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OCCUPIED BANDWIDTH AND SPURIOUS EMISSIONS MEASUREMENTS

TRANSLATOR K214EG

MONTICELLO, UTAH

24 OCTOBER 2023

2 October 2023

ENGINEERING REPORT

On the afternoon of 28 September 2023 I made equipment performance measurements pursuant to criteria in Part 73.317(a) through 73.317(d) for translator K214EG licensed to Monticello, Utah.

These measurements were made with the translator broadcasting normal programming material. It was in stereophonic mode operating at the licensed ERP, 31 watts, specified in the construction permit.

The RF sample was taken from a non-directional coupler temporarily placed in the feedline at the output of a bandpass filter.

The RF sample was fed to an Agilent Model E4401B Serial Number: MY41440302 with a recent calibration. The analyzer was set to a center frequency of 90.7 MHz for the occupied spectrum measurements and to the relevant harmonic and calculated intermodulation distortion (mixing product) frequencies at the transmitter site to eliminate the possibility of out of specification emissions. The spectrum analyzer plots are representations of the average of 100 sweeps.

The resulting plots were saved in the analyzer's memory and copies are included below as Figures 1 – 7.

47CFR 73.317 (b) & (c) requires that all signals between 120 and 240 KHz removed from the carrier be attenuated below the level of the carrier at least 25dB; that all signals between 240 KHz and 600 KHz removed from the carrier be attenuated at least 35 dB; and that all signals greater than 600 KHz removed from the carrier by at least 57.9 dB below the level of the carrier. In lieu of a mask representing those limits on the spectrum analyzer I measured the levels at these discrete limits using the marker feature in the instrument. Figures 1 – 5 are the results.

Emissions beyond 600 KHz removed from the carrier must meet or exceed the attenuation determined by the expression: $43 + 10 \text{ LOG}(\text{power in watts})$ or 80 dB which ever is the lesser attenuation. The ERP in this case is 31 watts so the limit is = 57.9 dB.

Figures 1 – 5 are spectrum analyzer screens for the translator under 100% modulation. Figure 6 is the measurement of the one detectable harmonic, the 2nd harmonic at 181.4 MHz measured at 80.26 dB below the unmodulated carrier. All other harmonics were below this level and for the most part in the noise floor of the instrument.

Two other FM transmitters (KBDX 92.7 MHz and KUHU 88.1 MHz) are co-located on the same tower as the K214EG transmitting antenna so the potential for IMD (mixing products) exist and were included in these measurements. The highest amplitude mixing product on 88.7 MHz is -85.51 dBm represented in Figure 7. All others are below this level.

The tabulation below illustrates the results of all of the measurements.

ENGINEERING REPORT

Emissions measurements translator K214EG - Abajo Peak 28 Sept 2023
RF sample from non-directional couple at output of bandpass filter
to an Agilent E4401B spectrum analyzer SN: MY41440302

Frequency	Harmonic	Level	Re: Carrier	Req'd	Margin
				Note2	Note1
MHz		dBm	dB	dB	dB
90.7	Fundamental	-7.892	0.00		
181.4	2	-87.4	-79.51	-57.91	21.59
272.1	3	-88.15	-80.26	-57.91	22.34
362.8	4	-98.7	-90.81	-57.91	32.89
453.5	5	-99.52	-91.63	-57.91	33.71
544.2	6	-99.46	-91.57	-57.91	33.65
634.9	7	-99.53	-91.64	-57.91	33.72
725.6	8	-99.78	-91.89	-57.91	33.97
816.3	9	-98.93	-91.04	-57.91	33.12
907.0	10	-99.46	-91.57	-57.91	33.65

Frequency	Product	Level	Re: Carrier	Req'd	Margin
Potential mixing products with existing 88.1 transmitter.					
269.5	2A+B	-97.72	-89.83	-57.91	31.91
93.3	2A-B	-93.93	-86.04	-57.91	28.12
266.9	2B+A	-98.44	-90.55	-57.91	32.63
85.5	2B-A	-104.3	-96.41	-57.91	38.49

Potential mixing products with existing 92.7 transmitter.					
274.1	2A+B	-97.33	-89.44	-57.91	31.52
88.7	2A-B	-86.5	-78.61	-57.91	20.69
276.1	2B+A	-97.4	-89.51	-57.91	31.59
94.7	2B-A	-98.11	-90.22	-57.91	32.30

Third order mixing products of 88.1, 90.7, & 92.7 MHz						
86.1		-98.36	-90.47	-57.91	32.55	Slight bump
83.5		-99.15	-91.26	-57.91	33.34	Noise
88.7		-85.51	-77.62	-57.91	19.70	Also 2A-B
85.5		-104.3	-96.41	-57.91	38.49	Also 2A-B
93.3		-93.93	-86.04	-57.91	28.12	Also 2A-B

90.1	-90.71	-82.82	-57.91	24.90	
95.3	-97.60	-89.71	-57.91	31.79	Noise
94.7	-98.11	-90.22	-57.91	32.30	Also 2A-B
97.3	-98.54	-90.65	-57.91	32.73	
111.1	-99.93	-92.04	-57.91	34.12	Noise

90.7 Modulated vs unmodulated carrier

Freq MHz		Level dBm*	Re: Carrier	Req'd	
90.10	-600KHz	-90.64	-82.75	-42.89	39.86
90.46	-240KHz	-88.12	-80.23	-42.89	37.34
90.58	-120KHz	-75.22	-67.33	-32.89	34.44
90.82	+120KHz	-77.43	-69.54	-32.89	36.65
90.94	+240KHz	-89.58	-81.69	-42.89	38.80
91.30	+600 KHz	-91.41	-83.52	-42.89	40.63

* Relative to unmodulated carrier

Measurements in instrument noise floor.

Note2 Required per part 73.317 (b) & (c)

Note 1. Measured emission margin below the required attenuation per Part 73.317 (b) & (c)

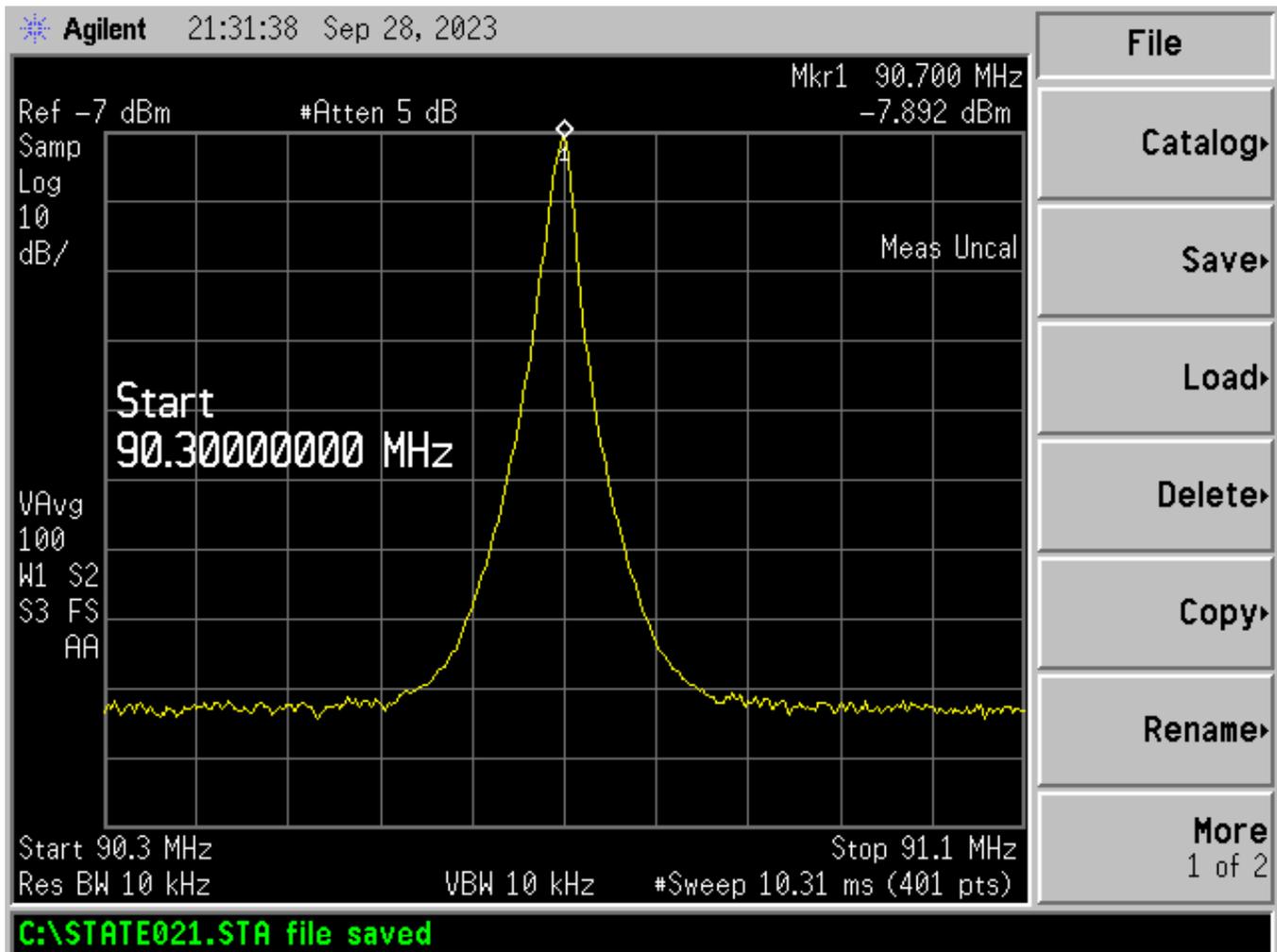


FIGURE 1. K214EG UNMODULATED CARRIER LEVEL USED FOR SUBSEQUENT EMISSIONS MEASUREMENTS

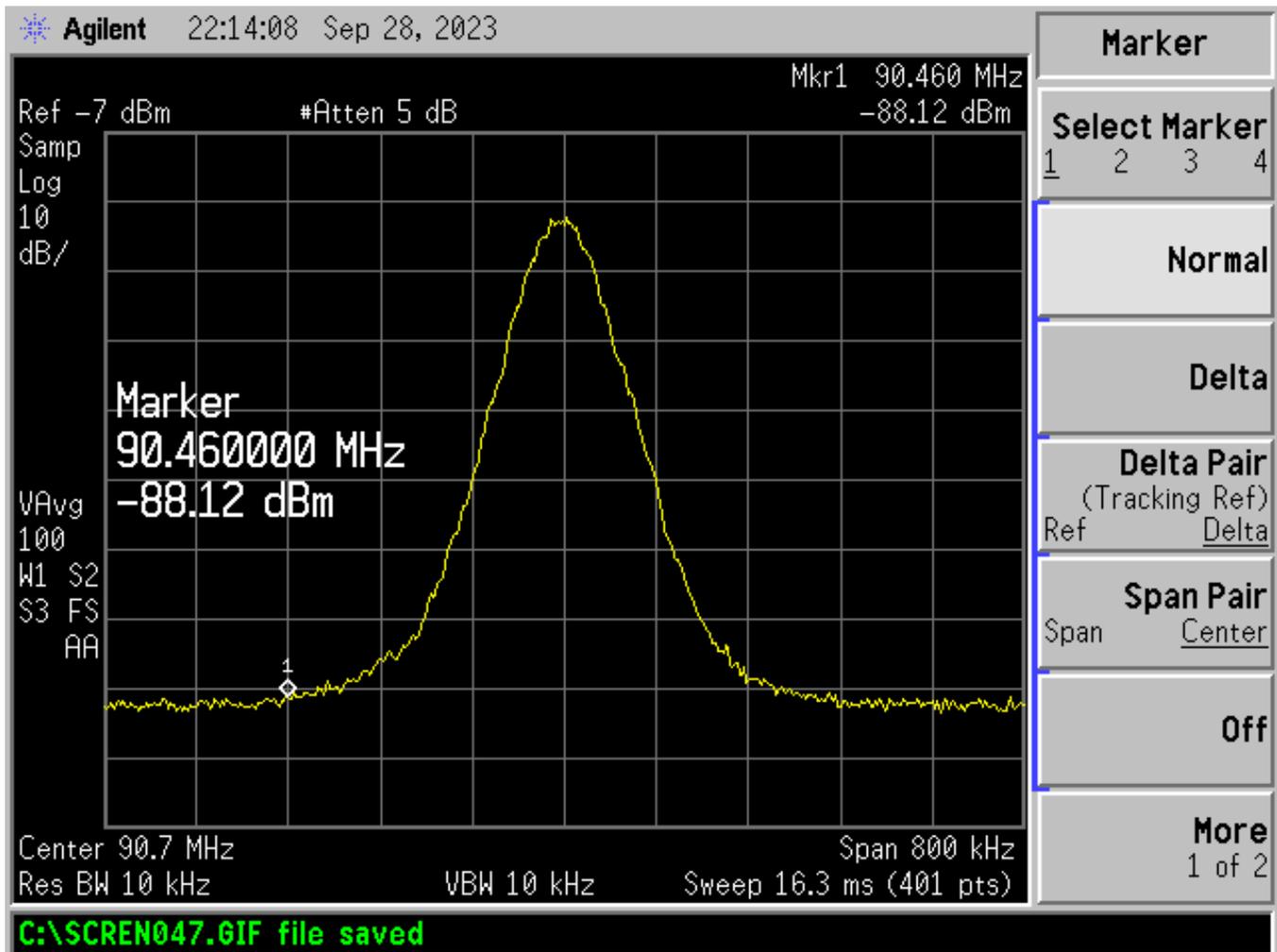


FIGURE 2. K214EG UNDER 100% MODULATION WITH MARKER AT 240 KHz BELOW CARRIER LEVEL -88.12 dBm, 80.23 dB BELOW UNMODULATED CARRIER

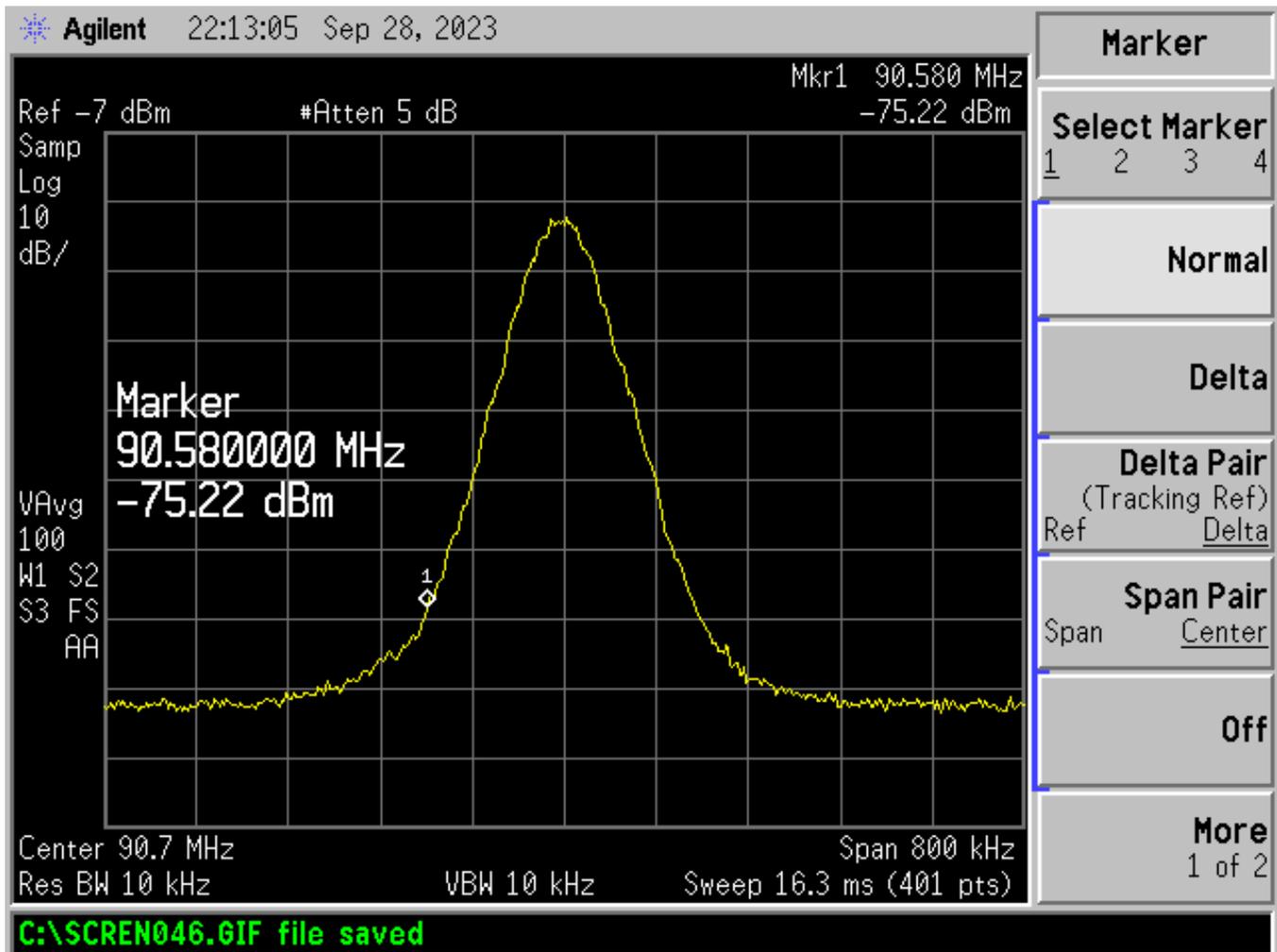


FIGURE 3. K214EG UNDER 100% MODULATION WITH MARKER AT 120 KHz BELOW CARRIER LEVEL -75.22 dBm, 67.33 dB BELOW UNMODULATED CARRIER

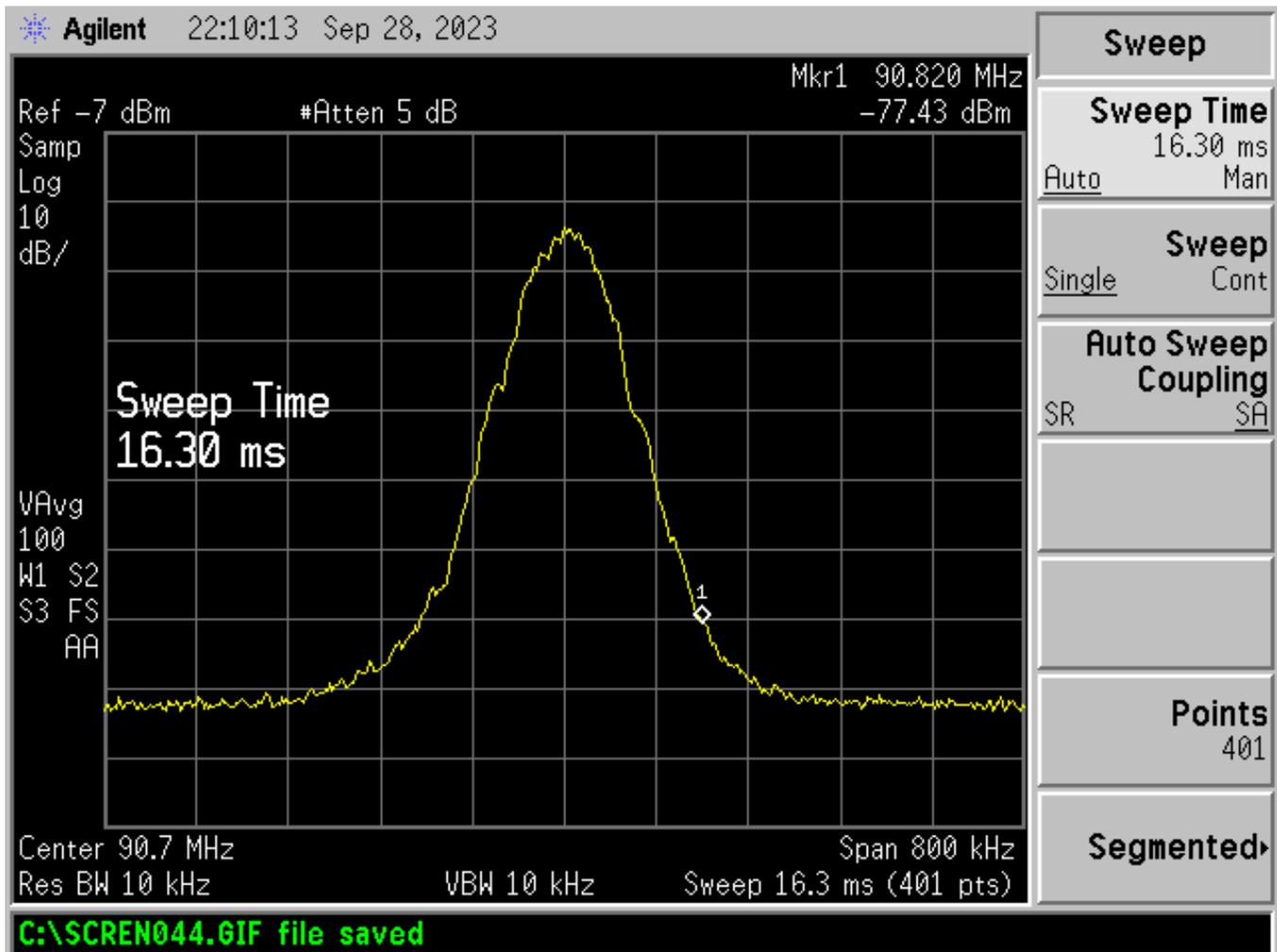


FIGURE 4. K214EG UNDER 100% MODULATION WITH MARKER AT 120 KHz ABOVE CARRIER LEVEL -77.43 dBm, 67.54 dB BELOW UNMODULATED CARRIER

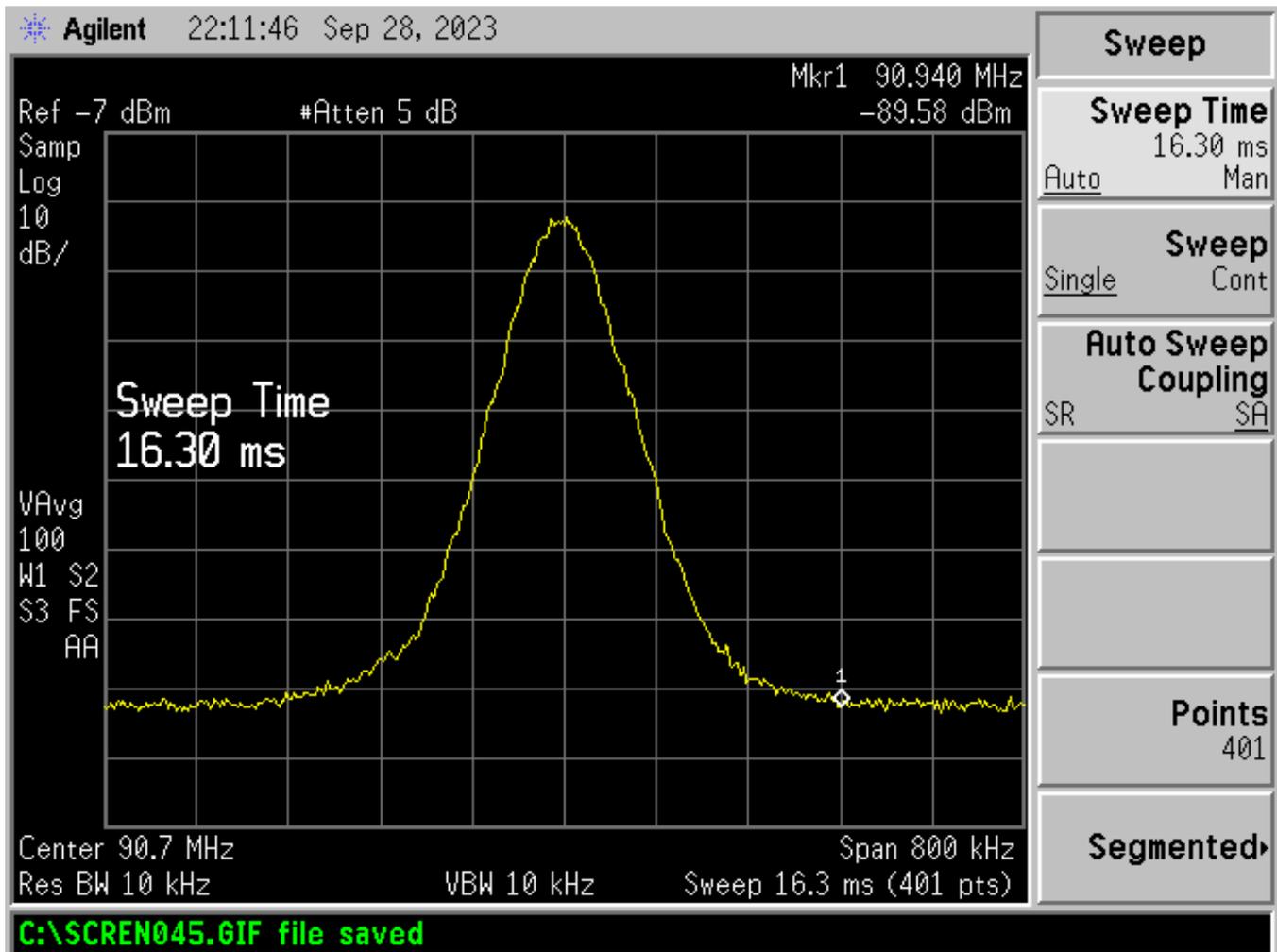


FIGURE 5. K214EG UNDER 100% MODULATION WITH MARKER AT 240 KHz ABOVE CARRIER LEVEL -89.58 dBm, 81.69 dB BELOW UNMODULATED CARRIER

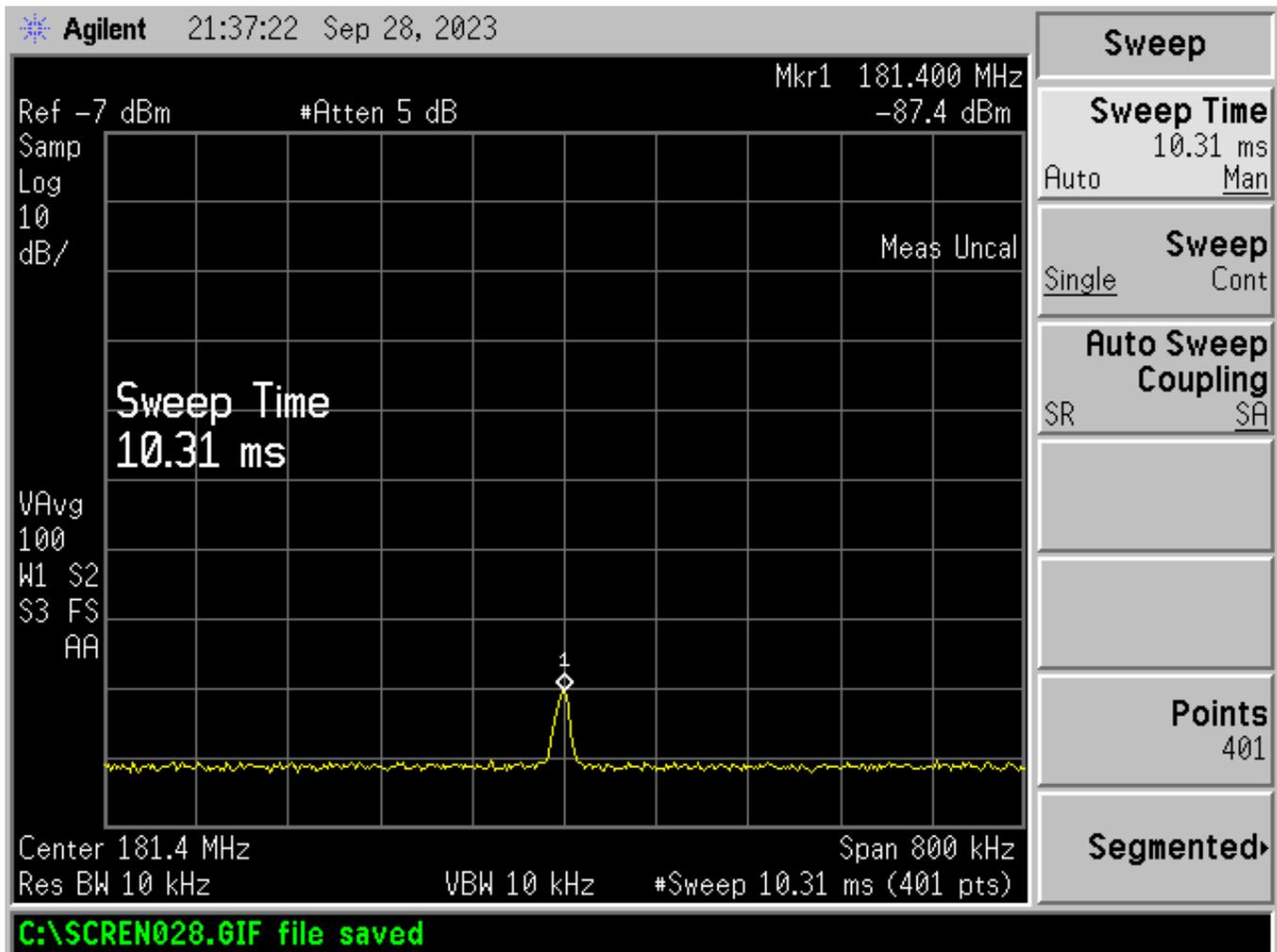


FIGURE 6. K214EG 2ND HARMONIC OF UNMODULATED CARRIER LEVEL -87.4 dBm, 79.51 dB BELOW UNMODULATED CARRIER

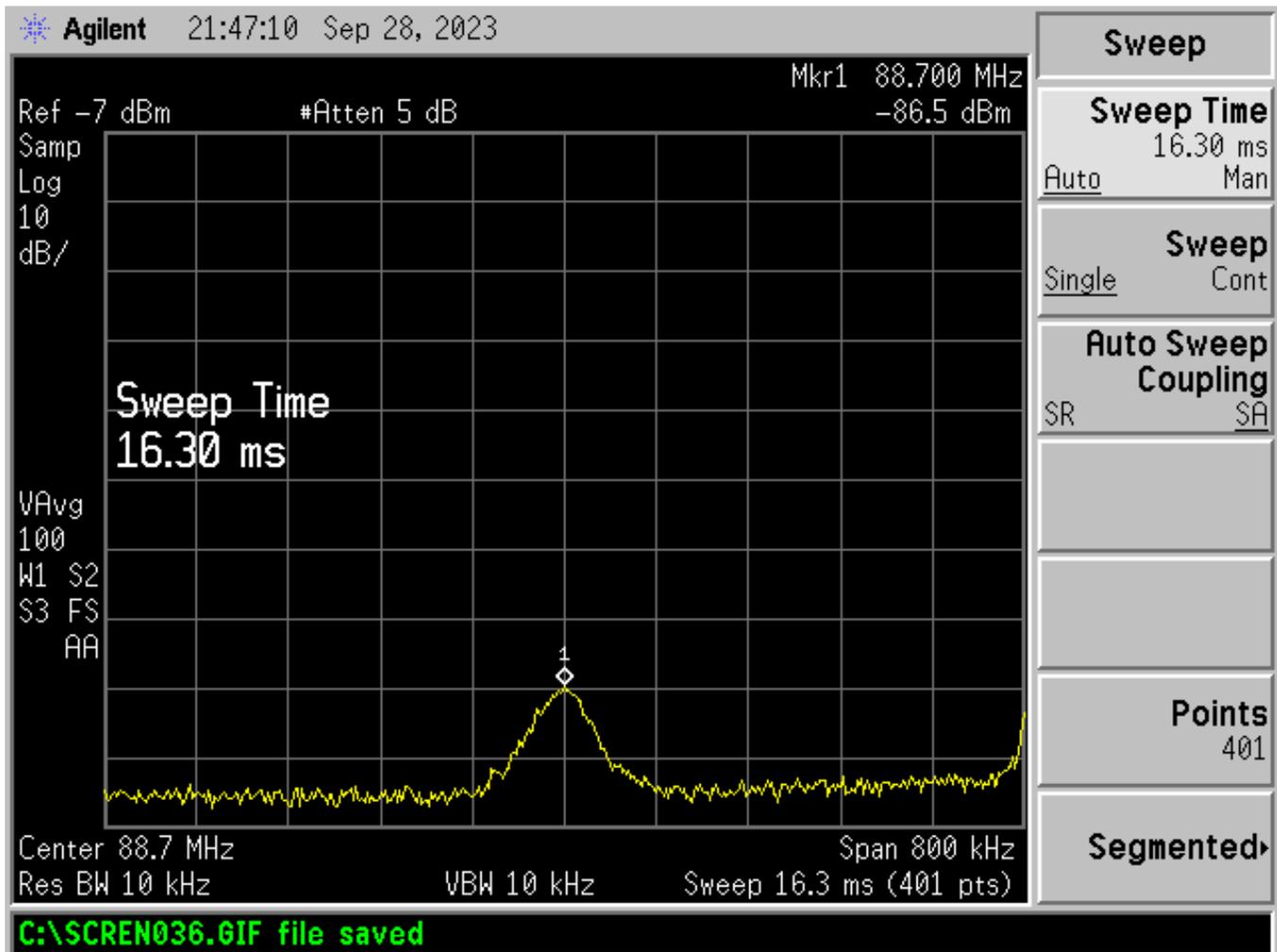


FIGURE 7. K214EG MIXING PRODUCT WITH KBDX 92.7 MHz, -86.5 dBm, 78.61 dB BELOW UNMODULATED CARRIER