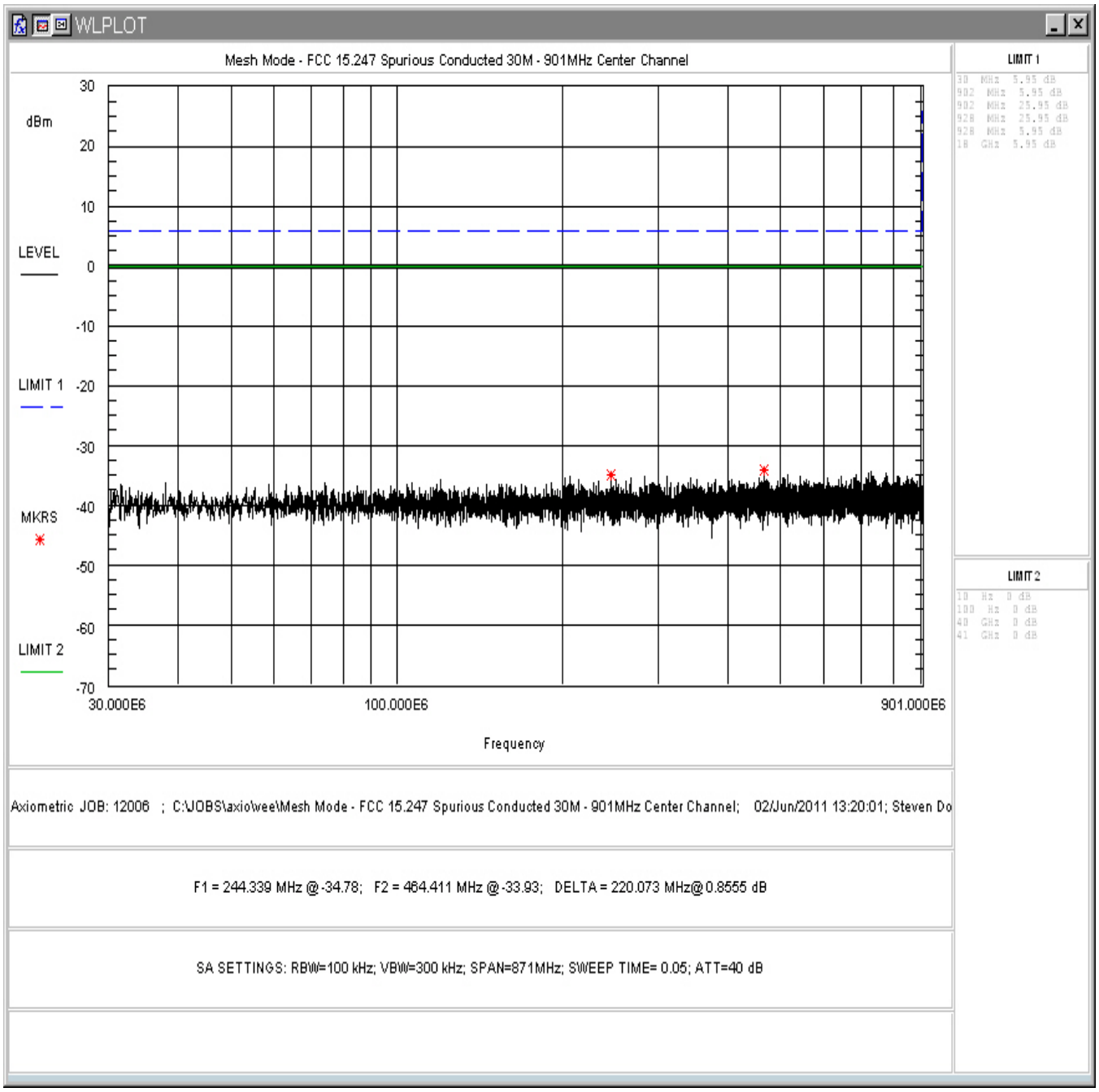

Figure 24. Conducted, Spurious Emissions, Mesh Mode, Center Channel 30-901 MHz

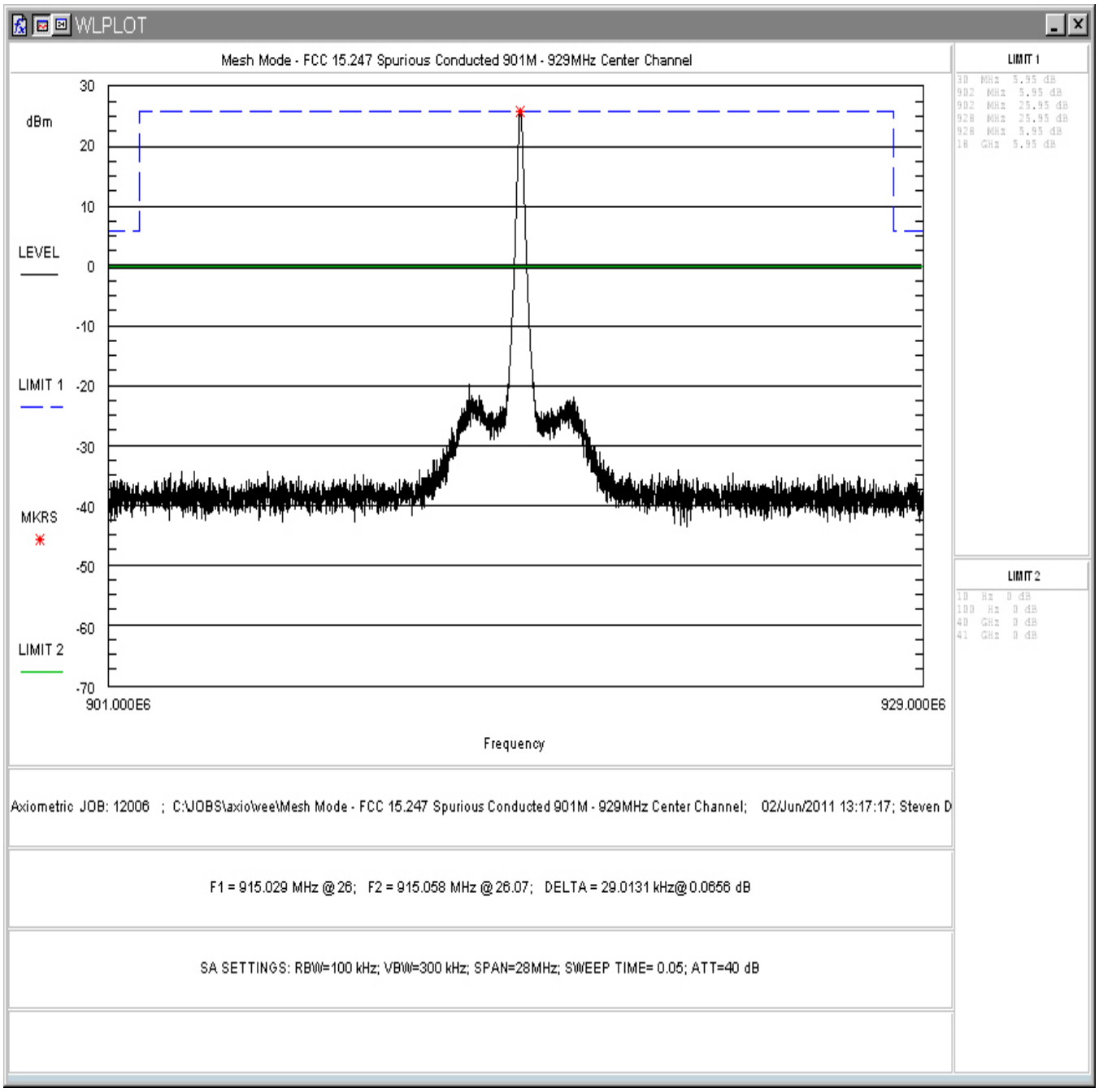

Figure 25. Conducted, Spurious Emissions, Mesh Mode, Center Channel 901-929 MHz

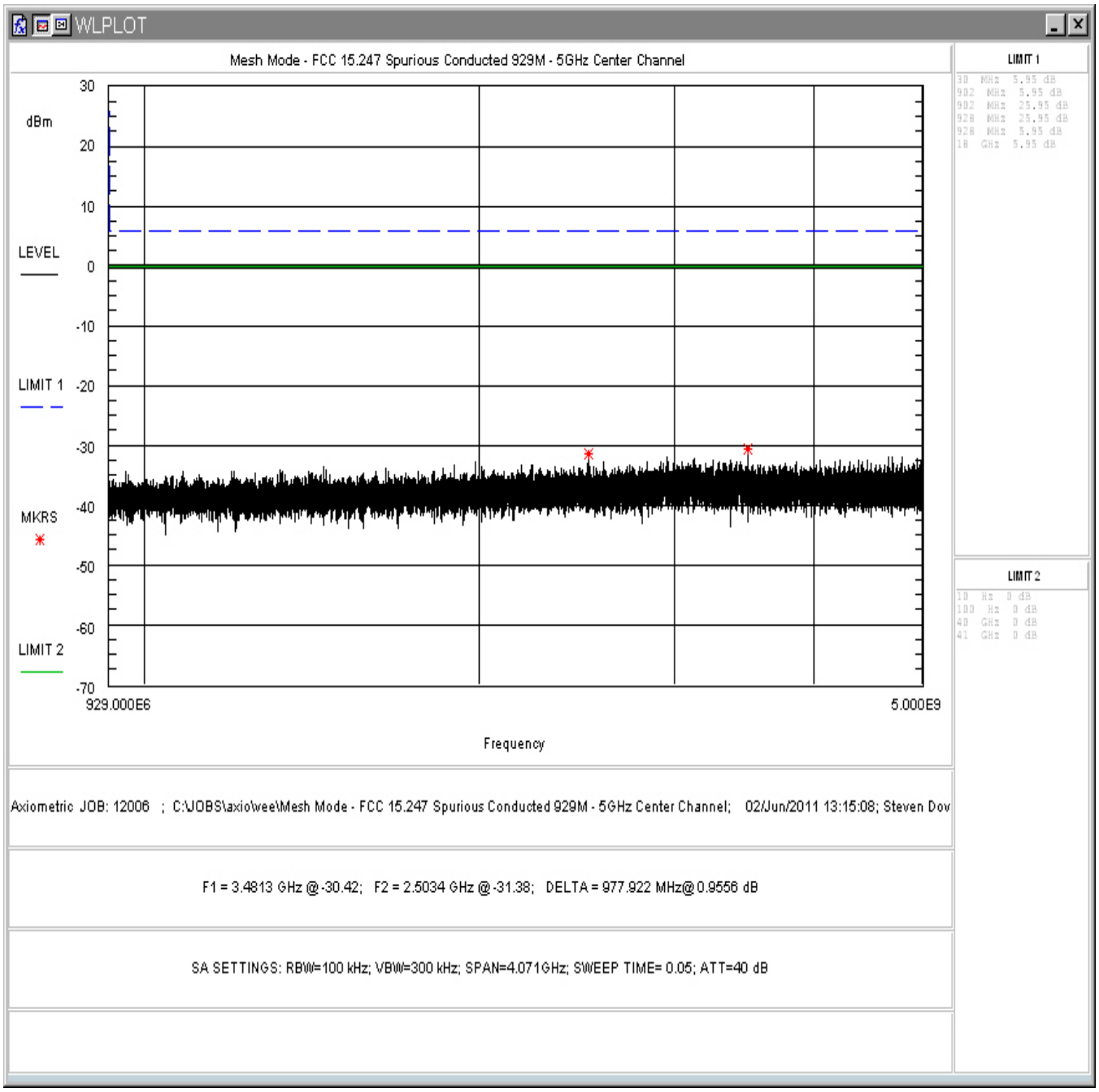

Figure 26. Conducted, Spurious Emissions, Mesh Mode, Center Channel 929 -5000MHz

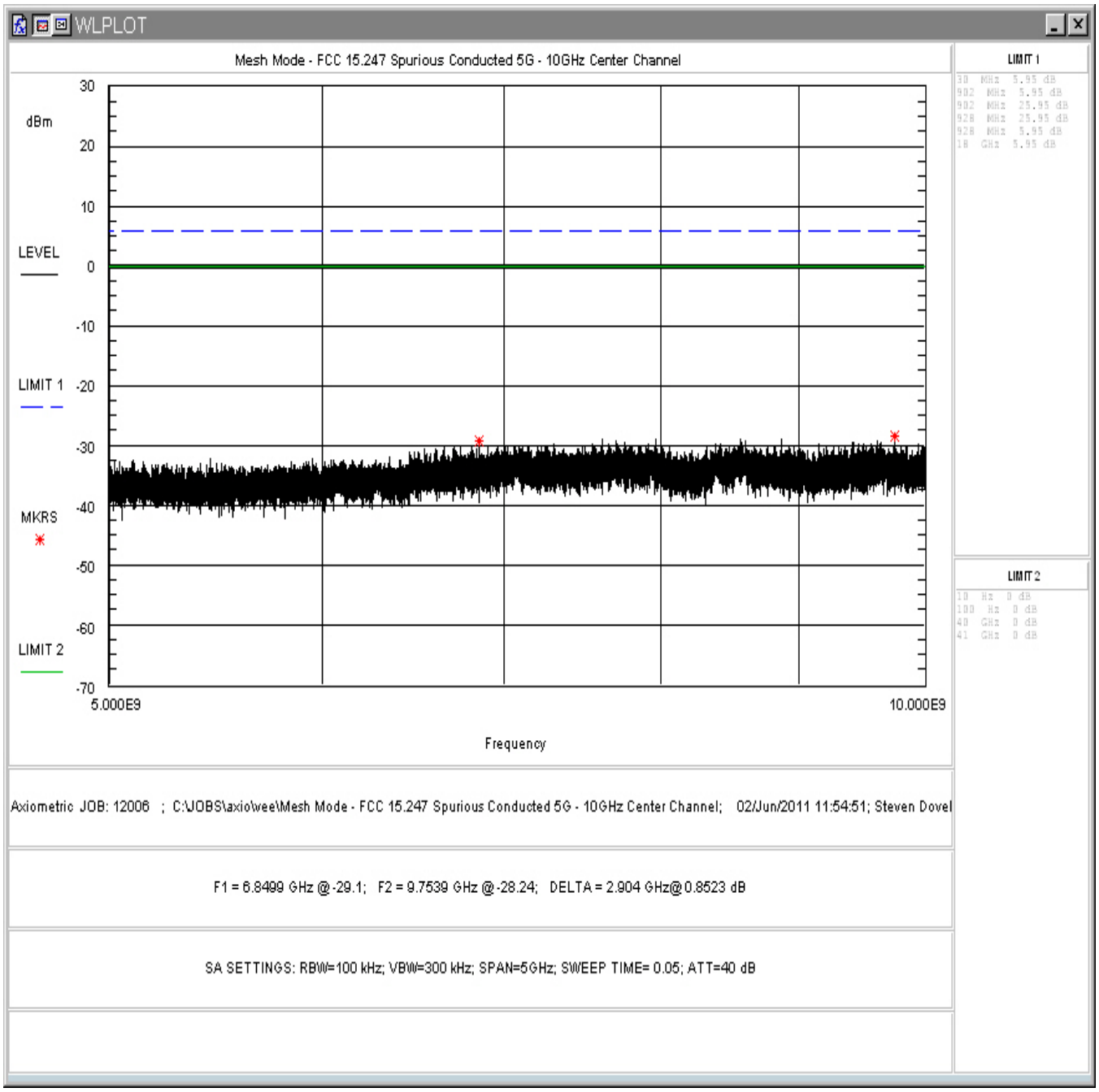

Figure 27. Conducted, Spurious Emissions, Mesh Mode, Center Channel 5-10GHz

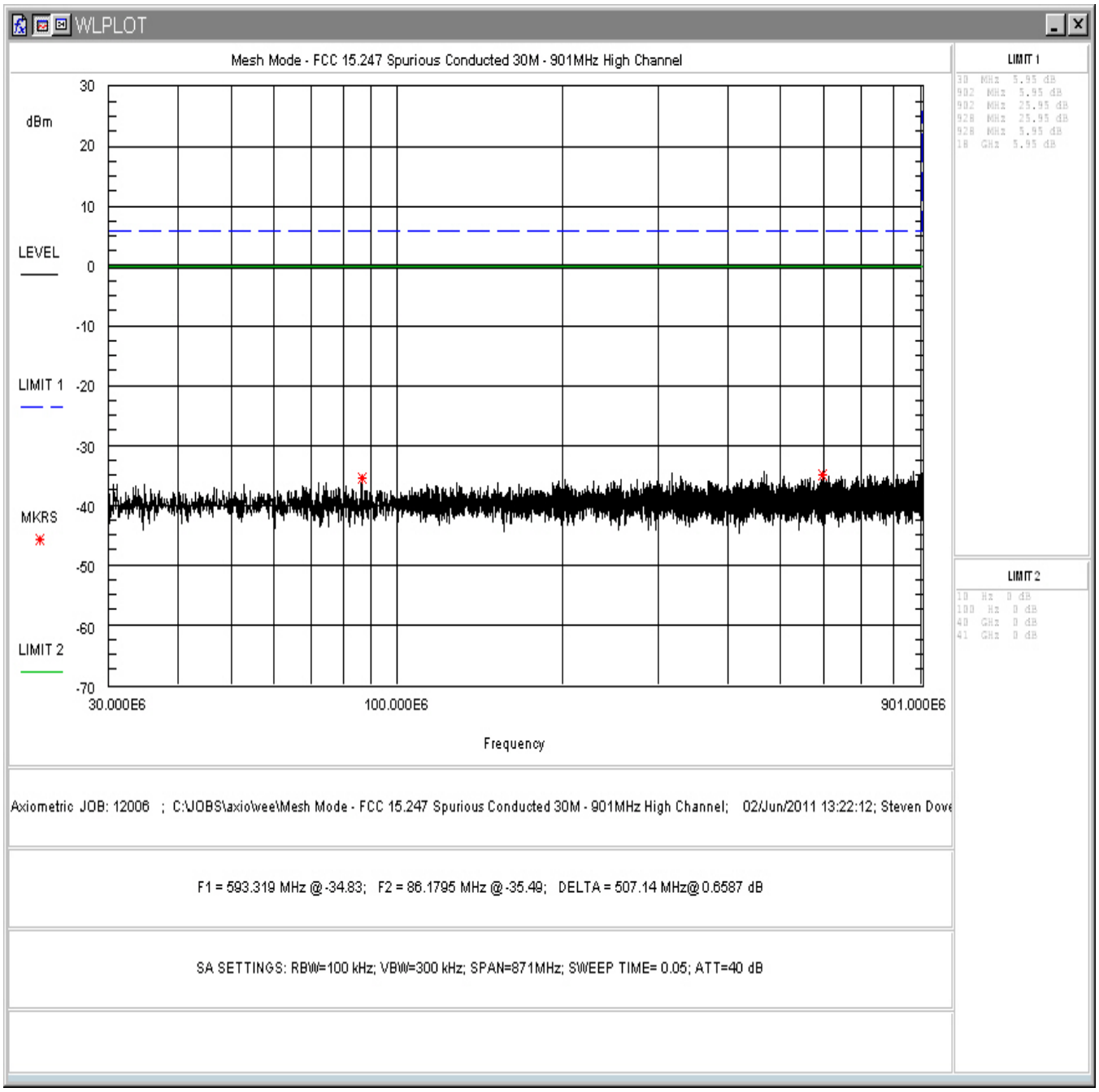

Figure 28. Conducted, Spurious Emissions, Mesh Mode, High Channel 30-901MHz

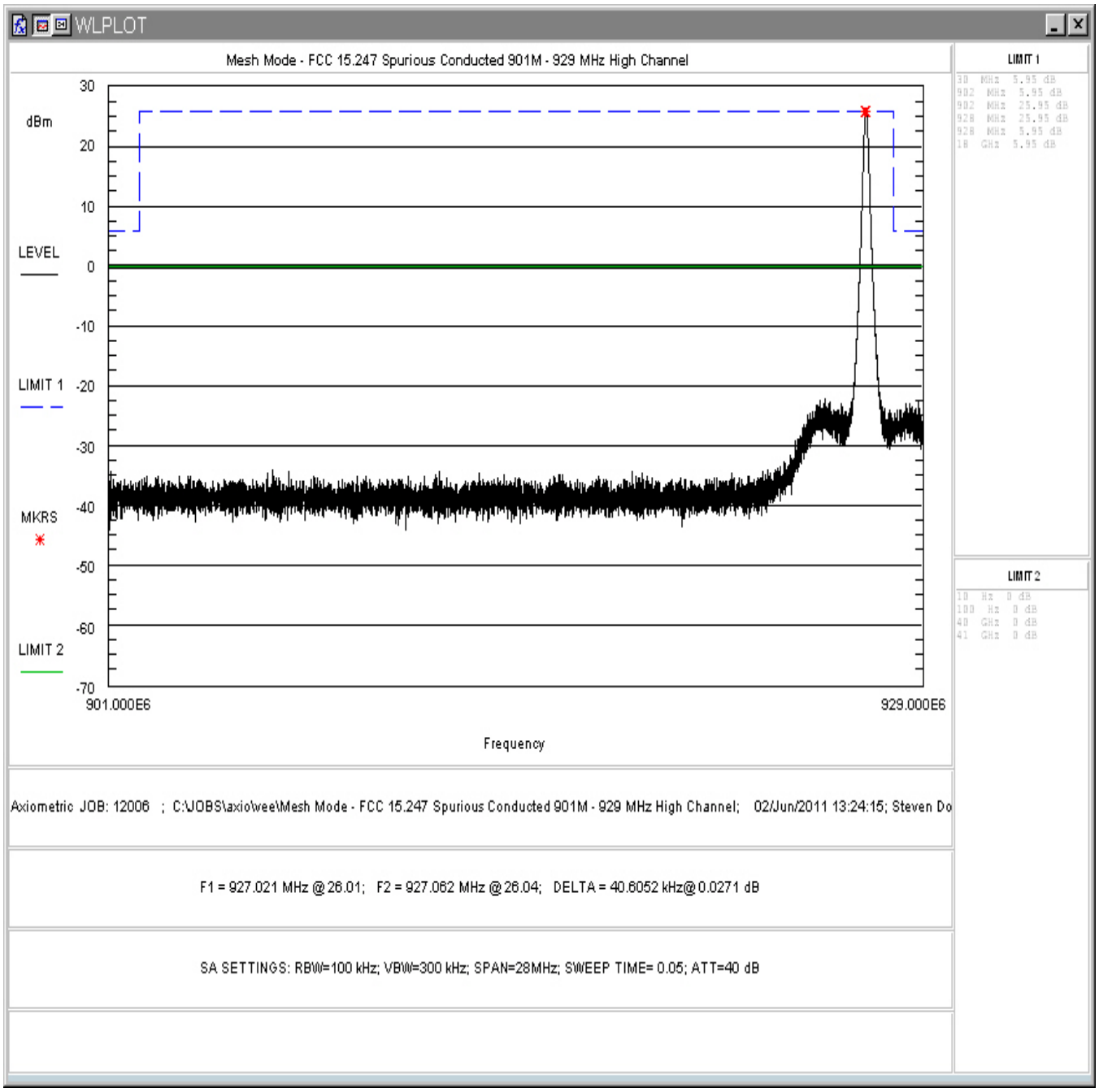

Figure 29. Conducted, Spurious Emissions, Mesh Mode, High Channel 901-929MHz

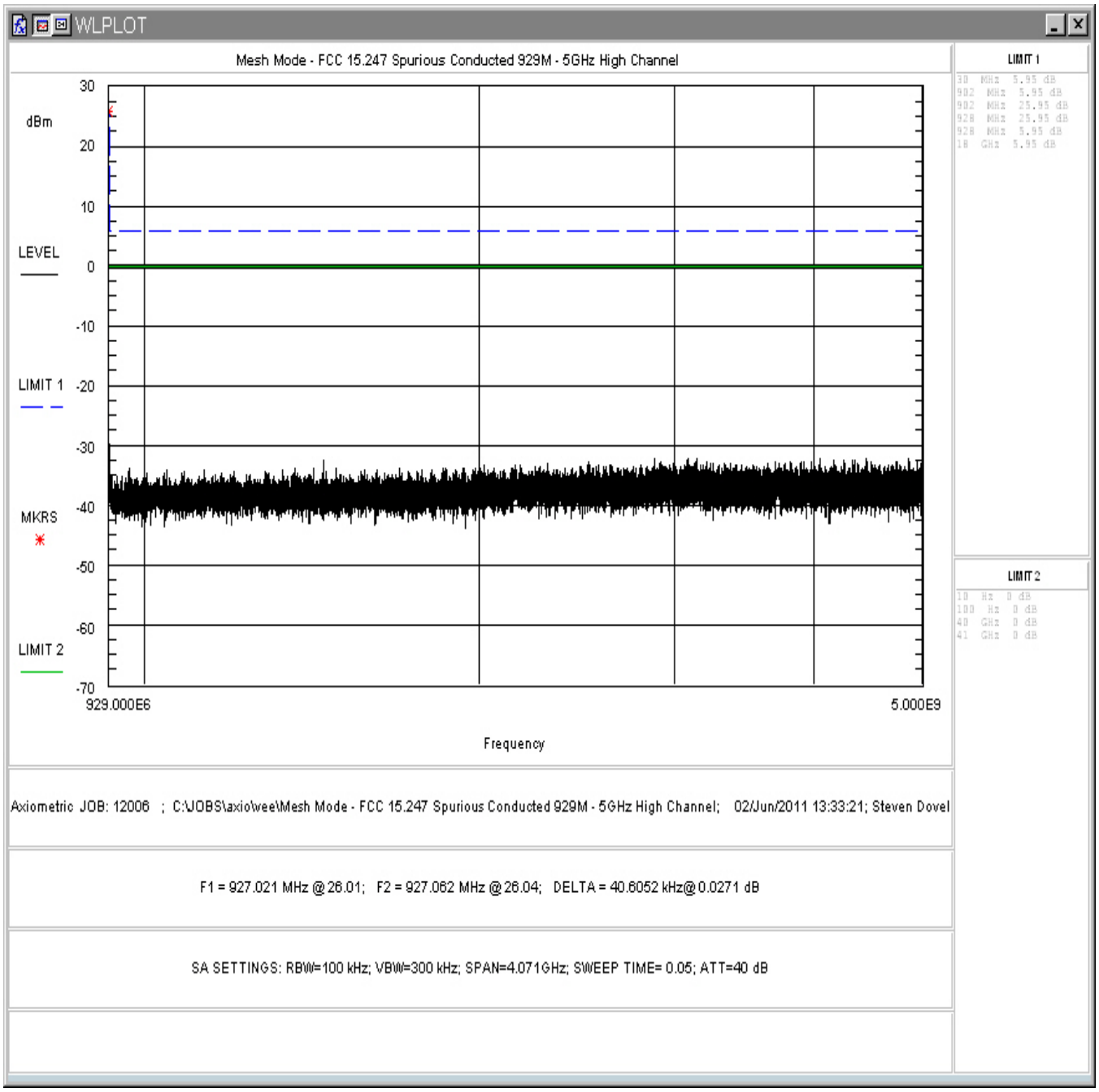

Figure 30. Conducted, Spurious Emissions, Mesh Mode, High Channel 929-5000MHz

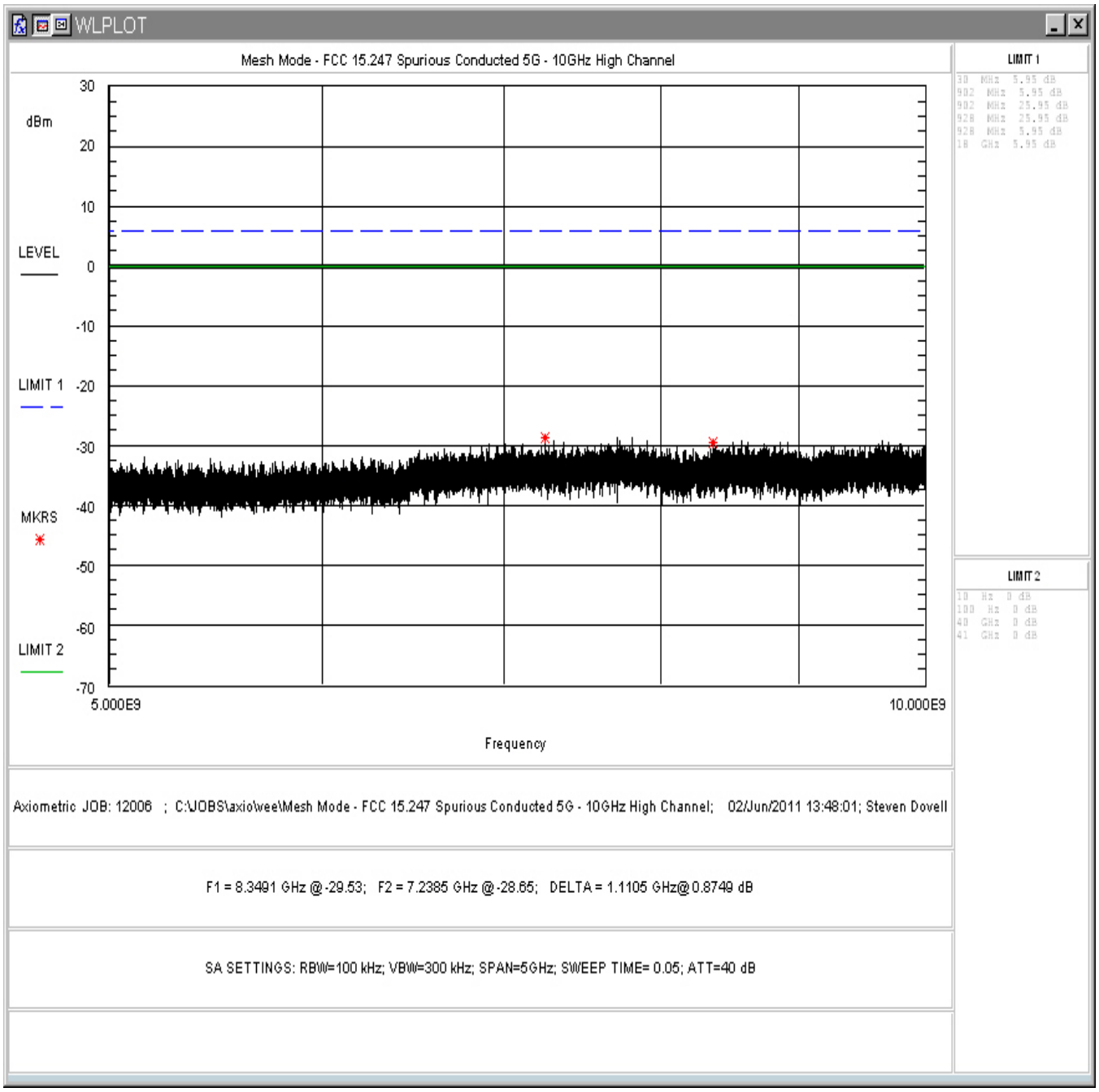

Figure 31. Conducted, Spurious Emissions, Mesh Mode, High Channel 5-10GHz

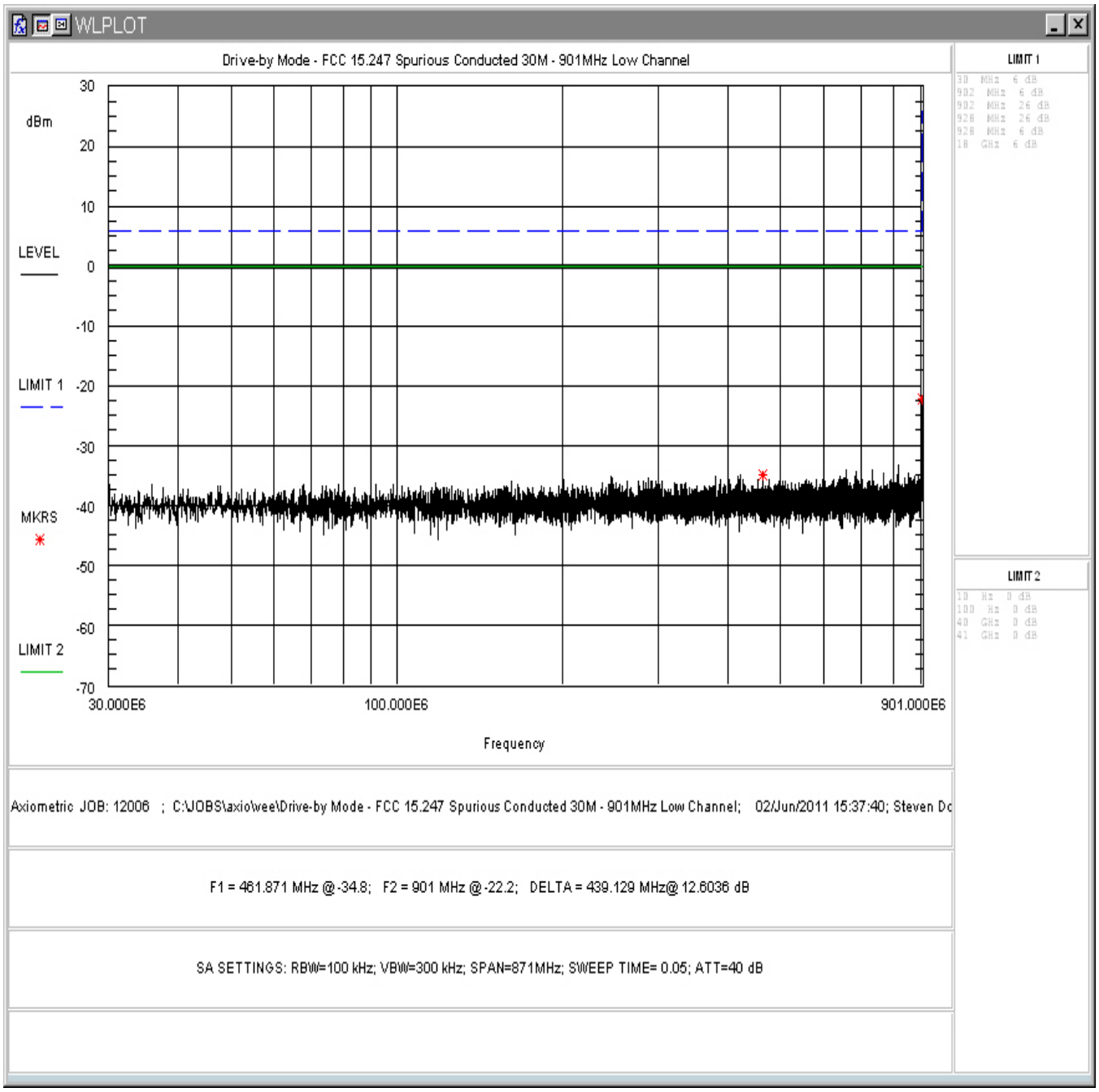

Figure 32. Conducted, Spurious Emissions, Drive-by Mode, Low Channel 30-901MHz

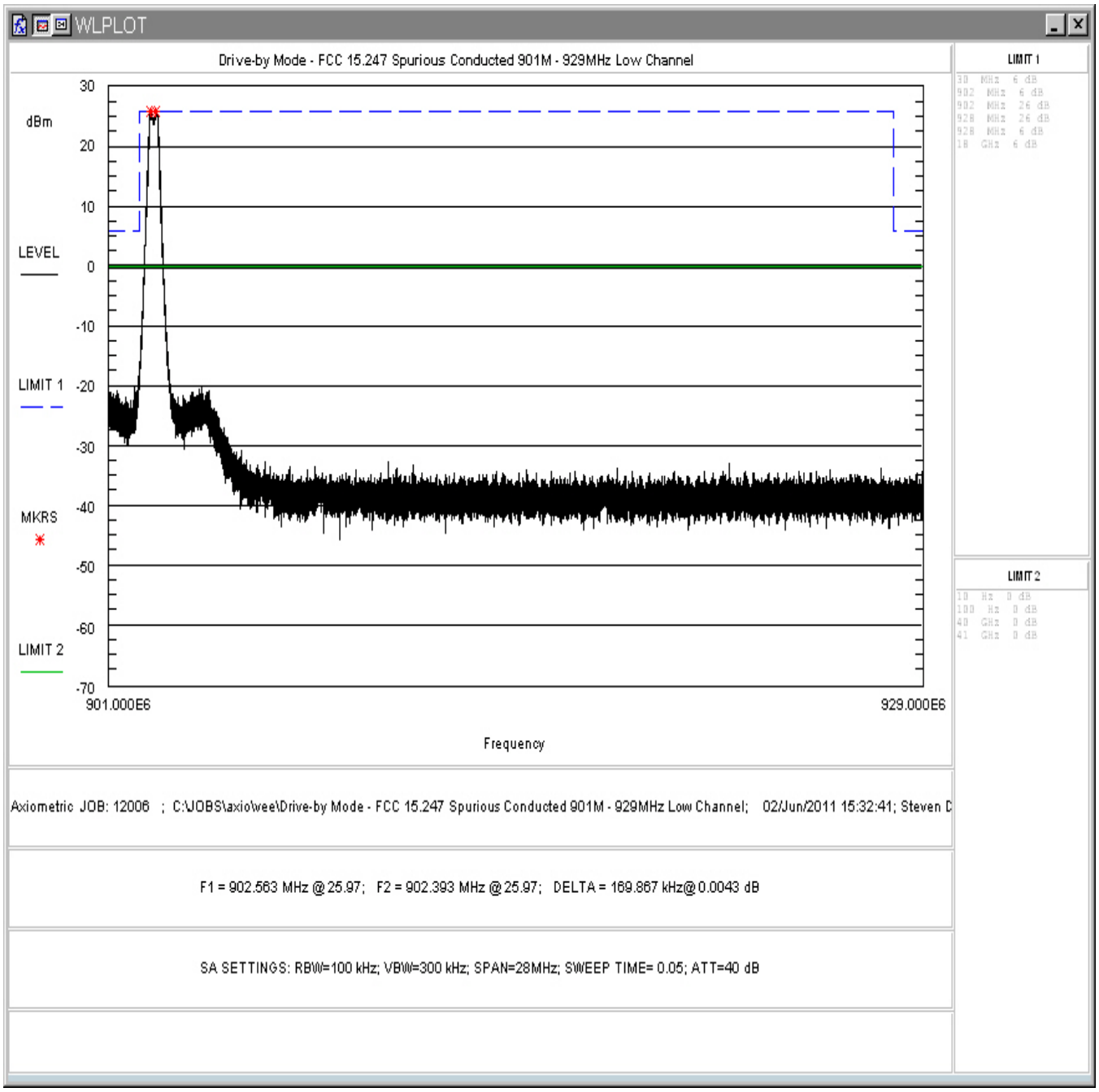

Figure 33. Conducted, Spurious Emissions, Drive-by Mode, Low Channel 901-929MHz

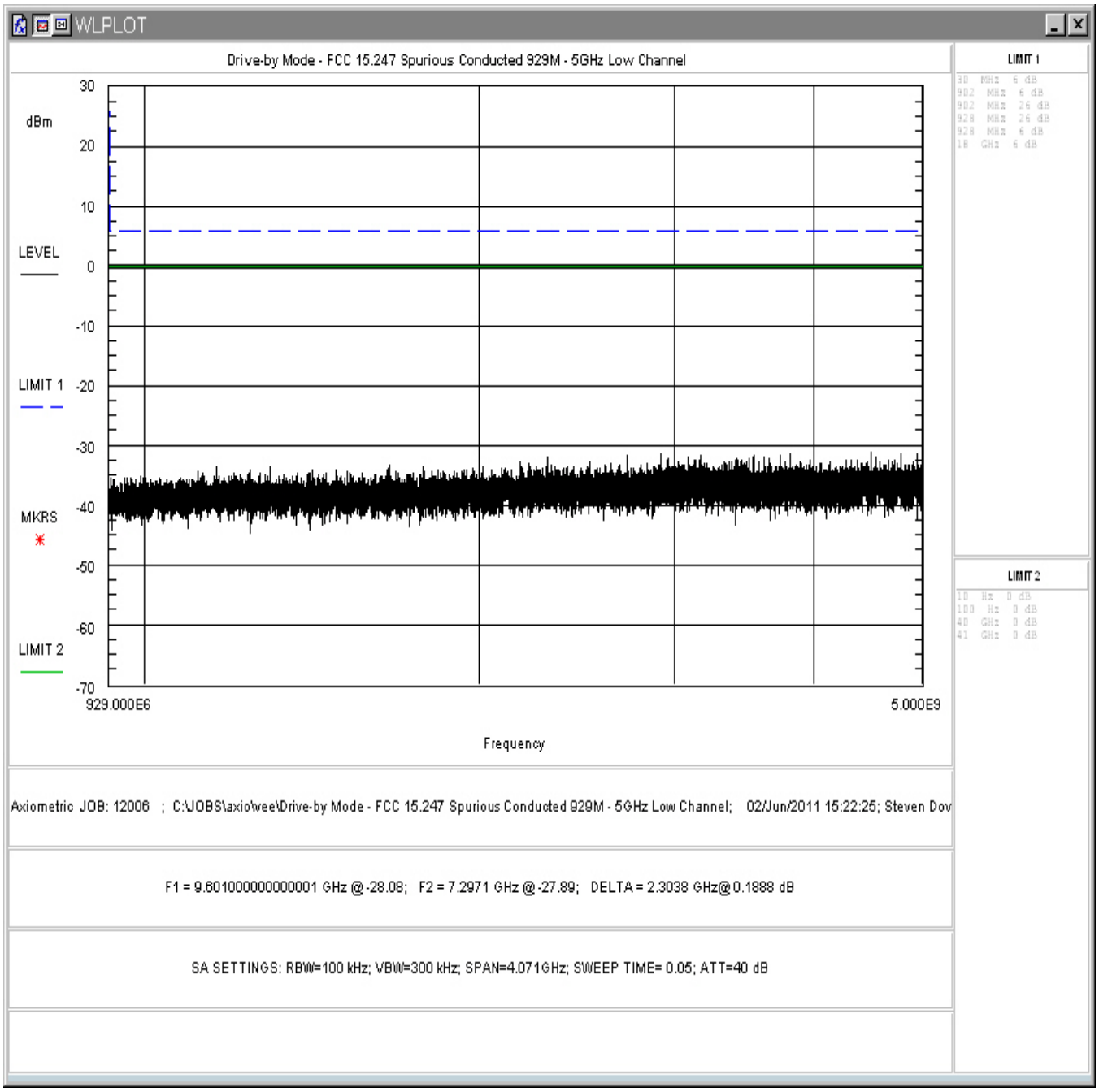

Figure 34. Conducted, Spurious Emissions, Drive-by Mode, Low Channel 929-5000MHz

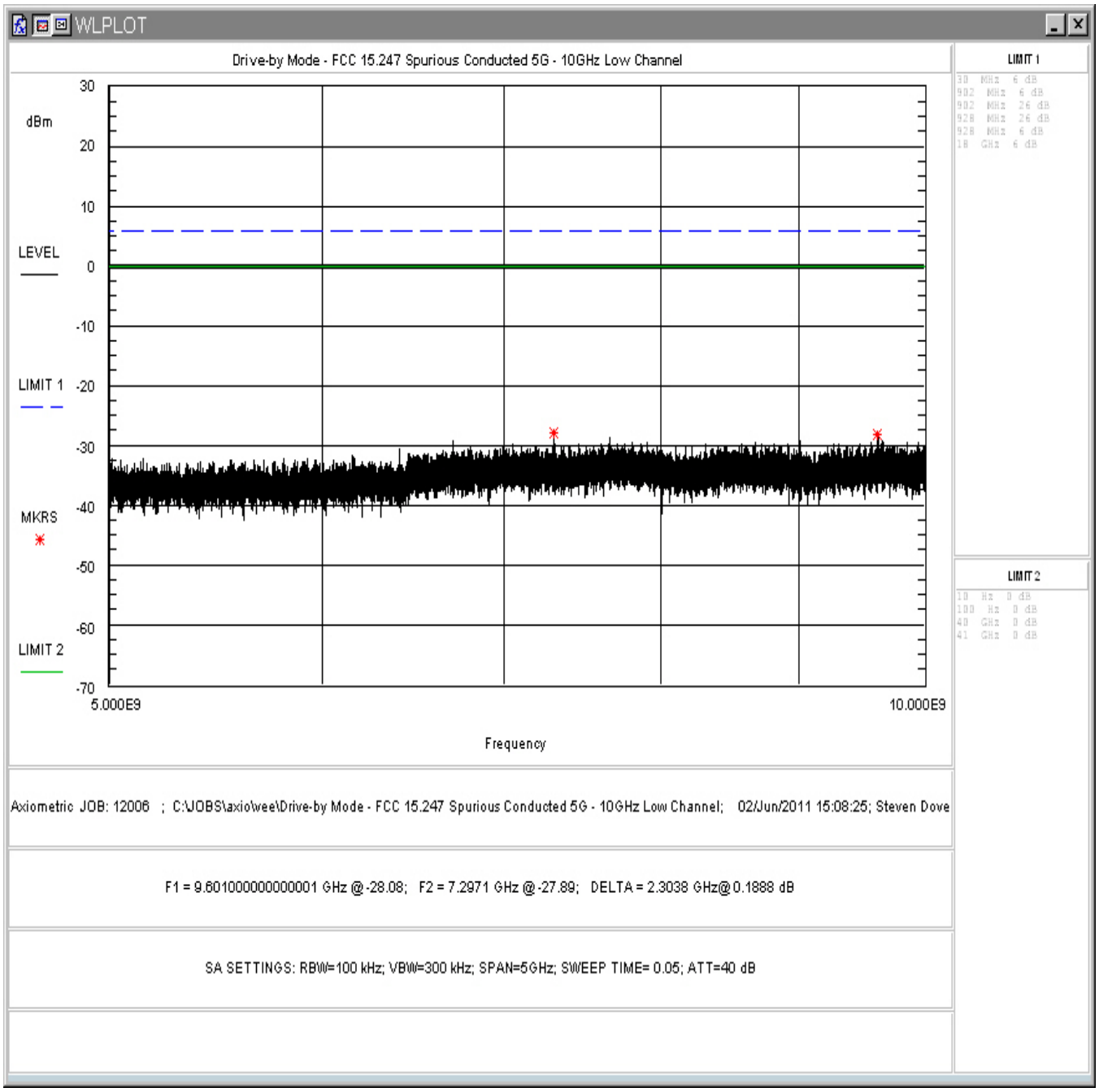

Figure 35. Conducted, Spurious Emissions, Drive-by Mode, Low Channel 5-10GHz

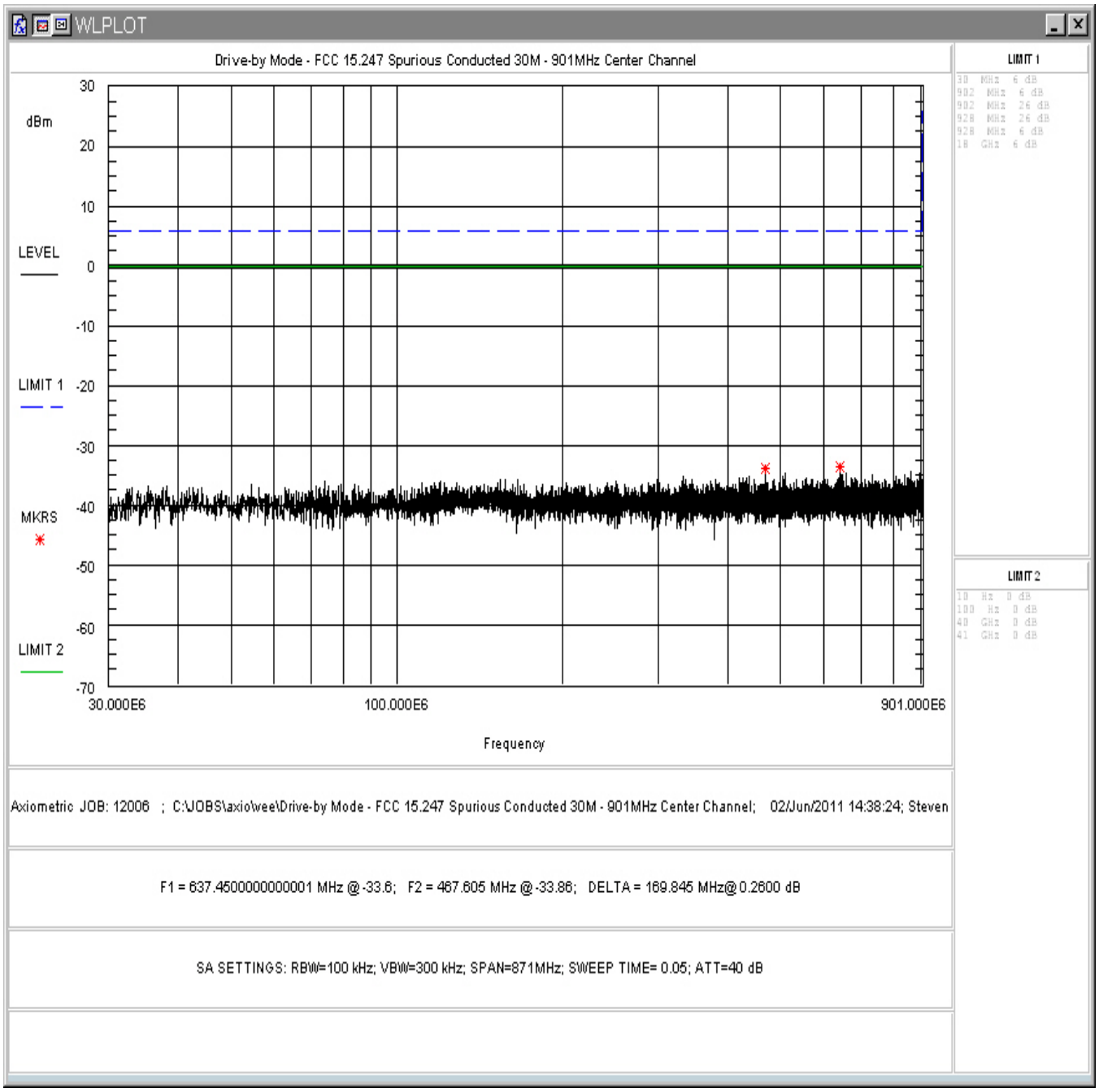

Figure 36. Conducted, Spurious Emissions, Drive-by Mode, Center Channel 30 - 901MHz

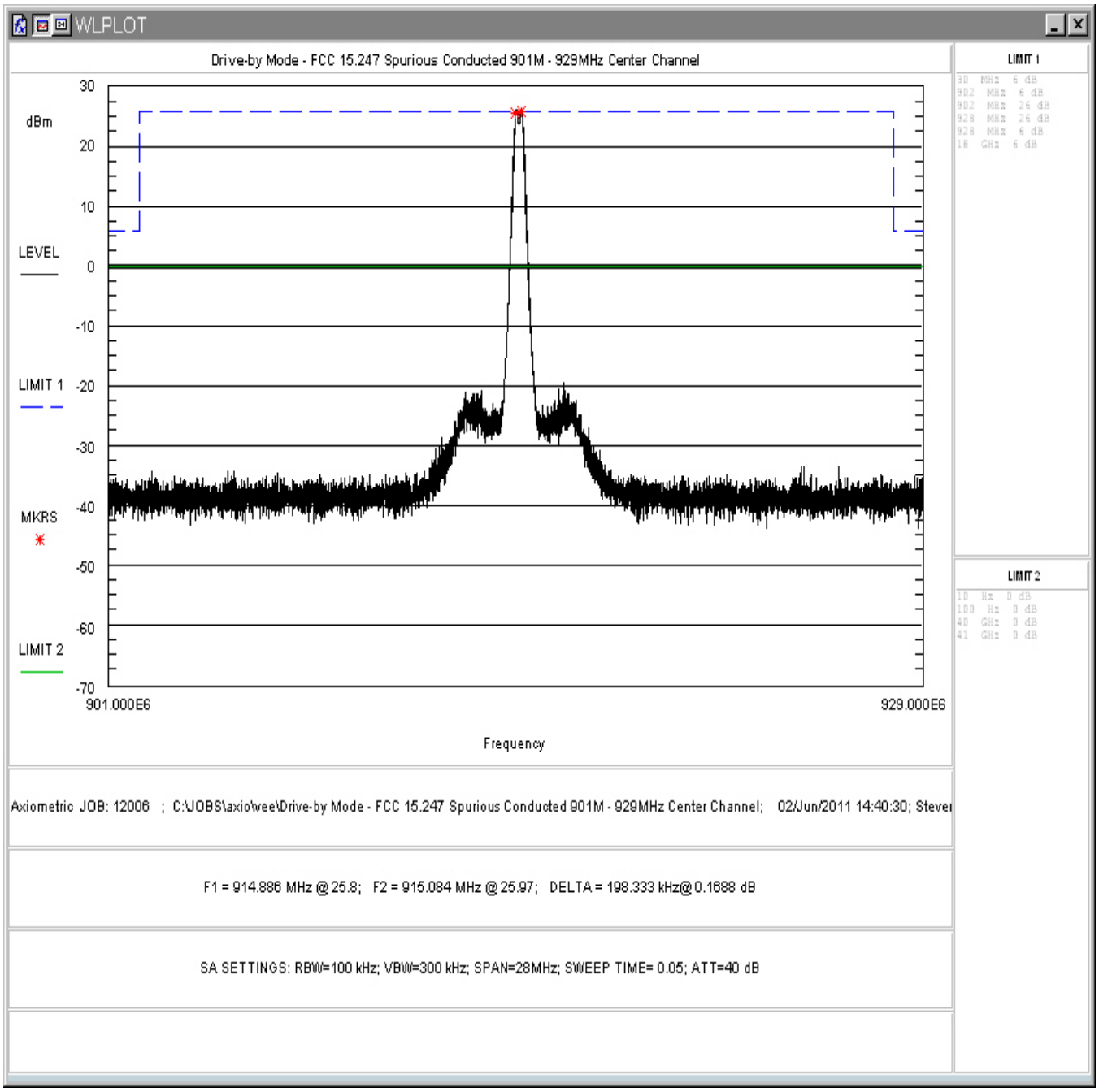

Figure 37. Conducted, Spurious Emissions, Drive-by Mode, Center Channel 901-929MHz

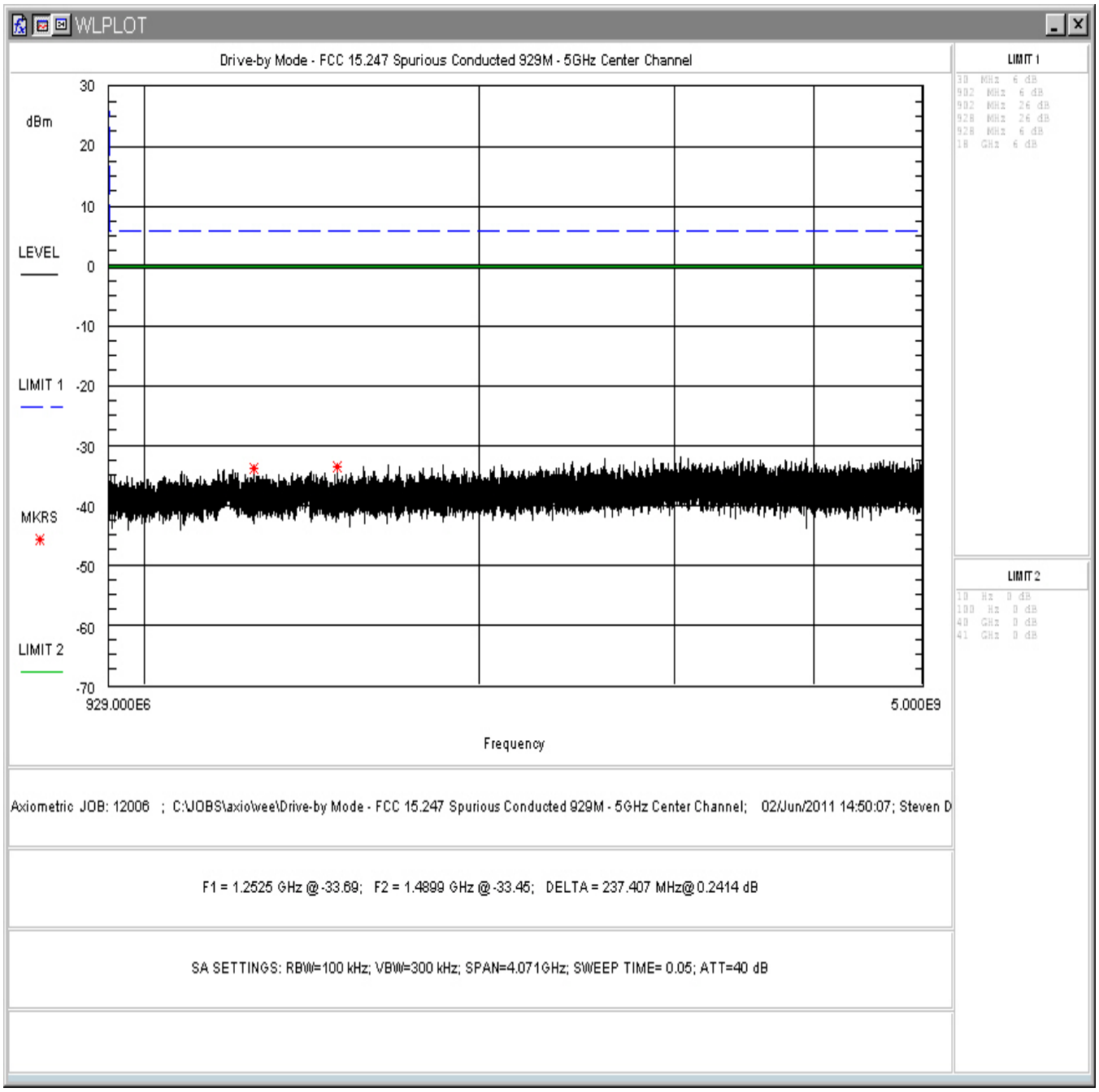

Figure 38. Conducted, Spurious Emissions, Drive-by Mode, Center Channel 929-5000MHz

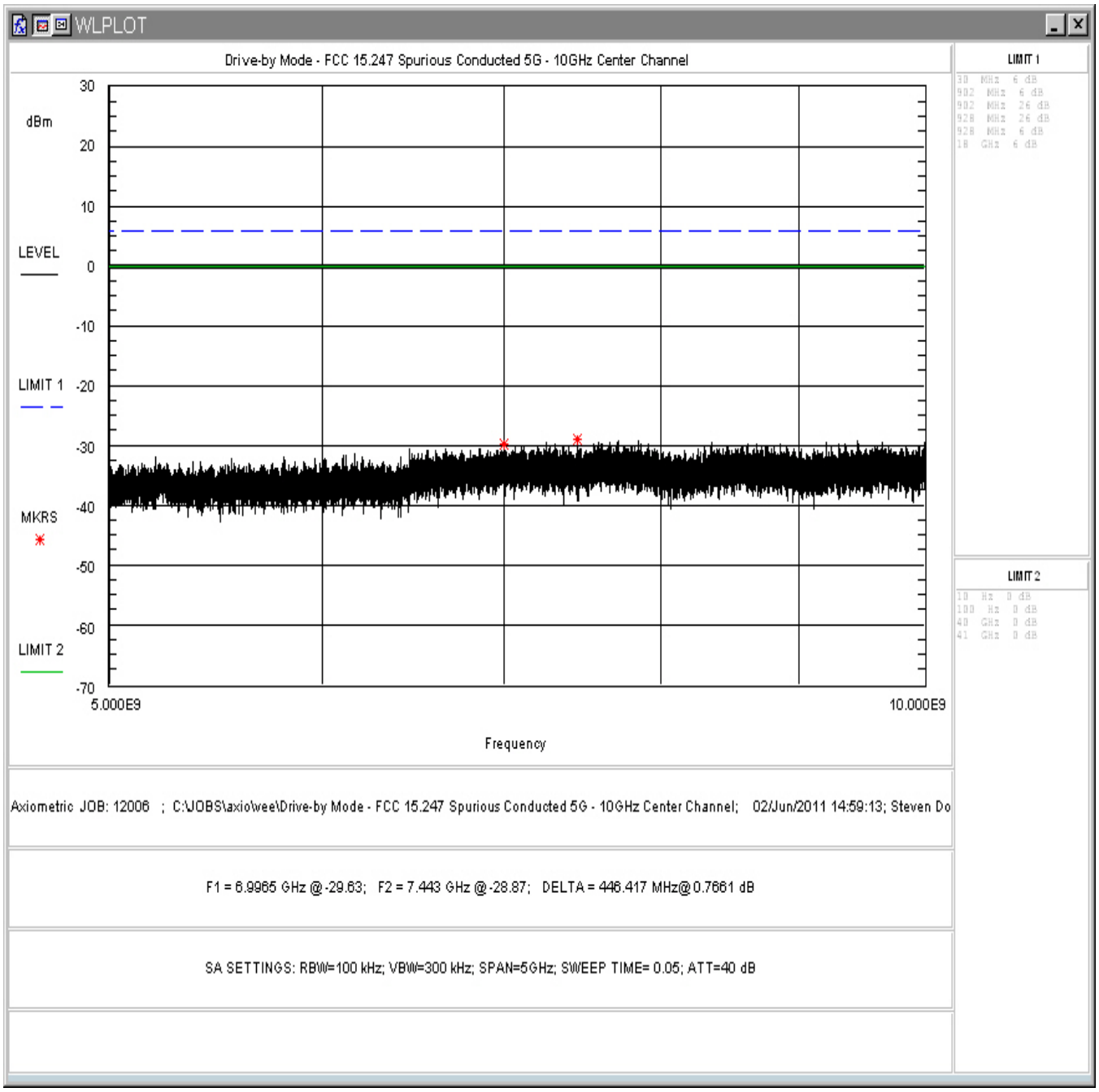

Figure 39. Conducted, Spurious Emissions, Drive-by Mode, Center Channel 5-10GHz

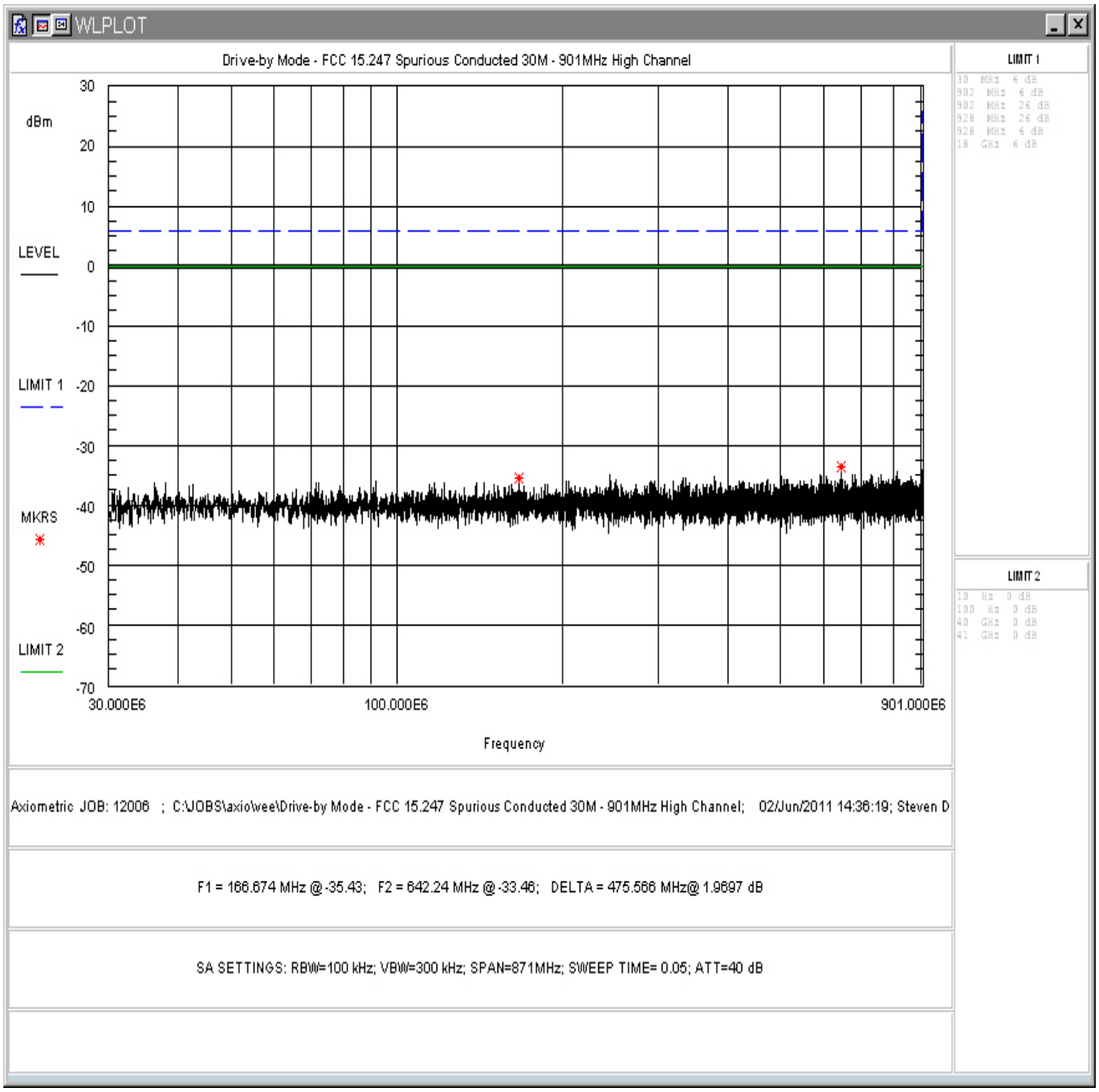

Figure 40. Conducted, Spurious Emissions, Drive-by Mode, High Channel 30-901MHz

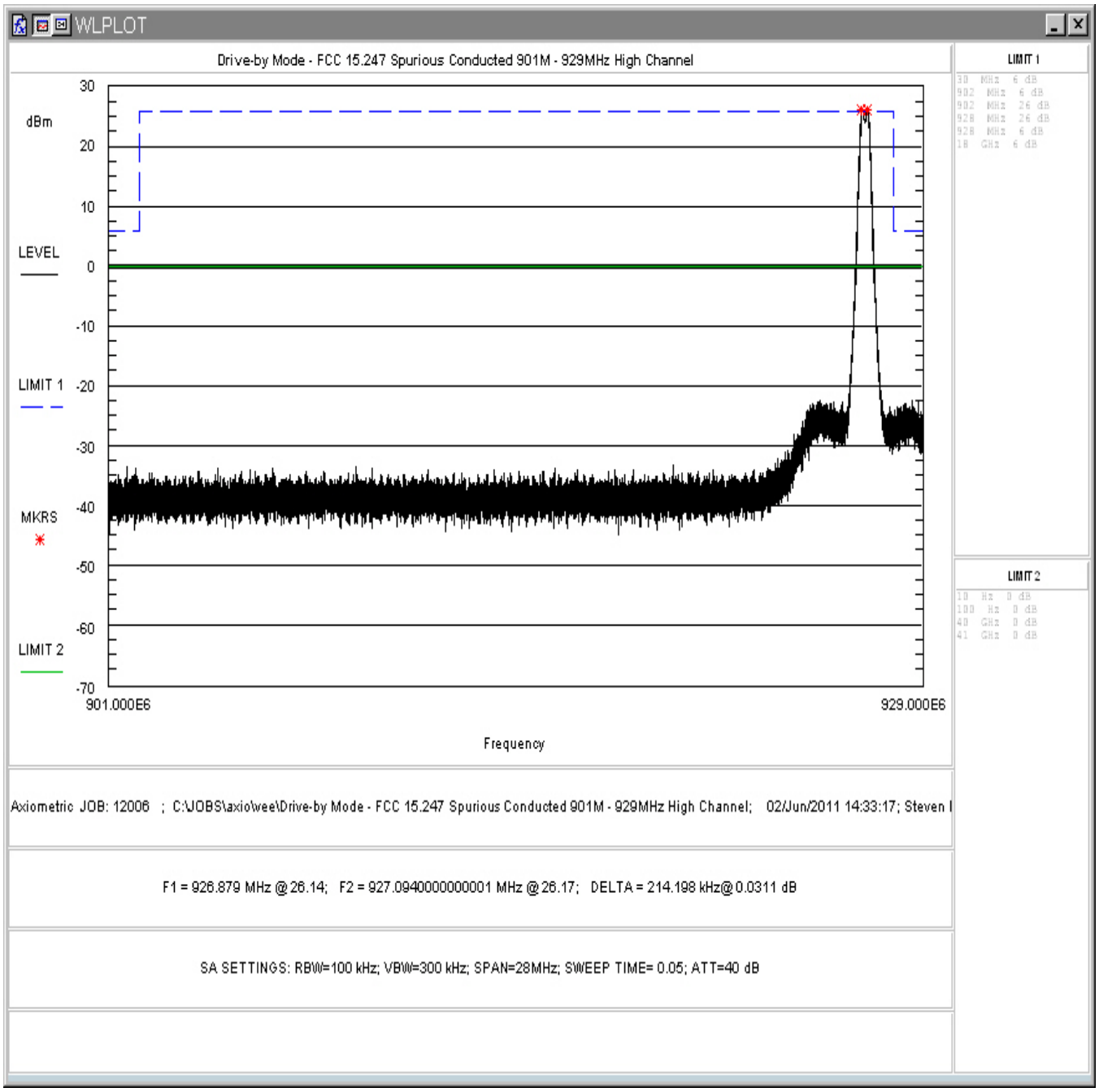

Figure 41. Conducted, Spurious Emissions, Drive-by Mode, High Channel 901-929MHz

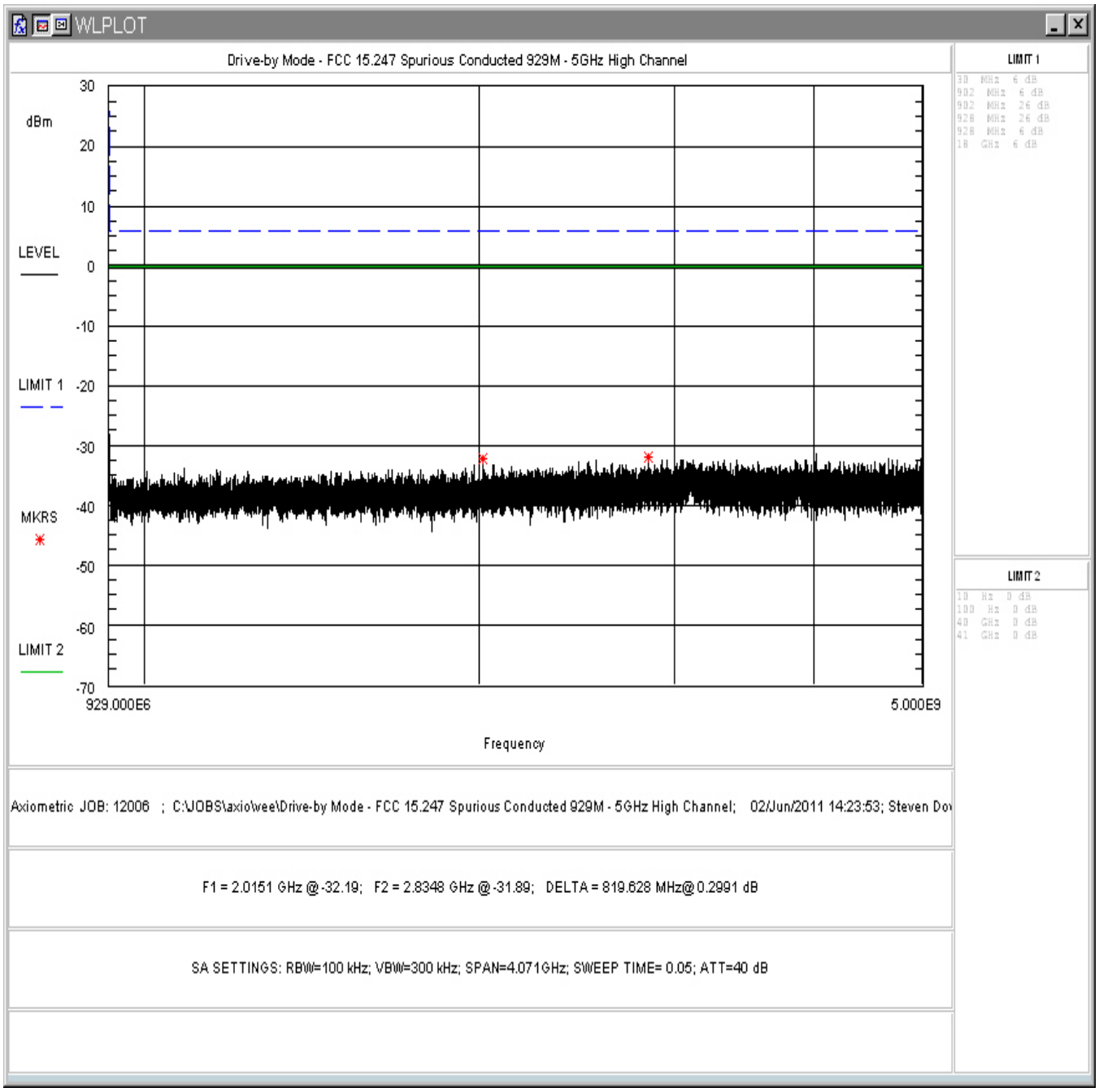

Figure 42. Conducted, Spurious Emissions, Drive-by Mode, High Channel 929-5000MHz

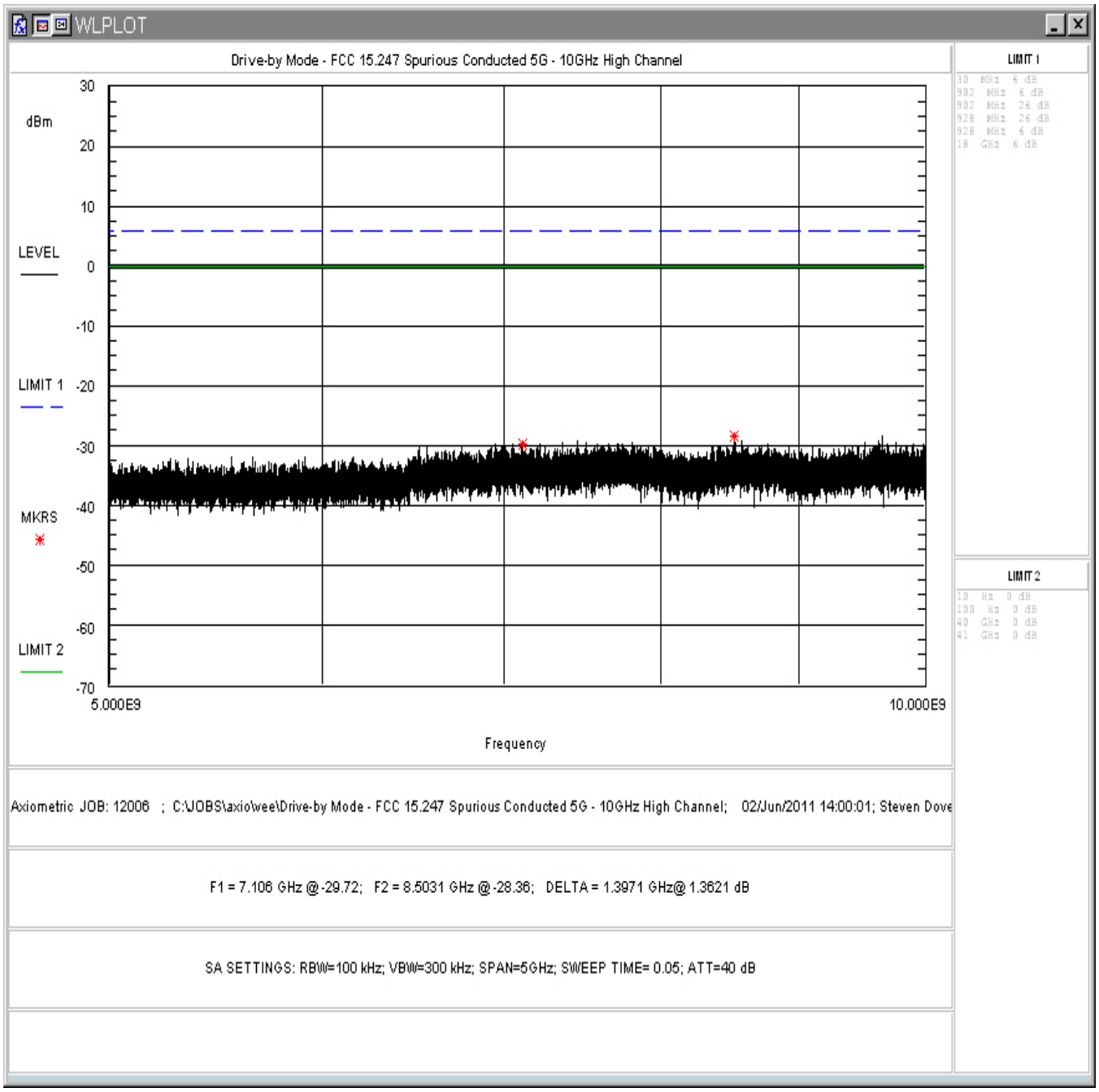

Figure 43. Conducted, Spurious Emissions, Drive-by Mode, High Channel 5-10GHz

5.5.1 Band Edge Requirements

Close up plots of the upper and lower 902-928MHz Band-edges in both Mesh and Drive-by modes are provided below with the EUT fixed at the lower and upper frequencies. Plots are also provided with the EUT hopping functions enabled. Emissions must be attenuated 20dB from the peak emission outside of the 902-928 Band.

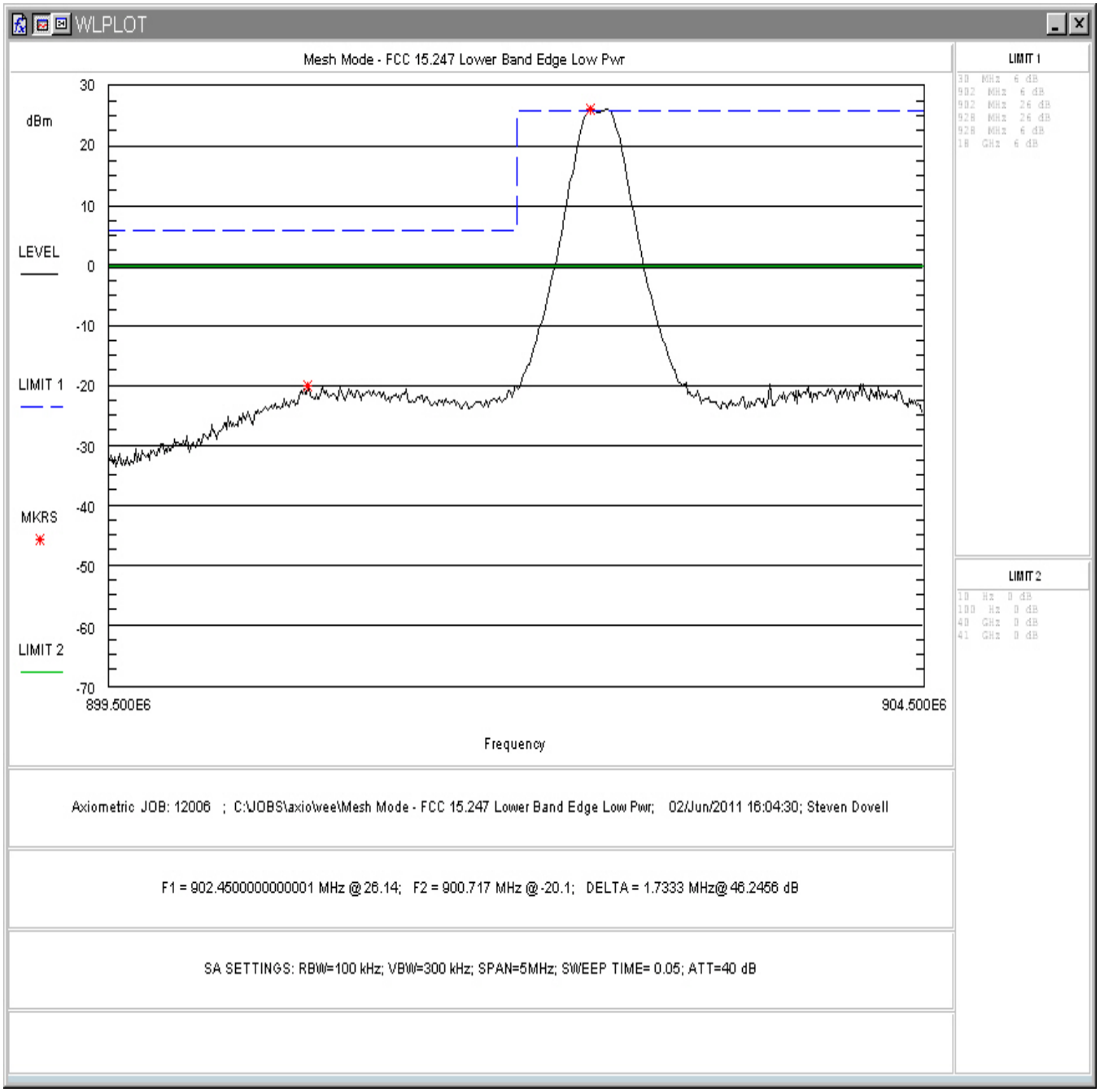

Figure 44. Conducted, Lower Band-edge, Mesh Mode, Low Channel

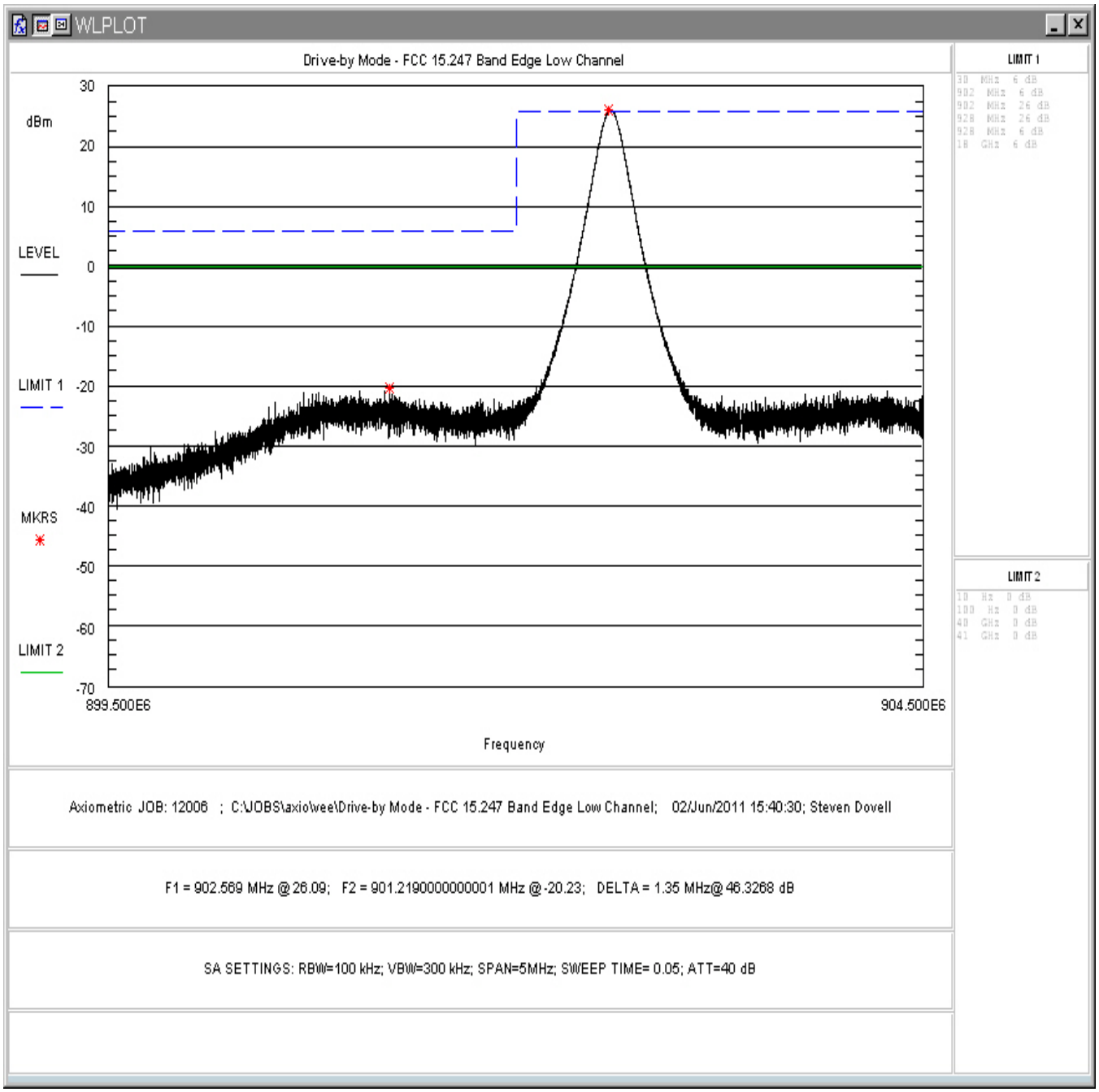

Figure 45. Conducted, Lower Band-edge, Drive-by Mode, Low Channel

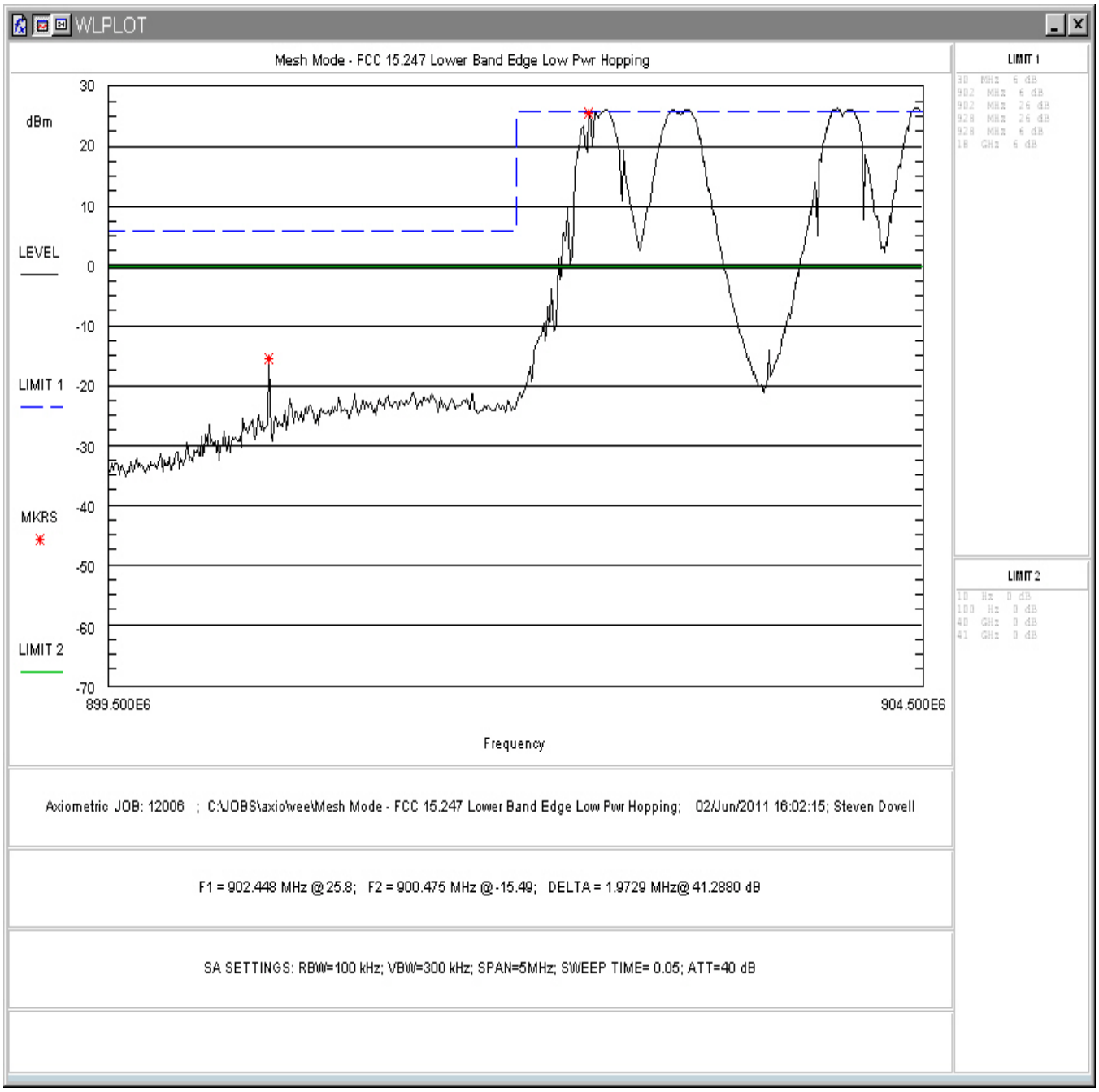

Figure 46. Conducted, Lower Band-edge, Mesh Mode, Hopping

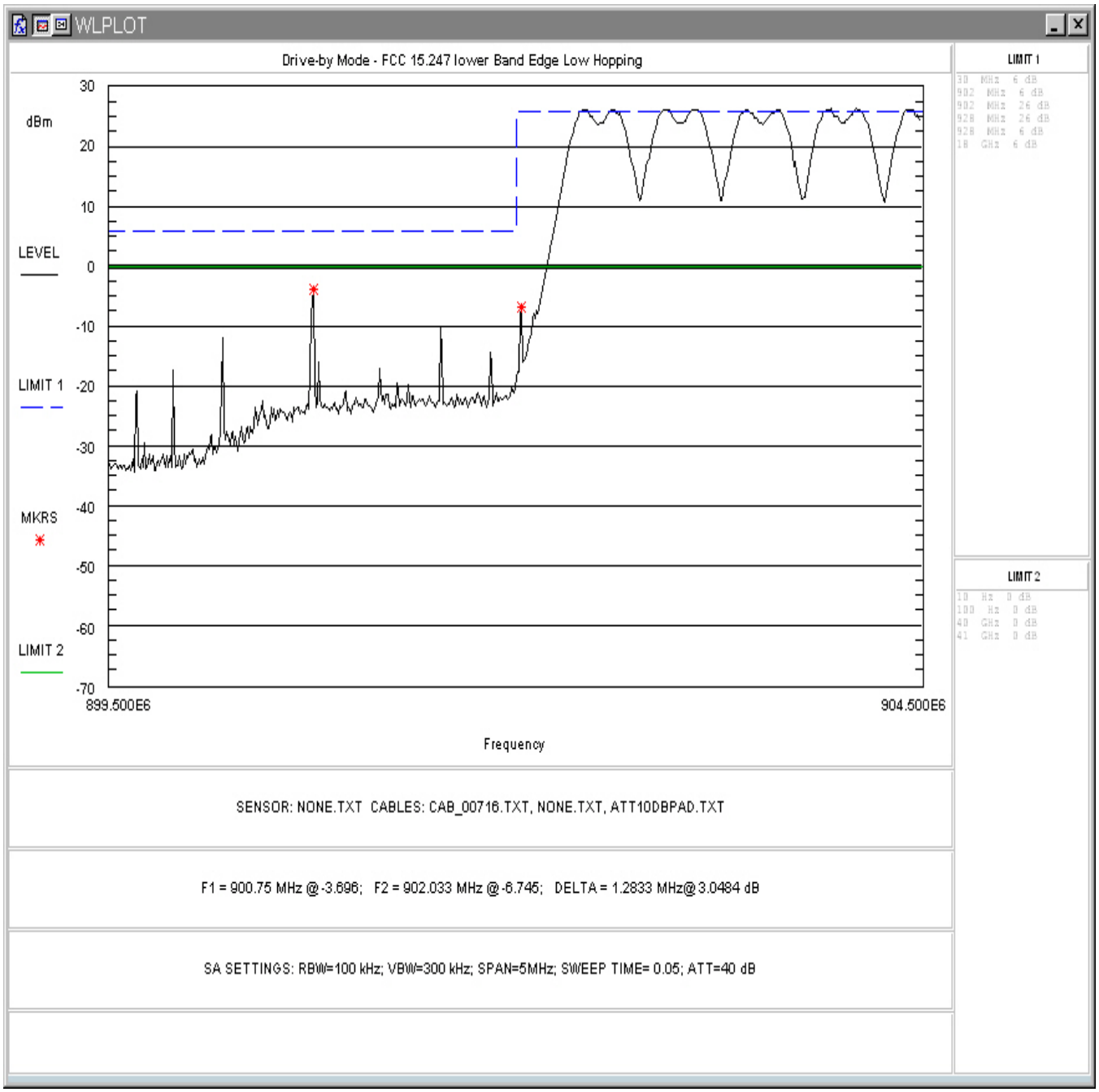

Figure 47. Conducted, Lower Band-edge, Drive-by Mode, Hopping

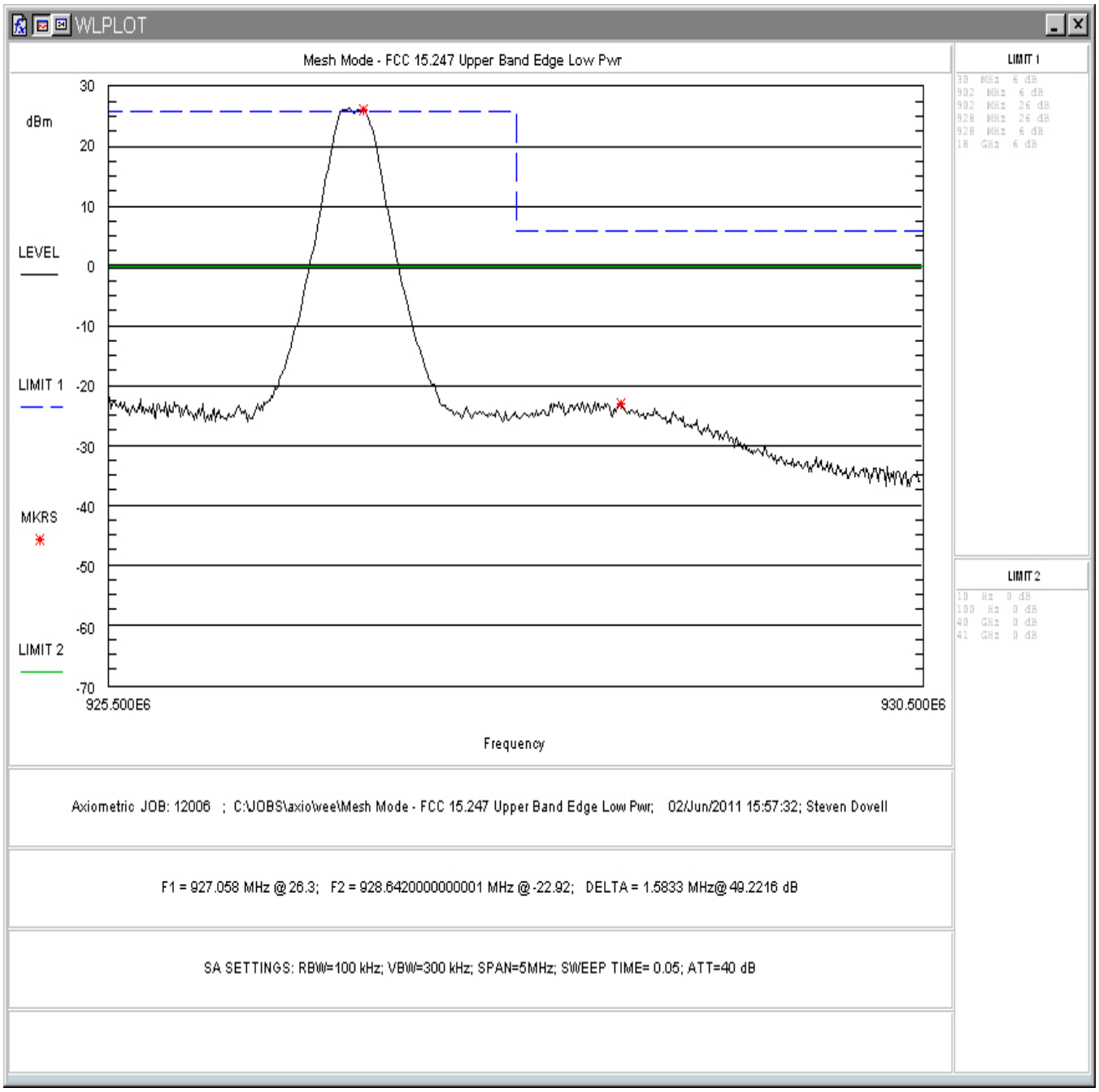

Figure 48. Conducted, Upper Band-edge, Mesh Mode, High Channel

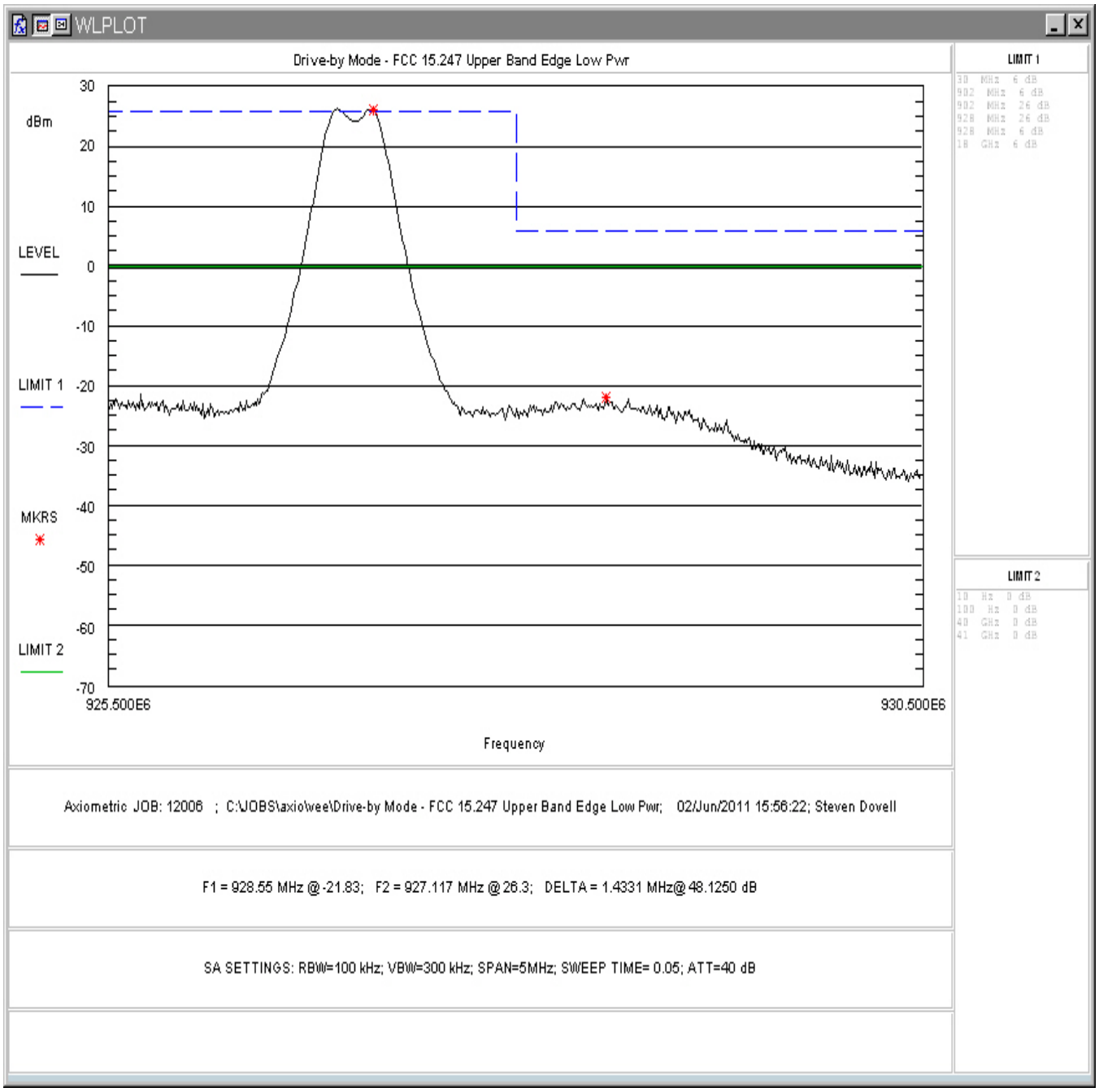

Figure 49. Conducted, Upper Band-edge, Drive-by Mode, High Channel

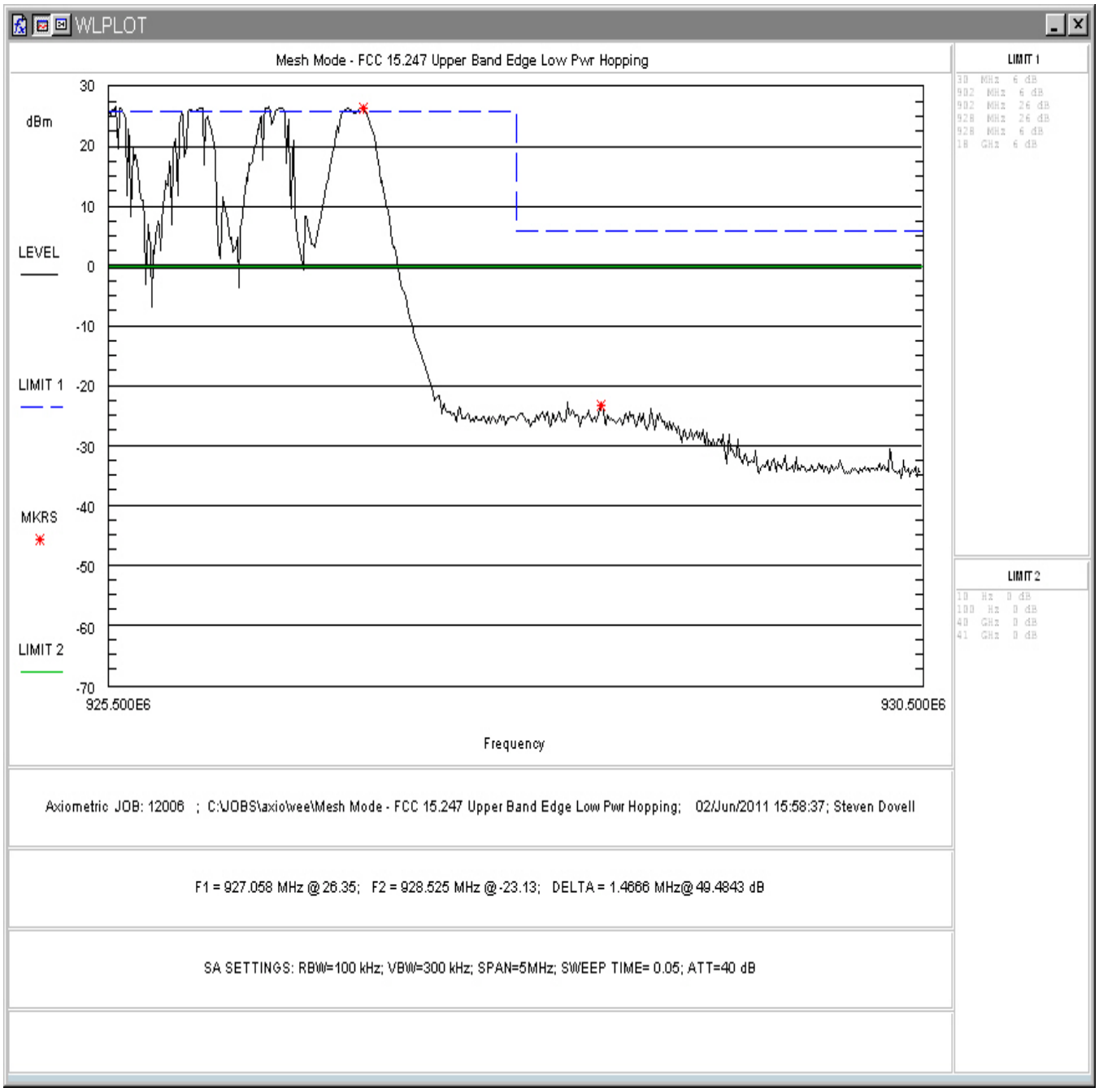

Figure 50. Conducted, Upper Band-edge, Mesh Mode, Hopping

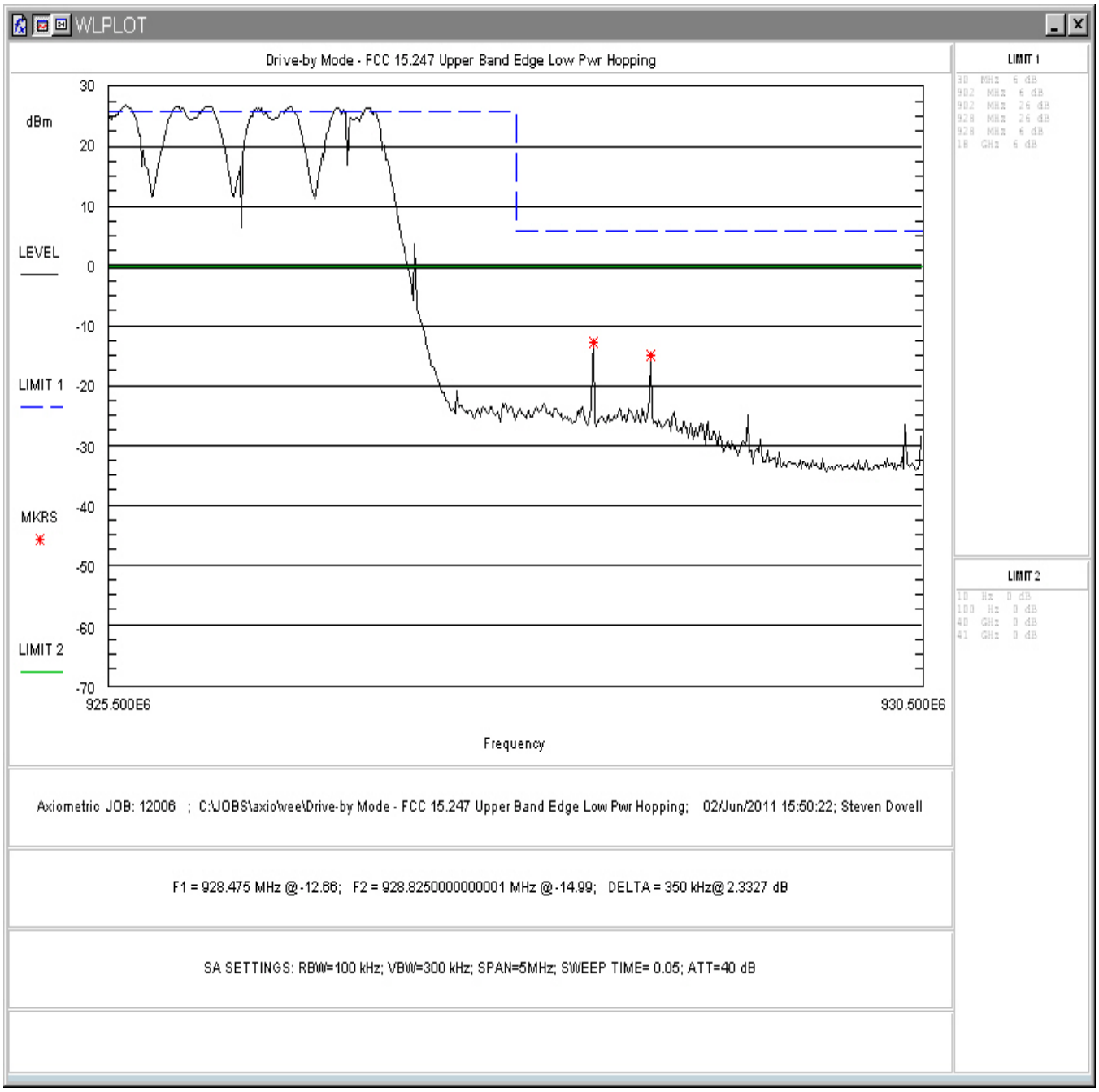

Figure 51. Conducted, Upper Band-edge, Drive-by Mode, Hopping

5.6 Radiated Spurious Emissions: (FCC Part §2.1053)

The EUT must comply with the requirements for radiated spurious emissions that fall within the restricted bands. These emissions must meet the limits specified in §15.209 and §15.35(b) for peak measurements.

5.6.1 Test Procedure

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 C63.4-2003. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured. The module was tested in 3 orthogonals with the worst case readings reported (unit flat was worst case). The radiated tests were measured with the EUT connected to an 8dBi whip antenna.

The emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	10 Hz (Avg.) 1MHz (Peak)

Table 7: Radiated Emission Test Data (Restricted Bands), <1GHz (Common to all Channels)

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
33.03	V	354.00	1.00	4.70	18.3	14.1	100.0	-17.0	
43.88	V	348.00	1.00	10.20	11.1	11.7	100.0	-18.7	
65.25	V	125.00	1.00	13.40	8.2	12.0	100.0	-18.4	
71.06	V	84.00	1.00	10.00	8.8	8.7	100.0	-21.2	
144.02	V	90.00	1.00	26.80	14.0	110.2	150.0	-2.7	QP
267.00	V	180.00	1.00	5.10	15.3	10.5	200.0	-25.6	
288.03	V	185.00	1.60	15.20	15.9	36.0	200.0	-14.9	
360.00	V	180.00	1.00	7.00	17.5	16.8	200.0	-21.5	
504.00	V	228.00	1.00	10.90	20.6	37.7	200.0	-14.5	
990.27	V	200.00	1.00	10.60	28.0	85.1	500.0	-15.4	
994.33	V	90.00	1.00	9.90	28.2	80.1	500.0	-15.9	
40.66	H	50.00	4.00	6.20	13.0	9.1	100.0	-20.8	
64.51	H	0.00	4.00	12.70	8.2	11.1	100.0	-19.1	
65.31	H	0.00	4.00	12.20	8.2	10.5	100.0	-19.6	
70.43	H	185.00	4.00	10.80	8.7	9.5	100.0	-20.5	
144.00	H	180.00	2.22	26.30	14.0	104.0	150.0	-3.2	QP
288.00	H	250.00	1.26	20.36	15.9	65.3	200.0	-9.7	
432.00	H	180.00	1.00	10.80	19.4	32.3	200.0	-15.8	
504.00	H	270.00	1.00	11.10	20.6	38.6	200.0	-14.3	

Table 8: Radiated Emission Test Data (Restricted Bands), Low Channel

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
TX 902									
2707.50	V	0.00	2.88	47.58	-2.6	177.4	5000.0	-29.0	Peak
3610.00	V	350.00	2.90	45.10	-0.5	170.0	5000.0	-29.4	Peak
4512.50	V	19.00	2.80	45.20	0.7	197.4	5000.0	-28.1	Peak
5415.00	V	0.00	2.77	44.40	3.4	244.4	5000.0	-26.2	Peak
8122.50	V	324.00	2.32	45.95	7.5	469.1	5000.0	-20.6	Peak
9025.00	V	333.00	2.32	48.30	9.0	734.3	5000.0	-16.7	Peak
2707.50	V	0.00	2.88	40.78	-2.6	81.1	500.0	-15.8	Average
3610.00	V	350.00	2.90	32.50	-0.5	39.8	500.0	-22.0	Average
4512.50	V	19.00	2.80	37.60	0.7	82.3	500.0	-15.7	Average
5415.00	V	0.00	2.77	31.20	3.4	53.5	500.0	-19.4	Average
8122.50	V	324.00	2.32	41.00	7.5	265.3	500.0	-5.5	Average
9025.00	V	333.00	2.32	37.70	9.0	216.7	500.0	-7.3	Average
2707.50	H	21.00	2.42	48.20	-2.6	190.5	5000.0	-28.4	Peak
3610.00	H	296.00	2.08	42.73	-0.5	129.4	5000.0	-31.7	Peak
4512.50	H	59.00	1.87	44.60	0.7	184.2	5000.0	-28.7	Peak
5415.00	H	53.00	1.87	45.64	3.4	281.9	5000.0	-25.0	Peak
8122.50	H	73.00	1.50	47.57	7.5	565.2	5000.0	-18.9	Peak
9025.00	H	82.00	1.53	46.61	9.0	604.5	5000.0	-18.4	Peak
2707.50	H	21.00	2.42	43.10	-2.6	105.9	500.0	-13.5	Average
3610.00	H	296.00	2.08	32.50	-0.5	39.8	500.0	-22.0	Average
4512.50	H	59.00	1.87	38.40	0.7	90.2	500.0	-14.9	Average
5415.00	H	53.00	1.87	39.01	3.4	131.4	500.0	-11.6	Average
8122.50	H	73.00	1.50	42.90	7.5	330.2	500.0	-3.6	Average
9025.00	H	82.00	1.53	36.07	9.0	179.6	500.0	-8.9	Average

Table 9: Radiated Emission Test Data (Restricted Bands), Center Channel

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
TX = 915.00									
2745.00	V	3.09	2.48	48.20	-2.6	191.4	5000.0	-28.3	Peak
3660.00	V	3.07	2.46	42.80	-0.5	130.7	5000.0	-31.7	Peak
4575.00	V	0.00	2.46	46.00	0.8	218.0	5000.0	-27.2	Peak
7320.00	V	326.00	2.47	44.30	7.5	390.7	5000.0	-22.1	Peak
8235.00	V	278.00	2.49	50.98	7.7	860.6	5000.0	-15.3	Peak
9150.00	V	18.00	2.45	42.03	9.2	363.9	5000.0	-22.8	Peak
2745.00	V	3.09	2.48	43.74	-2.6	114.5	500.0	-12.8	Average
3660.00	V	3.07	2.46	32.90	-0.5	41.8	500.0	-21.6	Average
4575.00	V	0.00	2.46	38.20	0.8	88.8	500.0	-15.0	Average
7320.00	V	326.00	2.47	35.13	7.5	135.9	500.0	-11.3	Average
8235.00	V	278.00	2.49	45.30	7.7	447.5	500.0	-1.0	Average
9150.00	V	18.00	2.45	32.25	9.2	118.0	500.0	-12.5	Average
2745.00	H	230.00	2.24	51.10	-2.6	267.2	5000.0	-25.4	Peak
3660.00	H	344.00	2.56	41.57	-0.5	113.4	5000.0	-32.9	Peak
4575.00	H	35.00	2.23	46.26	0.8	224.6	5000.0	-27.0	Peak
7320.00	H	286.00	1.90	43.85	7.5	371.0	5000.0	-22.6	Peak
8235.00	H	297.00	1.91	51.40	7.7	903.2	5000.0	-14.9	Peak
9150.00	H	305.00	1.90	41.17	9.2	329.6	5000.0	-23.6	Peak
2745.00	H	230.00	2.24	47.78	-2.6	182.3	500.0	-8.8	Average
3660.00	H	344.00	2.56	32.06	-0.5	38.0	500.0	-22.4	Average
4575.00	H	35.00	2.23	39.16	0.8	99.2	500.0	-14.1	Average
7320.00	H	286.00	1.90	36.26	7.5	154.8	500.0	-10.2	Average
8235.00	H	297.00	1.91	44.20	7.7	394.3	500.0	-2.1	Average
9150.00	H	305.00	1.90	32.10	9.2	116.0	500.0	-12.7	Average

Table 10: Radiated Emission Test Data (Restricted Bands), High Channel

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
927.00									
2781.00	V	7.00	2.86	48.23	-2.5	192.9	5000.0	-28.3	Peak
3708.00	V	303.00	2.89	44.62	-0.5	161.6	5000.0	-29.8	Peak
4635.00	V	325.00	3.11	46.80	0.8	240.4	5000.0	-26.4	Peak
7416.00	V	353.00	3.09	48.20	7.2	587.6	5000.0	-18.6	Peak
8343.00	V	315.00	2.44	45.96	8.0	501.2	5000.0	-20.0	Peak
	V								
2781.00	V	7.00	2.86	39.28	-2.5	68.8	500.0	-17.2	Average
3708.00	V	303.00	2.89	32.49	-0.5	40.0	500.0	-21.9	Average
4635.00	V	325.00	3.11	36.62	0.8	74.5	500.0	-16.5	Average
7416.00	V	353.00	3.09	39.25	7.2	209.7	500.0	-7.5	Average
8343.00	V	315.00	2.44	41.94	8.0	315.5	500.0	-4.0	Average
2781.00	H	279.00	1.69	48.24	-2.5	193.1	5000.0	-28.3	Peak
3708.00	H	309.00	1.61	41.59	-0.5	114.0	5000.0	-32.8	Peak
4635.00	H	296.00	1.77	47.23	0.8	252.6	5000.0	-25.9	Peak
7416.00	H	317.00	1.77	49.22	7.2	660.9	5000.0	-17.6	Peak
8343.00	H	306.00	1.92	44.90	8.0	443.6	5000.0	-21.0	Peak
	H								
2781.00	H	279.00	1.69	43.64	-2.5	113.7	500.0	-12.9	Average
3708.00	H	309.00	1.61	32.06	-0.5	38.1	500.0	-22.4	Average
4635.00	H	296.00	1.77	40.32	0.8	114.0	500.0	-12.8	Average
7416.00	H	317.00	1.77	41.72	7.2	278.7	500.0	-5.1	Average
8343.00	H	306.00	1.92	36.93	8.0	177.2	500.0	-9.0	Average

5.7 Receiver Radiated Spurious Emissions: (FCC Part §15.209, RSS-Gen [7.2.3.2])

The EUT must comply with the requirements for radiated spurious emissions from the receiver. These emissions must meet the limits specified in §15.209 and RSS-Gen.

5.7.1 Test Procedure

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 emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	<30 Hz (Avg.)

5.7.2 Test Summary

The EUT complied with the requirements for receiver radiated emissions FCC 15.209 IC RSS-Gen. Receiver Radiated Spurious Test Data. The receiver was scanned from 30-2781MHz (3 times the highest receiver frequency of 927MHz).

Table 11: Receiver Radiated Test Data

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
33.03	V	354.00	1.00	4.70	18.3	14.1	100.0	-17.0	
43.88	V	348.00	1.00	10.20	11.1	11.7	100.0	-18.7	
71.06	V	84.00	1.00	10.00	8.8	8.7	100.0	-21.2	
144.02	V	90.00	1.00	26.80	14.0	110.2	150.0	-2.7	QP
267.00	V	180.00	1.00	5.10	15.3	10.5	200.0	-25.6	
288.03	V	185.00	1.60	15.20	15.9	36.0	200.0	-14.9	
360.00	V	180.00	1.00	7.00	17.5	16.8	200.0	-21.5	
504.00	V	228.00	1.00	10.90	20.6	37.7	200.0	-14.5	
40.66	H	50.00	4.00	6.20	13.0	9.1	100.0	-20.8	
70.43	H	185.00	4.00	10.80	8.7	9.5	100.0	-20.5	
144.00	H	180.00	2.22	26.30	14.0	104.0	150.0	-3.2	QP
288.00	H	250.00	1.26	20.36	15.9	65.3	200.0	-9.7	
432.00	H	180.00	1.00	10.80	19.4	32.3	200.0	-15.8	
504.00	H	270.00	1.00	11.10	20.6	38.6	200.0	-14.3	

5.8 AC Conducted Emissions (FCC Pt.15.207, RSS-Gen [7.2.2])

5.8.1 Requirements

Test Arrangement: Table Top

Compliance Standard: FCC Class B

FCC Compliance Limits		
Frequency	**Quasi-peak**	**Average**
0.15 - 0.5MHz	66 to 56dBµV	56 to 46dBµV
0.5 - 5MHz	56dBµV	46dBµV
5 - 30MHz	60dBµV	50dBµV

5.8.2 Test Procedure

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 Ω/50 µH 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 was supplied to the peripherals through a second LISN. The peripherals were placed on the table in accordance with ANSI C63.4-2003. Power and data cables were moved about to obtain maximum emissions.

The 50 Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 150 kHz to 30 MHz were measured. The detector function was set to quasi-peak, peak, or average 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. For average measurements the post-detector filter was set to 10 Hz.

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed.

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed. The Conducted emissions level to be compared to the FCC limit is calculated as shown in the following example.

Example:

Spectrum Analyzer Voltage: VdBµV

LISN Correction Factor: LISN dB

Cable Correction Factor: CF dB

Electric Field: EdBµV = V dBµV + LISN dB + CF dB

5.8.3 Test Data

The EUT complied with the Class B Conducted Emissions requirements. This system runs off of 120VAC. Table 10-11 provides the test results for phase and neutral line power line conducted emissions.

Emissions were tested in both "transmit on" and "transmit off "state with the EUT tuned to 915MHz.

As the module is typically powered from DC, the unit was powered via a PRS AC/DC adaptor Model HP-5V2 (supplied by Axiometric).

Table 12: Conducted Emissions Data, Transmit On

NEUTRAL

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.150	23.5	23.5	10.3	0.5	34.3	34.3	66.0	56.0	-31.7	-21.7
1.144	21.7	21.7	10.4	0.4	32.5	32.5	56.0	46.0	-23.5	-13.5
3.244	7.5	7.5	10.7	0.4	18.5	18.5	56.0	46.0	-37.5	-27.5
11.730	14.5	14.5	11.1	0.9	26.5	26.5	60.0	50.0	-33.5	-23.5
12.060	16.4	16.4	11.1	0.9	28.5	28.5	60.0	50.0	-31.5	-21.5
25.900	16.3	16.3	11.8	2.6	30.7	30.7	60.0	50.0	-29.3	-19.3

PHASE

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.155	22.4	22.4	10.3	0.7	33.4	33.4	65.7	55.7	-32.3	-22.3
1.191	14.5	14.5	10.4	0.4	25.3	25.3	56.0	46.0	-30.7	-20.7
4.327	16.2	16.2	10.8	0.5	27.5	27.5	56.0	46.0	-28.5	-18.5
8.570	15.3	15.3	11.0	0.8	27.1	27.1	60.0	50.0	-32.9	-22.9
9.760	16.2	16.2	11.0	1.0	28.2	28.2	60.0	50.0	-31.8	-21.8
11.670	15.7	15.7	11.1	1.3	28.2	28.2	60.0	50.0	-31.8	-21.8

Table 13: Conducted Emissions Data, Transmit Off

NEUTRAL

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.150	23.5	23.5	10.3	0.5	34.3	34.3	66.0	56.0	-31.7	-21.7
1.144	21.7	21.7	10.4	0.4	32.5	32.5	56.0	46.0	-23.5	-13.5
3.244	7.5	7.5	10.7	0.4	18.5	18.5	56.0	46.0	-37.5	-27.5
11.730	14.5	14.5	11.1	0.9	26.5	26.5	60.0	50.0	-33.5	-23.5
12.060	16.4	16.4	11.1	0.9	28.5	28.5	60.0	50.0	-31.5	-21.5
25.900	16.3	16.3	11.8	2.6	30.7	30.7	60.0	50.0	-29.3	-19.3

PHASE

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.155	22.4	22.4	10.3	0.7	33.4	33.4	65.7	55.7	-32.3	-22.3
1.191	14.5	14.5	10.4	0.4	25.3	25.3	56.0	46.0	-30.7	-20.7
4.327	16.2	16.2	10.8	0.5	27.5	27.5	56.0	46.0	-28.5	-18.5
8.570	15.3	15.3	11.0	0.8	27.1	27.1	60.0	50.0	-32.9	-22.9
9.760	16.2	16.2	11.0	1.0	28.2	28.2	60.0	50.0	-31.8	-21.8
11.670	15.7	15.7	11.1	1.3	28.2	28.2	60.0	50.0	-31.8	-21.8