

Interactive Technologies Inc

**Interactive Technologies, Inc.
Smoke Alarm
B4Z-778A-SMOKE
Certification**

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Interactive Technologies Inc

**ESL 562 Smoke Alarm
B4Z-778A-SMOKE**

01/05/2001

**Interactive Technologies, Inc.
2266 North Second Street
North Saint Paul, MN 55109
(651) 777-2690**

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1. Introduction

This device is a wireless fire alarm transmitter for use in a wireless security system. The unit is self-contained and powered by two 3.0 Volt Lithium batteries. The transmitter's frequency is crystal controlled and is not adjustable by the user. The device measures approximately 5" in diameter and 2.25" in height. The unit weighs approximately 8 ounces without batteries.

We are requesting Certification under FCC Rules, Part 15, Subpart C, Paragraph 15.231.

Please send comments/suggestions on the report format to knelson@itii.com.

2. Statement of Compliance

§2.907

Certification

This is an application for certification

§2.911

Application

- a) This is an application and has been filed electronically with form 731.
- b) All information required has been supplied.
- c) The applicant has signed the application (electronically).
- d) The technical data has been signed.
(See Radiated Emissions)
- e) Applicant signature block on electronic form 731 completed by officer of the company or authorized company personnel.
- f) The appropriate fee has been paid electronically with VISA on 01/05/01.

§2.915

Grant

This application demonstrates that all applicable technical standards have been met and a grant of this application will serve the public interest.

§2.925

Label

Each piece of equipment for which authorization will be granted will be uniquely identified with "FCC ID: B4Z-778A-SMOKE." The required statement will appear with the FCC ID on the product and, although not required, in the installation instructions. See Exhibit A, PDF file *id_label.pdf*

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§2.947 Measurement Procedure

- a) The measurement procedure follows ANSI C63.4 procedure.
Procedural notes are contained in the laboratory report.
- d) A list of test equipment used is contained in the laboratory report.

§2.948 Description of Measurement Facilities

Measurements were performed at TUV Testing Services Open Test Site. The FCC keeps a full description of the measurement facilities on file. TUV's acceptance and approval is dated as December 5, 1993 in a letter received from the FCC.

The address of the test facility is:

TUV Product Service
19035 Wild Mountain Road
Taylors Falls, MN 55084-1758

Phone: 651-638-0297
Contact: Joel Schneider
Test Engineer in Charge

See Exhibit F, PDF file *test_pho.pdf* for sketch of measurement setup

§2.1033 Application for Certification

- a) Form 731 has been electronically filed on 01/05/01. Items that did not apply were left blank.
- b) This technical report contains the following information where applicable.
 - 1) Full name and mailing address of manufacturer and applicant for certification:
Interactive Technologies Inc
2266 North Second Street
North Saint Paul, MN 55109
 - 2) FCC Identifier:
B4Z-778A-SMOKE
 - 3) Copy of installation instructions:
See Exhibit G, PDF file: *user_man.pdf*
 - 4) Brief Description of circuit functions and device operation:
See Exhibit I, PDF file *op_desc.pdf*
See Exhibit D, PDF file *schemat.pdf* for schematics (page 1) and parts placement (page 2) diagrams.

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- 5) Block Diagram
See Exhibit C, PDF file *block.pdf*.
- 6) Report of the measurements of radiation and conducted emissions:
This document.
- 7) Photographs
External:
See Exhibit B, PDF file *extern.pdf*
Internal:
See Exhibit H, PDF file *intern.pdf*
- 8) Peripheral or Accessory devices:
This is not applicable since this device is stand-alone product.
- 9) Transition Rules
This application is not pursuant to the transition rules of §15.37
- 10) Emergency Broadcast decoding:
This is not applicable to device in this application.
- 11) Application for direct sequence spread spectrum devices...
This is not applicable to device in this application.
- 12) Application for scanning receivers...
This is not applicable to device in this application.
- c) Composite Systems
This is not applicable to device in this application.

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3. Lab Measurements Discussion / Test Notes

3.1 Test Notes

3.1.1 Transmissions shall cease within 5 seconds of activation [**§15.231(a)(2)**]

In the event of a smoke alarm, 10 packets are sent in the transmission. The packet duration is, 19.5 mS, see **Duty Cycle Correction Factor [§15.231(b)(2) and §15.35(c)]**. The time between packets is nominally 90 mS so the length of the longest transmission is:

$$10*20\text{mS} + 9*90\text{mS} = 1.10 \text{ seconds.}$$

So long as the fire alarm condition is present, the device will re-transmit every minute as allowed in §15.231(a)(4).

The following plot shows an 10-packet transmission that concludes in less than 5 seconds.

(P) 06:49:40 NOV 9, 2000

RL 0.00 dBm

MKR #1 SWT 1.725 sec

ATTEN 10 dB

-6.24 dBm

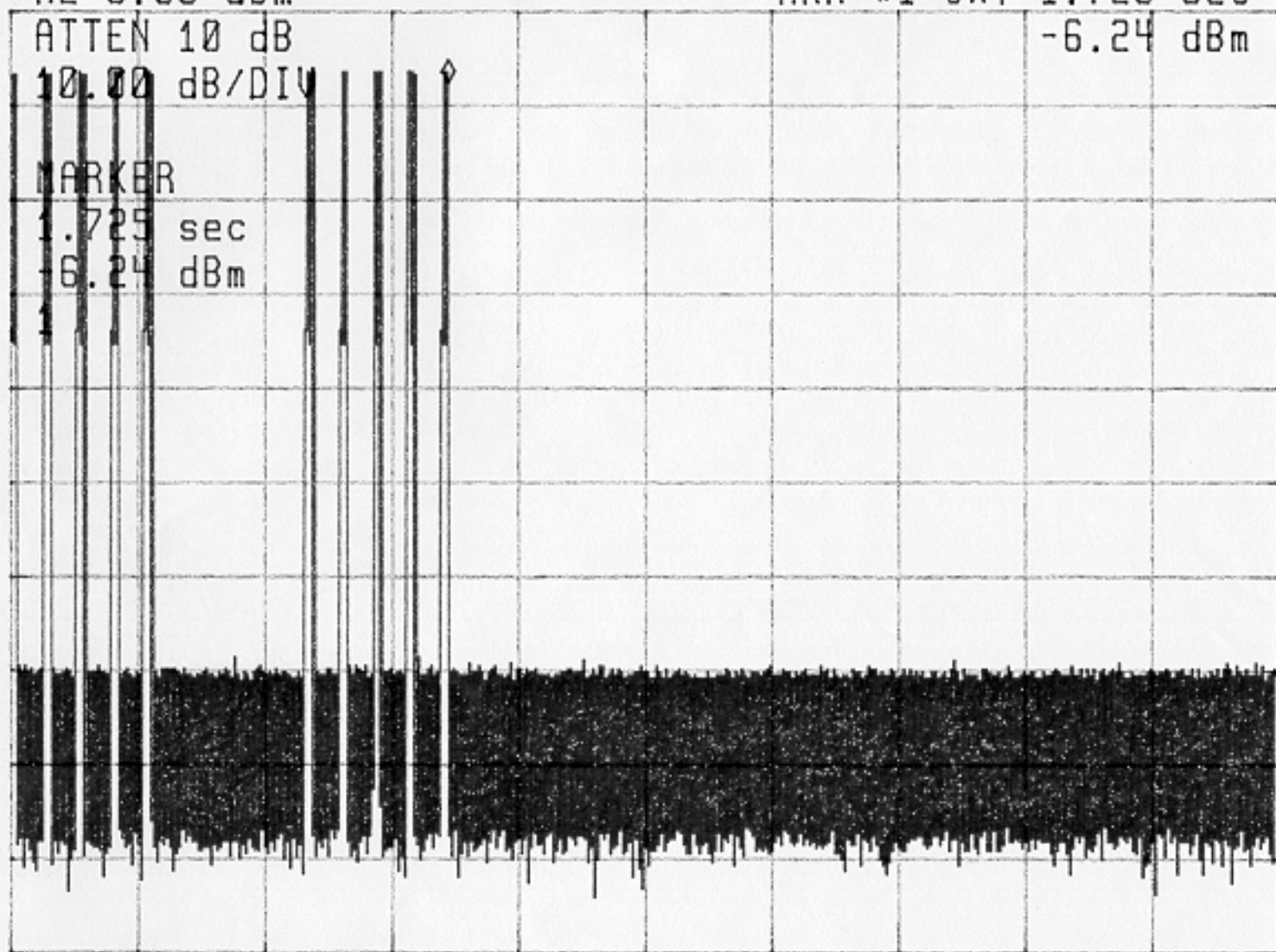
10.00 dB/DIV

MARKER

1.725 sec

-6.24 dBm

1



CENTER 345.000 000 MHz

SPAN 0 Hz

*RB 300 kHz

*VB 100 kHz

*ST 5.000 sec

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3.1.2 Supervisory Calculation [§15.231(a)(3)]

As permitted, this device will transmit five packets for supervision purposes. The inter-packet delay is a time of 90 mS. The packet itself is never more than 20 ms depending on the data sent. The longest time to conclude a supervisory transmission is then:

$$5 * 20 \text{ mS} + 4 * 90\text{mS} = 460 \text{ mS}$$

3.1.3 Duty Cycle Correction Factor [§15.231(b)(2) and §15.35(c)]

The transmitter employs amplitude modulation and transmits 63 bits. On average each bit, has an “ON” time of 141 μ S, and a “OFF” time of 141 μ S. The total on time of a single packet is:

$$63 * 141 \mu\text{S} = 8.88 \text{ mS.}$$

Only one packet is sent in any given 100 mS window for a duty cycle correction factor of:

$$20 * \text{LOG}(8.88/100) = -21.03 \text{ dB}$$

The maximum allowed correction factor is 20 dB.

The following plots show:

1. Single packet in 100 mS window.
2. Expanded view of a packet with a duration of 19.5 mS

06:39:06 NOV 9, 2000

RL 0.00 dBm

MKR #1 Δ SWT 19.50 msec

ATTEN 10 dB

27.54 dB

10.00 dB/DIV

MARKER Δ

19.50 msec

27.54 dB

1

CENTER 345.000 000 MHz

SPAN 0 Hz

*RB 300 kHz

*VB 100 kHz

*ST 100.0 msec

06:45:16 NOV 9, 2000

RL 0.00 dBm

MKR #1 Δ SWT 19.29 msec

ATTEN 10 dB

27.30 dB

10.00 dB/DIV

MARKER Δ

19.29 msec

27.30 dB

1

CENTER 345.000 000 MHz

SPAN 0 Hz

*RB 300 kHz

*VB 100 kHz

*ST 35.00 msec

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3.1.4 Bandwidth Measurement [§15.231(c)]

Bandwidth Measurements were made in peak mode, using a Hewlett Packard Spectrum Analyzer, model number 70000.

The spectrum analyzer 20 dB skirt bandwidth is 3.4 KHz.

The allowed 20 dB bandwidth is 0.25% of center frequency.

Estimated signal bandwidth = Measured signal bandwidth - analyzer bandwidth.

Center Frequency MHz	Measured 20 dB Bandwidth in KHz	Estimated 20 dB signal Bandwidth in KHz	FCC allowed 20 dB Bandwidth in KHz
345.08	38.3	35	799

The following three plots show:

1. Bandwidth of carrier without modulation
2. Bandwidth of signal with modulation, 200 KHz span
3. Bandwidth of signal with modulation, 200 MHz span

HP 07:48:11 NOV 9, 2000

RL 0.00 dBm

MKR #3 Δ FRQ 1.6 kHz

ATTEN 10 dB

-21.32 dB

10.00 dB/DIV

MKR AMPLITUDE right

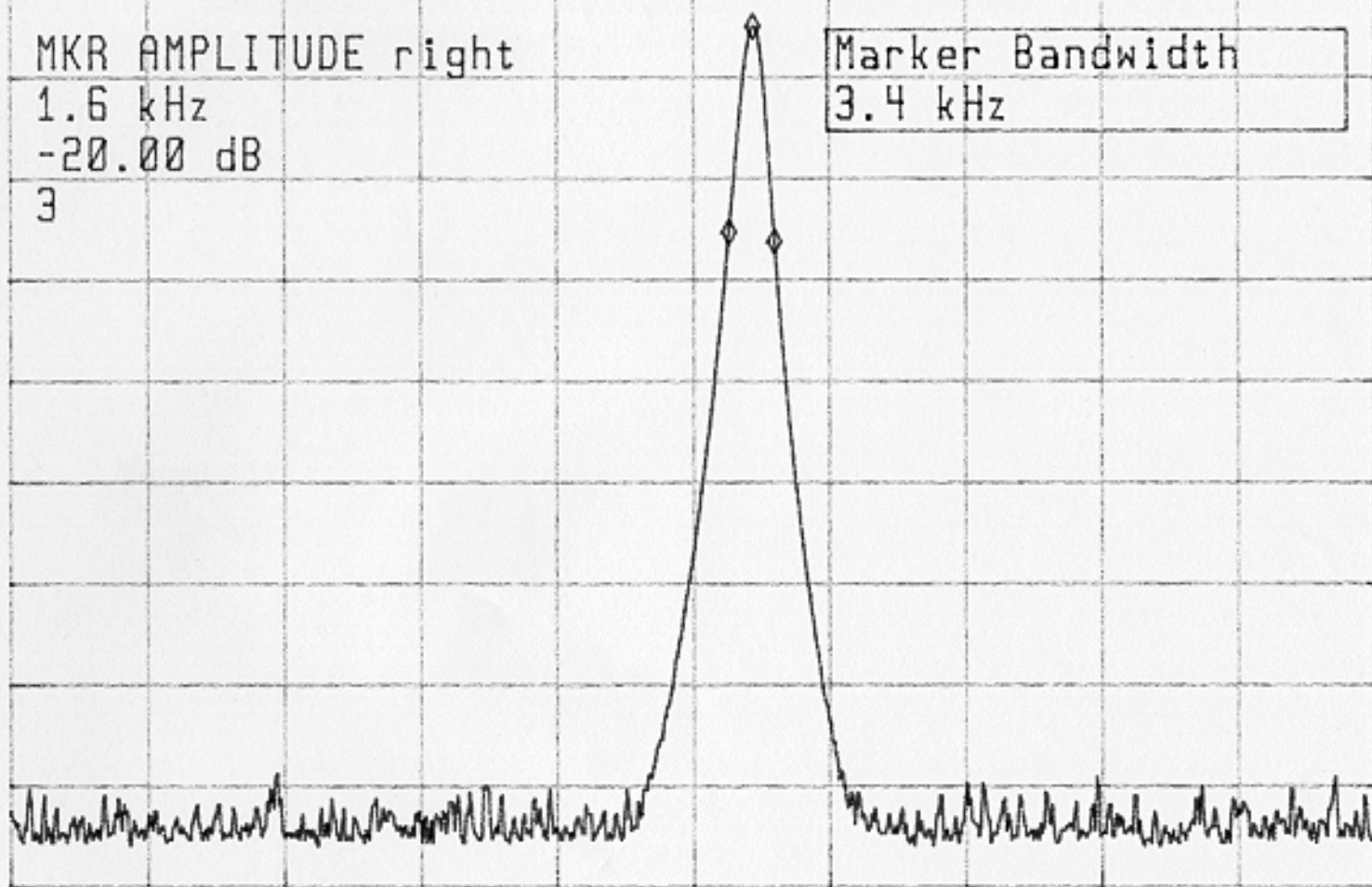
1.6 kHz

-20.00 dB

3

Marker Bandwidth

3.4 kHz



CENTER 344.960 0 MHz

SPAN 100.0 kHz

RB 1.00 kHz VB 1.00 kHz

ST 305.0 msec

07:01:51 NOV 9, 2000

RL 0.00 dBm

MKR #1 Δ FRQ 38.3 kHz

ATTEN 10 dB

-2.40 dB

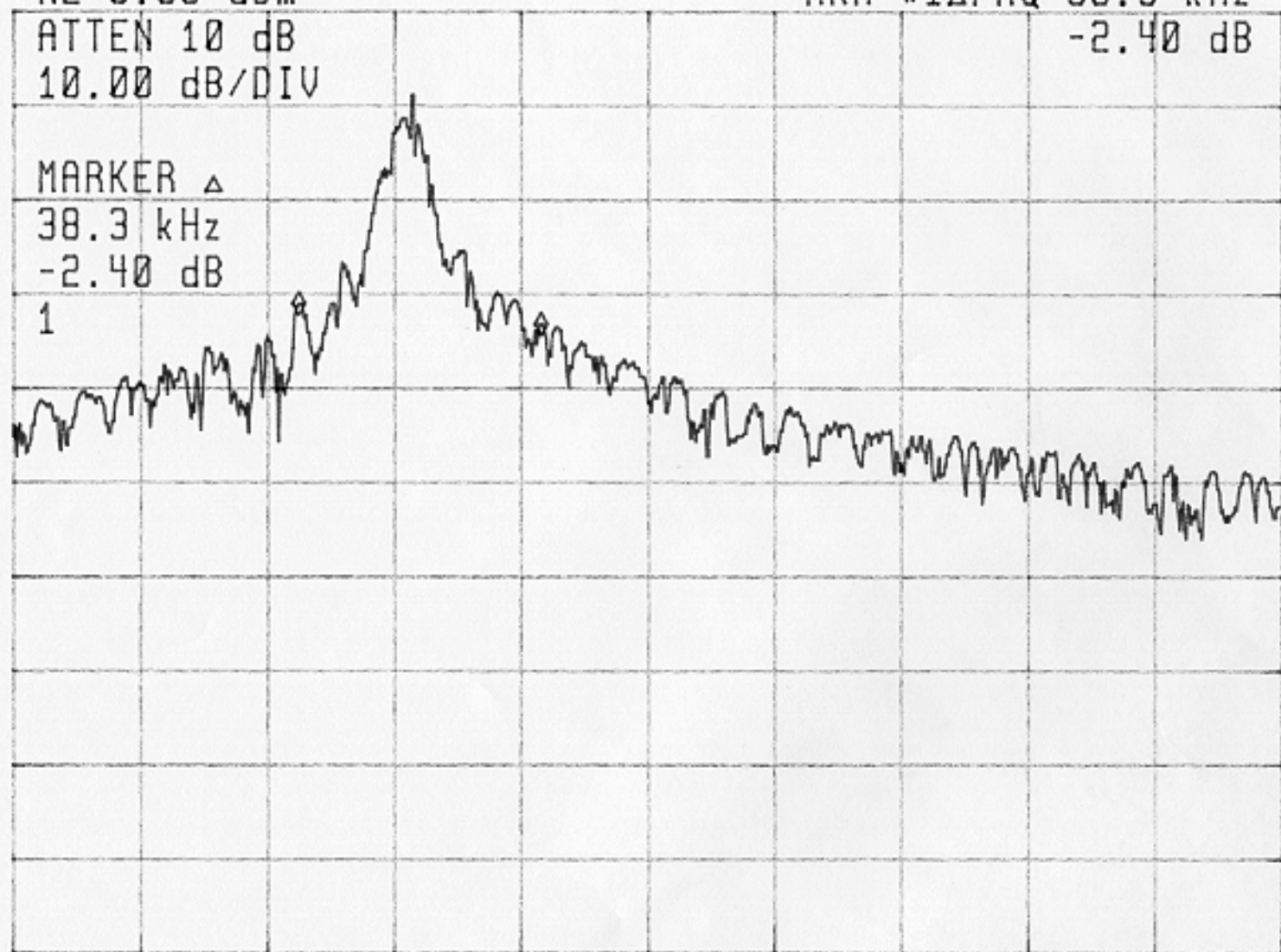
10.00 dB/DIV

MARKER Δ

38.3 kHz

-2.40 dB

1



CENTER 345.000 0 MHz

SPAN 200.0 kHz

RB 2.15 kHz

VB 3.00 kHz

ST 141.9 msec

07:18:49 NOV 9, 2000

RL 0.00 dBm

ATTEN 10 dB

10.00 dB/DIV

MKR #1 FRQ 345.5 MHz

-4.00 dBm

MARKER

345.5 MHz

-4.00 dBm

1

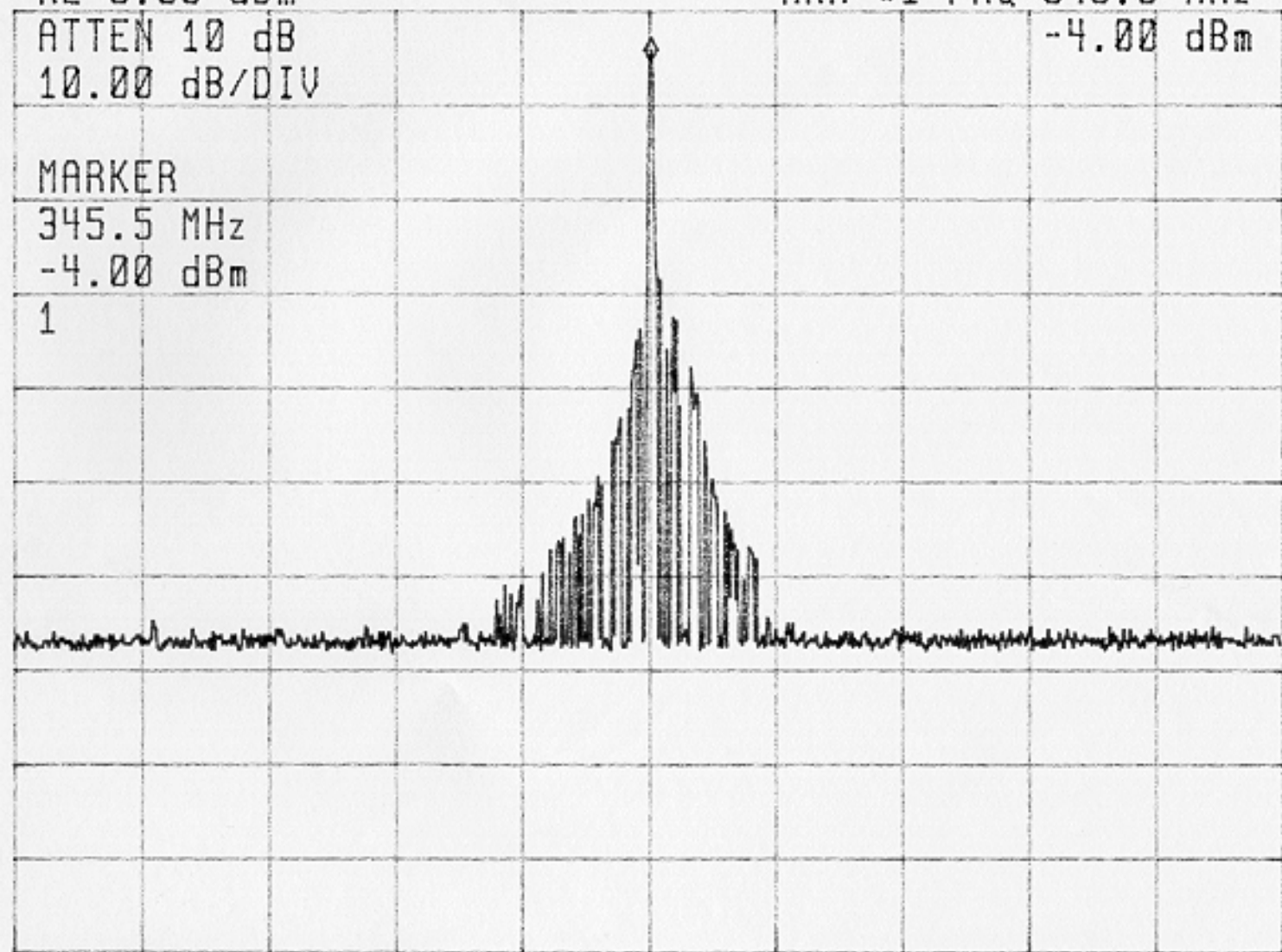
CENTER 345.0 MHz

RB 300 kHz

VB 300 kHz

SPAN 200.0 MHz

ST 10.00 msec



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3.1.5 Emissions Measurements

3.1.5.1 Radiated Emissions Summary

The Smoke Alarm passes FCC Rules Part 15, Subpart C, Paragraph 15.231. The highest fundamental radiated emission was 5.5 dB below the FCC limit at 345.08 MHz. The highest spurious emission measurement was 23.9 dB below the FCC limit at 690.18 MHz. The highest forbidden band emission was 25.6 dB below the FCC limit at 1380.37 MHz.

3.1.5.2 FCC Emissions Calculation

3.1.5.2.1 Terms

Term	Abbreviation	Units	Description
Analyzer Reading	AR	dB μ V	The power reading read directly from the analyzer without any correction for cabling or receive antenna.
Duty Cycle Correction	DC	dB	Correction for averaging measurement, see Duty Cycle Correction Factor [§15.231(b)(2) and §15.35(c)]
Antenna Factor	AF	dB	Calibration factor for measurement antenna which converts from dB μ V measured with antenna to the field strength received by the antenna in dB μ V/M.
Cable Loss	CL	dB	Amount of power lost in cable (and connectors, if any) between antenna and analyzer
Pre-Amp	PA	dB	Gain in pre-amp

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3.1.5.2.2 Example Calculation

AR = 99.3 dBμV

AF = 13.9 dB

CL = 3.8 dB

DC = 20 dB

PA=26.2 dB

The field strength for comparison to FCC limits is found to be:

$$AR + AF + CL - DC - PA = 99.3 + 13.9 + 3.8 - 20 - 26.2 = 70.8 \text{ dB}\mu\text{V/M}$$

Alternatively, the AR + AF +CL -PA is compared to the FCC limit + DC. This number is often written to the right of measurement data on the test results. For example, the FCC limit for ITI transmitters at 345.08 MHz is approximately 97.2 dBμV/M. The limit from §15.231(b) with linear interpolation yields a limit, without consideration for duty cycle, of approximately 77.2 dBμV/M.

To convert to μV/M the following equation is used:

$$\mu\text{V/M} = \text{INVLOG}(\text{dB}\mu\text{V/M} / 20)$$

For the above example, 70.8 dBμV/M is 3,467.369μV/M

3.1.5.3 Radiated Emissions

The highest fundamental emission along with the three highest spurious and restricted band emissions are listed below as per ANSI C63.4 paragraph 10.1.8.2. Emissions from 0.009 MHz to the tenth harmonic were measured as per FCC Rules Part 15, Subpart C, Paragraph 15.33(a). Emission limits were derived from §15.231(b).

Frequency	Analyzer Reading	Duty Cycle Correction	Cable Loss	Antenna Factor	Pre-Amp	Field Strength	Field Strength	FCC Limit
MHz	dBuV	dB	dB	dB	dB	dBuV/M	uV/M	uV/M
345.08	101.00	20	2.1	14.6	25.9	71.80	3,890	6,229
690.18	56.60	20	2.9	19.8	26.1	33.20	46	623
1380.37	46.50	20	4.3	26.1	25.4	31.50	38	623
1035.27	45.50	20	3.5	22.3	25.5	25.80	19	623

3.1.5.4 Forbidden Band4s

Noise floor of spectrum analyzer with antenna factors and duty cycle correction converted to μV/M at approximately one meter.

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All measurements were taken with an HP 8566B Spectrum Analyzer. The bandwidth was 100 KHz for measurements below 1000 MHz. The bandwidth was 1 MHz for measurements above 1000 MHz. The video filter was off.

The noise floor measurements are summarized in the table below. See also the test data included in this report.

Frequency Range									
Low Limit	High Limit	Noise Floor Reading	Duty Cycle Corr	Field Strength	Field Strength	FCC Limit @ 3M	FCC Limit @ 1M		
MHz	MHz	dBuV	dB	dBuV/M	uV/M	uV/M	uV/M		
0.09000	0.11000	N/A	20	N/A	N/A	2400/F			
0.49500	0.50500	N/A	20	N/A	N/A	2400/F			
2.13750	2.19050	N/A	20	N/A	N/A	30	90		
4.12500	4.12800	N/A	20	N/A	N/A	30	90		
4.17725	4.17775	N/A	20	N/A	N/A	30	90		
4.20725	4.20775	N/A	20	N/A	N/A	30	90		
6.21500	6.21800	N/A	20	N/A	N/A	30	90		
6.26775	6.26825	N/A	20	N/A	N/A	30	90		
6.31175	6.31225	N/A	20	N/A	N/A	30	90		
8.29100	8.29400	N/A	20	N/A	N/A	30	90		
8.36200	8.36600	N/A	20	N/A	N/A	30	90		
8.37625	8.38675	N/A	20	N/A	N/A	30	90		
8.41425	8.41475	N/A	20	N/A	N/A	30	90		
12.29000	12.29300	N/A	20	N/A	N/A	30	90		
12.51975	12.52025	N/A	20	N/A	N/A	30	90		
12.57675	12.57725	N/A	20	N/A	N/A	30	90		
13.36000	13.41000	N/A	20	N/A	N/A	30	90		
16.42000	16.42300	N/A	20	N/A	N/A	30	90		
16.69475	16.69525	N/A	20	N/A	N/A	30	90		
16.80425	16.80475	N/A	20	N/A	N/A	30	90		
25.50000	25.67000	N/A	20	N/A	N/A	30	90		
37.50000	38.25000	23.00	20	3.0	1.4	100	300		
73.00000	74.60000	17.20	20	-2.8	0.7	100	300		
74.80000	75.20000	19.00	20	-1.0	0.9	100	300		
108.00000	121.94000	14.50	20	-5.5	0.5	150	450		
123.00000	138.00000	14.50	20	-5.5	0.5	150	450		
149.90000	150.05000	14.50	20	-5.5	0.5	150	450		
156.52475	156.52525	14.50	20	-5.5	0.5	150	450		
156.70000	156.90000	14.50	20	-5.5	0.5	150	450		
162.01250	167.17000	14.50	20	-5.5	0.5	150	450		
167.72000	173.20000	14.50	20	-5.5	0.5	150	450		
240.0	285.0	21.80	20	1.8	1.2	200	600		
322.0	335.4	21.80	20	1.8	1.2	200	600		
399.9	410.0	21.80	20	1.8	1.2	200	600		
608.0	614.0	21.80	20	1.8	1.2	200	600		
960.0	1240.0	21.80	20	1.8	1.2	500	1500	1065, 1171	
1300.0	1427.0	36.80	20	16.8	6.9	500	1500	1384	
1435.0	1626.5	38.00	20	18.0	7.9	500	1500	1491,1597	
1645.5	1646.5	40.90	20	20.9	11.1	500	1500		
1660.0	1710.0	40.90	20	20.9	11.1	500	1500	1704	
1718.8	1722.2	43.70	20	23.7	15.3	500	1500		
2200.0	2300.0	41.60	20	21.6	12.0	500	1500	2236	
2310.0	2390.0	41.60	20	21.6	12.0	500	1500	2343	
2483.5	2500.0	41.60	20	21.6	12.0	500	1500		
2655.0	2900.0	41.60	20	21.6	12.0	500	1500	2662, 2769, 2875	
3260.0	3267.0	41.60	20	21.6	12.0	500	1500		
3332.0	3339.0	41.60	20	21.6	12.0	500	1500		
3345.8	3358.0	41.60	20	21.6	12.0	500	1500		
3600.0	4400.0	41.60	20	21.6	12.0	500	1500		

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The test data follows on the next 2 pages:

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Radiated Electromagnetic Emissions



Test Report #:	W0381 Run 02	Test Area:	LTS 3m		
Test Method:	N/A	Test Date:	10-Jul-2000		
EUT Model #:	395 SMOKE DETECTOR	EUT Power:	BATTERY		
EUT Serial #:		Temperature:	24	°C	
Manufacturer:	ITI	Relative Humidity:	72	%	
EUT Description:		Air Pressure:	98.2	kPa	
Notes:				Page:	1 of 2

FREQ (MHz)	LEVEL (dBuV/m)	CABLE / ANT / PREAMP (dB) / (dBm) / (dB)	Final Peak (dBuV/m)	POL / HGT / AZ (m) (DEG)	Final Ave (dBuV/m)	Limit FCC 15.231 (dBuV/m)
ALL READINGS ARE MAXIMIZED IN PEAK. 100KHZ RBW <1000MHZ - 1MHZ RBW >1000MHZ.						
345.08	101.0 Pk	2.1 / 14.6 / 25.9	91.7	H / 1.0 / 0.0	71.7	77.2
345.08	93.5 Pk	2.1 / 14.6 / 25.9	84.3	V / 1.0 / 0.0	64.3	77.2
690.18	56.6 Pk	2.9 / 19.8 / 26.1	53.3	H / 1.0 / 0.0	33.3	57.2
1035.27	45.5 Pk	3.5 / 22.3 / 25.5	45.8	H / 1.0 / 0.0	25.8	54.0
1380.37	46.5 Pk	4.3 / 26.1 / 25.4	51.6	H / 1.0 / 0.0	31.6	54.0
1725.47	44.2 Pk	5.6 / 27.3 / 25.8	51.4	H / 1.0 / 0.0	31.4	57.2
2070.57	43.3 Pk	4.7 / 29.1 / 25.8	51.4	H / 1.0 / 0.0	31.4	57.2
2415.67	45.1 Pk	4.9 / 30.1 / 26.6	53.6	H / 1.0 / 0.0	33.6	57.2
2760.77	38.8 Pk	6.0 / 30.8 / 26.6	49.0	V / 1.0 / 0.0	29.0	54.0
3105.87	35.9 Pk	6.0 / 31.4 / 26.4	46.8	V / 1.0 / 0.0	26.8	57.2
3450.97	34.9 Pk	6.3 / 32.2 / 26.9	46.5	V / 1.0 / 0.0	26.5	57.2
END OF SCAN.						

Tested by: ROSS M. JOHNSON

Printed

Signature

Reviewed by: J. T. Schneider

Printed

Signature

Radiated Electromagnetic Emissions



Test Report #:	W0381 Run 02	Test Area:	LTS 3m	
Test Method:	N/A	Test Date:	10-Jul-2000	
EUT Model #:	395 SMOKE DETECTOR	EUT Power:	BATTERY	
EUT Serial #:		Temperature:	24	°C
Manufacturer:	ITI	Relative Humidity:	72	%
EUT Description:		Air Pressure:	98.2	kPa
Notes:				Page: 2 of 2

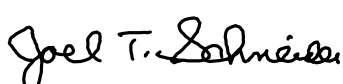
FREQ (MHz)	LEVEL (dBuV/m)	CABLE / ANT / PREAMP (dB) / (dBm) / (dB)	Final Peak (dBuV/m)	POL / HGT / AZ (m) (DEG)	Final Ave (dBuV/m)	Limit FCC 15.231 (dBuV/m)
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***** MEASUREMENT SUMMARY *****						
3450.97	34.9 Pk	6.3 / 32.2 / 26.9	46.5	V / 1.0 / 0.0	26.5	57.2
3105.87	35.9 Pk	6.0 / 31.4 / 26.4	46.8	V / 1.0 / 0.0	26.8	57.2
2760.77	38.8 Pk	6.0 / 30.8 / 26.6	49.0	V / 1.0 / 0.0	29.0	54.0
2415.67	45.1 Pk	4.9 / 30.1 / 26.6	53.6	H / 1.0 / 0.0	33.6	57.2
2070.57	43.3 Pk	4.7 / 29.1 / 25.8	51.4	H / 1.0 / 0.0	31.4	57.2
1725.47	44.2 Pk	5.6 / 27.3 / 25.8	51.4	H / 1.0 / 0.0	31.4	57.2
1380.37	46.5 Pk	4.3 / 26.1 / 25.4	51.6	H / 1.0 / 0.0	31.6	54.0
1035.27	45.5 Pk	3.5 / 22.3 / 25.5	45.8	H / 1.0 / 0.0	25.8	54.0
690.18	56.6 Pk	2.9 / 19.8 / 26.1	53.3	H / 1.0 / 0.0	33.3	57.2
345.08	101.0 Pk	2.1 / 14.6 / 25.9	91.7	H / 1.0 / 0.0	71.7	77.2

Tested by: ROSS M. JOHNSON
Printed


Signature

Reviewed by: J. T. Schneider
Printed


Signature