Cert. No. 1152.01
Electrical (EMC)

DATE: 16 February 2004

I.T.L. (PRODUCT TESTING) LTD.

EMC Test

for

EMTS Inc.

Equipment under test:

IntegrAlarm Smoke Detector

(Transmitter Section)

IA-SMK1

Approved by:_____
I. Raz, EMC Laboratory Manager

This report must not be reproduced, except in full, without the written permission of I.T.L. (Product Testing) Ltd.
This report relates only to items tested.

Cert. No. 1152.01
Electrical (EMC)

Measurement/Technical Report for

EMTS Inc.

IntegrAlarm Smoke Detector

(For Transmitter Section)

IA-SMK1

FCC ID:RUF150705

16 February 2004

This report concerns: Original Grant x Class II change

Class B verification ____ Class A verification_____Class I change

Equipment type: Radio Telemetry Transmitter
Request Issue of Grant:
__x__Immediately upon completion of review

Limits used:
CISPR 22 _____ Part 15 __x

Measurement procedure used is ANSI C63.4-2001.

Application for Certification
prepared by:
Ishaishou Raz
ITL (Product Testing) Ltd.
Kfar Bin Nun
D.N. Shimshon 99780
Israel
e-mail Sraz@itl.co.il

Applicant for this device:
(different from "prepared by")
Doron Lavee
EMTS Inc.
300 Alden Road
Markham, Ontario, L3R4C1
Canada
Tel: +1-905-946-8589
Fax: +1-905-947-0138
e-mail: doronl@aqi.co.il

TABLE OF CONTENTS

1. GENERAL INFORMATION ---------- 4
- 1.1 Administrative Information 4
- 1.2 List of Accreditations 5
- 1.3 Product Description 6
- 1.4 Test Methodology 7
- 1.5 Test Facility 8
- 1.6 Measurement Uncertainty 8

2. PRODUCT LABELING ---------- 9

3. SYSTEM TEST CONFIGURATION ---------- 10
- 3.1 Justification 10
- 3.2 EUT Exercise Software 10
- 3.3 Special Accessories 10
- 3.4 Equipment Modifications 10
- 3.5 Configuration of Tested System 11

4. BLOCK DIAGRAM ---------- 11
- 4.1 Schematic Block/Connection Diagram 11
- 4.2 Theory of Operation 11

5. CUSTOMER'S DECLARATION ---------- 12

6. SPURIOUS RADIATED MEASUREMENT PHOTO ---------- 13

7. SPURIOUS RADIATED EMISSION, BELOW 1 GHZ ---------- 14
- 7.1 Test Specification 14
- 7.2 Test Procedure 14
- 7.3 Measured Data 14
- 7.4 Test Instrumentation Used, Radiated Measurements 15
- 7.5 Field Strength Calculation 16

8. SPURIOUS RADIATED EMISSION ABOVE 1 GHZ ---------- 17
- 1.1 Radiated Emission Above 1 GHz 17
- 8.2 Test Data 17
- 8.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz 26

9. MAXIMUM TRANSMITTED PEAK POWER OUTPUT ---------- 27
- 9.1 Test procedure 27
- 9.2 Results table 28
- 9.3 Test Equipment Used. 29

10. PEAK POWER OUTPUT OUT OF 902-928 MHZ BAND ---------- 30
- 10.1 Test procedure 30
- 10.2 Results table 37
- 10.3 Test Equipment Used. 38

11. 20 DB BANDWIDTH ---------- 39
- 11.1 Test procedure 39
- 11.2 Results table 40
- 11.3 Test Equipment Used. 41

12. BAND EDGE SPECTRUM ---------- 42
- 12.1 Test procedure 42
- 12.2 Results table 44
- 12.3 Test Equipment Used. 45

13. ANTENNA GAIN ---------- 46

14. R.F EXPOSURE/SAFETY ---------- 47

15. PHOTOGRAPHS OF TESTED E.U.T. ---------- 48

1. General Information

1.1 Administrative Information

Manufacturer:	EMTS Inc.
Manufacturer's Address:	300 Alden Road Markham, Ontario L3E4C1 Canada Tel: +1-905-946-8589 Fax: +1-905-947-0138
Manufacturer's Representative:	Doron Lavee
Equipment Under Test (E.U.T):	IntegrAlarm Smoke Detector
Equipment Model No.:	IA-SMK1
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	13.01.04
Start of Test:	13.01.04
End of Test:	13.01.04
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15, Sub-part C

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), File No. IC 4025.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

The IntegrAlarm wireless security system includes a Control Panel and a number of wireless peripheral units. The system operates on the ISM wireless band of 902-928 MHz, in frequency hopping mode, transmitting short (about 10 ms) packets of data, with each packet transmitted on a different frequency. Time and frequency synchronization is maintained by a synchronization signal transmitted by the system Control Panel to the various peripherals (including the IA SMK-1) every 3 minutes. The system operates on 56 pseudo random selected channels.

In its present configuration, the system includes five types of peripheral units:

Door / window sensor.

PIR sensor.

Smoke detector.

Handheld remote control.

Remote siren.

The UL-approved smoke detector sensor unit consists of an RF transceiver, a micro-controller, a photoelectric smoke detector cell with processing ASIC, a test button, a buzzer and two batteries.

The sensor unit is composed of the following principal parts:

Mounting plate.

Sensor base.

Sensor PCB with RF controller, terminal block, test button, buzzer and LED.

9V alkaline battery type 1604.

3V Lithium HNO_2 battery type CR2

Cover.

Operating frequency band – ISM 902-928 MHz. The transmitter frequency range is 903.5-913.5 MHz.

Mode of operation – frequency hopping; every data packet is transmitted on a different pseudo random selected frequency.

Data packet transmission duration – less than 10 milliseconds.

Data packet validity check – CRC.

Transmission and reception verification – two-way communication; each received packet is acknowledged, with an automatic repeat request (ARQ) in case of unacknowledged data packet.

Automatic self-test (transmission of a data packet and receipt of acknowledgment).

Events reported – smoke detected, smoke cleared.

Smoke detector sensitivity – 3±0.7% / ft.

Smoke detector UL compliance – UL 217.

Power source – Smoke detector battery – alkaline, 9Volt, type 1604.

Wireless transceiver/controller battery - Lithium MNO_2, 3Volt type CR2.

Smoke detector average current drain – 10 uA

Transceiver average current drain – 5 uA.

Operating temperature range – 0°C to 45°C.

Dimensions (mm): ∅-116, H-60.

Weight (grams): 270.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2001. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing December 12, 2003).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Radiated Emission

The Open Site complies with the ±4 dB Normalized Site Attenuation requirements of ANSI C63.4-2001. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2. Product Labeling

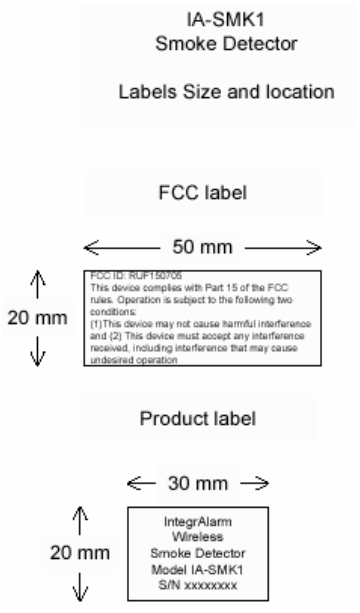

Figure 1. FCC Label

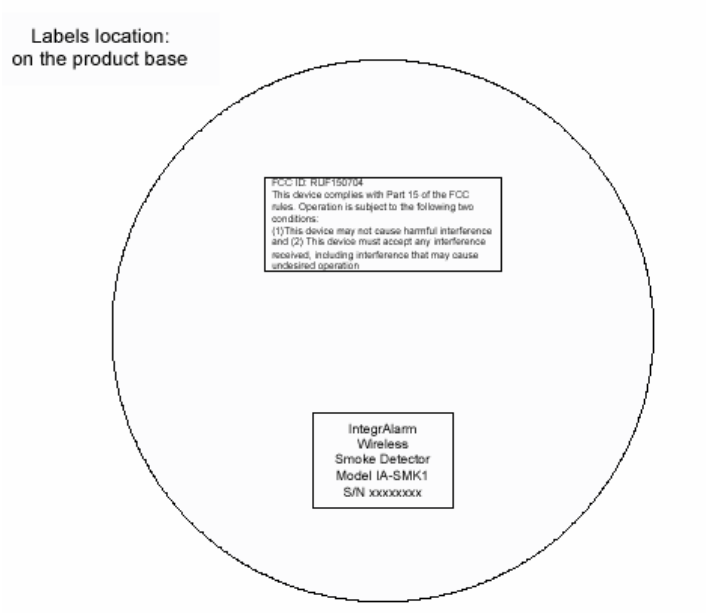

Figure 2. Location of Label on EUT

3. System Test Configuration

3.1 Justification

The E.U.T. is a fixed installation, ceiling mounted unit.

It is impossible to test the IA-SMK 1 under normal operating conditions. This is because the data packets transmitted by the IntegrAlarm system are too short (<10 ms) for the system to be tested for emission levels by any standard test equipment. Moreover, because the system operates in frequency hopping mode, with each packet transmitted on a different frequency, no standard test equipment is capable of synchronizing with the system for test purposes.

Accordingly, the IA-SMK 1 EUT is provided with two test pushbutton switches on the PCB. Test Mode includes three transceiver options. One press of the Test Mode button selects continuous reception, a second press selects continuous transmission of carrier wave only, a third press selects continuous transmission of modulated signal, and a fourth press returns the EUT to normal operating mode. If continuous transmission of modulated signal is selected, the EUT will transmit binary data (1 – 0 – 1 – 0 ...) at its normal transmission rate.

Test Mode transmission / reception takes place on one of four predefined frequencies (903.500, 913.500, 916.500 or 926.500 MHz). The default is 903.500 MHz. The IA-SMK 1 Test Frequency pushbutton switch is used to change the frequency while the EUT is in Test Mode.

3.2 EUT Exercise Software

The EUT does not include dedicated exercise software. The test conditions for the EUT are described in Section 3.1 above.

3.3 Special Accessories

No special accessories were needed to achieve compliance.

3.4 Equipment Modifications

All 12 pins of the transceiver metal shield were soldered to the grounding layers of the PCB.

3.5 Configuration of Tested System

Figure 3. Configuration of Tested System

4. Block Diagram

4.1 Schematic Block/Connection Diagram

Intentionally Blank for Reasons of Confidentiality

Figure 4. E.U.T. Block Diagram

4.2 Theory of Operation

The IA-SMK 1 is part of the IntegrAlarm System. This system consists of a Control Panel and a number of Wireless Peripheral Units, such as wireless security sensors, wireless environmental sensors and wireless actuators such as sirens/strobes. Two-way digital communication between the Control Panel and the Wireless Peripheral Units provides full control and supervision of the system by the CP and the Central Station operator.

Each time smoke is detected by the IA-SMK 1, the IA-SMK 1 sends an event data packet to the Control Panel. This is indicated by a red LED (visible through a hole in the IA-SMK 1 outer cover) which illuminates momentarily on the IA-SMK 1. The Control Panel then sends back an acknowledgment data packet (the IA-SMK 1 does not provide visible indication of receipt of the acknowledgment). If the IntegrAlarm System is armed, the Control Panel then sends a suitable code to the monitoring service (central station) via PSTN.

When the smoke has cleared from the area covered by the IA-SMK 1, the IA-SMK 1 again sends an event data packet to the Control Panel and receives an acknowledgment data packet.

5. Customer's Declaration

EMTS INC.
300 Alden Road
Markham, Ontario L3R 4C1
Canada

February 09, 2004

DECLARATION

To Whom It May Concern,

I hereby declare that the product, IntegrAlarm IA-SMK1 Smoke Detector, FCC ID RUF150705, complies with the following requirements of Part 15, Sub-part C, Section 15.247:

1. Number of hopping frequencies, Section 15.247 (a) (1).
2. Channel average time occupancy, Section 15.247 (a) (1).
3. Channel frequency separation, Section 15.247 (a) (1).

Thank you,

D Lavee

Doron Lavee
Engineering Manager
EMTS Inc.

Tel. (905) 946-8477
Fax (905) 947-0138

6. Spurious Radiated Measurement Photo

Figure 5. Spurious Radiated Emission Test. Front

7. Spurious Radiated Emission, Below 1 GHz

7.1 Test Specification

30kHz-1000 MHz, FCC, Part 15, Subpart C

7.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The frequency range 30kHz-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

Turning the E.U.T on and off.
Using a frequency span less than 10 MHz.
Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

7.3 Measured Data

The signals in the band 30 kHz – 1.0 GHz were below the spectrum analyzer noise level which is at least 6dB below the specification limit.

TEST PERSONNEL:

Tester Signature: _____ Date: 16.02.04

Typed/Printed Name: E. Pitt

7.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	January 31, 2003	1 year
RF Section	HP	85420E	3427A00103	January 31, 2003	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	April 20, 2003	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 20, 2003	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 17, 2003	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet 2225	2738508357.0	N/A	N/A

7.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS:	Field Strength [dBμv/m]
RA:	Receiver Amplitude [dBμv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

No external pre-amplifiers are used.

8. Spurious Radiated Emission Above 1 GHz

8.1 Radiated Emission Above 1 GHz

The E.U.T operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.
In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used. The test distance was 3 meters.
In the frequency range 2.9-9.5 GHz, a spectrum analyzer including a low noise amplifier was used. The test distance was 3 meters. During peak measurements, the I.F. bandwidth was 1 MHz, and video bandwidth 3 MHz. During average measurements, the I.F. bandwidth was 1 MHz and video bandwidth was 100 Hz.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

8.2 Test Data

JUDGEMENT: Passed by 12.7 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification. The worst cases were:

for 903.5 MHz, 13.7dB margin at 4517.00 MHz frequency, horizontal polarization.

for 913.5 MHz, 12.7dB margin at 2740.00 MHz frequency, vertical polarization

The details of the highest emissions are given in Figure 6 to Figure 13.

TEST PERSONNEL:

Tester Signature: _____ Date: 16.02.04

Typed/Printed Name: E. Pitt

Radiated Emission Above 1 GHz

E.U.T Description	IntegrAlarm Smoke Detector
Type	IA-SMK1
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 903.5 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq.	Peak Reading PR	Correction Factors Antenna AF	Cable CF	Pre Amp. PF	Peak. Specification	Peak Final Result FR (P)*	Peak. Margin
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
2710.00	23.7	31.8	3.2	-	74.0	58.7	-15.3
3614.00	46.6	33.7	3.9	30.2	74.0	54.0	-20.0
4517.00	50.4	35.2	4.6	29.9	74.0	60.3	-13.7
5420.00	42.5	36.6	5.2	29.9	74.0	54.4	-19.6
8130.50	36.2	40.0	6.5	28.2	74.0	54.5	-19.5

Figure 6. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note *: The field strength was manually calculated by using the following equation:

FR(P) = PR + AF+CF-PF

Where: FR (P) is final peak detector result.
PR Reading is peak detector measurement.
AF is antenna factor.
CF is cable factor.
PF is pre-amplifier gain.

Radiated Emission Above 1 GHz

E.U.T Description IntegrAlarm Smoke Detector
Type IA-SMK1
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 903.5 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Average

Freq.	AVG Reading AR	Correction Factors			DCF	AVG Spec	AVG Final Result FR (A)	AVG Margin
		Antenna AF	Cable CF	Pre Amp. PF				
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
2710.00	14.9	31.8	3.2	-	-20	54.0	29.9	-24.1
3614.00	43.0	33.7	3.9	30.2	-20	54.0	30.4	-23.6
4517.00	48.9	35.2	4.6	29.9	-20	54.0	38.8	-15.2
5420.00	37.5	36.6	5.2	29.9	-20	54.0	29.4	-24.6
8130.50	27.9	40.0	6.5	28.2	-20	54.0	26.2	-27.8

Figure 7. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: The field strength was manually calculated by using the following equation:

FR(A) = A R + AF+CF-PF + DCF

Where: FR(A) is final average detector result.

Avg Reading is average detector measurement.

AF is antenna factor.

CF is cable factor.

Pf is pre-amplifier gain.

DCF is Duty Cycle Factor= $20\log\frac{10}{100} = -20dB$

Maximum Transmission "ON" time is 10msec.

Radiated Emission Above 1 GHz

E.U.T Description	IntegrAlarm Smoke Detector
Type	IA-SMK1
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 903.5 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq.	Peak Reading PR	Correction Factors Antenna AF	Cable CF	Pre Amp. PF	Peak. Specification	Peak Final Result FR (P)*	Peak. Margin
(MHz)	(dBμV)	(dB)	(dB)	(dB)	(dB μV/m)	(dB μV/m) See Note *	(dB)
2710.00	24.3	31.8	3.2	-	74.0	59.3	-14.7
3614.00	41.2	33.7	3.9	30.2	74.0	48.6	-25.4
4517.00	49.7	35.2	4.6	29.9	74.0	56.9	-14.4
5420.00	40.1	36.6	5.2	29.9	74.0	52.0	-22.0

Figure 8. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note *: The field strength was manually calculated by using the following equation:

FR(P) = PR + AF+CF-PF

Where: FR (P) is final peak detector result.

PR Reading is peak detector measurement.

AF is antenna factor.

CF is cable factor.

PF is pre-amplifier gain.

Radiated Emission Above 1 GHz

E.U.T Description IntegrAlarm Smoke Detector
Type IA-SMK1
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 903.5 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Average

Freq.	AVG Reading AR	Correction Factors			DCF	AVG Spec	AVG Final Result FR (A)	AVG Margin
		Antenna AF	Cable CF	Pre Amp. PF				
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
2710.00	14.4	31.8	3.2	-	-20	54.0	29.4	-24.6
3614.00	35.1	33.7	3.9	30.2	-20	54.0	22.5	-31.5
4517.00	47.8	35.2	4.6	29.9	-20	54.0	37.7	-16.3
5420.00	31.7	36.6	5.2	29.9	-20	54.0	23.6	-30.4

Figure 9. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: The field strength was manually calculated by using the following equation:

FR(A) = A R + AF+CF-PF + DCF

Where: FR(A) is final average detector result.

Avg Reading is average detector measurement.

AF is antenna factor.

CF is cable factor.

Pf is pre-amplifier gain.

DCF is Duty Cycle Factor= $20\log\frac{10}{100} = -20dB$

Maximum Transmission "ON" time is 10msec.

Radiated Emission Above 1 GHz

E.U.T Description	IntegrAlarm Smoke Detector
Type	IA-SMK1
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 913.5 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq.	Peak Reading PR	Correction Factors Antenna AF	Cable CF	Pre Amp. PF	Peak. Specification	Peak Final Result FR (P)*	Peak. Margin
(MHz)	(dBμV)	(dB)	(dB)	(dB)	(dB μV/m)	(dB μV/m) See Note *	(dB)
2740.00	26.1	31.8	3.2	-	74.0	61.1	-12.9
3654.00	36.5	33.7	3.9	30.2	74.0	43.9	-30.1
4567.00	48.5	35.3	4.6	29.9	74.0	58.5	-15.5

Figure 10. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note *: The field strength was manually calculated by using the following equation:

FR(P) = PR + AF+CF-PF

Where: FR (P) is final peak detector result.

PR Reading is peak detector measurement.

AF is antenna factor.

CF is cable factor.

PF is pre-amplifier gain.

Radiated Emission Above 1 GHz

E.U.T Description IntegrAlarm Smoke Detector
Type IA-SMK1
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 913.5 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Average

Freq.	AVG Reading AR	Correction Factors			DCF	AVG Spec	AVG Final Result FR (A)	AVG Margin
		Antenna AF	Cable CF	Pre Amp. PF				
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
2740.00		31.8	3.2	-	-20	54.0	29.7	-24.3
3654.00	45.0	33.7	3.9	30.2	-20	54.0	32.4	-21.6
4567.00	44.9	35.3	4.6	29.9	-20	54.0	34.9	-19.1

Figure 11. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: The field strength was manually calculated by using the following equation:

FR(A) = A R + AF+CF-PF + DCF

Where: FR(A) is final average detector result.

Avg Reading is average detector measurement.

AF is antenna factor.

CF is cable factor.

Pf is pre-amplifier gain.

DCF is Duty Cycle Factor= $20\log\frac{10}{100} = -20dB$

Maximum Transmission "ON" time is 10msec.

Radiated Emission Above 1 GHz

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Frequency range: 1.0 GHz to 9.5 GHz
Test Distance: 3 meters
Detector: Peak
Operating Frequency: 913.5 MHz

Freq.	Peak Reading PR	Correction Factors Antenna AF	Cable CF	Pre Amp. PF	Peak. Specification	Peak Final Result FR (P)*	Peak. Margin
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
2740.00	26.3	31.8	3.2	-	74.0	61.3	-12.7
3654.00	41.1	33.7	3.9	30.2	74.0	48.5	-25.5
4567.00	48.1	35.3	4.6	29.9	74.0	58.1	-15.9

Figure 12. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note *: The field strength was manually calculated by using the following equation:

FR(P) = PR + AF+CF-PF

Where: FR (P) is final peak detector result.

PR Reading is peak detector measurement.

AF is antenna factor.

CF is cable factor.

PF is pre-amplifier gain.

Radiated Emission Above 1 GHz

E.U.T Description IntegrAlarm Smoke Detector
Type IA-SMK1
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 913.5 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Average

Freq.	AVG Reading AR	Correction Factors			DCF	AVG Spec	AVG Final Result FR (A)	AVG Margin
		Antenna AF	Cable CF	Pre Amp. PF				
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dB)	(dB µV/m)	(dB µV/m) See Note *	(dB)
2740.00	15.2	31.8	3.2	-	-20	54.0	30.2	-23.8
3654.00	32.0	33.7	3.9	30.2	-20	54.0	19.4	-34.6
4567.00	45.1	35.3	4.6	29.9	-20	54.0	25.9	-28.1

Figure 13. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Note*: The field strength was manually calculated by using the following equation:

FR(A) = A R + AF+CF-PF + DCF

Where: FR(A) is final average detector result.

Avg Reading is average detector measurement.

AF is antenna factor.

CF is cable factor.

Pf is pre-amplifier gain.

DCF is Duty Cycle Factor= $20\log\frac{10}{100} = -20dB$

Maximum Transmission "ON" time is 10msec.

8.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	January 31, 2003	1 year
RF Section	HP	85420E	3427A00103	January 31, 2003	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet2225	2738508357	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 31,2003	2 year
Double Ridged Waveguide Horn Antenna	EMCO	3115	9702-5111	May 1, 2003	1 year
Horn Antenna	ARA	SWH-28	1007	October 28, 2003	1 year
Band Pass Filter	SERNO	22102-0001	322	August 15, 2003	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	April 10, 2003	1 year
Spectrum Analyzer	HP	8592L	3926A01204	January 31,2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

9. Maximum Transmitted Peak Power Output

9.1 Test procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through EXT ATTT=24dB and an appropriate coaxial cable. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 1 MHz resolution BW. Peak power level was measured at selected operation frequencies.

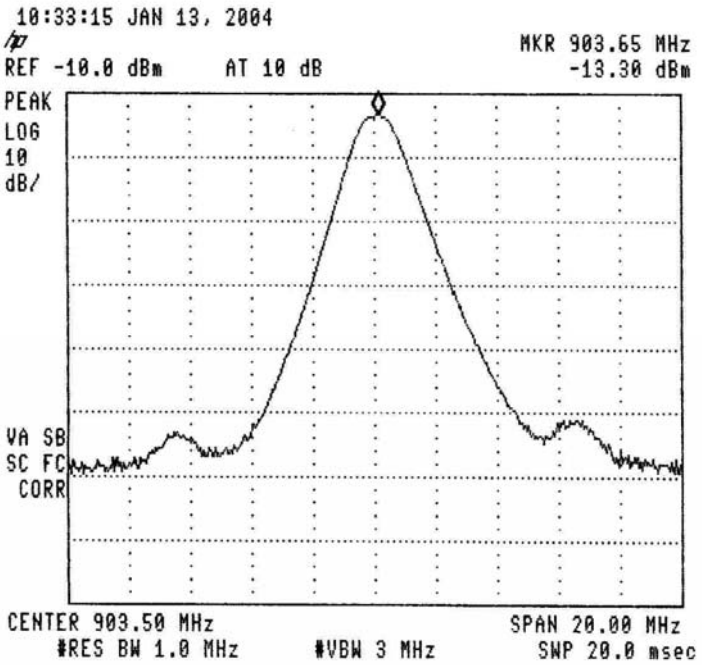

Figure 14.— 903.5 MHz

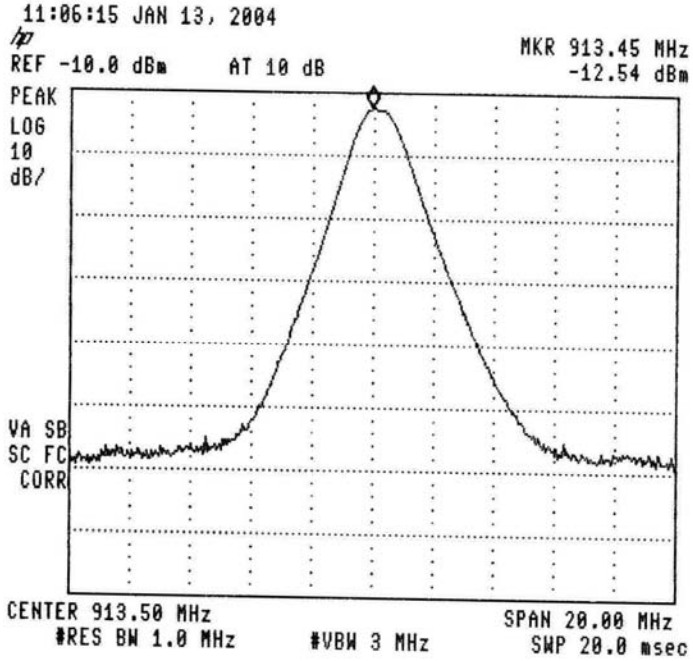

Figure 15.— 913.5 MHz

9.2 Results table

E.U.T. Description: IntegrAlarm Smoke Detector
Model No.: IA-SMK1
Serial Number: Not Designated
Specification: FCC Part 15, Subpart C

Operation Frequency (MHz)	Reading (dBm)	EXT ATT + CL (dB)	Final Result (dBm)	Specification (dBm)	Margin (dB)
903.5	-13.3	24.0	10.7	30.0	-19.3
913.5	-12.5	24.0	11.5	30.0	-18.5

Figure 16 Maximum Power Output

JUDGEMENT: Passed by 18.5 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 16.02.04

Typed/Printed Name: E. Pitt

9.3 Test Equipment Used.

Peak Power Output

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	January 31, 2003	1 year
Cable	Avnet	MTS	N/A	September 9, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 17 Test Equipment Used

10. Peak Power Output Out of 902-928 MHz Band

10.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through a 24dB attenuator and an appropriate coaxial cable. The spectrum analyzer was set to 3.0 kHz resolution BW for the frequency range 30 kHz-300kHz and 100 kHz resolution BW for the frequencies above 300 kHz. The frequency range from 30 kHz to 9.5 GHz was scanned. Level of spectrum components out of the 902-928 MHz was measured at the selected operation frequencies.

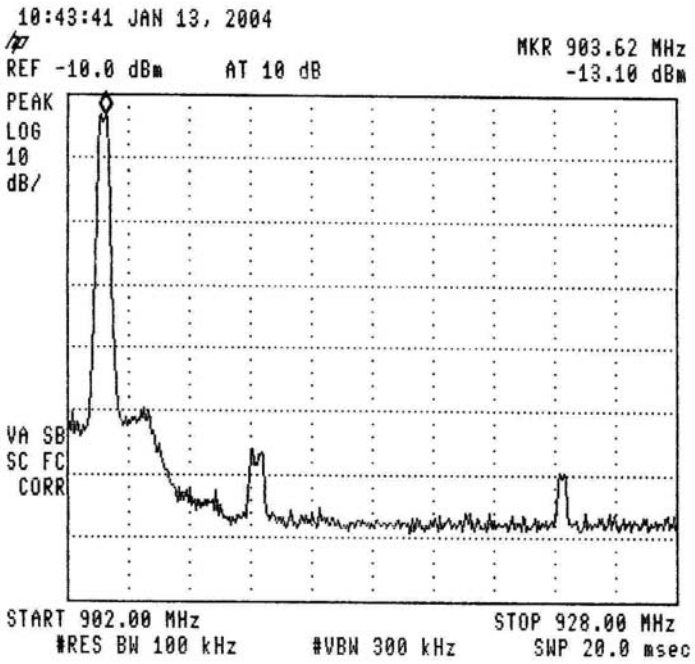

Figure 18.— 903.5 MHz

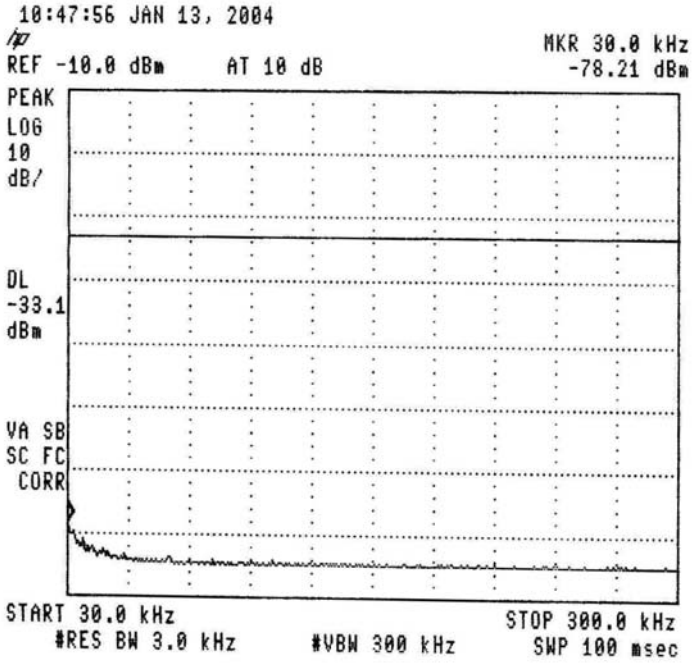

Figure 19.— 903.5 MHz

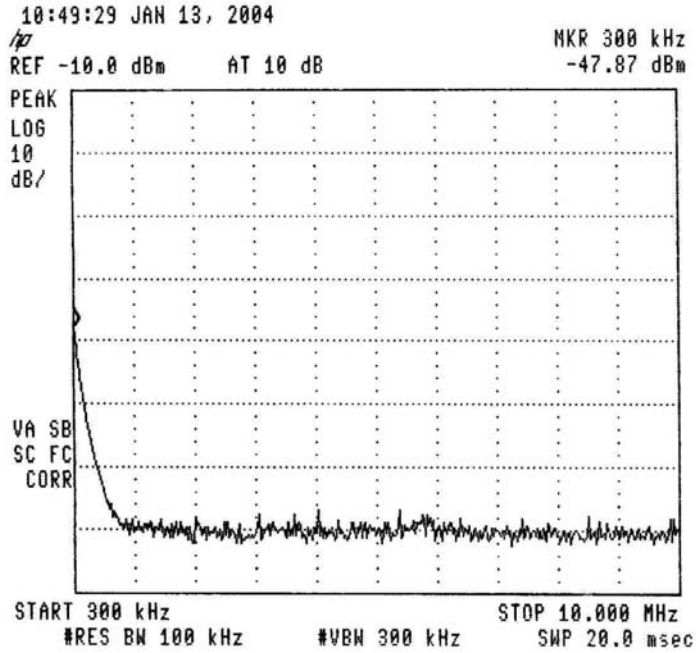

Figure 20.— 903.5 MHz

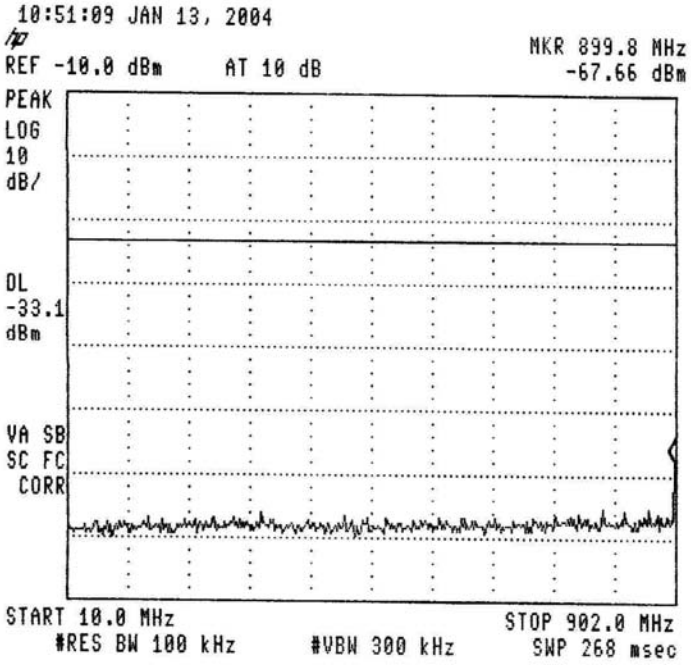

Figure 21.— 903.5 MHz

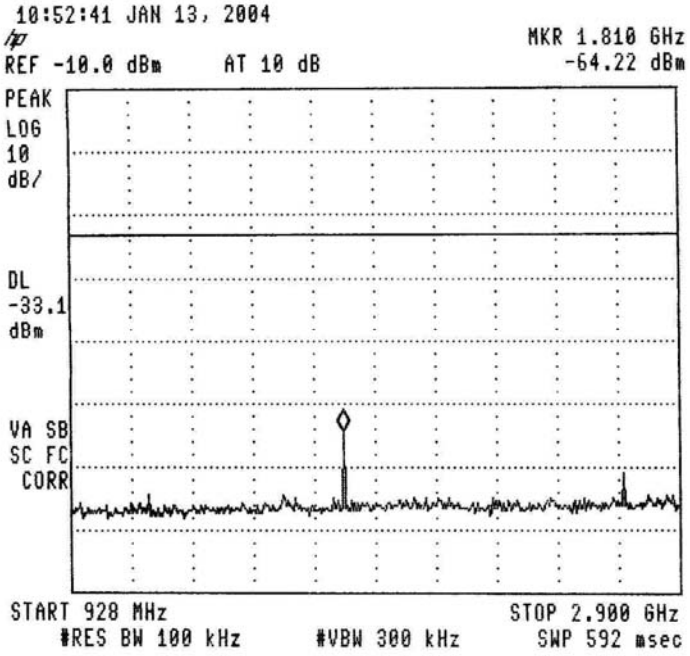

Figure 22.— 903.5 MHz

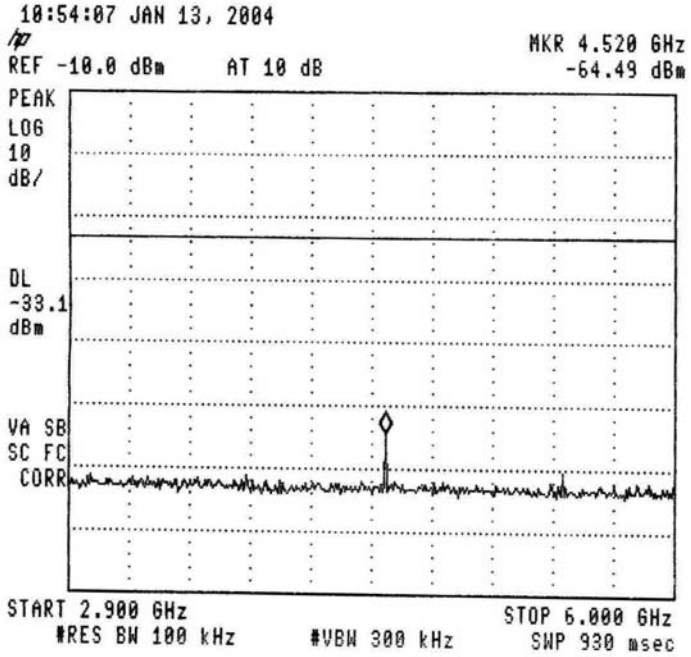

Figure 23.— 903.5 MHz

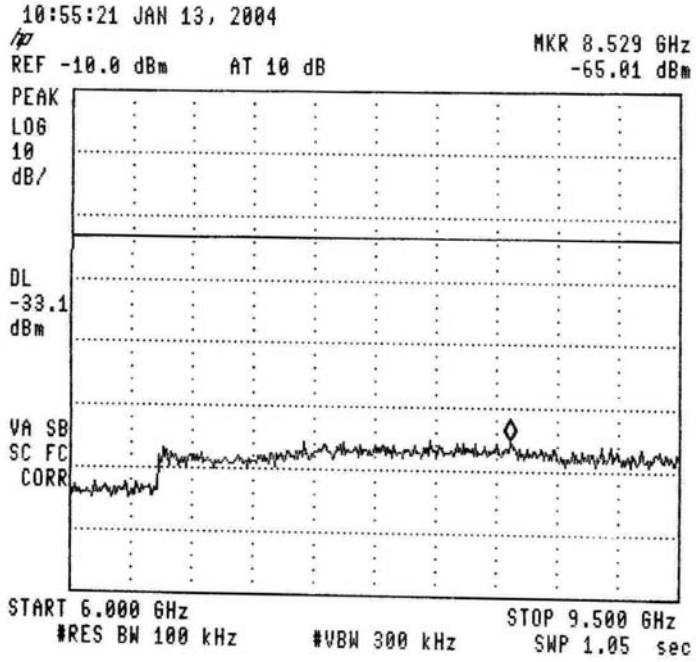

Figure 24.— 903.5 MHz

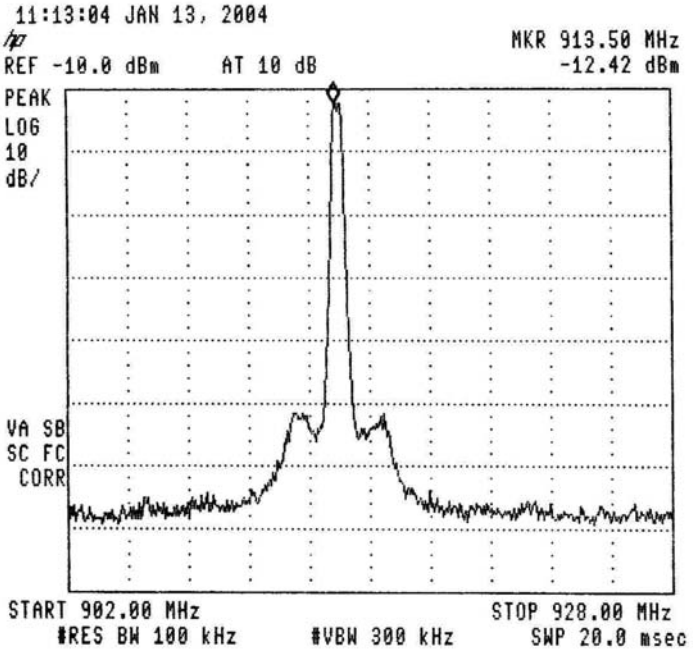

Figure 25.— 913.5 MHz

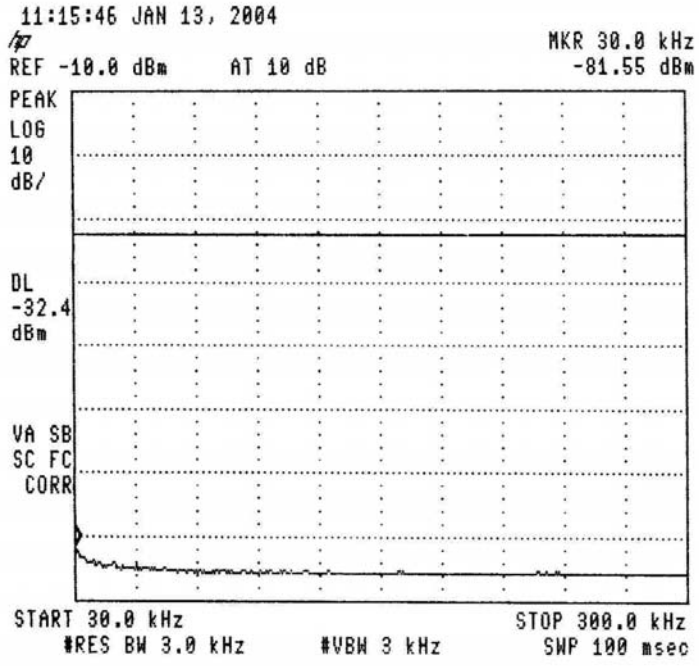

Figure 26.— 913.5 MHz

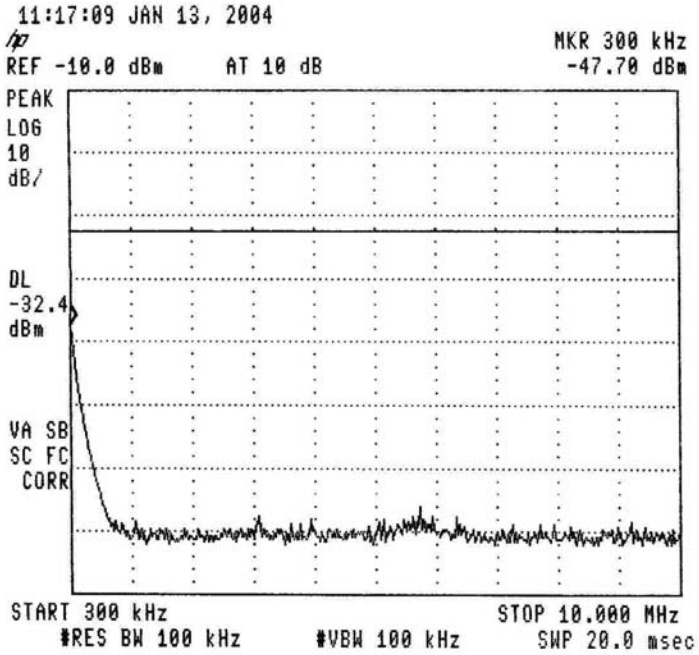

Figure 27.— 913.5 MHz

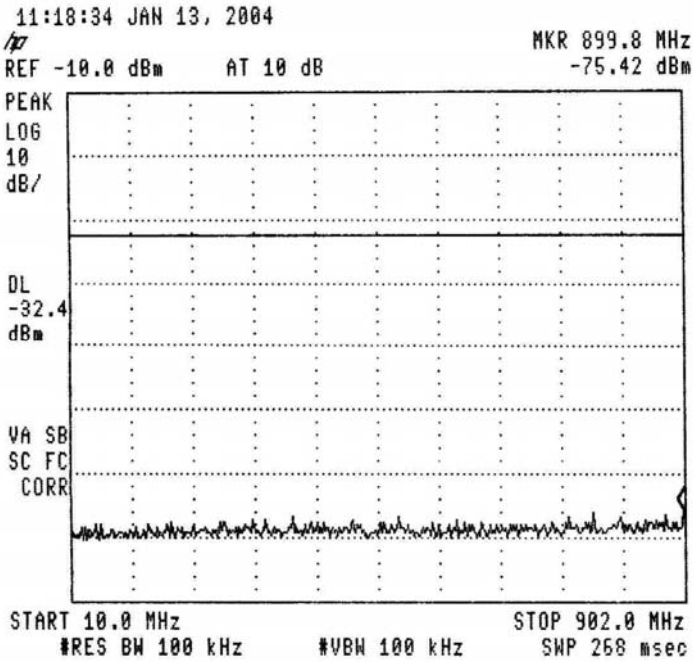

Figure 28.— 913.5 MHz

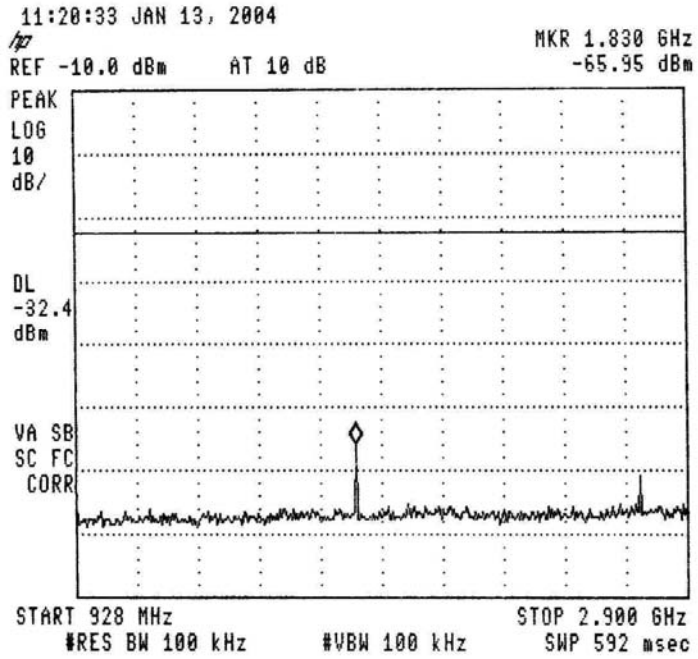

Figure 29.— 913.5 MHz

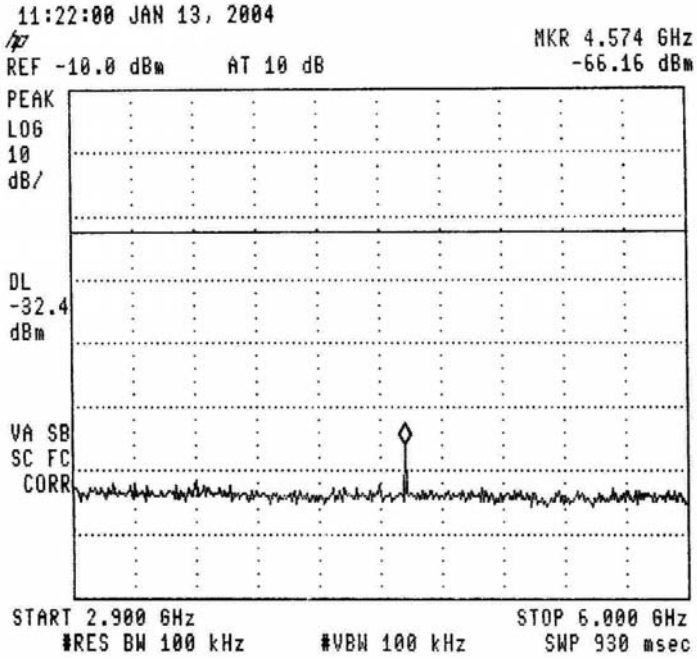

Figure 30.— 913.5 MHz

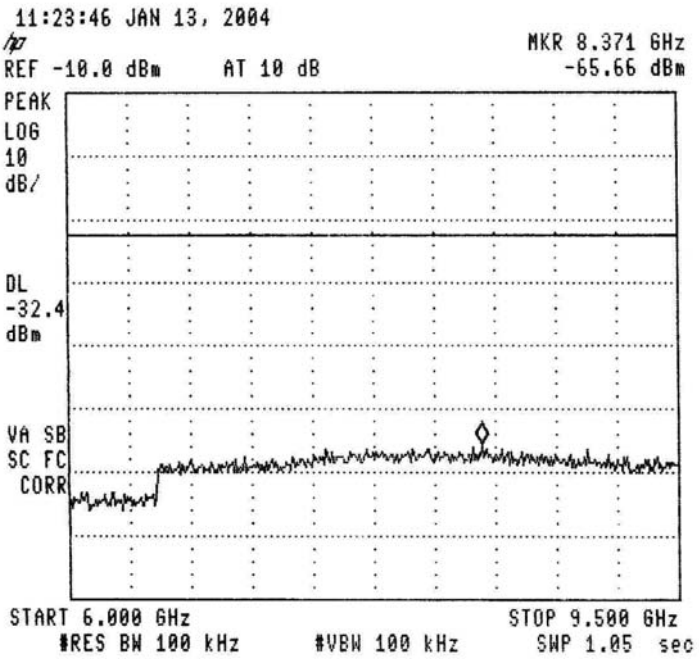

Figure 31.— 913.5 MHz

10.2 Results table

E.U.T. Description: IntegrAlarm Smoke Detector
Model No.: IA-SMK1
Serial Number: Not Designated
Specification: FCC Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading (dBc)	Specification (dBc)	Margin (dB)
903.5	51.1	20.0	-31.1
913.5	53.5	20.0	-33.5

Figure 32 Peak Power Output of 902-928 MHz Band

JUDGEMENT: Passed by 31.1 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 16.02.04

Typed/Printed Name: E. Pitt

10.3 Test Equipment Used.

Peak Power Output Out of 902-928 MHz Band

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	January 31, 2003	1 year
Cable	Avnet	MTS	N/A	September 20, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 33 Test Equipment Used

11. 20 dB Bandwidth

11.1 Test procedure

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through a 24dB attenuator and an appropriate coaxial cable. The spectrum analyzer was set to 10 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 20 dB below maximum peak power was measured and recorded.

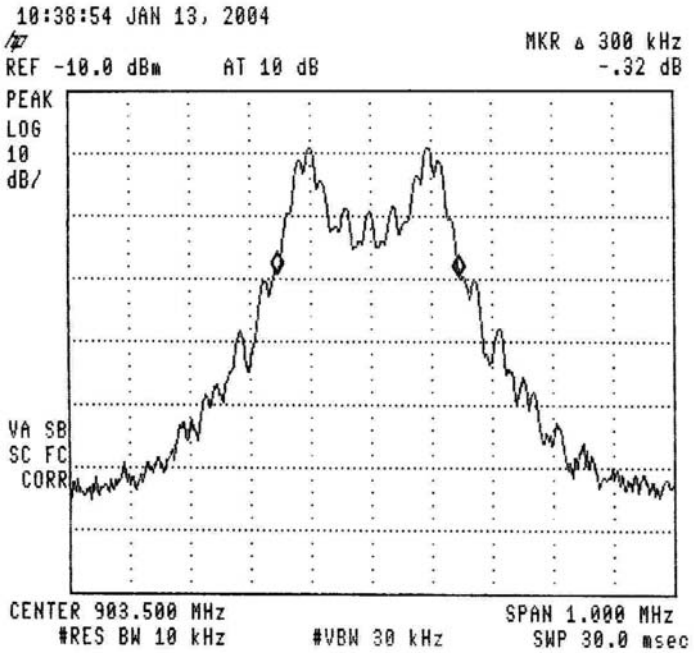

Figure 34 — 903.5 MHz

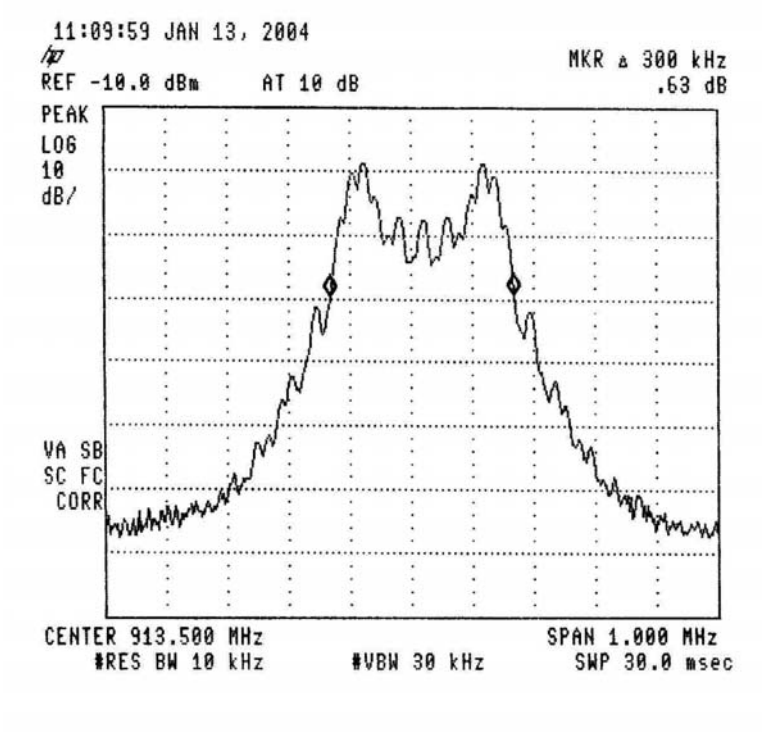

Figure 35 — 913.5 MHz

11.2 Results table

E.U.T. Description: IntegrAlarm Smoke Detector
Model No.: IA-SMK1
Serial Number: Not Designated
Specification: FCC Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Reading (kHz)	Specification (kHz)	Margin (kHz)
903.5	300	500.0	200
913.5	300	500.0	200

Figure 36 20 dB Bandwidth

JUDGEMENT: Passed by 200 kHz

TEST PERSONNEL:

Tester Signature: _____ Date: 16.02.04

Typed/Printed Name: E. Pitt

11.3 Test Equipment Used.

6 dB Minimum Bandwidth

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	January 31, 2003	1 year
Cable	Avnet	MTS	N/A	September 20, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 37 Test Equipment Used

12. Band Edge Spectrum

[In Accordance with section 15.247(c)]

12.1 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency (903.5 MHz) and the highest operation frequency (913.5 MHz) in which the E.U.T. is planned to be used.

The E.U.T. antenna terminal was connected to the spectrum analyzer through a 24dB attenuator and an appropriate coaxial cable. The spectrum analyzer was set to 100 kHz resolution BW. Maximum power level below 902 MHz and above 928 MHz was measured relative to power level at 903.5 MHz and 913.5 MHz correspondingly.

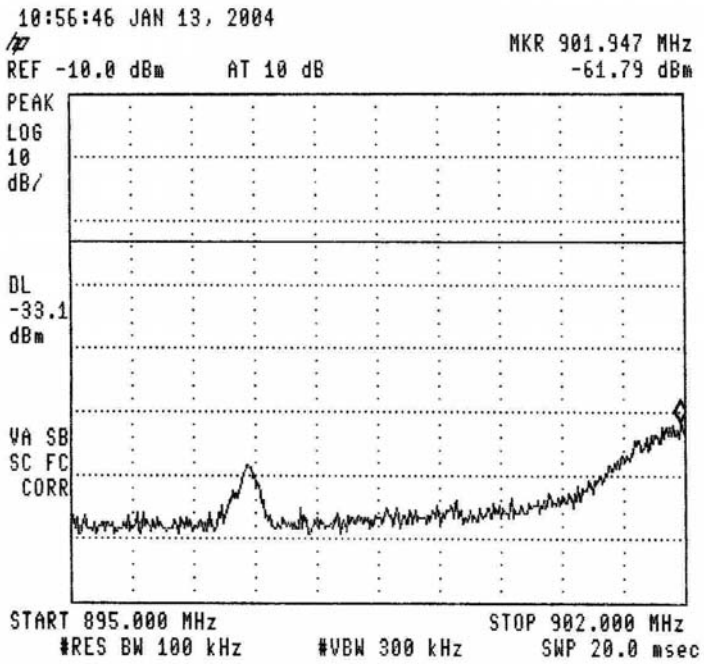

Figure 38 — 903.5 MHz

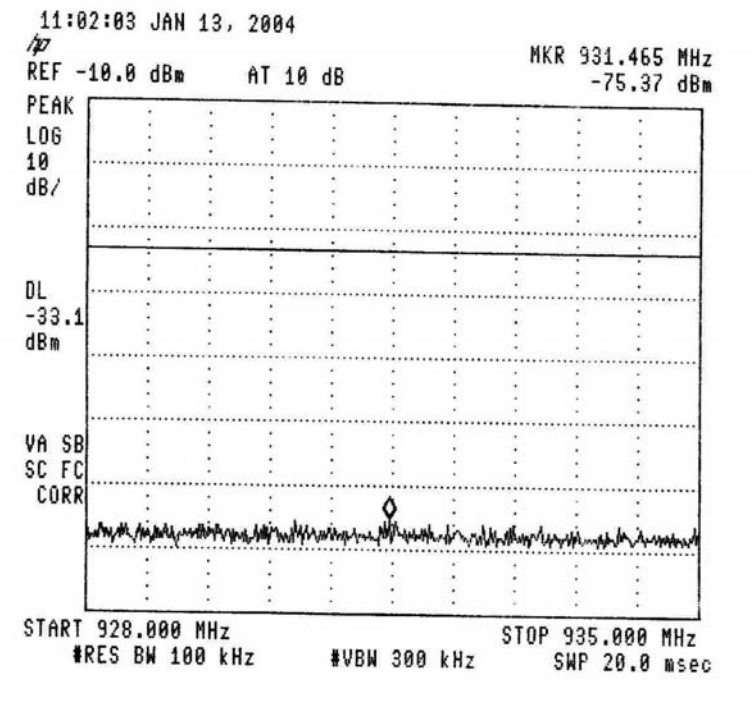

Figure 39 — 903.5 MHz

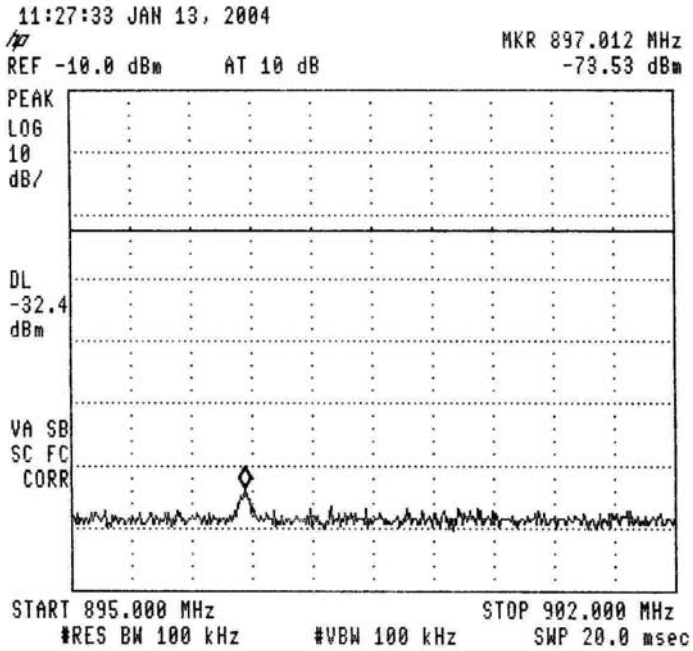

Figure 40 — 913.5 MHz

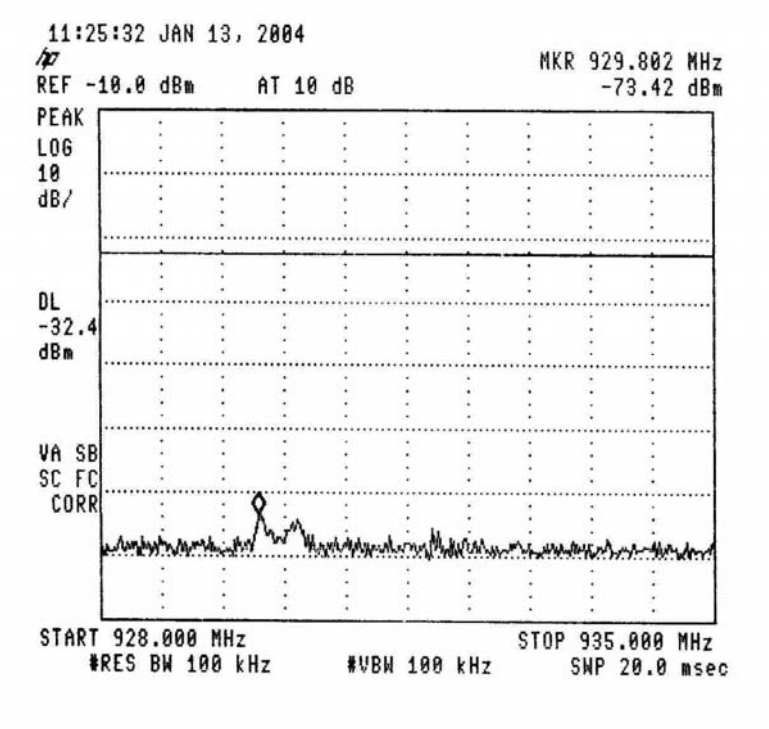

Figure 41 — 913.5 MHz

12.2 Results table

E.U.T. Description: IntegrAlarm Smoke Detector
Model No.: IA-SMK1
Serial Number: Not Designated
Specification: FCC Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBc)	Specification (dBc)	Margin (dB)
903.5	901.947	48.69	20.0	28.69
913.5	929.802	61.02	20.0	41.02

Figure 42 Band Edge Spectrum

JUDGEMENT: Passed by 41.02 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 16.02.04

Typed/Printed Name: E. Pitt

12.3 Test Equipment Used.

Band edge Spectrum

Instrument	Manufacture	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	January 31, 2003	1 year
Cable	Avnet	MTS	N/A	September 20, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 43 Test Equipment Used

13. Antenna Gain

The gain of the antenna is -4 dBi.

EMTS INC.
300 Alden Road
Markham, Ontario L3R 4C1
Canada

February 09, 2004

IntegrAlarm Smoke Detector model IA-SMK1, FCC ID RUF150705
RF/controller module

This is to confirm that the antenna used in the above module has a maximum gain of –4 dbi.

EMTS Inc.

D Lavee

Doron Lavee
Engineering Manager

Tel. (905) 946-8477
Fax (905) 947-0138

14. R.F Exposure/Safety

The E.U.T. is a ceiling mounted, fixed installation. The typical distance between the E.U.T. and the general population in normal use is at least 0.5m.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) Considering the worst case FCC limit at the operating frequency of 903.5 MHz the FCC limit is:

$$S = \frac{903.5}{1500} = 0.6\frac{mW}{cm^2}$$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is given by:

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t- Transmitted Power: +15dBm =31.6mW (max. measured power, +11.5dBm at 913.5 MHz)

G_T- Antenna Gain: -4dBi = 0.4

R- Distance from Transmitter using 20cm worst case

(c) The peak power density is :

$$S_p = \frac{31.6x0.4}{4\pi(20)^2} = 2.5x10^{-3}\frac{mW}{cm^2}$$

(d) The duty cycle of transmission in actual worst case is 10msec "on" and 200msec "Off".

The average power over 30 minutes is:

$$P_{AV} = \frac{31.6\times10}{200}1.58mW$$

(e) The averaged power density of the E.U.T. is:

$$S_{AV} = \frac{1.58\times0.4}{4\pi(20)^2} = 0.31X10^{-3}\frac{mW}{cm^2}$$

(f) This is more than 3 orders of magnitude below the FCC limit.

15. Photographs of Tested E.U.T.

Figure 44 Top View

Figure 45 Bottom View

Figure 46 Bottom View Without Cover

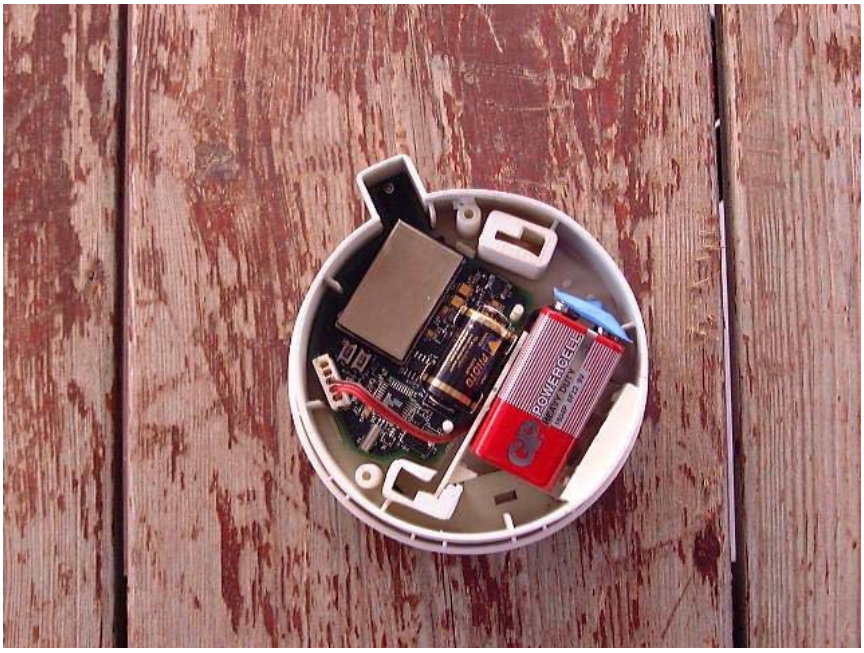

Figure 47 PCB in Unit

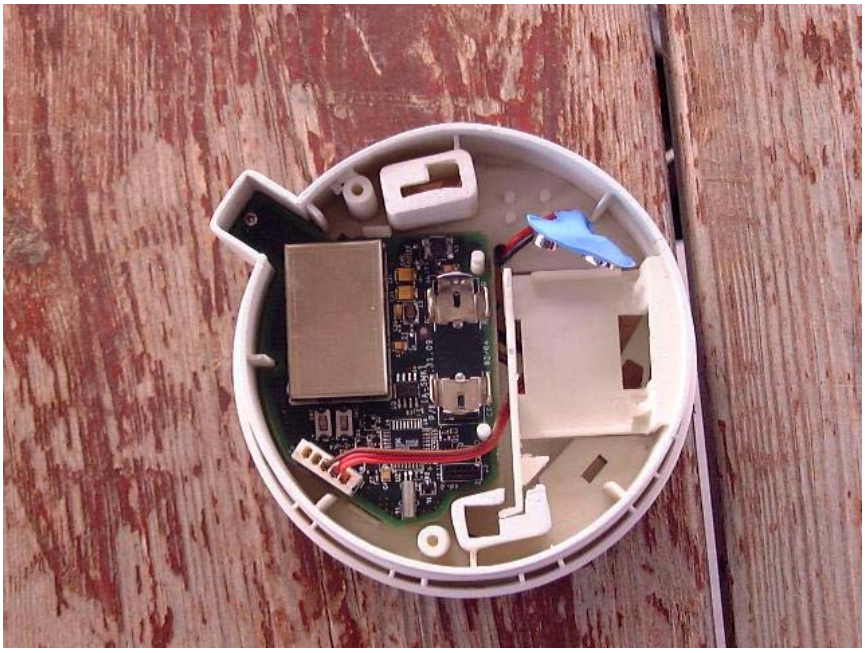

Figure 48 PCB in Unit Without Batteries

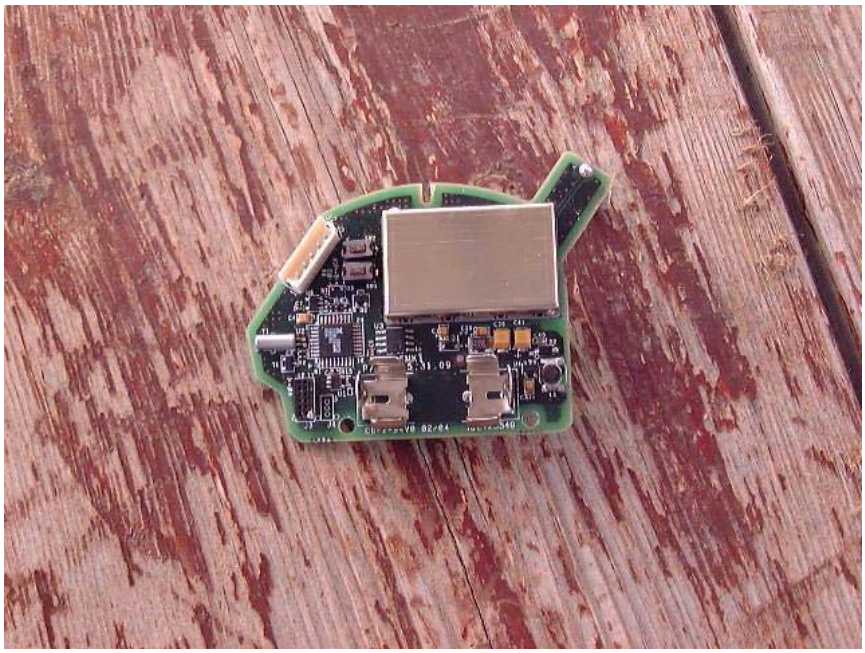

Figure 49 PCB Side 1

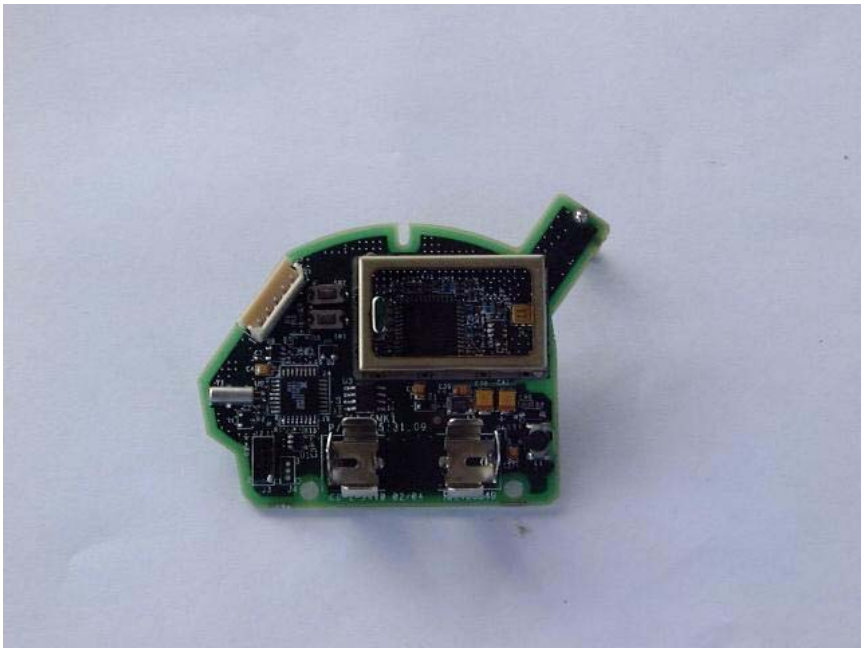

Figure 50 PCB Side 1 Without Shield

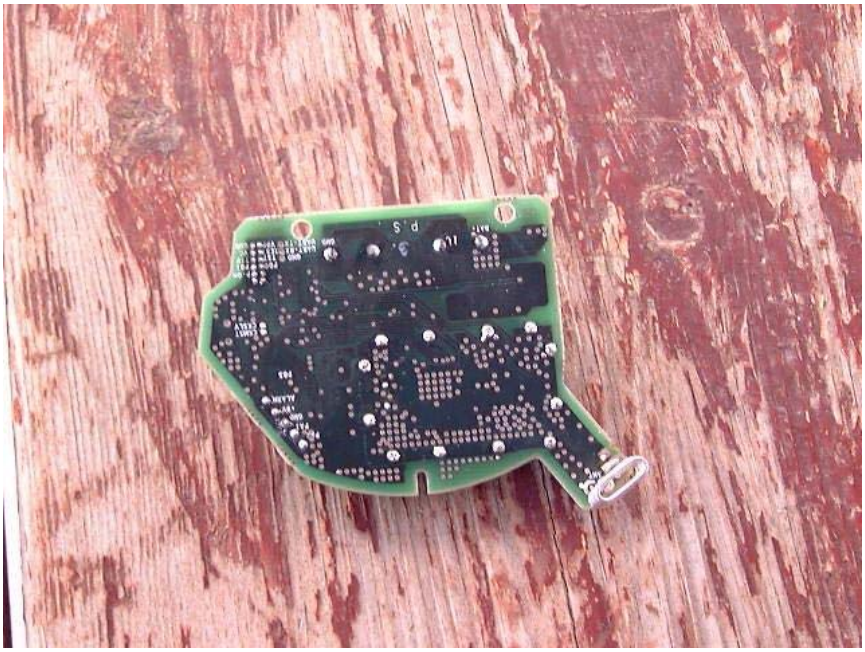

Figure 51 PCB Side 2