Mr. Jon Robinson
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Greensboro, NC 27408

Jon Robinson:

This letter documents FM transmitter measurements conducted by myself on March 7th 2008 near Rye, Colorado. The purpose of the measurements was to verify the compliance with FCC Rules, Part 73.317(a), (b), (c), and (d) for KRYE (104.9MHz FM channel 285). The FM station is located 32 miles south and west of Pueblo Colorado on the YMCA property known as Camp Jackson.

The site has one Harris FM-20 transmitter owned by KTPL which operates on 88.3MHz Channel 202 with 65KW, another transmitter is an Armstrong 15K transmitting at 11.5KW frequency of 90.9MHz Channel 215. The transmitter tested today is an Armstrong 10KW operating on 104.9MHz on Channel 285. None of the three transmitters are combined into a common antenna, each feeds an independent antenna on a common 199 foot tower located 250 feet from the building, the tower is elevated by an additional 50 feet from the building site due to local terrain features.

Each transmitter has a low pass filter, and a sample port or line section coupler. The measurements are typically taken from the "common" or "combined" sample port showing for the effects of the transmitter without external sources of influence. With the recent weather, access to the site was limited and this preferred method was not used. In lieu of connecting into a sample port of the transmission line, over the air measurements (OTAM) were collected approximately 1 mile from the site on Highway 165 with line of sight to the antenna used by KRYE, this monitoring point is marked Huckleberry Ranch.

To establish the reference power level of the FM transmitters, the power was first measured with a bandwidth of 10KHz centered on the fundamental frequency of the station. Peak-hold was then selected to capture any quick changes in modulation from the program test source, which content was mostly music. Using the peak-hold method, the measurements would indicate a true worst-case scenario albeit intermittent in nature.

Measurements of the spurious emissions from 120KHz through 600KHz was performed with a resolution bandwidth of 10KHz, this insured that any narrowband spurious emissions were properly captured. These tests were repeated numerous times to verify accuracy of the initial readings. Having a repeatable measurement is an indication that the process is working.

Measurements of harmonics were performed with the exact same configuration of RF sampling with the inclusion of a Mini-Circuits high pass filter with a cut off frequency of 175MHz. The high pass filter provides ample attenuation from the fundamental frequency, which in turn minimizes front end over load of the RF spectrum analyzer.

Included is an excerpt of Code of Federal Regulations Title 47 Part 73 that was relevant to the measurements taken in the field. Following pages will show the screen shots of the instrument's measurements taken at the site at YMCA Camp Jackson, Rye, Colorado.

Notes:

1. When viewing the measurements of KRYE-FM, the spectrum analyzer was setup with a variable step attenuator and Miteq pre-amp, all fed from a broadband antenna with a known calibration chart from each frequency of interest. The signal level was configured in such a way that the carrier was at well within the dynamic range of the spectrum analyzer. Because of the use of an external antenna additional FM stations prevented the ability for measures of 73.317(d) to be accurately taken.

2. 120KHz limit was at 25dBc after a peak hold of 10 minutes. This long duration of time was selected to show for the program audio heard on the station.

3. Harmonic measurements shown with the noise floor of the spectrum analyzer only, indicate that the energy is attenuated below the instruments ability to display that harmonic. The measurements taken are well beyond the limits set by Part 73.

4. The spectrum analyzer used for the measurements is within its yearly calibration cycle and was tested prior to my arrival at Camp Jackson. In the event of a fail condition, a second identical HP-8591A, also in it's yearly calibration cycle, was available to duplicate the results if needed. There was no failure condition at Red Top Ranch. There was no need to validate the readings with a second spectrum analyzer, or a second sample port.

5. The Mini-Circuits NHP-175 high pass filter has been characterized yearly against a calibration sheet furnished from the vendor. Any attenuation at the harmonic frequencies is factored into the amplitude measurements taken on site. As an example if the filter was known to exhibit 6dB loss at 300MHz, and the amplitude of the measurement from the spectrum analyzer at 300MHz was –90dBc, a sum of 6dB to the instruments reading would yield a final result of –84dBc. The insertion loss of the Mini-Circuits NHP-175 high pass filter is only +/- 0.5dB in the spectrum where the harmonic energy was measured. No scaling factors were performed on the amplitude values read from the spectrum analyzer. The results were recorded directly to this document.

If you have any questions or comments regarding the measurements taken, please contact me at (719) 687 7699 or via e-mail kit@ka0wuc.org

Kit Haskins
PG-GB-013355

§ 73.317 FM transmission system requirements.

(a) FM broadcast stations employing transmitters authorized after January 1, 1960, must maintain the bandwidth occupied by their emissions in accordance with the specification detailed below. FM broadcast stations employing transmitters installed or type accepted before January 1, 1960, must achieve the highest degree of compliance with these specifications practicable with their existing equipment. In either case, should harmful interference to other authorized stations occur, the licensee shall correct the problem promptly or cease operation.

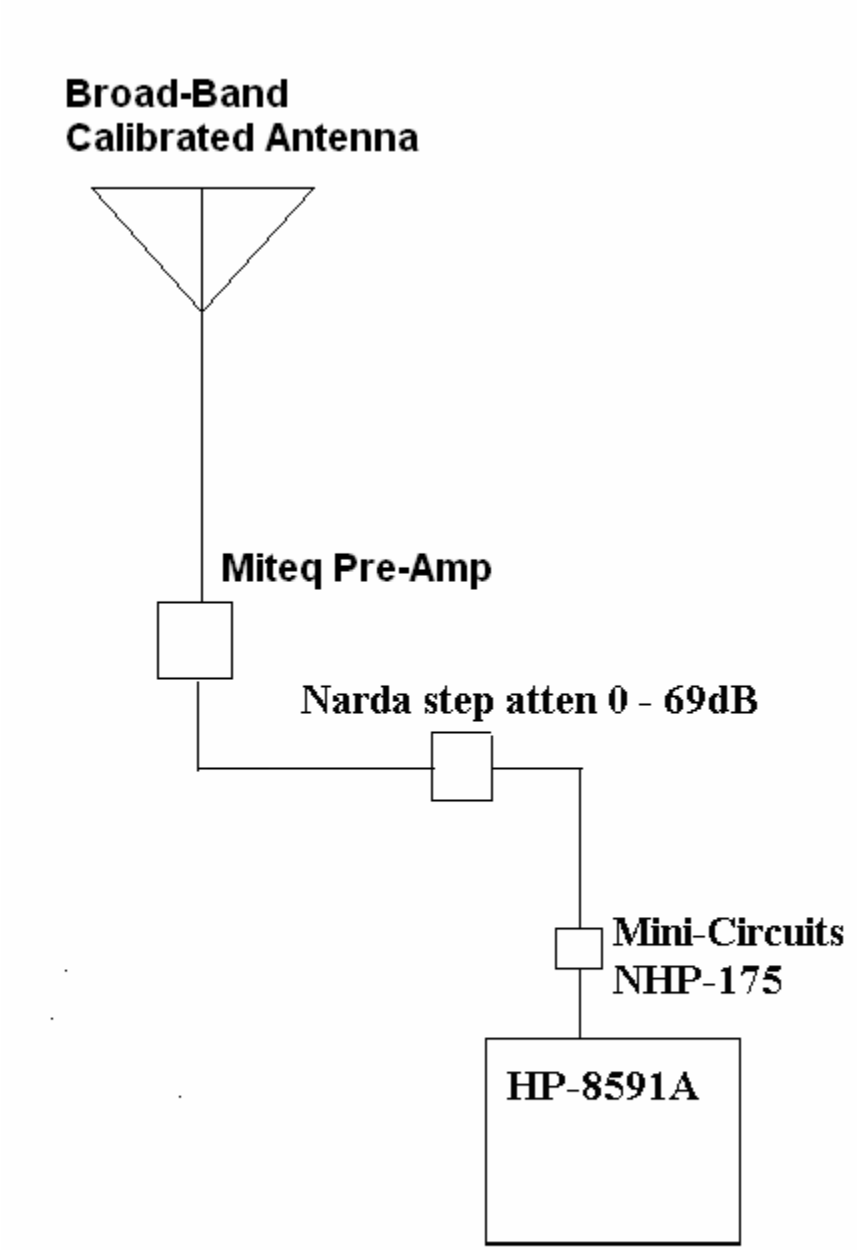
(b) Any emission appearing on a frequency removed from the carrier by between 120 kHz and 240 kHz inclusive must be attenuated at least 25 dB below the level of the unmodulated carrier. Compliance with this requirement will be deemed to show the occupied bandwidth to be 240 kHz or less.

(c) Any emission appearing on a frequency removed from the carrier by more than 240 kHz and up to and including 600 kHz must be attenuated at least 35 dB below the level of the unmodulated carrier.

(d) Any emission appearing on a frequency removed from the carrier by more than 600 kHz must be attenuated at least 43 + 10 Log10 (Power, in watts) dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

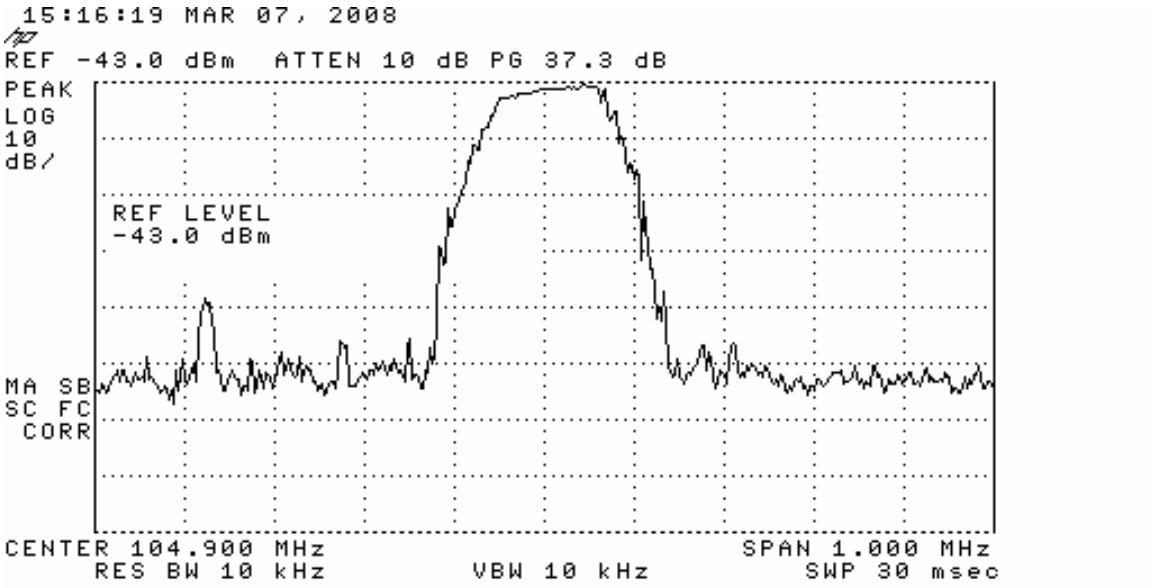
Table 1. Measurement Summary

	KRYE (Rye, CO)	limit	pass/fail
120-240	-34.50	-25	pass
240-600	-72.82	-35	pass
600	See Note	-80	Assume Pass
2nd	-87.14	-80	pass
3rd	-111.18	-80	pass
4th	-115.89	-80	pass
5th	-110.57	-80	pass
6th	-101.41	-80	pass
7th	-122.77	-80	pass
8th	-122.72	-80	pass
9th	-118.86	-80	pass
10th	-119.88	-80	pass

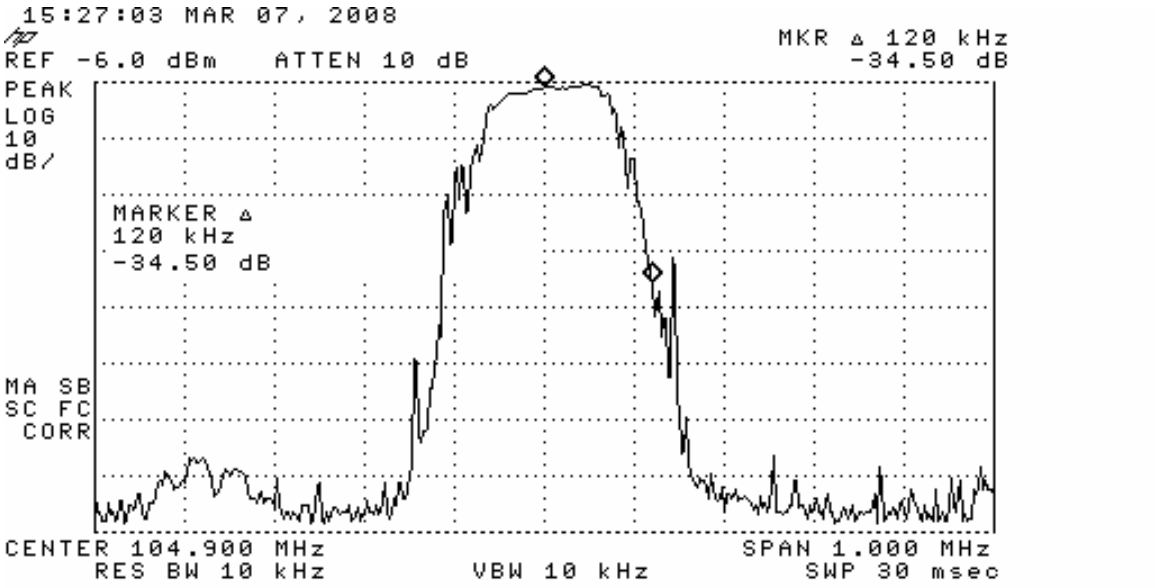


Above is a block diagram of the test jig, or equipment configuration during the measurements of the transmitter, near Rye Colorado.

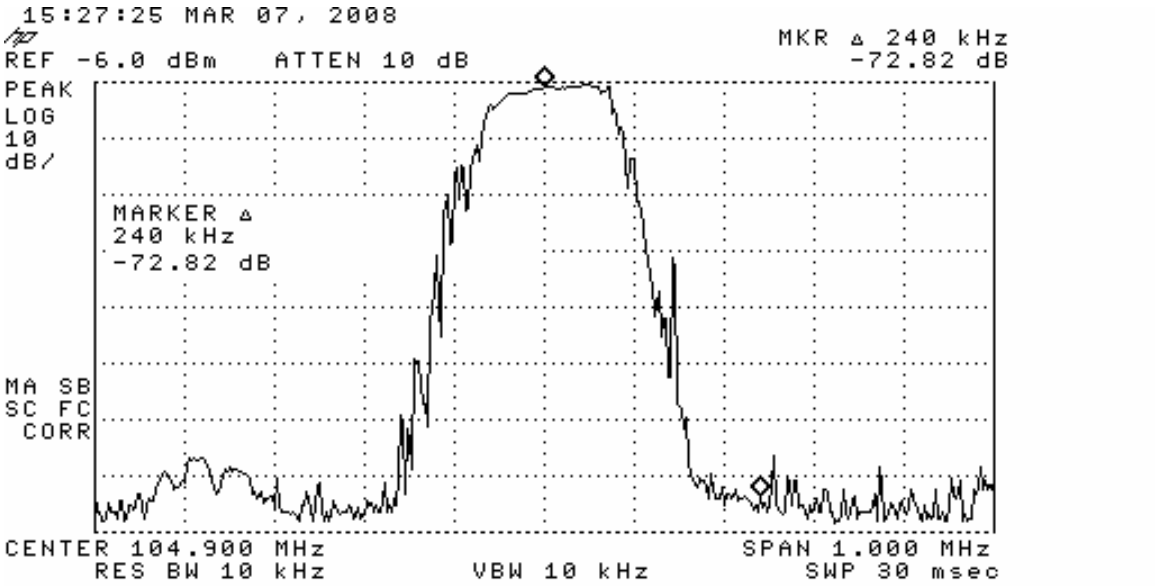
The NHP-175, high pass filter was inserted only during the harmonic measurements. All other measurements that viewed the modulation characteristics were performed without the high pass filter in line.



Above is the peak-hold of KRYE (104.9 MHz). This was verification that the amplitude was adjusted correctly with the Narda step attenuator so that a reference point for the remaining measurements relative to the carrier.

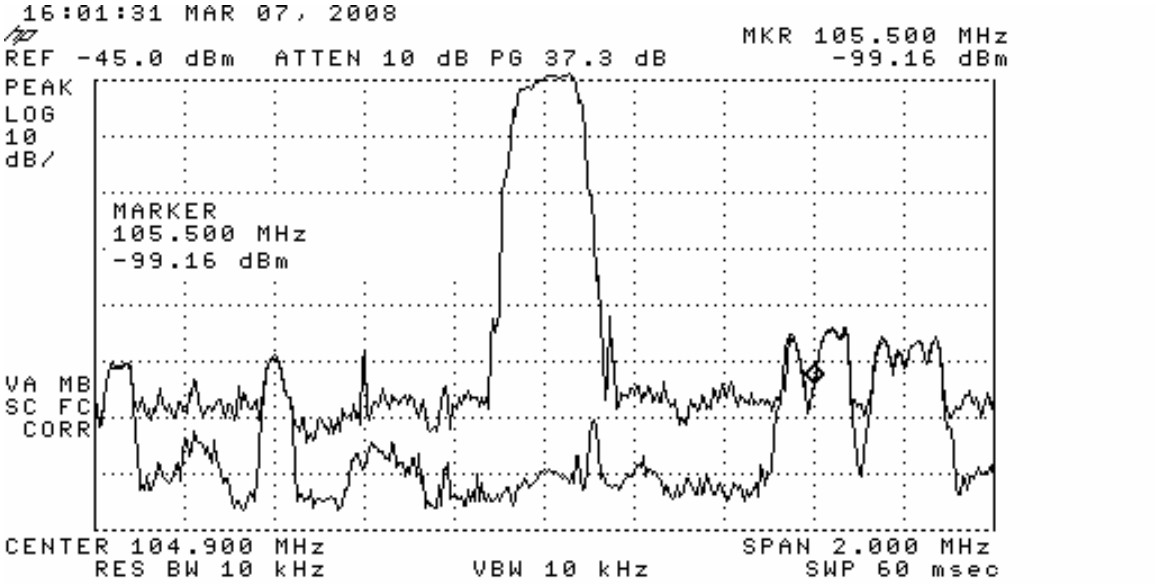


Measurement of 120KHz to 240KHz emissions Part 73.317(b) the passing condition is any measured value at or below –25dBc.

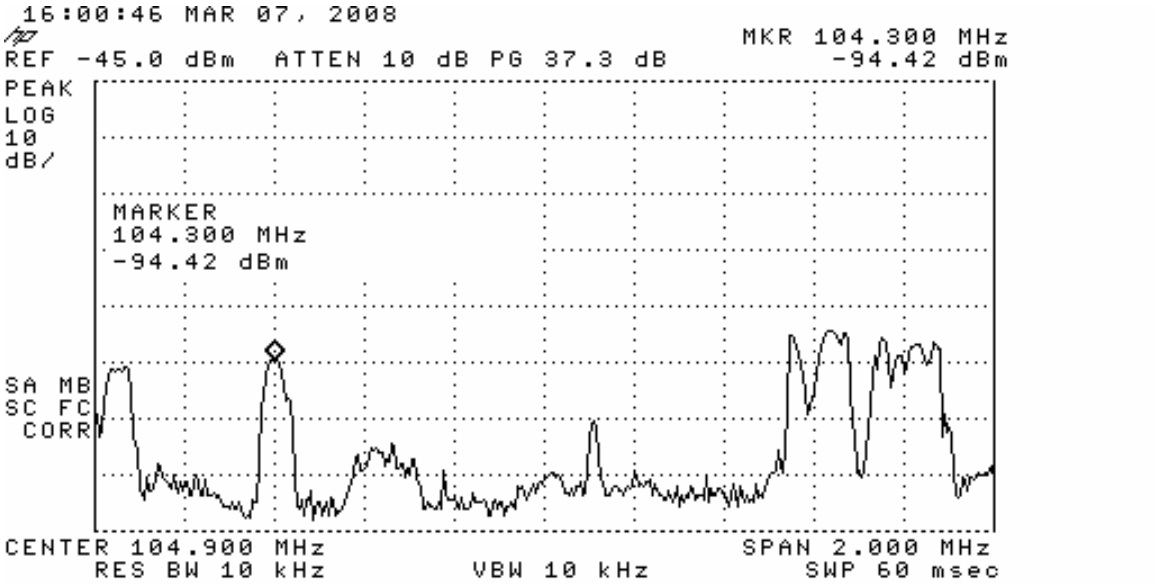


Measurement of 240KHz to 600KHz emissions Part 73.317(c) the passing condition is any measured value at or below –35dBc.

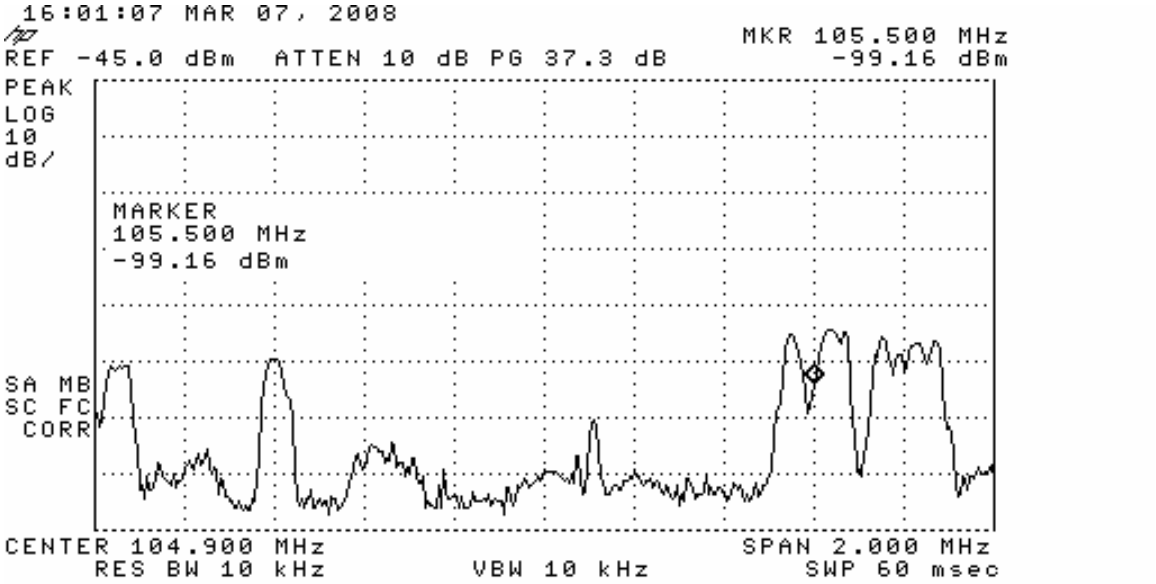
Measurement above and below 600KHz Part 73.317(d) the passing condition is any measured value at or below –80dBc. With our test configuration the measurements where not obtainable due to other FM stations that occupy that part of the spectrum. In reviewing the performance of the transmitter in all of the other measurement points, one can conclude that any 600KHz samples are assumed to be below the emission mask. The following plots will demonstrate the inability to make these measurements.



This plot shows the KRYE-FM carrier in the center with a second trace also captured and "held in memory" to measure when the KRYE-FM transmitter is turned off. If the captured trace does not change with the change of KRYE-FM, one can conclude that they are not from the transmitter.

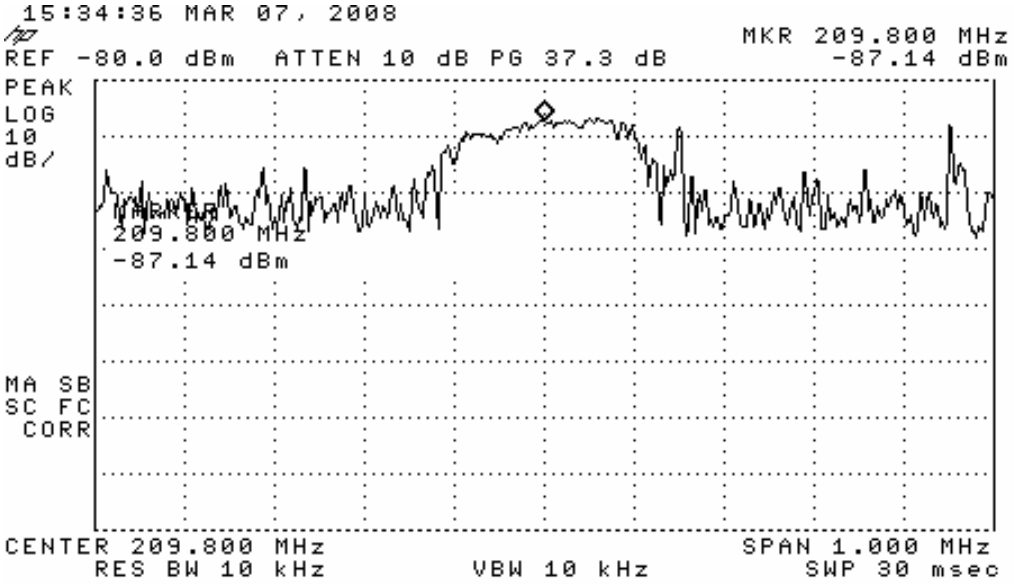


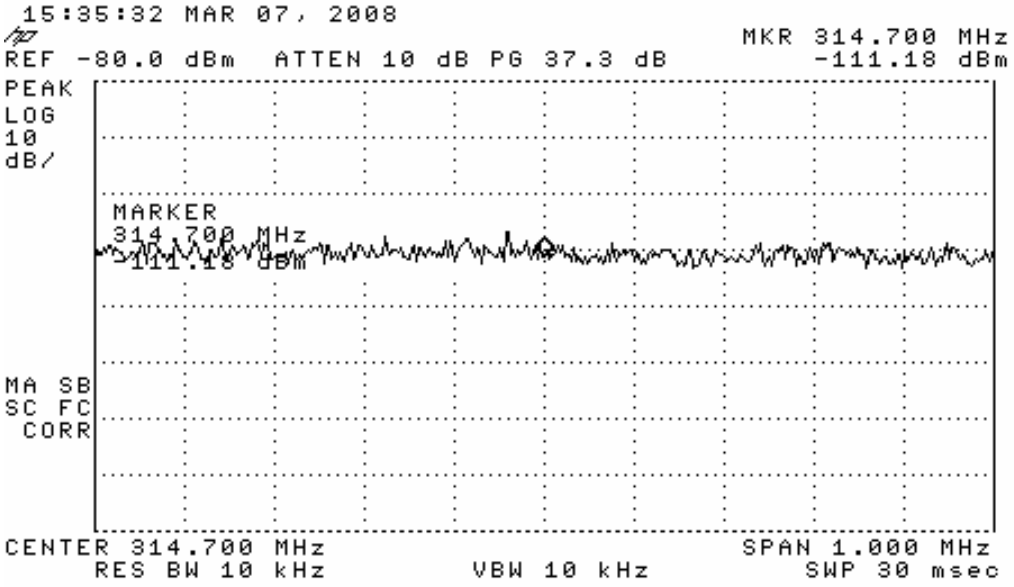
This plot shows an FM carrier that is 600KHz below KRYE-FM that prevents the 73.317(d) measurement.

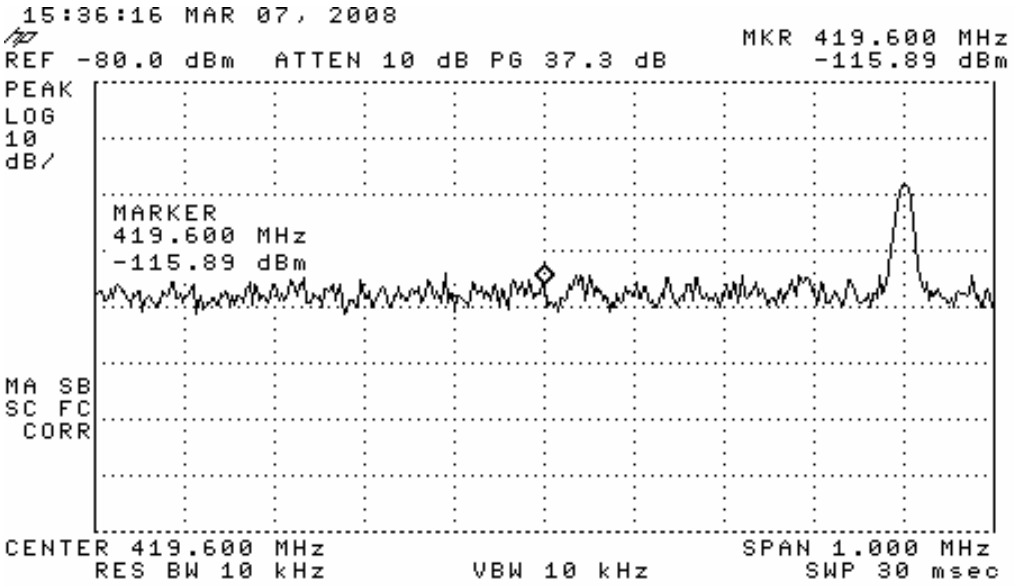


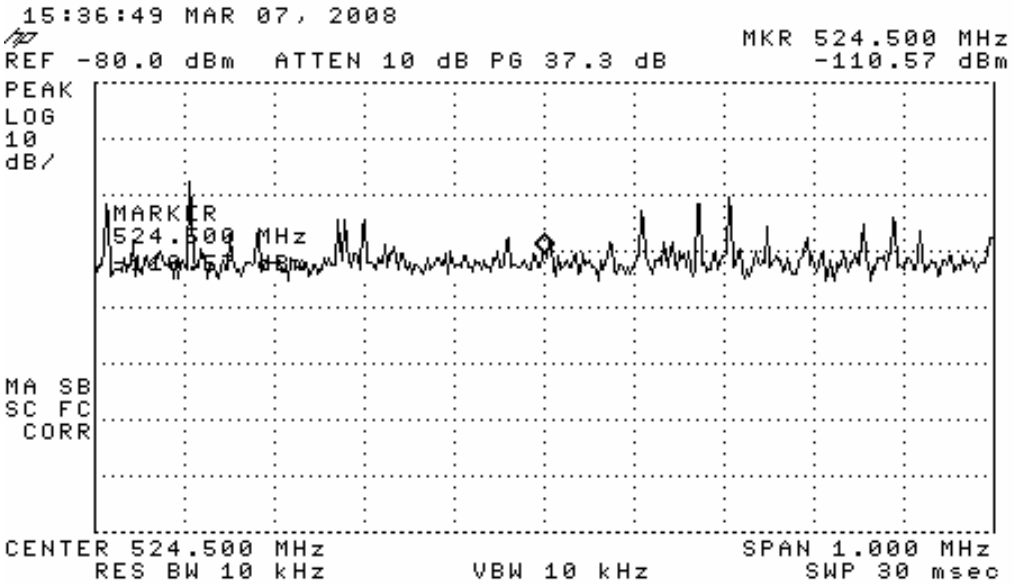
This plot shows an FM carrier that is 600KHz above KRYE-FM that prevents the 73.317(d) measurement.

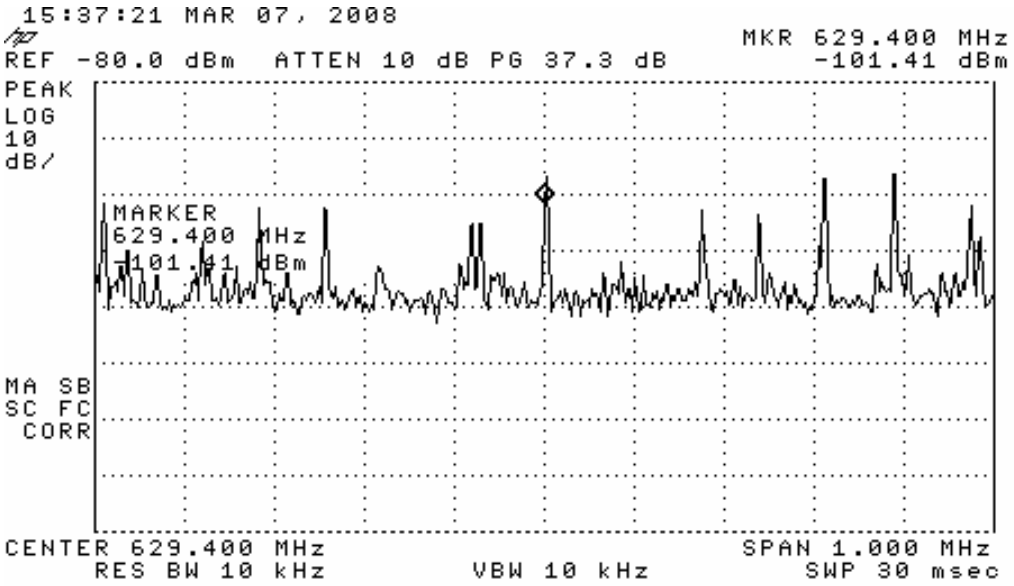
KRYE Harmonics

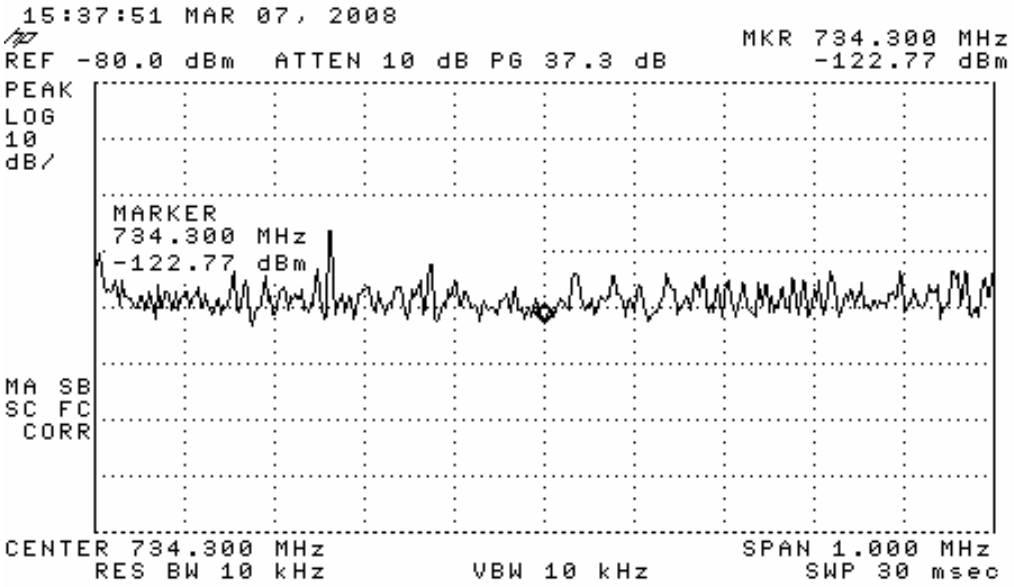


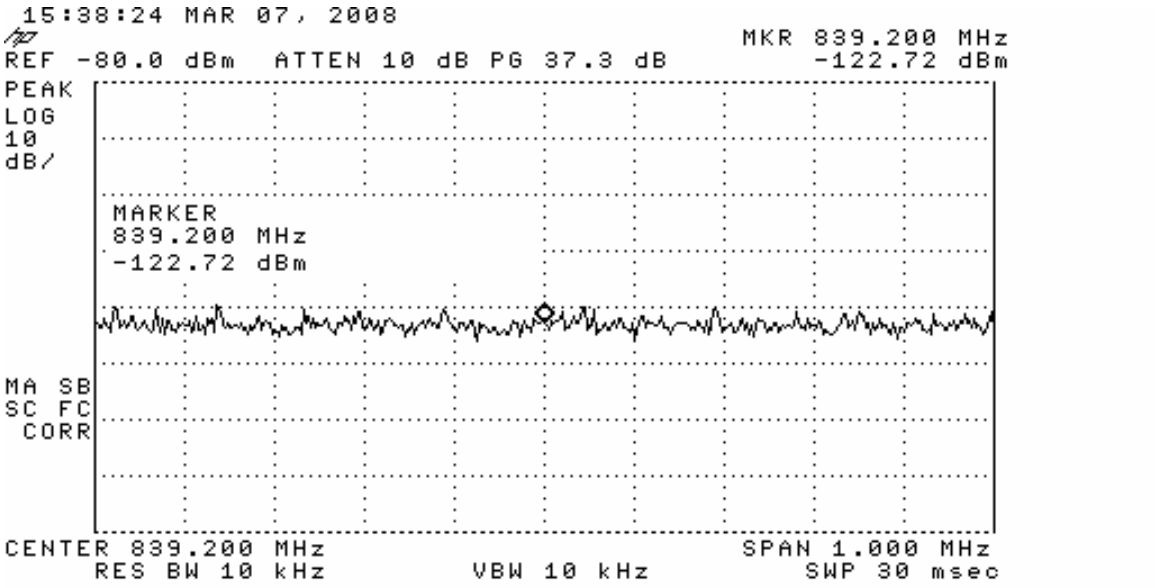


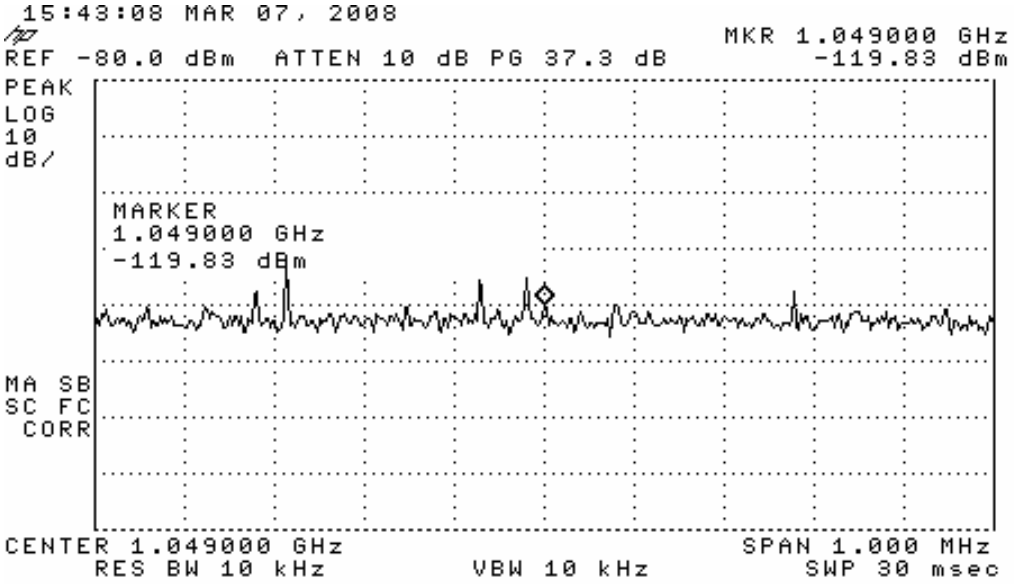

15:36:16 MAR 07, 2008
MKR 419.600 MHz
REF -80.0 dBm ATTEN 10 dB PG 37.3 dB -115.89 dBm
PEAK
LOG
10
dB/
MARKER
419.600 MHz
-115.89 dBm
MA SB
SC FC
CORR
CENTER 419.600 MHz
SPAN 1.000 MHz
RES BW 10 kHz
VBW 10 kHz
SWP 30 msec

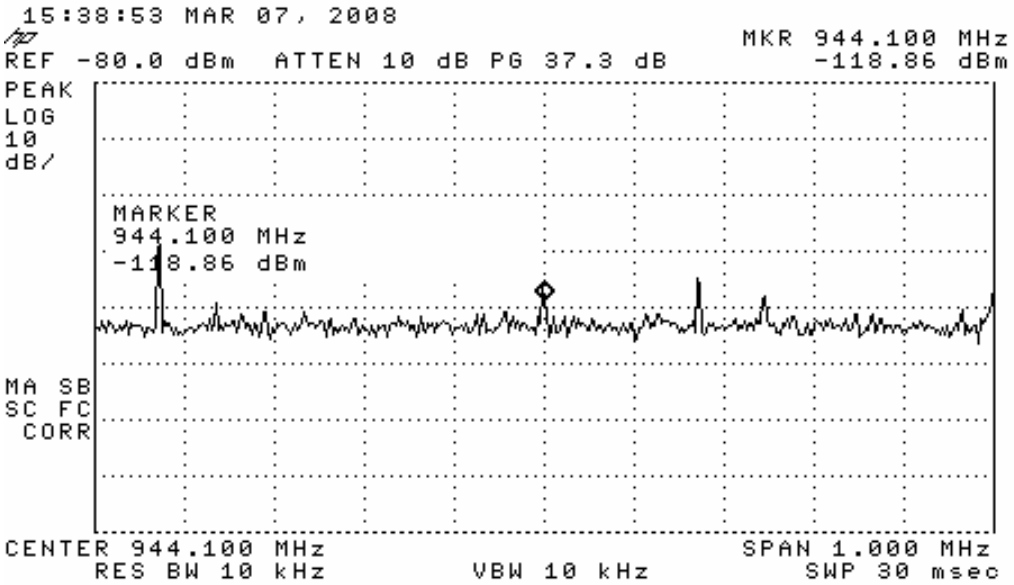

15:36:49 MAR 07, 2008
MKR 524.500 MHz
REF -80.0 dBm ATTEN 10 dB PG 37.3 dB -110.57 dBm
PEAK
LOG
10
dB/
MARKER
524.500 MHz
MA SB
SC FC
CORR
CENTER 524.500 MHz
SPAN 1.000 MHz
RES BW 10 kHz
VBW 10 kHz
SWP 30 msec


15:37:21 MAR 07, 2008
MKR 629.400 MHz
REF -80.0 dBm ATTEN 10 dB PG 37.3 dB -101.41 dBm
PEAK
LOG
10
dB/
MARKER
629.400 MHz
-101.41 dBm
MA SB
SC FC
CORR
CENTER 629.400 MHz
SPAN 1.000 MHz
RES BW 10 kHz
VBW 10 kHz
SWP 30 msec


15:37:51 MAR 07, 2008
MKR 734.300 MHz
REF -80.0 dBm ATTEN 10 dB PG 37.3 dB -122.77 dBm
PEAK
LOG
10
dB/
MARKER
734.300 MHz
-122.77 dBm
MA SB
SC FC
CORR
CENTER 734.300 MHz
SPAN 1.000 MHz
RES BW 10 kHz
VBW 10 kHz
SWP 30 msec


15:38:24 MAR 07, 2008
MKR 839.200 MHz
REF -80.0 dBm ATTEN 10 dB PG 37.3 dB -122.72 dBm
PEAK
LOG
10
dB/
MARKER
839.200 MHz
-122.72 dBm
MA SB
SC FC
CORR
CENTER 839.200 MHz
SPAN 1.000 MHz
RES BW 10 kHz
VBW 10 kHz
SWP 30 msec


15:43:08 MAR 07, 2008
MKR 1.049000 GHz
REF -80.0 dBm ATTEN 10 dB PG 37.3 dB -119.83 dBm
PEAK
LOG
10
dB/
MARKER
1.049000 GHz
-119.83 dBm
MA SB
SC FC
CORR
CENTER 1.049000 GHz
SPAN 1.000 MHz
RES BW 10 kHz
VBW 10 kHz
SWP 30 msec


15:38:53 MAR 07, 2008
MKR 944.100 MHz
REF -80.0 dBm ATTEN 10 dB PG 37.3 dB -118.86 dBm
PEAK
LOG
10
dB/
MARKER
944.100 MHz
-118.86 dBm
MA SB
SC FC
CORR
CENTER 944.100 MHz
SPAN 1.000 MHz
RES BW 10 kHz
VBW 10 kHz
SWP 30 msec