TEST REPORT

Report Number: 103197759MIN-004
Project Number: G103197759

Testing performed on the
KeyMe Kiosk

FCC ID: 2AOGB-KME0003540

to
47 CFR Part 15.209; Part 15.215:2017
RSS- Gen, Issue 4, 2015
RSS- 210, Issue 8, Amendment 1; 2015
47 CFR, Part 15:2017, §15.107 and §15.109, Class A / ICES-003, Issue 6:2016

For
Benchmark Electronics, Inc.

Test Performed by:
Intertek Testing Services NA, Inc.
7250 Hudson Blvd., Suite 100
Oakdale, MN 55128 USA

Test Authorized by:
Benchmark Electronics, Inc.
8 Pine Tree Drive Suite 200
Arden Hills, MN 55112 USA

Prepared by: _____
Simon Khazon

Reviewed by: _____
Norman Shpilsher

Date of issue: November 10, 2017

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1.0 GENERAL DESCRIPTION

Model:	KeyMe Kiosk
Type of EUT:	Key Station
FCC ID:	2AOGB-KME0003540
IC:	
Related Submittal(s) Grants:	None
Company:	Benchmark Electronics, Inc.
Customer:	Mr. Erik Morness
Address:	8 Pine Tree Drive Suite 200 Arden Hills, MN 55112 USA
Phone:	+1 (651) 757-4425
e-mail:	erik.morness@bench.com
Test Standards:	☒ 47 CFR, Part 15:2017, §15.209, §15.215 ☒ RSS- 210, Issue 8, Amendment 1; 2015 ☒ RSS-Gen, Issue 4, 2015 ☐ 47 CFR, Part 15:2010, §15.107 and §15.109, Class A ☐ ICES-003, Issue 4:2004 ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	November 6, 2017
Test Work Started:	November 6, 2017
Test Work Completed:	November 8, 2017
Test Sample Conditions:	☐ Damaged ☐Poor (Usable) ☒ Good

1.1 Product Description; Test Facility

Product Description:	125 / 134.5kHz Transmitter
Operating Frequency	125kHz 134.5kHz
Modulation:	ASK
Emission Designator:	1K6A1D
Antenna(s) Info:	Antenna 1 for 125kHz: Type Loop Antenna 2 for 134.5kHz: Type Loop
Antenna Installation:	☐ User ☐ Professional ☐ Factory
Transmitter Power Configuration:	☐ Internal battery ☐ External power source ☒ 5 VDC from Kiosk PS ☐ Other:
Special Test Arrangement:	As a hand-held device the EUT was rotated through three orthogonal axes to determine and tested with the maximum emissions
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2013

1.2 EUT Configuration

The equipment under test was operated during the measurement under the following conditions:

☐ - Standby
☐ - Continuous
☐ - Continuous un-modulated
☐ - Test program (customer specific)
☐ -

Operating modes of the EUT:

No.	Description
1	The transmitter was set to transmit continuously at both frequencies.
2	

Cables:

No.	Type	Length	Designation	Note
1	3 wires, unshielded	1.6 m	AC Power	
2				

Support equipment/Services:

No.	Item	Description
1	Laptop Computer	Local PC for some tests performed on the radio set outside of the kiosk.
2		

1.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

☒ **Normal**

Temperature: 15-35°C

Humidity: 30-60%

Atmospheric pressure: 86-106kPa

1.4 Measurement uncertainty

The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be: ±4 dB at 10m and ±5.4 dB at 3m

The expanded uncertainty (k = 2) for radiated emissions above 1GHz has been determined to be: ±6.4 dB at 3m

The expanded uncertainty (k = 2) for conducted emissions from 150 kHz to 30 MHz has been determined to be:
±2.6 dB

1.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:
FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(m^{-1})
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(µV) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(µV/m).

RA = 48.1 dB(µV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(µV/m)

General notes: None

2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

TEST SPECIFICATION	TEST PARAMETERS	RESULT
15.209, 15.215(b) / RSS-Gen 4.11	Field Strength of Fundamental and Spurious Emissions	Pass
15.215(c) / RSS-Gen 4.6.3	Bandwidth of the emission	Pass
15.207/RSS-Gen 7.2.4	Transmitter Power Line conducted emissions	Pass
15.109/ICES-003/ RSS-Gen 4.10	Digital device radiated emissions	Pass
15.107/ ICES-003	Digital device conducted emissions	Pass

3.0 TEST CONDITIONS AND RESULTS

3.1 Field Strength of Fundamental

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Max. Emissions margin at fundamental: **125 kHz –** 0.3dB below the limits
Max. Emissions margin at fundamental: **134.5 kHz –** 10.1dB below the limits

Notes:

1. Field strength measurements at Fundamental frequencies were performed at measurements distance at 1m and compared with the limits at 10 m (see Table 3.1.1).
2. Measurements were taken using Peak detector with RBW=200kHz and VBW= 300Hz

Date:	November 6-8, 2017	**Result: Pass**
Tested by:	Simon Khazon	
Standard:	FCC 15.209 / RSS-210 A1.1.2	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 38%(RH); 96.5kPa	
Equipment Verification:	☒	
Note:	None	

Table 3.1.1

Frequency MHz	Antenna Orient.	Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Peak Reading dBµV	Total @ 10m dBµV/m	15.209 Limit dBµV/m	Distance Factor (dB)	Limits at 10m dBµV/m	Margin dB
0.125	Side	63.2	0.1	28.8	49.7	84.2	25.7	59.1	84.8	-0.5
0.125	Front	63.2	0.1	28.8	49.9	84.4	25.7	59.1	84.8	-0.3
0.135	Side	62.7	0.1	28.8	39.8	73.8	25.0	59.1	84.1	-10.3
0.135	Front	62.7	0.1	28.8	40.0	74.0	25.0	59.1	84.1	-10.1

3.2 Spurious Emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Max. Margin of harmonics and spurious emissions: **2.8**dB below the limits

Notes:

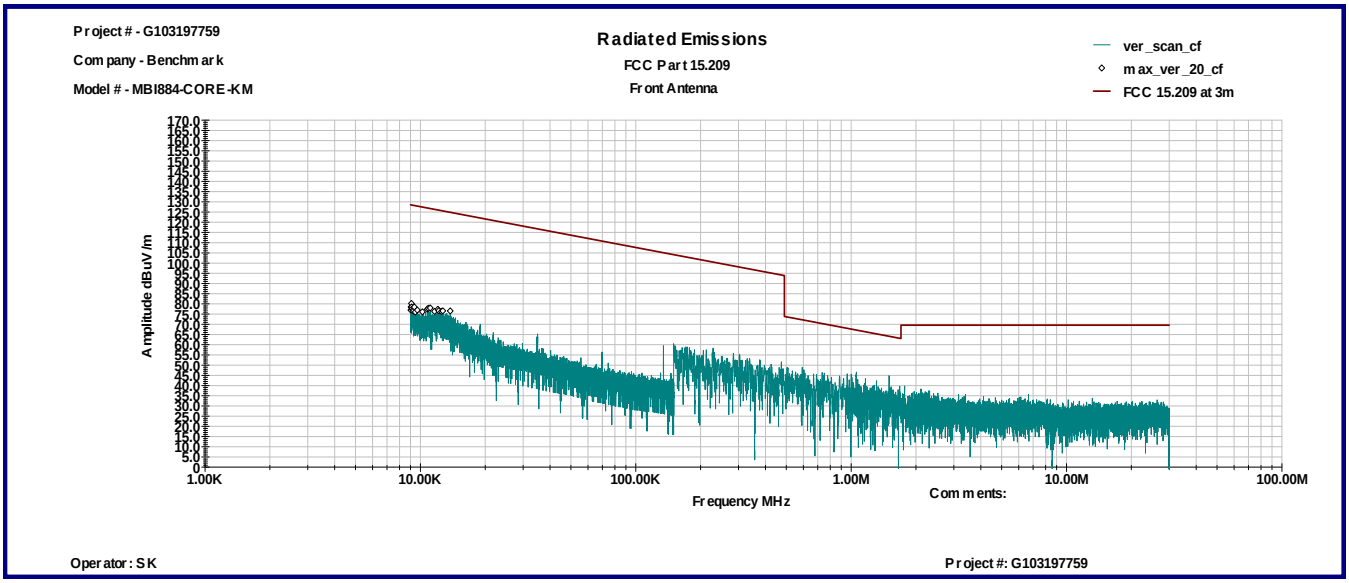
1. The Emissions scan was performed in the Anechoic chamber at 3m measurement distance (see Table 3.2.1 and Graphs 3.2.1 - 3.2.4)
2. No Spurious Emissions below 30MHz were detected (See Graphs 3.2.1 - 3.2.2)

Date:	November 6-8, 2017	**Result: Pass**
Tested by:	Simon Khazon	
Standard:	FCC 15.209 / RSS-210 A1.1.2	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 38%(RH); 96.5kPa	
Equipment Verification:	☒	
Note:	None	

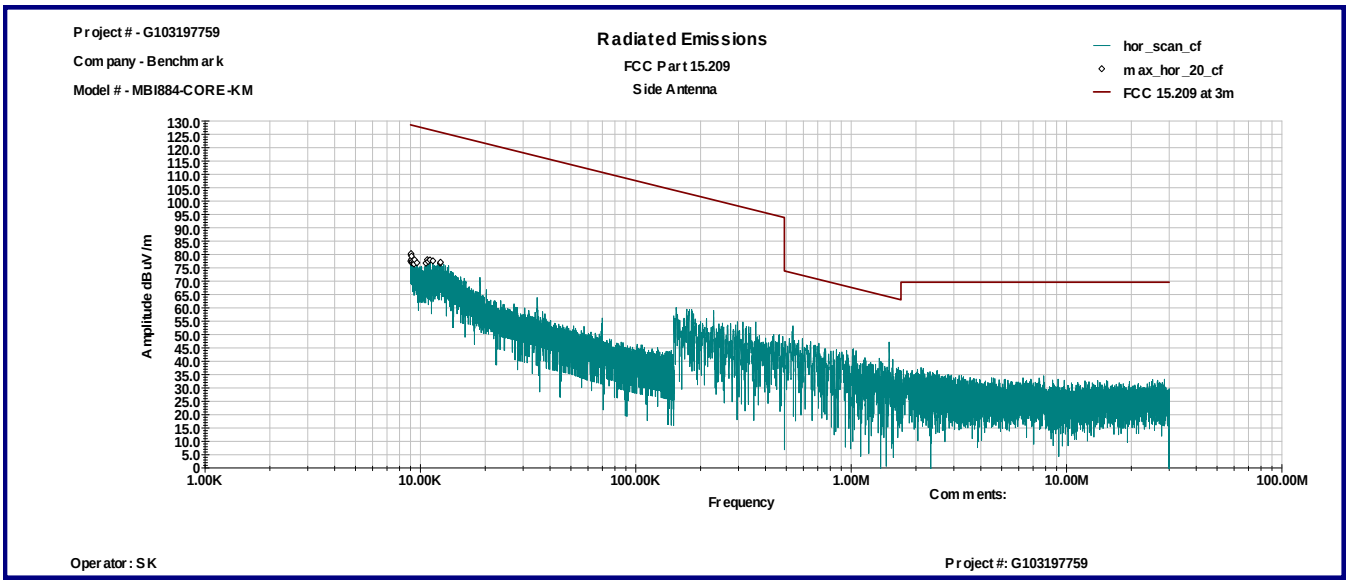
Table 3.2.1

Frequency MHz	Antenna Polarity	Peak Reading dBµV	Total C.F. dB1/m	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
87.987 MHz	V	26.9	9.9	36.7	40.0	-3.3
96.046 MHz	V	27.1	11.8	38.9	43.5	-4.6
104.03 MHz	V	27.8	12.9	40.7	43.5	-2.8
108.06 MHz	V	22.4	13.5	35.9	43.5	-7.7
112.01 MHz	V	23.0	13.7	36.7	43.5	-6.8
128.06 MHz	V	20.4	13.9	34.3	43.5	-9.2
136.04 MHz	V	20.6	13.5	34.1	43.5	-9.4
147.93 MHz	V	21.1	12.8	33.9	43.5	-9.7
159.98 MHz	V	23.3	12.0	35.4	43.5	-8.2
164.0 MHz	V	24.1	11.9	35.9	43.5	-7.6
168.02 MHz	V	22.8	11.7	34.5	43.5	-9.1
339.83 MHz	V	23.7	16.9	40.6	46.0	-5.5
347.79 MHz	V	20.9	17.3	38.2	46.0	-7.8
355.76 MHz	V	19.9	17.8	37.7	46.0	-8.3
881.17 MHz	V	12.9	25.1	38.0	46.0	-8.0
96.046 MHz	H	23.9	11.8	35.7	43.5	-7.8
104.03 MHz	H	25.9	12.9	38.8	43.5	-4.7
128.06 MHz	H	21.8	13.9	35.7	43.5	-7.8
136.04 MHz	H	23.1	13.5	36.6	43.5	-6.9
220.11 MHz	H	24.4	12.1	36.5	46.0	-9.5
227.98 MHz	H	25.4	12.7	38.1	46.0	-7.9
236.02 MHz	H	26.4	13.5	39.9	46.0	-6.1
244.06 MHz	H	27.3	14.2	41.6	46.0	-4.5
252.1 MHz	H	23.8	14.9	38.7	46.0	-7.3
260.13 MHz	H	20.8	15.9	36.7	46.0	-9.4
280.07 MHz	H	21.6	15.5	37.0	46.0	-9.0
288.1 MHz	H	22.3	15.5	37.7	46.0	-8.3
296.14 MHz	H	20.7	15.8	36.4	46.0	-9.6
315.93 MHz	H	22.4	16.4	38.8	46.0	-7.2
323.9 MHz	H	22.5	16.6	39.1	46.0	-6.9
331.86 MHz	H	24.6	16.8	41.4	46.0	-4.7
336.02 MHz	H	19.7	16.9	36.6	46.0	-9.5
339.83 MHz	H	23.7	16.9	40.6	46.0	-5.5

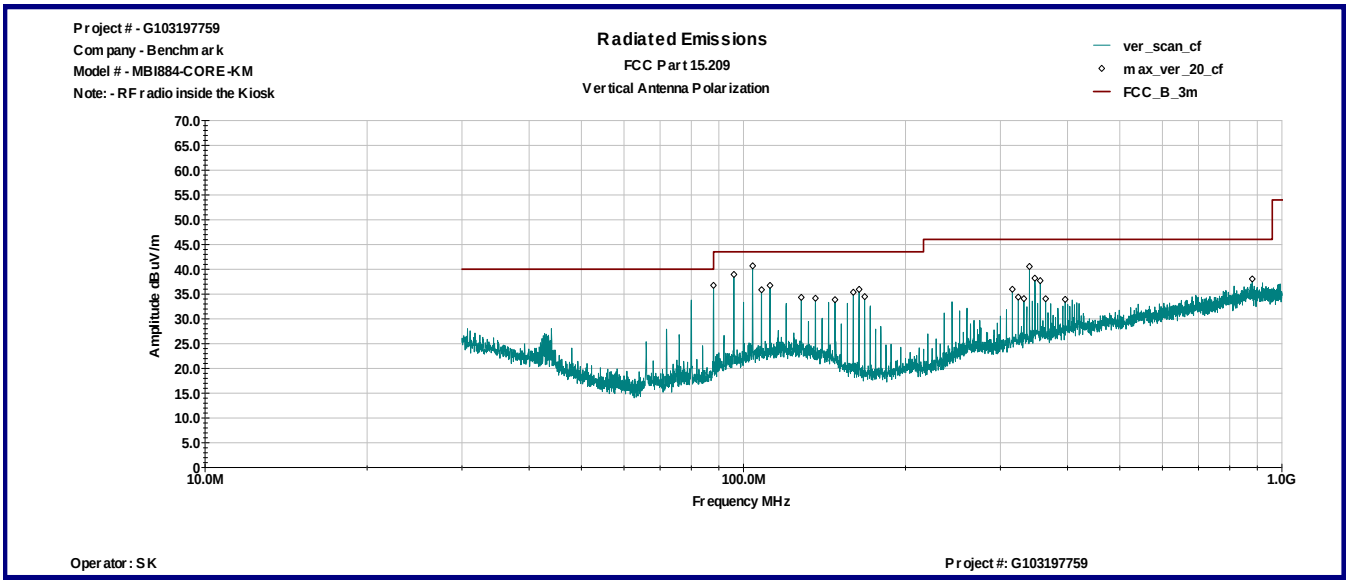
Graph 3.2.1



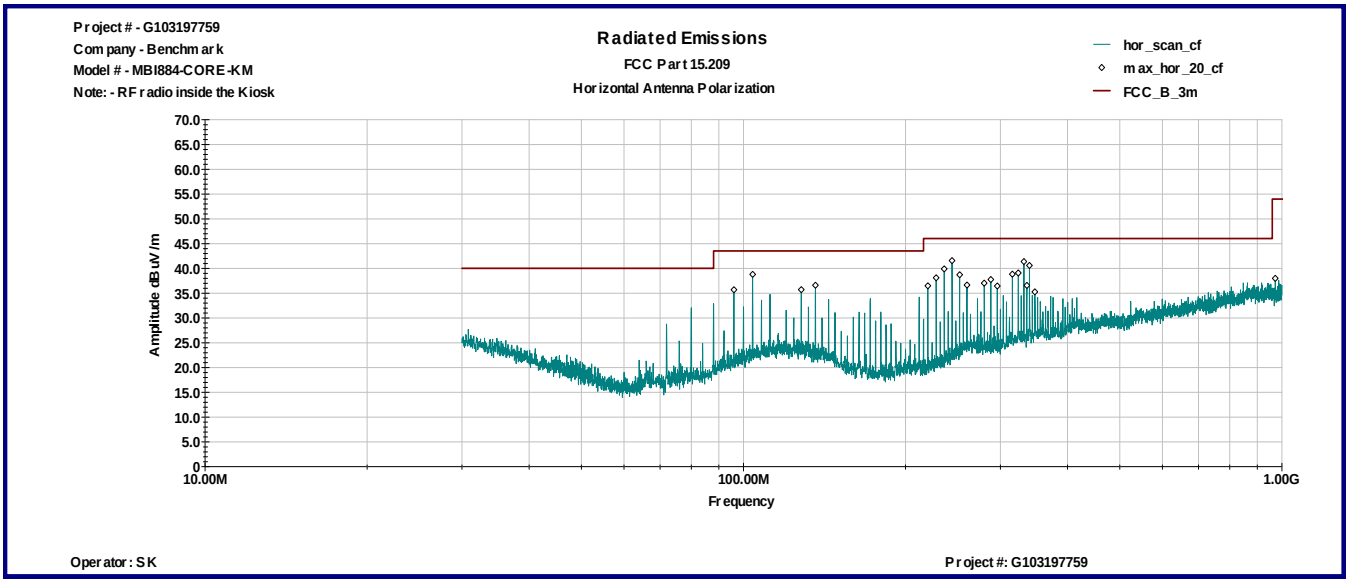
Graph 3.2.2



Graph 3.2.3



Graph 3.2.4



3.3 Bandwidth of Emissions

Frequency 125kHz

Center Frequency of operation MHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz	Result
0.125	1.84	1.57	**Pass**
RBW: **VBW:**	☐ 10kHz ☐ 100kHz ☒ other 1kHz ☐ 30kHz ☐ 300kHz ☒ other 1kHz		

Graphs 3-3-1 and 3-3-2 are show bandwidth of emissions

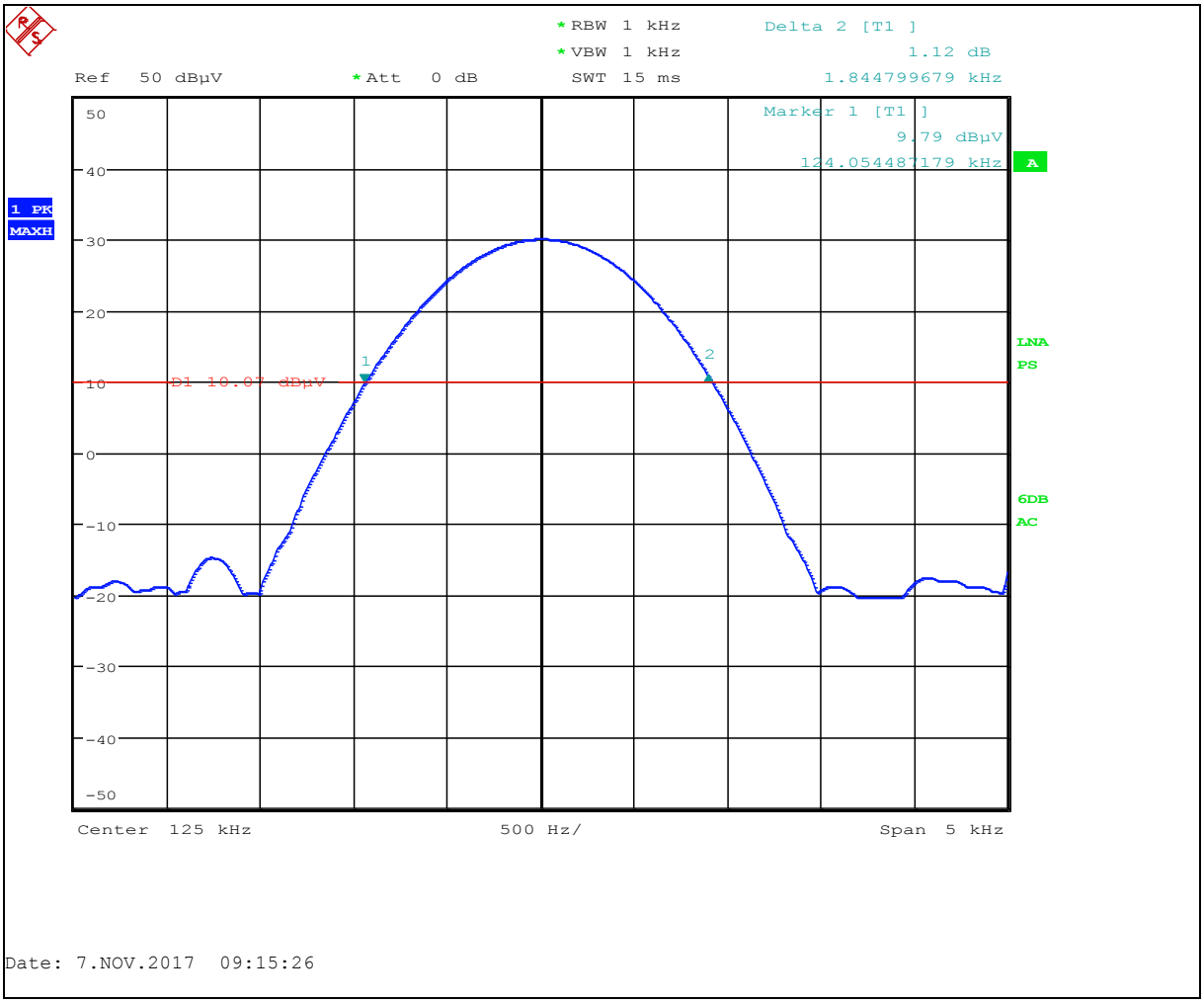
Frequency 134.5kHz

Center Frequency of operation MHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz	Result
0.135	1.85	1.57	**Pass**
RBW: **VBW:**	☐ 10kHz ☐ 100kHz ☒ other 1kHz ☐ 30kHz ☐ 300kHz ☒ other 1kHz		

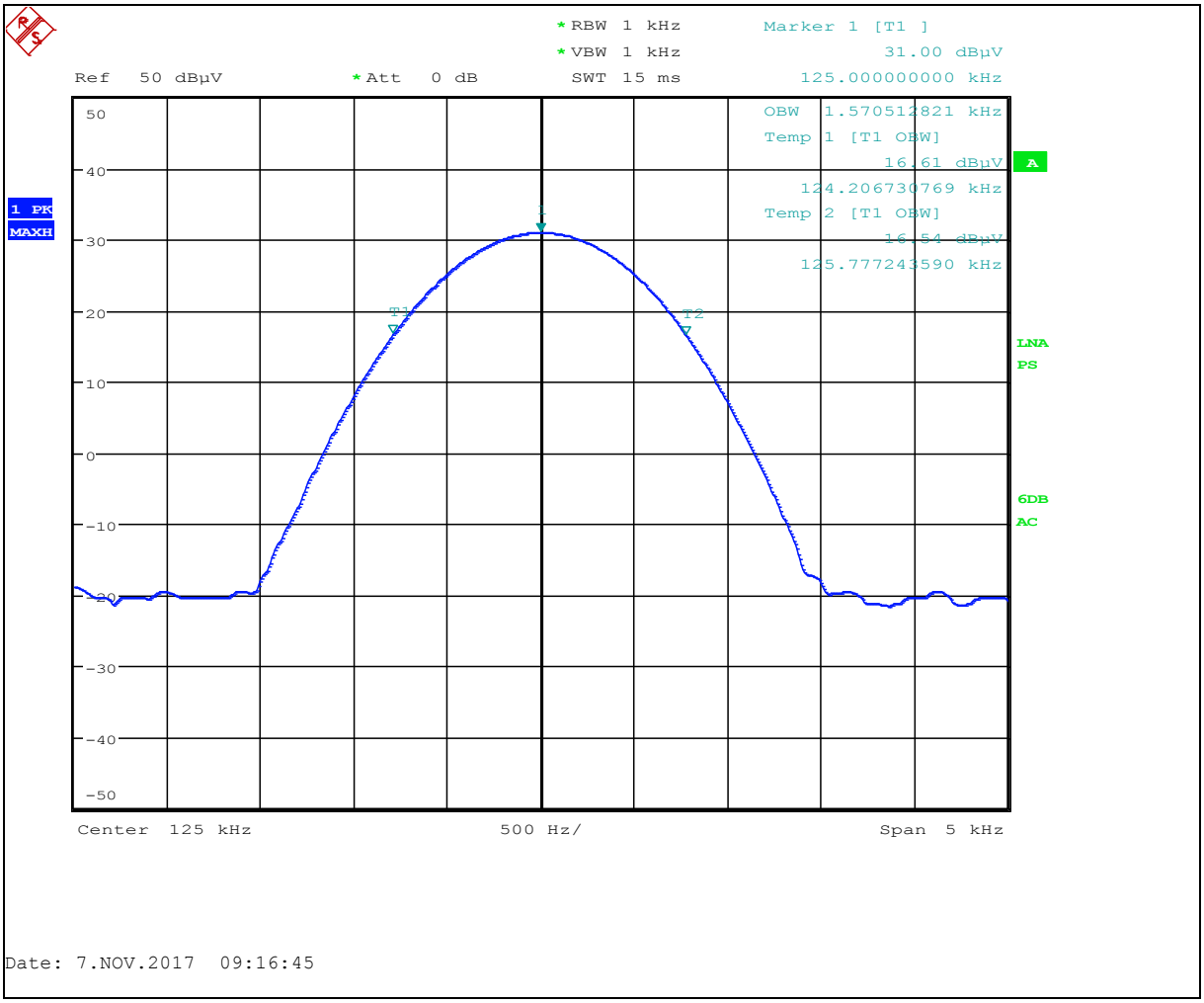
Graphs 3-3-3 and 3-3-4 are show bandwidth of emissions

Notes: None

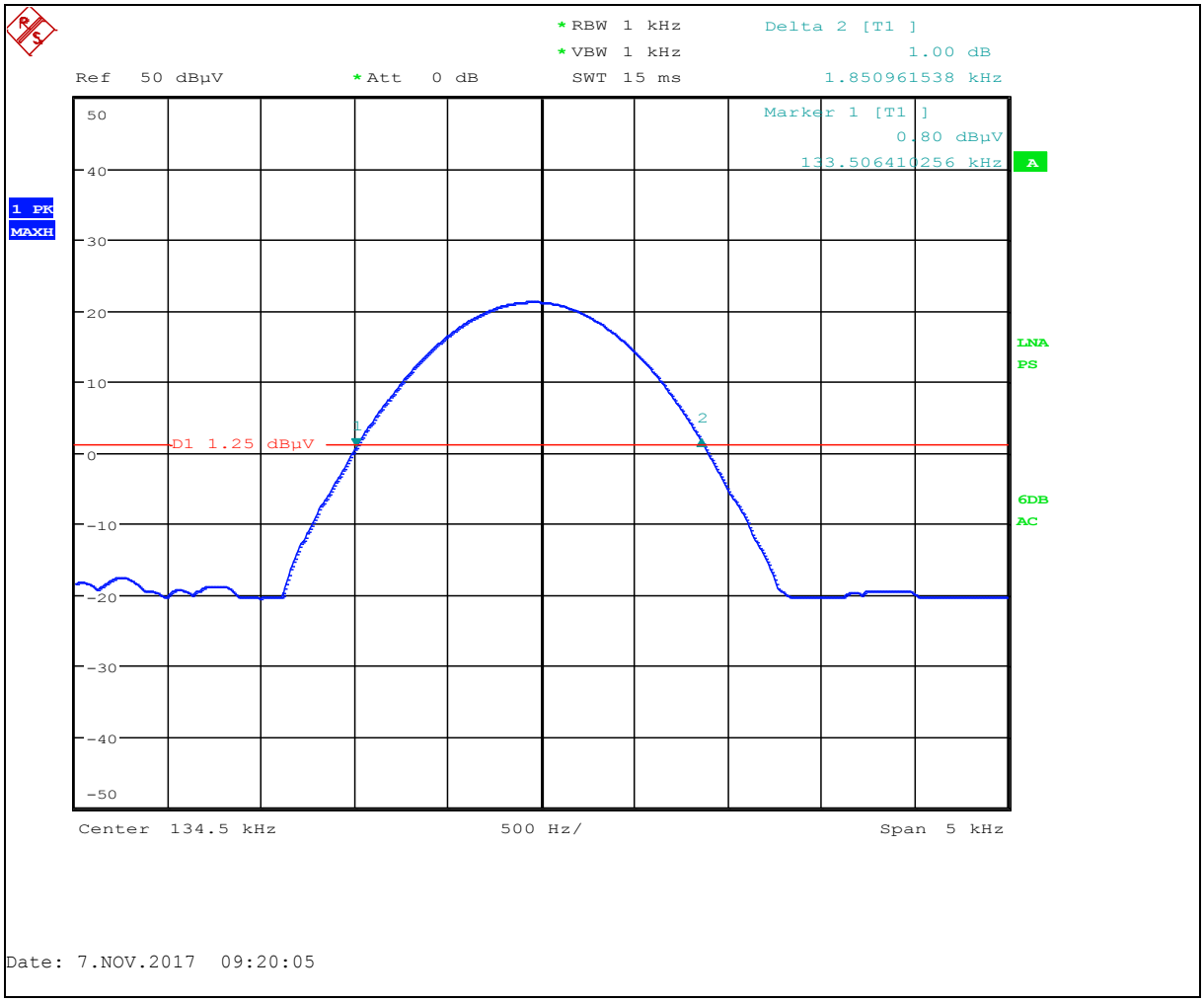
Graph 3.3.1


RBW 1 kHz
VBW 1 kHz
SWT 15 ms
Delta 2 [T1]
1.12 dB
1.844799679 kHz
Ref 50 dBµV
Att 0 dB
Marker 1 [T1]
9.79 dBµV
124.054487179 kHz
1 PK
MAXH
A
LNA
PS
6DB
AC
D1 10.07 dBµV
50
40
30
20
10
0
-10
-20
-30
-40
-50
Center 125 kHz
500 Hz/
Span 5 kHz
Date: 7.NOV.2017 09:15:26

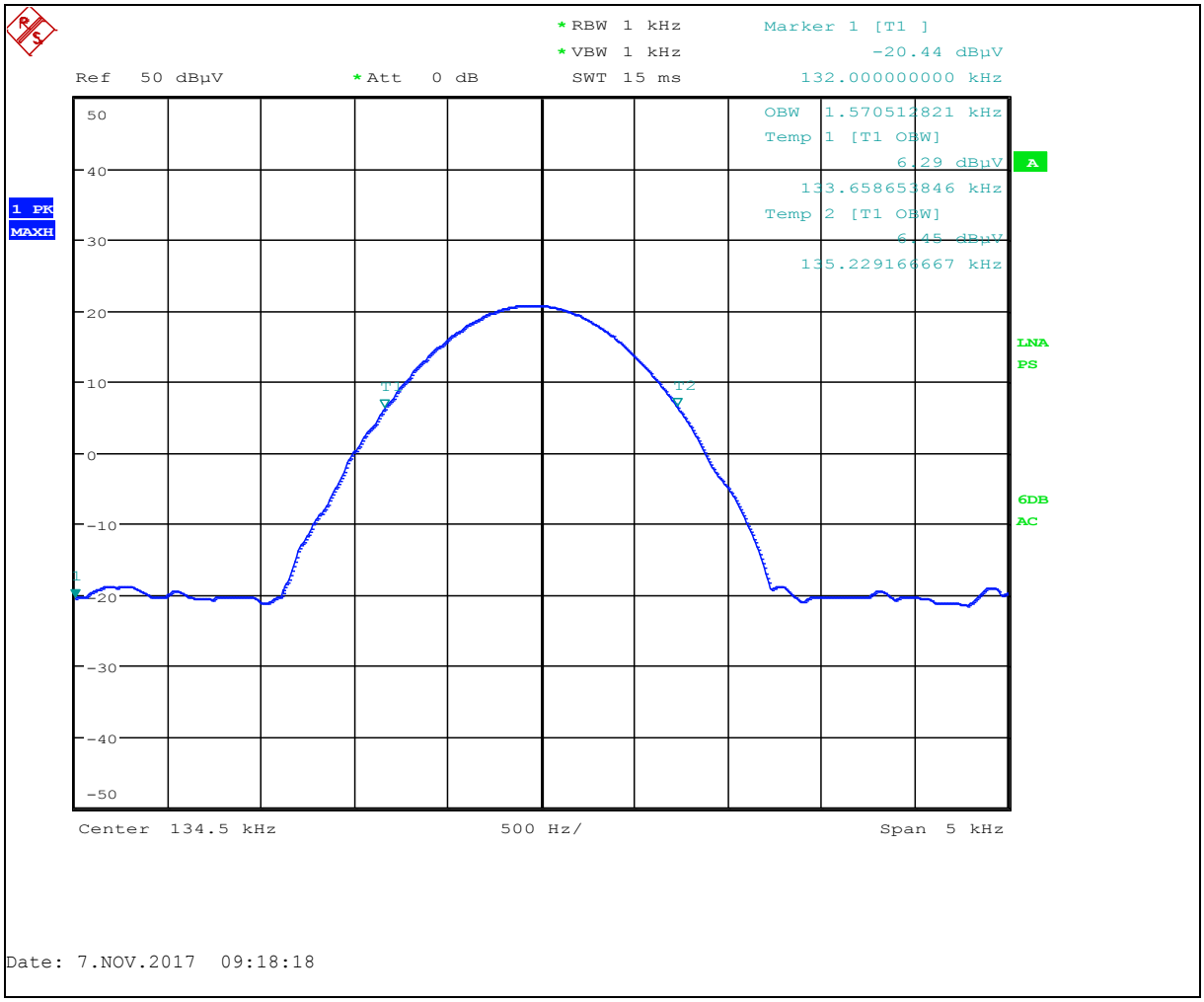
Graph 3.3.2


*RBW 1 kHz
*VBW 1 kHz
Ref 50 dBµV
*Att 0 dB
SWT 15 ms
Marker 1 [T1]
31.00 dBµV
125.000000000 kHz
OBW 1.570512821 kHz
Temp 1 [T1 OBW]
16.61 dBµV
124.206730769 kHz
Temp 2 [T1 OBW]
16.54 dBµV
125.777243590 kHz
1 PK
MAXH
A
LNA
PS
6DB
AC
50
40
30
20
10
0
-10
-20
-30
-40
-50
T1
T2
Center 125 kHz
500 Hz/
Span 5 kHz
Date: 7.NOV.2017 09:16:45

Graph 3.3.3


RBW 1 kHz
VBW 1 kHz
SWT 15 ms
Delta 2 [T1]
1.00 dB
1.850961538 kHz
Marker 1 [T1]
0.80 dBµV
133.506410256 kHz
Ref 50 dBµV
Att 0 dB
1 PK
MAXH
A
LNA
PS
6DB
AC
D1 1.25 dBµV
50
40
30
20
10
0
-10
-20
-30
-40
-50
Center 134.5 kHz
500 Hz/
Span 5 kHz
Date: 7.NOV.2017 09:20:05

Graph 3.3.4


* RBW 1 kHz
* VBW 1 kHz
Ref 50 dBµV
* Att 0 dB
SWT 15 ms
Marker 1 [T1]
-20.44 dBµV
132.000000000 kHz
OBW 1.570512821 kHz
Temp 1 [T1 OBW]
6.29 dBµV
133.658653846 kHz
Temp 2 [T1 OBW]
6.45 dBµV
135.229166667 kHz
1 PK
MAXH
A
LNA
PS
6DB
AC
50
40
30
20
10
0
-10
-20
-30
-40
-50
Center 134.5 kHz
500 Hz/
Span 5 kHz
Date: 7.NOV.2017 09:18:18

3.4 Transmitter power line conducted emissions

Test location:	☐ OATS ☒ Anechoic Chamber ☐ Other
Test result:	**Pass**
Frequency range:	0.15MHz-30MHz
Max. Emissions margin:	3.7dB below the limits

Note: None

Date:	November 7, 2017	**Result: Pass**
Tested by:	Randy Libersky	
Standard:	FCC Part 15.207	
Test Point:	Power Line	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 37%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	None	

Table 3.4.1

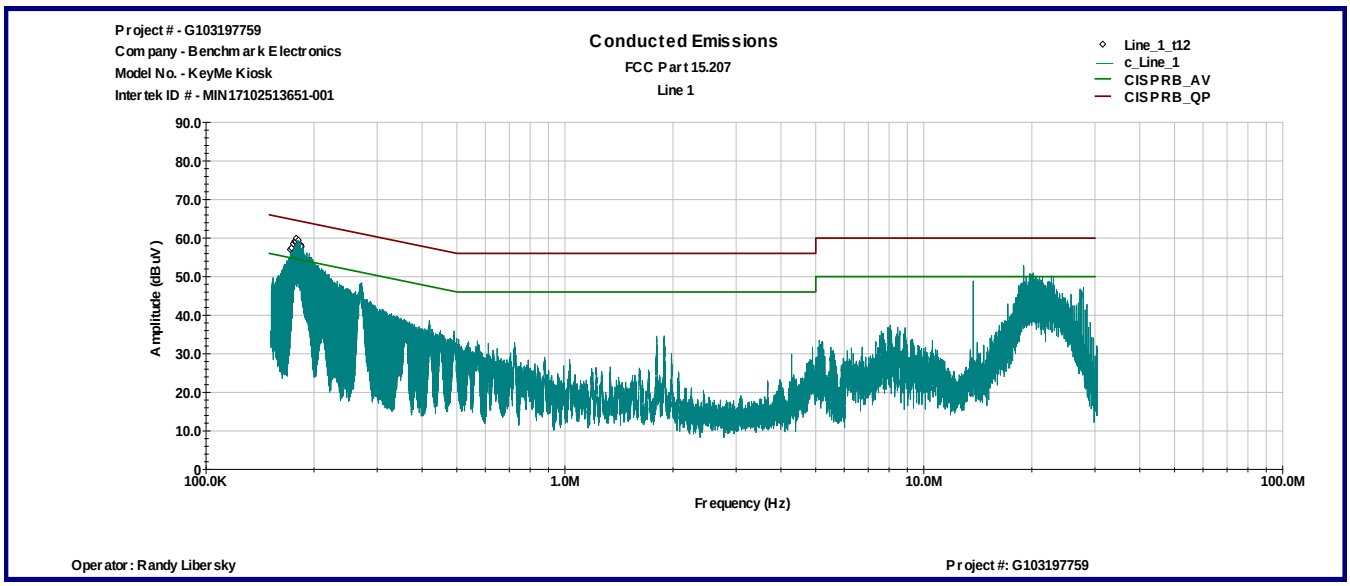
Line 1

Frequency	QP dBµV	AVG dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
175.53 KHz	53.4	48.4	64.7	54.7	-11.3	-6.4
178.72 KHz	55.4	50.9	64.5	54.5	-9.1	-3.7
191.69 KHz	49.0	35.6	64.0	54.0	-15.0	-18.3
18.971 MHz	37.1	41.6	60.0	50.0	-22.9	-8.4
19.869 MHz	45.5	41.1	60.0	50.0	-14.6	-8.9
23.002 MHz	43.6	36.1	60.0	50.0	-16.4	-13.9

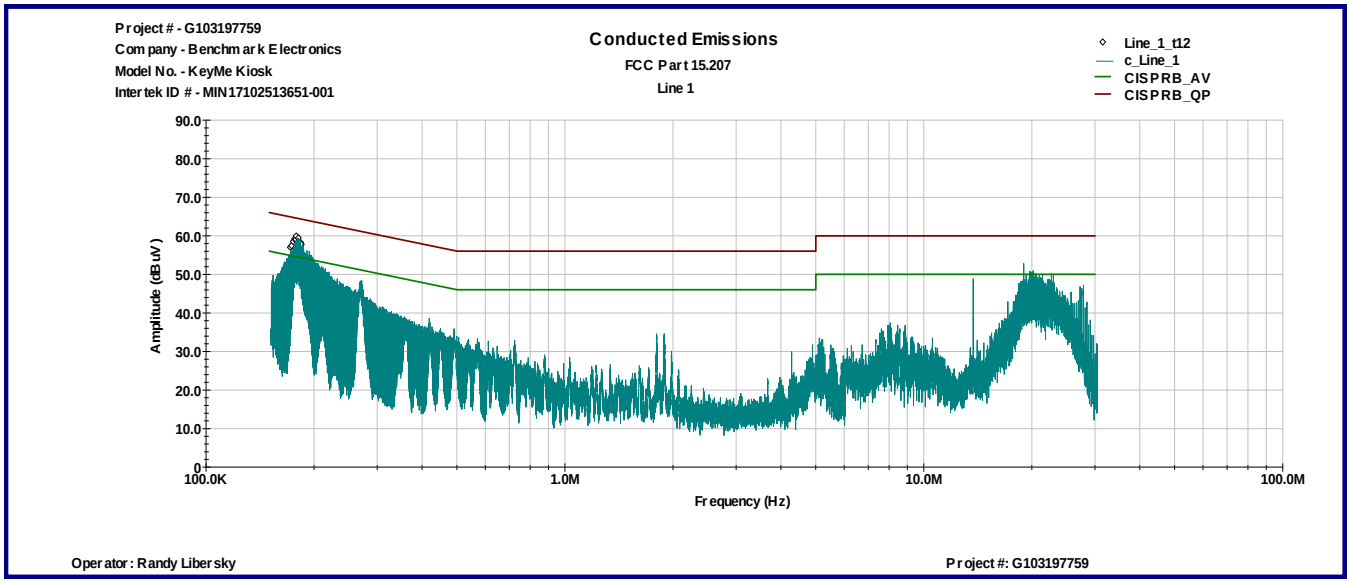
Line 2

Frequency	QP dBµV	AVG dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
174.79 KHz	58.7	46.6	64.7	54.7	-6.0	-8.1
175.58 KHz	58.9	50.4	64.7	54.7	-5.8	-4.3
192.65 KHz	48.3	33.4	63.9	53.9	-15.6	-20.5
19.149 MHz	50.2	38.8	60.0	50.0	-9.8	-11.2
19.861 MHz	46.1	42.7	60.0	50.0	-13.9	-7.4
22.053 MHz	37.1	37.4	60.0	50.0	-22.9	-12.6

Graph 3.4.1



Graph 3.4.2



3.5 Digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-15000MHz

Max. Emissions margin: 3.7dB below the limits

Notes: The Radiated Emissions scan was performed in the Anechoic chamber at 3m measurement distance (see Tables 3.5.1-3.5.2 and Graphs 3.5.1 – 3.5.4).

Date:	November 6-8, 2017	**Result: Pass**
Tested by:	Randy Libersky	
Standard:	FCC Part 15.109, Class A	
Test Point:	Enclosure	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 38%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Frequency Range 30-1000MHz	

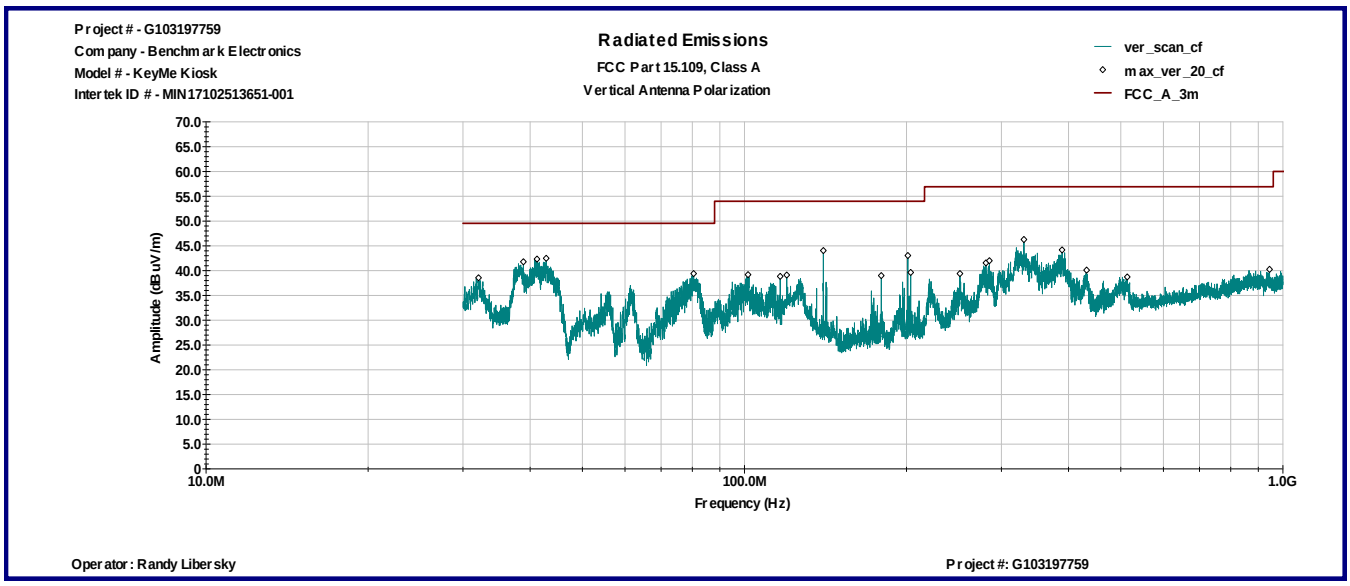
Table 3.5.1

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	QP Reading	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB	
38.86	V	100	19.0	0.4	0.0	16.2	35.7	49.5	-13.8	
42.94	V	100	16.9	0.5	0.0	24.1	41.5	49.5	-8.0	
81.33	V	100	11.9	0.7	0.0	25.7	38.3	49.5	-11.2	
140.18	V	100	16.3	0.8	0.0	11.5	28.6	54.0	-25.4	
201.23	V	100	14.5	1.1	0.0	12.9	28.5	54.0	-25.5	
322.04	V		18.5	1.4	0.0	22.7	42.6	56.9	-14.3	
80.00	H	248	11.7	0.7	0.0	33.4	45.8	49.5	-3.7	
127.38	H	183	16.7	0.8	0.0	24.6	42.1	49.5	-7.4	
225.15	H	175	14.8	1.2	0.0	31.6	47.5	54.0	-6.5	
269.00	H	100	17.8	1.3	0.0	24.7	43.7	54.0	-10.3	
293.86	H	100	17.7	1.4	0.0	27.2	46.3	54.0	-7.7	
322.92	H	217	18.5	1.4	0.0	28.8	48.7	56.9	-8.2	

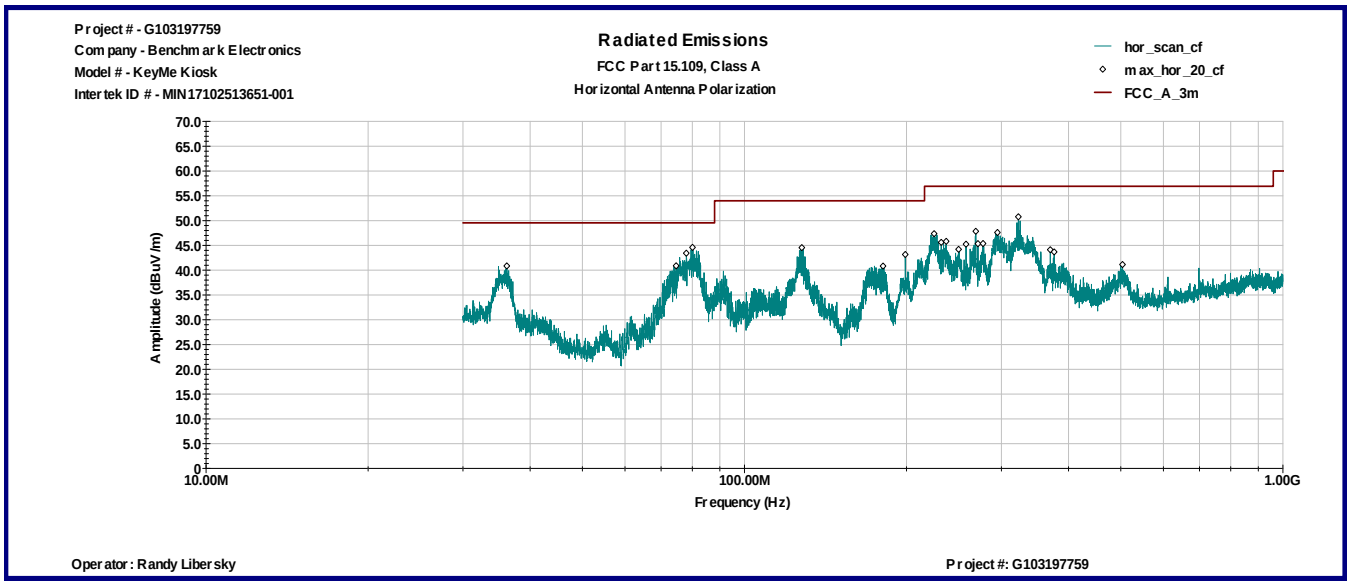
Date:	November 6-8, 2017	**Result: Pass**
Tested by:	Randy Libersky	
Standard:	FCC Part 15.109, Class A	
Test Point:	Enclosure	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 38%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Frequency Range 1000-15000MHz	

Table 3.5.2

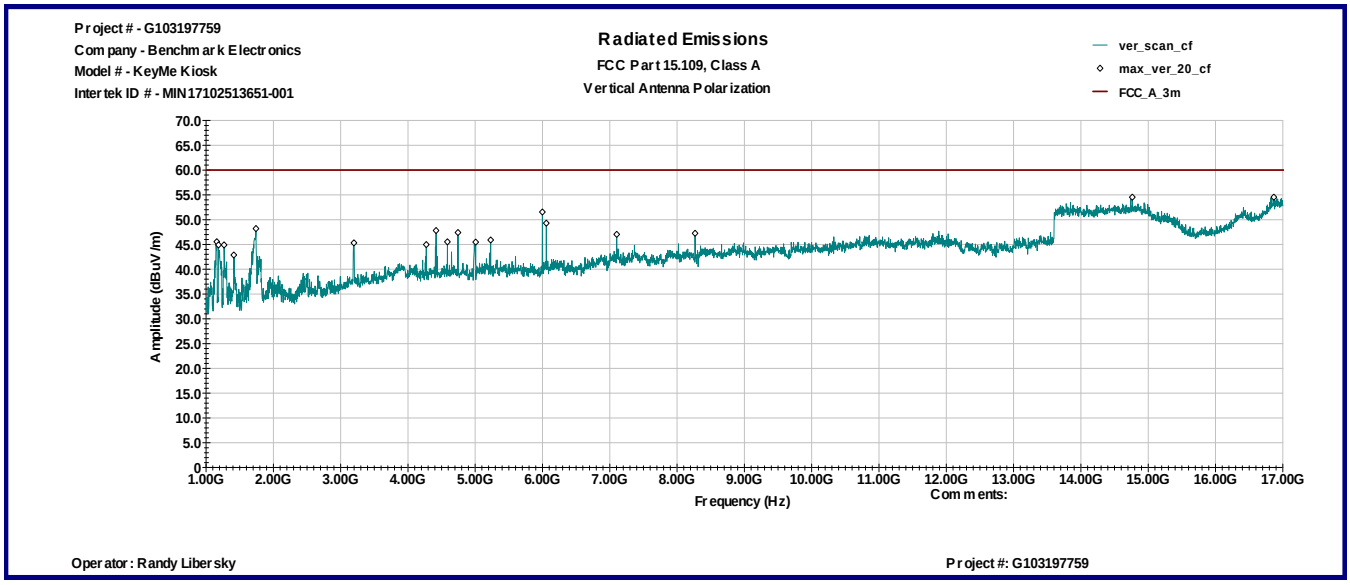
Frequency MHz	Antenna Polarity	Peak Reading dBµV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
1.16 GHz	V	60.9	26.6	41.9	45.5	60.0	-14.5
1.7424 GHz	V	60.9	28.6	41.3	48.2	60.0	-11.8
4.4176 GHz	V	50.9	36.5	39.6	47.8	60.0	-12.2
4.744 GHz	V	49.7	36.9	39.3	47.4	60.0	-12.6
5.9984 GHz	V	51.3	38.9	38.7	51.5	60.0	-8.5
6.056 GHz	V	49.0	39.0	38.7	49.3	60.0	-10.7
1.0576 GHz	H	71.7	26.1	41.9	55.8	60.0	-4.2
1.1696 GHz	H	67.2	26.7	41.9	52.1	60.0	-7.9
1.2304 GHz	H	65.8	27.1	41.8	51.0	60.0	-9.0
1.3008 GHz	H	69.6	27.4	41.8	55.2	60.0	-4.8
1.5536 GHz	H	64.2	27.7	41.6	50.3	60.0	-9.7
1.6816 GHz	H	64.5	28.4	41.4	51.5	60.0	-8.5
1.7072 GHz	H	63.4	28.5	41.3	50.6	60.0	-9.4
4.9456 GHz	H	55.2	37.1	39.1	53.3	60.0	-6.7
6.9392 GHz	H	51.6	40.3	38.4	53.5	60.0	-6.5



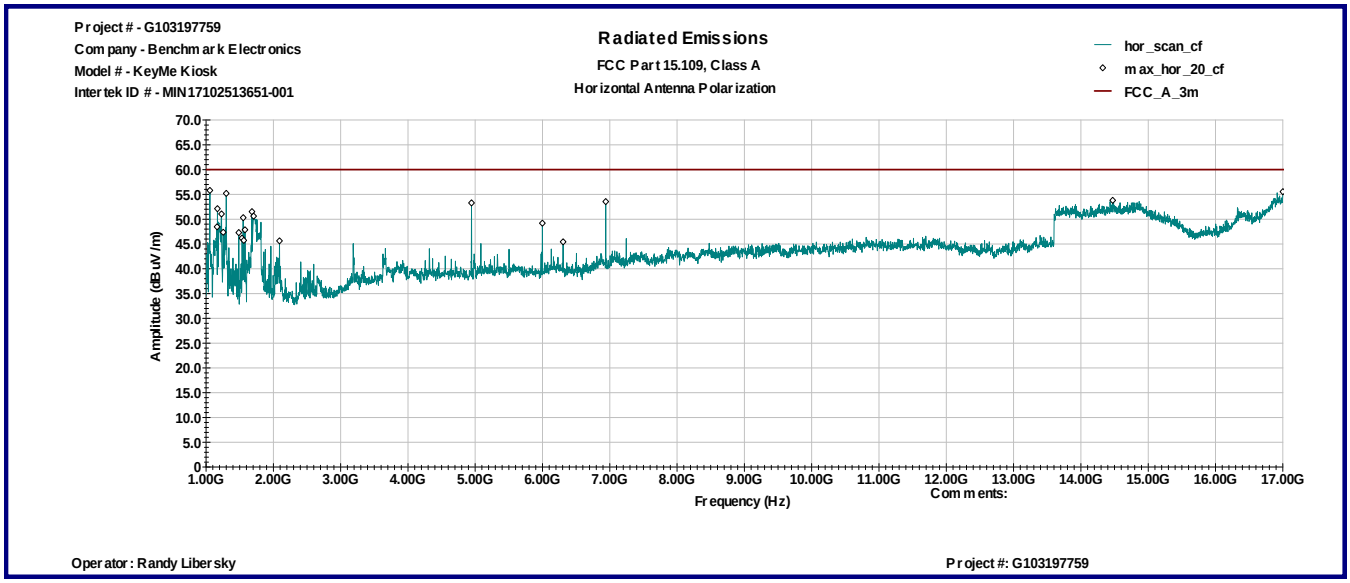
Graph 3.5.1



Graph 3.5.2



Graph 3.5.3



Graph 3.5.4

3.6 Digital device conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 15.1dB below the limits

Notes: None

Date:	November 7, 2017	**Result: Pass**
Tested by:	Randy Libersky	
Standard:	FCC Part 15.107 Class A	
Test Point:	Power Line	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 37%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	None	

Table 3.6.1

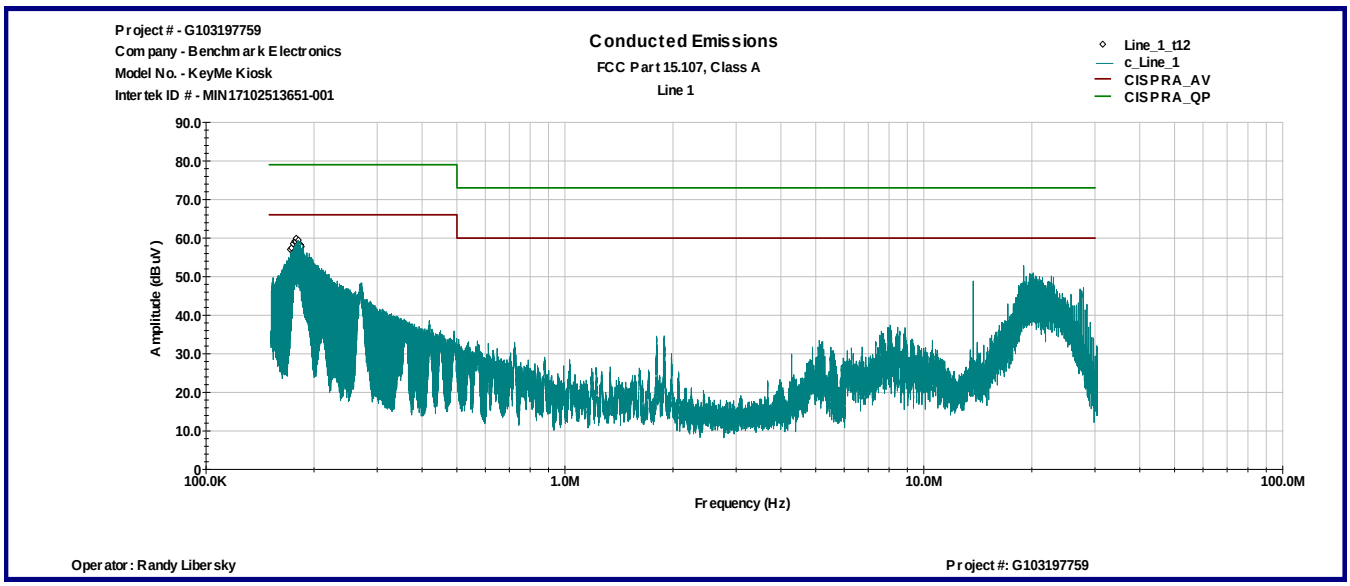
Line 1

Frequency	QP dBµV	AVG dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
175.53 KHz	53.4	48.4	79.0	66.0	-25.6	-17.7
178.72 KHz	55.4	50.9	79.0	66.0	-23.6	-15.1
191.69 KHz	49.0	35.6	79.0	66.0	-30.0	-30.4
18.971 MHz	37.1	41.6	73.0	60.0	-35.9	-18.4
19.869 MHz	45.5	41.1	73.0	60.0	-27.6	-18.9
23.002 MHz	43.6	36.1	73.0	60.0	-29.4	-23.9

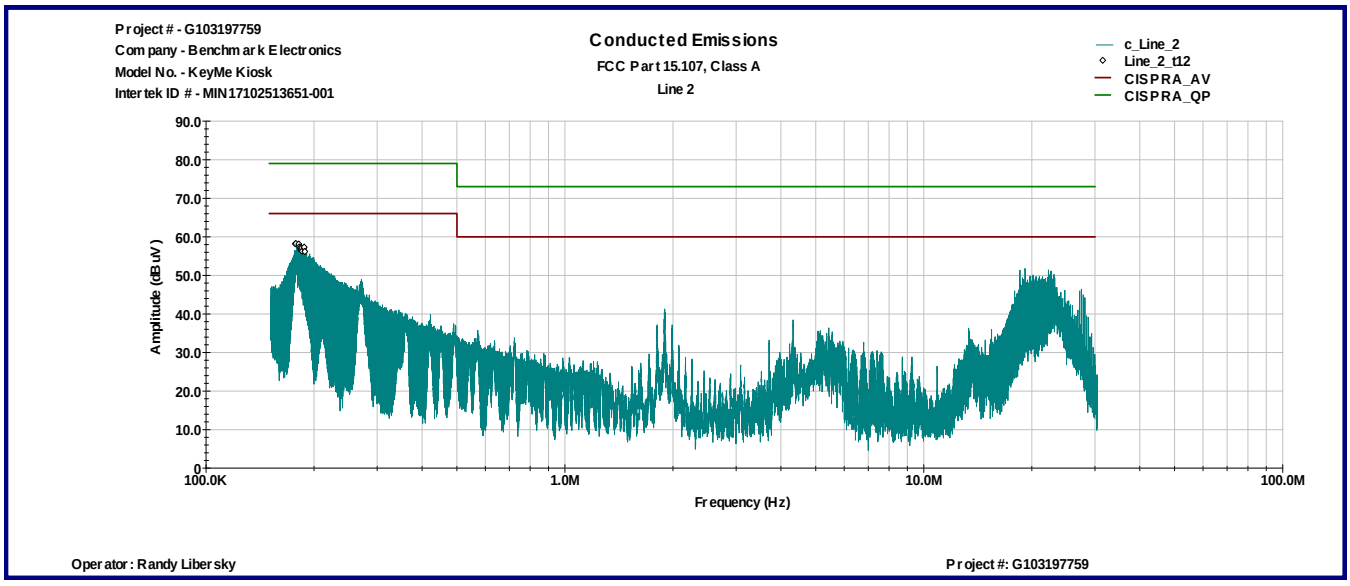
Line 2

Frequency	QP dBµV	AVG dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
174.79 KHz	58.7	46.6	79.0	66.0	-20.3	-19.4
175.58 KHz	58.9	50.4	79.0	66.0	-20.1	-15.6
192.65 KHz	48.3	33.4	79.0	66.0	-30.7	-32.6
19.149 MHz	50.2	38.8	73.0	60.0	-22.8	-21.2
19.861 MHz	46.1	42.7	73.0	60.0	-26.9	-17.4
22.053 MHz	37.1	37.4	73.0	60.0	-35.9	-22.6

Graph 3.6.1



Graph 3.6.2



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	LAST CAL DATE	CAL DUE	USED
Spectrum Analyzer	R & S	ESU	100398	25283	03/21/2017	03/21/2018	☒
Spectrum Analyzer	R & S	FSP 40	100024	12559	01/26/2017	01/26/2018	☒
Spectrum Analyzer	R & S	ESCI	100358	12909	10/30/2017	10/30/2018	☒
Horn Antenna	EMCO	3115	6579	15580	10/04/2017	10/04/2018	☒
Bicono-Log Antenna	Schaffner-Teseq	CBL6112B	2468	9734	06/15/2017	06/15/2018	☒
Loop Antenna	ETS	6512	00060486	19942	01/03/2017	01/03/2018	☒
LISN	COM-Power	Li-215A	191971	172316	06/14/2017	06/14/2018	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	12/01/2016	12/01/2017	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	VBU	☒

5.0 Revision History

REVISION LEVEL	DATE	REPORT NUMBER	PREPARED	REVIEWED	NOTES
0	11-10-2017	103197759MIN-004	SK	NS	Original Issue