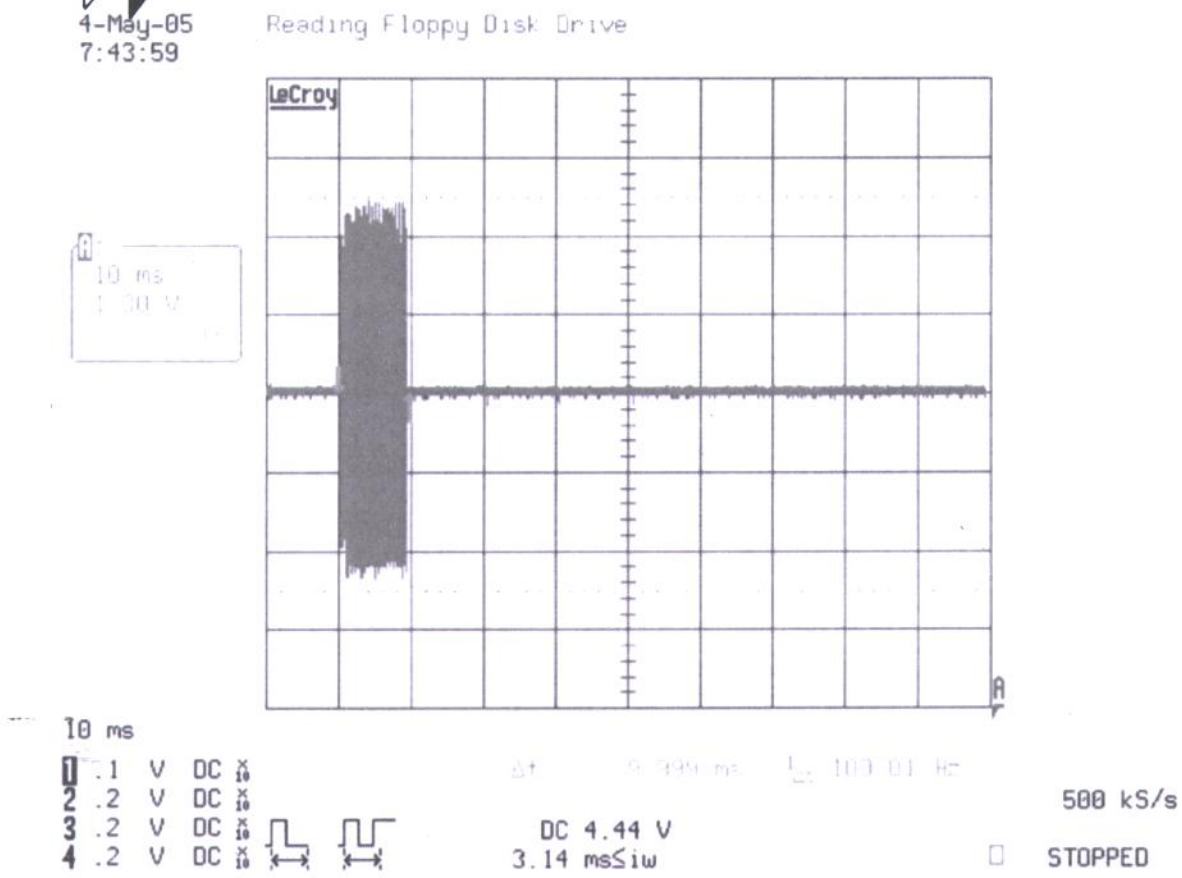


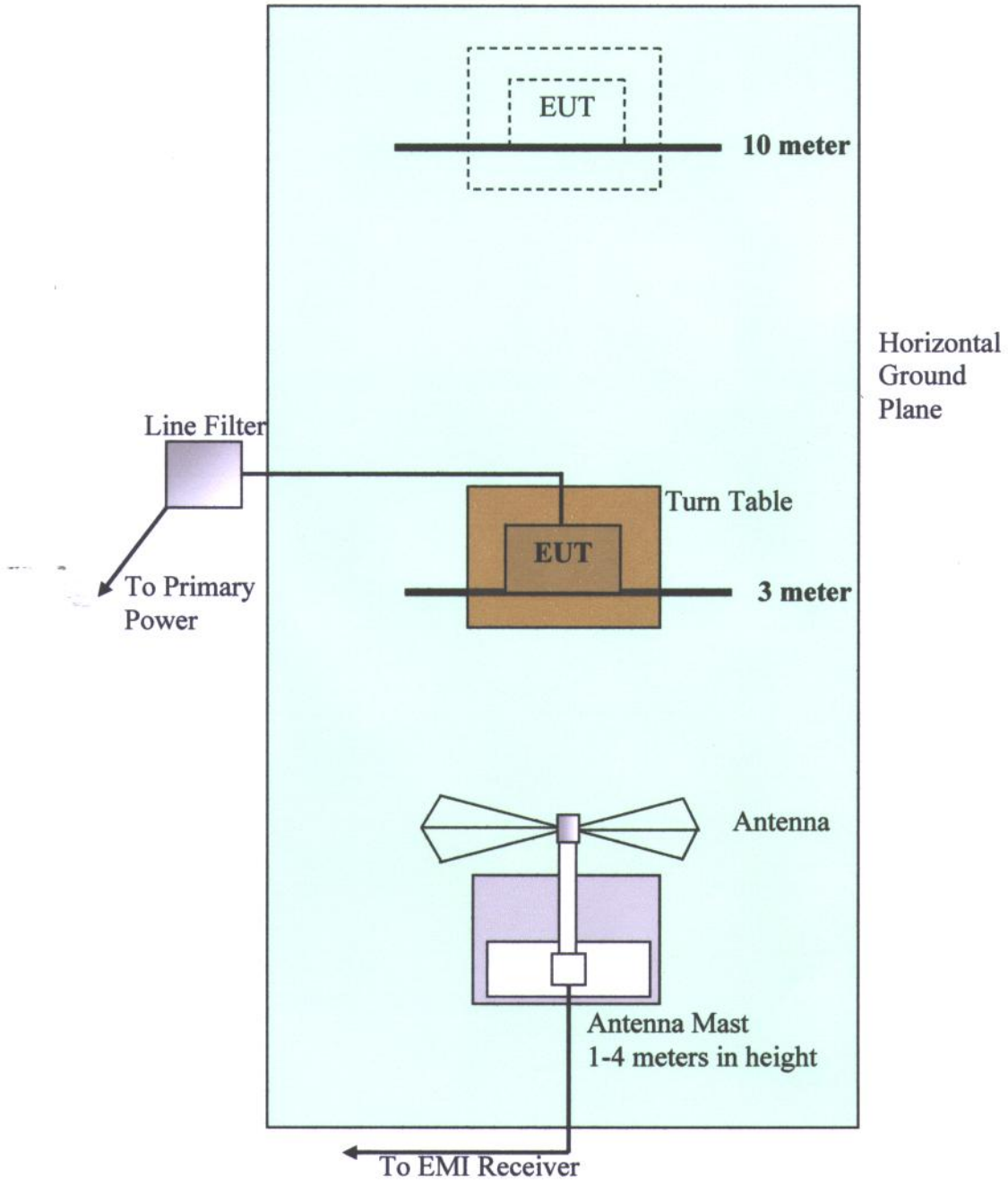
Duty Cycle Correction Factor Calculation:

Total Number of Pulses counted in 100ms

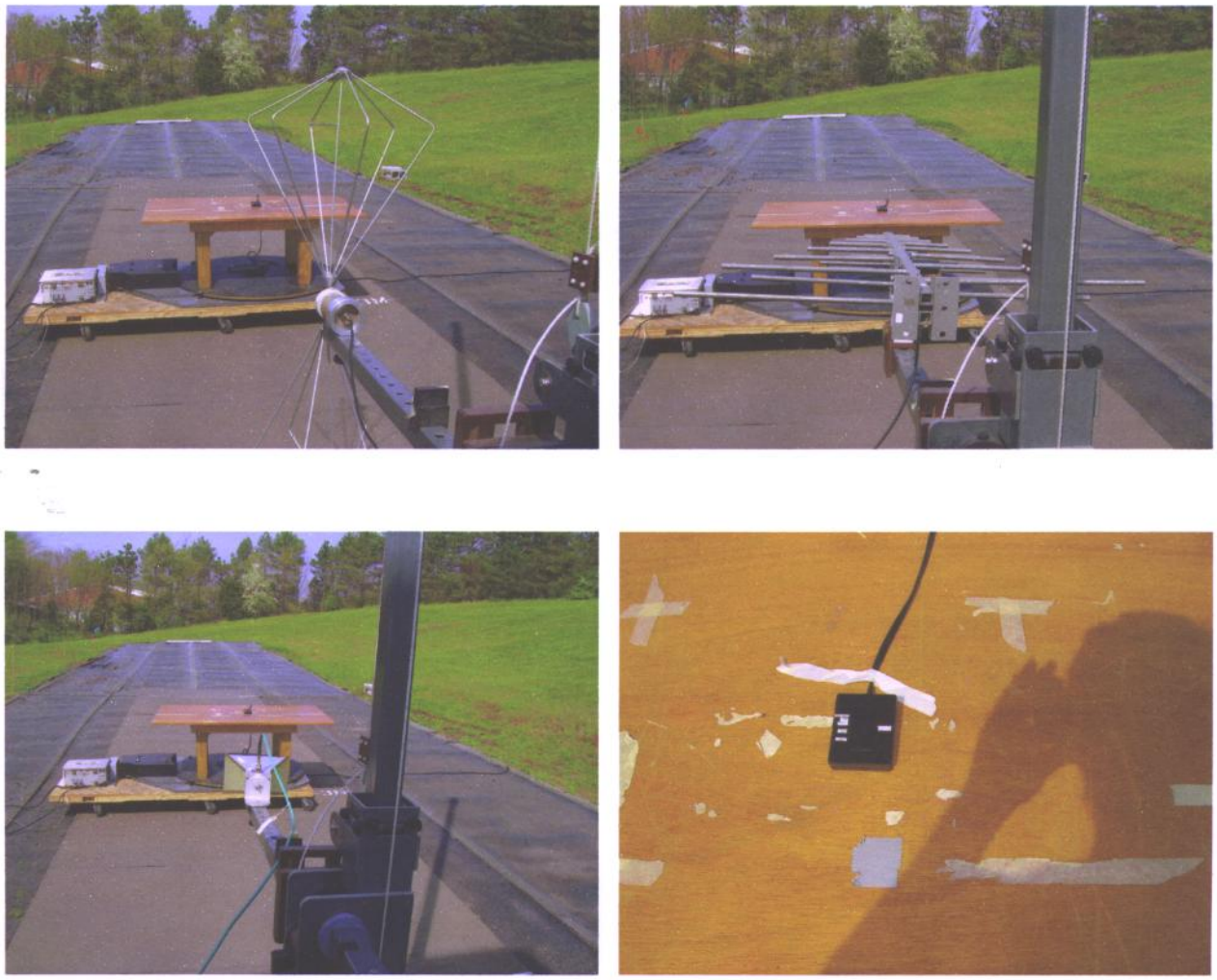
Total Time On = 9.999ms

Duty Cycle Correction Factor = 20 log [Time On / (Time On + Time Off)]
= 20 log [9.999 ms / 100 ms]
= 20 log [0.1]
= -20 dB

Duty Cycle Correction Factor
Figure 23



Radiated Emissions Test Setup Diagram
Figure 24



Radiated Emissions Test Setup Photographs
Figure 25

Electromagnetic Emission Test

EUT			
Manufacturer: Lutron Electronics **Model#:** HRT-3LD **Serial #:** 030071303095 **Mode:** Receive 431MHz.	**Date:** 4/25/2006 **Test Instruments:** RSI # 391, 75, 80, 708, 501, 502, 503 **Frequency Range:** 30– 1000MHz	Test Code **RE** Technician JK Engineer	

Temperature: 61.1°F **Humidity:** 31%	**Additional Info:**	**Test Spec:** FCC Part 15 Class B Unintentional Radiators
Radiated Distance: 3 meter Antenna: Bicon / Log	[X] HORIZ. [ ] BB [ ] NB [X] VERT. [ ] H [X] E	**Conducted** Line: Function: [ ] BB [ ] NB

FREQ.	IND. Level	Pre-Amp Factor	Correction Factors			Final Level	Antenna Height	EUT Azimuth	Remarks
			ANT.	Cable loss					
MHz	dBµV	dB	dB	dB		dBµV/m	Meters	Degree	
52.6	19.6		9.6	1.1		30.3	1.0	0.0	Vert/Bicon
52.9	19.4		9.6	1.1		30.1			
120.0	5.1		11.2	1.9		18.2			
200.0	1.5		14.6	2.3		18.4			
427.72	13.5		17.4	3.6		34.5			Vert/Log. P.
500.0	-1.6		17.9	4.0		20.3			
861.384	2.4		22.4	5.4		30.2			
1000.0	-0.2		24.2	5.8		29.8			
1292.0	46.9	-31.0	25.0	1.0		41.9			
1723.0	49.0	-33.0	26.3	1.0		43.3			
2153.0	44.6	-29.0	28.0	1.0		44.6			
72.0	21.4		8.5	1.4		31.3	2.43	180.0	Horiz./Bicon
75.6	24.2		8.8	1.4		34.4	2.43	180.0	
120.0	9.0		11.0	1.9		21.9	2.33	180.0	
200.0	7.2		14.0	2.3		23.5	1.65	180.0	
427.72	15.0		17.2	3.6		35.8	1.00	125.0	Horiz/Log .P
500.0	-1.6		18.2	4.0		20.6	1.00	0.0	
861.384	2.4		23.3	5.4		31.1	1.00	0.0	
1000.0	-0.2		24.6	5.8		30.2	1.00	0.0	
1292.0	46.6	-31.0	25.0	1.0		41.6	1.00	0.0	
1723.0	48.7	-33.0	26.6	1.0		43.3	1.00	0.0	
2153.0	45.5	-29.0	28.0	1.0		45.5	1.00	0.0	

Figure 26

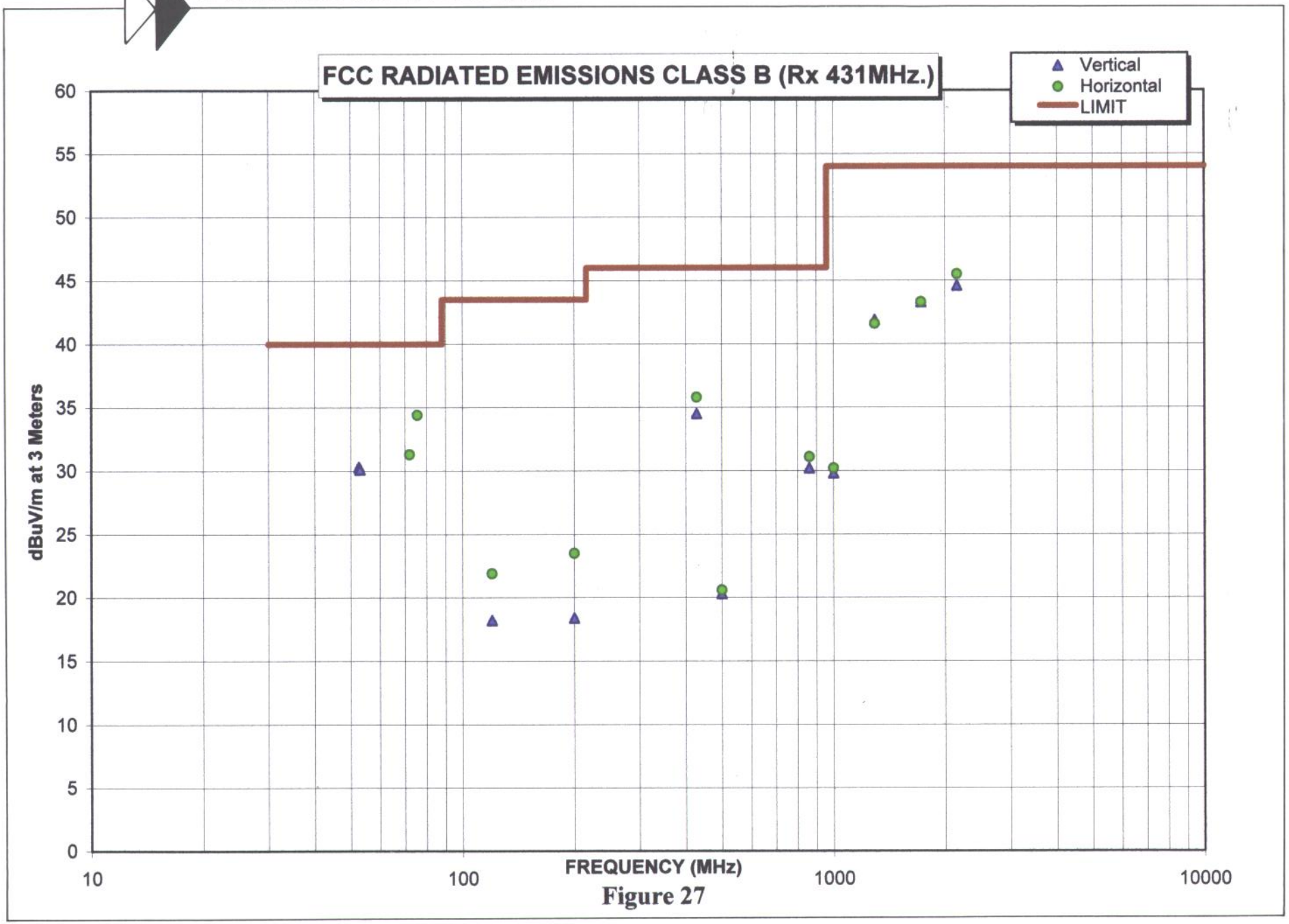

FCC RADIATED EMISSIONS CLASS B (Rx 431MHz.)
Vertical
Horizontal
LIMIT
dBuV/m at 3 Meters
FREQUENCY (MHz)
60
55
50
45
40
35
30
25
20
15
10
5
0
10
100
1000
10000

Figure 27

Electromagnetic Emission Test

EUT			
	Manufacturer: Lutron Electronics **Model#:** HRT-3LD **Serial #:** 030071303095 **Mode:** Receive 437MHz.	**Date:** 4/25/06 **Test Instruments:** RSI # 391, 75, 80, 708, 501, 502, 503 **Frequency Range:** 30 – 1000MHz	Test Code **RE** Technician JK Engineer

Temperature: 61°F **Humidity:** 31%	**Additional Info:**	**Test Spec:** FCC Part 15 Class B Unintentional Radiators
Radiated Distance: 3.0 meter Antenna: Bicon / Log	[X] HORIZ. [ ] BB [ ] NB [X] VERT. [ ] H [X] E	**Conducted** Line: Function: [ ] BB [ ] NB

FREQ.	IND. Level	Pre-Amp Level	Correction Factors			Final Level	Antenna Height	EUT Azimuth	Remarks
			ANT.	Cable loss					
MHz	dBµV	dB	dB	dB		dBµV/m	Meters	Degree	
52.6	19.3		9.6	1.1		30.0	1.00	0.0	Vertical/Bicon
120.0	17.6		11.1	1.9		30.6	1.00	0.0	
192.0	4.4		14.2	2.2		20.8	1.00	0.0	
200.0	1.7		14.6	2.3		18.6	1.00	0.0	
300.0	-1.4		14.8	3.0		16.4	1.00	0.0	Vertical/Log.P
434.0	14.4		17.4	3.6		35.4	1.00	0.0	
442.4	20.0		17.4	3.6		41.0	1.00	0.0	
500.0	-1.6		17.9	4.0		20.3	1.00	0.0	
873.384	2.4		22.8	5.4		30.6	1.00	0.0	
1000.0	-0.2		24.2	5.8		29.8	1.00	88.0	
1310.0	47.0	-31.0	25.1	1.0		42.1	1.00	0.0	Vertical/Horn
1747.0	49.0	-33.0	26.3	1.0		43.3	1.00	0.0	
2183.0	48.5	-29.0	28.0	1.0		48.5	1.00	0.0	
52.9	25.2		10.5	1.1		36.8	2.78	178.4	Horiz./Bicon.
75.0	24.8		8.8	1.4		35.0	2.39	135.7	
120.0	8.0		11.0	1.9		20.9	2.21	0.0	
200.0	6.8		14.0	2.3		23.1	2.21	0.0	
300.0	1.2		15.2	3.0		19.4	1.00	0.0	Horiz./Log.P.
442.4	19.0		17.1	3.7		39.8	1.00	125.0	
500.0	-1.1		18.2	4.0		21.1	1.00	0.0	
873.386	2.4		23.3	5.4		31.1	1.00	0.0	
1000.0	-0.2		24.6	5.8		30.2	1.00	0.0	Horiz./Horn
1310.0	47.0	-31.0	25.0	1.0		42.0	1.00	0.0	
1747.0	49.5	-33.0	26.0	1.0		43.5	1.00	0.0	
2183.0	48.5	-29.0	28.0	1.0		48.5	1.00	0.0	

Figure 28

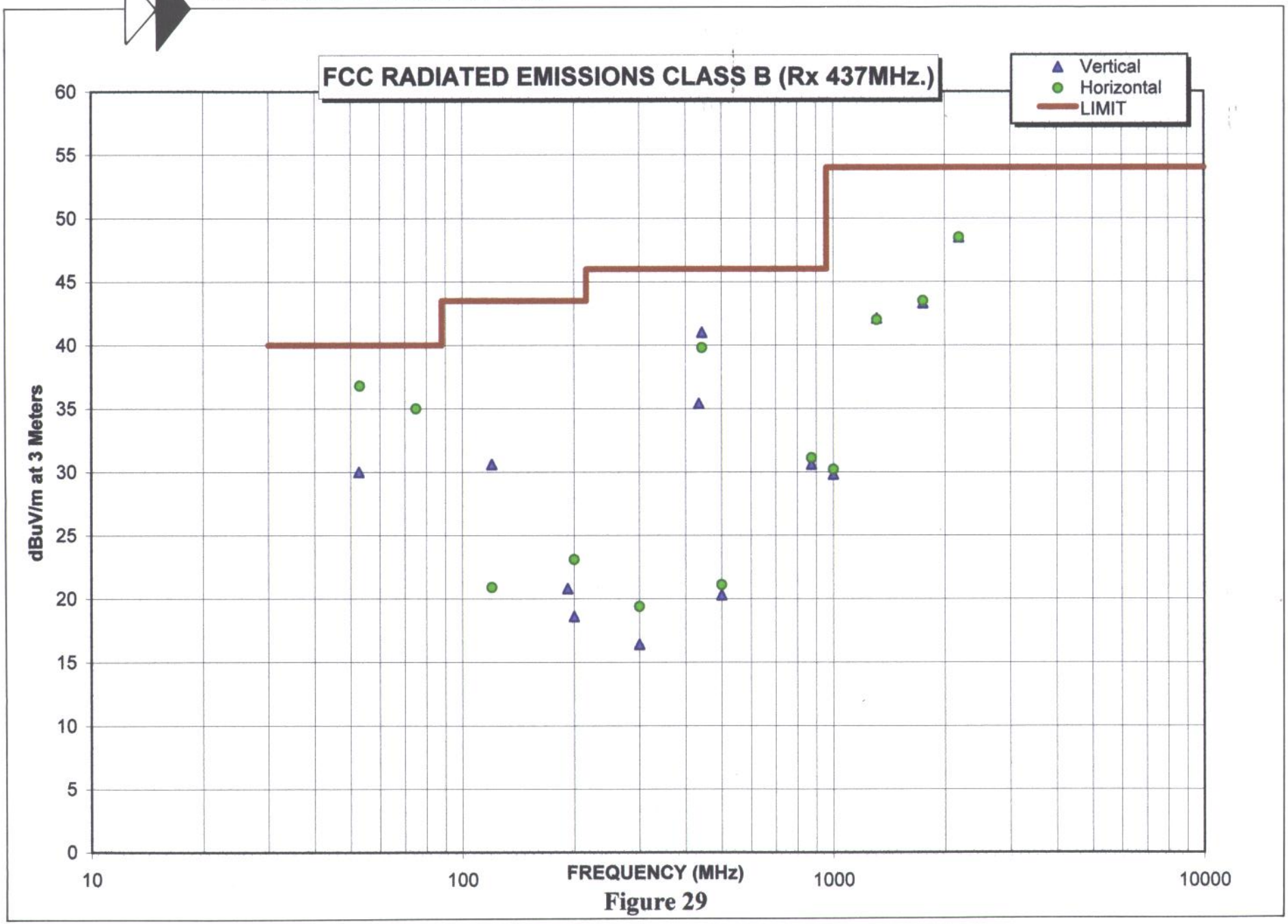

FCC RADIATED EMISSIONS CLASS B (Rx 437MHz.)
Vertical
Horizontal
LIMIT
dBuV/m at 3 Meters
FREQUENCY (MHz)
60
55
50
45
40
35
30
25
20
15
10
5
0
10
100
1000
10000

Figure 29

Company: Lutron Electronics
Model # HRT-3LD
Fund. Freq.: 431MHz
Mode: Tx (CW)

Test Personnel: J. Kavalusky 3K
Date: 4/25/2006

Radiated Emissions for UnIntentional Radiators

Frequency (MHz)	Polarity	Antenna Height (Meters)	Azimuth (Degrees)	Indicated Level (dBuV)	Antenna Factor (dB)	Pre-Amp Gain Factor (dB)	Cable Loss (dB)	Averaging Factor (dB)	Field Strength @ 3m (dBuV/m)	Limits @ 3m (dBuV/m)	Margin (dB)
52.6	Vert	1.00	0	19.6	9.6	0.0	1.1		30.3	41.93	-11.6
52.9	Vert	1.00	0	19.4	9.6	0.0	1.1		30.1	41.93	-11.8
120.0	Vert	1.00	0	5.0	11.2	0.0	1.9		18.10	41.53	-23.4
200.0	Vert	1.00	0	1.5	14.6	0.0	2.3		18.4	51.48	-33.1
300.0	Vert	1.00	0	0.2	14.8	0.0	3.0		18.0	54.67	-36.7
427.67	Vert	1.00	150.6	22.0	17.4	0.0	3.6		43.0	60.61	-17.6
434.31	Vert	1.00	150.6	19.7	17.2	0.0	3.6		40.5	60.84	-20.3
435	Vert	1.00	150.6	19.2	17.3	0.0	3.7		40.20	60.86	-20.7
435.6	Vert	1.36	128.4	21.2	17.4	0.0	3.6		42.2	60.88	-18.7
500.0	Vert	1.00	0	1.0	17.9	0.0	4.0		22.9	61.9	-39.0
861.386	Vert	1.22	128.4	2.4	22.4	0.0	5.4		30.2	61.9	-31.7
1000.0	Vert	1.00	0	-0.2	24.2	0.0	5.8		29.8	61.9	-32.1
1292.0	Vert	1.00	0	46.9	25.0	-31.0	1.0		41.9	61.9	-20.0
1723.0	Vert	1.00	0	49.0	26.3	-33.0	1.0		43.3	61.9	-18.6
2153.0	Vert	1.00	0	44.6	28.0	-29.0	1.0		44.6	61.9	-17.3

Figure 30

Company: Lutron Electronics
Model # HRT-3LD
Fund. Freq.: 431MHz
Mode: Tx (CW)

Test Personnel: J. Kavalusky JK
Date: 4/25/2006

Radiated Emissions for UnIntentional Radiators

Frequency (MHz)	Polarity	Antenna Height (Meters)	Azimuth (Degrees)	Indicated Level (dBuV)	Antenna Factor (dB)	Pre-Amp Gain Factor (dB)	Cable Loss (dB)	Averaging Factor (dB)	Field Strength @ 3m (dBuV/m)	Limits @ 3m (dBuV/m)	Margin (dB)
72	Horiz	2.43	180.0	24.2	8.6	0.0	1.4		34.2	41.93	-7.7
75.6	Horiz	2.43	180.0	24.2	8.8	0.0	1.4		34.4	41.93	-7.5
120.0	Horiz	2.33	180.0	9.0	11.0	0.0	1.9		21.9	41.58	-19.7
200.0	Horiz	1.65	180.0	7.2	14.0	0.0	2.3		23.5	51.48	-28.0
300.0	Horiz	1.00	127.9	-0.7	15.2	0.0	3.0		17.5	54.67	-37.2
427.67	Horiz	1.00	150.6	22.1	16.6	0.0	3.6		42.3	60.85	-18.6
434.36	Horiz	1.00	150.6	21.2	17.3	0.0	3.6		42.1	60.67	-18.6
435	Horiz	1.00	150.6	22.9	17.20	0.0	3.6		43.7	60.86	-17.2
500.0	Horiz	1.00	0	-1.1	18.2	0.0	4.0		21.1	61.9	-40.8
861.386	Horiz	1.00	0	2.4	22.7	0.0	5.4		30.5	61.9	-31.4
1000.0	Horiz	1.00	0	-0.2	24.6	0.0	5.8		30.2	61.9	-31.7
1292.0	Horiz	1.00	0	46.6	25.0	-31.0	1.0		41.6	61.9	-20.3
1723.0	Horiz	1.00	0	48.7	26.6	-33.0	1.0		43.3	61.9	-18.6
2153.0	Horiz	1.00	0	45.5	28.0	-29.0	1.0		45.5	61.9	-16.4

Figure 31

Company: Lutron Electronics
Model # HRT-3LD
Fund. Freq.: 437MHz
Mode: Tx (CW)

Test Personnel:J. Kavalusky JK
Date: 4/25/2006

Radiated Emissions for UnIntentional Radiators

Frequency (MHz)	Polarity	Antenna Height (Meters)	Azimuth (Degrees)	Indicated Level (dBuV)	Antenna Factor (dB)	Pre-Amp Gain Factor (dB)	Cable Loss (dB)	Averaging Factor (dB)	Field Strength @ 3m (dBuV/m)	Limits @ 3m (dBuV/m)	Margin (dB)
52.6	Vert	1.00	0.0	19.3	9.6	0.0	1.1		30.0	41.93	-11.9
120	Vert	1.00	0.0	4.5	11.2	0.0	1.9		17.6	41.53	-23.9
192.0	Vert	1.00	248	4.4	14.2	0.0	2.2		20.8	51.48	-30.7
200.0	Vert	1.00	102	1.7	14.6	0.0	2.3		18.6	51.48	-32.9
300.0	Vert	1.00	0	-1.1	14.8	0.0	3.0		16.7	54.67	-38.0
427.63	Vert	1.00	150.0	22.00	16.6	0.0	3.6		42.2	60.61	-18.4
434.36	Vert	1.00	150.0	19.7	17.2	0.0	3.6		40.5	60.84	-20.3
435	Vert	1.00	150.0	19.3	17.3	0.0	3.7		40.3	60.92	-20.6
500.0	Vert	1.40	97	-1.1	17.9	0.0	4.0		20.8	61.9	-41.1
873.386	Vert	1.38	97	2.4	22.8	0.0	5.4		30.6	61.9	-31.3
1000.0	Vert	1.38	97	-0.2	24.2	0.0	5.8		29.8	61.9	-32.1
1310.0	Vert	1.00	360	47.0	25.1	-31.0	1.0		42.1	61.9	-19.8
1747.0	Vert	1.00	360	49.0	26.3	-33.0	1.0		43.3	61.9	-18.6
2183.0	Vert	1.00	360	47.3	28.2	-29.0	1.0		47.5	61.9	-14.4

Figure 32

Company: Lutron Electronics
Model # HRT-3LD
Fund. Freq.: 437MHz
Mode: Tx (CW)

Test Personnel: J. Kavalusky JK
Date: 4/25/2006

Radiated Emissions for UnIntentional Radiators

Frequency (MHz)	Polarity	Antenna Height (Meters)	Azimuth (Degrees)	Indicated Level (dBuV)	Antenna Factor (dB)	Pre-Amp Gain Factor (dB)	Cable Loss (dB)	Averaging Factor (dB)	Field Strength @ 3m (dBuV/m)	Limits @ 3m (dBuV/m)	Margin (dB)
52.9	Horiz	2.38	178.4	25.2	10.5	0.0	1.1		36.8	41.93	-5.1
75	Horiz	2.39	135	24.8	8.8	0.0	1.4		35.0	41.93	-6.9
120.0	Horiz	2.21	0.0	8.0	11.0	0.0	1.9		20.90	41.58	-20.7
200.0	Horiz	2.21	0.0	6.8	14.0	0.0	2.3		23.1	51.48	-28.4
300.0	Horiz	1.00	126	-1.1	15.2	0.0	3.0		17.1	54.67	-37.6
427.63	Horiz	1.00	150.0	25.4	17.3	0.0	3.6		46.3	60.61	-14.3
434	Horiz	1.00	150.0	21.4	17.2	0.0	3.6		42.2	60.84	-18.6
435	Horiz	1.13	150.8	22.8	17.3	0.0	3.7		43.80	60.86	-17.1
500.0	Horiz	1.00	0	-1.1	18.2	0.0	4.0		21.1	61.9	-40.8
873.386	Horiz	1.00	252	2.4	23.3	0.0	5.4		31.1	61.9	-30.8
1000.0	Horiz	2.00	97	0.2	24.6	0.0	5.8		30.6	61.9	-31.3
1310.0	Horiz	1.00	360	47.0	25.1	-31.0	1.0		42.1	61.9	-19.8
1747.0	Horiz	1.00	360	49.5	26.6	-33.0	1.0		44.1	61.9	-17.8
2183.0	Horiz	1.00	360	48.5	28.2	-29.0	1.0		48.7	61.9	-13.2

Figure 33

Company: Lutron Electronics
Model # HRT-3LD
Fund. Freq.: 431MHz
Mode: Tx (CW)

Test Personnel: J. Kavalusky JK
Date: 4/25/2005

Radiated Emission for Intentional Radiators

Frequency (MHz)	Polarity	Antenna Height (Meters)	Azimuth (Degrees)	Indicated Level (dBuV)	Antenna Factor (dB)	Pre-Amp Gain Factor (dB)	Cable Loss (dB)	Averaging Factor (dB)	Field Strength @ 3m (dBuV/m)	Limits @ 3m (dBuV/m)	Margin (dB)
431	Vert	1.00	238.9	63.5	17.4	0.0	3.6	-20.0	64.5	80.73	-16.2
862	Vert	1.00	238.9	49.0	22.5	0.0	5.4	-20.0	56.9	61.93	-5.0
1293	Vert	1.00	0	56.00	25.0	-31.0	1.0	-20.0	31.00	61.93	-30.9
1724	Vert	1.00	0	54.40	26.3	-33.0	1.0	-20.0	28.70	61.93	-33.2
2155	Vert	1.00	0	48.1	28.0	-29.0	1.0	-20.0	28.1	61.93	-33.8
2586	Vert	1.00	0	46.00	30.0	-32.0	1.0	-20.0	25.00	61.93	-36.9
3017	Vert	1.00	0	42.00	30.3	-27.0	1.0	-20.0	26.30	61.93	-35.6
3448	Vert	1.00	0	41.0	31.3	-25.0	1.0	-20.0	28.3	61.93	-33.6
3879	Vert	1.00	0	41.5	32.4	-23.3	1.0	-20.0	31.60	54.0	-22.4
4310	Vert	1.00	0	41.5	32.5	-22.0	1.0	-20.0	33.0	54.0	-21.0
431	Horiz	1.00	238.9	71.6	17.3	0.0	3.6	-20.0	72.5	80.73	-8.2
862	Horiz	1.00	238.9	45.4	22.8	0.0	5.4	-20.0	53.6	61.93	-8.3
1293	Horiz	1.00	198	56.7	25.0	-31.0	1.0	-20.0	31.7	61.93	-30.2
1724	Horiz	1.00	0	50.4	26.6	-33.0	1.0	-20.0	25.0	61.93	-36.9
2155	Horiz	1.00	0	47.40	28.0	-29.0	1.0	-20.0	27.40	61.93	-34.5
2586	Horiz	1.00	0	45.70	29.9	-32.0	1.0	-20.0	24.6	61.93	-37.3
3017	Horiz	1.00	0	44.50	30.4	-27.0	1.0	-20.0	28.90	61.93	-33.0
3448	Horiz	1.00	0	41.40	31.4	-25.0	1.0	-20.0	28.80	61.93	-33.1
3879	Horiz	1.00	0	41.50	32.5	-23.3	1.0	-20.0	31.70	54.0	-22.3
4310	Horiz	1.00	0	41.50	32.5	-22.0	1.0	-20.0	33.00	54.0	-21.0

Figure 34

Company: Lutron Electronics
Model # HRT-3LD
Fund. Freq.: 437MHz
Mode: Tx (CW)

Test Personnel: J. Kavalusky JK
Date: 4/25/2006

Radiated Emission for Intentional Radiators

Frequency (MHz)	Polarity	Antenna Height (Meters)	Azimuth (Degrees)	Indicated Level (dBuV)	Antenna Factor (dB)	Pre-Amp Gain Factor (dB)	Cable Loss (dB)	Averaging Factor (dB)	Field Strength @ 3m (dBuV/m)	Limits @ 3m (dBuV/m)	Margin (dB)
437	Vert	1.28	242.9	69.9	17.4	0.0	3.6	-20.0	70.9	80.3	-9.4
874	Vert	3.50	242.9	40.0	22.8	0.0	5.4	-20.0	48.2	61.9	-13.7
1311	Vert	1.00	0	53.20	25.1	-32.0	1.0	-20.0	27.3	61.9	-34.6
1748	Vert	1.00	0	50.00	26.3	-33.0	1.0	-20.0	24.30	54.0	-29.7
2185	Vert	1.00	0	40.3	28.2	-29.0	1.0	-20.0	20.5	61.9	-41.4
2622	Vert	1.00	0	39.20	30.0	-32.0	1.0	-20.0	18.20	61.9	-43.7
3059	Vert	1.00	0	39.50	30.3	-27.0	1.0	-20.0	23.80	61.9	-38.1
3496	Vert	1.00	0	38.2	31.4	-25.0	1.0	-20.0	25.6	54.0	-28.4
3933	Vert	1.00	0	35.9	32.44	-23.3	1.0	-20.0	26.04	54.0	-28.0
4370	Vert	1.00	0	35.3	32.5	-22.0	1.0	-20.0	26.8	54.0	-27.2
437	Horiz	1.00	242.9	63.5	17.3	0.0	3.6	-20.0	64.4	80.3	-15.9
874	Horiz	1.00	242.9	40.0	23.3	0.0	5.4	-20.0	48.7	61.9	-13.2
1311	Horiz	1.00	98	54.70	25.1	-32.0	1.0	-20.0	28.80	61.9	-33.1
1748	Horiz	1.00	0	51.20	26.6	-33.0	1.0	-20.0	25.80	54.0	-28.2
2185	Horiz	1.00	0	37.40	28.2	-29.0	1.0	-20.0	17.6	61.9	-44.3
2622	Horiz	1.00	0	38.00	29.9	-32.0	1.0	-20.0	16.90	61.9	-45.0
3059	Horiz	1.00	0	37.20	30.4	-27.0	1.0	-20.0	21.60	61.9	-40.3
3496	Horiz	1.00	0	37.90	31.5	-25.0	1.0	-20.0	25.40	54.0	-28.6
3933	Horiz	1.00	0	35.90	32.54	-23.3	1.0	-20.0	26.14	54.0	-27.9
4370	Horiz	1.00	0	33.60	32.5	-22.0	1.0	-20.0	25.10	54.0	-28.9

Figure 35

4.3 Bandwidth Measurements, Paragraph 15.231

Bandwidth measurements were made at the three transmit frequencies of 431 and 437MHz.

RSI used an HP 8566 Spectrum Analyzer to perform bandwidth measurements. Bandwidth plots are shown on data sheets.

The requirement states that the bandwidth shall be no wider than .25% of the center frequency at the 20dB down points. Results of testing are shown in Figures 36 through 43.

THE BANDWIDTH MEASUREMENTS COMPLIED WITH THE FCC REQUIREMENTS SET FORTH IN PARAGRAPH 15.231.

Company: Lutron Electronics
Model # HRT-3LD
Fund. Freq.: 431MHz

Test Personnel: J. Kavalusky JK
Date: 04/26/2006

Bandwidth of Fundamental Frequency

	Frequency (MHz)	Measurement (dBuV/m)
Center Frequency	431.000	71.80
20 dB down	431.010	52.55
20 dB down	430.987	51.85

The bandwidth is 36kHz.

Allowable Bandwidth: 0.25% of Fundamental Frequency
For 431MHz: ±0.5388MHz

Figure 36

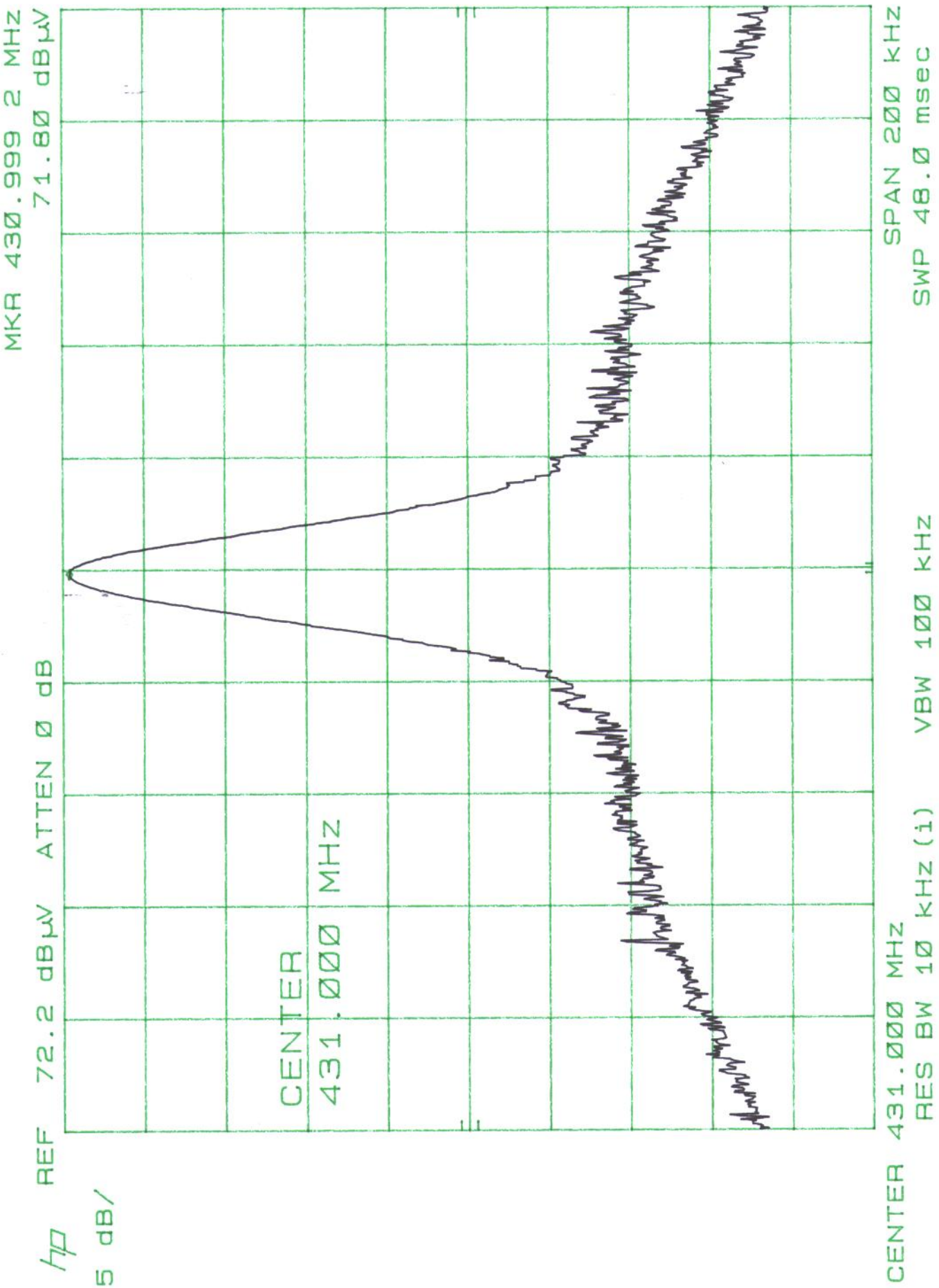

MKR 430.999 2 MHz
71.80 dBµV
hp
REF 72.2 dBµV
ATTEN 0 dB
5 dB/
CENTER
431.000 MHz
SPAN 200 kHz
SWP 48.0 msec
CENTER 431.000 MHz
RES BW 10 kHz (i)
VBW 100 kHz

FIGURE 37

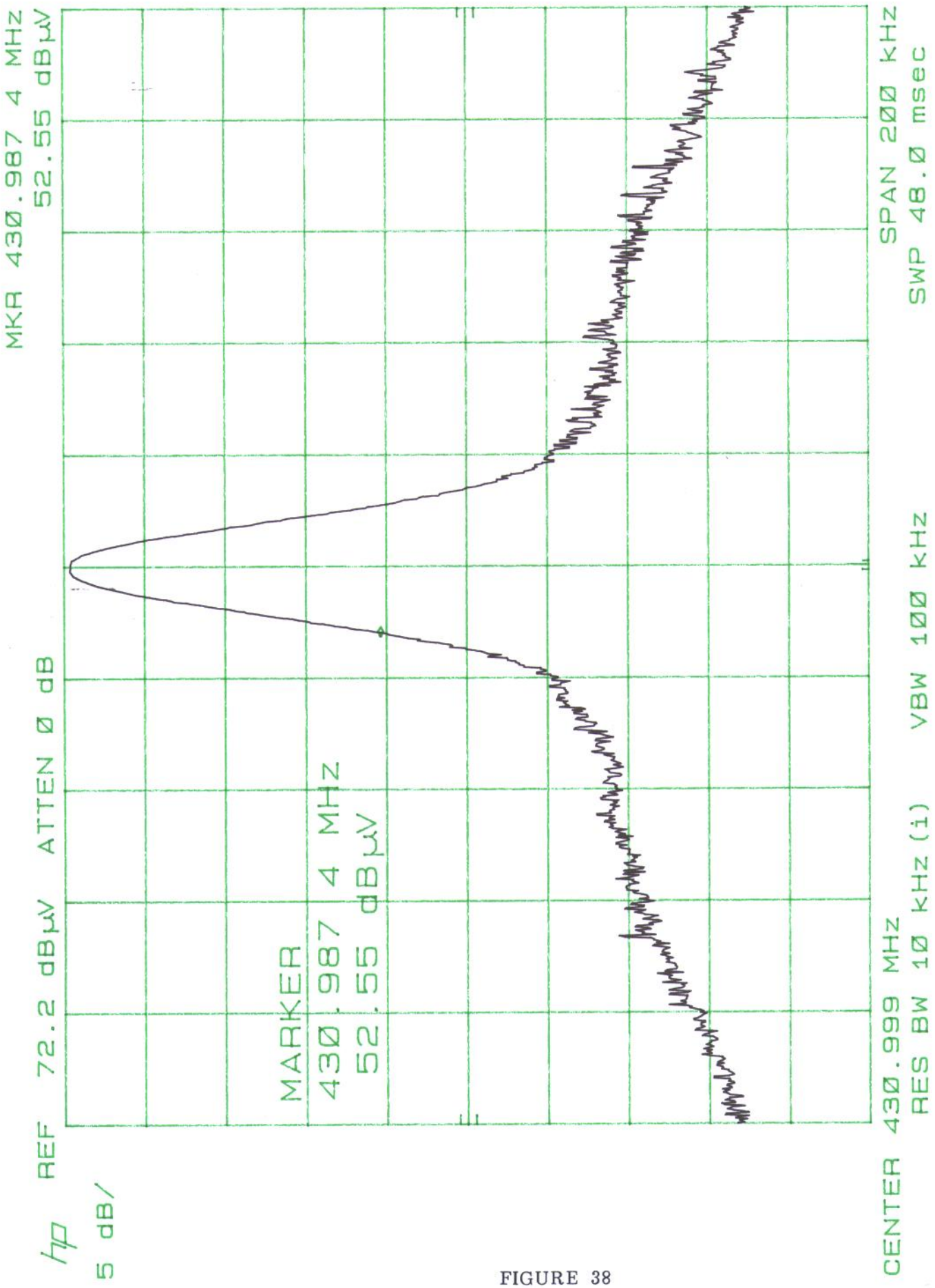

MKR 430.987 4 MHz
52.55 dBµV
REF 72.2 dBµV ATTEN Ø dB
5 dB/
MARKER
430.987 4 MHz
52.55 dBµV
CENTER 430.999 MHz
RES BW 10 kHz (i) VBW 100 kHz
SPAN 200 kHz
SWP 48.Ø msec

FIGURE 38