



TEST DATA REPORT

Test Data Number: 102459395MIN-001

Project Number: G102459395

Testing performed on the
5800RP-AT

to

47 CFR Part 15. 231:2015 / RSS-210, Issue 8, Amendment 1
Spurious Radiated Emissions

For

Honeywell International Inc.

Test Performed by:
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Test Authorized by:
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Date of issue: February 8, 2016

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1.0 GENERAL DESCRIPTION

Model:	5800RP-AT, with Power Supply by Powerline Interface, p/n: K10145X10
Type of EUT:	Wireless Repeater
Sample ID:	MEL-019 and MEL-020
Company:	Honeywell International Inc.
Customer:	Mr. Andrew Roussin
Address:	2 Corporate Center Drive Melville, NY 11747 USA
Phone:	(516) 577-5935
e-mail:	AndrewRoussin@Honeywell.com
Date Sample Submitted:	January 25, 2016
Test Work Started:	January 25, 2016
Test Work Completed:	January 27, 2016
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	Transceiver
Operating Frequency	344.95 MHz
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	Unit MEL-19 was setup to transmitting with Antenna 1
2	Unit MEL-20 was setup to transmitting with Antenna 2

Cables:

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

Support equipment/Services:

No.	Item	Description
	None	

General notes: Radiated Emissions at fundamentals and Radiated Spurious Emissions were performed only per client request

1.3 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 conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 2.6 dB

1.4 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).

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

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

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

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

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

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

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

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
15.231(b) / RSS-210 A1.1.2	Transmitter field strength of emissions	Pass
15.207/RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	Pass



3.0 TEST CONDITIONS AND RESULTS

3.1 Transmitter field strength of emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-4000MHz

Test result: **Pass**

Max. Emissions margin at fundamental: 12.7dB below the limits

Max. Margin of harmonics and spurious emissions: 10.3dB below the limits

Notes: Limits in Restricted Band of Operation (FCC Part 15.205) are according to FCC Part 15.209. Limits outside of the Restricted Band of Operation (FCC Part 15.205) are according to FCC Part 15.231(a).
Tables 3.1.1 and 3.1.3 show peak value of spurious emissions.
Tables 3.1.2 and 3.1.4 show average value of spurious emissions.
Plots 3.1.1 to 3.1.4 show peak of emissions, limits to FCC Part 15.209 are shown for reference.

Date:	January 25-26, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.231(b) / RSS-210 A1.1.2	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 30%(RH); 96.5kPa	
Equipment Verification:	☒	
Note:	MEL-019, Peak Value	

Table 3.1.1

Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBμV	Total @ 3m dBμV/m	Limit dBμV/m	Margin dB
Polarity	Hts(cm)								
Emissions at Fundamental Frequency									
344.90	V	100	15.3	1.5	0.0	61.5	78.3	97.3	-18.9
344.90	H	100	15.3	1.5	0.0	57.7	74.5	97.3	-22.7
Spurious and Harmonics Emissions									
689.85	V	100	20.0	2.0	0.0	27.6	49.6	77.3	-27.6
689.85	H	134	20.0	2.0	0.0	29.6	51.6	77.3	-25.6
1034.90	V	100	22.8	2.8	43.0	69.4	52.0	74.0	-22.0
1034.90	H	100	22.8	2.8	43.0	68.7	51.3	74.0	-22.7
1379.61	V	100	25.1	3.3	43.5	71.5	56.4	74.0	-17.6
1724.50	V	100	26.9	3.9	43.5	65.0	52.3	77.3	-25.0
2069.65	H	131	27.4	2.7	43.3	63.4	50.2	77.3	-27.1
2414.00	H	131	28.2	2.9	43.5	60.4	48.0	77.3	-29.3

Date:	January 25-26, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.231(b) / RSS-210 A1.1.2	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 30%(RH); 96.5kPa	
Equipment Verification:	☒	
Note:	MEL-019, Average Value	

Table 3.1.2

Frequency MHz	Antenna Polarity	Hts(cm)	Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBμV	Total @ 3m dBμV/m	Average C.F. (dB)	Total @ 3m after C.F. dBμV/m	Limit dBμV/m	Margin dB
Emissions at Fundamental Frequency											
344.90	V	100	15.3	1.5	0.0	61.5	78.3	14.7	63.7	77.3	-13.6
344.90	H	100	15.3	1.5	0.0	57.7	74.5	14.7	59.9	77.3	-17.4
Spurious and Harmonics Emissions											
689.85	V	100	20.0	2.0	0.0	27.6	49.6	14.7	35.0	57.3	-22.3
689.85	H	134	20.0	2.0	0.0	29.6	51.6	14.7	37.0	57.3	-20.3
1034.90	V	100	22.8	2.8	43.0	69.4	52.0	14.7	37.3	54.0	-16.7
1034.90	H	100	22.8	2.8	43.0	68.7	51.3	14.7	36.6	54.0	-17.4
1379.61	V	100	25.1	3.3	43.5	71.5	56.4	14.7	41.8	54.0	-12.2
1724.50	V	100	26.9	3.9	43.5	65.0	52.3	14.7	37.6	54.0	-16.4
2069.65	H	131	27.4	2.7	43.3	63.4	50.2	14.7	35.5	54.0	-18.5
2414.00	H	131	28.2	2.9	43.5	60.4	48.0	14.7	33.3	54.0	-20.7

Date:	January 25-26, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.231(b) / RSS-210 A1.1.2	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 30%(RH); 96.5kPa	
Equipment Verification:	☒	
Note:	MEL-020, peak Value	

Table 3.1.3

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Reading	Total @ 3m	Limit	Margin
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBμV	dBμV/m	dBμV/m	dB
Emissions at Fundamental Frequency									
344.90	V	100	15.3	1.5	0.0	62.4	79.2	97.3	-18.0
344.90	H	100	15.3	1.5	0.0	57.5	74.3	97.3	-22.9
Spurious and Harmonics Emissions									
128.06	H	130	12.6	0.8	0.0	28.5	41.9	63.5	-21.6
689.85	V	100	20.0	2.0	0.0	31.9	53.9	77.3	-23.3
689.85	H	140	20.0	2.0	0.0	38.4	60.4	77.3	-16.8
1034.83	V	133	22.8	2.8	43.0	72.5	55.1	74.0	-18.9
1034.83	H	100	22.8	2.8	43.0	75.8	58.4	74.0	-15.6
1379.70	V	119	25.1	3.3	43.5	72.1	57.0	74.0	-17.0
1724.46	V	100	26.9	3.9	43.5	65.0	52.3	77.3	-25.0
2069.60	V	100	27.4	2.7	43.3	65.8	52.6	77.3	-24.7
2069.60	H	100	27.4	2.7	43.3	65.2	52.0	77.3	-25.3
2416.00	V	100	28.2	2.9	43.5	63.0	50.6	77.3	-26.7

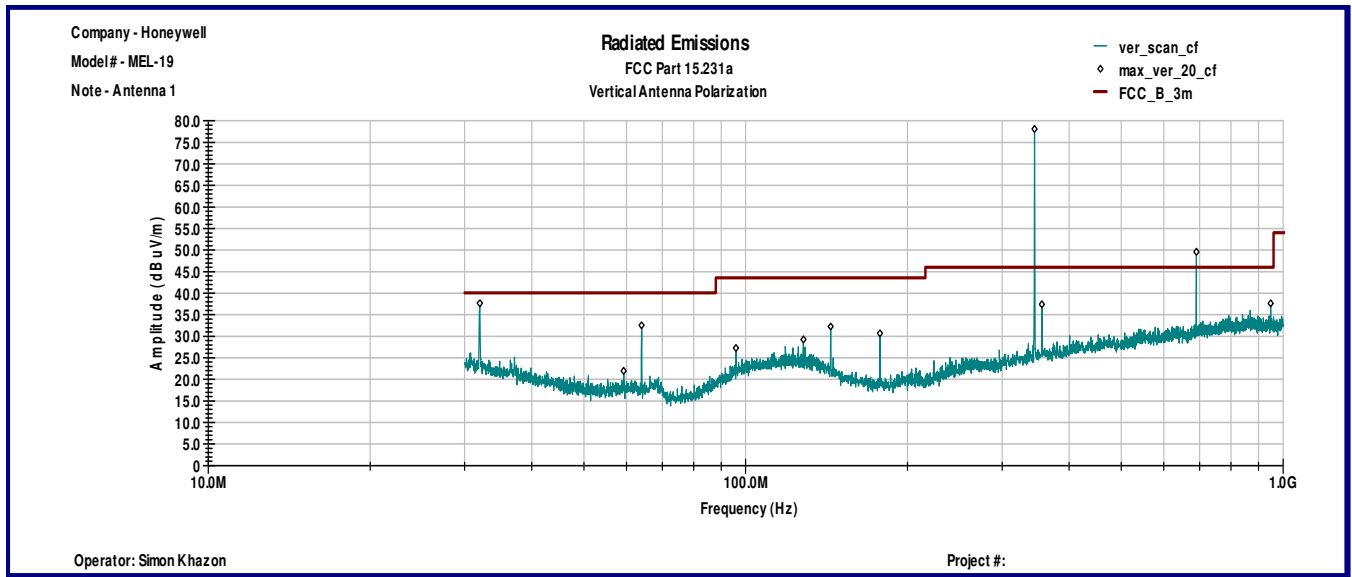
Date:	January 25-26, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.231(b) / RSS-210 A1.1.2	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 30%(RH); 96.5kPa	
Equipment Verification:	☒	
Note:	MEL-020, Average Value	

Table 3.1.4

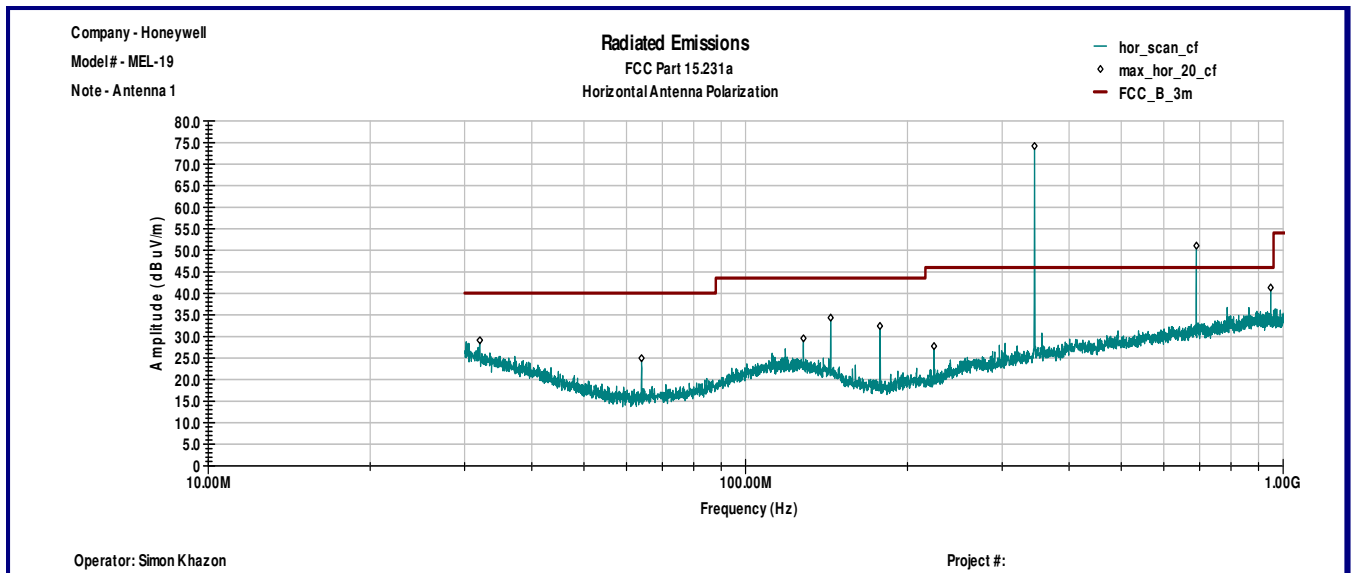
Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBμV	Total @ 3m dBμV/m	Average C.F. (dB)	Total @ 3m after C.F. dBμV/m	Limit dBμV/m	Margin dB
	Polarity	Hts(cm)									
			Emissions at Fundamental Frequency								
344.90	V	100	15.3	1.5	0.0	62.4	79.2	14.7	64.6	77.3	-12.7
344.90	H	100	15.3	1.5	0.0	57.5	74.3	14.7	59.7	77.3	-17.6
			Spurious and Harmonics Emissions								
128.06	H	130	12.6	0.8	0.0	28.5	41.9		41.9	43.5	-1.6
689.85	V	100	20.0	2.0	0.0	31.9	53.9	14.7	39.3	57.3	-18.0
689.85	H	140	20.0	2.0	0.0	38.4	60.4	14.7	45.8	57.3	-11.5
1034.83	V	133	22.8	2.8	43.0	72.5	55.1	14.7	40.4	54.0	-13.6
1034.83	H	100	22.8	2.8	43.0	75.8	58.4	14.7	43.7	54.0	-10.3
1379.70	V	119	25.1	3.3	43.5	72.1	57.0	14.7	42.4	54.0	-11.6
1724.46	V	100	26.9	3.9	43.5	65.0	52.3	14.7	37.6	57.3	-19.6
2069.60	V	100	27.4	2.7	43.3	65.8	52.6	14.7	37.9	57.3	-19.4
2069.60	H	100	27.4	2.7	43.3	65.2	52.0	14.7	37.3	57.3	-20.0
2416.00	V	100	28.2	2.9	43.5	63.0	50.6	14.7	35.9	57.3	-21.3

Graph 3.1.1

Vertical antenna polarization

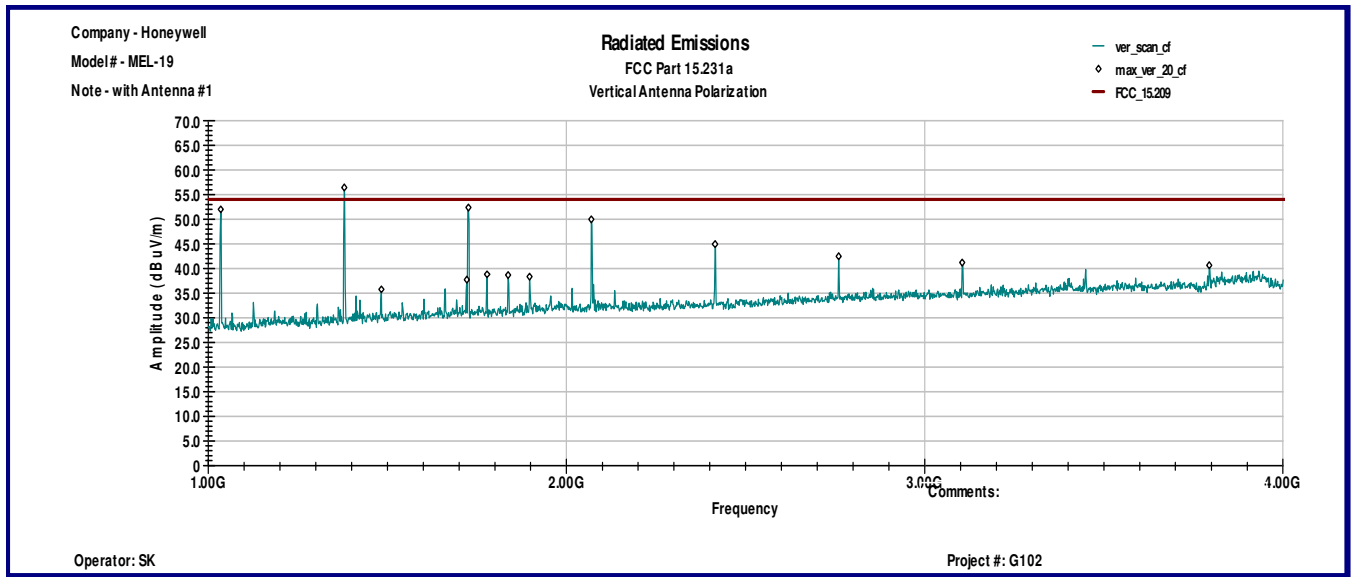


Horizontal antenna polarization

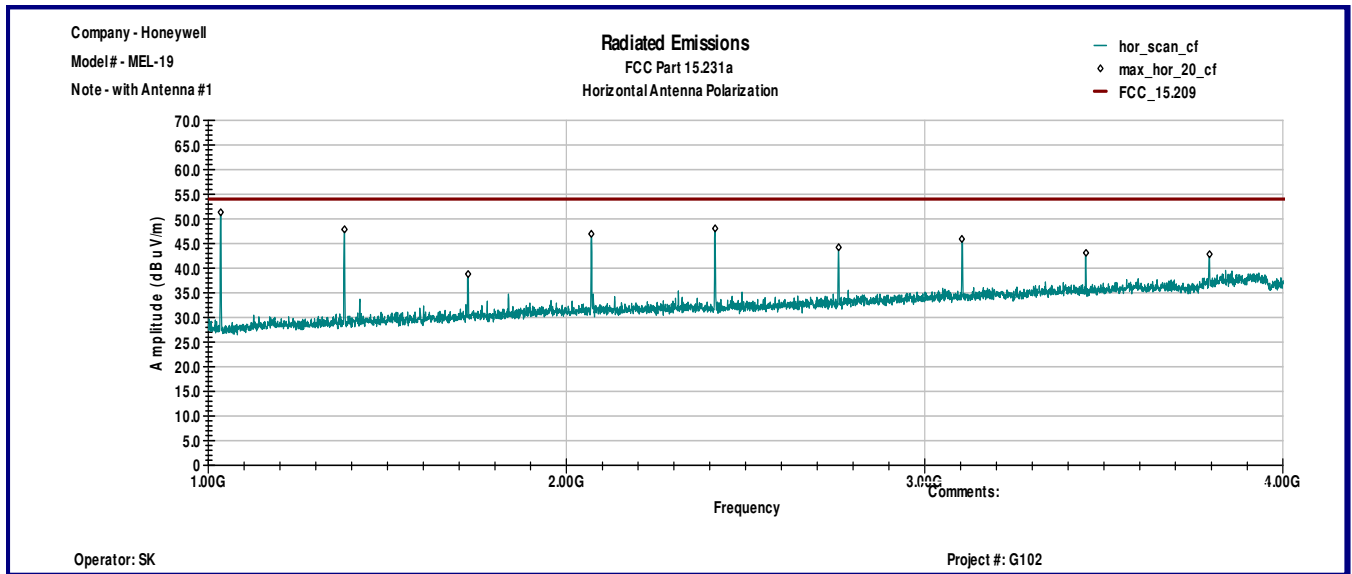


Graph 3.1.2

Vertical antenna polarization

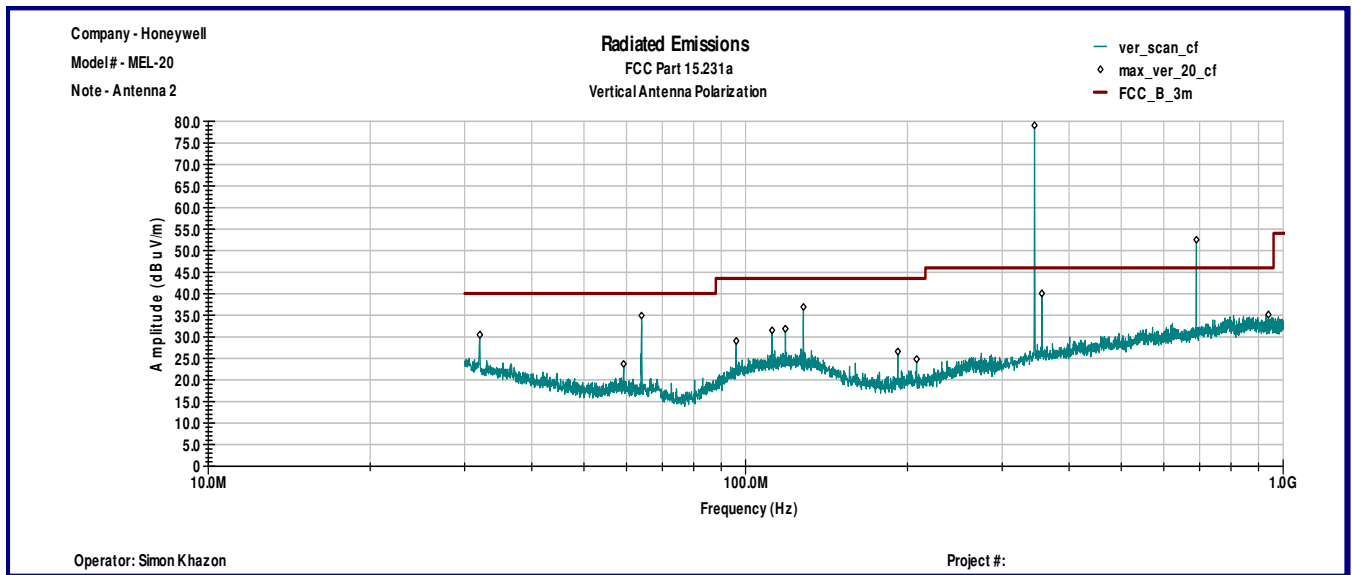


Horizontal antenna polarization

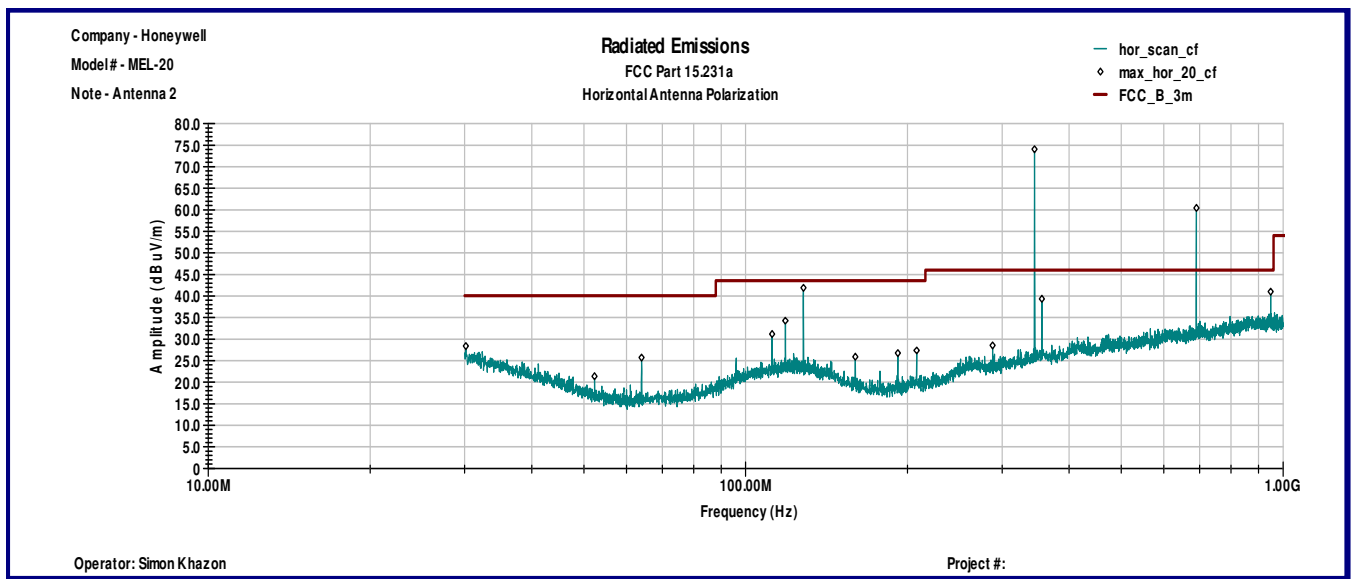


Graph 3.1.3

Vertical antenna polarization

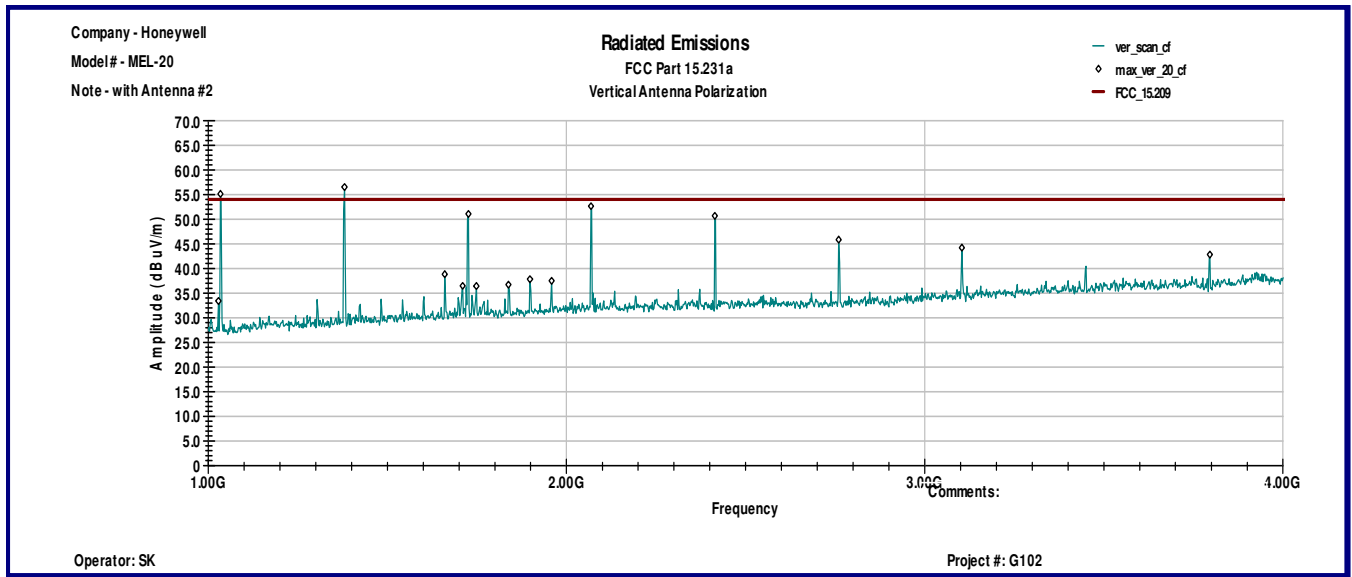


Horizontal antenna polarization

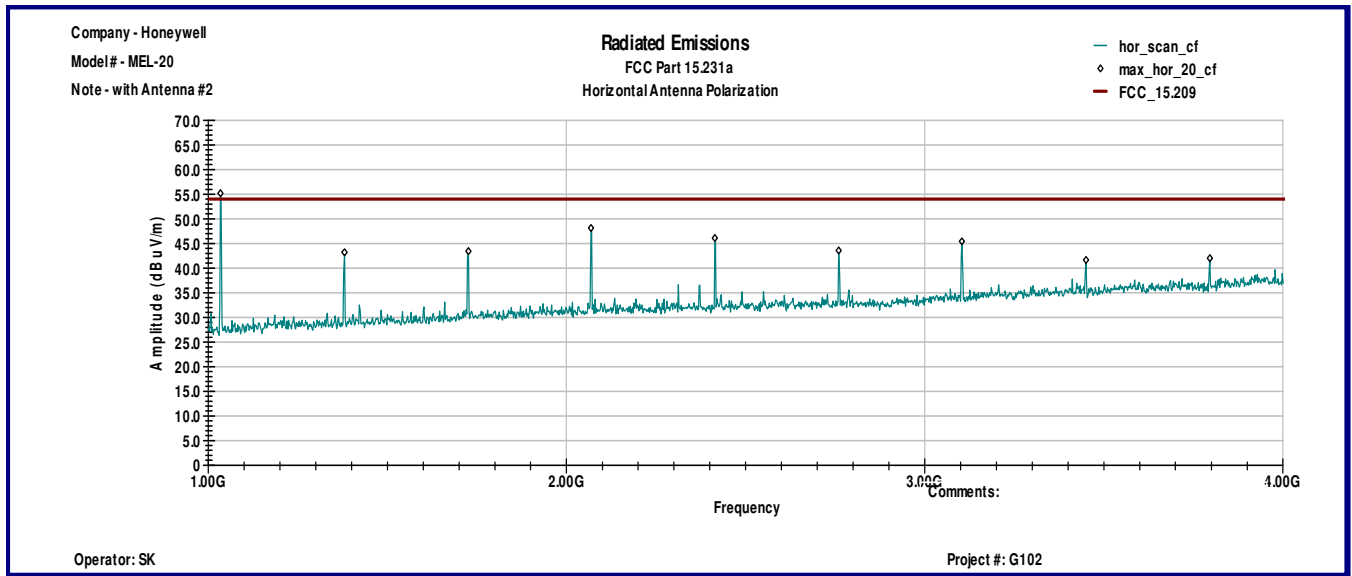


Graph 3.1.4

Vertical antenna polarization



Horizontal antenna polarization





3.1 Average correction factor calculation (provided by Client)

An Average correction factor is calculated by client in value of -14.66 dB (see calculations below).

There are a number of message protocols supported by the 5800RP-AT. All messages transmit using On-Off Keying of the carrier with Manchester encoding and a nominal 3.7Kbps data rate. Each message sent by repeating a message packet 6 times at 100 mS intervals (sextet), with the exception of the supervision message. The supervision message consists of 2 back-to-back sextets, with the second sextet separated from the first by a minimum 100mS. The message supported by the 5800RP-AT which has the most bytes (and therefore the highest duty factor) is described below:

Message protocol is: 13 ID/control bytes + 2 repeater bytes + 16 bit preamble = 136 bits

Packet time = 136 bits/packet * (1/3.7Kbps) = 36.99 mS/packet message time.

Transmit 'on' time in a 100mS window = (36.99 mS message time) * (50% transmit time per bit) = 18.5mS.

Duty Factor = transmit 'on' time / 100mS * 100% = 18.5mS / 100 mS * 100% = 18.5%.

Duty Factor, in dB = $20 \cdot \log(18.5\%) = 20 \cdot \log(.185) = -14.66$ dB.



3.2 Transmitter power line conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 26.4dB below the limits

Notes: None

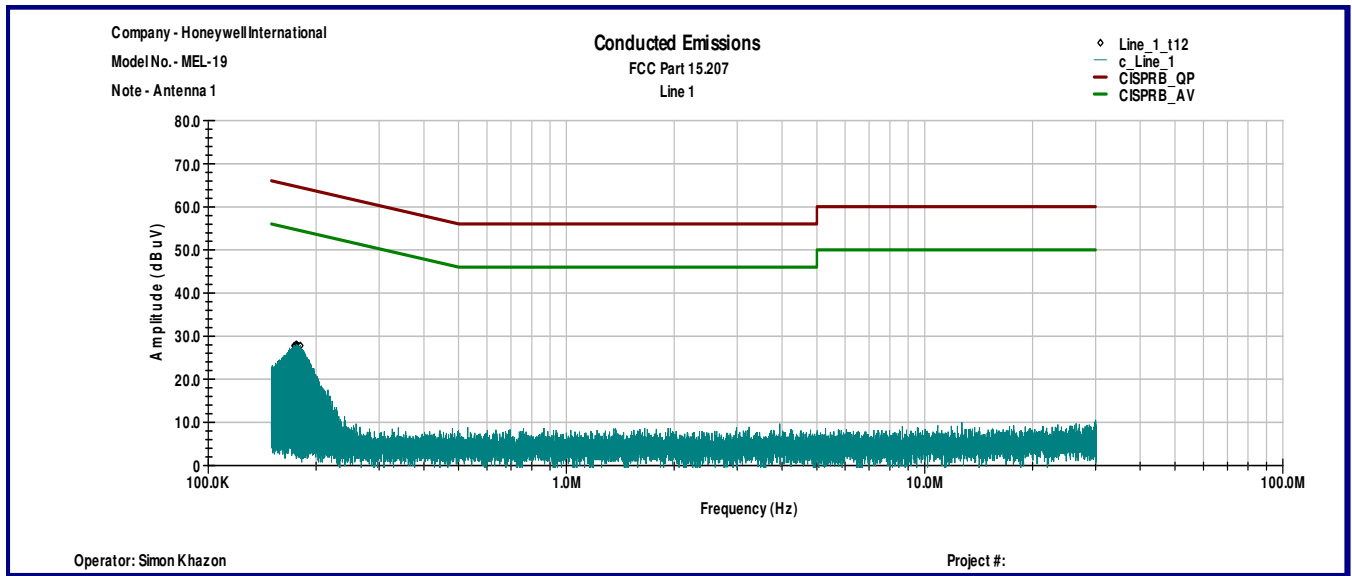
Date:	January 26, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.207	
Test Point:	Power Line	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 30%(RH); 96.5kPa	
Equipment Verification:	☒	
Note:	MEL-019	

Table 3.2.1

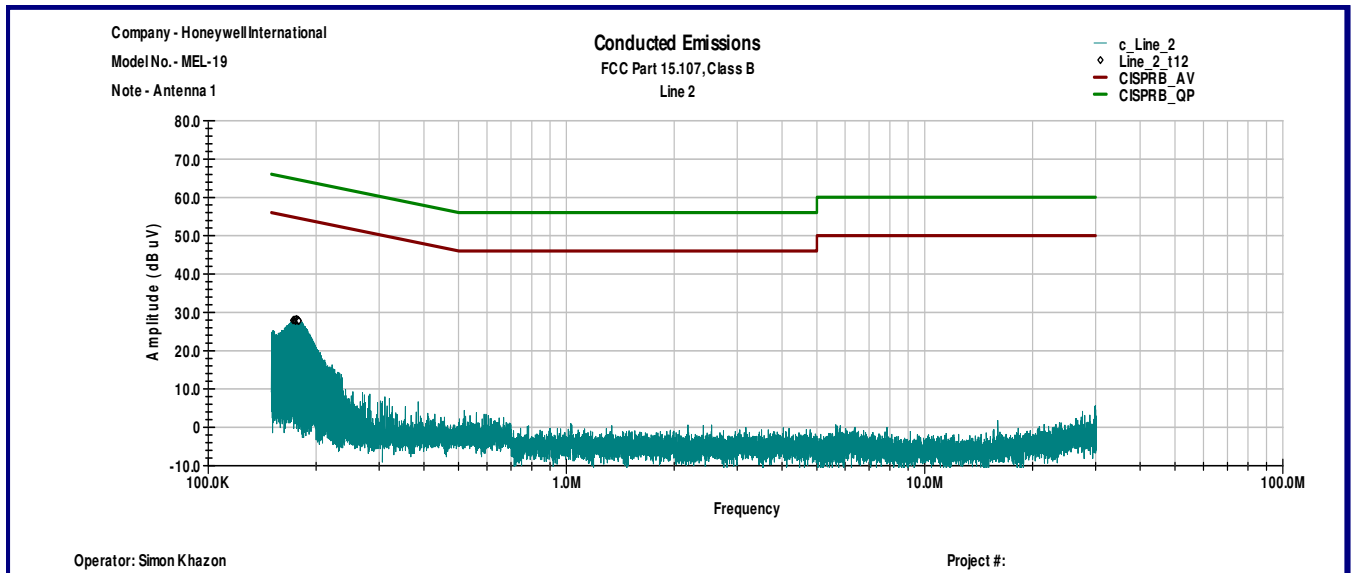
Line 1					
Frequency	Peak dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
173.81 KHz	27.8	64.8	54.8	-37.0	-27.0
174.35 KHz	27.7	64.8	54.8	-37.1	-27.1
176.22 KHz	28.1	64.7	54.7	-36.6	-26.6
176.45 KHz	27.5	64.7	54.7	-37.2	-27.2
176.88 KHz	27.5	64.6	54.6	-37.1	-27.1
177.07 KHz	27.8	64.6	54.6	-36.8	-26.8
177.54 KHz	27.8	64.6	54.6	-36.8	-26.8
177.73 KHz	27.6	64.6	54.6	-37.0	-27.0
178.27 KHz	27.5	64.6	54.6	-37.1	-27.1
178.82 KHz	27.7	64.5	54.5	-36.9	-26.9
179.05 KHz	27.6	64.5	54.5	-36.9	-26.9
180.88 KHz	27.8	64.5	54.5	-36.7	-26.7
Line 2					
Frequency	Peak dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
172.33 KHz	27.9	64.9	54.9	-36.9	-26.9
173.42 KHz	28.1	64.8	54.8	-36.7	-26.7
174.12 KHz	28.0	64.8	54.8	-36.7	-26.7
174.9 KHz	27.8	64.7	54.7	-36.9	-26.9
175.36 KHz	27.7	64.7	54.7	-37.0	-27.0
175.44 KHz	27.9	64.7	54.7	-36.8	-26.8
176.22 KHz	28.2	64.7	54.7	-36.4	-26.4
177.38 KHz	28.0	64.6	54.6	-36.6	-26.6
177.54 KHz	28.1	64.6	54.6	-36.5	-26.5
178.04 KHz	27.8	64.6	54.6	-36.8	-26.8
178.2 KHz	28.0	64.6	54.6	-36.6	-26.6
178.86 KHz	27.8	64.5	54.5	-36.8	-26.8

Graph 3.2.1

Line 1



Line 2



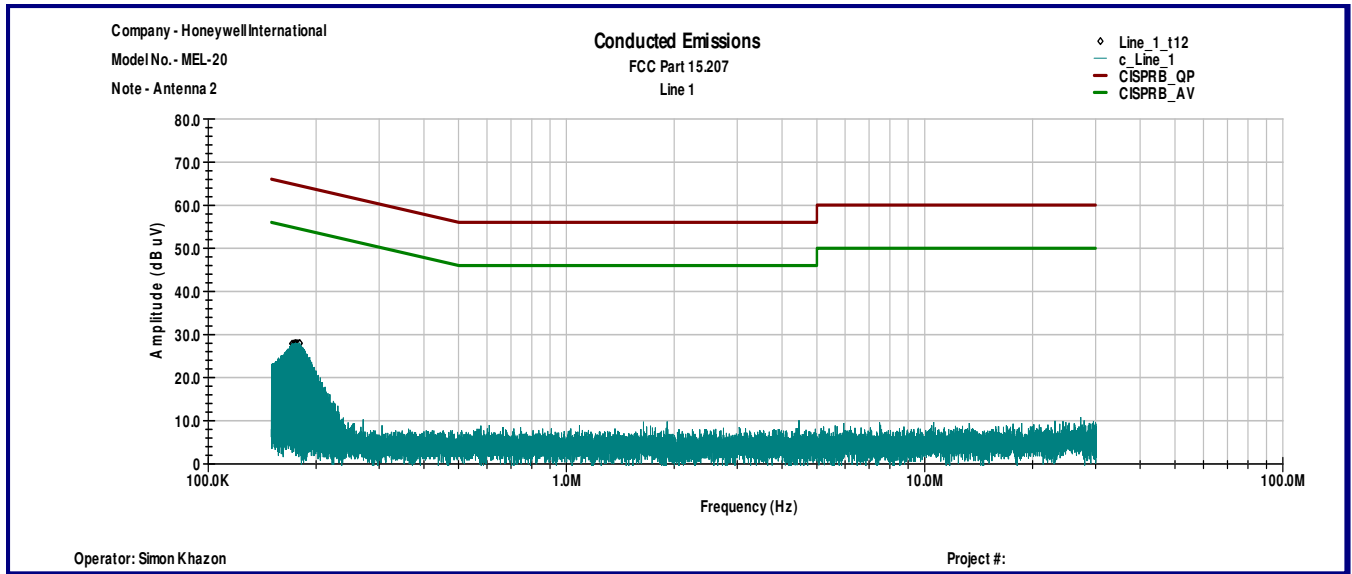
Date:	January 26, 2016	Result: Pass
Tested by:	Simon Khazon	
Standard:	FCC 15.207	
Test Point:	Power Line	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 30%(RH); 96.5kPa	
Equipment Verification:	☒	
Note:	MEL-020	

Table 3.2.2

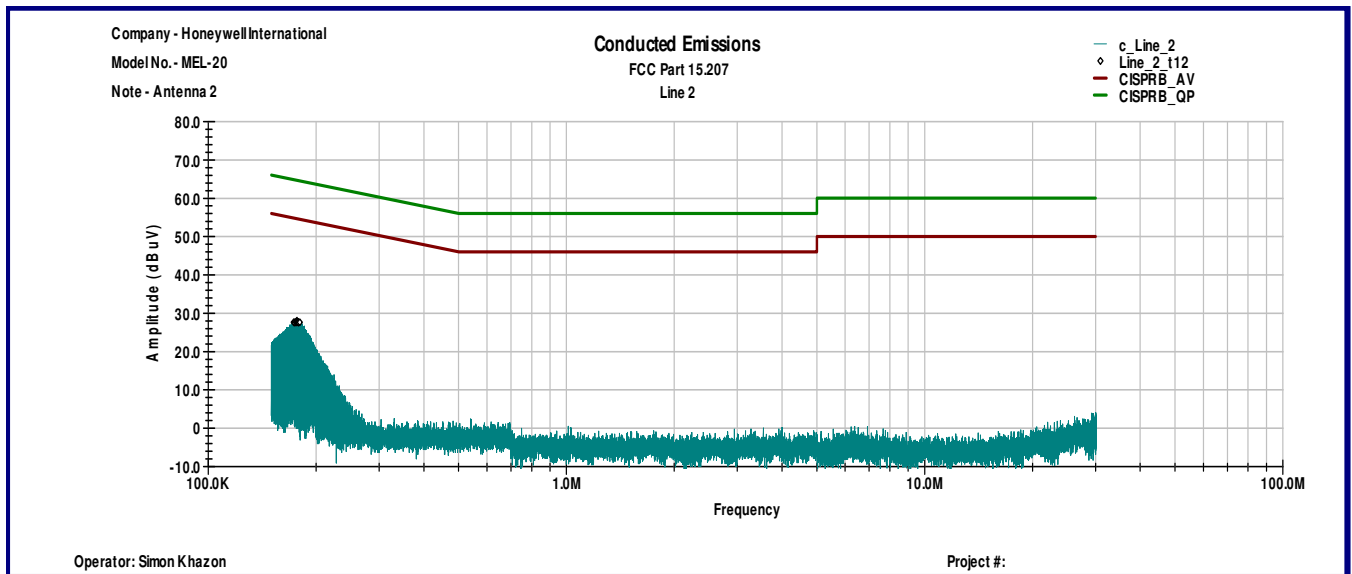
Line 1					
Frequency	Peak dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
171.48 KHz	27.9	64.9	54.9	-37.0	-27.0
173.46 KHz	27.9	64.8	54.8	-36.9	-26.9
174.04 KHz	27.8	64.8	54.8	-36.9	-26.9
174.78 KHz	27.8	64.7	54.7	-36.9	-26.9
175.36 KHz	28.0	64.7	54.7	-36.7	-26.7
176.1 KHz	27.9	64.7	54.7	-36.8	-26.8
176.72 KHz	27.8	64.6	54.6	-36.9	-26.9
176.88 KHz	27.9	64.6	54.6	-36.8	-26.8
177.34 KHz	27.9	64.6	54.6	-36.7	-26.7
177.96 KHz	27.7	64.6	54.6	-36.8	-26.8
179.28 KHz	28.0	64.5	54.5	-36.5	-26.5
180.02 KHz	28.0	64.5	54.5	-36.5	-26.5
Line 2					
Frequency	Peak dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
173.23 KHz	27.6	64.8	54.8	-37.2	-27.2
173.96 KHz	27.6	64.8	54.8	-37.2	-27.2
175.83 KHz	27.6	64.7	54.7	-37.1	-27.1
176.06 KHz	27.8	64.7	54.7	-36.9	-26.9
176.6 KHz	28.0	64.6	54.6	-36.7	-26.7
176.72 KHz	27.7	64.6	54.6	-36.9	-26.9
177.15 KHz	27.8	64.6	54.6	-36.9	-26.9
177.23 KHz	27.6	64.6	54.6	-37.0	-27.0
177.89 KHz	27.7	64.6	54.6	-36.9	-26.9
178.55 KHz	27.6	64.6	54.6	-36.9	-26.9
178.66 KHz	27.5	64.6	54.6	-37.0	-27.0
179.98 KHz	27.6	64.5	54.5	-36.9	-26.9

Graph 3.2.2

Line 1



Line 2



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	01/20/2017	☒
Spectrum Analyzer	R & S	ESCI	100358	12909	10/20/2016	☒
Bicono-Log Antenna	Teseq	CBL6112D	32859	25289	09/24/2016	☒
Horn Antenna	EMCO	3115	9507-4513	9936	07/01/2016	☒
LISN	COM-Power	Li-215A	191970	172315	05/11/2016	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1402232	172081	11/19/2016	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBV	☒

5.0 Revision History

REVISION LEVEL	DATE	REPORT NUMBER	PREPARED	REVIEWED	NOTES
0	02-08-2016	102459395MIN-001	SK	NS	Original Issue
1	05-13-2016	102459395MIN-001	SK <i>SKhejen</i>	NS <i>Har-Elabb</i>	Change the Average Correction factor to 18.5dB
2	05-16-2016	102459395MIN-001	SK <i>SKhejen</i>	NS <i>Har-Elabb</i>	Change the Average Correction factor to 14.7dB



Test Setup Photos

