



**Nemko USA, Inc.**  
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**Certification Test Report:** 2007 076353-2 FCC

**Project number:** 6353-2

**Equipment Under Test (EUT):** Keyfob

**Model:** 7642V, 7642P, 7642X

**FCC ID:** EZSDEI7642  
**IC:** 1513A-7642

**In Accordance With:** FCC Part 15 Subpart C, 15.247  
RSS-210, Issue 6 September 2005

**For:** Directed Electronics, Inc.  
One Viper Way  
Vista, CA 92081  
USA

**Tested By:** Nemko USA Inc.  
11696 Sorrento Valley Road, Suite F  
San Diego, CA 92121

**Authorized By:** *FR Fleury*  
FR Fleury, Manager

**Date:** JULY 30, 2007

**Total Number of Pages:** 34

## **2.1. Section 1. Summary of Test Results**

### **General**

#### **All measurements are traceable to national standards**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C and RSS-210, Issue 6 September 2005. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC and IC.

The assessment summary is as follows:

<b>Apparatus Assessed:</b>	Keyfob 7642V, 7642P, 7642X
<b>Specifications:</b>	FCC Part 15 Subpart C, 15.247 RSS-210, Issue 6 September 2005
<b>Date Received in Laboratory:</b>	July 20, 2007
<b>Compliance Status:</b>	Complies
<b>Exclusions:</b>	None
<b>Non-compliances:</b>	None

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Report Number: 2007 076353-2 FCC  
Specification: FCC Part 15 Subpart C, 15.247

**Report Release History:**

REVISION	DATE	COMMENTS
-	July 30, 2007	Prepared By: Alan Laudani
-	July 30, 2007	Initial Release: F. Fleury

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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TESTED BY:



Date: July 30, 2007

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Alan Laudani, EMC Test Engineer

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## Section 2: Equipment Under Test

### 2.1 Product Identification

The EUT is a hand held transmitter used as a remote control for vehicle security/convenience systems. It's comprised of a PCB which has an MCU, Battery, user interface (switches and LED display) and RF circuitry.

When a user activates a command with one of the EUT switches, the command is interpreted by the MCU which generates the data packets to be transmitted and controls the RFIC to generate the hopping sequence for as long as the user presses the button. When there are no buttons pressed, the EUT goes into sleep mode waiting for the next user switch press to wake-up and begin the code hopping transmission again.

The Transmission is achieved via a printed loop antenna on the PCB. This design employs 25 channels which operate in the 902MHz to 928MHz band. Each channel has a 20dB BW greater than 250KHz but less than 500KHz.

### 2.2 Technical Specifications of the EUT

<b>Manufacturer:</b>	Directed Electronics, Inc.
<b>Operating Frequency:</b>	909.546 to 918.780 MHz in the 902-928 MHz Band
<b>Output Power:</b>	95.0 dBuV/m @ 3m; 0.00094 W
<b>Modulation:</b>	FSK
<b>Antenna Data:</b>	Integral antenna trace on circuit board
<b>Antenna Connector:</b>	None
<b>Power Source:</b>	3 V battery

## **Section 3: Test Conditions**

### **3.1 Specifications**

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.247

Operation within the bands 902-928 MHz, 2400-2483.5 MHz,  
5725-5850 MHz and 24.0-24.25 GHz bands.

RSS-210, Issue 6 September 2005

Annex 8: Frequency Hopping and Digital Modulation Systems Operating in the  
902—928 MHz ... Band

### **3.2 Deviations From Laboratory Test Procedures**

No deviations from Laboratory Test Procedure

### **3.3 Test Environment**

All tests were performed under the following environmental conditions:

Temperature range	:	15.6 – 23.3 °C
Humidity range	:	26 - 65 %
Pressure range	:	86 - 106 kPa
Power supply range	:	+/- 1% of rated voltages

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**3.4 Test Equipment**

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
119	Antenna, Conical Log Spiral	Electro-Metrics	3101	3018	NCR	Ref. Only
317	Preamp	HP	8449A	2749A00167	2/9/2007	02/09/08
535	Spectrum Analyzer	HP	85680A	2517A01757	5/11/2007	05/11/08
128	Antenna	Electro-Metrics	3104	2882	11/10/2006	11/10/07
111	Antenna, LPA	EMCO	3146	1382	8/7/06	8/7/07
529	Antenna, DRWG	EMCO	3115	2505	8/31/2006	08/31/07
915	EMI Test Receiver 20 Hz- 26.5	Rohde & Schwarz	1088.7490.26	837491/0002	2/6/2007	02/06/08
674	Spectrum Analyzer	HP	8568B	2007A00910	3/13/2007	03/13/08
675	Spectrum Analyzer Display	HP	85662A	2005A01282	3/13/2007	03/13/08
676	Quasi-Peak Adapter	HP	85650A	2430A00576	3/13/2007	03/13/08

OATS: IC Site #: 2040B-1; RN#: 90579

## **Section 4: Observations**

### **4.1 Modifications Performed During Assessment**

No modifications were performed during assessment.

### **4.2 Record Of Technical Judgements**

No technical judgements were made during the assessment.

### **4.3 EUT Parameters Affecting Compliance**

The user of the apparatus could not alter parameters that would affect compliance.

### **4.4 Test Deleted**

No Tests were deleted from this assessment.

### **4.5 Additional Observations**

There were no additional observations made during this assessment.



**Section 5: Results Summary**

This section contains the following:

**Test Results**

The column headed “Required” indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

- N No: not applicable / not relevant
- Y Yes: Mandatory i.e. the apparatus shall conform to these test.
- N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

**5.1 Test Results**

Part 15	FCC Test Description	RSS-210 IC Test Description Annex 8: Frequency Hopping and Digital Modulation Systems Operating in the 902—928 MHz Band	Required	Result
15.247 a1i	20dB Bandwidth	A81(3) The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.	Y	Pass
12.247a1	Channel Separation	A81(3) If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10 second period.	Y	Pass
15.247a1i	Number of Hopping Channels	A81(3)	Y	Pass
15.247 b1	Peak Output Power	A81(2)	Y	Pass
15.209 a 15.247c	Radiated Emissions within Restricted Bands	A81(3), A2.9	Y	Pass
15.247c	Bandedge	A2.9	Y	Pass
15.109	Receiver Spurious Emissions	RSS-GEN	NA	Pass

## Appendix A: Test Results

### 20 dB Bandwidth

Clause 15.247(a)(1)(i)  
 (i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; **if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500kHz.**

### Test Conditions:

<b>Sample Number:</b>		<b>Temperature:</b>	74°F
<b>Date:</b>	7-20-07	<b>Humidity:</b>	65%
<b>Modification State:</b>	Lo/Mid/High Channels	<b>Tester:</b>	Alan Laudani
		<b>Laboratory:</b>	Nemko

### Test Results:

The EUT was placed <1m from the receiving antenna to allow a representative signal to fill the display > 30dB from the noise floor. The Spectrum Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 20 dB lower than PEAK level. The 20 dB bandwidth was determined from where the channel output spectrum intersected the display line.

Channel Range	20dB Bandwidth
Low (909.546 MHz)	326 kHz
Mid (914.439 MHz)	286 kHz
High (918.780 MHz)	310 kHz

Equipment Used: 119, 835

### Low Channel 909.546 MHz

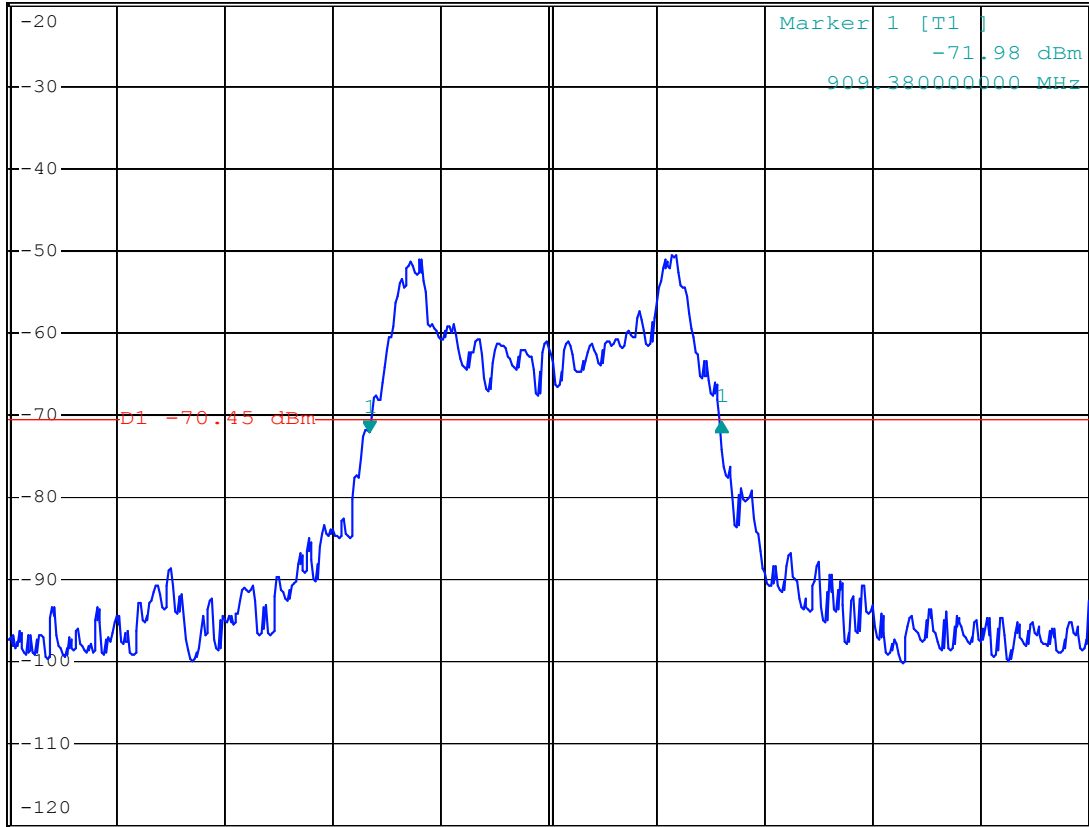


\*RBW 10 kHz    Delta 1 [T1 ]  
\*VBW 3 MHz                    1.26 dB  
SWT 10 ms                    326.00000000 kHz

Ref -20 dBm

Att 10 dB

1 PK  
VIEW



Center 909.546 MHz                    100 kHz/                    Span 1 MHz

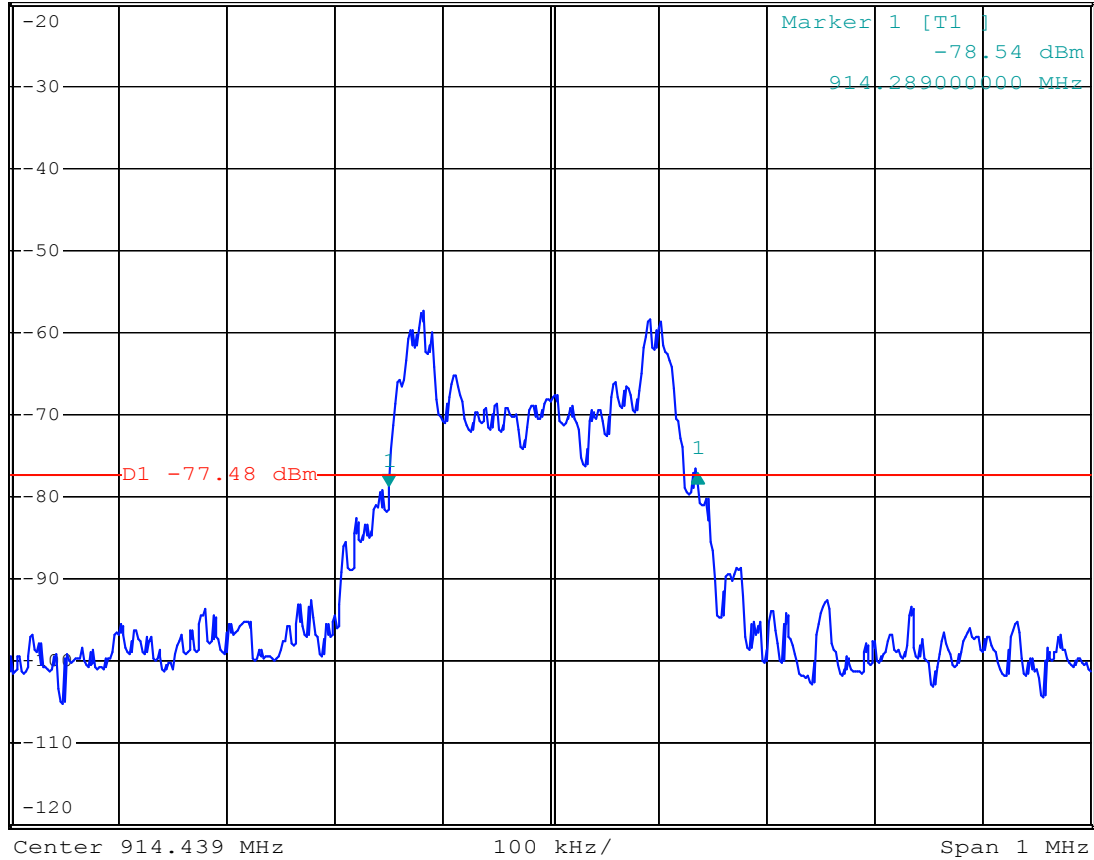
Date: 20.JUL.2007 10:09:46

### Mid Channel 914.439 MHz



\*RBW 10 kHz    Delta 1 [T1 ]  
\*VBW 3 MHz                    1.57 dB  
Ref -20 dBm    Att 10 dB    SWT 10 ms    286.00000000 kHz

1 PK  
VIEW



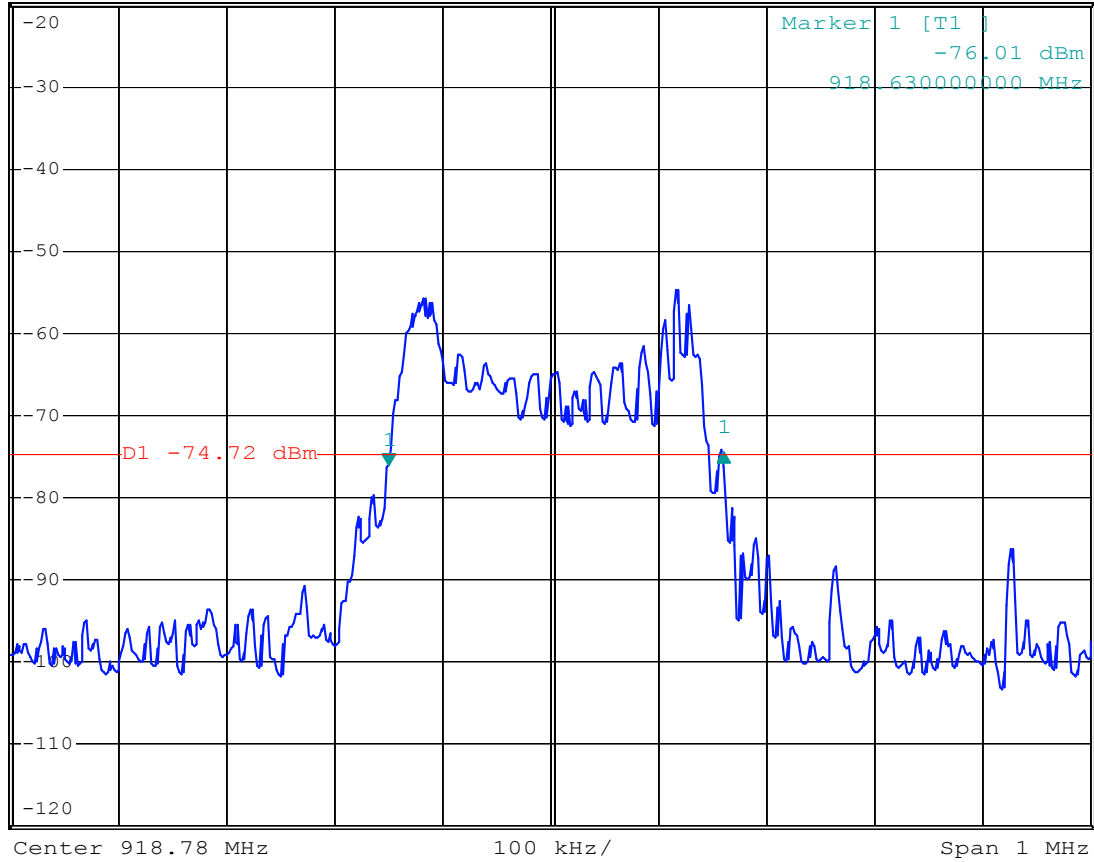
Date: 20.JUL.2007 10:05:52

### High Channel 918.780 MHz



\*RBW 10 kHz    Delta 1 [T1 ]  
\*VBW 3 MHz                    1.61 dB  
Ref -20 dBm    Att 10 dB    SWT 10 ms    310.000000000 kHz

1 PK  
VIEW



Date: 20.JUL.2007 10:08:21

**Time of Occupancy**

Clause 15.247(a)(1)(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, **the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.** The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

**Test Conditions:**

<b>Sample Number:</b>		<b>Temperature:</b>	74°F
<b>Date:</b>	7-25-07	<b>Humidity:</b>	60%
<b>Modification State:</b>	Lo/Mid/High Channels	<b>Tester:</b>	Alan Laudani
		<b>Laboratory:</b>	Nemko

**Test Results:**

The EUT was placed <1m from the receiving antenna to allow a representative signal to fill the display > 30dB from the noise floor. The Spectrum Analyzer RES BW was set to 100 kHz. The test sample was set to hopping mode and the frequency span was set zero. The sweep was set to 10 seconds.

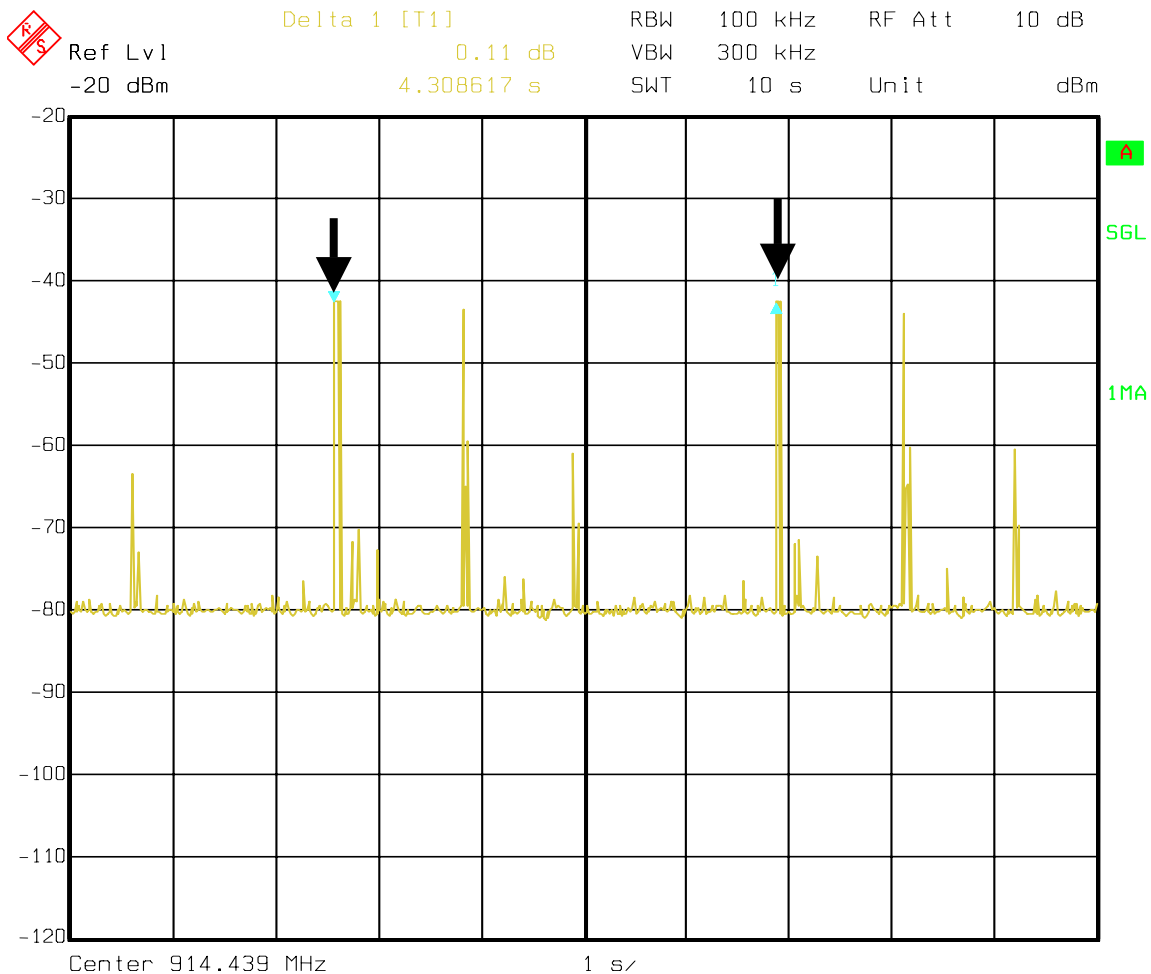
2 occurrences in 10 seconds x 48.8 ms = 96 ms which is less than 400 ms  
EUT complies.

**Duty Cycle Factor Calculation**

Since there is an emission for each channel 48.8ms in 200 ms and no repeat for 4.3 seconds, one could conclude that a duty cycle exists 48.8ms per 100 ms or 48.8%. Duty cycle factor is  $20 \times \text{Log}(\text{duty cycle}) = 20 \times \log (.488) = -6.23$ . Round to -6.2 as measurements are to nearest 0.1. Actual duty cycle would be less. Use of a Keyfob transmitter for remote control devices like garage door openers, automobile alarm systems, etc. imply intermittent use over time.

**Equipment Used: 119, 835**

This channel was on twice in 10 seconds 4.3 seconds apart.  
Other emissions are reflections of adjacent channels.

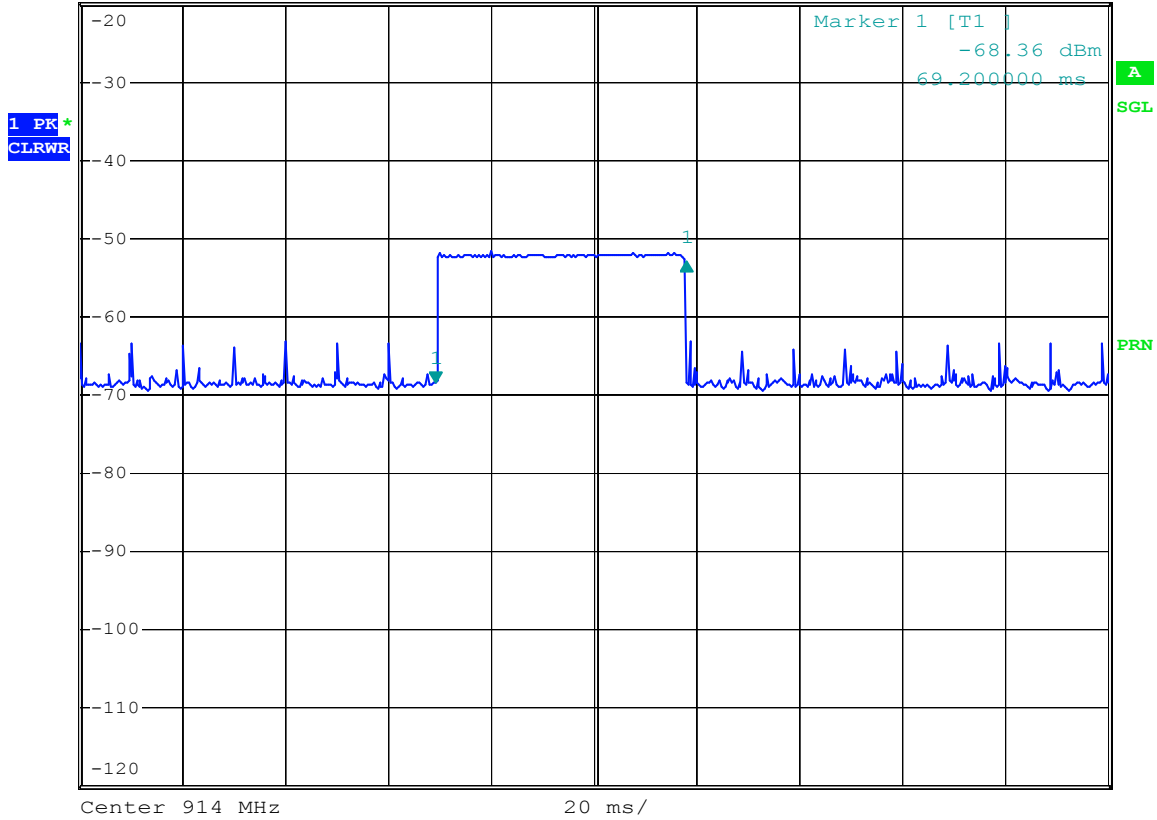


Date: 25.JUN.2007 16:39:07

This channel was on 48.8 ms.



RBW 10 MHz    Delta 1 [T1 ]  
\*VBW 3 MHz                    15.41 dB  
Ref -20 dBm            Att 10 dB            SWT 200 ms            48.800000 ms



Date:            20.JUL.2007    10:37:46



### Channel Separation

Clause 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

### Test Conditions:

<b>Sample Number:</b>		<b>Temperature:</b>	74°F
<b>Date:</b>	7-20-07	<b>Humidity:</b>	65%
<b>Modification State:</b>	Lo/Mid/High Channels	<b>Tester:</b>	Alan Laudani
		<b>Laboratory:</b>	Nemko

### Test Results:

The EUT was placed <1m from the receiving antenna to allow a representative signal to fill the display > 30dB from the noise floor. The Spectrum Analyzer RES BW was set to 10 kHz. The test sample was set to hopping mode and the frequency span was set to a value to capture two or more hopping channels. Marker delta shows frequency separation.

**Equipment Used: 119, 835**

Channel Separation equal to the 20 dB bandwidth.  
344 kHz

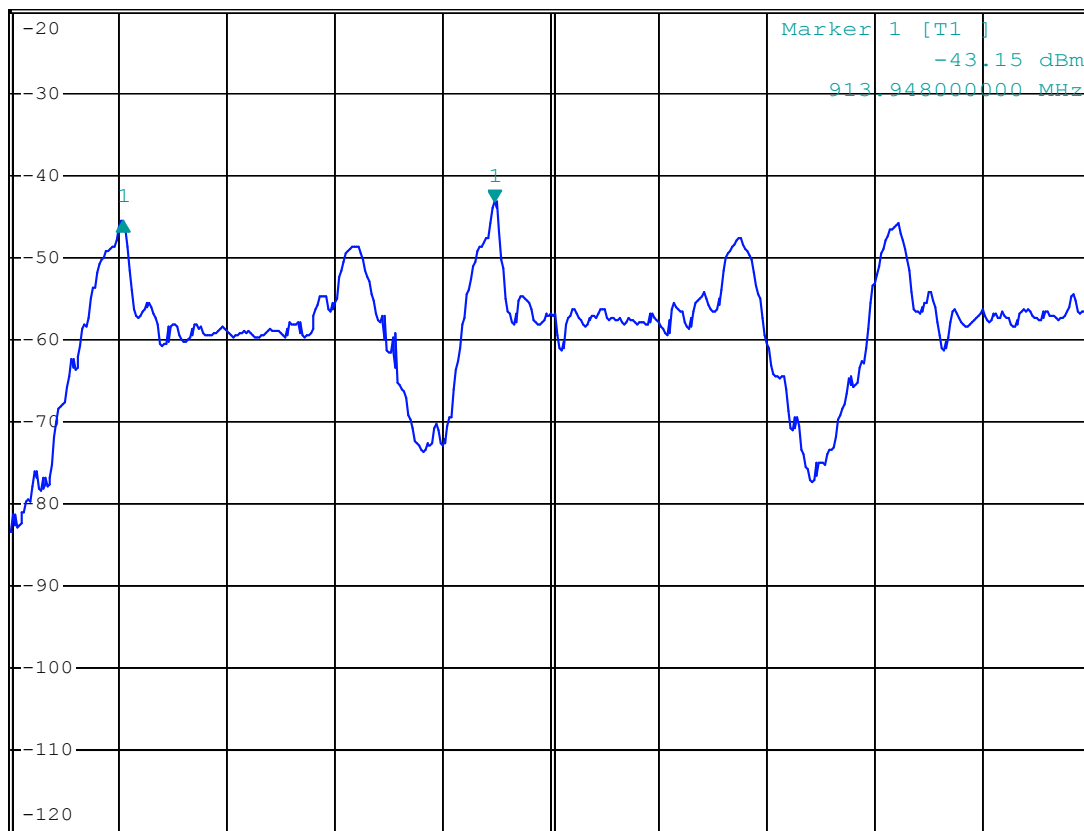


\*RBW 10 kHz Delta 1 [T1 ]  
\*VBW 3 MHz -2.35 dB  
SWT 10 ms -344.000000000 kHz

Ref -20 dBm

Att 10 dB

1 PK  
VIEW



Center 914 MHz

100 kHz/

Span 1 MHz

Date: 20.JUL.2007 10:31:46

### Frequency Plan

Clause 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. **The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.**

### Test Conditions:

<b>Sample Number:</b>		<b>Temperature:</b>	74°F
<b>Date:</b>	7-30-07	<b>Humidity:</b>	60%
<b>Modification State:</b>	Lo/Mid/High Channels	<b>Tester:</b>	Alan Laudani
		<b>Laboratory:</b>	Nemko

### Test Results:

The Frequency Plan is discussed in the Technical Description exhibit and was reviewed by this test engineer and was found to comply.

### Number of Hopping Channels

Clause 15.247(a)(1)(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, **the system shall use at least 25 hopping frequencies** and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

### Test Conditions:

<b>Sample Number:</b>		<b>Temperature:</b>	74°F
<b>Date:</b>	7-30-07	<b>Humidity:</b>	60%
<b>Modification State:</b>	Lo/Mid/High Channels	<b>Tester:</b>	Alan Laudani
		<b>Laboratory:</b>	Nemko

### Test Results:

The EUT was placed <1m from the receiving antenna to allow a representative signal to fill the display > 30dB from the noise floor. The Spectrum Analyzer RES BW was set to 30 kHz to discriminate channels. The test sample was set to hopping mode and the frequency span was set to a value small enough to display the channels to allow counting. Three continuous scans shows the complete band from 902 MHz to 928 MHz and 25 channels are evident.

Equipment Used: 119, 835

6 Hopping channels

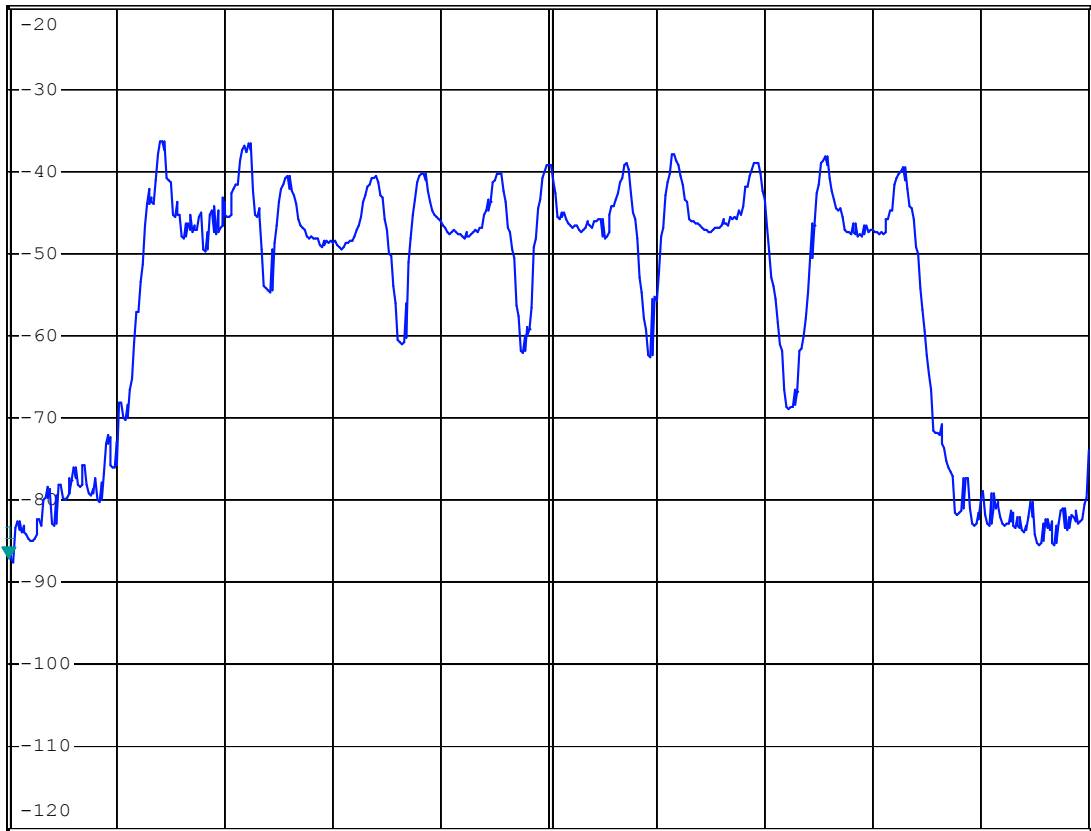


\*RBW 30 kHz    Marker 1 [T1 ]  
\*VBW 300 kHz    -87.15 dBm  
SWT 5 ms    909.00000000 MHz

Ref -20 dBm

Att 10 dB

1 PK  
MAXH



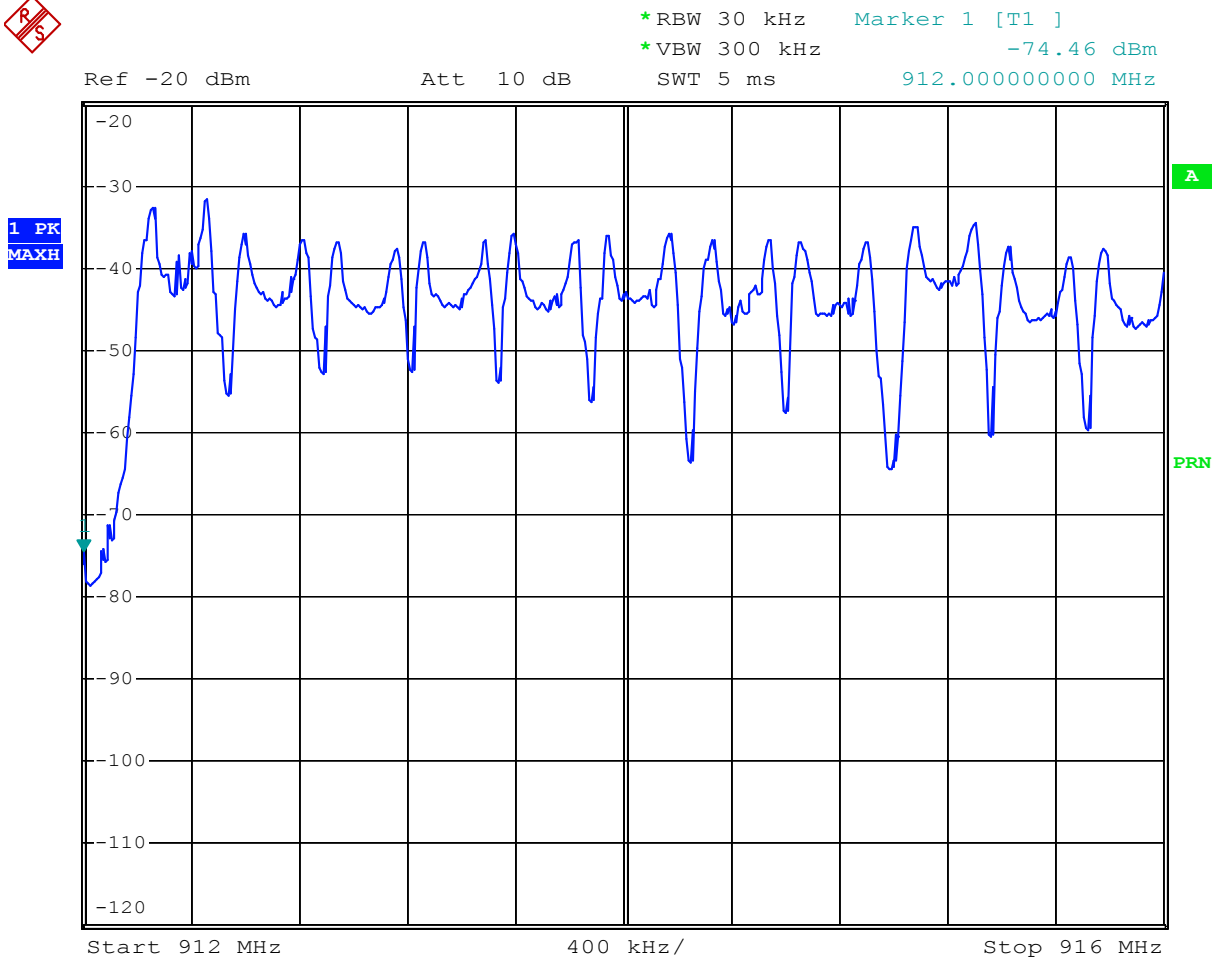
Start 909 MHz

300 kHz/

Stop 912 MHz

Date: 20.JUL.2007 09:57:59

11 Hopping channels  
Break in continuity between 6<sup>th</sup> and 7<sup>th</sup> as planned.

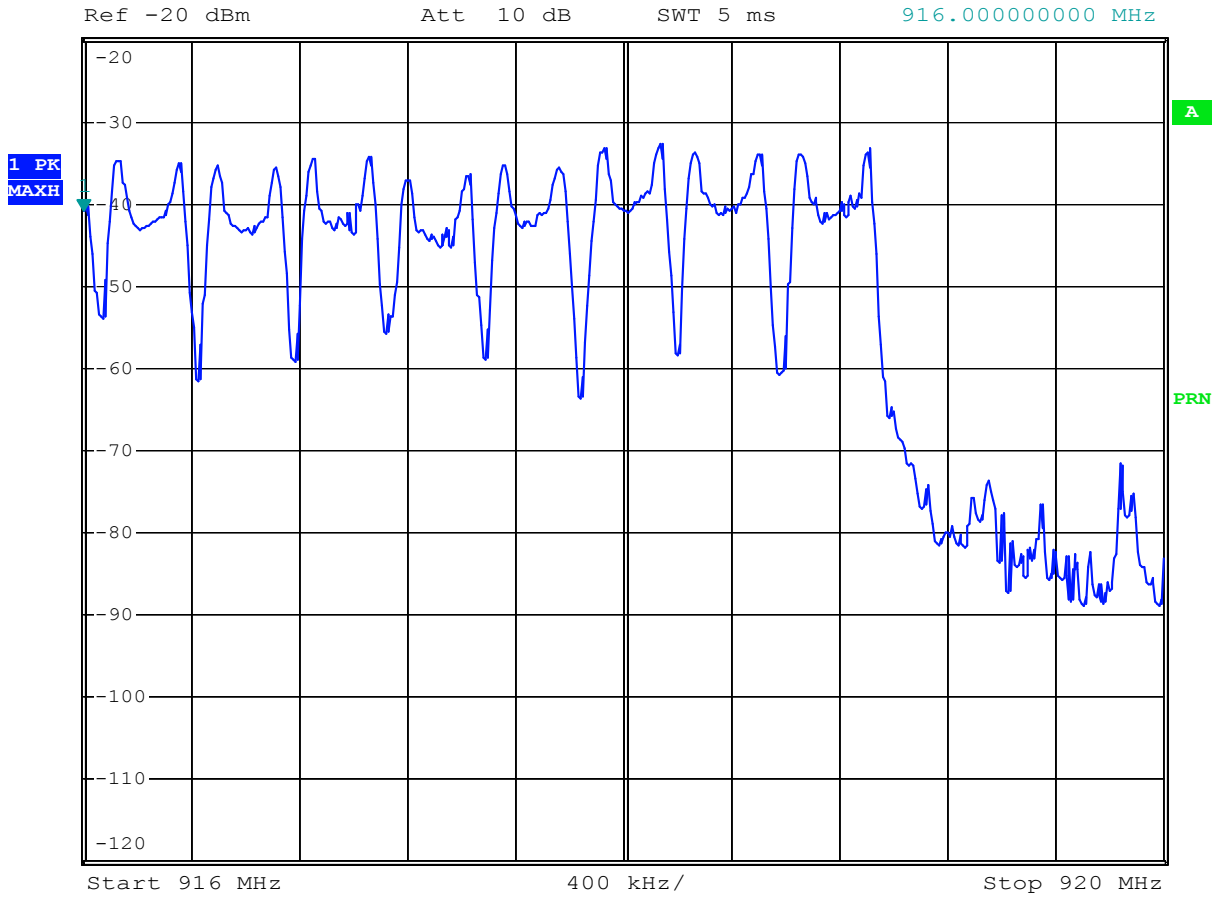


Date: 20.JUL.2007 10:00:56

8 Hopping channels  
 $6 + 11 + 8 = 25$



\*RBW 30 kHz    Marker 1 [T1 ]  
\*VBW 300 kHz    -40.96 dBm  
SWT 5 ms    916.00000000 MHz



Date: 20.JUL.2007 10:02:18

**Radiated Emissions within Restricted Bands**

Clause 15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (uV/meter)	Measurement Distance (meter)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a) must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

**Test Conditions:**

<b>Sample Number:</b>		<b>Temperature:</b>	74.0°F
<b>Date:</b>	7-20-07	<b>Humidity:</b>	65 %
<b>Modification State:</b>	Lo/Mid/High Channels	<b>Tester:</b>	A. Laudani
		<b>Laboratory:</b>	SOATS

**Test Results:**

See Table Below.

**Additional Observations:**

The Spectrum was searched from 30 MHz to the 10<sup>th</sup> Harmonic.

Three orthogonal axes were tried to maximize emissions. Worst case was used in measurements presented. A new battery was installed initially and replaced every 20 minutes of test time.

There are no emissions found that apply to the restricted bands defined in FCC Part 15 Subpart C, 15.205. The EUT was measured on three orthogonal axes. Worst case measured with antenna horizontal and vertical. Measurements below 1GHz were performed at 3m with a Quasi-Peak detector while Peak and Average detectors were used above 1GHz. As the emission is pulsing, a duty cycle factor was introduced to spurious harmonics. See calculation in section on Time of Occupancy.



**Nemko USA, Inc.**

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Report Number: 2007 076353-2 FCC

Specification: FCC Part 15 Subpart C, 15.247

### **Radiated Emissions 30 MHz to 1000 MHz**

No emissions found within 20 dB of the limits of Part 15, Subpart C 15.209 and 15.205.

Equipment used 111, 128, 674, 675, 676 in a 1m prescan in an enclosed shielded room.

Math: Corrected Reading =

Max of Vertical or Horizontal measured + Antenna Factor + Cable Loss – preamplifier (if used). – Duty Cycle Factor

CR/SL Dif = Limit – Corrected Reading. Pass if result is negative.

At 1819.092 MHz:  $52.4 = 59.1 + 25.5 + 2.0 - 28.0 - 6.2$

$52.4 - 74 = -21.6$

OATS: IC Site #: 2040B-1; RN#: 90579

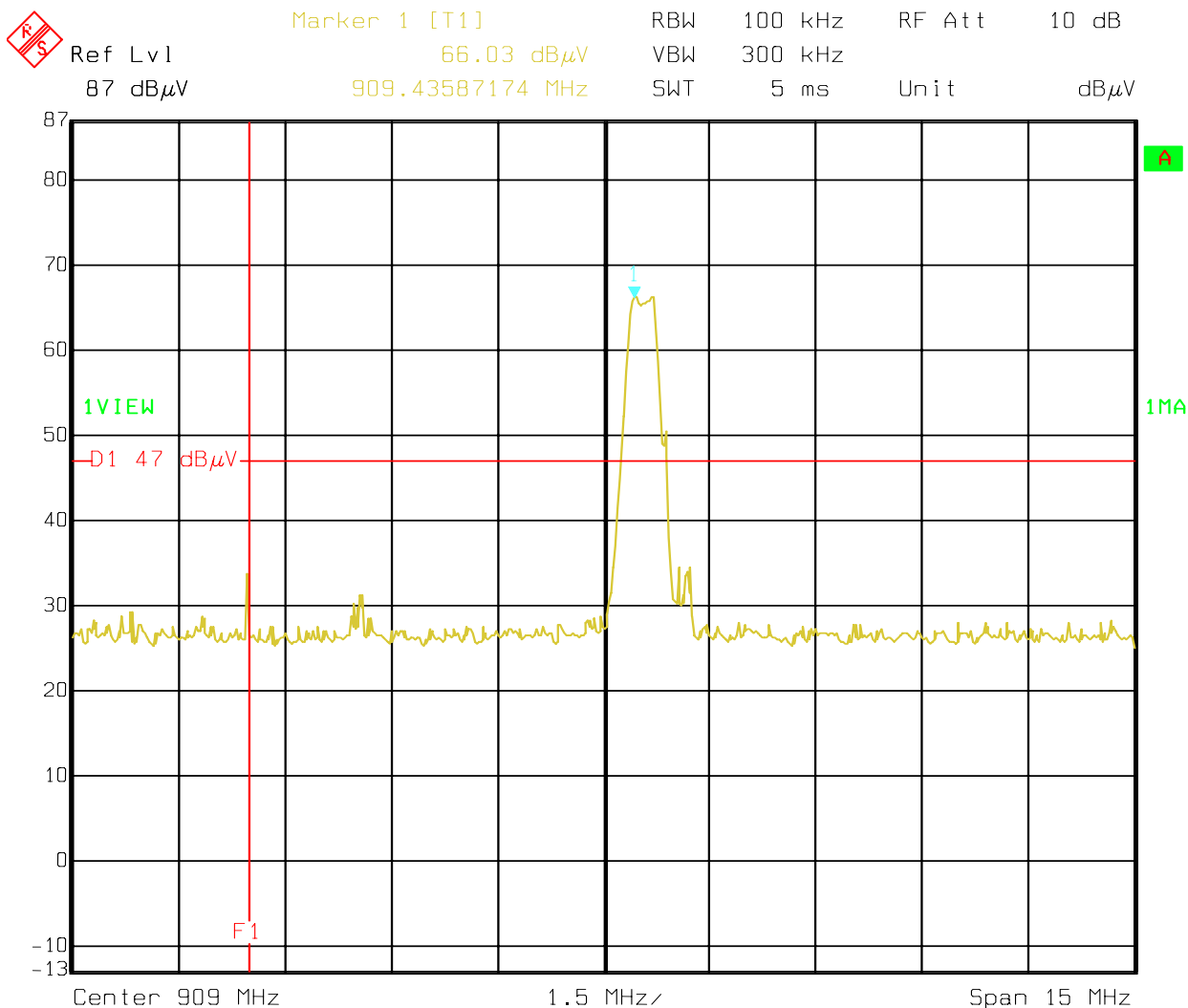


### Bandedge Measurements

3m site SOATS, equipment used: 835, 111, Peak hold three sweeps and view.

#### Low Channel Not Hopping Mode

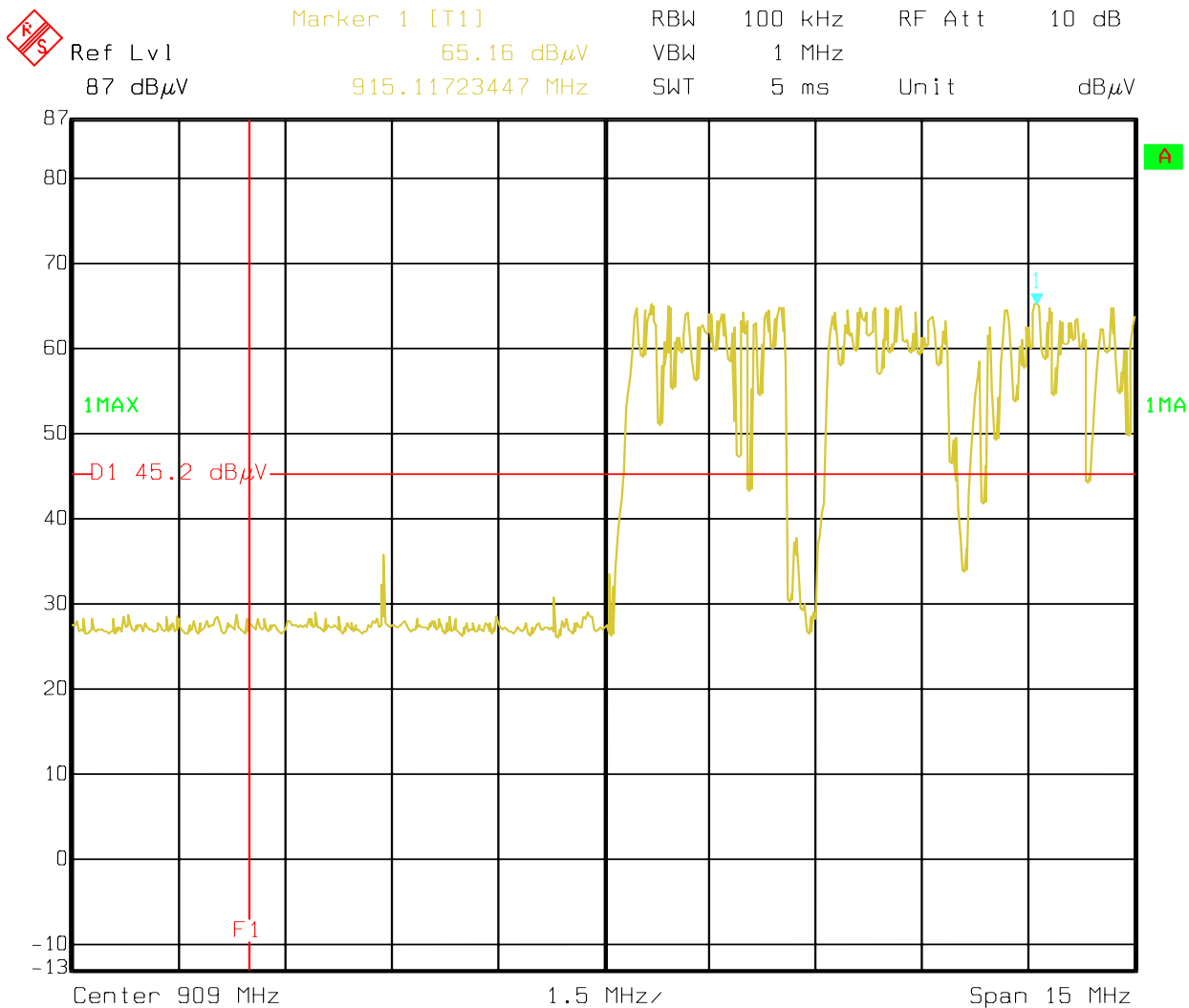
Frequency Line F1 is 902 MHz  
Display Line D1 is 20 dBc



Date: 20.JUN.2007 16:47:11

**Low Channel Hopping Mode**

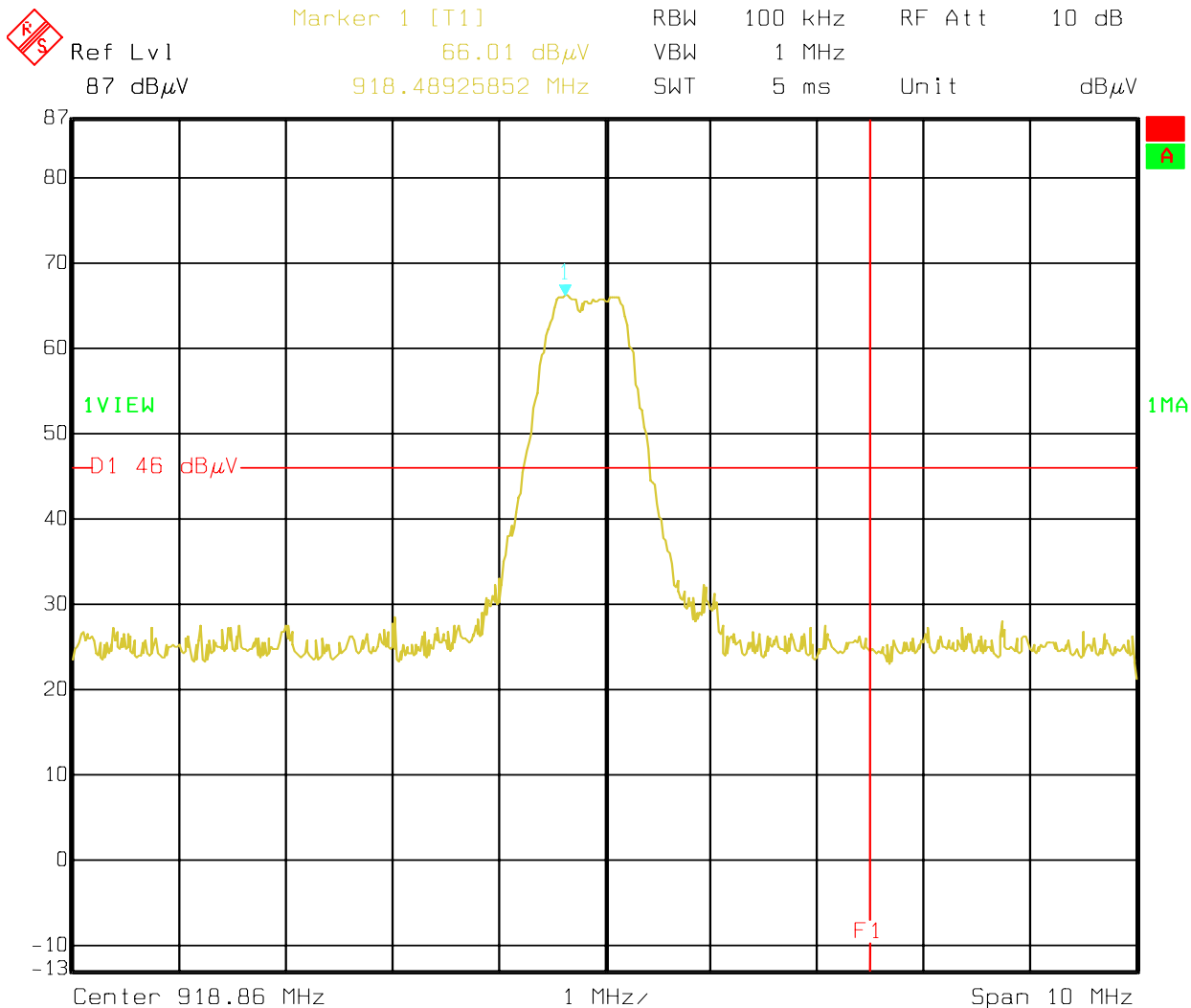
**Frequency Line F1 is 902 MHz**  
**Display Line D1 is 20 dBc**



Date: 20.JUN.2007 16:59:45

**High Channel Not Hopping Mode**

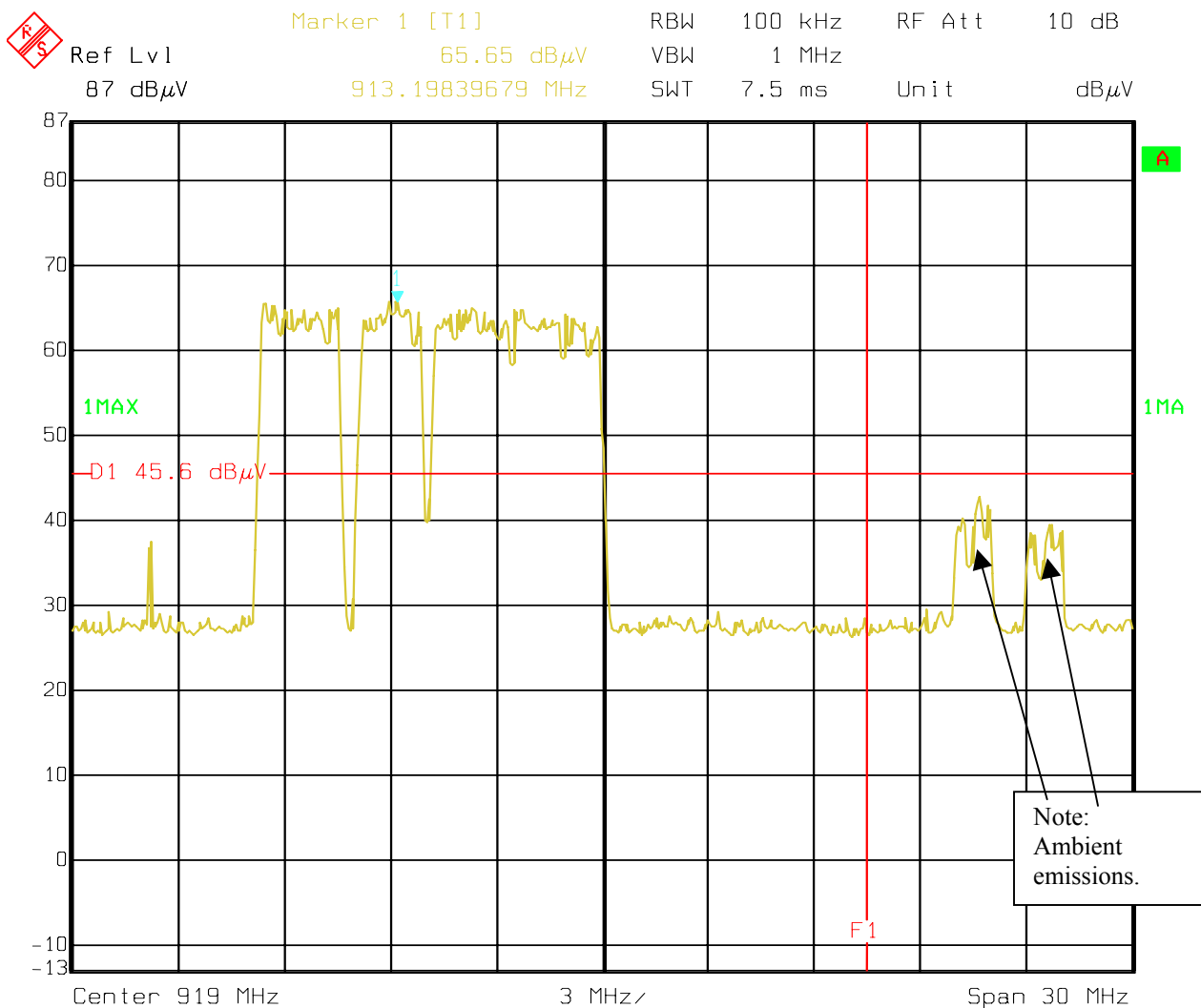
**Frequency Line F1 is 928 MHz**  
**Display Line D1 is 20 dBc**



Date: 20.JUN.2007 16:40:56

**High Channel Hopping Mode**

**Frequency Line F1 is 928 MHz**  
**Display Line D1 is 20 dBc**



Date: 20.JUN.2007 17:02:09

**Peak Output Power**

Clause 15.247(b)(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, **0.25 watts for systems employing less than 50 hopping channels**, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

**Test Conditions:**

<b>Sample Number:</b>		<b>Temperature:</b>	74°F
<b>Date:</b>	July 20, 2007	<b>Humidity:</b>	65%
<b>Modification State:</b>	Lo/Mid/High Channels	<b>Tester:</b>	Alan Laudani
		<b>Laboratory:</b>	Nemko

**Test Results:**

The equivalent power of the field strength is 1 mW therefore the EUT complies.

**Radiated Peak Output Power:**

Channel	Frequency	Corrected Field Strength dBuV/m	Calculated Output Power (W)
Low	909.546 MHz	94.4	0.00082
Mid	914.439 MHz	95.0	0.00094
High	918.780 MHz	94.4	0.00082

$10^{((\text{dBuV/m}-120)/20)} = \text{Volts/m}$

Field Strength in Volts/m = 5.5 x Square Root (Power in W)/3m

Power in Watts = (Field Strength x 3/5.5)<sup>2</sup>

95 dBuV/m = 0.056 V/m

Field Strength of 0.50 V/m = 0.00094 W.

## 2.1. Appendix B: Setup Photographs

### Radiated Emissions Setup:





**Nemko USA, Inc.**

IC: 1513A-7642

FCC ID: EZSDEI7642

11696 Sorrento Valley Road, Suite F, San Diego, CA 92121  
Phone (858) 755-5525 Fax (858) 452-1810

Report Number: 2007 076353-2 FCC  
Specification: FCC Part 15 Subpart C, 15.247

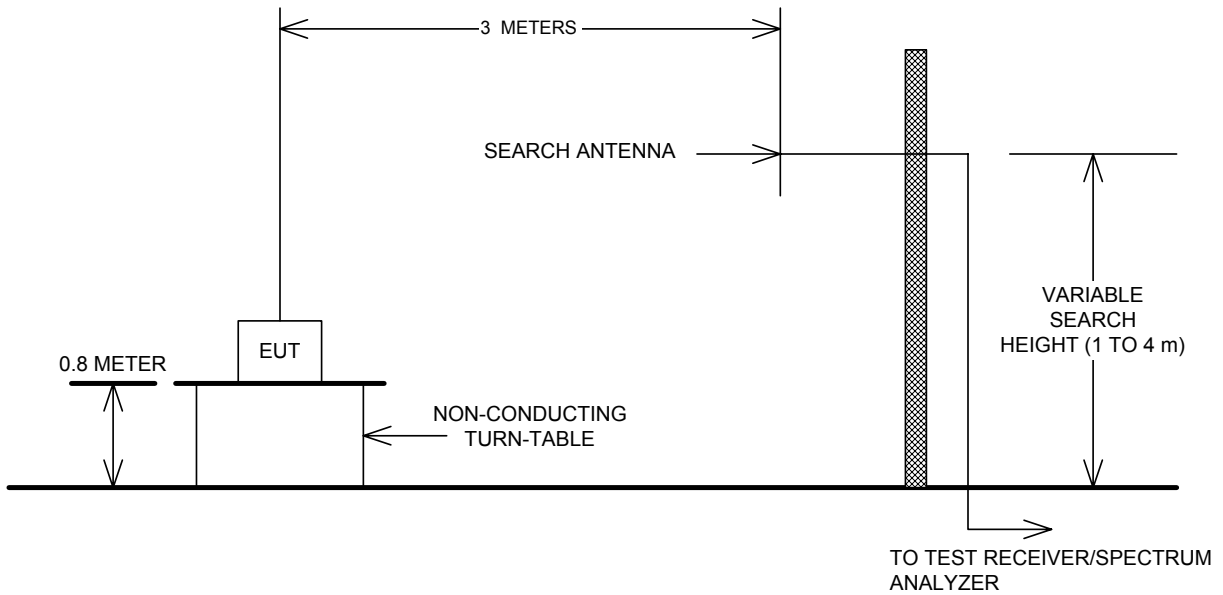
### **Relative Emissions Setup:**

Number of Hopping Frequencies, Channel Separation, ETC. where the actual amplitude is not measured.



## 2.2 Appendix C: Block Diagram of Test Setups

### Test Site For Radiated Emissions



### Conducted Emissions

Not tested as no connection can be made to the device.