



TEST REPORT

Report Number: 101182311MIN-001

Project Number: G101182311

Testing performed on the
T45

FCC ID: CNMT45

Industry Canada ID: 1360A-T45

to

47 CFR Part 15. 237:2010

47 CFR, Part 15:2010, §15.107 and §15.109, Class B
RSS- 210, Issue 8, 2010

For

Williams Sound Corp

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

Test Authorized by:
Williams Sound Corp
10300 Valley View Rd.
Eden Prairie, MN 55344 USA

Prepared by: SKhazon
Simon Khazon

Date: August 14, 2013

Reviewed by: Richard Blonigen
Richard Blonigen

Date: August 14, 2013

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1.0 GENERAL DESCRIPTION

Model:	T45 with ITE Power Supply model CENB1020A2403F01
Type of EUT:	Transmitter
Serial Number :	Rev. Z1#1
FCC ID:	CNMT45
Industry Canada ID:	1360A-T45
Related Submittal(s) Grants:	None
Company:	Williams Sound Corp.
Customer:	Mr. Butch Harrington
Address:	10300 Valley View Road Eden Prairie, MN 55344, USA
Phone:	(952) 224-7721
Fax:	(952) 943-2174
E-mail:	butchh@williamssound.com
Test Standards:	☒ 47 CFR, Part 15:2010, §15.237 ☒ RSS-210, Issue 8, 2010 ☐ RSS-Gen, Issue 3, 2010 ☒ 47 CFR, Part 15:2010, §15.107 and §15.109, Class B ☒ ICES-003, Issue 4:2004 ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	August 8, 2013
Test Work Started:	August 8, 2013
Test Work Completed:	August 9, 2013
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	Fixed FM Hearing Assistance Transmitter
Operating Frequency	72.0-73.0; 74.6-74.8 and 75.2-76.0 MHz
Number of Channels:	9 channels from 72.1 to 72.9MHz 1 Channel from 74.7MHz 8 Channels from 75.3 to 75.9 MHz
Modulation:	FM
Emission Designator:	154KF3E
Antenna(s) Info:	ANT 025
Antenna Installation:	☒ User ☐ Professional ☐ Factory
Transmitter Power Configuration:	☐ Internal battery ☒ External power source ☒ 100-240VAC 0.5 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 C63.10-2009

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	Continuously Transmitting Unmodulated Signal at 72.5MHz, 74.7MHz and 75.5MHz channels.
2	Continuously Transmitting Modulated (1KHz) Signal at 72.5MHz, 74.7MHz and 75.5MHz channels.

Cables:

No.	Type	Length	Designation	Note
1	3 wires, unshielded	1 m	AC Power	
2	2 wires, unshielded, terminated	1 m	Audio Input	
3	2 wires, unshielded, terminated	1 m	Line OUT Audio	
4	2 wires, unshielded, terminated	1 m	AES3 Audio Digital	
5	2 wires, unshielded, terminated	1 m	SPDIF Audio Digital	
6	2 wires, unshielded, terminated	1 m	Headphone Output	

Support equipment/Services:

No.	Item	Description
1	Instek GAG 810	Audio Signal Generator

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: 86-106 kPa

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 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:

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
15.237/ RSS-210 A4.1	Field strength of fundamental	Pass
15.237/ RSS-210 A4.1	Field strength of harmonics	Pass
15.237 / RSS-210 A4.1	Field strength of spurious emissions	Pass
15.215(c) / RSS- Gen 4.6.1	Bandwidth of the emission	Pass
15.207/RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	Pass
15.109/ICES-003	Receiver/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

Frequency range of measurements: 30MHz-1000MHz

Test result: **Pass**

Max. margin at fundamental: 0.2 dB below the limits

Notes: None

Date:	August 8, 2013	Result: Pass
Standard:	FCC 15.237/ RSS-210 A4.1	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	None	

Table 3.1.1

Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Peak Reading dBμV	Total @ 3m dBμV/m	Limit dBμV/m	Margin dB
	Polarity	Hts(cm)							
			Emissions at Fundamental Frequency						
72.50	V	124	6.8	0.9	0.0	90.2	97.9	98.1	-0.2
72.50	H	400	6.8	0.9	0.0	85.1	92.8	98.1	-5.3
74.70	V	127	7.2	0.9	0.0	88.8	96.8	98.1	-1.2
74.70	H	234	7.2	0.9	0.0	84.3	92.3	98.1	-5.7
75.50	V	138	7.3	0.9	0.0	89.0	97.1	98.1	-0.9
75.50	H	382	7.3	0.9	0.0	84.3	92.4	98.1	-5.6



3.2 Field strength of harmonics and spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-1000MHz

Test result: **Pass**

Maximum margin of emissions: 2.8 dB below the limits

Notes: Testing was performed at 3-meters distance (see Table 3.2.1 and Graphs 3.2.1 to 3.2.3, emissions at the Fundamental Frequency were excluded from the Table)

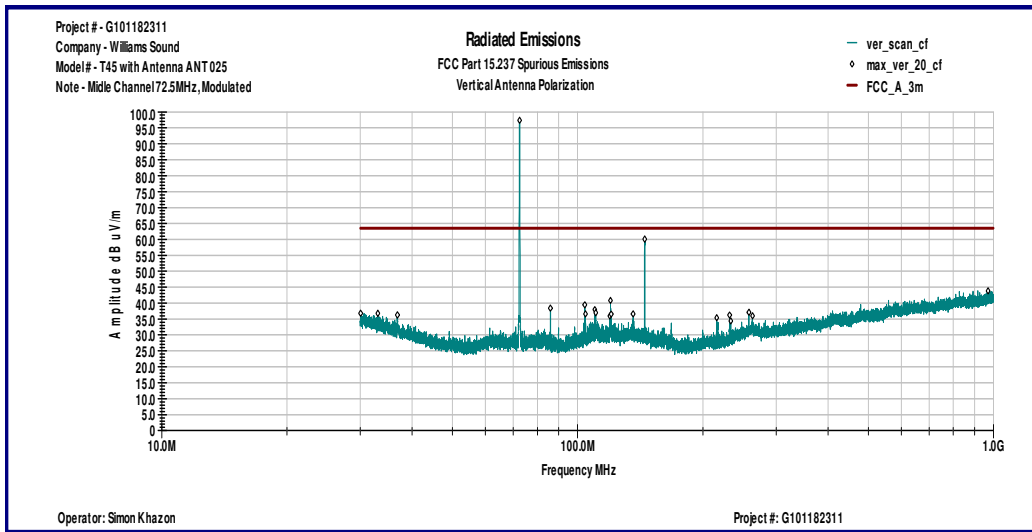
Date:	August 8, 2013	Result: Pass
Standard:	FCC 15.237and (d) / RSS-210 A4.1	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	None	

Table 3.2.1

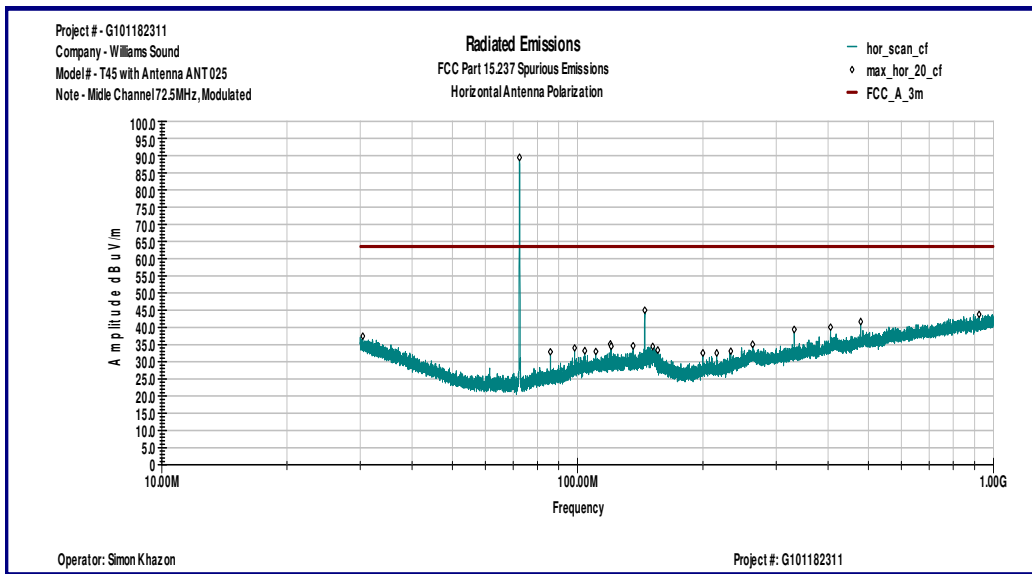
Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBμV	Total @ 3m dBμV/m	Limit dBμV/m	Margin dB
	Polarity	Hts(cm)							
			Channel 72.5MHz						
104.4	V	100	11.9	1.0	0.0	26.5	39.4	63.5	-24.1
110.6	V	100	12.5	1.1	0.0	24.3	37.9	63.5	-25.6
120.5	V	100	12.8	1.1	0.0	26.9	40.8	63.5	-22.7
145.0	V	100	11.8	1.3	0.0	47.0	60.1	63.5	-3.4
			Channel 74.7MHz						
36.88	V	100	15.9	0.6	0.0	19.1	35.6	63.5	-27.9
86.04	V	100	8.6	0.9	0.0	29.6	39.1	63.5	-24.4
120.00	V	100	12.8	1.1	0.0	25.3	39.2	63.5	-24.3
149.52	V	100	11.5	1.3	0.0	47.9	60.7	63.5	-2.8
149.45	H	154	11.5	1.3	0.0	33.9	46.7	63.5	-16.8
			Channel 75.5MHz						
85.60	V	100	8.5	0.9	0.0	28.8	38.3	63.5	-25.2
150.91	V	100	11.4	1.3	0.0	42.4	55.1	63.5	-8.4
215.99	V	100	10.6	1.6	0.0	23.4	35.6	63.5	-27.9
150.97	H	162	11.4	1.3	0.0	31.4	44.1	63.5	-19.4

Graph 3.2.1

Vertical antenna polarization

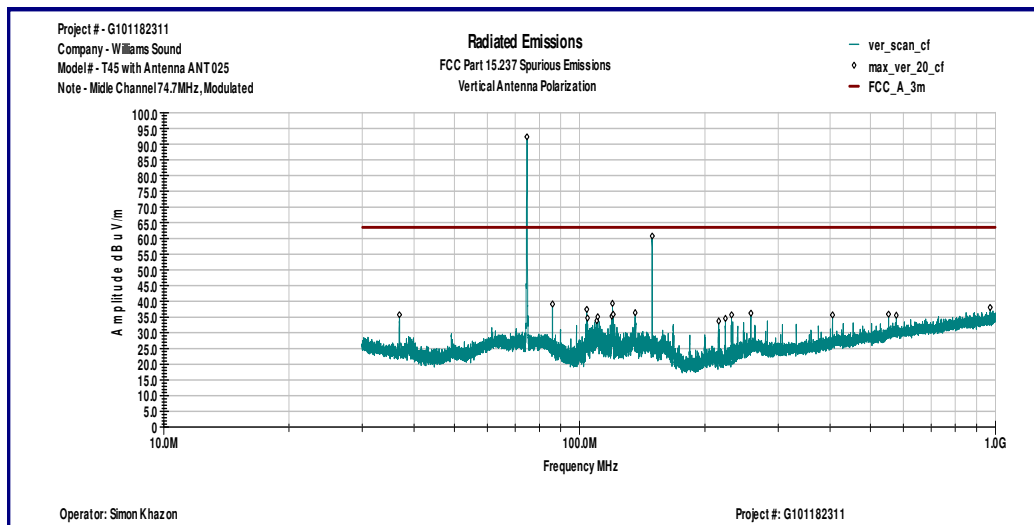


Horizontal antenna polarization

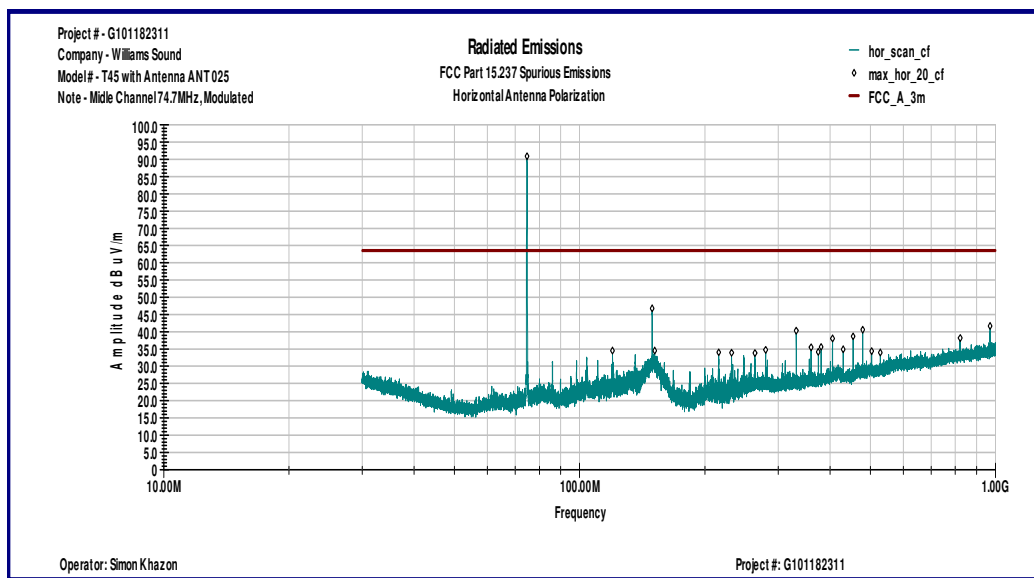


Graph 3.2.2

Vertical antenna polarization

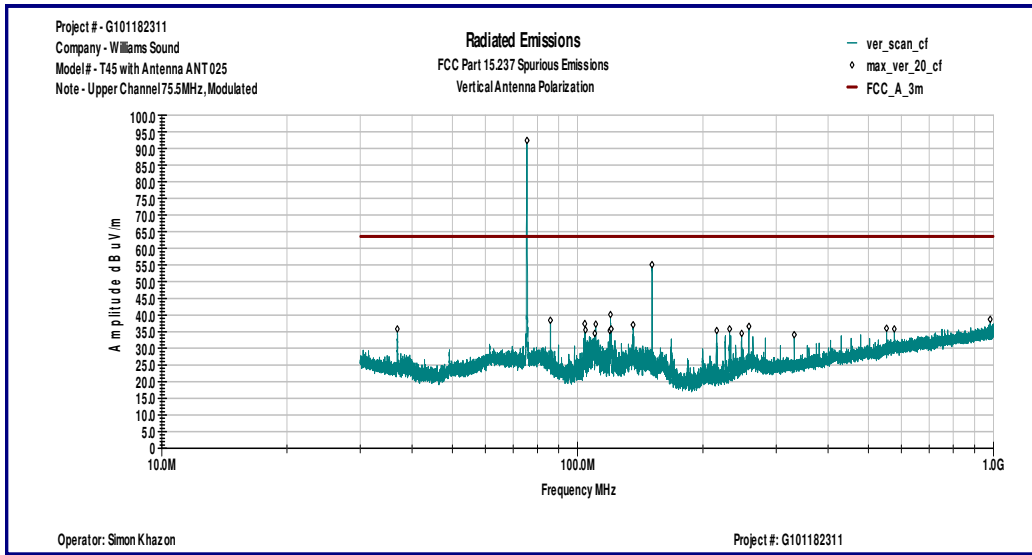


Horizontal antenna polarization

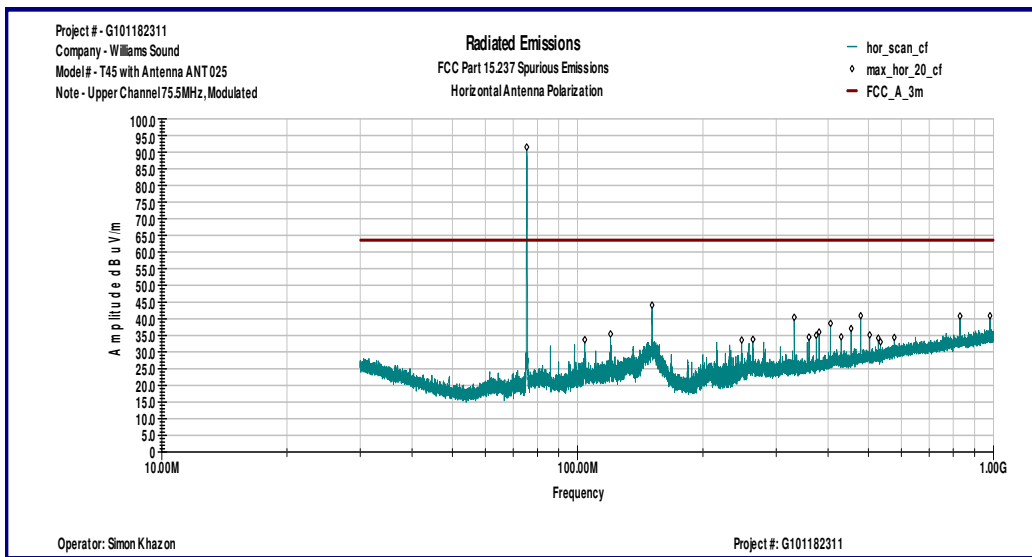


Graph 3.2.3

Vertical antenna polarization



Horizontal antenna polarization



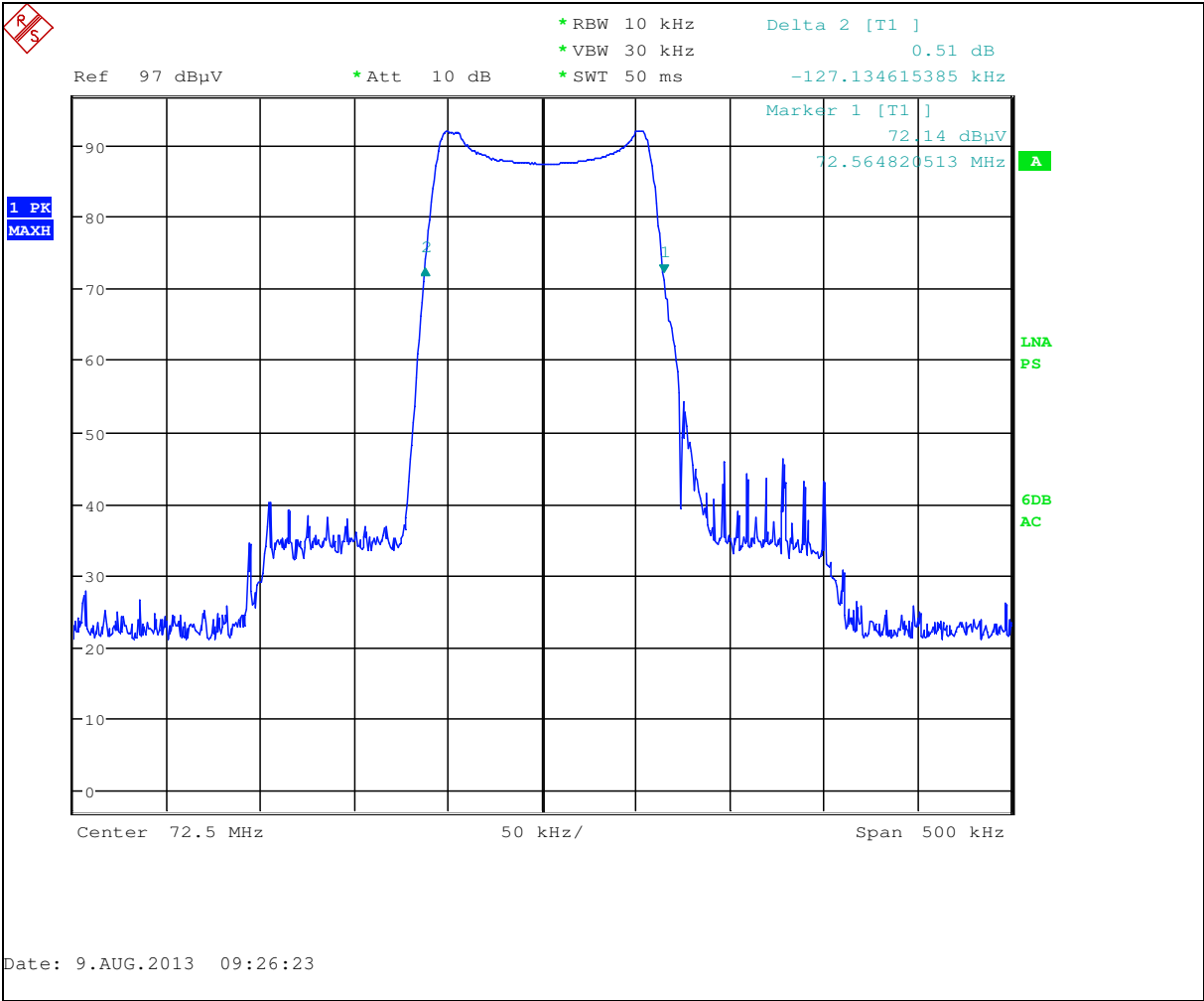
3.3 Bandwidth of Emissions

Center Frequency of operation MHz	Maximum allowed bandwidth kHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz	Result
72.5MHz	200	127.1	118.0	Pass
74.7MHz	200	134.9	126.5	Pass
75.5MHz	200	139.4	130.5	Pass
Maximum allowed bandwidth:	☐ 0.25% of the centre operating frequency ☐ 0.5% of the centre operating frequency			
RBW:	☒ 10kHz	☐ 100kHz	☐ other	kHz
VBW:	☒ 30kHz	☐ 300kHz	☐ other	kHz

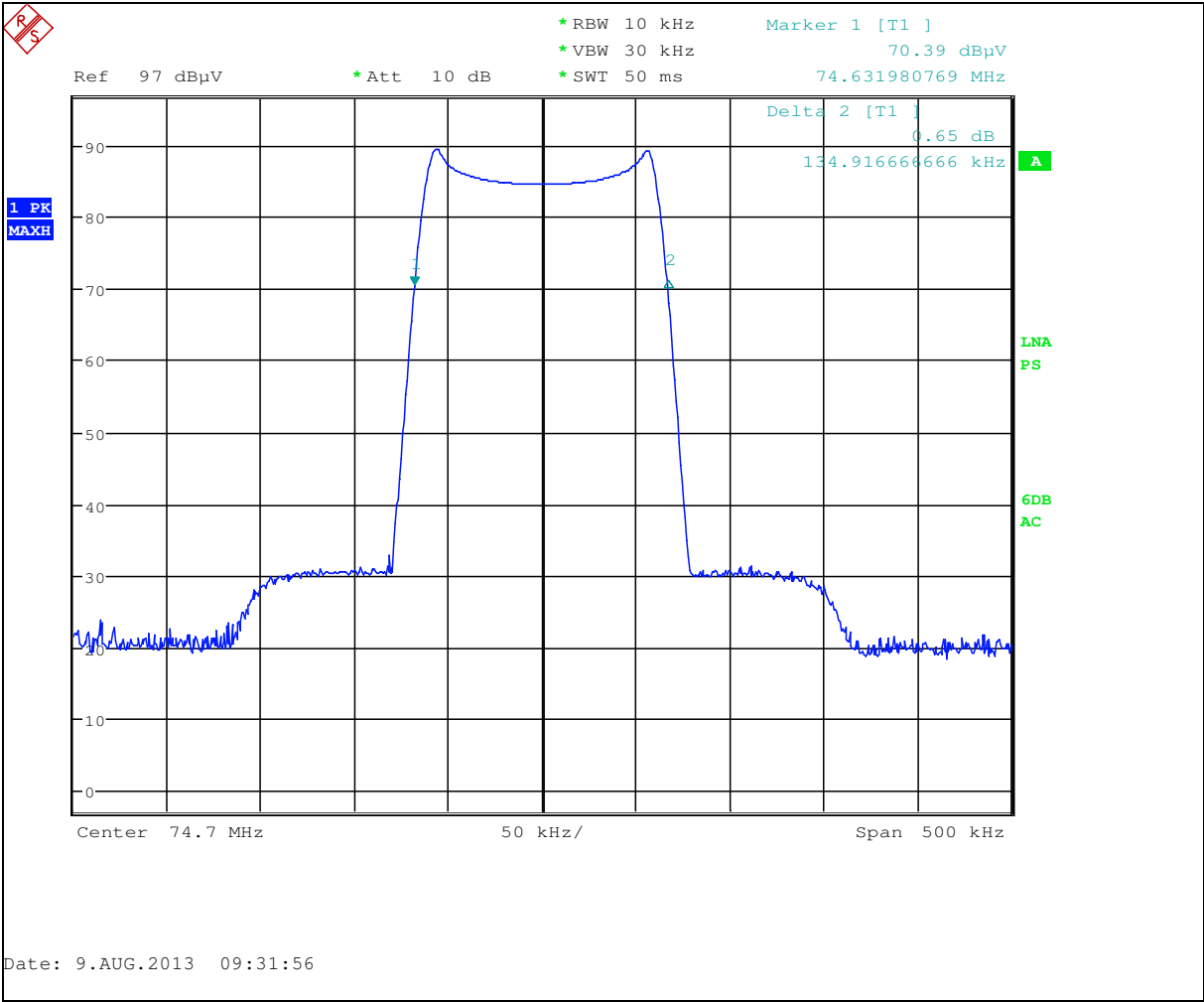
Graphs 3-3-1 and 3-3-6 are show bandwidth of emissions

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

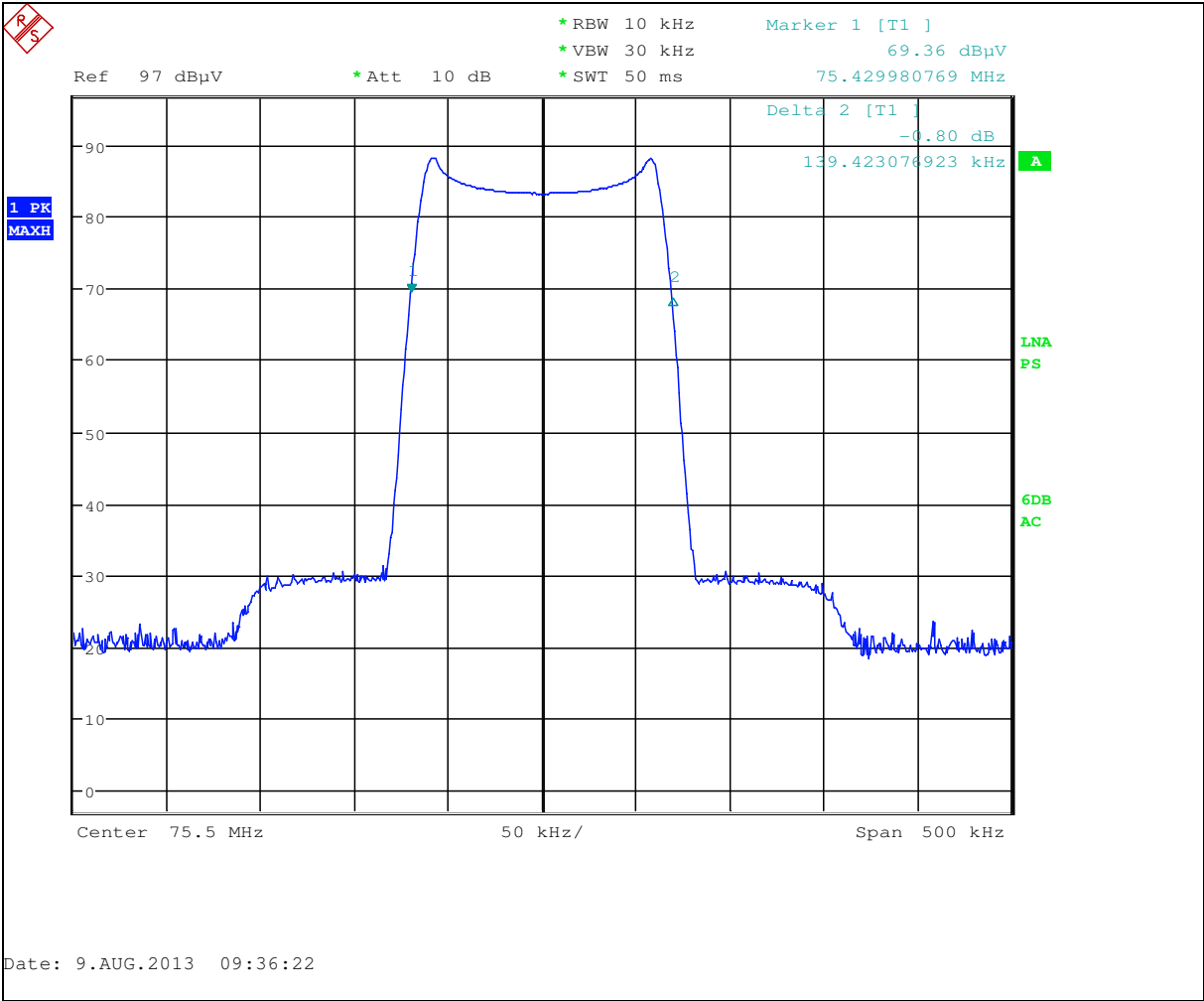
Graph 3.3.1



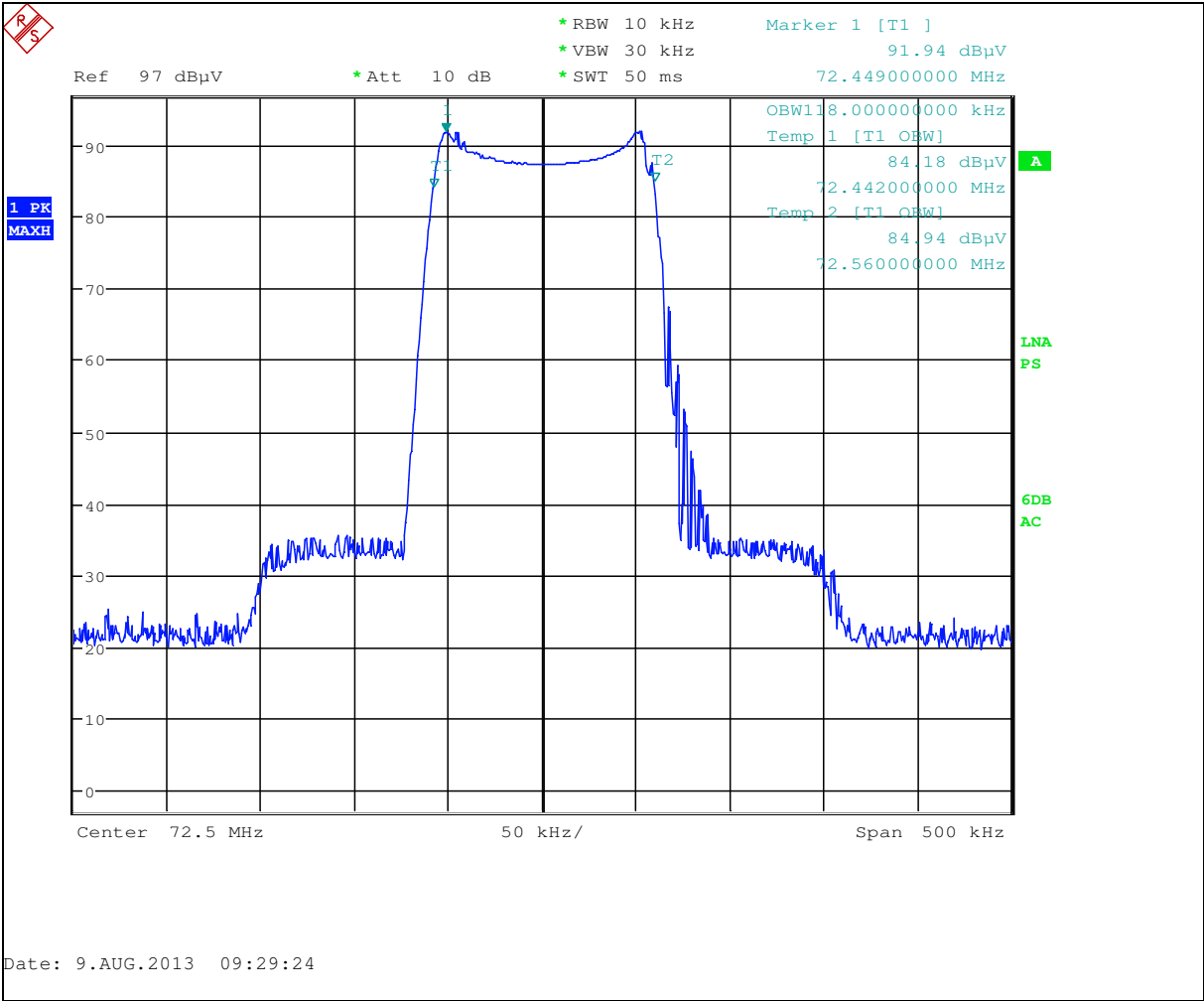
Graph 3.3.2



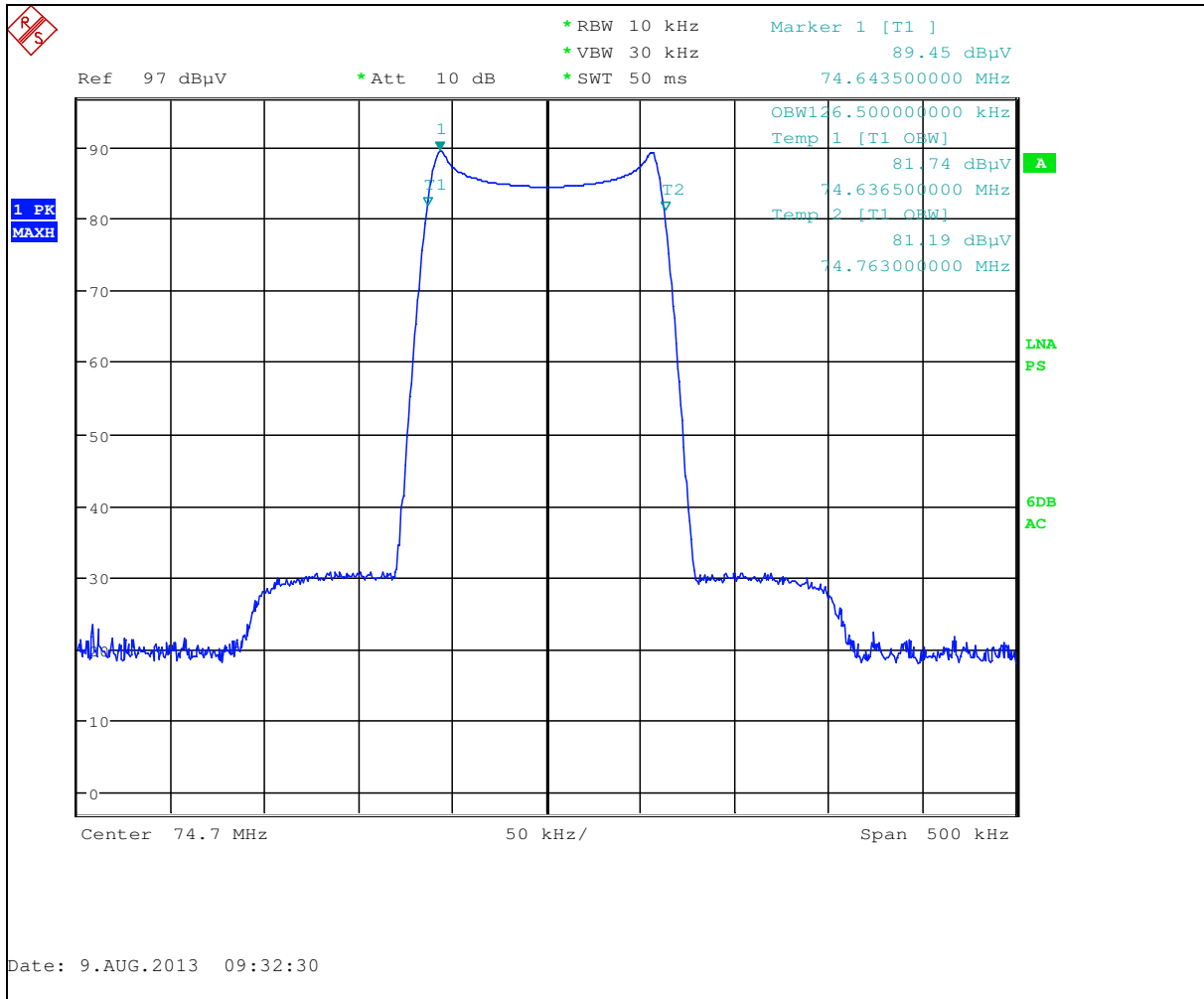
Graph 3.3.3



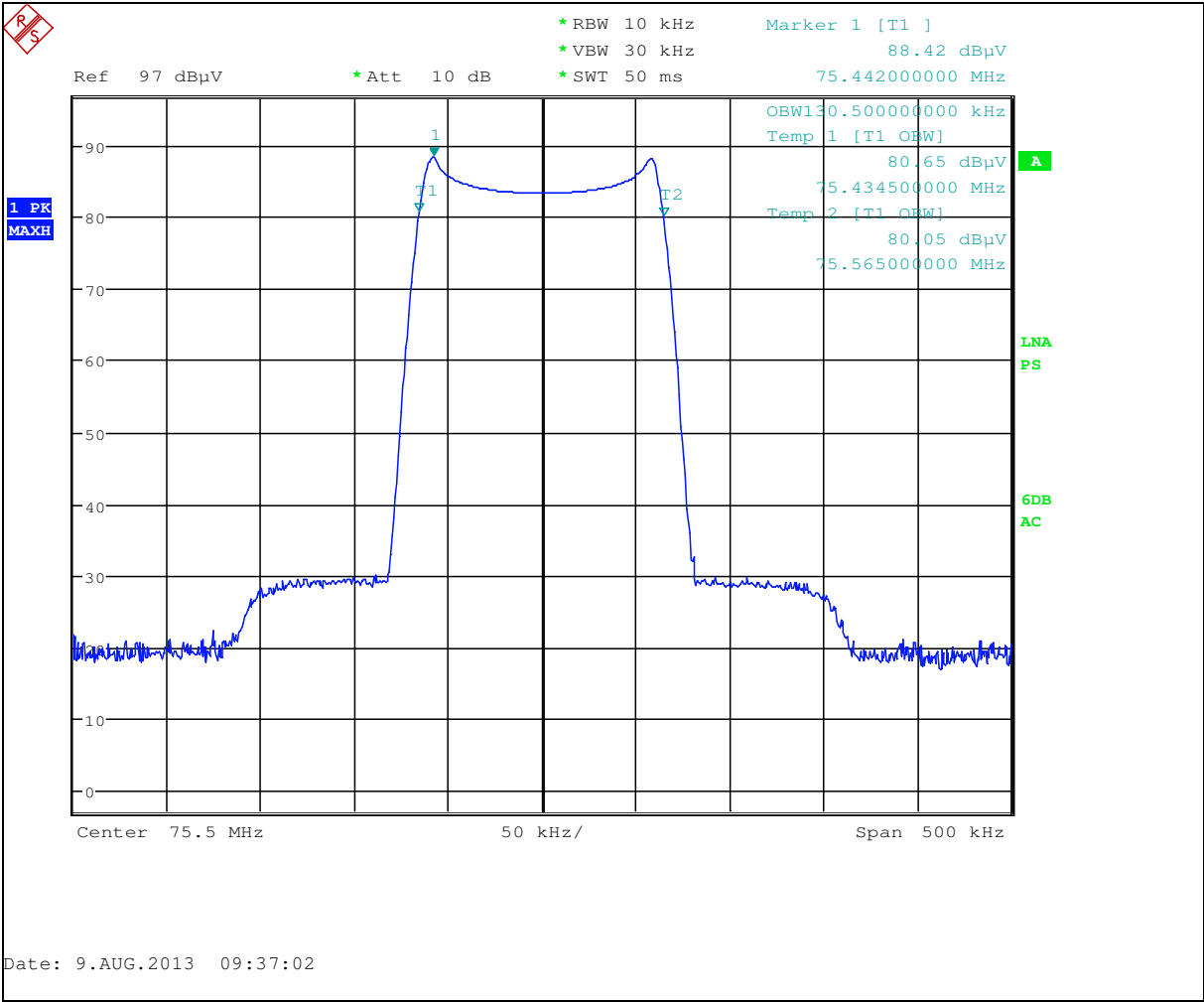
Graph 3.3.4



Graph 3.3.5



Graph 3.3.6





3.4 Transmitter power line conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 11.3dB below the limits

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

Date:	August 8, 2013	Result: Pass
Standard:	FCC 15.207	
Tested by:	Simon Khazon	
Test Point:	Power Line	
Operation mode:	See Page 5	
Note:		

Table 3.4.1

Line 1

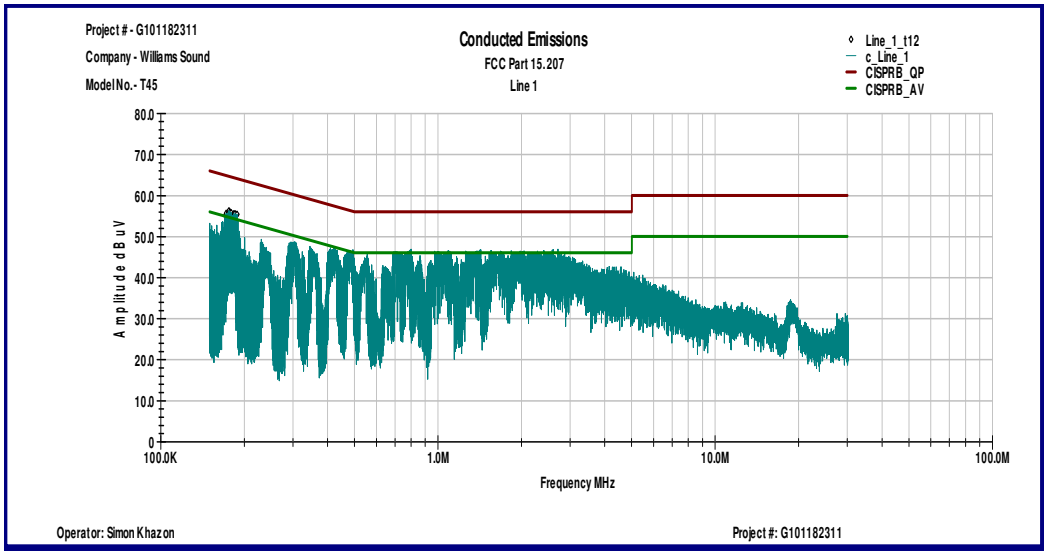
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
170.96 KHz	51.0	35.4	64.9	54.9	-13.9	-19.6
172.75 KHz	52.7	38.7	64.8	54.8	-12.2	-16.2
491.06 KHz	44.3	32.5	56.2	46.2	-11.8	-13.7
706.38 KHz	44.7	34.1	56.0	46.0	-11.3	-11.9
1.1198 MHz	40.3	29.2	56.0	46.0	-15.7	-16.8
1.4179 MHz	41.9	30.6	56.0	46.0	-14.2	-15.5
1.5556 MHz	43.0	31.2	56.0	46.0	-13.0	-14.8
2.2965 MHz	42.5	33.2	56.0	46.0	-13.5	-12.8
2.5832 MHz	42.9	33.6	56.0	46.0	-13.1	-12.4

Line 2

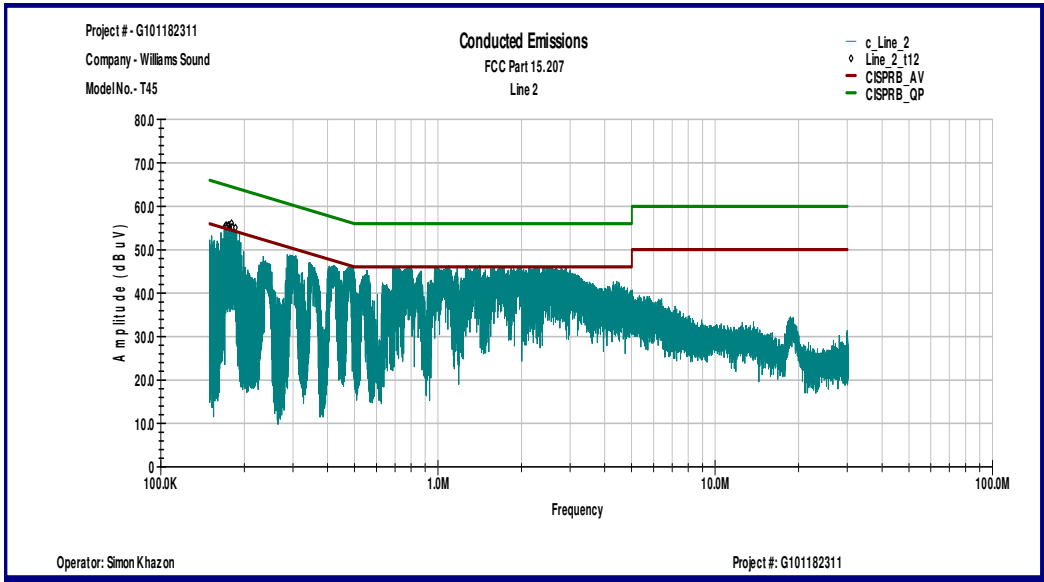
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
171.73 KHz	52.1	37.5	64.9	54.9	-12.8	-17.4
171.74 KHz	52.0	37.4	64.9	54.9	-12.9	-17.5
487.98 KHz	44.2	33.4	56.2	46.2	-12.0	-12.8
689.12 KHz	43.8	27.8	56.0	46.0	-12.2	-18.2
965.26 KHz	38.8	29.0	56.0	46.0	-17.2	-17.0
1.4069 MHz	41.8	31.8	56.0	46.0	-14.2	-14.2
1.6885 MHz	42.6	32.9	56.0	46.0	-13.4	-13.1
1.9569 MHz	42.3	33.4	56.0	46.0	-13.7	-12.6
2.5652 MHz	42.1	33.1	56.0	46.0	-13.9	-12.9

Graph 3.4.1

Line 1



Line 2





3.5 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-1000MHz

Max. Emissions margin: 3.8dB below the limits

Notes: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Table 3.5.1 and Graphs 3.5.1 - 3.5.3)

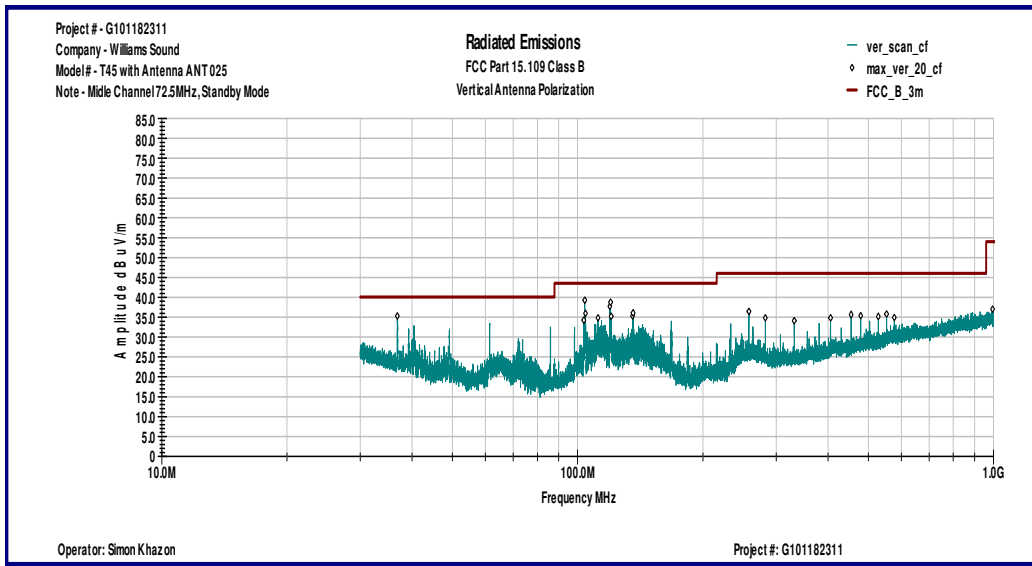
Date:	August 9, 2013	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Simon Khazon	
Test Point:	Enclosure	
Operation mode:	Standby	
Note:	None	

Table 3.5.1

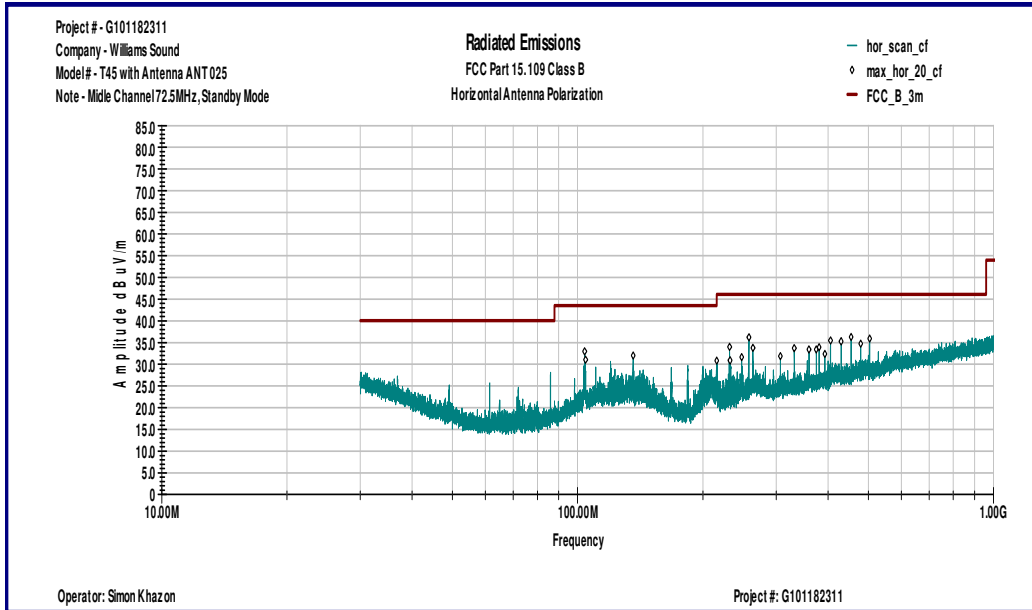
Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBμV	Total @ 3m dBμV/m	Limit dBμV/m	Margin dB
	Polarity	Hts(cm)							
			Channel 72.5MHz						
104.02	V	100	11.8	1.0	0.0	26.3	39.2	43.5	-4.3
120.03	V	100	12.8	1.1	0.0	21.3	35.2	43.5	-8.3
135.97	V	100	12.3	1.2	0.0	22.4	35.9	43.5	-7.6
258.07	H	212	14.0	1.8	0.0	20.5	36.3	46.0	-9.7
			Channel 74.7MHz						
36.86	V	100	15.9	0.6	0.0	18.4	34.9	40.0	-5.1
103.46	V	100	11.8	1.0	0.0	25.8	38.6	43.5	-4.9
120.00	V	100	12.8	1.1	0.0	25.1	39.0	43.5	-4.5
405.60	H	164	16.5	2.3	0.0	17.6	36.4	46.0	-9.6
430.00	H	137	16.8	2.4	0.0	17.1	36.3	46.0	-9.7
			Channel 75.5MHz						
58.81	V	100	6.7	0.8	0.0	28.7	36.1	40.0	-3.9
104.48	V	100	11.9	1.0	0.0	26.8	39.7	43.5	-3.8
120.03	V	100	12.8	1.1	0.0	24.6	38.5	43.5	-5.0
405.59	H	161	16.5	2.3	0.0	17.5	36.3	46.0	-9.7

Graph 3.5.1

Vertical antenna polarization

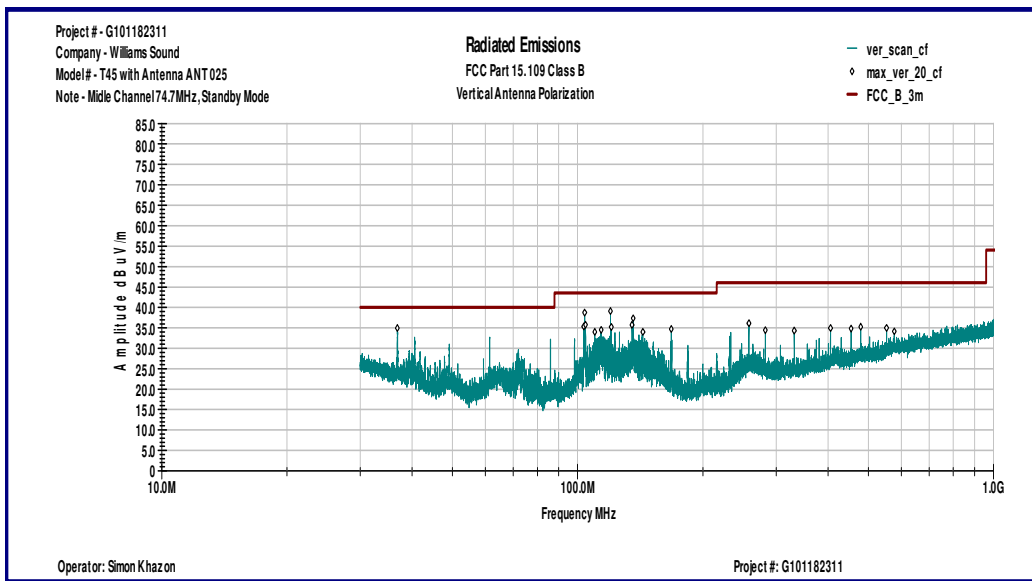


Horizontal antenna polarization

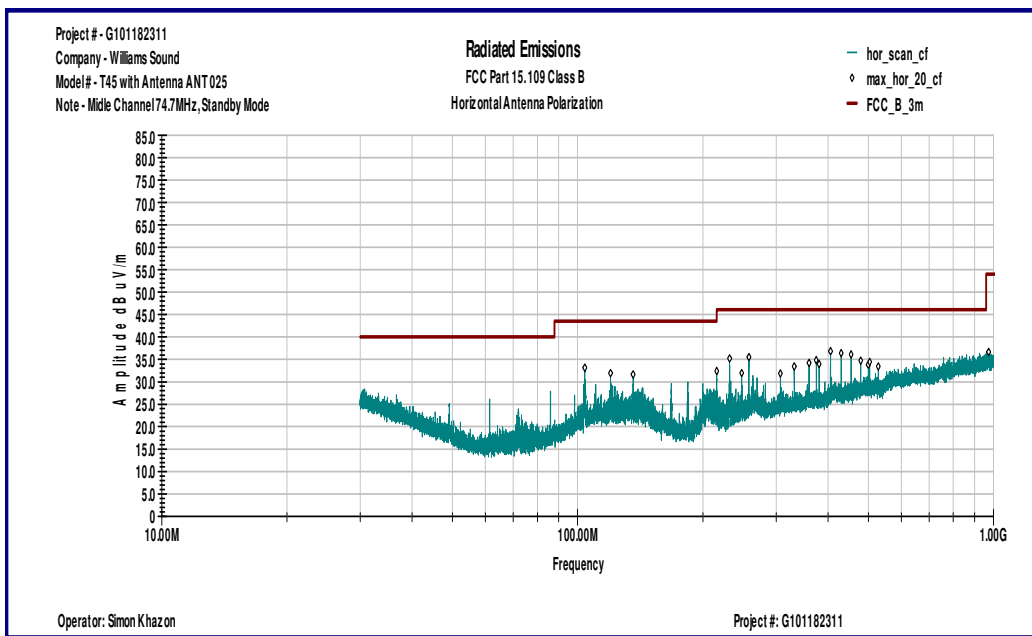


Graph 3.5.2

Vertical antenna polarization

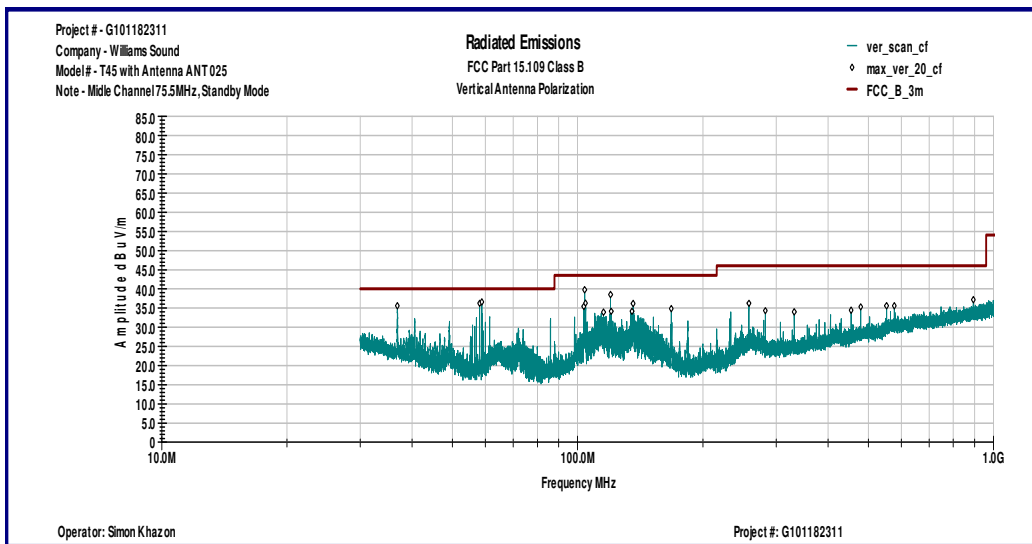


Horizontal antenna polarization

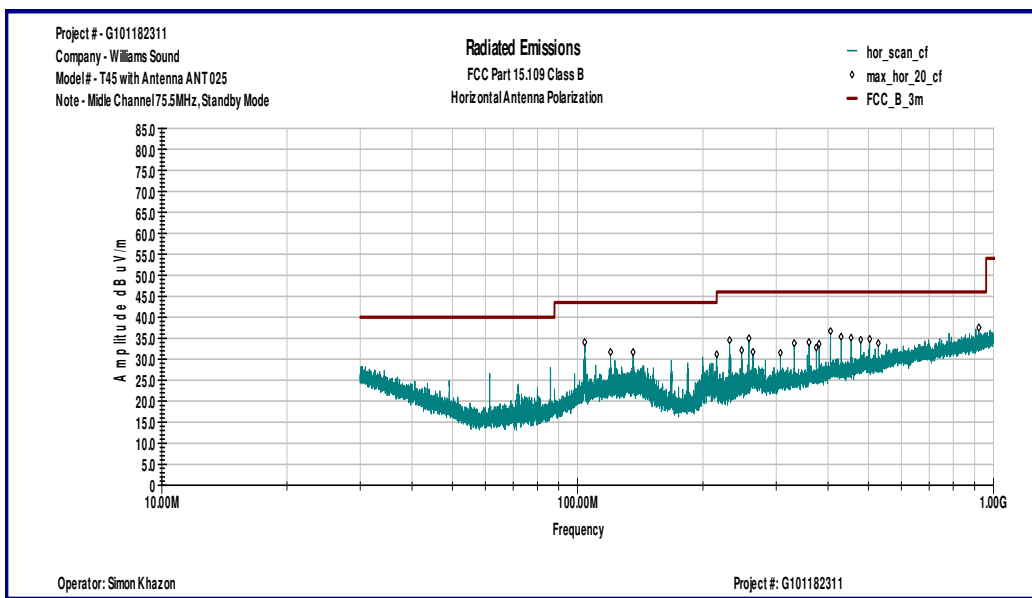


Graph 3.5.3

Vertical antenna polarization



Horizontal antenna polarization





3.6 Digital device conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 11.4dB below the limits

Notes: None

Date:	August 9, 2013	Result: Pass
Standard:	FCC 15.107, Class B	
Tested by:	Simon Khazon	
Test Point:	Power Line	
Operation mode:	Standby	
Note:		

Table 3.6.1

Line 1

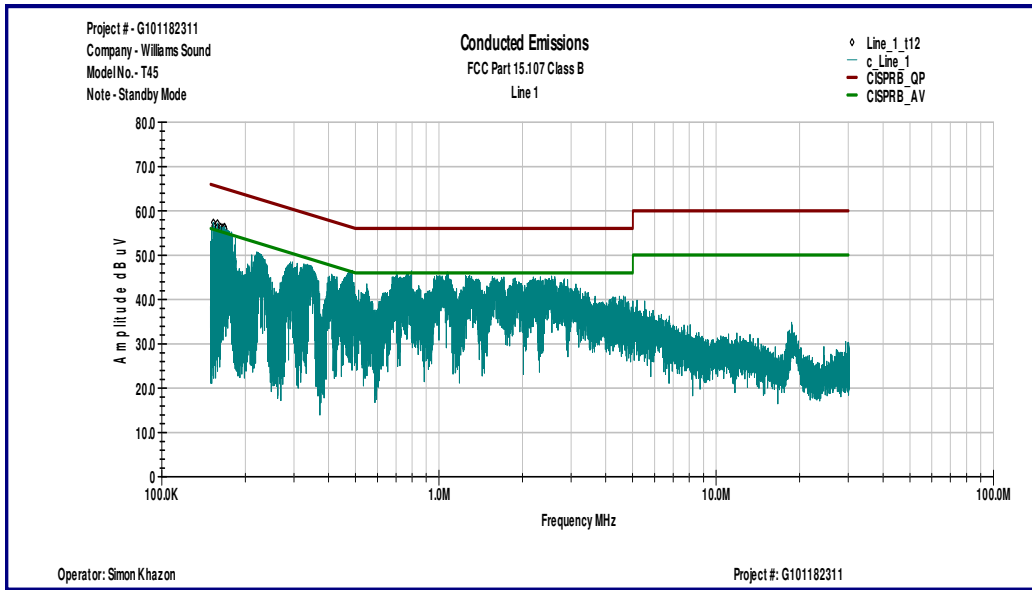
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
153.15 KHz	50.2	29.3	65.8	55.8	-15.7	-26.5
166.97 KHz	53.4	38.6	65.1	55.1	-11.8	-16.5
168.47 KHz	53.7	40.3	65.0	55.0	-11.4	-14.7
484.45 KHz	42.5	28.0	56.3	46.3	-13.8	-18.3
773.27 KHz	42.6	31.1	56.0	46.0	-13.4	-14.9
1.0734 MHz	41.9	32.7	56.0	46.0	-14.1	-13.3

Line 2

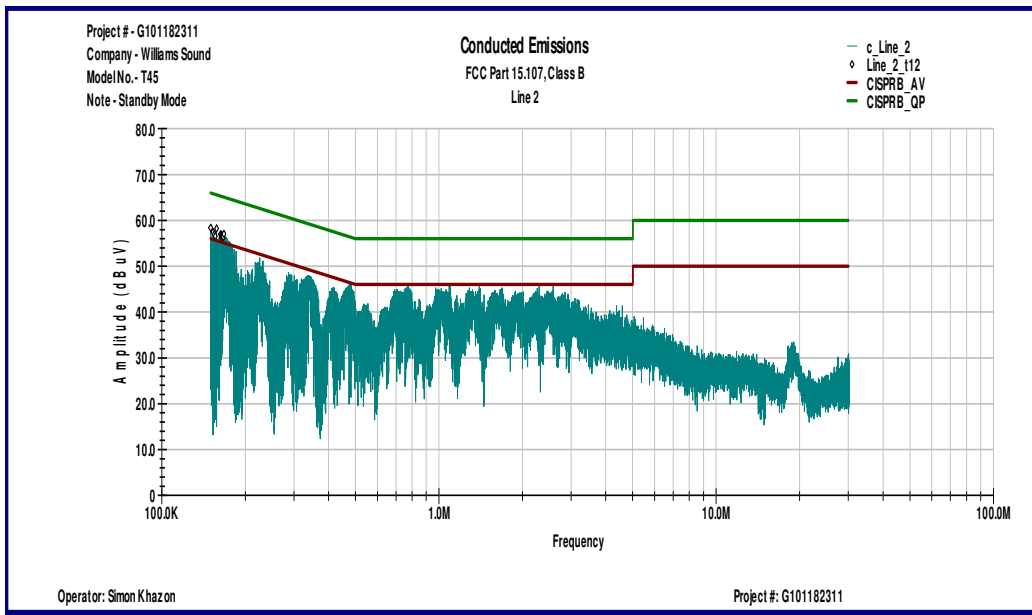
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
152.52 KHz	49.7	27.8	65.9	55.9	-16.2	-28.1
154.1 KHz	50.3	28.1	65.8	55.8	-15.5	-27.7
160.71 KHz	50.3	30.7	65.4	55.4	-15.2	-24.8
164.17 KHz	52.8	35.1	65.3	55.3	-12.4	-20.1
225.27 KHz	47.6	38.8	62.6	52.6	-15.0	-13.8
490.26 KHz	41.6	28.8	56.2	46.2	-14.6	-17.4
799.87 KHz	39.2	28.8	56.0	46.0	-16.8	-17.2
1.083 MHz	41.1	31.2	56.0	46.0	-14.9	-14.8

Graph 3.6.1

Line 1



Line 2





4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	ESU	100398	25283	12/19/2013	☒
Bicono-Log Antenna	Schaffner-Teseq	CBL6112B	2468	9734	11/30/2013	☒
ISN	TESEQ	ISN-T8	29421	24299	12/06/2013	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	☒



Test Setup Photos

