

2.9 Peak Radiated Spurious Emission in the Frequency Range 30 -25000 MHz (FCC Section 15.247(c))

The EUT was hop-stopped and when possible, placed into a continuous transmit mode of operation. A preliminary scan was performed on the EUT to determine frequencies that were caused by the transmitter portion of the product. Significant emissions that fell within restricted bands were then measured on an OAT's site. Radiated measurements below 1 GHz were tested with a RBW = 120 kHz. Radiated measurements above 1 GHz were measured using a RBW = VBW = 1 MHz. The results of peak radiated spurious emissions falling within restricted bands are given in Table 4a –4c and Figure 5a1 – Figure 5c7.

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Rev: 012804

Issue Date: April 1, 2005

Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

TABLE 4a PEAK RADIATED SPURIOUS EMISSIONS (Low Channel)

Peak Radiated Emissions							
Test By:	Test: Part 15.247 Certification Low Channel				Client: Wireless Detection		
DPB	Project: 05-0073				Model: SR-002		
Frequency	Test Data	Test Data	AF+CA-AMP	Results	Limits	Margin	PK = n
(MHz)	(dBm)	(dBuV)	(dB)	(uV/m)	(uV/m)	(dB)	/ QP
311.08	-71.3	35.7	19.7	591.7	84664.5	43.1	PK
902.31	-19.0	88.0	30.6	846644.8			PK
1804.67	-33.0	74.0	-4.7	2922.9	84664.5	29.2	PK
2707	-45.0	62.0	-2.5	939.8	5000.0	14.5	PK

Data corrected by 1 dB for loss of high pass filter except for fundamental frequency

SAMPLE CALCULATION:

RESULTS (uV/m @ 3m) = Antilog $((-71.3 + 19.7 + 107)/20) = 591.7$

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: March 30, 2005

Tester

Signature:  **Name:** David Blethen

Report Number: 05-0073

Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

Rev: 012804

Issue Date: April 1, 2005

Figure 5a-1
Peak Radiated Spurious Emission 15.247(c) Low Channel –
Sub-Harmonic

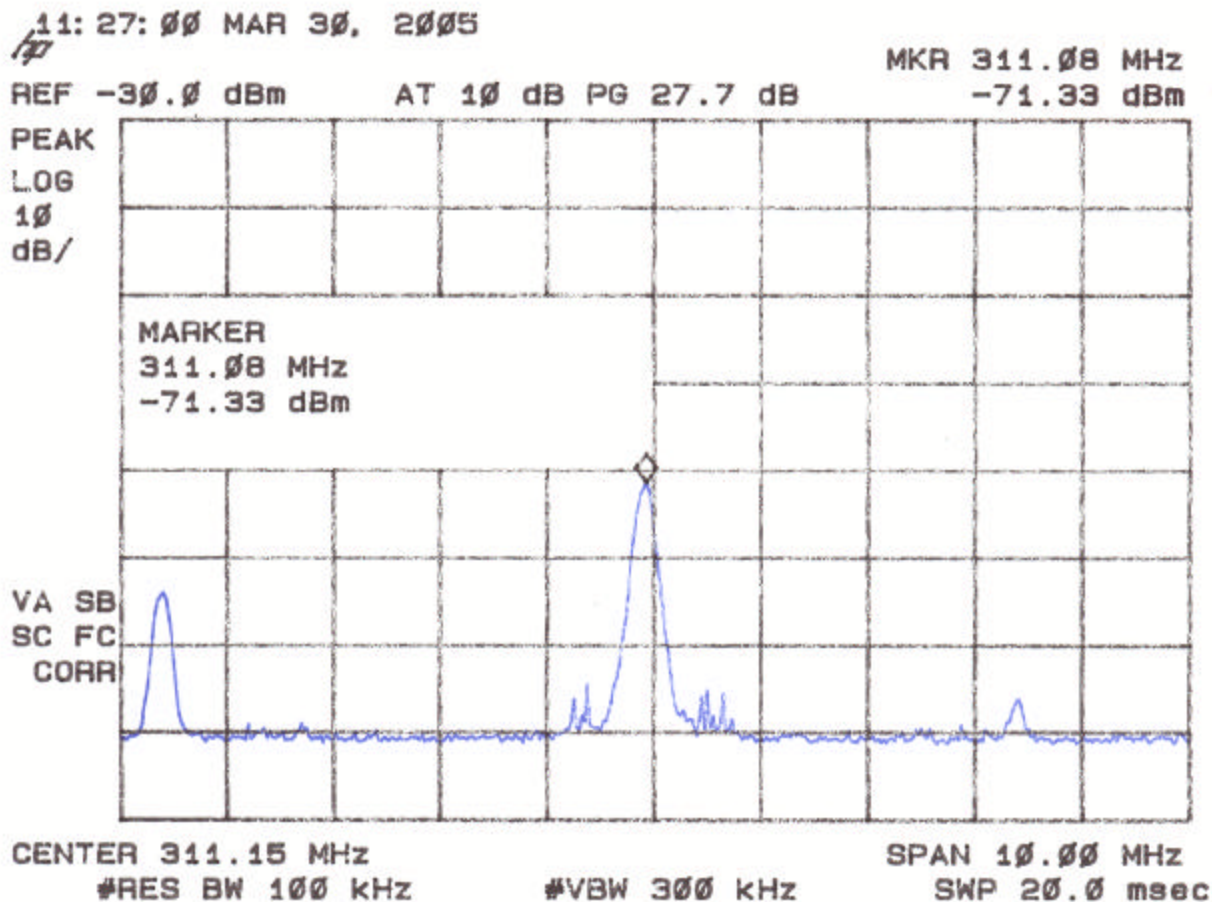


Figure 5a-2
Peak Radiated Spurious Emission 15.247(c) Low Channel –
Fundamental

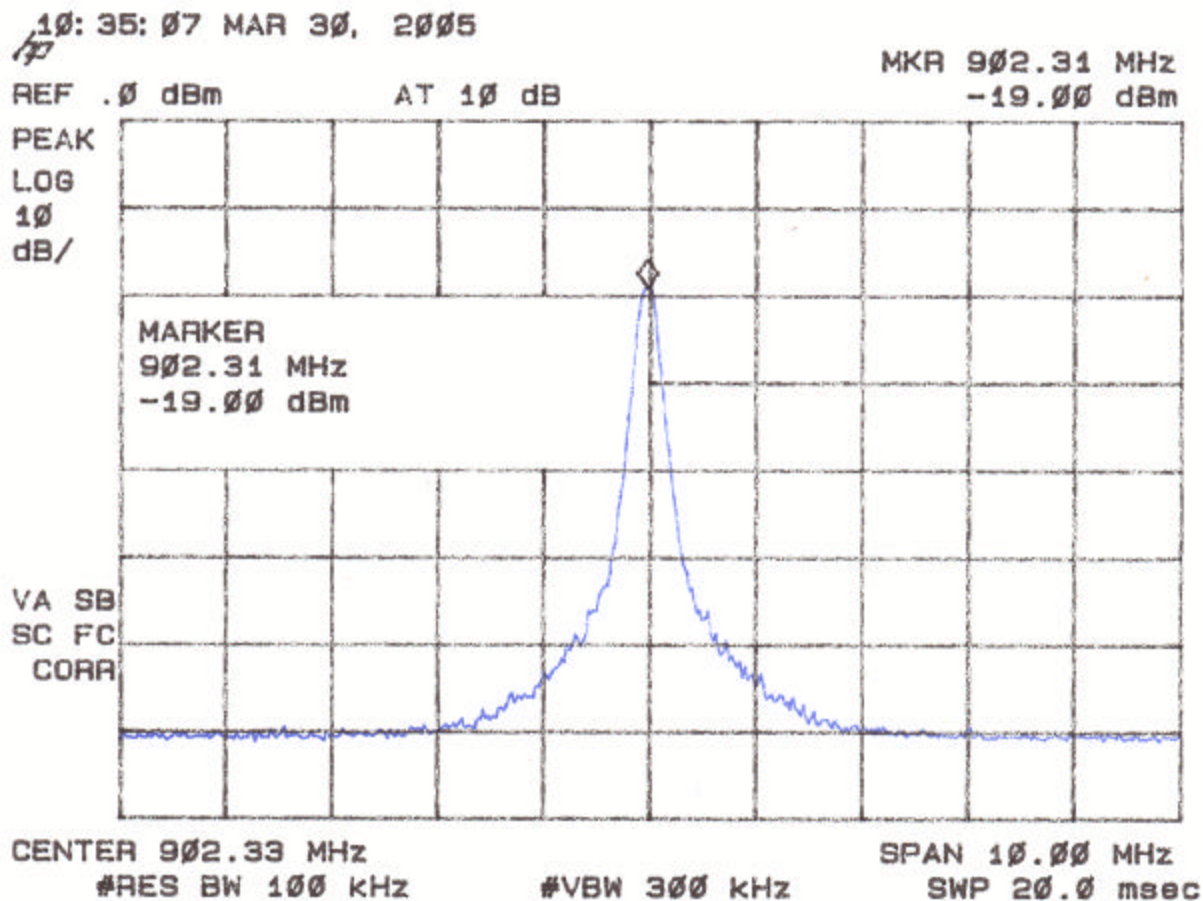
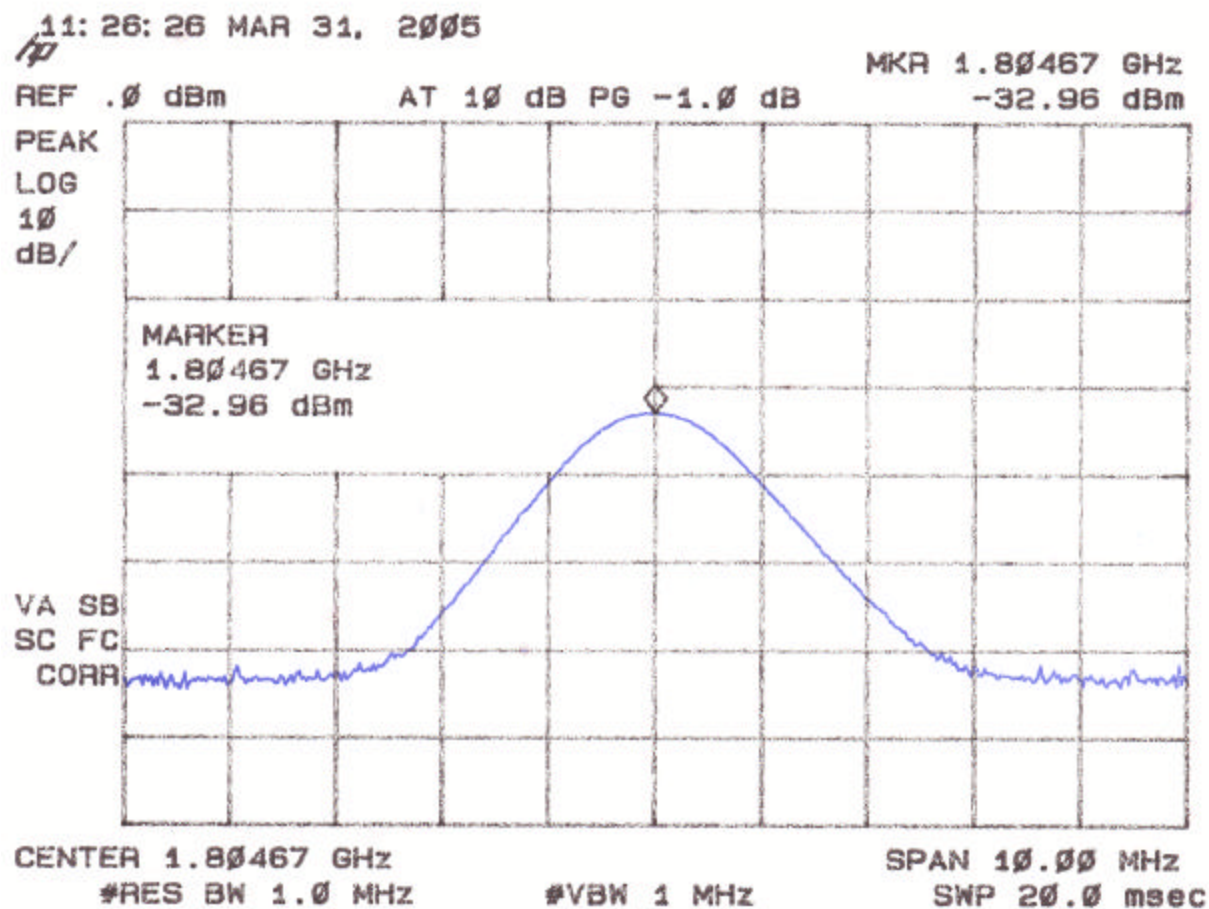


Figure 5a-3
Peak Radiated Spurious Emission 15.247(c) Low Channel –
2nd Harmonic



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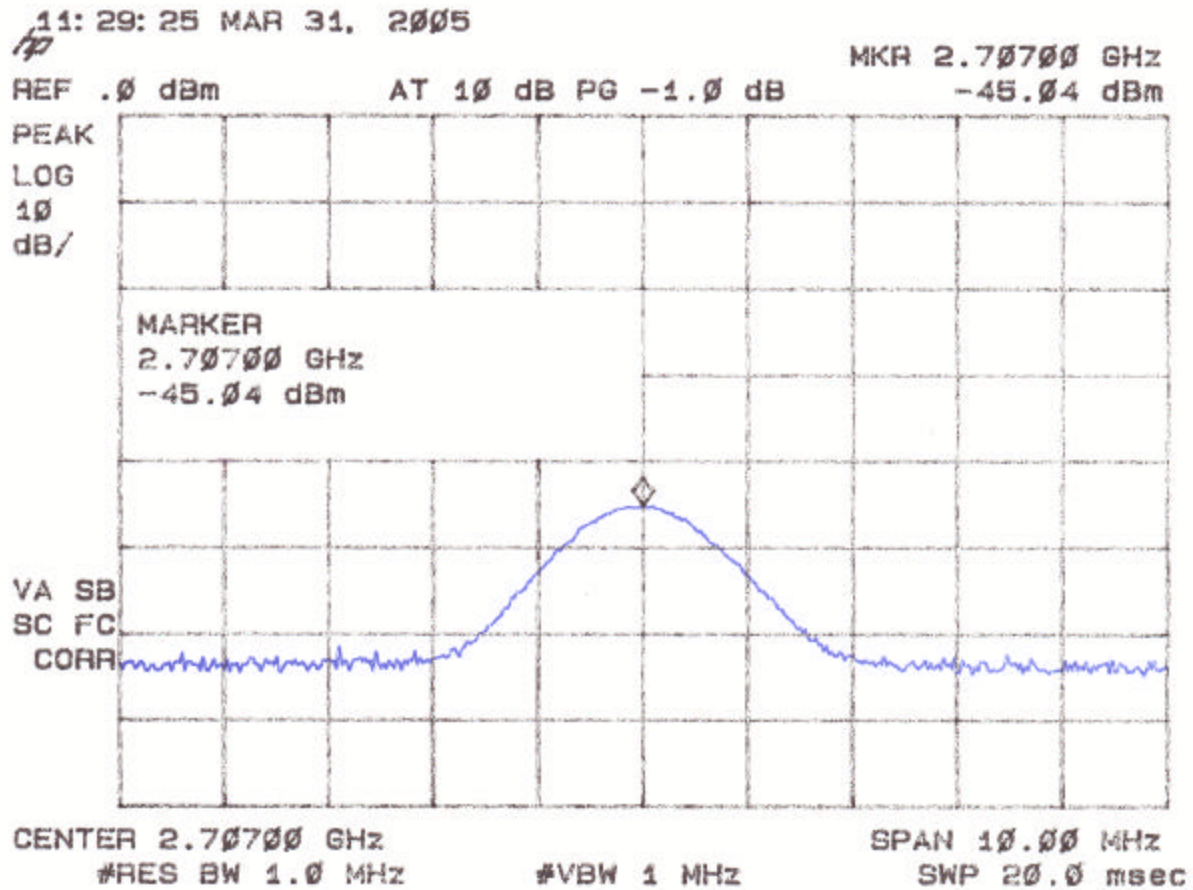
Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

Rev: 012804

Issue Date: April 1, 2005

Figure 5a-4
Peak Radiated Spurious Emission 15.247(c) Low Channel –
3rd Harmonic



Report Number: 05-0073
Customer: Wireless Detection
Model: SR-002 Rev 02 System Repeater

Rev: 012804
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TABLE 4b PEAK RADIATED SPURIOUS EMISSIONS (Mid Channel)

Peak Radiated Emissions							
Test By:	Test: Part 15.247 Certification Mid Channel				Client: Wireless Detection		
DPB	Project: 05-0073				Model: SR-002		
Frequency	Test Data	Test Data	AF+CA-AMP	Results	Limits	Margin	PK = n
(MHz)	(dBm)	(dBuV)	(dB)	(uV/m)	(uV/m)	(dB)	/ QP
323.73	-74.9	32.1	19.1	364.9	5000.0	22.7	PK
915.01	-19.1	87.9	30.8	859617.3			PK
1829.98	-32.6	74.4	-4.6	3107.3	85961.7	28.8	PK
2745.08	-41.4	65.6	-2.4	1438.8	5000.0	10.8	PK

Data corrected by 1 dB for loss of high pass filter except for fundamental frequency

SAMPLE CALCULATION:

RESULTS (uV/m @ 3m) = Antilog $((-74.9 + 19.1 + 107)/20)$ = 364.9

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: March 30, 2005

Tester

Signature:  **Name:** David Blethen

Report Number: 05-0073

Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

Rev: 012804

Issue Date: April 1, 2005

Figure 5b-1
Peak Radiated Spurious Emission 15.247(c) Mid Channel –
Sub Harmonic

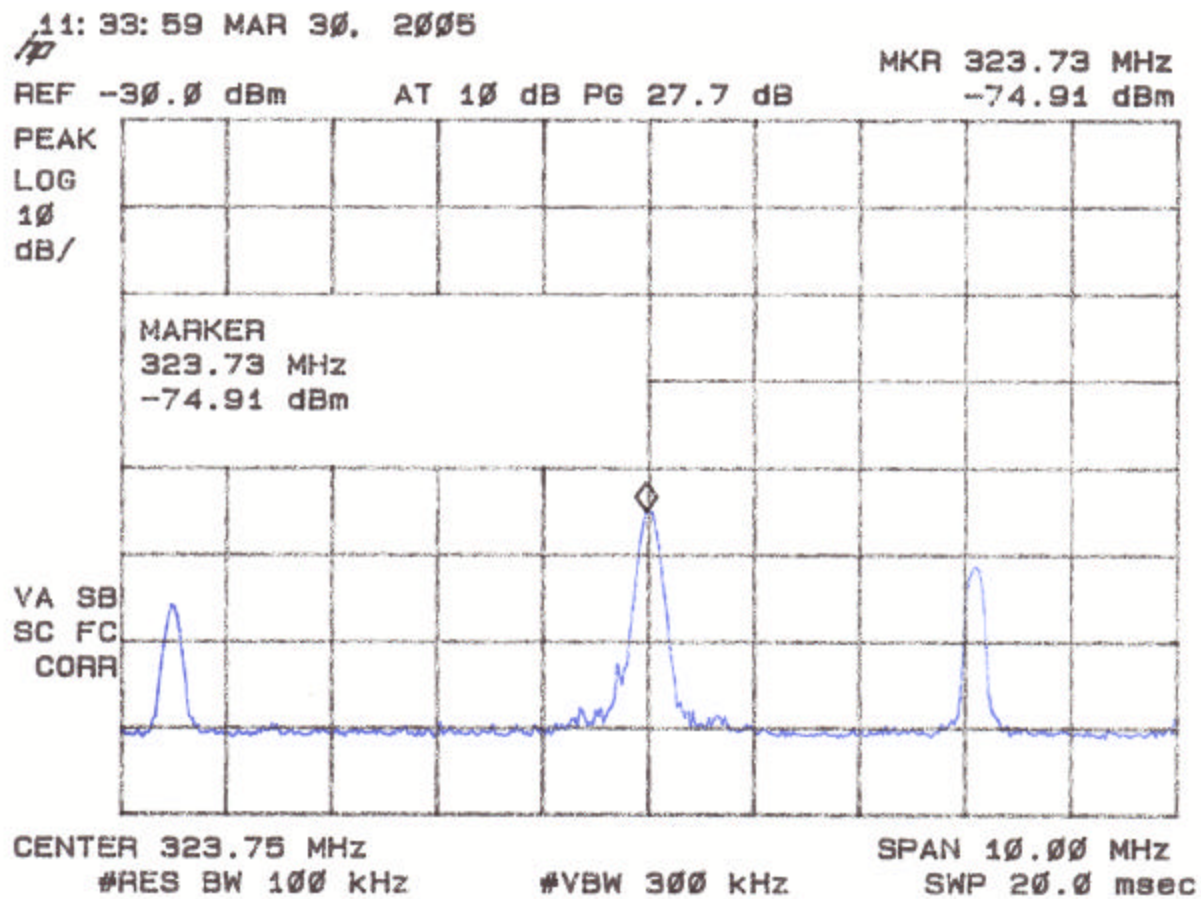
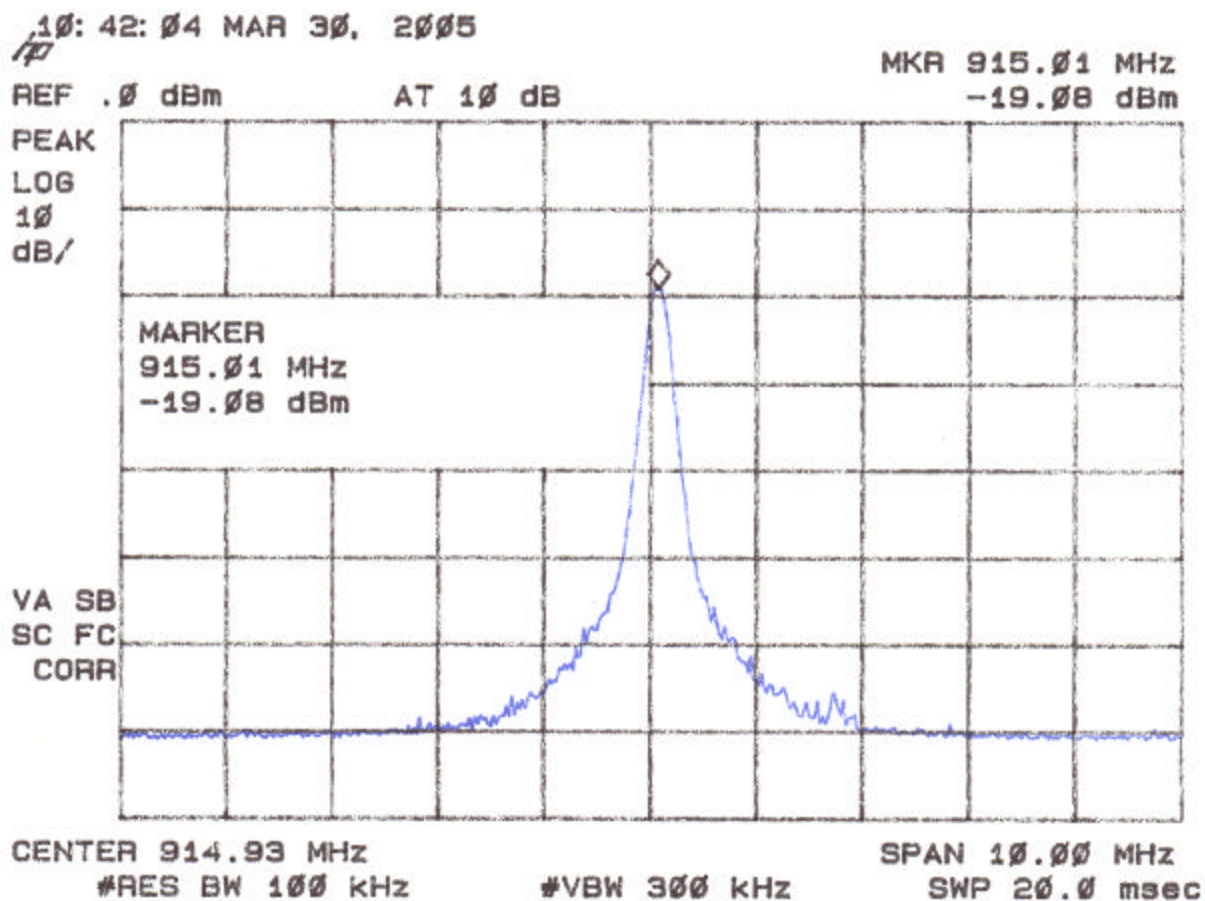


Figure 5b-2
Peak Radiated Spurious Emission 15.247(c) Mid Channel –
Fundamental



Report Number: 05-0073

Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

Rev: 012804

Issue Date: April 1, 2005

Figure 5b-3
Peak Radiated Spurious Emission 15.247(c) Mid Channel –
2nd Harmonic

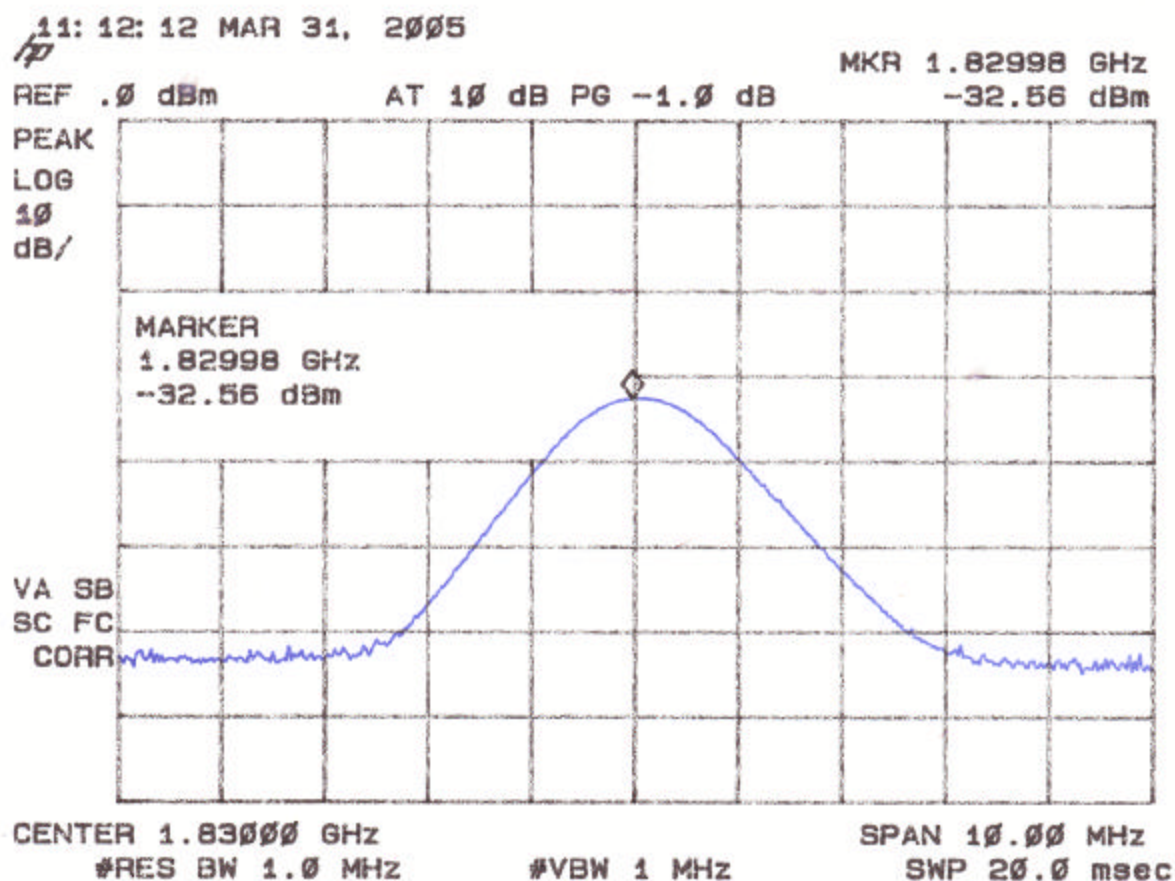
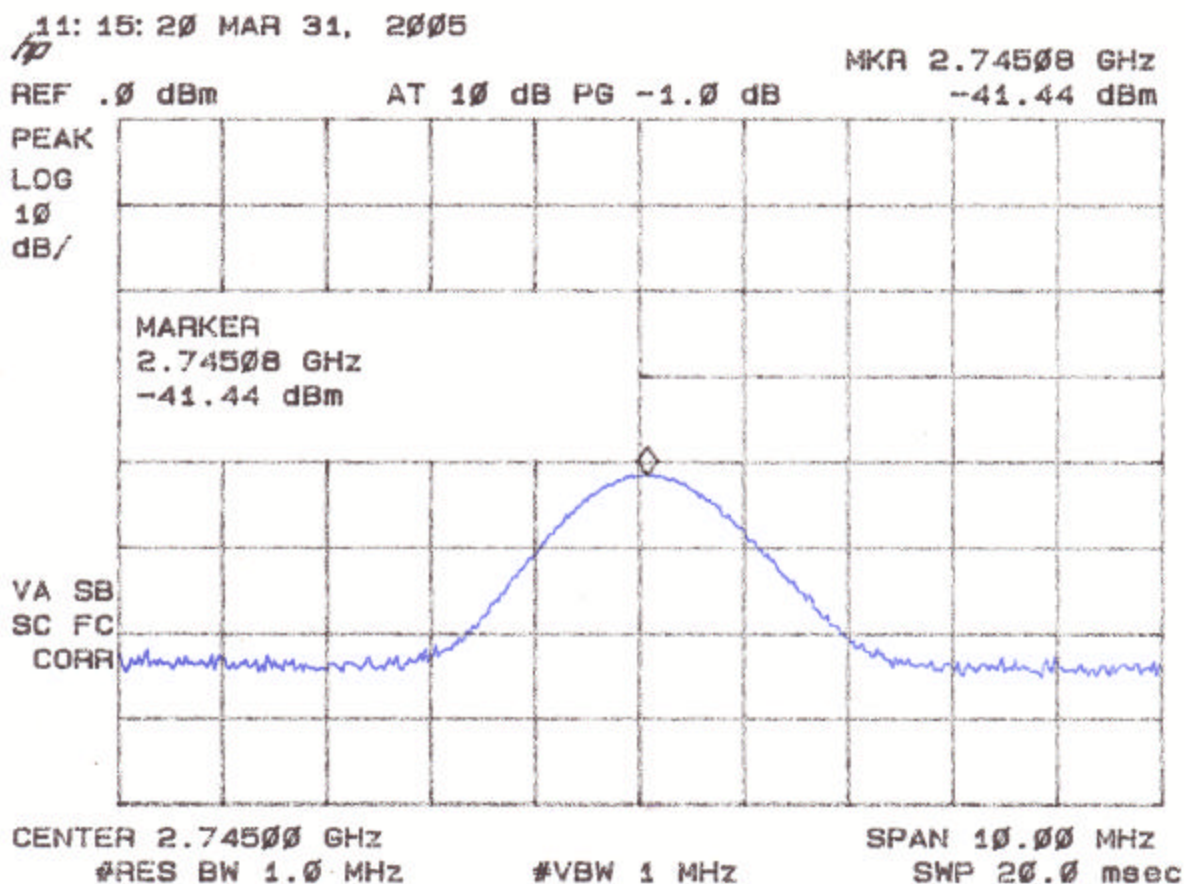


Figure 5b-4
Peak Radiated Spurious Emission 15.247(c) Mid Channel –
3rd Harmonic



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Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

Table 4c. PEAK RADIATED SPURIOUS EMISSIONS (High Channel)

Peak Radiated Emissions							
Test By:	Test: Part 15.247 Certification High Channel				Client: Wireless Detection		
DPB	Project: 05-0073				Model: SR-002		
Frequency	Test Data	Test Data	AF+CA-AMP	Results	Limits	Margin	PK = n
(MHz)	(dBm)	(dBuV)	(dB)	(uV/m)	(uV/m)	(dB)	/ QP
336.05	-77.2	29.8	19.0	276.8	67253.3	47.7	PK
927.28	-21.2	85.8	30.8	672533.0			PK
1854.57	-27.9	79.1	-4.4	5417.0	67253.3	21.9	PK
2781.9	-42.7	64.3	-2.3	1252.4	5000.0	12.0	PK

Data corrected by 1 dB for loss of high pass filter except for fundamental frequency

SAMPLE CALCULATION:

RESULTS (uV/m @ 3m) = Antilog $((-77.2 + 19.0 + 107)/20)$ = 276.8

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: March 30, 2005

Tester

Signature:  **Name:** David Blethen

Report Number: 05-0073

Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

Rev: 012804

Issue Date: April 1, 2005

Figure 5c-1
Peak Radiated Spurious Emission 15.247(c) High Channel –
Sub Harmonic

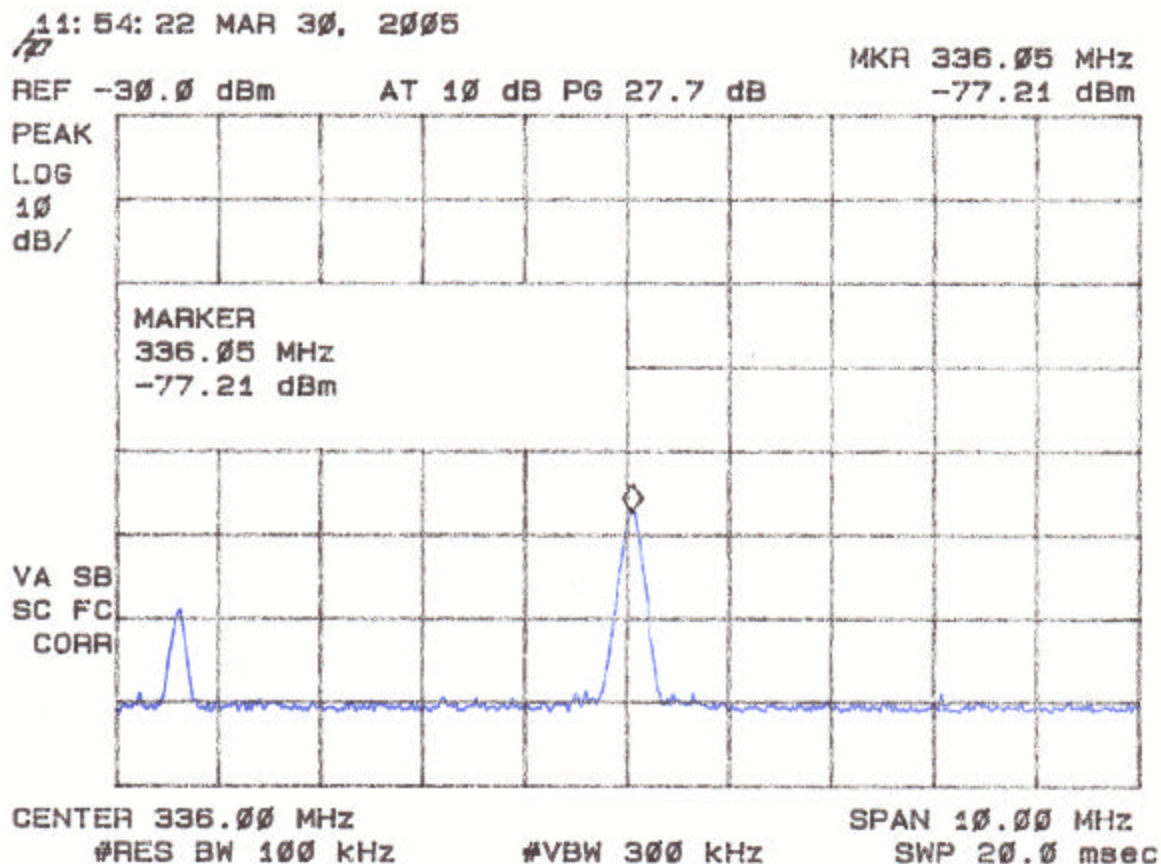


Figure 5c-2
Peak Radiated Spurious Emission 15.247(c) High Channel –
Fundamental

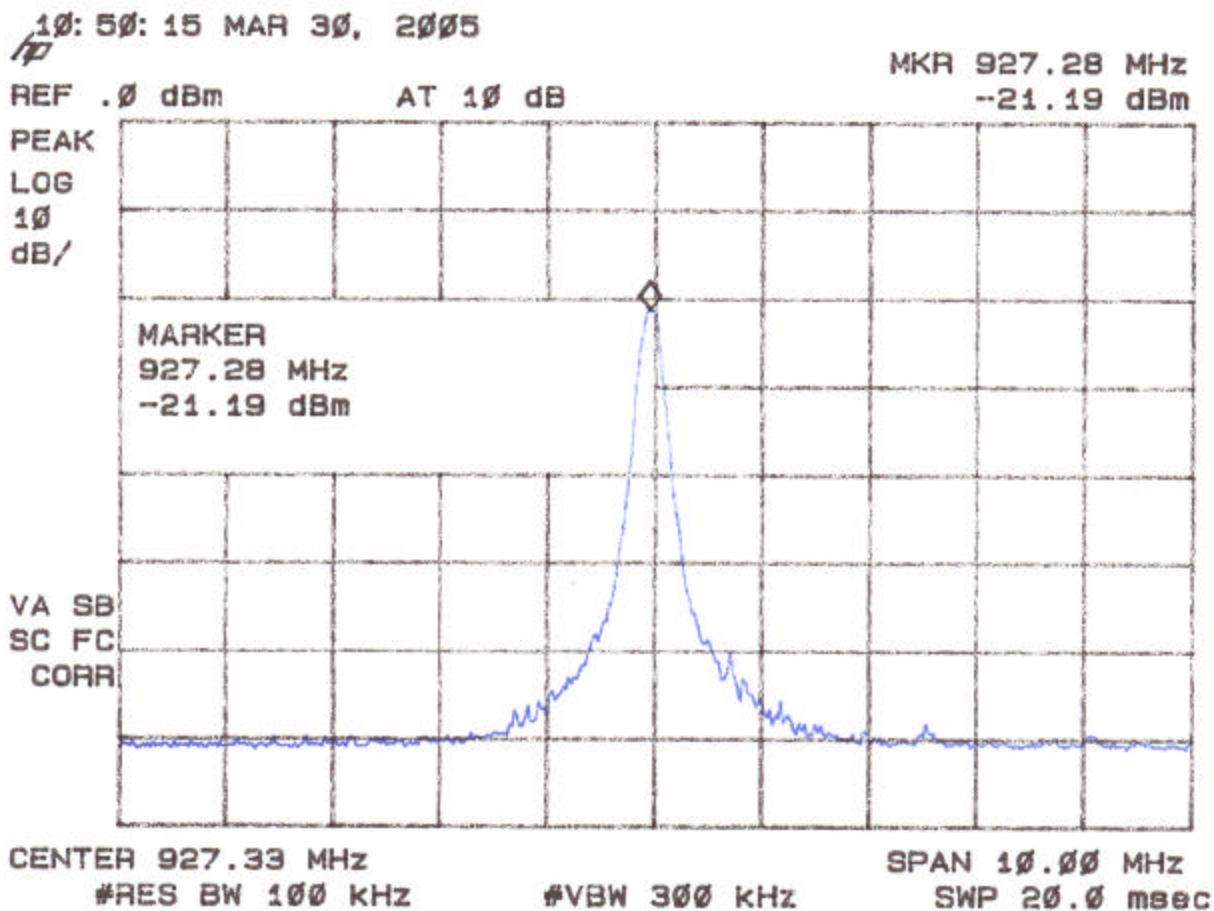


Figure 5c-3
Peak Radiated Spurious Emission 15.247(c) High Channel –
2nd Harmonic

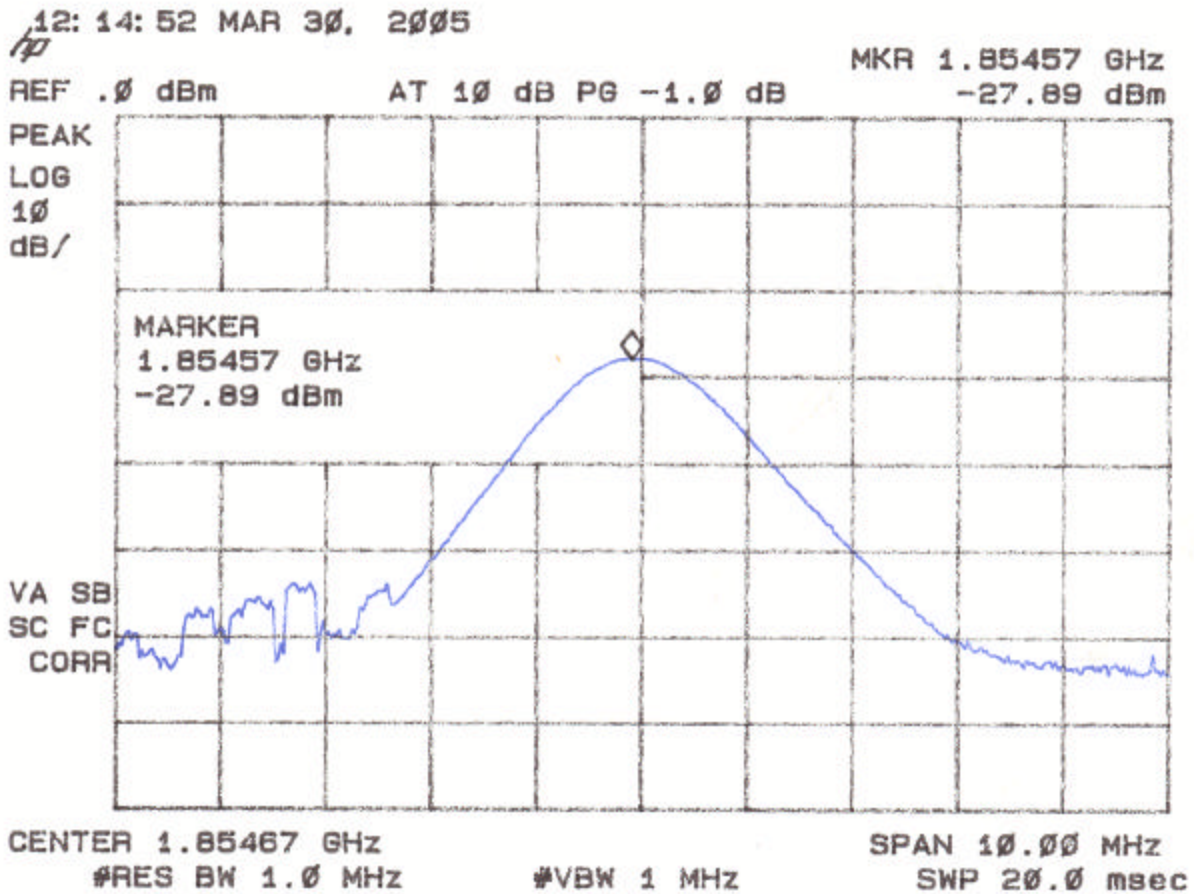
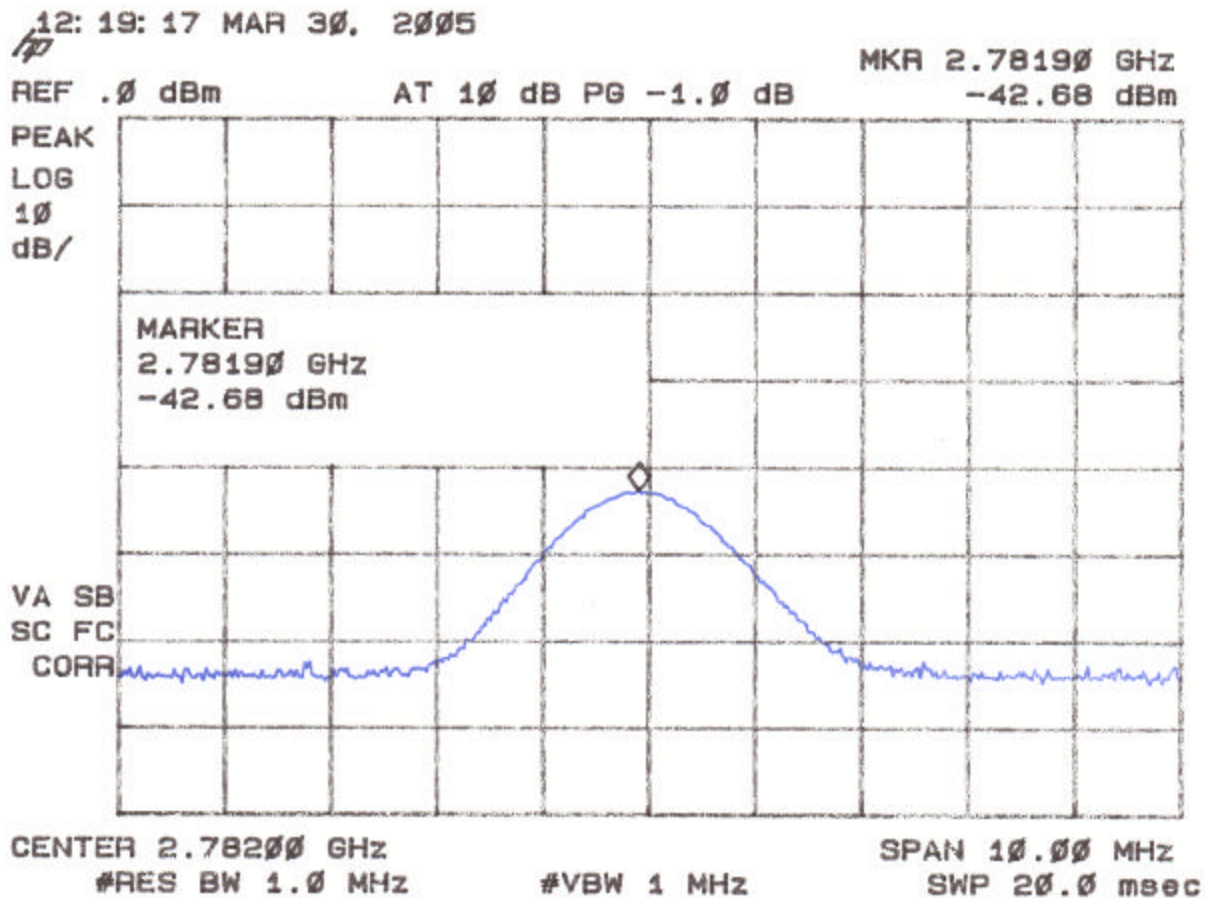


Figure 5c-4
Peak Radiated Spurious Emission 15.247(c) High Channel –
3rd Harmonic



2.10 Average Spurious Emission in the Frequency Range 30 - 25000 MHz (FCC Section 15.247(c))

The results of average radiated spurious emissions falling within restricted bands are given in Tables 5a – 5c. These values were calculated using the following duty cycle corrections:

The maximum transmit time of the EUT, based upon software and firmware settings, is 2.84 ms. Measured time of occupancy from Section 2.13 is 3.000 ms therefore:

$3.000 \text{ ms} / 100 \text{ ms} = 3\% \text{ duty cycle}$
 $20^{\log}(.03) = -30.5 \text{ dB correction factor}$

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Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

Table 5a. AVERAGE RADIATED SPURIOUS EMISSIONS Low Channel

Average Radiated Emissions, 3.125% duty cycle, - 30.5 dB correction							
Test By:	Test: FCC 15.247 Low Channel				Client: Wireless Detection		
DPB	Project: 05-0073				Model: SR-002		
Frequency	Test Data	Test Data	AF+CA-AMP	Results	Limits	Margin	PK = n
(MHz)	(dBm)	(dBuV)	(dB)	(uV/m)	(uV/m)	(dB)	/ QP
311.08	-101.8	5.2	19.7	17.7	2527.6	43.1	AVG
902.31	-49.5	57.5	30.6	25275.6			AVG
1804.67	-63.5	43.5	-4.7	87.3	2527.6	29.2	AVG
2707	-75.5	31.5	-2.5	28.1	500.0	25.0	AVG

Data corrected by 1 dB for loss of high pass filter except for fundamental frequency

SAMPLE CALCULATION:

RESULTS (uV/m @ 3m) = Antilog $((-101.8 + 19.7 + 107)/20) = 17.7$

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: March 30, 2005

Tester

Signature:



Name: David Blethen

Report Number: 05-0073

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Issue Date: April 1, 2005

Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

Table 5b. AVERAGE RADIATED SPURIOUS EMISSIONS Mid Channel

Average Radiated Emissions, 3.125% duty cycle, - 30.5 dB correction							
Test By:	Test: FCC 15.247 Mid Channel 3rd test				Client: Wireless Detection		
DPB	Project: 05-0073				Model: System Repeater Unit		
Frequency	Test Data	Test Data	AF+CA-AMP	Results	Limits	Margin	PK = n
(MHz)	(dBm)	(dBuV)	(dB)	(uV/m)	(uV/m)	(dB)	/ QP
323.73	-105.4	1.6	19.1	10.9	500.0	33.2	AVG
915.01	-49.6	57.4	30.8	25662.9			AVG
1829.98	-63.1	43.9	-4.6	92.8	2566.3	28.8	AVG
2745.08	-71.9	35.1	-2.4	43.0	500.0	21.3	AVG

Data corrected by 1 dB for loss of high pass filter except for fundamental frequency

SAMPLE CALCULATION:

RESULTS (uV/m @ 3m) = Antilog $((-105.4 + 19.1 + 107)/20)$ = 10.9

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: March 30, 2005

Tester

Signature:



Name: David Blethen

Report Number: 05-0073

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Issue Date: April 1, 2005

Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

Table 5c. AVERAGE RADIATED SPURIOUS EMISSIONS High Channel

Average Radiated Emissions, 3.125% duty cycle, - 30.5 dB correction							
Test By:	Test: FCC 15.247 High Channel, 3rd test			Client: Wireless Detection			
DPB	Project: 05-0073			Model: System Repeater Unit			
Frequency (MHz)	Test Data (dBm)	Test Data (dBuV)	AF+CA-AMP (dB)	Results (uV/m)	Limits (uV/m)	Margin (dB)	PK = n / QP
336.05	-107.7	-0.7	19.0	8.3	2007.8	47.7	AVG
927.28	-51.7	55.3	30.8	20077.7			AVG
1854.57	-58.4	48.6	-4.4	161.7	2007.8	21.9	AVG
2781.9	-73.2	33.8	-2.3	37.4	5000.0	42.5	AVG

Data corrected by 1 dB for loss of high pass filter except for fundamental frequency

SAMPLE CALCULATION:

RESULTS (uV/m @ 3m) = Antilog $((-107.7 + -0.7 + 107)/20) = 8.3$

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: March 30, 2005

Tester

Signature:



Name: David Blethen

2.11 20 dB Bandwidth per FCC Section 15.247(a)(1)(ii)

The antenna port was connected to a spectrum analyzer that was set for a 50 Ω impedance with the RBW = approximately 1/100 of the manufacturers claimed RBW & VBW > RBW. The results of this test are given in Table 6 and Figure 6a through 6c.

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TABLE 6
20 dB Bandwidth

Frequency (MHz)	20 dB Bandwidth (MHz)	MAXIMUM FCC LIMIT (MHz)
902.300	0.015	1.0
915.000	0.015	1.0
927.320	0.015	1.0

Test Date: March 30, 2005

Tester

Signature: _____



Name: David Blethen _____

Figure 6a.

20 dB Bandwidth per FCC Section 15.247(a)(1)(ii) (Low Channel)

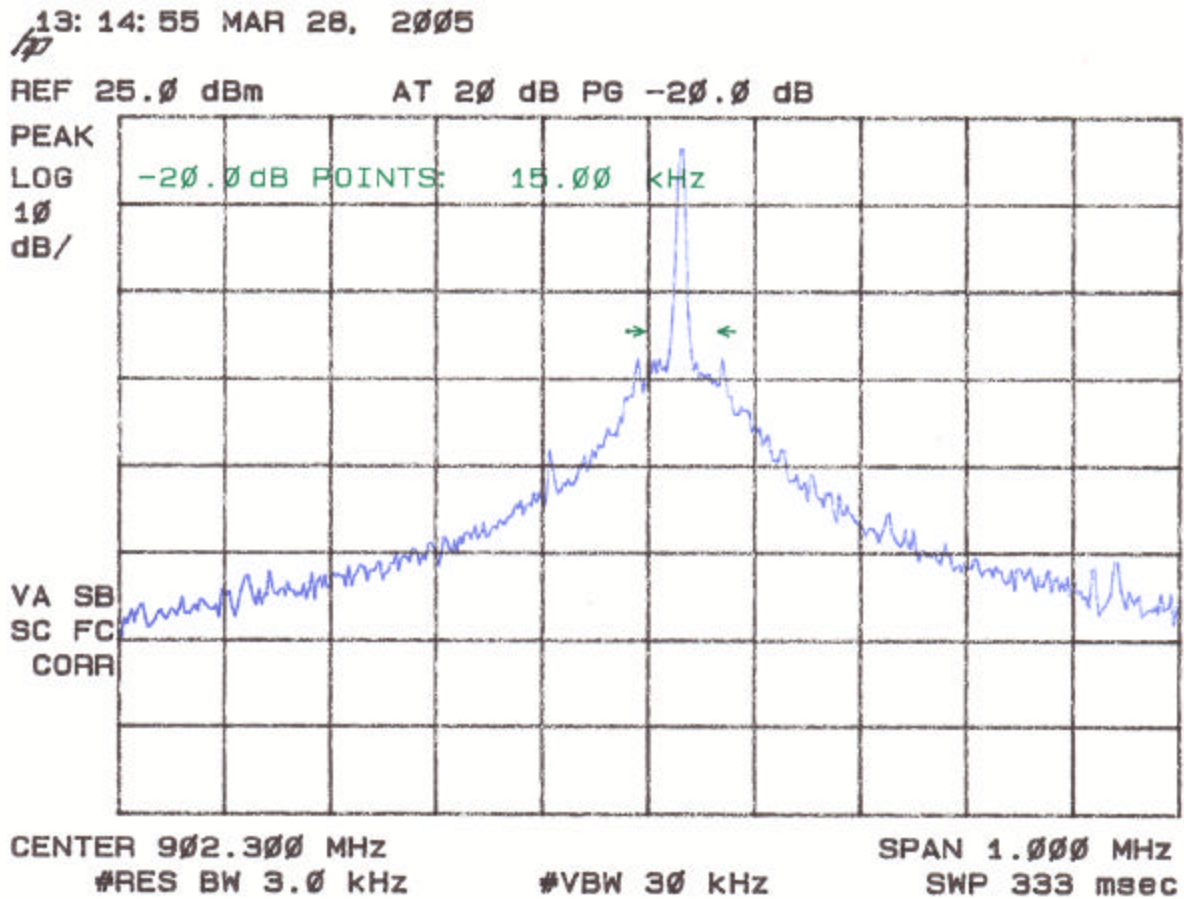
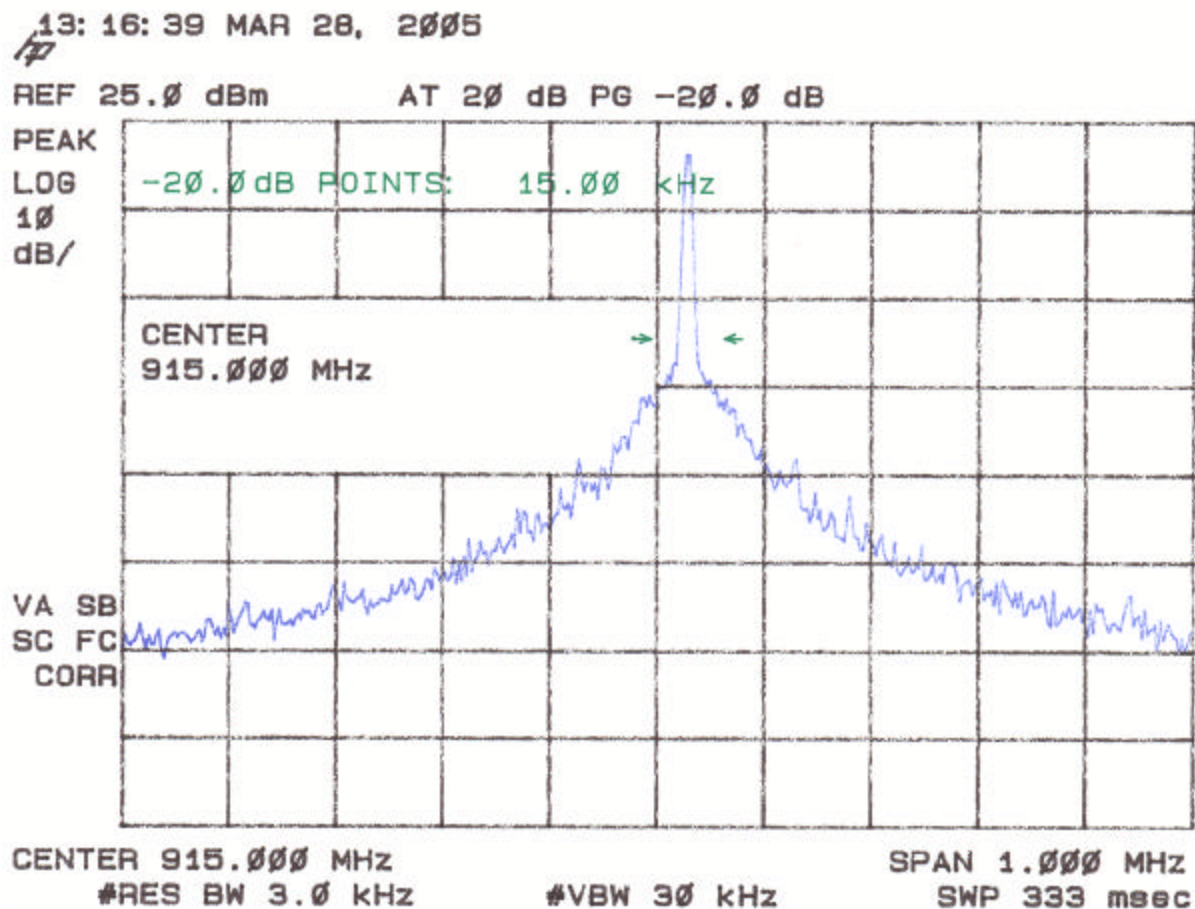


Figure 6b.
20 dB Bandwidth per FCC Section 15.247(a)(1)(ii) (Mid Channel)



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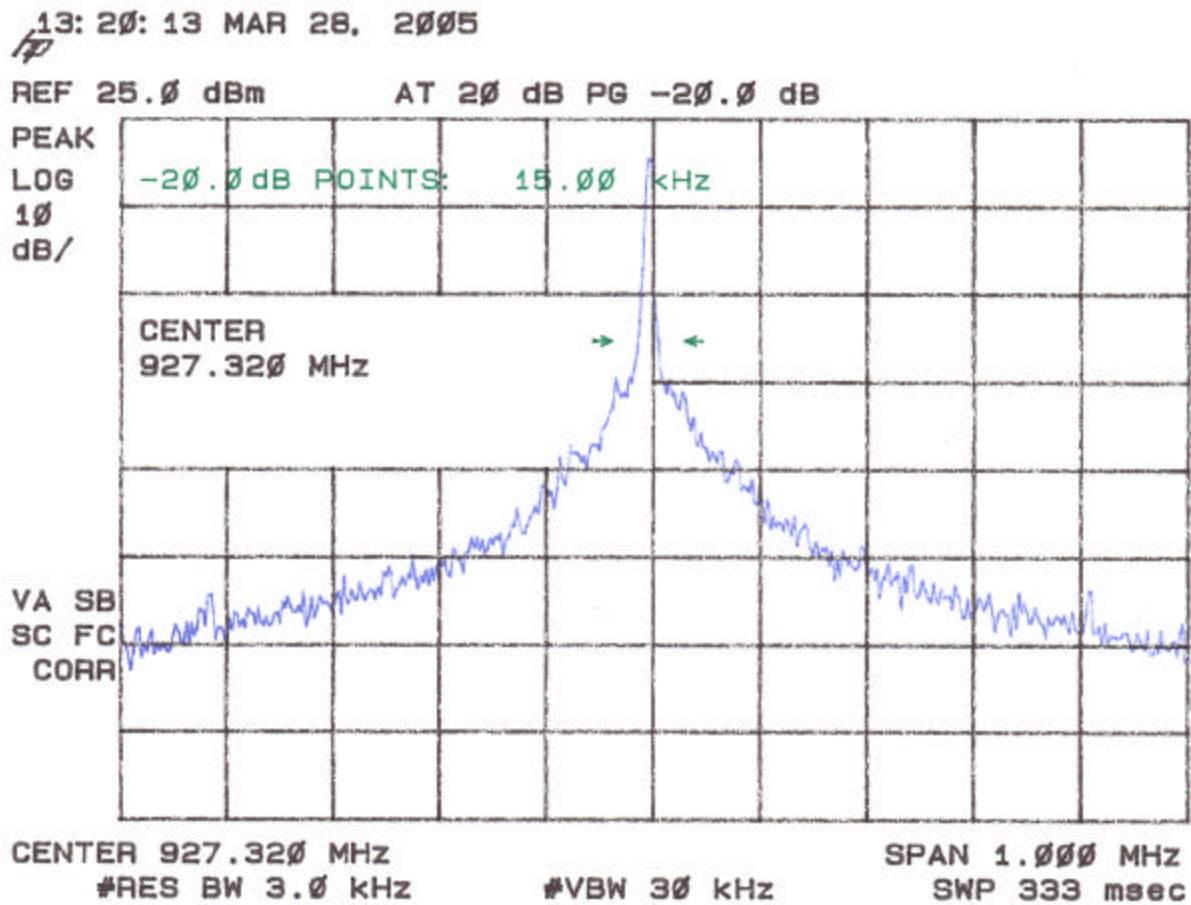
Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

Rev: 012804

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Figure 6c.
20 dB Bandwidth per FCC Section 15.247(a)(1)(ii) (High Channel)



2.12 Number of Hopping Channels FCC Section 15.247(a)(1)(ii)

The transmitter was placed into a typical frequency hopping mode of operation. The 902-928 MHz band was centered on the screen and the RBW and VBW chosen such that the individual channels could be discerned. The trace capture time was a minimum of 5 minutes.

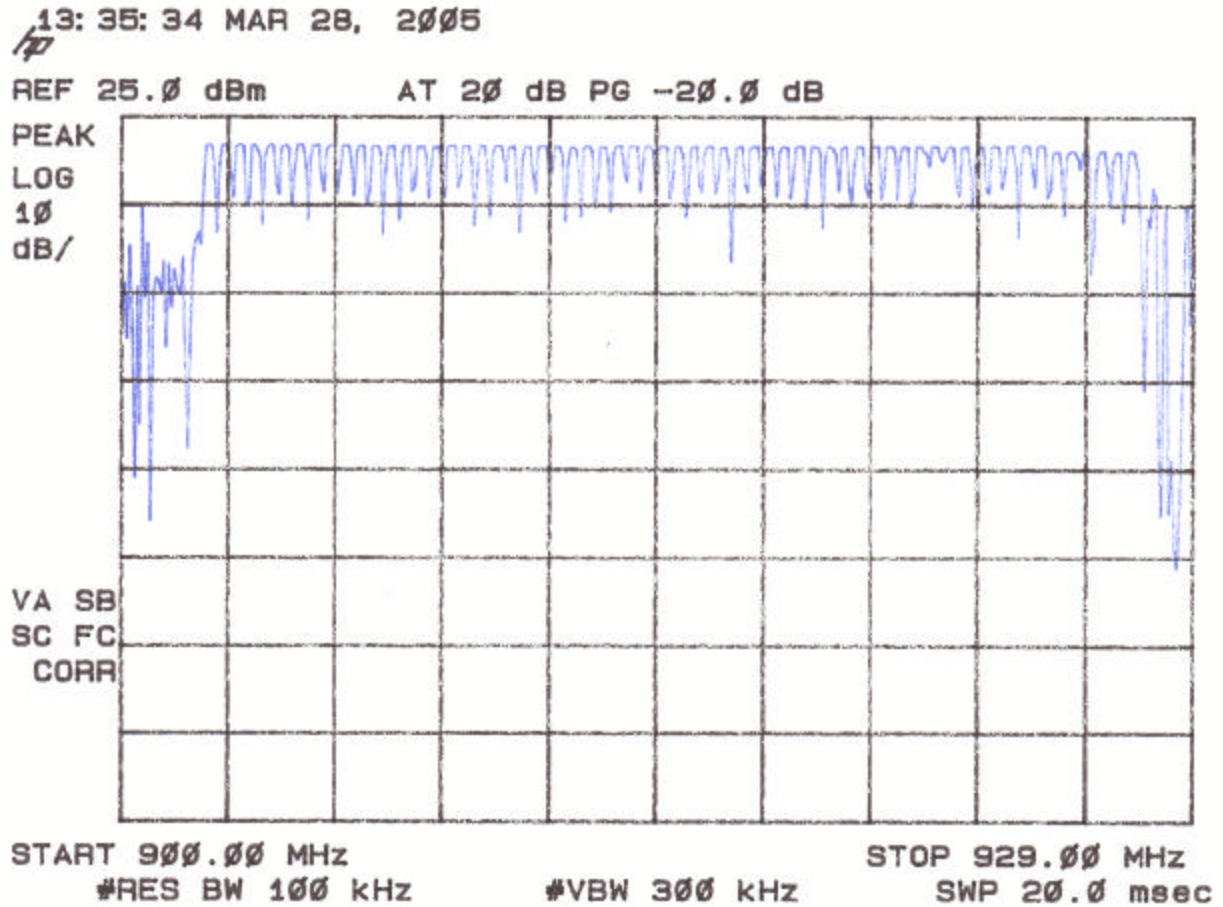
The results of this test are given in Table 7 and Figure 7.

TABLE 7

NUMBER OF HOPPING CHANNELS

Number of Hopping Frequencies Measured	FCC Limit (Minimum Number of Channels)
62	50

Figure 7
Number of Hopping Channels FCC Section 15.247(a)(1)(ii)



2.13 Average Time of Occupancy per Channel FCC Section 15.247(a)(1)(ii)

The maximum transmit time of the EUT, based upon software and firmware settings, is 3 ms average time of occupancy.

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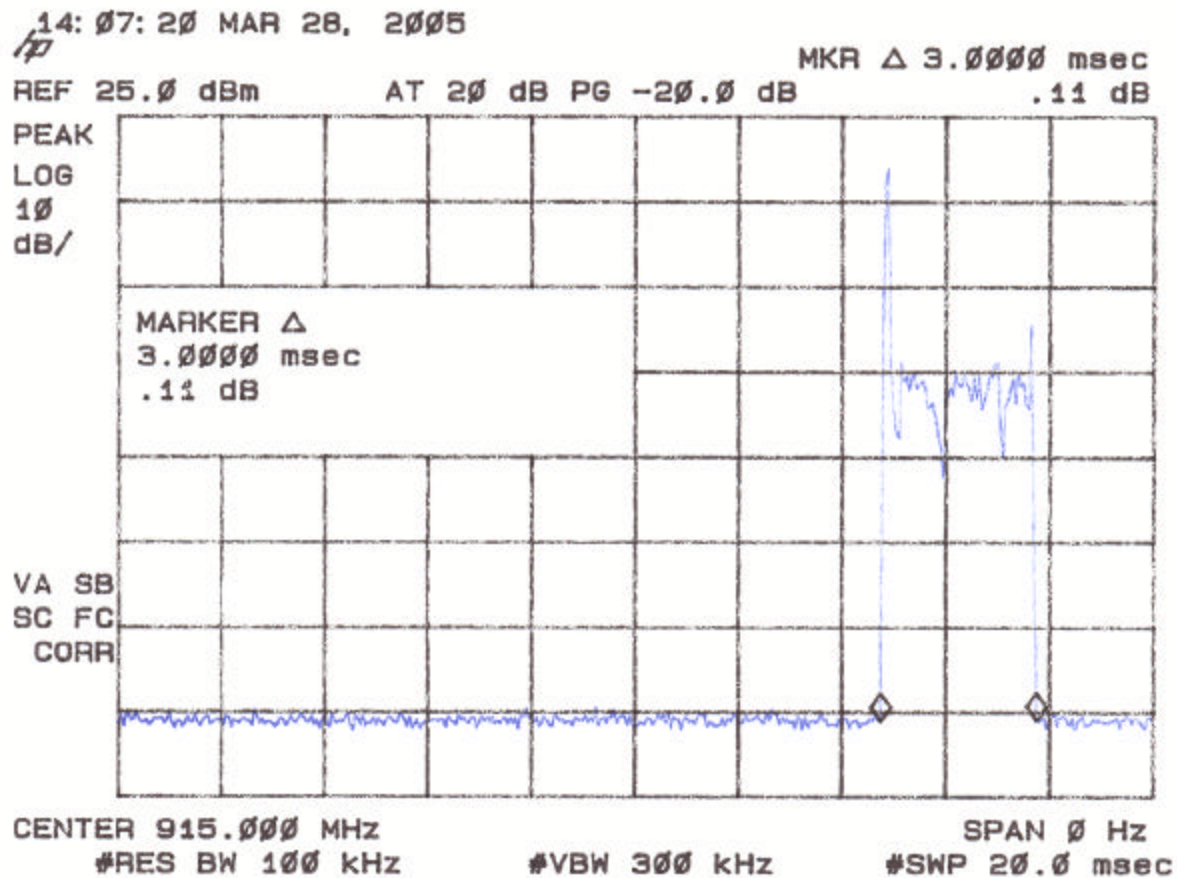
Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

Rev: 012804

Issue Date: April 1, 2005

Figure 8
Average Time of Occupancy per Channel FCC Section 15.247(a)(1)(ii)



2.14 Power Line Conducted Emissions for Transmitter FCC Section 15.207

The conducted voltage measurements have been carried out in accordance with FCC Section 15.207, with a spectrum analyzer connected to a LISN and the EUT placed into a continuous mode of transmit. The results are given in Tables 8a-8b.

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Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

TABLE 8a. CONDUCTED EMISSIONS DATA

CLASS B

(Peak-Quasi Peak Measurements vs Average Limits) PHASE DATA

Line Conducted Emissions							
Test By:	Test: FCC Part 15 Phase vs. AVG limits				Client: Wireless Detection		
DPB	Project: 05-0073				Model: SR-002		
Frequency	Test Data	Test Data	AF+CA-AMP	Results	Limits	Margin	PK = n
(MHz)	(dBm)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)	/ QP
0.18	-59.1	47.9	0.2	48.1	55.2	7.1	PK
19.665	-84.1	22.9	0.9	23.8	50.0	26.2	PK
28.328	-82.9	24.1	1.0	25.1	50.0	24.9	PK
28.925	-82.1	24.9	1.0	25.9	50.0	24.1	PK
29.52	-83.1	23.9	1.1	25.0	50.0	25.0	PK
29.82	-81.5	25.5	1.1	26.6	50.0	23.4	PK

SAMPLE CALCULATIONS: $47.9 + 0.2 = 48.1$ dBuV

Test Date: March 31, 2005

Tested by

Signature:



Name: David Blethen

Report Number: 05-0073

Rev: 012804

Issue Date: April 1, 2005

Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

TABLE 8b. CONDUCTED EMISSIONS DATA

CLASS B

(Peak-Quasi Peak Measurements vs Average Limits) NEUTRAL DATA

Line Conducted Emissions							
Test By:	Test: FCC Part 15 Neutral vs. AVG limits				Client: Wireless Detection		
DPB	Project: 05-0073				Model: SR-002		
Frequency	Test Data	Test Data	AF+CA-AMP	Results	Limits	Margin	PK = n
(MHz)	(dBm)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)	/ QP
0.18	-58.6	48.4	0.2	48.6	55.2	6.6	PK
19.665	-85.9	21.1	0.9	22.0	50.0	28.0	PK
28.328	-85.1	21.9	1.0	22.9	50.0	27.1	PK
28.925	-85.2	21.8	1.0	22.8	50.0	27.2	PK
29.52	-84.7	22.3	1.1	23.4	50.0	26.6	PK
29.82	-83.8	23.2	1.1	24.3	50.0	25.7	PK

SAMPLE CALCULATIONS: $48.4 + 0.2 = 48.6$ dBuV

Test Date: March 31, 2005

Tested by

Signature:



Name: David Blethen

2.15 Radiated Emissions for Digital Device & Receiver (47 CFR 15.109a)

Radiated emissions were evaluated from 30 to 14500 MHz while the EUT was placed into a Receive mode of operation. Measurements were made with the analyzer's bandwidth set to 120 kHz measurements made less than 1 GHz and 1 MHz for measurements made greater than or equal to 1 GHz. The results for less than 1 GHz are shown in Table 9.

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Issue Date: April 1, 2005

Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

**TABLE 9a. RADIATED EMISSIONS DATA
(Digital Device Receive Mode)**

CLASS B

Measurements 30 MHz – 1 GHz

Radiated Emissions							
Test By:	Test: FCC Part 15			Client: Wireless Detection			
DPB	Project: 05-0073			Model: SR-002			
Frequency	Test Data	Test Data	AF+CA-AMP	Results	Limits	Margin	PK = n
(MHz)	(dBm)	(dBuV)	(dB)	(uV/m)	(uV/m)	(dB)	/ QP
415.00	-96.0	11.0	20.9	39.3	200.0	14.1	PK
592	-93.0	14.0	24.7	86.4	200.0	7.3	PK

SAMPLE CALCULATION:

RESULTS (uV/m @ 3m) = Antilog $((-96.0 + 11.0 + 107)/20)$ = 20.9

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: March 29, 2005

Tested by

Signature:



Name: David Blethen

Report Number: 05-0073

Rev: 012804

Issue Date: April 1, 2005

Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

TABLE 9b. RADIATED EMISSIONS DATA
(Digital Device & Receiver)

CLASS B

Measurements 1 GHz – 5 GHz (PEAK)

Radiated Emissions								
Test By:	Test: Part 15 Digital device / Receive Mode					Client: Wireless Detection		
DPB	Project: 05-0073					Model: SR-002		
Frequency	Test Data	Test Data	AF+CA-AMP	Results	Limits	Distance /	Margin	PK = n
(MHz)	(dBm)	(dBuV)	(dB)	(uV/m)	(uV/m)	Polarity	(dB)	/ QP
NO EMISSIONS DETECTED WITHIN 20 dB OF THE FCC LIMIT								

Test Date: March 29, 2005

Tested by
Signature:



Name: David Blethen

Report Number: 05-0073

Rev: 012804

Issue Date: April 1, 2005

Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

TABLE 9b. RADIATED EMISSIONS DATA
(Digital Device & Receiver)

CLASS B

Measurements 1 GHz – 5 GHz (AVERAGE)

Radiated Emissions								
Test By:	Test: Part 15 Digital device / Receive Mode					Client: Wireless Detection		
DPB	Project: 05-0073					Model: SR-002		
Frequency	Test Data	Test Data	AF+CA-AMP	Results	Limits	Distance /	Margin	PK = n
(MHz)	(dBm)	(dBuV)	(dB)	(uV/m)	(uV/m)	Polarity	(dB)	/ QP
NO EMISSIONS DETECTED WITHIN 20 dB OF THE FCC LIMIT								

Test Date: March 28, 2005

Tested by
Signature: 

Name: David Blethen

2.16 Power Line Conducted Emissions for Digital Device and Receiver FCC Section 15.107

The conducted voltage measurements have been carried out in accordance with FCC Section 15.107, with a spectrum analyzer connected to a LISN and the EUT placed into an idle condition or a continuous mode of receive. Similar results were seen as compared to the EUT in a transmit mode of operation. **Therefore, please refer to the results as shown in Table 8a and 8b.**

2.17 Channel Separation

The transmitter was placed into a typical frequency hopping mode of operation. Using an RBW and UBW of 30 kHz, the delta between 2 peaks was measured and the distance between them was noted. Characteristics of the time of occupancy are shown in Figure 9 and Table 10.

TABLE 10

CHANNEL SEPARTAION

Channel Separation	FCC Limit (Minimum)
410 kHz	25 kHz, 20 dB Bandwidth

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Customer: Wireless Detection

Model: SR-002 Rev 02 System Repeater

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Issue Date: April 1, 2005

Figure 9
Channel Separation FCC Section 15.247(a)(1)(ii)

