



TEST REPORT

Report Number: 102811224MIN-002

Project Number: G102811224

Testing performed on the
MR102

FCC ID: RUVBIB2

IC: 22443-MR102

to

47 CFR Part 15. 225:2016

RSS- 210, Issue 9, 2016

RSS-Gen, Issue 4, 2014

47 CFR, Part 15:2016, §15.107 and §15.109, Class / ICES-003, Issue 6:2016

For

Bibliotheca LLC

Test Performed by:
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1.0 GENERAL DESCRIPTION

Model:	MR102 with AC/DC Power Supply manufactured by XP Power model: VEC40US12
Type of EUT:	RFID
Serial Number:	5671330
FCC ID:	RUVBIB2
IC:	22443-MR102
Related Submittal(s) Grants:	None
Company:	Bibliotheca LLC
Customer:	Mr. Seth Liefert
Address:	403 Hayward Avenue North Oakdale, MN 55128 USA
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e-mail:	S.Liefert@bibliotheca.com
Test Standards:	☒ 47 CFR, Part 15:2016, §15.225 ☒ RSS-210, Issue 9, 2016 ☒ RSS-Gen, Issue 4, 2014 ☒ 47 CFR, Part 15:2016, §15.107 and §15.109, Class B, test method: ANSI C63.4-2014 ☒ ICES-003, Issue 6:2016 ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	December 5, 2016
Test Work Started:	December 5, 2016
Test Work Completed:	January 5, 2017
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	RFID Transmitter
Operating Frequency	13.56MHz
Modulation:	FSK
Emission Designator:	6K1A1D
Antenna(s) Info:	Antenna 1 Magnetic Loop by Bibliotheca, model: RFID selfCheck 500 shielded. Gain 0 dBi, Connector SMA, s/n 10002015 Antenna 2: Magnetic Loop by Bibliotheca, model: RFID selfCheck. Gain 0 dBi, Connector SMA s/n 10002643 Antenna 3: Magnetic Loop by Bibliotheca, model: RFID workstation shielded. Gain 0 dBi, Connector SMA, Black Plexiglas Antenna 4: Magnetic Loop by Bibliotheca, model: selfCheck 1000. Gain 0 dBi, Connector SMA, s/n 1879 Antenna 5: Magnetic Loop by Bibliotheca, model: 78-8129-3044-0 hybrid selfCheck. Gain 0 dBi, Connector SMA Antenna 6: Magnetic Loop by Bibliotheca, model: RFID workstation/P12. Gain 0 dBi, Connector SMA, s/n PP1200544 Antenna 7: Magnetic Loop by Bibliotheca, model: hybrid workstation/M946. Gain 0 dBi, Connector SMA, s/n 9400130
Antenna Installation:	☐ User ☒ Professional ☐ Factory
Transmitter Power Configuration:	☐ Internal battery ☒ External power source ☒ 100-240VAC 1.7 Amp. ☒ 50/60Hz
Special Test Arrangement:	None
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 (See below)
- ☐ - Continuous un-modulated
- ☐ - Test program (customer specific)
- ☐ -

Operating modes of the EUT:

No.	Description
1	Continuous modulated mode
2	Continuous CW mode

Cables:

No.	Type	Length	Designation	Note
1	3 wire unshielded	1.6 m	AC Power	
2	2 wires unshelled	1.2 m	DC Power	
3	Shielded, USB	1.6 m	USB cable	
4.	Shielded, with pre-installed ferrites	1.9 m	Antenna	

Support equipment/Services:

No.	Item	Description
1	HP model EliteBook	Laptop
2	Agilent, model: E7402A	Spectrum Analyzer

Note: RF ID MR102 is transmitter only, and has no receiver portion.

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

☒ Extreme

Temperature: -20 to +50°C

Primary Supply Voltage: ± 15%

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(μ V/m)

RA = Receiver Amplitude in dB(μ V)

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(μ V) 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(μ V/m).

$$RA = 48.1 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(m^{-1})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 16.0 \text{ dB}$$

$$FS = RA + AF + CF - AG$$

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

$$FS = 41.1 \text{ dB}(\mu\text{V}/\text{m})$$

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
15.225(a)(b)(c) / RSS-210 A2.6(a)(b)(c)	Field strength within the band of operation	Pass
15.225(d) / RSS-210 A2.6(d)	Out of band emissions	Pass
15.215(c) / RSS- Gen 4.6.1	Bandwidth of the emission	Pass
15.225(e) / RSS-210 A2.6	Frequency tolerance	Pass
15.207/RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	Pass
15.109/ICES-003	Receiver/digital device radiated emissions	N/A
15.107/ ICES-003	Receiver/digital device conducted emissions	N/A



3.0 TEST CONDITIONS AND RESULTS

3.1 Field strength within the band of operation

Test location: ☒ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☒ 10 meters ☒ 3 meters

Test result: **Pass**

Max. Emissions margin at fundamental: **29.4dB** below the limits

Max. margin of harmonics and spurious emissions: **23.5dB** below the limits

Notes:

1. The Emissions pre-scan was performed in the Anechoic chamber at 3m measurement distance; final measurements were performed in the Open Area Test Site at 10m measurement distance (see Tables 3.1. - 3.1.7).
2. RBW=9 kHz

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(a)(b)(c) / RSS-210 A2.6(a)(b)(c)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: Black Plexiglas	

Table 3.1.1

Frequency	Ant. Orientation	Peak Reading dBμV	Ant.Factor dB1/m	Total at 10m dBμV/m	Limit dBμV/m	Margin dB
12.600 MHz	Front	-3.1	34.7	31.6	59.6	-28.0
13.110 MHz	Front	1.2	34.7	35.9	59.6	-23.7
13.410 MHz	Front	0.7	34.7	35.4	59.6	-24.2
13.553 MHz	Front	0.6	34.7	35.3	69.6	-34.3
13.560 MHz	Front	28.3	34.7	63.0	103.1	-40.1
13.567 MHz	Front	0.8	34.7	35.5	69.6	-34.1
13.710 MHz	Front	-0.3	34.7	34.4	59.6	-25.2
14.010 MHz	Front	-0.9	34.7	33.8	59.6	-25.8
14.500 MHz	Front	-3.1	34.7	31.6	59.6	-28.0
12.600 MHz	Side	-5.3	34.7	29.4	59.6	-30.2
13.110 MHz	Side	-2.9	34.7	31.8	59.6	-27.8
13.410 MHz	Side	-0.9	34.7	33.8	59.6	-25.8
13.553 MHz	Side	0.7	34.7	35.4	69.6	-34.2
13.560 MHz	Side	29.5	34.7	64.2	103.1	-38.9
13.567 MHz	Side	0.8	34.7	35.5	69.6	-34.1
13.710 MHz	Side	0.3	34.7	35.0	59.6	-24.6
14.010 MHz	Side	-0.4	34.7	34.3	59.6	-25.3
14.500 MHz	Side	-4.2	34.5	30.3	59.6	-29.3

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(a)(b)(c) / RSS-210 A2.6(a)(b)(c)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: s/n: 10002643	

Table 3.1.2

Frequency	Ant. Orientation	Peak Reading dBμV	Ant.Factor dB1/m	Total at 10m dBμV/m	Limit dBμV/m	Margin dB
12.600 MHz	Front	-2.7	34.7	32.0	59.6	-27.6
13.110 MHz	Front	-1.9	34.7	32.8	59.6	-26.8
13.410 MHz	Front	-0.9	34.7	33.8	59.6	-25.8
13.553 MHz	Front	1.3	34.7	36.0	69.6	-33.6
13.560 MHz	Front	37.6	34.7	72.3	103.1	-30.8
13.567 MHz	Front	1.6	34.7	36.3	69.6	-33.3
13.710 MHz	Front	0.1	34.7	34.8	59.6	-24.8
14.010 MHz	Front	-2.3	34.7	32.4	59.6	-27.2
14.500 MHz	Front	-4.1	34.7	30.6	59.6	-29.0
12.600 MHz	Side	-3.9	34.7	30.8	59.6	-28.8
13.110 MHz	Side	-1.9	34.7	32.8	59.6	-26.8
13.410 MHz	Side	0.3	34.7	35.0	59.6	-24.6
13.553 MHz	Side	1.0	34.7	35.7	69.6	-33.9
13.560 MHz	Side	37.8	34.7	72.5	103.1	-30.6
13.567 MHz	Side	1.3	34.7	36.0	69.6	-33.6
13.710 MHz	Side	0.7	34.7	35.4	59.6	-24.2
14.010 MHz	Side	0.1	34.7	34.8	59.6	-24.8
14.500 MHz	Side	-4.3	34.5	30.2	59.6	-29.4

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(a)(b)(c) / RSS-210 A2.6(a)(b)(c)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: s/n: 10002015	

Table 3.1.3

Frequency	Ant. Orientation	Peak Reading dBμV	Ant.Factor dB1/m	Total at 10m dBμV/m	Limit dBμV/m	Margin dB
12.600 MHz	Front	-3.9	34.7	30.8	59.6	-28.8
13.110 MHz	Front	1.1	34.7	35.8	59.6	-23.8
13.410 MHz	Front	1.0	34.7	35.7	59.6	-23.9
13.553 MHz	Front	1.6	34.7	36.3	69.6	-33.3
13.560 MHz	Front	35.6	34.7	70.3	103.1	-32.8
13.567 MHz	Front	1.9	34.7	36.6	69.6	-33.0
13.710 MHz	Front	1.3	34.7	36.0	59.6	-23.6
14.010 MHz	Front	1.0	34.7	35.7	59.6	-23.9
14.500 MHz	Front	-4.0	34.7	30.7	59.6	-28.9
12.600 MHz	Side	-5.1	34.7	29.6	59.6	-30.0
13.110 MHz	Side	1.0	34.7	35.7	59.6	-23.9
13.410 MHz	Side	1.1	34.7	35.8	59.6	-23.8
13.553 MHz	Side	1.3	34.7	36.0	69.6	-33.6
13.560 MHz	Side	35.8	34.7	70.5	103.1	-32.6
13.567 MHz	Side	1.9	34.7	36.6	69.6	-33.0
13.710 MHz	Side	1.4	34.7	36.1	59.6	-23.5
14.010 MHz	Side	0.9	34.7	35.6	59.6	-24.0
14.500 MHz	Side	-4.9	34.5	29.6	59.6	-30.0

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(a)(b)(c) / RSS-210 A2.6(a)(b)(c)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: s/n: 9400130	

Table 3.1.4

Frequency	Ant. Orientation	Peak Reading dBμV	Ant.Factor dB1/m	Total at 10m dBμV/m	Limit dBμV/m	Margin dB
12.600 MHz	Front	-3.1	34.7	31.6	59.6	-28.0
13.110 MHz	Front	-2.9	34.7	31.8	59.6	-27.8
13.410 MHz	Front	-1.1	34.7	33.6	59.6	-26.0
13.553 MHz	Front	1.1	34.7	35.8	69.6	-33.8
13.560 MHz	Front	37.2	34.7	71.9	103.1	-31.2
13.567 MHz	Front	1.4	34.7	36.1	69.6	-33.5
13.710 MHz	Front	0.1	34.7	34.8	59.6	-24.8
14.010 MHz	Front	-2.3	34.7	32.4	59.6	-27.2
14.500 MHz	Front	-3.6	34.7	31.1	59.6	-28.5
12.600 MHz	Side	-3.4	34.7	31.3	59.6	-28.3
13.110 MHz	Side	-3.0	34.7	31.7	59.6	-27.9
13.410 MHz	Side	1.1	34.7	35.8	59.6	-23.8
13.553 MHz	Side	1.3	34.7	36.0	69.6	-33.6
13.560 MHz	Side	39.0	34.7	73.7	103.1	-29.4
13.567 MHz	Side	1.6	34.7	36.3	69.6	-33.3
13.710 MHz	Side	0.4	34.7	35.1	59.6	-24.5
14.010 MHz	Side	0.2	34.7	34.9	59.6	-24.7
14.500 MHz	Side	-2.9	34.5	31.6	59.6	-28.0

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(a)(b)(c) / RSS-210 A2.6(a)(b)(c)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: s/n: P1200544	

Table 3.1.5

Frequency	Ant. Orientation	Peak Reading dBμV	Ant.Factor dB1/m	Total at 10m dBμV/m	Limit dBμV/m	Margin dB
12.600 MHz	Front	-3.7	34.7	31.0	59.6	-28.6
13.110 MHz	Front	1.2	34.7	35.9	59.6	-23.7
13.410 MHz	Front	0.9	34.7	35.6	59.6	-24.0
13.553 MHz	Front	1.1	34.7	35.8	69.6	-33.8
13.560 MHz	Front	34.5	34.7	69.2	103.1	-33.9
13.567 MHz	Front	1.2	34.7	35.9	69.6	-33.7
13.710 MHz	Front	1.4	34.7	36.1	59.6	-23.5
14.010 MHz	Front	0.9	34.7	35.6	59.6	-24.0
14.500 MHz	Front	-3.7	34.7	31.0	59.6	-28.6
12.600 MHz	Side	-5.0	34.7	29.7	59.6	-29.9
13.110 MHz	Side	1.4	34.7	36.1	59.6	-23.5
13.410 MHz	Side	1.4	34.7	36.1	59.6	-23.5
13.553 MHz	Side	0.1	34.7	34.8	69.6	-34.8
13.560 MHz	Side	22.2	34.7	56.9	103.1	-46.2
13.567 MHz	Side	0.1	34.7	34.8	69.6	-34.8
13.710 MHz	Side	0.3	34.7	35.0	59.6	-24.6
14.010 MHz	Side	0.7	34.7	35.4	59.6	-24.2
14.500 MHz	Side	-4.8	34.5	29.7	59.6	-29.9

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(a)(b)(c) / RSS-210 A2.6(a)(b)(c)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: s/n: 1879	

Table 3.1.6

Frequency	Ant. Orientation	Peak Reading dBμV	Ant.Factor dB1/m	Total at 10m dBμV/m	Limit dBμV/m	Margin dB
12.600 MHz	Front	-4.1	34.7	30.6	59.6	-29.0
13.110 MHz	Front	-0.3	34.7	34.4	59.6	-25.2
13.410 MHz	Front	-0.1	34.7	34.6	59.6	-25.0
13.553 MHz	Front	1.1	34.7	35.8	69.6	-33.8
13.560 MHz	Front	39.2	34.7	73.9	103.1	-29.2
13.567 MHz	Front	0.8	34.7	35.5	69.6	-34.1
13.710 MHz	Front	-0.6	34.7	34.1	59.6	-25.5
14.010 MHz	Front	-1.1	34.7	33.6	59.6	-26.0
14.500 MHz	Front	-3.9	34.7	30.8	59.6	-28.8
12.600 MHz	Side	-5.1	34.7	29.6	59.6	-30.0
13.110 MHz	Side	-2.7	34.7	32.0	59.6	-27.6
13.410 MHz	Side	-0.9	34.7	33.8	59.6	-25.8
13.553 MHz	Side	0.9	34.7	35.6	69.6	-34.0
13.560 MHz	Side	32.2	34.7	66.9	103.1	-36.2
13.567 MHz	Side	0.8	34.7	35.5	69.6	-34.1
13.710 MHz	Side	0.1	34.7	34.8	59.6	-24.8
14.010 MHz	Side	-1.4	34.7	33.3	59.6	-26.3
14.500 MHz	Side	-5.3	34.5	29.2	59.6	-30.4

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(a)(b)(c) / RSS-210 A2.6(a)(b)(c)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: built-in model; 78-8129-3044-0	

Table 3.1.7

Frequency	Ant. Orientation	Peak Reading dBμV	Ant.Factor dB1/m	Total at 10m dBμV/m	Limit dBμV/m	Margin dB
12.600 MHz	Front	-3.8	34.7	30.9	59.6	-28.7
13.110 MHz	Front	-2.7	34.7	32.0	59.6	-27.6
13.410 MHz	Front	-1.0	34.7	33.7	59.6	-25.9
13.553 MHz	Front	0.4	34.7	35.1	69.6	-34.5
13.560 MHz	Front	22.5	34.7	57.2	103.1	-45.9
13.567 MHz	Front	0.7	34.7	35.4	69.6	-34.2
13.710 MHz	Front	-1.3	34.7	33.4	59.6	-26.2
14.010 MHz	Front	-2.3	34.7	32.4	59.6	-27.2
14.500 MHz	Front	-3.7	34.7	31.0	59.6	-28.6
12.600 MHz	Side	-3.9	34.7	30.8	59.6	-28.8
13.110 MHz	Side	-3.3	34.7	31.4	59.6	-28.2
13.410 MHz	Side	-1.0	34.7	33.7	59.6	-25.9
13.553 MHz	Side	0.9	34.7	35.6	69.6	-34.0
13.560 MHz	Side	23.8	34.7	58.5	103.1	-44.6
13.567 MHz	Side	0.8	34.7	35.5	69.6	-34.1
13.710 MHz	Side	-0.9	34.7	33.8	59.6	-25.8
14.010 MHz	Side	-1.9	34.7	32.8	59.6	-26.8
14.500 MHz	Side	-3.1	34.5	31.4	59.6	-28.2



3.2 Field strength outside of the band of operation

Test location: ☒ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☒ 10 meters ☒ 3 meters

Frequency range of measurements: 0.15MHz-1000MHz

Test result: **Pass**

Max. margin of spurious emissions: 1.2dB below the limits

Notes: The Emissions pre-test in frequency range from 150kHz to 30MHz was performed in the Anechoic chamber at 3m measurement distance (see Graphs 3.2.1 - 3.2.7);
Final measurements were performed in the Open Area Test Site at 10m measurement distance: no emissions above the ambient were detected.
The Emissions test in frequency range from 30MHz to 1GHz was performed in the Anechoic chamber at 3m measurement distance (see Tables 3.2.1 – 3.2.7 and Graphs 3.2.8 – 3.2.15).

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(d) / RSS-210 A2.6(d)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: Black Glass Frequency Range: 30-1000MHz	

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
30.93 MHz	V	10.1	17.9	28.0	40.0	-12.0
81.351 MHz	V	23.8	8.0	31.8	40.0	-8.2
94.926 MHz	V	25.3	12.5	37.8	43.5	-5.7
108.5 MHz	V	15.9	14.0	29.9	43.5	-13.6
401.07 MHz	V	13.6	17.9	31.5	46.0	-14.5
860.03 MHz	V	12.5	23.3	35.8	46.0	-10.2
35.948 MHz	H	20.5	16.9	37.4	40.0	-2.6
81.351 MHz	H	30.1	8.6	38.8	40.0	-1.2
94.882 MHz	H	24.5	11.3	35.8	43.5	-7.7
102.9 MHz	H	20.1	12.7	32.7	43.5	-10.8
203.35 MHz	H	19.1	11.8	30.9	43.5	-12.6

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(d) / RSS-210 A2.6(d)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: s/n:10002643 Frequency Range: 30-1000MHz	

Table 3.2.2

Frequency MHz	Antenna Polarity	Peak Reading dBμV	Total C.F. dB1/m	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
30.416 MHz	V	9.5	18.3	27.8	40.0	-12.2
56.633 MHz	V	15.7	8.1	23.8	40.0	-16.2
94.927 MHz	V	25.1	12.5	37.6	43.5	-6.0
108.51 MHz	V	22.8	14.0	36.8	43.5	-6.8
203.39 MHz	V	15.6	11.9	27.5	43.5	-16.0
844.74 MHz	V	12.5	23.3	35.8	46.0	-10.2
31.004 MHz	H	8.6	19.8	28.4	40.0	-11.6
81.347 MHz	H	18.9	8.6	27.6	40.0	-12.4
94.927 MHz	H	28.2	11.3	39.5	43.5	-4.1
108.51 MHz	H	25.0	13.2	38.2	43.5	-5.4
122.09 MHz	H	16.9	13.6	30.5	43.5	-13.0
176.22 MHz	H	15.2	11.0	26.1	43.5	-17.4
189.88 MHz	H	16.3	10.9	27.2	43.5	-16.3
203.39 MHz	H	19.6	11.8	31.4	43.5	-12.1
908.05 MHz	H	13.4	24.5	37.8	46.0	-8.2

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(d) / RSS-210 A2.6(d)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: s/n:10002015 Frequency Range: 30-1000MHz	

Table 3.2.3

Frequency	Antenna	Peak Reading	Total C.F.	Total at 3m	Limit	Margin
30.035 MHz	V	8.8	18.6	27.3	40.0	-12.7
30.228 MHz	V	9.5	18.4	27.9	40.0	-12.1
56.78 MHz	V	15.8	8.1	23.9	40.0	-16.1
81.351 MHz	V	19.0	8.0	27.0	40.0	-13.0
94.926 MHz	V	24.5	12.5	37.0	43.5	-6.6
938.88 MHz	V	12.1	23.6	35.8	46.0	-10.3
30.579 MHz	H	7.8	20.0	27.8	40.0	-12.2
81.351 MHz	H	27.0	8.6	35.7	40.0	-4.3
94.926 MHz	H	24.8	11.3	36.1	43.5	-7.4
176.29 MHz	H	19.5	11.0	30.5	43.5	-13.0
189.84 MHz	H	18.0	10.9	28.8	43.5	-14.7
203.35 MHz	H	15.0	11.8	26.8	43.5	-16.7
895.76 MHz	H	11.8	24.6	36.4	46.0	-9.6

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(d) / RSS-210 A2.6(d)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: Built-in s/n: 9400130 Frequency Range: 30-1000MHz	

Table 3.2.4

Frequency	Antenna	Peak Reading	Total C.F.	Total at 3m	Limit	Margin
30.088 MHz	V	9.0	18.5	27.5	40.0	-12.5
38.984 MHz	V	11.9	13.2	25.1	40.0	-14.9
40.686 MHz	V	20.7	12.4	33.2	40.0	-6.8
81.351 MHz	V	18.2	8.0	26.2	40.0	-13.9
94.926 MHz	V	19.7	12.5	32.2	43.5	-11.4
111.1 MHz	V	17.8	14.1	31.8	43.5	-11.7
112.2 MHz	V	19.9	14.1	34.0	43.5	-9.5
114.5 MHz	V	20.0	14.3	34.3	43.5	-9.2
115.64 MHz	V	24.2	14.3	38.6	43.5	-5.0
116.79 MHz	V	19.0	14.4	33.4	43.5	-10.1
122.02 MHz	V	22.0	14.5	36.5	43.5	-7.0
135.57 MHz	V	15.5	14.1	29.6	43.5	-14.0
897.48 MHz	V	12.3	23.5	35.8	46.0	-10.2
32.071 MHz	H	8.7	19.2	27.8	40.0	-12.2
40.668 MHz	H	16.4	14.3	30.7	40.0	-9.3
67.82 MHz	H	29.3	7.1	36.4	40.0	-3.6
81.351 MHz	H	20.6	8.6	29.2	40.0	-10.8
94.926 MHz	H	23.9	11.3	35.2	43.5	-8.4
108.5 MHz	H	15.7	13.2	28.9	43.5	-14.7
122.02 MHz	H	24.7	13.6	38.3	43.5	-5.2
149.19 MHz	H	15.3	12.4	27.7	43.5	-15.9
162.74 MHz	H	14.2	11.6	25.8	43.5	-17.8

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(d) / RSS-210 A2.6(d)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: s/n:P1200544 Frequency Range: 30-1000MHz	

Table 3.2.5

Frequency MHz	Antenna Polarity	Peak Reading dBμV	Total C.F. dB1/m	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
30.035 MHz	V	8.8	18.6	27.3	40.0	-12.7
40.668 MHz	V	17.1	12.4	29.6	40.0	-10.4
94.926 MHz	V	25.4	12.5	37.9	43.5	-5.7
108.5 MHz	V	19.5	14.0	33.5	43.5	-10.0
885.16 MHz	V	11.8	23.5	35.3	46.0	-10.7
30.246 MHz	H	9.4	20.2	29.6	40.0	-10.4
94.926 MHz	H	29.9	11.3	41.2	43.5	-2.4
108.5 MHz	H	26.0	13.2	39.2	43.5	-4.4
189.84 MHz	H	17.5	10.9	28.3	43.5	-15.2
203.35 MHz	H	16.7	11.8	28.6	43.5	-14.9
928.78 MHz	H	11.7	24.3	36.0	46.0	-10.0

Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(d) / RSS-210 A2.6(d)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: s/n:1879 Frequency Range: 30-1000MHz	

Table 3.2.6

Frequency MHz	Antenna Polarity	Peak Reading dBμV	Total C.F. dB1/m	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
30.123 MHz	V	8.3	18.5	26.8	40.0	-13.3
38.58 MHz	V	11.8	13.4	25.1	40.0	-14.9
94.926 MHz	V	25.3	12.5	37.8	43.5	-5.8
104.93 MHz	V	16.9	14.1	30.9	43.5	-12.6
108.5 MHz	V	15.5	14.0	29.5	43.5	-14.1
400.89 MHz	V	13.1	17.9	31.0	46.0	-15.0
30.632 MHz	H	8.0	20.0	28.0	40.0	-12.0
94.926 MHz	H	27.3	11.3	38.6	43.5	-4.9
108.46 MHz	H	18.7	13.2	31.9	43.5	-11.6
203.35 MHz	H	20.3	11.8	32.1	43.5	-11.4
894.03 MHz	H	12.0	24.6	36.6	46.0	-9.4

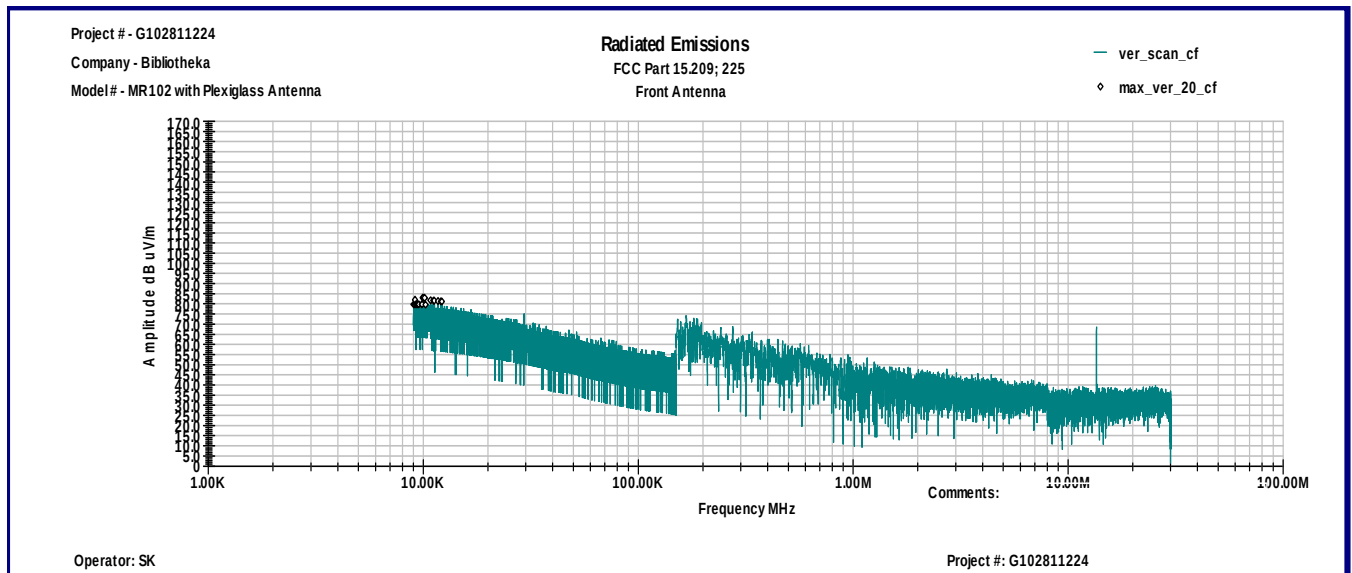
Date:	December 8-15, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.225(d) / RSS-210 A2.6(d)	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 36%(RH); 96.3kPa	
Equipment Verification:	☒	
Note:	Antenna: 78-8129-3044-0 built-in device not powered Frequency Range: 30-1000MHz	

Table 3.2.7

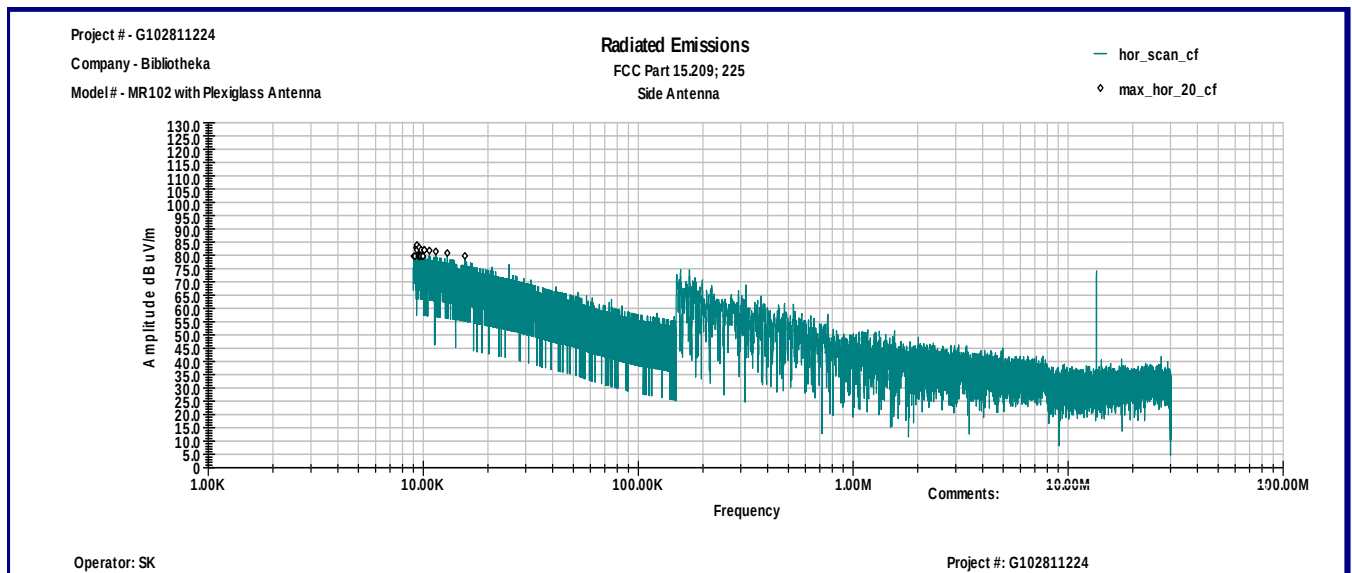
Frequency MHz	Antenna Polarity	Peak Reading dBμV	Total C.F. dB1/m	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
30.719 MHz	V	8.1	18.1	26.2	40.0	-13.8
67.792 MHz	V	22.2	6.9	29.0	40.0	-11.0
149.19 MHz	V	16.6	12.8	29.4	44.0	-14.6
162.74 MHz	V	11.7	12.3	24.0	44.0	-20.0
400.89 MHz	V	13.7	17.9	31.6	46.0	-14.4
953.42 MHz	V	11.5	23.9	35.4	46.0	-10.7
31.334 MHz	H	8.2	19.6	27.8	40.0	-12.2
67.82 MHz	H	22.4	7.1	29.5	40.0	-10.5
108.5 MHz	H	19.3	13.2	32.5	44.0	-11.5
244.09 MHz	H	15.4	13.7	29.2	46.0	-16.8

Graph 3.2.1

Front antenna orientation

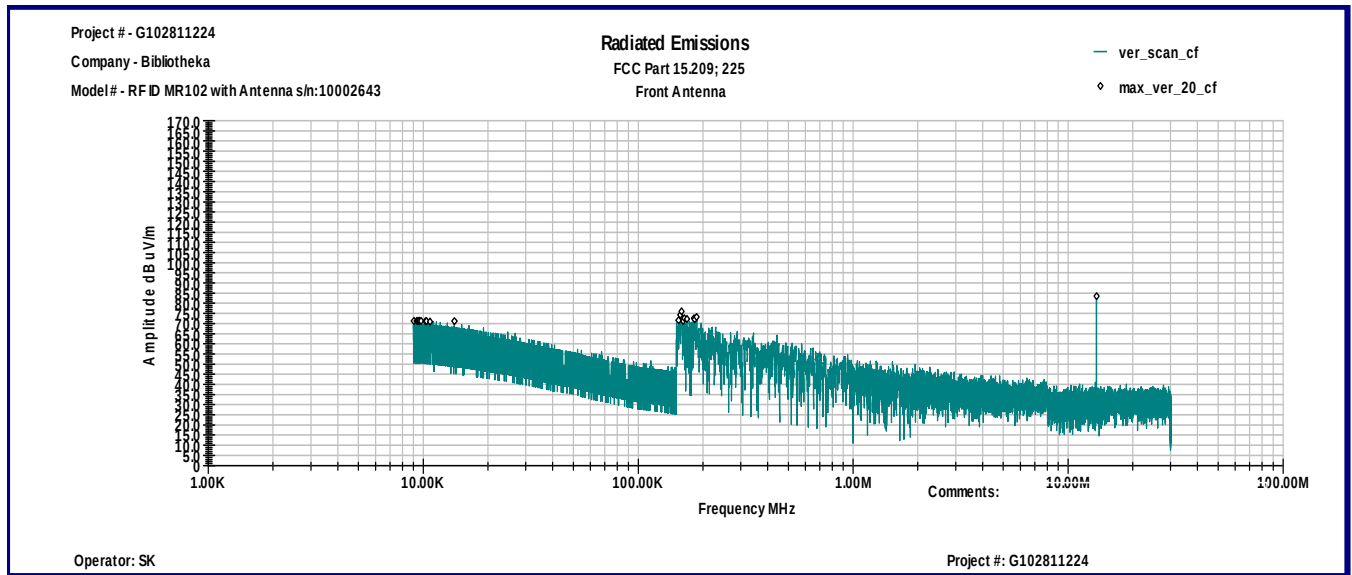


Side antenna orientation

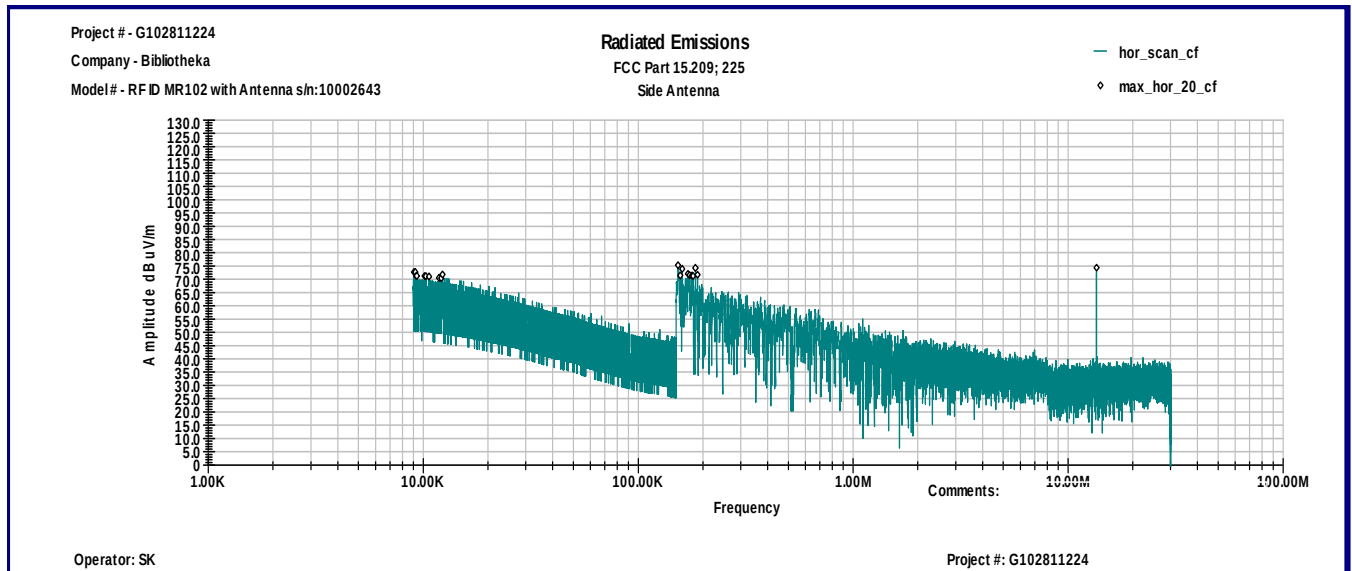


Graph 3.2.2

Front antenna orientation

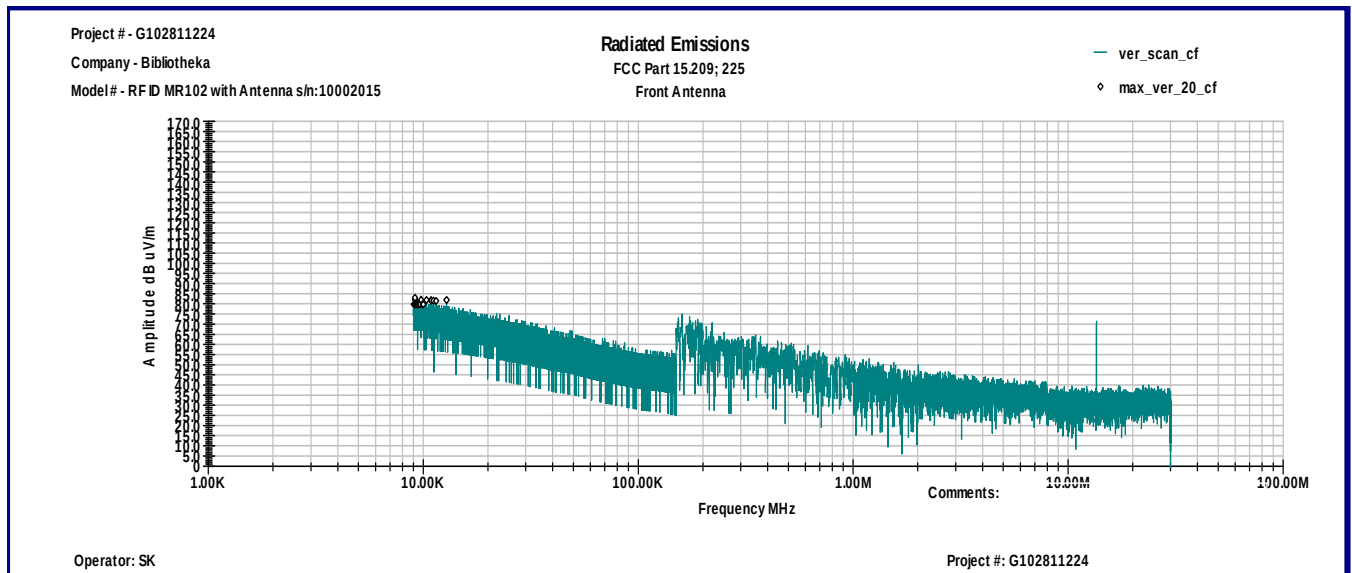


Side antenna orientation

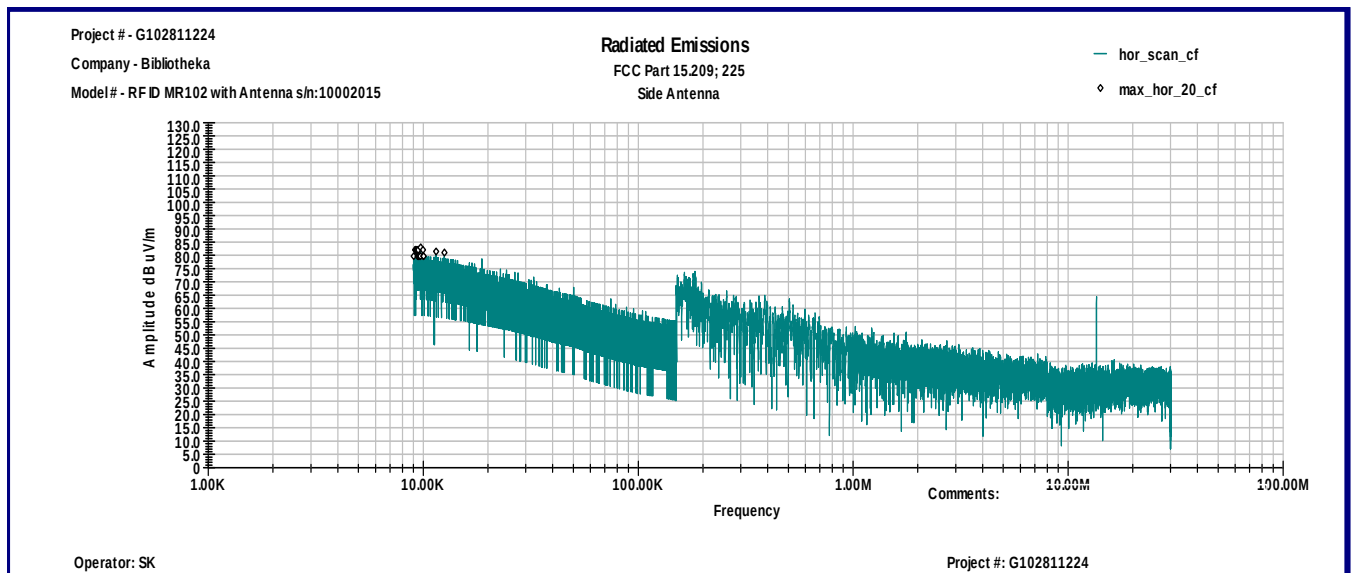


Graph 3.2.3

Front antenna orientation

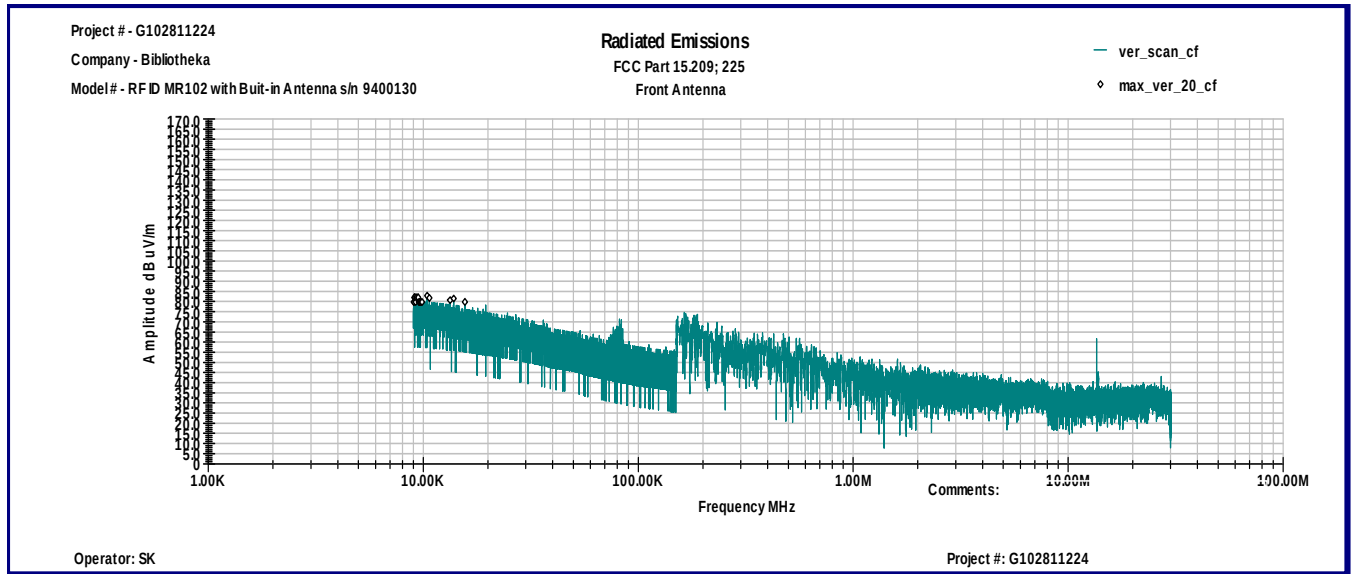


Side antenna orientation

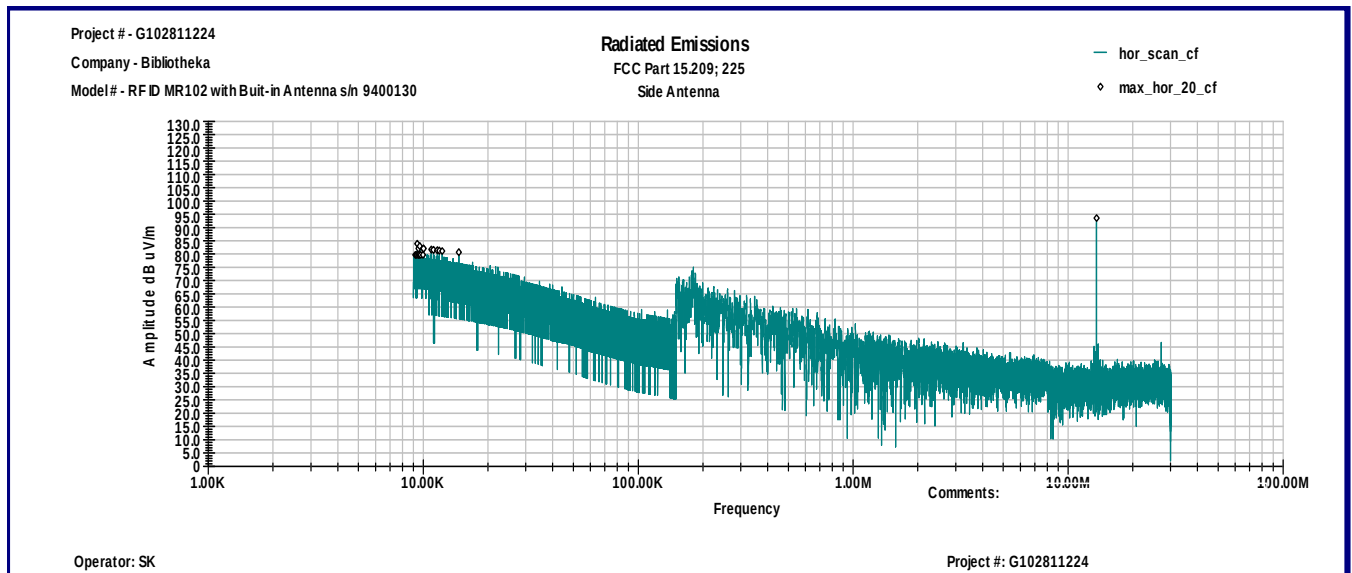


Graph 3.2.4

Front antenna orientation

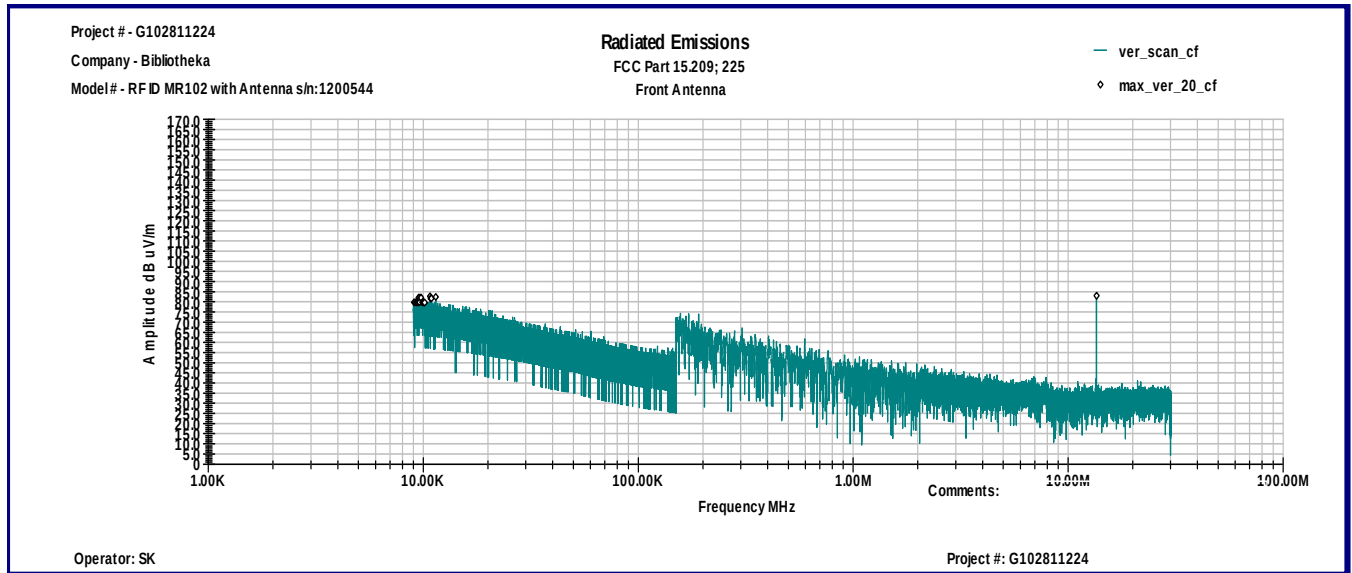


Side antenna orientation

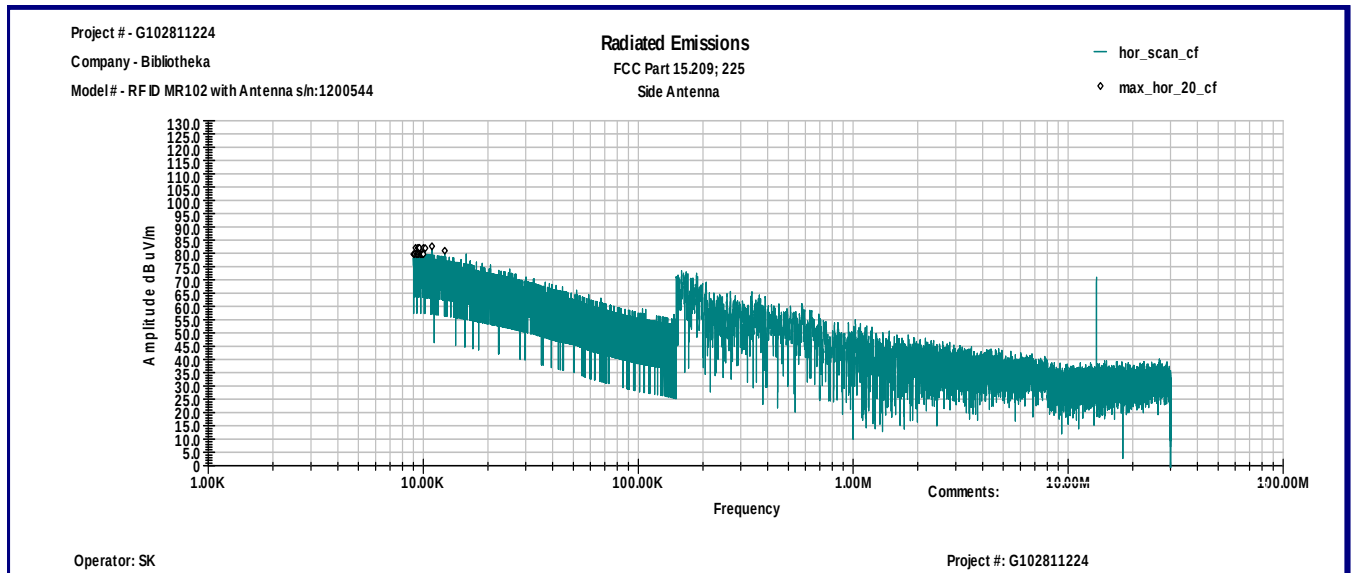


Graph 3.2.5

Front antenna orientation

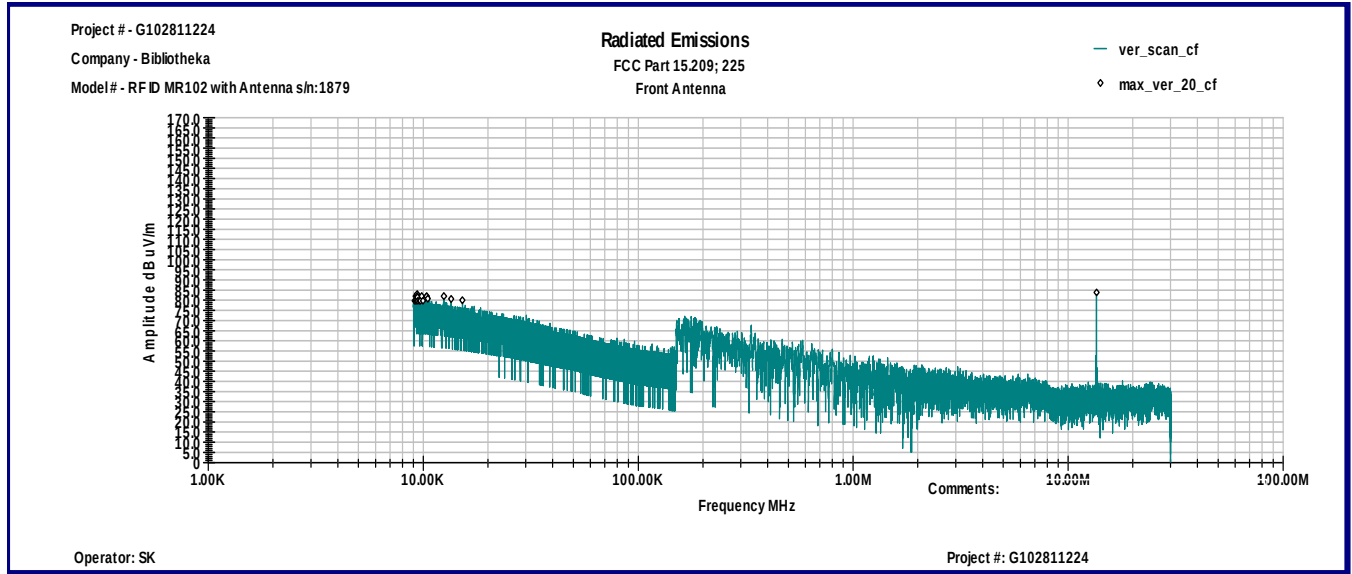


Side antenna orientation

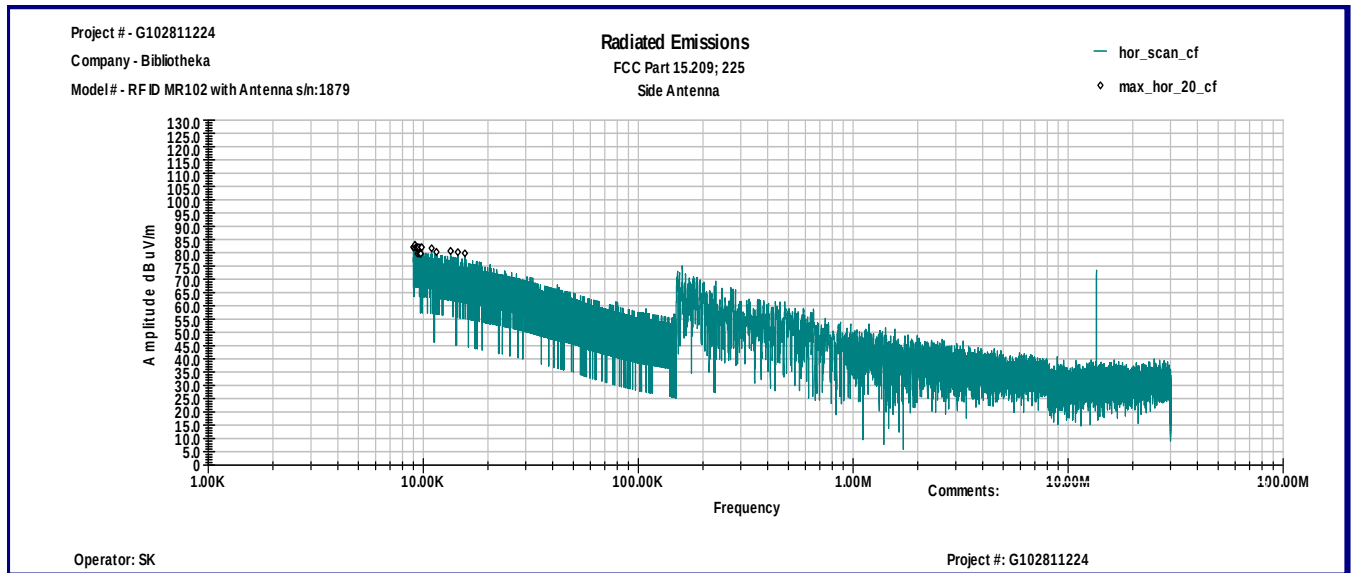


Graph 3.2.6

Front antenna orientation

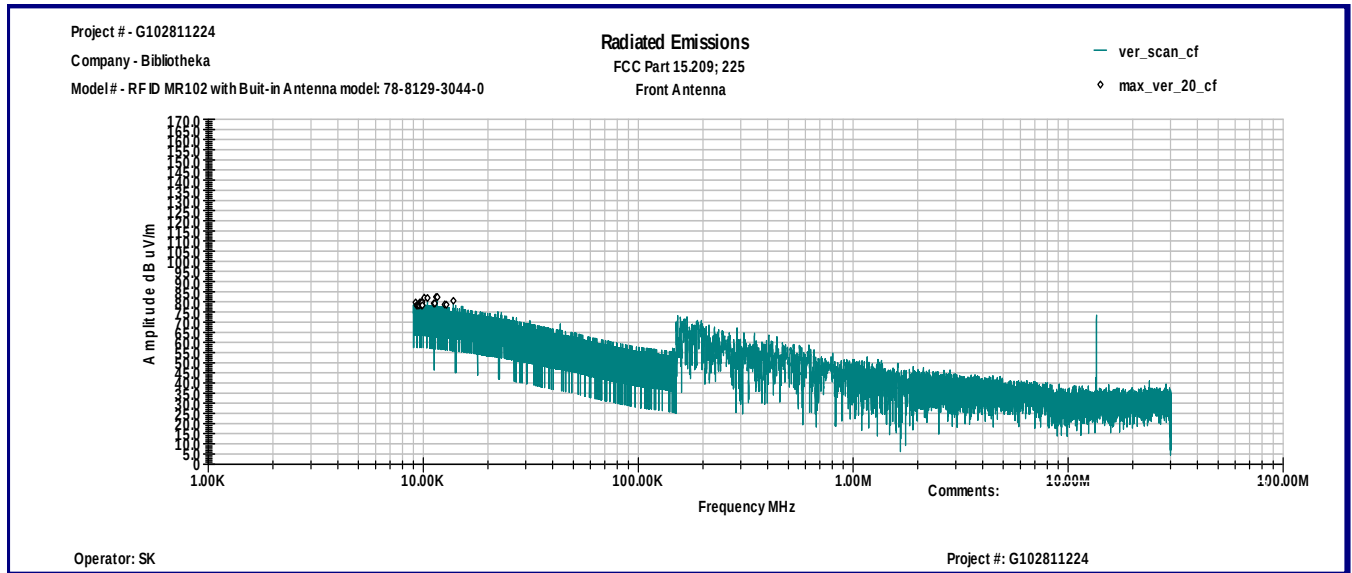


Side antenna orientation

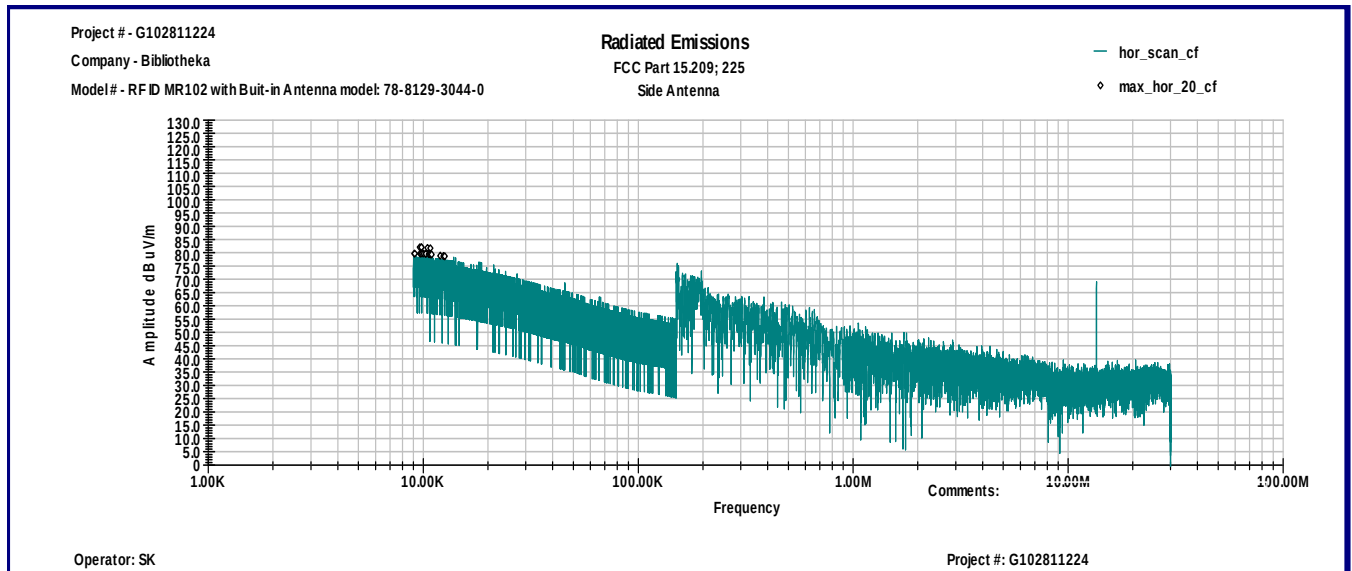


Graph 3.2.7

Front antenna orientation

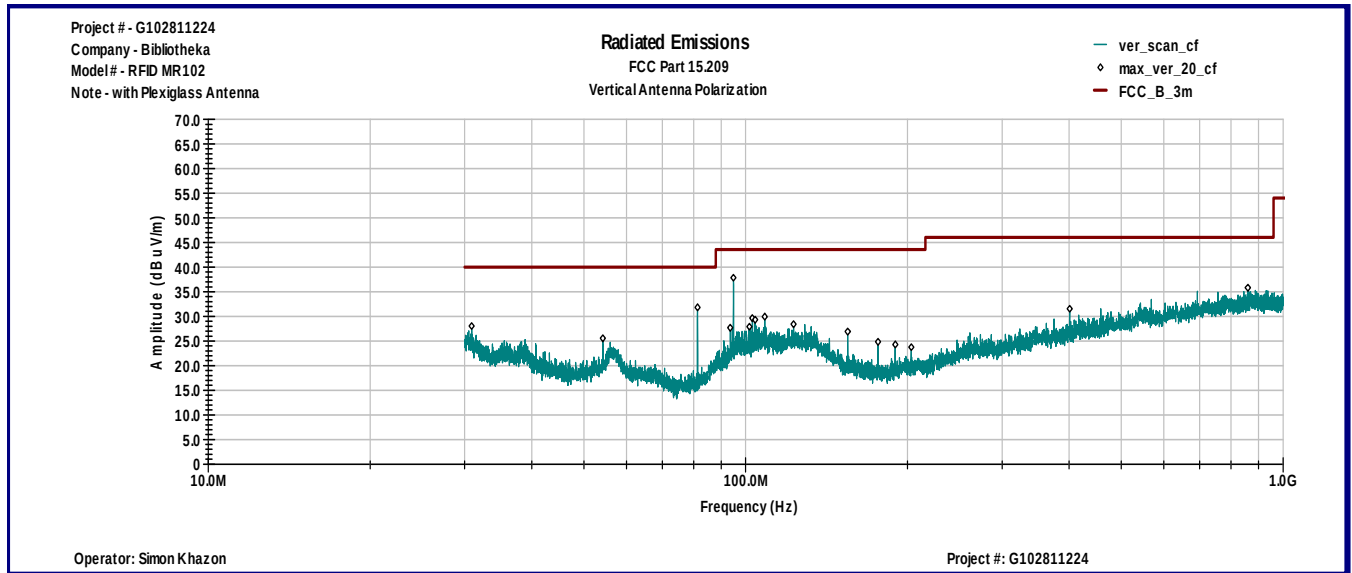


Side antenna orientation

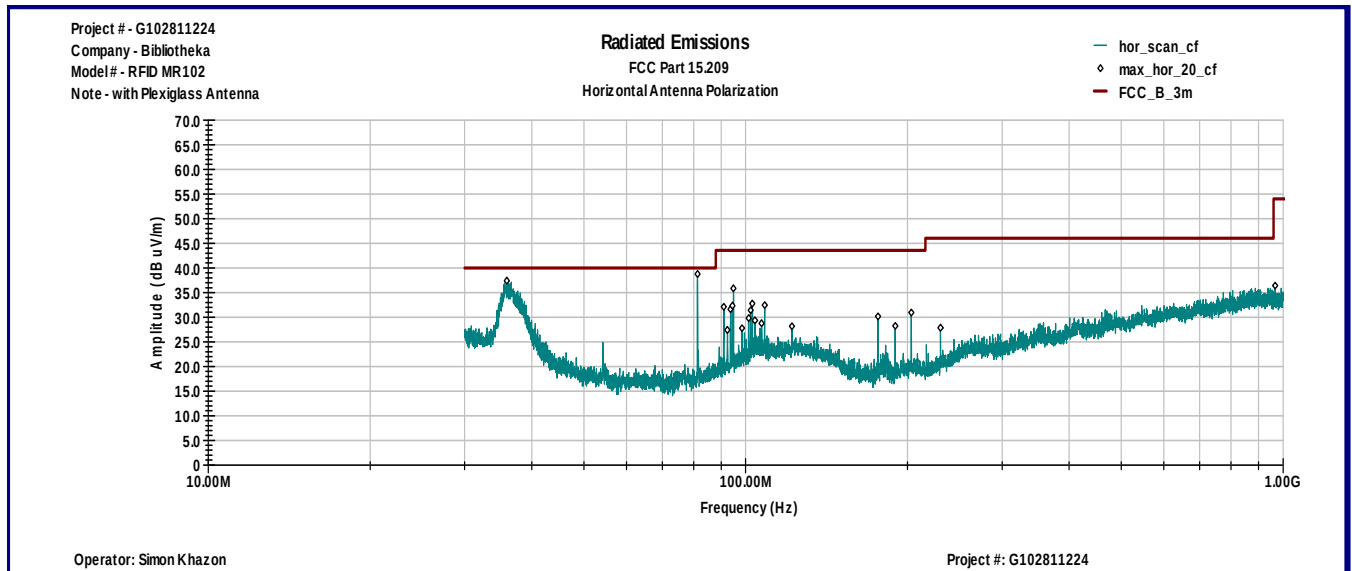


Graph 3.2.8

Vertical antenna polarization

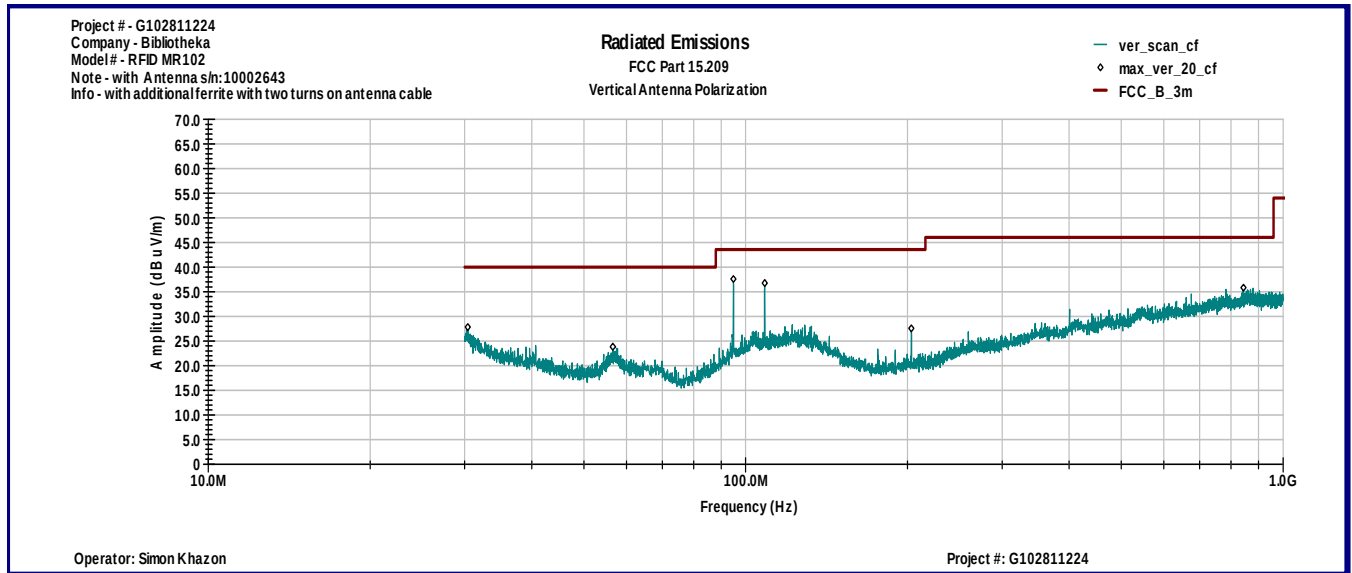


Horizontal antenna polarization

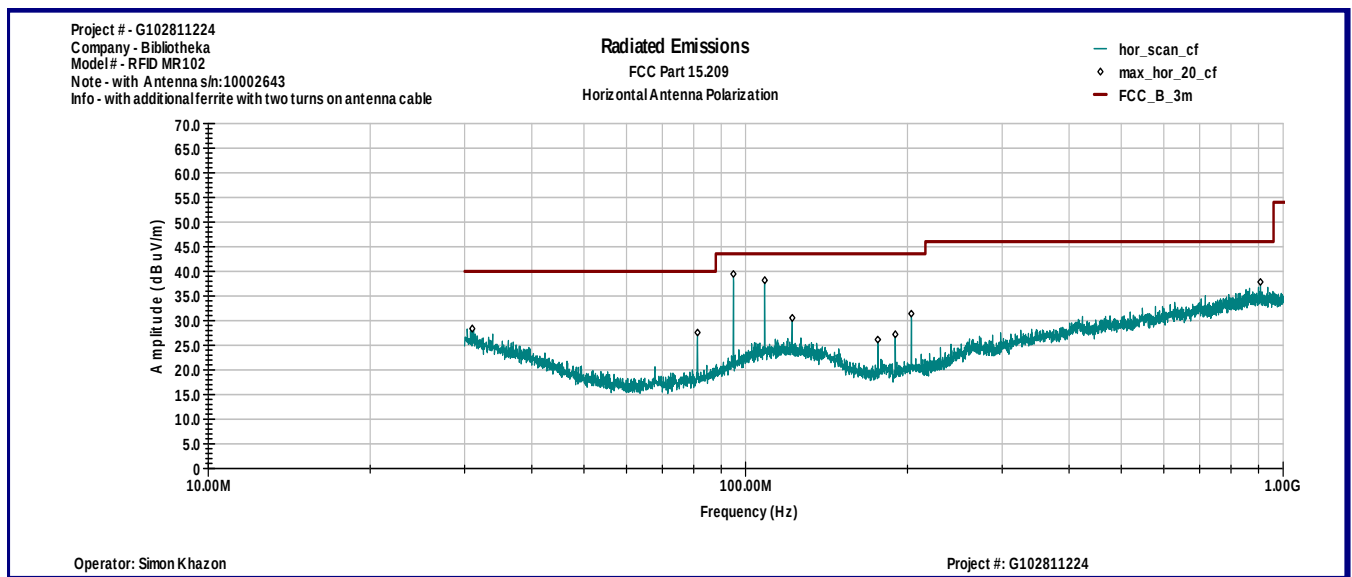


Graph 3.2.9

Vertical antenna polarization

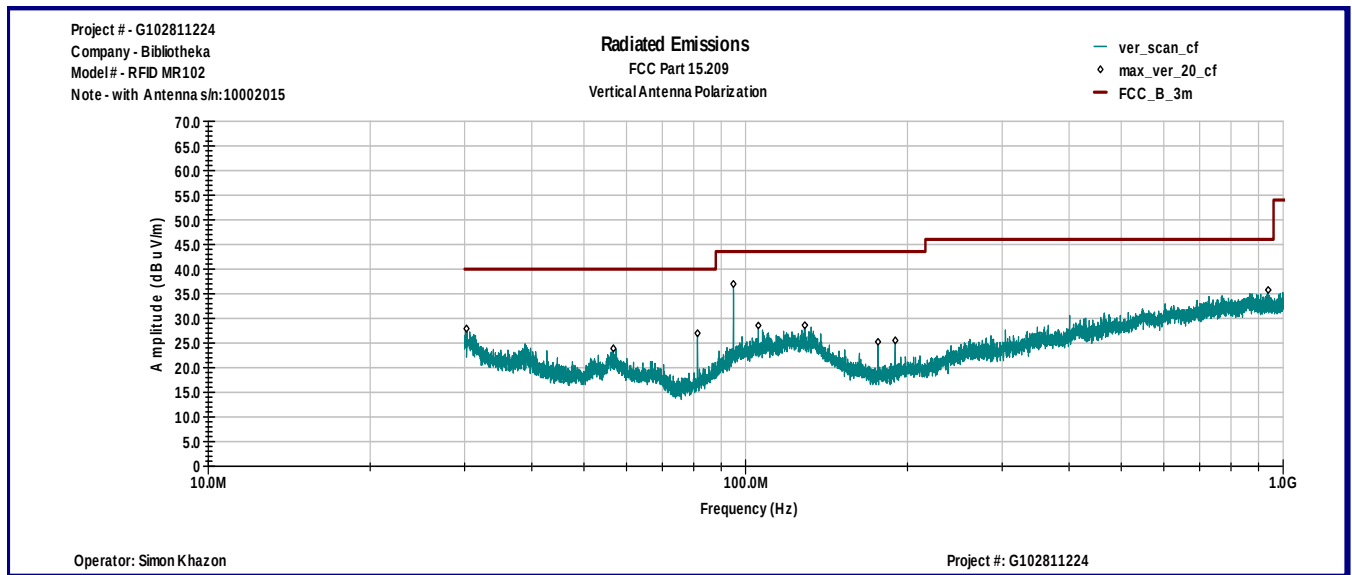


Horizontal antenna polarization

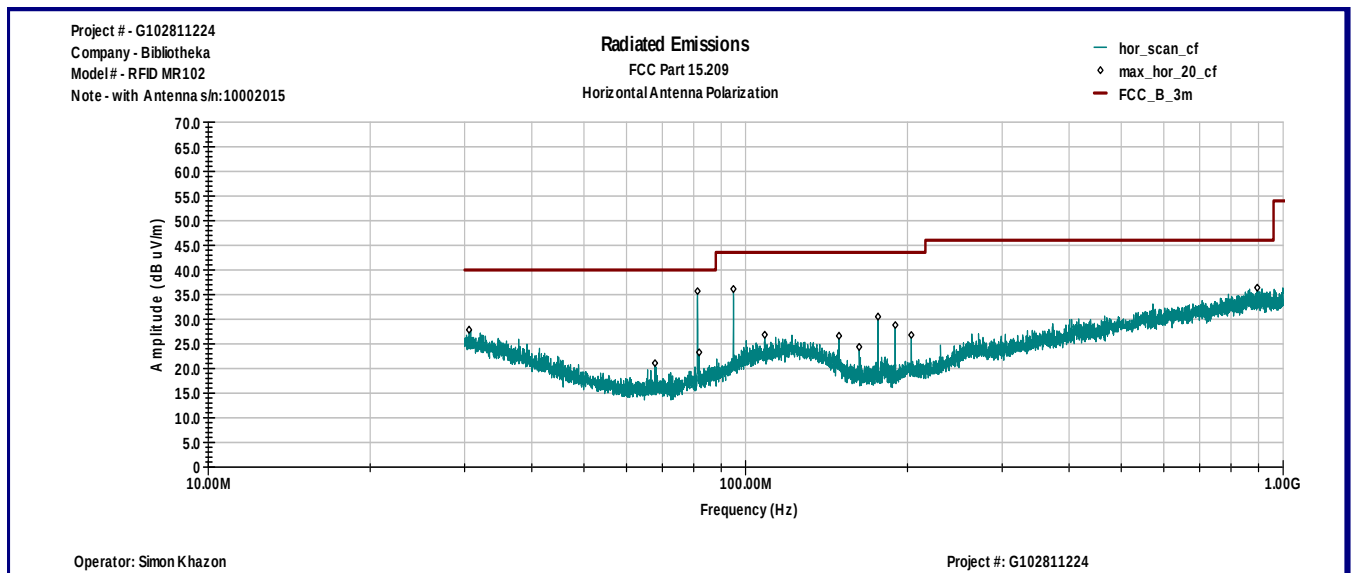


Graph 3.2.10

Vertical antenna polarization

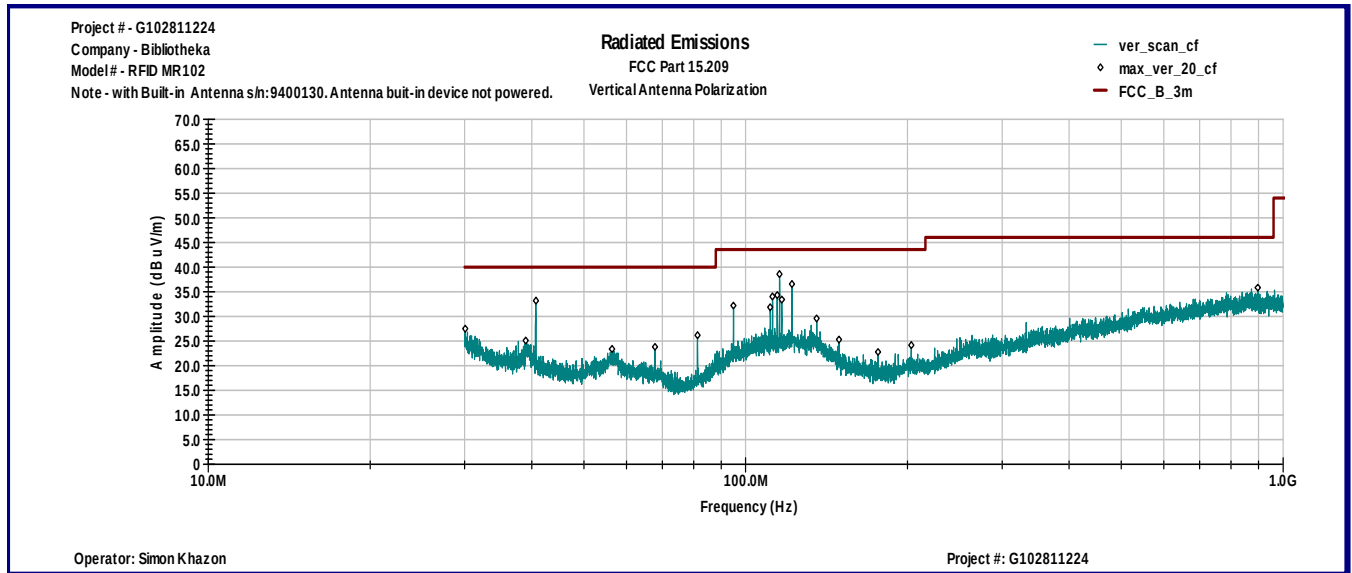


Horizontal antenna polarization

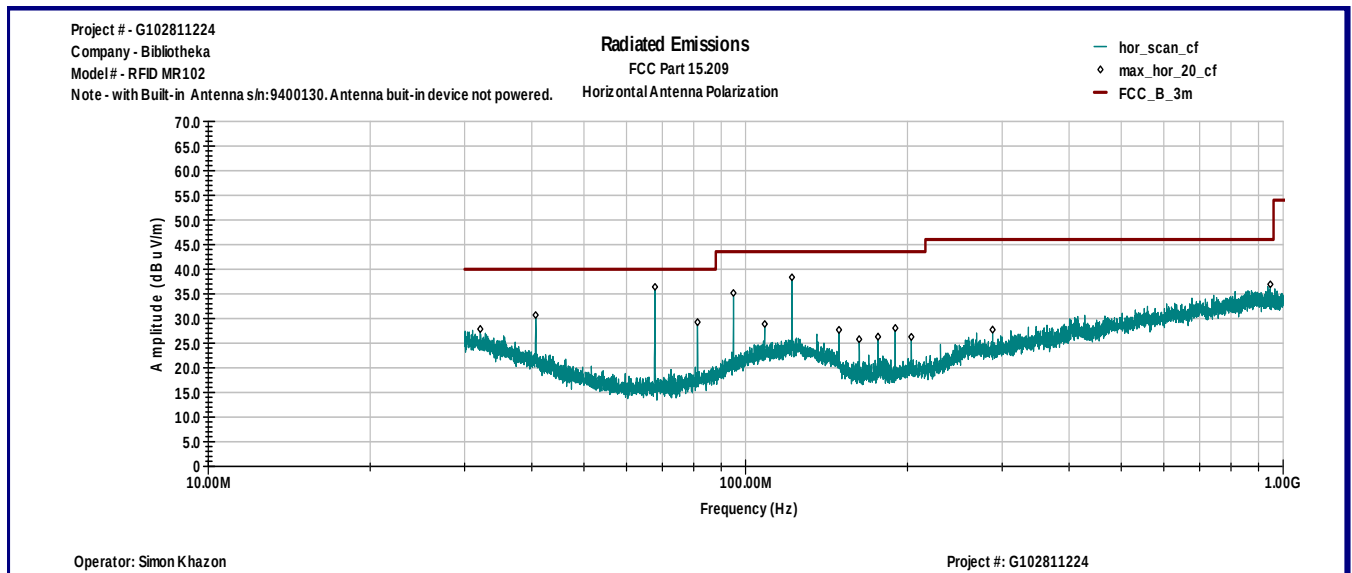


Graph 3.2.11

Vertical antenna polarization

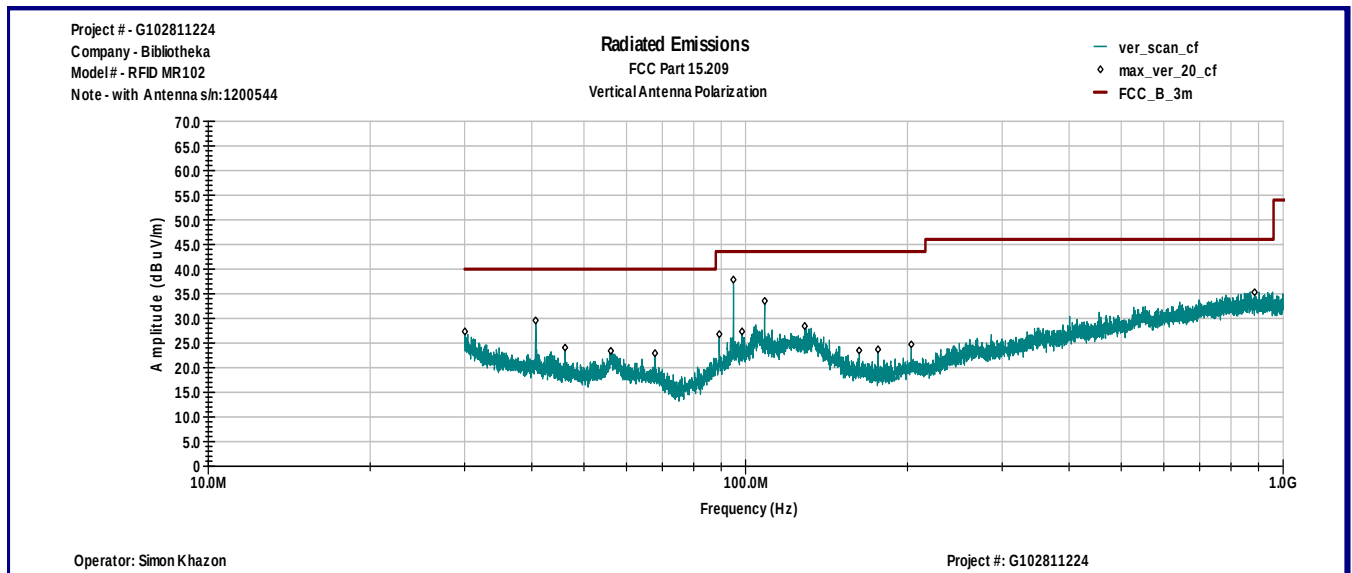


Horizontal antenna polarization

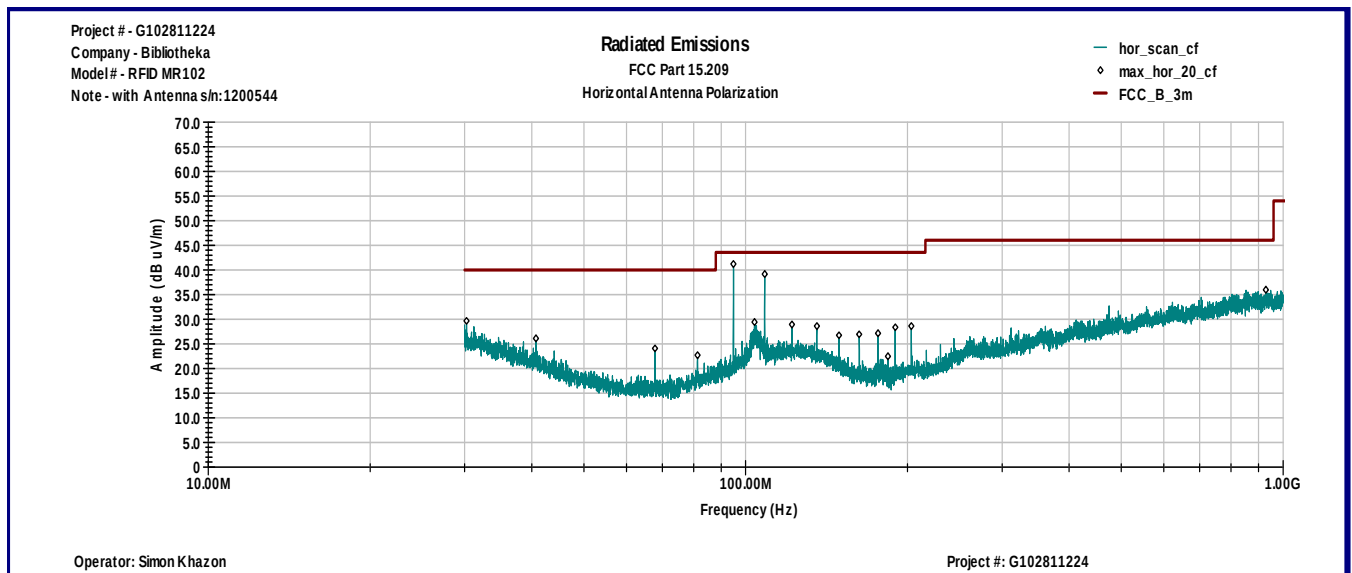


Graph 3.2.12

Vertical antenna polarization

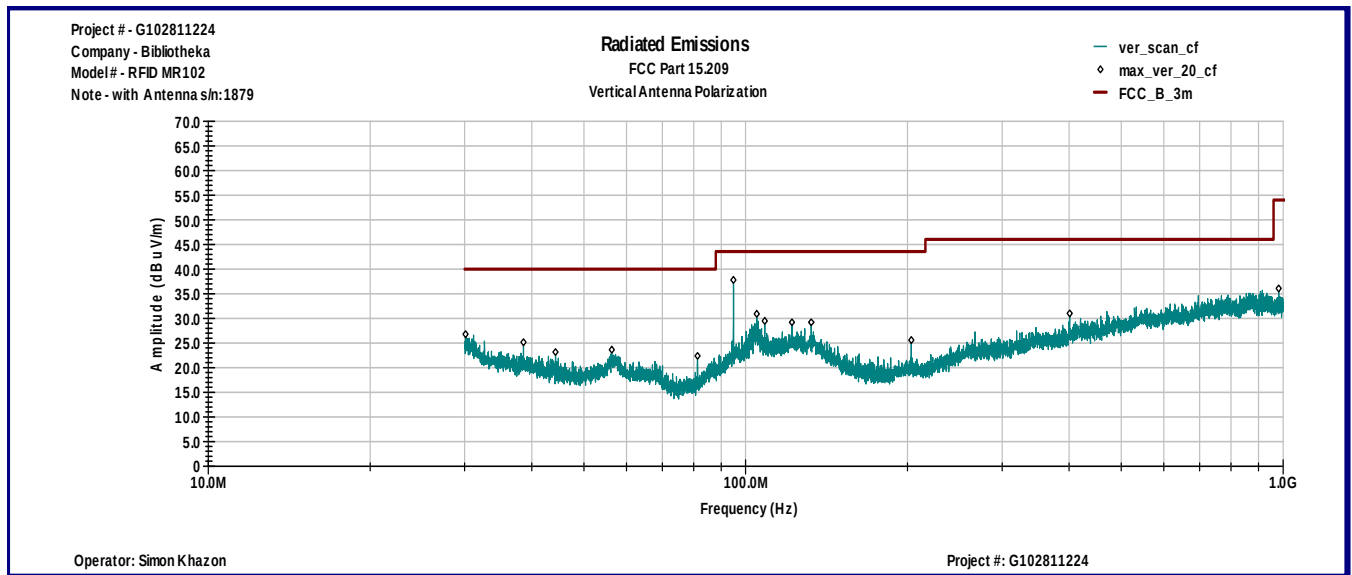


Horizontal antenna polarization

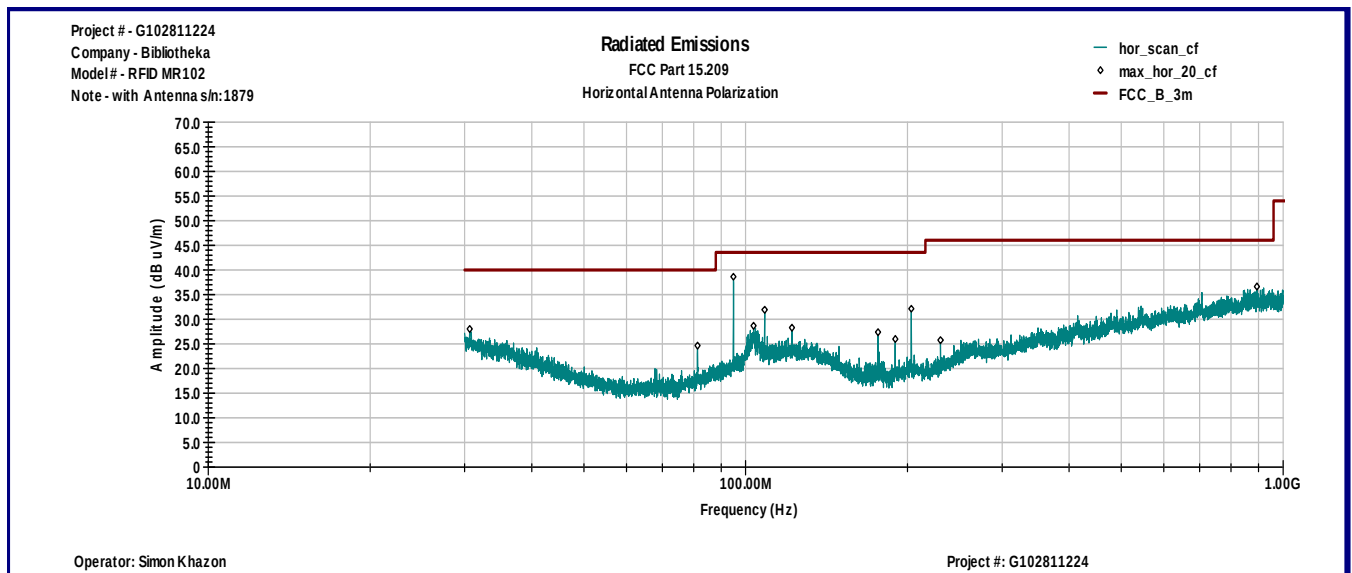


Graph 3.2.13

Vertical antenna polarization

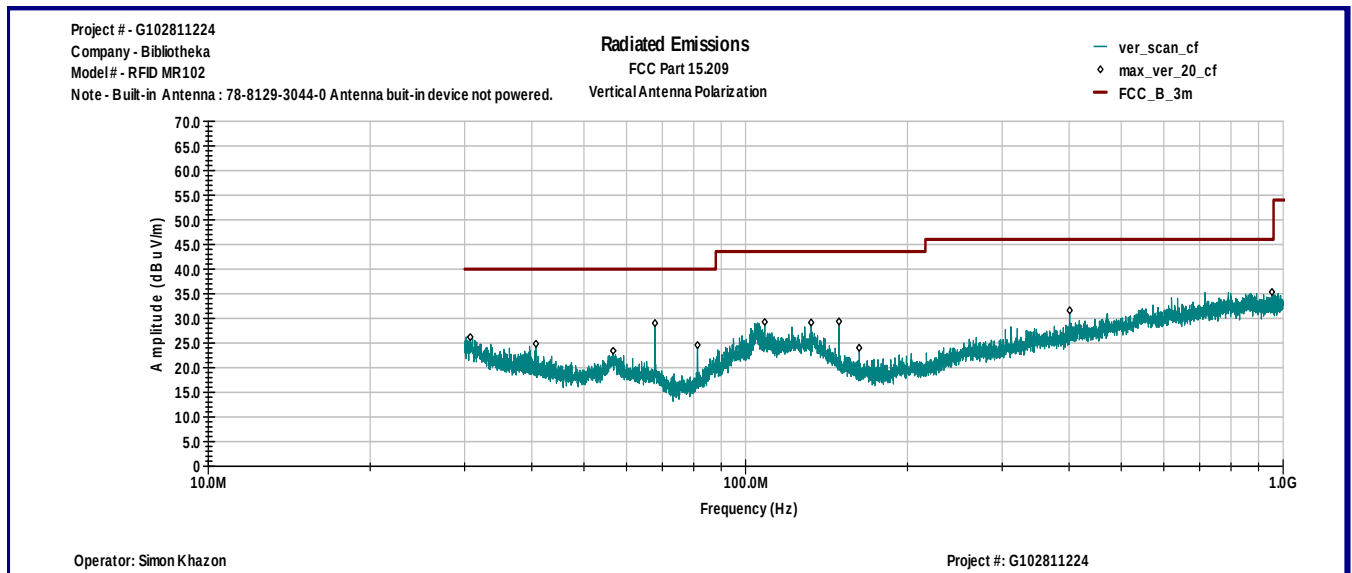


Horizontal antenna polarization

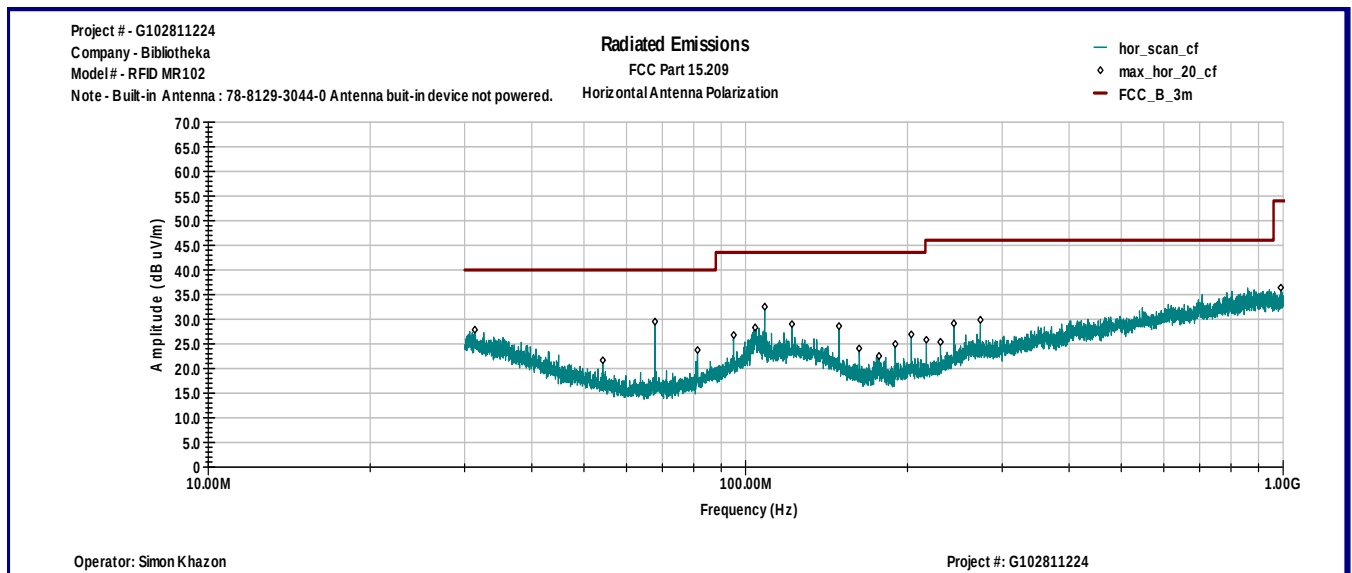


Graph 3.2.14

Vertical antenna polarization



Horizontal antenna polarization



3.3 Frequency Tolerance

Test location: ☐ OATS ☐ Anechoic Chamber ☐ Other

Test date: December 13-14, 2016

Tested by: Simon Khazon

Test result: **Pass**

Test Parameter		Measured Deviation (Hz)	Maximum Allowed Deviation (Hz)	Test Result
Temperature °C	Voltage V			
-20	120	-21.5	±1356	Pass
-10		-14.3	±1356	Pass
0		-136.2	±1356	Pass
10		-128.2	±1356	Pass
20		0	±1356	Pass
30		-48.2	±1356	Pass
40		-10.2	±1356	Pass
50		-3.1	±1356	Pass
20	102	0	±1356	Pass
	108	0	±1356	Pass
	114	0	±1356	Pass
	120	0	±1356	Pass
	126	0	±1356	Pass
	132	0	±1356	Pass
	138	0	±1356	Pass

Notes: The Transmitters operated in continuous CW mode during testing



3.4 Bandwidth of Emissions

Test location: ☐ OATS ☐ Anechoic Chamber ☒ Other

Test distance: ☐ 10 meters ☐ 3 meters

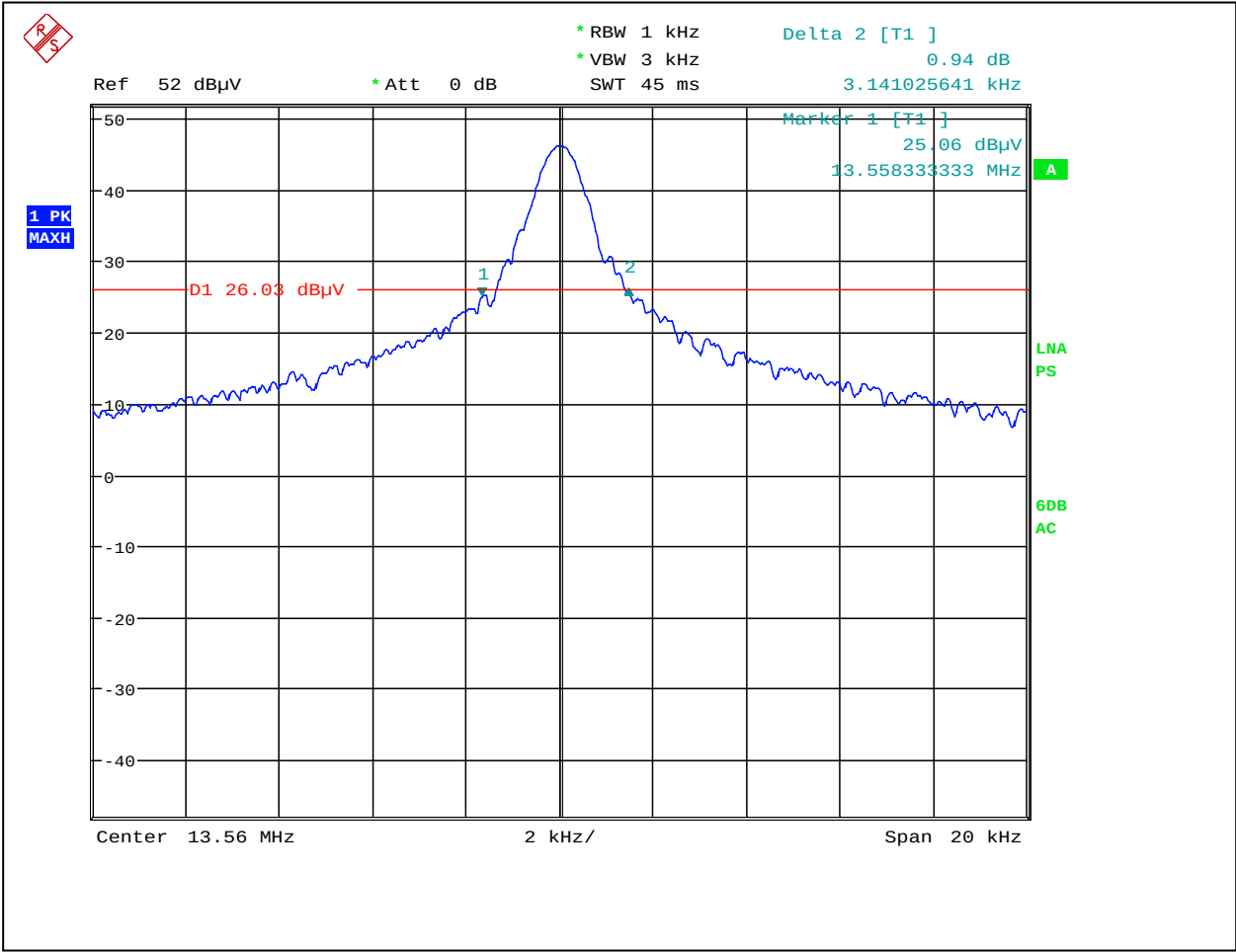
Test result: Pass

Center Frequency of operation MHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz
13.56	3.1	6.1

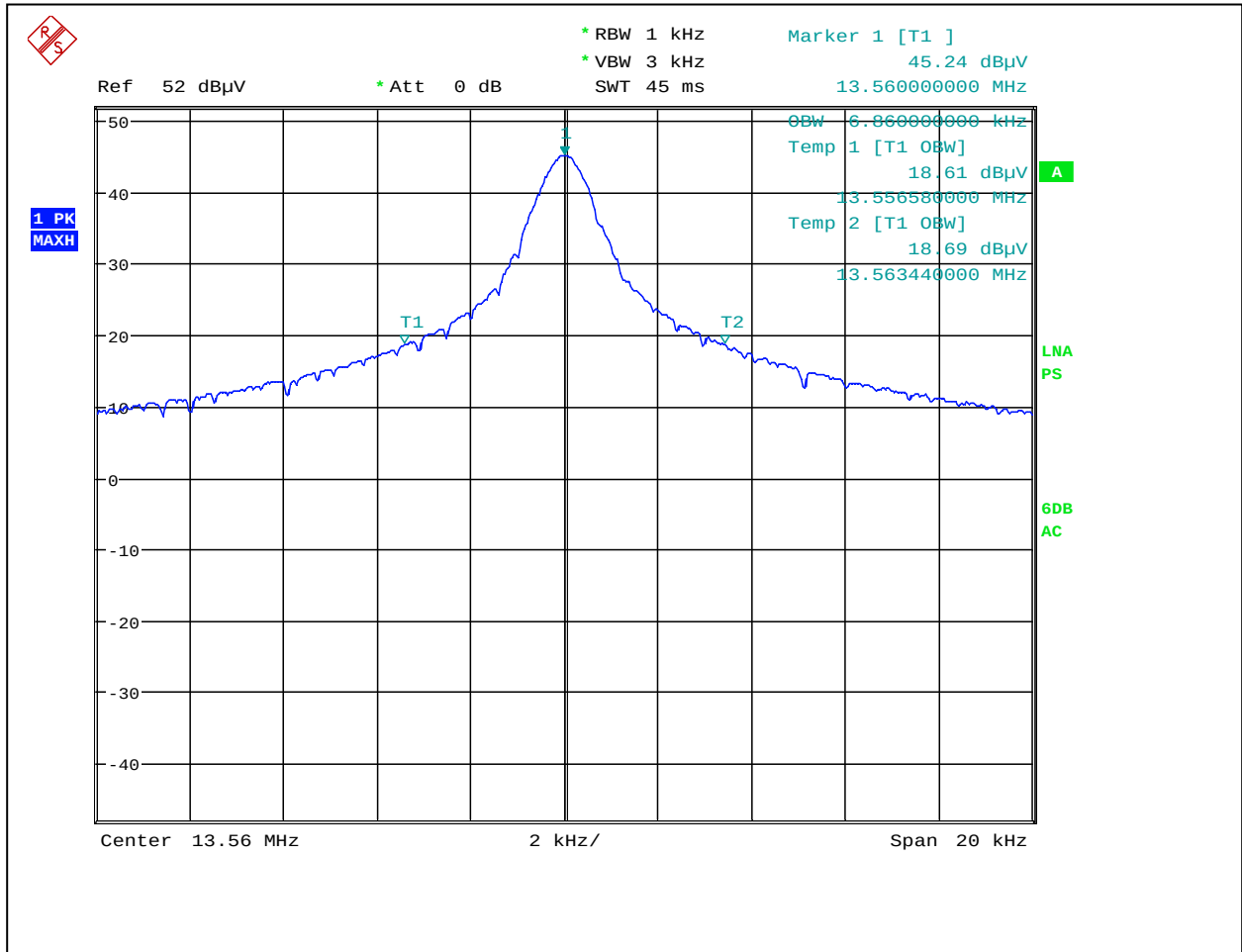
Graphs 3-4-1 and 3-4-2 are show bandwidth of emissions

Notes: The bandwidth of emissions is contained within the frequency band of operation

Graph 3.4.1



Graph 3.4.2





3.5 Transmitter power line conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 7.8dB below the limits

Notes: None

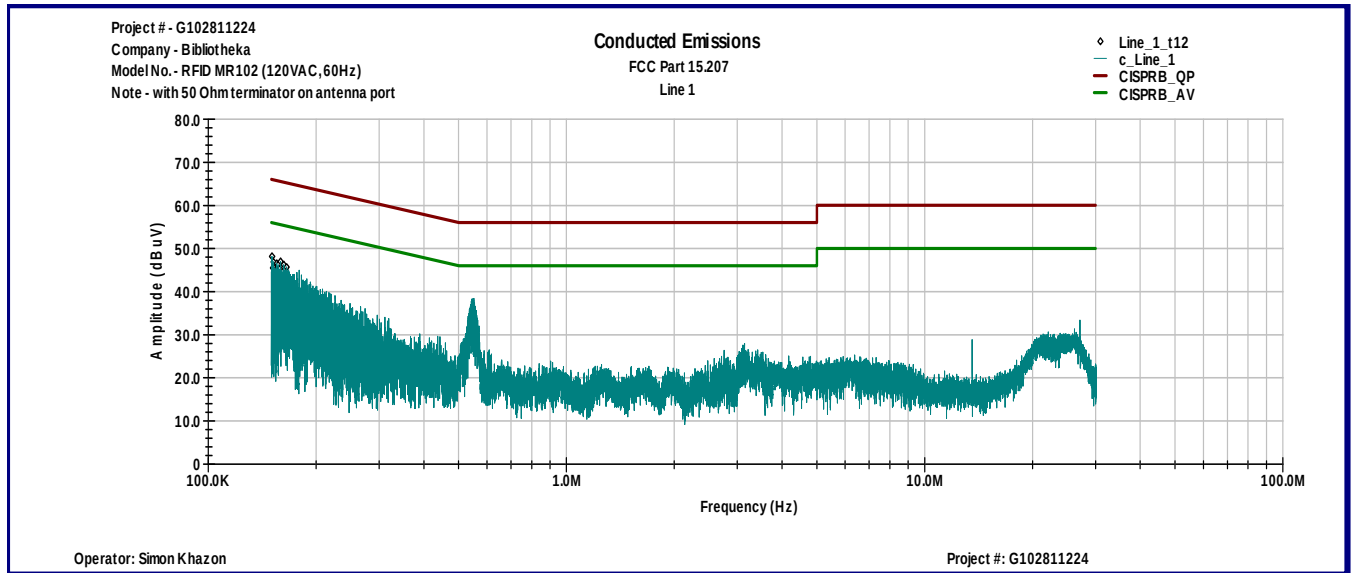
Date:	December 7, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC Part 15.207	
Test Point:	Power Line	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 32%(RH); 96.5kPa	
Equipment Verification:	☒	
Note:	EUT was powered at 120VAC, 60Hz Test was performed with 50 Ohm terminator on Antenna port.	

Table 3.5.1

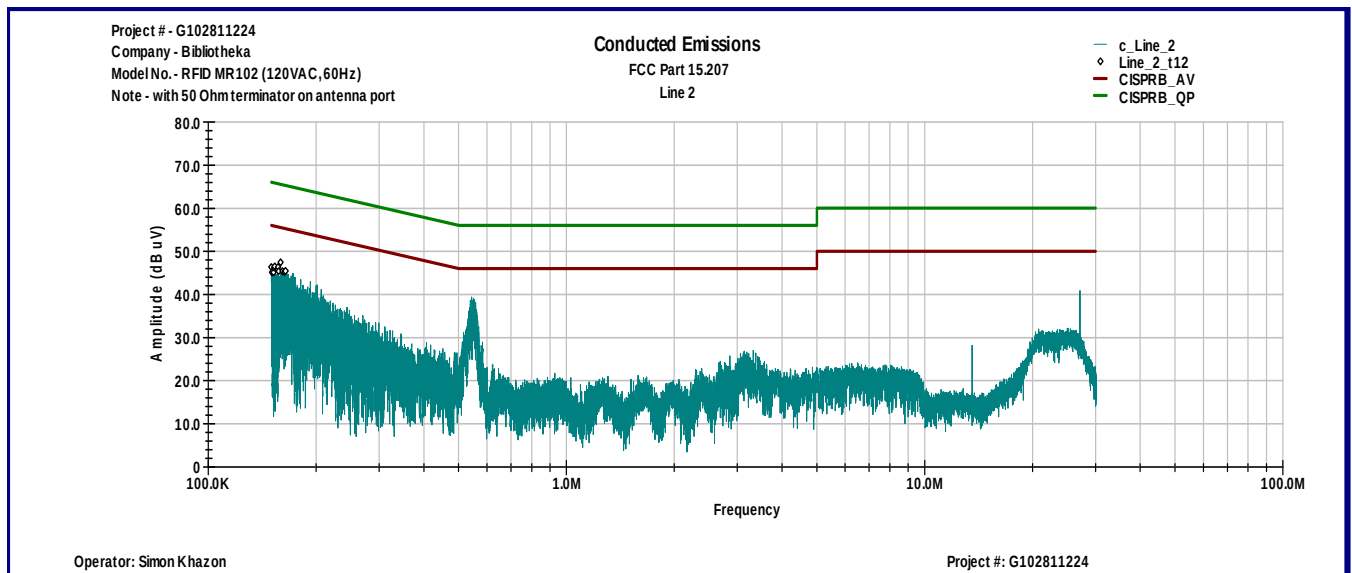
Line 1					
Frequency	Peak dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
150.7 KHz	48.2	66.0	56.0	-17.8	-7.8
151.48 KHz	45.5	65.9	55.9	-20.4	-10.4
152.02 KHz	46.8	65.9	55.9	-19.1	-9.1
153.22 KHz	45.4	65.8	55.8	-20.4	-10.4
154.62 KHz	45.2	65.8	55.8	-20.6	-10.6
155.17 KHz	46.5	65.7	55.7	-19.2	-9.2
155.4 KHz	45.1	65.7	55.7	-20.6	-10.6
156.68 KHz	46.2	65.6	55.6	-19.4	-9.4
158.51 KHz	45.3	65.5	55.5	-20.3	-10.3
159.28 KHz	47.0	65.5	55.5	-18.5	-8.5
162.39 KHz	46.2	65.3	55.3	-19.1	-9.1
165.54 KHz	45.7	65.2	55.2	-19.5	-9.5
Line 2					
Frequency	Peak dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
150.0 KHz	46.3	66.0	56.0	-19.7	-9.7
150.58 KHz	45.1	66.0	56.0	-20.9	-10.9
151.36 KHz	45.5	65.9	55.9	-20.4	-10.4
152.02 KHz	45.1	65.9	55.9	-20.8	-10.8
152.6 KHz	46.2	65.9	55.9	-19.7	-9.7
153.22 KHz	46.5	65.8	55.8	-19.3	-9.3
156.56 KHz	46.4	65.6	55.6	-19.3	-9.3
157.11 KHz	45.4	65.6	55.6	-20.2	-10.2
159.17 KHz	47.4	65.5	55.5	-18.1	-8.1
161.22 KHz	45.4	65.4	55.4	-20.1	-10.1
163.05 KHz	45.2	65.3	55.3	-20.1	-10.1
164.33 KHz	45.4	65.2	55.2	-19.8	-9.8

Graph 3.5.1

Line 1



Line 2





3.6 Receiver/digital device radiated emissions

Test location: ☐ OATS ☐ Anechoic Chamber

Test distance: ☐ 10 meters ☐ 3 meters

Test result: **N/A**

Frequency range: 30MHz-1000MHz

Max. Emissions margin: dB below the limits

Notes: EUT does not contain a Receiver portion.



3.7 Receiver/digital device conducted emissions

Test location: ☐ OATS ☐ Anechoic Chamber ☐ Other

Test result: **N/A**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: dB below the limits

Notes: EUT does not contain a Receiver portion.

3.8 SAR Test Exclusion Calculation

The EUT Output Power can be calculated using the formula:

$$P = (E \times d / 7.02)^2, \text{ where}$$

P – power in W,

E – field strength in V/m,

D – field strength measurement distance in m

The maximum measured field strength is 73.7dB μ V/m, or 0.005V/m at 10m distance

The maximum Radiated power P is $(0.005\text{V/m} \times 10\text{m} / 7.02)^2 = 0.000051\text{W} = 51\text{mW}$

The Maximum Exclusion Threshold power per Appendix C of KDB 447498 D01 v05r02 is 738mW

The Maximum Exemption Limits for SAR Routine Evaluation of RSS-102 (section2.5) is 345mW

Based on that the Transmitter is exempt from SAR testing.



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	ESU	100398	25283	02/11/2017	☒
Spectrum Analyzer	R & S	ESCI	100358	12909	10/31/2017	☒
Spectrum Analyzer	Agilent	E7402A	MY44212200	12660	08/02/2017	☒
Bicono-Log Antenna	Teseq	CBL6112D	32859	25289	10/03/2017	☒
Loop Antenna	ETS	6512	00060486	19942	12/28/2016	☒
LISN	COM-Power	Li-215A	191970	172315	06/13/2017	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	☒
Environmental Chamber	CSZ	ZH-16-3.5-SCT/AC	Z0414046	17092	04/07/2017	☒

5.0 Revision History

REVISION LEVEL	DATE	REPORT NUMBER	PREPARED	REVIEWED	NOTES
0	01-10-2017	102811224MIN-002	SK	NS	Original Issue
1	02-28-2017	102811224MIN-002	SK <i>SK Hejira</i>	NS <i>NS Hejira</i>	IC certification number was changed
2	03-20-2017	102811224MIN-002	SK <i>SK Hejira</i>	NS <i>NS Hejira</i>	FCC ID certification number is changed. SAR Test Exclusion Calculation page is added.



Test Setup Photos



