Interactive Technologies, Inc.
345MHz Saw PIR
B4Z-788C-PIR
Certification

Interactive Technologies Inc

345MHz Saw PIR
B4Z-788C-PIR

01/05/2001

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

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1. Introduction

This device is a wireless PIR motion alarm transmitter for use in a wireless security system. The unit is self-contained and powered by three 3.0 Volt Lithium batteries. The transmitter's frequency is crystal controlled and is not adjustable by the user. The device measures approximately 4.5″ in length, 3" in width and 2.″ in height. The unit weighs approximately 4.06 ounces without batteries.

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

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

2. Statement of Compliance

§2.907 **Certification**

This is an application for certification

§2.911 **Application**

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

§2.915 **Grant**

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

§2.925 **Label**

Each piece of equipment for which authorization will be granted will be uniquely identified with "FCC ID: B4Z-788C-PIR." The required statement will appear with the FCC ID on the product and, although not required, in the installation instructions. See Exhibit A, PDF file *id_label.pdf*

§2.947 Measurement Procedure

a) The measurement procedure follows ANSI C63.4 procedure. Procedural notes are contained in the laboratory report.

d) A list of test equipment used is contained in the laboratory report.

§2.948 Description of Measurement Facilities

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

The address of the test facility is:
TUV Product Service
19035 Wild Mountain Road
Taylors Falls, MN 55084-1758

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

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

§2.1033 Application for Certification

a) Form 731 has been electronically filed on 01/05/01. Items that did not apply were left blank.

b) This technical report contains the following information where applicable.

1) Full name and mailing address of manufacturer and applicant for certification:
Interactive Technologies Inc
2266 North Second Street
North Saint Paul, MN 55109

2) FCC Identifier:
B4Z-788C-PIR

3) Copy of installation instructions:
See Exhibit G, PDF file: *user_man.pdf*

4) Brief Description of circuit functions and device operation:
See Exhibit I, PDF file *op_desc.pdf*
See Exhibit D, PDF file *schemat.pdf* for schematics (page 1) and parts placement (page 2) diagrams.

5) Block Diagram
   See Exhibit C, PDF file *block.pdf*.
6) Report of the measurements of radiation and conducted emissions:
   This document.
7) Photographs
   External:
      See Exhibit B, PDF file *extern.pdf*
   Internal:
      See Exhibit H, PDF file *intern.pdf*

8) Peripheral or Accessory devices:
   This is not applicable since this device is stand-a-lone product.
9) Transition Rules
   This application is not pursuant to the transition rules of §15.37
10) Emergency Broadcast decoding:
   This is not applicable to device in this application.
11) Application for direct sequence spread spectrum devices...
   This is not applicable to device in this application.
12) Application for scanning receivers...
   This is not applicable to device in this application.

c) Composite Systems
This is not applicable to device in this application.

3. Lab Measurements Discussion / Test Notes

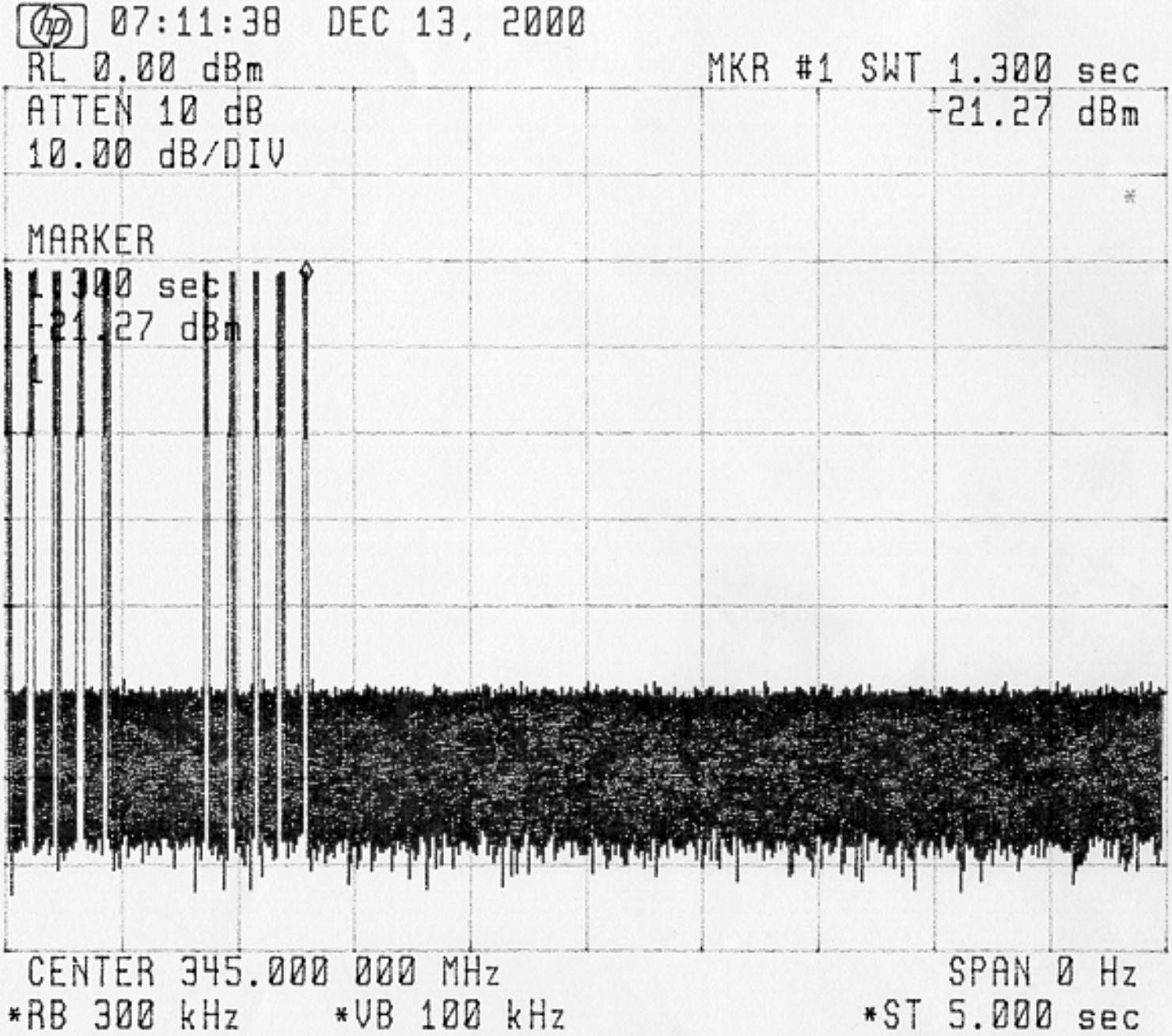
3.1 Test Notes

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

In the event of an alarm, 10 packets are sent in the transmission. The packet duration is, at most, 20 mS, see **Duty Cycle Correction Factor [§15.231(b)(2) and §15.35(c)].** The time between packets is nominally 90 mS so the length of the longest transmission is:

10*20mS + 9*90mS = 1.01 seconds.

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


07:11:38 DEC 13, 2000
RL 0.00 dBm
MKR #1 SWT 1.300 sec
ATTEN 10 dB
-21.27 dBm
10.00 dB/DIV
MARKER
1.300 sec
-21.27 dBm
CENTER 345.000 000 MHz
SPAN 0 Hz
*RB 300 kHz
*VB 100 kHz
*ST 5.000 sec

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

As permitted, this device will transmit 5 packets for supervision purposes. The inter-packet delay is a time 90 mS The packet itself is never more than 20 ms. The longest time to conclude a supervisory transmission is then:

5*20 + 4*90 = 460mS

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

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

63*141µS = 8.88mS

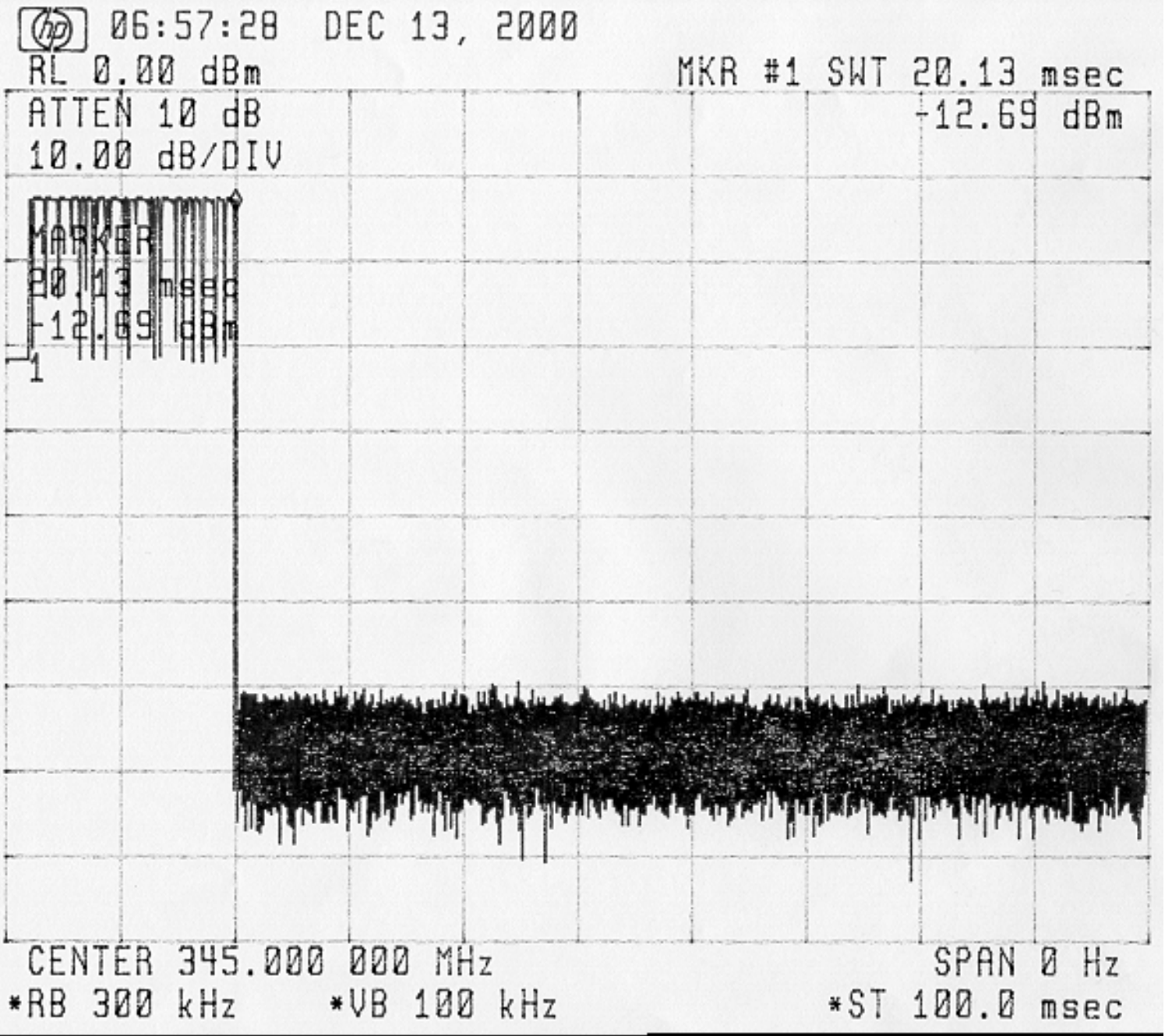
Only one packet is sent in any given 100 mS window for a duty cycle correction factor of:

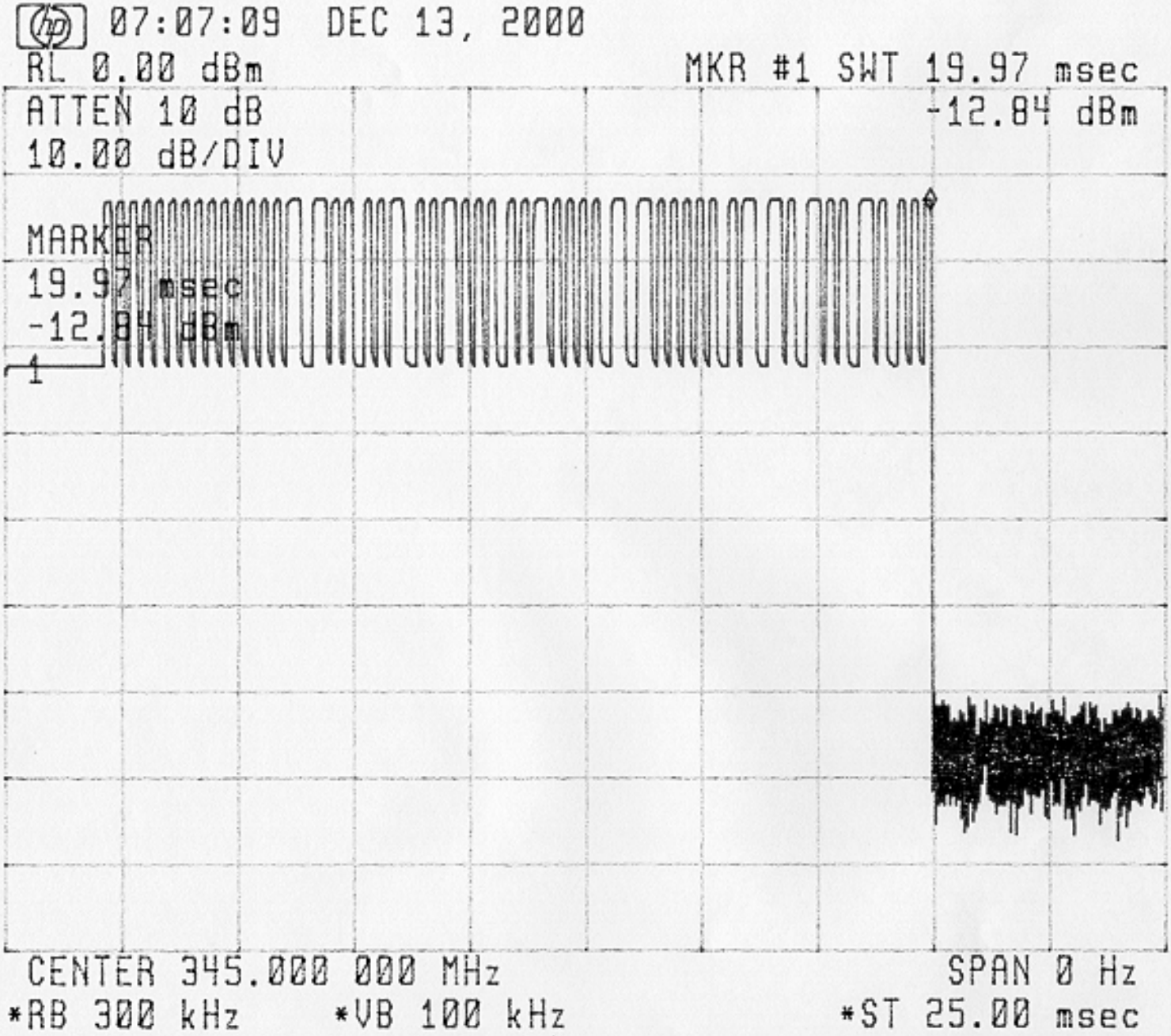
20*LOG(8.88/100) = -21.03dB

The maximum allowed correction factor is 20 dB.

The following plots show:

1. Single packet in 100 mS window.
2. Expanded view of a packet with a duration of 19.97 mS


06:57:28 DEC 13, 2000
RL 0.00 dBm
MKR #1 SWT 20.13 msec
ATTEN 10 dB
-12.69 dBm
10.00 dB/DIV
MARKER
20.13 msec
-12.69 dBm
1
CENTER 345.000 000 MHz
SPAN 0 Hz
*RB 300 kHz
*VB 100 kHz
*ST 100.0 msec


07:07:09 DEC 13, 2000
RL 0.00 dBm
MKR #1 SWT 19.97 msec
ATTEN 10 dB
-12.84 dBm
10.00 dB/DIV
MARKER
19.97 msec
-12.84 dBm
1
CENTER 345.000 000 MHz
SPAN 0 Hz
*RB 300 kHz
*VB 100 kHz
*ST 25.00 msec

3.1.4 Bandwidth Measurement [**§15.231(c)**]

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

The spectrum analyzer 20 dB skirt bandwidth is 3.4KHz.

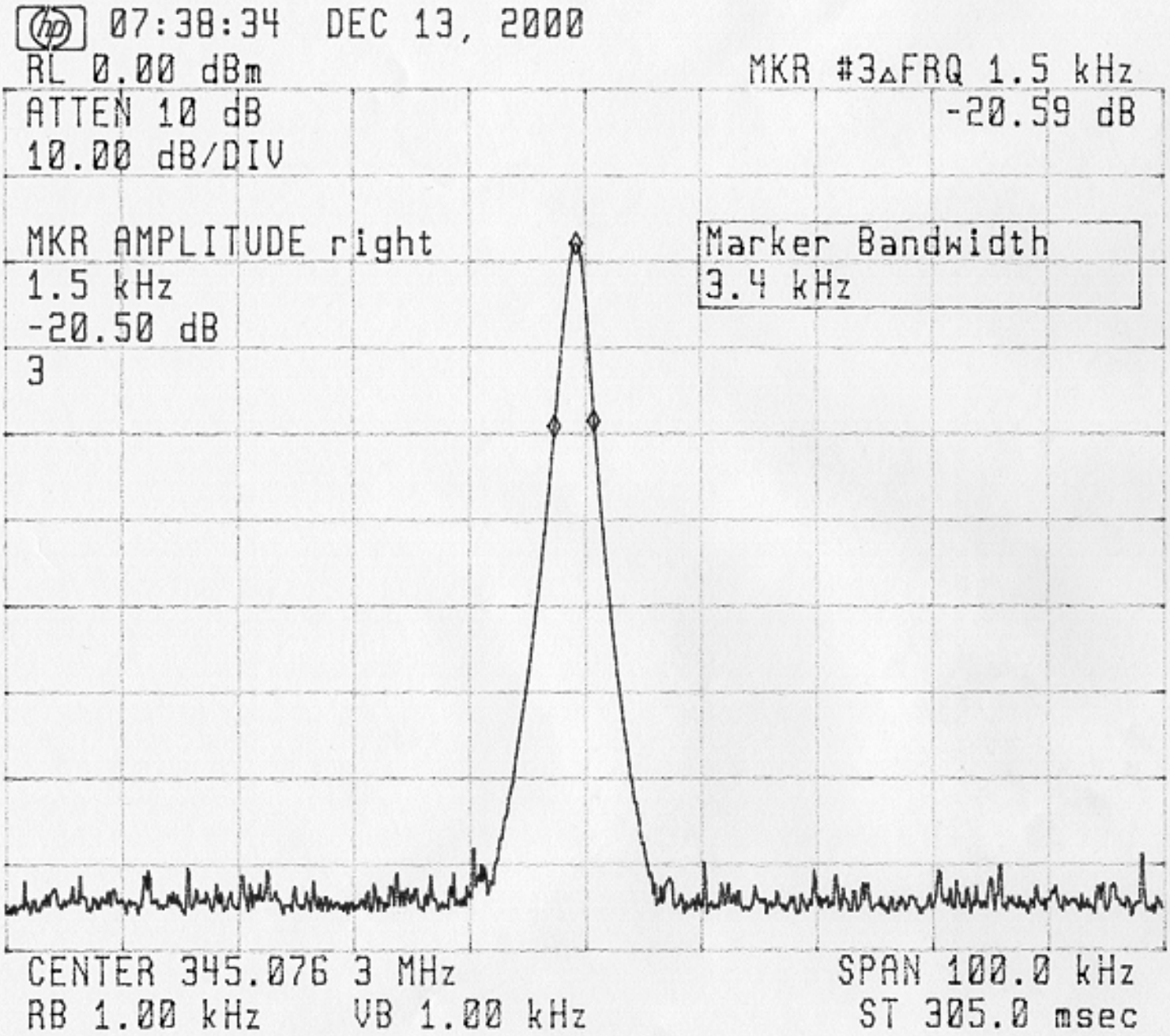
The allowed 20 dB bandwidth is 0.25% of center frequency.

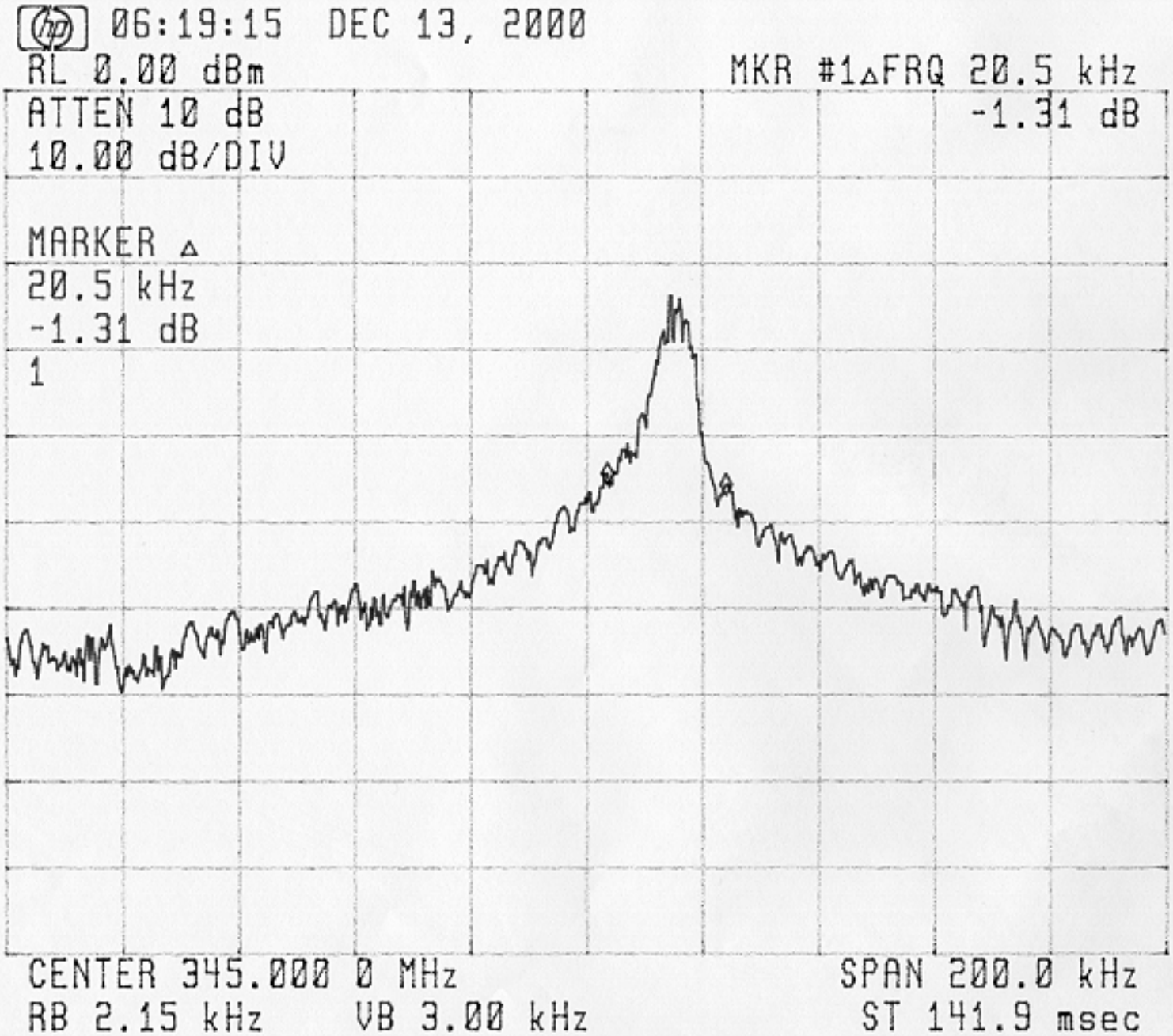
Estimated signal bandwidth = Measured signal bandwidth - analyzer bandwidth.

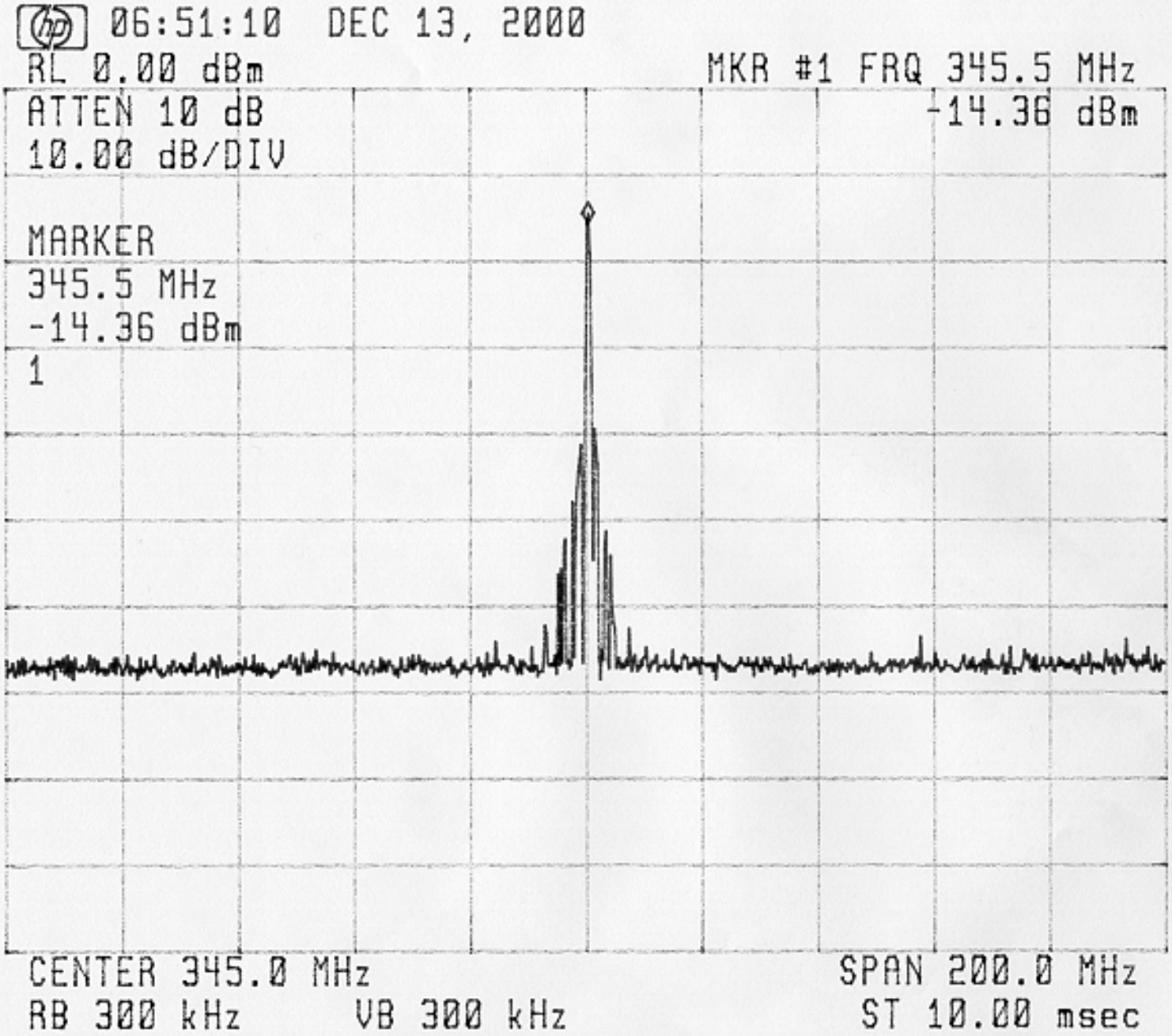
Center Frequency MHz	Measured 20 dB Bandwidth in KHz	Estimated 20 dB signal Bandwidth in KHz	FCC allowed 20 dB Bandwidth in KHz
345	28.1	24.7	799

The following three plots show:

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


07:38:34 DEC 13, 2000
RL 0.00 dBm
MKR #3ΔFRQ 1.5 kHz
ATTEN 10 dB
-20.59 dB
10.00 dB/DIV
MKR AMPLITUDE right
1.5 kHz
-20.50 dB
3
Marker Bandwidth
3.4 kHz
CENTER 345.076 3 MHz
SPAN 100.0 kHz
RB 1.00 kHz
VB 1.00 kHz
ST 305.0 msec


06:19:15 DEC 13, 2000
RL 0.00 dBm
MKR #1ΔFRQ 20.5 kHz
ATTEN 10 dB
-1.31 dB
10.00 dB/DIV
MARKER Δ
20.5 kHz
-1.31 dB
1
CENTER 345.000 0 MHz
SPAN 200.0 kHz
RB 2.15 kHz
VB 3.00 kHz
ST 141.9 msec


06:51:10 DEC 13, 2000
RL 0.00 dBm
MKR #1 FRQ 345.5 MHz
ATTEN 10 dB
-14.36 dBm
10.00 dB/DIV
MARKER
345.5 MHz
-14.36 dBm
1
CENTER 345.0 MHz
SPAN 200.0 MHz
RB 300 kHz
VB 300 kHz
ST 10.00 msec

3.1.5 Emissions Measurements

3.1.5.1 Radiated Emissions Summary

The 345MHZ Saw PIR passes FCC Rules Part 15, Subpart C, Paragraph 15.231. The highest fundamental radiated emission was 1.0dB below the FCC limit at 345MHz. The highest spurious emission measurement was 23.3dB below the FCC limit at 690.19MHz. The highest forbidden band emission was 23.3dB below the FCC limit at 1035.29MHz.

3.1.5.2 FCC Emissions Calculation

3.1.5.2.1 Terms

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

3.1.5.2.2 Example Calculation

AR = 99.3 dBµV
AF = 13.9 dB
CL = 3.8 dB
DC = 20 dB
PA=26.2 dB

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

AR + AF + CL –DC - PA = 99.3 + 13.9 + 3.8 -20 –26.2= 70.8 dBµV/M

Alternatively, the AR + AF +CL -PA is compared to the FCC limit + DC. This number is often written to the right of measurement data on the test results. For example, the FCC limit for ITI transmitters at 345 MHz is approximately 97.2dBµV/M. The limit from §15.231(b) with linear interpolation yields a limit, without consideration for duty cycle, of approximately 77.2 dBµV/M.

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

µV/M = INVLOG(dBµV/M / 20)

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

3.1.5.3 Radiated Emissions

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

Frequency	Analyzer Reading	Duty Cycle Correction	Cable Loss	Antenna Factor	Pre-Amp	Field Strength	Field Strength	FCC Limit
MHz	dBuV	dB	dB	dB	dB	dBuV/M	uV/M	uV/M
345.1	79.50	20	2.1	14.6	0	76.20	6,457	7,244
690.19	57.20	20	2.9	19.8	26.1	33.80	49	724
1035	53.60	20	3.5	22.3	25.5	33.90	50	724
1725.49	45.60	20	5.6	27.3	25.8	32.70	43	724

3.1.5.4 Forbidden Bands

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

All measurements were taken with an HP 8566B Spectrum Analyzer. The bandwidth was 100 KHz for measurements below 1000 MHz. The bandwidth was 1 MHz for measurements above 1000 MHz. The video filter was off.
The noise floor measurements are summarized in the table below. See also the test data included in this report.

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

The test data follows on the next 2 pages:

Radiated Electromagnetic Emissions

Test Report #:	**W0381 Run 01**	Test Area:	LTS 3m			
Test Method:	N/A	Test Date:	10-Jul-2000			
EUT Model #:	PIR DETECTOR	EUT Power:	BATTERY			
EUT Serial #:				Temperature:	24	°C
Manufacturer:	ITI			Relative Humidity:	72	%
EUT Description:				Air Pressure:	98.2	kPa
Notes:				Page:	1 of 2	

FREQ (MHz)	LEVEL (dBuV/m)	CABLE / ANT / PREAMP (dB) / (db/m) / (dB)	Final Peak (dBuV/m)	POL / HGT / AZ (m) (DEG)	Final Ave (dBuV/m)	Limit FCC 15.231 (dBuV/m)
ALL READINGS MAXIMIZED IN PEAK. 100KHZ RBW <1000 MHZ - 1MHZ RBW >1000 MHZ.						
345.10	79.5 Pk	2.1 / 14.6 / 0.0	96.2	H / 1.0 / 90.0	76.2	77.2
345.10	69.0 Pk	2.1 / 14.6 / 0.0	85.7	V / 1.0 / 90.0	65.7	77.2
690.19	57.2 Pk	2.9 / 19.8 / 26.1	53.9	H / 1.0 / 90.0	33.9	57.2
1035.29	53.6 Pk	3.5 / 22.3 / 25.5	53.9	H / 1.0 / 90.0	33.9	54.0
1380.39	35.7 Pk	4.3 / 26.1 / 25.4	40.8	H / 1.0 / 90.0	20.8	54.0
1725.49	45.6 Pk	5.6 / 27.3 / 25.8	52.7	H / 1.0 / 90.0	32.7	57.2
2070.59	34.4 Pk	4.7 / 29.1 / 25.8	42.4	H / 1.0 / 90.0	22.4	57.2
2415.69	35.3 Pk	4.9 / 30.1 / 26.6	43.8	H / 1.0 / 90.0	23.8	57.2
2760.79	35.0 Pk	6.0 / 30.8 / 26.6	45.2	H / 1.0 / 90.0	25.2	54.0
3105.89	33.0 Pk	6.0 / 31.4 / 26.4	44.0	H / 1.0 / 90.0	22.0	57.2
3450.99	34.7 Pk	6.3 / 32.2 / 26.9	46.3	H / 1.0 / 90.0	26.3	57.2
END OF SCAN.						

Tested by: ROSS M. JOHNSON

Printed — Signature

Reviewed by: J. T. Schneider

Printed — Signature

Radiated Electromagnetic Emissions

Test Report #:	**W0381 Run 01**	Test Area:	LTS 3m			
Test Method:	N/A	Test Date:	10-Jul-2000			
EUT Model #:	PIR DETECTOR	EUT Power:	BATTERY			
EUT Serial #:				Temperature:	24	°C
Manufacturer:	ITI			Relative Humidity:	72	%
EUT Description:				Air Pressure:	98.2	kPa
Notes:				Page:	2 of 2	

FREQ (MHz)	LEVEL (dBuV/m)	CABLE / ANT / PREAMP (dB) / (db/m) / (dB)	Final Peak (dBuV/m)	POL / HGT / AZ (m) (DEG)	Final Ave (dBuV/m)	Limit FCC 15.231 (dBuV/m)
********** MEASUREMENT SUMMARY **********						
3450.99	34.7 Pk	6.3 / 32.2 / 26.9	46.3	H / 1.0 / 90.0	26.3	57.2
3105.89	33.0 Pk	6.0 / 31.4 / 26.4	44.0	H / 1.0 / 90.0	24.0	57.2
2760.79	35.0 Pk	6.0 / 30.8 / 26.6	45.2	H / 1.0 / 90.0	25.2	54.0
2415.69	35.3 Pk	4.9 / 30.1 / 26.6	43.8	H / 1.0 / 90.0	23.8	57.2
2070.59	34.4 Pk	4.7 / 29.1 / 25.8	42.4	H / 1.0 / 90.0	22.4	57.2
1725.49	45.6 Pk	5.6 / 27.3 / 25.8	52.7	H / 1.0 / 90.0	32.7	57.2
1380.39	35.7 Pk	4.3 / 26.1 / 25.4	40.8	H / 1.0 / 90.0	20.8	54.0
1035.29	53.6 Pk	3.5 / 22.3 / 25.5	53.9	H / 1.0 / 90.0	33.9	54.0
690.19	57.2 Pk	2.9 / 19.8 / 26.1	53.9	H / 1.0 / 90.0	33.9	57.2
345.10	79.5 Pk	2.1 / 14.6 / 0.0	96.2	H / 1.0 / 90.0	76.2	77.2

Tested by: ROSS M. JOHNSON

Printed — Signature

Reviewed by: J. T. Schneider

Printed — Signature