

**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

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This report relates only to items tested.

**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:

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Applicant for this device:

(different from "prepared by")

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# 1. General Information

## 1.1 Administrative Information

|                                |                                                                                                     |
|--------------------------------|-----------------------------------------------------------------------------------------------------|
| Manufacturer:                  | EMTS Inc.                                                                                           |
| Manufacturer's Address:        | 300 Alden Road<br>Markham, Ontario L3E4C1<br>Canada<br>Tel: +1-905-946-8589<br>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.<br>Kfar Bin Nun,<br>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<sub>2</sub> 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 –  $3 \pm 0.7\%$  / ft.

Smoke detector UL compliance – UL 217.

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

Wireless transceiver/controller battery - Lithium  $\text{MNO}_2$ , 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): Ø-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  $\pm 4$  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

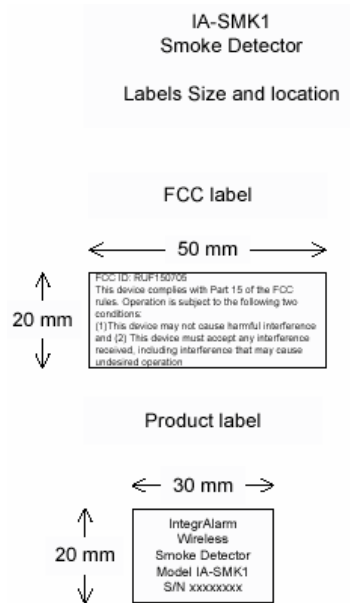


Figure 1. FCC Label

Labels location:  
on the product base

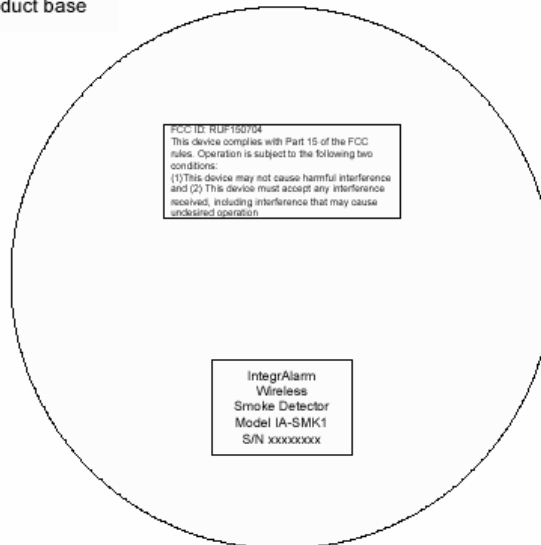


Figure 2. Location of Label on EUT

### **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

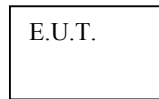


Figure 3. Configuration of Tested System

## 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,



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 [dB $\mu$ v/m]              |
| RA: | Receiver Amplitude [dB $\mu$ v]            |
| 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                    Frequency range: 1.0 GHz to 9.5 GHz  
 Test Distance: 3 meters                                Detector: Peak  
 Operating Frequency: 903.5 MHz

| Freq.   | Peak<br>Reading<br>PR | Correction Factors    |                     |                        | Peak.<br>Specification | Peak<br>Final<br>Result<br>FR (P)* | Peak.<br>Margin |
|---------|-----------------------|-----------------------|---------------------|------------------------|------------------------|------------------------------------|-----------------|
| (MHz)   | (dBμV)                | Antenna<br>AF<br>(dB) | Cable<br>CF<br>(dB) | Pre Amp.<br>PF<br>(dB) | (dB μV/m)              | (dB μV/m)<br>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                    Frequency range: 1.0 GHz to 9.5 GHz  
 Test Distance: 3 meters                                Detector: Average  
 Operating Frequency: 903.5 MHz

| Freq.<br>(MHz) | AVG<br>Reading<br>AR<br>(dBμV) | Correction Factors    |                     |                        | DCF<br>(dB) | AVG<br>Spec<br>(dB μV/m) | AVG<br>Final<br>Result<br>FR (A)<br>(dB μV/m)<br>See Note * | AVG<br>Margin<br>(dB) |
|----------------|--------------------------------|-----------------------|---------------------|------------------------|-------------|--------------------------|-------------------------------------------------------------|-----------------------|
|                |                                | Antenna<br>AF<br>(dB) | Cable<br>CF<br>(dB) | Pre Amp.<br>PF<br>(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.

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

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                    Frequency range: 1.0 GHz to 9.5 GHz  
 Test Distance: 3 meters                            Detector: Peak  
 Operating Frequency: 903.5 MHz

| <b>Freq.</b> | <b>Peak Reading PR</b> | <b>Correction Factors</b> |                 |                    | <b>Peak. Specification</b> | <b>Peak Final Result FR (P)*</b> | <b>Peak. Margin</b> |
|--------------|------------------------|---------------------------|-----------------|--------------------|----------------------------|----------------------------------|---------------------|
| (MHz)        | (dBμV)                 | <b>Antenna AF</b>         | <b>Cable CF</b> | <b>Pre Amp. PF</b> | (dB μV/m)                  | (dB μV/m)<br>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                    Frequency range: 1.0 GHz to 9.5 GHz  
 Test Distance: 3 meters                            Detector: Average  
 Operating Frequency: 903.5 MHz

| Freq.<br><br>(MHz) | AVG<br>Reading<br>AR<br><br>(dBμV) | Correction Factors    |                     |                        | DCF<br><br>(dB) | AVG<br>Spec<br><br>(dB μV/m) | AVG<br>Final<br>Result<br>FR (A)<br><br>(dB μV/m)<br>See Note * | AVG<br>Margin<br><br>(dB) |
|--------------------|------------------------------------|-----------------------|---------------------|------------------------|-----------------|------------------------------|-----------------------------------------------------------------|---------------------------|
|                    |                                    | Antenna<br>AF<br>(dB) | Cable<br>CF<br>(dB) | Pre Amp.<br>PF<br>(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.

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

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<br>Reading<br>PR | Correction Factors<br>Antenna<br>AF | Cable<br>CF | Pre Amp.<br>PF | Peak.<br>Specification | Peak<br>Final<br>Result<br>FR (P)*<br>See Note * | Peak.<br>Margin |
|---------|-----------------------|-------------------------------------|-------------|----------------|------------------------|--------------------------------------------------|-----------------|
| (MHz)   | (dBμV)                | (dB)                                | (dB)        | (dB)           | (dB μV/m)              | (dB μV/m)                                        | (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                    Frequency range: 1.0 GHz to 9.5 GHz  
 Test Distance: 3 meters                                Detector: Average  
 Operating Frequency: 913.5 MHz

| Freq.   | AVG<br>Reading<br>AR | Correction Factors    |                     |                        | DCF  | AVG<br>Spec | AVG<br>Final<br>Result<br>FR (A) | AVG<br>Margin |
|---------|----------------------|-----------------------|---------------------|------------------------|------|-------------|----------------------------------|---------------|
| (MHz)   | (dBμV)               | Antenna<br>AF<br>(dB) | Cable<br>CF<br>(dB) | Pre Amp.<br>PF<br>(dB) | (dB) | (dB μV/m)   | (dB μV/m)<br>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.

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

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

| <b>Freq.</b> | <b>Peak Reading PR</b> | <b>Correction Factors</b> |                 |                    | <b>Peak. Specification</b> | <b>Peak Final Result FR (P)*</b> | <b>Peak. Margin</b> |
|--------------|------------------------|---------------------------|-----------------|--------------------|----------------------------|----------------------------------|---------------------|
| (MHz)        | (dBμV)                 | <b>Antenna AF</b>         | <b>Cable CF</b> | <b>Pre Amp. PF</b> | (dB μV/m)                  | (dB μV/m)<br>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                    Frequency range: 1.0 GHz to 9.5 GHz  
 Test Distance: 3 meters                            Detector: Average  
 Operating Frequency: 913.5 MHz

| Freq.   | AVG<br>Reading<br>AR | Correction Factors    |                     |                        | DCF  | AVG<br>Spec | AVG<br>Final<br>Result<br>FR (A) | AVG<br>Margin |
|---------|----------------------|-----------------------|---------------------|------------------------|------|-------------|----------------------------------|---------------|
| (MHz)   | (dBμV)               | Antenna<br>AF<br>(dB) | Cable<br>CF<br>(dB) | Pre Amp.<br>PF<br>(dB) | (dB) | (dB μV/m)   | (dB μV/m)<br>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.

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

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.

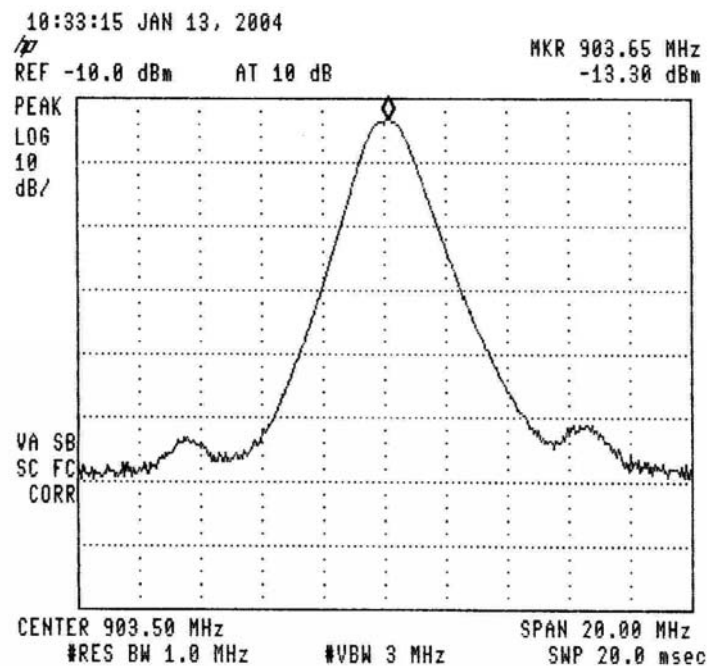


Figure 14.— 903.5 MHz

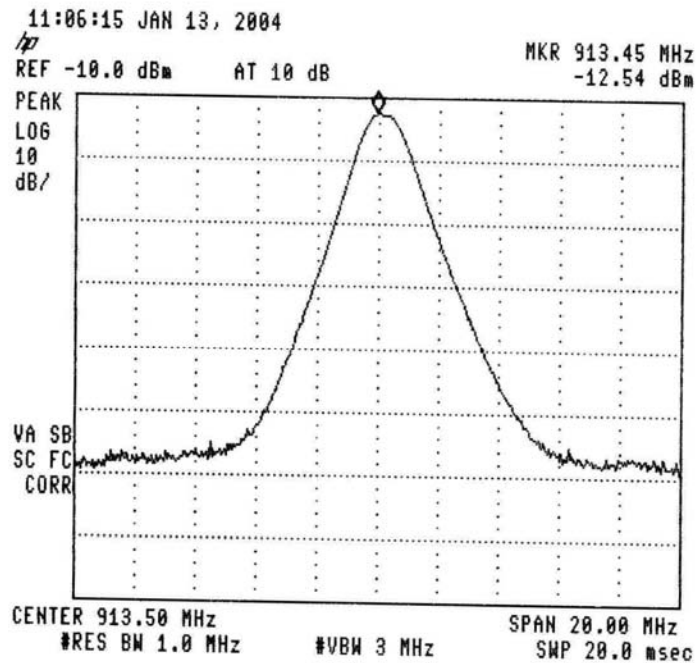


Figure 15.— 913.5 MHz

## 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           | Manufactur<br>e | Model       | Serial<br>Number | Calibration          |        |
|----------------------|-----------------|-------------|------------------|----------------------|--------|
|                      |                 |             |                  | Last<br>Calibr.      | Period |
| Spectrum<br>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,<br>2003 | 1 year |
| Attenuator           | MACOM           | M3933/25-74 | 0202             | November 13,<br>2003 | 1 year |
| Attenuator           | MACOM           | M3933/25-74 | 0211             | November 13,<br>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.

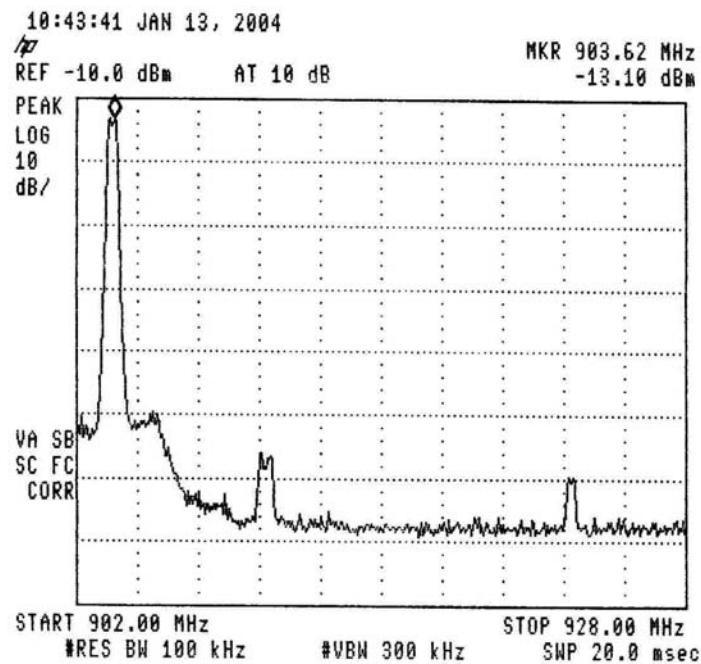


Figure 18.— 903.5 MHz

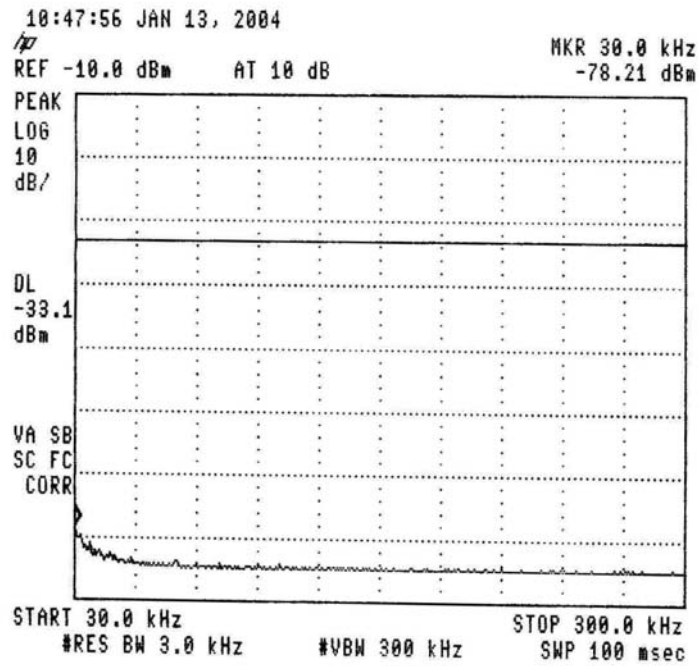


Figure 19.— 903.5 MHz

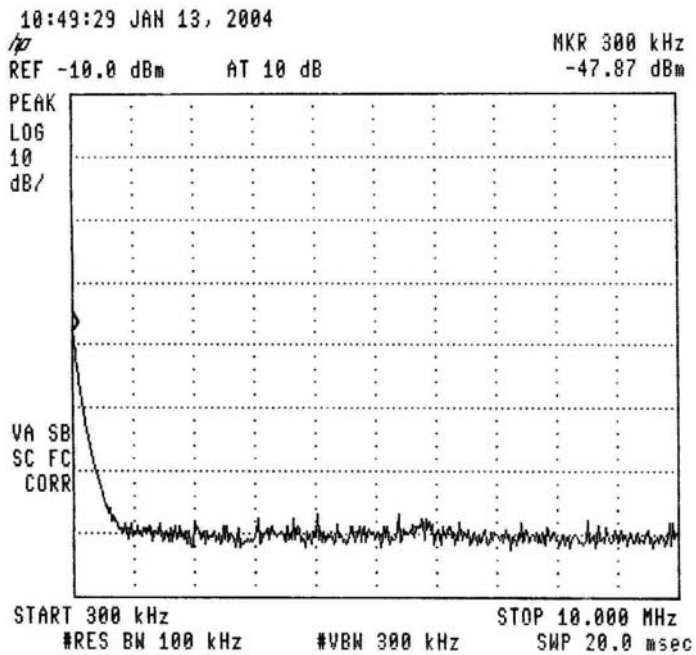


Figure 20.— 903.5 MHz

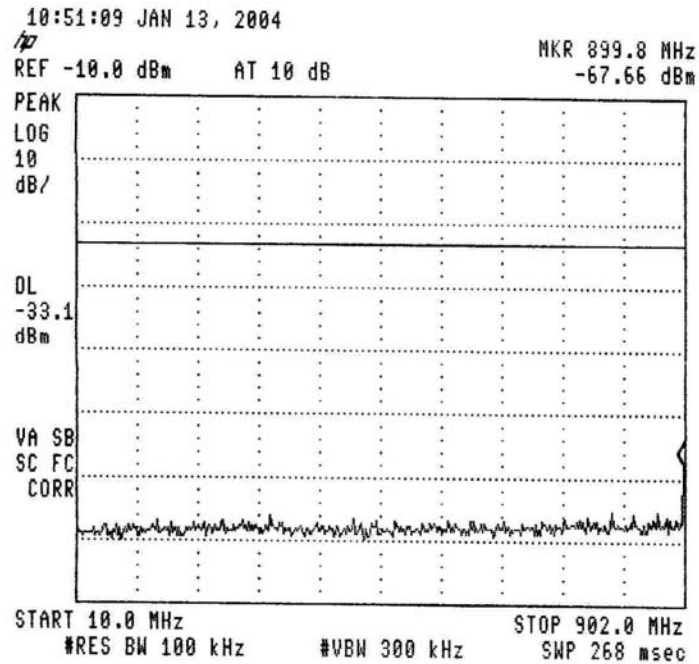


Figure 21.— 903.5 MHz

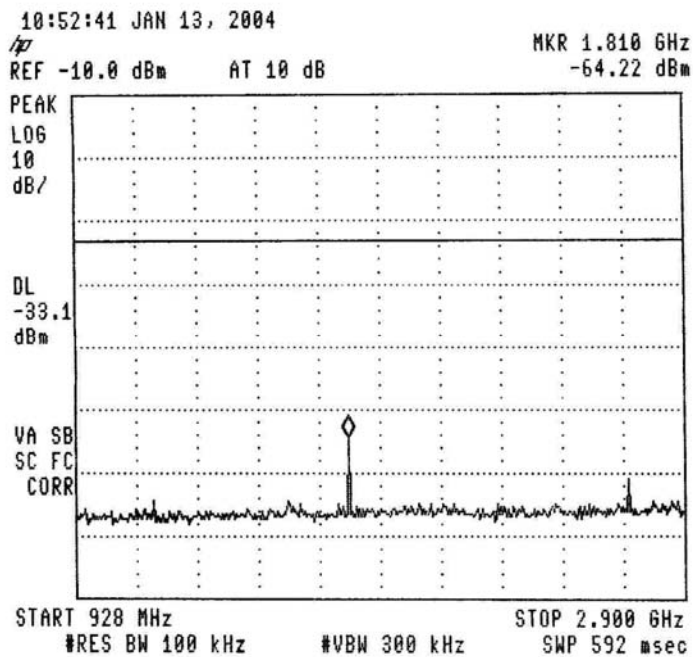


Figure 22.— 903.5 MHz

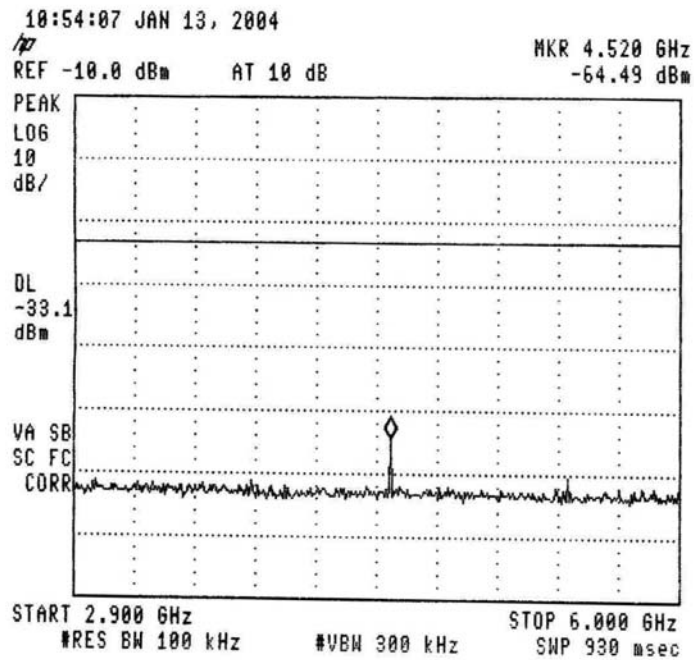


Figure 23.— 903.5 MHz

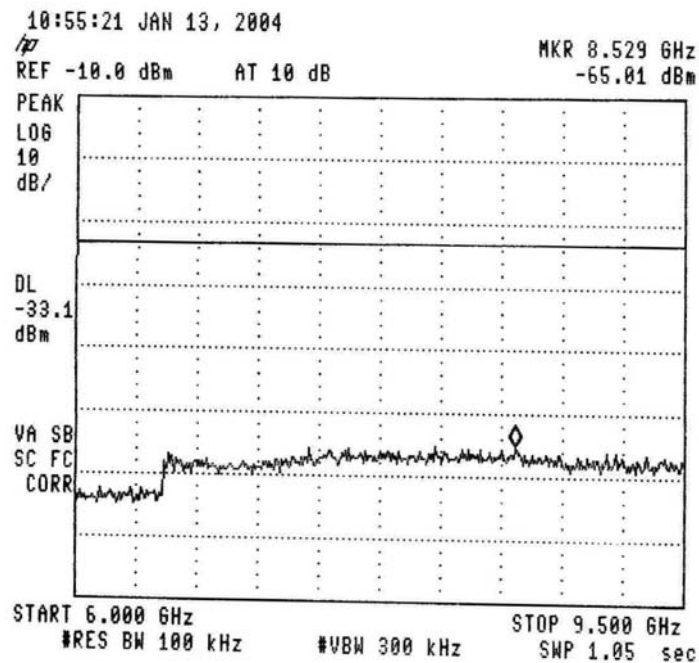


Figure 24.— 903.5 MHz

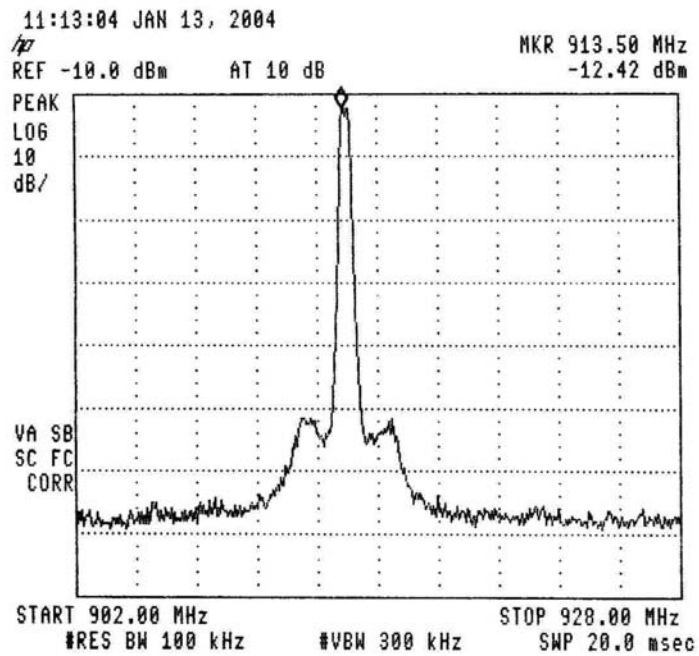


Figure 25.— 913.5 MHz

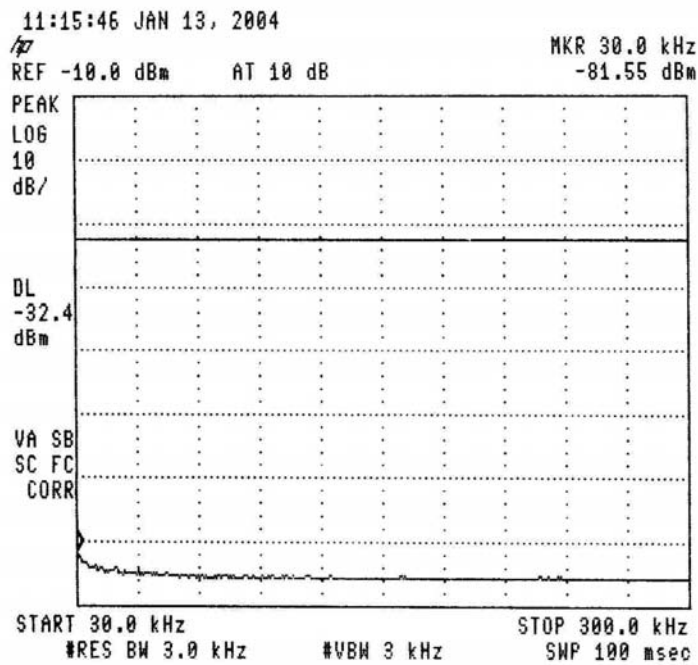


Figure 26.— 913.5 MHz

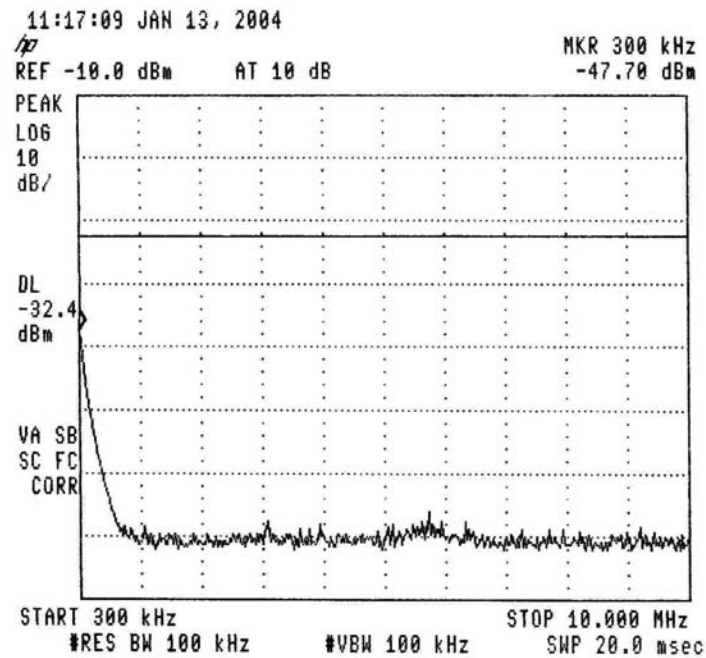


Figure 27.— 913.5 MHz

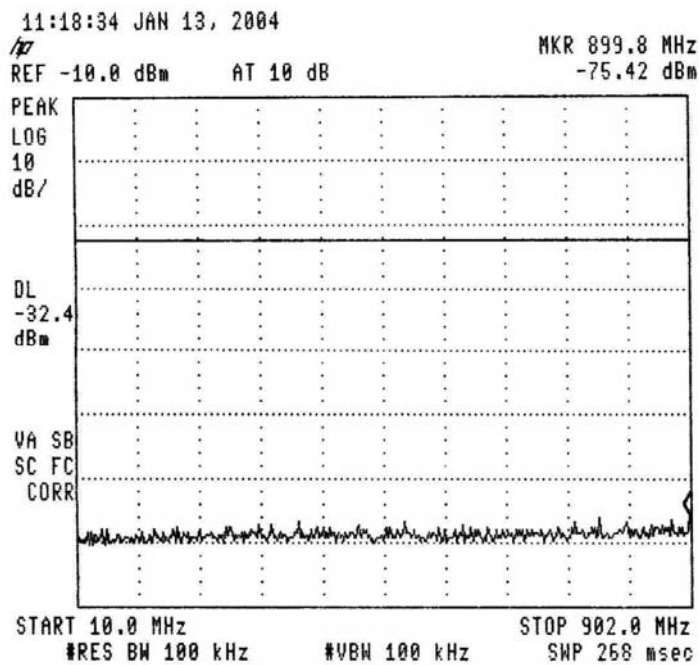


Figure 28.— 913.5 MHz

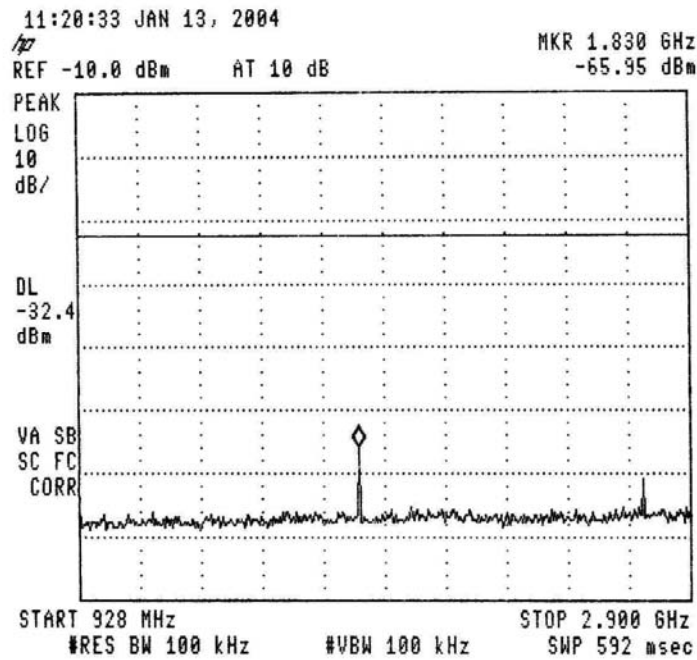


Figure 29.— 913.5 MHz

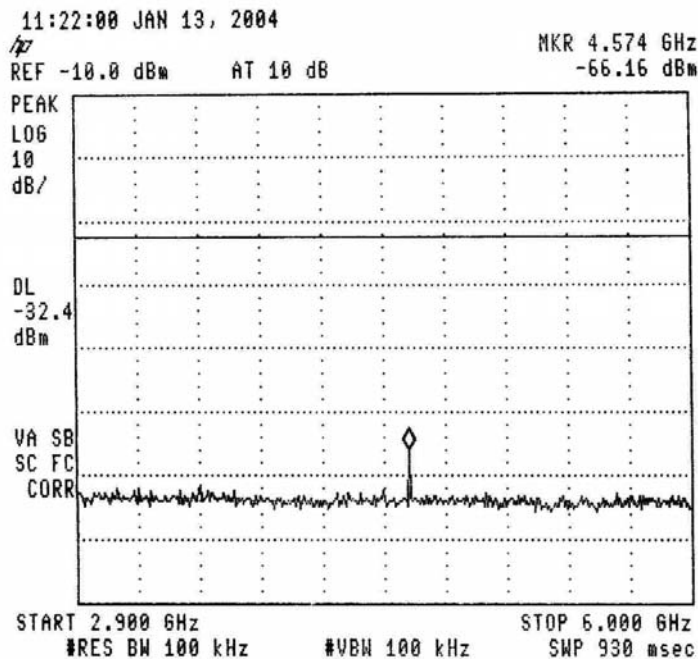


Figure 30.— 913.5 MHz

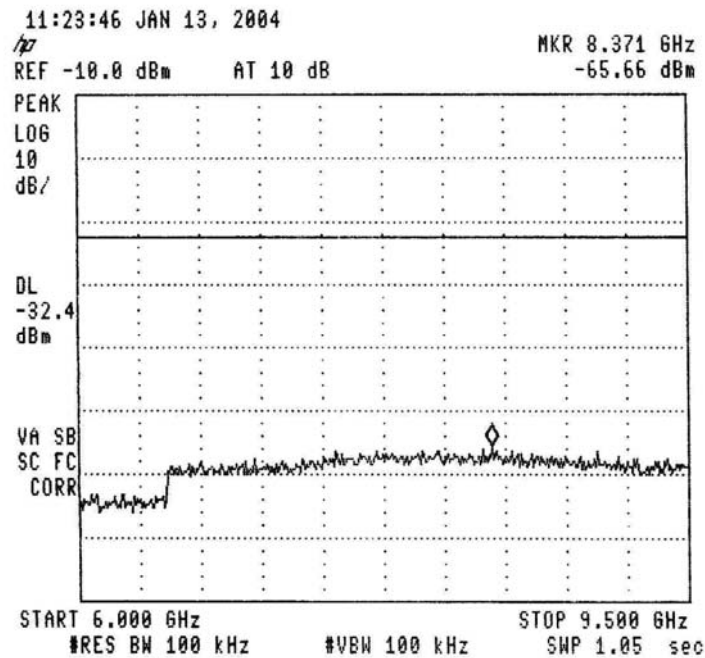


Figure 31.— 913.5 MHz

## 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<br>Frequency<br>(MHz) | Reading<br>(dBc) | Specification<br>(dBc) | Margin<br>(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           | Manufactur<br>e | Model       | Serial<br>Number | Calibration           |        |
|----------------------|-----------------|-------------|------------------|-----------------------|--------|
|                      |                 |             |                  | Last<br>Calibr.       | Period |
| Spectrum<br>Analyzer | HP              | 8592L       | 3826A01204       | January 31, 2003      | 1 year |
| Cable                | Avnet           | MTS         | N/A              | September 20,<br>2003 | 1 year |
| Attenuator           | MACOM           | M3933/25-74 | 0056             | November 13,<br>2003  | 1 year |
| Attenuator           | MACOM           | M3933/25-74 | 0202             | November 13,<br>2003  | 1 year |
| Attenuator           | MACOM           | M3933/25-74 | 0211             | November 13,<br>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.

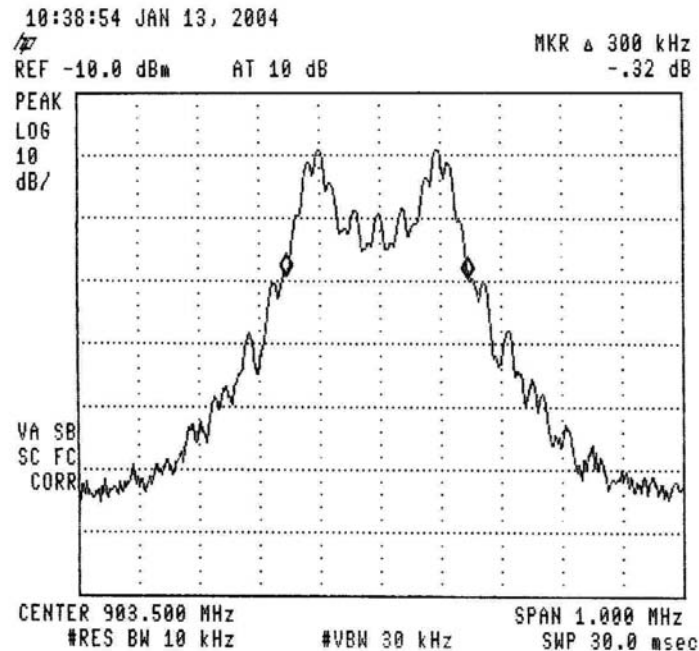


Figure 34 — 903.5 MHz

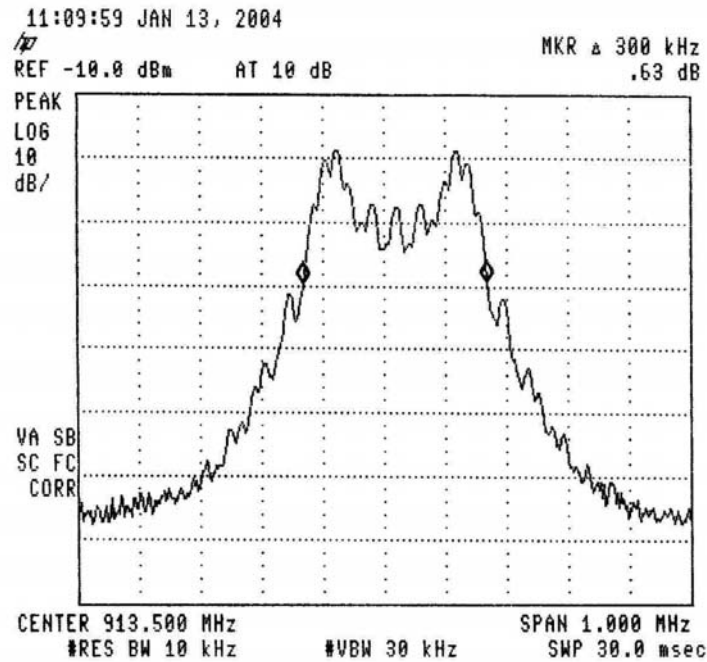


Figure 35 — 913.5 MHz

## 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<br>Frequency<br>(MHz) | Reading<br>(kHz) | Specification<br>(kHz) | Margin<br>(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        | Manufacturer | 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.

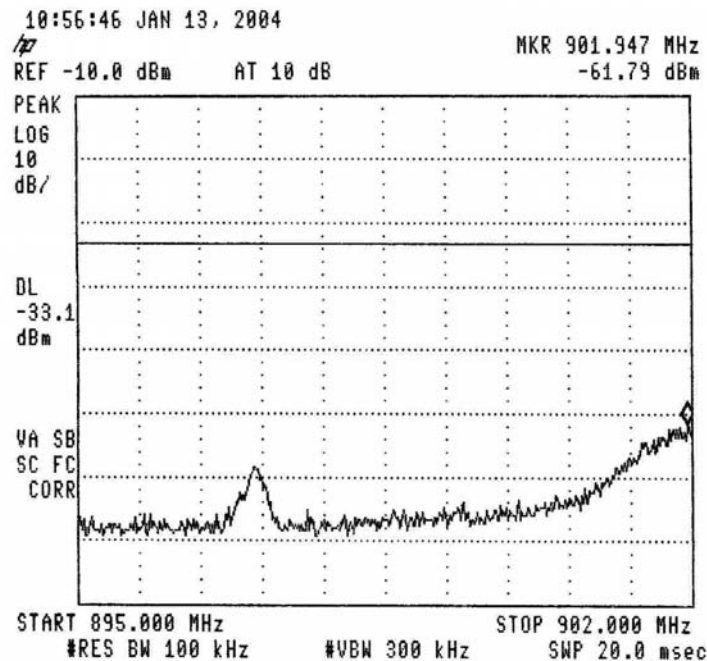


Figure 38 — 903.5 MHz

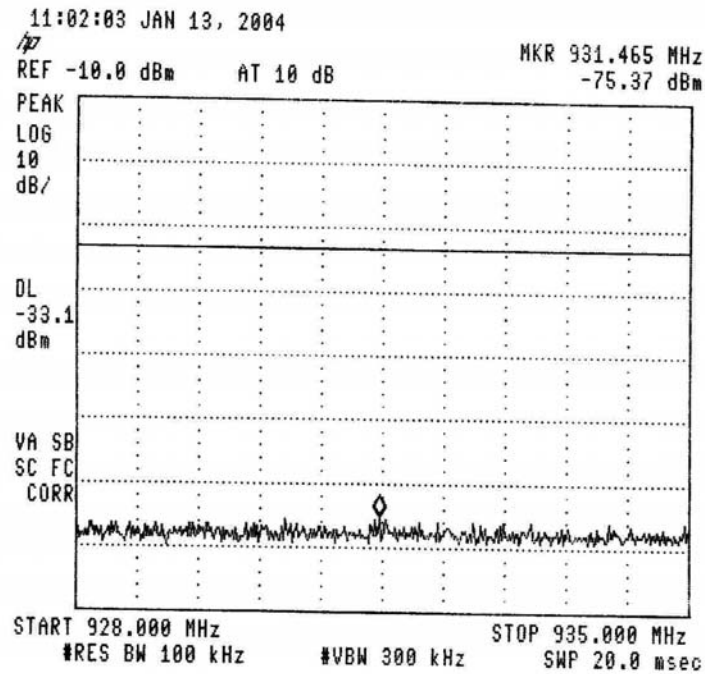


Figure 39 — 903.5 MHz

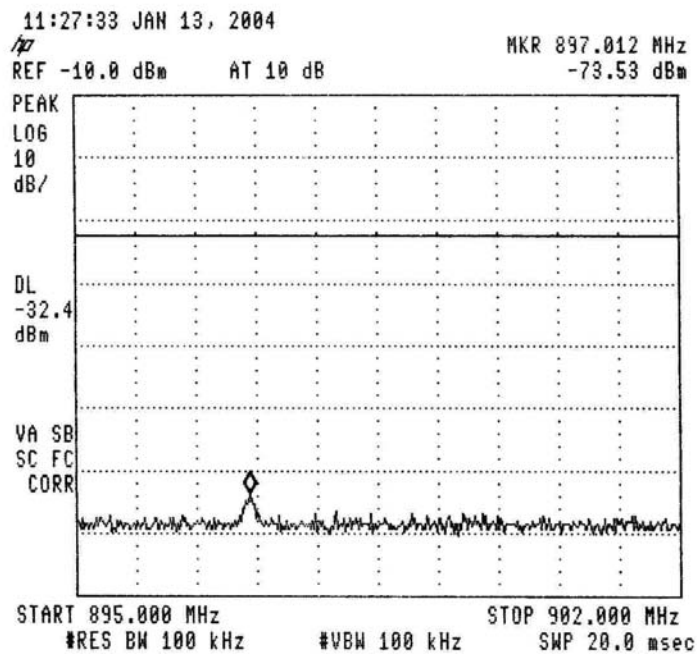


Figure 40 — 913.5 MHz

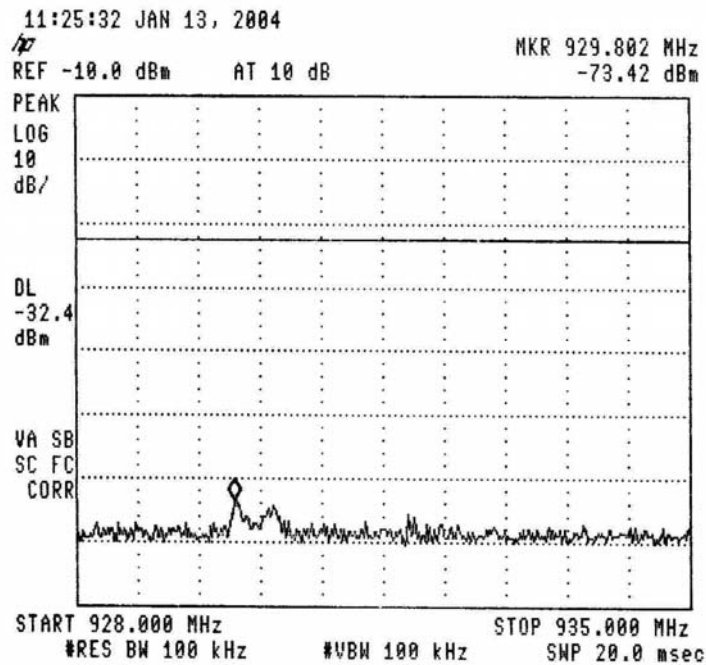


Figure 41 — 913.5 MHz

## 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: E. Pitt

Date: 16.02.04

Typed/Printed Name: E. Pitt

### 12.3 Test Equipment Used.

Band edge Spectrum

| Instrument        | Manufacturer | 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.



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 :

$$S_p = \frac{31.6 \times 0.4}{4\pi(20)^2} = 2.5 \times 10^{-3} \frac{mW}{cm^2}$$

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

The average power over 30 minutes is:

$$P_{AV} = \frac{31.6 \times 10}{200} = 1.58mW$$

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

$$S_{AV} = \frac{1.58 \times 0.4}{4\pi(20)^2} = 0.31 \times 10^{-3} \frac{mW}{cm^2}$$

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

## 15. Photographs of Tested E.U.T.



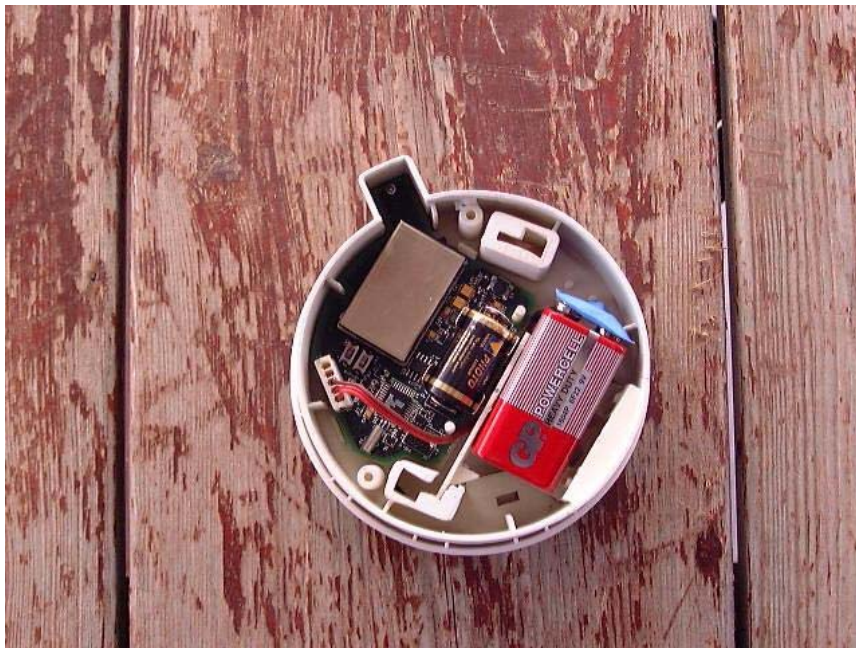
Figure 44 Top View



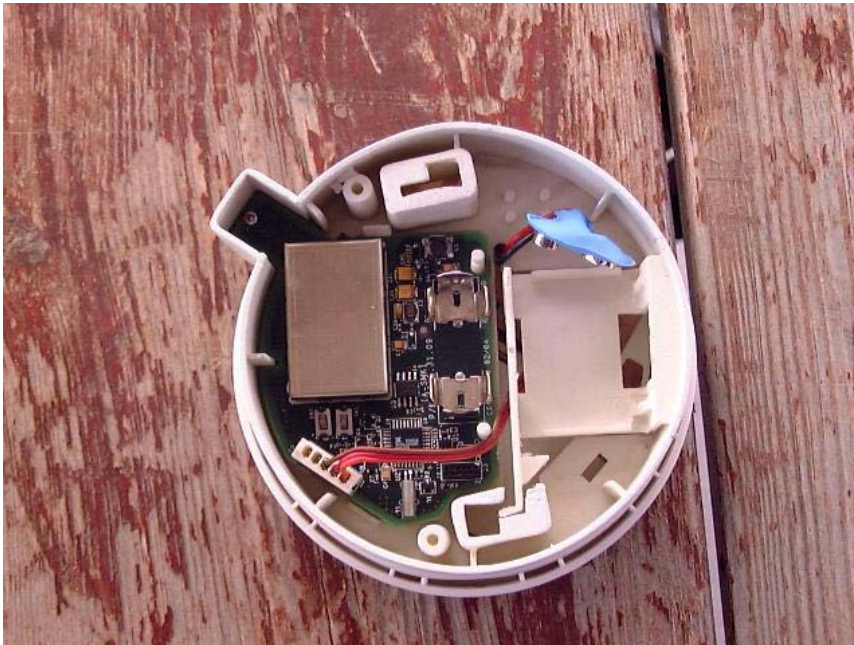
Figure 45 Bottom View



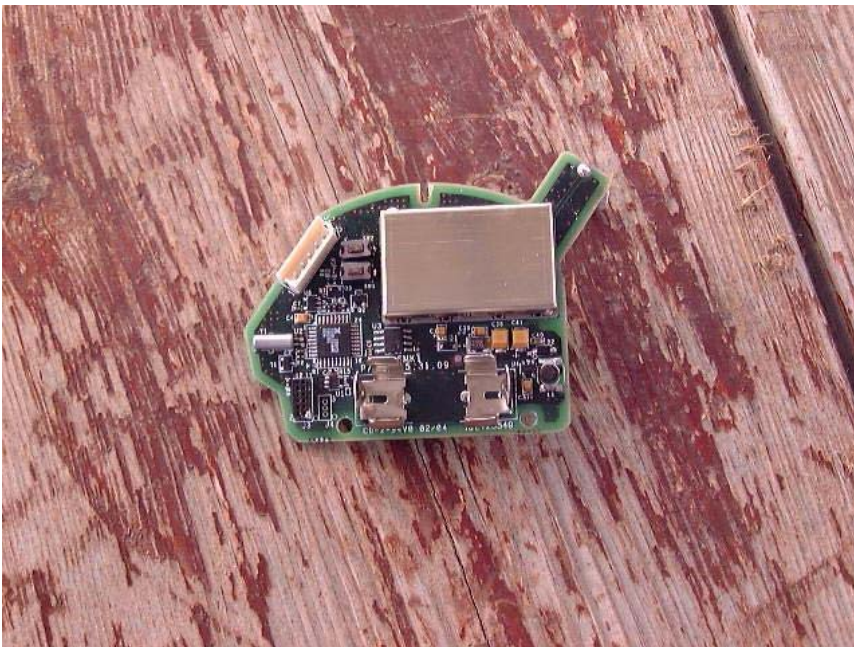
**Figure 46 Bottom View Without Cover**



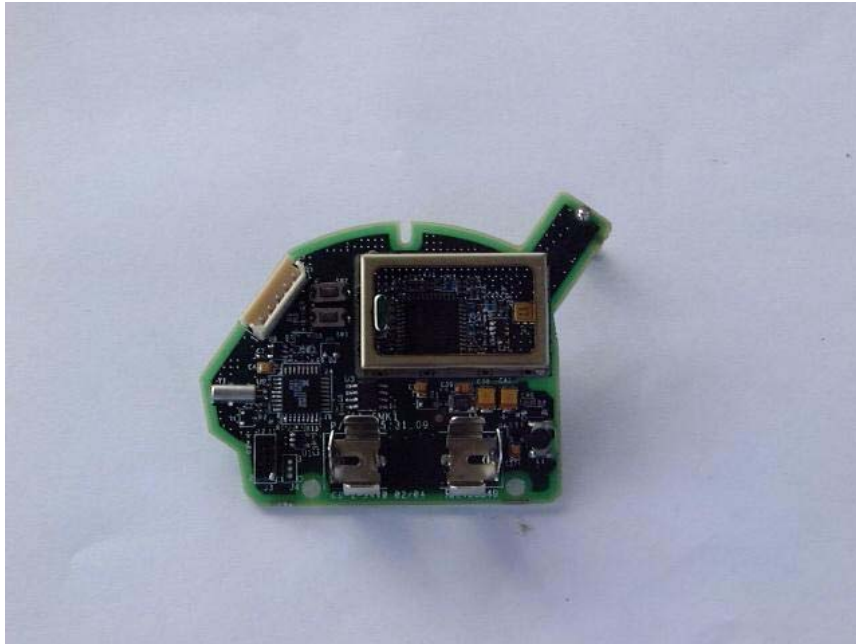
**Figure 47 PCB in Unit**



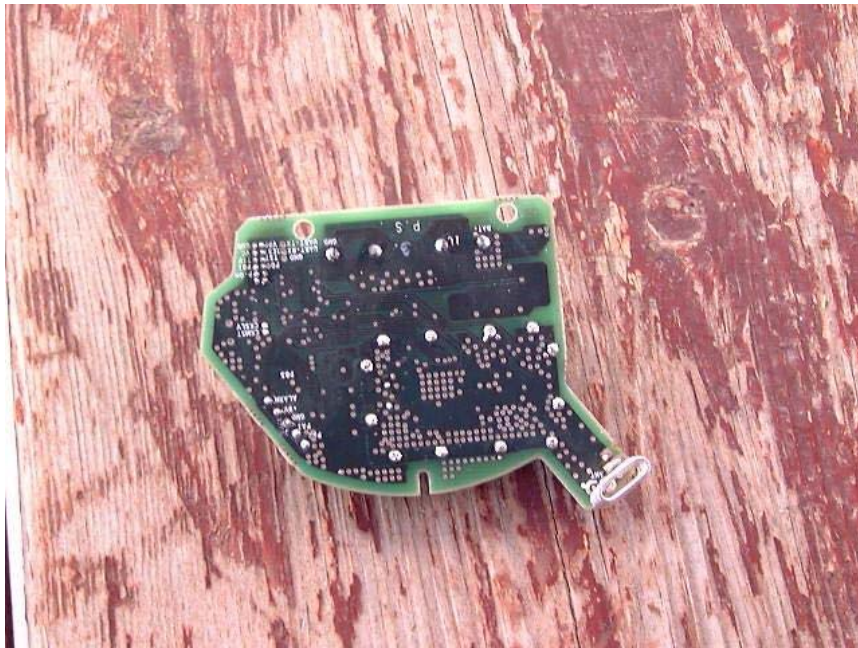
**Figure 48 PCB in Unit Without Batteries**



**Figure 49 PCB Side 1**



**Figure 50 PCB Side 1 Without Shield**



**Figure 51 PCB Side 2**