



TEST REPORT

Report Number: 100738267MIN-001

Project Number: G100738267

**Testing performed on the
ESL 562 Smoke Alarm**

**FCC ID: B4Z-773A-SMOKE
Industry Canada ID: 8671032273**

**to
47 CFR Part 15.231:2010
RSS- 210, Issue 8, 2010
Class II Permissive Changes**

**For
UTC Fire & Security Americas Corporation Inc.**

Test Performed by:
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Date: May 5, 2012

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1.0 GENERAL DESCRIPTION

Model:	ESL 562
Type of EUT:	Wireless Smoke Alarm
Part Number:	TX-6010-01-1
FCC ID:	B4Z-773A-SMOKE
Industry Canada ID:	8671032273
Related Submittal(s) Grants:	None
Company:	UTC Fire & Security Americas Corporation Inc.
Customer:	Mr. Kevin Flanders
Address:	1275 Red Fox Road Arden Hills, MN 55112, USA
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Test Standards:	☒ 47 CFR, Part 15:2010, §15.231 ☒ RSS-210, Issue 8, 20010 ☒ RSS-Gen, Issue 3, 2010 ☒ 47 CFR, Part 15:2010, §15.109, Class B ☒ ICES-003, Issue 4:2004 ☐ Other Note: Class II Permissive Changes
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	May 2, 20012
Test Work Started:	May 2, 20012
Test Work Completed:	May 4, 20012
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	Wireless Smoke Alarm
Operating Frequency	319.5MHz
Modulation:	AM
Emission Designator:	319KH1D
Antenna(s) Info:	Integral Antenna
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter power configuration:	☒ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☒ 6VDC Lithium Batteries ☐ Other: Amp. ☐ 50Hz ☐ 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 Transmitting Mode
- ☒ - Normal Operating Mode
- ☐ - Test program (customer specific)
- ☐ -

Operating modes of the EUT:

No.	Description
1	N/A

Cables:

No.	Type	Length	Designation	Note
1	None			

Support equipment/Services:

No.	Item	Description
1	None	

General notes: None

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).

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

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

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

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

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

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

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

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(a) / RSS-210 A1.1.1(a)	Transmitter deactivation time	Pass
15.231(b) / RSS-210 A1.1.2	Transmitter field strength of emissions	Pass
15.231(c) / RSS-210 A1.1.3	Bandwidth of the emission	Pass
15.207/RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	N/A
15.109/ICES-003/ RSS-Gen 4.10	Receiver/digital device radiated emissions	Pass
15.107/ ICES-003	Digital device conducted emissions	N/A

3.0 TEST CONDITIONS AND RESULTS

3.1 Transmitter deactivation time

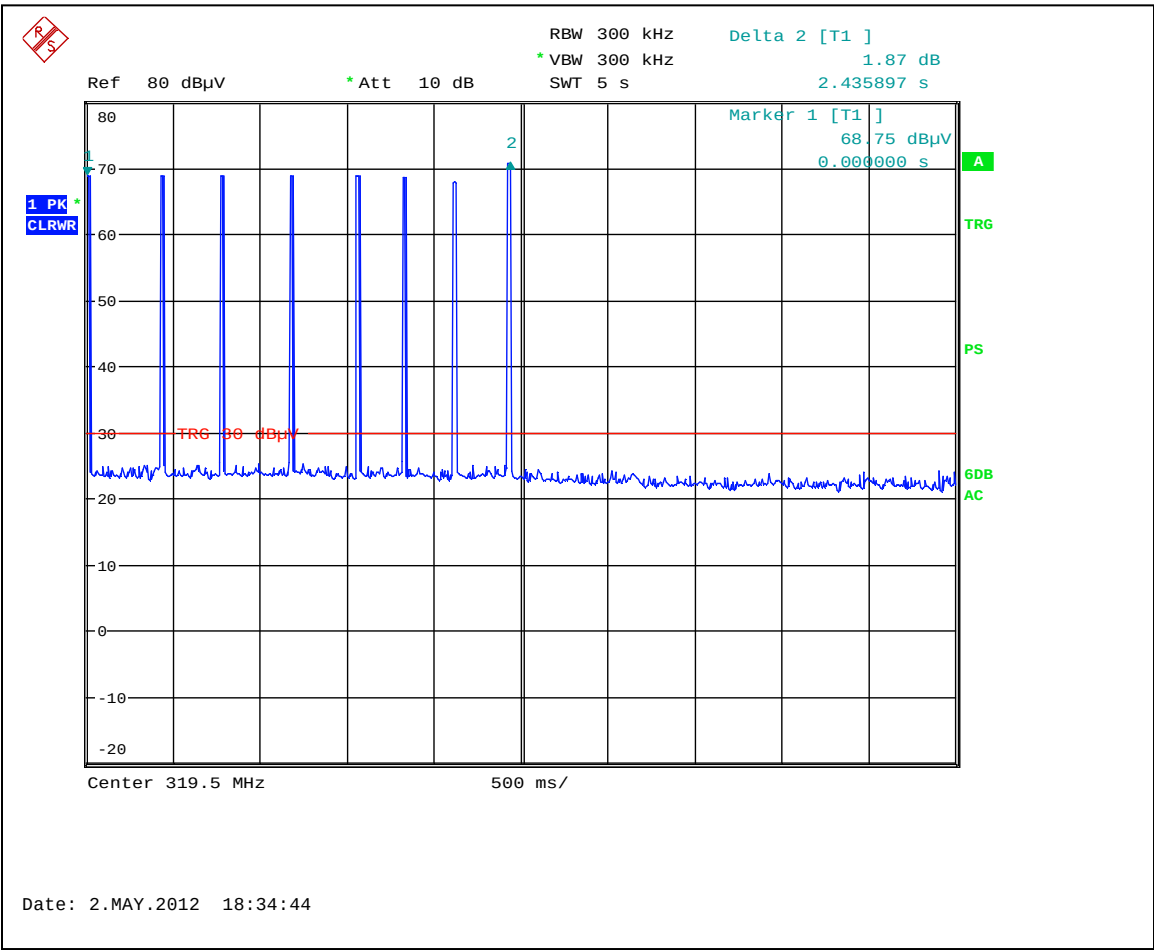
Maximum allowed deactivation time: 5 sec

Measured deactivation time: 2.43sec

Test result: Pass

Notes: Periodic transmission timing is shown in Graphs 3.1.1

Graph 3.1.1





3.2 Transmitter field strength of emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-5000MHz

Test result: **Pass**

Max. Emissions margin at fundamental: 2.1dB below the limits

Max. margin of harmonics and spurious emissions: 8.4dB below the limits

Notes: None

Date:	May 2, 2012	Result: Pass
Standard:	FCC 15.231(b) / RSS-210 A1.1.2	
Tested by:	Uri Spector	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Field Strength of fundamental	

Table 3.2.1

Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBμV	Total @ 3m dBμV/m	Average CF dB	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(cm)									
				Peak Readings							
319.50	V	206	14.5	2.0	0.0	69.0	85.5	0.0	95.9	-10.4	
319.50	H	100	14.5	2.0	0.0	72.1	88.6	0.0	95.9	-7.3	
				Average Value							
319.50	V	144	14.5	2.0	0.0	69.0	85.5	14.8	75.9	-5.2	
319.50	H	315	14.5	2.0	0.0	72.1	88.6	14.8	75.9	-2.1	

Date:	May 2, 2012	Result: Pass
Standard:	FCC 15.231(b) / RSS-210 A1.1.2	
Tested by:	Uri Spector	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Field Strength of Spurious Emissions form 30MHz to 1000MHz. Fundamental Transmitting Frequency was excluded form the table.	

Table 3.2.2

Frequency	Ant. Polarity	Reading dBμV	Ant.Factor dB1/m	Total at 3m dBμV/m	Average CF dB	Limit dBμV/m	Margin dB
Peak Readings							
33.221 MHz	V	17.8	17.8	36.4	0.0	75.9	-39.6
83.063 MHz	V	32.1	32.1	41.3	0.0	75.9	-34.6
86.868 MHz	V	36.4	36.4	46.1	0.0	75.9	-29.8
87.689 MHz	V	33.4	33.4	43.2	0.0	75.9	-32.7
106.49 MHz	V	25.7	25.7	39.0	0.0	75.9	-37.0
213.03 MHz	V	38.5	38.5	50.5	0.0	75.9	-25.4
639.4 MHz	V	28.8	28.8	51.5	0.0	75.9	-24.4
958.62 MHz	V	22.5	22.5	48.4	0.0	75.9	-27.5
31.351 MHz	H	23.7	19.6	43.2	0.0	75.9	-32.7
57.672 MHz	H	31.4	7.7	39.0	0.0	75.9	-36.9
85.525 MHz	H	34.8	9.5	44.3	0.0	75.9	-31.7
106.49 MHz	H	28.5	13.2	41.7	0.0	75.9	-34.2
213.03 MHz	H	40.5	12.0	52.5	0.0	75.9	-23.4
426.06 MHz	H	34.1	19.5	53.7	0.0	75.9	-22.3
532.73 MHz	H	26.1	20.7	46.7	0.0	75.9	-29.2
639.4 MHz	H	30.0	22.7	52.6	0.0	75.9	-23.3
745.36 MHz	H	20.0	23.7	43.8	0.0	75.9	-32.1
958.62 MHz	H	28.8	25.9	54.7	0.0	75.9	-21.2
Average Value							
106.53 MHz	V	32.0	13.3	45.3	14.8	55.9	-25.4
33.221 MHz	V	17.8	17.8	36.4	14.8	55.9	-34.4
83.063 MHz	V	32.1	32.1	41.3	14.8	55.9	-29.4
86.868 MHz	V	36.4	36.4	46.1	14.8	55.9	-24.6
87.689 MHz	V	33.4	33.4	43.2	14.8	55.9	-27.5
106.49 MHz	V	25.7	25.7	39.0	14.8	55.9	-31.8
213.03 MHz	V	38.5	38.5	50.5	14.8	55.9	-20.2
639.4 MHz	V	28.8	28.8	51.5	14.8	55.9	-19.2
958.62 MHz	V	22.5	22.5	48.4	14.8	55.9	-22.3
31.351 MHz	H	23.7	19.6	43.2	14.8	55.9	-27.5
57.672 MHz	H	31.4	7.7	39.0	14.8	55.9	-31.7
85.525 MHz	H	34.8	9.5	44.3	14.8	55.9	-26.5
106.49 MHz	H	28.5	13.2	41.7	14.8	55.9	-29.0
213.03 MHz	H	40.5	12.0	52.5	14.8	55.9	-18.2
426.06 MHz	H	34.1	19.5	53.7	14.8	55.9	-17.1
532.73 MHz	H	26.1	20.7	46.7	14.8	55.9	-24.0
639.4 MHz	H	30.0	22.7	52.6	14.8	55.9	-18.1
745.36 MHz	H	20.0	23.7	43.8	14.8	55.9	-26.9
958.62 MHz	H	28.8	25.9	54.7	14.8	55.9	-16.0

Date:	May 2, 2012	Result: Pass
Standard:	FCC 15.231(b) / RSS-210 A1.1.2	
Tested by:	Uri Spector	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Field Strength of Spurious Emissions form 1000MHz to 5000MHz.	

Table 3.2.3

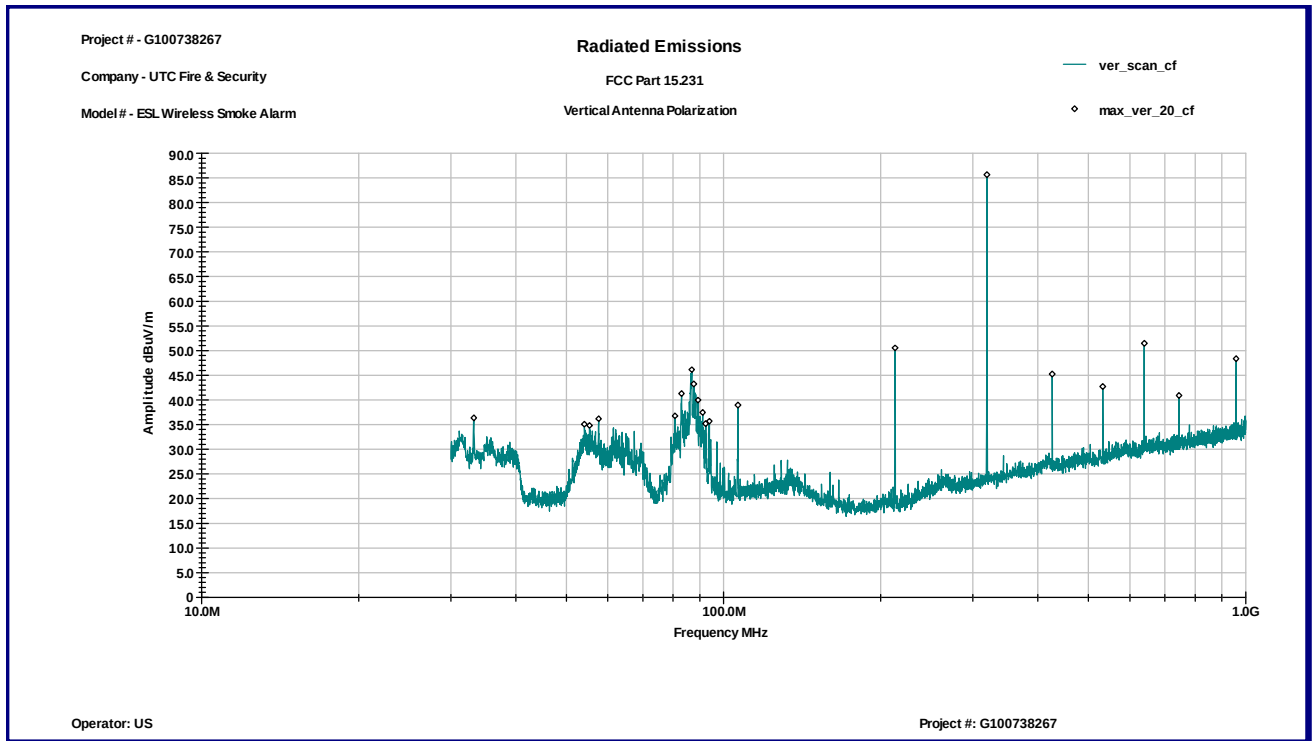
Frequency MHz	Antenna Polarity	Peak Reading dBμV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
Peak Readings							
2.875 GHz	V	67.8	33.1	43.7	57.2	75.9	-18.7
3.196 GHz	V	71.9	34.1	43.7	62.3	75.9	-13.6
3.304 GHz	V	65.6	34.5	43.7	56.4	75.9	-19.5
3.517 GHz	V	67.2	35.1	43.5	58.8	75.9	-17.2
4.153 GHz	V	66.9	36.6	42.8	60.7	75.9	-15.2
2.875 GHz	H	67.3	32.9	43.7	56.5	75.9	-19.4
3.196 GHz	H	70.5	34.0	43.7	60.8	75.9	-15.1
3.304 GHz	H	65.3	34.3	43.7	56.0	75.9	-19.9
3.517 GHz	H	66.3	35.0	43.5	57.8	75.9	-18.1
4.153 GHz	H	63.5	36.6	42.8	57.3	75.9	-18.6

Frequency MHz	Antenna Polarity	Peak Reading dBμV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBμV/m	Average CF dB	Limit dBμV/m	Margin dB
Average Value								
2.875 GHz	V	67.8	33.1	43.7	57.2	14.8	55.9	-13.5
3.196 GHz	V	71.9	34.1	43.7	62.3	14.8	55.9	-8.4
3.304 GHz	V	65.6	34.5	43.7	56.4	14.8	55.9	-14.3
3.517 GHz	V	67.2	35.1	43.5	58.8	14.8	55.9	-12.0
4.153 GHz	V	66.9	36.6	42.8	60.7	14.8	55.9	-10.0
2.554 GHz	H	66.9	31.8	43.5	55.2	14.8	55.9	-15.5
2.875 GHz	H	67.3	32.9	43.7	56.5	14.8	55.9	-14.2
3.196 GHz	H	70.5	34.0	43.7	60.8	14.8	55.9	-9.9
3.304 GHz	H	65.3	34.3	43.7	56.0	14.8	55.9	-14.7
4.048 GHz	H	60.0	36.5	42.9	53.6	14.8	55.9	-17.1
4.153 GHz	H	63.5	36.6	42.8	57.3	14.8	55.9	-13.4
4.261 GHz	H	58.5	36.7	42.6	52.5	14.8	55.9	-18.2

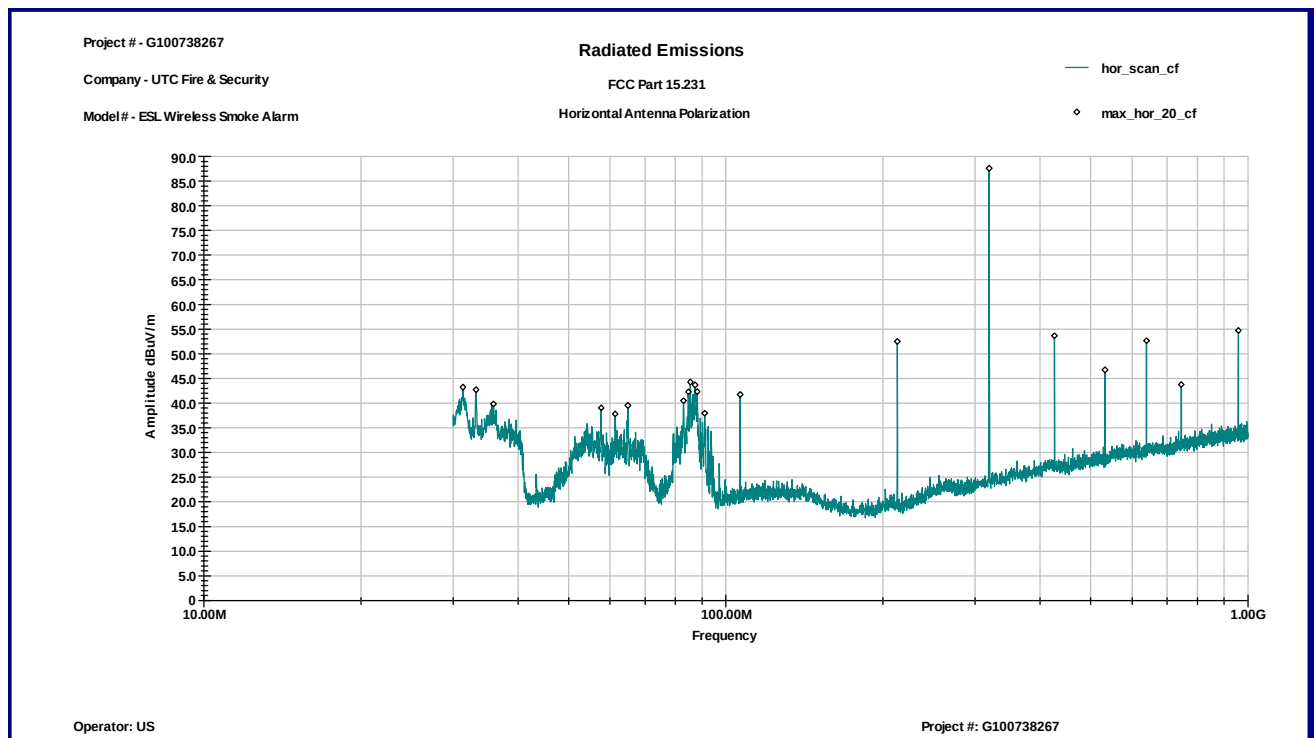


Graph 3.2.1

Vertical antenna polarization



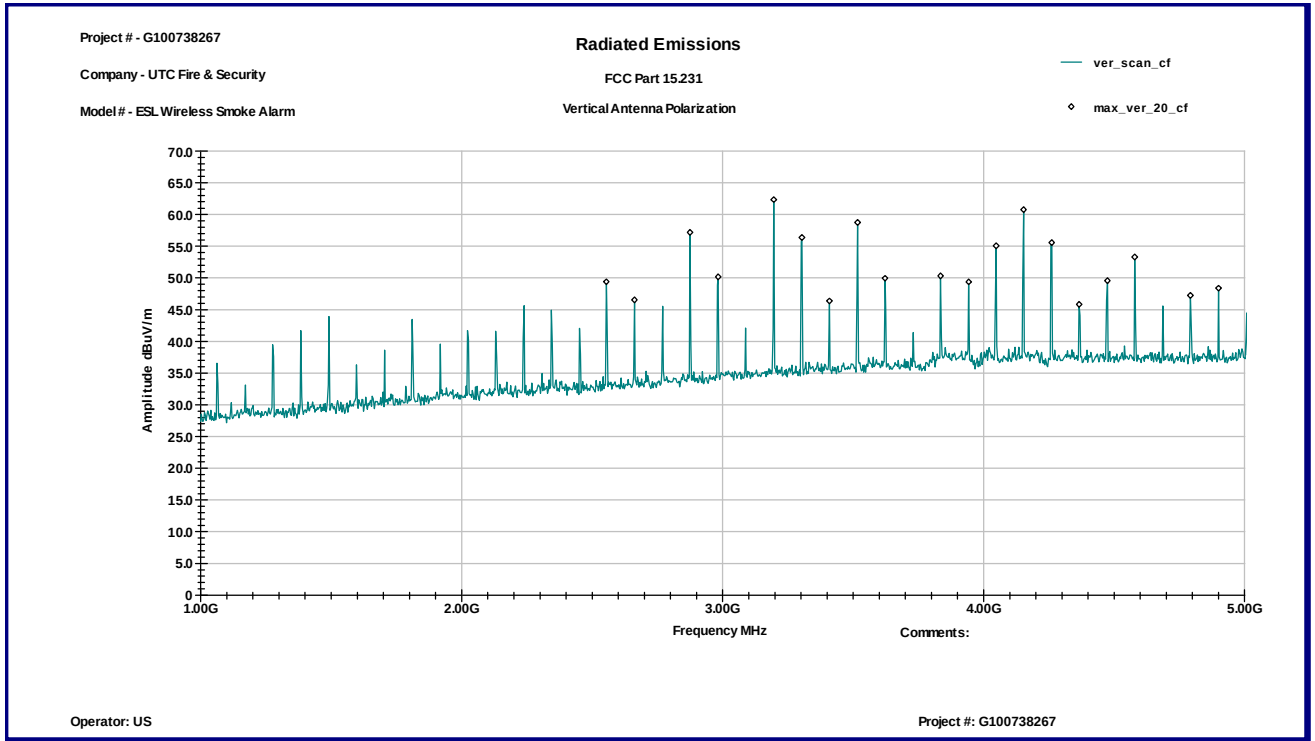
Horizontal antenna polarization



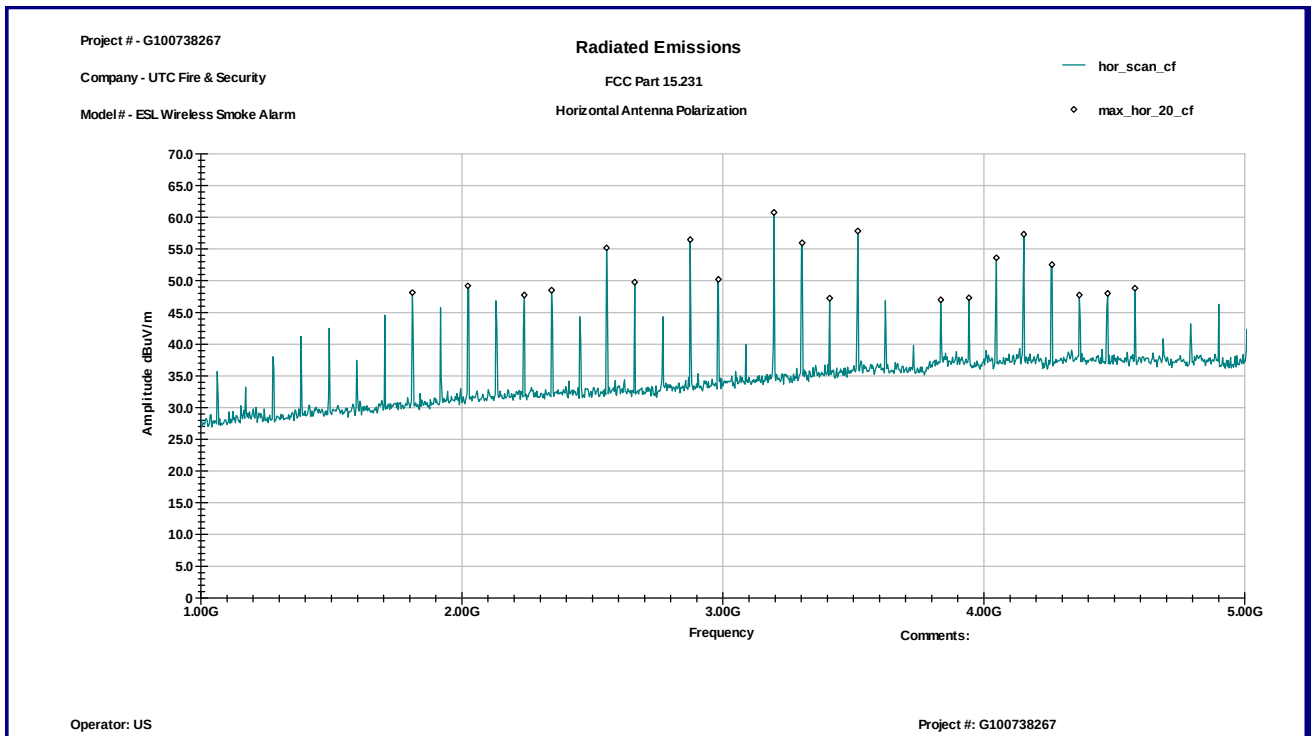


Graph 3.2.2

Vertical antenna polarization



Horizontal antenna polarization





3.2.1 Average correction factor calculation

An Average correction factor is calculated by averaging one complete pulse train.

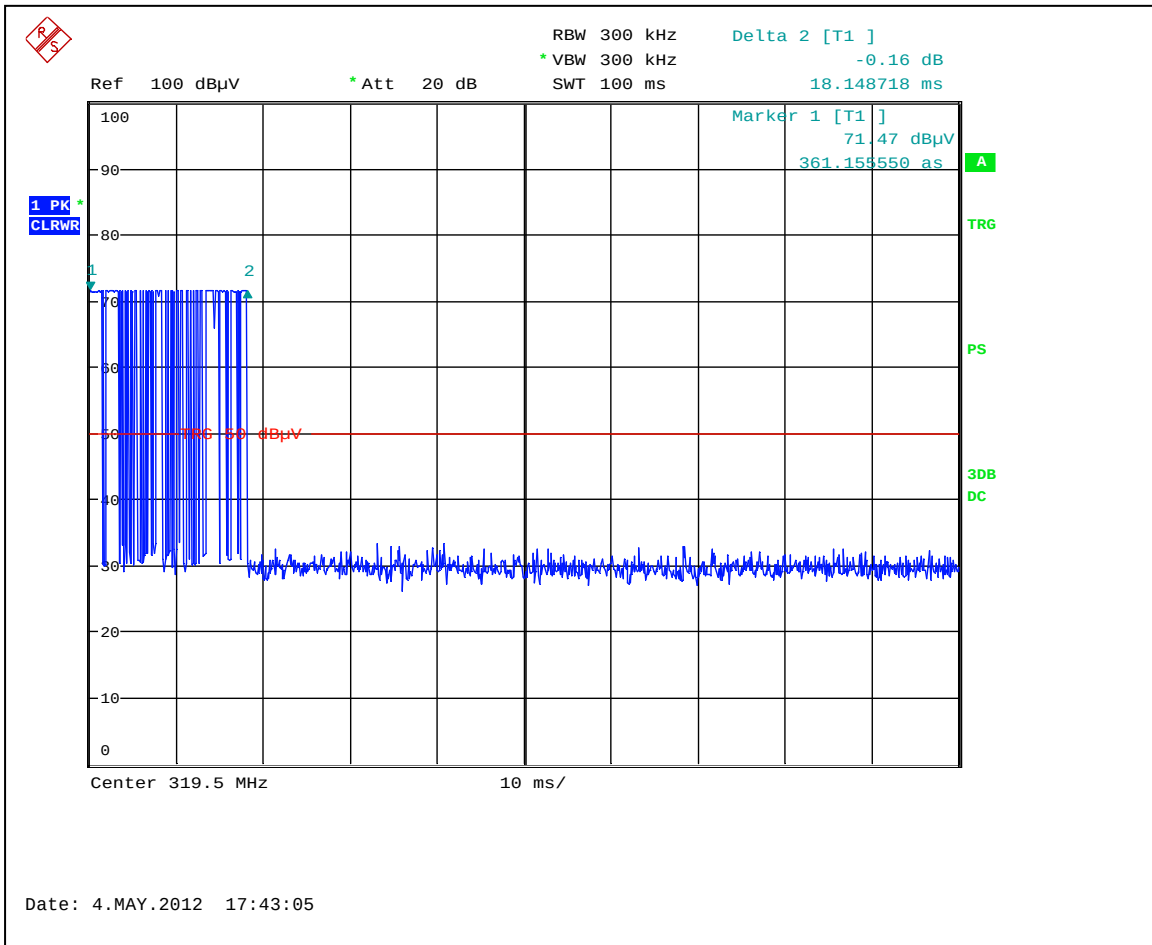
One complete pulse train = 18.14 ms (See Graph 3.2.3)

Cycle is more than 100ms, therefore the Average Correction Factor was calculated over 100 ms

Average Correction Factor = $20\text{Log}(18.14\text{ms}/100\text{ms}) = -14.8\text{dB}$

Graph 3-2-3 shows pulse train timing.

Graph 3.2.3





3.3 Bandwidth of Emissions

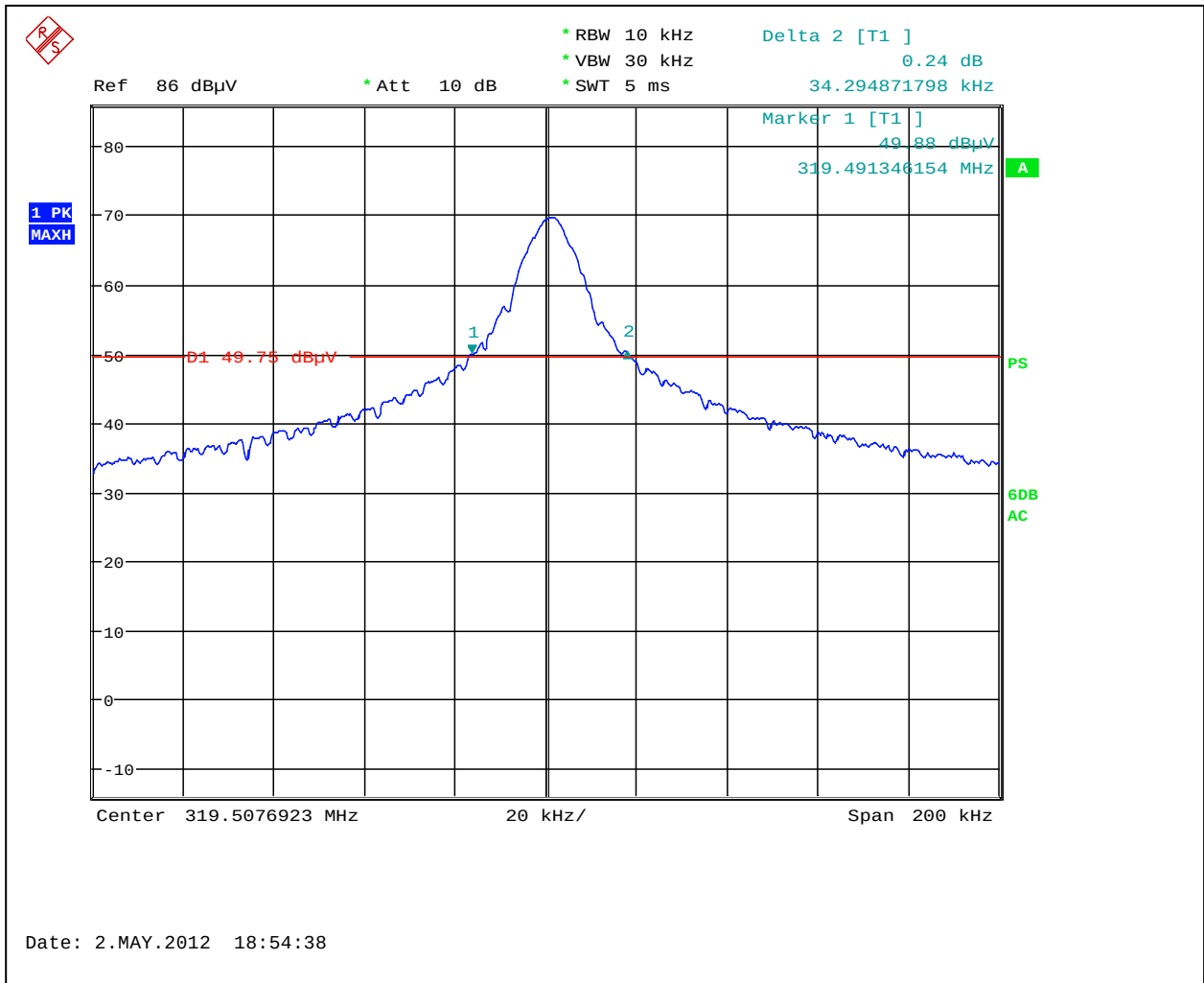
Center Frequency of operation MHz	Maximum allowed bandwidth kHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz	Result
319.5	768.8	34.3	83.6	Pass
Maximum allowed bandwidth:	☒ 0.25% of the centre operating frequency ☐ 0.5% of the centre operating frequency			
RBW:	☒ 10kHz	☐ 100kHz	☐ other	kHz
VBW:	☒ 30kHz	☐ 300kHz	☐ other	kHz

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

Notes:

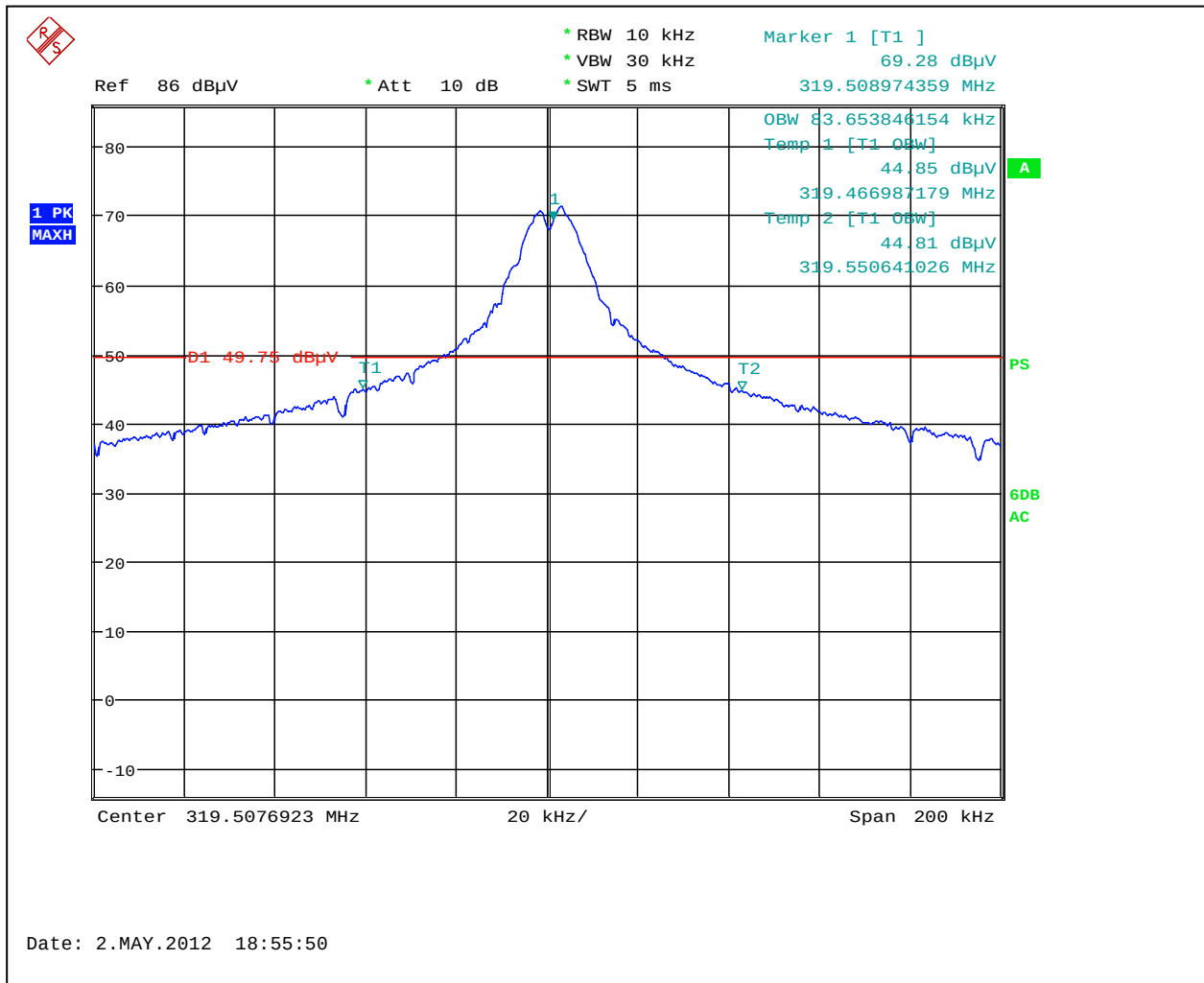


Graph 3.3.1





Graph 3.3.2





3.4 Transmitter power line 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: It was determined from consideration of the electrical characteristics and usage of particular apparatus that Conducted Emissions testing is inappropriate and therefore unnecessary (as battery operated equipment).



3.5 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-2000MHz

Max. Emissions margin: 12.4dB below the limits

Notes: None

Date:	May 3, 2012	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	Standby mode	
Note:	None	

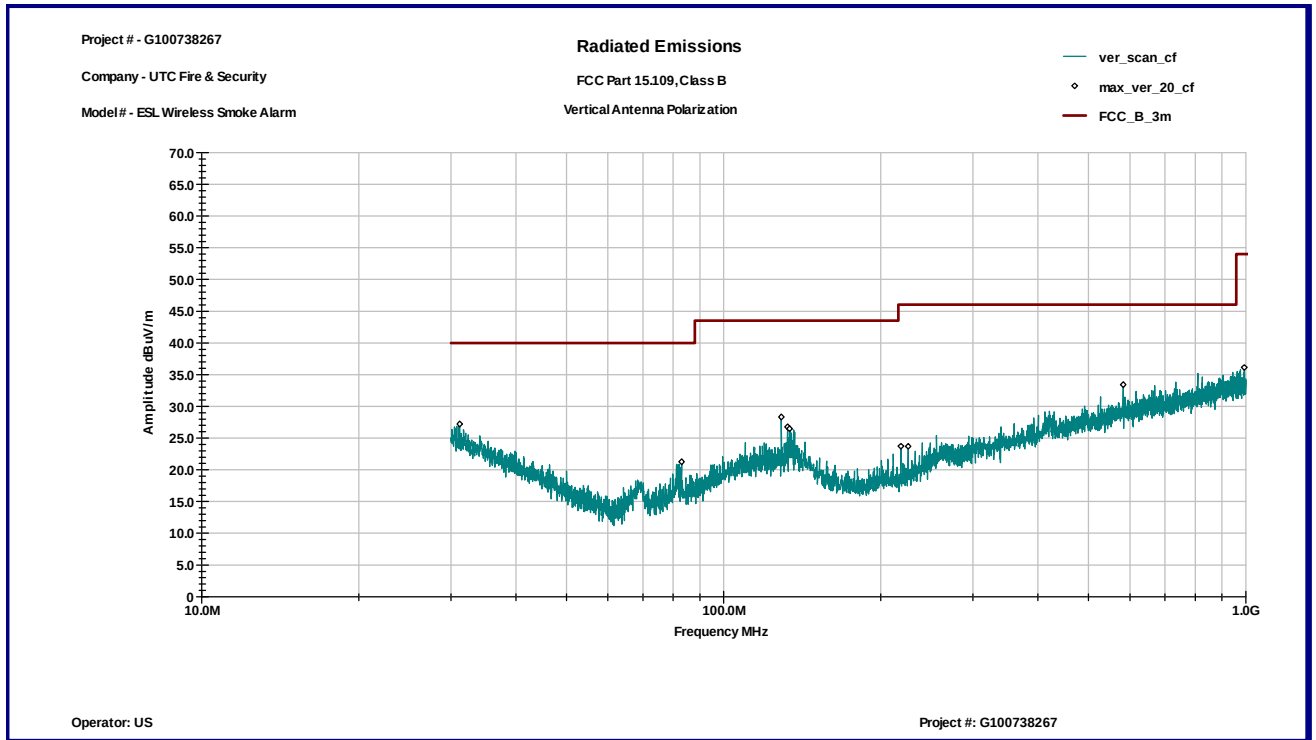
Table 3.5.1

Frequency	Ant. Polarity	Peak Reading dB μ V	Total C.F. dB1/m	Total at 3m dB μ V/m	Limit dB μ V/m	Margin dB
31.212 MHz	V	7.6	19.7	27.2	40.0	-12.8
83.063 MHz	V	12.1	9.2	21.3	40.0	-18.8
128.95 MHz	V	14.5	13.8	28.3	43.5	-15.2
132.53 MHz	V	13.0	13.8	26.8	43.5	-16.8
133.73 MHz	V	12.8	13.7	26.5	43.5	-17.0
218.5 MHz	V	11.6	12.1	23.7	46.0	-22.3
225.57 MHz	V	11.2	12.6	23.7	46.0	-22.3
582.61 MHz	V	11.2	22.2	33.4	46.0	-12.6
30.035 MHz	H	7.3	20.3	27.6	40.0	-12.4
135.14 MHz	H	11.4	13.7	25.1	43.5	-18.4

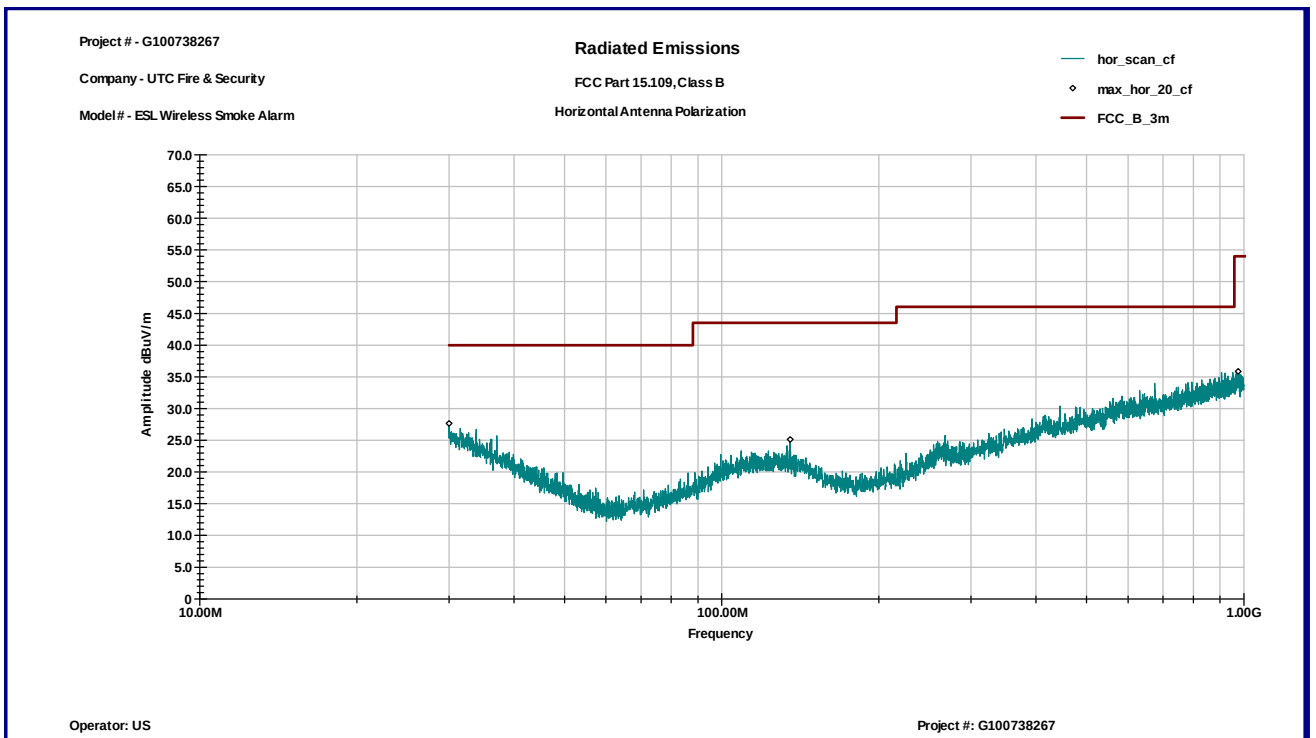


Graph 3.5.1

Vertical antenna polarization



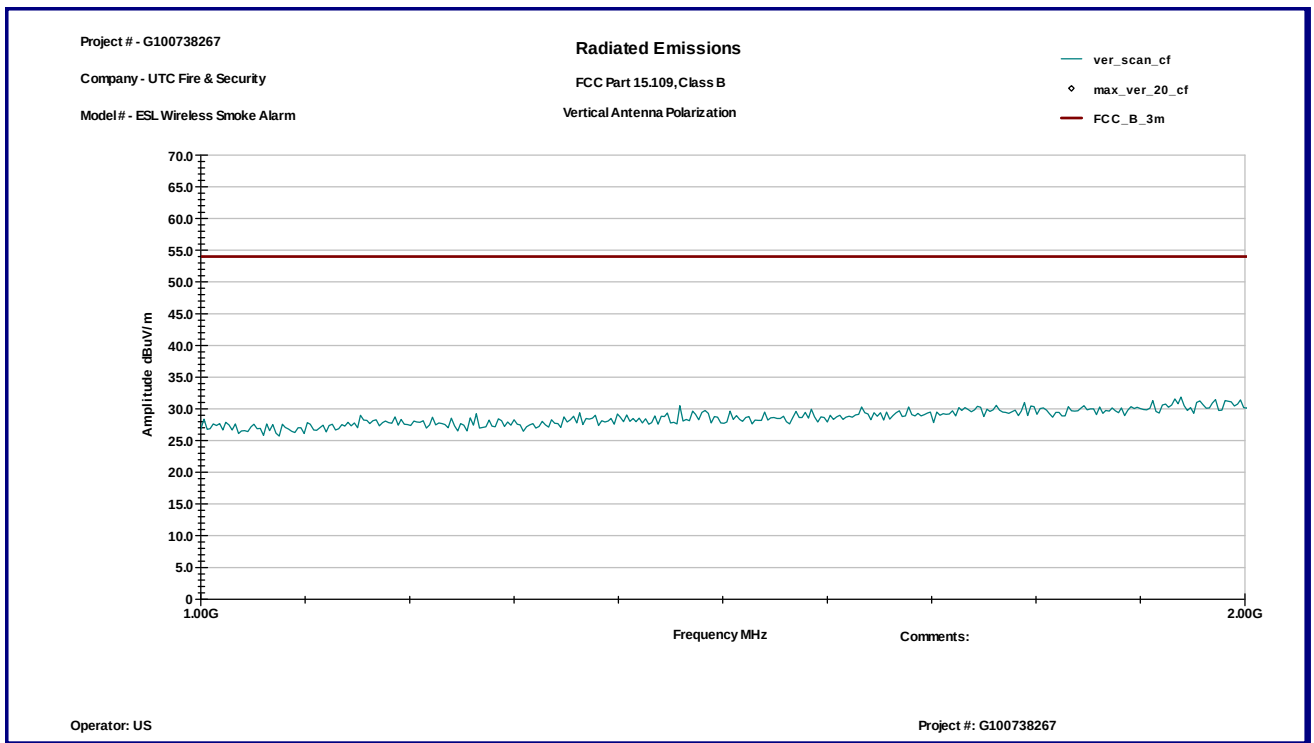
Horizontal antenna polarization



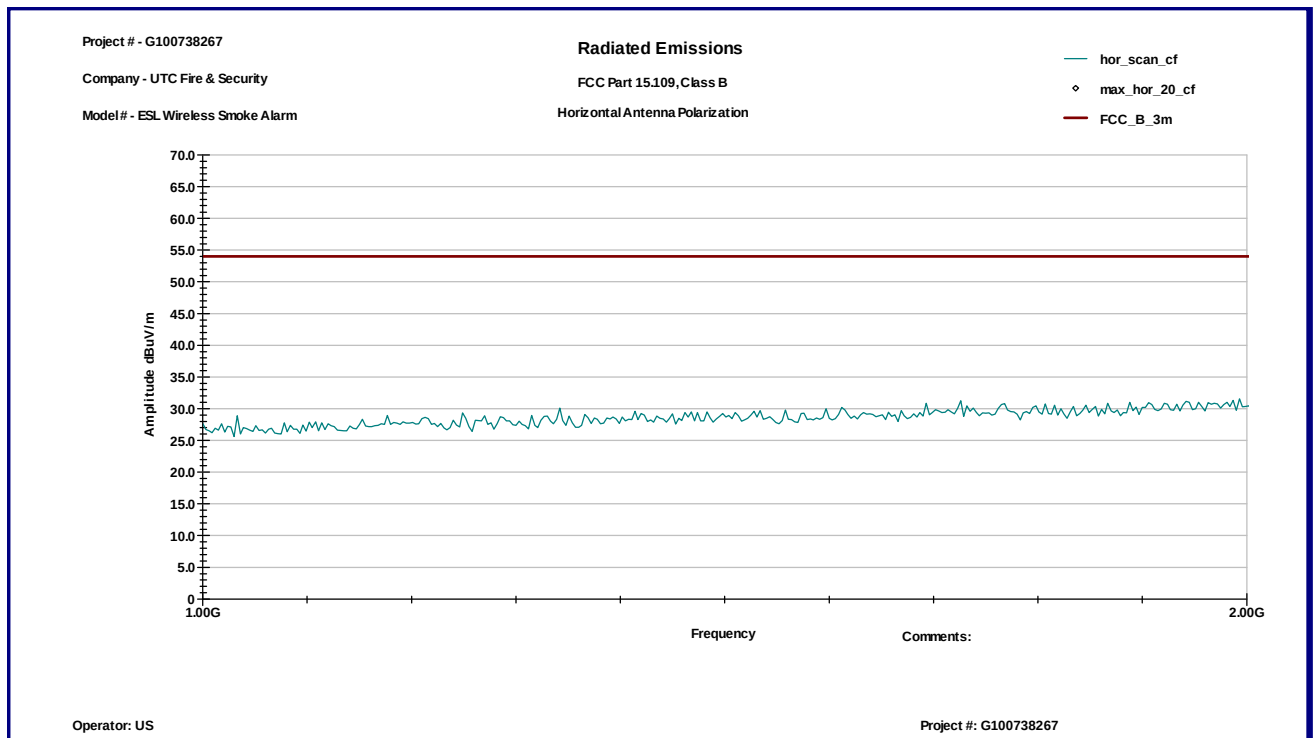


Graph 3.5.2

Vertical antenna polarization



Horizontal antenna polarization



3.6 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: It was determined from consideration of the electrical characteristics and usage of particular apparatus that Conducted Emissions testing is inappropriate and therefore unnecessary (as battery operated equipment).



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	11/17/2012	☒
Spectrum Analyzer	R & S	ESU	100398	25283	12/09/2012	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	9734	11/08/2012	☒
Horn Antenna	EMCO	3115	6579	15580	05/25/2012	☒
LISN	Fischer Custom Communications	FCC-LISN-2 MOD.SD	316	9945	05/26/2012	☐
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1402232	172081	10/31/2012	☒
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	10/31/2012	☐
Pre-Amplifier	MITEQ	AMF-6F-26004000-40-8P	13224444	MIN-0064	10/31/2012	☐
System	TILE! Instrument Control		Ver. 3.4.K.29	15259	VBU	☒