018	03/22/2019
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2018	07/25/2019
CBLBNC7'	30 ft 50 ohm coax, BNC - BNC	ITT Pomona	RG 58 C/U	CBLBNC7	01/18/2018	01/18/2019
ETS003'	9kHz-30MHz Active Loop Antenna	ETS Lindgren	6502	00143396	06/19/2018	06/19/2019

Software Utilized:

Name	Manufacturer	Version
None	--	--

7.3 Results:

The sample tested was found to Comply.

§15.225 Operation within the band 13.110-14.010 MHz.

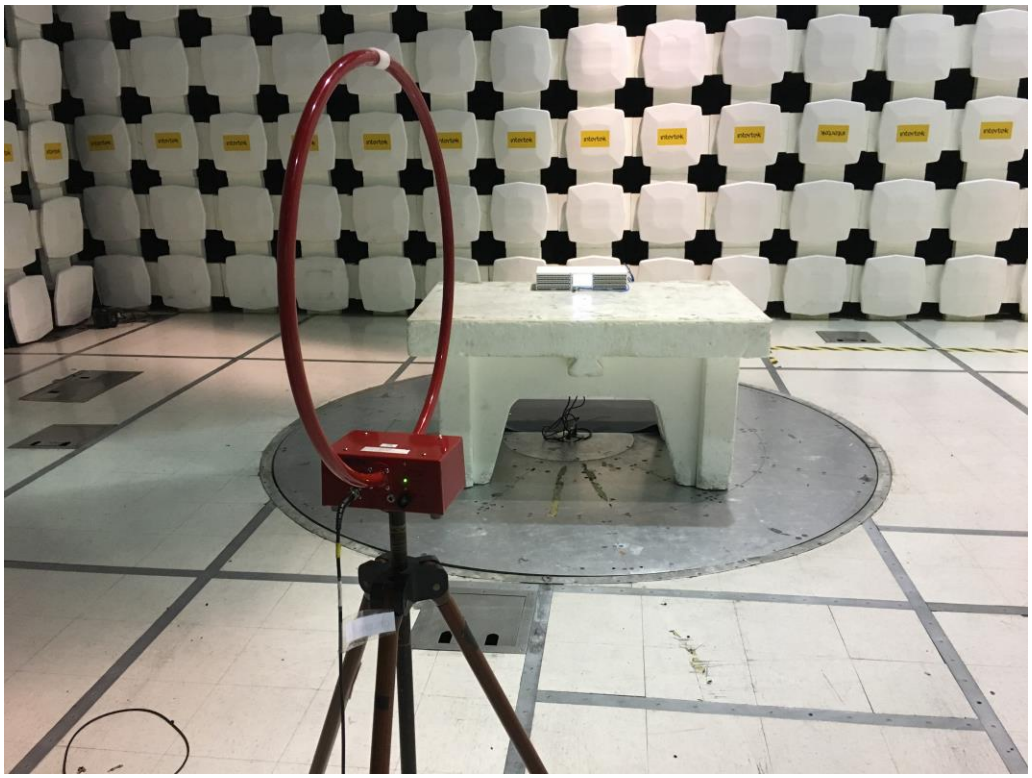
(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

Notes: The limit for ISED RSS-210 are identical to FCC Part 15.225.

7.4 Setup Photograph:

X-axis

Y-axis



Z-axis

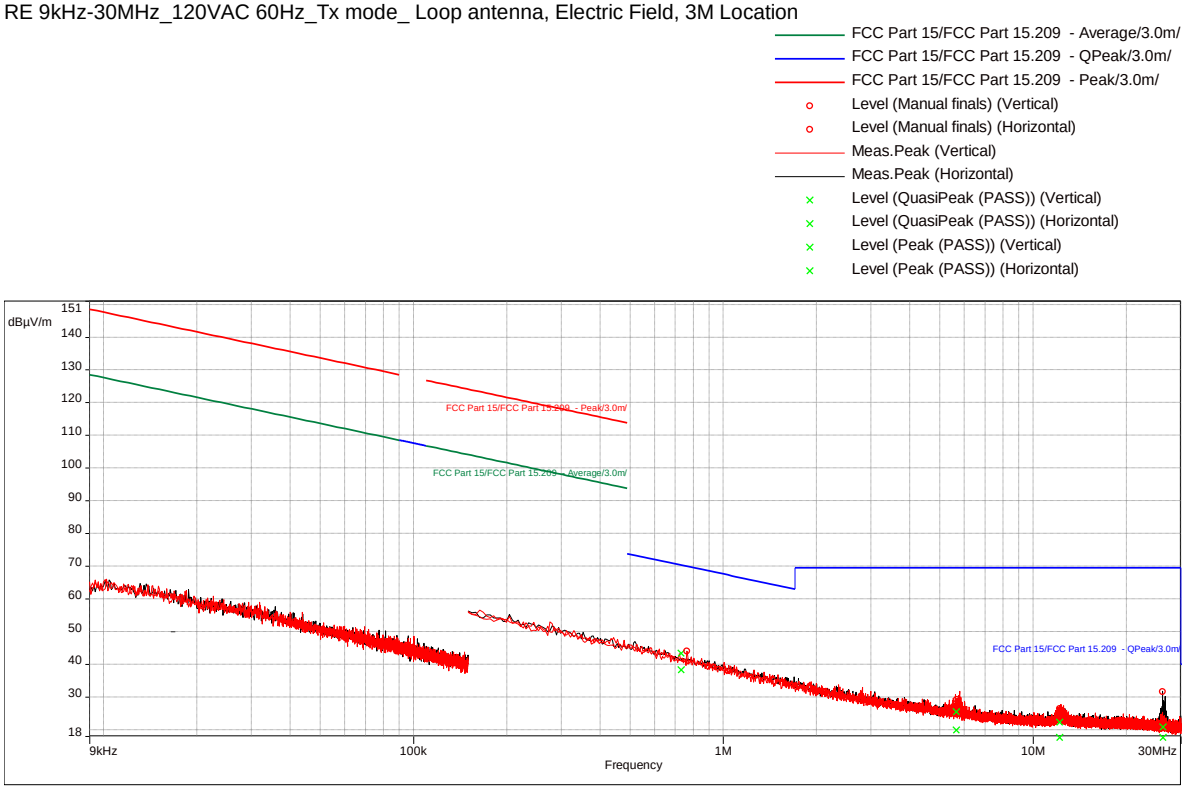
7.5 Plots/Data:

Test Information:

Date and Time	10/11/2018 8:49:06 PM
Client and Project Number	Fiber Mountain_Qu-00923259
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	53%
Atmospheric Pressure	993 mB
Comments	RE 9kHz-30MHz_120VAC 60Hz_Tx mode_ Loop antenna, Electric Field, 3M Location

Graph:

RE 9kHz-30MHz_120VAC 60Hz_Tx mode_ Loop antenna, Electric Field, 3M Location



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
0.7288421053	43.32	70.33	-27.01	284.00	1.00	Vertical	9000.00	11.30
5.656815789	25.51	69.54	-44.03	225.00	1.00	Horizontal	9000.00	11.52
12.17328947	22.32	69.54	-47.22	255.00	1.00	Horizontal	9000.00	11.49
26.23034211	20.78	69.54	-48.76	337.00	1.00	Horizontal	9000.00	10.09

QuasiPeak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
0.7288421053	38.24	70.33	-32.09	284.00	1.00	Vertical	9000.00	11.30
5.656815789	19.94	69.54	-49.60	225.00	1.00	Horizontal	9000.00	11.52
12.17328947	15.18	69.54	-54.36	255.00	1.00	Horizontal	9000.00	11.49
26.23034211	13.15	69.54	-56.39	337.00	1.00	Horizontal	9000.00	10.09

Test Personnel:	Vathana Ven VJV	Test Date:	10/11/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 47CFR Part 15.225 ISED RSS-210	Limit Applied:	See Report Section 7.3
Input Voltage:	120VAC 60Hz	Ambient Temperature:	20 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	53 %
		Atmospheric Pressure:	993 mbars

Deviations, Additions, or Exclusions: None

8 Transmitter Spurious Emissions Above 30MHz

8.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.225, ISED RSS-210, RSS-GEN, and ANSI C63.4, and ANSI C63.10.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	5.6 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.9 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.4 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.9 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.6 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.6 dB	N/A

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)} = 39.8\ \mu V/m$

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV002'	Weather Station	Davis Instruments	7400	PE80519A93	06/14/2017	06/14/2018
PRE11'	50dB gain pre-amp	Keith H	PRE11	PRE11	12/02/2017	12/02/2018
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	05/31/2017	05/31/2018
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/22/2018	03/22/2019
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2017	07/25/2018

Software Utilized:

Name	Manufacturer	Version
BAT.EMC	Nexio	3.16.0.69

8.3 Results:

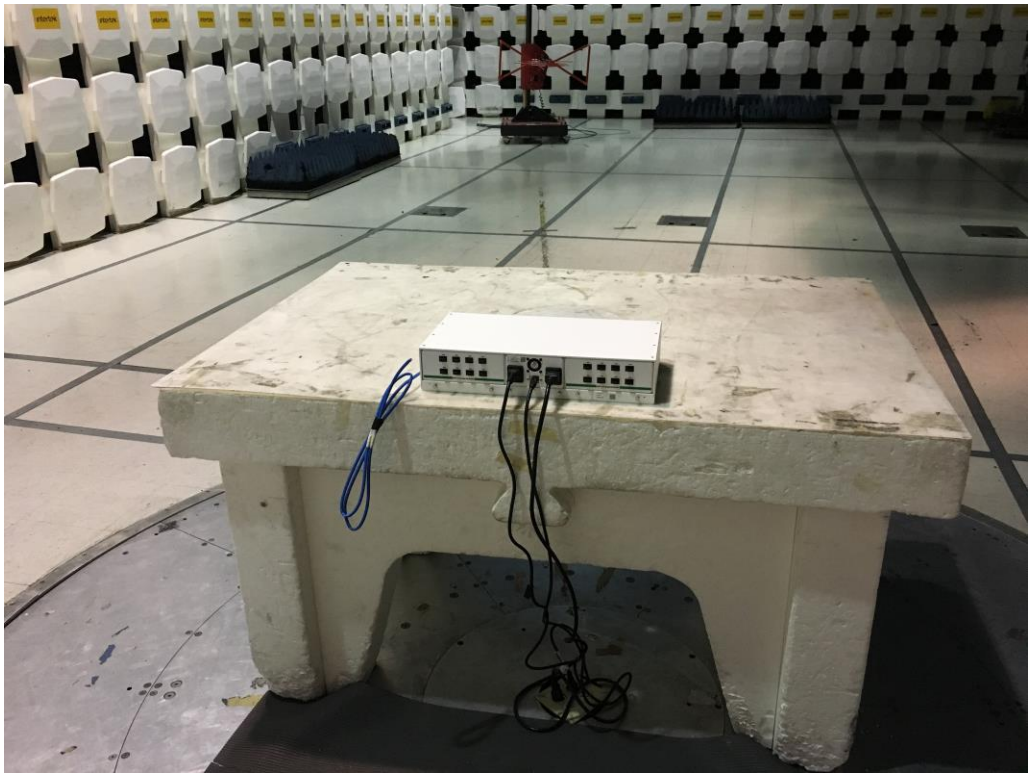
The sample tested was found to Comply.

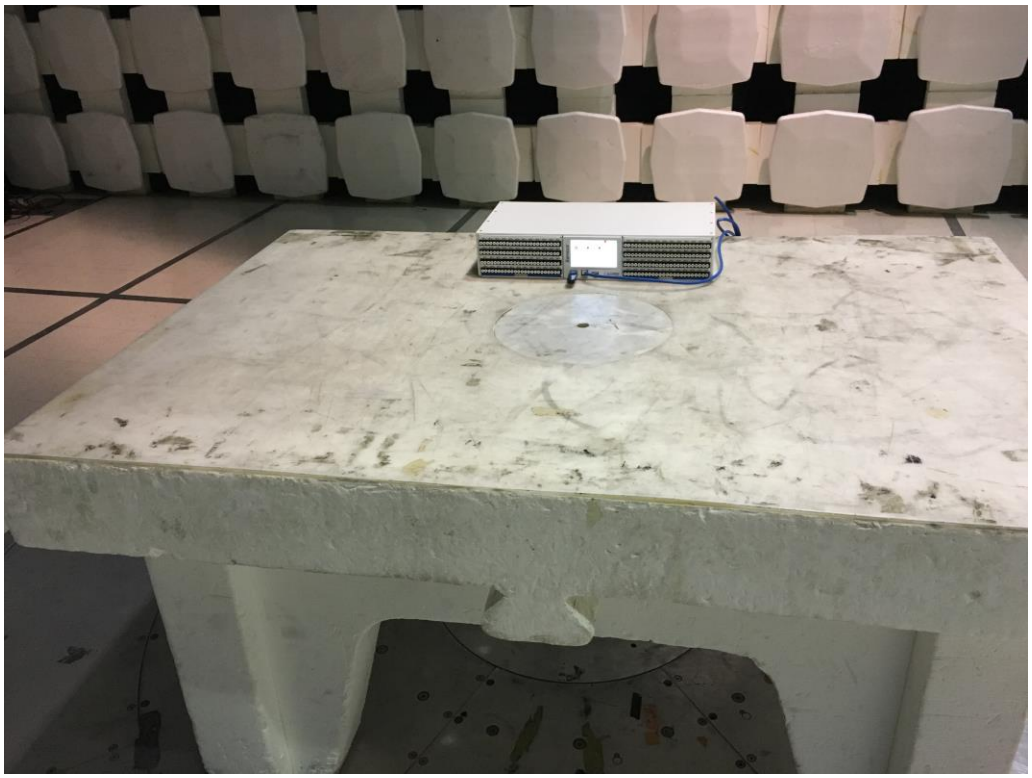
§15.225 Operation within the band 13.110-14.010 MHz.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

Notes: The limit for ISED RSS-210 are identical to FCC Part 15.225.

8.4 Setup Photographs:





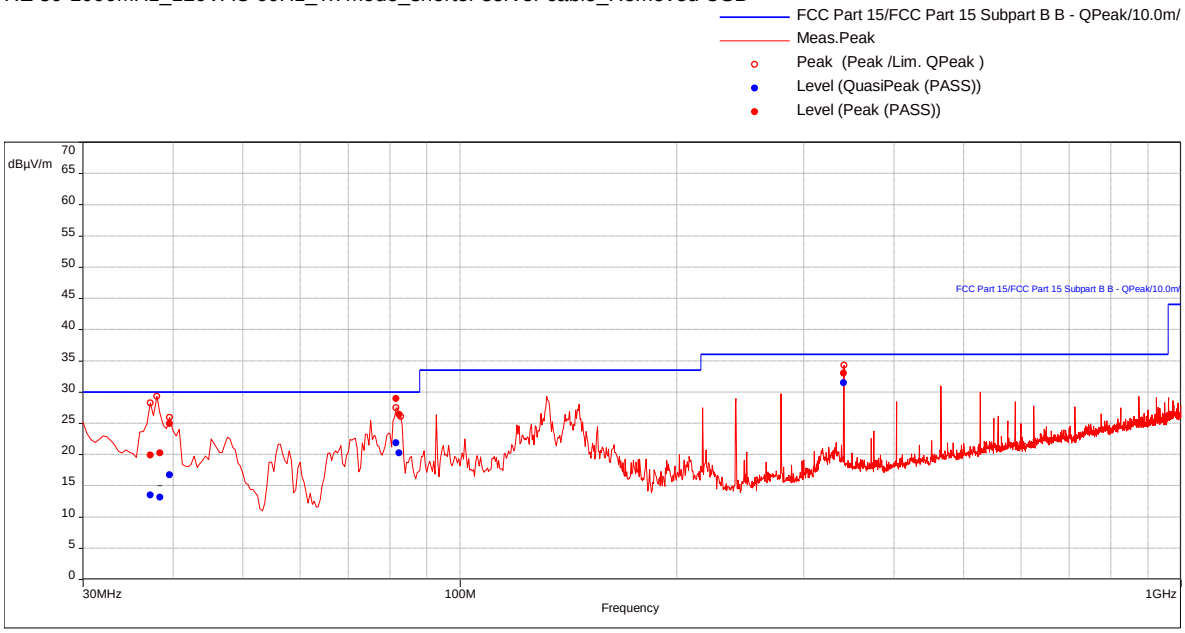
8.5 Plots/Data:

Test Information:

Date and Time	10/11/2018 7:12:03 PM
Client and Project Number	Fiber Mountain_Qu-00923259
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	53%
Atmospheric Pressure	993 mB
Comments	RE 30-1000MHz_120VAC 60Hz_Tx mode_shorter server cable_Removed USB

Graph:

RE 30-1000MHz_120VAC 60Hz_Tx mode_shorter server cable_Removed USB



Results:

QuasiPeak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
37.38947368	13.48	30.00	-16.52	33.00	3.74	Vertical	120000.00	-27.40
38.34736842	13.16	30.00	-16.84	40.00	1.99	Vertical	120000.00	-28.10
39.66315789	16.73	30.00	-13.27	34.00	2.48	Vertical	120000.00	-29.07
81.56842105	21.82	30.00	-8.18	356.00	3.89	Vertical	120000.00	-36.00
82.45263158	20.21	30.00	-9.79	108.00	4.00	Vertical	120000.00	-36.00
340.9789474	31.44	36.00	-4.56	294.00	3.44	Horizontal	120000.00	-26.79

Note: The client claimed that the USB port is intended to be used for diagnostics only.

Test Personnel:	Vathana Ven	Test Date:	10/11/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 47CFR Part 15.225 ISED RSS-210	Limit Applied:	See report section 8.3
Input Voltage:	120VAC 60Hz	Ambient Temperature:	20 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	53 %
		Atmospheric Pressure:	993 mbars

Deviations, Additions, or Exclusions: None

9 Receiver Spurious Emissions Above 30MHz

9.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.225, ISED RSS-210, RSS-GEN, and ANSI C63.4, and ANSI C63.10.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	5.6 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.9 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.4 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.9 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.6 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.6 dB	N/A

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
BAR1'	Digital 4 Line Barometer	Mannix	0ABA116	BAR1	04/30/2018	04/30/2019
PRE11'	50dB gain pre-amp	Keith H	PRE11	PRE11	12/02/2017	12/02/2018
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/16/2018	05/16/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/22/2018	03/22/2019
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2018	07/25/2019
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/25/2018	07/25/2019
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	06/14/2018	06/14/2019
ETS005'	1-18GHz horn antenna	ETS-Lindgren	3117	00218279	05/14/2018	05/14/2019

Software Utilized:

Name	Manufacturer	Version
BAT.EMC	Nexio	3.16.0.69

9.3 Results:

The sample tested was found to Comply.

§15.109 Radiated emission limits.

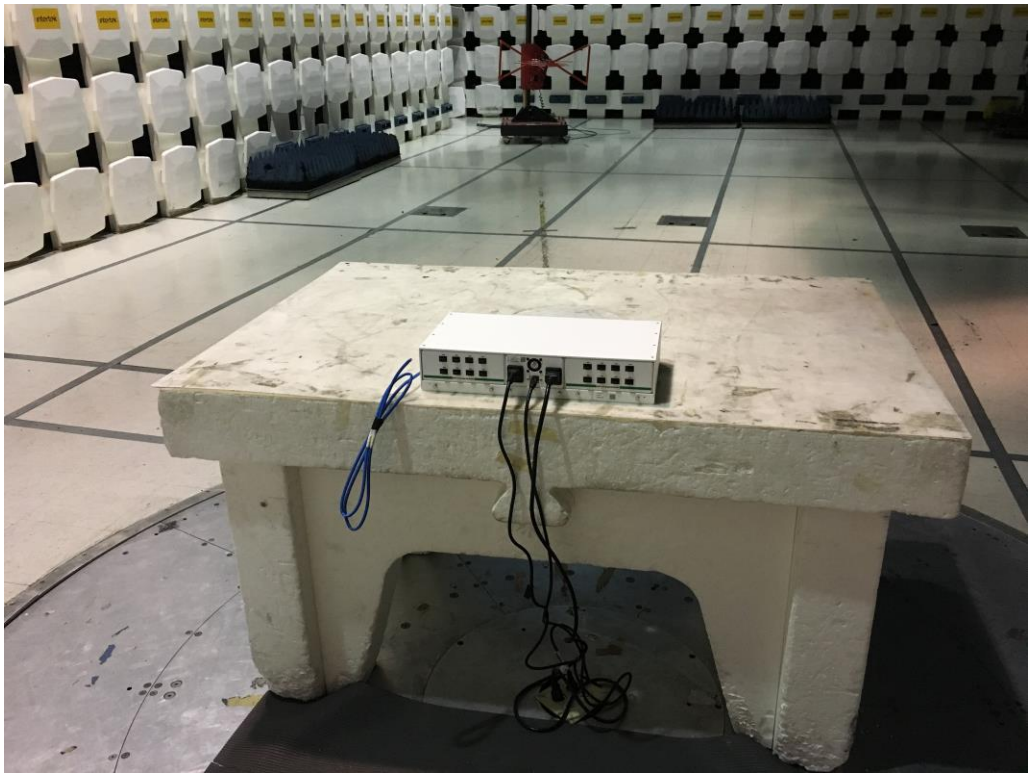
(a) The field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

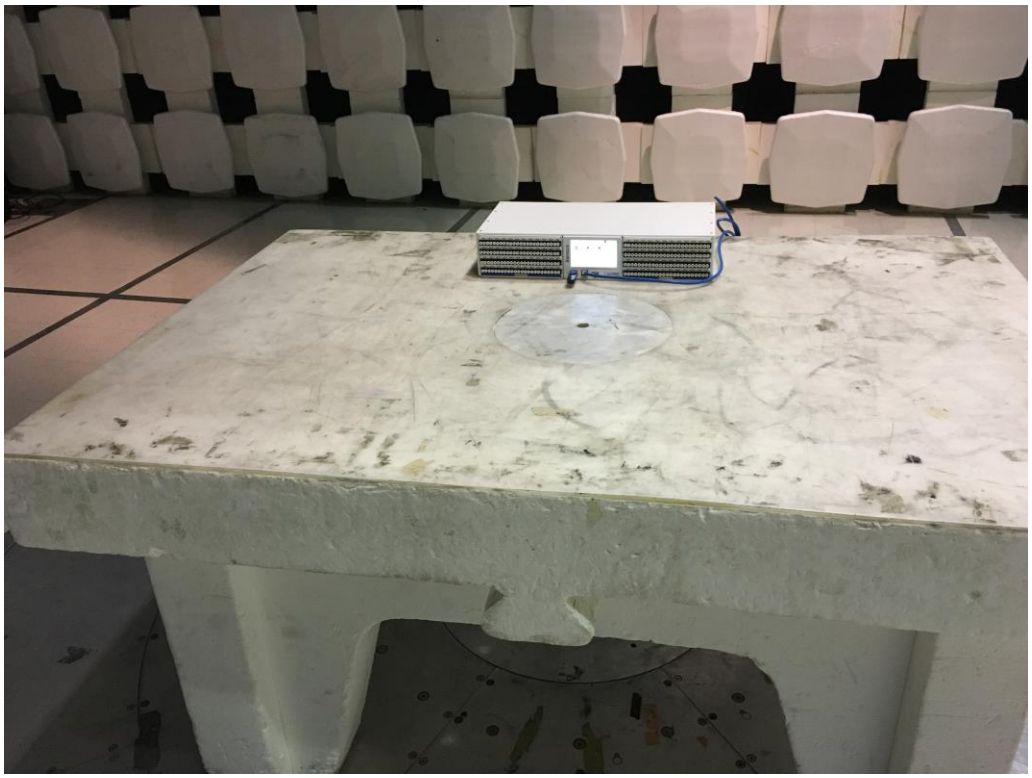
Frequency of emission (MHz)	Field strength (microvolts/meter)
30-88	100
88-216	150
216-960	200
Above 960	500

Notes: The limit for ISED RSS-210 are identical to FCC Part 15.225.

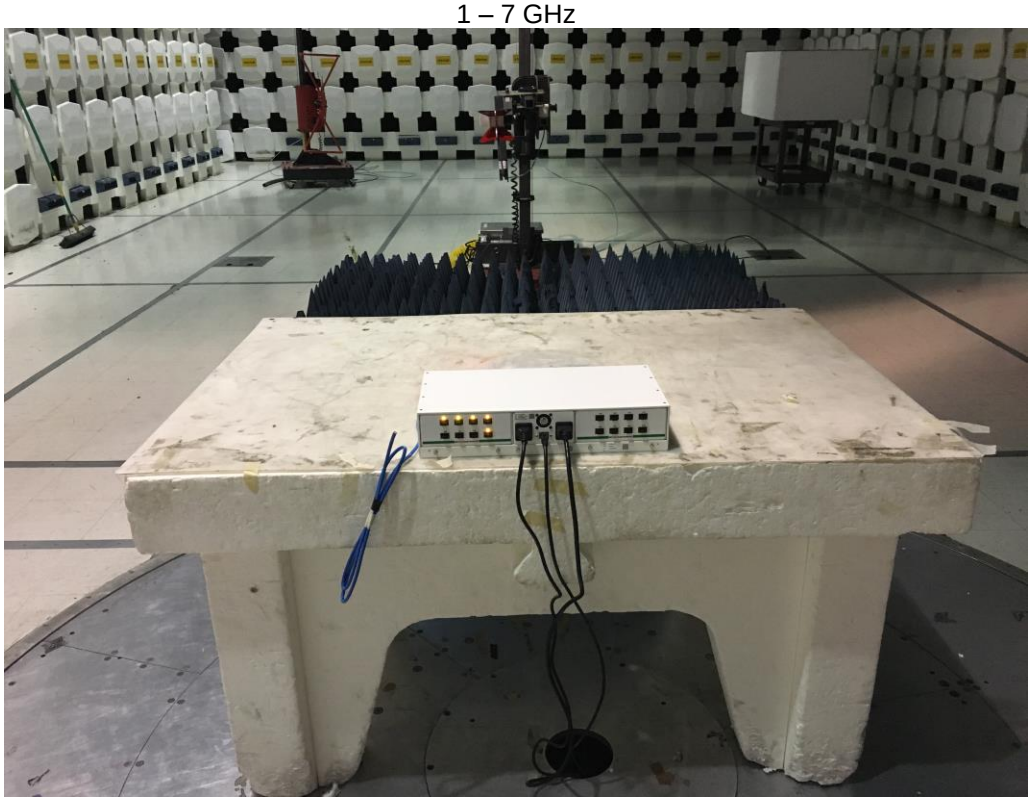
9.4 Setup Photographs:

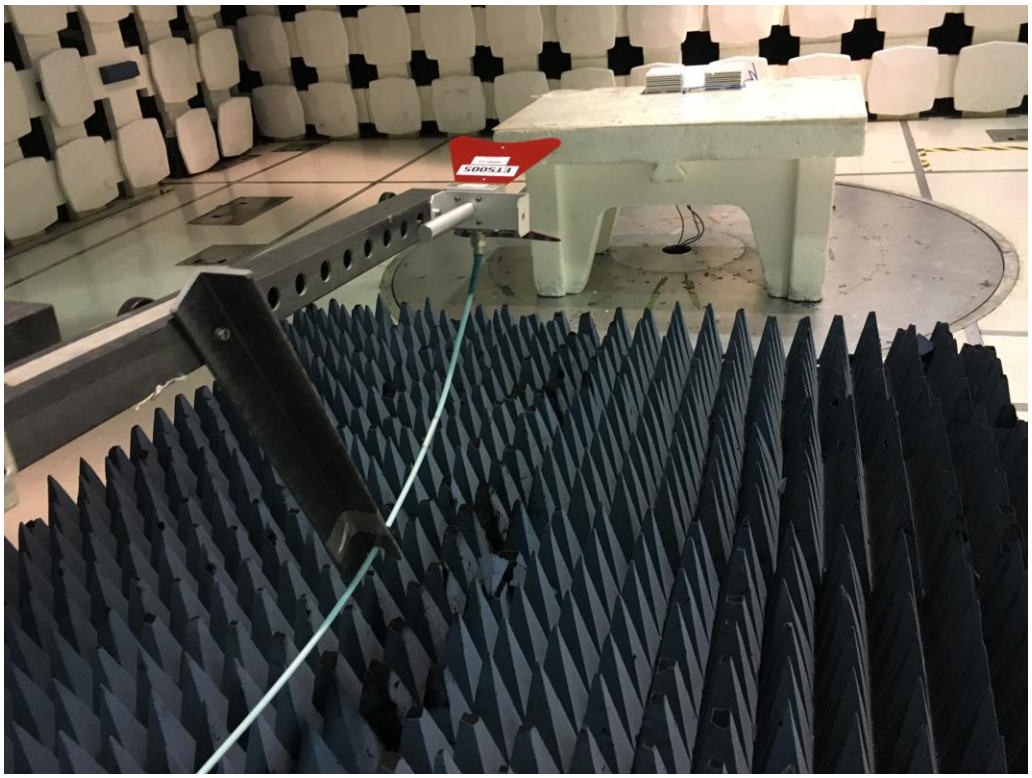
30 – 1000 MHz





1 – 7 GHz





9.5 Plots/Data:

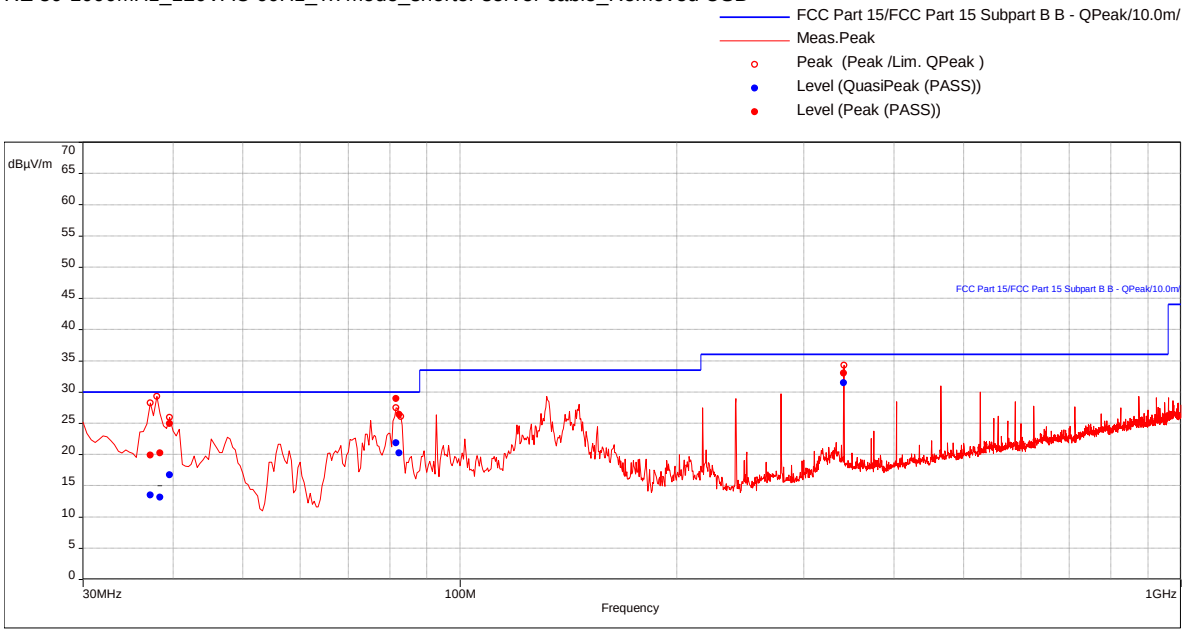
30 – 1000 MHz

Test Information:

Date and Time	10/11/2018 7:12:03 PM
Client and Project Number	Fiber Mountain_Qu-00923259
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	53%
Atmospheric Pressure	993 mB
Comments	RE 30-1000MHz_120VAC 60Hz_Tx mode_shorter server cable_Removed USB

Graph:

RE 30-1000MHz_120VAC 60Hz_Tx mode_shorter server cable_Removed USB



Results:

QuasiPeak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
37.38947368	13.48	30.00	-16.52	33.00	3.74	Vertical	120000.00	-27.40
38.34736842	13.16	30.00	-16.84	40.00	1.99	Vertical	120000.00	-28.10
39.66315789	16.73	30.00	-13.27	34.00	2.48	Vertical	120000.00	-29.07
81.56842105	21.82	30.00	-8.18	356.00	3.89	Vertical	120000.00	-36.00
82.45263158	20.21	30.00	-9.79	108.00	4.00	Vertical	120000.00	-36.00
340.9789474	31.44	36.00	-4.56	294.00	3.44	Horizontal	120000.00	-26.79

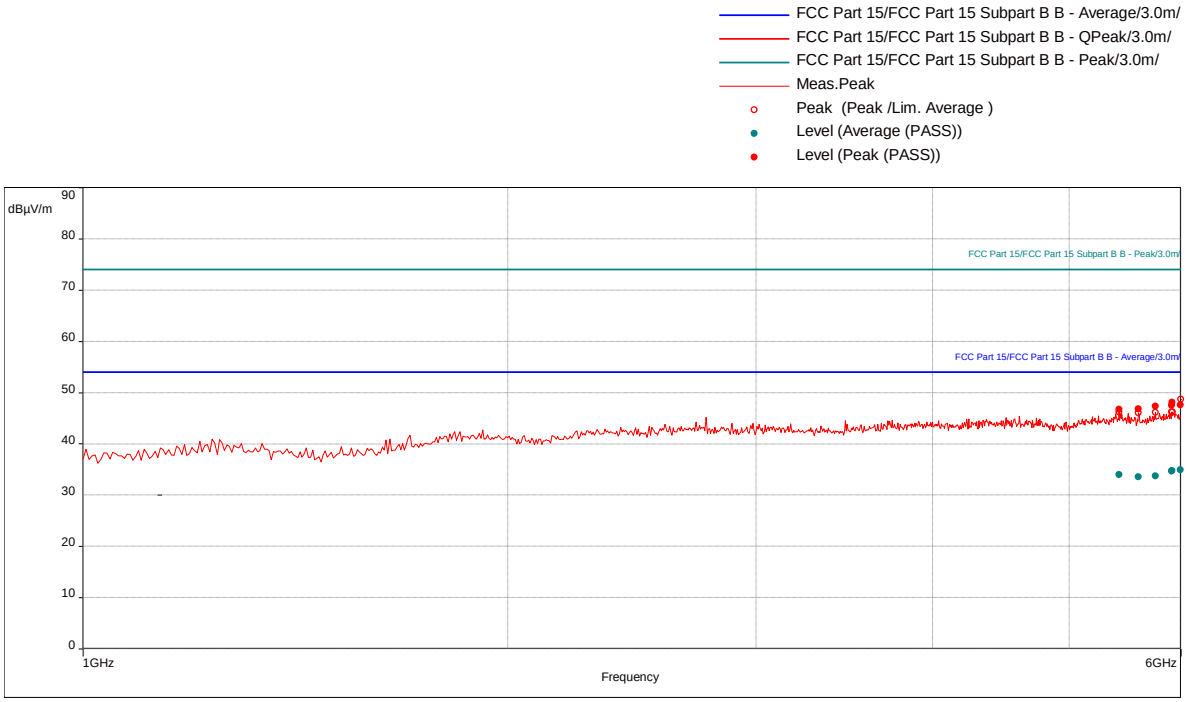
Notes: The receiver emissions are identical to transmitter emissions as both the receiver and transmitter were active during testing.

1 – 7 GHz

Test Information:

Date and Time	10/12/2018 8:09:57 PM
Client and Project Number	Fiber Mountain_Qu-00923259
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	53%
Atmospheric Pressure	993 mB
Comments	RE 1 to 6 GHz_120VAC 60Hz, manual scan was done from 6 to 7 GHz

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
5425.789474	46.73	74.00	-27.27	78.00	2.78	Horizontal	1000000.00	9.49
5598.684211	46.84	74.00	-27.16	4.00	3.51	Vertical	1000000.00	9.32
5755.263158	47.33	74.00	-26.67	204.00	1.90	Vertical	1000000.00	9.55
5908.684211	47.51	74.00	-26.49	247.00	3.01	Vertical	1000000.00	10.12
5916.315789	48.06	74.00	-25.94	182.00	2.78	Vertical	1000000.00	10.15
5996.052632	47.58	74.00	-26.42	107.00	2.16	Vertical	1000000.00	10.33

Average (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
5425.789474	34.01	54.00	-19.99	78.00	2.78	Horizontal	1000000.00	9.49
5598.684211	33.58	54.00	-20.42	4.00	3.51	Vertical	1000000.00	9.32
5755.263158	33.72	54.00	-20.28	204.00	1.90	Vertical	1000000.00	9.55
5908.684211	34.65	54.00	-19.35	247.00	3.01	Vertical	1000000.00	10.12
5916.315789	34.75	54.00	-19.25	182.00	2.78	Vertical	1000000.00	10.15
5996.052632	34.94	54.00	-19.06	107.00	2.16	Vertical	1000000.00	10.33

Test Personnel:	Vathana Ven VJV	Test Date:	10/12/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 47CFR Part 15.225 ISED RSS-210	Limit Applied:	See Report Section 9.3
Input Voltage:	120VAC 60Hz	Ambient Temperature:	20 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	53 %
		Atmospheric Pressure:	993 mbars

Deviations, Additions, or Exclusions: None

10 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	10/17/2018	103382409BOX-020	VFV VFV	KPS KPS	Original Issue