

4 Test Results

4.1 Peak Conducted Transmit Output Power: (FCC Part §15.407(a)(3))

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer (HP8564E). The method of measurement chosen was one that has been an acceptable test procedure per the FCC. The following describes the test procedure used.

The analyzer offset was adjusted to compensate for the attenuator and other losses in the system. The 26 dB Emission Bandwidth was measured and used to ensure that the spectrum analyzer bandwidth was not set too low. The following formula was used for calculating the minimum VBW:

$$EBW / (2 * \pi * 30)$$

The EBW was measured at 40.42MHz for Plan A and 40 MHz for Plan B. Using these in the previous formula results in a minimum VBW of 300kHz.

Using the spectrum analyzers Band Power Measurement Function over the appropriate EBW gives the peak output reading. The following table lists the conducted power measurements. Note the limit in this table is calculated using a maximum of 30 dBm conducted power with a fixed point-to-point directional gain of 23 dBi.

Table 3. RF Power Output

Frequency	Measured Level	Limit	Pass/Fail
Low Channel 5750 MHz	20.3 dBm	30 dBm	Pass
High Channel 5800 MHz	20.1 dBm	30 dBm	Pass

Note the limit in this table is based on the maximum of 30 dBm conducted power limit specified in the FCC Rules. With the fixed point-to-point installation a maximum EIRP of 53 dBm is allowed. Based on the measured power level a directional gain antenna of a maximum 32.7 dBi may be used with the Tracer 4305. During testing a parabolic antenna with 28.5 dBi gain was used. Figure 1 and Figure 2 are the spectrum analyzer peak power measurement results.

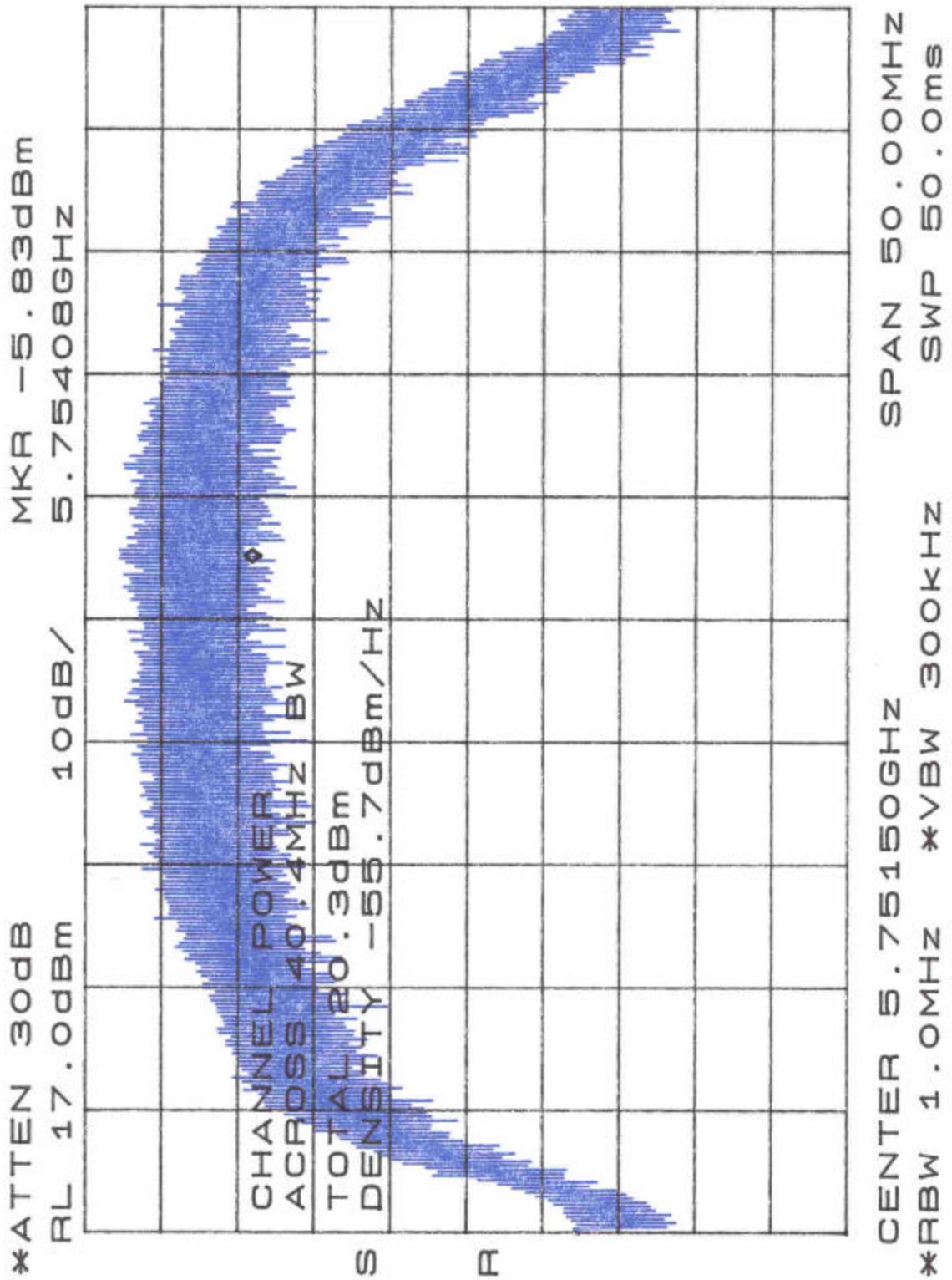


Figure 1: Conducted Output Power, Plan A, 5750 MHz

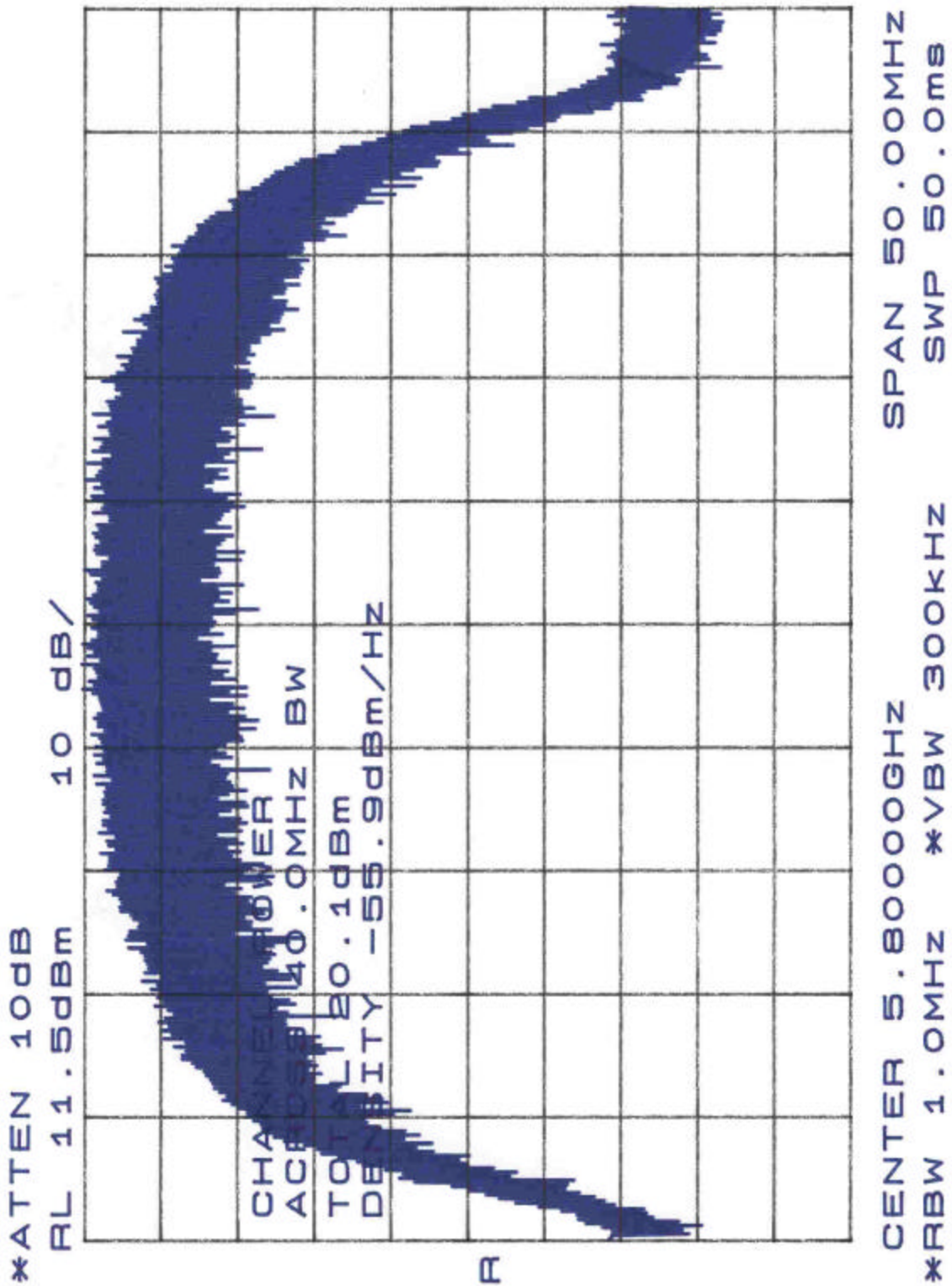


Figure 2: Conducted Output Power, Plan B, 5800 GHz

4.2 Occupied Bandwidth: (FCC Part §2.1049)

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer. The Emissions BandWidth (EBW) was measured at the 26 dB down points with the VBW > RBW setting of the spectrum analyzer.

At full modulation, the occupied bandwidth was measured as shown in Figure 3 and Figure 4.

Table 4: Emission Bandwidth

Plan	Frequency (MHz)	Emission Bandwidth (MHz)
A	5750	40.42
B	5800	40.08

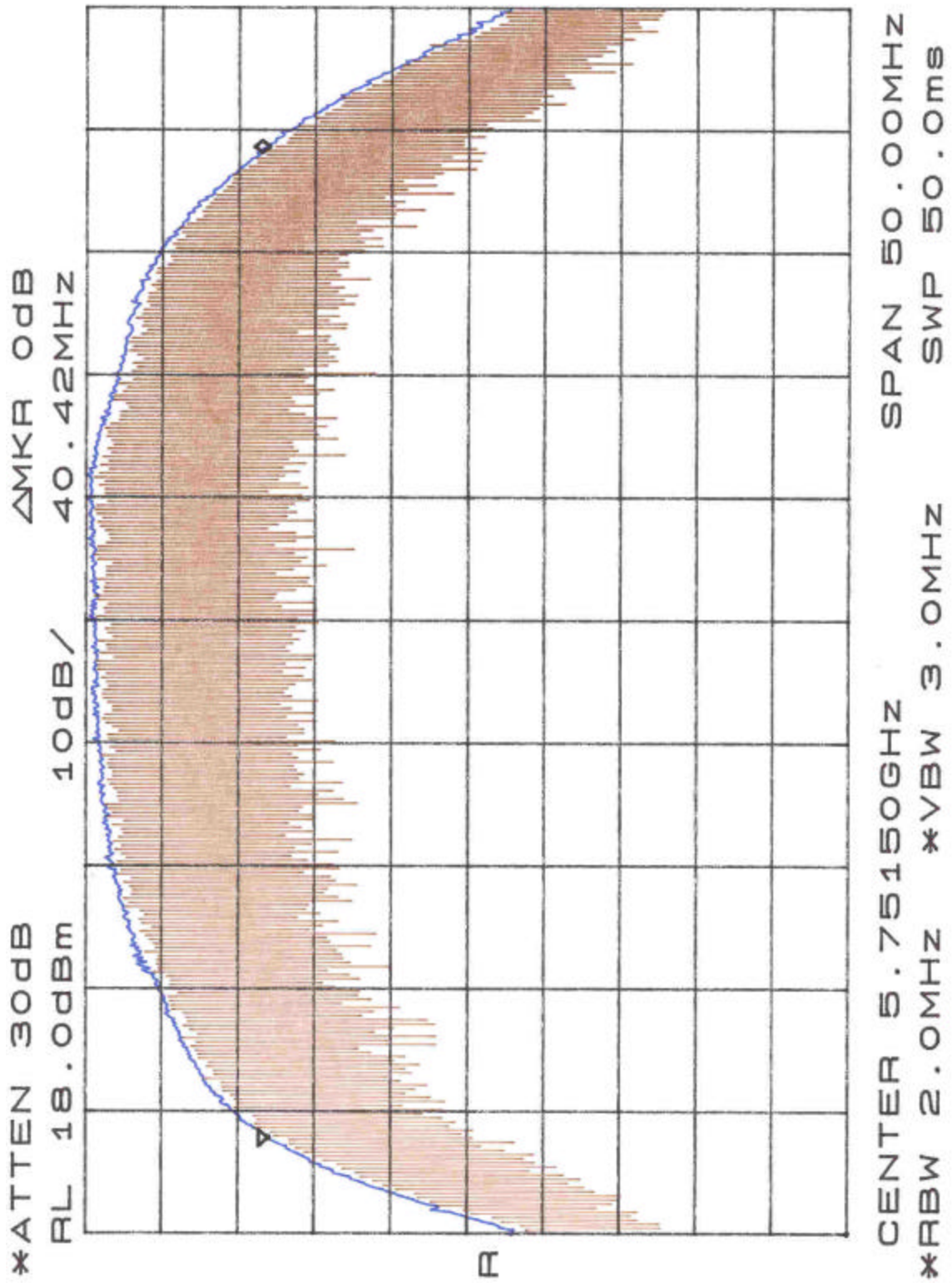


Figure 3. Emission Bandwidth, Plan A, 5750 MHz

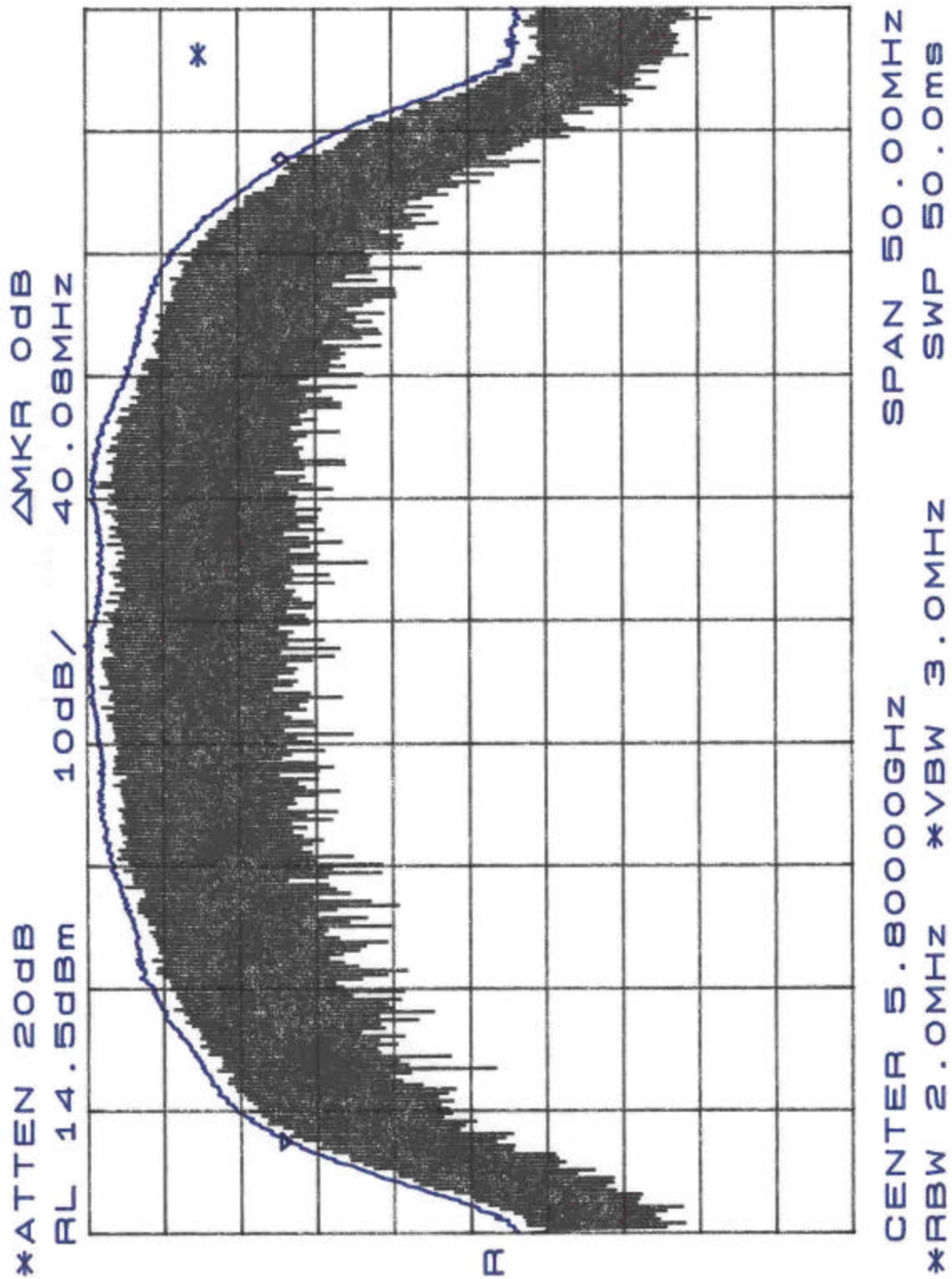


Figure 4: Emission Bandwidth, Plan B, 5800 MHz

4.3 Peak Power Spectral Density (FCC Part §15.407(a)(5))

Per §15.407(a)(5)

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer (HP8564E). The method of measurement chosen was one that has been an acceptable test procedure per the FCC. The following describes the test procedure used.

The spectrum analyzer was setup to view the entire bandwidth of the emission. Two traces were captured on the spectrum analyzer.

4.4 Peak Excursion Measurement (FCC Part §15.407(a)(6))

Per §15.407(a)(6) the peak excursion of the modulation envelope to the peak transmit power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer (HP8564E). The method of measurement chosen was one that has been an acceptable test procedure per the FCC. The following describes the test procedure used.

The spectrum analyzer was setup to view the entire bandwidth of the emission. Two traces were captured on the spectrum analyzer. The first trace was performed with the RBW and VBW set to 1 MHz. The second trace was captured with the RBW set to 1 MHz and the VBW set to 300 kHz.

The traces were then compared and it was verified that the ratio between the two plots did not exceed 13dB in any 1 MHz band. Figure 5 and Figure 6 show the Peak Excursion measurement results.

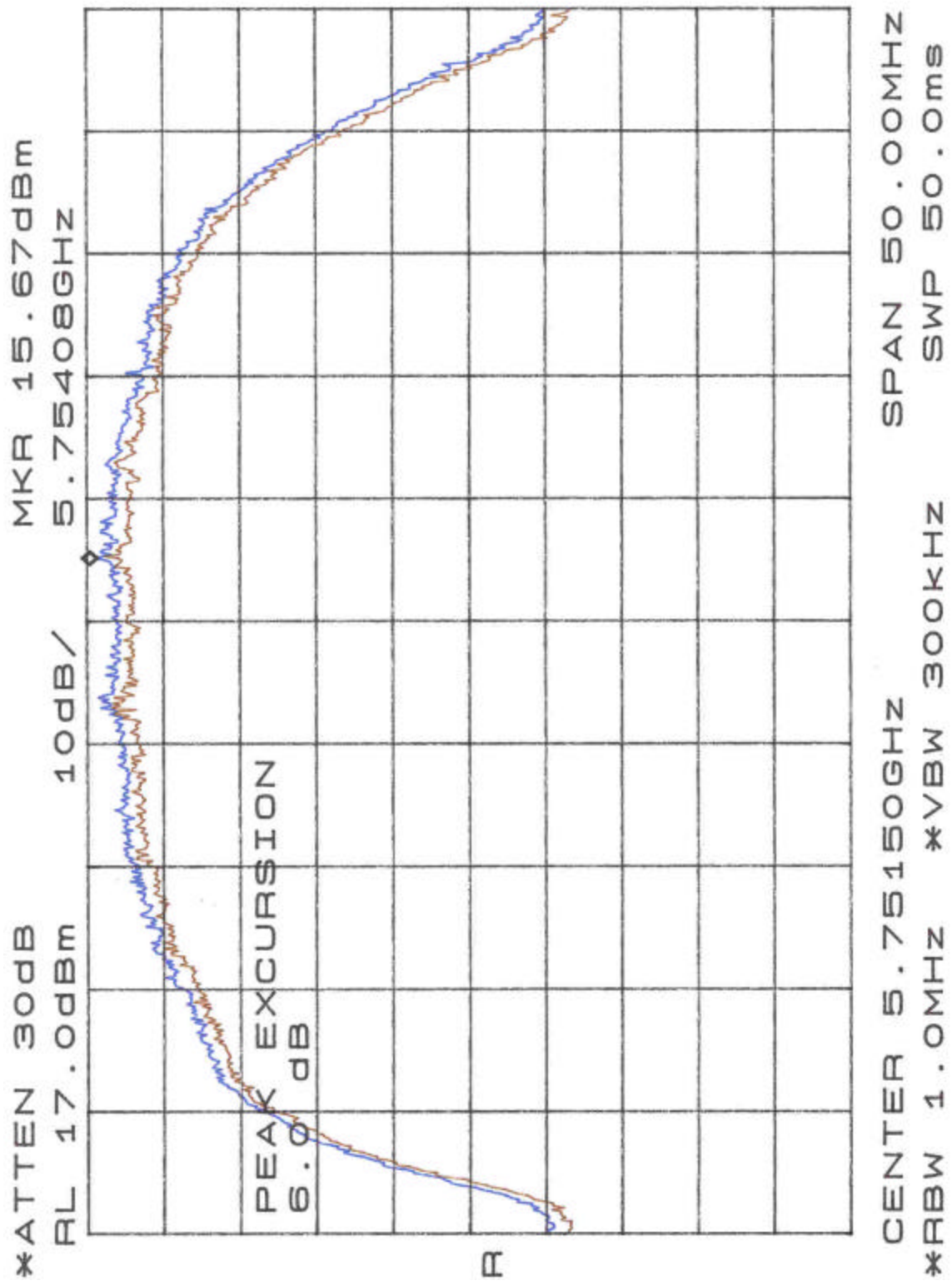


Figure 5: Peak Excursion, Plan A, 5750 MHz

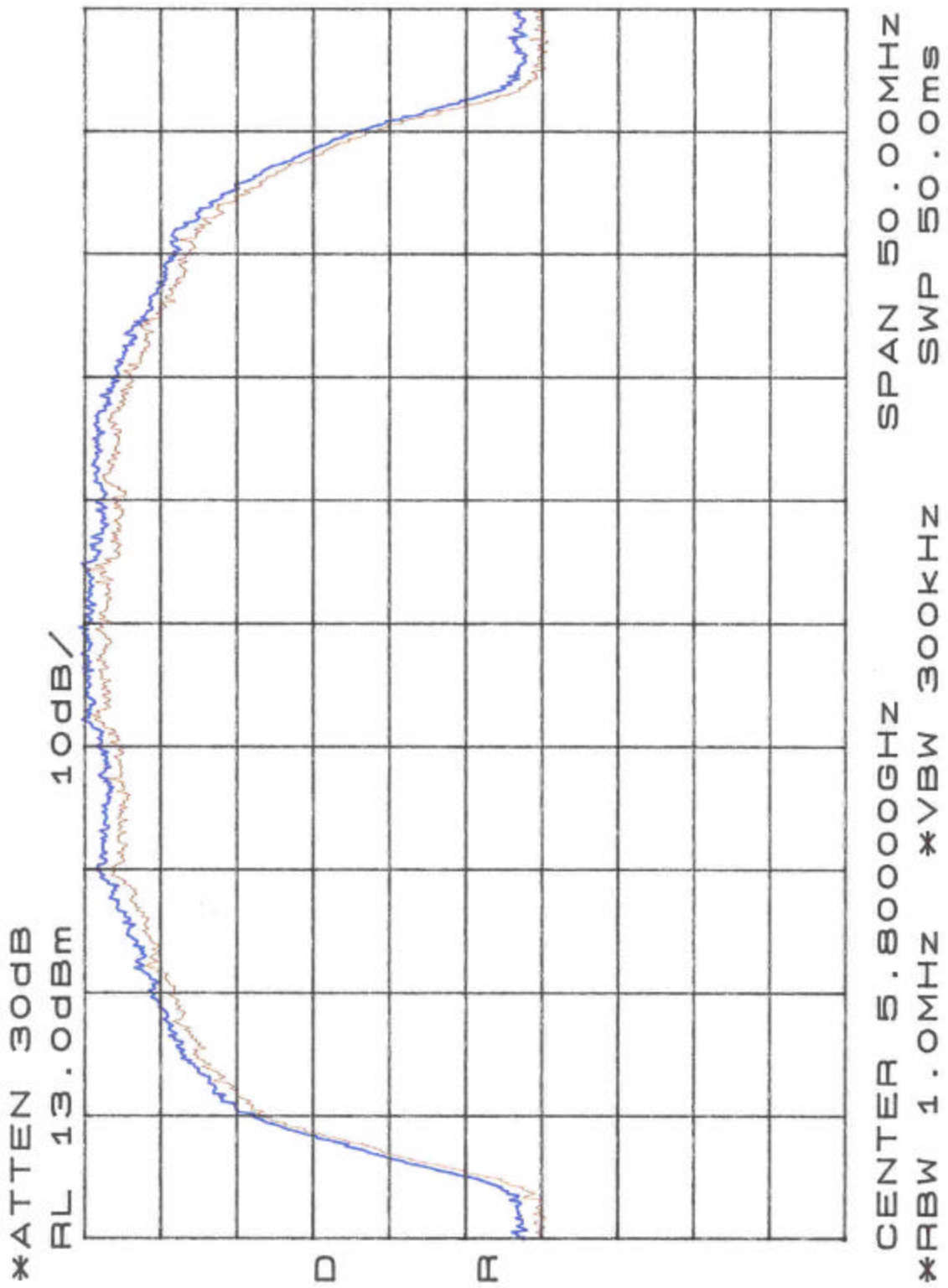


Figure 6: Peak Excursion, Plan B, 5800 MHz

4.5 Spurious Emissions: (FCC Part §15.407(b))

The EUT must comply with requirements for undesirable spurious emissions.

For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz (78.3 dBuV/m); for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz (68.3 dBuV/m).

4.5.1 Test Procedure

For the conducted spurious emissions at the antenna terminal, the Spectrum Analyzer was connected to the output of the EUT. For measurements above 1 GHz, the Resolution Bandwidth was set to 1 MHz; for measurements below 1 GHz, the Resolution Bandwidth was set 100 kHz, and the Video Bandwidth was set to 100 kHz.

The conducted spurious emissions were swept over the frequency range from 30MHz to 40GHz. Plots of the conducted spurious emissions are shown in Figures 7 through 18.

For the radiated spurious emissions, the EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-1992. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

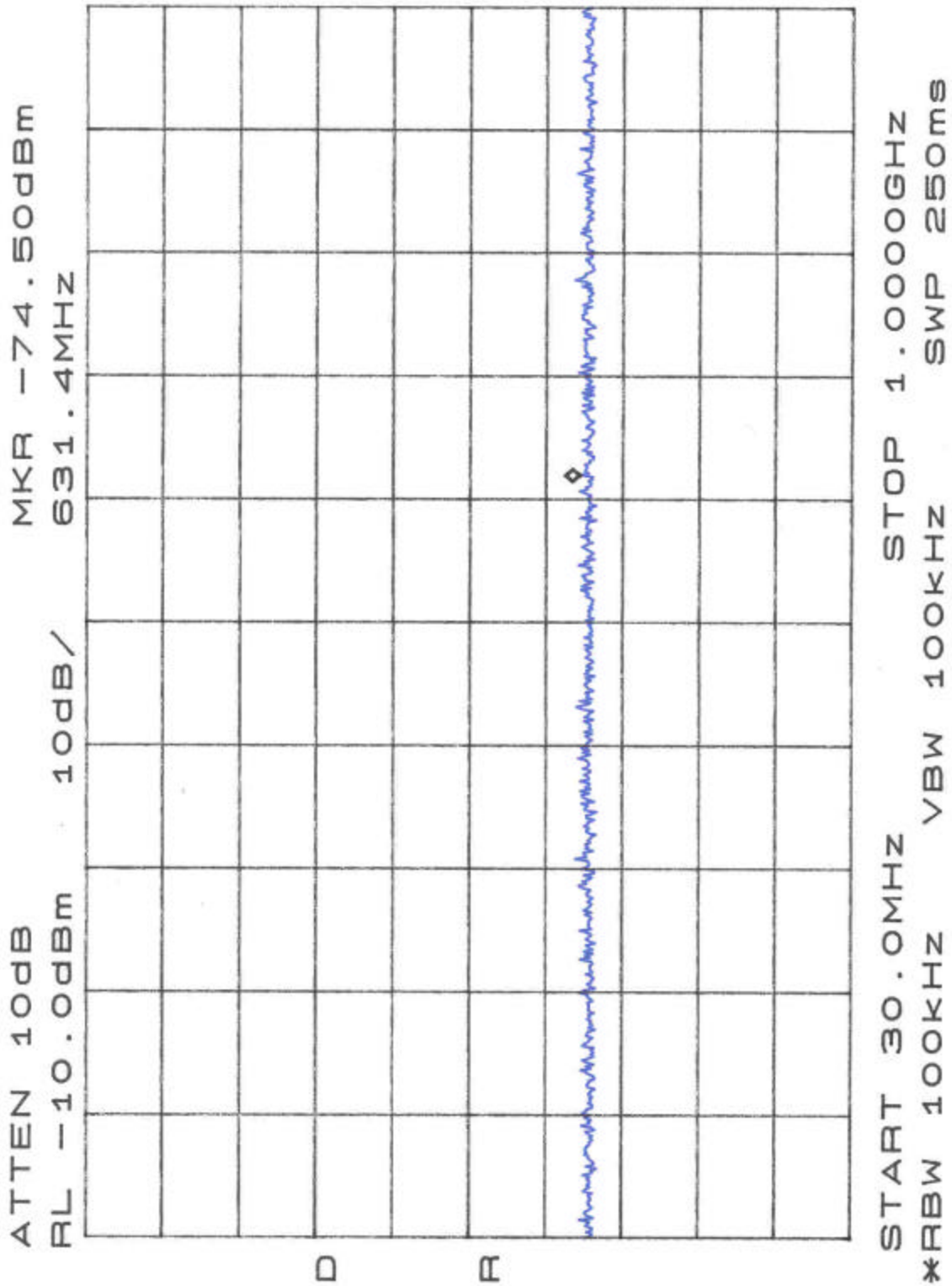


Figure 7: Conducted Spurious Emissions, 5.75GHz, 30 MHz to 1 GHz

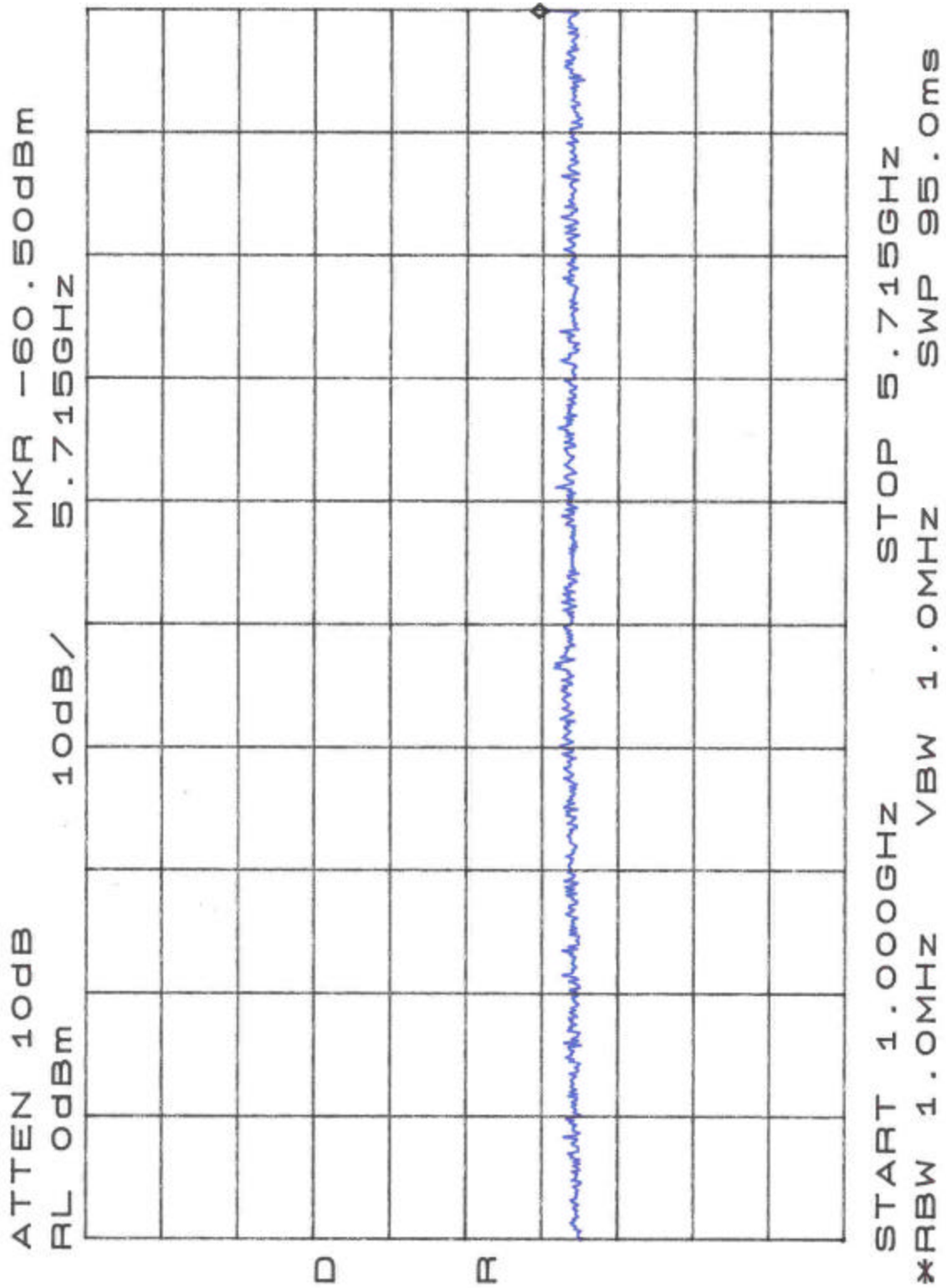


Figure 8: Conducted Spurious Emissions, 5.75GHz, 1GHz to 5.715 GHz

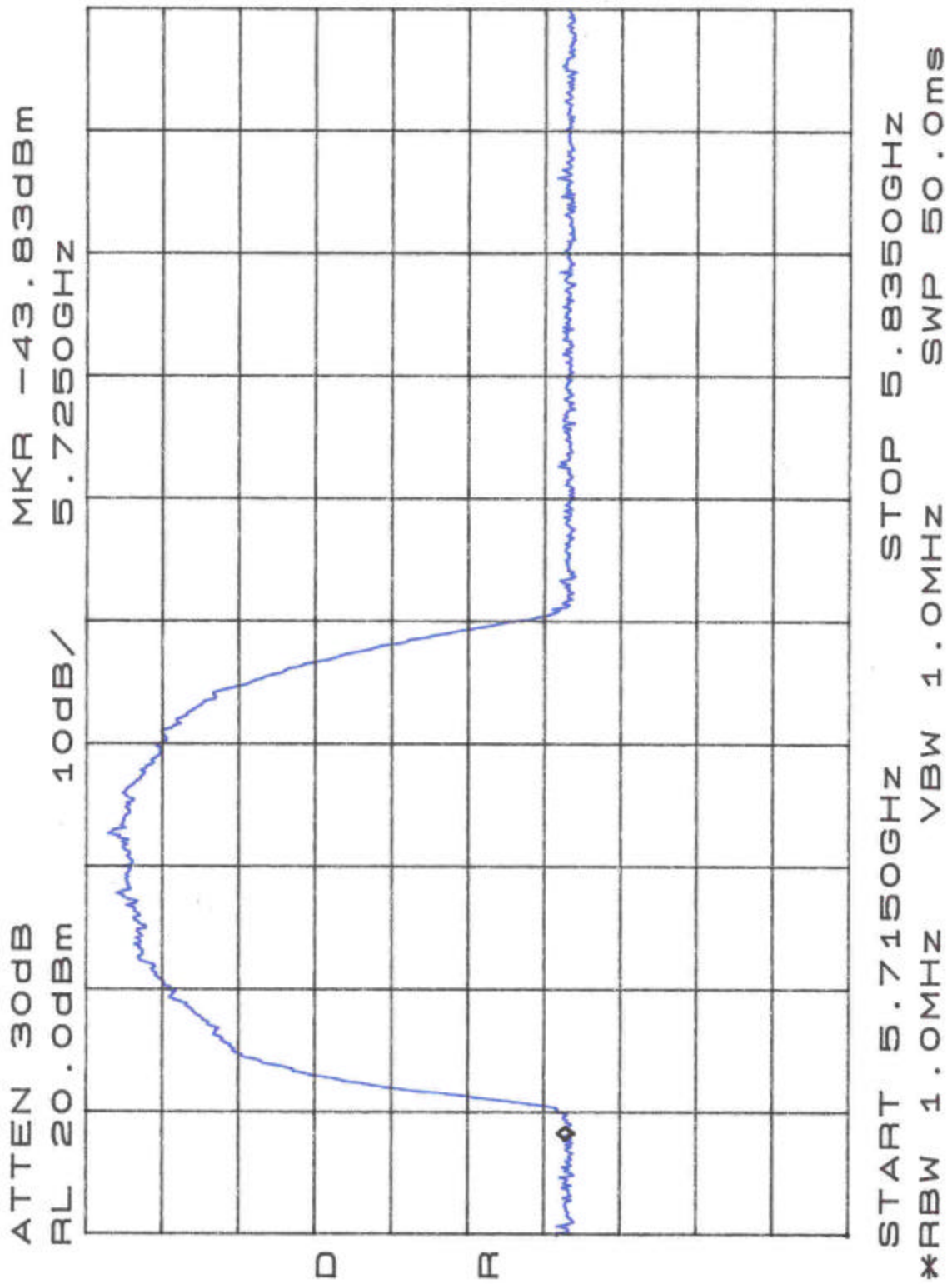


Figure 9: Conducted Spurious Emissions, 5.75GHz, 5.715 GHz to 5.835 GHz

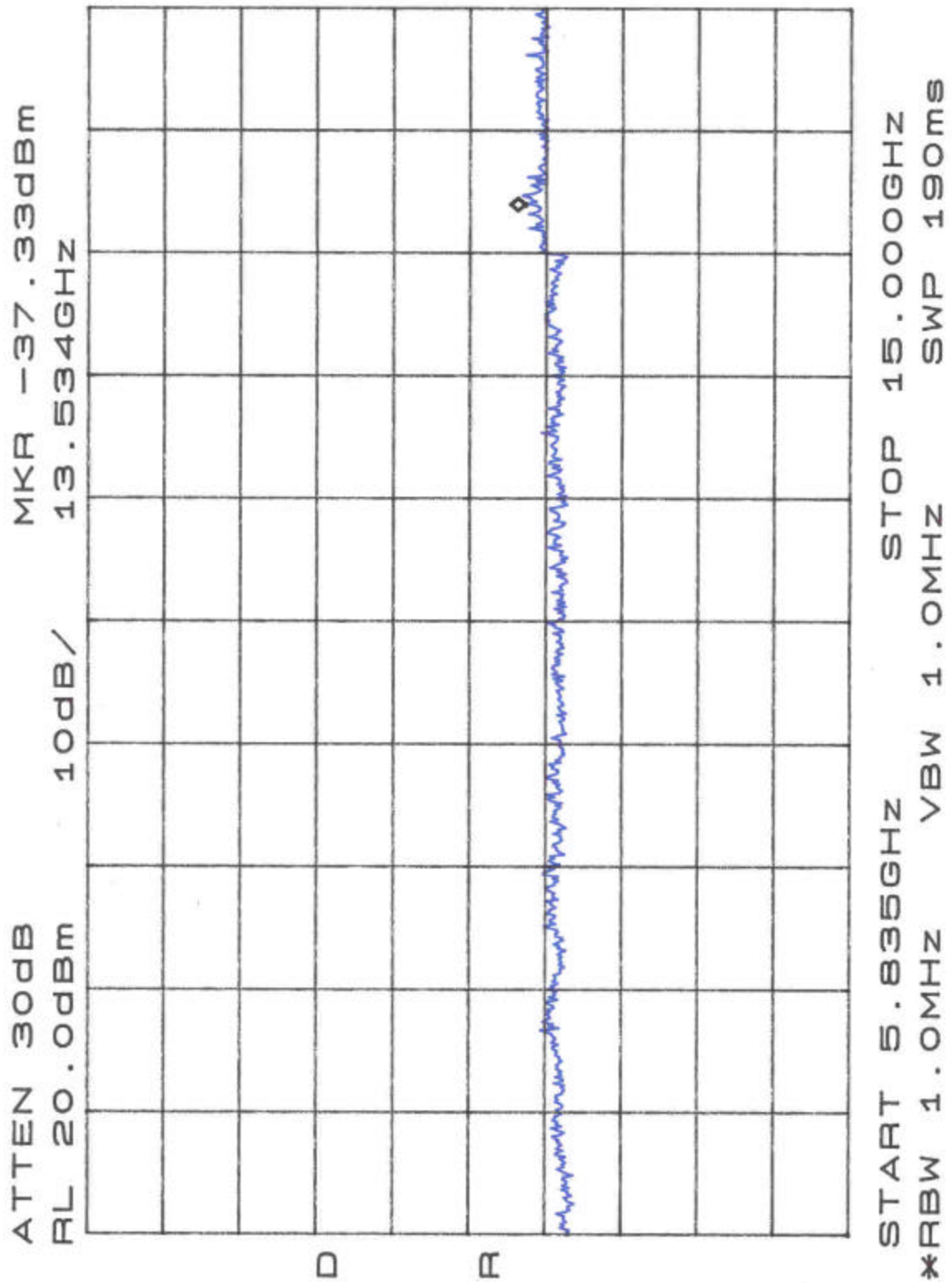


Figure 10: Conducted Spurious Emissions, 5.75GHz, 5.835 GHz to 15 GHz

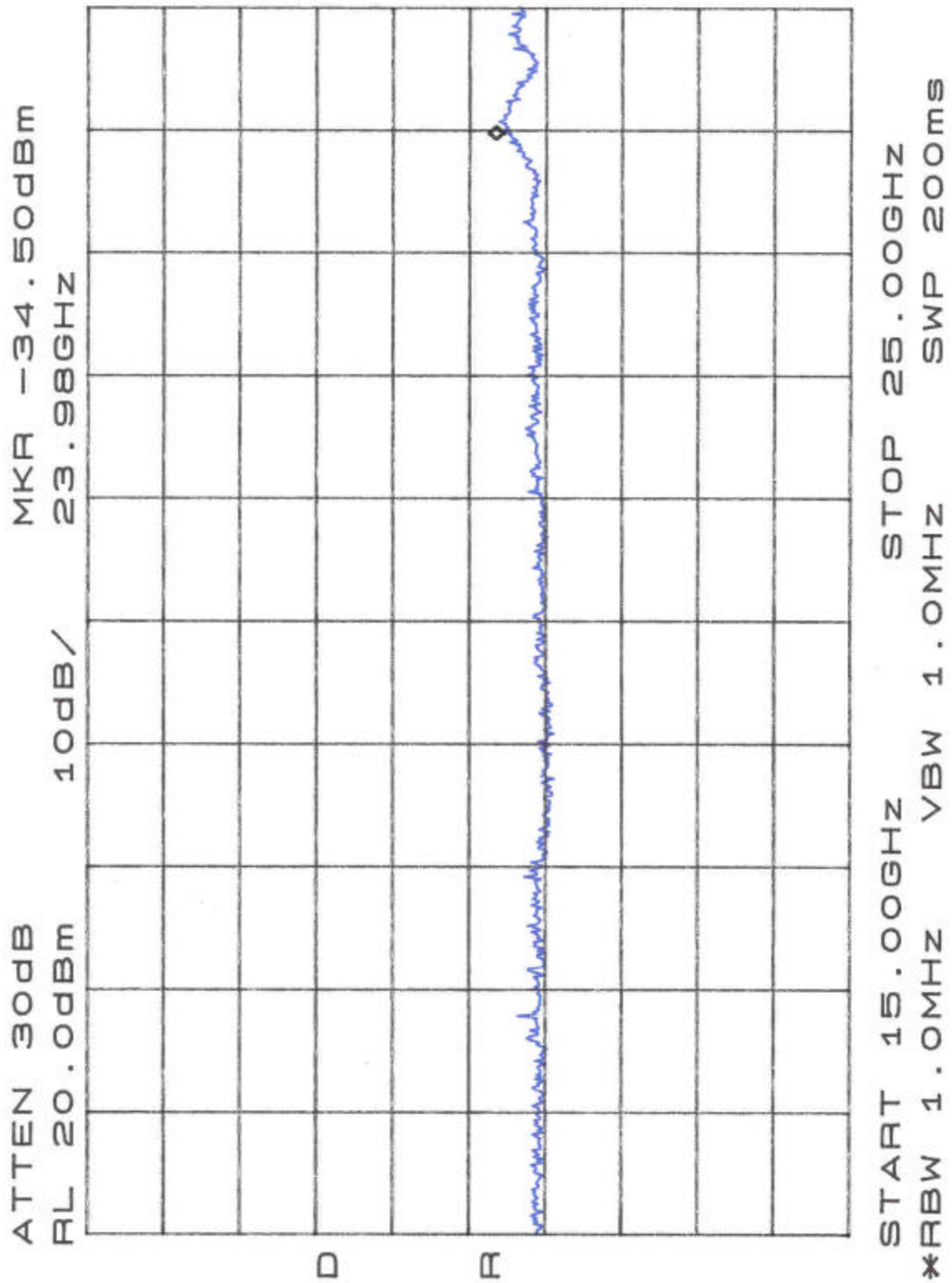


Figure 11: Conducted Spurious Emissions, 5.75GHz, 15 GHz to 25 GHz

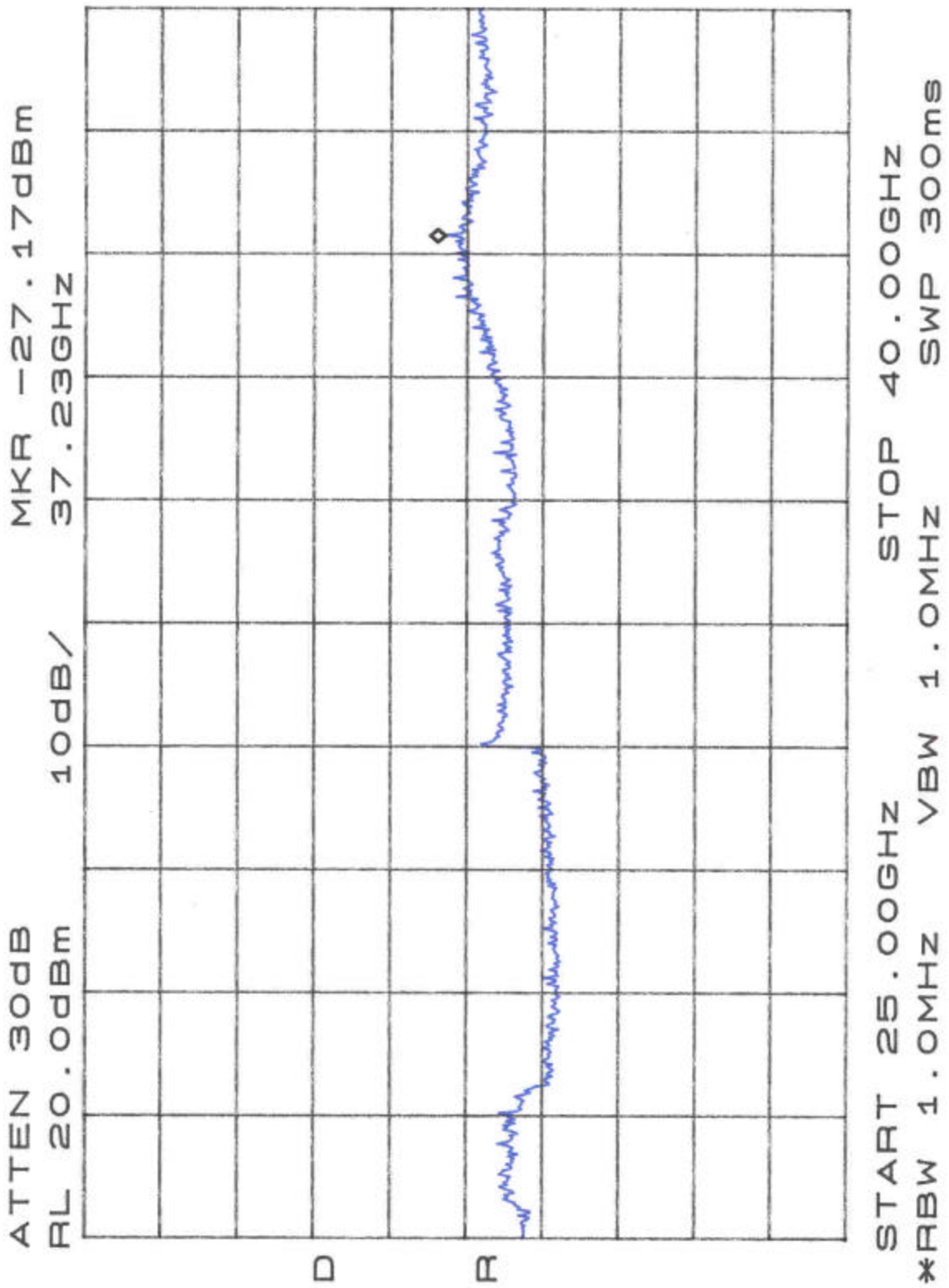


Figure 12: Conducted Spurious Emissions, 5.75GHz, 25 GHz to 40 GHz

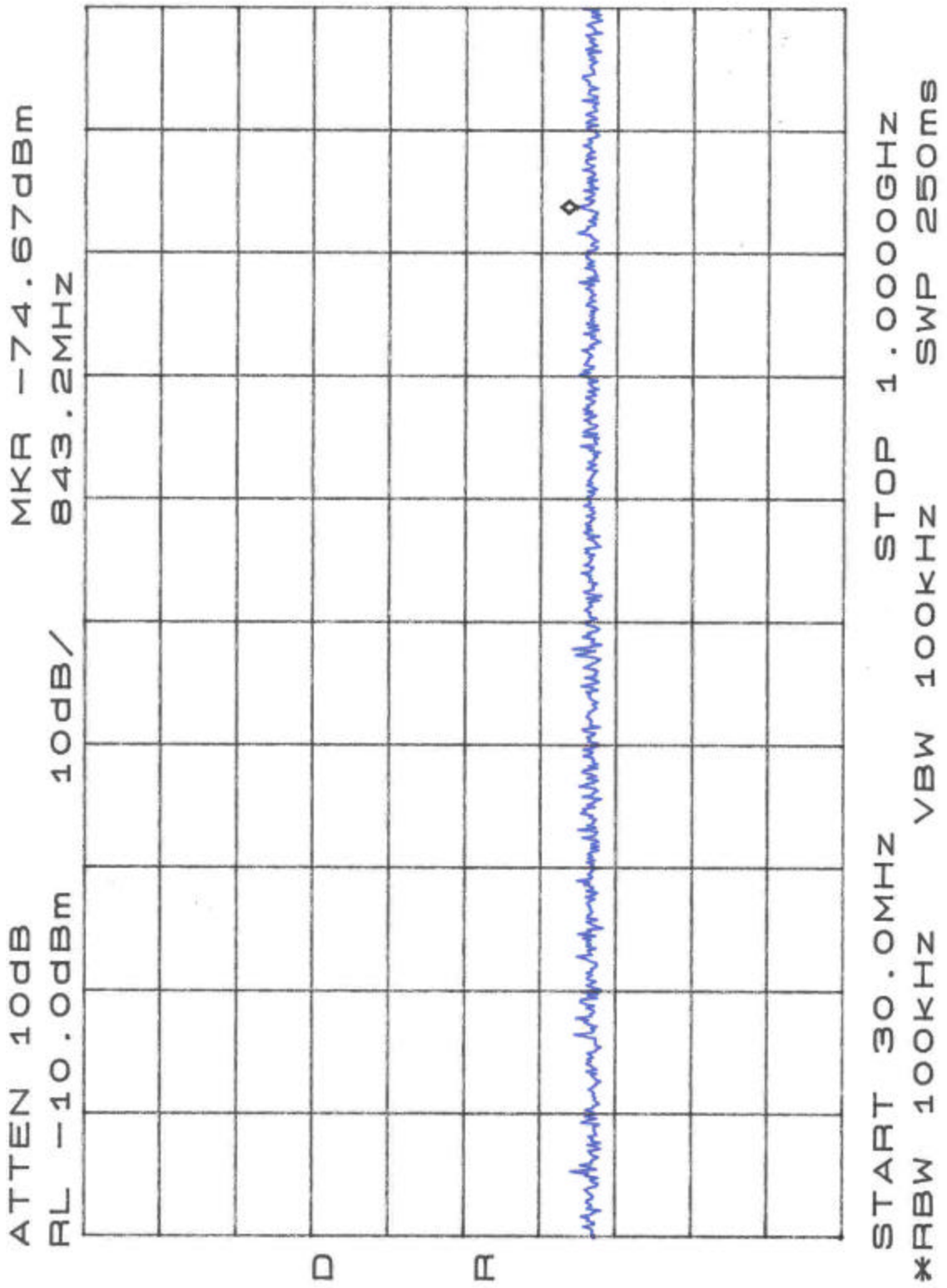


Figure 13: Conducted Spurious Emissions, 5.8GHz, 30 MHz to 1 GHz

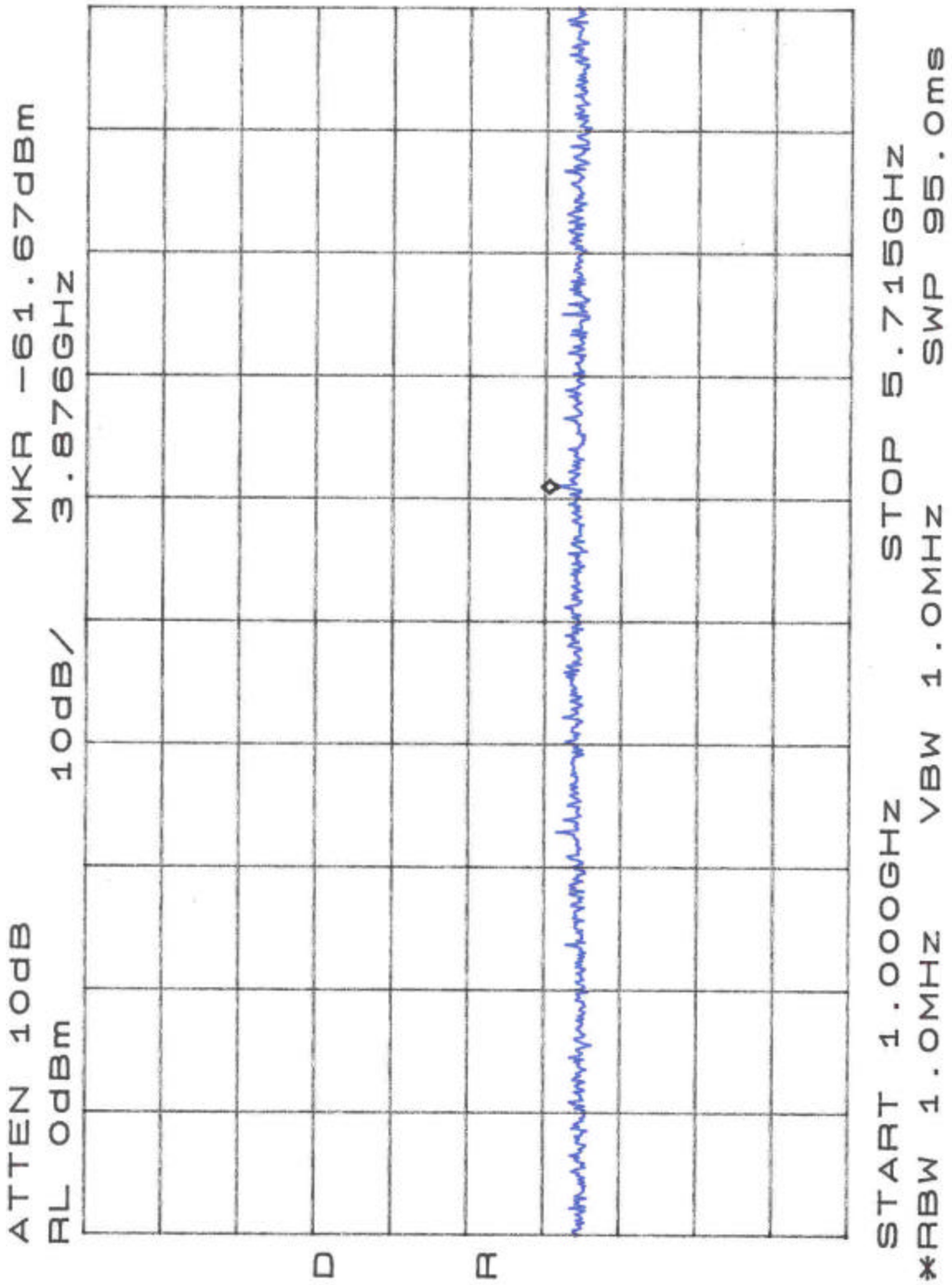


Figure 14: Conducted Spurious Emissions, 5.8GHz, 1 GHz to 5.715 GHz

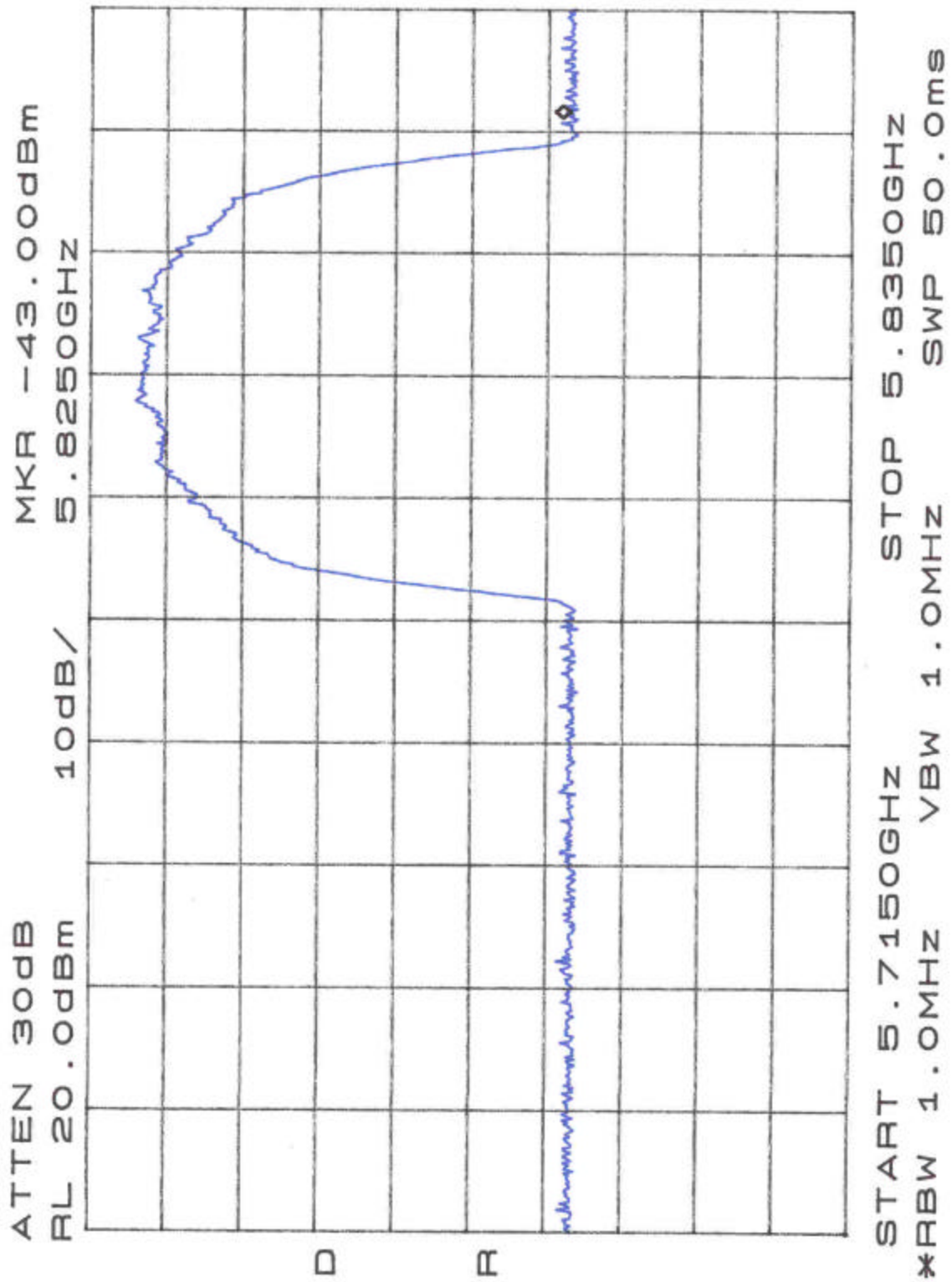


Figure 15: Conducted Spurious Emissions, 5.8GHz, 5.715 GHz to 5.835 GHz

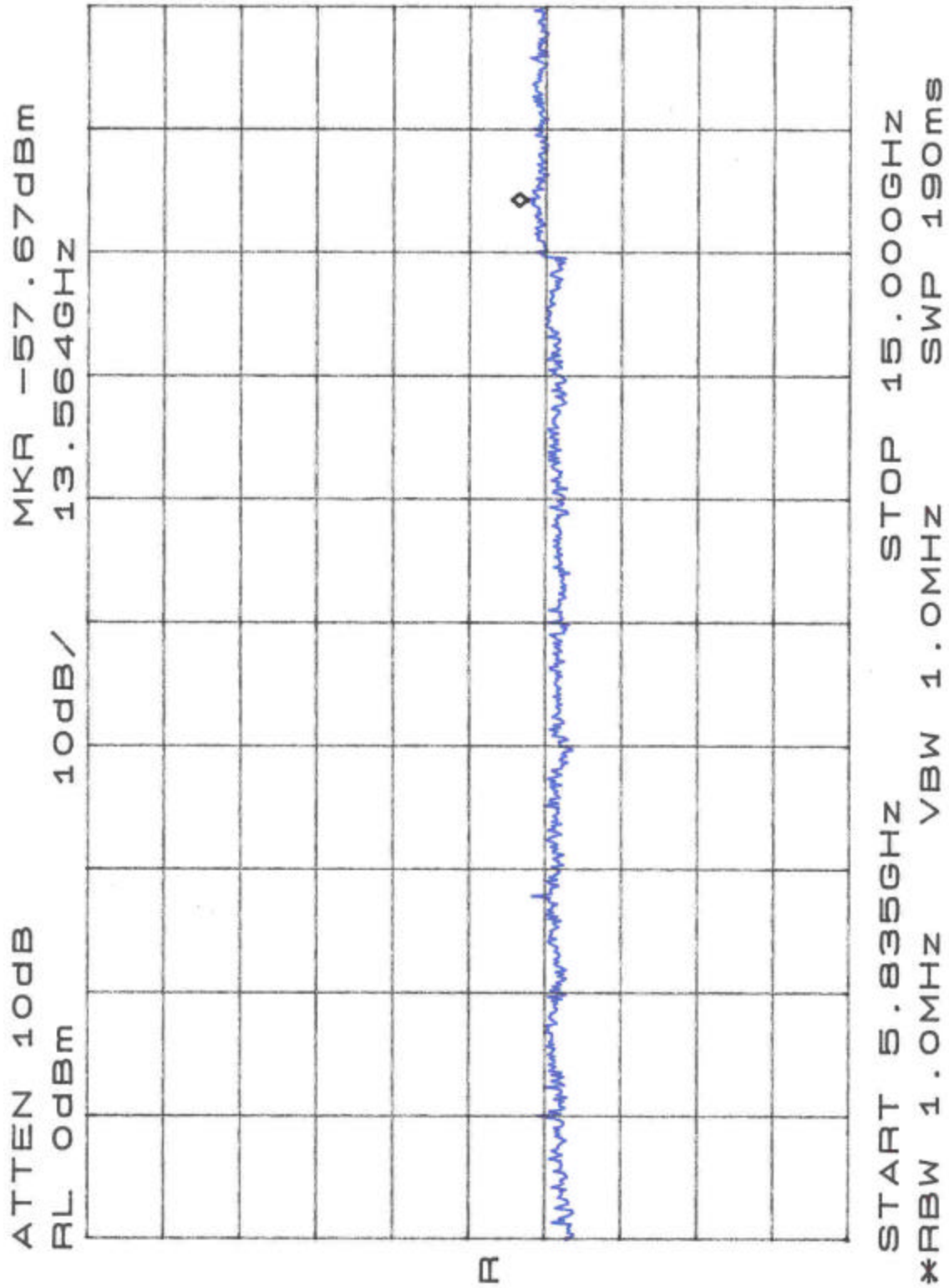


Figure 16: Conducted Spurious Emissions, 5.8GHz, 5.835 GHz to 15 GHz

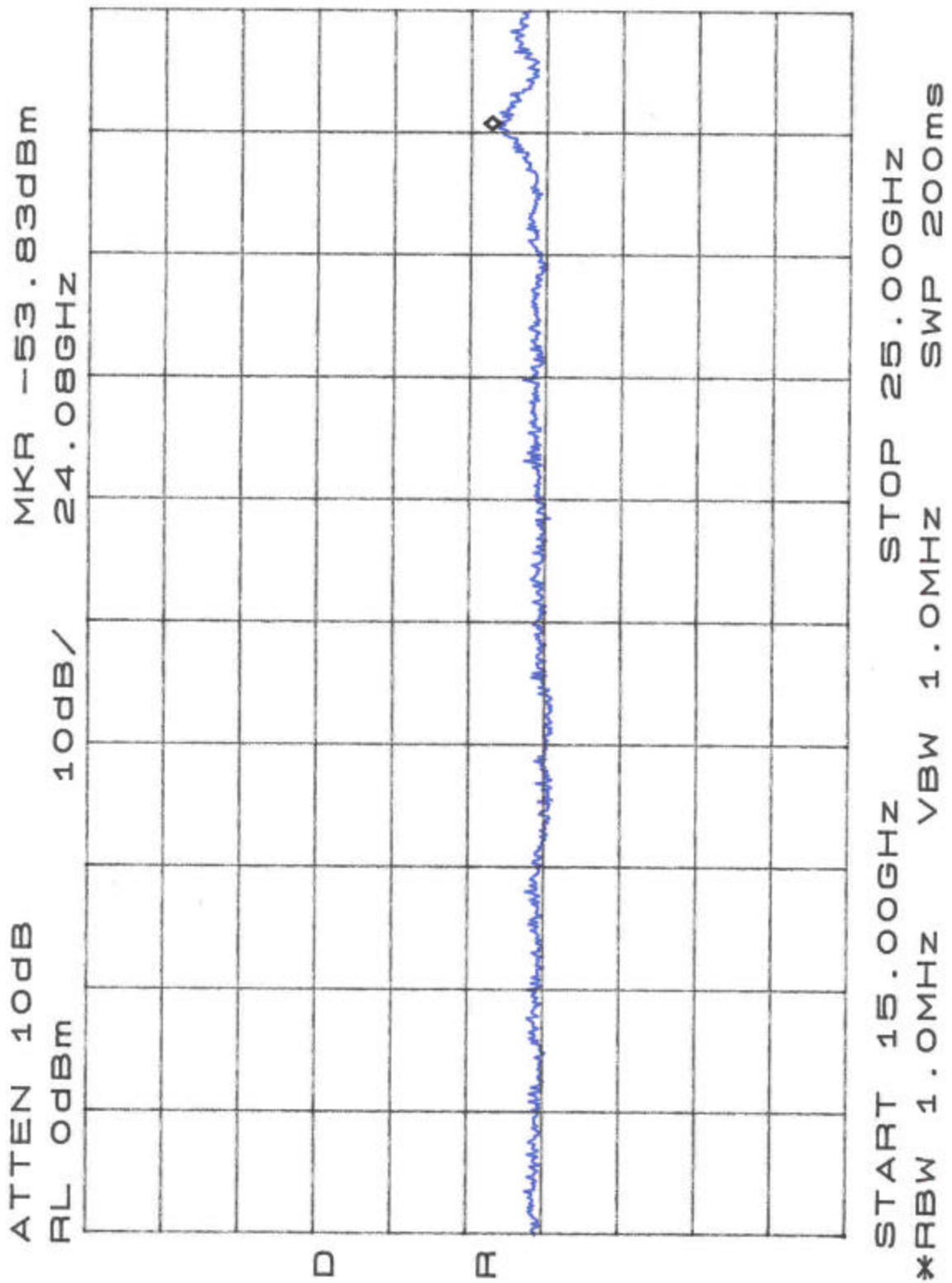


Figure 17: Conducted Spurious Emissions, 5.8GHz, 15 GHz to 25 GHz

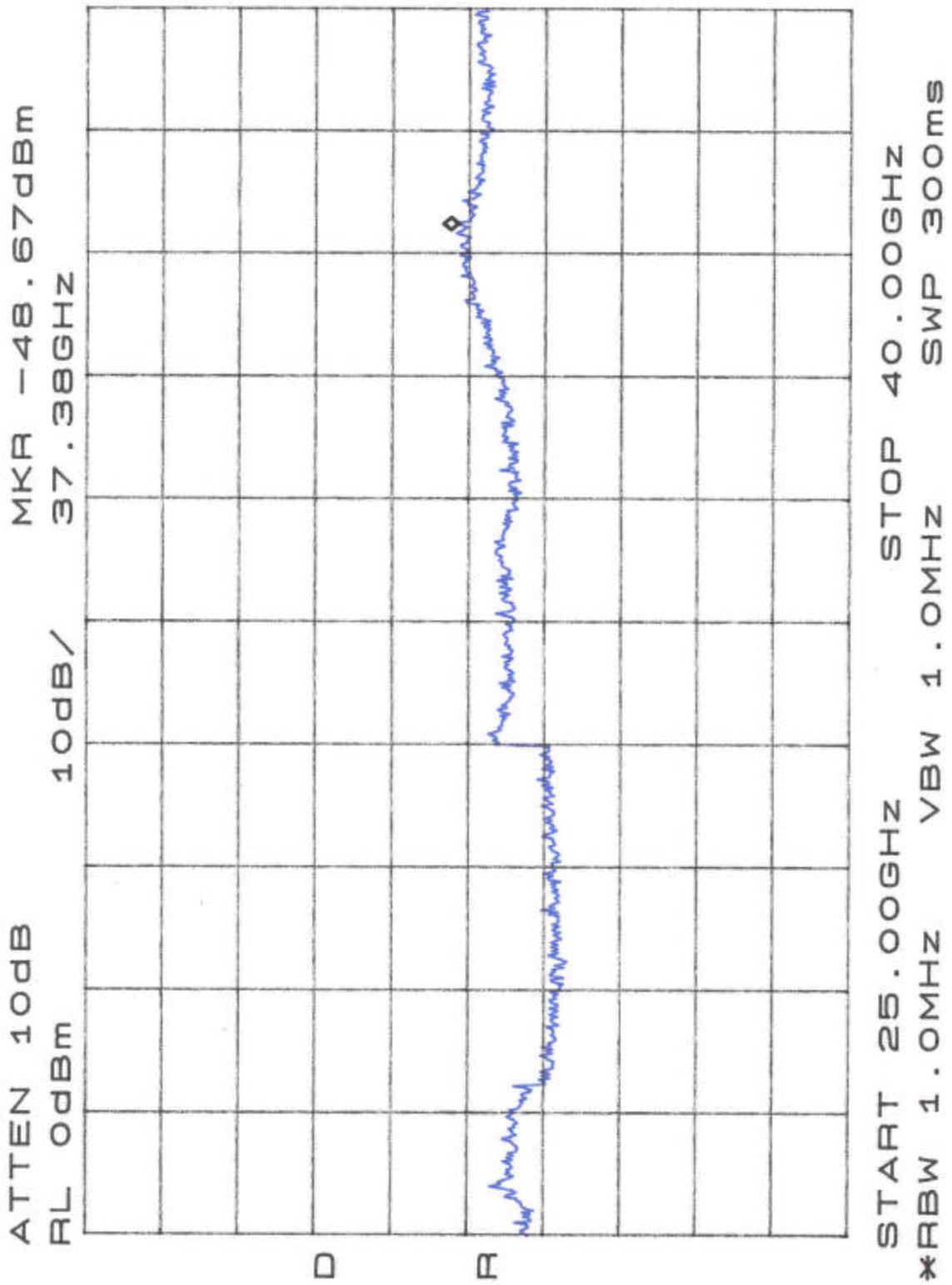


Figure 18: Conducted Spurious Emissions, 5.8GHz, 25 GHz to 40 GHz

Table 5: Spurious Radiated Emission Test Data

CLIENT: Adtran DATE: 4/30/02 and 5/9/02
 TESTER: Santo Lavorata/ Greg Snyder
 JOB #: 7080
 EUT: Tracer 4305 U-NII Device
 TX FREQUENCY: 5.750GHz

Peak Measurements:

Freq.	Polarity	SA Level	Pre Amp	Afc	Distance	Corr.	Limit	Margin	Notes:
GHz	H/V	PEAK dBuV	Gain dB	Factor dB/m	Correction dB	Level dBuV/m	dBuV/m	dB	
11.495	H	42.5	36.0	47.7	0.0	54.2	74.0	-19.8	
11.495	V	52.2	36.0	47.7	0.0	63.9	74.0	-10.1	
17.248	H	32.2	36.0	49.8	0.0	46.0	74.0	-28.0	
17.248	V	48.8	36.0	49.8	0.0	62.6	74.0	-11.4	
22.978	H	46.2	36.0	40.5	9.5	41.2	74.0	-32.8	
22.978	V	39.8	36.0	40.5	9.5	34.8	74.0	-39.2	
23.004	H	40.8	36.0	40.5	9.5	35.8	74.0	-38.2	
23.004	V	38.0	36.0	40.5	9.5	33.0	74.0	-41.0	
28.755	H	39.0	0.0	43.8	20.0	62.8	74.0	-11.2	NF
28.755	V	38.7	0.0	43.8	20.0	62.5	74.0	-11.5	NF
34.481	H	44.7	0.0	44.1	20.0	68.8	74.0	-5.2	NF
34.481	V	44.7	0.0	44.1	20.0	68.8	74.0	-5.2	NF

NF = Noise Floor

Average Measurements:

Freq.	Polarity	SA Level	Pre Amp	Antenna	Distance	Corr.	Limit	Margin	Notes:
GHz	H/V	AVG dBuV	Gain dB	Factor dB/m	Correction dB	Level dBuV/m	dBuV/m	dB	
11.495	H	31.6	36.0	47.7	0.0	43.3	54.0	-10.7	
11.495	V	38.6	36.0	47.7	0.0	50.3	54.0	-3.7	
17.248	H	29.8	36.0	49.8	0.0	43.6	54.0	-10.4	
17.248	V	36.4	36.0	49.8	0.0	50.2	54.0	-3.8	
22.978	H	36.5	36.0	40.5	9.5	31.5	54.0	-22.5	
22.978	V	32.4	36.0	40.5	9.5	27.4	54.0	-26.6	
23.004	H	38.8	36.0	40.5	9.5	33.8	54.0	-20.2	
23.004	V	33.7	36.0	40.5	9.5	28.7	54.0	-25.3	
28.755	H	28.0	0.0	43.8	20.0	51.8	54.0	-2.2	NF
28.755	V	28.0	0.0	43.8	20.0	51.8	54.0	-2.2	NF
34.481	H	26.8	0.0	44.1	20.0	50.9	54.0	-3.1	NF
34.481	V	26.8	0.0	44.1	20.0	50.9	54.0	-3.1	NF

NF: Noise Floor

Afc: Composite antenna factor including cable losses

Distance Correction Factor: Used when testing at 1m and 0.3m.

Tests above 18GHz were made at 1 meter.

Tests above 26.5GHz were made at 0.3 meter.

CLIENT: Adtran

DATE: 5/9/02
 TESTER: Greg Snyder
 JOB #: 7080
 EUT: Tracer 4305 U-NII Device
 TX FREQUENCY: 5.8GHz

Peak
 Measurements:

Freq. GHz	Polarity H/V	SA Level PEAK dBuV	Pre Amp Gain dB	Afc Factor dB/m	Distance Correction dB	Corr. Level dBuV/m	Limit dBuV/m	Margin dB	Notes:
11.600	H	51.8	36.0	47.7	0.0	63.5	74.0	-10.5	
11.600	V	52.3	36.0	47.7	0.0	64.0	74.0	-10.0	
17.400	H	45.7	36.0	49.8	0.0	59.5	74.0	-14.5	NF
17.400	V	45.7	36.0	49.8	0.0	59.5	74.0	-14.5	NF
23.196	H	51.2	36.0	40.5	9.5	46.2	74.0	-27.8	
23.196	V	50.0	36.0	40.5	9.5	45.0	74.0	-29.0	
28.996	H	38.8	0.0	43.8	20.0	62.6	74.0	-11.4	NF
28.996	V	38.8	0.0	43.8	20.0	62.6	74.0	-11.4	NF
34.796	H	45.3	0.0	44.1	20.0	69.4	74.0	-4.6	NF
34.796	V	45.3	0.0	44.1	20.0	69.4	74.0	-4.6	NF

Average
 Measurements:

Freq. GHz	Polarity H/V	SA Level AVG dBuV	Pre Amp Gain dB	Antenna Factor dB/m	Distance Correction dB	Corr. Level dBuV/m	Limit dBuV/m	Margin dB	Notes:
11.600	H	38.9	36.0	47.7	0.0	50.6	54.0	-3.4	
11.600	V	36.3	36.0	47.7	0.0	48.0	54.0	-6.0	
17.400	H	34.7	36.0	49.8	0.0	48.5	54.0	-5.5	NF
17.400	V	34.7	36.0	49.8	0.0	48.5	54.0	-5.5	NF
23.196	H	43.7	36.0	40.5	9.5	38.7	54.0	-15.3	
23.196	V	37.8	36.0	40.5	9.5	32.8	54.0	-21.2	
28.996	H	27.8	0.0	43.8	20.0	51.6	54.0	-2.4	NF
28.996	V	27.8	0.0	43.8	20.0	51.6	54.0	-2.4	NF
34.796	H	27.0	0.0	44.1	20.0	51.1	54.0	-2.9	NF
34.796	V	27.0	0.0	44.1	20.0	51.1	54.0	-2.9	NF

NF: Noise Floor

Afc: Composite antenna factor including cable losses

Distance Correction Factor: Used when testing at 1m and 0.3m.

Tests above 18GHz were made at 1 meter.

Tests above 26.5GHz were made at 0.3 meter.

4.6 Conducted Emissions

The EUT was placed on an 80 cm high 1 x 1.5 m non-conductive table above a ground plane. Power to the EUT was provided through a Solar Corporation 50 /50 mH Line Impedance Stabilization Network bonded to a 3 x 2 meter ground plane. The LISN has its AC input supplied from a filtered AC power source. Power and data cables were moved about to obtain maximum emissions.

The 50 output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 450 kHz to 30 MHz was measured. The detector function was set to quasi-peak or peak, as appropriate, and the resolution bandwidth during testing was at least 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth.

AC Power Line conducted emissions test data are included in Table 7.

Table 6: FCC Part 15.209 Radiated Emissions Test Data Below 1GHz

CLIENT: Adtran DATE: 4/30/2002
 TESTER: S. Lavorata/J.Ritter JOB #: 7080
EUT Information: UNII Device
 EUT: Tracer 4305
 CONFIGURATION: Looped back DS3 In and Out Ports
Test Equipment/Limit: A_00008 **Test Requirements:** FCC Part 15
 ANTENNA: CSITE2_3m TEST STANDARD: 3m
 CABLE: LFCC_3m_Class_B DISTANCE: B
 LIMIT: CLASS:

Freq.	Pol.	Azimuth	Ant. Height	SA Level (QP)	Ant. Corr.	Cable Corr.	Corr. Level	Corr. Level	Limit	Margin
(MHz)	H/V	Degree	(m)	(dBuV)	(dB/m)	(dB)	(dBuV/m)	(uV/m)	(uV/m)	dB
51.43	V	180.0	1.8	9.2	13.1	1.5	23.8	15.5	100.0	-16.2
51.43	H	180.0	2.3	7.3	13.1	1.5	21.9	12.4	100.0	-18.1
53.12	V	180.0	1.5	2.8	12.5	1.6	16.8	6.9	100.0	-23.2
53.12	H	180.0	4.0	14.7	12.5	1.6	28.7	27.3	100.0	-11.3
64.32	V	180.0	1.5	6.8	8.1	1.8	16.7	6.9	100.0	-23.3
64.32	H	180.0	3.5	20.6	8.1	1.8	30.5	33.7	100.0	-9.5
65.70	V	45.0	2.1	14.0	7.7	1.8	23.5	15.0	100.0	-16.5
65.70	H	158.0	3.5	19.5	7.7	1.8	29.0	28.2	100.0	-11.0
72.70	V	180.0	1.3	25.0	6.1	1.9	33.0	44.6	100.0	-7.0
72.70	H	338.0	3.3	24.8	6.1	1.9	32.8	43.6	100.0	-7.2
111.84	V	0.0	1.7	10.2	9.6	2.6	22.4	13.1	150.0	-21.2
111.84	H	180.0	3.0	14.0	9.6	2.6	26.2	20.3	150.0	-17.4
134.21	V	45.0	3.3	10.9	9.5	2.8	23.3	14.6	150.0	-20.3
134.21	H	0.0	2.8	21.5	9.5	2.8	33.9	49.4	150.0	-9.7
223.69	V	0.0	2.0	4.6	11.6	3.5	19.7	9.6	200.0	-26.3
223.69	H	90.0	1.5	8.5	11.6	3.5	23.6	15.1	200.0	-22.4
257.15	V	180.0	1.8	13.2	12.6	3.7	29.5	29.9	200.0	-16.5
257.15	H	190.0	1.5	16.5	12.6	3.7	32.8	43.8	200.0	-13.2
447.35	H	338.0	1.3	14.6	15.4	4.7	34.7	54.1	200.0	-11.4
447.38	V	0.0	2.3	18.1	15.4	4.7	38.2	81.0	200.0	-7.8
462.85	H	90.0	1.4	14.5	16.9	4.8	36.2	64.4	200.0	-9.8
462.86	V	180.0	1.5	14.2	16.9	4.8	35.9	62.4	200.0	-10.1
565.73	V	345.0	1.3	6.7	17.3	5.3	29.4	29.4	200.0	-16.7
565.73	H	180.0	1.0	11.3	17.3	5.3	34.0	49.9	200.0	-12.1
584.98	V	45.0	1.3	9.4	18.1	5.4	32.9	44.3	200.0	-13.1
584.98	H	45.0	2.3	10.8	18.1	5.4	34.3	52.1	200.0	-11.7
626.30	V	0.0	1.2	14.8	17.6	5.7	38.1	80.6	200.0	-7.9
668.50	V	0.0	1.3	15.0	18.2	6.0	39.2	91.3	200.0	-6.8
668.50	H	338.0	1.8	13.7	18.2	6.0	37.9	78.2	200.0	-8.2
719.99	V	0.0	1.3	12.7	20.1	6.4	39.2	90.8	200.0	-6.9
764.99	V	345.0	1.8	12.4	20.1	6.7	39.2	91.1	200.0	-6.8
764.99	H	90.0	2.0	10.4	20.1	6.7	37.2	72.4	200.0	-8.8

Table 7: Conducted Emissions Test Data Sheet

CLIENT: Adtran
 DATE: 5/14/2002
 TESTER: S. Lavorata/ J. Ritter
 JOB #: 7080

TEST STANDARD: FCC Part 15
 CLASS: FCC_B
 TEST VOLTAGE: 120 VAC

LINE 1 - NEUTRAL

Freq. MHz	Voltage (QP) dBuV	Voltage uV	FCC Limit uV	Margin dB
1.01	41.0	112.2	250.0	-7.0
6.75	34.2	51.3	250.0	-13.8
7.07	34.1	50.7	250.0	-13.9
10.02	38.6	85.1	250.0	-9.4
14.69	33.6	47.9	250.0	-14.4
16.79	32.8	43.7	250.0	-15.2
21.80	33.5	47.3	250.0	-14.5
29.50	43.9	156.7	250.0	-4.1

LINE 2 - PHASE

Freq. MHz	Voltage (QP) dBuV	Voltage uV	FCC Limit uV	Margin dB
0.50	38.4	83.2	250.0	-9.6
0.97	37.5	75.0	250.0	-10.5
1.01	41.2	114.8	250.0	-6.8
7.15	37.9	78.5	250.0	-10.1
10.00	41.9	124.5	250.0	-6.1
18.50	36.1	63.8	250.0	-11.9
13.13	37.1	71.6	250.0	-10.9
29.49	34.5	52.8	250.0	-13.5